

PROJECT MANUAL

Volume I of I

Fillmore Unified School District

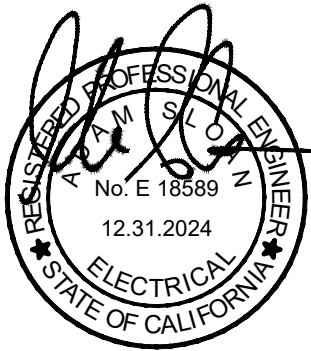
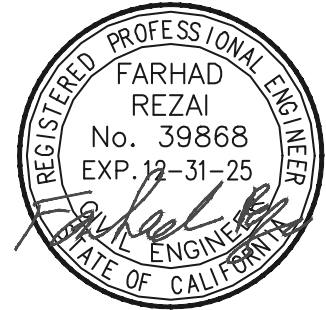
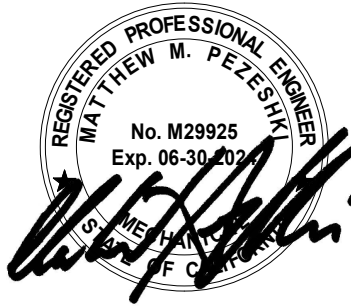
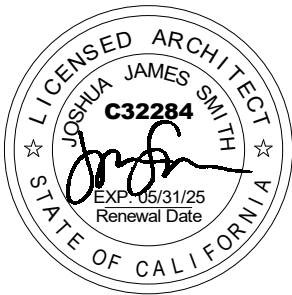
Gymnasium Locker Room Modernization

555 Central Avenue, Fillmore, CA 93015

A#03-123955
DSA File Number 56-H1

WD Project #23443

SECTION 00 01 07
SEALS PAGE



IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT

APP: 03-123955 INC:

REVIEWED FOR

SS ☒ FLS ☒ ACS ☒

DATE: 06/18/2024

END OF SECTION

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**SECTION 00 40 00
PROCUREMENT FORMS AND SUPPLEMENTS**

PART 1 GENERAL

**1.01 CONTRACTOR IS RESPONSIBLE FOR OBTAINING A VALID LICENSE TO USE ALL
COPYRIGHTED DOCUMENTS SPECIFIED BUT NOT INCLUDED IN THE PROJECT MANUAL.**

1.02 FORMS

- A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in the procurement requirements.
 - 1. Bid Bond
 - 2. Non-Collusion Affidavit
 - 3. Prevailing Wage
 - 4. Performance Bond
 - 5. Payment Bond
 - 6. Certificate of Contractor and Subcontractor Division of Industrial Relations Registration
 - 7. Information Required for Bidder
 - 8. List of Designated Subcontractors

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 10 00
PROJECT INFORMATION**

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Fillmore High School Locker Room Modernization.
- B. Project Address: 555 Central Avenue, Fillmore, California 93015
- C. Owner's Name: Fillmore Unified School District.
- D. The Project consists of the following alterations and improvements:
 - 1. Subdivide the existing Gymnasium Building boys PE locker room and showers into a girls PE locker room and a boys PE locker room.
 - 2. Associated site work including accessible path of travel ramp, wheelchair lift, paving, and gates/fencing modifications.

1.02 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

1.03 CONTRACTOR USE OF SITE AND PREMISES

- A. Arrange use of site and premises to allow:
 - 1. Owner occupancy.
- B. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Preconstruction meeting.
- C. Site mobilization meeting.
- D. Progress meetings.
- E. Preinstallation Conferences
- F. Construction progress schedule.
- G. Progress photographs.
- H. Submittal Schedule
- I. Submittals for review, information, and project closeout.
- J. Number of copies of submittals.
- K. Requests for Interpretation (RFI) procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 33 00 - Submittal Procedures
- B. Section 01 60 00 - Product Requirements: General product requirements.
- C. Section 01 63 00 - Product Substitution Procedures
- D. Section 01 70 00 - Contract Closeout

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Make the following types of submittals to Architect:
 - 1. Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Owner will schedule a meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.

4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 5. Submission of initial Submittal schedule.
 6. Designation of personnel representing the parties to Contract, Fillmore USD and <1|A/E|>.
 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 8. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

- A. Owner will schedule meeting at the Project site prior to Contractor occupancy.
- B. Attendance Required:
1. Contractor.
 2. Owner.
 3. Architect.
 4. Contractor's superintendent.
 5. Major subcontractors.
- C. Agenda:
1. Use of premises by Owner and Contractor.
 2. Owner's requirements.
 3. Construction facilities and controls provided by Owner.
 4. Temporary utilities provided by Owner.
 5. Survey and building layout.
 6. Security and housekeeping procedures.
 7. Schedules.
 8. Application for payment procedures.
 9. Procedures for testing.
 10. Procedures for maintaining record documents.
 11. Requirements for start-up of equipment.
 12. Inspection and acceptance of equipment put into service during construction period.
- D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
1. Contractor.
 2. Owner.
 3. Architect.
 4. Contractor's superintendent.
 5. Major subcontractors.
- D. Agenda:
1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of RFIs log and status of responses.
 7. Review of off-site fabrication and delivery schedules.

8. Maintenance of progress schedule.
 9. Corrective measures to regain projected schedules.
 10. Planned progress during succeeding work period.
 11. Coordination of projected progress.
 12. Maintenance of quality and work standards.
 13. Effect of proposed changes on progress schedule and coordination.
 14. Other business relating to work.
- E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PREINSTALLATION CONFERENCES

- A. Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, and coordination with adjacent activities. Prepare agenda appropriate to Work.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

3.05 CONSTRUCTION PROGRESS SCHEDULE

- A. Refer to Section 01 32 16 - Construction Progress Schedule
- B. Within 10 days after date established in Notice to Proceed, submit preliminary schedule defining planned operations for the first 30 days of work, with a general outline for remainder of work.
- C. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- D. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
1. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.
- E. Within 10 days after joint review, submit complete schedule.
- F. Submit updated schedule with each Application for Payment.

3.06 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of site and construction throughout progress of work.
- D. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
1. Delivery Medium: Via email.
 2. File Naming: Include project identification, date and time of view, and view identification.

3.07 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:

1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 2. Prepare in a format and with content acceptable to Owner.
 3. Combine RFI and its attachments into a single PDF electronic file.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 2. Owner's, Architect's, and Contractor's names.
 3. Discrete and consecutive RFI number, and descriptive subject/title.
 4. Issue date, and requested reply date.
 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Highlight items requiring priority or expedited response.
- H. Review Time: Architect will respond and return RFIs to Contractor within 4 working days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 - 1. Response period may be shortened or lengthened for specific items, subject to the complexity of the RFI.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
 - 1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 - 2. Notify Architect within 4 working days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.08 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
 - 1. Coordinate with Contractor's construction schedule and schedule of values.
 - 2. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
 - 3. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.09 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 - 1. Product data.
 - 2. Shop drawings.
 - 3. Samples for selection.
 - 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. Provide copies and distribute in accordance with Section 01 33 00 - Submittal Procedures .

3.10 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Design data.
 - 2. Certificates.
 - 3. Test reports.
 - 4. Inspection reports.
 - 5. Manufacturer's instructions.
 - 6. Manufacturer's field reports.
 - 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.11 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.

- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 70 00 - Contract Closeout.
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
- D. Submit for Owner's benefit during and after project completion.

3.12 NUMBER OF COPIES OF SUBMITTALS

- A. Documents for Review:
 - 1. Small Size Sheets, Not Larger Than 11 x 17 inches: Submit one copy; the Contractor shall make Contractor's own copies from original returned by the Architect after making a file copy.
 - 2. Larger Sheets, Not Larger Than 30 x 42 inches: Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.
- B. Documents for Information: Submit one copy.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.13 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Refer to Section 01 33 00 - Submittal Procedures

END OF SECTION

SECTION 01 31 30
ELECTRONIC PROJECT MANAGEMENT INFORMATION SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section is in addition to the Contract General Conditions.
- B. The Contractor shall be required to use the District's Electronic Project Management Information System (PMIS), Transcend PM (app.transcendpm.com) for electronic construction management document control and communications between the District, Architect of Record, Inspector of Record, other project-related consultants, and Contractor. The system will be operated collaboratively by the Project Team.
- C. The PMIS will contain the following information available to the contractor and project team:
 - 1. Change Orders (CO) and Logs
 - 2. Construction Change Directives (CCD) and Logs
 - 3. Daily Reports: GC's, Subcontractors, Special Inspectors, Materials Testing Reports, etc.
 - 4. Field Observations and Reports
 - 5. Final Completion
 - 6. Incident Reports and Logs
 - 7. Inspection Requests (IR) and Logs
 - 8. IOR Daily Reports
 - 9. Meeting Minutes
 - 10. Notices to Proceed (NTP)
 - 11. Payment Applications
 - 12. Potential Change Orders (PCO) and Logs
 - 13. Requests for Information (RFI) and Logs
 - 14. Submittals and Logs
 - 15. Substantial Completion
 - 16. Project FTP Site
 - 17. Electronic Drawings, Sketches, and Architect's Supplemental Instructions (ASI)
 - 18. Other Documentation as determined by the District's Representative.
 - a. D. All Daily Reports, Incident Reports, IRs, PCOs, RFIs, and Submittals shall submit electronically, via the Transcend PM Website. The District will NOT accept faxed and/or computer generated documentation and/or hand written documentation of these documents.
 - 19. The Contractor shall be solely responsible for data entry via the Transcend PM Website.
 - 20. The Contractor shall be solely responsible for the scanning of sketches / drawings as necessary for the electronic submittal and attachment of required information.
 - 21. The Contractor shall supply field personnel all necessary computer equipment required for electronic data entry.
 - 22. Submittals shall be submitted via Section 013300 Submittal Procedures. Transcend PM, with hard copies provided per

1.02 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor shall have sufficient computer(s) with capabilities to access the system at their on-site and off-site project offices. At the pre-construction meeting, the Contractor shall provide to the District's Representative the email address of all Contractor representative(s) that the Contractor designates to have access to the PMIS. This representative(s) shall have sufficient computer skills required to access the Internet, log on to the PMIS, and utilize the PMIS. The District shall provide technical support to the Contractor's personnel for use of the PMIS. The Contractor shall plan on an average of 4-hours training for the Contractor's representative(s) who will be using the system. Having the above capability in place on-site is a condition precedent to processing the Contractor's first payment request.

1.03 OFFICIAL RECORDS

- A. The documentation and records maintained on the PMIS will be the Official Records for the project. This documentation shall be the records for the adjudication of any and all disputes.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

- A. Section 01 30 00 - Administrative Requirements

1.03 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Sheet Size: Multiples of 11 x 17 inches.
- C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- D. Provide separate schedule of submittal dates for shop drawings, product data, and samples, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- E. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Update diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

**SECTION 01 33 00
SUBMITTAL PROCEDURES**

PART 1. - GENERAL

1.01 SUMMARY

- A. Submit to the Architect, progress schedule, application for payment, shop drawings, project data, and miscellaneous submittals required by the Contract Documents.
- B. Related Requirements Specified Elsewhere:
 - 1. General Conditions
 - 2. Supplementary Conditions
- C. Designate in a progress schedule, or in a separate coordinated schedule, the dates for submission and the dates reviewed shop drawings, and project data will be needed for each product.

1.02 CONTRACTOR RESPONSIBILITIES

- A. Review shop drawings, and product data prior to submission. Provide review stamp on submittals. See Example "A" form at the end of this section and General Conditions for specific requirements
- B. Determine and Verify:
 - 1. Field measurements.
 - 2. Field construction criteria.
 - 3. Catalog numbers and similar data.
 - 4. Conformance with specifications.
- C. Coordinate each submittal with requirements of the work and of the Contract documents.
- D. Notify the Architect in writing, at time of submission, of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not begin fabrication or work, which requires submittals until return of submittals with Architect's approval.

1.03 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that requires sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

1.04 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the work or in the work of any other contractor.
- B. Schedule submissions for the Architect to receive them at least 10 working days before dates reviewed submittals will be needed.
- C. Provide Electronic Submittals for:
 - 1. Shop Drawings
 - 2. Product Data
 - 3. Miscellaneous paper submittals required by the Contract Documents
- D. Accompany submittals with transmittal form provided by Architect, (sample provided at end of this section) in duplicate, containing:
 - 1. Date.

2. Project title and number.
 3. Contractor's name and address.
 4. The number of each shop drawing and product data submitted.
 5. Notification of deviations from Contract Documents.
 6. Other pertinent data.
- E. Submittals to include:
1. Date and revision dates.
 2. Project title and number.
 3. The names of:
 - a. Architect/Engineer.
 - b. Contractor.
 - c. Subcontractor.
 - d. Supplier.
 - e. Manufacturer.
 - f. Separate detailer when pertinent.
 4. Identification of product or material.
 5. Relation to adjacent materials.
 6. Field dimensions, clearly identified as such.
 7. Specification section number.
 8. Applicable standards, such as ASTM number or Federal Specification.
 9. A blank space, 8" x 3", for the Contractor and Architect stamps.
 10. Identification of deviations from Contract Documents.
 11. Contractor's stamp, signed, certifying to review of submittal, verification of field measurements and compliance with Contract Documents. Sample text of Contractors Review Stamp is provided at the end of this Section, identified as "Example 'A'."
- F. All items required to be submitted for review are to bear the review stamp of the Contractor certifying that he has reviewed the content of the submittal, that the submittal complies with the Contract Documents and contains no unauthorized substitutions.
- G. The Architect reserves the right to reject and return, unreviewed, all submittals not bearing the review stamp of the Contractor; poor quality or incomplete Shop Drawings and all submittal which do not meet the requirements of this Section and General Conditions Article 23, Shop Drawings, Product Data, and Samples. Construction delays resulting from returned, incomplete or incorrect submittals are the responsibility of the Contractor and not the Architect

1.05 RESUBMISSION REQUIREMENTS

- A. Shop Drawings:
1. Revise initial drawings as required and resubmit as specified for initial submittal.
 2. Indicate on drawings any changes, which have been made other than those, requested by Architect.
 3. Product Data: Submit new data as required for initial submittal.

1.06 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Critical-Path Schedule: Prepare a fully developed, Critical Path Method type Contractor's construction schedule. Submit within 7 days after the date established for "Award of Contract". Submit Schedule in compliance with General Conditions Article 32, Progress Schedule.
1. Provide a separate time for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
 2. Within each time period indicate estimated completion percentage in 10 percent increments. As Work progresses, indicate Actual Completion.
 3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
 4. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.

5. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.

1.07 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
- B. Shop Drawings 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.
 3. Compliance with specified standards.
 4. Notation of coordination requirements.
 5. Notation of dimensions established by field measurement.
 6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 30" x 42".
 7. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.
- C. Number of copies submittals:
 1. Electronic documents:
 - a. Small sheet (8-1/2" x 11" and 11" x 17"), submit electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
 - b. Hard copy submittals:
 - 1) Large sheet, not larger than 30" x 42": submit 3 copies. One to be returned to the contractor for contractors use and reproduction, with other copies retained by architect and architects consultant.

1.08 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information. Delete information, which is not applicable.
 2. Submittals: Submit 2 copies of each required submittal; submit 4 copies where required for maintenance manuals. The Architect will retain one, and will return the other marked with action taken and corrections or modifications required.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 3. Distribution: Furnish copies of approved submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until an applicable copy of Product Data applicable is in the installer's possession. Do not permit use of unmarked copies of Product Data in connection with construction.

1.09 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and

swatches showing color, texture and pattern.

1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect's Sample. Include the following:
 - a. Generic description of the Sample.
 - b. Sample source.
 - c. Product name or name of manufacturer.
 - d. Compliance with recognized standards.
 - e. Availability and delivery time.
2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
 - b. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
4. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal. Sample sets may be used to obtain final acceptance of the construction associated with each set.
5. Field Samples specified in individual Sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.
 - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.10 ARCHITECT'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly.
 1. Compliance with specified characteristics is the Contractor's responsibility.

1.11 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

- A. Contractor is to distribute reproductions of Shop Drawings and copies of Product Data which carry the Architect or Engineer stamp to:
 1. Job site file.
 2. Record Documents file.
 3. Subcontractors.
 4. Supplier or Fabricator.
 5. Project Inspector.

1.12 TIMING OF SUBMITTALS

- A. Make submittals far enough in advance of scheduled dates for installation to provide the required time for reviews, for securing necessary approvals of DSA if required, for possible revision and resubmittals, for placing orders and securing delivery.
- B. Delays: Cost of delays occasioned by tardiness of Contractor submittals may be back charged as necessary and is not to be borne by the School District or Architect.

PART 2. PRODUCTS (NOT APPLICABLE)

PART 3. EXECUTION (NOT APPLICABLE)

END OF SECTION

**SECTION 01 40 00
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General Quality Assurance.
 - 1. Workmanship.
 - 2. Tolerances
 - a. References.
 - b. Mockup.
 - c. Manufacturers' Field Services and Reports.
- B. RELATED SECTIONS
 - 1. Section 01 30 00 - Administrative Requirements
 - 2. Section 01 63 00 - Product Substitution Procedures
- C. WORKMANSHIP
 - 1. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
 - a. Comply with manufacturers' instructions, in full detail, including each step in sequence.
 - b. Should manufacturers' instructions conflict with Project Documents, request clarification from Architect before proceeding.
 - c. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
 - d. Perform work by persons qualified to produce workmanship of specified quality.
 - e. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
- D. TOLERANCES
 - 1. Monitor tolerance control of installed Products to produce acceptable Work. Do not permit tolerances to accumulate to result in unacceptable field conditions.
 - 2. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Project Documents, request clarification from Architect before proceeding.
 - 3. Adjust Products to appropriate dimensions; position before securing Products in place.
- E. MOCK-UP
 - 1. Accepted mock-ups shall be representative of the quality required for the Work.
 - a. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so.
- F. MANUFACTURERS' FIELD SERVICES AND REPORTS
 - 1. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
 - a. Manufacturers' representative shall be subject to approval of Architect.
 - b. Manufacturers' representative shall submit a written report of observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
 - c. Submit report in duplicate within 30 days of observation to Architect for information.

PART 2 PRODUCTS

2.01 NOT APPLICABLE

PART 3 EXECUTION

3.01 NOT APPLICABLE

END OF SECTION

**SECTION 01 41 00
TESTING AND INSPECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selection and payment.
- B. Contractor submittals.
- C. Laboratory responsibilities.
- D. Laboratory reports.
- E. Limits on testing laboratory authority.
- F. Contractor responsibilities.
- G. Schedule of tests and inspections.

1.02 RELATED SECTIONS

- A. Section 01 33 00 - Submittal Procedures: Manufacturer's certificates.
- B. Section 01 65 00 - Starting of Systems
- C. Section 01 70 00 - Contract Closeout: Project Record Documents.
- D. Individual Specification Sections and Drawings: Inspections and tests required, and standards for testing.

1.03 REFERENCES

- A. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete.
- B. ASTM C31 - Making and Curing Concrete Test Specimens in the Field.
- C. ASTM C88 - Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate.
- D. ASTM C140 - Sampling and Testing Concrete Masonry Units.
- E. ASTM C426 - Standard Test Method for Drying Shrinkage of Concrete Block.
- F. ASTM D1556 - Standard Test for Density of Soil in Place by the Sand-Cone Method.
- G. AWS D1.1 - Structural Welding Code - Steel.
- H. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
- I. T24, CCR - Title 24, California Code of Regulations.
- J. CBC - California Building Code, Volume II - Standards

1.04 SELECTION AND PAYMENT

- A. Owner will employ and pay for services of an independent testing laboratory to perform specified testing and review and comment upon welding procedures. Owner will employ and pay for services of a DSA certified inspector to perform specified inspections. The Contractor shall not pay for any laboratory testing or inspections to testing laboratory or inspector.
- B. Testing Laboratory and inspector will be approved by the Division of the State Architect, per T24, CCR, Part I, Section 4-335. Testing lab must have DSA LEA acceptance.
- C. Employment of testing laboratory in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- D. Costs of initial testing and inspection, except as specifically modified herein, or specified otherwise in technical sections, will be paid for by the District, providing such testing and inspection indicates compliance with Contract Documents. Initial tests and inspections are defined as the first tests and inspections as hereinafter specified. The District may be reimbursed by the Contractor for testing costs under the Contract conditions contained herein, and in the General Conditions.
- E. In the event a test or inspection indicates failure of a material or procedure to meet requirements of Contract Documents, costs for re-testing and re-inspection will be paid by the

District and deducted from payments to Contractor.

- F. Additional tests and inspections not herein specified but requested by District or Architect, will be paid for by the District, unless results of such tests and inspections indicate non-compliance with Contract Documents, in which case the District will pay all costs for initial testing as well as re-testing and re-inspection and deduct such costs from payments to Contractor.
- G. Costs for additional tests or inspections required because of change in materials being provided or change of source or supply will be paid by District and deducted from payments to the Contractor.
- H. Costs for work required to correct deficiencies shall be borne by the Contractor.
- I. Cost of testing, which is required solely for the convenience of Contractor in his scheduling and performance of work, shall be borne by the Contractor. Overtime costs shall be borne by the Contractor when work is performed during hours other than normal workweek and laboratory inspection is required. District will pay normal cost of laboratory inspection, and Contractor shall pay that portion of laboratory inspection cost due to overtime.
- J. Testing Laboratory will separate and identify on the invoices, the costs covering all testing and inspections that are to be deducted from payments to the Contractor, as specified above.
- K. Testing Laboratory will furnish to District a cost estimate breakdown covering initial tests and inspections required by Contract Documents. Estimate will include number of tests, man-hours required for tests, field and plant inspections, travel time and costs.
- L. The cost of shop fabrication inspection and material testing outside the State of California or outside of a 150-mile radius of the job site shall be paid for by the District and deducted from payments to the Contractor.

1.05 TESTING LABORATORY

- A. Testing and inspection services shall be performed by an independent testing laboratory, and shall be in accordance with requirements of Title 24, CCR, and the requirements specified herein. The duties of the Testing service are described in T24, CCR, Part I, Article 4-335.
- B. Testing and inspection services shall verify that work incorporated into the project meets the requirements of the Contract Documents.
- C. In general, tests and inspections for structural materials shall include all items listed on the Structural Tests and Inspections list for this project as prepared and distributed by the Architect, and approved by the Division of the State Architect.
- D. Test reports shall be signed by a Registered Civil Engineer licensed in the State of California.

1.06 TESTS

- A. Selection of the material to be tested shall be by the laboratory or the District's representative and not by the Contractor.
- B. The Contractor shall notify the District's representative a sufficient time in advance of the manufacture of material to be supplied by him under the Contract Documents, which must by terms of the Contract be tested, in order that the District may arrange for the testing of same at the source of supply.
- C. Any material shipped by the Contractor from the source of supply before having satisfactorily passed such testing and inspection or before the receipt of notice from said representative that such testing and inspection will not be required shall not be incorporated in the job.

1.07 TEST AND INSPECTION REPORTS

- A. Testing Laboratory will certify in writing that all work specified or required to be tested and inspected conforms to or does not conform to drawings, specifications and applicable building codes.
- B. The Testing Laboratory will make the following distribution of all test and inspections reports within 14 days of the date of the test:
 - 1. Project Inspector of Record 1
 - 2. Specialty Inspectors 1

- | | | | |
|----|--------------------------------------|---|---|
| 3. | Architect | 2 | |
| 4. | Structural Engineer | | 1 |
| 5. | Contractor | 1 | |
| 6. | School District/Construction Manager | 2 | |
| 7. | Division of the State Architect | 1 | |

- C. One copy of all test reports shall be forwarded to the Division of the State Architect within 14 days of the date of the test by the testing agency. Such reports shall include all tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory.
1. Samples taken but not tested shall also be reported.
 2. Records of special sampling operations as required shall also be reported.
 3. The reports shall indicate that the material or materials were sampled and tested in accordance with the requirements of T24, CCR and with the approved specifications.
 4. Test reports shall show the specified design strength.
 5. Test reports shall also state definitely whether or not the material or materials tested comply with requirements.

1.08 VERIFICATION OF TEST REPORTS

- A. Each testing agency shall submit to the Division of the State Architect a verified report in duplicate covering all of the tests which are required to be made by that agency during the progress of the project. Such report shall be furnished each time that work on that project is suspended, covering the tests up to that time, and at the completion of the project, covering all tests.

1.09 REPORTING TEST FAILURES

- A. Immediately upon Testing Laboratory determination of a test failure, the Laboratory will telephone the results of test to Architect. On the same day, Laboratory will send written test results to those named on above distribution list.

1.10 AVAILABILITY OF SAMPLES

- A. Contractor shall make materials required for testing available to Laboratory and assist in acquiring these materials as directed by the District's Inspector. The samples shall be taken under the immediate direction and supervision of the Testing Laboratory.
- B. If work, which is required to be tested or inspected, is covered up without prior notice or approval, such work may be uncovered at the discretion of Architect at no additional cost to the District. Refer to Article 1.04 of this section.
- C. Unless otherwise specified, Contractor shall notify Testing Laboratory a minimum of three working days in advance of all required tests, and a minimum of three working days in advance of all required inspections. Extra laboratory expenses resulting from failure to notify the Laboratory shall be paid for by the District and deducted from payments to the Contractor.
- D. Contractor shall give sufficient advance notice to Testing Laboratory in the event of cancellation or time extension of a scheduled test or inspection. Charges due to insufficient advance notice of cancellations or time extensions shall be paid for by the District and deducted from payments to the Contractor.

1.11 REMOVAL OF MATERIALS

- A. Unless otherwise directed, materials not conforming to the requirements of Contract Documents shall be promptly removed from the job site.

1.12 INSPECTION BY THE DISTRICT

- A. The District and his representatives shall at all times have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.
- B. The District shall have the right to reject materials and workmanship that are defective, or to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the District. If the Contractor does not correct such rejected work within a reasonable time, fixed by written notice, the District

- may correct such conditions and deduct the costs from payments to the Contractor.
- C. Should it be considered necessary or advisable by the District at any time before final acceptance of the entire work to make an examination of work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials. If such work is found to be defective in any respect due to fault of the Contractor or his subcontractor, the Contractor shall bear the expense of such examinations and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be reimbursed to the Contractor by the District.

1.13 CONTRACTOR RESPONSIBILITIES

- A. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
- B. Verify that all required examinations and test samples have been made prior to covering work.
- C. Provide incidental labor and facilities:
1. To provide access to Work to be tested,
 2. To obtain and handle samples at the site or at source of Products to be tested,
 3. To facilitate tests and inspections,
 4. To provide storage and curing of test samples.

1.14 DISTRICT'S INSPECTOR

- A. A DSA Certified Inspector employed by the District in accordance with the requirements of T24, CCR, will be assigned to the work. The duties of the Inspector are described in T24, CCR, Part I, Article 4-333 & Article 4-342 and CBC Chapter 17A.
- B. Special Inspectors may be employed by the District as required by T24, CCR. They shall be afforded every right of access and cooperation required of the Contractor for the Inspector of Record.
- C. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Inspector. He shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Inspector reasonable facilities for obtaining the information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract.
- D. Contractor shall keep Inspector advised at all times of all work in advance of its execution. Such advance notice shall be in conformance with the time limitations established in the project manual and CCR, T24. The minimum notice shall be 24 hours in advance of performance of the work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SCHEDULE OF TESTS AND INSPECTIONS

- A. Provide reference to the approved DSA 103 for complete listing structural test and special inspections.
- B. Tests and inspections for the following will be required, as applicable. Section references are to T24 CCR, Part 2.
- C. Concrete
1. Concrete Mix Design:
 - a. The District will pay for the sampling of aggregate and preparation of mix design one time for each strength and/or aggregate size specified. Testing cost for additional mix designs will be paid for by the District and deducted from payments to the Contractor. The District will pay continuous batch plant inspection and all tests of materials, but Contractor payments will be reduced accordingly for all tests performed on materials that do not meet specification requirements.
 - b. Test concrete aggregates for mix design only.

- c. Deliver samples of approved aggregate to job for comparison with material delivered, if job mixed concrete is used.
 - d. Test suitability of aggregates in accordance with ASTM C88 if material is under suspicion and if so directed by Architect or Division of the State Architect.
- 2. If compressive test of core specimens fail to show compressive strength specified, remove and replace concrete or adequately strengthen in a manner acceptable to Architect and Division of the State Architect.
- 3. Certification shall be made before a Notary Public that tests, the results of which shall be shown, were made in accordance with provisions of Rules and Regulations of the Division of the State Architect.
- 4. Make all tests, take samples, and prepare samples in accordance with the latest standards adopted by American Society for Testing and Materials, or ASTM.
- 5. Concrete mixed at certified automatic concrete batch plants shall have quality control as follows:
 - a. Laboratory designed mixes using adequate cement factors.
 - b. The testing laboratory shall perform continuous batch plant inspection.
- 6. Concrete mixed at non-certified plants shall have quality control as follows:
 - a. Laboratory designed mixes using adequate cement factors.
 - b. The testing laboratory shall perform continuous batch plant inspection.
 - c. Measure all water, including wash water, so total on truck does not exceed 95 percent of maximum allowed in mix design.
 - d. Legible, certified weighmaster's certificates shall be provided to the Project Inspector for all structural and nonstructural concrete, in accordance with the requirements of the Division of the State Architect.
 - e. At end of job, furnish affidavit to Division of the State Architect on form SSS 411-8, certifying that all concrete furnished conformed in every particular, to requirements of T24, CCR, and approved Contract Documents.
- 7. Continuous batch plant inspection requirement may be waived by the Architect in accordance with Section 1705A.3.3. Such waiver shall be in writing, with approval of the Division of the State Architect.
- 8. Reinforcing Steel:
 - a. Tests shall be performed before the delivery of steel to job site. Steel not meeting specifications shall not be shipped to the job.
 - b. Testing procedure shall conform to ASTM A615.
 - c. Sample at the place of distribution, before shipment: Make one tensile test and one bending test from samples out of 10 tons, or fraction thereof, of each size and kind of reinforcing steel, where taken from bundles as delivered from the mill and properly identified as to heat number. Mill analysis shall accompany report.
 - d. Where identification number cannot be ascertained, or where random samples are taken, make one series of tests from each 2-1/2 ton, or fraction thereof, of each size and kind of reinforcing steel. Tests on unidentified reinforcing steel will be paid for by the District and deducted from payments to the Contractor.
 - e. Samples shall include not fewer than two pieces, each 18 inches long, of each size and kind of reinforcing steel.
 - f. Inspection of welding of reinforcing steel shall be done by a specially qualified laboratory inspector and tested in accordance with AWS D1.4
 - g. District's Inspector will inspect all reinforcement for concrete work for size, dimensions, locations and proper placement. Inspector shall be present during welding of all reinforcing steel.
- 9. Inspection by District's Inspector:
 - a. Placement of reinforcing steel and concrete at job.
 - b. Obtain load ticket and identify mix before accepting load. Keep daily record of pour, identifying each truckload, time of receipt, and location of concrete in structure. Keep record until completion of structure and have available for inspection. Forward two copies of weighmaster's certificate to the Division of the State Architect immediately.

- c. During progress of work, samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards (38.2 meters squared) of concrete, or not less than once for each 2,000 square feet (186 meters squared) of surface area for slabs or walls. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete work or whenever the mix or aggregate is changed.
 - d. Each sample shall be taken in three parts from the same batch, one part to be tested at 7 days, and the others to be tested at 28 days.
 - e. Make and store cylinders according to ASTM C31.
 - f. Deliver cylinders to laboratory or store cylinders in a suitable protected environment for pick up by laboratory personnel.
 - g. Make a slump test of wet concrete according to ASTM C143, at least at the same frequency that the test cylinders are taken.
10. Concrete materials shall be tested to conform to the following:
- a. General Testing Requirements: Sections 1903A, 1905A, 1913A.1, ACI318, Ch. 5.
 - b. Portland Cement:
 - c. Concrete Aggregates: Section 1903A.6.
 - d. Reinforcing Bars, Tendons, Pipes, or Tubing: Section 1913A.2.
 - e. Admixtures: Section 1903A, 1904A.
11. Mixed concrete quality shall be tested and inspected to conform to the following:
- a. Batch Plant Inspection: Section 1705A.3.2.
 - b. Proportions of Concrete: Section 1903A, 1904A.
 - c. Strength Tests of Concrete: ACI 318, Ch. 5.
12. Placement of concrete shall be inspected to conform to the following:
- a. Job Site Inspection: Section 1705A.3.5, 1705A.3.6.
 - b. Welding of Reinforcing Bars: Section 1705A.2.2, 1705A.2.2.1.2.
13. Placement of post-installed concrete anchors.
- a. Expansion and epoxy anchors, shot pins: Section 1913A.7.
- D. Lightweight Metals
- 1. Certification that the alloys and tempers of materials used in the work are as called for in Contract Documents shall be provided to the Project Inspector. Certification shall be furnished by an independent testing laboratory approved by the Division of the State Architect and shall conform to CBC Ch. 17A, as for steel, per CBC Ch. 20.
 - 2. Each member shall be positively identified and marked to indicate alloy and temper, as per Section 2210A.
 - 3. The Project Inspector shall inspect all fabrication and erection, as required for structural steel.
 - 4. Welding inspection shall be as required for steel fabrication.
- E. Gypsum Board and Plaster:
- 1. Testing of materials for conformance with reference standards and the requirements of the Contract Documents, shall be performed by the Testing Laboratory if required by the Division of the State Architect or as directed by the Architect.
 - 2. The Project Inspector shall inspect the attachment of all lath and gypsum plaster prior to covering and finishing.
- F. Fire-Resistive Patching of Penetrations in Fire-Rated Assemblies:
- 1. Inspection by District's Inspector:
 - a. Inspector will inspect all locations of Fire-Resistive Patching for conformance with listed requirements of Underwriter's Laboratories.
 - b. Contractor shall not conceal areas patched, until such time as the Inspector accepts the work as conforming to the Contract requirements.
- G. All tests and/or inspections required on the following page(s), Form DSA-103-1, Structural Test & Inspections.

END OF SECTION

**SECTION 01 60 00
PRODUCT REQUIREMENTS**

PART 1. - GENERAL

1.01 SUMMARY

- A. The intent of this section is to ensure that specified product options exceed or equal the quality of the specified products and are furnished and installed in accordance with the design intent.

1.02 RELATED SECTIONS

- A. Section 01 30 00 - Administrative Requirements
- B. Section 01 63 00 - Product Substitution Procedures

1.03 PRODUCT OPTIONS

- A. Where product options are included in the specifications sections and are specified by naming more than one, or several acceptable products or manufacturers, select any product or manufacturer listed.
- B. Where more than one manufacturer or product is listed in the specifications and only one manufacturer or product is specified in detail with model numbers and features, the one specified in detail shall be considered the standard of quality required for all manufacturers or products listed.
 - 1. Where product options are included in the specifications and they are followed by an "or equal " or "approved equal" or equal meeting a specified standard, review and approval by the Architect and School District is required for Contractor proposed equal items. Procedures specified in Section 01 63 00 are to be followed.
 - 2. For items specified only by Reference Standards, select any item meeting standards.
 - 3. Performance Specifications: For items specified by performance requirements, select any item meeting the performance standards specified.
 - 4. Descriptive Specifications: When specifications describe a product or assembly, listing exact components and characteristics, without the use of a brand or trade name, provide a product or assembly that contains the components and characteristics specified.
 - 5. Compliance with Standards Specifications: When specifications only require compliance with a Code, Regulation or Voluntary Standard, Provide products that comply with the specified Codes, Regulations or Standards.
 - 6. Submit request, as required for substitution, for any item or manufacturer not specifically named in the specifications per the requirements of section 01 63 00 - Product Substitution Requirements.
 - a. Architect and School District will determine acceptability of proposed substitutions.

PART 2. - PRODUCTS (NOT APPLICABLE)

PART 3. - EXECUTION (NOT APPLICABLE)

END OF SECTION

**SECTION 01 63 00
PRODUCT SUBSTITUTION PROCEDURES**

PART 1. GENERAL

1.01 SECTION INCLUDES

- A. This Section establishes procedures for Contractor submittal of substitutions.
- B. This Section provides procedures for review and compliance with Public Contract Code Section 3400 for the "or equal" clause allowing bidders to furnish any equal material, product, thing or service. Or equal items proposed by bidders are considered substitutions and are subject to approval of the Architect and School District. Burden of proof for "Or Equals is the responsibility of the Contractor.
- C. The intent of this section is to insure that proposed substitutions exceed or equal the quality of the specified products and are furnished and installed in accordance with the Contract Documents.

1.02 RELATED SECTIONS

- A. General and Supplementary Conditions
- B. Section 01 60 00 - Product Requirements

1.03 SUBSTITUTIONS

- A. Substitution requests are to be submitted by General Contractors only. Requests submitted by Subcontractors, Material Suppliers, Manufacturers and other interested parties, other than General Contractors, will not be considered. Submit requests on the attached FORM "A", SUBSTITUTION REQUEST FORM at the end of this section.
- B. Comply with provisions of Articles for Substitutions in the General Conditions and any modifications to General Conditions provided in the Supplementary Conditions.
- C. Tabulate products by specification section number and title.
- D. Submit separate request for each substitution. In addition to "FORM A", SUBSTITUTION REQUEST FORM", support each request with a side by side itemized comparison of the proposed substitution with product specified; including significant variations. Substitution requests without side by side itemized comparisons will not be reviewed, not accepted. Support each request with:
 - 1. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:
 - a. Product identification, including manufacturer's name and address.
 - b. Manufacturer's literature; identify:
 - 1) Product description.
 - 2) Reference standards.
 - 3) Performance and test data.
 - 4) Fire resistance and fire ratings.
 - c. Samples, as applicable.
 - d. Name and address of similar projects on which product has been used, and date of each installation.
 - 2. List significant variations.
 - 3. Any effect the substitution may have on other trade contracts.
 - 4. List of changes required in other work or products.
 - 5. Accurate cost data comparing proposed substitution with product specified.
 - a. Amount of any change in cost.
 - 6. Designation of required license fees or royalties.
 - 7. Designation of availability of maintenance services, sources of replacement materials.
 - 8. Comparison of physical size and weight with product specified.
 - 9. Comparison of physical shape and available finishes.
- E. Substitutions will not be considered for acceptance when:

1. They are indicated or implied on shop drawings or product data submittals and where not approved in compliance with the General Conditions and this section.
 2. They are requested after the Contract has been executed.
 3. Substitution request procedures included in this Section and in the General and Supplementary Conditions are not complied with by the Contractor.
 4. The School District has determined that compatibility, standardization, technological sophistication, service and uniformity are necessary with regard to technological and certain safety items across the Schools in the District.
- F. Substitute products shall not be installed in the construction without written acceptance of the Architect and School District.
- G. Architect and School District will determine acceptability of proposed substitutions prior to awarding of the Contract. Substitutions may be approved after award of the contract only where the following conditions exist.
1. Specified item has been discontinued or is not unavailable to meet project schedule.
 2. The School District requested the Substitution.
 3. Substitution will reduce the Contract Amount and Contract Time (Credit Back to the District) without reducing quality.

1.04 CONTRACTOR'S SUBSTITUTION CERTIFICATION

- A. In making formal request for substitution contractor certifies that:
1. He has investigated proposed product and has determined that it is equal to or superior in all respects to that specified.
 2. He will provide same warranties or bonds for substitution as for product specified.
 3. He will coordinate installation of accepted substitution into the work, and will make such changes as may be required for the work to be complete in all respects including modification of the work of other trades.
 4. He waives claims for additional costs caused by substitution which may subsequently become apparent.
 5. Substituted material is similar in physical appearance, size and weight and will install with the same opening and attachments.
 6. Substituted material has the same or better fire rating and fire resistive qualities, including flame spread, smoke developed, UL tested and listing.

1.05 ARCHITECT'S DUTIES

- A. Review contractor's request for substitutions with reasonable promptness.
- B. Consult with District and provide notification to contractor, in writing, of decision to accept or reject requested substitution.

1.06 AVAILABILITY OF SPECIFIED ITEMS

- A. Verify prior to bidding that all specified and substituted items will be available in time for installation during orderly and timely progress of the work.
- B. In the event specified items will not be available, notify the Architect prior to receipt of bids.
- C. Cost of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back-charged as necessary and shall not be borne by the Architect or School District.

1.07 SUBSTITUTION WARRANTY REQUIREMENTS

- A. Submit with the substitution request an executed Substitution Warranty.
- B. The Contractor is to warrant, in writing, that the substituted items are to perform as specified, and assume complete responsibility for the same. This includes responsibility and costs required for modifications to building, other materials, or equipment, and any additional coordination with work of other trades. Testing, of Substitution proposed, if required or requested by the Architect or School District shall be paid for by the Contractor.

PART 2. PRODUCTS (NOT APPLICABLE)

PART 3. EXECUTION (NOT APPLICABLE)

END OF SECTION

01 63 00 SUBSTITUTION REQUEST FORM A

TO:

PROJECT:

SPECIFIED ITEM: _____
 Section Page Paragraph Description

The contractor requests consideration of the following:

REQUESTED SUBSTITUTION:

PROPOSED CHANGE IN CONTRACT SUM: Deduct the sum of _____

Attached data includes product description, specifications, drawings, photographs, performance, and test adequate for evaluation of the requests; applicable portions of the data are clearly identified.

Attached data also includes description of changes to Contract Documents which proposed substitution will require for proper installation.

The Contractor states that the following paragraphs are correct:

1. The proposed substitution does not affect dimensions shown on Drawings.
2. The Contractor will pay for changes to the design of Project, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse effect on other work, directly related or otherwise, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed situation.

The Contractor further states that the function, appearance, and quality of the proposed substitutions are equivalent or superior to the specified item.

SUBMITTED BY CONTRACTOR:

Signature: _____

Firm: _____

Address: _____

Date: _____

FOR USE BY ARCHITECT:

Attachments:

☐ Accepted

☐ Not Accepted

☐ Accepted as Noted

☐ Received Too Late

Remarks: _____

Owner: _____

Date: _____

**SECTION 01 65 00
STARTING OF SYSTEMS**

PART 1 GENERAL

SECTION INCLUDES

2.01 STARTING SYSTEMS.

- A. Demonstration and instructions.
- B. Testing, adjusting, and balancing.
- C. RELATED SECTIONS
 - 1. Section 01 40 00 - Quality Control: Manufacturers field reports.
 - a. Section 01 70 00 - Execution and Closeout Requirements: System operation and maintenance data and extra materials.
- D. STARTING SYSTEMS
 - 1. Coordinate schedule for start-up of various equipment and systems.
 - a. Notify Architect and Owner seven days prior to start-up of each item.
 - b. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or for other conditions that may cause damage.
 - c. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
 - d. Verify wiring and support components for equipment are complete and tested.
 - e. Execute start-up under supervision of applicable manufacturer's representative or Contractors' personnel in accordance with manufacturers' instructions.
 - f. When specified in individual specification sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
 - g. Submit a written report in accordance with Section 01400 that equipment or system has been properly installed and is functioning correctly.
- E. DEMONSTRATION AND INSTRUCTIONS
 - 1. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
 - a. Demonstrate Project equipment and instruct in a classroom environment located at Owner's premises and instructed by a qualified manufacturers' representative who is knowledgeable about the equipment.
 - 1) C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
 - 2) Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
 - 3) Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time at equipment location.
 - 4) Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
 - b. The amount of time required for instruction on each item of equipment and system is that specified in individual sections. Allow additional time as required to ensure Owner's representative understands all aspects of operation.
 - c. TESTING, ADJUSTING, AND BALANCING
 - d. Owner will appoint and employ services of an independent firm to perform testing, adjusting, and balancing. Contractor shall pay for services.
 - e. The independent firm will perform services specified in Division 15.

- f. Reports will be submitted by the independent firm to the Architect indicating observations and results of tests and indicating compliance or non-compliance with the requirements of the Contract Documents.

PART 2 PRODUCTS

3.01 NOT USED

PART 3 EXECUTION

4.01 NOT USED

END OF SECTION

**SECTION 01 70 00
CONTRACT CLOSEOUT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Closeout Procedures.
- B. Final Cleaning.
- C. Adjusting.
- D. Observation of Completed Work
- E. Project Record Documents.
- F. Operation and Maintenance Data.
- G. Warranties.
- H. Spare Parts and Maintenance Materials.

1.02 CLOSEOUT PROCEDURES

- A. When work is complete, submit written certification that Project Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Project Documents and ready for Inspector, District, and Architect review. Certification shall request final inspection by District.
- B. Submit the following:
 - 1. Division of the State Architect, Verified Report, DSA-6.
 - 2. Close-out submittals as required by State and local agencies.
 - 3. Close-out submittals as required in individual specification sections.
 - 4. Completed Record Drawings.
 - 5. Executed Warranties.

1.03 REQUIREMENTS PREPARATORY TO COMPLETION

- A. All temporary facilities and utilities shall be removed from the site.
- B. The buildings and site shall be thoroughly cleaned as specified in this Section.
- C. All plumbing and mechanical equipment shall operate quietly and free from vibration. Properly adjust, repair, balance, or replace equipment producing objectionable noise or vibration. Provide additional brackets, bracing, water hammer arrestors, or other methods to prevent objectionable noise or vibration. All systems shall operate without humming, surging, or rapid cycling.
- D. All operating instructions for equipment shall be properly mounted and posted as specified in their respective sections.
- E. Record (As-built) drawings shall be completed, signed, endorsed by the Inspector, and submitted to the Architect.
- F. The Material and Equipment maintenance instructions, as specified in the body of the Specifications, shall be submitted to the Architect.
- G. All guarantees and warranties shall be submitted to the Architect.
- H. All tools, which are a permanent part of equipment installed in the Work, shall be delivered to the District.
- I. All keys, construction and permanent, properly identified shall be delivered to the District.
- J. Contractor shall make final gas, water, waste, vent and electrical connections.

1.04 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment. Employ skilled workmen experienced in cleaning construction materials.

- B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.
- C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- D. Replace filters of mechanical equipment and any other filter installations performed as a part of the work.
- E. Clean debris from roofs, gutters, downspouts, and drainage systems.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces within the scope of work.
- G. Remove from the site waste and surplus materials, rubbish, and construction facilities .
- H. Wash and shine glazing and mirrors.
- I. Polish glossy surfaces to a clear shine.
- J. Dust and damp mop all tile and concrete flooring.

1.05 ADJUSTING

- A. Adjust operating products, systems, and equipment to ensure smooth and unhindered operation.

1.06 OBSERVATION OF COMPLETED WORK

- A. When the Work is complete, and after all requirements preparatory to Completion have been performed as herein specified, Contractor shall notify the Architect in writing.
- B. When requested by the District or Architect, the Contractor (and subcontractors as required by District or Architect), shall accompany the District and/or Architect on a tour of the Work.
- C. If corrective work is identified, the Contractor may be provided with a "punch-list" identifying work that is incomplete and/or in need of correction. A "punch-list" shall not relieve the Contractor of any requirement of the Project Documents, nor shall such a list be considered to be all-inclusive of remaining work. The Contractor is responsible for completing all work required by the Project Documents, including all incomplete and corrective work, within the time requirements of the Contract.
- D. If a "punch-list" or other notice of correction is issued to the Contractor, Contractor shall notify the Architect in writing, when all such work is complete. Contractor shall include with the written notification, a copy of all punch-lists issued to him. Each punch-list item shall be annotated with the construction superintendent's initials, and the date that the item was observed by him to have been completed. The Contractor shall reimburse all costs incurred by the District, Architect, or Architect's consultants, associated with reviewing incomplete or corrective work of the Contractor.

1.07 PROJECT RECORD DOCUMENTS

- A. Maintain on site, one set each of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract including, but not limited to, all RFI's, CCD's and CO's.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress. Do not permanently conceal any work until required information has been recorded.

- E. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish main floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Include all plumbing systems, fire protection systems, and electrical systems. For gravity flow lines such as sewers and storm drains, locate all cleanouts, and indicate invert elevations at building lines, changes in direction, intersections, and property lines.
 - 5. Field changes of dimension and detail.
 - 6. Details not on original Contract Drawings.
- G. Methods of documenting changes:
 - 1. Make reproducible transparencies of the Contract Drawings, and a reproducible copy of the Project Manual, all Addenda, Change Orders, and other Contract Documents.
 - 2. Legibly mark documents with permanent ink; color code as appropriate to separate various types of work.
 - 3. Provide all required data for Inspector verification prior to closing in concealed work.
 - 4. Make all changes, corrections, deletions, or additions on transparencies by a competent draftsman.
 - 5. The construction superintendent shall endorse the transparencies certifying the record drawings are an accurate illustration of the completed Work.
- H. Remove Architect title block and all registration seals from all documents.
- I. Submit documents to Architect prior to final Application for Payment.

1.08 OPERATION AND MAINTENANCE DATA

- A. Submit data bound in 8-1/2 x 11-inch text pages, three ring (D shape) side binders with durable plastic covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project. Include subject matter of binder when multiple binders are required.
- C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, typed on 30-pound white paper, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.

- b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties and bonds.
- E. Data specified in Article 1.07 D above shall incorporate the following:
- 1. Manufacturer's Manuals: Complete installation, operation, maintenance and service manuals, and printed instructions and parts lists for all materials and equipment where such printed matter is regularly available from the manufacturer. This includes, but is not limited to such service manuals as may be sold by the manufacturer covering the operation and maintenance of his items, and complete replacement parts lists sufficiently detailed for parts replacement ordering to manufacturer. Bound publications need not be assembled in binders.
 - 2. Equipment Nameplate Data: A typewritten list of all mechanical and electrical equipment showing all equipment nameplate data exactly. Identify equipment by means of names, symbols, and numbers used in the contract documents.
 - 3. System Operating Instructions: Typewritten instructions covering operation of the entire system as installed (not duplicating manufacturer's instructions for operating individual components). Include schematic flow and control diagrams as appropriate and show or list valves, control elements, and equipment components using identification symbols and numbers. List rooms, area of equipment served, and show proper settings for valves, controls and switches.
 - 4. System Maintenance Instructions: Typewritten instructions covering routine maintenance of system. List each item of equipment requiring inspection, lubrication, or service and briefly describe such maintenance, including types of lubricants and frequency of service. It is not intended that these instructions duplicate manufacturer's detailed instructions. Give name, address and phone number of nearest firm authorized or qualified to service equipment or provide parts.
- F. Submit 1 draft copy of completed volumes 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
- G. Submit two sets of revised final volumes, within 10 days after final inspection.
- H. Wall-Mounted Data: Frame one set of typewritten system instructions and diagrams as required under Paragraph 3 and 4 above, covered with glass and mounted in locations as directed by the District. This set of instruction is in addition to those required herein before.

1.09 WARRANTIES

- A. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.
- B. Provide Table of Contents and assemble in three ring (D-shape) side ring binder with durable plastic cover.
- C. Name District as the beneficiary. In addition, for all equipment and machinery, or components thereof, bearing a manufacturer's warranty that extends for a longer time period than the Contractor's warranty, secure and deliver the manufacturer's warranties in the same manner.
- D. Submit prior to final inspection.
- E. Form of Warranty: Written warranties, except manufacturers' standard printed warranties, shall be on the Contractor's, subcontractor's, material suppliers', or manufacturer's own letterhead, addressed to the District. All warranties shall be submitted in duplicate, and in the form shown on the following page, modified as approved to suit the conditions pertaining to the warranty.
- F. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

1.10 SPARE PARTS AND MAINTENANCE MATERIALS

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

B. Deliver to Project site and place in location as directed; obtain receipt prior to final payment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

**SECTION 01 71 23
FIELD ENGINEERING**

PART 1 - GENERAL

1.01 SUMMERY

- A. Surveying requirements for the work

1.02 RELATED SECTIONS

- A. Section 31 22 00 - Grading
- B. Section 31 10 00 - Site Clearing
- C. Section 32 11 23 - Base Course
- D. Section 32 12 16 - Asphaltic Paving
- E. Section 32 12 17 - Site Concrete Paving

PART 2 - PRODUCTS

2.01 SUBMITTALS

- A. Submit the name and adress of the state of California licensed surveyor to CMR, Architect, and Owner including any changes as they may occur.
- B. Submit to Owner, CMR, and Architect copies of cut sheets, coordinate plots, data collector printouts, and other documentation as available to verify completeness and/or accuracy of field surveying work.
- C. Statement of Compliance: Submit a statement of certification signed and sealed by Surveyor, counter-signed by Contractor indicating compliance with grade elevations, slopes and tolerances.

2.02 LAYOUT OF THE WORK

- A. Contractor shall employ a State of California licensed surveyor to lay out the entire Work, set grades, lines, levels, control points, vertical and horizontal control, elevations, grids and positions. Before the commencement of Work, surveyor shall, in conjunction with OWNER and CMR provided engineering survey of the Project site, locate all reference points and benchmarks, then lay out all lines, elevations, and measurements for the entire Work including but not limited to, buildings, grading, paving and utilities.
- B. All work under this contract shall be built in accordance with the lines and grades shown on the plans. Field survey for establishing these, and for the control of construction, shall be the responsibility of the Contractor. All such survey work including construction staking shall be done under the supervision of a California Licensed Land Surveyor or authorized Civil Engineer. Staking shall be done on all items ordinarily requiring grade and alignment, at intervals normally accepted by the agencies and trade involved.
- C. The Contractor shall be responsible for any errors in the finished work, and shall notify the Engineer, in writing, within 24 hours, of any discrepancies, or design errors during the construction staking.
- D. Contractor shall immediately remediate any areas found not to meet specification requirements.

2.03 PERMANENT SURVEY MARKERS

- A. Prior to the start of construction, the Contractor's licensed Land Surveyor or qualified Civil Engineer shall, in conformance with Section 8771 of the California State Business and Professions Code, locate all monuments (both of record and not of record), bench marks, and centerline ties within the construction zone, i.e., within one hundred feet of the construction activity. Additional ties to monuments shall be set when ties are missing (min. 4 ties per monument). The Contractor's Surveyor or qualified Civil Engineer shall prepare and submit for review to the City Engineer separate tie sheets and Corner Record sheets (monuments not of record shall have only tie sheets prepared). Corner Records shall conform to the County Engineers' Association of California's "Guide to the Preparation of Records of Survey and Corner Records" document as provided by the County Surveyor's Office. Upon review by the

City Engineer, the Land Surveyor shall file the Corner Records with the County Surveyor's Office. Certified Corner Records shall be filed with the City Engineer of the City that the work is being completed in.

- B. After construction and prior to final acceptance by the Owner of the construction project, the Contractor's land surveyor or qualified Civil Engineer shall re-survey all field monuments and centerline ties within the construction zone, prepare tie sheets and Corner Record sheets as indicated above, and file them with the City Engineer for review. After review by the City Engineer, the Land Surveyor shall file the Corner Records with the County Land Surveyors Office, and file certified copies of the Corner Records with the City Engineer.
- C. All survey monuments removed or altered as a result of construction shall be reset, Corner Records filed with the County Surveyor's Office, and approved final Corner Records filed with the City Engineer. Centerline ties removed as a result of construction shall be reset and tie sheets filed with the City Engineer.
- D. The Land Surveyor shall provide a letter of certification for all monuments having four or more existing ties which are within 0.02 ft plus or minus of the original City tie sheet records. When several monuments and ties appear on one tie sheet and one of the ties has changed the Land Surveyor shall re-measure all of the ties and re-file a new tie sheet with the City as required herein.
- E. County permanent and temporary bench marks within the construction zone shall be located by the surveyor, and the Contractor's Land Surveyor shall send a written notification of impending construction to the County of Orange Surveyor's Office two weeks prior to construction.

2.04 SURVEY REQUIREMENTS

- A. Establish a minimum of two permanent horizontal and vertical control points on the Project site, remote from the building area, referenced to data established by the survey control points.
- B. Indicate the reference points on the project record drawings with the basis of elevation being the established benchmarks
- C. Establish lines, grades, locations and dimensions by instrumentation. From time to time, verify the layout of all Work by the same methods.
- D. Establish lines, grades, locations and dimensions by instrumentation. From time to time, verify the layout of all Work by the same methods.
- E. 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.
- F. Calculate and layout proposed finished elevations and intermediate control as required to provide smooth transitions between the spot elevations indicated in the Contract Documents.
- G. Provide stakes and elevations for grading, fill, and topsoil placement.
- H. 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 AC surfaces at key locations such as BC's, EC's, grade breaks, corners or angle points in sufficient number to demonstrate the Work complies with the intent of the Contract Documents.
- I. Provide horizontal and vertical control for batter boards for drainage, utility, and other on-site structures as required.
 - 1. 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.
 - 2. 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'. Building pad tolerance will be $\pm 0.10'$.

2.05 ESTABLISHMENT OF GRADES IN HARDSCAPE AREAS

- A. All work shall conform to the lines, elevations, and grades shown on the Grading Plans. Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.
- B. Areas having drainage gradients of 2 percent or more shall have elevation stakes, set with instrument, at grid intervals of 25 feet. Intermediate stakes may be set by using a tightly-drawn string line over the tops of adjacent stakes. Grade stakes must be set at all grade breaks, grade changes, etc.
- C. Protect and maintain stakes in place until their removal is approved by the Owner. Grade or location stakes lost or disturbed by Contractor, shall be reset by the Surveyor at the expense of Contractor.

2.06 STORM DRAIN & SANITARY SEWER PIPE INSTALLATION

- A. All storm drain pipelines, sanitary sewer pipelines, trench drains, catch basins, cleanouts and drain inlets shall be staked by a licensed surveyor if slope of grade is less than 2% and a complete set of cut sheets shall be supplied to the inspector. All construction staking shall be installed and verified for grade and alignment prior to the start of construction.

2.07 RECORD DRAWINGS

- A. Upon Substantial Completion, CONTRACTOR shall obtain and pay for reproducible transparencies of the as built survey drawings. Deliver to ARCHITECT, final "record" drawings of the original drawings and completed within specified tolerances.
- B. Record drawings shall indicate locations by coordinate of 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 manholes
- C. Completed record drawing transparencies shall be signed and certified as correct and within specified tolerances by the licensed surveyor.
- D. Attention is called to other sections of the Contract Documents requiring verification or measurements of installed Work by survey. Surveyor shall perform and certify all such surveys or verification are completed in accordance with the Contract Documents.

END OF SECTION

SECTION 01 73 29
CUTTING AND PATCHING REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements and procedural requirements for cutting and patching, including:
 - 1. Cutting and patching existing construction altered or disturbed to accommodate new modifications.
 - 2. Cutting and patching existing construction damaged or defaced during new construction as required to restore to existing or better condition at the time of award of Contract.
 - 3. Cutting and patching required to:
 - a. Install or correct non-coordinated Work.
 - b. Remove and replace defective and non-conforming Work.

1.02 RELATED REQUIREMENTS

- A. Section 02 41 00 - Selective Demolition: Removal of existing site elements and construction.

1.03 SUBMITTALS

- A. Written Request for Cutting and Alterations
 - 1. Submit written request in advance of cutting or alteration which affects:
 - a. Structural integrity of any element of new or existing construction.
 - b. Integrity of weather-exposed or moisture-resistant elements.
 - c. Efficiency, maintenance, or safety of operational elements.
 - d. Visual qualities of elements exposed to view in the completed construction.
 - e. Existing construction not otherwise indicated to be revised by Work under the Contract.
 - 2. Include in requests for cutting and alteration:
 - a. Location and description of affected Work. Include shop drawings as necessary to identify locations and communicate descriptions.
 - b. Explanation of necessity for cutting and patching.
 - c. Description of proposed Work and products to be used.
 - d. Alternatives to cutting and patching.
 - e. Effect on existing construction.
 - f. Effect on the work performed by other trades.
 - 3. Provide written evidence that trades performing other work have been notified and acknowledge that cutting and patching work will be occurring.
 - 4. Indicate date and time cutting and patching Work will be performed, including duration.
 - 5. Describe the extent of cutting and patching required and how it is to be performed.
 - 6. 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 and other significant visual elements.
 - 7. List products to be used and firms or entities that will perform work.
 - 8. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
 - 9. Where cutting and patching involves addition of reinforcement to structural elements, submit details to show how reinforcement is integrated with the original structure.
 - 10. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.
 - 11. Minimize effects on user operations and on concurrent operations construction by other trades.

1.04 QUALITY ASSURANCE

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

1. Obtain approval from the Architect of the cutting and patching proposal before cutting and patching the following structural elements:
 - a. Bearing and retaining walls Structural concrete Structural steel
 - b. Lintels
 - c. Timber and primary wood framing Structural decking
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety-related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
 1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety-related systems:
 - a. Primary operational systems and equipment Air or smoke barriers
 - b. Water, moisture, or vapor barriers Membranes and flashings
 - c. Fire protection systems
 - d. Noise and vibration control elements and systems Control systems
 - e. Communication systems Electrical wiring systems
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.01 PATCHING MATERIALS

- A. Patching Materials, General: As required for original installation and to match surrounding construction.
 1. Provide same products or types of construction as that in existing structure, as needed to patch, extend or match existing.
 2. Generally the Contract Documents will not define products or standards of workmanship present in existing construction; Contractor shall determine products by inspection and necessary testing, and determine quality of workmanship by using existing as a sample for comparison.
 3. The presence of a product, finish, or type of construction requires that patching, extending or matching shall be performed as necessary to make work complete and consistent with identical standards of quality.
- B. Patching at Paving: At Portland cement concrete (PCC) paving, use concrete mix with maximum 3/8-inch aggregate and minimum 3000 psi 28-day compressive strength. Contractor shall provide dowels to existing paving with min. 6" penetration into existing surface and reinforce new paving with minimum No. 3 reinforcing steel bars at 16-inches on center each way placed in the vertical center of the slab. Welded wire fabric reinforcement will not be acceptable.
 1. All PCC paving shall be cut and patched from score line to score line and shall match as closely as possible in color and texture of the adjacent finish.
- C. Patching of Lawns and Grasses:
 1. Restore areas trenched, disturbed or damaged. Provide sod or seeded planting mix, to match existing lawn or grass area.
 2. Properly barricade the area until such time as the planting mix establishes.
- D. Patching of Building Finish Materials: Contractor shall
 1. Match existing products and finishes.
 2. Confirm colors, patterns and textures with Architect.
 3. Custom cut new materials to fit and to match joint patterns with existing materials.
- E. Product Substitutions: For each proposed change in materials, submit request for Architects approval.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.
- B. Before proceeding, meet at the site with parties involved in cutting and patching. Review areas of potential interference and conflict, coordinate procedures, and resolve potential conflicts before proceeding.
- C. Beginning of cutting or patching shall be interpreted to mean that existing conditions were found by Contractor to be acceptable.
- D. After uncovering existing Work, inspect conditions affecting proper accomplishment of Work.

3.02 PREPARATION

- A. Temporary Supports: provide supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project 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. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.
- E. Weather Protection: Provide protection from elements for areas which may be exposed by uncovering Work. Maintain excavations free of water.

3.03 CUTTING AND PATCHING

- A. General:
 - 1. Execute cutting, fitting, and patching, excavation and fill, as necessary to complete the Work.
 - 2. employ skilled workers to perform cutting and patching.
 - 3. Coordinate installation or application of products for integrated Work. Avoid having to cut and patch new substrates and finishes.
 - 4. Uncover completed Work as necessary to install or apply products out of sequence.
 - 5. Cut, remove and replace defective and non-conforming Work.
 - 6. Cut and patch as necessary to provide openings in the Work for penetration of plumbing, fire protection, HVAC and electrical Work.
 - 7. Where partitions are removed, patch floors, walls, and ceilings with finish materials to match existing.
 - 8. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting. Update as-built set with photographs or notations for the actual conditions.
- B. Cutting:
 - 1. Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations. Provide appropriate surfaces to receive final finishing. It is recommended to photograph the existing condition prior to cutting. This photo record shall serve as the pre-cut condition for comparison to the final patched outcome.
 - 2. Execute cutting and patching of weather-exposed, moisture-resistant elements and surfaces exposed to view by methods to preserve weather, moisture and visual integrity.

3. Cut rigid materials using carbide tip saw blades, diamond grit abrasive saw blades, diamond core drills and hole saws, and similar cutters for smooth edges. Do not overcut corners.
 - a. Core drill holes through concrete and masonry.
 4. Provide fire and smoke seals at new penetrations to maintain fire rating at all penetrations.
- C. Patching:
1. Provide durable seams that are as invisible as possible.
 2. Comply with specified tolerances.
 3. Restore substrates and finishes with products to match existing construction.
 4. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 5. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 6. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.
 7. Patch, repair or re-hang existing ceilings as necessary to provide an even plane surface of uniform appearance.
 8. Finish surfaces flush and textured to match surrounding finishes.
 9. Fit work neat and tight allowing for expansion and contraction.
 10. Butt new finished to existing exposed structure, pipes, ducts, conduit, and other penetrations through surfaces.
- D. Finishing: Refinish surfaces to match adjacent and similar finishes as used for the Project.
1. For continuous surfaces, Contractor shall refinish to nearest intersection or natural break.
 2. For an assembly, Contractor shall refinish entire unit.
- E. Restoration and Finishing: Finish surfaces to match adjacent and similar finishes as used for the Project.
1. Patch and replace any portion of an existing finished surface which is found to be damaged, lifted, discolored, or shows other imperfections, with matching material.
 2. Provide adequate support of substrate prior to patching the finish.
 3. Refinish patched portions of painted or coated surfaces in a manner to produce uniform color and texture over the entire surface.
 4. When existing surface finish cannot be matched, refinish entire surface to nearest intersections.
- F. Transition from Existing to New Construction:
1. When new work abuts or finishes flush with existing work, make a smooth and clean transition. Patched work shall match existing adjacent work in texture and appearance so that the patch or transition is invisible at a distance of five feet.
 2. When finished surfaces are cut in such a way that a smooth and clean transition with the new work is not possible, notify Architect. Terminate existing surface in a neat manner along a straight line at a natural line of division, and provide trim appropriate to finished surface, or as otherwise directed by Architect.
- G. Plaster Installation: Comply with manufacturer's instructions and install thickness and coats as indicated.

3.04 CLEANING

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access to work.
- B. Remove completely paint splatter, mortar, oils, putty and items of similar nature.

- C. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied.

END OF SECTION

**SECTION 02 41 00
SELECTIVE DEMOLITION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of site elements.
- B. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 22 05 14 - Selective Plumbing Demolition
- B. Section 23 05 14 - Selective HVAC Demolition
- C. Section 31 10 00 - Site Clearing

1.03 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

PART 3 EXECUTION

2.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Provide, erect, and maintain temporary barriers and security devices.
 - 5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 7. Do not close or obstruct roadways or sidewalks without permit.
 - 8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
 - 1. Stop work immediately if adjacent structures appear to be in danger.
- D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- F. Perform demolition in a manner that maximizes salvage and recycling of materials.

2.02 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

2.03 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction, utility arrangements, and items located on walls or ceilings are as shown.
 - a. Report discrepancies to Architect before disturbing existing conditions.
 - 2. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
- C. Remove existing work as indicated and as required to accomplish new work.
- D. Services (Including but not limited to HVAC, Plumbing, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- E. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.
 - 5. Work indicated to remain but which requires removal to complete the work shall be carefully removed and replaced upon completion. The replaced work shall match, as a minimum, its condition at the start of the work.

2.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site.
- C. Leave site in clean condition, ready for subsequent work.

END OF SECTION

**SECTION 03 30 00
CAST-IN-PLACE CONCRETE**

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture, by a recognized, approved testing laboratory.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete"
 - 2. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials"
 - 3. ACI 318 - 11, "Building Code Requirements for Structural Concrete"

PART 2 PRODUCTS

2.01 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) or ASTM A 706 where welded rebar occurs, deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.03 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type V, gray
- B. Normal-Weight Aggregates: ASTM C 33, graded.
 - 1. Maximum Coarse-Aggregate Size: 1 inch
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.04 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those

permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.05 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

2.06 VAPOR BARRIERS

- A. Sheet Vapor Barrier: As required by existing field conditions.

2.07 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

2.08 RELATED MATERIALS

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

2.09 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 and ACI 318, Ch. 5.
- B. Cementitious Materials: Fly ash requirements with CBC 1903A.6. Fly ash or other pozzolan can be used as a partial substitute for ASTM C 150 portland cement as follows:
 1. Fly ash or other pozzolan shall conform to ASTM C 618 for Class N or Class F materials (Class C is not permitted)
 2. More than 15 percent by weight of fly ash or other pozzolans shall be permitted to be substituted for ASTM C 150 portland cement if the mix design is proportioned per ACI 318 Section 26.4.3. See section 1904A for durability requirements.
 3. More than 40 percent by weight of ground-granulated blast-furnace slag conforming to ASTM C 989 shall be permitted to be substituted for ASTM C 150 portland cement if the mix design is proportioned per ACI 318 Section 26.4.3. See section 1904A for durability requirements.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
- D. Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: 4500 psi (31 MPa) at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit:
 - a. Footings, Slabs on Grade, and mass concrete: 3" plus or minus 1 inch
 - b. For other concrete: 4" plus or minus 1 inch.
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.10 FABRICATING REINFORCEMENT

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

2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer where indicated at exterior corners and edges of permanently exposed concrete.

3.02 EMBEDDED ITEMS

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

3.03 VAPOR BARRIERS

- A. Sheet Vapor Barriers: Protect, and repair sheet vapor barrier according to ASTM E 1643 and manufacturer's written instructions.

3.04 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.05 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to one-fourth of concrete thickness as follows:
 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

- E. Waterstops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

3.06 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
- C. Cold-Weather Placement: Comply with ACI 306.1.
- D. Hot-Weather Placement: Comply with ACI 305R.

3.07 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Float Finish: Apply to surfaces indicated to receive trowel finish and are to be covered with fluid-applied or sheet waterproofing.
- C. Trowel Finish Slab on Grade: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Trowel Finish: Apply to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
- D. Trowel and Fine-Broom Finish Flatwork: Apply a first trowel finish to surfaces, while concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete steps, ramps, and elsewhere as indicated.
- F. Sand Blast Finish: Light and medium where indicated.

3.08 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less

than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.09 CONCRETE SURFACE REPAIRS

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

3.10 FIELD QUALITY CONTROL

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

END OF SECTION

**SECTION 03 35 00
CONCRETE SEALER**

PART 1 GENERAL

1.01 SUMMARY

- A. Product used to densify, seal and dust-proof horizontal interior/exterior concrete surfaces.

1.02 RELATED SECTIONS

- A. Section 03 30 00 - Cast-in-Place concrete

1.03 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Submit manufacturer's data sheets and safety data sheets (SDS) on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Samples: Submit samples of specified traffic deck system. Samples shall be construed as examples of finished color and texture of the system only.
 - 5. Warranty: Submit copy of manufacturer's standard warranty.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.
- B. Applicator Qualifications: Minimum 2 year experience installing similar products.
- C. Field Sample:
 - 1. Install a sizeable field sample at the discretion of the Engineer of Record.
 - 2. Apply material in accordance with manufacturer's written application instructions.
 - 3. Field sample will be standard for judging color and texture on remainder of project.
 - 4. Maintain field sample during construction for workmanship comparison.
 - 5. Do not alter, move, or destroy field sample until work is completed and approved by owner's representative.
- D. Requirement of Regulatory Agencies: comply with applicable codes, regulations, ordinances and laws regarding use and application of coating systems.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver: Materials shall be delivered in original sealed containers, clearly marked with supplier's name, brand name, type of material and legible lot number.
- B. Storage and Handling: Recommended material storage temperature is 75°F (23°C). Handle products to prevent damage to container. All materials shall be stored in compliance with fire and safety requirements. Do not store at high temperatures or in direct sunlight.

1.06 PROJECT CONDITIONS

- A. Prior to starting work, read and follow the Safety Data Sheet (SDS) and container labels for detailed health and safety information.
- B. Do not proceed with application of material when surface temperature is less than 40°F, if precipitation is imminent, or when a damp, unclean or frosty surface. Ambient temperature should be a minimum 40°F and rising, and more than 5° above dew point. Special precautions are to be taken when ambient and/or surface temperature are approaching, at, or above 100°F and it may be necessary to limit material application to evening hours for exterior exposed decks.
- C. Coordinate waterproofing work with other trades. Applicator shall have sole right of access to the specified area for the time needed to complete the application and allow the vehicular traffic coatings to cure adequately.

- D. Protect plants, vegetation or other surfaces not to be coated against damage or soiling.
- E. Keep products away from spark or flame. Do not allow the use of a spark producing equipment during application and until all vapors have dissipated. Post "No Smoking" signs.
- F. Maintain work area in a neat and orderly condition, removing empty containers, rags and rubbish daily from the site.

1.07 WARRANTY

- A. Provide manufacturer's standard warranty for institutional projects.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bases of Design Manufacturer: MAPEI Americas, 1144 E. Newport Center Dr., Deerfield Beach, FL 33442, Tel. 888-365-0614, Email: mpineda@mapei.com
- B. Requests for substitutions will be considered in accordance with 01 63 00 - Product Substitution Procedures.

2.02 MATERIALS

- A. Concrete Densifier and Sealer
 - 1. MAPECRETE HARD LI

2.03 MATERIAL PERFORMANCE CRITERIA

- A. Product Characteristics:
 - 1. Water-based, VOC-free, lithium-silicate solution
 - 2. Solids content: 16%
 - 3. Consistency: Clear, thin liquid
 - 4. VOC's (Rule of California's SCAQMD): 0 g per L
 - 5. pH: 12.3

PART 3 EXECUTION

3.01 EXAMINATION

- A. New, cured of at least 7 days old and existing concrete surfaces.

3.02 PREPARATION

- A. For new concrete:
 - 1. After final troweling, moisture-cure or sheet-membrane-cure in accordance with ASTM C171, or use a clear, non-residual curing compound in accordance with ASTM C309. Cure for 7 days or longer for best results.
 - 2. Concrete surface must be free of loose particles, efflorescence, paints, tars, grease, asphaltic materials, bond breakers, curing compounds, wax and any other contaminants before application.
 - 3. Allow the concrete to air-dry at least 24 hours after cleaning.

3.03 MIXING

- A. Comply with manufacturer's instructions for mixing procedures.

3.04 APPLICATION

- A. Additional coats may be applied if the concrete surface is very absorptive.
- B. Remove all excess material. Do not allow excess to dry on the surface.
- C. Any areas showing patches of white on the floor should be immediately flooded with hot water and scrubbed.

END OF SECTION

**SECTION 05 40 00
COLD-FORM METAL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed steel stud interior wall framing.
- B. Exterior wall sheathing.
- C. Water-resistive barrier over sheathing.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Sealants and Caulking.
- B. Section 09 21 16 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

- A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2007 with 2010 supplement. (replaced SG-971)
- B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2013.
- C. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2013.
- D. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022)
- F. AWS D1.3 - Structural Welding Code - Sheet Steel; 2018

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS

- A. See Section 01 33 00- Submittal Procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, and limitations.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing:
 - 1. Clarkwestern Dietrich Building Systems LLC; www.clarkdietrich.com. <<http://www.clarkdietrich.com/>>
 - 2. Marino; www.marinoware.com. <<http://www.marinoware.com/>>
 - 3. The Steel Network, Inc; www.SteelNetwork.com. <<http://www.SteelNetwork.com/>>
- B. Framing Connectors and Accessories:
 - 1. Same manufacturer as metal framing, or as indicated on drawings.

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.03 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
 - 1. Gage and depth: As indicated on the drawings.
 - 2. Galvanized in accordance with ASTM A653/A653M G90/Z275 coating.
 - 3. Provide components fabricated from ASTM A1008/A1008M, Designation SS steel.

2.04 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness as indicated on drawings; finish to match framing components.
- B. Plates, Gussets, Clips: Formed Sheet Steel, thickness as indicated on drawings; finish to match framing components.
- C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.05 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
 - 1. Products:
 - a. ITW Commercial Construction North America; ITW CCNA-Buildex Teks Select Series; www.ITWBuildex.com. <<http://www.ITWBuildex.com/>>
- B. Anchorage Devices: Powder actuated, Drilled expansion bolts, and threaded concrete anchors.
- C. Welding: In conformance with AWS D1.1 and AWS D1.3.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces and building framing components are ready to receive work.
- B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.
- B. Install load bearing studs full length in one piece. Splicing of studs is not permitted, unless otherwise indicated.
- C. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- D. Install intermediate studs above and below openings to align with wall stud spacing.
- E. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
- F. Attach track backing to studs for attachment of fixtures anchored to walls.
- G. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- H. Touch-up field welds and damaged galvanized surfaces with primer.

3.03 WALL SHEATHING

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
 - 1. Use plywood or other acceptable structural panels at building corners, for not less than 96 inches, measured horizontally.

2. Provide steel diagonal bracing at corners.
3. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

3.04 TOLERANCES

- A. Maximum Variation from True Position: 1/4" inch.
- B. Maximum Variation of any Member from Plane: 1/4" inch.

END OF SECTION

**SECTION 05 52 13
PIPE AND TUBE RAILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ramp handrails.
- B. Stair railings and guardrails.
- C. Landing guardrails.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete:

1.03 REFERENCE STANDARDS

- A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.
- D. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
 - 1. Handrails for stairs and ramps shall be 1 ¼" to 1 ½" diameter (1 ½" nominal) and mounted 1 ½" clear from side walls. Comply with CBC Sections 11B.505.5, 505.6, 505.7 and 505.8.
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated.
- G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A 53/A 53M Grade B Schedule 40, galvanized finish.

- C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- D. Exposed Fasteners: No exposed bolts or screws.
- E. Galvanizing: In accordance with requirements of ASTM A123/A123M.
 - 1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type II - Organic.

2.03 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured.
- D. Welded Joints:
 - 1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 - 2. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Supply items required to be cast into concrete with setting templates, for installation as work of other sections.

3.03 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- B. Anchor railings securely to structure as indicated on shop drawings..
- C. All welded joints and surfaces shall be ground smooth, no sharp or abrasive corners, edges or surfaces. Wall surfaces adjacent to handrail shall be smooth. CBC Sections 11B-505.6 and 11B-505.8
- D. Conceal anchor bolts and screws whenever possible.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

**SECTION 06 10 00
ROUGH CARPENTRY**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Framing with dimension lumber.
 - 2. Shear wall panels.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Wood blocking, cants, and nailers.
 - 5. Wood furring.
 - 6. Wood sleepers.
 - 7. Plywood backing panels.

1.02 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent or less, unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an approved inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: As indicated on drawings.
- B. Framing Other Than Non-Load-Bearing Interior Partitions: As indicated on drawings.
- C. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
 - 1. Application: Exposed exterior and interior framing.
 - 2. Species and Grade: As indicated above for load-bearing construction of same type.

2.04 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
- B. For items of dimension lumber size, provide No. 1 and Better grade lumber of any species.

2.05 WOOD PANEL PRODUCTS

- A. Plywood: DOC PS 1.

2.06 WALL SHEATHING

- A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing.

2.07 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing.

2.08 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.
 - 1. Plywood 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."

2.09 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M, or stainless steel fasteners.
- B. Power-Driven Fasteners: ICC ESR-1482.
- C. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.10 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Simpson Strong-Tie Co., Inc.
- C. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Product values are to be published in an ICC ESR Report.
- D. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
 - 1. Use for interior locations unless otherwise indicated.

2.11 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with 2022 CBC Chapter 23 and AF&PA's WCD 1, "Details for Conventional Wood Frame Construction,"
- C. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole unless noted otherwise on drawings.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.
- H. Install joists, beams and rafters with crown up, unless directed otherwise by manufacturer.

3.02 PANEL INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated.
- D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements. Provide 1/8" gap between abutting panels.

3.03 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated on plans:

3.04 PROTECTION

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

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated Compact Plastic Laminated and High Pressure Plastic Laminated millwork units.
- B. Hardware.

1.02 REFERENCE STANDARDS

- A. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- B. BHMA A156.9 - Cabinet Hardware; 2020.
- C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- D. UL (DIR) - Online Certifications Directory; Current Edition.
- E. WI (CCP) - Certified Compliance Program (CCP); Current Edition.
- F. WI (CSIP) - Certified Seismic Installation Program (CSIP); Current Edition.
- G. WI (MCP) - Monitored Compliance Program (MCP); Current Edition.

1.03 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1 inch to 1 foot, minimum.
 - 2. Provide the information required by Woodwork Institute (WI).
 - 3. Include certification program label.
- C. Product Data: Provide data for hardware accessories.
- D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
 - 2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
 - 3. Single Source Responsibility: Provide and install this work from single fabricator.
- B. Quality Certification:
 - 1. Comply with WI (CCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section:
<https://woodworkinstitute.com>.
 - 2. Provide labels or certificates indicating that the installed work complies with WI requirements for grade or grades specified.
 - 3. Provide designated labels on shop drawings as required by certification program.WI
 - 4. Provide designated labels on installed products as required by certification program.
 - 5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
 - 6. Replace, repair, or rework all work for which certification is refused.

1.05 ACCESSIBLE CASEWORK

- A. Operable parts for all accessible casework shall comply with CBC Section 11B-309 for clear floor space, height, and operation requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.
- B. Buildings should be climatized (HVAC working) before installation of casework.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Grade: Unless otherwise indicated provide products of quality specified by WI Architectural Woodwork Standards for Custom Grade or better.
- B. Cabinets:
 - 1. Finish - Exposed Exterior Surfaces: High Pressure Plastic Laminate (HPPL) as scheduled on drawings.
 - 2. Finish - Exposed Interior Surfaces: HPPL as scheduled on drawings.
 - 3. Finish - Interior Concealed Surfaces: Melamine.
 - 4. Door Front Edge Profiles: 1mm edge band.
 - 5. Door Front Retention Profiles: Fixed panel.
 - 6. Casework Construction Type: Type A - Frameless.
 - 7. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay.
 - 8. Adjustable Shelf Loading: 40 psf.
 - a. Deflection: L/144.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.
- B. Use minimum 3/4" plywood for cabinet construction, including shelving cores.
- C. Drawer bottoms to be 1/4" plywood with white melamine finish.

2.03 LAMINATE MATERIALS

- A. Manufacturers:
 - 1. As listed on drawing Finish Schedule
 - 2. Substitutions: see Section 01 63 00 - Product Substitution Requirements.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3.
- C. Provide specific types As indicated on drawings.

2.04 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Fasteners: Size and type to suit application.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- D. Concealed Joint Fasteners: Threaded steel.

2.05 HARDWARE

- A. Hardware: BHMA A156.9, types as scheduled or, if not indicated, provide per WI standards for Custom Grade.
- B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, satin chrome finish, for nominal 1 inch spacing adjustments.
- C. and Door Pulls: "U" shaped wire pull as scheduled on drawings.

1. Provide U shaped wire pulls or equally accessible pull hardware at all accessible casework. CBC Section 1125B.4.
- D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
 1. All casework shall lock, Each room shall be keyed alike with one master key for all casework.
- E. Hinges: Heavy Duty 5-knuckle institutional type, mill ground with hospital tips, 270 degree. Rockford Process RPS 376 <http://www.rockfordprocess.com/> or equal

2.06 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline with manufacturers color match caulking at butt joints; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
 1. Cap exposed plastic laminate finish edges with material of same finish and pattern.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floor and wall per drawings.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, shelves, hardware, fittings, and fixtures.

END OF SECTION

**SECTION 07 92 00
JOINT SEALANTS AND CAULKING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants, joint backing and preparation of substrate surfaces.
- B. Section is inclusive; see plans for location of specific sealant conditions.

1.02 REFERENCES

- A. ASTM C790 - Use of Latex Sealing Compounds.
- B. ASTM C804 - Use of Solvent-Release Type Sealants.
- C. ASTM C834 - Latex Sealing Compounds.
- D. ASTM C919 - Use of Sealants in Acoustical Applications.
- E. ASTM C920 - Elastomeric Joint Sealants.
- F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- G. ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).
- H. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.
- I. 2022 California Green Building Standards Code

1.03 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations and color availability.
- C. Samples: Submit six samples, 2 x 2 inch in size illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with SWRI requirements for materials and installation.
- B. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- C. Perform acoustical sealant application in accordance with ASTM C919.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum five years documented experience.

1.06 ENVIRONMENTAL REQUIREMENTS (SECTION 5.504.4.1)

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.
- B. Adhesives, adhesive bonding primers, sealants, sealant primers and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 yoe limits, as shown in Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene, and trichloroethylene), except for aerosol products as specified in Subsection C.

- C. Aerosol adhesives and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

Table 5.504.4.1 - Adhesive VOE Limit

Table 5.504.4.2 - Sealant VOE Limit

1.07 COORDINATION

- A. Coordinate work under provisions of Section 01039.
- B. Coordinate the work with all sections referencing this section.

1.08 WARRANTY

- A. Warranty: Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 GENERAL

- A. Staining of adjacent surfaces by sealant, calking, or accessory products is cause for rejection of material submitted or installed, and shall result in repair or replacement by Contractor at no additional cost to Owner.
- B. Sealant materials shall resist deterioration due to ultra-violet radiation, and shall be colorfast.

2.02 SEALANTS

- A. Acrylic Latex (Type A): ASTM C834; permanently flexible, waterproof, single-component, odorless, non-bleeding, non-sagging; Product: Bostik Chem-Calk 600.
- B. Silicone Sanitary (Type B): ASTM C920; Federal Specification TT-S-001543A, Class A; mildew-resistant, single-component, acetox; Products: Polymeric Systems PSI-611, GE Silicones Sanitary 1700.
- C. Two-Part Polyurethane (Type C): ASTM C920, Type M, Grade NS, Class 25; Federal Specification TT-S-00227E, Type 11, Class A; two-component, non-sagging; Product\$: Polymeric Systems Flexiprene 2000, Sikaflex 2C/NS by Sika.
- D. One-Part Polyurethane (Type D): ASTM C920, Type S, Grade NS, Class 25; Federal Specification TT-S-00230C, Type II, Class A; single-component; Products: Polymeric Systems Flexiprene 1000, Bostik Chem-Calk 900.
- E. Self-Leveling Polyurethane (Type E): ASTM C920, Type M, Grade P, Class 25; Federal Specification TT-S-00227E, Type I, Class A; two-component, self-leveling, traffic grade, ; Products: Polymeric Systems PSI-551/RC-2, Bostik Chem-Calk 550.
- F. Latex Acoustic (Type F): Highly elastic, water-based calking compound; Product: USG Acoustical Sealant by United States Gypsum.
- G. Colors:
 - 1. Type A: White, black, or gray, as selected by Architect.
 - 2. Types B and F: White.
 - 3. Types C and D: White, off-white, black, gray, tan, or bronze, as selected by Architect.
 - 4. Type E: White, black, gray, or tan, as selected by Architect.

2.03 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1565, round section, open cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces and joint openings are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials, dirt, dust, mortar, oil, and all other foreign matter that might impair adhesion of sealant. Where necessary remove grease with a solvent or degreasing agent approved for use with sealant materials.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with ASTM C804 for solvent release and ASTM C790 for latex base sealants.
- D. Perform preparation in accordance with manufacturer's instructions.
- E. Protect elements surrounding the work of this section from damage or disfiguration. Provide masking tape or equivalent protection to prevent sealants from contacting surfaces to remain exposed in finished work.
- F. Etch concrete or masonry surfaces to remove excess alkalinity, unless 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, and rinse thoroughly with water before starting installation.
- G. Allow surfaces to dry thoroughly before starting application of sealants.

3.03 INSTALLATION

- A. Perform installation in accordance with ASTM C804 for solvent release and ASTM C790 for latex base sealants.
- B. Install sealant in accordance with manufacturer's instructions.
- C. Measure joint dimensions and size materials to achieve 2:1 width/depth ratios.
- D. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
- E. Sealant depth at building joints shall not exceed 1/2 inch, except where specifically indicated on drawings.
- F. Joints at concrete walks, paving, slabs, and similar conditions shall be filled to a depth equal to 75 percent of the joint width, but not more than 3/4 inch deep, or less than 3/8 inch deep. Joints shall be slightly convex to permit a flush condition when sealant is compressed with light pressure.
- G. Install bond breaker where joint backing is not used. Bond breaker or joint backing shall be installed to prevent sealant from bonding to back of joint.
- H. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- I. Apply sealant within recommended application temperature ranges. Refer to manufacturer's recommendations when sealant cannot be applied within these temperature ranges.
- J. Tool joints concave, except where indicated otherwise.
- K. Seal around all openings in exterior walls and in other locations indicated or required for complete weatherproofing and waterproofing of building.
- L. Match sealant type to substrate material in accordance with sealant and substrate material manufacturer's recommendations.
- M. Concrete, masonry, similar porous surfaces, and any other surface recommended by the manufacturer, shall be primed before applying sealant. Primer shall be applied as required to reach all parts of joint to be filled with sealant.

- N. Do not use sealants when they become too jellied to be discharged in a continuous flow from gun. Modification of sealants by addition of liquids, solvents, or powders will not be permitted.
- O. Apply sealants with guns having proper size nozzles. Sufficient pressure shall be used to fill all voids and joints solid. In sealing around openings, include entire perimeter of each opening, unless indicated or specified otherwise. Where the use of the gun is impracticable, suitable hand tools shall be used.
- P. Sealed joints shall be neatly pointed on flush surfaces with beading tool, and internal corners with eaving 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 applied.
- Q. Sealants applied around exterior window and door frames, or other equivalent joints exposed on the exterior of the building, shall be painted to match the adjacent finish material. Refer to Section 09 90 00 for painting.
- R. Install sealants at the exterior of the building after sandblasting and exterior painting preparation is complete.

3.04 MISCELLANEOUS SEALING AND CAULKING WORK

- A. The entire extent of sealing work is not necessarily fully or individually described herein. Sealing shall be provided wherever required to prevent light leakage as well as moisture leakage. Refer to drawings for conditions and related parts of the work.

3.05 CLEANING

- A. Clean work under provisions of 01 70 00.
- B. Clean adjacent soiled surfaces.
- C. Remove excess materials from other finished surfaces as soon as sealing or calking in area is completed. Thin films of cured compound shall be removed with stripping compound known to be harmless to surfaces in contact with excess sealant. No abrasives shall be used.

3.06 PROTECTION OF FINISHED WORK

- A. Protect finished installation under provisions of Section 01 50 00.
- B. Protect sealants until cured.
- C. Damaged sealants shall be repaired or replaced as recommended by manufacturer, at no additional cost to Owner.

3.07 SCHEDULE

- A. Type A Sealant: Use at interior locations only, to decoratively seal abutting materials not otherwise described in this schedule.
- B. Type B Sealant: Use at interior locations only, where plumbing fixtures and escutcheon plates abut finish materials.
- C. Type C Sealant: Use at vertical joints in concrete or masonry at the exterior of the building.
- D. Type D Sealant: Use at perimeter of openings in exterior walls, including under thresholds, and all other exterior locations not specifically described in this schedule.
- E. Type E Sealant: Use at areas subject to foot or vehicular traffic.
- F. Type F Sealant: Use between floor and bottom plate at sound or fire rated walls; refer to drawings and sound or fire rated assembly descriptions.

END OF SECTION

**SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Thermally insulated hollow metal doors with frames.
- C. Accessories, including louvers, matching panels, and Infill Panels.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware.
- B. Section 09 96 00 - High-Performance Coatings

1.03 ABBREVIATIONS AND ACRONYMS

- A. HMMA: Hollow Metal Manufacturers Association.
- B. NAAMM: National Association of Architectural Metal Manufacturers.
- C. SDI: Steel Door Institute.

1.04 REFERENCE STANDARDS

- A. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2018.
- B. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2020.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
- H. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2016.
- I. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- J. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2017.
- K. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- L. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- M. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2019.

1.05 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: <https://steeldoor.org/sdi-certified/#sle>.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- C. Coordination:
 - 1. Verify that substrate conditions are as detailed in the drawings, and are acceptable for product installation in accordance with the manufacturer's instructions.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
 - a. Exterior: Ceco Trio-E Series
 - b. Interior: Ceco Legion Series
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
 - a. Exterior: Curries 777-E Series
 - b. Interior: Curries 707 Series
 - 3. Steelcraft: www.steelcraft.com.
 - 4. Substitutions: See Section 01 63 00 - Product Substitution Procedures..

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 3. Door Edge Profile: Manufacturers standard for application indicated.
 - 4. Typical Door Face Sheets: Flush.
 - 5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - 6. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvanized) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvanized) for corrosive locations.
- B. Metal Infill Panels: Same construction, performance, and finish as doors.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
 - 1. Coordinate compatibility of factory primer with field finished paint requirements.

- B. Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model: Full Flush.
 - d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
 - e. Zinc-iron Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
 - 2. Door Core Material: 22 Gauge steel stiffeners spaced every 6" apart with injected polyurethane foam.
 - 3. Door Thickness: 1-3/4 inches, nominal.
- C. Interior Doors, Non-Fire-Rated:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model: Full Flush.
 - d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
 - e. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
 - 2. Door Thickness: 1-3/4 inches, nominal.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvanized) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 - 2. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.
 - 3. Weatherstripping: Integral, recessed into frame edge.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Terminated Stops: Provide at interior doors; closed end stop terminated 4 inch, maximum, above floor at 45 degree angle.
 - 2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10.

2.06 ACCESSORIES

- A. Louvers: For flush mounting in hollow metal door transom frame
 - 1. Style: Inverted "Y" Blade.
 - 2. Louver Free Area: 50 percent.
 - 3. Blades and Frame: 18 gauge minimum and zinc-plated for corrosion resistance.
 - 4. Size: As scheduled on drawings.
 - 5. Finish: Factory primed and field finished to match door.
 - 6. Insect Screen: 18 x14 fiberglass mesh insect screen installed to the inside between the two louvers.
 - 7. Manufacturers:
 - a. Trademark Hardware; 800core: tmhardware.com.
 - b. Activar; 700TL: activarcpg.com.
 - c. Or Approved Equal.
- B. In-fill Panels:
 - 1. Construct from 0.032 in. (0.8 mm) minimum thick steel, of the same type specified for the frame product, laminated to each face of 1/2" cement board backing.

- C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- D. Astragals for Double Doors: Specified in Section 08 7100.
- E. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- F. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Install door hardware as specified in Section 08 71 00.
- D. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08 41 13
CENTER GLAZED ALUMINUM MULLIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Aluminum-Framed Center Glazed
 - a. Arcadia, Inc., A400 Series, 1 $\frac{3}{4}$ " x 4" Non-Thermal; center glazed, screw spline, shear block, compensating stick or punched opening fabrication for $\frac{1}{4}$ " glass.

1.02 REFERENCES

- A. American Architectural Manufacturers Association (AAMA)
- B. American Society for Testing and Materials (ASTM)
- C. Aluminum Association (AA)

1.03 SYSTEM DESCRIPTION

- A. General: In addition to requirements shown or specified, comply with:
 - 1. Applicable provisions of AAMA Aluminum Storefront and Entrance Manual for design, materials, fabrication and installation of component parts.
- B. Design Requirements: Arcadia A400 Series is a framing system suitable for outside or inside glazing.
- C. Performance Requirements:
 - 1. System shall not deflect more than 1/8" at the center point, or 1/16" at the center point of a horizontal member, once deadload points have been established.
 - 2. Seismic testing shall conform to AAMA recommended static test method for evaluating performance of curtain walls and storefront wall systems due to horizontal displacements associated with seismic movements and building sway.

1.04 WARRANTY

- A. System shall be warranted against failure and/or deterioration of metals due to manufacturing process for a period of two (2) years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturers:
 - 1. Arcadia, Inc., 2301 East Vernon, Vernon, CA. Telephone 323/269-7300, Fax 323/269-7390.
 - 2. a. Product:
- B. Acceptable Products: A400 Series
 - 1. Arcadia, Inc., A400 Series.
- C. Substitutions: Under provisions of Section 01 63 00 Product Substitution Procedures.

2.02 FRAMING MATERIALS AND ACCESSORIES

- A. Framing members, transition members, mullions, adaptors, and mounting: Extruded 6063-T6 aluminum alloy (ASTM B221 – Alloy G.S. 10a T6). Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc-plated steel in accordance with ASTM.A-164. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from aluminum.
- B. Glazing Gasket
 - 1. Compression-type design, replaceable, molded or extruded santoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).
 - 2. Shall be of type that locks securely into the glazing reglet to prevent glazing gaskets from disengaging.

2.03 FINISH

- A. Finish all exposed areas of aluminum and components as indicated:
 - 1. Fluorocarbon Coating: AAMA 2605.2.
 - a. Resin: 70% PVDF Kynar 500/Hylar 5000.
 - b. Substrate: cleaned and pretreated with chromium phosphate.
 - c. Primer: Manufacturer's standard resin base compatible coating. Dry film thickness.
 - d. Extrusion: Minimum 0.20 mil.
 - e. Color Coat: 70% PVDF, dry film thickness.
 - 1) Extrusion: 1.0 mil.
 - f. Color: Match School Campus standard sample.
 - g. Acceptable Coatings Manufacturers:
 - 1) PPG Industries, Inc.
 - 2) Valspar Corporation
 - 3) BASF

2.04 SYSTEM FABRICATION

- A. Framing members shall be internally reinforced and secured at head and sill as necessary for structural performance requirements, for hardware attachment, and as indicated.
- B. Fasteners shall be so located as to ensure concealment from view in the final assembly.

PART 3 EXECUTION

3.01 EXAMINATIONS

- A. Examine conditions and verify substrate conditions are acceptable for product installation.

3.02 INSTALLATION

- A. Install in accordance with approved shop drawings and manufacturers installation instructions.

END OF SECTION

**SECTION 08 71 00
DOOR HARDWARE**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Door hardware for hollow metal doors.

1.02 REFERENCES:

- A. Use date of standard in effect as of Bid date.
1. American National Standards Institute
 - a. ANSI 156.18 – Materials and Finishes.
 2. BHMA – Builders Hardware Manufacturers Association
 3. 2022 California Building Code
 - a. Chapter 11B – Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing
 4. DHI – Door and Hardware Institute
 5. NFPA – National Fire Protection Association
 - a. NFPA 80 2019 Edition – Standard for Fire Doors and Other Opening Protectives.
 - b. NFPA 105 – Smoke and Draft Control Door Assemblies
 - c. NFPA 252 – Fire Tests of Door Assemblies
 6. UL – Underwriters Laboratories
 - a. UL 10C – Positive Pressure Fire Tests of Door Assemblies.
 - b. UL 305 – Panic Hardware
 7. WHI – Warnock Hersey Incorporated State of California Building Code
 8. Local applicable codes
 9. SDI – Steel Door Institute
 10. WI – Woodwork Institute
 11. AWI – Architectural Woodwork Institute
 12. NAAMM – National Association of Architectural Metal Manufacturers
- B. Abbreviations
1. Manufacturers: see table at 2.1.A of this section
 2. Finishes: see 2.7 of this section.

1.03 SUBMITTALS & SUBSTITUTIONS

- A. SUBMITTALS: Submit six copies of schedule per D. Only submittals printed one sided will be accepted and reviewed. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information:
1. Type, style, function, size, quantity and finish of hardware items.
 2. Use BHMA Finish codes per ANSI A156.18.
 3. Name, part number and manufacturer of each item.
 4. Fastenings and other pertinent information.
 5. Location of hardware set coordinated with floor plans and door schedule.
 6. Explanation of abbreviations, symbols, and codes contained in schedule.
 7. Mounting locations for hardware.
 8. Door and frame sizes, materials and degrees of swing.
 9. List of manufacturers used and their nearest representative with address and phone number.
 10. Catalog cuts.
 11. Point-to-point wiring diagrams.
 12. Manufacturer’s technical data and installation instructions for electronic hardware.
- B. Bid and submit manufacturer’s updated/improved item if scheduled item is discontinued.

- C. Deviations: Highlight, encircle or otherwise identify deviations from "Schedule of Finish Hardware" on submittal with notations clearly designating those portions as deviating from this section.
- D. If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.
- E. Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.
- F. Items listed with no substitute manufacturers have been requested by Owner to meet existing standard.
- G. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, riser and point-to-point wiring diagrams, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report.

1.04 QUALITY ASSURANCE:

- A. Hardware: Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.
- B. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- C. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.
- D. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.

1.05 DELIVERY, STORAGE AND HANDLING:

- A. Delivery: coordinate delivery to appropriate locations (shop or field).
 - 1. Permanent keys and cores: secured delivery direct to Owner's representative.
- B. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.
- C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

1.06 PROJECT CONDITIONS AND COORDINATION:

- A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.
- B. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:
 - 1. Location of embedded and attached items to concrete.
 - 2. Location of wall-mounted hardware, including wall stops.
 - 3. Location of finish floor materials and floor-mounted hardware.
 - 4. At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or

- breaking the installer's bits.
5. Locations for conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.
 6. Coordinate: low-voltage power supply locations.
 7. Coordinate: back-up power for doors with automatic operators.
 8. Coordinate: flush top rails of doors at outswinging exteriors, and throughout where adhesive-mounted seals occur.
 9. Manufacturers' templates to door and frame fabricators.
- C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.
- D. Environmental considerations: segregate unused recyclable paper and paper product packaging, uninstalled metals, and plastics, and have these sent to a recycling center.

1.07 WARRANTY:

- A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties.
- B. Include factory order numbers with close-out documents to validate warranty information, required for Owner in making future warranty claims:
- C. Minimum warranties:

1.	Locksets:	Three years
2.	Extra Heavy Duty Cylindrical Lock:	Seven Years
3.	Exit Devices:	Three years mechanical One year electrical
4.	Closers:	Thirty years mechanical Two years electrical
5.	Hinges:	One year
6.	Other Hardware	Two years

1.08 COMMISSIONING:

- A. Conduct these tests prior to request for certificate of substantial completion:
1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.

1.09 REGULATORY REQUIREMENTS:

- A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2022 California Building Code, Section 11B-404.2.7.
1. Panic hardware: locate between 36 inches to 44 inches above the finished floor.
- B. Handles, pull, latches, locks, other operable parts:
1. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate. 2022 California Building Code Section 11B-309.4.
 2. Force required to activate the operable parts: 5.0 pounds maximum, per 2022 California Building Code Section 11B-309.4.
- C. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2022 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.
1. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.

- D. Low-energy powered doors: comply with ANSI/BHMA A156.19. Reference: 2022 California Building Code Section 11B-404.2.9.
 - 1. Where powered door serves an occupancy of 100 or more, provide back-up battery power or stand-by generator power, capable of supporting a minimum of 100 cycles.
 - 2. Actuators, vertical bar type: minimum 2-inches wide, 30-inches high, bottom located minimum 5-inches above floor or ground, top located minimum 35-inches above floor or ground. Displays International Symbol of Accessibility, per 2022 California Building Code Section 11B-703.7.
 - 3. Actuators, plate type: use two at each side of the opening. Minimum 4-inches diameter or 4-inches square. Displays International Symbol of Accessibility, per 2022 California Building Code Section 11B-703.7. Locate centerline of lower plate between 7- and 8-inches above floor or ground, and upper plate between 30- and 44-inches above floor or ground.
 - 4. Actuator location: conspicuously located, clear and level floor/ground space for forward or parallel approach.
- E. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2022 California Building Code Section 11B-404.2.8.
 - 1. Spring hinges: adjust for 1.5 seconds minimum for 70 degrees to fully-closed.
- F. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2022 California Building Code Section 11B-404.2.10.
 - 1. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.
 - 2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.
- G. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2022 California Building Code Section 11B-404.2.3.
 - 1. Exception: doors not requiring full passage through the opening, that is, to spaces less than 24 inches in depth, may have the clear opening width reduced to 20 inches. Example: shallow closets.
 - 2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2022 California Building Code 11B-307.4.
- H. Thresholds: floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2022 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches: beveled to slope no greater than 1:2 (50 percent slope). 2022 California Building Code Section 11B-303.2 & ~.3.
- I. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).
- J. Pairs of doors with independently-activated hardware both leafs: limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2022 California Building Code Section 11B-703.4.2.
- K. Door and door hardware encroachment: when door is swung fully-open into means-of-egress path, the door may not encroach/project more than 7 inches into the required exit width, with the exception of door release hardware such as lockset levers or panic hardware. These hardware items must be located no less than 34-inches and no more than 48-inches above the floor/ground. 2022 California Building Code, Section 1005.7.1.
 - 1. In I-2 occupancies, surface mounted latch release hardware, mounted to the side of the door facing away from the adjacent wall where the door is in the open position, is not exempt from the inclusion in the 7-inch maximum encroachment, regardless of its mounting height, per 2022 California Building Code, Section 1005.7.1 at Exception 1.

- L. New buildings that are included in public schools (kindergarten through 12th grade) state funded projects and receiving state funding pursuant to Leroy F. Green, School Facilities Act of 1998, California Education Code Sections 17070.10 through 17079, and that are submitted to the Division of the State Architect for plan review after July 1, 2011 in accordance with the Education Code 17075.50, shall include locks that allow doors to classrooms and any room with an occupancy of five or more persons to be locked from the inside. The locks shall conform to the specification and requirements found in Section 1010.1.9. 2022 California Building Code Section 1010.1.11

1. Exceptions:

- a. Doors that are locked from the outside at all times such as, but not limited to, janitor's closet, electrical room, storage room, boiler room, elevator equipment room and pupil restroom.
- b. Reconstruction projects that utilize original plans in accordance with California Administrative Code, Section 4-314.
- c. Existing relocatable buildings that are relocated within same site in accordance with California Administrative Code, Section 4-314.

ITEM	MANUFACTURER	ACCEPTABLE ALTERNATE
Hinge	(IVE) Ives	Bommer
Continuous Hinge	(IVE) Ives	Select
Closers	(LCN) LCN	Owner Standard
Silencers	(IVE) Ives	Rockwood, Trimco
Push & Pull Plates	(IVE) Ives	Rockwood, Tremco
Stops	(IVE) Ives	Rockwood, Tremco
seals	(ZER) Zero	NGP, Pemko

PART 2 PRODUCTS

2.01 MANUFACTURERS:

- A. Listed acceptable alternate manufacturers: these will be considered; submit for review products with equivalent function and features of scheduled products.

2.02 HINGING METHODS:

- A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.
- B. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.
- C. Conventional Hinges: Steel or stainless steel pins and approved bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.
 1. Outswinging exterior doors: non-ferrous with non-removable (NRP) pins and security studs.
 2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.
- D. Continuous Hinges:
 1. Geared-type aluminum.
 - a. Use wide-throw units where needed for maximum degree of swing, advise architect if commonly available hinges are insufficient.
 - b. If units are used at storefront openings, color-coordinate hinge finish with storefront color. Custom anodizing and custom powdercoat finishes subject to Architect

approval.

2.03 LOCKSETS, LATCHSETS, DEADBOLTS:

- A. Extra Heavy Duty Cylindrical Locks and Latches: as scheduled.
 - 1. Chassis: cylindrical design, corrosion-resistant plated cold-rolled steel, through-bolted.
 - 2. Locking Spindle: stainless steel, integrated spring and spindle design.
 - 3. Latch Retractors: forged steel. Balance of inner parts: corrosion-resistant plated steel, or stainless steel.
 - 4. Latchbolt: solid steel.
 - 5. Backset: 2.75 inches typically, more or less as needed to accommodate frame, door or other hardware.
 - 6. Lever Trim: accessible design, independent operation, spring-cage supported, minimum 2.00 inches clearance from lever mid-point to door face.
 - 7. Electric operation: Manufacturer-installed continuous duty solenoid.
 - 8. Strikes: 16 gage curved steel, bronze or brass with 1.00 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
 - 9. Lock Series and Design: Schlage ND series, "Rhodes" design.
 - 10. Certifications:
 - a. ANSI A156.2, Series 4000, Grade 1.
 - b. UL listed for A label and lesser class single doors up to 4 feet x 8 feet.
 - 11. Accessibility: Require not more than 5 lb to retract the latchbolt or deadbolt, or both, per CBC 2022 11B-404.2.7 and 11B-309.4

2.04 EXIT DEVICES / PANIC HARDWARE

- A. General features:
 - 1. Independent lab-tested 1,000,000 cycles.
 - 2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
 - 3. Deadlocking latchbolts, 0.75 inch projection.
 - 4. End caps: impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.
 - 5. No exposed screws to show through glass doors.
 - 6. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
 - 7. Releasable in normal operation with 15-pound maximum operating force per UBC Standard 10-4, and with 32-pound maximum pressure under 250-pound load to the door.
 - 8. Exterior doors scheduled with XP-series devices: Static load force resistance of at least 2000 pounds.
 - 9. Accessibility: Require not more than 5 lb to retract the latchbolt, per CBC 2022 11B-404.2.7 and 11B-309.4.
 - a. Mechanical method: Von Duprin "AX-" feature, where touchpad directly retracts the latchbolt with 5 lb or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb requirement.
 - b. Electrical method: Von Duprin's "RX-QEL-", where lightly pressing the touchpad with 5 lb or less of force closes an electric switch, activating quiet electric latch retraction.
- B. Specific features:
 - 1. Non-Fire Rated Devices: cylinder dogging.
 - 2. Lever Trim: breakaway type, forged brass or bronze escutcheon min. 0.130 inch thickness, compression spring drive, match lockset lever design.
 - 3. Rod and latch guards with sloped full-width kickplates for doors fitted with surface vertical rod devices with bottom latches.
 - 4. Fire-Labeled Devices: UL label indicating "Fire Exit Hardware". Vertical rod devices less bottom rod (LBR) unless otherwise scheduled.

5. Impact recessed devices: 1.25 inch projection when push-pad is depressed. Sloped metal end caps to deflect carts, etc. No pinch points to catch skin between touchbar and door.
6. Delayed Egress Devices: Function achieved within single exit device component, including latch, delayed locking device, request-to-exit switch, nuisance alarm, remote alarm, key switch, indicator lamp, relay, internal horn, door position input, external inhibit input plus fire alarm input. NFPA 101 "Special Locking Arrangement" compliant.
7. Electrically Operated Devices: Single manufacturer source for electric latch retraction devices, electrically controlled trim, power transfers, power supplies, monitoring switches and controls.
8. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key. Furnish storage brackets for securely stowing the mullion away from the door when removed.
9. Accepted substitutions: None

2.05 CLOSERS

A. Surface Closers:

1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
2. ISO 2000 certified. Units stamped with date-of-manufacture code.
3. Independent lab-tested 10,000,000 cycles.
4. Non-sized and adjustable. Place closers inside building, stairs and rooms.
5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
6. Advanced Variable Backcheck (AVB): where scheduled, these units commence backcheck at approximately 45 degrees.
7. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2022 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.
 - a. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leaves or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.
8. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
9. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units. EDA arms: rigid main and forearm, reinforced elbow.
10. Exterior door closers: tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
11. Exterior doors: seasonal adjustments not required for temperatures from 120 degrees F to -30 degrees F, furnish checking fluid data on request.
12. Non-flaming fluid, will not fuel door or floor covering fires.
13. Pressure Relief Valves (PRV) not permitted.
14. Accepted substitutions: None

2.06 OTHER HARDWARE

- A. Automatic Flush Bolts: Low operating force design.
- B. Overhead Stops: Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- C. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.
- D. Door Stops: Provide stops to protect walls, casework or other hardware.
 1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall type. If neither can be used, provide overhead type.

2. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum: 90deg stop / 95deg deadstop. Note degree of opening in submittal.
- E. Thresholds: As scheduled and per details. Comply with CBC 2022 11B-404.2.5. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.
 1. Saddle thresholds: 0.125 inches minimum thickness.
 2. Exteriors: Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Minimum 0.25 inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors. National Guard Products' "COMBO" or Pemko Manufacturing's "FHSL".
 3. Fire-rated openings, 90-minutes or less duration: use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, include a 0.25in high 5in wide saddle in the bid, and request direction from Architect.
 4. Fire-rated openings, 3-hour duration: Thresholds, where scheduled, to extend full jamb depth.
 5. Acoustic openings: Set units in full bed of Division-7-compliant, leave no air space between threshold and substrate.
 6. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
 7. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.
- F. Through-bolts: Do not use. Coordinate with wood doors; ensure provision of proper blocking to support wood screws for mounting panic hardware and door closers. Coordinate with metal doors and frames; ensure provision of proper reinforcement to support machine screws for mounting panic hardware and door closers.
 1. Exception: surface-mounted overhead stops, holders, and friction stays.
- G. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Leave no unfilled/uncovered pre-punched silencer holes. Intent: door bears against silencers, seals make minimal contact with minimal compression – only enough to effect a seal.

2.07 FINISH:

- A. Generally: BHMA 626 Satin Chromium.
 1. Areas using BHMA 626: furnish push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise scheduled.
- B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

2.08 KEYING REQUIREMENTS:

- A. Key System: (Verify with owner) Schlage Everest [D] Primus [29] high-security utility-patented keyway, conventional cylinders with the exception of interchangeable core type operating cylinders for panic hardware. Utility patent protection to extend at least until 2029. Key blanks available only from factory-direct sources, not available from after-market keyblank manufacturers. For estimate use factory GMK charge. Initiate and conduct meetings(s) with Owner and Allegion representatives to determine system keyway(s), keybow styles, structure, stamping, degrees of physical security and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner. Owner will install permanent cylinders/cores.
 1. Existing factory registered master key system.
 2. I. C. Construction keying: furnish temporary keyed-alike cylinders and cores. Remove at substantial completion and install permanent cylinders and cores in Owner's presence. Demonstrate that construction key no longer operates.

3. Temporary cylinders/cores remain Supplier's property.
 4. Non-I.C. construction keying: furnish inserted type partial key. At substantial completion, remove inserts in Owner's presence; demonstrate consequent non-operability of construction key. Give all removed inserts and all construction keys to Owner, provide accounting for all the pieces.
 5. Furnish 10 construction keys.
 6. Furnish 2 construction control keys.
- B. Key Cylinders: furnish 6-pin solid brass construction.
- C. Cylinders/cores: keyed at factory of lock manufacturer where permanent records are maintained. Locksets and cylinders same manufacturer.
- D. Permanent keys: use secured shipment direct from point of origination to Owner.
1. For estimate: 3 keys per change combination, 5 master keys per group, 5 grand-master keys, 3 control keys.
 2. For estimate: VKC stamping plus "DO NOT DUPLICATE".
- E. Bitting List: use secured shipment direct from point of origination to Owner at completion.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS:

- A. Can read and understand manufacturers' templates, suppliers' hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers' furnished fasteners. Available to meet with manufacturers' representatives and related trades to discuss installation of hardware.

3.02 PREPARATION:

- A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.
- B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
1. Notify Architect of code conflicts before ordering material.
- C. Locate latching hardware between 34 inches to 44 inches above the finished floor, per California Building Code, Section 1010.1.9.2 and 11B-404.2.7.
1. Locate panic hardware between 36 inches to 44 inches above the finished floor.
 2. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.
- D. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.

3.03 INSTALLATION

- A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.
1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
 2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
 3. Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.
 4. Replace fasteners damaged by power-driven tools.
- B. Locate floor stops no more that 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is

questionable or difficult, contact Architect for direction.

- C. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.
- D. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.
- E. Drill pilot holes for fasteners in wood doors and/or frames.
- F. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

3.04 ADJUSTING

- A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
 - 1. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner's satisfaction.
 - 2. Adjust doors to fully latch with no more than 1 pound of pressure.
 - a. Door closer valves: turn valves clockwise until at bottom – do not force. Turn valves back out one and one-half turns and begin adjustment process from that point. Do not force valves beyond three full turns counterclockwise.
 - 3. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.
 - 4. Adjust door closers per 1.9 this section.
- B. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:
 - 1. Has re-adjusted hardware.
 - 2. Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner's personnel.
 - 3. Has identified items that have deteriorated or failed.
 - 4. Has submitted written report identifying problems.

3.05 DEMONSTRATION:

- A. Demonstrate mechanical hardware and electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.

3.06 PROTECTION/CLEANING:

- A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.
- B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

3.07 SCHEDULE OF FINISH HARDWARE

- A. See door schedule in drawings for hardware set assignments.
- B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.
- C. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

3.08 HARDWARE SETS

HARDWARE GROUP NO. 01

Provide each PR door(s) with the following:

QTY	DESCRIPTION	CATALOG #	FINISH	MFR
2 EA	CONT. HINGE	224XY	628	IVE
1 EA	REMOVABLE MULLION	KR4954	689	VON

1 EA	PANIC HARDWARE	CD-PA-AX-98-EO	626	VON
1 EA	PANIC HARDWARE	CD-PA-AX-98-NL-OP-110MD	626	VON
1 EA	MULLION STORAGE KIT	MT54	626	VON
1 EA	RIM CYLINDER	20-057 ICX	626	SCH
1 EA	MORTISE CYLINDER	20-061 ICX X K510-730 36-083	626	SCH
2 EA	MORTISE CYLINDER	20-061 ICX X K510-730 XQ11-948 36-083	626	SCH
4 EA	FSIC CORE	23-030	626	SCH
1 EA	DOOR PULL	VR910 DT	630	IVE
1 EA	DOOR PULL	VR910 NL	630	IVE
2 EA	SURFACE CLOSER	4111 HEDA	689	LCN
2 EA	FLOOR STOP	FS436/FS438 AS REQ'D	626	IVE
1 EA	MULLION SEAL	8780NBK PSA	BK	ZER
2 EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 02

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG #	FINISH	MFR
3 EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1 EA	STOREROOM LOCK	ND81TD RHO	626	SCH
1 EA	FSIC CORE	23-030	626	SCH
1 EA	SURFACE CLOSER	4011	689	LCN
1 EA	FLOOR STOP	FS436/FS438 AS REQ'D	626	IVE
3 EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 03

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1 EA	CLASSROOM DEAD LOCK	L463T	626	SCH
1 EA	FSIC CORE	23-030	626	SCH
1 EA	PUSH PLATE	8200 8" X 16" CFC	630	IVE

1 EA	PULL PLATE	8302 10" 6" X 16" CFT	630	IVE
1 EA	SURFACE CLOSER	4011	689	LCN
1 EA	FLOOR STOP	FS436/FS438 AS REQ'D	626	IVE
3 EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 04

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1 EA	STOREROOM LOCK	ND81TD RHO	626	SCH
1 EA	FSIC CORE	23-030	626	SCH
1 EA	SURFACE CLOSER	4111	689	LCN
1 EA	FLOOR STOP	FS436/FS438 AS REQ'D	626	IVE
3 EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 05

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1 EA	CLASSROOM SECURITY	ND75TD RHO XN12-035	626	SCH
2 EA	FSIC CORE	23-030	626	SCH
1 EA	SURFACE CLOSER	4011	689	LCN
1 EA	FLOOR STOP	FS436/FS438 AS REQ'D	626	IVE
3 EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 06

Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1 EA	FAC RESTRM W/IND CYL	ND85P6D RHO	626	SCH
1 EA	SURFACE CLOSER	4011	689	LCN
1 EA	FLOOR STOP	FS436/FS438 AS REQ'D	626	IVE
3 EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 07

Provide each PR door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2 ea	CONT. HINGE	224XY	628	IVE
1 EA	REMOVABLE MULLION	KR4954	689	VON
1 EA	PANIC HARDWARE	CD-PA-AX-98-EO	626	VON
1EA	PANIC HARDWARE	CD-PA-AX-98-NL-OP-110MD	626	VON
1 EA	MULLION STORAGE KIT	MT54	689	VON
1 EA	RIM CYLINDER	20-057 ICX	626	SCH
1 EA	MORTISE CYLINDER	20-061 ICX X K510-730 36-083	626	SCH
2 EA	MORTISE CYLINDER	20-061 ICX X K510-730 XQ11-948 36-083	626	SCH
4 EA	FSIC CORE	23-030	626	SCH
1 EA	DOOR PULL	VR910 DT	630	IVE
1 EA	DOOR PULL	VR910 NL	630	IVE
2 EA	SURFACE CLOSER	4111 HEDA	689	LCN
2 EA	FLOOR STOP	FS436/FS438 AS REQ'D	626	IVE
1 EA	GASKETING	328AA-S AT JAMB LEGS	AA	ZER
1 EA	GASKETING	429AA-S AT HEAD	AA	ZER
1 EA	MULLION SEAL	8780NBK PSA	BK	ZER
1 EA	THRESHOLD	THRESHOLD AS DETAILED		
2EA	DOOR SWEEP	39A	A	ZER

MAINTENANCE MATERIALS, PROVIDE THE FOLLOWING:

- A. As-built hardware schedule
- B. Copies of warranty information for each hardware type
- C. Binder of catalog cuts or complete catalog sections of items used, installation and maintenance/adjustment information.

- D. Collection of tools that were included with the hardware: wrenches, drivers, etc.

END OF SECTION

**SECTION 08 80 00
GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass and glazing for doors and framed openings.

1.02 RELATED SECTIONS

- A. Section 07 92 00 - Sealants and Caulking.
- B. Section 08 41 13 Center Glazed Aluminum Mullions

1.03 REFERENCES

- A. AAMA 605.2 American Architectural Manufacturers Association; Voluntary Specification for High Performance Organic Coatings.
- B. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
- C. ASTM C1193 - Use of Joint Sealants.
- D. ASTM C864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- E. ASTM C1036 - Standard Specification for Flat Glass.
- F. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass.
- G. CPSC 16 CFR 1201- Consumer Products Safety Commission Safety Standards for Architectural Glazing Materials.
- H. FGMA - Flat Glass Marketing Association Glazing Manual.
- I. T24, CCR - Title 24, California Code of Regulations, Chapter 24.

1.04 PERFORMANCE REQUIREMENTS

- A. Provide glass and glazing materials for continuity of building enclosure vapor retarder and air barrier throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- B. Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less, when tested in accordance with ASTM E330.

1.05 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, and special handling or installation requirements.
- C. Product Data on Accessories: Submit manufacturers descriptive information and installation instructions for all glazing accessories required for installation according to this section and other sections referencing this section.
- D. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, and special application requirements.
- E. Product Data on Opaque Glazing Panels: Submit manufacturers descriptive literature and installation instructions; indicate thickness and dimensions of parts, and fastening and anchoring methods.
- F. Samples: Submit three samples 4 x 4 inch in size, for each type of glass or glazing panel. Grind and radius edges. Identify each unit with an indelibly marked label.
- G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with FGMA Glazing Manual, FGMA Sealant Manual
- B. Conform to T24, CCR.

- C. Label each piece of glazing material with manufacturers name and grade or quality of material. Labels shall be intact before and after installation.

1.07 QUALIFICATIONS

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.08 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver glass, opaque panels, and glazing materials with manufacturers labels intact.
- B. Protect glass and opaque panels from discoloration, marking, or damage.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Do not install glazing when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
- C. Perform glazing on clean, dry surfaces only.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

- A. Vitro Architectural Glass
- B. Guardian Glass, LLC
- C. Pilkington North America, Inc
- D. Viracon, Inc
- E. Substitutions: Refer to Section 01 63 00 - Product Substitution Procedures.

2.02 MONOLITHIC INTERIOR VISION GLAZING

- A. Glass Type: ¼" Clear Heat Strengthened unless otherwise required to be Fully Tempered

2.03 GLAZING ACCESSORIES

- A. Setting Blocks: ASTM C864, Option I; Neoprene 80 to 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- B. Spacer Shims: ASTM C864, Option I; Neoprene 50 to 60 Shore A durometer hardness, minimum 3 inch long x one half the height of the glazing stop x thickness to suit application.
- C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
- D. Glazing Gaskets: ASTM C864 Option I, Resilient polyvinyl chloride extruded shape to suit glazing channel retaining slot; color as selected by Architect.
- E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items to be glazed under provisions of Section 01 03 90.
- B. Verify that openings for glazing are correctly sized and within tolerance.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

- C. Prime surfaces scheduled to receive sealant.

3.03 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass, opaque panels, and adjacent surfaces.

3.04 PROTECTION OF FINISHED WORK

- A. Glazing damaged or broken prior to final acceptance shall be replaced at no additional expense to Owner.

END OF SECTION

**SECTION 09 23 00
GYPSUM PLASTERING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Gypsum plastering.
- B. Gypsum lath.

1.02 REFERENCE STANDARDS

- A. ASTM C842 - Standard Specification for Application of Interior Gypsum Plaster; 2005 (Reapproved 2021).
- B. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide data on plaster materials, characteristics, and limitations of products specified.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.05 FIELD CONDITIONS

- A. Comply with ASTM C 842 requirements or gypsum plaster manufacturer's written recommendations, whichever are more stringent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bases of Design Gypsum Plaster:
 - 1. USG: www.usg.com
- B. National Gypsum Company: www.goldbondbuilding.com
- C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GYPSUM PLASTER ASSEMBLIES

2.03 PLASTER MATERIALS

- A. Basecoat Plaster
 - 1. Diamond® Brand Veneer Basecoat Plaster.
- B. Finish Coat Plaster
 - 1. Diamond Brand Veneer Finish Plaster.

2.04 LATH AND ACCESSORIES

- A. Gypsum Lath: ASTM C1396/C1396M, standard type.

2.05 PLASTER MIXES

PART 3 EXECUTION

3.01 PLASTERING

- A. Apply gypsum plaster in accordance with ASTM C842 and manufacturer's instructions.
- B. Thickness of Plaster including Finish Coat:

END OF SECTION

**SECTION 09 29 00
GYPSUM BOARD ASSEMBLY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustic insulation.
- B. Gypsum wallboard.
- C. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Structural steel stud framing.
- B. Section 07 27 26 - Gypsum Air and Vapor Barrier Sheathing System: Cement Board
- C. Section 09 22 10 - Non-Structural Metal Framing.
- D. Section 09 30 00 - Tiling

1.03 REFERENCE STANDARDS

- A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.
- B. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2019b.
- C. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2018.
- D. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2018.
- E. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2019.

1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittals for submittal procedures.
- B. Product Data: Provide data on gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.
- C. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, illustrating finish color and texture.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.

PART 2 PRODUCTS

2.01 BOARD MATERIALS

- A. Manufacturers
 - 1. National Gypsum Company; Bases of Design: www.nationalgypsum.com.
 - 2. Georgia-Pacific Gypsum: www.gpgypsum.com.
 - 3. USG Corporation: www.usg.com.
 - 4. Or Approved Equal.
- B. Board Products
 - 1. General
 - a. All gypsum board products shall be:
 - 1) Mildew and mold resistant, with a score of 10 on ASTM D3273.
 - 2) water resistant
 - 3) 5/8-inch thick, unless noted otherwise.
 - 4) Type X

2. Mold and Mildew Resistant Tile Backer
 - a. Product: Gold Bond eXP Tile Backer
 - b. Panel Physical Characteristics:
 - 1) Core: Mold and moisture resistant gypsum core.
 - 2) Surface: Fiberglass Mat; moisture resistant, acrylic coated water barrier on front.
 - 3) Water Absorption: less than 5% when tested in accordance with ASTM C473.
 - 4) Combustibility: Noncombustible when tested in accordance with ASTM E136.
 - 5) Flame spreads/smoke Developed: 0/0 when tested in accordance with ASTM E84.
 - 6) Provide low emitting material complying with the requirements of ASTM C 1178.
3. Gypsum Board
 - a. Product: Gold Bond XP Gypsum Board
 - b. Panel Physical Characteristics:
 - 1) Core: Enhanced Mold Moisture-Resistant
 - 2) Face Paper: Mold and Moisture-Resistant.
 - 3) ASTM E84 Surface Burning Characteristics:
 - (a) Flame spread: 15
 - (b) Smoke Development: 0
 - 4) Panel complies with requirements of ASTM C 1396

2.02 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Insulation: Meeting ASTM C665; preformed glass fiber, friction fit type, unfaced.
 1. Thickness: Full depth of wall stud.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
 1. Products:
 - a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
 - b. Liquid Nails, a brand of PPG Architectural Coatings; AS-825 Acoustical Sound Sealant: www.liquidnails.com/#sle.
 - c. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: www.stifirestop.com/#sle.
 2. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 - a. Corner Beads: Low profile, for 90 degree outside corners.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
- D. Fasteners: ASTM C1002, United States Gypsum type S, S12, W, G, and Durock cement board screws, or approved equal, as recommended by manufacturer; corrosion resistant; sizes as recommended by manufacturer or as indicated.
- E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SOUND INSULATED PARTITIONS

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

1. Place continuous bead at perimeter of each layer of gypsum board.
2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.03 BOARD INSTALLATION

- A. General
 1. Installation on Metal Framing: Use screws for attachment of gypsum board.
 2. Install using largest pieces possible.
- B. Abuse Resistant Gypsum Board Installation
 1. Install in accordance with manufacturer recommendations, ASTM C840 and GA-216
- C. Tile Backer Gypsum Board Installation
 1. General
 - a. Install in accordance with manufacturer recommendations, ASTM C840 and GA-216
 - b. Install with acrylic coated water barrier side facing away from the framing, so that finishes shall be applied to the coated side.
 - c. Caulk or seal penetrations and abutments to dissimilar materials.
 2. For Walls
 - a. Install panels horizontal or vertical to supports spaced a maximum of 16-inches on center.
 - b. Space fasteners 8-inches on center along all support members. Drive fasteners flush with the panel surface, do not countersink.
 3. For Ceilings
 - a. Install panels perpendicular to supports spaced a maximum of 12-inches on center for 1/2-inch thick panels and 16 inches on center for 5/8-inch thick panels.
 - b. Space fasteners 8 inches on center along all support members. Drive fasteners flush with the panel surface, do not countersink.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.05 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C840 as follows:
 1. Level 5: Walls and ceilings to receive:
 - a. Semi-gloss paint finish.
 - b. Gloss paint finish.
 - c. Enamel paint finish.
 - d. Other areas specifically indicated.
 2. Level 4: Walls and ceilings to receive:
 - a. Paint finish other than semi-gloss or gloss or enamel.
 - b. Premium Primer as the first coat such as SheetRock First Coat Primer or equal.
 - c. Other areas specifically indicated.
 3. Level 3: Walls to receive textured wall finish.
 4. Level 2: On backing board to receive tile finish.
 5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes as follows:
 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 2. Fill all corners and recesses between boards with sufficient thickness of joint compound to completely hide board at all joints. Center tape on joint and press tightly to 2 panels using suitable tool. Lay excess joint compound squeezed from beneath tape smoothly on top of tape.

3. When first coat is dry, spread a second coat of joint compound evenly over entire joint to beyond tapered edge of board or edge of tape.
4. When second coat is dry, apply sufficient joint compound to level all surfaces of joint.
5. Apply at least 2 coats of joint compound to completely fill screw depressions flush with surface of panel. Treat all other depressions in panel surface as required for screws.
6. At metal trim, apply 3 full coats of joint compound, feathering away from flanges. At corner beads, apply joint compound full thickness at bead and feather out at least 10 inches.
7. Between coats of joint compound, rough spots or areas shall be sanded smooth.
8. When dry, the finish coat shall be sanded as required to leave joints and filled depressions flat, flush, and smooth, ready for finishing.
9. For Level 2, joint compound applied over the body of the tape at time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.

3.06 TEXTURE FINISH

- A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.
 1. Texture Required: Orange Peel Finish unless otherwise noted on drawings.

3.07 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.08 GYPSUM BOARD TYPE - SCHEDULE

<u>BOARD TYPE</u>	<u>LOCATION</u>
Mold and Mildew Resistant Tile Backer	Where wall tile is scheduled
	Where FRP is scheduled
XP Gypsum Board	All walls and ceilings unless noted otherwise

END OF SECTION

**SECTION 09 30 00
TILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ceramic tile wall and base.
- B. Thin-set mortar installation.

1.02 RELATED SECTIONS

- A. Section 05 40 00 - Cold Formed Metal Framing.
- B. Section 07 92 00 - Joint Sealants and Caulking.
- C. Section 09 29 00 - Gypsum Board Assemblies; For cementitious backer board.

1.03 REFERENCES

- A. ANSI A108.1B - Installation of Ceramic Tile with Latex-Portland Cement Mortar.
- B. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
- C. ANSI A108.10 - Installation of Grout in Tilework.
- D. ANSI A108.11 - Installation of Cementitious Backer Units
- E. ANSI A118.4 - Latex-Portland Cement Mortar.
- F. ANSI A118.6 - Ceramic Tile Grouts.
- G. TCA (Tile Council of America) - Handbook for Ceramic Tile Installation; Current Edition.
- H. T24, CCR - Title 24, California Code of Regulations.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide instructions for using adhesives and grouts.
- C. Samples: Submit six sets of manufacturers literature, standard line of colors, standard medley mixtures, and standard patterns for each type of tile. Submit six samples of each color selected
 - 1. by the Architect, including each color included in medley mixtures or patterns selected by the Architect, for each type and texture of tile.
- D. Shop Drawings: Indicate tile layout, patterns and color arrangement for each finished space, including locations of control and expansion joints.
- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.05 MAINTENANCE DATA

- A. Submit under provisions of Section 01 70 00.
- B. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.06 QUALITY ASSURANCE

- A. Obtain all like materials from the same source throughout the project.

1.07 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum five years documented experience, approved by manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
- B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

- C. Store sheet materials flat, supported above ground or floor. Avoid damage to edges or ends of materials.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives in an unventilated environment.

PART 2 PRODUCTS

2.01 TILE MANUFACTURERS

- A. Basis of Design Manufacturers as indicated on Drawings
 - 1. Products submitted as Equal will be considered as substitutions in accordance with provisions of Section 01 63 99 - Product Substitutions Procedures.

2.02 CERAMIC TILE MATERIALS

- A. Glazed Wall and Base Tile:
 - 1. Tag B1: as indicated on drawings
 - 2. Tag B3: as indicated on drawings
 - 3. Tag T2: as indicated on drawings
 - 4. Tag T4: as indicated on drawings
 - 5. Tag T5: as indicated on drawings
 - 6. Tag T6: as indicated on drawings
 - 7. Tag T7: as indicated on drawings
- B. Glazed Floor Tile:
 - 1. Tag T1: as indicated on drawings
 - 2. Tag T3: as indicated on drawings
 - 3. Tag T3A: as indicated on drawings
- C. Special Shapes & Trim:
 - 1. Match tile dimensions, finish, color selection, and test characteristics.
 - 2. Wainscot Cap: extruded aluminum profile as indicated on drawings.
 - 3. Wall Base: cove base or extruded aluminum profile as indicated on drawings.

2.03 MORTAR MATERIALS

- A. Latex-Portland Cement Mortar Manufacturers:
 - 1. Custom Building Products Versabond Modified Thinset.
 - 2. Listed and tested by CTI; Extra-Heavy Service Rating.
- B. Latex-Portland Cement Mortar Materials:
 - 1. Latex-Portland Cement Mortar: ANSI A118.4, tile mortar, non-staining, fortified with latex additive, grey or white.
- C. Portland Cement Mortar Bed Materials:
 - 1. Mortar Sand: ASTM C144.
 - 2. Portland Cement: ASTM C150, Type I, grey or white, non staining.
 - 3. Hydrated Lime: ASTM C207 or ASTM C206, Type S.
 - 4. Water: Potable.

2.04 GROUT MATERIALS

- A. Manufacturers:
 - 1. Laticrete single component grout or equal
 - 2. Listed and tested by CTI; Heavy Service Rating.
- B. Grout: ANSI A108, 10 & A118.7 high performance cement grout.
- C. Color:
 - 1. Tag B1: 78 Sterling Silver
 - 2. Tag B3: 78 Sterling Silver
 - 3. Tag T2: 78 Sterling Silver
 - 4. Tag T4: 78 Sterling Silver
 - 5. Tag T5: 78 Sterling Silver

6. Tag T6: 78 Sterling Silver
7. Tag T7: 60 Dusty Grey
8. Tag T1: 78 Sterling Silver
9. Tag T3: 78 Sterling Silver
10. Tag T3A: 78 Sterling Silver

2.05 ACCESSORIES

- A. Cleavage Membrane: No. 15 asphalt saturated felt.
- B. Reinforcing Mesh: 2 x 2 inch size weave of 16/16 wire size; welded fabric, galvanized.
- C. Tile Floor Edging and Reducers: as indicated on drawings
- D. Cementitious Backer Board: ANSI A108.11 and ANSI A118.9; High density, cementitious, fiber reinforced, 5/8 inch thick, type X fire rated; 2 inch wide coated glass fiber tape for joints and corners; Non-corrosive, non-oxidizing, bugle head screw fasteners, Type W 1-1/4 inches long.
- E. Moisture Barrier: 4 mil thick polyethylene film. Building paper as specified in Section 09200, where indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify substrate under provisions of Section 01 03 90.
- B. Verify that surfaces are ready to receive work. Substrates shall be free of any imperfections that will telegraph through tile installation.
- C. Substrate tolerances: Maximum variation in substrates.
 1. Walls: 1/8 inch in 10 feet.
 2. Floor Surfaces: 1/4 inch in 10 feet.
- D. Verify that tile assembly will not conflict with thresholds at openings.

3.02 PREPARATION

- A. Protect surrounding work from damage or disfiguration.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler recommended for type of substrate. Level existing substrate surfaces to specified substrate tolerances.

3.03 INSTALLATION - WALLS

- A. Install moisture barrier on shower wall locations.
- B. Install cementitious backer board over framing where scheduled at interior locations, in accordance with board manufacturer's instructions and ANSI A108.11. All horizontal and vertical joints and corners shall have 1/8" spacing which must be filled solid with latex- portland cement mortar. Tape joints and corners, cover with skim coat of mortar to a feather edge.
- C. Perform cutting, fitting, drilling and repairing of tile necessary for this work and work of other trades is in connection with tile work. Cutting and drilling shall be neatly done without marring exposed surfaces. Grind and joint cut edges of tile carefully, and fit closely around penetrations through tile, fixtures, switch boxes, and pipes so that regular plates or collars will overlap the tile.
- D. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- E. Lay out work so that tiles will be centered on each wall or section of wall, so as to avoid small cuts. Base row shall be of full-size, uncut tile. Spot setting bed with mortared tile, set plumb & true, to accurately indicate plane of finished tile surfaces.
- F. Install tile over properly finished substrate using "thin-set" method. Latex-Portland cement mortar and tile shall be installed in accordance with manufacturer's printed instructions and ANSI A108.5.
- G. Set wall tile with joints approximately and uniformly 1/16 inch in width, with each tile tamped in place and set true with finished surfaces. Horizontal joints shall be level, vertical joints shall be

plumb and true.

- H. Place tile joints uniform in width, and aligned. Align floor, base and wall joints. Make joints watertight, without voids, cracks, excess mortar or excess grout.
- I. Sound tile after setting. Replace hollow sounding units.
- J. Keep expansion control joints free of mortar or grout. Apply sealant to joints.
- K. After dry-set mortar has set, wash tile with water and allow to dry 24 hours. Grout joints with specified grout in the consistency of thick cream. Grout shall be forced into joints, finished flush, all surplus removed and face of tiles left clean. Conform to ANSI A108.10.
- L. Install expansion and control joints over structural joints in accordance with TCA Method EJ171.

3.04 CLEANING

- A. Clean tile and grout surfaces.

3.05 PROTECTION OF FINISHED WORK

- A. Protect finished Tile Work
- B. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

**SECTION 09 78 00
FIBERGLASS REINFORCED WALL PANELS (FRP)**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic (FRP) wall paneling adhered to unfinished gypsum wallboard.
- B. PVC Trim
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies

1.03 REFERENCE STANDARDS

- A. ASTM D790 › Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- B. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
- C. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).
- D. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2018).
- E. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor; 2013a.
- F. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- G. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2017.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. See Section 01 33 00 - Submittals, for submittal procedures.
- C. Product Data: Submit manufacturer's descriptive literature for each specified product; include data to indicate compliance with these specifications. Including: anchorage devices specific to project substrate types.
 - 1. Preparation instructions and recommendations.
 - 2. Installation methods including anchorage devices specific to project substrate types..
- D. Shop Drawings: Submit elevations for each application and location. Indicate details of joints and attachments.
- E. Samples: Submit two samples 4 inches by 4 inches in size, indicating finish, color, and texture for each type of panels.
- F. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in manufacturer's original packaging, marked with manufacturer's product identification.
- B. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

1.06 WARRANTY

- A. See Section 01 78 36 - Warranties, for additional warranty requirements.
- B. Furnish one-year guarantee against defects in material and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. FRP Wall Paneling:
 - 1. Marlite, Inc; STANDARD FRP: www.marlite.com.
 - 2. Equal product substitution requests will be considered in accordance with provisions of Section 01 25 10 - Product Options and Substitutions.

2.02 FRP WALL PANELING

- A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
 - 1. Surface Texture: As indicated on drawings
 - 2. Color: As indicated on drawings
 - 3. Panel Thickness: 0.090 inch.
- B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
 - 1. Scratch Resistance: Barcol hardness score greater than 30, when tested in accordance with ASTM D2583.
 - 2. Flexural Strength - 1.7 x 10⁴ psi per ASTM D 790.
 - 3. Tensile Strength – 8.0 x 10³ psi per ASTM D 638.
 - 4. Tensile Modulus – 9.43 x 10⁵ psi per ASTM D 638.
 - 5. Water Absorption - 0.17% per ASTM D 570.
 - 6. Izod Impact Strength of 7.0 ft. lbs./in ASTM D 256
- C. Accessories:
 - 1. Trim:
 - a. Material: Vinyl.
 - b. Color/Finish: White.
 - c. Inside Corner Trim: Standard angle.
 - d. Edge Trim: Manufacturer's standard shape.
 - e. Division: Manufacturer's standard trim.
 - 2. Adhesive: Type recommended by panel manufacturer.
 - 3. Sealant: Type recommended by paneling manufacturer; clear.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate surfaces for adhered items are clean and smooth.
 - 1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer.
- C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install panels in accordance with manufacturer's instructions.
- B. Apply adhesive to back side of panel using trowel recommended by adhesive manufacturer.
- C. Apply panels to wall with vertical joints plumb and horizontal joints level and pattern aligned with adjoining panels.
- D. Using a roller, apply pressure to panel face to ensure proper adhesion between surfaces.
- E. Install panels with manufacturer's recommended gaps for panel field and corner joints.
- F. Install trim with adhesive.

- G. Seal joints at wall base and between panels with approved sealant to prevent moisture intrusion.
- H. Remove excess sealant after paneling is installed and prior to curing.

3.03 ADJUSTING

- A. Replace paneling installed out of plumb and/or not aligned with adjacent panels or construction.

3.04 CLEANING

- A. Clean panel faces using cleaning agents and methods recommended by manufacturer to remove soiling.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals for closeout submittals.
- B. See Section 01 77 00 - Contract Closeout and Final Cleaning.

3.06 PROTECTION

- A. Protect installed interior wall paneling from subsequent construction operations.

END OF SECTION

**SECTION 09 90 00
PAINTING AND COATING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Interior painting and coating systems.
- C. Exterior painting and coating systems.
- D. Exposed Mechanical, Electrical, and Structural Items
- E. Scope:
 - 1. Finish surfaces exposed to view, unless fully factory-finished or unless otherwise noted..

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel
- B. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- C. Section 07 19 00 - Water Repellents.
- D. Section 09 96 00 - High-Performance Coatings: Other painted metal items.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.
- C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- D. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
- E. SSPC-SP 13 - Surface Preparation of Concrete; 2018.

1.04 REGULATORY REQUIREMENTS

- A. Conform to T24, CCR for flame and smoke rating requirements for finishes.
- B. Conform to T19, CCR for all application processes and safety procedures.
- C. Materials shall comply with FDA requirements.
- D. Conform to requirements of SCAQMD.
- E. 2022 California Green Building Standards Code

1.05 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.06 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Product characteristics.
 - 2. Surface preparation instructions and recommendations.
 - 3. Primer requirements and finish specification.
 - 4. Storage and handling requirements and recommendations.
 - 5. Application methods.
 - 6. Clean-up information.
- C. Samples: Submit four paper draw down samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

- D. Maintenance Data: Submit coating maintenance manual including care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon of each color and gloss, store where directed.
 - 3. Label each container with color, type, and gloss in addition to manufacturer's label.

1.07 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.08 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for general requirements for mock-ups.
- B. Provide one accent wall as directed by Architect to demonstrate color and finish.
- C. Locate where directed by Architect.
- D. Approved Mock-up may remain as part of the work.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, product name, product code, color designation, VOC content, batch date, environmental handling, surface preparation, application, and use instructions.
- C. Paint Materials: Store at a minimum of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.10 FIELD CONDITIONS

- A. Do not apply materials when environmental conditions are outside the ranges required by manufacturer.
- B. Follow manufacturer's recommended procedures for producing the best results, including testing substrates, moisture in substrates, and humidity and temperature limitations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Products: Subject to compliance with requirements, provide Dunn Edwards products indicated; Contact Kim Hampton – Kim.Hampton@DunnEdwards.com
- B. Acceptable Manufacturers subject to submitting products that meet or exceed performance and physical characteristics of basis of design products:
 - 1. Sherwin Williams.
 - 2. PPG.
 - 3. Vista.

2.02 PAINTINGS AND COATINGS

- A. General:
 - 1. Provide materials for use within each paint system that are compatible with one another, and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. Provide factory-mixed coatings unless otherwise indicated.
 - 3. Do not reduce, thin, or dilute coatings or add materials to coatings unless specifically indicated in manufacturer's instructions.
- B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction
- C. Colorants: The use of colorants containing hazardous chemicals, such as ethylene glycol, is prohibited and zero VOC colorants should be used whenever possible.

- D. Colors: As selected by the Architect.
- E. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

2.03 PAINT SCHEDULE - EXTERIOR

- A. Cement Plaster: 3 coats
 - 1. Prime Coat: Primer, alkali resistant, waterbased, Eff-Stop Premium ESPR00.
 - 2. Intermediate Coat: Latex, exterior, matching topcoat.
 - 3. Topcoat: Latex, exterior, velvet, Dunn-Edwards, Spartashield SSSL20 100% acrylic
- B. Tilt-Up Concrete: 3 coats
 - 1. Prime Coat: Primer, alkali resistant, waterbased, Eff-Stop Premium ESPR00.
 - 2. Intermediate Coat: Latex, exterior, matching topcoat.
 - 3. Topcoat: Latex, exterior, velvet, Dunn-Edwards, Spartashield SSSL20
- C. Steel Substrates: 3 coats:
 - 1. Prime Coat:
 - a. Primer (Spot Prime), Bloc-Rust Premium BRPR00.
 - b. Primer (Full Prime), Enduraprime Rust Preventative Primer ENPR00.
 - 2. Intermediate Coat: Latex, exterior, matching topcoat.
 - 3. Topcoat: Latex, exterior, eggshell, Dunn-Edwards, Endura-Coat Eggshell ENTC30 or Spartashield Eggshell SSSL30
- D. Galvanized Metal Substrates: 3 Coats
 - 1. Prime Coat: Primer, waterbased, Ultrashield Galvanized Metal Primer ULGM00.
 - 2. Intermediate Coat: Latex, exterior, matching topcoat.
 - 3. Topcoat: Latex, exterior, eggshell, Dunn-Edwards, Edura-Coat Eggshell ENTC30 or Spartashield Eggshell SSSL30
- E. Aluminum Substrates: 3 coats
 - 1. Prime Coat: Primer, waterbased, Ultrashield Galvanized Metal Primer ULGM00.
 - 2. Intermediate Coat: Latex, exterior, matching topcoat.
 - 3. Topcoat: Latex, exterior, eggshell, Edura-Coat Eggshell ENTC30 or Spartashield Eggshell SSSL30
- F. Elastomeric System:
 - 1. Primer: As recommended by manufacturer for proposed application.
 - a. SUPER-LOC Premium (SLPR00
 - b. EFF-STOP Select (ESSL00
 - c. FLEX-PRIME Select (FPSL00)
 - 2. Topcoat: ENDURALASTIC 10 Flat (EDLX10), 100% acrylic

2.04 PAINT SCHEDULE - INTERIOR

- A. Tilt-up Concrete: 3 coats.
 - 1. Prime Coat: Primer, alkali resistant, waterbased, Eff-Stop Premium ESPR00.
 - 2. Intermediate Coat: Latex, interior, matching topcoat.
 - 3. Topcoat: Latex, interior, eggshell, Spartawall Eggshell SWLL30
- B. Gypsum Board Substrates: 3 coats
 - 1. Prime Coat: Primer sealer, latex, Vinylastic Premium VNPR00.
 - 2. Intermediate Coat: Latex, interior, matching topcoat.
 - 3. Topcoat: Paint gloss as scheduled on drawings.
 - a. Latex, interior, eggshell, Spartawall Eggshell SWLL30
 - b. Latex, interior, semi-gloss, Spartawall Eggshell SWLL50
 - c. Latex, interior, flat, Spartazero Flat SZRO10
- C. Gypsum Board Substrates (where indicated for enamel paint): 3 coats
 - 1. Prime Coat: Vinylastic Slect Latex wall sealer (VNSL00)

2. Intermediate Coat: Enduracat Semi-Gloss Pre-CAtalyzed, water based, single component epoxy (ENPX50)
3. Topcoat: Enduracat Semi-Gloss Pre-Catalyzed, water based, single component epoxy (ENPX50)
- D. Galvanized Metal Substrates:
 1. Prime Coat: Primer, waterbased, Ultra-Grip Select UGSL00 or Ultrashield Galvanized Metal Primer ULGM00
 2. Intermediate Coat: Latex, interior, matching topcoat.
 3. Topcoat: Latex, interior, eggshell, Dunn-Edwards, Spartawall SWLL30,
- E. Aluminum (Not Anodized or Otherwise Coated) Substrates:
 1. Prime Coat: Primer, waterbased, Ultra-Grip Select UGSL00 or Ultrashield Galvanized Metal Primer ULGM00
 2. Intermediate Coat: Latex, interior, matching topcoat.
 3. Topcoat: Latex, interior, eggshell, Dunn-Edwards, Spartawall SWLL30
- F. Exposed Mechanical, Electrical, Plumbing, and Building Structure in Occupied Spaces:
 1. Overhead Surfaces
 - a. Latex dry fall, flat, Aquafall AQUA10
- G. Wood Substrates:
 1. Prime Coat: Ultra-Grip Select Zero VOC Acrylic Multi-surface Primer (UGSL00) OR Decoprime Interior Wood Primer (DCPR00)
 2. Intermediate Coat: Latex, interior, matching topcoat
 3. Topcoat: Spartawall Semi-Gloss SWLL50
- H. Graffiti Topcoat: VandlGuard IsoFree-Zero VOC Water-Based Aliphatic Polyurethane Coating

PART 3 EXECUTION

3.01 EXAMINATION

3.02 PREPARATION

- A. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing. Mask permanent labels for items certified or tested by Underwriter's Laboratories, Warnock-Hersey, or other testing agencies, fusible links, and identification stamps.
- B. Clean surfaces thoroughly and correct defects prior to application.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- D. Remove mildew from impervious surfaces by scrubbing with solution of water and bleach. Rinse with clean water and allow surface to dry.
- E. Concrete:
 1. Remove release agents, curing compounds, efflorescence, and chalk.
 2. Fill bug holes, air pockets, and other voids with cement patching compound.
- F. Gypsum Board: Fill minor defects with filler compound; sand smooth and remove dust prior to painting.
- G. Aluminum: Remove surface contamination and oil; wash with solvent according to SSPC-SP 1.
- H. Galvanized Surfaces:
 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- I. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.
 2. Remove rust, loose mill scale, and other foreign substances using methods recommended by paint manufacturer and blast cleaning according to SSPC-SP 6. Protect from corrosion until coated.
- J. Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions.
- C. Apply coatings at spread rate required to achieve manufacturer's recommended dry film thickness and a uniform finish.
- D. Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- E. Walls with Base: Paint the entire wall, including the wall behind the base.

3.04 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to Division 15 and Division 16 for schedule of color-coding and identification banding of equipment, ductwork, piping, and conduit.
- B. Paint shop primed equipment. Do not paint factory-finished items, except where specifically indicated.
- C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.
- E. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers and grilles to match face panels.
- F. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

3.05 MECHANICAL, ELECTRICAL WORK

- A. Interior: Except where interior mechanical and electrical work is factory-finished, or specified to receive another finish, work occurring in finished rooms and spaces shall be cleaned, pre-treated and painted. 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.
- B. Exterior: Except where exterior mechanical and electrical work is factory-finished, or specified to receive another finish, work exposed on the exterior of the building shall be cleaned, pre-treated and painted. 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.

3.06 PRIMING

- A. Apply primer to all surfaces unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.
- B. Primers specified in painting schedules may be omitted on items factory primed or factory finished items if acceptable to top coat manufacturers.

3.07 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.08 PROTECTION

- A. Protect finished coatings from damage until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 10 14 00 SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Engraved plastic signs.
- B. Painted metal signs.
- C. Mounting and anchorage.
- D. Disabled Access Signage

1.02 RELATED SECTIONS

- A. Section 05 40 00 - Cold Formed Metal Framing: Blocking in framed walls.

1.03 REFERENCES

- A. ADA - American with Disabilities Act.
- B. T19, CCR - Title 19, California Code of Regulations.
- C. T24, CCR - Title 24, California Code of Regulations.
- D. 2022 California Building Code (CBC)

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate sign styles, lettering font and size, foreground and background colors, mounting locations, mounting methods, material specifications, and dimensions of each sign.
- C. Signage Schedule: Provide a schedule of signage, indicating location, sign type, and text and/or graphics for every sign.
- D. Samples: Submit two sample signs of each type, full size, illustrating texture, style, Braille text, letter font, and colors specified. Submit four chains of color options and a contrast chart.
- E. Manufacturer's Installation Instructions: Include installation template and attachment devices. Incorporate requirements of Contract Documents.
- F. Manufacturer's Certificate: Certify that materials meet or exceed specified requirements, including applicable California codes.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to T24, CCR, and ADA requirements for persons with disabilities.
- B. Conform to T19, CCR requirements for fire and life safety.
- C. Where regulatory conflict occur, most restrictive in opinion of Architect shall govern.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
- B. Package signs, labeled in name groups.
- C. Store adhesive attachment tape at ambient room temperatures.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not install signs when ambient temperature is lower than recommended by manufacturer.

1.09 COORDINATION

- A. Coordinate signage mounting locations with placement of blocking in wood framed walls and partitions.

PART 2 PRODUCTS

2.01 MANUFACTURERS -PLASTIC SIGNAGE

- A. Manufacturers:
 - 1. Best Mfr. Sign Systems; System HC200 ADA.
 - 2. Mohawk Sign Systems; Series 200A.
 - 3. System 2/90 Inc.; Series ADA Integral.
 - 4. Substitutions: Refer to Section 01 63 00 - Substitution Procedures

2.02 MANUFACTURERS - METAL SIGNAGE

- A. Manufacturers:
 - 1. Best Mfr. Sign Systems; Traffic Sign Series.
 - 2. Substitutions: Refer to Section 01 60 00. Approved equal.

2.03 PLASTIC SIGNAGE

- A. Background material:
 - 1. Solid color %" THERMOFORMED Kadex; non-static, fire-retardant, and self-extinguishing; impervious to common acids, alkalines, alcohol, solvents, abrasives, and boiling water.
 - 2. Total Thickness: 1/8 inch minimum; 1/4 inch minimum at toilet room door signs.
 - 3. Height: As required for text, numbers, graphics and margin; as detailed.
 - 4. Edges: Square
 - 5. Color: As selected by Architect from manufacturer's standard color line of not less than 20 colors; core color contrasting with raised text and graphics.
 - 6. Finish: Matte.
 - 7. Corners: Rounded, approximately 1/4" radius.
- B. Text and Graphics: Raised characters to comply with CBC Section 11B-703.2
 - 1. Material: Raised tactile surface produced by removing background material not necessary for intended text or graphics; removal to occur with graphics and text through thermoformed process. Applied characters are not acceptable. Matte finish.
 - 2. Character Color: As selected by Architect from manufacturer's standard color line of not less than 20 colors; minimum 70 percent contrast between text or graphics and background, either light characters on a dark background or dark characters on a light background and have a non-glare finish. CBC Section 11B-703.5.1
 - 3. Character Depth: 1/32 inch raised, minimum, sans serif, uppercase and be duplicated in braille. CBC Section 11B-703.2.5.
 - 4. Text Height and Font: Raised characters shall be a minimum of 5/8 inch (15.9 mm) and a maximum of 2 inch (51 mm), Sans serif; upper case. CBC Section 11B- 703.2.5
 - 5. Proportions: It shall be selected from fonts where the width of the uppercase letter "O" is 60% minimum and 110% maximum of the height of the uppercase letter "I". Stroke thickness of the uppercase letter "I" shall be 15% maximum of the height of the character. CBC Section 11B-703.4 and 11B-703.6.
 - 6. Braille Text:
 - a. California Contracted Grade 2, raised 1/32 inch minimum and shall comply with CBC Section 11B-703.3 and 11B-703.4. Braille dots shall be domed or rounded and comply with CBC Table and Figure CBC Sec 11B-703.1.
 - b. Provide Braille to accompany text at all room identification signs, and at other locations as detailed and required by T24, CCR, and ADA.
 - c. Braille to occur a minimum of 3/8" and a maximum of 1/2-inch below text.
 - 7. Character Spacing: Spacing between individual tactile characters shall comply with CBC Section 11B-703.2.7 and 11B-703.2.8.
 - 8. Mounting Height: A tactile sign shall be located 48" minimum to the baseline of the lowest Braille cells and 60" maximum to the baseline of the highest line of raised characters above the finish floor or ground surface.
 - 9. Mounting location: A tactile sign shall be located on the approach side, as one enters or exits rooms or space, and be reached within 0" of the required clear floor space per CBC Section and Figure 11B-703.4.2 as follows:

- a. A clear floor space of 18" x 18" minimum, centered on the tactile characters, shall be provided beyond the arc of any door swings between the closed position and 45 degree open position.
 - b. On the wall at the latch side of a single door.
 - c. On the inactive leaf of a double door with one active leaf.
 - d. On the wall at the right side of a double door with two active leaves.
 - e. On the nearest adjacent wall where there is no wall space at the latch side of a single door or no space at the right side of a double door with two active leaves.
- 10. Visual Characters shall comply with CBC Section 11B-703.5 and shall be 40" minimum above finish floor or ground.
 - 11. Pictograms shall comply with CBC Section 11B-703.6.
 - 12. Symbol of accessibility shall comply with CBC Section 11B-703.7.
 - 13. Symbol Graphics, Sizes, and Proportions: As detailed in Drawings; pictograms conforming to T24, CCR, and ADA.

2.04 ACCESSORIES - PLASTIC SIGNAGE

- A. Anchorage:
 - 1. Vinyl foam tape.
 - 2. Adhesive: Silicone adhesive suitable for vinyl wall coverings and other irregular surfaces.
 - 3. Fasteners: Stainless steel, tamper-resistant, flat or oval head, wood or sheet metal screws as appropriate for substrate.

2.05 METAL SIGNAGE

- A. Base Material: 18 gage bonderized steel.
- B. Graphics and Text: Screen printed on base material, over painted contrasting background; baked enamel finish.
- C. Text: Helvetica medium; upper case; size as detailed in Drawings.
- D. Symbol Graphics, Sizes, and Proportions: As detailed in Drawings; pictograms conforming to T24, CCR, and ADA.
- E. Background and Copy Colors: As detailed in Drawings, and as selected by Architect from manufacturer's standard color line of not less than 6 colors; minimum 70 percent contrast between text or graphics and background.
- F. Corners: Radiused.
- G. Mounting Holes: Predrilled.

2.06 ACCESSORIES - METAL SIGNAGE

- A. Mounting Post: 2 inch square galvanized steel, perforated on opposing faces to receive bolt anchors; concrete footings as detailed.
- B. Fasteners: Tamper resistant sex bolts.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work of this section.

3.02 INSTALLATION - PLASTIC SIGNS

- A. Install as detailed; in absence of details, install in accordance with manufacturer's instructions.
- B. Install signs after surfaces are finished, in locations indicated in Drawings, and as scheduled herein.
- C. Wall Signs: Tape and screw fasten sign to solid substrates, including building finishes; anchor sign to blocking within hollow wall construction. Four countersunk screws per sign.
- D. Door signs: Tape and screw fasten signs to solid substrates; 3 countersunk screws per sign to door.
- E. Supplement vinyl tape with silicone adhesive where substrate is irregular or vinyl coated.

- F. Where placement directions require mounting signs to glazing, anchor sign to glass with vinyl tape, and provide a blank backup plate on opposite side of glass to match color of sign background; fabricate blank to same size as overall sign dimensions. Clean glass immediately prior to mounting to ensure complete adhesion of vinyl tape.
- G. Install signs plumb and level, tight to substrate.
- H. Conform to all requirements of T24, CCR and ADA for sign placement.
- I. Locate room identification signs on wall outside the room as follows:
 - 1. 60 inches maximum above finish floor to baseline of the highest line of raised characters and 48 inches minimum above finish floor to the tactile characters on the sign.
 - 2. Position sign relative to door as detailed in Drawings with a clear floor space of 18 inches minimum by 18 inches minimum centered on the sign tactile characters per CBC 11B-703.4.2 Location.
- J. Locate door signs as follows:
 - 1. Center of sign 60 inches above finish floor, in center of outside of door.
- K. Place informational signs as shown in Drawings.
- L. Before fabrication of signs, obtain a final list of room names and numbers from Owner. No signs shall be manufactured or installed until such list has been obtained.

3.03 INSTALLATION - METAL SIGNS

- A. Install as detailed; in absence of details, install in accordance with manufacturer's instructions.
- B. Bottom of post-mounted signs shall clear the ground by 80 inches.
- C. Anchor post-mounted signs with 2 sex bolts per sign.
- D. Install other signs on wall or other surface indicated, centered at 60 inches above finish grade; Mechanical anchorage shall be as indicated; use no less than 4 screws to wall surfaces, 1 in each corner.
- E. Install signs plumb and level, tight to substrate.
- F. Conform to all requirements of T24, CCR and ADA for sign placement.

3.04 PROTECTION OF FINISHED WORK

- A. Exercise all means necessary to protect signs before, during, and after installation. In the event of damage, replace signs at no additional cost to Owner.

3.05 SCHEDULES

- A. Numbered Signs: Provide one plastic sign per existing and new door into each building space. Allow for up to of 4 characters per sign.
- B. Text Signs: Provide one plastic sign per new and existing door into each building space. Allow for up to 15 characters per sign.
- C. Exit and Occupancy Signs: As indicated and required per T19, CCR and T24, CCR.
- D. Graphic Signs, including text when detailed:
 - 1. Pictograms, Toilet Rooms: One per door leading into toilet rooms and toilet room vestibules.
 - 2. Pictograms, International Symbol of Accessibility: One per exterior door leading into usable, non-instructional spaces.
- E. Special Signs: Directional, informational, accessibility, stair and elevator signage as indicated and required by T24, CCR and ADA.

END OF SECTION

**SECTION 10 21 13
HDPE TOILET COMPARTMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid plastic toilet compartments including the following:
 - 1. Floor mounted overhead-braced toilet compartments.
 - 2. Urinal screens

1.02 RELATED REQUIREMENTS

- A. Section 10 28 00 - Toilet Accessories.

1.03 REFERENCE STANDARDS

- A. United States EPA (Environmental Protection Agency) Registration - Bactericidal Surfaces Registered with the U.S. EPA to Legally Make Claims that these Materials Kill Infectious Bacteria.
- B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

1.04 REGULATORY REQUIREMENTS

- A. Accessible Toilet Compartments:
 - 1. Wheelchair accessible compartment shall comply with **CBC Section 11B-604.8.1**.
 - 2. Toe clearance for at least one side partition of a wheelchair accessible compartment shall comply with **CBC Section and Figure 11B-604.8.1.4**. Toe clearance shall be 9" high minimum above the finish floor and 6" deep minimum beyond the compartment side face of the partition, exclusive of partition support members. It shall be 12" high minimum above the finish floor for children's use. Partition components at toe clearances shall be smooth without sharp edges or abrasive surfaces. Toe clearance at the side partition is not required in a compartment greater than 66" wide.
 - 3. Ambulatory accessible compartments shall be provided where there are six or more toilet compartments, or where the combination of urinals and water closets totals six or more fixtures. Such compartments shall be provided in the same quantity as wheelchair accessible compartments per **CBC Section 11B-213.3.1** and shall comply with **CBC Section 11B-604.8.2**.
 - 4. Door and door hardware for accessible compartments shall be self-closing and shall comply with **CBC Section 11B-404** except that if the approach is to the latch side of an ambulatory compartment door, clearance between the door side of the compartment and any obstruction shall be 44" minimum. **CBC Figure 11B-604.8.2**.
 - 5. A door pull complying with **CBC Section 11B-404.2.7** shall be placed on both sides of the accessible compartment door near the latch.
 - 6. A door pull complying with **CBC Section 11B-404.2.7** shall be placed on both sides of the accessible compartment door near the latch.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls.

1.06 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Installation Instructions
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings, and type of hardware required.

- D. Samples: Submit two samples of partition panels, 4" by 4" inch in size illustrating panel finish, color, and sheen.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: A company regularly engaged in installation of products specified in this Section, with a minimum of 5 years experience.
- B. Materials: Doors, panels and pilasters, constructed from high density polyethylene (HDPE) resins. Partitions to be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments. Cover all plastic components with a protective plastic masking.
- C. Performance Requirements:
 - 1. Fire Resistance: Partition materials shall comply with the following requirements, when tested in accordance with ASTM E 84:
 - a. Class A flame spread/smoke developed rating.
 - 2. Material Fire Ratings:
 - a. National Fire Protection Association (NFPA) 286: Pass.
 - 3. Antimicrobial Touch Surfaces:
 - a. Hardware touch surfaces shall be manufactured from substrates that are registered with the U.S. EPA to kill specific bacteria tested according to U.S. EPA protocols.

1.08 WARRANTY

- A. Manufacturer guarantees its plastic against breakage, corrosion, and delamination under normal conditions for 25 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design Manufacturer:
 - 1. Scranton Products, 801 E. Corey St.; Scranton, PA 18505; 800-445-5148, www.scrantonproducts.com.
- B. Substitutions: See Section 01 63 00 - Product Substitution Procedures.

2.02 MATERIAL

- A. Plastic Panels: High density polyethylene (HDPE) suitable for exposed applications, waterproof, non-absorbent, and graffiti-resistant textured surface.
- B. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.
- C. Stainless Steel Castings: ASTM A167, Type 304.
- D. Aluminum: ASTM 6463-T5 alloy.

2.03 SOLID PLASTIC TOILET COMPARTMENTS

- A. Basis of Design: Hiny Hiders Toilet Partitions
- B. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and urinal screens made of solid molded high density polyethylene (HDPE); floor-mounted headrail-braced.
 - 1. Color: Sandcastle.
 - 2. Doors:
 - a. Thickness: 1 inch.
 - b. Width: 30 inch.
 - c. Width for Handicapped Use: 36 inch.
 - d. Height: 60 inch.
 - 3. Panels:
 - a. Thickness: 1 inch.
 - b. Height: 60 inch.

4. Pilasters:
 - a. Thickness: 1 inch.
 - b. Width: As required to fit space; minimum 4 inch.
5. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

2.04 ACCESSORIES

- A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.
- B. Head Rails: Extruded aluminum, anti-grip profile.
- C. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
- D. Hinges: Anodized aluminum, manufacturer's standard finish.
 1. Continuous-type hinge, self closing.
- E. Door Hardware: Chromium-plated brass, manufacturer's standard finish.
 1. Door Latch: Slide type.
 2. Door Strike and Keeper with Rubber Bumper.
 3. Door pull: for ADA compliant doors.
- F. Coat Hook with Rubber Bumper: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated on shop drawings.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in full closed position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

**SECTION 10 28 00
TOILET ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet room and shower accessories.
- B. Under-lavatory pipe supply covers.

1.02 RELATED REQUIREMENTS

- A. Section 09 30 00 - Tiling
- B. Section 10 21 13 - HDPE Toilet Compartments.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1999 (Reapproved 2009).
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 01 33 00 for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.06 REGULATORY REQUIREMENTS

- A. Toilet accessories required to be accessible shall be mounted:
 - 1. At heights in compliance with CBC Sections 11B-308 and 11B-309.
 - 2. At locations in compliance with CBC Sections 11B-602 through 11B-612.
 - 3. Grab bars in toilet facilities shall comply with CBC Section 11B-609. Grab bars and any wall or other surfaces adjacent to the grab bar shall be free of sharp or abrasive elements and shall have rounded edges. The space around the grab bars shall be as follows:
 - a. 1 1/2-inches between the grab bar and the wall.
 - b. 1 1/2-inches minimum between the grab bar and projecting objects below and at the ends.
 - c. 12-inches minimum between the grab bar and projecting objects above.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Accessories:
 - 1. Bobrick, Bases of Design
 - 2. ASI
 - 3. Or Equal
 - 4. See Section 01 63 00 - Product Substitution Procedures for substitution requirements to bases of design accessories.

2.02 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted on Fixture Schedule.

2.03 TOILET ROOM AND SHOWER ACCESSORIES

- A. Bases of Design accessories as scheduled on drawings.

2.04 UNDER-LAVATORY PIPE AND SUPPLY COVERS

- A. Specified in 22 42 00 - Commercial Plumbing Fixtures.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install plumb and level, securely and rigidly anchored to substrate.
- B. Mounting locations and heights for accessories required to be accessible reference Section 1.06 Regulatory Requirements.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

**SECTION 10 44 00
FIRE PROTECTION SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers and cabinets
- B. Accessories.

1.02 SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- B. Shop Drawings: Indicate cabinet dimensions, rough-in measurements for recessed cabinets, and locations.
- C. Product Data: Provide operational features of extinguishers, hose racks, cabinets and accessories, colors, finishes, and anchorage details.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.03 OPERATION AND MAINTENANCE DATE

- A. Submit under provisions of Section 01 70 00 - Contract Closeout.
- B. Maintenance Data: Include test refill or recharge schedules and re-certification requirements.

1.04 QUALITY ASSURANCE

- A. Provide units conforming with UL 711.

1.05 REGULATORY REQUIREMENTS

- A. Conform to T24 & Title 19 CCR and NFPA 13 and CFC Amendments, and must comply with CBC Sections 11B-307, 11B-308, 11B-309 and 11B-403

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Potter-Roemer, bases of design.
- B. Larsen's Manufacturing Co.
- C. Comparable Product Substitutions: Under provisions of Section 01 63 00 - Product Substitution Procedures.

2.02 EXTINGUISHERS

- A. Model 3005-3: Dry Chemical Type: UL 299; steel cylinder with pressure gage, hose and horn; steel valve assembly; FM approved.

2.03 MOUNTING

- A. Fire-Protection Cabinet
 1. .Basis-of-Design Product: Potter Roemer;
 2. Cabinet Type: Suitable for fire extinguisher locations as indicated and detailed on drawings.
 3. Cabinet Material: Enameled-steel sheet.
 4. Semi-recessed cabinet: Roemer Model 7008
 5. Door Material: Steel sheet.
 6. Door Style: Fully glazed panel with frame.
 7. Door Glazing: Tempered float glass (clear).

8. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - a. Provide projecting door pull and friction latch.
 - b. Provide manufacturer's standard hinge permitting door to open 180 degrees.
9. Accessories:
 - a. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, with plated or baked-enamel finish.
10. Finishes:
 - a. Manufacturer's standard baked-enamel paint for the following:
 - 1) Exterior of cabinet door, and trim, except for those surfaces indicated to receive another finish.
 - 2) Interior of cabinet and door.
11. FINISHES
 - a. Extinguisher: Polyester powder-coated; red.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10 51 13 METAL LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal lockers.
- B. Locker benches.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete base construction.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes, and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.04 QUALITY ASSURANCE

- A. Manufactured units shall be ISO 9001:2015 certified.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect locker finish and adjacent surfaces from damage.

1.06 WARRANTY

- A. Manufacturer's standard warranty to repair or replace components of locker products that fail in materials or workmanship within 3 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Salsbury Industries - Bases of Design
 - 1. 18300 Central Avenue, Carson, CA
 - 2. salsbury@lockers.com
 - 3. 1-800-562-5377
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOCKER APPLICATIONS

- A. Locker Room Metal Lockers.
 - 1. Wall mounted on concrete base
 - 2. Mounted back to back on concrete base
- B. Two tier lockers, Series 62168
 - 1. Width: 12 inch.
 - 2. Depth: 18 inches.
 - 3. Height: 72 inches.
 - 4. Provide the following locker options:
 - a. Sloping Hoods
 - b. Compartment Shelf
 - c. Anchoring Brackets
 - d. Three (3) single wall hooks
 - e. Double prong ceiling hook
 - f. Name and Number Plates
 - g. Latches and Door Handles: Manufacturer's standard.
- C. Six tier lockers, Series 66168

1. Width: 12 inch.
2. Depth: 18 inches.
3. Height: 72 inches.
4. Quantity and layout as indicated on drawings.
5. Provide the following locker options:
 - a. Sloping Hoods
 - b. Anchoring Brackets
 - c. Name and Number Plates
 - d. Latches and Door Handles: Manufacturer's standard.
- D. Locker Fillers: Front, Sloped Hood and Sloped Corner as indicated on drawings.
- E. Finished End Panels:
 1. Single end panel for end of unit rows.
 2. Double end panel for back-to-back unit installations.

2.03 CONSTRUCTION

- A. Locker Doors: Steel specially formed for added strength and rigidity and to ensure tight joints at fastening points.
 1. Door:
 - a. 16 gauge - .060 inch thick steel.
 - b. Holes provided for attaching number plates.
 2. Ventilation: Vents provided in louver pattern.
 - a. Double-tier lockers: Four 5-3/4 inch louvers top and bottom.
 - b. Six-tier lockers: Four 5-3/4 inch louvers
 3. Double-tier locker multi-point latch: Full channel formation of adequate depth to fully conceal lock bar on lock side, channel formation on hinge side, right angle formations across top and bottom.
 4. Six-tier locker Hasp: 16-gauge steel hasp with padlock attachment.
- B. Locker Body: Solid steel specially formed for added strength and rigidity and to ensure tight joints at fastening points.
- C. Hinges: Hinge: 0.074 inch thick sheet steel, double spun, full loop, tight pin, projection welded to door frame and securely fastened to the door.
 1. Two 2 inch high five-knuckle hinges.
- D. Factory assembly of locker bodies using heavy duty steel rivets.

2.04 LOCKER BENCHES

- A. Locker Benches: Free standing type; bench top of aluminum ; aluminum pedestals.
 1. ADA Locker Bench with back support
 - a. Tag SN.04a: Model # 77771-ADAB, 42" W x 39" H x 23" D
 - b. Tag SN.04b: Model # 77772-ADAB, 48" W x 39" H x 23" D
 - c. Tag SN.04c: Model # 77773, 36" W x 18" H x 10" D
 - d. Tag SN.04d: Model # 77774, 48" W x 18" H x 10" D

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared bases are in correct position and configuration.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Place and secure on prepared base.
- C. Install lockers plumb and square.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.
- E. Bolt adjoining locker units together to provide rigid installation.

- F. Install end panels, filler panels, and sloped tops.
- G. Install fittings if not factory installed.
- H. Replace components that do not operate smoothly.

3.03 CLEANING

- A. Clean locker interiors and exterior surfaces.

END OF SECTION

**SECTION 14 42 00
WHEELCHAIR LIFTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vertical unenclosed platform wheelchair lift.
- B. Maintenance contract.

1.02 REFERENCE STANDARDS

- A. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts 2020.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Include data on material descriptions, construction details, component dimensions and profiles, and finishes; include data on rated capacities, electrical and operating characteristics, and necessary accessories.
- C. Shop Drawings: Include plans, elevations, sections, and attachment details; include equipment assembly details with dimensions, weights, loads, required clearances, components, size and location of anchors and required field connections, and methods for field assembly; provide diagrams indicating signal, power, and control wiring.
- D. Installer's qualification statement.
- E. Executed warranty.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

1.05 FIELD CONDITIONS

- A. Use of wheelchair lifts during construction for hoisting materials or personnel is not permitted.

1.06 WARRANTY

- A. Manufacturer Warranty: Provide 1 -year Labor and 4 - year factory parts. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 UNENCLOSED VERTICAL PLATFORM WHEELCHAIR LIFTS

- A. Bases of Design Manufacturer:
 - 1. Symmetry Elevating Solutions
 - a. Email: customerservice@symmetryelevator.com
 - b. Phone: 877-568-5804
 - 2. Request for substitutions will be considered in accordance with provisions of section 01 63 00 - Product Substitution Procedures.
- B. General Description: The Unenclosed vertical platform lift is designed for lifting heights up to 63 inches in outdoor use.
- C. Model: UL-60, 63 inches maximum lift height.
 - 1. Type of Vertical Platform Wheelchair Lift:
 - 2. Configuration:
 - a. Straight through entry/exit, with front and rear openings.
 - b. Number of Stops: Two.
 - 3. Location:
 - a. Exterior of building, as indicated on drawings.
 - 4. Lift Load Capacity: 750 lb, maximum.

5. Lifting Height from Bottom to Upper Floor Level: As indicated on drawings.
 6. Platform Clear Width: 36 inches.
 7. Platform Clear Length: 54 inches.
 8. Lift controls: Constant Pressure (Hold to Run)
 9. Machine room: Self Contained
- D. Lower Gate Construction:
1. Provide a 42 inch tall steel framed platform gate that travels with the platform including pull handle and required interlock.
 - a. Gate Construction: Solid 18 gauge galvanized steel fill panel
 - b. Opening / Closing Mechanism
 - 1) Self Closing Hinges
- E. Upper Gate Construction:
1. Provide a 42 inch tall steel framed landing gate including pull handle and required interlock.
 2. Gate Construction:
 - a. Solid 18 gauge galvanized steel fill panel
 3. Opening / Closing Mechanism
 - a. Self Closing Hinges
- F. Access Ramp at Bottom Landing: Fixed ramp to transition from floor level to lift platform, with ramp finish to match lift platform.
1. Size: Provide end ramps at least 32 inches wide and side ramps at least 42 inches wide; length as required for slope with 1:12 maximum slope.
- G. Drive System:
1. Self-lubricating acme screw drive.
 - a. Rated Speed: 10 fpm, nominal.
 - b. Motor: 1 ½ HP, 115 volt, 1 phase.
 - c. Power Supply: 115 VAC, 25 Amp, Single Phase.
 - d. Battery Powered Emergency Lowering:
 - 1) Battery powered platform lowering device which automatically activates in the event of power failure.
 - 2) Capable of running lift up and down for a minimum of 5 trips with rated load at full speed.
- H. Lift Components:
1. Symmetry Elevating Solutions PLC Controller with self diagnostics and digital display. A.W.A.R.E. Diagnostic System (Active Wiring, Accessories, Relay & Electronics) generates on-demand diagnostic codes identifying trouble codes.
 2. Symmetry Elevating Solutions PLC Controller with self diagnostics and digital display. A.W.A.R.E. Diagnostic System (Active Wiring, Accessories, Relay & Electronics) generates on-demand diagnostic codes identifying trouble codes.
 3. Platform shall be constructed of 12-gauge minimum hot rolled steel. If unit is not installed in a 3-inch pit, an auto-retracting ramp, or stationary ramp, shall be provided.
 4. Platform side panels shall be 42 inches high, side panel framework shall be a minimum of 1 inch x 1 ½ inch steel. Solid infill panels shall be a minimum of 18 gauge steel.
 5. Carriage platform supports shall be a minimum of ½ inch steel
 6. Nonmetallic rollers shall be used for axial carriage guidance and wear pads shall be used for horizontal stability.
 7. Loaded fasteners shall be grade eight or higher. Locking fasteners shall be used in all critical locations.
- I. Platform Base and Frame Installation:
1. Floor Mount: (non-recess application) with fixed mounted ramp.
 - a. Platform Access Ramp: 12 gauge galvanized steel plates; slip resistant surfaces.
- J. Platform Controls:

1. Constant pressure up/down control switches shall be installed on the platform. All switches meet IP66 requirements.
 2. An illuminated emergency stop switch shall be provided on the platform controls with an audible alarm as a means of signaling for assistance in the event of an emergency.
 3. Operation Type:
 - a. Keyless Operation
 4. Emergency Telephone
 - a. Platform shall be equipped with a telephone meeting the following requirements:
 - 1) ADA compliant.
 - 2) Shall be operational in the event of power failure.
- K. Landing Controls:
1. Constant pressure, elevator-style, control switches provided at each landing.
 2. Operation Type:
 - a. Keyless operation.
 3. Landing Station Mounting:
 - a. Lower:
 - 1) Flush Mount.
 - b. Upper:
 - 1) Flush Mount.
- L. Safety Features/Devices:
1. Grounded electrical system with upper and lower limit switches.
 2. Upper final limit switch.
 3. Safety Pan shall be provided to prevent the unit from moving downward when an obstruction is encountered.
 4. A grab rail shall be provided on the platform
 5. A gate with a minimum height of 42 inches and a combination mechanical lock with an electric contact shall be provided at the upper landing, the gate must be closed for the lift to move away from landing.
 6. At all landings, electromechanical interlocks shall be used to keep doors closed when lift is on another floor.
 7. Electrical disconnect which will shut off power to the lift.
- M. Finishes
1. Baked-On Factory Finish for Structural Metal Surfaces: Clean surfaces of rust, oil, or grease and wipe clean with solvent; apply manufacturer's standard two-coat, baked-on finish consisting of primer and thermosetting top coat.
 - a. Color: Grey
 2. Outdoor Protection: The lift shall be primed with zinc rich primer prior to the final powder coat finish and all exposed fasteners or hinges will be made from stainless steel or hot dip galvanized.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that areas and conditions comply with installation tolerances and other conditions affecting this work.
- B. Verify that locations for electrical rough-in connections to system equipment are in acceptable locations before installing equipment.
- C. Verify that electrical power is available and of correct characteristics.
- D. Do not proceed with installation until unacceptable conditions have been corrected.

3.02 PREPARATION

- A. Prepare surfaces of substrates using methods in accordance with lift manufacturer's installation instructions.
- B. Clean surfaces thoroughly before starting installation of lifts.

3.03 INSTALLATION

- A. Install wheelchair lift system and components in accordance with manufacturer's written installation instructions.
- B. Install wheelchair lift system securely to supporting structure, and flush with adjacent surfaces.
- C. Install structural components using methods that comply with requirements indicated relative to layout and structural position.

3.04 ADJUSTING

- A. Adjust wheelchair lift equipment to operate smoothly and safely.
- B. Verify vertical travel of wheelchair lift system; adjust as necessary to maintain operating range indicated.

3.05 CLEANING

- A. Remove protective coverings from finished surfaces.
- B. Clean surfaces and components.

3.06 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate operation of wheelchair lift system to Owner's personnel.
 - 1. Use operation and maintenance data as a reference during the demonstration.
 - 2. Briefly describe function, operation, and maintenance of each component.
- B. Training: Train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Instructor: Manufacturer's training personnel.

3.07 MAINTENANCE

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Perform maintenance work using competent personnel under supervision of wheelchair lift installer.
- C. Examine monthly; clean, adjust, and lubricate equipment.
- D. Repair, or replace parts when required with parts produced by original equipment manufacturer.
- E. Provide emergency call back service 24 hours per day during maintenance period.

END OF SECTION

SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Project specification Sections, apply to this and the other sections of Division 22.
- B. This Division is an integrated whole comprising interrelated and interdependent Section and shall be considered in its entirety in determining requirements of the Work.
- C. Refer to other sections of this Division for additional requirements or information regarding the subjects of this Section.

1.02 SECTION INCLUDES

- A. This Section includes general administrative and procedural requirements for Plumbing installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:
 - 1. Submittals.
 - 2. Coordination drawings.
 - 3. Record documents.
 - 4. Maintenance manuals.
 - 5. Rough-in.
 - 6. Mechanical installations.
 - 7. Cutting and patching.

1.03 SUBMITTALS

- A. General: Follow the procedures specified in Division 01.
- B. Plumbing submittals shall include shop drawings, product data, and samples per requirements of each section of specification
- C. Plumbing Submittals and Product Data: Assemble "submittals" and "product data" into tabbed brochures according to main areas of work.
 - 1. Assemble each brochure with tabbed separators for each Specification Section where products are noted to be submitted, with separate tabs for each product listed.
 - 2. For items such as valves, hangers, and accessories, indicate specific items and where they are to be used.
 - 3. Contractor need only to submit for review those items specified to be submitted, unless requested by the Architect for special review.
- D. All submittals shall be submitted in hard copy, electronic submittals are not acceptable.
- E. Increase the number of Plumbing related submittals including shop drawings, product data, and samples submitted to allow for required distribution by one additional copy, which will be retained by the Mechanical Consulting Engineer.
- F. Submit for review, only the specific items required in this Section or other Sections of Division 22.
- G. Additional submittals shall include, but not limited:
 - 1. Air balance reports and equipment data record drawings.
 - 2. Certification of completion of testing.
 - 3. Certification of completion of operation instructions.
 - 4. Operating instruction brochure.
 - 5. Maintenance instruction brochures.
 - 6. Equipment guarantees.
 - 7. 1/4" = 1'-0" or larger scale layouts of "Equivalent" equipment or "Or Approved Equal" equipment.
 - 8. Coordination Drawings, where requested or required.

- H. Submittal materials will be reviewed for substantial conformity with the intent of the contract plans and specifications only. Such review does not indicate approval of dimensions, quantities, coordination with other trades, or work methods of the contractor, which are indicated thereon.
- I. Additional copies may be required by individual sections of these specifications.

1.04 COORDINATION

- A. The Contractor shall be totally responsible for coordinating the layout of all building elements to avoid conflict of the work of the structural, mechanical, electrical systems, and architectural features of the building.
- B. The cost of any extra work of any kind caused by a conflict due to this lack of coordination shall be borne by the Contractor.

1.05 COORDINATION OF DRAWINGS

- A. Prepare coordination drawings in accordance with requirements of Project Specification to a scale of 1/4" = 1'-0" or larger; detailing major elements, components, required clearances, and systems of Plumbing equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of the installations are of importance to the efficient flow of the Work, including but not necessarily limited to the following:
 - 1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
 - a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - b. Equipment for connections and support details.
 - 2. Prepare reflected ceiling plans to coordinate and integrate installations with other systems and components, such as, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.
- B. Submittal of "Or Equal" substitutions of equipment will not be reviewed unless accompanied by coordination drawings.

1.06 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements of project specification. In addition to the requirements of project specification, indicate the following installed conditions:
 - 1. Record drawings of all installed as specified in Division 01 the locations and invert elevations of underground installations.

1.07 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Project specification and Division 23 Section "Supplementary HVAC Requirements."

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, mill certification, and other information needed for identification.

1.09 EQUIVALENT EQUIPMENT

- A. In these specification and drawings, whenever more than one (1) manufacturer's product is specified, the manufacturer specified on the drawings and the first named product in these specifications is the basis of design and the use of alternate-named manufacturer's product or substitutes may require modification in the design work and agency approvals. If such alternatives or substitutions are proposed by the contractor, contractor shall adhere to the following requirements:
 - 1. Contractor shall clearly identify all proposed alternatives or substitutions in the submittal package.

2. The Contractor shall assume all costs required to make all necessary revisions and modifications of the contract documents resulting from the substitution or selection of an alternate manufacturer's product, including all professional fees and the cost of DSA approval.
 3. The Contractor shall assume all costs required for any additional modification to building structure, electrical and all other related construction costs resulting from the substitution or selection of an alternate manufacturer's product.
- B. These specifications and/or drawings, names and specifies certain equipment in detail which are the basis of design and are explained in paragraph 1.09-A above. It also names alternate equipment by manufacturer, which is not considered to be a "substitution."
- C. Submit equivalent equipment to the Architect for review per the requirements of Division 01, and Section "Common Work Results for Plumbing."
- D. Equipment of Manufacturers named in Division 22 will be considered equivalent to that specified in detail and/or named on the drawings if:
1. The proposed equipment is of equivalent quality, capacity.
 2. Equipment is as fully equipped, fits the space allotted, and has physical configuration and weight similar to the equipment specified in detail.
- E. A complete lay out of an equipment room or area must be submitted for equivalent equipment. Notice space limitations. Layouts to include plans and section views at a scale of not less than 1/4" = 1 ft.
- F. The Architect shall determine the acceptability of "Equivalent Equipment."

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 ROUGH-IN

- A. Verify final locations for rough-in with field measurements and with the requirements of the actual equipment to be connected.

3.02 MECHANICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of Plumbing systems, materials, and equipment. Comply with the following requirements:
1. Coordinate Plumbing systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for Plumbing installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of Plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible as required by California Building Code.
 7. Coordinate connection of Plumbing system with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect prior to commencement of installation.

9. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components.
10. Install all Plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components in full compliance with California Building Code and the equipment manufacturer's recommendations. If the drawings or the manufacturer does not provide a specific space requirement for servicing equipment, provide as a minimum, horizontal distance of 36" from face of equipment to opposite vertical surface.
11. Install access panels or doors for all equipment and components which require access for adjustment and maintenance, where units are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Any equipment located above a ceiling that has any component, which is serviceable shall be installed within 12" of the top-of the ceiling.

3.03 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with project specification. In addition to the requirements specified in project specification, the following requirements apply:
 1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of Plumbing equipment and materials required to:
 1. Uncover Work to provide for installation of ill-timed Work.
 2. Remove and replace defective work.
 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 4. Remove samples of installed Work as specified for testing.
 5. Install equipment and materials in existing structures.
 6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- C. Cut, remove, and legally dispose of selected Plumbing equipment, components, and materials as indicated, including but not limited to removal of Plumbing piping, refrigerant lines, heating units, and other Plumbing items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 1. Patch existing finished surfaces and building components using experienced installers and new materials matching existing materials. For installer's qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

SECTION 22 05 11
SUPPLEMENTARY PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies supplementary requirements for Plumbing installations and includes requirements common to more than one section of Division 22. It expands and supplements the requirements specified in Section 22 05 00 "Common Work Results for Plumbing."

1.02 DESCRIPTION

- A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

1.03 COORDINATION

- A. Coordination of the work is the responsibility of the Contractor.
- B. Contractor shall designate an individual competent and versed in the Plumbing trades to coordinate the Plumbing work with the work of other trades.

1.04 DEFINITIONS (AS USED ON DIVISION 22 DRAWINGS AND HEREIN)

- A. "Provide" means furnish, install, and connect unless otherwise described in specific instances.
- B. "Piping" means pipes, fittings, valves, and all like pipe accessories connected thereto.
- C. "Extend", "Submit", "Repair" and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.
- D. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constituted authorities and public utility franchise holders having jurisdiction.
- E. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.
- F. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces, which are not included in the utility areas definition.
- G. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.
- H. "Below Grade" means buried in the ground.
- I. "Substantial Completion" means all components of all systems are functioning but lacking in final adjustment.
- J. Pressure rating specified (such as for valves and the like) means design working pressure for and with references to the fluid, which the device will serve.

1.05 RELATED WORK

- A. Coordination: Refer to Architectural, HVAC, Plumbing, Civil, Structural, and Electrical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order the work of this Division so that progress will harmonize with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of Plumbing work in relation to the work of other Divisions.
- B. Examine other Divisions for work related to the Work of this Division, especially Divisions 22 & 26.

1.06 EXISTING CONDITIONS

- A. Visit the site prior to bidding and investigate the existing conditions, which affect or will be affected by the work of this Division. Become thoroughly familiar with the working conditions and take into account any special or unusual features peculiar to this job. By the act of submitting a Bid, the Contractor will be deemed to have complied with the foregoing, to have accepted such conditions, and to have made allowance therefore in preparing his Bid.
- B. The locations of existing concealed utility lines are shown in accordance with reference data received by the Architect. The Architect does not guarantee the accuracy of such data. The points of connection are therefore approximate, and the Bidder shall include adequate funds in his Bid to cover costs of connection regardless of their exact location.
- C. Exercise extreme caution during trenching operations. Repair the damage caused by such operations, to existing utility lines at no cost to the Owner, whether the lines are shown on drawings or not.

1.07 DRAWINGS AND SPECIFICATIONS

- A. These drawings and specification do not include necessary components for construction safety.
- B. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option."
- C. Except where dimensioned, the drawings relating to this division are a diagrammatic presentation of the design concept, which indicates the general area where piping and ductwork is to be run. The drawings do not necessarily indicate any, and all offsets and configurations required for coordination with other trades. The contractor is responsible for the correct placing of his work, and the proper location and connection of his work in relation to the work or other trades.

1.08 PERMITS AND INSPECTIONS

- A. Obtain, schedule, and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.
- B. Afford the Architect's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

1.09 CODES AND REGULATIONS

- A. By submitting a Bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. In case of conflict between the Contract Documents and Code requirements, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specific references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him permission to use options, which are permitted by Codes.
- B. Applicable Codes: (Current editions unless otherwise noted)
 - 1. All local codes; city and/or county as applicable.
 - 2. OSHA requirements.
 - 3. California Building Code.
 - 4. California Code of Regulations (CCR) Titles (as applicable).
 - 5. Fire Marshal Regulations.
 - 6. State, County, City Health Department Ordinances and Regulations.
 - 7. Regulations of all other authorities having jurisdiction.
 - 8. California Mechanical Code.
 - 9. California Plumbing Code.
- C. Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.10 RECORD AND DOCUMENTATION

- A. Accumulate the following and deliver to the Owner's representative prior to final acceptance of the work.
1. Record (As-Built) Drawings:
 - a. Maintain in good order in the field office a complete set of prints for all work being done under Division 22. Update the drawings daily with neat and legible annotations in red ink showing the work as actually installed.
 - b. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stub-outs shall be accurately located and dimensioned from building walls or other permanent landmarks.
 - c. Furnish the original marked up AS-Built drawings and an electronic copy in AutoCAD-14 format.
 2. Operation and Maintenance Manual: Furnish an operation and maintenance manual covering the stipulated Plumbing systems and equipment. Seven copies of the manual, bound in hardback binders or an approved equivalent shall be provided to the Architect.
 3. Furnish one complete manual prior to the time that system or equipment tests are performed.
 4. Furnish the remaining manuals before the contract is completed.
 5. The following identification shall be inscribed on the cover:

OPERATION AND MAINTENANCE MANUAL
PROJECT TITLE
CONTRACTOR NAME & CONTACT INFORMATION
 6. Provide a Table of Contents.
 - a. Insert tab sheets to identify discrete subjects.
 - b. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in.
 - c. The manual shall be complete in all respects for all materials, piping, valves, devices and equipment, controls, accessories, and appurtenances stipulated. Include as a minimum the following:
 - 1) Updated approved materials lists, shop drawings and catalog information of all items of Plumbing system equipment.
 - 2) System layout showing piping, valves, and controls.
 - 3) Wiring and control diagrams with data to explain detailed operation and control of each component.
 - 4) A control sequence describing start-up, operation, and shutdown.
 - 5) Detailed description of the function of each principal component of the system.
 - 6) Procedure for starting.
 - 7) Procedure for operating.
 - 8) Shut-down instructions.
 - 9) Installation instructions.
 - 10) Adjustments, maintenance, and overhaul instructions.
 - 11) Lubrication schedule including type, grade, temperature range and frequency.
 - 12) Safety precautions, diagrams, and illustrations.
 - 13) Test procedures.
 - 14) Performance data.
 - 15) Parts list, with manufacturer's names and catalog numbers.
 - 16) Preventive maintenance schedule.
 - 17) Service organization with name, address, and telephone number.
 - 18) Valve identification chart and schedule.
 - 19) ASME certificates.
- B. Standards Compliance: Where equipment or materials are specified to conform to requirements of standards of recognized technical or industrial organizations such as American

National Standards Institute (ANSI) American Society for Mechanical Engineers (ASME) American Society for Testing Materials (ASTM), Underwriters Laboratories (UL), American Gas Association (AGA), American Refrigeration Institute (ARI), or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence.

- C. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements.
- D. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- E. Factory Tests: Factory tests are tests, which are required to be performed on the actual materials or equipment, proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- F. Permits and Certificates of Inspection: Furnish the originals.
- G. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- H. Other data required by other sections of this Division. Furnish 2 copies.

1.11 CONSTRUCTION COST BREAKDOWN

- A. Prepare and submit for review a construction cost breakdown for the major subdivisions of the Plumbing work in accordance with General and Supplemental Conditions and Project Specification.
- B. Subdivide each item on the breakdown into two headings: labor and materials. Include overhead and profit in each entry.
- C. Submit one copy of the breakdown directly to the Engineer and the remaining copies sent through regular channels.

1.12 TOOLS

- A. Provide all special tools needed for proper operation and routine adjustment and maintenance of systems and equipment. Deliver tools to Owner's representative and request a receipt for same.

1.13 WARRANTIES

- A. Refer to Project Specification for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.
- B. Where periods more than one year are specified in the specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components, which are inactive because of, said failure shall be suspended. The warranty period for such components shall resume to-run for the remaining portion of the warranty period when failed component is completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.
- C. Neither payment for work, nor total or partial occupancy of work by the Owner, within or prior to the warranty period specified, shall be construed as acceptance of faulty work, or shall condone any negligence or omission of Contractor in doing the work.
- D. Compile and assemble the warranties specified in Division 22, into a separated set of vinyl covered, three ring binders, tabulated, and indexed for easy reference.
- E. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names and addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.14 SEISMIC RESTRAINT

- A. Provide seismic restraint for Plumbing equipment, piping, and ductwork.
- B. Contractor shall submit certification of suitability of seismic restraint methods signed by Licensed Structural Engineer registered in State of California.

1.15 SYSTEM OPERATIONAL TESTS

- A. The Contractor shall inform the Owner one week prior to start of testing in order that the Owner's representative may be present.
- B. After balancing and prior to final inspection, the contractor shall operate all systems continuously trouble free and stable for a minimum period of fourteen (14) consecutive days including Saturday and Sunday. Each day shall be a minimum of an 8-hour day. Should a problem arise, the fourteen (14) day period shall be restarted and repeated until successfully operated for full 14 days. A written report certified by the Owner's representative shall indicate the successful completion of a stable and trouble free 14-day period.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Standard Products: Materials and equipment shall be essentially the standard cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be their latest standard designs that comply with the specification requirements.
- B. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening unless more stringent requirements are specified. Where two or more units of the same type of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer.
- C. Each major component of equipment shall have manufacturer's name, address, model, and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.
- D. In these specification and drawings, whenever more than one (1) manufacturer's product is specified, the manufacturer specified on the drawings and the first named product in these specifications is the basis of design and the use of alternate-named manufacturer's product or substitutes shall comply with the requirements of Section 22 05 00.

2.02 PRODUCT LISTING

- A. When two or more items of same material or equipment are required (pipe and fittings, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, sheet metal, wire, steel bar stock, welding rods, solder, fasteners, and similar items used in Work, except as otherwise indicated.

2.03 NAMEPLATE DATA

- A. Provide permanent operational data nameplate on each item of power operated Plumbing equipment, indicating manufacturer, product name, model name, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.04 SUBSTITUTIONS

- A. General: Submittals of "Substitutions" shall be in accordance with requirements of Division 01.
- B. By proposing a-substitution it is deemed that the Contractor shall bear the cost of any, and all design and construction changes (whether architectural, structural, electrical, HVAC and Plumbing) necessary to accommodate the substitution, if said substitution is accepted.
- C. Specific: Refer to Specification Sections 22 05 00 & 22 05 12 for additional requirements.

2.05 SUBMITTALS

- A. General: Make submittals in accordance with requirements of Division 01.

- B. Specific: Refer to Specification Sections 22 05 00 for additional requirements.

PART 3 - EXECUTION

3.01 WORKMANSHIP AND INSTALLATION METHODS

- A. Workmanship shall be in the best standard practice of the trade.
- B. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

3.02 TESTS

- A. General:
 - 1. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
 - 2. Provide instruments and personnel for tests and demonstrations. Submit signed test results.
- B. Specific: Refer to the other sections of this Division for test requirements.

3.03 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK

- A. Protect materials against dirt, water, chemical and mechanical damages both while in storage and during construction.
- B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.
- C. Keep cabinets and other openings closed to prevent entry of foreign matter.
- D. Specific: Refer to other sections of this Division for additional requirements.

3.04 PROJECT CONDITIONS

- A. Check and coordinate for clearance, accessibility, and placement of equipment either by going through openings provided or by placing equipment during construction. Ordering of equipment to be shipped disassembled, or disassembly of equipment at Project Site and reassembly of equipment to accomplish this requirement shall be executed without additional cost. Where provided openings are inadequate to accommodate equipment, provide new openings and restoration of same, all at no additional cost. Obtain written approval for new openings before proceeding.
- B. Verify location of all equipment within finished spaces with the Architectural Drawings. In the event, that Plumbing drawings do not indicate exact locations, or are in conflict, with the Architectural drawings, obtain information regarding proper locations. Installation of work without proper instruction under such circumstances will result in relocation of work, when directed, without additional cost.

3.05 INSTRUCTION TO OWNER PERSONNEL

- A. Contractor shall furnish, without additional expense to the Owner, the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance of work. Instruction shall be given at the Owner's convenience. The number of man-days (eight-hours) of instruction furnished shall be as specified in other sections.

When more than four man-days of instruction are specified, approximately half of the time shall be used for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.

- B. Contractor shall videotape, both visual and audio, instruction to Owner's personnel on the maintenance and operation of the Plumbing systems.

- C. Submit certification, signed by Owner's agent that instructions have been completed and the videotape has been reviewed and delivered to the Owner.
- D. Printed operating instructions and a copy of wiring diagrams are to be mounted in all equipment areas, framed and behind glass or encased in plastic. Printed operating instructions shall include steps for starting up and securing equipment. As a precedent to final acceptance four (4) copies of instructions are to be submitted to the Architect for review. Contractor shall turn over to Owner in a neat brochure form, equipment-guarantee, and maintenance instructions.

3.06 CLEANING

- A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.
- B. Refer the Division 01 for general requirements for cleaning.
- C. Leave exposed parts of the Plumbing work in a neat, clean, and usable condition, with painted surfaces unblemished and plated metal surfaces polished.
- D. Thoroughly clean all materials, equipment, and appliances. Clean and prepare all surfaces to be painted. Clean the entire premises of unused materials, debris, spots, and marks to the satisfaction of the Architect.
- E. Remove, thoroughly clean, and replace all strainers and automatic valves after the system has been put in operation until system is clear of all foreign matter and repeat this operation after ten (10) days and again after the system has been in operation thirty (30) days. Submit certification that this operation has been completed.

3.07 SAFETY REQUIREMENTS

- A. Enclose and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts in accordance with OSHA requirements. Insulate, guard, and cover any high-temperature equipment and piping so located as to endanger personnel or create a fire hazard.

END OF SECTION

SECTION 22 05 12
PLUMBING PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies administrative and procedural requirements for handling requests made after award of the Contract for substitutions of products specified in Division 22.

1.02 RELATED SECTIONS

- A. Procedure for Contractor's construction Schedule and the Schedule of Submittals are included under Division 01.
- B. Standards: Refer to Division 01 for applicability of industry standards to products specified.
- C. Procedural requirements governing the Contractor's selection of products and product options are included under Division 01.
- D. Refer to Division 01 for Products and Substitutions.
- E. Refer to Sections 22 05 00 & 22 05 11 for additional requirements.

1.03 DEFINITIONS

- A. "Products" is defined to include purchased items for incorporation into the work, regardless of whether specifically purchased for project or taken from Contractor's stock of previously purchased products. "Materials" is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of work.
- B. "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.). Definitions in this paragraph are not intended to negate the meaning of other terms used in contract documents, including "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction", and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

1.04 SUBSTITUTIONS

- A. The requirements for substitutions do not apply to specified Contractor options on products and construction methods. Revisions to contract documents, where requested by Owner, Architect or Engineer, are "changes" not "substitutions". Substitutions requested during bidding period, which have been accepted prior to Contract Date, are included in contract document and are not subject to requirements for substitutions as specified herein. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions"; and do not constitute a basis for change orders, except as provided for in contract documents. Otherwise, contractor's requests of changes in products, materials and methods of construction required by contract documents are considered requests for "substitutions" and are subject to requirements hereof.
- B. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise, requests will be returned without action except to record noncompliance with these requirements.
 - 1. Extensive revisions to Contract Documents are not required.
 - 2. Proposed changes are in keeping with the general intent of Contract Documents.
 - 3. The request is directly related to an "or approved equal" clause or similar language in the Contract Documents.
 - 4. All costs required to make all necessary revisions and modifications to the contract documents resulting from the substitution, including but not limited to, all professional fees and the cost of DSA approval will be the Contractor's responsibility.

5. All costs required to make all necessary revisions and modifications to the building structure, electrical and all other related construction costs resulting from the substitution, including but not limited to, material, products, equipment, testing, and inspection will be the Contractor's responsibility.
6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
7. Contractor will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.
8. Contractor certifies that the substitution is not heavier than the specified item and does not necessitate any structural and electrical redesign; will fit within the room or area designed for the specified item; and will not exceed any maximum dimensions specified or shown on the original contract Documents.
9. All roof mounted equipment must be less than or equal to the maximum height dimension from the finished roof as shown on the drawings.
10. Contractor represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.
11. Contractor represents that he will provide the same warranty for the substitution that he would for that specified.

1.05 SUBMITTALS

- A. Requests for Substitutions: Any request for substitution shall follow the guidelines of Substitution Requirements in Division 01, Section 22 05 00 & 22 05 11.
- B. Substitution Warranty: All submittals of Request for Substitutions under the General and Supplementary Conditions of this Section shall be accompanied by a completely executed (filled out) and signed Substitution Warranty in the form entitled "Substitution Warranty", bound herein. Substitutions will not be accepted without the Substitution Warranty. In addition to other requirements, Contractor shall warrant in writing on his own letterhead that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, and any additional coordination with work of other trades. Testing, if required, shall be paid by Contractor.
- C. Responsibility of Contractor: The contractor shall be solely and directly responsible for fitting accepted substitute material and equipment into the available space in a manner acceptable to the Architect, and for the proper operation of the substituted equipment with all other equipment with which it may be associated. The Contractor shall bear all costs of meeting the above requirements for presenting a proposed substitution, and if the substitution is accepted, he must bear all costs involved.
- D. Submit the following as part of the Request for Substitutions:
 1. Data showing proposed equipment is "equal" to that specified and is fully equipped, fits the space allotted and has physical configuration and weight similar-to the equipment specified in detail.
 2. A complete layout, where applicable, of equipment room or area must be submitted for equipment proposed in "Request for Substitution". Submittal shall conform to requirements of Division 01 and Section 22 05 00 "Common Work Results for Plumbing" as it applies to "Coordination Drawings."
 3. Seismic Restraint: Where seismic restraint is required for products or equipment as specified, methods of seismic restraint signed by licensed Structural Engineer registered in the State of California, shall be submitted for review to the Division of the State Architect.

1.06 ARCHITECT'S ACTION

- A. The Architect may request additional information or documentation necessary for evaluation of the request. Requests, by the Architect, for additional information or documentation will be in accordance with Division 01 requirements. The Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, Contractor shall use the "Bases of Design" product specified by name in the contract documents. Acceptance will be in the form of a Change Order.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

- A. Substitutions shall conform to the product requirements for the specified products or equipment.

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SAMPLE
SUBSTITUTIONS WARRANTY

In addition to other requirements, Contractor shall warrant in writing that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, and any additional coordination with work of other trades. Testing, if required, shall be paid by contractor. The following is an example of the type of Substitution Warranty which shall be executed by the Contractor, on his own letterhead:

SUBSTITUTION WARRANTY

We propose to provide the following,

(Describe items being proposed for substitution)
for _____ in lieu of
(List project name)
as indicated on the drawings and described in Section _____ of the Specifications.

We agree to assume the cost of any, and all modifications to the Contract Documents and to other portions of the work as indicated in the Specification Sections 23 05 00, 23 05 11, & 23 05 12, and as necessary to accommodate for substituted material(s) and system(s) as indicated in this letter of "Substitution Warranty."

We hereby warrant that _____
(Provide Description)
is the equivalent of _____
(Specified Product)

in every respect and will perform satisfactorily under the conditions and use indicated on the Drawings and described in the Specifications.

Signed: _____ Date: _____
(Manufacturer/Supplier)

Signed: _____ Date: _____
(Subcontractor)

Signed: _____ Date: _____
(Contractor)

NOTE: Affix Corporate Seal over Signatures.

SECTION 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies the basic requirements for electrical components, which are an integral part of packaged Plumbing equipment. These components include, but are not limited to factory-installed motors, starters, and disconnect switches furnished as an integral part of packaged Plumbing equipment.
- B. Specific electrical requirements (i.e., horsepower and electrical characteristics) for Plumbing equipment are scheduled on Drawings.
- C. All motors, power driven equipment and automatic control equipment, except motor starters as hereinafter set forth required and connected with the work of this section of the specifications are to be furnished and installed under Division 22.
- D. Control low (24V) and control line (120V) voltage wiring, conduit and related switches and relays required for the automatic control and/or interlock of motors and equipment includes final connection, are to be furnished and installed under Division 22. Materials and installation to conform to Class 1 or 2, CAC Title 24, Article E725, and as restricted under Division 26 of these specifications.
- E. Power wiring, conduit, outlets, disconnect switches, motor starters and motor-rated contactors, and making of final connections, except as hereinafter specified, are to be furnished and installed under the Division 26 of these Specification.
- F. Identify circuits and equipment as outlined in the Electrical Sections of these Specifications.
- G. Coordinate requirements for underground conduit only between buildings for control interlocks shown on the drawings. This conduit to be furnished and installed under Division 26 of these Specifications.
- H. Space provisions have been made on electrical panels for control power source.

1.02 RELATED SECTIONS

- A. Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.
- B. This section applies to all Division 22 sections specifying Plumbing equipment.

1.03 REFERENCES

- A. NEMA Standards MG 1: Motors and Generators.
- B. NEMA Standards ICS 2: Industrial Control Devices, Controllers, and Assemblies.
- C. NEMA Standard 250: Enclosures for Electrical Equipment.
- D. NEMA Standard KS 1: Enclosed Switches.
- E. Comply with National Electrical Code (NFPA 70).

1.04 SUBMITTALS

- A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.05 QUALITY ASSURANCE

- A. Electrical components and materials shall be UL labeled.

PART 2 - PRODUCTS

2.01 MOTORS

- A. Provide all motors necessary for equipment under the Plumbing Work. See Electrical Drawings for voltage and phase of electrical services.
- B. The following are basis requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
 - 1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
 - 2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.
 - 3. 2-speed motors shall have 2 separate windings on poly-phase motors.
 - 4. Temperature Rating: As a minimum, motors shall be rated for 40 degree C environment with maximum 50 degree C temperature rise for continuous duty at full load (Class A Insulation).
 - 5. Starting capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly time spaced starts per hour for manually controlled motors.
 - 6. Service Factor: 1.23 for poly-phase motors and 1.35 for single-phase motors.
 - 7. Motor construction: NEMA Standard MG 1, general purpose, continuous duty, design "B", except "C" where required for high starting torque.
 - a. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
 - b. Bearings:
 - 1) Ball or roller bearings with inner and outer shaft seals.
 - 2) Re-greasable bearings, except permanently sealed where motor is normally inaccessible for regular maintenance.
 - 3) Bearings designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
 - 4) Bearings for fractional horsepower, light duty motors, sleeve type bearings are permitted.
 - c. Enclosure Type:
 - 1) Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.
 - 2) Guarded drip-proof motors where exposed to contact by employees or building occupants.
 - 3) Weather protected Type I for outdoor use, Type II where not housed (Epoxy encapsulated or TEFC).
 - d. Overload protection: Polyphase built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter. Single phase, provide thermal overload protection.
 - e. Noise rating: "Quiet".
 - f. Efficiencies shall be guaranteed minimum values in accordance with the following tabulation. Efficiencies shall be established in accordance with NEMA Test Standards MG1-12.53A using IEEE Test Procedure 112, Method B:

HP	EFFICIENCY
1 - 2	81.5
3 - 5	86.5
7-1/2 - 10	90.6
15 - 30	92.0

- g. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
- h. Provide all motors with junction boxes or terminals boxes and provide adjustable slide rails for all motors with belt drives.

- i. Motors rated 1 HP and larger shall have shaft, bearings and, etc. capable of operating with multiple grooved sheaves and two or more belts.
- j. V Type Belt Drives: Drives requiring not more than 2 belts; variable pitch type; size for mid-point of operating range. Drives requiring 3 or more belts; nonadjustable constant speed type. Provide belts in matched sets.

2.02 MOTOR STARTERS

- A. Unless provided as part of packaged Plumbing equipment or otherwise indicated, starters for motors will be provided under Division 26. Provide to Division 26 the data necessary for motor starter heater sizing for all motors.
- B. Starters for factory Plumbing equipment specified under Division 22 shall be provided as part of the package.
- C. Motor Starter Characteristics:
 - 1. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs, or units in hazardous locations, which shall have NEC proper class and division.
 - 2. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.
- D. Manual switches shall have:
 - 1. Pilot lights and extra positions for multi-speed motors.
 - 2. Overload protection: melting alloy type thermal overload relays.
- E. Magnetic Starters:
 - 1. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
 - 2. Trip-free thermal overload relays, each phase.
 - 3. Interlocks, switches, and similar devices as required for coordination with control requirements.
 - 4. Built-in control circuit transformer, fused from line side, where service exceeds 240 volts.
 - 5. Externally operated manual reset.
 - 6. Under-voltage release or protection.
- F. Motor Connections:
 - 1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

2.03 DISCONNECT SWITCHES

- A. When applied as part of factory furnished and mounted equipment, disconnects shall meet the requirements for disconnect switches set forth in Division 26.

PART 3 - EXECUTION

3.01 SEISMIC RESTRAINT

- A. All electrical devices shall be seismically restrained.

END OF SECTION

22 05 14
SELECTIVE PLUMBING DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes limited scope of selective Plumbing demolition work as follows:
 - 1. Nondestructive removal of materials and equipment for reuse or salvage as indicated.
 - 2. Dismantling Plumbing fixtures, materials and equipment made obsolete by these installations.

1.02 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 and Division 22 Specification Sections.
- B. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.
 - 1. Coordinate sequencing and Owner occupancy specified in Division 01.
 - 2. Coordinate other selective demolition work as outlined in Division 01.

1.03 PROJECT CONDITIONS

- A. Conditions Affecting Selective Demolition: The following project conditions apply:
 - 1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
 - 2. Locate, identify, and protect plumbing services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas. Provide minimum of 72-hour notice to Owner prior to utility interruption.

1.04 SEQUENCE AND SCHEDULING

- A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.
- B. Notify the Architect at least 7 days prior to commencing demolition operations.
- C. Perform demolition in phases as indicated.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas where selective demolition is to occur. Determine extent of work and affect on existing conditions to remain. Advise Architect of any conditions that might create extensive alterations beyond indicated scope.

3.02 SELECTIVE DEMOLITION

- A. General: Demolish, remove, demount, and disconnect abandoned Plumbing fixtures, materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- B. Materials and Equipment to be Salvaged: Remove, demount, and disconnect existing Plumbing fixtures, materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
 - 1. Protect all removed and salvaged equipment from being damaged during the demolition work.
- C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.
- D. Plumbing Materials and Equipment: Demolish, remove, demount, and disconnect the following items:

1. Inactive and obsolete, piping, fittings and specialties, equipment, controls, fixtures, and insulation.
 - a. Obtain written approval form Architect and owner for piping embedded in floors, walls, and ceilings which may remain, if such materials do not interfere with new installations.
 - 1) Drain and cap piping allowed to remain.
 - b. Remove materials above accessible ceilings.
2. Perform cutting and patching required for demolition.

END OF SECTION

SECTION 22 05 15
ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes limited scope of general construction materials and methods for access doors and panels in walls and ceilings for access to Plumbing materials.
- B. Requirements of access doors are outlined in Division 08.
- C. Access doors and panels are required for all Plumbing equipment requiring maintenance, inspection, adjustment, monitoring, etc... which are installed in inaccessible areas such as behind walls, above ceiling, under floor, etc.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of access door or panel.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer Qualifications: Engage an experienced Installer for the installation of access panels and doors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
 - 1. Elmdor / Stoneman.
 - 2. Jay R. Smith Mfg. Co.
 - 3. Milcor Inc.

2.02 ACCESS DOORS

- A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation.
- B. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
- C. Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange.
 - 1. For installation in masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
 - 2. For gypsum wallboard or plaster: perforated flanges with wallboard bead.
 - 3. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter frame.
- D. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
 - 1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.
- E. Locking Devices: Flush, screwdriver-operated cam locks.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which access door and panel products are to be installed. Do not proceed with work until unsatisfactory conditions have been in manner acceptable to Installer.

3.02 APPLICATION

- A. Nonrated Walls and Ceilings: Prime coat finish door and frame, Allen key latch face of wall type; Smith 4760, Elmdor / Stoneman DW Series.
- B. Fire Rated Walls and Ceilings: "B" Labeled U.L. 1-1/2 hours, prime coat finish door and frame, flush keyed cylinder lock; Milcor.
- C. Tile Walls: Cover and frame 18-8 satin stainless steel, face-of-wall type, vandal resistant screws; J. R. Smith 4762, Elmdor / Stoneman DW Series.

3.03 INSTALLATION OF ACCESS DOORS

- A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
- B. Adjust hardware and panels after installation for proper operation.

3.04 COORDINATION

- A. General: Coordinate locations of ceilings access doors with lights, air outlets, speakers, etc. Submit drawings showing relative locations of doors to other ceiling items for acceptance by the Architect prior to installation. Transparencies of floor plans and/or reflected ceiling plans will be available from the Architect for this purpose.
- B. Location: Doors may be located to serve more than one item where feasible, providing they are approved as specified. Sizes suitable for purpose intended, with 12" x 12" minimum.
- C. Access doors and panels not required in accessible ceiling systems where direct access to HVAC items is possible.

END OF SECTION

SECTION 22 05 23
GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes general duty valves common to most mechanical piping systems.
 - 1. Special purpose valves are specified in individual piping system specifications.

1.02 RELATED SECTIONS

- A. Division 22 Section "Plumbing Identification" for valve tags and charts.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract, Division 01 Specification Sections, and Section 22 05 00 "Common Work Results for Plumbing."
 - 1. Product data, including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.
 - 2. Provide valve schedule showing manufacturer's figure number and sizes.

1.04 QUALITY ASSURANCE

- A. Single Source Responsibility: Comply with the requirements specified in Division 01 Section "Materials and Equipment," under "Source Limitations."
- B. American Society of Mechanical Engineers (ASME) Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.
- C. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Compliance: Comply with the various MSS Standard Practices referenced.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Preparation For Transport: Prepare valves for shipping as follows:
 - 1. Ensure valves are dry and internally protected against rust and corrosion.
 - 2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
 - 3. Set valves in best position for handling. Set globe and gate valves closed to prevent ratting; set ball and plug valves open to minimize exposure of functional surfaces; and block swing check valves in either closed or open position.
- B. Storage: Use the following precautions during storage:
 - 1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products from one of the manufacturers listed in valve schedule.
- B. No ball valves are to be installed on this project.

2.02 VALVE FEATURES, GENERAL

- A. Valve Design: Rising stem or rising outside screw and yoke stems.
 - 1. Non-rising stem valves may be used where headroom prevents full extension of rising stems.
- B. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.

- C. Sizes: Same size as upstream pipe, unless otherwise indicated.
- D. Operators: Provide the following special operator features:
 - 1. Hand wheels, fastened to valve stem, for valves other than quarter turn.
 - 2. Lever handles, on quarter-turn valves 6-inch and smaller, except for plug valves. Provide plug valves with square heads; provide one wrench for every 10 plug valves.
 - 3. Chain-wheel operators, for valves 2-1/2 inch and larger, install 72 inches or higher above finished floor elevation. Extend chains to an elevation of 5'-0" above finished floor elevation.
 - 4. Gear drive operators, on quarter-turn valves 8-inch and larger.
- E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
- F. End Connections: As indicated in the valve specifications.
 - 1. Threads: Comply with ANSI B1.20.1.
 - 2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.
 - 3. Solder-Joint: Comply with ANSI B16.18.
 - a. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg. F. for gate, globe, and check valves; below 421 deg. F. for ball valves.

2.03 GATE VALVES

- A. Gate Valves, 2-Inch and Smaller: MSS SP-80; Class 150, body and union bonnet of ASTM B62 cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron hand wheel. Do not use solder end valves for hot water heating or steam piping applications.

MANUFACTURER	THREADED NRS	THREADED RS	SOLDER NRS	SOLDER RS
Crane	X	431UB	X	X
Grinnell	3050	3060	X	X
Milwaukee	1141	1151	X	1169
Nibco	T-136	T-135	S-136	X
KITZ	X	42	X	43

"X" means not available. Provide lead-free products.

- B. Gate Valves, 2-1/2 Inch and Larger: MSS SP-70; Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A126 class B; with flanged ends, "Teflon" impregnated packing, and two-piece backing gland assembly.

MANUFACTURER	OS & Y RS	NRS
Crane	465-1/2	461
Grinnell	6020A	6060A
Nibco	617-O	F-619
Milwaukee	F-2885	F-2882
KITZ	72	75

"X" means not available. Provide lead-free products.

2.04 CHECK VALVES

- A. Swing Check Valves, 2-Inch and Smaller: MSS SP-80; Class 125, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze disc; and having threaded or solder ends. Provide valves capable of being reground while the valve remains in the line. Provide Class 150 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 125 valves are not available.

MANUFACTURER	CLASS 125THREADED ENDS	CLASS 125SOLDER ENDS	CLASS 125THREADED ENDS
Crane	37	1342	137
Milwaukee	509	1509	510
Nibco	T-413	S-413	T-433
KITZ	22	23	29

Grooved Ends: Victaulic Series 712. Provide lead-free products.

- B. Swing Check Valves, 2-1/2 Inch and Larger: MSS SP-71; Class 125 (Class 175 FM approved for fire protection piping systems), cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal wing, and bronze disc or cast-iron disc with bronze disc ring; and flanged ends. Provide valves capable of being refitted while the valve remains in the line.

MANUFACTURER	CLASS 125	CLASS 175
Crane	373	X
Milwaukee	F2974	X
Nibco	F-918	X
KITZ	78	X

"X" means not available. Provide lead-free products.

- C. Lift Check Valves, 2-Inch and Smaller: Class 125; cast-bronze body and cap conforming to ASTM B 62; horizontal or angle pattern, lift-type valve, with stainless steel spring, bronze disc holder with renewable "Teflon" disc, and threaded ends. Provide valves capable of being refitted and ground while the valve remains in the line.

MANUFACTURER	HORIZONTAL	ANGLE
Jenkins	655-A	X
Lunkenheimer	233	X

"X" means not available. Provide lead-free products.

PART 3 - EXECUTION

3.01 EXAMINATION

- Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.
- Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.
- Examine threads on both the valve and the mating pipe for form (i.e., out-of-round or local indentation) and cleanliness.
- Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.
- Replace defective valves with new valves.

3.02 VALVE ENDS SELECTION

- A. Select valves with the following ends or types of pipe/tube connections:
 - 1. Copper Tube Size, 2-Inch and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
 - 2. Steel Pipe Sizes, 2-Inch and Smaller: threaded or grooved end.
 - 3. Steel Pipe Sizes 2-1/2 Inch and Larger: grooved end or flanged.

3.03 VALVE INSTALLATIONS

- A. General Application: Refer to piping system specification sections for specific valve applications and arrangements. Use gate, ball, and butterfly valves for shut-off duty. Use globe, plug, and ball valves for throttling duty.
- B. Locate valves for easy access and provide separate support where necessary. Where concealed, install behind access panel with valve located for complete accessibility for servicing.
- C. Install valves and unions for each fixture and item of equipment. Arrange valves to allow equipment removal without system shutdown. Unions are not required on flanged devices.
- D. Install three-valve bypass around each pressure reducing valve using throttling-type valves.
- E. Install valves in horizontal piping with stem at or above the center of the pipe.
- F. Install valves in a position to allow full stem movement.
- G. Installation of Check Valves: Install for proper direction of flow as follows:
 - 1. Swing Check Valves: Horizontal position with hinge pin level.
 - 2. Lift Check Valve: With stem upright and plumb.
- H. Where shut-off valves are installed in a confined space such as in a wall or furring, install ball valves with operating handle parallel with face of wall.
- I. Where valves are located in walls, do not install more than 6'-0" from finished floor. Where valves are located above ceilings, install centered on access point and not greater than 24" above access point.

3.04 SOLDER CONNECTIONS

- A. Cut tube square and to exact lengths.
- B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket in same manner.
- C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.
- D. Open gate and globe valves to full open position.
- E. Remove the cap and disc holder of swing check valves having composition discs.
- F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.
- G. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.
- H. Use 95-5 tin/antimony lead-free solder for all solder joints unless indicated otherwise.

3.05 THREADED CONNECTIONS

- A. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
- B. Align threads at point of assembly.
- C. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).

- D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.06 FLANGED CONNECTIONS

- A. Align flange surfaces parallel.
- B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

3.07 FIELD QUALITY CONTROL

- A. Tests: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.08 ADJUSTING AND CLEANING

- A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

3.09 VALVE PRESSURE/TEMPERATURE CLASSIFICATION SCHEDULES

- A. Below schedules are for standard installation conditions. Variations or special valves and/or conditions set forth in other Division 15 Sections shall take precedence.

1. VALVES, 2-INCH AND SMALLER

SERVICE	GATE	GLOBE	BALL	CHECK
Condenser Water	125	125	150	125
Chilled Water	125	125	150	125
Domestic Hot and Cold Water	125	125	150	125
Heating Hot Water	150	150	150	150
Low-Pressure Steam	150	150	150	150

2. VALVES, 2-1/2 INCH AND LARGER

SERVICE	GATE	GLOBE	BUTTERFLY	CHECK
Condenser	125	125	200	125
Chilled Water	125	125	200	125
Domestic Hot and Cold Water	125	125	200	125
Heating Hot Water	125	125	200	125
Low-Pressure Steam	125	125	200	125

END OF SECTION

SECTION 22 05 29
SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Extent of supports and anchors required by this section is indicated on drawings or in other Division 22 sections and include the following:
 - 1. Horizontal-Piping Hangers and Supports.
 - 2. Vertical-Piping Clamps.
 - 3. Hanger-Rod Attachments.
 - 4. Building Attachments.
 - 5. Saddles and Shields.
 - 6. Miscellaneous Materials.
 - 7. Anchors.
 - 8. Equipment Supports.

1.02 RELATED SECTIONS

- A. This section is part of each Division 22 section, making reference to or requiring supports and anchors specified herein.
- B. Supports and anchors furnished as part of factory fabricated equipment are specified as part of equipment assembly in other Division 22 sections.
- C. Section 03 30 00: Cast-in-Place Concrete.

1.03 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
 - 2. UL and FM Compliance: Provide products which are UL Listed and FM approved.
 - 3. MSS Standard Compliance:
 - a. Provide pipe hangers and supports of which materials, design, and manufacturer comply with MSS SP-58.
 - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
 - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
 - d. Terminology used in this section is defined in MSS SP-90.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

- A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.
 - 1. Components shall have galvanized coatings, where installed for piping and equipment that will not have field-applied finish.
 - 2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Thermal Hanger Shield Inserts: 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.

2.02 HORIZONTAL PIPING HANGERS AND SUPPORTS

- A. General: Except as otherwise indicated, provide factory fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. 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.
 - 1. Adjustable Steel Clevis Hangers: MSS Type 1.
 - 2. Adjustable Swivel Pipe Rings: MSS Type 6.

2.03 VERTICAL PIPING CLAMPS

- A. General: Except as otherwise indicated, provide factory fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer 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.
- B. Two-Bolt Riser Clamps: MSS Type 8.

2.04 HANGER ROD AND BUILDING ATTACHMENTS

- A. General Hanger Rod Attachment: Refer to structural drawings for requirements of hanger rod and building attachments. If a specific attachment that is required is not detailed on the structural drawings, one of the following attachments may be submitted for review by the structural engineer prior to installation. Except as otherwise indicated, provide factory fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers, and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- B. General Building Attachment: Except as otherwise indicated, provide factory fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate 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.
 - 1. Concrete Inserts: MSS Type 18.
 - 2. Center Beam Clamps: MSS Type 21.
 - 3. Steel Beam Clamps W/Eye Nut: MS Type 28.
 - 4. Linked Steel Clamps W/Eye Nut: MSS Type 29.
 - 5. Malleable Beam Clamps: MSS Type 30.
 - 6. Steel Brackets: One of the following for indicated loading:
 - 7. Light Duty: MSS Type 31.

2.05 SADDLES AND SHIELDS

- A. General: Except as otherwise indicated, provide saddles, or shields under piping hangers, and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Protection Shields: MSS Type 40; provide high density insert of same thickness of insulation.

2.06 MANUFACTURERS OF HANGERS AND SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - 1. B-Line Systems, Inc.
 - 2. Tolco, Inc.
 - 3. Elcen Metal Products Co.
 - 4. Fee & Mason Mfg. Co.; Div. Figgie International.

5. ITT Grinnel Corp.

2.07 MISCELLANEOUS MATERIALS

- A. Steel Plates, Shapes and Bars: ASTM A36.
- B. Cement Grout: Portland cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 parts cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
- C. Pipe Alignment Guides: Factory fabricated, of cast semisteel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.
- D. Pipe Roll Stand: Factory fabricated cast iron stand, size as required, with insulation installed on piping.

2.08 ISOLATORS

- A. Isolators: Provide factory-fabricated isolators of size required.
- B. Spring Isolators: Refer to Section 22 05 48 "Vibration Control for Plumbing."

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine substrates and conditions under which supports, and anchors are to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors, and other building structural attachment.
- B. Prior to installation of hangers, supports, anchors and associated work, installer shall meet at project site with Contractor, installer of each component of associated work, inspection, and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF BUILDING ATTACHMENTS

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top of inserts.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69.
- B. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers, and supports of same type and type as installed for adjacent similar piping.

- D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- E. Provisions of Movement: Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors.
- F. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide required pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- H. Bare Piping: Install isolators for all bare domestic water and bare hydronic piping.
- I. Insulated Piping: Comply with the following installation requirements.
 - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
 - 2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. Provide rigid insulation reinforcement at shields.
- J. Hangers and supports to be capable to resist the minimum seismic forces indicated in drawings.

3.05 EQUIPMENT SUPPORTS

- A. Concrete housekeeping bases will be provided as work of Division 03.
- B. Furnish to Contractor, scaled layouts of all required bases, with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

3.06 ADJUSTING AND CLEANING

- A. Hanger Adjustment: Adjust hangers so-as to distribute loads equally on attachments.
- B. Support Adjustment: Provide grout under supports so-as to bring piping and equipment to proper level and elevations.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- D. Touch-Up Painting: Immediately after erection of anchors and supports, clean field welds and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA-1 requirements for touch-up of field-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- E. For galvanized surfaces clean welds bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 22 05 48
VIBRATION CONTROL FOR PLUMBING

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

- A. It is the intent of this Specification to provide the necessary design for the avoidance of excessive noise or vibration in the building due to the operation of machinery or equipment, or due to interconnected piping, ductwork, or conduit and to seismically restraint piping, ductwork, and equipment per the applicable codes against seismic forces in any direction.
1. All isolators shall:
 - a. Be provided by a single manufacturer.
 - b. Be designed or treated for resistance to corrosion. Structural steel bases shall be cleaned of welding slag and coated with an SCAQMD compliant primer.
 - c. Be selected to perform their function without undue stress or overloading. All isolators shall have a method for leveling and have a 1/4" thick ribbed neoprene acoustical pad under the spring baseplate.
 - d. Be installed in a manner to prevent the transmission of vibration to the structure. No rigid connections between rotating or oscillating equipment or piping and the building will be permitted.
 - e. Be designed to be non-resonant with equipment forcing frequencies or support structure natural frequencies.
 2. Anchor floor mounted isolated equipment to concrete housekeeping pads of sufficient size to accommodate the anchorage of seismic restraints. Housekeeping pads shall be anchored to the structure as specified by the Structural Engineer of Record.
 3. Each fan and motor assembly shall be supported on a single structural steel frame. Flexible duct connections shall be provided at inlet and discharge ducts.
 4. Where called for in the specifications or on the drawings, all structural steel bases, including concrete pouring form bases, shall be designed, and fabricated by the isolation manufacturer. Isolation manufacturer shall be a licensed fabricator for the City of Los Angeles, California.
 5. Unless otherwise indicated, all equipment mounted on vibration bases shall have a minimum operating clearance of 1" between structural steel base and floor or support base beneath. The minimum operating clearance between concrete inertia bases and housekeeping pads shall be 1 inch. Check clearance space after installation to ensure that no debris has been left to possibly short circuit isolation bases.
 6. Where necessary due to height limitations, provide height saving brackets.
 7. Design isolators for positive anchorage against uplift and overturning.

1.02 MANUFACTURERS

- A. Acceptable Isolation Manufacturer:
- B. M. W. Sausse' & Co., Inc. (Vibrex).
- C. Mason Industries, Inc.
- D. Or Approved Equal.
- E. Purchased and/or fabricated equipment must be designed and manufactured with provision for positive anchorage against seismic forces.
- F. Seismic restraints for pipes and ducts shall be as per the SMACNA Guidelines for seismic Restraint of Mechanical Systems and shall be approved by DSA.
- G. Seismic restraints for equipment and piping shall be designed to meet the criteria of the current California Code of Regulations.

- H. The manufacturer of Vibration Isolation and Seismic Control Equipment shall have the following responsibilities:
1. Determine adequate vibration isolation and seismic restraint sizes and locations.
 2. Provide piping and equipment isolation systems and seismic restraints as scheduled and/or specified.
 3. Provide installation instructions and drawings to assure proper installation and performance.

1.03 SUBMITTALS

- A. Make Submittals in Accordance with:
1. Contract General Provisions - Division 01.
 2. Mechanical General Provisions - Sections 22 05 00 and 22 05 11.
- B. Submit Shop Drawings and Manufacturer's Literature.
1. Specific vibration isolators and seismic restraints to be utilized showing compliance with the specifications.
 2. Isolation frame construction for each machine including dimensions, structural member sizes, support points and restraint locations and details.
 3. Methods for isolation and restraint of suspended piping, ductwork, and equipment.
 4. Methods for guides and isolation of piping risers.
 5. Seismic restraint calculations signed and stamped by an engineer licensed in the State of California and experienced in the design of isolation and seismic restraint for flexibly mounted equipment.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATOR TYPES

- A. "RMS" shall be a laterally stable un-housed spring isolator. Spring, top plate, and baseplate assembly shall be welded. Mounting shall comply with all requirements stated in paragraph above.
- B. "RMSG" shall be the same as "RMS" above but shall include height saving brackets for attachment to the equipment frame or isolation base.
- C. "RMSP-EQ" shall be the same as "RMS" above except that the spring shall be enclosed in a welded steel cylinder with uplift restraints for horizontal and vertical seismic control.
- D. "RMLS-EQ" shall be the same as "RMS" above and shall be equipped with a steel housing designed for seismic restraint and with vertical limit stops to prevent the equipment changing from its loaded height should it be necessary to remove a portion of its weight. This housing may also be used as rigid blocking during rigging so that the installed height and the operating height of the isolated equipment remain the same. O.S.H.P.D. (HCAi) pre-approval # OPA-0029.
- E. "RMLS-SB" shall be a steel frame constructed of structural wide flange members unless shown otherwise and shall be rectangular in shape. The depths of the steel members shall not be less than one tenth (1/10) of the longest span between base supports or designed for a maximum beam deflection of .005". If the latter method is used, submittals shall include calculations showing the necessary moment of inertia. All steel members shall be coped and fitted or constructed using the overlap insert method to assure a structural strength that is greater than the individual member strength. The steel frame is placed directly on top of the RMLS-EQ type isolators. O.S.H.P.D. (HCAi) pre-approved isolator/seismic restraints.
- F. "RMU-EQ-SH": shall be an individual semi-housed steel spring isolator complete with vertical motion limit stops incorporating seismic restraints, leveling, and ribbed neoprene pad bonded to the base plate. O.S.H.P.D. (HCAi) pre-approval # OPA-0098.

- G. "AS" shall be air spring isolators and shall incorporate the following:
1. A complete vibration isolation system consisting of a minimum of three air springs and a total of three height sensing valves. If there are two or more air springs per location, they shall be connected to the outlet of the height control valve in parallel. An associated interconnecting air supply system is required which is not included in this work.
 2. The air spring shall operate at its normal operating height and the maximum pressure shall not exceed the manufacturer's recommended rating of 100 PSI. The system shall maintain an elevation of $\pm 1/8"$, once adjusted.
 3. The type of air spring to be utilized shall be based upon the required natural frequency as indicated in the schedule. In-order to avoid instability, auxiliary height saving brackets, housings, etc. may be utilized, subject to approval.
- H. "RP-EQ" shall be a rubber pad type elastomer mounting, consisting of a steel bearing plate with $1/4"$ thick neoprene ribbed acoustical pad. Maximum loading shall be 60 PSI. Proper anchorage for seismic loads shall be indicated on drawings.
- I. FUD-EQ shall be rubber-in-shear isolators incorporating mounting bolts for bolting to equipment base, a bottom steel plate for bolting isolator to sub-base or structure and built-in seismic restraints.
- J. "RMXA" shall be a rectangular steel housing that shall be bolted to the overhead structure and designed to allow up to 30 degrees rod misalignment. Hanger shall consist of a steel spring located in a molded neoprene retaining cup with hanger rod bushing.
- K. "PRMXA" - Same as type "RMXA" with the addition of a steel load transfer plate so that the equipment or piping operating height is the same as the installed height.
- L. "HXA" -Same as type "RMXA" with the addition of a neoprene element in series to isolate the upper connection.
- M. "PHXA" - Same as type "HXA" with the addition of a steel load transfer plate so that the equipment or piping operating height is the same as the installed height.
- N. "HSS" - shall be a 'rubber in shear' isolator element contained within a rectangular steel housing.

2.02 RAIL AND BASE TYPES

- A. "RMR" spring rail isolator. Rails shall have springs of proper size and constant, installed between a continuous structural steel channel (upper member) and a continuous flat steel plate (bottom member) in such manner, quantity, and location that efficient uniform deflection and loading to the structure is assured. Rails shall be furnished with Vibrex hold down stabilizers to restrict excessive amplitudes. Cross bracing must be used when necessary for seismic stability.
- B. "RMB" shall be the same as "RMR" above except that it shall be designed as an integral fan and motor base with an adjustable motor slide base.
- C. "RMSR" shall be a set of wide flange structural steel rails supplied with height saving brackets to reduce the mounting height of the equipment. The maximum allowable deflection of any point on the loaded frame relative to the unloaded frame shall be $0.005"$. A wide flange section depth greater than $1/10$ the supporting span between isolators will be accepted as satisfying the deflection requirement.
- D. "RMSB" shall be a steel frame constructed of structural wide flange members unless shown otherwise and shall be rectangular in shape. The depths of the steel members shall not be less than one tenth ($1/10$) of the longest span between base supports or designed for a maximum beam deflection of $.005"$. If the latter method is used, submittals shall include calculations showing the necessary moment of inertia.

- E. All steel members shall be coped and fitted or constructed using the overlap insert method to assure a structural strength that is greater than the individual member strength. Adjustable motor slide bases shall be included when required for centrifugal fan applications. The steel bases shall have an operating clearance of one (1") inch above the supporting structure. Where bases are used to mount pumps, the bases shall be large enough to support the pipe elbows if required.
- F. "RMSBI" shall be a steel frame inertia base with all welded members and constructed of structural channel shapes. The base shall be designed for a thickness or inertia mass to equipment weight ratio as shown on the schedule with a minimum thickness of six (6") inches. The bases shall include a template and anchor bolts to anchor the equipment. Inertia bases shall have 1/2" (#4) rebar spaced a maximum of 12" on centers in each direction and located 1-1/2" from the bottom of the base. Adjustable motor slide bases shall be included when required for centrifugal fan applications. Bases shall be supplied with height saving brackets to reduce the mounting height of the equipment.
- G. "RMUAB-EQ" shall be a steel frame made of structural angle with type "RMU-EQ-SH" O.S.H.P.D. (HCAi) pre-approved combination isolator/restraints.
- H. "RMLSR" shall be a set of multiple wide flange structural steel rails supplied with type RMLS-EQ vibration isolator/seismic restraints and height saving brackets to reduce the mounting height of the equipment. The maximum allowable deflection of any point on the loaded frame relative to the unloaded frame shall be 0.005". A wide flange section depth greater than 1/10 the supporting span between isolators will be accepted as satisfying the deflection requirement.
- I. Type "RMLSB" shall be a steel frame constructed of structural wide flange members unless shown otherwise and shall be rectangular in shape. The depths of the steel members shall not be less than one tenth (1/10) of the longest span between base supports or designed for a maximum beam deflection of .005". If the latter method is used, submittals shall include calculations showing the necessary moment of inertia. All steel members shall be coped and fitted or constructed using the overlap insert method to assure a structural strength that is greater than the individual member strength. Frame shall be supplied complete with height saving brackets and type RMLS-EQ, O.S.H.P.D. (HCAi) pre-approved isolator/seismic restraints.
 - 1. Type RMLS-SB is the same as type "RMLSB" but rather than utilizing height saving brackets the steel frame is placed directly on top of the RMLS-EQ type isolators.

2.03 CURB TYPES

- A. Type "VIC-EQ-SS" shall be a factory fabricated combination roof mounting curb and vibration isolation base for rooftop package units over 25 tons. The curb assembly shall be designed so that it can be re-roofed without disturbing the HVAC equipment. Curbs must be designed so that roofing material cannot cover access to isolators. The vibration isolation portion of the assembly shall be constructed of structural steel and designed to mate with the bottom of the rooftop unit. System shall include factory fabricated duct supports and any required bracing welded in place. The sheet metal weather proofing curb portion shall be supplied complete with a wood-nailer strip to facilitate flashing by the roofing contractor. Internal vibration isolator/seismic restraints shall be O.S.H.P.D. (HCAi) pre-approved number OPA-0029 as manufactured by MW Sausse' & company, inc. Required anchorage calculations shall be supplied with submittal package. When required, curb shall include an optional acoustical package for sound reduction.
- B. Type "VIC-EQ" shall be a factory fabricated combination roof mounting curb and vibration isolation base for rooftop package units up to 20 tons. Steel members and cross bracing shall all be welded. The assembly shall be shipped and installed in one piece complete with curb, weather-seal, removable O.S.H.P.D. (HCAi) pre-approved isolator/restraints #OPA-0098, exterior accessible leveling device, and minimum 14 gage galvanized steel top section to match the unit. Curb shall be fabricated of minimum 12 gage galvanized steel designed to carry the seismic loads to the supporting structure.

System shall include factory fabricated duct supports welded in place as well as insulated panels when required. Required anchorage and lower curb structural calculations shall be supplied with submittal package. When required, curb shall include an optional acoustical package for sound reduction. Curb shall be manufactured to match roof slope if specified in drawings.

2.04 SEISMIC RESTRAINTS

- A. Shall be capable of safely accepting external forces as specified in the applicable codes without failure. Restraints shall maintain equipment, duct, and piping in a captive position during an earthquake. Restraints shall not short circuit vibration isolation systems or transmit objectionable vibration or noise under normal operating conditions. Seismic restraints shall be provided on all equipment as scheduled on the drawings. Submit calculations by a Licensed Structural Engineer Registered in State of California to verify snubber capacities.
- B. Type "3500" seismic restraint shall be constructed of steel plate, concentric steel pipes, and structural members in an all-welded assembly. All contact points shall be cushioned with minimum 1/4" thick resilient pad. Restraints shall be O.S.H.P.D. (HCAi) pre-approved type OPA-0029.
- C. Type "3200" seismic restraint shall be all directional type with interlocking steel members constructed of structural angle and A-36 threaded rod. All contact points shall be cushioned with minimum 1/4" thick resilient pad or bushing.
- D. Type "CR" seismic restraints shall be constructed of 7x19 strand galvanized aircraft cable. Cable assembly shall come complete with minimum (2) "U" bolt clamps per end and thimbles to protect cable from chafing. Allowed loads shall be the cable breaking strength with a safety factor of three. Actual loads shall be calculated with the worst case of all loads applied to one cable and anchor pattern. Cable shall be installed with 1/4" slack to prevent the transmission of vibration to the structure.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install in accordance with manufacturer's written instructions. Vibration isolators must not be installed in a manner that will result in piping stress or misalignment.
- B. The structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the equipment or isolators. The isolators shall be installed without raising the equipment and frame assembly.
- C. After the entire installation is complete and under full operational load, the isolator shall be adjusted so that the load is transferred from the blocks or shims to the isolator. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.
- D. Once the equipment is in operation, install and anchor the seismic restraints with proper operating clearances as indicated on drawings.
- E. Plumbing equipment shall be isolated from the building structure by vibration isolators as scheduled on the drawings.
- F. All piping 1 1/4" and over located in mechanical equipment rooms, and for a minimum of fifty (50) feet or 100 pipe diameters whichever is greater, from connection to vibrating mechanical or electrical equipment, shall be isolated from the building structure by means of vibration isolators as identified above.
- G. All Plumbing piping and vertical risers shall be isolated from the building structure by means of vibration isolators and guides.

- H. All piping and ductwork to be isolated shall freely pass-through walls and floors without contact. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork and maintain adequate clearance (Minimum of 2 inches all around) around the outside surfaces. Any materials used to fill the clearance space shall be permanently flexible so that vibration will not pass through it.
- I. No rigid connections between equipment and building structure, including electrical conduit and refrigerant lines, shall be made that degrades the vibration isolation system herein specified. Inform other following trades, such as plastering, or electrical, to avoid any contact which would short-circuit the vibration isolation.
- J. Bring to the Architect's attention prior to installation any conflicts with other trades which will result in unavoidable rigid contact with equipment or piping as described herein, due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the contractor's expense.
- K. Bring to the Architect's attention any discrepancies between the specifications and field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the contractor's expense.
- L. Obtain inspection and approval of any isolation installation to be covered or enclosed, prior to such closure.
- M. Thrust restraints shall consist of spring hangers with the same deflection as specified for the spring mountings. Thrust restraints shall be attached to the fan at the centerline of air discharge opening.
- N. Correct, at no additional cost, all installations that are deemed defective in workmanship or materials.

3.02 PIPING ISOLATORS

- A. All piping except fire standpipe systems, are included under this section.
- B. Isolate piping within 50 feet of rotating equipment and pressure reducing stations.
- C. The isolators shall be installed with the isolator hanger box attached to, or hung as close as possible to, approved locations on the supporting structure.
- D. The isolators shall be suspended from substantial structural members, not from slab diaphragm unless specifically permitted.
- E. Hanger rods shall be aligned to clear the hanger box.
- F. Horizontal floor supported piping shall be isolated by type "RMLS-EQ", with a minimum static deflection of 1.0 inch or the same deflection as isolated equipment to which pipe is connected, whichever is greater.
- G. Vertical riser pipe support and restraint system shall consist of type "RMS" springs and type "PG-EQ" guides. Install vertical riser guides so that clearances are maintained around concentric pipes in the guides. Install vertical restraints on the floor location as shown on drawings.
- H. Pipe anchors, where required, shall utilize resilient pipe anchors, type "RPA" or equivalent, to avoid direct contact of piping with building.
- I. Pipe Extension and Alignment connectors: Provide connectors at pump suction and discharge, riser take offs, cooling, and heating coils, and elsewhere as required to accommodate thermal expansion and misalignment.
- J. Seismic restraint spacing shall be in accordance with applicable codes.

SECTION 22 05 53
PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Extent of Plumbing identification work required by this section is indicated on drawings or specified in other Division 22 sections, and includes the following:
 - 1. Painted Identification Materials.
 - 2. Plastic Pipe Markers.
 - 3. Plastic Tape.
 - 4. Underground-Type Plastic Line Marker.
 - 5. Plastic Duct Markers.
 - 6. Valve Tags.
 - 7. Diagram and Schedule Frames.
 - 8. Engraved Plastic-Laminate Signs.
 - 9. Plastic Equipment Markers.
 - 10. Plasticized Tags.

1.02 RELATED SECTIONS

- A. This section is part of each Division 22 section, making reference to identification devices specified herein.
- B. HVAC identification furnished as part of factory-fabricated equipment is specified as part of equipment assembly in other Division 22 sections.
- C. Refer to Division 26 Sections for identification requirements of electrical work; not work of this section.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
- B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.
- C. Schedules and Diagrams:
 - 1. Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any).
 - 2. Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule.
 - 3. Submit temperature control diagrams and Sequence of Operation on bond paper suitable for framing.
- D. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01 and Division 22 Section 22 05 11 "Supplementary Plumbing Requirements."

1.04 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
 - 2. No adhesive-type identification markers will be accepted. All markers and tags shall be permanently attached to pipe, etc.
 - 3. All identification markers installed exterior of buildings shall be ultra-violet resistant.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide HVAC identification materials of one of the following:
 - 1. Seton Name Plate Corp.
 - 2. Allen Systems, Inc.
 - 3. Brady (W.H.) Co.; Signmark Div.
 - 4. Industrial Safety Supply Co., Inc.

2.02 PLUMBING IDENTIFICATION MATERIALS

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than single type is specified for application, selections is Installer's option, but provide single selection for each product category.

2.03 PLASTIC PIPE MARKERS

- A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.
- B. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subject to fluid temperatures of 125oF. (52oC.) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
- C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - 1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 - 2. Laminated or bonded application of pipe marker to pipe (or insulation).
 - 3. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2."
- D. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
 - 1. Laminated or bonded application of pipe marker to pipe (or insulation).
 - 2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, taped lapped 3".
 - 3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless-steel bands.
- E. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
 - 1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

2.04 PLASTIC TAPE

- A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
- B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.
- C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.05 UNDERGROUND TYPE PLASTIC LINE MARKER

- A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates the type of service of buried pipe.
 - 1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

2.06 VALVE TAGS

- A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamped-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
 - 1. Provide 1-1/2" diameter tags, except as otherwise indicated.
 - 2. Fill tag engraving with black enamel.
- B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves and manufactured specifically for that purpose.
- C. Access panel markers: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves and manufactured specifically for that purpose.
- D. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

2.07 DIAGRAM AND SCHEDULE FRAMES

- A. General: For each page of schedule and/or diagrams, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.08 ENGRAVED PLASTIC LAMINATE SIGNS

- A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, white with black core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
- B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.
- C. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.09 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in HVAC identification work, with corresponding designations shown, specified, or scheduled. Provide numbers, lettering and wording as indicated, as recommended by the manufacturer's or as required for proper identification and operation/maintenance of Plumbing systems and equipment.
 - 1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

2.10 EQUIPMENT MARKERS

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
 - 1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 - 2. Location: Accessible and visible.
 - 3. Fasteners: As required to mount on equipment.

- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
 - 1. Terminology: Match schedules as closely as possible.
 - 2. Data.
 - 3. Name and plan number.
 - a. Equipment service.
 - b. Design capacity.
 - c. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
 - 4. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine sub-core, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
 - 1. Data: Instructions for operation of equipment and for safety procedures.
 - 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
 - 3. Retain and edit subparagraph above or first subparagraph below.
 - 4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
 - 5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
 - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.11 PLASTIC DUCT MARKERS

- A. Engraved color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finishes, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING SYSTEM IDENTIFICATION

- A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
 - 1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot-non-insulated pipes.
- B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
 - 1. Near each valve and control device.
 - 2. Near each branch, mark each pipe at branch, where there could be question of flow pattern.
 - 3. Near locations where pipes pass through walls, floors ceilings, or enter non-accessible enclosures.
 - 4. At access doors, manholes similar access points which permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment. On piping above removable acoustical ceilings, except omit intermediately.

3.03 UNDERGROUND PIPING IDENTIFICATION

- A. General: During back-filling/top soiling of each exterior underground piping systems, except sanitary sewer and storm drainage install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.

3.04 VALVE IDENTIFICATION

- A. General: Provide valve tag on every valve, cock, and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units. List each tagged valve on valve schedule for each piping system.
- B. Mount valve schedule frames and schedules in machine rooms, where indicated or, if not otherwise indicated, where directed by Architect/Engineer.

3.05 PLUMBING EQUIPMENT IDENTIFICATION

- A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of Plumbing equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
 1. Fuel-burning units including boilers, furnaces, heaters.
 2. In addition to the equipment tag, install an identification tag in locations approved by Architect to indicate where each unit is installed above the ceiling. Coordinate the installation location, type, size, and color of this tag with the Architect.
- B. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.
- C. Test of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.06 ADJUSTING AND CLEANING

- A. Adjusting: Relocate any Plumbing identification device which has become visually blocked by work of this division or other divisions.
- B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Extent of Plumbing insulation required by this section is indicated on drawings and schedules, and by requirements of this section, and includes the following:
 - 1. Piping Systems Insulation:
 - a. Fiberglass.
 - b. Calcium Silicate.
 - c. Flexible Unicellular.
 - 2. Ductwork System Insulation:
 - a. Fiberglass.
 - b. Flexible Unicellular.
 - 3. Equipment Insulation:
 - a. Fiberglass.
 - b. Calcium Silicate.
 - c. Flexible Unicellular.
 - 4. Acoustical Insulation:
 - a. Fiberglass.

1.02 RELATED SECTIONS

- A. Refer to Division 22 Section "Supports and Anchors" for protection saddles, protection shields, and thermal hanger shields; not work of this section.
- B. Refer to Division 22 Section "Plumbing Identification" for installation of identification devices for piping, ductwork, and equipment; not work of this section.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of Plumbing insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each Plumbing system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of Plumbing insulation. Include this data and product data in maintenance manual.

1.04 QUALITY ASSURANCE

- A. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
- B. As a minimum, insulation shall meet installed conductance as set forth in Title 24 California Code of Regulations (CCR) 2022 Building Energy Efficiency Standards or as indicated in contract documents, whichever is greater.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. Owens-Corning Fiberglas Corp.
 - 2. Manville Products Corp.

3. CertainTeed Corp.
4. Armstrong World Industries, Inc.
5. Knauf Fiber Glass GmbH.

2.02 PIPING INSULATION MATERIALS

- A. Fiberglass (Mineral Fiber) Piping Insulation: ASTM C547, Class 1 unless otherwise indicated. Manville Products Corp. Micro-Lok, Owens-Corning Fiberglas Corp., ASJ/SL-II or equivalent.
- B. Calcium Silicate Piping Insulation: ASTM C533, Type I. Owens-Corning Fiberglass Corp. "Kaylo Asbestos Free" or equivalent.
- C. Flexible Unicellular Piping Insulation: ASTM C534, Type I. Armstrong World Industries, Inc. meeting ASTM E-84 25/50 index.
- D. Jackets for Piping Insulation: ASTM C921, Type I (Vapor Barrier) for piping with temperatures below ambient. (Type II (Water Vapor Permeable) for piping with temperatures above ambient. Type I may be used for all piping at Installer's option.
 1. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations. Zeston PVC Insulated fitting covers or equivalent.
 2. Encase exterior piping insulation with aluminum jacket with weather-proof construction.
- E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
- F. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.
- G. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

2.03 EQUIPMENT INSULATION MATERIALS

- A. Flexible Fiberglass Equipment Insulation: ASTM C553, Type II, Class F-1, Owens-Corning Fiberglass, Inc., Type 701 1.5 lbs/Ft³.
- B. Calcium Silicate Equipment Insulation: ASTM C533, Type I, Block; Owens/Corning Fiberglass, Inc., Kaylo Asbestos Free, U-Grooved block insulation.
- C. Jacketing Material for Equipment Insulation: Provide canvas jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.
- D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
- E. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape corner angles, anchors and stud piping as recommended by insulation manufacturer for applications indicated.
- F. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

2.04 ACOUSTICAL INSULATION

- A. Rigid Fiberglass Insulation: ASTM C612, Class 1, Owens/Corning Fiberglass, Inc., 10 Lbs/Cu. Ft.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which HVAC insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PLUMBING PIPING SYSTEM INSULATION

- A. Insulation Omitted: Omit insulation on the following:
 1. Hot piping within radiation enclosures.
 2. Hot unions, flanges, strainers, flexible connections, and expansion joints.

- B. Cold Piping (40°F to ambient):
 - 1. Application Requirements: Insulate the following cold HVAC piping systems:
 - a. HVAC chilled water supply and return piping.
 - b. Air conditioner condensate drains piping.
 - 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
 - a. Fiberglass: 1" thick for pipe sizes up to and including 4", 1-1/2" thick for pipe sizes over 4".
 - b. Flexible Unicellular: 1/2" thick for pipe sizes up to 1-1/2" (A.C. condensate piping only).
- C. Hot Low-Pressure Piping (to 250°F.):
 - 1. Application Requirements: Insulate the following hot low pressure HVAC piping systems (steam piping up to 15 PSI, water piping up to 250°F. (121°C.).
 - a. HVAC heating water supply and return piping.
 - 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
 - a. Fiberglass: 1" thick for pipe sizes up to and including 1", 1-1/2" thick for pipe sizes 1-1/2"; 2" thick for piping over 2".

3.03 EQUIPMENT INSULATION

- A. Cold Equipment (Below Ambient Temperature):
 - 1. Application requirements: Insulate the following cold equipment:
 - a. Refrigeration equipment, including chillers, tanks, and pumps.
 - b. Drip pans under chilled equipment.
 - c. Cold and chilled water pumps.
 - d. Pneumatic water tanks.
 - 2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
 - a. Fiberglass: 2" thick for cold surfaces above 35°F. and 3" thick for surfaces 35°F. and lower.
- B. Hot Equipment (Above Ambient Temperature):
 - 1. Application Requirements: Insulate the following hot equipment:
 - a. Boilers (not pre-insulated at factory).
 - b. Water heaters.
 - c. Hot water expansion tanks.
 - d. Hot water pumps.
 - 2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation.
 - a. Fiberglass: 2" thick, except 3" thick for low-pressure boilers and steam-jacketed heat exchangers.
- C. Breeching and Stacks:
 - 1. Application Requirements: Insulate the following breechings and stacks:
 - a. Breechings between heating equipment outlet and stack or chimney connection, except for double wall or factory insulated breechings.

3.04 INSTALLATION OF PIPING INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems, subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor barrier jackets on pipe insulation and protect to prevent puncture or other damage.
- F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

3.05 INSTALLATION OF EQUIPMENT INSULATION

- A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
- B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.
- C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
- D. Do not apply insulation to equipment, breechings, or stacks while hot.
- E. Apply insulation using the staggered joint method for both single, and double-layer construction, where feasible. Apply each layer of insulation separately.
- F. Coat insulated surfaces with layer of insulating cement, trowel in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.
- G. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.
- H. Do not insulate boiler manholes, hand-holes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- I. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames, and accessories.
- J. Equipment exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by the manufacturer.

3.06 ACOUSTICAL INSTALLATION

- A. Install within confines of roof curbs for roof mounted air handlers and air conditioning units, and elsewhere as indicated on drawings.
- B. Cut to fit snugly within curb and around duct at duct penetrations, 4" minimum thickness.

3.07 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 22 10 00
PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies piping materials and installation methods common to more than one section of Division 22 and includes joining materials, fire stop sealants, and basic piping installation instructions.

1.02 RELATED SECTIONS

- A. The following sections contain requirements that relate to this section:
 - 1. Division 22 Section "Common Work Results for Plumbing" applies to this Section.
 - 2. Piping materials and installation methods peculiar to individual systems are specified within their respective system specification sections of Division 02 and 22.
 - 3. Valves are specified in a separate section and in individual piping system sections of Division 22.
 - 4. Division 22 Section "Supports and Anchors."
 - 5. Division 22 Section "Plumbing Identification."

1.03 SUBMITTALS

- A. Refer to Division 01 and Division 22 Section "Common Work Results for Plumbing" for administrative and procedural requirements for submittals.
- B. Product Data: Submit product data on fire stop sealants.

1.04 QUALITY ASSURANCE

- A. Welding procedures and testing shall comply with ANSI Standard B31.1.0 - Standard Code for Pressure Piping, Power Piping, and The American Welding Society, Welding Handbook.
- B. Soldering and brazing procedures shall conform to ANSI B9.1 Standard Safety Code for Mechanical Refrigeration.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, and clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.
- C. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

- A. Refer to the individual piping system specification Sections in Division 22 for specifications on piping and fittings relative to that particular system.
- B. Weld-O-Lets: Welding Weld-O-Lets of domestic manufacture may be used in lieu of tees where branch connection pipe size is two or more pipe sizes smaller than main header size.

2.02 JOINING MATERIALS

- A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
- B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.

- C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.
 - 1. Soldering materials shall not contain lead.
- D. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.03 SLEEVES AND SEALS

- A. Sleeves:
 - 1. Sheet-Metal Sleeves: 5" and Smaller, 20 gage galvanized sheet metal; 6" and Larger, 10 gage galvanized sheet metal, round tube closed with welded longitudinal joint.
 - 2. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.
 - 3. Galvanized steel telescoping type: Galvanized sheet metal per manufacturer's standards.
 - 4. Polyethylene Sleeves: Manufacturer's standard product.
- B. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.04 FIRESTOP SEALANT

- A. Fire stopping material shall be asbestos-free and capable of maintaining an effective barrier against flame and gases in compliance with the following requirements:
 - 1. Flame Spread: 25 or less, ASTM E 84.
 - 2. Smoke Development: 50 or less, ASTM E 84.
 - 3. Combustibility: Noncombustible, ASTM E 136.
- B. Material when installed shall have the same fire rating as the assembly in which it is being installed.

2.05 PIPING ISOLATION

- A. Manufacturer's standard product for providing sound and electrolysis isolation.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

3.02 INSTALLATIONS

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated. Refer to individual system specifications for requirements for coordination drawing submittals.
- B. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated otherwise.
- C. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated on the Drawings.
- E. Install piping tight to slabs, beams, joists, columns, walls and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

- F. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- G. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.
- H. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals.
- I. Coordinate to provide curb, minimum 4" above finish floor, for all pipe shafts or floor openings for multiple pipes.
- J. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained.

3.03 PIPE SUPPORTS AND HANGERS

- A. All pipe Supports and Hangers shall be per requirements of Specification Section 22 05 29 "Supports And Anchors".

3.04 FITTINGS AND SPECIALTIES

- A. Use fittings for all changes in direction and all branch connections.
- B. Remake leaking joints using new materials.
- C. Install Y-type strainers with blow-down valves on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.
- D. Install unions adjacent to each valve and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.
- E. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.
- F. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air, vacuum).
- G. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water, steam).

3.05 JOINTS

- A. Steel Pipe Joints:
 - 1. Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint and tighten to leave not more than 3 threads exposed.
 - 2. Pipe Larger than 2":
 - a. Weld pipe joints (except for exterior water service pipe) in accordance with ASME Code for Pressure Piping, B31.
 - b. Weld pipe joints of exterior water service pipe in accordance with AWWA C206.
 - c. Install flanges on all valves, apparatus, and equipment. Weld pipe flanges to pipe ends in accordance with ASME B31.1.0 Code for Pressure Piping. Clean flange faces and install gaskets. Tighten bolts to torque specified by manufacturer of flange and flange bolts, to provide uniform compression of gaskets.
- B. Non-ferrous Pipe Joints:
 - 1. Brazed and Soldered Joints: For copper tube and fitting joints, braze joints in accordance with ANSI B31.1.0 -Standard Code for Pressure Piping, Power Piping and ANSI B9.1 - Standard Safety Code for Mechanical Refrigeration.
 - 2. Thoroughly clean tube surface and inside surface of the cup of the fittings, using every fine emery cloth, prior to making soldered or brazed joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.

3. Mechanical Joints: Flared compression fittings may be used for refrigerant lines 3/4" and smaller.

C. Joints for other piping materials are specified within the respective piping systems sections.

3.06 INSTALLATION OF SLEEVES

- A. Provide pipe sleeves for pipes to pass through walls, floor and roofs. Diameter of sleeve to be 1-inch larger than the outside diameter of pipe or pipe and covering of insulated pipe. Galvanized steel telescoping type sleeves or polyethylene may be used. Where seepage may occur, use steel pipe sleeves.
- B. All pipe sleeves through floors other than floors on grade shall extend 2-inches above finished floor and shall be caulked with mineral wool. Provide collar where polyethylene sleeve is used.
- C. Where required in existing construction, or where sleeves have been omitted, openings for pipe may be core drilled in floors and/or walls or partitions, providing prior acceptance of such core drilling is obtained from the Architect. Holes core drilled through floors above grade shall be provided with sleeves extending 2-inches above finish floor as hereinbefore specified.
- D. Seal with resilient sealant: Dow Corning "Fire Stop" or approved equal.

3.07 INSTALLATION OF FIRE STOP SEALANT

- A. Fire-stopping shall be provided at, but not limited to, duct, and piping penetrations through floor slabs and through time rated partitions or firewalls.
- B. Install fire-stopping materials in accordance with the manufacturer's instructions and the following requirements.
 1. Filling: Fire-stopping materials shall completely fill the void spaces.
- C. Coordination: Coordinate the work with other trades. Firestopping materials at penetrations of insulated pipes and ducts shall be applied prior to insulation, unless the insulation meets the requirements specified for firestopping.
- D. Surface Preparation: Surfaces to be in contact with firestopping materials shall be free of dirt, grease, oil, loose material, rust, or other substances that may affect proper fitting or the required fire resistance.

3.08 INSTALLATION OF PIPE ISOLATION

- A. Provide sound and electrolysis isolation on all un-insulated, pipes, Semco "Trisolators" or Potter-Roemer "Prisolators".

3.09 INSTALLATION OF PIPE FLASHING

- A. Pipe flashing assemblies, "Semco" Fig. 1100-4, as required, seal the joint between flashing and pipe with waterproofing compound. Install counter-flashing sleeve to cover a minimum of 3/4-inch to top of lead flashing, making the top joint permanently watertight.

3.10 TESTING OF PIPING

- A. Provide notification of test at least three working days prior to tests on all or part of any piping system. Do not allow or cause any piping system to be insulated, covered, concealed or enclosed until such systems have been tested and reviewed. Provide all necessary materials (including temporary isolation valves or caps), pumps, testing media and labor for testing. Temporarily remove any device in piping system, which will not withstand test pressure specified, and reinstall same after successful testing. Test time begins to accrue after full test pressure is achieved.
- B. Testing and inspection of all piping systems and associated equipment for leaks shall be accomplished after installation and cleaning and prior to placing into service. Flanges, threaded joints and all welds shall be left unpainted and uninsulated until the piping systems have been approved.
- C. A rigid visual inspection of each specific piping system shall be made prior to conducting tightness tests, to ascertain that all appurtenances and equipment are provided, properly connected and supported, and in all respects ready for testing.

- D. Equipment such as pumps, chillers, tanks, heat exchangers, flexible hose, safety valves and similar equipment shall not be subjected to the piping system test pressure. Equipment shall either be disconnected from the piping or be isolated by valves or blanks during testing and reinstalled after acceptance by the Owner.
- E. Indicating pressure gauges mounted locally may be tested with the lines provided the test pressure does not exceed the scale range.
- F. Orifice plates, rotometers, displacement meters and other line inserts shall either not be installed until completion of all testing, or shall be removed prior to any tests and reinstalled after test has been accepted by the Owner.
- G. The application of pressure to a system shall be under control at all times, so that in no case shall the test pressure be exceeded by more than 6 percent.
- H. Gauges used for testing shall be tested for accuracy as directed or approved by the Owner, and then installed as close as possible to the low point of the piping system.
- I. Do not apply test pressure until the piping system and its contents approach the same temperature.
- J. While piping is under test, exercise care that excessive pressure does not occur due to increase in ambient temperature.
- K. Control Valves:
 - 1. Control valves which are installed with block and by-pass valve shall have the block valve closed, the by-pass valve opened, and a temporary pipe piece inserted in place of the control valve (or a test blank may be installed on each side of the control valve) until all flushing and testing of all lines of that system is completed and accepted by the Owner, after which they shall be reinstalled.
 - 2. Control valves installed without block or by-pass valves shall be replaced by a pipe piece during flushing and testing of the system. After acceptance of the flushing they shall be reinstalled.
- L. Minimum piping test pressures shall be as noted in tabulation; or they shall be 150 percent of design pressure for the specific system being tested, whichever is higher.

SYSTEM	TEST MEDIUM	TESTING PRESSURE (PSIG)	DURATION (HOURS)	ACCEPTABLE TOLERANCE
Soil, Water, Vent, & Storm Water	Water	Top of highest vent	4	No joint sweat
Water	Water	150	4	None. Except temperature change.
Fuel Gas	Air	60	4	None. Except temperature change.
Fire Sprinkler	Water	200	4	None. Except temperature change.

- M. Conduct hydrostatic tests with water at a temperature below 100 degrees F.
 - 1. Fill the system slowly with water and vent at highest points to expel the air before pressurizing.
 - 2. Carefully examine all joints for leaks or defects.
 - 3. Provide connections as required to accomplish the above.
- N. Keep accurate test records of each line or system tested and provide copies of same to Owner after acceptance. Each test shall include:
 - 1. Identification of piping system and test number.
 - 2. Testing medium.
 - 3. Test pressure.
 - 4. Date of test acceptance.

3.11 ADJUSTMENTS

- A. At the completion of the Work, completely adjust all valves and equipment for their proper use and rating.

END OF SECTION

SECTION 22 11 16
WATER DISTRIBUTION PIPING (INSIDE BUILDING)

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section includes potable cold water, hot water, and circulation hot water piping, fittings, and specialties within the building to a point of 5 feet outside the building.

1.02 RELATED SECTIONS

- A. The following sections contain requirements that relate to this section.
 - 1. Division 22
 - a. Section 220500 "Common Work Results for Plumbing."
 - b. Section 220511 "Supplementary Plumbing Requirements."
 - c. Section 220519 "Meters And Gages."
 - d. Section 220523 "Valves."
 - e. Section 220553 "Plumbing Identification."
 - 2. Division 31 Section 31 13 13.
 - 3. Division 07 Section "Joint Sealers" for materials and methods for sealing pipe penetrations through rated walls and fire and smoke barriers.
- B. Separate sections of Division 22 specify Plumbing Piping, Supports and Anchors, piping system identification materials and requirements, general duty valves, pipe insulation, fire protection piping, and plumbing equipment.

1.03 DEFINITIONS

- A. Water Distribution Pipe: A pipe within the building or on the premises that conveys water from the water service pipe or meter to the points of usage.
- B. Water Service Pipe: The pipe from the water main or other source of potable water supply to the water distributing system of the building served.
- C. Pipe sizes used in this Specification are nominal pipe size (NPS).

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specifications Sections.
 - 1. Product data for each piping specialty and valve specified.
 - 2. Test reports specified in Part 3 of this Section.
 - 3. Maintenance data for each piping specialty and valve specified for inclusion in Maintenance Manual specified in Division 01 and Division 22 Section "Common Work Results for Plumbing."

1.05 QUALITY ASSURANCE

- A. Codes and Standards
 - 1. California Building Code 2022, Title 24, Part 2 for Accessibility Requirements.
 - a. Accessible plumbing fixtures for adults; dimensions shall comply with the requirements of CCT, T-24, Section 1115.B.
 - b. Heights and location of fixtures shall be according to CCR, T-24, Chapter 11-B and Table 1115.B-1.
 - c. Fixture Controls shall comply with CCR, T-24 Section 1115.B.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, clay pipe. Maintain end caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.
- C. Protect flanges, fittings and specialties, from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.
- D. Store CPVC, and PVC pipe and fittings where protected from direct sunlight.
- E. Store pipe in a manner to prevent sagging and bending.

1.07 SEQUENCING AND SCHEDULING

- A. Coordinate the size and location of concrete equipment pads. Cast anchor-bolt inserts into pad. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate the installation of pipe sleeves for foundation wall penetrations.

1.08 EXTRA MATERIALS

- A. Maintenance Stock: Furnish one valve key for each key-operated wall hydrant, hose bib, fixture supply, or faucet installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer Uniformity: Conform to the requirements specified in Division 22 Section "Common Work Results For Plumbing."
 - 1. Hose Bibs:
 - a. Acorn.
 - b. Woodford Mfg. Co.
 - c. Watts Regulator Co.
 - 2. Relief Valves:
 - a. Cash (A. W.) Valve Mfg. Corp.
 - b. Watts Regulator Co.
 - c. Zurn Industries, Inc. Wilkins Regulator Divs.
 - 3. Water Hammer Arresters:
 - a. Precision Plumbing Products, Inc.
 - b. Smith (Jay R.) Mfg. Co.
 - c. Sioux Chief.
 - d. Watts Regulator Co.
 - e. Zurn Industries, Inc.; Hydromechanics Div.
 - 4. Vacuum Breakers for Hose Connections:
 - a. Cash (A.W.) Valve Mfg. Corp.
 - b. Conbraco Industries, Inc.
 - c. Watts Regulator Co.
 - 5. Mechanical Sleeve Seals:
 - a. Thunderline Corp.
 - 6. Pipe Escutcheons:
 - a. McGuire.
 - b. BrassCraft.
 - c. Pasco.
 - 7. Dielectric Waterway Fittings:
 - a. Epco Sales, Inc.
 - b. Victaulic Company of America.

8. Dielectric Unions:
 - a. Eclipse, Inc.
 - b. Perfection Corp.
 - c. Watts Regulator Co.

2.02 PIPE AND TUBE MATERIALS, GENERAL

- A. Pipe and Tube: Refer to Part 3, Article "Application, General," for identification of systems where the below materials are used.
- B. Copper Tube: (Within Building) ASTM B88, Type L Water Tube, drawn temper.
- C. Copper Tube: (Underground) ASTM B88, Type K Water Tube, annealed temper.

2.03 FITTINGS

- A. Wrought Copper Solder-Joint Fittings: ANSI B16.22, streamlined pattern.
- B. Wrought Copper and Bronze Grooved-End Fittings: ASTM B75 Tube and ASTM B584 Bronze Castings.
- C. Unions: ASME B16.39, malleable iron, Class 150, hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces, female threaded ends. Threads shall conform to ASME B1.20.1.
- D. Dielectric Unions: Threaded, solder, or grooved-end connections as required to suit application; constructed to isolate dissimilar metals, prevent galvanic action, and prevent corrosion.
- E. Dielectric Unions: Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze wire reinforced protective jacket; minimum 150 psig working pressure, maximum 250 degree F operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be 12" long and capable of 3/4-inch misalignment. Sweat ends are not acceptable.

2.04 JOINING MATERIALS

- A. Solder Filler Metal: ASTM B32, 95-5 Tin-Antimony 'lead-free' solder.
- B. Brazing Filler Metals: AWS A5.8, BCUP Series.
- C. Gasket Material: Thickness, material, and type suitable for fluid to be handled and design temperatures and pressure.

2.05 GENERAL DUTY VALVES

- A. General-duty valves (i.e., gate, globe, check, ball, and butterfly valves) are specified in Division 22 Section "Valves." Special duty valves are specified below by their generic name; refer to Part 3 Article "Valve Application" for specific uses and applications for each valve specified.

2.06 SPECIAL DUTY VALVES

- A. Balance Cocks: 400 PSI WOG, 2 piece, ball valve, handle, memory stop, with threaded-end connections conforming to ASME B1.20.1.
- B. Balance Cocks: 400 PSI WOG, 2 piece bronze, ball valve, handle, memory stop, with solder-end connections.

2.07 PIPING SPECIALTIES

A. Water Hammer Arresters:

1. J.R. Smith or Approved Equal.
2. Bellows type, with stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201 shall be of the following sizes unless otherwise indicated on the drawings:
 - a. Self-closing valves, lavatories, sinks, etc.

Supply header or pipe size (Inch)	Manufacturer Name	Water Hammer Arrester Model No.
1/2"	J.R. Smith	5005
3/4"	J.R. Smith	5005
1"	J.R. Smith	5010

3. Flushometer, automatic and solenoid valves:
 - a. J.R. Smith or Approved Equal.

Supply header or pipe size (Inch)	Manufacturer Name (a)	Water Hammer Arrester Model No.
3/4"	J.R. Smith	5010
1"	J.R. Smith	5010
1-1/4"	J.R. Smith	5030
1-1/2"	J.R. Smith	5040
2"	J.R. Smith	5050

- B. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 233 per square inch. Strainers in copper lined to have bronze bodies.
 1. Provide strainers with 125 psi working pressure rating for low pressure applications, and 250 psi pressure rating for high pressure application.
 2. Threaded ends, 2" and Smaller: Cast-iron body, or bronze body, screwed screen retainer with centered blow-down fitted with pipe plug.
 3. Threaded Ends, 2-1/2" and Larger: Cast-iron body or bronze body bolted screen retainer with off-center blow-down fitted with pipe plug.
 4. Flanged Ends, 2-1/2" and Larger: Cast-iron body or bronze body, bolted screen retainer with off-center blow-down fitted with pipe plug.
- C. Hose-Connections: Hose connections shall have garden hose threaded outlets conforming to ASME B1.20.7.
- D. Hose Bibs: Bronze body with chrome- or nickel-plated finish, with renewable composition disc, removable wheel handle, vacuum breaker, 3/4- inch solder inlet, hose outlet.
- E. Vacuum Breakers: Hose connection vacuum breakers shall conform to ASSE Standard 1011, with finish to match hose connection.
- F. Relief Valves: Sizes for relief valves shall be in accordance with ASME Boiler and Pressure Vessel Codes for indicated capacity of the appliance for which installed.
 1. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Temperature relief valves shall be factory set at 210 deg. F, and pressure relief at 150 psi.
- G. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation.

- H. Sleeves:
 - 1. Sheet-Metal Sleeves: 10 gage, galvanized sheet metal, round tube closed with welded longitudinal joint.
 - 2. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.
- I. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine rough-in requirements for plumbing fixtures and other equipment with water connections to verify actual locations of piping connections prior to installation.

3.02 PREPARATION

- A. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

3.03 PIPE APPLICATIONS

- A. Install Type L, drawn copper tube with wrought copper fittings and solder joints for pipe sizes 4 inches and smaller, above ground, within building.
- B. Install Type K, annealed temper copper tube for pipe sizes 2 inches and smaller, with minimum number of joints, below ground.
- C. Water piping in sizes 2-1/2 to 6 inches may be Type L drawn copper tube with roll-grooved ends and mechanical couplings, above ground within building.

3.04 PIPING INSTALLATION

- A. General Locations and Arrangements; Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.
- B. Use fittings for all changes in direction and branch connections.
- C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted unless expressly indicated.
- D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- E. Conceal all piping installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1-inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- G. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- H. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4-inch ball valve, and short 3/4-inch threaded nipple and cap.
- I. Pipe sleeves smaller than 6 inches shall be galvanized steel pipe; pipe sleeves 6 inches and larger shall be galvanized steel sheet metal.
- J. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls with sleeves and mechanical sleeve seals.

- K. Fire Barrier Penetrations: Where pipes pass through fire-rated walls, partitions, ceilings, and floors, maintain the fire-rated integrity. Refer to Division 07 for special sealers and materials.

3.05 HANGERS AND SUPPORTS

- A. General: Hanger, support, and anchor devices conforming to MSS SP-69 are specified in Division 22, Section "Supports and Anchors." Conform to the table below for maximum spacing of supports:
- B. Pipe Attachments: Install the following:
1. Adjustable steel clevis hangers, MSS Type 1, for individual horizontal runs less than 20 feet in length.
 2. Adjustable roller hangers, MSS Type 43, and spring hangers, MSS Type 41 with Type 49, for individual horizontal runs 20 feet and longer.
 3. Pipe roll, complete MSS Type 44 for multiple horizontal runs, 20 feet or longer, support on a trapeze.
 4. Spring hangers to support vertical runs.
- C. Install hangers for horizontal piping with the following maximum spacing and minimum rod sizes:

Steel & Copper Nom. Pipe Size – In.	Steel Pipe Max. Span – Ft.	Steel Pipe Min. Rod	Copper Tube Max. Span – Ft.	Copper Tube Min. Rod
Up to 3/4	7	3/8	5	3/8
1	7	3/8	6	3/8
1-1/4	7	3/8	7	3/8
1-1/2	9	3/8	8	3/8
2	10	3/8	8	3/8
2-1/2	11	3/8	9	3/8
3	12	1/2	10	1/2
3-1/2	13	1/2	11	1/2
4	14	5/8	12	1/2
5	16	5/8	13	1/2
6	17	3/4	14	5/8
8	19	7/8	16	3/4
10	22	7/8	18	3/4
12	23	7/8	19	3/4

- D. Support vertical steel pipe and copper tube at each floor.

3.06 PIPE AND TUBE JOINT CONSTRUCTION

- A. Soldered Joints: Comply with the procedures contained in the AWS "Soldering Manual."
- B. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
1. CAUTION: Remove stems, seats, and packing of valves and accessible internal parts of piping specialties before soldering and brazing.
 2. Fill the tubing and fittings during soldering and brazing with an inert gas (nitrogen or carbon dioxide) to prevent formation of scale.
 3. Heat joints to proper and uniform temperature.
- C. Threaded Joints: Conform to ASME B1.20.1, tapered pipe threaded for field-cut threads. Join pipe fittings and valves as follows:
1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 2. Align threads at point of assembly.
 3. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).

4. Assembly joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.
 - a. Damaged Threads: Do not use pipe with corroded or damaged threads. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.
- D. Flanged Joints: Align flange surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.
- E. Grooved-End Joints: Prepare pipe and tubing and install in accordance with manufacturer's installation instructions.

3.07 SERVICE ENTRANCE

- A. Extend water distribution piping to connect to water service piping, of size and in location indicated for service entrance to building. Water service piping is specified in separate section of Division 22.
- B. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation.

3.08 VALVE APPLICATIONS

- A. General-Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Shut-off duty: Use gate, ball, and butterfly valves.
 2. Throttling duty: Use globe and ball valves.

3.09 INSTALLATION OF VALVES

- A. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated. For sectional valves 2 inches and smaller, use gate valves; for sectional valves 2-1/2 inches and larger, use gate or butterfly valves.
- B. Shutoff Valves: Install shutoff valves at inlet and outlet of each plumbing equipment item and elsewhere as indicated.
 1. At plumbing equipment: 2" and smaller use gate or ball valves.
 2. At plumbing equipment: 2-1/2" and larger use gate or butterfly valves.
 3. For plumbing fixtures see fixture trim.
 4. All other locations use gate valves.
- C. Drain Valves: Install drain valves on each plumbing equipment item, located to drain equipment completely for service or repair. Install drain valves at the base of each riser, at low points of horizontal runs, and elsewhere as required to drain distribution piping system completely. For drain valves use 3/4" hose end drain valve.
- D. Hose Bibs: Install on exposed piping where indicated. Provide vacuum breaker.

3.10 INSTALLATION OF PIPING SPECIALTIES

- A. Install backflow Preventers at each connection to mechanical equipment and systems and in compliance with the plumbing code and authority having jurisdiction. Install air cap fitting and pipe relief outlet drain without valves to nearest floor drain. Identify all piping downstream of backflow preventers as "industrial water".
- B. Install pressure-regulating valves with inlet and outlet shutoff valves and balance cock bypass. Install pressure gage on valve outlet.

3.11 INSTALLATION OF PIPING WATER HAMMER ARRESTORS

- A. Provide an air chamber at each valve water outlet or fixture supply for fixtures with manual closing valves. Air chamber shall be 18 inches long and one pipe size larger than supply to outlet. For a battery of fixtures, one air chamber 30 inches long and the full size of the header, but not less than 1 inch may be installed in lieu of individual air chambers. Precision Plumbing Products, JMJ "System Rated" arrestors are acceptable in lieu of air chambers.

- B. Install water hammer arrestors on supply line to fixtures with self-closing, automatic or Flushometer valves. Arrestors shall be as close as possible to individual fixtures and on the end of the header for a battery of fixtures. Arrestors shall be installed in the wall or furring, whenever possible, behind an access panel large enough to permit removal of the arrestor. Sizes as shown on the drawings or as specified hereinafter. Sizes and model numbers are J. R. Smith; equivalent arrestors by Josam, Wade or Zurn are acceptable.

3.12 EQUIPMENT CONNECTIONS

- A. Piping Run-outs to Fixtures: Provide hot and cold water piping Run-outs to fixtures of sizes indicated, but in no case smaller than required by plumbing code.
- B. Equipment Connections: Connect hot and cold water piping system to equipment as indicated. Provide shutoff valve and union for each connection; provide drain valve on drain connection. For connections 2-1/2 inches and larger, use flanges instead of unions.

3.13 FIELD QUALITY CONTROL

- A. Inspections: Inspect water distribution piping as follows:
 - 1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
 - 2. During the progress of the installation, notify the plumbing official having jurisdiction at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
 - a. Rough-In Inspection: After system is roughed in and prior to setting fixtures, arrange for inspection of the piping system before concealed or closed in.
 - b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to ensure compliance with the requirements of the plumbing code.
 - 3. Re-inspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections, and arrange for re-inspection by the plumbing official.
 - 4. Reports: Prepare inspection reports signed by the plumbing official.
- B. Test water distribution piping as follows:
 - 1. Test for leaks and defects all new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
 - 2. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.
 - 3. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to-stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 4. Repair all leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
 - 5. Prepare reports for all tests and required corrective action.

3.14 ADJUSTING AND CLEANING

- A. Clean and disinfect water distribution piping as follows:
 - 1. Purge all new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired prior to use.

2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction or, in case a method is not prescribed by that authority, the procedure described in either AWWA C651, or AWWA C652, or as described below:
 - a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
 - b. Fill the system or part thereof with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system or part thereof and allow to stand for 24 hours.
 - c. Drain the system or part thereof of the previous solution and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
 - d. Following the allowed standing time, flush the system with clean, potable water until chlorine does not remain in the water coming from the system.
 - e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.
- B. Prepare reports for all purging and disinfecting activities.

3.15 COMMISSIONING

- A. Fill the system. Check compression tanks, where used, to determine that they are not air bound and that the system is completely full of water.
- B. Before operating the system, perform these steps:
 1. Close drain valve, hydrants, and hose bibs.
 2. Open valves to full-open position.
 3. Remove and clean strainers.
 4. Check pumps for proper direction of rotation. Correct improper wiring.
 5. Lubricate pump motors and bearings.

END OF SECTION

SECTION 22 11 19
PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies piping specialties and installation methods common to more than one section of Division 22.

1.02 RELATED SECTIONS

- A. This section applies to all piping systems specified in Division 22.
- B. Valves are specified in a separate section and in individual piping system Sections of Division 22.
- C. Fire Barrier Penetration Seals are specified in Section 22 10 00.

1.03 SUBMITTALS

- A. Refer to Division 01 and Section 22 05 00 "Common Work Results for Plumbing" for administrative and procedural requirements for submittals.
- B. Product Data: Submit product data on the following items:
 - 1. Escutcheons
 - 2. Dielectric Unions and Fittings
 - 3. Mechanical Sleeve Seals
 - 4. Strainers

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer Uniformity: Conform to the requirements specified in Common Work Results for Plumbing, under "Product Options."
- B. Manufacturer: Subject to compliance with requirements, provide piping materials and specialties from one of the following:
 - 1. Pipe Escutcheons:
 - a. McGuire.
 - b. BrassCraft.
 - c. Pasco.
 - 2. Dielectric Waterway Fittings:
 - a. Epco Sales, Inc.
 - b. Victaulic Company of America.
 - 3. Dielectric Unions:
 - a. Eclipse, Inc.
 - b. Perfection Corp.
 - c. Watts Regulator Co.
 - 4. Strainers:
 - a. Armstrong Machine Works
 - b. Hoffman Specialty ITT; Fluid Handling Div.
 - c. Metraflex Co.
 - d. R-P&C Valve; Div. White Consolidated Industries, Inc.
 - e. SpiraxSarco.
 - f. Trane Co.
 - g. Victaulic Co. of America. (low-pressure applications only).
 - h. Watts Regulator Co.

- 5. Mechanical Sleeve Seals:
 - a. Thunderline Corp.

2.02 PIPE AND FITTINGS

- A. Refer to the individual piping system specification sections in Division 22 for specifications on piping and fittings relative to that particular system.

2.03 JOINING MATERIALS

- A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
- B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.
- C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.
- D. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.04 PIPING SPECIALTIES

- A. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings.
- B. Unions: Malleable-iron, Class 150 for low pressure service and class 250 for high pressure service; hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.
- C. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged), which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.
- D. Dielectric Waterway Fittings: Electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.
- E. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 225 holes per square inch.
 - 1. Provide strainers with 125 psi working pressure rating for low-pressure applications, and 250 psi pressure rating for high-pressure application.
 - 2. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
 - 3. Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
 - 4. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blow-down fitted with pipe plug.
 - 5. Butt Welded Ends, 2-1/2" and Larger for Low Pressure Application: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with pipe plug.
 - 6. Butt Welded Ends, 2-1/2" and Larger for High Pressure Application: Schedule 80 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with pipe plug.
 - 7. Grooved Ends, 2-1/2" and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.
- F. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

PART 3 - EXECUTION

3.01 ESCUTCHEONS

- A. Install escutcheons at all exposed penetrations of piping through walls, ceilings, and floors in rooms with finish surfaces.

3.02 FITTINGS AND SPECIALTIES

- A. Install strainers on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.
- B. Install unions adjacent to each valve and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.
- C. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.
- D. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air, vacuum).
- E. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water, steam).

END OF SECTION

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes building sanitary and storm drainage and vent piping systems, including drains and drainage specialties.

1.02 RELATED SECTIONS

- A. The following sections contain requirements that relate to this section:
 - 1. Division 22 Section "Plumbing Identification," for labeling and identification of drainage and vent piping.

1.03 DEFINITIONS

- A. Building Drain: That part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer.
- B. Building Sewer: That part of the piping within public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal.
- C. Drainage System: Includes all the piping within public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.
- D. Vent System: A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and backpressure.

1.04 SUBMITTALS

- A. Product data for the following products:
 - 1. Drainage piping specialties.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with the provisions of the following:
 - 1. California Plumbing Code (CPC): Current edition in use by authority having jurisdiction.

1.06 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of roof drains, flashing, and roof penetrations.
- B. Coordinate flashing materials installation of roofing, waterproofing, and adjoining substrate work.
- C. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.
- D. Coordinate with installation of sanitary and storm sewer system as necessary to interface building drains with drainage piping system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide drainage and vent systems from one of the following:
 - 1. Drainage Piping Specialties, including backwater valves, expansion joints, drains, trap primers, and vandal-proof vent caps:
 - a. J. R. Smith Mfg. Co.
 - b. Josam Mfg. Co.
 - c. Zurn Industries Inc; Hydromechanics Div.
 - d. Tyler Pipe; Subs. of Tyler Corp.

2.02 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS

- A. General: Select from the following options:
 - 1. Pipe Sizes Larger than 2": Cast-iron soil pipe. Conform to ASTM A74, for service weight, hub-and-spigot soil pipe and fittings, with clamps and compression gasket joints conforming to ASTM C564. Piping shall bear the CISPI stamp.
 - 2. Pipe Sizes Larger than 2": Hub-less cast-iron soil pipe. Conform to CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310. Piping shall bear the CISPI stamp.

2.03 UNDERGROUND BUILDING DRAIN PIPE AND FITTINGS

- A. Pipe and fittings shall have heavy coating of coal tar varnish or 'asphaltum' on both inside and outside surfaces.
- B. General: For pipe and fittings below grade and/or below finish floor of floors on grade select from the following options:
 - 1. Pipe Sizes 15" and Smaller: Cast-iron soil pipe. Conform to ASTM A74, for standard weight hub and spigot soil pipe and fittings, with clamps and neoprene gasket, conforming to ASTM C564. Piping shall bear the CISPI stamp.
 - 2. Pipe Sizes 16" and Smaller: Hub-less cast iron soil pipe, conform to CISPI Standard 301, service weight; with "Best" or "MG" cast iron joint connection couplings. Coupling body shall conform to ASTM A-48 or ASTM A-74 with neoprene gasket conforming to ASTM C-564. Piping shall bear the CISPI stamp.

2.04 DRAINAGE PIPE SPECIALTIES

- A. Trap Primers: Bronze body valve with automatic vacuum breaker, with 1/2 inch connections matching piping system. Complying with ASSE 1018.
- B. Expansion Joints: Cast-iron body with adjustable bronze sleeve, bronze bolts with wing nuts.
- C. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

2.05 CLEANOUTS

- A. Cleanouts on cast iron soil pipe, iron body with ABS plugs screwed into caulking ferrules. Cleanouts on steel pipe, ABS plugs. Cleanouts on vitrified clay pipe, vitrified clay pipe. Where cleanouts occur in finished interior surfaces, smooth polished chromium plated. Exposed parts of floor cleanouts in finished rooms, non-slip polished nickel bronze. Floor cleanouts adjustable type. Where cleanouts occur in carpeted floor areas, the cover shall be elevated so as to be flush with finished carpeted areas.
- B. Floor Cleanouts: Cast-iron body and frame, with cleanout plug and adjustable round top as follows:
 - 1. Floor level type in rooms with concrete floor: Smith #4021, Josam 58330-2, or Zurn Z1420-25 with cast iron top.
- C. Wall Cleanouts: Cast-iron body adaptable to pipe with ABS plastic plug; stainless steel cover including screws.
 - 1. Wall type for cast-iron pipes: Smith #4532, Josam 58790-4, or Zurn Z-1445-1.
 - 2. Wall type for steel pipes: Smith #4472, Josam 58890-4, or Zurn 1460-8.
- D. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide under-deck clamp and sleeve length as required.
- E. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks.
- F. Vandal-Proof Vent Caps: Cast-iron body full size of vent pipe, with caulked base connection for cast-iron pipes, threaded base for steel pipes.

2.06 FLOOR DRAINS

- A. Floor drains are specified in Section 22 42 00 "Commercial Plumbing Fixtures."

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify all dimensions by field dimensions. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.
- C. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.
- D. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.
- E. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION FOUNDATION FOR UNDERGROUND BUILDING DRAINS

- A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.
- B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.
- C. Shape bottom of trench to fit bottom of pipe for 90-degrees (bottom 1/4 of the circumference). Fill unevenness with tamped sand backfill. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.

3.03 PIPE APPLICATIONS - ABOVE GROUND, WITHIN BUILDING

- A. General: Select from following options:
 - 1. Install hub-and spigot, service weight, cast-iron soil pipe with compression gasket joints for larger than 2 inches drainage and vent pipe. Piping shall bear the CISPI stamp.
 - 2. Install Hub-less, service weight, cast-iron soil pipe and fittings for larger than 2 inch drainage and vent pipe. Piping shall bear the CISPI stamp.

3.04 PIPE APPLICATIONS - BELOW GROUND, WITHIN BUILDING

- A. General: Select from the following options:
 - 1. Install hub-and-spigot, heavy service weight, cast-iron, soil pipe and fittings with gasket joints for 15 inch and smaller drainage pipe. Piping shall bear the CISPI stamp.
 - 2. Install hub-less, service weight, cast-iron soil pipe with Anaco Husky SD 4000 stainless steel couplings with neoprene gaskets. Piping shall bear the CISPI stamp.

3.05 PIPE AND TUBE JOINT CONSTRUCTION

- A. Copper Tubing: Solder joints in accordance with the procedures specified in AWS "Soldering Manual."
- B. Cast-Iron Soil Pipe: Make lead and oakum caulked joints, compression joints, and hub-less joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.
- C. Install couplings per manufacturer's recommendations.

3.06 INSTALLATION

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.
- B. Use fittings for all changes in direction and all branch connections.
- C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

- D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Allow sufficient space above removable ceiling panels to allow for panel removal.
- G. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inches and larger shall be sheet metal.
- H. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings and floors, maintain the fire rated integrity.
- I. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, half-wye, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.
- J. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- K. Install building drain pitched down at minimum slope of 1/4 inch per foot (2 percent) for piping 3 inch and smaller, and 1/8 inch per foot (1 percent) for piping 4 inch and larger.
- L. Extend building drain to connect to sewer piping, of size and in location indicated for service entrance to building. Sewer piping is specified in a separate section of Division 22.
- M. Install sleeve and mechanical sleeve through foundation wall for watertight installation.

3.07 HANGERS AND SUPPORTS

- A. General: Hangers, supports, and anchorage devices are specified in Division 22 Section "Plumbing Piping." Conform to the table below for maximum spacing of supports:
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
- C. Install hangers at the following intervals:

Pipe material	Max. Horizontal Spacing (Ft.)	Max. Vertical Spacing (Ft.)
Cast Iron Pipe	5	15
Copper Tubing 1-1/2" & Smaller	6	10
Copper Tubing 2" & Larger	10	10

3.08 INSTALLATION OF PIPE SPECIALTIES

- A. Install backwater valves in sanitary building drain piping as indicated, and as required by the plumbing code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service.
- B. Install expansion joints on vertical risers as indicated, and as required by the plumbing code.
- C. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:
 - 1. As required by plumbing code.
 - 2. At each horizontal change in direction of piping greater than 135 degrees.
 - 3. At maximum intervals of 50' for piping 3" and smaller and 100' for larger piping.
 - 4. At base of each vertical soil or waste stack.
- D. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping.
- E. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.09 INSTALLATION OF TRAP PRIMERS

- A. Install trap primers with piping pitched towards drain trap, minimum of 1/8 inch per foot (1 percent). Adjust trap primer for proper flow. Provide trap primer for all floor drains and floor sinks. Multiple outlet primers are acceptable.

3.10 CONNECTIONS

- A. Piping Run-outs to Fixtures: Provide drainage and vent piping run-outs to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.

3.11 FIELD QUALITY CONTROL

- A. Inspections:
 - 1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
 - 2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
 - a. Rough-In Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 - b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
 - 3. Re-inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspection by the plumbing official.
 - 4. Reports: Prepare inspection reports, signed by the plumbing official.
- B. Piping System Test: Test drainage and vent system in accordance with the procedures of the authority having jurisdiction, or in the absence of a published procedure, as follows:
 - 1. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
 - 2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, which has been covered or concealed before it has been tested and approved.

3. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open jointed drain tile, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
4. Finished Plumbing Test Procedure: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
5. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for all tests and required corrective action.

3.12 ADJUSTING AND CLEANING

- A. Clean interior of piping system. Remove dirt and debris as work progresses.
- B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.13 PROTECTION

- A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION

SECTION 22 34 36
COMMERCIAL TANKLESS ELECTRIC WATER HEATER

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Extent of water heater work required by this section is indicated on drawings and schedules, and by requirements of this section.

1.02 RELATED SECTIONS

- A. Refer to other Division 22 sections for water piping, specialties, pumps, fuel piping, and breechings which are required external to water heaters for installation; not work of this section.
- B. Refer to other Division 22 sections for field installed automatic temperature controls required in conjunction with water heaters; not work of this section.
- C. Electrical Work: Refer to Division 22 section "Common Motor Requirements For Plumbing Equipment" for requirements.
- D. Refer to Division 26 sections for other electrical wiring including motor starters, disconnects, wires/cables, raceways, and other required electrical devices; not work of this section.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data including rated capacities and efficiencies of selected model clearly indicated; operating weights; furnished specialties and accessories; and installation and start-up instructions.
- B. Wiring Diagrams: Submit manufacturer's electrical requirements for electrical power supply wiring to water heaters. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of water heaters and controls. Differentiate between portions that are to be field-installed.
- C. Warranties: Submit certificates for all heaters requiring extended warranties.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of water heaters of types and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Codes and Standards:
 - 1. UL Compliance: Construct water heaters in accordance with the following UL standards:
 - a. Unit shall be listed and tested to UL 499 appliance standards.
 - b. Unit shall comply with UL 353 and CSA C22.2 for temperature limit control.
 - c. UBC, CEC, and NAECA standards.
 - 2. California Code of Regulations (CCR): All water heater models submitted for review shall have identification label on certification showing compliance with CCR Title 24, "Energy Conservation Standards".
 - 3. NEC Compliance: Install electric water heaters in accordance with requirements of NFPA 70, "National Electrical Code".
 - 4. NSF Labels: Provide water heaters which are listed and labeled by the National Sanitation Foundation.
 - 5. ASHRAE Compliance: Provide water heaters with Performance Efficiencies not less than prescribed in ASHRAE 90A, "Energy Conservation in New Building Design."

1.05 DELIVERY, STORAGE, AND HANDING

- A. Handle water heaters and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged water heaters or components; remove from site and replace with new.
- B. Store water heaters and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with manufacturer's rigging and installation instructions for unloading water heaters, and moving units to final location for installation.

1.06 SPECIAL PROJECT WARRANTY

- A. Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, water heaters with inadequate or defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.
 - 1. Warranty Period: 5 years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 COMMERCIAL ELECTRIC WATER HEATERS

- A. General: Provide commercial electric water heaters of sizes, capacities, and electrical characteristics as indicated.
- B. Heater: Working pressure of 150 PSI, magnesium anode rod; glass lining on internal surfaces exposed to water.
- C. Heating Elements: Heavy-duty, medium watt density, with incoloy sheath, thermostat stepped through magnetic contactors.
- D. Safety Controls: Double pole, manual reset, high limit; probe type electric low water cutoff; both factory wired.
- E. Jacket: Equip with full size control compartments with front panel opening. Insulate tank with vermin-proof glass fiber insulation. Provide outer steel jacket with bonderized undercoat and baked enamel finish.
- F. Accessories: Provide brass drain valve; 3/4" temperature and pressure relief valve; ASME tank, construction for 125 PSI working pressure; and 4" x 6" hand hole cleanout.
- G. Controls: Adjustable immersion thermostat; power circuit fusing.
- H. Manufacturers: Subject to compliance with requirements, provide commercial electric water heaters of one of the following:
 - 1. A. O. Smith Corp. - Consumer Products Div.
 - 2. Rheem Water Heating Division, City Investing Company.
 - 3. Or approved equal.

2.02 ELECTRIC WATER HEATERS (COMMERCIAL)

- A. General: Provide commercial tankless electric water heater of size and electrical characteristics as indicated. A. O. Smith "Commercial" Model C2VA-140X or approved equal.
- B. Provide heavy-duty medium-watt density immersion heaters with incoloy sheathing and pre-wired leads. Voltage phase and capacity as indicated.
- C. Provide hinged control compartment to house 120 V control circuit transformer, transformer fusing (one per element), magnetic contactor(s), immersion style thermostat(s), element fusing per N.E.C. and flanged heater elements.
- D. Safety Controls: equip with high-temperature cut-off for each element, high- and low-pressure switches, factory wired.
- E. Accessories; Provide brass drain valve, ASME temperature and pressure relief valve.
- F. Manufacturers: Subject to compliance with requirements, provide commercial tankless electric water heaters of one of the following:
 - 1. O. Smith Corp. - Consumer Products Division.
 - 2. Rheem Water Heater Division, City Investing Company.
 - 3. Or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which water heaters are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF WATER HEATERS

- A. General: Install water heaters in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Support: Place units on concrete pads, orient so controls and devices needing service and maintenance have adequate access.
- C. Piping: Connect hot and cold water piping to units with shutoff valves and unions. Connect recirculating water line to unit with shutoff valve, check valve, and union. Extend relief valve discharge to closet floor drain, or as indicated.
- D. Gages: Provide thermometers on inlet and outlet piping of water heaters, in accordance with Basic Mechanical Materials and Methods Section "Meters and Gages."
- E. Electric Water Heaters:
 - 1. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - a. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Do not proceed with water heater start-up until wiring installation is acceptable to water heater Installer.

3.03 FIELD QUALITY CONTROL

- A. Start-Up: Start-up, test, and adjust gas-fired water heaters in accordance with manufacturer's start-up instructions, and utility company's requirements. Check and calibrate controls, adjust burner for maximum efficiency.
- B. Start-Up: Start-up, test, and adjust electric water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.

END OF SECTION

SECTION 22 42 00
COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section specifies plumbing fixtures and trim. The types of fixtures specified include the following:
 - 1. Water Closets.
 - 2. Urinals.
 - 3. Lavatories (including wheelchair type).
 - 4. Service Sinks.
 - 5. Drinking Fountains (including wheelchair type).
 - 6. Faucets.
 - 7. Flush Valves.
 - 8. Fixture Supports (including wheelchair type).
 - 9. Toilet Seats.
 - 10. Fittings, Trim, and Accessories.
 - 11. Floor Drains.
 - 12. Roof Drains.

1.02 RELATED SECTIONS

- A. Separate grab bars and toilet accessories not in integral part of plumbing fixtures and are specified in Division 10.
- B. Electrical Requirements for, Water Heaters, water conditioners, and other plumbing equipment are specified in other Sections of Division 22 and Division 26.

1.03 SUBMITTALS

- A. Product Data: Submit Product Data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified; clearly indicate rated capacities of selected models of water coolers, and water heaters.
- B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with Architectural Woodwork shop drawings specified in Division 06 for fixtures installed in countertops and cabinets. Furnish templates for use in woodwork shop.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements and wiring diagrams for power supply to units. Clearly differentiate between portions of wiring that are factory installed and field installed portions.
- D. Maintenance Data: Include data in Maintenance Manual specified in Division 01 and Section 22 05 00.
- E. Quality Control Submittals:
 - 1. Submit certification of compliance with specified ANSI, UL, and ASHRAE Standards.
 - 2. Submit certification of compliance with performance verification requirements specified in this Section.

1.04 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. California Building Code 2022, Title 24, Part 2 for Accessibility Requirements.
 - a. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with **CBC Section 11B-213.2** shall comply with **CBC Section 11B-213.3**.
 - b. Effective March 1, 2017, all single-user toilet facilities shall be identified as Gender-Neutral facilities by a door symbol that complies with **CBC Sections 11B-216.8 and 11B-703.7.2.6.3**. No pictogram, text or braille is required on the symbol. If tactile jamb signage is provided, the signage shall comply with the appropriate technical requirements of **CBC Section 11B-703**.

Examples of appropriate designations are "ALL-GENDER RESTROOM", "RESTROOM" or "UNISEX RESTROOM". **DSA BU 17-01.**

- c. Accessible plumbing fixtures shall comply with all the requirements in **CBC Chapter 11B, Division 6.**
- d. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per **CBC Section 11B-604.3.1.**
- e. Heights and location of all accessible plumbing fixtures and components shall be mounted according to **CBC Section 11B-602 through 11B-612.**
- f. Accessible fixture controls shall comply with **CBC Sections 11B-602.3** for drinking fountains, **11B-604.6** for water closets, **11B-604.9.5** for children's water closets, **11B-605.4** for urinals, **11B-606.4** for lavatories and sinks, **11B-607.5** for bathtubs, **11B-608.5** for showers, and **11B-611.3** for washing machines and clothes dryers.
- g. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with **CBC Section 11B-306** when a forward approach is required. **CBC Sections 11B-606.3 and 11B-606.7.**

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommended temperatures to prevent damage.
- B. Store fixtures and trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture or trim.
- C. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per **CBC Section 11B-604.3.1.**

1.06 SEQUENCE AND SCHEDULING

- A. Schedule rough-in installations with the installation of other building components.

1.07 MAINTENANCE

- A. Extra Stock: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt in a quantity of one device for each 10 fixtures.
- B. Repair Kits: Furnish faucet repair kits complete with all necessary washers, springs, pins, retainer packings, O-rings, sleeves, and seats in a quantity of 1 kit for each 40 faucets.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer uniformity shall be as specified in Section 22 05 00: "Common Work Results for Plumbing."
- B. The following specification mentions manufacturers to establish a standard quality. The following fixtures and accessories are acceptable, if used throughout:
 - 1. Water Closets, Urinals, Lavatories, Service Sinks:
 - a. American Standard.
 - b. Kohler Co.
 - 2. Stainless Steel Sinks:
 - a. Elkay Mfg. Co.
 - b. Just Mfg. Co.
 - 3. Faucets:
 - a. Chicago Faucet Co.
 - b. T & S Brass.
 - c. Speakman.
 - 4. Flush Valves:
 - a. Sloan Valve Co.

5. Water Closet Seats:
 - a. Church Products.
 - b. Bemis.
 - c. Beneke Corp.
6. Fixture Supports:
 - a. Jay R. Smith Manufacturing Co.
 - b. Josam Mfg. Co.
 - c. Zurn Industries, Inc.; Hydromechanics Div.
7. Drains:
 - a. Jay R. Smith Manufacturing Co.
 - b. Josam Mfg. Co.
 - c. Zurn Industries, Inc.; Hydromechanics Div.

2.02 FIXTURES

- A. Plumbing fixture trim and exposed supplies and wastes are to be brass with polished chromium plated finish unless otherwise specified. Provide individual lose key or screwdriver stops for all fixture supplies. Separately trap all wastes. Furnish chrome plated wall escutcheons for all exposed supplies and trap arms. Locate stops below fixtures or countertops. All fixtures for use by the disabled shall have exposed hot water pipe and tailpiece and trap insulated with 1/2" rubber foam insulation.
- B. All plumbing fixture faucets submitted for review shall have identification label or certification showing compliance with California Title 24, Part 5, Article 1, "Energy Conservation Standards"; Article 1, T20-1406; Article 2, T20-1525 and Article 4, 1604, and 1606.
- C. Provide fixtures as scheduled on plumbing drawings and requirements of this Section.

2.03 SINK FAUCET

- A. Description: General Service faucet. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 1. Maximum Flow Rate: 1.5 GPM.

2.04 LAVATORY FAUCET

- A. Description: General Service faucet. Include hot- and cold-water indicators as occurs; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
 1. Maximum Flow Rate: 0.35 GPM.

2.05 FLUSHOMETER

- A. Description: Flushometer for urinal and water-closet]-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
 1. Consumption for Urinal: 0.125 gal./flush.
 2. Consumption for Water closet: 1.28 gal./flush.

2.06 WATER CLOSET

- A. Description Accessible Wall-mounting, back-outlet, top-spud, vitreous-china fixture designed for flushometer valve operation.
 1. Style: Flushometer valve.
 - a. Design Consumption: 1.28 gal./flush.
- B. Description: Accessible Floor-mounting, floor-outlet, top-spud, vitreous-china fixture designed for flushometer valve operation.
 1. Style: Flushometer valve.
 - a. Design Consumption: 1.28 gal./flush.

2.07 URINAL

- A. Description: Accessible, Wall-mounting, back-outlet, top-spud, vitreous-china fixture designed for flushometer valve operation.
 - 1. Design Consumption: 0.125 gal./flush.

2.08 FIXTURE SUPPORTS

- A. Lavatory Supports: Adjustable cast iron, with thin concealed arms and sleeves, and complete with escutcheons and mounting fasteners.
- B. Water Closet Supports: Adjustable, factory painted, cast iron face plate, support base, and appropriate type waste fitting having face plate gasket; zinc plated steel fixture studs and fasteners; coated and threaded adjustable wall coupling with neoprene closet outlet gasket; and chrome plated fixture cap nuts and fiber fixture washers. Provide an appropriate model to suit deep or shallow rough-in, siphon jet or blow-out water closet, and type of sanitary piping system to which it is connected.
- C. Wheelchair Water Closet Supports: Adjustable, factory painted, cast iron face plate, support base, and appropriate type waste fitting having face plate gasket; zinc plated steel fixture studs and fasteners; coated and threaded adjustable wall coupling with neoprene closet outlet gasket; and chrome plated fixture cap nuts and fiber fixture washers. Units shall have elevated mounting heights of wheelchair fixtures, siphon jet or blow-out water closet, and type of sanitary piping system to which it is connected.

2.09 ESCUTCHEONS

- A. Select one of the two options below:
 - 1. Chrome-plated cast brass with set screw.
 - 2. Chrome-plated sheet steel with friction clips.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.
- C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- D. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF FIXTURES

- A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.
- B. Comply with the installation requirements of the 2022 California Building Code "CBC" Division 6 for accessible plumbing fixtures. Reference Article 1.04, A.,1., a. thru g. of this Section.
- C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
- D. Securely attach wall hung fixtures to a 3/8 inch x 6 inch wide steel plate. Steel plate to extend at least one stud beyond first and last mounting point. Drill and tap plate at time of installation of fixture or fixture hanger. Support fixture hanger with 1/2" diameter threaded studs, jamb nuts, C.P. Acorn nuts and completely free of wall by means of a second set of jamb nuts. Weld plate to each metal stud crossed by means of a continuous vertical fillet weld and same size as stud thickness. Secure plate to each wood stud crossed by securely bolting to each stud crossed with two 1/2-inch steel bolts, 4-inch center with 1/8-inch maximum x 1-1/2 inch steel back up plates. Notch studs to set plate flush with surface.
- E. Set mop basins in a leveling bed of cement grout.

- F. Install a stop valve in an accessible location in the water connection to each fixture.
- G. Install chrome plated brass escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and with cabinets and millwork.
- H. Seal fixtures to walls and floors using silicone sealant as specified in Section 07 90 00. Match sealant color to fixture color.
- I. Provide abrasive washers under all single drilling deck mounted trim.

3.03 INSTALLATION OF FLOOR DRAINS

- A. Install floor drains in accordance with manufacturer's written instructions and in locations indicated.
- B. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
- C. Set drain elevation depressed below finished slab elevation as listed below to provide proper slope to drain:

Depression (Inch)	Radius Of Area Drained (Feet)
1/2	5
3/4	10
1	15
1-1/4	20
1-1/2	25

- D. Trap all drains connected to the sanitary sewer.
- E. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
- F. Position drains so that they are accessible and easy to maintain.

3.04 INSTALLATION OF TRAP PRIMERS

- A. Install trap primers with piping pitched towards drain trap, minimum of 1/8 inch per foot (1 percent). Adjust trap primer for proper flow.

3.05 INSTALLATION OF ROOF DRAINS

- A. Install roof drains at low points of roof areas, in accordance with the roof membrane manufacturer's installation instructions.
- B. Install drain flashing collar or flange so that no leakage occurs between roof drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.
- C. Position roof drains so that they are accessible and easy to maintain.

3.06 FIELD QUALITY CONTROL

- A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
- B. Inspect each installed unit for damage. Replace damaged fixtures.

3.07 ADJUSTING

- A. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow and stream.
- B. Replace washers or leaking or dripping faucets and stops.
- C. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.08 CLEANING

- A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.09 PROTECTION

- A. Provide protective covering for installed fixtures, water coolers, and trim.
- B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by Owner.

3.10 MOUNTING HEIGHTS SCHEDULE

Fixture	Mounting Height
Water Closet	See Architectural Drawings
Accessible Water Closet	See Architectural Drawings
Urinal	See Architectural Drawings
Accessible Urinal	See Architectural Drawings
Lavatory or Sink	See Architectural Drawings
Accessible Lavatory / Sink	See Architectural Drawings
Accessible Water Cooler	See Architectural Drawings

3.11 ROUGH-IN FOR FIXTURES

- A. Rough-in for all fixtures and/or equipment as shown on any drawings, including the architectural drawings, which forms a part of the contract documents. This shall include all fixtures and equipment shown and/or noted as N.I.C. (not in contract) or as U.O.S. (furnished under another section of the specification). Stub out all piping to the exact location of the fixtures and set symmetrical with the fixture. Stub out for fixture supply pipes with drop ear fittings secured to stud or backing plate. Stub out two pipe diameter and terminate with pipe cap. When liens are indicated as capped or plugged at floor level, plug flush with the finished floor.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Project specification Sections, apply to this and the other sections of Division 23.
- B. This Division is an integrated whole comprising interrelated and interdependent Section and shall be considered in its entirety in determining requirements of the Work.
- C. Refer to other sections of this Division for additional requirements or information regarding the subjects of this Section.

1.02 SECTION INCLUDES

- A. This Section includes general administrative and procedural requirements for HVAC installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:
 - 1. Submittals.
 - 2. Coordination drawings.
 - 3. Record documents.
 - 4. Maintenance manuals.
 - 5. Rough-ins.
 - 6. Mechanical installations.
 - 7. Cutting and patching.

1.03 SUBMITTALS

- A. General: Follow the procedures specified in Division 01.
- B. HVAC submittals shall include shop drawings, product data, and samples per requirements of each section of specification
- C. HVAC Submittals and Product Data: Assemble "submittals" and "product data" into tabbed brochures according to main areas of work i.e. (HVAC); Temperature Control; Testing, Adjusting, and Balancing.
 - 1. Assemble each brochure with tabbed separators for each Specification Section where products are noted to be submitted, with separate tabs for each product listed.
 - 2. Temperature "control shop drawings" may be submitted separately after preparations for review.
 - 3. For items such as valves, hangers and accessories, indicate specific items and where they are to be used.
 - 4. Contractor need only to submit for review those items specified to be submitted, unless requested by the Architect for special review.
- D. All submittals shall be submitted in hard copy, electronic submittals are not acceptable.
- E. Increase the number of HVAC related submittals including shop drawings, product data, and samples submitted to allow for required distribution by one additional copy, which will be retained by the Mechanical Consulting Engineer.
- F. Submit for review, only the specific items required in this Section or other Sections of Division 23.
- G. Additional submittals shall include, but not limited:
 - 1. Air balance reports and equipment data record drawings.
 - 2. Certification of completion of testing.
 - 3. Certification of completion of operation instructions.
 - 4. Operating instruction brochure.
 - 5. Maintenance instruction brochures.

6. Equipment guarantees.
 7. 1/4" = 1'-0" or larger scale layouts of "Equivalent" equipment or "Or Approved Equal" equipment.
 8. Coordination Drawings, where requested or required.
- H. Submittal materials will be reviewed for substantial conformity with the intent of the contract plans and specifications only. Such review does not indicate approval of dimensions, quantities, coordination with other trades, or work methods of the contractor, which are indicated thereon.
- I. Additional copies may be required by individual sections of these specifications.

1.04 COORDINATION

- A. The Contractor shall be totally responsible for coordinating the layout of all building elements to avoid conflict of the work of the structural, mechanical, electrical systems, and architectural features of the building.
- B. The cost of any extra work of any kind caused by a conflict due to this lack of coordination shall be borne by the Contractor.

1.05 COORDINATION OF DRAWINGS

- A. Prepare coordination drawings in accordance with requirements of Project Specification to a scale of 1/4" = 1'-0" or larger; detailing major elements, components, required clearances, and systems of HVAC equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of the installations are of importance to the efficient flow of the Work, including but not necessarily limited to the following:
1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
 - a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - b. Equipment for connections and support details.
 2. Prepare reflected ceiling plans to coordinate and integrate installations with other systems and components, such as, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.
- B. Submittal of "Or Equal" substitutions of equipment will not be reviewed unless accompanied by coordination drawings.

1.06 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements of project specification. In addition to the requirements of project specification, indicate the following installed conditions:
1. Record drawings of all installed as specified in Division 01 the locations and invert elevations of underground installations.

1.07 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Project specification and Division 23 Section "Supplementary Mechanical Requirements."

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, mill certification, and other information needed for identification.

1.09 EQUIVALENT EQUIPMENT

- A. In these specification and drawings, whenever more than one (1) manufacturer's product is specified, the manufacturer specified on the drawings and the first named product in these specifications is the basis of design and the use of alternate-named manufacturer's product or substitutes may require modification in the design work and agency approvals. If such alternatives or substitutions are proposed by the contractor, contractor shall adhere to the following requirements:

1. Contractor shall clearly identify all proposed alternatives or substitutions in the submittal package.
 2. The Contractor shall assume all costs required to make all necessary revisions and modifications of the contract documents resulting from the substitution or selection of an alternate manufacturer's product, including all professional fees and the cost of DSA approval.
 3. The Contractor shall assume all costs required for any additional modification to building structure, electrical and all other related construction costs resulting from the substitution or selection of an alternate manufacturer's product.
- B. These specifications and/or drawings, names and specifies certain equipment in detail which are the basis of design and are explained in paragraph 1.09-A above. It also names alternate equipment by manufacturer, which is not considered to be a "substitution."
- C. Submit equivalent equipment to the Architect for review per the requirements of Division 01, and Section "Common Work Results for HVAC."
- D. Equipment of Manufacturers named in Division 23 will be considered equivalent to that specified in detail and/or named on the drawings if:
1. The proposed equipment is of equivalent quality, capacity.
 2. Equipment is as fully equipped, fits the space allotted, and has physical configuration and weight similar-to the equipment specified in detail.
- E. A complete lay out of an equipment room or area must be submitted for equivalent equipment. Notice space limitations. Layouts to include plans and section views at a scale of not less than 1/4" = 1 ft.
- F. The Architect shall determine the acceptability of "Equivalent Equipment."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 ROUGH-IN

- A. Verify final locations for rough-in with field measurements and with the requirements of the actual equipment to be connected.

3.02 MECHANICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of HVAC systems, materials, and equipment. Comply with the following requirements:
1. Coordinate HVAC systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for HVAC installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of HVAC materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible as required by California Building Code.
 7. Coordinate connection of HVAC system with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect prior to commencement of installation.
9. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components.
10. Install all HVAC equipment to facilitate servicing, maintenance, and repair or replacement of equipment components in full compliance with California Building Code and the equipment manufacturer's recommendations. If the drawings or the manufacturer does not provide a specific space requirement for servicing equipment, provide as a minimum, horizontal distance of 36" from face of equipment to opposite vertical surface.
11. Install access panels or doors for all equipment and components which require access for adjustment and maintenance, where units are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Any equipment located above a ceiling that has any component, which is serviceable shall be installed within 12" of the top-of the ceiling.

3.03 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with project specification. In addition to the requirements specified in project specification, the following requirements apply:
 1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of HVAC equipment and materials required to:
 1. Uncover Work to provide for installation of ill-timed Work.
 2. Remove and replace defective work.
 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 4. Remove samples of installed Work as specified for testing.
 5. Install equipment and materials in existing structures.
 6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- C. Cut, remove, and legally dispose of selected HVAC equipment, components, and materials as indicated, including but not limited to removal of HVAC piping, refrigerant lines, heating units, and other HVAC items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 1. Patch existing finished surfaces and building components using experienced installers and new materials matching existing materials. For installer's qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

SECTION 23 05 11
SUPPLEMENTARY HVAC REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies supplementary requirements for HVAC installations and includes requirements common to more than one section of Division 23. It expands and supplements the requirements specified in Section 23 05 00 "Common Work Results for HVAC."

1.02 DESCRIPTION

- A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

1.03 COORDINATION

- A. Coordination of the work is the responsibility of the Contractor.
- B. Contractor shall designate an individual competent and versed in the HVAC trades to coordinate the HVAC work with the work of other trades.

1.04 DEFINITIONS (AS USED ON DIVISION 23 DRAWINGS AND HEREIN)

- A. "Provide" means furnish, install, and connect unless otherwise described in specific instances.
- B. "Piping" means pipes, fittings, valves, and all like pipe accessories connected thereto.
- C. "Ductwork" means ducts, plenums, compartments, or casings including the building structure, which are used to convey or contain air.
- D. "Extend", "Submit", "Repair" and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.
- E. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constituted authorities and public utility franchise holders having jurisdiction.
- F. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.
- G. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces, which are not included in the utility areas definition.
- H. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.
- I. "Below Grade" means buried in the ground.
- J. "Substantial Completion" means all components of all systems are functioning but lacking in final adjustment.
- K. Pressure rating specified (such as for valves and the like) means design working pressure for and with references to the fluid, which the device will serve.

1.05 RELATED WORK

- A. Coordination: Refer to Architectural, HVAC, Plumbing, Civil, Structural, and Electrical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order the work of this Division so that progress will harmonize with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of HVAC work in relation to the work of other Divisions.
- B. Examine other Divisions for work related to the Work of this Division, especially Divisions 22 & 26.

1.06 EXISTING CONDITIONS

- A. Visit the site prior to bidding and investigate the existing conditions, which affect or will be affected by the work of this Division. Become thoroughly familiar with the working conditions and take into-account any special or unusual features peculiar to this job. By the act of submitting a Bid, the Contractor will be deemed to have complied with the foregoing, to have accepted such conditions, and to have made allowance therefore in preparing his Bid.
- B. The locations of existing concealed utility lines are shown in accordance with reference data received by the Architect. The Architect does not guarantee the accuracy of such data. The points of connection are therefore approximate, and the Bidder shall include adequate funds in his Bid to cover costs of connection regardless of their exact location.
- C. Exercise extreme caution during trenching operations. Repair the damage caused by such operations to the existing utility lines, at no cost to the Owner, whether the lines are shown on drawings or not.

1.07 DRAWINGS AND SPECIFICATIONS

- A. These drawings and specification do not include necessary components for construction safety.
- B. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".
- C. Except where dimensioned, the drawings relating to this division are a diagrammatic presentation of the design concept, which indicates the general area where piping and ductwork is to be run. The drawings do not necessarily indicate any, and all offsets and configurations required for coordination with other trades. The contractor is responsible for the correct placing of his work, and the proper location and connection of his work in relation to the work or other trades.

1.08 PERMITS AND INSPECTIONS

- A. Obtain, schedule, and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.
- B. Afford the Architect's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

1.09 CODES AND REGULATIONS

- A. By submitting a Bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. In case of conflict between the Contract Documents and Code requirements, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specific references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him permission to use options, which are permitted by Codes.
- B. Applicable Codes: (Current editions unless otherwise noted).
 - 1. All local codes; city and/or county as applicable.
 - 2. OSHA requirements.
 - 3. California Building Code.
 - 4. California Code of Regulations (CCR) Titles (as applicable).
 - 5. Fire Marshal Regulations.
 - 6. State, County, City Health Department Ordinances and Regulations.
 - 7. Regulations of all other authorities having jurisdiction.
 - 8. California Mechanical Code.
 - 9. California Plumbing Code.
- C. Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.10 RECORD AND DOCUMENTATION

- A. Accumulate the following and deliver to the Owner's representative prior to final acceptance of the work.
1. Record (As-Built) Drawings:
 - a. Maintain in good order in the field office a complete set of prints for all work being done under Division 23. Update the drawings daily with neat and legible annotations in red ink showing the work as actually installed.
 - b. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stub-outs shall be accurately located and dimensioned from building walls or other permanent landmarks.
 - c. Furnish the original marked up AS-Built drawings and an electronic copy in AutoCAD-14 format.
 2. Operation and Maintenance Manual: Furnish an operation and maintenance manual covering the stipulated HVAC systems and equipment. Seven copies of the manual, bound in hardback binders or an approved equivalent shall be provided to the Architect.
 3. Furnish one complete manual prior to the time that system or equipment tests are performed.
 4. Furnish the remaining manuals before the contract is completed.
 5. The following identification shall be inscribed on the cover:

OPERATION AND MAINTENANCE MANUAL
PROJECT TITLE
CONTRACTOR NAME & CONTACT INFORMATION
 6. Provide a Table of Contents.
 - a. Insert tab sheets to identify discrete subjects.
 - b. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in.
 - c. The manual shall be complete in all respects for all materials, piping, valves, devices and equipment, controls, accessories, and appurtenances stipulated. Include as a minimum the following:
 - 1) Updated approved materials lists, shop drawings and catalog information of all items of HVAC system equipment.
 - 2) System layout showing piping, valves, and controls.
 - 3) Wiring and control diagrams with data to explain detailed operation and control of each component.
 - 4) A control sequence describing start-up, operation, and shutdown.
 - 5) Detailed description of the function of each principal component of the system.
 - 6) Procedure for starting.
 - 7) Procedure for operating.
 - 8) Shut-down instructions.
 - 9) Installation instructions.
 - 10) Adjustments, maintenance, and overhaul instructions.
 - 11) Lubrication schedule including type, grade, temperature range and frequency.
 - 12) Safety precautions, diagrams, and illustrations.
 - 13) Test procedures.
 - 14) Performance data.
 - 15) Parts list, with manufacturer's names and catalog numbers.
 - 16) Preventive maintenance schedule.
 - 17) Service organization with name, address, and telephone number.
 - 18) Valve identification chart and schedule.
 - 19) ASME certificates.
 - 20) Air balance report.
 - 21) Hydronic balance report.

- B. Standards Compliance: Where equipment or materials are specified to conform to requirements of standards of recognized technical or industrial organizations such as American National Standards Institute (ANSI) American Society for Mechanical Engineers (ASME) American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), American Society for Testing Materials (ASTM), Underwriters Laboratories (UL), American Gas Association (AGA), American Refrigeration Institute (ARI), or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence.
- C. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements.
- D. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- E. Factory Tests: Factory tests are tests, which are required to be performed on the actual materials or equipment, proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- F. Permits and Certificates of Inspection: Furnish the originals.
- G. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- H. Other data required by other sections of this Division. Furnish 2 copies.

1.11 CONSTRUCTION COST BREAKDOWN

- A. Prepare and submit for review a construction cost breakdown for the major subdivisions of the HVAC work in accordance with General and Supplemental Conditions and Project Specification.
- B. Subdivide each item on the breakdown into two headings: labor and materials. Include overhead and profit in each entry.
- C. Submit one copy of the breakdown directly to the Engineer and the remaining copies sent through regular channels.

1.12 TOOLS

- A. Provide all special tools needed for proper operation and routine adjustment and maintenance of systems and equipment. Deliver tools to Owner's representative and request a receipt for same.

1.13 WARRANTIES

- A. Refer to Project Specification for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.
- B. Where periods more than one year are specified in the specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components, which are inactive because of, said failure shall be suspended. The warranty period for such components shall resume to-run for the remaining portion of the warranty period when failed component is completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.
- C. Neither payment for work, nor total or partial occupancy of work by the Owner, within or prior to the warranty period specified, shall be construed as acceptance of faulty work, or shall condone any negligence or omission of Contractor in doing the work.
- D. Compile and assemble the warranties specified in Division 23, into a separated set of vinyl covered, three ring binders, tabulated, and indexed for easy reference.

- E. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names and addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.14 SEISMIC RESTRAINT

- A. Provide seismic restraint for HVAC equipment, piping, and ductwork.
- B. Contractor shall submit certification of suitability of seismic restraint methods signed by Licensed Structural Engineer registered in State of California.
- C. Contractor may refer to details applicable in the SMACNA, "GUIDELINES FOR SEISMIC RESTRAINT OF HVAC SYSTEMS", using the 'g' forces for "other buildings" classification CCR Title 24 all such details shall be DSA approved. Deliver a copy of these Guidelines to the Owner's Resident Inspector.

1.15 SYSTEM OPERATIONAL TESTS

- A. The Contractor shall inform the Owner one week prior to start of testing in order that the Owner's representative may be present.
- B. After balancing and prior to final inspection, the contractor shall operate all systems continuously trouble free and stable for a minimum period of fourteen (14) consecutive days including Saturday and Sunday. Each day shall be a minimum of an 8-hour day. Should a problem arise, the fourteen (14) day period shall be restarted and repeated until successfully operated for full 14 days. A written report certified by the Owner's representative shall indicate the successful completion of a stable and trouble free 14-day period.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Standard Products: Materials and equipment shall be essentially the standard cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be their latest standard designs that comply with the specification requirements.
- B. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening, unless more stringent requirements are specified. Where two or more units of the same type of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer.
- C. Each major component of equipment shall have manufacturer's name, address, model, and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.
- D. In these specification and drawings, whenever more than one (1) manufacturer's product is specified, the manufacturer specified on the drawings and the first named product in these specifications is the basis of design and the use of alternate-named manufacturer's product or substitutes shall comply with the requirements of Section 23 05 00.

2.02 PRODUCT LISTING

- A. When two or more items of same material or equipment are required (pipe and fittings, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, sheet metal, wire, steel bar stock, welding rods, solder, fasteners, and similar items used in Work, except as otherwise indicated.

2.03 NAMEPLATE DATA

- A. Provide permanent operational data nameplate on each item of power operated HVAC equipment, indicating manufacturer, product name, model name, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.04 SUBSTITUTIONS

- A. General: Submittals of "Substitutions" shall be in accordance with requirements of Division 01.
- B. By proposing a-substitution it is deemed that the Contractor shall bear the cost of any, and all design and construction changes (whether architectural, structural, electrical, HVAC and Plumbing) necessary to accommodate the substitution, if said substitution is accepted.
- C. Specific: Refer to Specification Sections 23 05 00 & 23 05 12 for additional requirements.

2.05 SUBMITTALS

- A. General: Make submittals in accordance with requirements of Division 01.
- B. Specific: Refer to Specification Sections 23 05 00 for additional requirements.

PART 3 - EXECUTION

3.01 WORKMANSHIP AND INSTALLATION METHODS

- A. Workmanship shall be in the best standard practice of the trade.
- B. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

3.02 TESTS

- A. General:
 - 1. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
 - 2. Provide instruments and personnel for tests and demonstrations. Submit signed test results.
- B. Specific: Refer to the other sections of this Division for test requirements.

3.03 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK

- A. Protect materials against dirt, water, chemical and mechanical damages both while in storage and during construction.
- B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.
- C. Replace or refinish any damaged materials including fronts of control panels, ductwork fittings, and shop-fabricated ductwork.
- D. Air distribution systems shall be aggressively protected from dust during the construction process to ensure that no contamination of the duct system occurs.
- E. The use of permanently installed AHUs and associated air distribution systems for temporary heating and cooling during construction is prohibited.
- F. Keep cabinets and other openings closed to prevent entry of foreign matter.
- G. Specific: Refer to other sections of this Division for additional requirements.

3.04 PROJECT CONDITIONS

- A. Check and coordinate for clearance, accessibility, and placement of equipment either by going through openings provided or by placing equipment during construction. Ordering of equipment to be shipped disassembled, or disassembly of equipment at Project Site and reassembly of equipment to accomplish this requirement shall be executed without additional cost. Where provided openings are inadequate to accommodate equipment, provide new openings and restoration of same, all at no additional cost. Obtain written approval for new openings before proceeding.
- B. Verify location of all equipment within finished spaces with the Architectural Drawings. In the event, that HVAC drawings do not indicate exact locations, or are in conflict, with the Architectural drawings, obtain information regarding proper locations. Installation of work without proper instruction under such circumstances will result in relocation of work, when directed, without additional cost.

3.05 INSTRUCTION TO OWNER PERSONNEL

- A. Contractor shall furnish, without additional expense to the Owner, the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance of work. Instruction shall be given at the Owner's convenience. The number of man-days (eight-hours) of instruction furnished shall be as specified in other sections. When more than four man-days of instruction are specified, approximately half of the time shall be used for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.
- B. Contractor shall videotape, both visual and audio, instruction to Owner's personnel on the maintenance and operation of the HVAC systems.
- C. Submit certification, signed by Owner's agent that instructions have been completed and the videotape has been reviewed and delivered to the Owner.
- D. Printed operating instructions and a copy of wiring diagrams are to be mounted in all equipment areas, framed and behind glass or encased in plastic. Printed operating instructions shall include steps for starting up and securing equipment. As a precedent to final acceptance four (4) copies of instructions are to be submitted to the Architect for review. Contractor shall turn over to Owner in a neat brochure form, equipment-guarantee, and maintenance instructions.

3.06 CLEANING

- A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.
- B. Refer the Division 01 for general requirements for cleaning.
- C. Leave exposed parts of the HVAC work in a neat, clean, and usable condition, with painted surfaces unblemished and plated metal surfaces polished.
- D. Thoroughly clean all materials, equipment, and appliances. Clean and prepare all surfaces to be painted. Clean the entire premises of unused materials, debris, spots, and marks to the satisfaction of the Architect.
- E. Remove, thoroughly clean, and replace all strainers and automatic valves after the system has been put in operation until system is clear of all foreign matter and repeat this operation after ten (10) days and again after the system has been in operation thirty (30) days. Submit certification that this operation has been completed.

3.07 SAFETY REQUIREMENTS

- A. Enclose and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts in accordance with OSHA requirements. Insulate, guard, and cover any high-temperature equipment and piping so located as to endanger personnel or create a fire hazard.

END OF SECTION

SECTION 23 05 12
HVAC PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies administrative and procedural requirements for handling requests made after award of the Contract for substitutions of products specified in Division 23.

1.02 RELATED SECTIONS

- A. Procedure for Contractor's construction Schedule and the Schedule of Submittals are included under Division 01.
- B. Standards: Refer to Division 01 for applicability of industry standards to products specified.
- C. Procedural requirements governing the Contractor's selection of products and product options are included under Division 01.
- D. Refer to Division 01 for Products and Substitutions.
- E. Refer to Sections 23 05 00 & 23 05 11 for additional requirements.

1.03 DEFINITIONS

- A. "Products" is defined to include purchased items for incorporation into the work, regardless of whether specifically purchased for project or taken from Contractor's stock of previously purchased products. "Materials" is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of work.
- B. "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.). Definitions in this paragraph are not intended to negate the meaning of other terms used in contract documents, including "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction", and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

1.04 SUBSTITUTIONS

- A. The requirements for substitutions do not apply to specified Contractor options on products and construction methods. Revisions to contract documents, where requested by Owner, Architect or Engineer, are "changes" not "substitutions". Substitutions requested during bidding period, which have been accepted prior to Contract Date, are included in contract document and are not subject to requirements for substitutions as specified herein. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions"; and do not constitute a basis for change orders, except as provided for in contract documents. Otherwise, contractor's requests of changes in products, materials and methods of construction required by contract documents are considered requests for "substitutions" and are subject to requirements hereof.
- B. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise, requests will be returned without action except to record noncompliance with these requirements.
 - 1. Extensive revisions to Contract Documents are not required.
 - 2. Proposed changes are in keeping with the general intent of Contract Documents.
 - 3. The request is directly related to an "or approved equal" clause or similar language in the Contract Documents.
 - 4. All costs required to make all necessary revisions and modifications to the contract documents resulting from the substitution, including but not limited to, all professional fees and the cost of DSA approval will be the Contractor's responsibility.

5. All costs required to make all necessary revisions and modifications to the building structure, electrical and all other related construction costs resulting from the substitution, including but not limited to, material, products, equipment, testing, and inspection will be the Contractor's responsibility.
6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
7. Contractor will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.
8. Contractor certifies that the substitution is not heavier than the specified item and does not necessitate any structural and electrical redesign; will fit within the room or area designed for the specified item; and will not exceed any maximum dimensions specified or shown on the original contract Documents.
9. All roof mounted equipment must be less than or equal to the maximum height dimension from the finished roof as shown on the drawings.
10. Contractor represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.
11. Contractor represents that he will provide the same warranty for the substitution that he would for that specified.

1.05 SUBMITTALS

- A. Requests for Substitutions: Any request for substitution shall follow the guidelines of Substitution Requirements in Division 01, Section 23 05 00 & 23 05 11.
- B. Substitution Warranty: All submittals of Request for Substitutions under the General and Supplementary Conditions of this Section shall be accompanied by a completely executed (filled out) and signed Substitution Warranty in the form entitled "Substitution Warranty", bound herein. Substitutions will not be accepted without the Substitution Warranty. In addition to other requirements, Contractor shall warrant in writing on his own letterhead that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, and any additional coordination with work of other trades. Testing, if required, shall be paid by Contractor.
- C. Responsibility of Contractor: The contractor shall be solely and directly responsible for fitting accepted substitute material and equipment into the available space in a manner acceptable to the Architect, and for the proper operation of the substituted equipment with all other equipment with which it may be associated. The Contractor shall bear all costs of meeting the above requirements for presenting a proposed substitution, and if the substitution is accepted, he must bear all costs involved.
- D. Submit the following as part of the Request for Substitutions:
 1. Data showing proposed equipment is "equal" to that specified and is fully equipped, fits the space allotted and has physical configuration and weight similar-to the equipment specified in detail.
 2. A complete layout, where applicable, of equipment room or area must be submitted for equipment proposed in "Request for Substitution". Submittal shall conform to requirements of Division 01 and Section 23 05 00 "Common Work Results for HVAC" as it applies to "Coordination Drawings."
 3. Seismic Restraint: Where seismic restraint is required for products or equipment as specified, methods of seismic restraint signed by licensed Structural Engineer registered in the State of California, shall be submitted for review to the Division of the State Architect.

1.06 ARCHITECT'S ACTION

- A. The Architect may request additional information or documentation necessary for evaluation of the request. Requests, by the Architect, for additional information or documentation will be in accordance with Division 01 requirements. The Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, Contractor shall use the "Bases of Design" product specified by name in the contract documents. Acceptance will be in the form of a Change Order.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

- A. Substitutions shall conform to the product requirements for the specified products or equipment.

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SAMPLE

SUBSTITUTIONS WARRANTY

In addition to other requirements, Contractor shall warrant in writing that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, and any additional coordination with work of other trades. Testing, if required, shall be paid by contractor. The following is an example of the type of Substitution Warranty which shall be executed by the Contractor, on his own letterhead:

SUBSTITUTION WARRANTY

We propose to provide the following,

(Describe items being proposed for substitution)

for _____ in lieu of
(List project name)

as indicated on the drawings and described in Section _____ of the Specifications.

We agree to assume the cost of any, and all modifications to the Contract Documents and to other portions of the work as indicated in the Specification Sections 23 05 00, 23 05 11, & 23 05 12, and as necessary to accommodate for substituted material(s) and system(s) as indicated in this letter of "Substitution Warranty."

We hereby warrant that _____
(Provide Description)

is the equivalent of _____
(Specified Product)

in every respect and will perform satisfactorily under the conditions and use indicated on the Drawings and described in the Specifications.

Signed: _____ Date: _____
(Manufacturer/Supplier)

Signed: _____ Date: _____
(Subcontractor)

Signed: _____ Date: _____
(Contractor)

NOTE: Affix Corporate Seal over Signatures.

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies the basic requirements for electrical components, which are an integral part of packaged HVAC equipment. These components include, but are not limited to factory-installed motors, starters, and disconnect switches furnished as an integral part of packaged HVAC equipment.
- B. Specific electrical requirements (i.e., horsepower and electrical characteristics) for HVAC equipment are scheduled on Drawings.
- C. All motors, power driven equipment and automatic control equipment, except motor starters as hereinafter set forth required and connected with the work of this section of the specifications are to be furnished and installed under Division 23.
- D. Control low (24V) and control line (120V) voltage wiring, conduit and related switches and relays required for the automatic control and/or interlock of motors and equipment includes final connection, are to be furnished and installed under Division 23. Materials and installation to conform to Class 1 or 2, CAC Title 24, Article E725, and as restricted under Division 26 of these specifications.
- E. Power wiring, conduit, outlets, disconnect switches, motor starters and motor-rated contactors, and making of final connections, except as hereinafter specified, are to be furnished and installed under the Division 26 of these Specification.
- F. All power supply wiring for providing a power source to control dampers, control valves, VAV boxes, control transformers, etc., shall be furnished and installed under Division 23.
- G. Identify circuits and equipment as outlined in the Electrical Sections of these Specifications.
- H. Coordinate requirements for underground conduit only between buildings for control interlocks shown on the drawings. This conduit to be furnished and installed under Division 26 of these Specifications.
- I. Space provisions have been made on electrical panels for control power source.

1.02 RELATED SECTIONS

- A. Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.
- B. This section applies to all Division 23 sections specifying packaged HVAC equipment.

1.03 REFERENCES

- A. NEMA Standards MG 1: Motors and Generators.
- B. NEMA Standards ICS 2: Industrial Control Devices, Controllers, and Assemblies.
- C. NEMA Standard 250: Enclosures for Electrical Equipment.
- D. NEMA Standard KS 1: Enclosed Switches.
- E. Comply with National Electrical Code (NFPA 70).

1.04 SUBMITTALS

- A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.05 QUALITY ASSURANCE

- A. Electrical components and materials shall be UL labeled.

PART 2 - PRODUCTS

2.01 MOTORS

- A. Provide all motors necessary for equipment under the HVAC Work. See Electrical Drawings for voltage and phase of electrical services.
- B. The following are basis requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
 - 1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
 - 2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.
 - 3. 2-speed motors shall have 2 separate windings on poly-phase motors.
 - 4. Temperature Rating: As a minimum, motors shall be rated for 40 degree C environment with maximum 50 degree C temperature rise for continuous duty at full load (Class A Insulation).
 - 5. Starting capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly time spaced starts per hour for manually controlled motors.
 - 6. Service Factor: 1.23 for poly-phase motors and 1.35 for single-phase motors.
 - 7. Motor construction: NEMA Standard MG 1, general purpose, continuous duty, design "B", except "C" where required for high starting torque.
 - a. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
 - b. Bearings:
 - 1) Ball or roller bearings with inner and outer shaft seals.
 - 2) Re-greasable bearings, except permanently sealed where motor is normally inaccessible for regular maintenance.
 - 3) Bearings designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
 - 4) Bearings for fractional horsepower, light duty motors, sleeve type bearings are permitted.
 - c. Enclosure Type:
 - 1) Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.
 - 2) Guarded drip-proof motors where exposed to contact by employees or building occupants.
 - 3) Weather protected Type I for outdoor use, Type II where not housed (Epoxy encapsulated or TEFC).
 - d. Overload protection: Polyphase built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter. Single phase, provide thermal overload protection.
 - e. Noise rating: "Quiet".
 - f. Efficiencies shall be guaranteed minimum values in accordance with the following tabulation. Efficiencies shall be established in accordance with NEMA Test Standards MG1-12.53A using IEEE Test Procedure 112, Method B:

HP	EFFICIENCY
1 - 2	81.5
3 - 5	86.5
7-1/2 - 10	90.6
15 - 30	92.0

- g. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
- h. Provide all motors with junction boxes or terminals boxes and provide adjustable slide rails for all motors with belt drives.

- i. Motors rated 1 HP and larger shall have shaft, bearings and etc. capable of operating with multiple grooved sheaves and two or more belts.
- j. V Type Belt Drives: Drives requiring not more than 2 belts; variable pitch type; size for mid-point of operating range. Drives requiring 3 or more belts; nonadjustable constant speed type. Provide belts in matched sets.

2.02 MOTOR STARTERS

- A. Unless provided as part of packaged HVAC equipment or otherwise indicated, starters for motors will be provided under Division 26. Provide to Division 26 the data necessary for motor starter heater sizing for all motors.
- B. Starters for factory packaged HVAC equipment specified under Division 23 shall be provided as part of the package.
- C. Motor Starter Characteristics:
 - 1. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs, or units in hazardous locations, which shall have NEC proper class and division.
 - 2. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.
- D. Manual switches shall have:
 - 1. Pilot lights and extra positions for multi-speed motors.
 - 2. Overload protection: melting alloy type thermal overload relays.
- E. Magnetic Starters:
 - 1. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
 - 2. Trip-free thermal overload relays, each phase.
 - 3. Interlocks, switches, and similar devices as required for coordination with control requirements.
 - 4. Built-in control circuit transformer, fused from line side, where service exceeds 240 volts.
 - 5. Externally operated manual reset.
 - 6. Under-voltage release or protection.
- F. Motor Connections:
 - 1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

2.03 DISCONNECT SWITCHES

- A. When applied as part of factory furnished and mounted equipment, disconnects shall meet the requirements for disconnect switches set forth in Division 26.

PART 3 - EXECUTION

3.01 SEISMIC RESTRAINT

- A. All electrical devices shall be seismically restrained.

END OF SECTION

23 05 14
SELECTIVE HVAC DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes limited scope of selective HVAC demolition work as follows:
 - 1. Nondestructive removal of materials and equipment for reuse or salvage as indicated.
 - 2. Dismantling HVAC materials and equipment made obsolete by these installations.

1.02 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 and Division 23 Specification Sections.
- B. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.
 - 1. Coordinate sequencing and Owner occupancy specified in Division 01.
 - 2. Coordinate other selective demolition work as outlined in Division 01.

1.03 PROJECT CONDITIONS

- A. Conditions Affecting Selective Demolition: The following project conditions apply:
 - 1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
 - 2. Locate, identify, and protect HVAC services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas. Provide minimum of 72-hour notice to Owner prior to utility interruption.

1.04 SEQUENCE AND SCHEDULING

- A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.
- B. Notify the Architect at least 7 days prior to commencing demolition operations.
- C. Perform demolition in phases as indicated.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas where selective demolition is to occur. Determine extent of work and affect on existing conditions to remain. Advise Architect of any conditions that might create extensive alterations beyond indicated scope.

3.02 SELECTIVE DEMOLITION

- A. General: Demolish, remove, demount, and disconnect abandoned HVAC materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- B. Materials and Equipment to be Salvaged: Remove, demount, and disconnect existing HVAC materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
 - 1. Protect all removed and salvaged equipment from being damaged during the demolition work.
- C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.

- D. HVAC Materials and Equipment: Demolish, remove, demount, and disconnect the following items:
1. Inactive and obsolete piping, fittings and specialties, equipment, air distribution ductwork and all associated accessories, controls, fixtures, and insulation.
 - a. Obtain written approval from Architect and owner for piping and ducts embedded in floors, walls, and ceilings which may remain if such materials do not interfere with new installations.
 - 1) Drain and cap piping and ducts allowed to remain.
 - b. Remove materials above accessible ceilings.
 2. Perform cutting and patching required for demolition.

END OF SECTION

SECTION 23 05 15
ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes limited scope of general construction materials and methods for access doors and panels in walls and ceilings for access to HVAC materials.
- B. Requirements of access doors are outlined in Division 08.
- C. Access doors and panels are required for all HVAC equipment requiring maintenance, inspection, adjustment, monitoring, etc... which are installed in inaccessible areas such as behind walls, above ceiling, under floor, etc.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of access door or panel.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer Qualifications: Engage an experienced Installer for the installation of access panels and doors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
 - 1. Elmdor / Stoneman.
 - 2. Jay R. Smith Mfg. Co.
 - 3. Milcor Inc.

2.02 ACCESS DOORS

- A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
- B. Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange.
 - 1. For installation in masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
 - 2. For gypsum wallboard or plaster: perforated flanges with wallboard bead.
 - 3. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter frame.
- C. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
 - 1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.
- D. Locking Devices: Flush, screwdriver-operated cam locks.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which access door and panel products are to be installed. Do not proceed with work until unsatisfactory conditions have been in manner acceptable to Installer.

3.02 APPLICATION

- A. Nonrated Walls and Ceilings: Prime coat finish door and frame, Allen key latch face of wall type; Smith 4760, Elmdor / Stoneman DW Series.
- B. Fire Rated Walls and Ceilings: "B" Labeled U.L. 1-1/2 hours, prime coat finish door and frame, flush keyed cylinder lock; Milcor.
- C. Tile Walls: Cover and frame 18-8 satin stainless steel, face-of-wall type, vandal resistant screws; J. R. Smith 4762, Elmdor / Stoneman DW Series.

3.03 INSTALLATION OF ACCESS DOORS

- A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
- B. Adjust hardware and panels after installation for proper operation.

3.04 COORDINATION

- A. General: Coordinate locations of ceilings access doors with lights, air outlets, speakers, etc. Submit drawings showing relative locations of doors to other ceiling items for acceptance by the Architect prior to installation. Transparencies of floor plans and/or reflected ceiling plans will be available from the Architect for this purpose.
- B. Location: Doors may be located to serve more than one item where feasible, providing they are approved as specified. Sizes suitable for purpose intended, with 12" x 12" minimum.
- C. Access doors and panels not required in accessible ceiling systems where direct access to HVAC items is possible.

END OF SECTION

SECTION 23 05 29
SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Extent of supports and anchors required by this section is indicated on drawings or in other Division 23 sections and include the following:
 - 1. Horizontal-Piping Hangers and Supports.
 - 2. Vertical-Piping Clamps.
 - 3. Hanger-Rod Attachments.
 - 4. Building Attachments.
 - 5. Saddles and Shields.
 - 6. Miscellaneous Materials.
 - 7. Anchors.
 - 8. Equipment Supports.

1.02 RELATED SECTIONS

- A. This section is part of each Division 23 section making reference to or requiring supports and anchors specified herein.
- B. Supports and anchors furnished as part of factory fabricated equipment are specified as part of equipment assembly in other Division 23 sections.

1.03 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
 - 2. UL and FM Compliance: Provide products which are UL-Listed and FM approved.
 - 3. MSS Standard Compliance:
 - a. Provide pipe hangers and supports of which materials, design, and manufacturer comply with MSS SP-58.
 - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
 - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
 - d. Terminology used in this section is defined in MSS SP-90.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

- A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.
 - 1. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.
 - 2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Thermal Hanger Shield Inserts: 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.

2.02 HORIZONTAL PIPING HANGERS AND SUPPORTS

- A. General: Except as otherwise indicated, provide factory fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. 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.
 - 1. Adjustable Steel Clevis Hangers: MSS Type 1.
 - 2. Adjustable Swivel Pipe Rings: MSS Type 6.

2.03 VERTICAL PIPING CLAMPS

- A. General: Except as otherwise indicated, provide factory fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer 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.
- B. Two-Bolt Riser Clamps: MSS Type 8.

2.04 HANGER ROD AND BUILDING ATTACHMENTS

- A. General Hanger Rod Attachment: Refer to structural drawings for requirements of hanger rod and building attachments. If a specific attachment that is required is not detailed on the structural drawings, one of the following attachments may be submitted for review by the structural engineer prior to installation. Except as otherwise indicated, provide factory fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- B. General Building Attachment: Except as otherwise indicated, provide factory fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate 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.
 - 1. Concrete Inserts: MSS Type 18.
 - 2. Center Beam Clamps: MSS Type 21.
 - 3. Steel Beam Clamps W/Eye Nut: MS Type 28.
 - 4. Linked Steel Clamps W/Eye Nut: MSS Type 29.
 - 5. Malleable Beam Clamps: MSS Type 30.
 - 6. Steel Brackets: One of the following for indicated loading:
 - 7. Light Duty: MSS Type 31.

2.05 SADDLES AND SHIELDS

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Protection Shields: MSS Type 40; provide high density insert of same thickness of insulation.

2.06 MANUFACTURERS OF HANGERS AND SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - 1. B-Line Systems, Inc.
 - 2. Tolco, Inc.
 - 3. Elcen Metal Products Co.
 - 4. Fee & Mason Mfg. Co.; Div. Figgie International.

5. ITT Grinnel Corp.

2.07 MISCELLANEOUS MATERIALS

- A. Steel Plates, Shapes and Bars: ASTM A36.
- B. Cement Grout: Portland cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 parts cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
- C. Pipe Alignment Guides: Factory fabricated, of cast semisteel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.
- D. Pipe Roll Stand: Factory fabricated cast iron stand, size as required, with insulation installed on piping.

2.08 ISOLATORS

- A. Isolators: Provide factory-fabricated isolators of size required.
- B. Spring Isolators: Refer to Section 23 05 48 "Vibration Control for HVAC."

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine substrates and conditions under which supports, and anchors are to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors, and other building structural attachment.
- B. Prior to installation of hangers, supports, anchors and associated work, installer shall meet at project site with Contractor, installer of each component of associated work, inspection, and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF BUILDING ATTACHMENTS

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top of inserts.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69.
- B. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers, and supports of same type and type as installed for adjacent similar piping.

- D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- E. Provisions of Movement: Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors.
- F. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide required pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- H. Bare Piping: Install isolators for all bare domestic water and bare hydronic piping.
- I. Insulated Piping: Comply with the following installation requirements.
 - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
 - 2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. Provide rigid insulation reinforcement at shields.
- J. Hangers and supports to be capable to resist the minimum seismic forces indicated in drawings.

3.05 EQUIPMENT SUPPORTS

- A. Concrete housekeeping bases will be provided as work of Division 03.
- B. Furnish to Contractor, scaled layouts of all required bases, with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

3.06 ADJUSTING AND CLEANING

- A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
- B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- D. Touch-Up Painting: Immediately after erection of anchors and supports, clean field welds and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA-1 requirements for touch-up of field-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- E. For galvanized surfaces clean welds bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 05 48
VIBRATION CONTROL FOR HVAC

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

- A. It is the intent of this Specification to provide the necessary design for the avoidance of excessive noise or vibration in the building due to the operation of machinery or equipment, or due to interconnected piping, ductwork, or conduit and to seismically restraint piping, ductwork, and equipment per the applicable codes against seismic forces in any direction.
1. All isolators shall:
 - a. Be provided by a single manufacturer.
 - b. Be designed or treated for resistance to corrosion. Structural steel bases shall be cleaned of welding slag and coated with an SCAQMD compliant primer.
 - c. Be selected to perform their function without undue stress or overloading. All isolators shall have a method for leveling and have a 1/4" thick ribbed neoprene acoustical pad under the spring baseplate.
 - d. Be installed in a manner to prevent the transmission of vibration to the structure. No rigid connections between rotating or oscillating equipment or piping and the building will be permitted.
 - e. Be designed to be non-resonant with equipment forcing frequencies or support structure natural frequencies.
 2. Anchor floor mounted isolated equipment to concrete housekeeping pads of sufficient size to accommodate the anchorage of seismic restraints. Housekeeping pads shall be anchored to the structure as specified by the Structural Engineer of Record.
 3. Each fan and motor assembly shall be supported on a single structural steel frame. Flexible duct connections shall be provided at inlet and discharge ducts.
 4. Where called for in the specifications or on the drawings, all structural steel bases, including concrete pouring form bases, shall be designed, and fabricated by the isolation manufacturer. Isolation manufacturer shall be a licensed fabricator for the City of Los Angeles, California.
 5. Unless otherwise indicated, all equipment mounted on vibration bases shall have a minimum operating clearance of 1" between structural steel base and floor or support base beneath. The minimum operating clearance between concrete inertia bases and housekeeping pads shall be 1 inch. Check clearance space after installation to ensure that no debris has been left to possibly short circuit isolation bases.
 6. Where necessary due to height limitations, provide height saving brackets.
 7. Design isolators for positive anchorage against uplift and overturning.

1.02 MANUFACTURERS

- A. Acceptable Isolation Manufacturer:
- B. M. W. Sausse' & Co., Inc. (Vibrex).
- C. Mason Industries, Inc.
- D. Or Approved Equal.
- E. Purchased and/or fabricated equipment must be designed and manufactured with provision for positive anchorage against seismic forces.
- F. Seismic restraints for pipes and ducts shall be as per the SMACNA Guidelines for seismic Restraint of Mechanical Systems and shall be approved by DSA.
- G. Seismic restraints for equipment and piping shall be designed to meet the criteria of the current California Code of Regulations.
- H. The manufacturer of Vibration Isolation and Seismic Control Equipment shall have the following responsibilities:
1. Determine adequate vibration isolation and seismic restraint sizes and locations.

2. Provide piping and equipment isolation systems and seismic restraints as scheduled and/or specified.
3. Provide installation instructions and drawings to assure proper installation and performance.

1.03 SUBMITTALS

- A. Make Submittals in Accordance with:
 1. Contract General Provisions - Division 01.
 2. Mechanical General Provisions - Sections 23 05 00 and 23 05 11.
- B. Submit Shop Drawings and Manufacturer's Literature.
 1. Specific vibration isolators and seismic restraints to be utilized showing compliance with the specifications.
 2. Isolation frame construction for each machine including dimensions, structural member sizes, support points and restraint locations and details.
 3. Methods for isolation and restraint of suspended piping, ductwork, and equipment.
 4. Methods for guides and isolation of piping risers.
 5. Seismic restraint calculations signed and stamped by an engineer licensed in the State of California and experienced in the design of isolation and seismic restraint for flexibly mounted equipment.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATOR TYPES

- A. "RMS" shall be a laterally stable un-housed spring isolator. Spring, top plate, and baseplate assembly shall be welded. Mounting shall comply with all requirements stated in paragraph above.
- B. "RMSG" shall be the same as "RMS" above but shall include height saving brackets for attachment to the equipment frame or isolation base.
- C. "RMSP-EQ" shall be the same as "RMS" above except that the spring shall be enclosed in a welded steel cylinder with uplift restraints for horizontal and vertical seismic control.
- D. "RMLS-EQ" shall be the same as "RMS" above and shall be equipped with a steel housing designed for seismic restraint and with vertical limit stops to prevent the equipment changing from its loaded height should it be necessary to remove a portion of its weight. This housing may also be used as rigid blocking during rigging so that the installed height and the operating height of the isolated equipment remain the same. O.S.H.P.D. (HCAi) pre-approval # OPA-0029.
- E. "RMLS-SB" shall be a steel frame constructed of structural wide flange members unless shown otherwise and shall be rectangular in shape. The depths of the steel members shall not be less than one tenth (1/10) of the longest span between base supports or designed for a maximum beam deflection of .005". If the latter method is used, submittals shall include calculations showing the necessary moment of inertia. All steel members shall be coped and fitted or constructed using the overlap insert method to assure a structural strength that is greater than the individual member strength. The steel frame is placed directly on top of the RMLS-EQ type isolators. O.S.H.P.D. (HCAi) pre-approved isolator/seismic restraints.
- F. "RMU-EQ-SH": shall be an individual semi-housed steel spring isolator complete with vertical motion limit stops incorporating seismic restraints, leveling, and ribbed neoprene pad bonded to the base plate. O.S.H.P.D. (HCAi) pre-approval # OPA-0098.
- G. "AS" shall be air spring isolators and shall incorporate the following:
 1. A complete vibration isolation system consisting of a minimum of three air springs and a total of three height sensing valves. If there are two or more air springs per location, they shall be connected to the outlet of the height control valve in parallel. An associated interconnecting air supply system is required which is not included in this work.

2. The air spring shall operate at its normal operating height and the maximum pressure shall not exceed the manufacturer's recommended rating of 100 PSI. The system shall maintain an elevation of $\pm 1/8$ ", once adjusted.
 3. The type of air spring to be utilized shall be based upon the required natural frequency as indicated in the schedule. In-order to avoid instability, auxiliary height saving brackets, housings, etc. may be utilized, subject to approval.
- H. "RP-EQ" shall be a rubber pad type elastomer mounting, consisting of a steel bearing plate with 1/4" thick neoprene ribbed acoustical pad. Maximum loading shall be 60 PSI. Proper anchorage for seismic loads shall be indicated on drawings.
- I. FUD-EQ shall be rubber-in-shear isolators incorporating mounting bolts for bolting to equipment base, a bottom steel plate for bolting isolator to sub-base or structure and built-in seismic restraints.
- J. "RMXA" shall be a rectangular steel housing that shall be bolted to the overhead structure and designed to allow up to 30 degrees rod misalignment. Hanger shall consist of a steel spring located in a molded neoprene retaining cup with hanger rod bushing.
- K. "PRMXA" - Same as type "RMXA" with the addition of a steel load transfer plate so that the equipment or piping operating height is the same as the installed height.
- L. "HXA" -Same as type "RMXA" with the addition of a neoprene element in series to isolate the upper connection.
- M. "PHXA" - Same as type "HXA" with the addition of a steel load transfer plate so that the equipment or piping operating height is the same as the installed height.
- N. "HSS" - shall be a 'rubber in shear' isolator element contained within a rectangular steel housing.

2.02 RAIL AND BASE TYPES

- A. "RMR" spring rail isolator. Rails shall have springs of proper size and constant, installed between a continuous structural steel channel (upper member) and a continuous flat steel plate (bottom member) in such manner, quantity, and location that efficient uniform deflection and loading to the structure is assured. Rails shall be furnished with Vibrex hold down stabilizers to restrict excessive amplitudes. Cross bracing must be used when necessary for seismic stability.
- B. "RMB" shall be the same as "RMR" above except that it shall be designed as an integral fan and motor base with an adjustable motor slide base.
- C. "RMSR" shall be a set of wide flange structural steel rails supplied with height saving brackets to reduce the mounting height of the equipment. The maximum allowable deflection of any point on the loaded frame relative to the unloaded frame shall be 0.005". A wide flange section depth greater than 1/10 the supporting span between isolators will be accepted as satisfying the deflection requirement.
- D. "RMSB" shall be a steel frame constructed of structural wide flange members unless shown otherwise and shall be rectangular in shape. The depths of the steel members shall not be less than one tenth (1/10) of the longest span between base supports or designed for a maximum beam deflection of .005". If the latter method is used, submittals shall include calculations showing the necessary moment of inertia.
- E. All steel members shall be coped and fitted or constructed using the overlap insert method to assure a structural strength that is greater than the individual member strength. Adjustable motor slide bases shall be included when required for centrifugal fan applications. The steel bases shall have an operating clearance of one (1") inch above the supporting structure. Where bases are used to mount pumps, the bases shall be large enough to support the pipe elbows if required.

- F. "RMSBI" shall be a steel frame inertia base with all welded members and constructed of structural channel shapes. The base shall be designed for a thickness or inertia mass to equipment weight ratio as shown on the schedule with a minimum thickness of six (6") inches. The bases shall include a template and anchor bolts to anchor the equipment. Inertia bases shall have 1/2" (#4) rebar spaced a maximum of 12" on centers in each direction and located 1-1/2" from the bottom of the base. Adjustable motor slide bases shall be included when required for centrifugal fan applications. Bases shall be supplied with height saving brackets to reduce the mounting height of the equipment.
- G. "RMUAB-EQ" shall be a steel frame made of structural angle with type "RMU-EQ-SH" O.S.H.P.D. (HCAi) pre-approved combination isolator/restraints.
- H. "RMLSR" shall be a set of multiple wide flange structural steel rails supplied with type RMLS-EQ vibration isolator/seismic restraints and height saving brackets to reduce the mounting height of the equipment. The maximum allowable deflection of any point on the loaded frame relative to the unloaded frame shall be 0.005". A wide flange section depth greater than 1/10 the supporting span between isolators will be accepted as satisfying the deflection requirement.
- I. Type "RMLSB" shall be a steel frame constructed of structural wide flange members unless shown otherwise and shall be rectangular in shape. The depths of the steel members shall not be less than one tenth (1/10) of the longest span between base supports or designed for a maximum beam deflection of .005". If the latter method is used, submittals shall include calculations showing the necessary moment of inertia. All steel members shall be coped and fitted or constructed using the overlap insert method to assure a structural strength that is greater than the individual member strength. Frame shall be supplied complete with height saving brackets and type RMLS-EQ, O.S.H.P.D. (HCAi) pre-approved isolator/seismic restraints.
 - 1. Type RMLS-SB is the same as type "RMLSB" but rather than utilizing height saving brackets the steel frame is placed directly on top of the RMLS-EQ type isolators.

2.03 CURB TYPES

- A. Type "VIC-EQ-SS" shall be a factory fabricated combination roof mounting curb and vibration isolation base for rooftop package units over 25 tons. The curb assembly shall be designed so that it can be re-roofed without disturbing the HVAC equipment. Curbs must be designed so that roofing material cannot cover access to isolators. The vibration isolation portion of the assembly shall be constructed of structural steel and designed to mate with the bottom of the rooftop unit. System shall include factory fabricated duct supports and any required bracing welded in place. The sheet metal weather proofing curb portion shall be supplied complete with a wood-nailer strip to facilitate flashing by the roofing contractor. Internal vibration isolator/seismic restraints shall be O.S.H.P.D. (HCAi) pre-approved number OPA-0029 as manufactured by MW Sausse' & company, inc. Required anchorage calculations shall be supplied with submittal package. When required, curb shall include an optional acoustical package for sound reduction.
- B. Type "VIC-EQ" shall be a factory fabricated combination roof mounting curb and vibration isolation base for rooftop package units up to 20 tons. Steel members and cross bracing shall all be welded. The assembly shall be shipped and installed in one piece complete with curb, weather-seal, removable O.S.H.P.D. (HCAi) pre-approved isolator/restraints #OPA-0098, exterior accessible leveling device, and minimum 14 gage galvanized steel top section to match the unit. Curb shall be fabricated of minimum 12 gage galvanized steel designed to carry the seismic loads to the supporting structure. System shall include factory fabricated duct supports welded in place as well as insulated panels when required. Required anchorage and lower curb structural calculations shall be supplied with submittal package. When required, curb shall include an optional acoustical package for sound reduction. Curb shall be manufactured to match roof slope if specified in drawings.

2.04 SEISMIC RESTRAINTS

- A. Shall be capable of safely accepting external forces as specified in the applicable codes without failure. Restraints shall maintain equipment, duct, and piping in a captive position during an earthquake. Restraints shall not short circuit vibration isolation systems or transmit objectionable vibration or noise under normal operating conditions. Seismic restraints shall be provided on all equipment as scheduled on the drawings. Submit calculations by a Licensed Structural Engineer Registered in State of California to verify snubber capacities.
- B. Type "3500" seismic restraint shall be constructed of steel plate, concentric steel pipes, and structural members in an all-welded assembly. All contact points shall be cushioned with minimum 1/4" thick resilient pad. Restraints shall be O.S.H.P.D. (HCAi) pre-approved type OPA-0029.
- C. Type "3200" seismic restraint shall be all directional type with interlocking steel members constructed of structural angle and A-36 threaded rod. All contact points shall be cushioned with minimum 1/4" thick resilient pad or bushing.
- D. Type "CR" seismic restraints shall be constructed of 7x19 strand galvanized aircraft cable. Cable assembly shall come complete with minimum (2) "U" bolt clamps per end and thimbles to protect cable from chafing. Allowed loads shall be the cable breaking strength with a safety factor of three. Actual loads shall be calculated with the worst case of all loads applied to one cable and anchor pattern. Cable shall be installed with 1/4" slack to prevent the transmission of vibration to the structure.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install in accordance with manufacturer's written instructions. Vibration isolators must not be installed in a manner that will result in piping stress or misalignment.
- B. The structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the equipment or isolators. The isolators shall be installed without raising the equipment and frame assembly.
- C. After the entire installation is complete and under full operational load, the isolator shall be adjusted so that the load is transferred from the blocks or shims to the isolator. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.
- D. Once the equipment is in operation, install and anchor the seismic restraints with proper operating clearances as indicated on drawings.
- E. HVAC equipment shall be isolated from the building structure by vibration isolators as scheduled on the drawings.
- F. All piping 1 1/4" and over located in mechanical equipment rooms, and for a minimum of fifty (50) feet or 100 pipe diameters whichever is greater, from connection to vibrating mechanical or electrical equipment, shall be isolated from the building structure by means of vibration isolators as identified above.
- G. All HVAC piping and vertical risers shall be isolated from the building structure by means of vibration isolators and guides.
- H. All piping and ductwork to be isolated shall freely pass-through walls and floors without contact. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork and maintain adequate clearance (Minimum of 2 inches all around) around the outside surfaces. Any materials used to fill the clearance space shall be permanently flexible so that vibration will not pass through it.
- I. No rigid connections between equipment and building structure, including electrical conduit and refrigerant lines, shall be made that degrades the vibration isolation system herein specified. Inform other following trades, such as plastering, or electrical, to avoid any contact which would short-circuit the vibration isolation.

- J. Bring to the Architect's attention prior to installation any conflicts with other trades which will result in unavoidable rigid contact with equipment or piping as described herein, due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the contractor's expense.
- K. Bring to the Architect's attention any discrepancies between the specifications and field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the contractor's expense.
- L. Obtain inspection and approval of any isolation installation to be covered or enclosed, prior to such closure.
- M. Thrust restraints shall consist of spring hangers with the same deflection as specified for the spring mountings. Thrust restraints shall be attached to the fan at the centerline of air discharge opening.
- N. Correct, at no additional cost, all installations that are deemed defective in workmanship or materials.

3.02 PIPING ISOLATORS

- A. All piping except fire standpipe systems, are included under this section.
- B. Isolate piping within 50 feet of rotating equipment and pressure reducing stations.
- C. The isolators shall be installed with the isolator hanger box attached to, or hung as close as possible to, approved locations on the supporting structure.
- D. The isolators shall be suspended from substantial structural members, not from slab diaphragm unless specifically permitted.
- E. Hanger rods shall be aligned to clear the hanger box.
- F. Horizontal floor supported piping shall be isolated by type "RMLS-EQ", with a minimum static deflection of 1.0 inch or the same deflection as isolated equipment to which pipe is connected, whichever is greater.
- G. Vertical riser pipe support and restraint system shall consist of type "RMS" springs and type "PG-EQ" guides. Install vertical riser guides so that clearances are maintained around concentric pipes in the guides. Install vertical restraints on the floor location as shown on drawings.
- H. Pipe anchors, where required, shall utilize resilient pipe anchors, type "RPA" or equivalent, to avoid direct contact of piping with building.
- I. Pipe Extension and Alignment connectors: Provide connectors at pump suction and discharge, riser take offs, cooling, and heating coils, and elsewhere as required to accommodate thermal expansion and misalignment.
- J. Seismic restraint spacing shall be in accordance with applicable codes.

3.03 INSPECTION

- A. On completion of installation of all vibration isolation and seismic control devices herein specified, the local representative of the isolation materials manufacturer shall inspect the completed system and report in writing any installation error, improperly selected isolation devices, or other faults in the system that could affect the performance of the system. The contractor shall submit a report to the Architect, including the above report with consequent steps taken to properly complete the isolation work.

END OF SECTION

SECTION 23 05 53
HVAC IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Extent of HVAC identification work required by this section is indicated on drawings or specified in other Division 23 sections, and includes the following:
 - 1. Painted Identification Materials.
 - 2. Plastic Pipe Markers.
 - 3. Plastic Tape.
 - 4. Underground-Type Plastic Line Marker.
 - 5. Plastic Duct Markers.
 - 6. Valve Tags.
 - 7. Diagram and Schedule Frames.
 - 8. Engraved Plastic-Laminate Signs.
 - 9. Plastic Equipment Markers.
 - 10. Plasticized Tags.

1.02 RELATED SECTIONS

- A. This section is part of each Division 23 section making reference to identification devices specified herein.
- B. HVAC identification furnished as part of factory-fabricated equipment is specified as part of equipment assembly in other Division 23 sections.
- C. Refer to Division 26 Sections for identification requirements of electrical work; not work of this section.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
- B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.
- C. Schedules and Diagrams:
 - 1. Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any).
 - 2. Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule.
 - 3. Submit temperature control diagrams and Sequence of Operation on bond paper suitable for framing.
- D. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01 and Division 23 Section 23 05 11 "Supplementary HVAC Requirements."

1.04 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
 - 2. No adhesive type identification markers will be accepted. All markers and tags shall be permanently attached to pipe, etc.
 - 3. All identification markers installed exterior of buildings shall be ultra-violet resistant.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide HVAC identification materials of one of the following:
 - 1. Seton Name Plate Corp.
 - 2. Allen Systems, Inc.
 - 3. Brady (W.H.) Co.; Signmark Div.
 - 4. Industrial Safety Supply Co., Inc.

2.02 HVAC IDENTIFICATION MATERIALS

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Where more than single type is specified for application, selections is Installer's option, but provide single selection for each product category.

2.03 PLASTIC PIPE MARKERS

- A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.
- B. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subject to fluid temperatures of 125oF. (52oC) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
- C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - 1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 - 2. Laminated or bonded application of pipe marker to pipe (or insulation).
 - 3. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".
- D. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
 - 1. Laminated or bonded application of pipe marker to pipe (or insulation).
 - 2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, taped lapped 3".
 - 3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless-steel bands.
- E. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
 - 1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

2.04 PLASTIC TAPE

- A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
- B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.
- C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.05 UNDERGROUND TYPE PLASTIC LINE MARKER

- A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates the type of service of buried pipe.
 - 1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

2.06 VALVE TAGS

- A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamped-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
 - 1. Provide 1-1/2" diameter tags, except as otherwise indicated.
 - 2. Fill tag engraving with black enamel.
- B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves and manufactured specifically for that purpose.
- C. Access panel markers: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves and manufactured specifically for that purpose.
- D. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

2.07 DIAGRAM AND SCHEDULE FRAMES

- A. General: For each page of schedule and/or diagrams, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.08 ENGRAVED PLASTIC LAMINATE SIGNS

- A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, white with black core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
- B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.
- C. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.09 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in HVAC identification work, with corresponding designations shown, specified, or scheduled. Provide numbers, lettering and wording as indicated, as recommended by the manufacturers or as required for proper identification and operation/maintenance of HVAC systems and equipment.
 - 1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

2.10 EQUIPMENT MARKERS

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
 - 1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 - 2. Location: Accessible and visible.
 - 3. Fasteners: As required to mount on equipment.

- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
 - 1. Terminology: Match schedules as closely as possible.
 - 2. Data.
 - 3. Name and plan number.
 - a. Equipment service.
 - b. Design capacity.
 - c. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
 - 4. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine sub-core, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
 - 1. Data: Instructions for operation of equipment and for safety procedures.
 - 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
 - 3. Retain and edit subparagraph above or first subparagraph below.
 - 4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
 - 5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
 - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.11 PLASTIC DUCT MARKERS

- A. Engraved color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finishes, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING SYSTEM IDENTIFICATION

- A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
 - 1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot-non-insulated pipes.
- B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
 - 1. Near each valve and control device.
 - 2. Near each branch, mark each pipe at branch, where there could be question of flow pattern.
 - 3. Near locations where pipes pass through walls, floors ceilings, or enter non-accessible enclosures.
 - 4. At access doors, manholes similar access points which permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment. On piping above removable acoustical ceilings, except omit intermediately.

3.03 UNDERGROUND PIPING IDENTIFICATION

- A. General: During back-filling/top soiling of each exterior underground piping systems, except sanitary sewer and storm drainage install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.

3.04 VALVE IDENTIFICATION

- A. General: Provide valve tag on every valve, cock, and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units. List each tagged valve on valve schedule for each piping system.
- B. Mount valve schedule frames and schedules in machine rooms, where indicated or, if not otherwise indicated, where directed by Architect/Engineer.

3.05 HVAC EQUIPMENT IDENTIFICATION

- A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of HVAC equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
 1. Fuel-burning units including boilers, furnaces, heaters.
 2. Pumps, compressors, chillers, condensers. and similar motor-driven units.
 3. Fans and blowers.
 4. Packaged HVAC central-station or zone-type units.
 5. Split air conditioner indoor and outdoor units
 6. Single Duct terminal units and all equipment in ceiling space.
 7. In addition to the equipment tag, install an identification tag for VAV units in locations approved by Architect to indicate where each unit is installed above the ceiling. Coordinate the installation location, type, size, and color of this tag with the Architect.
- B. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.
- C. Test of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.06 ADJUSTING AND CLEANING

- A. Adjusting: Relocate any HVAC identification device which has become visually blocked by work of this division or other divisions.
- B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING

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 testing, adjusting, and balancing HVAC systems to produce design objectives and measurement and reporting of sound and vibration levels. including the following:
 - 1. Balancing airflow and water flow within distribution systems, including sub-mains, branches, and terminals, to indicated quantities according to specified tolerances.
 - 2. Test, adjust and balance hydronic system based on the requirements of the existing variable flow chilled and heating water systems.
 - 3. Adjusting total HVAC systems to provide indicated quantities.
 - 4. Measuring electrical performance of HVAC equipment.
 - 5. Setting quantitative performance of HVAC equipment.
 - 6. Verifying that automatic control devices are functioning properly.
 - 7. Reporting results of the activities and procedures specified in this Section.
- B. Related Sections include the following:
 - 1. Testing and adjusting requirements unique to particular-systems and equipment are included in the Sections that specify those systems and equipment.
 - 2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.03 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including sub-mains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- K. Test: A procedure to determine quantitative performance of a system or equipment.
- L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

- M. AABC: Associated Air Balance Council.
- N. T&B: Testing, adjusting, and balancing.
- O. T&B Agency: An independent entity certified by AABC to perform testing and balancing work.
- P. TBE: AABC certified test and balance engineer.
- Q. TBT: AABC certified test and balance technician.
- R. HVAC: Heating, ventilating, and air conditioning.
- S. BAS: Building automation systems.
- T. Contract documents: the mechanical drawings and test and balance specification.
- U. NC: noise criteria.
- V. RC: room criteria.
- W. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.04 SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation T&B of AABC certification of T&B agency and personnel, including a sample copy of the AABC "National Performance Guaranty." If not submitted within the timeframe specified, the engineer has the right to choose an AABC agency at the Contractor's expense.
- B. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit T&B strategies and step-by-step procedures as specified in "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- C. System Readiness Checklists: Within 60 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article to be used and filled out by systems Installers verifying that systems are ready for T&B.
- D. Examination Report: Within 60 days of Contractor's Notice to Proceed, provide a summary report of the examination review required in Part 3 "Examination", if issues are discovered that may preclude the proper testing and balancing of the systems.
- E. Certified T&B reports: Within 14 days of completion of balancing work, submit AABC-Certified T&B report.
 - 1. Submit one copy of the final T&B Report directly to the design professional of record. Provide five additional copies to the contractor.
- F. Warranty: Submit 6 copies of special warranty specified in the "Warranty" Article below.
- G. Provide a summary of any discrepancies found in the system, by Air balance contractor to each system as described hereafter. Include a complete list of deficiencies and problems found in system being tested and balanced. Add this report to final submittal package.

1.05 QUALITY ASSURANCE

- A. T&B Agency Qualifications: Engage a T&B entity certified by AABC.
 - 1. T&B Field Supervisor: Employee of the T&B Agency who is certified by AABC.
 - 2. T&B Technician: Employee of the T&B Agency and who is certified by AABC as a TBT.
- B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items: Include at least the following:
 - a. Submittal distribution requirements.
 - b. Contract Documents examination report.
 - c. Testing, adjusting, and balancing plan.
 - d. Work schedule and Project site access requirements.

- e. Systems readiness checklists.
 - f. Coordination and cooperation of trades and subcontractors.
 - g. Coordination of documentation and communication flow.
- C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
- 1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
 - 2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
- D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC "National Standards for Testing, Adjusting, and Balancing."
- E. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.
- F. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.06 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire T&B period. Cooperate with Owner during T&B 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 T&B operations to minimize conflicts with Owner's operations.

1.07 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
- B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.
- D. Review Division 23 contract documents to assure that the design has considered all required components necessary for a complete and successful testing, adjusting, and balancing of the system as described hereafter. Prepare a report for this examination of contract documents and propose any additional components required to complete the scope of work this section no later than 45 days after the award of the contract.

1.08 WARRANTY

- A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. National Project Performance Guarantee: Provide a guarantee on AABC "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
 - 1. The certified Agent has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
 - 1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
- 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.
 - 1. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation. Note the locations of devices that are not accessible for testing and balancing.
- C. Examine approved submittal data of HVAC systems and equipment.
- D. Examine project record documents described in Division 01 Section "Project Record Documents."
- E. Examine ceiling plenums and under-floor air plenums used for supply, return, or relief air to verify that are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine HVAC equipment and verify that bearings are greased, belts are aligned, and tight, clean permanent filters are installed, and equipment with functioning controls is ready for operation.
- G. Examine Architect's and Engineer's 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.
- H. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- J. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- K. Examine system and equipment test reports.
- L. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- M. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- N. Examine Air Conditioning equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

- O. Examine terminal units, such as variable-air-volume boxes, VVT dampers and By-Pass Dampers are accessible and their controls are connected, configured by the Controls Contractor, and functioning.
- P. Examine strainers to verify that mechanical contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.
- Q. Examine Air Conditioning heat-transfer coils for clean and straight fins.
- R. Examine air vents to verify that mechanical contractor has removed all air from all hydronic systems.
- S. Examine equipment for installation and for properly operating safety interlocks and controls.
- T. Prior to examination of the vibration isolation system, verify that all system and equipment installations are complete and that testing, adjusting, and balancing specified in the contract documents have been performed.
- U. Examine all vibration Isolation system. All vibration isolated equipment and piping must be inspected and examined before startup and shall include the following:
 - 1. Verify that all isolators are installed in accordance with manufacturer's recommendations.
 - 2. Verify that all isolation roof curbs have been adjusted by unit manufacturer. Provide a copy of the manufacturer's certification for adjustment of the isolators of the roof curb.
 - 3. Verify that piping, duct, and conduit penetrations through mechanical equipment room envelope are sealed, and if required, rigid contact with building structure does not exist.
 - 4. Steel isolation bases must be inspected for cracked welds, excessive bending or twisting of steel members.
 - 5. Concrete isolation bases must be examined for cracked concrete. Isolator retainer brackets must be checked for looseness. The concrete base must be flat and true in plane.
 - 6. Elastomer isolators must be examined for cracks in the rubber and for loose bonds between the rubber and steel plates or other steel components. Adequate clearance must be provided between bolts and the side of the bolt holes to prevent short circuiting.
 - 7. Steel spring isolators must be examined for loose or missing bolts, nuts or lock washers. Check for spring overloading or under-loading, completely collapsed spring coils, and cocked springs. Note if rubber or glass fiber pad between the bottom plate of the steel spring and the concrete slab or supporting structure is present.
 - 8. Housed steel springs must be examined for proper centering of the springs, clearance between the cast housing and rubber snubber, and the steel spring for tilted or cocked springs.
 - 9. When the specifications require that the isolators be bolted to the concrete slab or other supporting structure, the bolts may be isolated by means of rubber bushings and rubber washers.
 - 10. Inspect isolators with restraint devices to make sure that all shims have been removed and supportive nuts have been properly adjusted to allow for free floating of the isolated system.
 - 11. Seismic restraints shall not prevent the proper functioning of vibration isolation system.
 - 12. Pneumatic isolators must be inspected for overload or under-load by checking the air pressure gauge against manufacturer's submittals or catalog. The pneumatic isolator system should include the isolator, strainer, oil separator, height regulator, and air pressure gauge. Inspect the vicinity of the isolator. Note if the isolator is exposed to damage from vehicle or other traffic.
 - 13. Carefully inspect the space under all isolated bases to assure that these spaces are clean and free of debris to prevent short-circuiting.
 - 14. Check to ensure that all shipping bolts associated with spring isolators have been removed.
 - 15. Inspect all flexible piping, hoses, and expansion joints as to type, length and location as called for by the specifications. Examine flexible hose for excessive elongation.

16. Inspect all electrical and control connections to ensure that they do not restrain the movement of the vibration isolated equipment.
 17. Inspect all fabric connections between fans and ductwork to ensure that a fabric "bellows" exists when the fans are operating.
 18. Each piece of vibration isolated machinery must be free of any structural tie or rigid connection that may "short circuit" the isolation system. All limit stops, shipping bolts, and leveling bolts on all isolators must be inspected to ensure that they are not "short circuiting" the isolation system.
 19. Hanger isolators should be free of misalignment and over / under-loading. Under no circumstances the isolator rod should be allowed to make rigid contact with the hanger housing.
 20. Report deficiencies as discovered to the appropriate parties.
- V. Examine automatic temperature system components to verify the following:
1. Dampers, valves, and other controlled devices operate by the intended controller.
 2. Dampers and valves are in the position indicated by the controller.
 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multi-zone units, mixing boxes, and variable-air-volume terminals.
 4. Automatic modulating and shutoff valves, including 2-way valves, are properly connected.
 5. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 6. Sensors are located to sense only the intended conditions.
 7. Sequence of operation for control modes is according to the Contract Documents.
 8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
 9. Interlocked systems are operating.
 10. Changeover from heating to cooling mode occurs according to design values.
- W. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.02 PREPARATION

- A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures that includes the following:
1. Equipment and systems to be tested.
 2. Strategies and step-by-step procedures for balancing the systems.
 3. Instrumentation to be used.
 4. Sample forms with specific identification for all equipment.
- B. Prepare system-readiness checklists, as described in the "AABC National Standards for Total System Balance," for use by systems installers in verifying system readiness for T&B. These shall include, at a minimum, the following:
1. Airside:
 - a. Ductwork is complete with terminals installed.
 - b. Volume, smoke, and fire dampers are open and functional.
 - c. Clean filters are installed.
 - d. Fans are operating, free of vibration, and rotating in correct direction.
 - e. Variable-frequency controllers' start-up are complete and safeties are verified.
 - f. Automatic temperature-control systems are operational.
 - g. Ceilings are installed.
 - h. Windows and doors are installed.
 - i. Suitable access to balancing devices and equipment is provided.
 2. General
 - a. Permanent electrical power wiring is complete.
 - b. Equipment and duct access doors are securely closed.

3.03 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC "National Standards for Total System Balance" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for T&B procedures.
- 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 approved submittals and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare single-line schematic diagram of systems "as-built" for the purpose of identifying HVAC components.
- 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. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check condensate drains for proper connections and functioning.
- H. Check for proper sealing of air-handling-unit components.
- I. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- J. Check dampers for proper position to achieve desired airflow path.
- K. Check for airflow blockages.

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. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report any artificial loading of filters at the time static pressures are measured.
 - 3. 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, sub-main ducts, and major branch ducts to indicated airflows.
 - 1. Measure airflow of sub-main and branch ducts.
 - 2. Adjust sub-main and branch duct volume dampers for specified airflow.
Re-measure each sub-main and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
 - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 - 2. Measure airflow at all inlets and outlets.
 - 3. Adjust each inlet and outlet for specified airflow.
 - 4. Re-measure each inlet and outlet after all have been adjusted.
- D. Verify final system conditions.
 - 1. Re-measure and confirm minimum outdoor air, return and relief airflows are within design.
Readjust to design if necessary.
 - 2. Re-measure and confirm total airflow is within design.
 - 3. Re-measure all final fan operating data, RPM, Volts, Amps, static profile.
 - 4. Mark all final settings.
 - 5. Test system in economizer mode. Verify proper operation and adjust, if necessary.
 - 6. Measure and record all operating data.
 - 7. Record final fan performance data.

3.06 TEMPERATURE TESTING

- A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature control system.
- B. Measure indoor wet-bulb and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside air wet-bulb and dry-bulb temperatures.

3.07 PROCEDURES FOR VIBRATION MEASUREMENTS

- A. Perform vibration measurements when other building and outdoor vibration sources are at a minimum level and will not influence measurements of equipment being tested.
 - 1. Turn off equipment in the building that might interfere with testing.
 - 2. Restrict people from occupying areas where human activity may affect accuracy of measurements.
 - 3. Note all exterior vibration sources i.e., trains, roadway traffic, adjacent construction activities, etc.
- B. Attach and secure the vibration transducer in accordance with the latest edition of the AABC S&V Procedural Standards for Measurement of Sound and Vibration.
- C. Measure and record, on all pumps and fans over 3 HP, and all chillers and compressors over 5 HP, at discrete frequencies or in 1/3 octave bands as follows:
 - 1. Discrete vibration levels from 1 to 200 Hz in 1 Hz increments, or
 - 2. In each 1/3 octave band from 12.5 Hz to 100 Hz.
- D. Measure and record equipment vibration, bearing vibration, equipment base vibration, and on building structure adjacent to equipment. Record velocity and displacement readings in the radial vertical, radial horizontal and axial planes, where measurements can be performed safely.
 - 1. Fans and HVAC Equipment with Fans:
 - a. Fan Bearing: Drive end and opposite end.
 - b. Motor Bearing: Drive and opposite end.
 - c. Equipment Base: Top and side, within 6" of each isolator.
 - d. Building: Floor adjacent to fan/motor, within 6" of each isolator.

2. Chillers and HVAC Equipment with Compressors:
 - a. Compressor Bearing: Drive end and opposite end.
 - b. Motor Bearing: Drive end and opposite end.
 - c. Equipment Base: Top and side, within 6" of each isolator.
 - d. Building: Floor adjacent to equipment, within 6" of each isolator.
- E. Vibration Measurement Reports:
 1. Date and time of test.
 2. Equipment designation, location, equipment speed, motor speed and motor horsepower.
 3. Measured acceleration (in units of g's, inches/sec²), and measured velocity (in units of inches/sec) and measured displacement (in units of inches).

3.08 PROCEDURES FOR SOUND LEVEL MEASUREMENTS

- A. Close windows and doors to the space.
- B. Perform measurements when the space is not occupied, or when the occupant noise levels from other spaces in the building and outside are at a minimum, or do not affect sound readings.
- C. Clear the space of temporary sound sources so unrelated disturbances will not be measured. Turn off all sound sources (personal computers, printers, fax machines, etc) in the space that may affect sound readings.
- D. Position testing personnel during measurements to achieve a direct line-of-sight between the sound source and the sound-level meter.
- E. Take sound measurements at a height approximately 48 inches above the floor and at least 36 inches from a wall, column, or any other large surface capable of altering the measurements.
- F. Take sound measurements in dB (linear or flat), with the slow time constant, in the octave bands from 31.5 to 8000 Hz.
- G. Take sound measurements with the HVAC systems off to establish the background levels and take sound measurements with the HVAC systems operating. Calculate the difference between measurements. Apply a correction factor depending on the difference and adjust measurements.
- H. Perform sound testing in all occupied space horizontally and vertically adjacent to all mechanical equipment rooms and all mechanical chases.
- I. Perform sound testing at 10% of locations on the project for each type of the following spaces. For each space type tested, select a measurement location that has the greatest anticipated sound level. If testing multiple locations for each space type, select at least one location that is near and at least one location that is remote from the predominant sound source.
 1. Private office.
 2. Open office area.
 3. Conference room.
 4. Auditorium/large meeting room/lecture hall.
 5. Classroom/training room.
 6. Library open space.
 7. Public areas (such as, lobbies, hallways, break rooms).
 8. Perform sound testing in all spaces with a design criterion of NC or RC 25 or less.
- J. Sound Measurement Reports: Record sound measurements on appropriate test forms, indicating the decibel levels measured in for both "background" and "HVAC system operating" readings. Record each tested location on a separate NC or RC chart. Record the following on the forms.
 1. Date and time of test.
 2. Equipment operational parameters – speed / frequency at time of measurements.
 3. Indoor measurements - space location within building including floor level and room /space number.

4. Outdoor measurements – location identifier such as location relative to equipment, building, or property line.
5. Indicate where measurements meet or exceed design criteria.

3.09 CONTROL VERIFICATION

- A. In conjunction with system balancing perform the following:
 1. Work with the temperature control contractor to ensure the system is operating within the design limitations and gain a mutual understanding of intended control performance.
 2. Confirm that the sequences of operation are in-compliance with the approved drawings. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
 3. Verify that controllers are calibrated and function as intended.
 4. Verify that controller set points are as specified.
 5. Verify operation of limiting controllers (i.e., high, and low temperature controllers).
 6. Verify the operation of lockout or interlock systems.
 7. Verify the operation of all valve and damper actuators.
 8. Verify that all controlled devices are properly installed and connected to the correct controller.
 9. Verify that all controlled devices travel freely and are in the position indicated by the controller: open, closed, or modulating.
 10. Verify the location and installation of all sensors to ensure they will sense only the intended temperatures, humidity, or pressures. Note conditions that would adversely affect control functions.
 11. Record controller settings and note variances between set points and actual measurements.
 12. Confirm interaction of electrically operated switch transducers.
 13. Verify main control supply-air pressure and observe compressor and dryer operations.
 14. Record voltages of power supply and controller output. Determine if the system operates on a grounded or non-grounded power supply.
 15. Note operation of electric actuators using spring return for proper fail-safe operations.
- B. Reporting
 1. The report shall include a summary of verifications performed, remaining deficiencies, and any variations from specified conditions.

3.10 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 1. Supply, Return, and Exhaust Fans: Minus 10 to plus 10 percent.
 2. Fresh air intake: 0 to plus 5%.
 3. Air Outlets and Inlets: Minus 10 to plus 10 percent.
 4. Heating-Water Flow Rate: Minus 5 to plus 5 percent.
 5. Cooling-Water Flow Rate: Minus 5 to plus 5 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.11 REPORTING

- A. Initial Construction Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

- A. General: Computer printout in letter-quality font, on standard bond paper, in a fine quality 3-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. The final report for sound and vibration measurement shall be in accordance with the requirements of the current edition of the AABC Procedural Standards for Measurement of Sound and Vibration.
- C. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of the instruments used for procedures, along with proof of calibration.
- D. Final Report Contents: In addition to the certified field report data, include the following:
 - 1. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
- E. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of testing, adjusting, and balancing Agent.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address and field technician responsible for the project.
 - 8. Report date.
 - 9. Signature of testing, adjusting, and balancing Agent who certifies the report.
 - 10. Summary of contents, including the following:
 - a. Design versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 11. Nomenclature sheets for each item of equipment.
 - 12. Data for terminal units, including manufacturer, type size, and fittings.
 - 13. Notes to explain why certain final data in the body of reports vary from design values.
 - 14. Test conditions for fans and pump performance forms, including the following:
 - a. Settings for outside-air, return-air, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet-bulb, 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.
- F. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
 - 1. Quantities of outside, 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. Balancing stations.
- G. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
 1. Unit Data: Include the following:
 - 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. Sheave dimensions, center to-center and amount of adjustments in inches.
 - j. Number of belts, make, and size.
 - k. Number of filters, type, and size.
 2. Motor Data: Include the following:
 - a. 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. Sheave dimensions, center-to-center, and amount, of adjustments in inches.
 3. Test Data: Include design and actual values for the following:
 - a. Total airflow rate in CFM.
 - b. Total system static pressure in Inches W.G.
 - c. Fan RPM.
 - d. Discharge static pressure in Inches W.G.
 - e. Filter static-pressure differential in Inches W.G.
 - f. Preheat coil static-pressure differential in Inches W.G.
 - g. Cooling coil static-pressure differential in Inches W.G.
 - h. Heating coil static-pressure differential in Inches W.G.
 - i. Outside airflow in CFM.
 - j. Return airflow in CFM.
 - k. Outside-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.
- H. Apparatus-Coil Test Reports: For apparatus coils, include the following:
 1. Coil Data: Include the following:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch.
 - 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: Include design and actual values for the following:
 - a. Airflow rate in CFM.
 - b. Average face velocity in FPM.
 - c. Air pressure drop in Inches W.G.
 - d. Outside-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.
- I. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data: Include the following:
 - 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. Sheave dimensions, center to-center and amount of adjustments in inches.
 - 2. Motor Data: Include the following:
 - a. 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. Sheave dimensions, center to-center and amount of adjustments in inches.
 - g. Number of belts, make, and size.
 - 3. Test Data: Include design and actual values for the following:
 - a. Total airflow rate in CFM.
 - b. Total system static pressure in Inches W.G.
 - c. Fan RPM.
 - d. Discharge static pressure in Inches W.G.
 - e. Suction static pressure in Inches W.G.
- J. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
- 1. Report Data: Include the following:
 - a. System and air-handling unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in Inches W.G.
 - e. Duct size in Inches.
 - f. Duct area in Sq. Ft.
 - g. Design airflow rate in CFM.
 - h. Design velocity in FPM.
 - i. Actual airflow rate in CFM.
 - j. Actual average velocity in FPM.
 - k. Barometric pressure in PSIG.
- K. Air-Terminal-Device Reports: For terminal units, include the following:
- 1. Unit Data: Include the following:
 - a. System identification.
 - b. Location.

- c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
- 2. Test Data: Include design and actual values for the following:
 - a. Airflow rate in CFM.
 - b. Air velocity in FPM.
 - c. Preliminary airflow rate as needed in CFM.
 - d. Preliminary velocity as needed in FPM.
 - e. Final airflow rate in CFM.
 - f. Final velocity in FPM.
 - g. Space temperature in deg F.
- L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
 - 1. Unit Data: Include the following:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flow-meter type.
 - 2. Test Data: Include design and actual values for the following:
 - a. Airflow 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.
- M. Instrument Calibration Reports: For instrument calibration, include the following:
 - 1. Report Data: Include the following:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.13 ADDITIONAL TESTS

- A. Within 90 days of completing testing, adjusting, and balancing. Perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.
- C. Duct Leakage Testing:
 - 1. Perform duct pressure/leakage testing on newly constructed ductwork.
 - 2. Verify that proper test methods are used and that leakage rates are within specified tolerances per section 23 31 13.
 - 3. Report any deficiencies observed.

END OF SECTION

SECTION 23 07 00
HVAC INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Extent of HVAC insulation required by this section is indicated on drawings and schedules, and by requirements of this section, and includes the following:
 - 1. Piping Systems Insulation:
 - a. Fiberglass.
 - b. Calcium Silicate.
 - c. Flexible Unicellular.
 - 2. Ductwork System Insulation:
 - a. Fiberglass.
 - b. Flexible Unicellular.
 - 3. Equipment Insulation:
 - a. Fiberglass.
 - b. Calcium Silicate.
 - c. Flexible Unicellular.
 - 4. Acoustical Insulation:
 - a. Fiberglass.

1.02 RELATED SECTIONS

- A. Refer to Division 23 Section "Supports and Anchors" for protection saddles, protection shields, and thermal hanger shields; not work of this section.
- B. Refer to Division 23 Section "HVAC Identification" for installation of identification devices for piping, ductwork, and equipment; not work of this section.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of HVAC insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each HVAC system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of HVAC insulation. Include this data and product data in maintenance manual.

1.04 QUALITY ASSURANCE

- A. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
- B. As a minimum, insulation shall meet installed conductance as set forth in Title 24 California Code of Regulations (CCR) 2022 Building Energy Efficiency Standards or as indicated in contract documents, whichever is greater.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. Owens-Corning Fiberglas Corp.
 - 2. Manville Products Corp.
 - 3. CertainTeed Corp.

4. Armstrong World Industries, Inc.
5. Knauf Fiber Glass GmbH.

2.02 PIPING INSULATION MATERIALS

- A. Fiberglass (Mineral Fiber) Piping Insulation: ASTM C547, Class 1 unless otherwise indicated. Manville Products Corp. Micro-Lok, Owens-Corning Fiberglas Corp., ASJ/SL-II or equivalent.
- B. Calcium Silicate Piping Insulation: ASTM C533, Type I. Owens-Corning Fiberglass Corp. "Kaylo Asbestos Free" or equivalent.
- C. Flexible Unicellular Piping Insulation: ASTM C534, Type I. Armstrong World Industries, Inc. meeting ASTM E-84 25/50 index.
- D. Jackets for Piping Insulation: ASTM C921, Type I (Vapor Barrier) for piping with temperatures below ambient. (Type II (Water Vapor Permeable) for piping with temperatures above ambient. Type I may be used for all piping at Installer's option.
 1. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations. Zeston PVC Insulated fitting covers or equivalent.
 2. Encase exterior piping insulation with aluminum jacket with weather-proof construction.
- E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
- F. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.
- G. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

2.03 DUCTWORK INSULATION MATERIALS

- A. Flexible Fiberglass Ductwork Insulation: ASTM C553, Type I, Class B-2, Owens-Corning Fiberglas Inc. un-faced duct wrap insulation, Type 100 or equivalent.
 1. Nominal thickness or equivalent to provide installed R-value as follows:
 - a. 1.5" thick - Installed R = 4.2
 - b. 2.0" thick - Installed R = 5.6
- B. Flexible Fiberglass Ductwork Insulation: ASTM C612, with ASTM C921 Type I vapor barrier jacket. Owens/Corning Fiberglas All Service Wrap Insulation, Type 100 or equivalent:
 1. Nominal thickness or equivalent to provide an installed R-value as follows:
 - a. 1.5" thick - Installed R = 4.2
 - b. 2.0" thick - Installed R = 5.6
- C. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- D. Rooftop ductwork and ductwork that are not in conditioned space or indirectly conditioned spaces are to be insulated with material to achieve minimum installed R value equal to 8.0 to meet the 2022 Building Energy Efficiency Standards. For double wall rooftop ductwork see HVAC drawings.
- E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes, and similar compounds as recommended by insulation manufacturer for applications indicated.
- F. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

2.04 EQUIPMENT INSULATION MATERIALS

- A. Flexible Fiberglass Equipment Insulation: ASTM C553, Type II, Class F-1, Owens-Corning Fiberglass, Inc., Type 701 1.5 lbs/Ft3.
- B. Calcium Silicate Equipment Insulation: ASTM C533, Type I, Block; Owens/Corning Fiberglass, Inc., Kaylo Asbestos Free, U-Grooved block insulation.

- C. Jacketing Material for Equipment Insulation: Provide canvas jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.
- D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics, and protective finishes as recommended by insulation manufacturer for applications indicated.
- E. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape corner angles, anchors and stud piping as recommended by insulation manufacturer for applications indicated.
- F. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

2.05 ACOUSTICAL INSULATION

- A. Rigid Fiberglass Insulation: ASTM C612, Class 1, Owens/Corning Fiberglass, Inc., 10 Lbs/Cu. Ft.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which HVAC insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 HVAC PIPING SYSTEM INSULATION

- A. Insulation Omitted: Omit insulation on the following:
 - 1. Hot piping within radiation enclosures.
 - 2. Hot unions, flanges, strainers, flexible connections, and expansion joints.
- B. Cold Piping (40°F to ambient):
 - 1. Application Requirements: Insulate the following cold HVAC piping systems:
 - a. HVAC chilled water supply and return piping.
 - b. Air conditioner condensate drains piping.
 - 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
 - a. Fiberglass: 1" thick for pipe sizes up to and including 4", 1-1/2" thick for pipe sizes over 4".
 - b. Flexible Unicellular: 1/2" thick for pipe sizes up to 1-1/2" (A.C. condensate piping only).
- C. Hot Low-Pressure Piping (to 250°F):
 - 1. Application Requirements: Insulate the following hot low pressure HVAC piping systems (steam piping up to 15 PSI, water piping up to 250°F (121°C)).
 - a. HVAC heating water supply and return piping.
 - 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
 - a. Fiberglass: 1" thick for pipe sizes up to and including 1", 1-1/2" thick for pipe sizes 1-1/2"; 2" thick for piping over 2".

3.03 DUCTWORK SYSTEM INSULATION

- A. Insulation Omitted:
 - 1. Do not insulate outside air ductwork unless otherwise indicated.
 - 2. Do not insulate exhaust air ductwork unless otherwise indicated.
 - 3. All ductwork specified to be insulated that is located in mechanical rooms, located on roofs or where exposed in conditioned spaces or to weather shall be internally lined under Section 23 31 13 "Metal Ductwork"; unless noted otherwise in these specifications or on the drawings.

- B. Insulate the following with flexible fiberglass insulation, faced, 1.5" thickness unless otherwise noted. Firmly wrap insulation around duct work with all joints lapped a minimum of 2 inches. Secure insulation to ducts by means of 16 gauge soft-annealed galvanized wire spaced 12 inches on centers at loose ends.
 - 1. Warm air heating ductwork in concealed spaces, unless in ceiling plenum provide all service wrap insulation.
 - 2. Return air ductwork in non-conditioned concealed spaces unless in ceiling supply plenum uses all service wrap insulation.
 - 3. Return air ductwork located in return air ceiling plenums and outside air ductwork supplying fan coil units.
- C. Insulate the following with Flexible Fiberglass insulation with all service vapor barrier facing, 1.5" thickness unless noted otherwise.
 - 1. HVAC hot/cold mixed air ductwork between fan discharge or HVAC unit discharge, and room terminal unit.
 - 2. Outdoor air intake ductwork between air entrance and indoor fan inlet or indoor HVAC unit inlet.
 - 3. Installation:
 - a. Neatly wrap insulation around ducts with all joints tightly butted together.
 - b. Seal transverse joints with vapor barrier facing tab overlapping all joints 2 inches and secure with vapor barrier adhesive or outward-clinch staples on 4-inch centers.
 - c. Seal longitudinal joints with 4-inch wide, vapor barrier adhesive tape.
 - d. Secure insulation to underside of ducts, 100 percent coverage, with ductwork insulation adhesive.
 - e. In addition to adhesive, on underside of ducts 24-inches or greater in width use mechanical fasteners on maximum 12-inch centers.
 - f. Seal all penetrations of vapor barrier facing with vapor barrier mastic.
- D. Insulate the following with Rigid Fiberglass Insulation, 2.0" thickness unless noted otherwise.
 - 1. HVAC and unit housings not pre-insulated at the factory or where lining has been specifically omitted.
 - 2. Installation: Fasten to ductwork with adhesive and pins per manufacturer's recommendations. Provide all Butt-joints with a 16 gage corner angles at corners. Seal all joints with approved duct tape.
- E. Contractor's Option: Contractor may provide duct liner as set forth in Section 23 31 13, using equivalent installed "R" values; in lieu of external duct-wrap or rigid insulation as specified above unless ductwork is specifically indicated as being unlined.
- F. Hot Ductwork:
 - 1. Application Requirements: Insulate range and hood exhaust ductwork with PABCO "Super Fire Temp" asbestos free, non-combustible fireproofing board.
 - a. Provide 1 to 4-hour fire rating as indicated.
 - b. Install per manufacturer's instructions.

3.04 EQUIPMENT INSULATION

- A. Cold Equipment (Below Ambient Temperature):
 - 1. Application requirements: Insulate the following cold equipment:
 - a. Refrigeration equipment, including chillers, tanks, and pumps.
 - b. Drip pans under chilled equipment.
 - c. Cold and chilled water pumps.
 - d. Pneumatic water tanks.
 - 2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
 - a. Fiberglass: 2" thick for cold surfaces above 35°F and 3" thick for surfaces 35°F and lower.

- B. Hot Equipment (Above Ambient Temperature):
 - 1. Application Requirements: Insulate the following hot equipment:
 - a. Boilers (not pre-insulated at factory).
 - b. Water heaters.
 - c. Hot water expansion tanks.
 - d. Hot water pumps.
 - 2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation.
 - a. Fiberglass: 2" thick, except 3" thick for low-pressure boilers and steam-jacketed heat exchangers.
- C. Breeching and Stacks:
 - 1. Application Requirements: Insulate the following breechings and stacks:
 - a. Breechings between heating equipment outlet and stack or chimney connection, except for double wall or factory insulated breechings.

3.05 INSTALLATION OF PIPING INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems, subsequent-to installation of heat tracing, painting, testing, and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor barrier jackets on pipe insulation and protect to prevent puncture or other damage.
- F. Cover valves, fittings, and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- G. Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise indicated.
- H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

3.06 INSTALLATION OF DUCTWORK INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor barrier on ductwork insulation and protect it to prevent puncture and other damage.
- E. Extend ductwork insulation without interruption through walls, floors, and similar ductwork penetrations, except where otherwise indicated.
- F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.

- G. Ductwork Exposed to Weather: Where external insulation has been specifically indicated, protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by manufacturer.
- H. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

3.07 INSTALLATION OF EQUIPMENT INSULATION

- A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
- B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.
- C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
- D. Do not apply insulation to equipment, breechings, or stacks while hot.
- E. Apply insulation using the staggered joint method for both single, and double-layer construction, where feasible. Apply each layer of insulation separately.
- F. Coat insulated surfaces with layer of insulating cement, trowel in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.
- G. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.
- H. Do not insulate boiler manholes, hand-holes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- I. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames, and accessories.
- J. Equipment exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by the manufacturer.

3.08 ACOUSTICAL INSTALLATION

- A. Install within confines of roof curbs for roof mounted air handlers and air conditioning units, and elsewhere as indicated on drawings.
- B. Cut to fit snugly within curb and around duct at duct penetrations, 4" minimum thickness.

3.09 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 23 09 00
INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide all work for the complete installation of automatic temperature controls.
- B. Work in this Section:
 - 1. Electronic and electric controls, includes sensors, switches, relays, control panels for instruments.
 - 2. Local control panels.
 - 3. Adjustment and validation of control system. Instruction of Owner's representative on maintenance and operation of control equipment.
 - 4. Electric diagrams showing interlocks between equipment furnished under the other sections and control furnished herein.
 - 5. Direct digital control for systems.
 - 6. Wiring and Conduit: Low voltage for the control system under Division 15, all required conduits and Power Wiring under Division 26.

1.02 SYSTEM

- A. The Temperature Control System to be installed shall consist of all sensors, actuators, direct digital controllers, supervisory controller, electrical low voltage (24 VAC) and line voltage control wiring for a complete and operating installation as specified herein. The system shall be a standard product with the manufacturer who will guarantee ongoing parts availability and factory trained field support for five (5) years after system acceptance.

1.03 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. General: The publications listed below form a part of this specification to the extent applicable:
 - a. ASHRAE Handbook of Fundamentals, Latest Edition.
 - b. EIA - Electrical Characteristics of Balanced Voltage Digital Interface Circuits; RS-485.
 - c. NEMA - Enclosures for Electrical Equipment (1000 volts maximum); 250-1979 NFPA 70 - National Electrical Code.
 - d. NFPA 90A - Air Conditioning and Ventilation Systems.

1.04 SUBMITTALS

- A. Submit installation drawings, control strategy flow charts, sequences of operation and catalog cut sheets for each device of the proposed system prior to installation for engineer's approval. The drawings shall include the location and intercommunication of all stand-alone and subordinate control panels; the schematic diagrams, of the controlled equipment with sensors and actuators shown interconnected to the system controllers; and logic diagrams that depict the sequence of operation.
- B. After completion of the installation and commissioning of the system including final adjustments, a full set of as-built documentation shall be turned over to the Owner. The as-builts shall include one (1) set of reproducible drawings and two (2) copies of the database on flexible or removable hard disk for each stand-alone controller and the supervisory computer.
 - 1. As-built documentation shall include diagrammatic layouts of the automatic control systems specified herein. Layouts shall show all control equipment, and the function of each item shall be indicated for the different seasons. Layouts, shall be located in plastic protective folder and placed in the control panels.
 - 2. All Drawings shall be accompanied with a complete description of sequence of operation. Each control element mentioned in the sequence description shall be identified with the same mark as shown- on the control diagram.
- C. Submittal of Materials:

1. Material submittals shall be manufacturers prepared catalog cuts indicating type, size and technical details.
 2. Reference catalog cuts to the applicable specification article (e.g., 2.02A).
 3. Catalog cuts shall be submitted in complete groups of manufacturer's material.
 4. Partial submittals of groups or systems are not acceptable.
 5. Verify that the submittal has been reviewed in detail and is in fact the Contractor's choice of materials.
- D. Upon receipt of contract and prior to the delivery of parts, submit the following drawings:
1. Submit schematic drawings showing the respective locations of components, as applicable and interconnecting wiring between all devices. Also, all field terminal and sensing devices. Also, all field terminal and sensing devices shall be listed, by function and point number and shall display interconnecting wiring and terminals of controlled systems and devices.

1.05 MANUFACTURERS

- A. Acceptable Manufacturers:
1. Johnson Controls, Inc (District Standard) or Approved Equal.
- B. Contractor shall have adequate experience installing systems of similar size and complexity with the control product line proposed for this project.
- C. Minimum five years of experience installing products and systems of similar scope and complexity.
- D. Installer shall submit certification from the equipment manufacturer indicating that installer is an authorized representative of the equipment manufacturer and is trained on network applications.
- E. Installer shall maintain a fully equipped service organization capable of furnishing repair service to the equipment and shall maintain, a spare set of major parts for the system at, all times.
- F. Installer shall furnish a letter from manufacturer of equipment certifying equipment has been installed according to factory standards and that system is operating properly.
- G. Contractor shall have completed and commissioned a minimum of 10 service agreements that provide similar support services to those needed for this project.

1.06 WARRANTY

- A. Provide all labor, material, and equipment necessary to maintain beneficial performance of the entire Building Automation System for a period of one (1) year after acceptance of the system, or parts thereof, by an authorized representative of the Owner. Any defects in workmanship or material during the warranty period shall be promptly corrected by the Contractor at no charge to the Owner. All work shall be accomplished during normal working hours, Monday through Friday excluding legal holidays. Precaution shall be taken to minimize disruption of facility operations.
- B. A prepaid Warranty Service Agreement shall be turned over to the Owner at the time of the acceptance test as a prerequisite of system acceptance. The contract shall include the terms and conditions stated herein.
- C. Service work shall be performed by service personnel in the direct employ of the control contractors. The service technicians shall be factory trained and certified by the manufacturer to be competent in all aspects of the installed system. The technician shall have a working knowledge of calibration techniques, preventive maintenance, troubleshooting, software diagnostics and microprocessor repair.
- D. System modifications shall be incorporated into the as-built documentation and/or operators and maintenance manuals when operating parameters, control point settings or control strategies are changed. System modifications made by the user of the controls contractor shall have both parties' approvals in order, to maintain the Warranty Service Agreement. All database changes shall be saved on disk for backup to the system.
- E. Software upgrade program shall be implemented on the anniversary or anniversaries of the warranty period. The upgrade shall provide all enhancements offered by the manufacturer for programs in the accepted systems.

- F. System enhancements beyond the scope of the project shall be field upgradable with pull out/plug-in ease. Provided, at reasonable value added cost these upgrades may be purchased at the Owner's option.

PART 2 - PRODUCTS

2.01 COMMUNICATION

- A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet or LonWorks internetwork.
- B. Install new wiring and network devices as required to provide a complete and workable control network.
- C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
- D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
 - 1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data and status shall be viewable and editable from each internetwork controller.
 - 2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.
- E. System shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. If applicable, system shall automatically adjust for daylight saving and standard time.

2.02 FIELD INSTALLED SENSORS

- A. Space Sensors. Space sensors shall have setpoint adjustment, override switch, display, and communication port.
- B. CO2 Sensors. Space carbon dioxide sensors for Demand Control Ventilation (DCV).

2.03 CONTROLLER SOFTWARE

- A. Building and energy management application software shall reside and operate in system controllers. Applications shall be configurable through the operator workstation, web browser interface, or engineering workstation.
- B. Memory and System Time. All controllers shall have a Non-Volatile Memory providing indefinite storage of application and configuration data. The system must have an ability to maintain time, and automatically correct for daylight savings time and leap year adjustments. In the event of power failure or user generated power cycle, all system components must automatically be updated with current time and date from a network Time Sync device. The controller shall also have the capability of changing occupancy mode by reading a set of discrete, dry contacts controlled by an external time clock.
- C. Stand-alone capability. All controllers shall be capable of providing all control functions of the HVAC system without the use of a computer. The controllers shall include the inherent capability to access the system control selections as well as to monitor system performance by means of a communicating network with a PC and EMS software program.
- D. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms.
- E. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of out-puts.

- F. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.
- G. Anti-Short Cycling. Binary output objects shall be protected from short cycling by means of preconfigured minimum on-time and off-time settings (5 min. adj), customized for the specific requirements of the application.
- H. On and Off Control with Differential. System shall provide direct- and reverse-acting on and off algorithms with adjustable differential to cycle a binary output based on a controlled variable and setpoint.
- I. Energy Conservation.
 - 1. Peak Demand Limiting. Controllers in the system shall have the capability of being overridden by separate heating and cooling Peak Demand Limiting signals. Option/General purpose controller existing on the communications bus shall be able to send a demand limiting broadcast to reduce overall energy consumption and control on and off peak-time kW usage.

2.04 CONTROLLERS

- A. General. The control system shall be available as a complete package with the required input sensors and devices readily available. Provide Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), and Sensors (SEN) as required to achieve performance specified in Paragraph 2.4.
- B. Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135, BACnet Annex L, unless otherwise specified.
- C. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports, where shown on drawings.
- D. Signal Management. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
- E. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.
- F. Stand-Alone Operation. Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.
- G. Environment. Controller hardware shall be suitable for anticipated ambient conditions.
- H. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).
- I. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).
- J. Keypad. Where specified provide a local keypad and display for each BC and ASC. Operator shall be able to use keypad to view and edit data. Keypad and display shall require password to prevent unauthorized use. If the manufacturer does not normally provide a keypad and display for each BC and ASC, provide the software and any interface cabling needed to use a laptop computer as a Portable Operator's Terminal for the system.
- K. Serviceability.
 - 1. Controllers shall have diagnostic LEDs for power, communication, and processor.
 - 2. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.
- L. All controllers in the system shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

- M. Memory.
 - 1. Controller memory shall support operating system, database, and programming requirements.
 - 2. Each controller in the system shall use nonvolatile memory providing indefinite storage of BIOS, application programming, and all configuration data in the event of power loss.
- N. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
- O. Rooftop Unit Controller (RTC). Defined, as Application Specific Controllers (ASC), shall control all associated HVAC rooftop equipment functions. The resident algorithms shall use error reduction logic as designated in ASHRAE standard 90.1 to provide temperature control and energy usage.
 - 1. Capacity control shall be based on the use of a programmable thermostat. The controls shall provide separate occupied and unoccupied cooling and heating setpoints.
 - 2. RTC shall feature and maintain a 365-day Real-Time Clock/Calendar with holiday functions.
 - 3. RTC shall be capable of stand-alone or networked operation.
 - 4. In the stand-alone mode, each RTC shall establish occupancy scheduling based on its own local occupancy schedule, the closure of a contact connected to an external time clock or EMS system, or by a timed override request (1 to 24 hours) through its space temperature sensor override button.
 - 5. When networked, RTC occupancy may be established by user interface or occupancy signal from other controller located in network.
 - 6. RTC shall utilize fan control, 2 stages of cooling, and up to 3 stages of heating to maintain zone temperature at setpoint.
 - 7. RTC shall provide analog output signal for economizer control.
 - 8. RTC shall monitor CO2 concentration via space CO2 sensor. OSA damper will be positioned accordingly to maintain acceptable CO2 levels initially set at 600 ppm (Parts Per Million).

2.05 SYSTEM INTERFACE

- A. Description. The control system shall be as shown and consist of a high-speed, peer-to-peer network of DDC controllers and a stand-alone web server operator interface. Depict each mechanical system and building floor plan by a point-and-click graphic. A web server shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface. Operators with sufficient access level shall have an ability to make changes to all system and equipment graphics in the web server in addition to having a full DDC system access to make configuration changes to the control system. Any tools required for making graphic changes shall be provided with web server.
- B. Web Server Hardware. Furnish one compact web server with Ethernet port for LAN or direct operator client computer access. The web server shall be capable of communicating to the peer-to-peer DDC controller network. Any required installation or commissioning software shall be pre-installed on the web server. Installation or commissioning of the web server shall be done through a client computer with a standard web browser.

PART 3 - EXECUTION

3.01 GENERAL

- A. All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and requirements. All necessary interconnections, services and adjustments required for a complete and operable system, shall be provided by the contractor.

3.02 INSTALLATION

- A. GENERAL
 - 1. Electric Wiring: This contractor is responsible for all electrical installation and wiring for a fully operational Building Control System. Perform all electrical installation in accordance with local and national electrical codes. Provide conduit in walls for thermostat locations and in all

exposed areas. Plenum wire may be used in ceilings where anchored support is provided every 10 feet.

2. Install all electronic wiring, 24VDC or less, in No. 20 AWG as a minimum. Provide shields as required by equipment manufacturer.

3.03 PERMITS AND FEES

- A. This contractor shall secure and pay for all necessary permits, licenses, and inspections as required by federal, state or local law. This includes providing required notices, plans, licenses, and fees, obtaining any necessary approvals from authorities having jurisdiction, and delivering any certificates of inspection as may be required. No work is to proceed until all proper certificates and licenses are obtained and posted.

3.04 CLEAN-UP

- A. This contractor shall clean up regularly in order, to maintain clean site conditions. In general, clean-up programs shall be scheduled by contractor at least once per week; however, the contractor shall clean up more often if required to meet OSHA standards.
- B. This contractor is responsible for coordinating the work so as, to eliminate unnecessary cutting and patching.

3.05 OWNER TRAINING

- A. Provide training for designated owner's representatives. Onsite training shall be provided for familiarization with all of the HVAC controls installed. Owner's representatives shall be provided a booklet showing the system layout, components, and operation and maintenance data.
- B. Training to include.
 1. Explanation of drawings and diagrams.
 2. Walkthrough of jobsite to locate control components.
 3. Overview of operation and maintenance features.
 4. System front end operation.
- C. Manufacturer will operate a free 40 hour a week customer support hotline for additional user support services that are required.

END OF SECTION

SECTION 23 31 13
METAL DUCTWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Rectangular and round metal ducts and plenums for heating, ventilating, and air conditioning system from minus 2" to plus 5" Water Gage.

1.02 RELATED SECTIONS

- A. Refer to other Division 23 Sections for exterior insulation of metal ductwork; not work of this section.
- B. Refer to other Division 23 Sections for ductwork accessories; not work of this section.
- C. Refer to other Division 23 Sections for fans and air handling units; not work of this section.
- D. Refer to other Division 23 Sections for testing, adjusting, and balancing of metal ductwork systems; not work of this section.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.
- B. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 01.
- C. Maintenance Data: Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual in accordance with requirements of Division 01.

1.04 QUALITY ASSURANCE

- A. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.
- B. Codes and Standards:
 - 1. SMACNA Standards: Comply with SMACNA "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
 - 2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.
 - 3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
- C. Field Reference Manual: Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage, and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 DUCTWORK MATERIALS

- A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including but not limited to those which would impair painting.

- B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A653/A653M, lock forming quality, with G90 zinc coating in accordance with ASTM A653/A653M; and mill phosphatized for exposed locations.

2.02 MISCELLANEOUS DUCTWORK MATERIALS

- A. General: Provide miscellaneous materials and products of types and sizes indicated or, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 18-degree change of direction per section. Unless specifically detailed otherwise, use 45-degree laterals and 45-degree elbows for branch takeoff connections. Where 90-degree branches are indicated, provide conical type tees.
- C. Screws and bolts shall be cadmium plated.
- D. Duct Liner: Permacote Linacoustic (rectangular), Permacote Spiracoustic (Round), complying with Thermal Insulation Manufacturer's Association (TIMA) AHC-101; of thickness indicated. 1 inch thick; 2" thick above roofline, unless indicated otherwise. Or approved equal.
- E. Duct Liner Adhesive: Comply with ASTM C 916 "Specifications for Adhesives for Duct Thermal Insulation". Adhesive used on the project shall meet the requirements of CalGreen Section 5.504.4.1.
- F. Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards, Article S2.11.
- G. Duct Sealant: Non-hardening, non-migrating mastic, or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. Sealant used on the project shall meet the requirements of CalGreen Section 5.504.4.1.
- H. Duct Cement. Non-hardening migrating mastic or liquid neoprene-based cement, type applicable for fabrication/installation detail, as compounded, and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork. Cement used on the project shall meet the requirements of CalGreen Section 5.504.4.1.
- I. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
- J. Flexible ducts: Manufacturer based upon Casco Model Silent Flex II. Equal products by Thermaflex or approved equal. Insulated flexible ductwork shall be a factory fabricated assembly composed of a high carbon spring steel wire with a non-corrosive zinc coating spiral helix permanently bound to a spun-bonded nonwoven nylon interior liner and supporting a fiberglass insulating blanket with a polyethylene jacket vapor barrier. Working pressure: + 1-1/2" W.G. minimum, complying with UL 181; with factory installed metal collar connectors, maximum length 6 feet. Suspend at maximum 3'-0" O.C.
- K. Under slab Ducts: For ductwork placed in concrete slabs, or under slabs on grade, fabricate ductwork of one of the following materials:
 - 1. Galvanized Steel.

2.03 FABRICATION

- A. Shop-fabricate ductwork in 4, 8, 10 or 12-ft lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible so-as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.
- B. Shop-fabricate ductwork of gages and reinforcement complying with SMACNA "HVAC Duct Construction Standards". All ducts shall be fabricated of galvanized sheet metal no less than 24 gauge.

- C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.
- D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division 23 Section "Ductwork Accessories" for accessory requirements.
- E. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive and fasten with mechanical fasteners.

2.04 FACTORY FABRICATED LOW PRESSURE DUCTWORK

- A. General: At Installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct, and fittings.
- B. Material: Galvanized sheet steel complying with ASTM A517, lock forming quality, with ASTM A525, G90 zinc coating, mill phosphatized.
- C. Gage: 24-gage minimum for round and oval ducts and fittings, 4" through 24" diameter.
- D. Elbows: One-piece construction for 90 degrees and 45-degree elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.
- E. Divided Flow Fittings: 90-degree tees, constructed with saddle tap spot welded and bonded to duct fitting body.
- F. Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following or equal:
 - 1. Semco Mfg., Inc.
 - 2. United Sheet Metal Div. United McGill Corp.
 - 3. Or approved equal.

PART 3 - EXECUTION

3.01 INSPECTION

- A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF METAL DUCTWORK

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type, which will hold ducts true-to-shape, and to prevent buckling. Support vertical ducts at every floor.
- B. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
- C. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation.

Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

- D. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures.
- E. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate.
- F. Where ducts pass through fire-rated floors, walls, or partitions, provide fire stopping between duct and substrate.
- G. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls, and other associated work of ductwork system.
- H. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

3.03 INSTALLATION OF DUCT LINER

- A. General: Install duct liner utilizing duct liner fasteners in accordance with SMACNA HVAC Duct Construction Standards.

3.04 INSTALLATION OF FLEXIBLE DUCT

- A. Maximum Length: For any duct run using flexible ductwork, do not exceed 5'-0" extended length.
- B. Installation: Install in accordance with Section III of SMACNA "HVAC Duct Construction Standards, Metal and Flexible."
- C. Bends in flexible ducts shall have a radius of not less 1.5 times the internal diameters.

3.05 EQUIPMENT CONNECTIONS

- A. General: Connect metal ductwork to equipment as indicated; provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

3.06 ADJUSTING AND CLEANING

- A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances, which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
- B. Temporary closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, or the period of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, provide temporary closure of duct openings and protection of mechanical equipment during construction.
- C. All duct and other related air distribution component openings shall be covered with polyethylene film, tape, plastic, sheet metal or other methods acceptable to the enforcing agency which will prevent entrance of dust and debris.
- D. Balancing: Refer to Division 23 Section "Testing, Adjusting and Balancing" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION

SECTION 23 33 00
DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Types of ductwork accessories required for project include the following:
 - 1. Dampers.
 - a. Low pressure manual dampers
 - b. Control dampers
 - c. Counterbalanced relief dampers
 - 2. Fire and smoke dampers.
 - 3. Turning vanes.
 - 4. Duct hardware.
 - 5. Duct access doors.
 - 6. Flexible connections.

1.02 RELATED SECTIONS

- A. Refer to other Division 23 Sections for testing, adjusting, and balancing of ductwork accessories; not included in work of this section.
- B. Division 23 Section "Metal Ductwork."
- C. Division 23 Section "HVAC Identification."

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.

1.04 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
 - 2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
 - 3. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers".
 - 4. Fire dampers shall bear California State Fire Marshal Listing Number.
 - 5. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

PART 2 - PRODUCTS

2.01 DAMPERS

- A. Low Pressure Manual Dampers: Provide dampers of single blade type or multi-blade type, constructed in accordance with SMACNA "HVAC Duct Construction Standards". "Jiffy" type dampers are not acceptable.
- B. Manufacturers: Subject to compliance with requirements set forth in construction documents, provide dampers of one of the following:
 - 1. Ruskin Manufacturing Co.
 - 2. Air Balance Co.
 - 3. Pottorff Company, Inc.

2.02 BACKDRAFT DAMPERS

- A. General: Provide back-draft dampers of types and sizes indicated. Construct casings of 0.090-inch thickness aluminum with mitered corners.

- B. Blades, 0.025" formed aluminum with extruded vinyl edge seals. Bearings, Zytel. Linkage 1/8" x 1/8" aluminum tie bars concealed in frame.
- C. Counterbalance: Zinc plated bar on blades (except top blade). Adjustable for final setting Mill finish
- D. Manufacturers: Subject to compliance with requirements, provide dampers of one of the following:
 - 1. Ruskin Manufacturing Co.
 - 2. Air Balance Co.
 - 3. Pottorff Company, Inc.
- E. Control Dampers: Refer to Division 23 section "Sequence of Operation" for control dampers; not work of this section.
- F. Counterbalanced Relief Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at indicated static pressure. Construct blades of 16-ga aluminum provide 1/2" diameter ball bearings, 1/2" diameter steel axles spaced on 9" centers. Construct frame of 2" x 1/2" x 1/8" steel channel for face areas 25 sq. ft. and under; 4" x 1-1/2" x 16-ga channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up.
- G. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:
 - 1. Air Balance, Inc.
 - 2. Ruskin Mfg. Co.
 - 3. Pottorff Company, Inc.

2.03 FIRE AND SMOKE DAMPERS

- A. California State Fire Marshal approved, designed, and constructed in accordance with NFPA 90A and UL Standard 555 and bear stamp showing compliance.
- B. Fire Dampers: Provide fire dampers, of types and sizes indicated. Construct casings of 11-ga galvanized steel. Provide fusible link rated at 160 to 165 degrees F. (71 to 74 degrees C.) (unless otherwise indicated.) Provide damper with positive lock in closed position, and with the following additional features.
 - 1. Damper Blade Assembly: Curtain type.
- C. Manufacturer: Subject to compliance with requirements, provide fire and smoke dampers of one of the following:
 - 1. Air Balance, Inc.
 - 2. Ruskin Mfg. Co.
 - 3. Pottorff Company, Inc.

2.04 TURNING VANES

- A. Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2" wide curved blades set at 3/4" O.C., supported with bars perpendicular to blades set at 2" O.C., and set into side strips suitable for mounting in ductwork.
- B. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of airfoil shaped aluminum extrusion with perforated faces and fiberglass fill.
- C. Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:
 - 1. Aero Dynen Co.
 - 2. Airsan Corp.
 - 3. Anemostat Products Div.; Dynamics Corp. of America
 - 4. Barber-Colman Co.
 - 5. Duro Dyne Corp.
 - 6. Environmental Elements Corp. Subs, Koppers Co., Inc.

7. Hart & Cooley Mfg. Co.
8. Register & Grille Mfg. Co., Inc.
9. Souther, Inc.

2.05 DUCT HARDWARE

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
 1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
 2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.
- B. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:
 1. Ventfabrics, Inc.
 2. Young Regulator Co.

2.06 DUCT ACCESS DOORS

- A. General: Provide duct access doors where required.
- B. Construction: Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for un-insulated ductwork, extended frames for externally insulated duct. Provide one side hinged and other side with one handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors.
- C. Manufacturer: Subject to compliance with requirements, provide duct access doors of one of the following:
 1. Air Balance Inc.
 2. Duro Dyne Corp.
 3. Register & Grille Mfg. Co., Inc.
 4. Ruskin Mfg. Co.
 5. Ventfabrics, Inc.
 6. Zurn Industries, Inc.; Air Systems Div.

2.07 FLEXIBLE CONNECTORS

- A. General: Provide flexible duct connections wherever ductwork connects to vibration-isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement and, also capable of absorbing vibration of connected equipment.
- B. Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:
 1. American/Elgen Co.; Energy Div.
 2. Duro Dyne Corp.
 3. Flexaust (The) Co.
 4. Ventfabrics, Inc.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF DUCTWORK ACCESSORIES

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install turning vanes in square or rectangular 90-degree elbows in supply and exhaust air systems, and elsewhere as indicated.
- C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- D. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.03 FIELD QUALITY CONTROL

- A. Operate install ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak proof performance.

3.04 ADJUSTING AND CLEANING

- A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
 - 1. Label access doors in accordance with Division 23 Section "HVAC Identification."
 - 2. Final positioning of manual dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."
- B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.05 EXTRA STOCK

- A. Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range; obtain receipt.

END OF SECTION

SECTION 23 34 23
POWER AND GRAVITY VENTILATORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Types of power and gravity ventilators specified in this section include the following:
 - 1. Power ventilators.
 - a. Centrifugal roof ventilators.
 - b. In-Line roof ventilators.
 - 2. Utility set ventilator.
 - 3. Gravity ventilators.
 - a. Hooded gravity ventilators.
 - 4. Prefabricated roof curbs.

1.02 RELATED SECTIONS

- A. Refer to Division 23 Section "Testing, Adjusting, And Balancing" for balancing of power and gravity ventilators; not work of this section.
- B. Refer to Division 23 Section "Common Motor Requirements for Mechanical Equipment."
- C. Refer to Division 26 Sections for the following work; not included in work of this section:
 - 1. Power supply wiring from power source to power connection on ventilators. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
- D. Refer to Division 23 Section "Vibration Control for HVAC."

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for power and gravity ventilators, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions.
- B. Fan curve: Submit manufacturer's fan curve data for power ventilators.
 - 1. For belt driven equipment, submit graph of fan curve with system curve that indicates intended point of operation. The graph shall also indicate manufacturer's recommended operating range of fan curve.
 - 2. For direct driven equipment with speed controller, submit graph of fan curve with system curve that indicates intended point of operation. The graph shall also indicate manufacturer's recommended operating range of fan curve. On the same graph, also provide fan curves representing maximum operating RPM and minimum operating RPM utilizing manufacturer's speed controller.
 - 3. For direct driven equipment, submit graph of fan curve with system curve that indicates intended point of operation. The graph shall also indicate manufacturer's recommended operating range of fan curve.
- C. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.
- D. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to power ventilators. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field installed.
- E. Maintenance Data: Submit maintenance data and parts list for each type of power and gravity ventilator, accessory, and control. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 01.
- F. Exhaust fan unit equipment manufacturer shall furnish calculations showing the estimated sound power levels for each supply air, return air and unit casing radiation for each exhaust fan unit.

- G. The results of the tests shall be certified by the testing agency and submitted to the Architect for approval. The report shall include the manufacturer's designation of the tested unit, a complete description of the testing conditions, the measurement procedure, and the calculated PWL values (dB re. 10-12 watts), and calculations showing how the sound power levels were obtained from test data.

1.04 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. AMCA Compliance: Provide power ventilators, which have been tested and rated in accordance with AMCA standards, and bear AMCA Certified Rating Seal.
 - 2. UL Compliance: Provide power ventilators, which are designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."
 - 3. NEMA Compliance: Provide motors and electrical accessories complying with NEMA Standards.

PART 2 - PRODUCTS

2.01 POWER VENTILATORS

- A. General: Except as otherwise indicated, provide standard prefabricated power ventilator units of type and size indicated, modified as necessary to comply with requirements and as required for complete installation.

2.02 CENTRIFUGAL ROOF VENTILATORS (EXHAUST AND SUPPLY)

- A. Centrifugal Roof Ventilators: Provide centrifugal roof type, curb mounted, power ventilators of type, size, and capacity as scheduled, and as specified herein.
- B. Type: Centrifugal fan, direct or belt driven as scheduled. Provide aluminum, or fiberglass weatherproof housings as scheduled. Provide square base to suit roof curb.
- C. Motors: Provide permanent split-capacitor type motor for direct driven fans; capacitor-start, induction-run type motor for belt driven fans.
- D. Electrical: Provide factory-wired non-fusible type disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor. Provide conduit chase within unit for electrical connection.
- E. Bird Screens: Provide removable bird screen, 1/2" mesh 16-Ga. aluminum or brass wire.
- F. Dampers: Provide gravity-actuated louvered dampers in curb bases unless noted to provide motorized louvered dampers with linkage in curb base.
- G. Manufacturer: Subject to compliance with requirements, provide centrifugal roof ventilators of one of the following:
 - 1. Cook Co., Loren.
Greenheck Fan Corp.
 - 2. Or approved equal.

2.03 UTILITY SET VENTILATOR

- A. Description: Fan shall be a single width, single inlet, backward inclined flat blade, belt driven centrifugal vent set featuring spark resistant AMCA Type "A" construction.
- B. Certifications: Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL/CUL 705) for US and Canada. Fan shall bear the AMCA certified ratings seal for air performance.
- C. Construction: The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The scroll wrapper shall be minimum 0.100" aluminum and the scroll side panels shall be minimum 0.100" aluminum. The entire fan housing shall be aluminum and spark-proof, shall have continuously welded seams for leak-proof operation. A performance cut-off shall be furnished to prevent the recirculation of air in the fan housing.

The fan housing shall be field rotatable to any one of eight discharge positions and shall have a minimum 1-1/2-inch outlet discharge flange.

Bearing support shall be minimum 10-gauge welded steel. Side access inspection ports shall be provided with quick release latches for access to the motor compartment without removing the weather cover. Lifting lugs shall be provided for ease of installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.

- D. Coating: Fan components shall have an electrostatically applied, baked polyester powder coating. Each powder coated component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000-hour salt spray under ASTM B117 test method.
- E. Wheel: Wheel shall be aluminum centrifugal backward inclined, non-overloading flat blade type. Blades shall be continuously welded to the back plate and deep spun inlet shroud. Wheel hub shall be keyed and securely attached to the fan shaft. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.
- F. Motor: Provide explosion proof motor. Motor shall be NEMA design B with class B insulation rated for continuous duty and furnished at the specified voltage, phase, and enclosure.
- G. Bearings: Bearings shall be designed and tested specifically for use in air handling applications. Construction shall be heavy duty re-greasable ball or roller type in a cast iron pillow block housing selected for a minimum L50 life in-excess of 200,000 hours at maximum cataloged operating speed.
- H. Blower Shaft: Blower shaft shall be Type 316 Stainless Steel accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum RPM.
- I. Belts and Drives: Belts shall be oil and heat resistant, static conducting. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.
- J. Provide utility set ventilator with explosion proof motor, spark proof housing and spark proof impeller wheel construction.
- K. Provide with manufacturer's aluminum inlet and outlet adapter.
- L. Manufacturer: Subject to compliance with requirements, provide utility set ventilator of one of the following:
 - 1. Cook Co., Loren.
 - 2. Greenheck Fan Corp.
 - 3. Or approved equal.

2.04 GRAVITY VENTILATORS

- A. General: Except as otherwise indicated, provide standard prefabricated gravity ventilator units of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation.
- B. Hooded Gravity Ventilators: Provide gravity ventilators, hooded type, curb mounted, of size, type and capacity as scheduled, and as specified herein.
 - 1. Type: Stationary, natural draft type. Provide weatherproof housings to match power ventilators in materials and finish. Provide square or rectangular base to suit roof curb.
 - 2. Bird Screens: Provide removable bird screens, 1/2" mesh, 16-Ga. aluminum, or brass wire.
 - 3. Dampers: Provide gravity-actuated louvered dampers in curb bases.

4. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - a. Cook Co., Loren.
 - b. Greenheck Fan Corp.
 - c. Or approved equal.

2.05 PREFABRICATED ROOF CURBS

- A. General: Provide manufacturer's standard shop-fabricated units, modified if necessary to comply with requirements.
- B. Fabricate structural framing for units of structural quality, aluminum formed to profiles indicated or, if not indicated, to manufacturer's standard profiles for coordination with roofing, insulation, and deck construction.
- C. Include 45-deg. cant strips and deck flanges with offsets to accommodate roof insulation. Weld corners and seams to form watertight units.
- D. Reinforce continuous runs of over 3'-0" length by inserting welded stiffeners of heavy gage with flanges as required to provide sufficient rigidity and strength to withstand maximum lateral forces in addition to superimposed vertical loads.
- E. Sloping Roof Decks: For deck slopes of 1/4" per foot and more, fabricate support units to form level top edge.
- F. Gage and Height: Fabricate units of metal gage and to height above roof surface as indicated.
 1. Where gage or height is not indicated, fabricate units of 14-Ga. metal, and nominal height of 14" above roof surface.
- G. Insulate units inside structural support wall with rigid glass fiber insulation board of approximately 3-Lb. density and 1-1/2" minimum thickness, except as otherwise indicated.
- H. Provide support liners where shown.
 1. Use perforated metal for support liners, with approximately 1000, 3/32" diameter holes per Sq. Ft., to provide sound absorbing surfaces.
 2. Provide sound insulation insert for curbs so indicated. Construct of 1" thick rigid fiberglass panels secured in galvanized steel framework, with rounded edges to minimize airflow resistance.
- I. Manufacturer: Subject to compliance with requirements, provide prefabricated roof curbs of the same manufacturer as ventilator.

PART 3 - EXECUTION

3.01 INSPECTION

- A. General: Examine areas and conditions under which power and gravity ventilators are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF POWER AND GRAVITY VENTILATORS

- A. General: Except as otherwise indicated or specified, install power ventilators in accordance with manufacturer's installation instructions and recognized industry practices to insure, that products serve the intended function.
- B. Coordinate ventilator work with work of roofing, walls, and ceilings, as necessary for proper interfacing.
- C. Ductwork: Refer to Division 23 Section "Metal Ductwork." Connect ducts to ventilators in accordance with manufacturer's installation instructions.
- D. Roof Curbs: Furnish roof curbs to roofing Installer for installation.

- E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections.
 - 2. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- F. Remove shipping bolts and temporary supports within ventilators. Adjust dampers for free operation.

3.03 FIELD QUALITY CONTROL

- A. Testing: After installation of ventilators has been completed, test each ventilator to demonstrate proper operation of unit at performance requirements specified. When possible, field correct malfunctioning units, and then retest to demonstrate compliance. Replace units, which cannot be satisfactorily corrected.

3.04 ADJUSTING AND CLEANING

- A. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.05 SPARE PARTS

- A. General: Furnish to Owner, with receipt, one spare set of belts for each belt driven power ventilator.

END OF SECTION

SECTION 23 37 13
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Types of outlets and inlets required for project include the following:
 - 1. Linear slot diffusers and returns.
 - 2. Ceiling air diffusers, rectangular, square, round.
 - 3. Wall registers and grilles.

1.02 RELATED SECTIONS

- A. Refer to other Division 23 Sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.
- B. Refer to other Division 23 Sections for balancing of air outlets and inlets; not work of this section.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
 - 1. Schedule of air outlets and inlets indicating drawing designation, room location, quantity furnished, model number, size, and accessories furnished.
 - 2. Data sheet for each type of air outlet and inlet, and accessory furnished indicating construction, finish, and mounting details.
 - 3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature, and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.
 - 4. ANSI/ASHRAE Standard 70-1991.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 01.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver air outlets and inlets wrapped in factory-fabricated fiberboard type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors, when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

1.05 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. ANSI/ASHRAE Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ANSI/ASHRAE Standard 70-1991.
 - 2. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.01 CEILING AIR DIFFUSERS

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity, and type indicated; constructed of materials and components as indicated, and as required for complete installation.

- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems, which will contain each type of ceiling air diffuser.

2.02 MANUFACTURER

- A. Subject to compliance with requirement diffusers of one of the following:
 - 1. Krueger Mfg. Co.
 - 2. Titus Air Distribution Products
 - 3. Anemostat Air Distribution Products
- B. Manufacturers and model numbers are listed and/or scheduled to set a standard of quality. Equivalent manufacturers and models accepted by Architect/Engineer may be used. Equivalents must be submitted for review.
 - 1. Equivalents: Other manufacturers offering a similar product which is in accordance with the design criteria indicated may be submitted upon architect's written acceptance prior to bidding. The cost to conduct all tests as may be directed by the architect to demonstrate that the equivalent product can achieve the criteria indicated, including all travel costs, shall be borne by the submitting contractor.

2.03 LINEAR SLOT DIFFUSER AND RETURN

- A. General: Provide acoustical ceiling air distribution system. Consisting of ceiling slot air diffusers, base-frames, air chambers and entry collars.
- B. Air Distribution Base Frames:
 - 1. Linear air diffusers base frames shall mechanically lock into the grid system. The base frames shall be extruded aluminum sections. Length shall be 48" unless otherwise noted or required.
 - 2. Provide air distribution base frame with full supply air pattern control air weir gates. When used for return air, these air weir gates act as a return airflow control damper. Close air weir gates where return is not necessary.
 - 3. Base frame shall present a substantially uniform appearance through the air slot when used as supply, returns or fully closed. All interior portions of the throat, including the vertical stems of the extrusions, shall be painted flat black to prevent unsightly visual deviations. Paint all exposed surfaces baked white enamel. Base frame shall be compatible with type of ceiling where linear slot diffuser is installed.
 - 4. Base frame shall be provided with spacer channels located on the ceiling module. The spacer channel shall act as the support means for the adjustable full pattern control air weir gates, which are provided throughout the entire length of the base frame.
 - 5. The noise criteria of the air distribution base frame shall be expressed in sound power levels (decibels 10-12 Watts) in octave bands 2 through 7 with a room attenuation of 10 decibels and shall not exceed noise-criteria of 30. All data shall be based on tests performed in a certified laboratory.
 - 6. Where noted on drawings or as required, blank-off airtight backside of supply air linear slot where duct connection is not made.
- C. Supply or Return Air Chambers:
 - 1. Supply or Return air plenum chambers shall be designed, tested, and fabricated by the same manufacturer that furnishes the base frames. Shop fabricated air chambers not acceptable. Provide with damper at inlet to plenum, which is accessible through face of linear diffuser for adjustment.

2. Provide adjustable air pattern controllers that are accessible through the base frame slot for field adjustment of the spread of the air stream. This will be accomplished without the removal of acoustical tile.
3. Provide a round neck air entry collar sized for maximum average air entry velocity of 750 FPM. A volume damper shall be installed at connection to plenum, which is accessible through face of diffuser for adjustment.
4. Construct supply air chamber from not less than 26-gauge galvanized steel and will be lined with one- quarter inch 2 Lbs./Cu. Ft. density thermal acoustical insulating. All surfaces visible through the slot will be painted flat black.
5. Provide spring clip keepers to securely attach the chamber to the base frame when in operation. These spring clips permit releasing of the air chamber for easy relocation.
6. The supply air chamber shall have been tested as composite assembly with the linear base frame for air distribution and noise level performance. The tests shall be conducted in accordance with ANSI/ASHRAE Standard 70-1991.
7. For return air plenums above the ceiling, install Krueger Model DFRH plenum hood on all linear return air bars.

D. Manufacturer: Krueger Model DFL linear slot diffuser.

2.04 SIDEWALL SUPPLY AND RETURN REGISTERS AND GRILLES

- A. Supply register - Krueger 1600 or as indicated elsewhere on contract documents.
- B. Return register - Krueger S-5480 or as indicated elsewhere on contract documents.
- C. Return grille - Krueger S-5480 or as indicated elsewhere on contract documents.

2.05 CONSTANT AIR VOLUME SYSTEM - CEILING DIFFUSERS (SUPPLY)

- A. Concealed Spline - Krueger 5PLQ or as indicated elsewhere on contract documents.
- B. Glued on Acoustile - Krueger 5PLQ or as indicated elsewhere on contract documents.
- C. Plaster or Drywall - Krueger 5PLQ or as indicated elsewhere on contract documents.
- D. 24" x 24" T-Bar - Krueger 5PLQ or as indicated elsewhere on contract documents.

Note: For 24" x 48" T-bar ceilings, coordinate with ceiling installer for auxiliary tees as required to create 24" x 24" space.

2.06 CONSTANT AIR VOLUME SYSTEM - CEILING RETURN, EXHAUST AND TRANSFER GRILLES AND REGISTERS

- A. Registers shall be provided with opposed blade dampers.
- B. Concealed Spline - Krueger EGC5 or EGC5-01 or as indicated elsewhere on contract documents.
- C. Glued on Acoustile - Krueger EGC5 or EGC5-01 or as indicated elsewhere on contract documents.
- D. Plaster or drywall - Krueger EGC5 or EGC5-01 or as indicated elsewhere on contract documents.
- E. 24" x 24" T-bar - Krueger EGC5-F23 or EGC5-01-F23 or as indicated elsewhere on contract documents.

Note: For 24" x 48" T-bar ceilings, coordinate with ceiling installer for auxiliary tees as required to provide 24" x 24" space.

- F. Transfer Grille - Ceiling - Same as return grilles.

2.07 VARIABLE AIR VOLUME SYSTEM - MODULAR CEILING DIFFUSERS (SUPPLY)

- A. Krueger Model 1900SQ and shall have a frame style to interface with the ceiling grid system being used.

- B. Manufactured from extruded aluminum. Provided with air pattern control weirs, and an integral deflection rail allowing for one- to four-way direction air flow producing uniform ceiling effect.
- C. The air motion in the occupancy zone at maximum cubic feet per minute shall not exceed 50 feet per minute. Inner panel of matching acoustical tile shall provide an airtight joint.
- D. Supply, Return and Exhaust Chambers:
 - 1. Designed and fabricated by the manufacturer of the base frames. Field fabricated chambers will not be accepted. Chamber to be supplied with spring clips to attach to the base frame. Constructed from not less than 26-gauge galvanized steel and lined with 1/4" 2 LBS/CU. FT. density thermal insulation. All surfaces visible through the air slot painted flat black.
 - 2. Chamber shall be supplied with a factory installed round entry collar for flex duct connection. Collar shall be sized for maximum average air entry velocity of 750 fpm. Chamber must be tested as a composite assembly with the base frame for air distribution and noise level performance by a certified testing laboratory. If used with side inlet, furnish and install vertical pressure equalizing baffle.

2.08 VARIABLE AIR VOLUME SYSTEM - MODULAR CEILING RETURN

- A. Krueger Model 1900SQ Return diffuser.
- B. Base frame from extruded aluminum. Frame shall have fixed weirs creating a continuous one-inch closed slot. Provide opposite blade volume damper.

2.09 VARIABLE AIR VOLUME SYSTEM - TRANSFER GRILLES

- A. Krueger Model 1900SQ Return diffuser.
- B. Base frame from extruded aluminum. Frame shall have fixed weirs creating a continuous one-inch closed slot. Provide opposite blade volume damper.

2.10 SUPPLY, RETURN AND EXHAUST CONNECTIONS TO METAL LINEAR CEILING

- A. Air Factors sheet metal air boot (eight-slot for connecting to back of metal linear ceiling with slot openings with labyrinths, as applicable) for supply, return, and exhaust. Air boot shall lock onto back of ceiling system.

2.11 CIRCULAR CEILING DIFFUSERS

- A. Krueger Model RA2 circular diffuser with adjustable inner cone.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Provide 12" high plenum box with 1" acoustical insulation. Refer to installation detail on plans for additional requirements.
- C. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- D. Coordinate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

- E. Supply outlets to provide the required air throw and spread with no apparent drafts or excessive air movement within space being supplied. Contractor to provide necessary accessories to accomplish satisfactory air distribution.
- F. Provide felt, cork or rubber gasket between finish-surface and frame to prevent vibration and assure tight fit. Contractor shall be responsible for the correct location of ductwork and outlets.
- G. For filler panel type, outlets the manufacturer shall coordinate his design with the ceiling suspension system being used. The Contractor and manufacturer shall match up sizes of outlets to properly fit in ceiling systems, between concrete or masonry components, between architectural items before fabrication.
- H. When installing removable core type outlets, secure to frame with screws.
- I. Secure outlets to ceiling suspension systems as required by Division of the State Architect.

END OF SECTION

SECTION 23 81 20
ROOFTOP PACKAGED HEAT PUMP

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Section includes package rooftop heating and cooling units.

1.02 RELATED SECTIONS

- A. Division 23
 - 1. Section "Common Motor Requirement for HVAC."
 - 2. Section "Metal Ductwork."
 - 3. Section "Testing, Adjusting, and Balancing."
- B. Division 26
 - 1. Section "Electrical Connections for Equipment."

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including rated capacities at scheduled conditions of selected model clearly indicated, dimensions, required clearances, weights, furnished specialties and accessories; and installation and start-up instructions.
- B. Shop Drawings:
 - 1. Submit shop drawings detailing the manufacturer's electrical requirements for power supply wiring for rooftop heating and cooling units. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
 - 2. Submit shop drawings detailing the mounting, securing, and flashing of the roof curb to the roof structure.
 - 3. Submit shop drawings detailing method of securing rooftop unit to roof curb to meet seismic restraint requirement.
 - 4. If an equal unit is being proposed to be used in lieu of the base specified unit, the contractor shall coordinate all differences as hereinafter described and note such differences on the shop drawings and incorporate all changes (if any) required by the structural and electrical engineers to accommodate the equal unit.
- C. Operation and Maintenance Data: Submit maintenance data and parts list for each rooftop unit, including "trouble shooting" maintenance guide, servicing guide and preventative maintenance schedule and procedures. Include this data in maintenance manual in accordance with requirements of Division 01.

1.04 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. Unit meets ASHRAE 90.1 minimum efficiency requirements.
 - 2. Unit shall be rated in accordance with AHRI Standards 210/240 and 340/360.
 - 3. Unit shall be designed to conform to ASHRAE 15, 2001.
 - 4. Unit shall be UL-tested and certified in accordance with ANSI Z21.47 Standards and UL-listed and certified under Canadian standards as a total package for safety requirements.
 - 5. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
 - 6. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).
 - 7. Unit casing shall be capable of withstanding Federal Test Method Standard No. 141 (Method 6061) 5000-hour salt spray.
 - 8. Unit shall be designed in accordance with ISO 9001 and shall be manufactured in a facility registered by ISO 9001.
 - 9. Roof curb shall be designed to conform to NRCA Standards.
 - 10. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory and must be available upon request.

11. Unit shall be designed in accordance with UL Standard 1995, including tested to withstand rain.
12. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 MPH.
13. Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.
14. High-Efficient Motors listed shall meet Section 313 of the Energy Independence and Security Act of 2007 (EISA 2007).
15. Unit shall meet requirements of CCR Title 24.
16. Unit shall be EER or SEER rated in accordance with ARI Standard 210-81 and California Administrative Title 24.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Handle rooftop units and components per manufacturer's recommendations and carefully to prevent damage. Replace damaged rooftop units or components with new.
- B. Store rooftop units and components in clean dry place, off the ground and protect from weather, water, and physical damage. Unit shall only be stored or positioned in the upright position.
- C. Rig rooftop units to comply with manufacturer's rigging and installation instructions for unloading rooftop units and moving them to final location.

1.06 SCHEDULING AND SEQUENCING

- A. Coordinate installation of roof mounting curb with roof structure.
- B. Coordinate roof-opening locations for mechanical and electrical connections.

1.07 SPECIAL WARRANTY

- A. Warranty on Compressor (and Heat Exchanger): Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, compressors (and heat exchangers) with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only and does not include labor for removal and reinstallation.
 1. Warranty Period: 4-year extension from date of basic 1-year warranty, See Division 01.

1.08 MAINTENANCE

- A. Extra Materials: Furnish to Owner, with receipt, the following spare parts for each rooftop heating and cooling unit:
 1. One set of matched fan belts for each belt-driven fan.

PART 2 - PRODUCTS

2.01 ROOFTOP UNITS (GENERAL)

- A. General Description: Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing a hermetic scroll compressor(s) for cooling duty and heat pump for heating duty. Factory assembled, single piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field startup.
- B. Unit shall be installed in accordance with the manufacturer's instructions.
- C. Unit must be installed in compliance with local, state, and federal codes.
- D. Subject to compliance with the requirements project documents provide packaged rooftop air conditioning unit of one of the following manufacturers:
 1. Carrier Corporation (Basis of Design).
 2. Trane.
 3. York.

- E. Units as manufactured by Carrier are used as the basis of design and their capacities, weights, dimensions, and mechanical, structural, and electrical characteristics, compatibility with existing roof curbs and existing ductwork connection point are scheduled on the drawings and contract documents. Use of alternate units named in this spec requires owner approval. Contractor shall include such approval in their bid documents. By submitting Alternate equipment named in this specification, contractor shall bear all additional cost and responsibility associated with all additional electrical, mechanical, structural, Title-24 energy calculations. Contractor shall be responsible for resubmitting and obtaining DSA approval for all such changes. Contractor shall provide As-built drawing based on the Alternate equipment information at the project closeout.
- F. Carrier units are used as the basis of design and their efficiencies are the bases of energy calculations for Title-24 compliance. Contractor submitting units by other manufacturers named in this specification as alternate shall provide the required Title-24 calculations demonstrating compliance. This effort shall be at no cost to the owner, and all required calculations shall be submitted within 14 calendar days after the award of contract. Job will be awarded on basis of specified product. Alternates must comply with the performance and features as specified within these specifications and indicated on the design documents. Any, and all additional cost due to submission of alternate units for redesign and/or increase in construction cost of other trades and/or re-submittal fee to DSA and authorities having jurisdiction shall be borne by the contractor.

2.02 OPERATING CHARACTERISTICS

- A. Unit shall be capable of starting and running at 125°F. (52°C.) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 340/360 at $\pm 10\%$ voltage.
- B. Compressor with standard controls shall be capable of operation down to 30°F. (-1°C.), ambient outdoor temperatures. Accessory Low Ambient controls are available if mechanically cooling at ambient temperatures below 30°F. (-1°C.).
- C. Unit shall be capable of simultaneous heating duty and defrost cycle operation when using accessory electric heaters.
- D. Unit shall discharge supply air vertically or horizontally as shown on contract drawings.
- E. Unit shall be factory configured for vertical supply & return configurations.
- F. Unit shall be field convertible from vertical to horizontal configuration.
- G. Unit shall be capable of mixed operation: vertical supply with horizontal return or horizontal supply with vertical return.
- H. Electrical Requirements.
 - 1. Main power supply voltage, phase, and frequency must match those required by the manufacturer.

2.03 CONTROLS

- A. Control Module: Unit-mounted digital panel for interlock with the energy management system for heating, cooling, and fan operation. Include the following features (Refer to specification section 23 09 23 and construction document drawings for additional requirements):
 - 1. Low Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg. F. outdoor air temperature.
 - 2. Temperature-Limit Control: Prevents occupant from exceeding preset setup temperature.
 - 3. Building Automation System Interface: Allows remote on-off control with setback temperature control.

2.04 UNIT CABINET

- A. Unit cabinet shall be constructed of galvanized steel and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.
- B. Unit cabinet exterior paint shall be, film thickness, (dry) 0.003 inches minimum, gloss (per ASTM D523, 60°F): 60, Hardness: H-2H Pencil hardness.

- C. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 210/240 or 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2-in. thick, 1 1/2 Lb. density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- D. Base of unit shall have a minimum of three locations for thru-the-base electrical connections (factory-installed or field-installed), standard.
- E. Base Rail
 - 1. Unit shall have base rails on a minimum of 2 sides.
 - 2. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
 - 3. Holes shall be provided in the base rail for moving the rooftop by fork truck.
 - 4. Base rail shall be a minimum of 16-gauge thickness.
- F. Condensate pan and connections:
 - 1. Shall be a sloped condensate drain pan made of a non-corrosive material.
 - 2. Shall comply with ASHRAE Standard 62.
 - 3. Shall use a 3/4-in. -14 NPT drain connection, possible either through the bottom or end of the drain pan. Connection shall be made per manufacturer's recommendations.
- G. Top panel:
 - 1. Shall be a single piece on all 04 to 09 models. Two-piece on size 12 models.
 - 2. shall be removable for coil removal.
- H. Electrical Connections
 - 1. All unit power wiring shall enter unit cabinet at a single, factory prepared, knock-out location.
 - 2. Thru-the-base capability.
 - a. Standard unit shall have a thru-the-base electrical location(s) using a raised, embossed portion of the unit base-pan.
 - b. Optional, factory approved, watertight connection method must be used for thru-the-base electrical connections.
 - c. No base-pan penetration, other than those authorized by the manufacturer, is permitted.
- I. Component access panels (standard).
 - 1. Cabinet panels shall be easily removable for servicing.
 - 2. Unit shall have one factory-installed, tool-less, removable, filter access panel.
 - 3. Panels covering control box, indoor fan, indoor fan motor, gas components (where applicable), and compressors shall have molded composite handles.
 - 4. Handles shall be UV modified, composite, permanently attached, and recessed into the panel.
 - 5. Screws on the vertical portion of all removable access panels shall engage into heat resistant, molded composite collars.
 - 6. Collars shall be removable and easily replaceable using manufacturer recommended parts.

2.05 COILS

- A. Standard Aluminum/Copper Coils: on all models.
 - 1. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
 - 2. Evaporator coils shall be leak tested to 150 PSIG. Pressure tested to 450 PSIG and qualified to UL 1995 burst test at 1775 PSIG.
 - 3. Condenser coils shall be leak tested to 150 PSIG. Pressure tested to 650 PSIG and qualified to UL 1995 burst test at 1980 PSIG.

- B. Optional Pre-coated aluminum fin condenser coils: on all models.
 - 1. Shall have a durable epoxy-phenolic coating to provide protection in mildly corrosive coastal environments.
 - 2. Coating shall be applied to the aluminum fin stock prior to the fin stamping process to create an inert barrier between the aluminum fin and copper tube.
 - 3. Epoxy-phenolic barrier shall minimize galvanic action between dissimilar metals.
- C. Optional Copper-fin evaporator and condenser coils: on all models.
 - 1. Shall be constructed of copper fins mechanically bonded to copper tubes and copper tube sheets.
 - 2. Galvanized steel tube sheets shall not be acceptable.
 - 3. A polymer strip shall prevent coil assembly from contacting the sheet metal coil pan to minimize potential for galvanic corrosion between coil and pan.
- D. Optional E-coated aluminum-fin evaporator and condenser coils: on all models.
 - 1. Shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins.
 - 2. Coating process shall ensure complete coil encapsulation of tubes, fins, and headers.
 - 3. Color shall be high gloss black with gloss per ASTM D523-89.
 - 4. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges.
 - 5. Superior hardness characteristics of 2H per ASTM D3363-92A and cross hatch adhesion of 4B-5B per ASTM D3359-93.
 - 6. Impact resistance shall be up to 160 in.-lb (ASTM D2794-93).
 - 7. Humidity and water immersion resistance shall be up to minimum 1000 and 250 hours respectively (ASTM D2247-92 and ASTM D870-92).
 - 8. Corrosion durability shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90.

2.06 BI-POLAR IONIZATION

- A. Each piece of air conditioning unit, so designated on the plans, details, equipment schedules and/or specifications shall contain a plasma ion generator, and the required transformer with bipolar ionization output as noted below.
- B. Effectively killing microorganisms downstream of the bipolar ionization equipment (mold, bacteria, virus, etc.).
- C. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
- D. Reducing space static charges and space particle counts
- E. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition as noted below. Manufacturers not providing the equivalent space kill rates shall not be acceptable.
 - 1. MS2 Bacteriophage (COVID): 99.0% in 10 minutes or less
 - 2. MRSA: 99.5% in 60 minutes or less
 - 3. E. Coli: 99.4% in 30 minutes or less
 - 4. H1N1: 86.6% in 60 minutes or less
 - 5. H1N5: 99.0% in 60 minutes or less
 - 6. Staphylococcus Aureus 91.5% in 60 minutes or less
 - 7. Aspergillus Niger: 97.1% in 60 minutes or less
 - 8. Candida Albicans: 36.0% in 30 minutes or less
 - 9. Pseudomonas Aeruginosa 99.9% in 60 minutes or less
 - 10. Cladosporium 97.7% in 60 minutes or less
 - 11. Dichobotrys Abundans 90.0% in 60 minutes or less
 - 12. Penicillium 95.0% in 60 minutes or less
 - 13. Bacillus Subtilis var Niger 89.3% in 60 minutes or less

- F. The bipolar ionization system shall operate in such a manner that equal amounts of positive and negative ions are produced. Single pole ion devices shall not be acceptable.
- G. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration, or dangerous conditions to the air purification system.
- H. Ionization Equipment Requirements:
 - 1. Each plasma generator with bipolar ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity.
 - 2. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
 - 3. Ionization output when tested in the occupied space shall be between 800 to 1200 ions/cm³.
 - 4. Manufacturer shall demonstrate that no voltage potential exists due to exposed electrical components in the duct system or plenum. Exposed needles protruding into the air stream will not be accepted.
- I. RTU Installation:
 - 1. Ion generators for DX Packaged Rooftop Units shall be brush type needlepoint units similar, to Plasma Air PA600/660 series is designed to be mounted at the fan inlet.
 - 2. The unit shall be rated to treat up to 2,400 CFM or 6 tons nominal capacity. For airflows greater than 2,400 CFM, multiple units shall be utilized.
 - 3. The PA600/660 housing is made from ABS plastic, contains an LED ionization output indicating LED, and an in-line 1 Amp fuse.
 - 4. The unit shall contain two (2) mounting feet and shall be configured so the needles are oriented perpendicular to the flow of air entering the fan wheel.
 - 5. Plasma Air 660 series include integral dry contacts which indicate ionizer functionality to a Building Automation System (BAS).
- J. Certifications:
 - 1. Bipolar ionization units shall be tested and listed by either UL or ETL according to UL Standard 867 – Electrostatic Air Cleaners and/or UL 2998 - Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners.
- K. Electrical Requirements:
 - 1. Ion generators shall contain a built-in power supply and operate on 24V AC and shall connect to the fan and common terminals of the air handling unit served. Ion generators requiring a loose 24V, 120V or 230V transformer or power supply shall not be accepted.
 - 2. Wiring, conduit, and junction boxes shall be furnished and installed by the electrical contractor within housing plenums and shall be UL and NEC NFPA 70 approved.
- L. Bipolar Ionization Control Requirements:
 - 1. All plasma ion generators shall include internal short circuit protection, overload protection, and automatic fault reset. Manual fuse replacement shall not be accepted.
 - 2. Plasma ion generator shall include an external BMS interface to indicate ion generator status and alarm.
- M. BMS Controls: RTU manufacturer shall provide a BACnet MS/TP Communication Interface

2.07 REFRIGERANT COMPONENTS

- A. Refrigerant circuit shall include the following control, safety, and maintenance features:
 - 1. Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb, without removing the valve body.
 - 2. Refrigerant filter drier on each refrigerant circuit.
 - 3. Service gauge connections on suction and discharge lines.
 - 4. Pressure gauge access through a specially designed access port in the top panel of the unit.

5. Suction line accumulator to provide protection in all operating modes from cooling, heating and reverse cycle switching, standard on each refrigerant circuit.
- B. There shall be gauge line access port in the top of the rooftop, covered by a black, removable plug.
 1. The plug shall be easy to remove and replace.
 2. When the plug is removed, the gauge access port shall enable maintenance personnel to route their pressure gauge lines.
 3. This gauge access port shall facilitate correct and accurate condenser pressure readings by enabling the reading with the compressor access panel on.
 4. The plug shall be made of a leak proof, UV-resistant, composite material.
- C. Compressors
 1. Unit shall use one fully hermetic, scroll compressor for each independent refrigeration circuit.
 2. Models shall be available with single compressor designs on 04-07 models, plus additional 2 compressor (stage) models from 08-12 sizes.
 3. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
 4. Compressors shall be internally protected from high discharge temperature conditions.
 5. Compressors shall be protected from an over-temperature and over-amperage conditions by an internal, motor overload device.
 6. Compressor shall be factory mounted on rubber grommets.
 7. Compressor motors shall have internal line break thermal, current overload and high-pressure differential protection.
 8. Crankcase heaters shall be utilized on all models to protect compressor with specific refrigerant charge.
 9. Compressors shall have a 5-year warranty.
- D. Filter Section
 1. Filters access is specified in the unit cabinet section of this specification.
 2. Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation.
 3. Shall consist of factory-installed, low velocity, throw-away 2-in. thick fiberglass filters.
 4. Filter media shall provide minimum efficiency reporting value of MERV 8.
 5. Filters shall be standard, commercially available sizes.
 6. Only one size filter per unit is allowed.

2.08 EVAPORATOR FAN AND MOTOR

- A. Evaporator fan motor:
 1. Shall have permanently lubricated bearings.
 2. Shall have inherent automatic-reset thermal overload protection or circuit breaker.
 3. Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required.
- B. Electric Drive (Direct Drive) X13 – 5 Speed/Torque Evaporator Fan:
 1. Multi speed motor with easy quick adjustment settings.
 2. Blower fan shall be double inlet type with forward curved blades.
 3. Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.
 4. Standard on all 04-06 models.
- C. Belt-driven Evaporator Fan:
 1. Belt drive shall include an adjustable pitch motor pulley.
 2. Shall use sealed, permanently lubricated ball-bearing type.
 3. Blower fan shall be double inlet type with forward curved blades.
 4. Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.
 5. Standard on all 07-12 size models, optional on all 04-06 3-phase models.

2.09 CONDENSER FANS AND MOTORS

- A. Condenser fan motors:
 - 1. Shall be a totally enclosed motor.
 - 2. Shall use permanently lubricated bearings.
 - 3. Shall have inherent thermal overload protection with an automatic reset feature.
 - 4. Shall use a shaft down design on all sizes.
- B. Condenser Fans:
 - 1. Shall be a direct driven propeller type fan.
 - 2. Shall have aluminum blades riveted to corrosion resistant steel spiders and shall be dynamically balanced.

2.10 SAFETIES

- A. Compressor overtemperature, overcurrent.
- B. Loss of charge switch.
 - 1. Units with 2 compressors shall have different sized connectors for the circuit 1 and circuit 2 loss of charge switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.
 - 2. Loss of charge switch shall use different color wire than the high-pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
- C. High pressure switch.
 - 1. Units with 2 compressors shall have different sized connectors for the circuit 1 and circuit 2 high pressure switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.
 - 2. High pressure switch shall use different color wire than the low-pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
- D. Freeze protection thermostat, evaporator coil.
- E. Automatic reset, motor thermal overload protector.

2.11 ELECTRONIC CONTROL

- A. Shall be complete with self-contained low voltage control circuit protected by a resettable circuit breaker on the 24-V transformer side. Transformer shall have 75VA capability.
- B. Shall utilize color-coded wiring.
- C. Shall include a central control terminal board to conveniently, and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, economizer, thermostat, DDC control options, loss of charge, freeze switch, high pressure switches.
- D. Unit shall include a minimum of one 8-pin screw terminal connection board for connection of control wiring.
- E. Shall include integrated defrost system to prevent excessive frost accumulation during heating duty, and shall be controlled as follows:
 - 1. Defrost shall be initiated on the basis-of time and coil temperature.
 - 2. A 30, 60, 90, 120-minute timer shall activate the defrost cycle only if the coil temperature is low enough to indicate a heavy frost condition.
 - 3. Defrost cycle shall terminate when defrost thermostat is satisfied and shall have a positive termination time of 10 minutes.
- F. Defrost system shall also include:
 - 1. Defrost Cycle Indicator LED.
 - 2. Dip-switch selectable defrost time between 30, 60, 90 and 120 minutes. Factory set at 30 minutes.
 - 3. Molded plug connection to insure proper connection.

2.12 ROOF CURB

- A. General: Roof Curb shall be of down-shot arrangement and shall be of an approved manufacturer as indicated on the drawings and specification section 23 05 48 and shall include an insulated panel under compressor section to prevent condensation forming on the bottom. Dimensions shall be provided to allow for each duct location and connection to roof curb prior to unit placement. Roof curb shall be a minimum of 14 in. high, except otherwise noted on drawings. Curb design shall comply with National Roofing Contractors Association requirements. Roof curb must be a manufactured pitched roof curb when applicable. If the manufacturer of the roof curb cannot provide a pitched roof curb due to the excessive slope of the roof, provide a structural leveling platform, then install a level roof curb at no additional cost to the owner. Coordinate this effort with work of all other trades involved.
- B. Isolation Roof Curb Type: Roof Curbs shall be of Prefabricated Isolation Curb type. Unit manufacturer shall furnish spring isolation curbs specifically designed for the air conditioning units. Isolation curb isolators must be pre-approved OSHPD (HCAi). Pre-approval number must be included with the submittal. OSHPD (HCAi) approval numbers must be included with the submittal. Numbers subject to approval will not constitute pre-approval. Springs must be a minimum of 2" deflection with seismic restraint. Curb shall have access doors for easy inspection and adjustment of each spring without dismantling any portion of the unit or curb assembly. Isolation curb must include a vandal-proof, galvanized steel counter-flashing skirt to assure long-term air and water seal integrity. Exposed rubber skirt seals are not acceptable. Curb and flashing shall be fully welded. Field assembled and bolted construction not acceptable. Seismic attached (hold-down) clips with certified calculations by a registered California Structural Engineer shall be furnished with the isolation curb. Installation prior to submittal approval by mechanical engineer shall be subject to removal without any cost or obligation to the Owner. The contractor shall not install any unit without written approval.
- C. Roof curb must be a manufactured pitched roof curb when applicable. If the manufacturer of the roof curb cannot provide a pitched roof curb due to the excessive slope of the roof, provide a structural leveling platform at no additional cost to the owner, then install a level roof curb. Coordinate this effort with work of all other trades involved.

2.13 POWER EXHAUST AND ECONOMIZER

- A. Power exhaust shall have a modulating centrifugal blower provided with variable frequency drive (VFD). Economizer control (Down-shot) shall include return air (R.A.) and outdoor air filter and hood, and fully modulating electric control system with O.A. thermostat and mixed air thermostat. Economizer control shall be capable of introducing up to 100% outdoor air. Power Exhaust shall be capable of relieving 100% of system air. The control changeover from mechanical cooling to economizer operation shall be fully automatic through an adjustable integrated control sensing pre-assigned outside air requirements. Economizer shall be integrated type capable of simultaneous compressor and economizer operation for maximum benefit of outdoor air. Economizer shall utilize low leakage, opposing blade, gear driven dampers with UL approved gears.
- B. Provide economizer control for all units unless specifically indicated otherwise. Economizer shall incorporate a full-sized barometric relief that has the same face area as the outside air inlet. The relief shall be sized to relieve up to 100% relief air.

2.14 THERMOSTAT SHALL:

- A. Have capability to energize 2 different stages of cooling, and 2 different stages of heating, manual and automatic changeover, fan control and integrated time delay protection.
- B. Include capability for occupancy scheduling.

2.15 MANUFACTURERS

- A. Subject to compliance with the requirements project documents provide packaged rooftop air conditioning unit of one of the following manufacturer's:
 - 1. Carrier Corporation (Basis of Design).
 - 2. Trane.

3. York.
- B. Carrier Corporation units are used as the basis of design and their efficiencies are the bases of energy calculations for Title-24 compliance. Contractor submitting units by other manufacturers named in this specification as alternate shall provide the required Title-24 calculations demonstrating compliance. This effort shall be at no cost to the owner, and all required calculations shall be submitted within 14 calendar days after the award of contract. Job will be awarded on basis of specified product. Alternates must comply with the performance and features as specified within these specifications and indicated on the design documents. Any and all additional cost due to submission of alternate units for redesign and/or increase in construction cost of other trades and/or re-submittal fee to City authorities shall be bonded by the contractor.

2.16 CONTROLS

- A. Control Module: Unit-mounted digital panel for interlock with the energy management system for heating, cooling, and fan operation. Include all the following features:
 1. All requirements set forth in Control Drawings.
 2. All requirements set forth in Specification Section 23 09 23 "Direct Digital Control System for HVAC."
 3. Low Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg. F. outdoor air temperature.
 4. Temperature-Limit Control: Prevents occupant from exceeding preset setup temperature.
 5. Building Automation System Interface: Allows remote on-off control with setback temperature control.
- B. Remote Control: Standard unit-mounted controls with remote-mounted, low-voltage adjustable thermostat with heat anticipator, heat-off-cool-auto switch, and on-auto fan switch.

2.17 CAPACITIES AND CHARACTERISTICS

- A. Outdoor Air-Intake Rate: Unit outdoor air-intake rates shall be per equipment schedules on contract document drawings.
- B. Cooling Capacity: Unit cooling capacities shall be per equipment schedules on contract document drawings.
- C. Energy-Efficiency Ratio: Minimum unit Energy-Efficiency (EER) or Seasonal Energy Efficiency (SEER) Ratios shall be per equipment schedule on contract document drawings.

2.18 BI-POLAR IONIZATION

- A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a plasma ion generator with bipolar ionization output as noted below.
- B. Effectively killing microorganisms downstream of the bipolar ionization equipment (mold, bacteria, virus, etc.).
- C. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
- D. Reducing space static charges and space particle counts.
- E. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition as noted below. Manufacturers not providing the equivalent space kill rates shall not be acceptable.
 1. MS2 Bacteriophage (COVID): 99.0% in 10 minutes or less
 2. MRSA: 99.5% in 60 minutes or less
 3. E. Coli: 99.4% in 30 minutes or less
 4. H1N1: 86.6% in 60 minutes or less
 5. H1N5: 99.0% in 60 minutes or less
 6. Staphylococcus Aureus 91.5% in 60 minutes or less

7. Aspergillus Niger: 97.1% in 60 minutes or less
 8. Candida Albicans: 36.0% in 30 minutes or less
 9. Pseudomonas Aeruginosa 99.9% in 60 minutes or less
 10. Cladosporium 97.7% in 60 minutes or less
 11. Dichobotrys Abundans 90.0% in 60 minutes or less
 12. Penicillium 95.0% in 60 minutes or less
 13. Bacillus Subtilis var Niger 89.3% in 60 minutes or less
- F. The bipolar ionization system shall operate in such a manner that equal amounts of positive and negative ions are produced. Single pole ion devices shall not be acceptable.
- G. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration, or dangerous conditions to the air purification system.
- H. Ionization Equipment Requirements:
1. Each plasma generator with bipolar ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity.
 2. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
 3. Ionization output when tested in the occupied space shall be between 800 to 1200 ions/cm³.
 4. Manufacturer shall demonstrate that no voltage potential exists due to exposed electrical components in the duct system or plenum. Exposed needles protruding into the air stream will not be accepted.
- I. RTU Installation:
1. Ion generators for DX Packaged Rooftop Units shall be brush type needlepoint units similar-to Plasma Air PA600/660 series is designed to be mounted at the fan inlet.
 2. The unit shall be rated to treat up to 2,400 CFM or 6 tons nominal capacity. For airflows greater than 2,400 CFM, multiple units shall be utilized.
 3. The PA600/660 housing is made from ABS plastic, contains an LED ionization output indicating LED, and an in-line 1 Amp fuse.
 4. The unit shall contain two (2) mounting feet and shall be configured so the needles are oriented perpendicular to the flow of air entering the fan wheel.
 5. Plasma Air 660 series include integral dry contacts which indicate ionizer functionality to a Building Automation System (BAS).
- J. Certifications:
1. Bipolar ionization units shall be tested and listed by either UL or ETL according to UL Standard 867 – Electrostatic Air Cleaners and/or UL 2998 - Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners.
- K. Electrical Requirements:
1. Ion generators shall contain a built-in power supply and operate on 24V AC and shall connect to the fan and common terminals of the air handling unit served. Ion generators requiring a loose 24V, 120V or 230V transformer or power supply shall not be accepted.
 2. Wiring, conduit, and junction boxes shall be furnished and installed by the electrical contractor within housing plenums and shall be UL and NEC NFPA 70 approved.
- L. Bipolar Ionization Control Requirements:
1. All plasma ion generators shall include internal short circuit protection, overload protection, and automatic fault reset. Manual fuse replacement shall not be accepted.
 2. Plasma ion generator shall include an external BMS interface to indicate ion generator status and alarm.
- M. BMS Controls: RTU manufacturer shall provide a BACnet MS/TP Communication Interface.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which rooftop units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

- A. General: Install rooftop units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Support: Install and secure roof curb to roof structure, in accordance with National Roofing Contractors Association (NRCA) installation recommendations and shop drawings. Install and secure rooftop units on curbs and coordinate roof penetrations and flashing.
 - 1. Provide substructure as required to set curbs plumb and level.
- C. Electrical Connections: Refer to Section "Electrical Connections for Equipment" for final connections to equipment and installation of loose shipped electrical components.
- D. Unit protection: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, or the period of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, provide temporary closure of duct openings and protection of mechanical equipment during construction. All duct and other related air distribution component openings shall be covered with polyethylene film, tape, plastic, sheet metal or other methods acceptable to the enforcing agency which will prevent entrance of dust and debris.

3.03 DEMONSTRATION

- A. Start-Up Services:
 - 1. Provide the services of a factory-authorized service representative to start-up rooftop units, in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements.
 - 2. Replace damaged or malfunctioning controls and equipment. Provide written start-up report for each unit.
- B. Operating and Maintenance Training:
 - 1. Provide two (2), four-hour training classes by manufacturer's service representative to instruct Owner's personnel on how to operate and maintain the rooftop unit.
 - 2. Video Tape each class and provide three (3) digital copy of each class to the Owner at the end of each class.
 - 3. Training provided by manufacturer's service representative to instruct Owner's personnel in operation and maintenance of rooftop units shall include start-up and shutdown, servicing and preventative maintenance schedule and procedures, and trouble-shooting procedures plus procedures for obtaining repair parts and technical assistance. Review operating and maintenance data contained in the Operating and Maintenance Manuals specified in Division One.

END OF SECTION

SECTION 23 82 00
SEQUENCE OF OPERATION

PART 1 - GENERAL

1.01 ROOFTOP UNITS (HP-1 & HP-2)

- A. Indoor Fan: During Occupied periods, fan shall operate continuously. During Unoccupied periods, fan shall operate when the space temperature exceeds the unoccupied heating or cooling set-points. The fan operates at single speed and provides on/off operation.
- B. Heating Mode: When space temperature is below the occupied heating set-point, unit shall operate in the heating mode. Unit shall stage available heat stages to satisfy demand in the occupied space.
- C. Cooling Mode: When space temperature is above occupied cooling set-point, unit shall operate in the cooling mode. Unit shall enable available cooling stages to satisfy demand in the occupied space. Outside air shall be used as the first stage of cooling based on Economizer operation.
- D. Economizer: Economizer dampers shall close when fan is off or during a loss of power. During occupied hours, when fan is energized, the economizer shall open to adjustable minimum position equal to provide the minimum outside air value shown on the equipment schedule or per requirements of the occupied space Co2 sensor. When outside air temperature is 5 ° F. below space temperature set-point and occupied space requires cooling, economizer shall open to 100% and provide 100% outside air as the first stage of cooling. When economizer air is not sufficient to meet the occupied space cooling demand, economizer shall close to provide only the minimum outside air required per equipment schedule or per requirements of the occupied space Co2 sensor and then unit shall enable available cooling stages to satisfy demand in the occupied space.
- E. Co2 Control: Unit shall monitor space Co2 during when the supply fan is energized. When Co2 is above set-point, economizer shall modulate open toward an adjustable maximum Co2 position.
- F. Filter Status: When the pressure across the filter bank exceeds the set-point of the differential pressure switch, an alarm indicates a dirty filter.

1.02 INTERLOCK SCHEDULE FOR EXHUAUST FANS EF-1 THRU EF-6

Sequence Of Operation For EF-1 thru EF-6		
EF Unit	Interlock	Area Served
EF-1	HP-1	Girl's RR 103
EF-2	HP-2	Boy's RR 113
EF-3	Space Lighting / Occupancy Sensor	Girl's PE Coach RR 105
EF-4	Space Lighting / Occupancy Sensor	Boy's PE Coach RR 115
EF-5	HP-1	Janitor 102
EF-6	HP-2	Janitor 112

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 26 01 00

GENERAL ELECTRICAL SPECIFICATIONS

1.1 WORK INCLUDED:

- A. This specification shall apply to all phases of Work hereinafter specified, shown on Drawings, or as required to provide a complete installation of electrical systems for this Project. Work required under this specification, is not limited to just the Electrical Drawings - refer to Architectural, Structural, Landscape, and Mechanical / Plumbing Drawings, as well as all other drawings applicable to this project, which designate the scope of work to be accomplished. The intent of the Drawings and Specifications is to provide a complete and operable electrical system that includes all documents that are a part of the Contract.
1. Work Included. Furnish labor, material, services and skilled supervision necessary for the construction, erection, installation, connections, testing, and adjustment of all circuits and electrical equipment specified herein, or shown or noted on Drawings, and its delivery to the Owner complete in all respects ready for use.
 2. The electrical Work includes installation or connection of certain materials and equipment furnished by others. Verify installation details, installation and rough-in locations from the actual equipment or from the equipment shop drawings.
- B. Electrical Drawings. Electrical Drawings are diagrammatic, and are intended to convey the scope of work, indicating intended general arrangement of equipment, conduit and outlets. Follow Drawings in laying out Work and verify spaces for installation of materials and equipment based on actual dimensions of equipment furnished.

1.2 QUALITY ASSURANCE

- A. Design, manufacture, testing and method of installation of all apparatus and materials furnished under requirements of these specifications shall conform to latest publications or standard rules of the following:
- Institute of Electrical and Electronic Engineers - IEEE
 - National Electrical Manufacturers' Association - NEMA
 - Underwriters' Laboratories, Inc. - UL
 - National Fire Protection Association - NFPA
 - Federal Specifications - Fed. Spec.
 - American Society for Testing and Materials - ASTM
 - American National Standards Institute - ANSI
 - National Electrical Code - NEC
 - National Electrical Safety Code - NESC
 - Insulated Cable Engineers Association - ICEA
 - American Institute of Steel Construction - AISC
 - State and Municipal Codes In Force In The Specific Project Area
 - Occupational Safety and Health Administration (OSHA)
 - Electronics Industries Association/ Telecommunications Industry Association (EIA/TIA)
 - California Electrical Code (where adopted)
 - Local Authority Having Jurisdiction (AHJ) Published Electrical Standards and Codes

GENERAL ELECTRICAL REQUIREMENTS
26 00 00 - 2

- B. Perform Work in accordance with the National Electrical Code, applicable building ordinances, and other applicable codes, hereinafter referred to as the "Code." The Contractor shall comply with the Code including local amendments and interpretations without added cost to the Owner. Where Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.
 - 1. Comply with all requirements for permits, licenses, fees and codes. The Contractor, at Contractor's expense, shall obtain all permits, licenses, fees, special service costs, inspections and arrangements required for Work under this contract, unless otherwise specified.
 - 2. Comply with requirements of the applicable utility companies serving this Project. Make all arrangements with utility companies for proper coordination of Work.

1.3 GENERAL REQUIREMENTS

- A. Guarantee: Furnish a written guarantee for a period of one (1) year from date of acceptance.
- B. Wherever a discrepancy in quantity or size of conduit, wire, equipment, devices, circuit breakers, etc., (all materials), arises on the Drawing and/or Specifications, the Contractor shall be responsible for providing and installing all material and services required by the strictest condition noted on Drawings and/or in Specifications to ensure complete and operable systems as required by the Owner and Engineer.
- C. All Core Cutting, Drilling, and Patching:
 - 1. For the installation of work under this Section, the aforementioned shall be performed under this Section of the Specifications and the Concrete section of the Specifications.
 - 2. No holes will be allowed in any structural members without the written approval of the Project's Structural Engineer.
 - 3. For penetrations of concrete slabs or concrete footings, the work shall be as directed in the Concrete Section of Specifications.
 - 4. The Contractor shall be responsible for patching and repairing surfaces where he is required to penetrate for work under this contract.
 - 5. Penetrations shall be sealed to meet the rated integrity of the surface required to be patched and repaired. The patched surface shall be painted or finished to match the existing surface.
- D. Verifying Drawings and Job Conditions:
 - 1. This Contractor shall examine all Drawings and Specifications in a manner to be fully cognizant of all work required under this Section.
 - 2. This Contractor shall visit the site and verify existing conditions. Where existing conditions differ from Drawings, adjustment(s) shall be made and allowances included for all necessary equipment to complete all parts of the Drawings and Specifications.

1.4 WORK IN COOPERATION WITH OTHER TRADES

- A. Examine the Drawings and Specifications and determine the work to be performed by the electrical, mechanical and other trades. Provide the type and amount of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested and ready for use. This shall include all conduit, wire, disconnects, relays, and other devices for the required operation sequence of all electrical, mechanical and other systems or equipment.
- B. Provide a conduit only system for low voltage wiring required for control of mechanical and plumbing equipment described in this or other parts of the Contract Documents. Install all control housings, conduits and backboxes required for installing conductors and wire to the controls.
- C. Install separate conduits between each heating, ventilating and air conditioning sensing device and its control panel and/or control motor. Before installing any conduit for heating, ventilating and air conditioning control wiring, verify the exact requirements from the control diagrams provided with the equipment manufacturer's shop drawings.

1.5 TESTING AND ADJUSTMENT

- A. Upon completion of all electrical work, this Contractor shall test all circuits, switches, light fixtures, lighting control & dimming systems including distributed systems, motors, circuit breakers, motor starters and their auxiliary circuits and any other electrical items to ensure perfect operation of all electrical equipment.
- B. Equipment and parts in need of correction and discovered during such testing, shall be immediately repaired or replaced with all new equipment and that part of the system shall then be retested. All such replacement or repair shall be done at no additional cost to the Owner.
- C. All circuit(s) shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.
- D. All test reports, including copies of any required Energy Code Acceptance Forms (e.g. CA Title 24 Acceptance for Code Compliance Forms) should be submitted to the Engineer at completion of project.

1.6 IDENTIFICATION

- A. Nameplates shall be provided for unit substations, switchgear, switchboards, distribution boards, distribution panels, panel boards, motor control centers, transformers, transfer switches, contactors, starters, disconnect switches, enclosed circuit breakers/switches, Inverters, UPSs, PDUs, RDCs, Lighting Control Panels, Dimming Panels, Door Releasing System Panels, Fire Alarm / Central Monitoring terminal cabinets/power supplies/control panels, and all low voltage system terminal & control cabinets. Nameplate inscriptions shall be identical to the equipment designations indicated in plans and specifications.

All circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDU output circuit breakers and motor control centers shall have individual nameplates located immediately adjacent to the respective device. Nameplate inscription shall identify the downstream equipment or device served by the circuit breaker or fuse.

Nameplates for contactors, starters, disconnect switches, and enclosed circuit breakers shall be

engraved with the device designation/identification on the top line, source identification for the device on the 2nd line and load designation for the device on the bottom line. Where device designation is not indicated on plans/specifications, Contractor shall submit a written clarification request to the Engineer.

- B. Identification nameplates, UON, shall be laminated 1/8" thick micarta with beveled edges and engraved white letters 3/8" high, minimum, on 1-1/2" high black background for single line of text. Where two lines of text are required, provide min. 2" high nameplate. Where three lines of text are required, provide min. 2.5" high nameplate.
- C. Identification nameplates for new switchgear, switchboards, distribution boards, distribution panels, panel boards & motor control centers shall be attached with switchgear manufacturer-provided screws via switchgear manufacturer factory pre-drilled holes. A factory option to rivet identification nameplates to the equipment is only acceptable if screw-fastened nameplates are not an available option from the switchgear manufacturer. Field drilling or other mechanical attachment methods that change/void the NEMA or NTRL rating of the enclosure are strictly forbidden.
- D. Identification nameplates for transformers, transfer switches, disconnect switches, enclosed circuit breakers/switches, Inverters, UPSs, PDUs, RDCs, Lighting Control Panels, Dimming Panels, Door Releasing System Panels, Terminal cabinets and all circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDUs, PDU output circuit breakers, and motor control centers shall be attached to the equipment by self-adhesive backing integral to the nameplates. When equipment is located outdoors, provide nameplates without self-adhesive backing and attach to equipment using weather-rated, UV- resistant epoxy. In all cases, clean surfaces before applying identification nameplates parallel to equipment lines.
- E. Warning Placards, as required by General Single Line Diagram Notes for multiple power sources, or Instruction Placards, as required for all kirk-key interlock schemes, all UPS bypass procedures or as required elsewhere in the plans/specifications shall be self-adhesive, 1/8" thick micarta with beveled edges, engraved 1/2" high white lettering on a Red background. Warning/Instruction Placards shall be attached to the face of the equipment directly related to the placards. Provide a formal placard submittal for review by the Engineer prior to ordering any Warning/Instruction Placards. In all cases, clean surfaces before applying Warning/Instruction Placards parallel to equipment lines.
- F. Receptacles that are part of a UL-listed under floor computer room whip assembly, ceiling and/or cable/ladder tray-mounted receptacles used in lab, manufacturing, commercial kitchen environments or that are serving telcom/data/av racks & cabinets shall have identification nameplates located on the wiring device plate cover. Nameplates shall be self-adhesive, 1/8" thick micarta with beveled edges, engraved 1/4" high white lettering on black background with serving power source, circuit identification and NEMA/IEC receptacle type. Use of two (2) separate nameplates per device plate cover is acceptable. Affix nameplates to be visible when plugs are occupying receptacles.
- G. See wiring device section of this specification for additional wiring device plate cover labeling requirements.
- H. See drawings for panel board schedule directory installation requirements.
- I. See conduit installation section of this specification for conduit labeling requirements.

1.7 FINAL INSPECTION AND ACCEPTANCE

- A. After all requirements of the Specifications and/or the Drawings have been fully completed, representatives of the Owner will inspect the work. Contractor shall provide competent personnel to demonstrate the operation of any item or system to the full satisfaction of each representative.
- B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.

1.8 RECORD DRAWINGS

- A. Drawings of Record: The Contractor shall provide and keep up-to-date, a complete record set of drawings. These shall be corrected daily and show every change from the original Drawings. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case. Upon completion of the work, a set of reproducible Contract Drawings shall be obtained from the General Contractor and all changes as noted on the record set of prints shall be incorporated thereon with black ink in a neat, legible, understandable and professional manner. Refer to the Supplementary General Conditions for complete requirements.

1.9 APPROVALS, EQUALS, SUBSTITUTIONS, ALTERNATIVES, NO KNOWN EQUAL

- A. Approvals: Where the words (or similar terms) "approved", "approval", "acceptable", and "acceptance" are used, it shall be understood that acceptance by the Owner, Architect and Engineer are required.
- B. Equal: Where the words (or similar terms) "equal", "approved equal", "equal to", "or equal by", "or equal" and "equivalent" are used, it shall be understood that these words are followed by the expression "in the opinion of the Owner, Architect, and Engineer". For the purposes of specifying products, the above words shall indicate the same size, made of the same construction materials, manufactured with equivalent life expectancy, having the same aesthetic appearance / style (includes craftsmanship, physical attributes, color and finish), and the same performance.
- C. Substitution: For the purposes of specifying products "substitution" shall refer to the submittal of a product not explicitly approved by the construction documents / specifications.
 - 1. Substitutions of specified equipment shall be submitted and received by the Engineer ten (10) days prior to the bid date for review and written approval. Regulatory Agency approval for all substitutions will be the sole responsibility of the Contractor. To receive consideration, requests for substitutions must be accompanied by documentary proof of its equality with the specified material. Documentary proof shall be in letterform and identify the specified values/materials alongside proposed equal values/materials. In addition, catalog brochures and samples, if requested, must be included in the submittal. ONLY PRE-BID APPROVED PRODUCTS, ISSUED VIA A FORMAL BID ADDENDUM TO ALL BIDDERS, WILL BE ALLOWED ON THE PROJECT. REGARDLESS OF THE APPROVAL ON ANY SUBSTITUTION, ALL BIDS SHALL BE BASED ON THE PRODUCTS EXACTLY AS SPECIFIED. PRICING FOR EACH APPROVED SUBSTITUTION SHALL BE INCLUDED IN THE BID SUBMITTAL AS A SEPARATE LINE ITEM.

2. In the event that written authorization is given for a substitution, after award of contract, the Contractor shall submit to the Engineer quotations from suppliers / distributors of both the specified and proposed equal material for price comparison, as well as a verification of delivery dates that conform to the project schedule.
 3. In the event of cost reduction, the Owner will be credited with 100 percent of the reduction, arranged by Change Order.
 4. The Contractor warrants that substitutions proposed for specified items will fully perform the functions required.
- D. Alternates \ Alternatives: For the purposes of specifying products, "alternatives / alternates" may be established to enable the Owner / Architect / Engineer to compare costs where alternative materials or methods might be used. An alternate price shall be submitted in addition to the base bid for consideration. If the alternate is deemed acceptable, written authorization will be issued.
- E. No Known Equal: For the purposes of specifying products, "No Known Equal" shall mean that the Owner / Architect / Engineer is not aware of an equivalent product. The Contractor will need to submit a "Substitution" item, per the requirements listed above, if a different product is proposed to be utilized.

1.10 SHOP DRAWINGS / SUBMITTALS

- A. Shop Drawings / Submittals shall be submitted in six (6) bound sets accompanied by Letter of Transmittal, which shall give a list of the number and dates of the drawings submitted. Drawings shall be complete in every respect and bound in sets.
- B. The Shop Drawings / Submittals submitted shall be marked with the name of the project, numbered consecutively and bear the approval of the Contractor as evidence that the Contractor has checked the Drawings. Any Drawings submitted without this approval will be returned to the Contractor for resubmission.
- C. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in the Contractor's letter of transmittal. If the substitution is accepted, the Contractor shall be responsible for proper adjustment that may be caused by the substitution. Samples shall be submitted when requested.
- D. Only products listed as "Equal" within the contract documents, along with formally approved "Substitutions" will be reviewed. Products not conforming to these items will not be reviewed and will be returned to the Contractor for re-submittal.
- E. Review comments used in response to shop drawings / submittals are:
- "No Exception Taken" Product approved as submitted.
 - "Furnish As Corrected" Re-submittal not required, although the Contractor shall provide the submitted product with corrections as noted.
 - "Revise And Resubmit" Re-submittal required with corrections as noted.

- “Rejected” Re-submittal required based upon the originally specified product.

F. Shop drawings shall be submitted on the following but not limited to:

- Lighting Fixtures, Lamps and Ballasts.
- Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information.
- Transformers.
- Fire alarm System/Central Monitoring System.
- Wiring Devices.
- Lighting Control System / Dimming System Products.
- Pullboxes and Underground Vaults
- Terminal Cabinets
- Lighting Inverters, UPSs, RDCs, PDUs, Generators, Transfer Switches, TVSS Systems
- Cable Tray, Flexible Cable tray and Cable Runway
- Power Poles and Floor Boxes
- Arc Flash, Short-Circuit & Coordination studies
- All other products called out on drawings that call for shop drawing submittal.

1.11 MAINTENANCE, SERVICING, INSTRUCTION MANUALS AND WIRING DIAGRAMS

- A. Prior to final acceptance of the job, the Electrical Contractor shall furnish to the Owner at least four (4) copies of operating and maintenance and servicing instructions, as well as four (4) complete wiring diagrams for the following items or equipment:
- Lighting Control System / Dimming Systems.
 - Fire alarm system.
 - Transformers.
 - Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with over current device information.
 - Lighting Inverters, UPSs, PDUs, Generators, Transfer Switches, TVSS Systems
- B. All wiring diagrams shall specifically cover the system supplied. Typical drawings will not be accepted. Four (4) copies shall be presented to the Owner.

1.12 INTERRUPTION OF SERVICE OR SERVICE SHUTDOWN:

- A. Any interruption of electrical services, electrical circuits, electrical feeders, signal systems, communication systems, fire alarm systems, etc. required to perform work shall meet the specific prior-approval requirements of the Owner. Such work shall be scheduled with the Owner to be performed at the Owner's convenience.
- B. Interruptions/outages of any of the Owner's systems and services mentioned above shall be scheduled to occur during other than the Owner's normal business hours. Any overtime costs shall be borne by the Contractor.
- C. See drawings for any additional requirements regarding outages, interruption and any temporary services required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials and Equipment: All electrical materials and equipment, including custom-made equipment, shall be new and shall be listed by Underwriter's Laboratories (UL) and bear their label or be listed and certified by a Nationally Recognized Testing Lab (NRTL) that is also recognized by the local Authority-Having-Jurisdiction (AHJ).
- B. Switchgear /Switchboards / Distribution Boards / Motor Control Centers:
 - 1. See general single line notes on single line drawing for more information.
- C. Panel boards - Branch Circuit:
 - 1. See drawings for requirements and panel board schedules; and Specification Section 26 24 16 for additional requirements.
- D. Lighting Fixtures:
 - 1. See drawings for lighting fixture and lamp schedules and additional specifications. Furnish, install and connect a lighting fixture at each outlet where a lighting fixture type symbol (designated on plans) is shown as being installed. Each fixture shall be complete with all required accessories including sockets, glassware, boxes, spacers, mounting devices, fire rating enclosure and lamps.
 - 2. LED Drivers: See lighting fixture schedule notes. All noisy driver shall be replaced at no cost to the Owner.
 - 3. Lamps: See lamp / fixture schedule and lamp / lighting fixture schedule notes.
- E. Wiring Devices:
 - 1. Provide wiring devices indicated per plan. Devices shall be specification grade. Acceptable manufactures are Leviton, Arrow-Hart and Hubbell. Provide all similar devices of same manufacturer, unless indicated otherwise. All device colors shall be from the full range of manufacturer standard color options as selected by the Architect. This selection will be made during the shop drawing review process
 - 2. Receptacles:
 - a. Duplex receptacles shall be specification grade, 20 amperes, 125 volts, 3 wire, side wired with binding screws, parallel slots, U-ground, plaster ears and captive mounting screws. Body shall be phenolic, plastic or bakelite. Receptacles shall be heavy duty, 3-blade current carrying contacts and double wide flat blade ground contacts. Receptacles shall be Arrow-Hart 5242-I, Hubbell 5242-I or Leviton 5242-I or approved equal.
 - b. Single receptacles shall be specification grade, grounding type, side wired, with binding screws, receptacles shall have standard size ivory bakelite base. For circuits consisting of one single receptacle only, ampere rating of receptacle shall be the same as circuit breaker or fuse. 20 ampere, 125 volt receptacles shall be NEMA 5-20R, Arrow-Hart 5721-I.

- c. Kiln receptacles and range receptacles shall be 3-pads, 4-wire, grounding type, rated 50 amperes at 125/250 volts, polarized, Arrow-Hart #5754, and shall be provided with a 2-gang, stainless steel plate, Arrow-Hart #9336.
- d. Dryer receptacles shall be 3-wire, non-grounding type, rated 30 amperes at 125/250 volts, polarized, with "L" shaped and angled straight contacts and ivory bakelite base, Arrow-Hart #9344N with a 2-gang stainless steel plate Arrow-Hart S703.
- e. Ground fault interrupter type receptacles shall consist of a single receptacle and reset device manufactured in a standard configuration for use with a duplex plate. Receptacles shall be feed-thru, 20 ampere, NEMA 5-20R, ivory in color and shall be Leviton 6399-I, or equal. Exterior mounted receptacles shall be weatherproof.
- f. Tamper resistant receptacles shall be 20 amp, 125 volts, Hubbell Cat. No. HBLSG62HI, Nema 5-20R.

F. Switches:

1. Local Switches:

- a. Local switches shall be tumbler type, specification grade, rated 20 amperes at 120-277 volts AC only, with plaster ears, binding screws for side wiring, and standard size composition cups which fully enclose the mechanism. Switches shall be approved for use at currents up to the full rating on resistive, inductive, tungsten filament lamp and fluorescent lamp loads, and for up to 80% of the rating for motor loads. Switches shall be single pole, double pole, 3-way, 4-way, non-lock type. Non-lock type switches shall have ivory handles, and switch shall be Hubbell HBL 1221-I single pole, HBL 1222-I double pole, HBL 1223-I 3-way, and HBL 1224-I 4-way.
- b. All lock type switches shall have metal or nylon key guides with ON/OFF indication, and shall be operable by the same key. Key switches shall be Hubbell 1209
- c. Rotary lock switches shall incorporate a tumbler type lock to prevent unauthorized operation. Lock shall be tumbler type by P & F Corbin, keyed to a HH41 key. Lock switch shall be installed with pin tumblers facing downward. Key shall be removable in all positions. Each device shall be complete with 2 keys. Keys shall be delivered only to the District's Electrical Inspector. Switches shall be rated at 20 amperes, 120-277 volt AC. Switches shall be as follows: single pole switches shall be Arrow-Hart 1191; double pole switches shall be Arrow-Hart 1192; 3-way switches shall be Arrow-Hart 1193. Switch plates shall be of stainless steel, engraved with "ON" and "OFF" positions. Switch plates shall be Arrow-Hart 1187. For switch plates of 2 or more gangs, provide special order plates equal to the single gang plate.
- d. Pilot light switches shall be rated 20 amps and shall conform to the specifications for "local switches". The switches shall have red, rugged "Lexan" handles that are lighted by long-lasting neon lamps. Pilot light shall light when

- load is on. Single pole, 120 volt switches shall be Hubbell HBL1221-PL. Single pole, 277 volt switches shall be Hubbell HBL1221-PL7.
- e. Remote control switches for mechanically held contactors arranged for 3-wire control shall be tumbler type, momentary contact, single pole, 3-position with center "OFF", rated 20 amperes at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclose mechanism, and ivory handles; Hubbell HBL1556-I.
2. The following device plates shall be engraved:
- a. Key operated switches, switches with Pilot Lights and Switches for the control of motors, heaters and ventilators. Engraving shall be black and occur on the exposed side of the plate and indicate the motor, heater, or ventilator controlled.
 - b. Receptacles on generator and/or UPS power shall have custom stamped plates with the words "Generator" or "UPS" in black letters.
3. Weatherproof Outlet Covers/Assemblies. All Receptacles identified as weatherproof on the drawings shall be GFCI type and equipped as follows:
- a. Subscript WP-A: Recessed wall box, 6" x 6"x 5 1/2" deep, with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed raintight while-in-use. Unit shall comply with NEC, or CEC where adopted, Article 406.8(A) and (B). C.W. Cole TL-310-9-GFI-PH-MOD-CUSTOM COLOR Series with an interior metal plate suitable for a GFCI receptacle in one compartment separated from a second compartment with a metal separation barrier. The second compartment shall have a blank metal plate suitable for field installation of power, AV or communications devices. This compartment shall have a minimum 3/4" C.O. with pull string routed from the box to the facility telephone backboard unless otherwise noted on the drawings. Provide 1 key minimum per device to the Owner's project manager upon completion of project. Include all costs for custom color powder coat finish as selected by Architect.
 - b. Subscript WP-B: Wet location-listed raintight while-in-use cast copper-free aluminum lockable cover with baked aluminum lacquer finish and one gang GFCI receptacle. Hubbell WP26M series. Polycarbonate covers are unacceptable. Unit shall comply with NEC, or CEC where adopted, Article 406.8(A) and (B). Contractor shall field paint custom color as selected by Architect.
 - c. Subscript WP- C: Single Service BK Lighting #CUS-1204-46 raintight while-in-use cast copper-free aluminum lockable cover with baked aluminum lacquer finish and one-gang GFCI receptacle. Hubbell WP26M series or equal. Polycarbonate covers are unacceptable. Wet location-listed weatherproof cover shall comply with NEC, or CEC where adopted, Article 406.8(A) and (B). Contractor shall provide custom color by manufacturer as selected by Architect. See drawings for additional details.
 - d. Subscript WP-D: Dual Service BK Lighting #CUS-1204-47 with raintight while-in-use cast copper-free aluminum lockable cover(s) with baked

aluminum lacquer finish, internal barrier, one gang GFCI receptacle and one gang telecommunications outlet. Hubbell WP26M series. Polycarbonate covers are unacceptable. Wet location-listed weatherproof cover(s) shall comply with NEC, or CEC where adopted, Article 406.8(A) and (B). Contractor shall provide custom color by manufacturer as selected by Architect. See drawings for additional details.

- G. Motor Controllers / Starters: See drawings for motorized equipment schedules and specifications.
- H. Circuit Breakers:
 - 1. Service entrance circuit breakers smaller than 400 Amp frame shall be thermal-magnetic trip with inverse time current characteristics unless otherwise indicated below. Service entrance main circuit breakers, 400 Amp frame and larger shall be 100% rated, solid-state type as outlined in this specification. All other service entrance circuit breakers, 400 Amp frame and larger, shall be 100% rated, solid-state type as outlined in this specification.
 - 2. All non-service entrance circuit breakers 225 Amp and larger shall be thermal magnetic type and have continuously adjustable magnetic pick-ups of approximately 5 to 10 times trip rating. Breakers shall have easily changed trip rating plugs with trip ratings as indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Additionally, all non-service entrance circuit breakers, 600 Amp frame and larger, located in 480v 3 phase, 3-wire or 277/480v, 3 phase 4-wire switchgear, distribution boards or panel boards, shall be solid state, 100% rated. Breaker shall have built-in test points for testing long delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120-volt operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400 Amp and above - at the Engineer's request.
 - 3. All non-service entrance circuit breakers less than 225 Amp shall be molded plastic case, air circuit breakers conforming to UL 489. Provide breakers with thermal magnetic trip units, and a common trip bar for two- or three-pole breakers, connected internally to each pole so tripping of one pole will automatically trip all poles of each breaker. Provide breakers of trip-free and trip-indicating bolt-on type, with quick-make, quick-break contacts. Provide single two- or three-pole breaker interchangeability. Provide padlocking device for circuit breakers as shown on the Drawings.
 - 4. Where a Current Limiting Circuit Breaker (CLCB) is indicated on drawings or as required elsewhere in this specification, provide a U.L. listed current limiting thermal magnetic circuit breaker(s) u.o.n. An independently operating limiter section within a molded case is not allowed. Coordinate CLCB ratings as required to protect electrical system components on the load side of the CLCB to include, but not limited to, protecting automatic transfer switches, panel boards and lighting control panels.
 - 5. Where a solid-state circuit breaker is indicated on drawings or as required elsewhere in this specification, provide a solid-state circuit breaker with minimum five function complete with built-in current transformers. The five functions shall be independently adjustable and consist of Overload/Long Time Amp Rating, Long Time Delay, Short Time Delay, Short Circuit/Instantaneous Pickup, but may also include Shunt Trip and/or

Ground Fault if so indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Breaker shall have built-in test points for testing long delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120-volt operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400 Amp and above - at the Engineer's request.

6. Ground Fault Interrupting Breakers. Provide with molded plastic case, air circuit breakers, similar to above with ground fault circuit interrupt capability, conforming to UL Class A, Group 1.
 7. Arc Fault Interrupting Breakers. Provide with molded plastic case, air circuit breakers, similar to above with arc fault circuit interrupt capability, conforming to UL 1699 & UL Class A, Group 1. Provide on all-dwelling unit circuits supplying bedrooms, sleeping quarters etc as required to comply with NEC, or CEC where adopted, Article 210.12(B).
 8. Tandem or half-sized circuit breakers are not permitted.
 9. Series Rated Breakers. UL listed series rated combinations of breakers can be used to obtain panelboard-interrupting ratings shown on Drawings. If series rated breakers are used, switchboards, distribution boards and panel boards shall be appropriately labeled to indicate the use of series rated breakers. Shop drawing submittal shall include chart of U.L. listed devices, which coordinate to provide series rating.
 10. Circuit breakers shall be standard interrupting construction. Panelboard shall accept standard circuit breakers up to 225 amperes.
 11. Circuit breaker handle accessories shall provide provisions for locking handle in the on or off position.
 12. Shunt trip equipped circuit breakers shall be provided on all elevator feeders.
 13. Temperature compensating circuit breaker(s) shall be provided when located in outdoor enclosure(s) or when located in an enclosure subject to high ambient heat due to nearby industrial processes etc.
 14. Provide 75 degree Celsius-rated conductor lugs/lug kits as required on all circuit breakers to accept conductor quantities and sizes shown on drawings.
 15. All circuit breaker terminations shall be suitable for use with 75 degrees Celsius ampacity conductors.
- I. Disconnect Switches:
1. Non-fusible or fusible, heavy-duty, externally operated horsepower-rated, 600V A.C. Provide NEMA 3R, lockable enclosures for all switches located on rooftops, in wet or damp areas and in any area exposed to the elements.
 2. Fusible switches shall be Class "R".
 3. Amperage, Horsepower, Voltage and number of poles per drawings- all of which shall be clearly marked on the switch nameplate.

4. Provide the Owner's project manager with one (1) spare set of fuses and two (2) sets of fuse clips/fuses for every set of fuses on the project.

J. Fuses:

1. Provide fuses at all locations shown on the Drawings and as required for supplemental protection.
 - a. Fuses shall be manufactured by Bussman, Shawmut, or equal.
 - b. All fuses shall be the product of a single manufacturer.
2. Main and Feeder Protection.
 - a. Where rating of protective device is greater than 600A, provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.
 - b. Where rating of protective device is 600A or less, provide Bussman Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
3. Motor Protection.
 - a. Where rating of protective device is greater than 600A, provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.
 - b. Where rating of protective device is 600A or less, provide Bussman Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
 - c. Where fuses feeding motors are indicated but not sized, it shall be the responsibility of the Contractor shall coordinate the fuse size with the motor to provide proper motor running protection.
 - d. When rejection type fuses are specified (Class RK series) the fuse holder of all switches (specified in other Sections) shall be suitable for the fuses provided.

K. Cable Tray, Flexible Cable Tray and/or Cable Runway:

1. See drawings for Cable Tray, Flexible Cable Tray and/or Cable Runway specifications.

L. Lighting Control / Dimming Systems:

1. See drawings for lighting Control and/or Dimming Systems schedules and specifications.
2. Wall box dimmers shall be rocker-type as manufactured by Lutron - no known equal. Dimmers and dimmer faceplates shall match the color of adjacent switches and faceplates. Dimmers and dimmer faceplates in wood finished areas shall generally be black unless otherwise indicated by the Architect. The Contractor shall obtain written approval of the Architect regarding final dimmer and dimmer faceplate color selection prior to ordering material. Multiple dimmers/switches shall be ganged together with a common cover plate. Provide dimmers as follows:

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| a. | Incandescent: | Lutron DIVA DV-10P or DV-103P (3-way) (1000 Watt max.) |
| b. | Electronic Low Voltage: | Lutron DIVA DVELV-300P or DVELV-303P-(3-way) (300 Watt) |
| c. | Magnetic Low Voltage: | Lutron DIVA DVLV-10P or DVLV-303p (3-way) (800 Watt max.) |
| d. | Fluorescent (3-Wire): | Lutron DIVA DVF-103P (single/3way, 8A @ 120v) or DVF-103P-277 (single/3way, 6A @ 277v) |
| e. | Fluorescent (0-10V): | Lutron DIVA MW-DV. |
| f. | Fluorescent (LutronTu-Wire): | Lutron DIVA DVFTU-5A3P with Lutron H.P. module where required. |
| g. | Fan Control: | Lutron DIVA DVFSQ-F (1.5A @ 120V. max, 3 speed, single pole, 3-way) |

Contractor shall verify if dimmer(s) requires derating when ganged. Provide Lutron H.P. module, Lutron Power Boosters, and/or Lutron Interfaces where required to accommodate loads higher than dimmers' standard or derated load carrying capacity. .

M. Fire Alarm System/Central Monitoring System:

1. See drawings for Fire Alarm System or Central Monitoring System specifications.

Q. Fire Alarm, Clock, Security Intrusion Detection, Public Address, and Telephone Systems wiring shall be continuous from terminal cabinets or from equipment to each device. Splices are not allowed between devices and/or terminal cabinets at junction and pull boxes. Wiring shall be terminated at approved terminal blocks only.

R. All systems of wiring shall be so installed that, when completed, systems will be free from short circuits and grounds, other than required grounds. Electrical contractor shall include in his bid cost of services an approved independent testing laboratory to test all feeders insulation resistance.

The tests to be performed are as follows:

1. With a megger insulation tester, use the time-resistance method (Sometimes referred to as absorption test) to test each feeder and branch circuit wire. Tests must be conducted with wire disconnected at each end in order to test the wire itself. A second test must be conducted with the wire connected at each end and the circuit breakers or switches in the closed positions.
2. Tests shall be performed in presence of the District Electrical Inspector.

Three copies of the test results shall be submitted to the District Electrical Inspector. Test results shall be submitted on an official form from the independent testing laboratory showing project location, test engineer, test conditions, test equipment data,

and final test results.

S. Outlet Boxes and Fittings:

1. Outlet boxes used in concealed work shall be galvanized steel, pressed or welded type, with knockouts.
2. In exposed work, outlet boxes and conduit fittings required where conduit runs change direction or size, shall be cast metal with threaded cast hubs cast integral with box or fitting. Boxes and fittings shall not have unused spare hubs except as otherwise indicated or specified.
3. Fittings shall be cast metal and non-corrosive. Ferrous metal fittings shall be cadmium plated or zinc galvanized. Castings shall be true to pattern, smooth, straight, with even edges and corners, of uniform thickness of metal, and shall be free of cracks, gas holes, flaws, excessive shrinkage and burnt-out sand.
4. Covers for fittings shall be galvanized steel or non-corrosive aluminum and shall be designed for particular fitting used.
5. Light fixture outlets shall be 4" octagon, 4" square, 2 1/8" deep or larger, depending upon number of wires or conduits therein, and shall be equipped with 3/8" malleable iron fixture studs, and plaster rings. Plaster rings shall have round opening with 2 ears drilled 2-23/32" center to center.
6. For local switch outlets use 4" square 2 1/8" deep, boxes for single gang, 5" square boxes for two-gang, and special solid gang boxes with gang plaster ring for more than 2 switches.
7. For all receptacle, clock, bell, fire alarm pull station, speaker, thermostat, telephone, and data outlets, use 4" square, 2 1/8" deep boxes or larger, if necessary, with single gang plaster rings. For television outlets, use 4-gang deep boxes and 4-gang plaster rings.
8. Plaster rings shall be provided on all flush mounted outlet boxes except where otherwise indicated or specified. All plaster rings shall be same depth as finished surface.
9. In existing plywood wall or drywall construction, and where flexible steel conduit is fished into walls, one-gang and two-gang outlets for wiring devices may be sectional steel boxes with plaster ears. Boxes shall be fastened to plywood with a flat head screw in each plaster ear screw hole.
10. Factory made knock-out seals shall be installed to seal all box knock-outs which are not intact.
11. At each location where flexible conduit is extended from a flush outlet box, provide and install a weather-proof universal box extension adapter.

T. Junction and Pull-Boxes:

1. Junction and pull-boxes, in addition to those indicated, shall only be used where absolutely necessary with specific direction of the District's Electrical Inspector in each

case.

2. Interior and non-weatherproof boxes shall be constructed of blue or galvanized steel with ample laps, spot welded, and shall be rigid under torsional and deflecting forces. Boxes shall have auxiliary angle iron framing where necessary to ensure rigidity. Covers shall be fastened to box with a sufficient number of brass machine screws to ensure continuous contact all around. Flush type boxes shall be drilled and tapped for cover screws at Site if boxes are not installed plumb. All surfaces of pull and junction boxes and covers shall be given one coat of metal primer, and one coat of aluminum paint.
3. Weatherproof pull and junction boxes shall conform to foregoing for interior boxes with following modifications: Cover of flush mounting boxes shall have a weather-tight gasket cemented to and trimmed even with cover all around. Surface or semi-flush mounting pull and junction boxes shall be UL approved as rain-tight and shall be complete with threaded conduit hubs. All exposed portions of boxes shall be galvanized and finished with a prime coat and coat of baked-on gray enamel.
4. All junction and pull-boxes shall be rigidly fastened to the structure and shall not depend on conduits for support.
5. Underground Concrete Pull Boxes:
 - a. Precast Concrete Pull Boxes. Concrete pull boxes shall be traffic type, reinforced for H-20 Traffic bridge loading, Precast concrete. Pull boxes with inside dimensions 2'-0"x 3'-0" x 3'-0"D shall consist of a base section, top ring and cover. Base section shall have two 10"x10" knockouts in each 3'-0" side, and one 20"x20" knockout in each 2'-0" side. Pull boxes with inside dimension 4'-0 x 4'-0"x 4'-0"D shall consist of a base section, mid section, topping, and cover. Base section shall have two 8"x 16" knockouts on each of two opposite sides, and one 20" x 20" knockout on each of the other two opposite sides. All pull boxes shall have a minimum of 6" diameter sump knockout, and 1" diameter ground rod knockout. In each pull box, furnish and install cable racks on walls. Each rack shall be equipped with 3 porcelain cable holders on a vertical steel mounting bar. Each pull box shall have 3/4" diameter pull irons. Covers shall be traffic type consisting of steel safety plate bolted to frame. Covers shall be marked "Electrical", "Power" "Telephone", "Signal" or "Ground", as required. Pull boxes shall be as manufactured by Quickset, or approved equal.
 - b. Provide end bells in all duct entrances. Terminate each metal conduit with insulated bushing having grounding terminal, O.Z. Type "Big".
 - c. Place pulling irons on opposite walls and below horizontal centerlines of ducts and bricked-up openings, and in bottom. Install pulling irons with each end hooked around a reinforcing bar.
 - d. Install a floor drain in every concrete pullbox into a sump containing 10 cubic feet of 1" crushed rock; minimum size 48" deep and 36" diameter. Provide 36" length of tile pipe extending down into the sump. Provide a grille over the top opening of pipe.
 - e. Install a 3/4" diameter, 10'-0" copperweld steel ground rod in every power concrete pull-box. Locate near a wall with 6" projection above floor for

ground clamps. Permanently and effectively ground all metal equipment cases, cable racks, etc., in all pull boxes.

- f. Provide a 6" deep sand base under each pull box.
 - g. Identify all power and signal cables by tagging in all manholes and pull boxes. Tie securely to cables with nylon cord or insulated type TW wire. Tie so that turns of wires do not form a closed electrical circuit.
 - h. Top of steel plate shall have a minimum coefficient of static friction of 0.5 for either wet or dry conditions, when tested for any shoe sole material. Testing and certification of the friction factor shall be conducted by an independent testing laboratory approved by the engineer, under the direction of a registered Civil or Quality Engineer. Testing shall conform to ASTM D1047 or F489 or F609, or other procedure approved by the Engineer.
6. Underground utility boxes shall be reinforced concrete with non-setting shoulders to prevent settlement following installation. Boxes shall be furnished with cast iron cover with finger hole, size as indicated on Drawings. Utility boxes shall be as manufactured by Quickset, or approved equal.
7. Manholes, vaults and pull-boxes required by utility company, and installed by Electrical Contractor, shall meet all requirements of utility company.
- U. Plywood Backboards: Where indicated for telephone or communications system terminals or other equipment assemblies, provide backboards of size indicated. Use 3/4" thick x 8' tall (length per plans), Douglas Fir, void-free, kiln-dried, fire-rated plywood finished on one side and prime coat painted on all surfaces with finish coat of enamel paint, color by Architect. Leave one (1) fire-rating stamp/sheet exposed for inspection.
- V. Terminal Cabinets:
- 1. Terminal cabinets shall be fabricated of hot dipped galvanized code gauge sheet metal for flush or surface mounting, complete with barriered sections, a door for each vertically barriered section and sizes as indicated on plan. Doors shall be hinged and lockable. Locks shall be keyed to match the branch circuit panelboards. Terminal cabinet trims shall match the branch circuit panels.
 - 2. Provide each terminal cabinet with a full size plywood backboard.
 - 3. Terminal cabinets shall be installed complete with full-length skirts of the same construction and finish as the terminal cabinet.
 - 4. Where mounted outdoors, terminal cabinets shall be NEMA 3R, weatherproof complete with gaskets and required sealant to prevent moisture from entering the terminal cabinet.
 - 5. All terminal cabinets and terminal cabinet barriered sections shall be labeled by the cabinet or cabinet section use (i.e. CATV, Security, etc). Labels shall be Micarta type as specified elsewhere in these specifications. Unless otherwise noted, all termination blocks and cables shall be labeled per ANSI/EIA 606 standard.

- W. Painting: Terminal cabinets, panels, junction boxes, pull boxes, etc., and conduit installed in public view shall be painted with colors selected by the Architect to match the subject surface. Refer to painting section of the specifications for additional requirements.
- X. Seismic Design and Anchoring of Electrical Equipment:
1. Seismic Protection Criteria: All Electrical and Mechanical machinery installations provided, as part of this contract located in any Seismic Risk Zone of the Uniform Building Code Seismic Risk Map shall be protected from earthquakes in accordance with the International Building Code and, as applicable, the state and local building codes and regulations. Protection criteria for these zones shall be a Horizontal Force Factor as prescribed by the IBC, or locally adopted building codes, multiplied by the machinery weight considered passing through the machinery center of gravity in any horizontal direction. Unless vibration isolation is required to protect machinery against unacceptable structure transmitted noise and/or vibration, machinery shall be protected from earthquakes by rigid structurally sound attachment to the load supporting structure. The force factor and anchorage shall be determined by calculations performed and submitted to the Architect by a professional engineer registered in state where the work is being performed (civil or structural) hired by the Contractor. The Contractor shall be responsible for the design of seismic restraint systems for all pieces of equipment weighing over 50 pounds including but not limited to the following:
 - a. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, and Panel boards.
 - b. Conduits/Conduit support trapezes
 - c. Transformers
 - d. Light Fixtures
 - e. Inverters, UPSs, RDCs, PDUs, Generators, Transfer Switches
 - f. Cable Tray, Flexible Cable Tray, Ladder Tray
 - g. Bus Duct
 2. Seismic protection, labor, materials and design shall be included in the Contract sum.
- Y. Trenching and Backfilling: Contractor shall be responsible for trenching and backfilling. Refer to Trenching and Backfilling section of the specifications for complete requirements.

PART 3 - EXECUTION

3.1 PREPARATION AND INSTALLATION

- A. Installation of Conduit and Outlet Boxes:
1. All conduit installed in the dry walls or ceilings of a building shall be steel tube (EMT), aluminum tube (EMT), or Intermediate Metal Conduit (IMC). Flexible conduit shall not be used in lieu of EMT, IMC or rigid conduit except as noted herein.
 2. Galvanized rigid conduit (GRC) or intermediate metal conduit (IMC) shall be used as follows:
 - when noted on the drawings.
 - when considered exposed to damage by the local AHJ.

- when installed in wet or damp locations and of a trade size where listed-raintite fittings, connectors, couplings etc. are unavailable.
 - when required by NEC or CEC Article 517.13.
 - when installed in concrete and masonry. The use of ENT in CMU walls and parking structures may be allowed only as directed in writing by the Engineer. Request for ENT substitution must be made prior to bid and in accordance with pre-bid substitution requests requirements of these specifications.
3. Intermediate metal conduit (IMC), is approved for use in all locations as approved for GRC or EMT and in accordance with NEC, or CEC where adopted, Article 342.
 4. Flexible steel conduit shall only be permitted to be used at light fixture outlets and connections to vibrating electrical equipment. All flexible steel conduit runs shall be less than 6'-0". All outdoor installation shall be made using liquid-tight flex with approved fittings. Include a separate insulated green ground conductor sized per NEC in each conduit. Other uses of flexible conduit shall be allowed only as approved in writing by the Engineer.
 5. Flexible liquidtight conduit shall be installed in lieu of the flexible steel; where required by the NEC, or CEC where adopted, in damp and wet location, where exposed to weather, in refrigerated area (65°F or less), and/or between seismic joints. All rotating electrical equipment shall be supplied with flexible, liquid-tight conduit with appropriate slack and shall not exceed thirty-six (36) inches. Include a separate insulated green ground conductor sized per NEC in each conduit. Other uses of liquidtight flexible conduit shall be allowed as approved in writing by the Engineer on a case by case basis.
 6. Rigid metallic conduit installed underground or embedded in concrete shall be 1" trade size minimum and shall be wrapped with 20 mil polyvinyl chloride plastic tape, PVC conduit installed underground or embedded in concrete shall be 3/4 " minimum trade size.
 7. Where required for providing an Electrical Circuit Protective System to comply with NEC, or CEC where adopted, Articles 695 and 700, utilize UL listed 2-hour fire-rated, RHH-RHW conductors in conduit.
 8. Conduit shall be run so as not to interfere with other piping fixtures or equipment.
 9. The ends of all conduits shall be cut square, carefully reamed out to full size and shall be shouldered in fitting.
 10. No running threads will be permitted in locations exposed to the weather, in concrete or underground. Special union fittings shall be used in these locations.
 11. Where conduit is underground, under slabs or grade, exposed to the weather, or in wet locations, make joints liquid tight and gas tight.
 12. All metal conduit in masonry and concrete and where concealed under floor slabs shall have joints painted with thread compound prior to makeup.

13. PVC conduit shall not be run in walls.
14. Where conductors enter a raceway or a raceway in a cabinet, pull box, junction box, or auxiliary gutter, the conductors shall be protected by a plastic bushing type fitting providing a smoothly rounded insulating surface.
15. Where conduit extends through roof to equipment on roof area, this Contractor shall provide flashing material compatible with the roofing system as required by the roofing specifications or as required by the Owner's roof warranty. This flashing shall be delivered to the roofing contractor for installation. The actual location of all such roof penetrations and outlets shall be verified by the Architect/Owner. Contractor shall verify type of flashing prior to bid and include all costs.
16. All conduit shall be supported at intervals not less than 6'-0" and within 12" from any outlet and at each side of bends and elbows. Conduit supports shall be galvanized, heavy stamped, two-hole conduit clamp properly secured.
17. Where conduit racks are used the rack shall consist of two piece conduit clamps attached to galvanized steel slotted channels, properly secured via threaded rods attached directly to the building structure.
18. Nail-in conduit supports, one-piece set screw type conduit clamps or perforated iron for supporting conduit shall not be used.
19. Seismic Conduit Support:
 - a. All conduit shall be supported in such a manner that it is securely attached to the structure of the building. Attachment is to be capable of supporting the tributary weight of conduit and contents in any direction. Maximum spacing of support and braces are to be as follows:

<u>CONDUIT SIZE</u>	<u>MAXIMUM SPACING</u>
1/2" to 3"	6'-0"
3-1/2" to 4"	8'-0"
20. All conduit runs shall be installed parallel or perpendicular to walls, structural members, or intersection of vertical planes and ceilings. Field made bends and offset shall be avoided where possible. Crushed or deformed raceway shall not be installed.
21. Open knockouts in outlet boxes only where required for inserting conduit.
22. Locate wall outlet of the same type at same level in all rooms, except where otherwise noted.
23. Outlet boxes on metal studs shall be attached to metal hangers, tack welded or bolted to studs; on wood studs attachment shall be with wood screws, nails not acceptable.
24. Recessed boxes shall not be mounted back-to-back in any wall; minimum offset shall be 24 inches.
25. Junction Boxes that do not contain any device(s) shall be located in storage rooms,

electrical closets, or above accessible ceilings, not in hard lid ceilings or other forms of inaccessible ceilings. Place boxes which must be exposed to public view in a location approved by the Owner's Project Manager. Provide covers or plates to match adjacent surfaces as approved by the Owner's Project manager.

26. Surface mounted pull boxes, terminal cabinets, junction boxes, panel boards etc., shall be attached to walls using appropriate screws, fasteners, backing plates, stud blocking etc., as detailed on Architectural and/or Structural drawings. If architectural and/or Structural drawings are not provided on the Project, Contractor shall provide all necessary mounting hardware and backing support to comply with local building code requirements and any additional requirements imposed by the local Authority-Having-Jurisdiction.
27. Except where below grade, sleeves shall be installed where conduit passes through masonry or concrete walls and shall be 24 gauge galvanized steel no more than 1/2" greater in diameter than the outside diameter of the conduit. When located in non-rated structures, caulk conduit sleeve with stone wool. When located in fire rated structures, provide U.L. listed fire stopping system. See fire stopping section of this specification for additional requirements.
28. All boxes shall be covered with outlet box protector, Appleton SB-CK, or similar device / method to keep dirt / debris from entering box, conduit or panels. If dirt / debris does get in, it shall be removed prior to pulling wires.
29. All boxes installed outdoors shall be suitable for outdoor installations, gasketed, screw cover and painted as directed by the Architect with weatherproof paint to match building.
30. All conduit entries to outdoor mounted panels, cabinets, boxes, etc., shall be made using Myers "SCRU-TITE" hubs Series ST.
31. Provide nylon or a 1/8-inch O.D. polyethylene rope, rated at 250 pounds tensile strength, in all conduits more than 5 feet in length left empty for future use. Not less than 5 feet of rope shall be left at each end of the conduit. Tag all lines with a plastic tag at each end indicating the termination/stub location of the opposite end of the conduit.
32. All multiple conduit runs within suspended ceilings shall be suspended from building structure by means of unistrut hangers/racks, Conduit shall not be allowed to lay on ceiling or be supported from ceiling suspension wires or other suspension system. Support conduit to structure above suspended ceilings 8" minimum above ceiling to allow removal of ceiling tile. Maintain two-inch clearance above recessed light fixtures
33. All exposed conduits and support hardware shall be painted to match the finish of the wall or ceiling to which it is supported.
34. Where conduits or wireways cross seismic joints, provide approved flexible conduit connection or approved expansion/deflection fitting to allow for displacement of conduit in all three axes. Connection shall allow for movement in accordance with design of seismic joint. Non-flexible raceways crossing expansion joints or other areas of possible structural movement shall make provision for 3-way movement at such

points by means of expansion/deflection fittings. Fittings shall be installed in the center of their axes of movement and shall not be deflected to make part of a conduit bend, or compressed or extended to compensate for incorrect conduit expansion/deflection fittings(s) complete with ground jumpers.

Where necessary, provide approved expansion joints to allow for thermal expansion and contraction of conduit(s). Install expansion joints complete with ground jumpers.

35. Seal all conduits where termination is subject to moisture or where conduit penetrates exterior wall, floor or roof, in refrigerated areas, classified (hazardous areas) and as indicated on the drawings.
36. Except as otherwise indicated on the Drawings or elsewhere in these specifications, bends in feeder and branch circuit conduit 2 inches or larger shall have a radius or curvature of the inner edge, equal to not less than ten (10) times the internal diameter of the conduit. Except where sweeping vertically into a building where sweep radius equals ten (10) times conduit diameter, underground communications and building interconnect conduits 3 inches or larger shall have a minimum 12'-6" radius or curvature of the inner edge. For the serving utilities, radius bends shall be made per their respective specifications.
37. Tag all empty conduits at each accessible end with a permanent tag identifying the purpose of the conduit, footage end-to-end, and the location of the other end. In wet, corrosive outdoor or underground locations, use brass, bronze, or copper 16 gauge tags secured to conduit ends with #16 or larger galvanized wire. Inscribe on the tags, with steel punch dies, clear and complete identifying information.
38. The following additional requirements shall apply to underground conduits:
 - a. Underground conduit shall be Schedule 40 PVC (polyvinyl chloride) unless otherwise indicated elsewhere in these specifications or as required per NEC, or CEC where adopted Article 517.13.
 - b. In all cases, where any conduit(s) pass under a building slab or footing, the electrical contractor will provide a Bentonite clay or concrete barrier that conforms to the height and width of the trench excavation and is a minimum of 18" thick. In all cases, where conduit(s) pass thru a sleeve in a footing or other foundation element, the electrical contractor will provide a Bentonite clay or concrete barrier between the sleeve and the conduit(s) surrounding the conduit(s) for the entire depth of the sleeve. The barrier is required to prevent passage of moisture under or thru the slab or footing via the trench or sleeve.
 - d. Where underground conduit passes under a building slab, concrete encasement may not be required, except as required above, contact the Engineer for written direction prior to omitting any encasement.
 - e. Underground conduits, which terminate inside building(s) below grade, such as in a basement level, or which slope so that water might flow into interior building spaces, shall be sealed at the point of penetration with a modular conduit seal (Link-Seal or equal by Rox Systems). Conduit/conduit sealing system penetrations of waterproofing membranes/systems on existing structures shall be completely restored as required to maintain

membrane/system manufacturer and installer warrantee for the installation. All conduits shall be provided with a 4% slope away from buildings. All conduits shall be installed such that the water cannot accumulate in the conduit and such that water drains into the nearest manhole, pull box or vault – not into the facility. In instances where grade changes or elevation differences prevent sloping of conduit away from a building into the nearest manhole, pull box or vault or where accumulation of water in a manhole, pull box or vault may result in water traveling into the facility, conduits shall be sealed internally at each end of each conduit using conduit sealing bushing, sized as required for the conductors contained within the conduit (O-Z Gedney #CSBG 100psig withstand or equal). In all cases, install plugs or caps in spare (empty) conduits at both ends of each conduit (Jackmoon or equal) able to seal both water and gas from entering the facility via the conduits.

- f. All conduits installed underground shall be entirely encased in concrete 3" thick on all sides with multiple conduits spaced not less than 1-1/2" apart, except where otherwise specified. Provide approved conduit spacers as required to prevent any deflection of conduits when concrete is placed and to preserve position and alignment of conduits in concrete. Conduits shall be tied to spacers. Anchors shall be installed to prevent floating of conduits during pouring of concrete. Red concrete shall be used to encase conduits of systems operating above 600 volts.
- g. All underground conduits shall be buried to a depth of not less than 24" below finished grade to top of the concrete envelope, unless otherwise specified.
- h. Assemble sections of conduit with approved fittings and stagger all joints. Cut ends of conduit shall be reamed to remove all rough edges. Joints in all conduits shall be made liquid-tight. All bends at risers shall be completely below surface where possible.
- i. Two or more conduit runs in a common trench shall be separated by at least 1-1/2" of concrete. Electric conduit runs installed in a common trench with other utility lines shall be separated from such lines by at least 12" horizontally. Public telephone conduits shall be separated from electric conduits or other utility lines by not less than 3" of concrete.
- j. The District's Electrical Inspector shall be called to the site for approval of all underground installations before and during concrete pour. The Contractor shall demonstrate the usability of the underground raceways installed as part of this contract. a round, tapered, rigid mandrel shall be drawn through each run of conduit in the presence of the District Inspector, and utility company inspector where applicable, before and after pouring concrete. Mandrel shall be 6" in length minimum, and have a diameter which is within 1/4" of the diameter of the conduit to be tested. Contractor shall repair or replace any conduit(s) which will not readily pass the mandrel test.
- k. Nonmetallic conduit installations shall comply with following additional requirements: All joints in PVC conduit shall be sealed by means of approved solvent-weld cement supplied by conduit manufacturer. All nonmetallic

conduit bends and deflections shall comply with requirements of applicable electrical code, except that minimum radius of any bend or offset for conduits sized from 1/2" to 1-1/2" inclusive shall not be less than 24". All bends at risers and risers shall be rigid steel conduit. Radius of curve of any bend or offset, in nonmetallic conduit for public telephone system shall be not less than 10 times trade size of conduit, unless otherwise specifically approved by public telephone system.

- l. Furnish and install a 6" wide polyethylene red underground barrier type 12" above full length of concrete "CAUTION ELECTRIC LINE BURIED BELOW".
- m. All underground conduit systems for use by serving utility company shall meet all requirements of utility company.

B. Installation of 600-Volt Conductors:

- 1. All electrical wire, including signal circuits, shall be installed in conduit.
- 2. All circuits and feeder wires for all systems shall be continuous from over current protective device or switch to terminal or farthest outlet. No joints shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.
 - a. Utilize preinsulated "winged" spring type connectors, 3M Company "Performance Plus" #O/B or #R/Y as required for splices and taps in conductors #6 AWG and smaller. When a spring connector is used in an underground environment or when subject to moisture, utilize a 3M Company Scotchcast 3507G epoxy resin connector sealing pack to seal the spring connector.
 - b. Wires #4 AWG and larger AWG shall be joined together as follows:
 - i. When located in an underground environment or when subject to moisture, the splice shall be made with compression connector and sealed by a 3M, or equal, PST cold shrink connector insulator.
 - ii. When located in an interior environment, the splice shall be made with an IlSCO or equal dual rated, insulated splice-reducer connector or multi-tap connector-listed for use with 75/90 degree Celsius rated conductors.
 - c. Connections to busbar shall be made with dual-rated copper/aluminum one-piece compression lugs. Paralleled conductor connections shall be by mechanical lugs.
- 3. Thoroughly clean all conduit and wire-ways and see that all parts are perfectly dry before pulling any wires.
- 4. Install UL approved fixture wire from all lighting fixture lamp sockets into fixture outlet or junction box.
- 5. For 20 ampere branch circuit wiring, increase #12 conductors to #10 for 120 volt circuits longer than 100 feet and for 277 volt circuits longer than 150 feet.

6. Conductor Support. Provide conductor supports as required by codes and recommended by cable manufacturer. Where required, provide cable supports in vertical conduits and provide lower end of conduit with a ventilator.

C. Grounding / Bonding:

1. Provide grounding and bonding for entire electric installation as shown on plans, as listed herein and as required by applicable codes. Included, but not limited to, are items that require grounding / bonding:
 - a. Conduit, Raceways and Cable Trays.
 - b. Neutral or identified conductors of interior wiring system.
 - c. Panel boards, Distribution Boards, Switchgear and Switchboards.
 - d. Non-current carrying metal parts of fixed equipment.
 - e. Telephone distribution equipment.
 - f. Inverters, UPS, PDU, RDC, Transfer Switch and Generator Systems.
 - g. Raised Flooring.
 - h. Antennas.
 - i. Lightning Protection Systems.
 - j. Metal piping installed in or attached to a building/structure.
 - k. Metallically isolated structural steel.
 - l. Metallically isolated underground metal water piping.
 - m. Elevator hydraulic piston/lift case.
2. In multi-occupancy buildings, Contractor shall bond metal water piping systems installed in, under or attached to a building and/or structure serving individual occupancies where the piping system(s) are metallically isolated from each other. Per NEC, or CEC where adopted Art. 250.104(A)(2) and (4), the bonding conductor shall be sized per Table 250.122 and connected to the switchboard/panelboard serving that suite/occupancy.
3. Use of Ground Rods: Furnish and install required number of 3/4" x 10' copper clad ground rods to meet specified resistance, all required grounding wires, conduit and clamps. The size of the grounding conductors shall be not less than that set forth in the latest edition of the California Code of Regulations, Title 24, State of California and NEC (CEC, where adopted), unless otherwise indicated. Rods shall be installed such that at least 10 feet of length is in contact with the soil. Where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from vertical or shall be buried in a trench that is at least 30 inches deep. The upper end of the electrode shall be flush with or below ground level unless the above ground end and the grounding electrode conductor attachments are protected against physical damage. Unless otherwise noted, connection to the grounding electrode conductor may be by compression type or exothermic process connector. Mechanical connectors shall not be used.
4. Grounding System Connection:
 - a. Compression connectors shall be unplated copper, manufactured by Burndy, or approved equal, designed specifically for the intended connection.
 - b. Exothermic weld-type connectors shall be 'Cadweld' manufactured by Erico Products, or approved equal, designed specifically for the intended

connection.

c. Mechanical connectors shall not be used.

5. Isolated Ground Receptacles shall have an insulated ground wire connected between the receptacle and the panelboard isolated ground bus. Unless otherwise noted, this ground wire shall not be grounded at any other point, and shall be distinguished from other ground wires by a continuous yellow stripe.
6. Provide separate green equipment ground conductor in all electrical raceways, to effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and noncurrent carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through #10 AWG. Use NEC (or CEC where adopted) Table 250.122 for conductor size with phase conductors # 8 and larger, if not shown on the Drawings.
7. Clean the contact surfaces of all ground connections prior to making connections.
8. Ductwork. Provide a flexible ground strap, No. 6 AWG equivalent, at each flexible duct connection at each air handler, exhaust fan, and supply fan, and install to preclude vibration.
9. Motors. Connect the ground conductor to the conduit with an approved grounding bushing, and to the metal frame with a bolted solderless lug. Bolts, screws and washers shall be bronze or cadmium plated steel.
10. Building grounding system resistance to ground shall not exceed 25 ohms.

D. Line Voltage and Low Voltage Power Supplies to all Mechanical Equipment Including Plumbing, Heating and Air Conditioning Units;

1. An electric power supply, including conduit, any necessary junction and/or outlet boxes and conductors and connection shall be furnished and installed by this Contractor for each item or mechanical equipment.
2. Power supplies to individual items of equipment shall be terminated in a suitable outlet or junction box adjacent to the respective item of equipment, or a junction box provided by the manufacturer or the equipment and directed by the Mechanical Contractor. Allow sufficient lengths of conductor at each location to permit connection to the individual equipment without breaking the wire run.
3. The location of all conduit terminations to the equipment is approximate. The exact location of these conduit terminations shall be located and installed as directed by the Mechanical and Plumbing Contractor.
4. Provide power supplies to all plumbing and mechanical equipment, including but not limited to, equipment furnished and installed by Owner or Contractor such as heating and air conditioning equipment, pumps, boilers, auto valves, water coolers, trap primers etc. The installation shall produce a complete and operable system.
5. Unless otherwise noted, this Contractor shall furnish and install all conduit, boxes,

wires, etc., for line voltage wiring and low voltage wiring.

6. It is the Contractor's responsibility to verify with the Drawings of other trades regarding the extent of his responsibility for mechanical equipment. The bid must include a sum sufficient to cover the cost of the installation.
 7. The location of all power supply connection and/or terminations to the mechanical equipment is approximate. The exact locations of these terminations shall be verified with other trades during construction.
- E. Prefabricated Equipment: Installation of all prefabricated items and equipment shall conform to the requirements of the manufacturer's specifications and installation instruction pamphlets. Where code requirements affect installation of materials and equipment, the more stringent requirements, code or manufacturer's instructions and/or specifications, shall govern the work.
- F. Firestopping:
1. The Contractor shall be responsible for furnishing all material, labor, equipment, and services, in conjunction with the selection and installation of a complete and fully functioning and code compliant UL-listed fire stop assembly/system(s) as required by project conditions.
 2. Each fire stop assembly/system shall have an "F" and/or "T" rating as required by each condition requiring fire stopping. Each fire stop assembly/system shall have a current U.L. listing, as indicated in the latest edition of the U.L. Fire Resistance Directory. Contractor shall verify acceptability of all fire stopping methods and system selections with the authority having jurisdiction prior to installation. The Contractor shall install each firestop assembly/system in accordance with the manufacturer's printed instructions.
 3. Each fire stop assembly/system shall be labeled with fire stop manufacturer-furnished label on each side of the fire stopping systems depicting UL # etc.
- G. Housekeeping Pads
1. Provide a minimum 3" high housekeeping pad above finished floor/finished grade for all exterior floor mounted switchgear, switchboards, distribution boards, transformers, motor control centers etc flush with the face of the equipment. Provide a minimum 3" high housekeeping pad for all floor mounted switchgear, distribution boards, transformers, motor control centers, transfer switches etc located in mechanical central plant(s) and other mechanical spaces flush with the face of the equipment. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions regarding housekeeping pads are met.
 1. Unless otherwise noted above, provide a minimum 1-1/2" high housekeeping pad above finished floor/finished grade for all interior floor mounted switchgear, switchboards, distribution boards, transformers, motor control centers, transfer switches etc flush with the face of the equipment. All housekeeping pad heights are as measured from finished floor or grade. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions regarding housekeeping pads are met.

2. Provide a 1-1/2" high housekeeping pad above finished floor/finished for service equipment. Prior to pad rough-in, Contractor shall verify serving utility company's maximum meter height requirements and, if necessary, adjust height of housekeeping pad to comply with those requirements. In indoor applications, the pad shall be flush the face of the switchgear. In outdoor applications, the housekeeping pad shall extend a minimum of 4 feet from the front of switchgear/switchboard's weatherproof enclosure. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions regarding housekeeping pads are met.
3. All housekeeping pads located in, on or attached to a building shall be seismically braced/connected to the building structure.

H. Feeder Identification

1. Lighting, power, low voltage feeder wires and cables shall be identified at each point conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of a heat shrink wire marker, which provides terminal strain relief, Raychem Shrinkmark, or Brady Permasleeve markers. Identification in other areas shall be by means of wraparound tape markers Raychem Cable Markers, or Brady Perma-Code. All markers shall include the feeder designation, size and description.

I. Tape

1. Splices, joints and connectors joining conductors shall be covered with insulation equivalent to that on conductors. Free ends of conductors connected to an energized source shall be taped. Voids in irregular connectors shall be filled with insulating compound before taping. Thermoplastic insulating tape approved by UL for use as sole insulation of splices shall be used and shall be applied according to manufacturer's printed specifications.

J. Testing

1. The Contractor shall obtain an independent NETA certified testing service that will provide all instrumentation and tests on the entire campus electrical system and all new and/or existing electrical equipment as hereinafter described and further directed by the Architect. The test shall be performed after the completion of all electrical systems. All tests shall be recorded, documented and submitted to the Architect for review. Submit three (3) copies on an official form indicating project location, test engineer, test conditions, test equipment data, ground system layout or diagram and final test results.
 - a. Test for Phase to Ground/Defective Insulation Condition:
 - Open main service disconnect.
 - Isolate the system neutral from ground by removing the neutral disconnect link located in the service switchboard.
 - Close all submain disconnects.
 - Close all branch feeder circuit breakers.

- Measure the resistance of each phase to ground. A properly calibrated "Megger" type test instrument to be used. The test voltage shall be 500 volts.
 - Record all readings after one-minute duration and document into a complete report.
- b. Isolating Grounds: In the event that low resistance grounds are found in the system, they shall be isolated and located by testing each circuit individually as outlined above. Make proper corrections to restore the resistance values to an acceptable value.
2. Method of obtaining ground resistance shall be in accordance with the latest edition of the James G. Biddle (Plymouth Meeting, Pennsylvania) manual published on this subject.
- a. Perform "fall-of-potential" tests on the main grounding electrode of system per IEEE Standard No. 81, Section 8.2.1.5 when suitable locations for test rods are not available, a low resistance dead earth or reference ground will be utilized.
- b. Perform the two-point method test per IEEE Standard No. 81, Section 8.2.1.1, to determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points, ground rod and building steel, utility piping such as water and gas and panelboard grounds. Metal railings at building entrances and handicap ramps shall also be tested.
- c. Acceptable testing equipment: Vibroground by Associated Research, Inc.; Megger Earth Tester by James G. Biddle Company; or equivalent by Megger.
3. Provide arc flash analysis for all new and existing switchgear on campus, whether or not shown in the Contract Documents and include arc flash hazard labels.
4. Provide a complete circuit breaker coordination study from the main circuit breaker at the main switchboard down to branch circuit breakers at the panelboards. The system shall be fully coordinated such that a fault anywhere in the system will only affect the next circuit protective device ahead of the fault.
5. All instrumentation and personnel required for testing shall be provided by the Contractor at the Contractors expense.
6. All ground fault equipment shall be tested by a certified testing laboratory and shall be set as recommended by the switchgear manufacturer so as to be coordinated with other protection devices within the electrical design. Copies of the coordination test and settings shall be sent to the Architect.
7. Take and record ampere and line voltage measurements under full load on all panels and switchboard feeders and motor circuits over 10 horsepower and/or 14 amperes. Record measurements at the equipment served and submit to the Architect for review.
8. If, in the opinion of the Architect, the voltages and regulations are not met within acceptable limits, make arrangements with the serving utility for proper electrical service and then verify that such has been provided.

GENERAL ELECTRICAL REQUIREMENTS
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9. Refer to testing (additional requirements) elsewhere in this specification for additional testing requirements.
10. The maximum resistance to ground shall not exceed 5 ohms.
11. Upon completion of work, the Contractor shall make additional tests as necessary to satisfy the Owner or the Architect or his representative that the true intent and meaning of the drawings and specifications have been carried out. Contractor shall provide all instruments and labor necessary to make such tests. Any work showing faults under test, and any work not in accordance with the specifications, shall be made good by the Contractor at his own expense. Such tests may occur at anytime during the guarantee period.

END OF SECTION 26 00 00

SECTION 26 01 70
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.

1.2 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. C.E.C. - California Electrical Code.

1.3 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 20 ohms maximum.

1.4 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.
- B. Accurately record actual locations of grounding points.

PART 2 - PRODUCTS

2.1 ROD ELECTRODE

- A. Material: Copper-clad steel.
- B. Diameter: 3/4 inch.
- C. Length: 10 feet.

2.2 MECHANICAL CONNECTORS

- A. Material: Bronze.

2.3 WIRE

- A. Material: Stranded copper.
- B. Foundation Electrodes: 4/0 AWG.
- C. Grounding Electrode Conductor: Size to meet CEC requirements, minimum.

- D. Equipment Grounding Conductor: Size conductors based on CEC Table 250-122.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that final backfill and compaction has been completed before driving electrodes.

3.2 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install rod electrodes at locations indicated.
- C. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.
- D. Provide bonding to meet Regulatory Requirements.
- E. Provide isolated grounding conductor for circuits supplying isolated ground receptacles.
- F. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- G. Raceway Systems: Install metallic raceways mechanically and electrically secure at all joints and at all boxes, cabinets, fittings and equipment. At the point of electrical service entrance, bond all metallic raceways together with a ground conductor and connect to the system ground bus. Bond all boxes for equipment.
- H. Receptacles: Permanently connect the ground terminal on each receptacle to the green ground conductor.
- I. Motors: Connect the ground conductor to the conduit with an approved grounding bushing and to the metal frame with a bolted solderless lug. Bolts, screws, and washers shall be bronze or cadmium plated steel. Remove paint where grounding bushing attaches to the disconnect switch.
- J. Telecom Room: Provide one No. 6 THW copper wire in 21 mm (3/4") conduit from the main telephone cabinet to the grounding system or as indicated on drawings.
- K. Ductwork: Provide a flexible ground strap, No. 6 AWG equivalent, at each flexible duct connection at each air handler, exhaust fan, and supply fan, and install to preclude vibration.
- L. Bond together metal siding and other metal objects not attached to grounded structure; bond to ground.
- M. Bond together each metallic raceway, pipe and duct at least at one point; bond to ground.

3.3 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of potential method.

END OF SECTION 26 01 70

SECTION 26 01 90
SUPPORTING DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Conduit and equipment supports.
- B. Fastening hardware.

1.2 COORDINATION

- A. Coordinate size, shape and location of concrete pads with Section Cast-in-Place Concrete.

1.3 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Support Channel: Galvanized or painted steel.
- B. Hardware: Corrosion resistant.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Use expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- B. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- C. Do not use powder-actuated anchors.
- D. Do not drill structural steel members without Structural Engineer approval.
- E. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- F. Provide conduit support systems under provisions of Section 26 01 11.

END OF SECTION 26 01 90

SECTION 26 01 95
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Nameplates.
- B. Wire and cable markers.

1.2 SUBMITTALS

- A. Submit shop drawings under provisions of Division 01.
- B. Include schedule for nameplates and tape labels.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.
- B. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.
- C. Conduit label markers: Color coded, weather resistant adhesive backed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Degrease and clean surfaces to receive nameplates.
- B. Install nameplates and tape labels parallel to equipment lines.
- C. Secure nameplates to equipment fronts using screws, or rivets. Secure nameplate to inside face of recessed panelboard doors in finished locations.
- D. Embossed tape will not be permitted for any application.

3.2 WIRE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with panel and branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams equipment manufacturer's shop drawings for control wiring.

3.3 NAMEPLATE ENGRAVING

- A. Provide nameplates to identify all circuits in the service distribution and power distribution panelboards; branch circuit panelboards; separately mounted starting switches; disconnecting switches; motor control push-button stations; selector switches; terminal cabinets; telephone cabinets, etc. Clearly identify on the nameplate the equipment such as "Air Handling Unit AH-1" and "Hot Water Cir. Pump P-1" in lieu of abbreviated plan references such as "AH-1" or "P-1". In addition all voice and data racks, patch panels and workstation outlets will be labeled.
- B. Provide nameplates of minimum letter height as scheduled below.
- C. Panelboards and Switchboards: 1/4 inch; identify equipment designation, voltage rating, and source.
- D. Individual Circuit Breakers In Panelboards and Switchboards: 1/8 inch; identify circuit and load served, including location.
- E. Individual Circuit Breakers, Enclosed Switches and Motor Starters: 1/8 inch; identify voltage rating, ampere rating and load served including location.
- F. HVAC and Plumbing Control Equipment: 1/8 inch; identify equipment designation and equipment served including location.
- G. Communication Terminal Cabinets: 1/4 inch; identify cabinet designation and type of system.
- H. Patch Panels: Will be uniquely numbered in each BDF as follows: Patch Panels A through Z; Patch panel jack numbers 1 thru 48.
- I. Voice/Data workstation outlets: All workstation outlets will clearly labeled to indicate BDF room number, patch panel letter and jack number. Example "15A44" ; Indicating BDF room #15, Patch panel A, jack # 44.

3.4 RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Color for Printed Legend:
 - Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
 - Color: Black letters on orange field.
 - Color tracer on neutral conductors for identification. Legend: Indicate system or service and voltage, if applicable.
 - Control Circuits: Control wire numbers indicated on schematic or interconnection diagrams on shop drawings.

1. Self-Adhesive Vinyl Labels: Pre-printed, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
2. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, 2 inches wide, fade resistant, compounded for outdoor use.
3. Raceway/Conduits Identification Labels:
 - a. All signal systems and lighting systems shall be identified with weather-resistant, fade-resistant labels identifying the system. Each system shall be color-coded as described below.
 - b. Labels shall be placed by Electrical and/or Low Voltage Contractor on every conduit run, within 2 feet of every junction box or connector, and each 10 feet thereafter (1 label per every 10 feet of conduit). Labels shall wrap around conduit and placed for maximum visibility.
 - c. All junction boxes, not otherwise identified, shall have a system identification label on the cover.
 - d. A laminated schedule shall be posted in each electrical, mechanical, and signal room, showing each label and the system it identifies.
 - e. Label Colors:

System Type	Identification	Background	Lettering
Lighting and Power	Standard Voltage	Orange	White
Cable Television	CATV	Brown	White
Clock	CLOCK	Black	White
Data	DATA	Violet	White
Emergency Circuits	EMERG	Yellow	Black
Energy Management System	EMS	White	Black
Fiber Optic System	FIBER	Pink	Black
Fire Alarm	FIRE	Red	White
Independent Public Address	IPA	Gray	White
Security/Intrusion	SECUR	Green	White
Telecommunications	TELECOM	Blue	White

END OF SECTION 26 01 95

SECTION 26 04 40
DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Disconnect switches.
- B. Fuses.
- C. Enclosures.

1.2 REFERENCES

- A. ANSI/UL 198C - High-Intensity Capacity Fuses; Current Limiting Types.
- B. ANSI/UL 198E - Class R Fuses.
- C. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses).
- D. FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted.
- E. NEMA KS 1 - Enclosed Switches.
- F. C.E.C. California Electrical Code.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - DISCONNECT SWITCHES

- A. Square D
- B. Eaton Cutler-Hammer.
- C. GE.

2.2 DISCONNECT SWITCHES

- A. Fusible Switch Assemblies: NEMA KS 1; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: FS W-F-870.
- B. Enclosures: NEMA KS 1; Type 1, for interior dry locations; Type 3R for exterior or wet locations. Furnish 1 padlock and two keys for each disconnect, Master 611 or M-20.
- C. Switch Ratings: Number of poles, voltage, current and horsepower rating as required for installation.

2.3 ACCEPTABLE MANUFACTURERS - FUSES

- A. Littelfuse.
- B. Gould Shawmut.
- C. Bussman.

2.4 FUSES

- A Fuses 600 Amperes and Less: ANSI/UL 198E, Class RK1; current limiting, one-time fuse, 250 volt.
- B. Interrupting Rating: 200,000 rms amperes.
- C. Size fuses based on motor nameplate rating.

PART 3: EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches where indicated on Drawings.
- B. Install fuses in fusible disconnect switches, otherwise required by Code.
- C. Properly align switches and support independent of the connecting raceway.
- D. Provide independent 'Unistrut' (or equal) support for connection to mechanical equipment to maintain access to mechanical equipment and meet code required clearances.

END OF SECTION

SECTION 26 05 19
LOW VOLTAGE POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.1 SECTIONS INCLUDES

- A. Basic conductor / cable types and limitations of usage. Requirements on termination to panels and vertical runs.
- B. Furnish and install proper lugs in all panelboards, switchboards, gutters, etc., required to properly terminate every cable. Where paralleled conductors or conductors of large size are to terminate on a breaker a short length of copper cable (of capacity of the breaker) shall be connected to the breaker, and the proper bolt or compression type lug installed to connect this cable to the feeder cable. The cutting of cable strands to fit the breaker will not be permitted. Lugs shall be Burndy, ILSCO or approved equal.
- C. Vertical cable supports shall be provided in all light and power system runs at all pull boxes or at panelboards in vertical feeders and in all other light and power system runs other than feeders at spacing's not exceeding code requirements. Cable supports shall be with split type impregnated hardwood plugs for synthetic insulated cables, O.Z./Gedney Company Type "S" for voltages to 600 and Type "R" for voltages above 2,000.

PART 2 – PRODUCTS

2.1 COPPER, 600 VOLTS

- A. All conductors shall be delivered to the site in their original unbroken packages, plainly marked or tagged as follows:
 - 1. Underwriters' labels.
 - 2. Size, kind and insulation of wire.
 - 3. Name of the manufacturing company and the trade name of the wire.
 - 4. Month and year when manufactured which date shall not exceed 2 years prior to the date of delivery to the site.
- B. All conductors shall be minimum of 98% conductivity, soft drawn copper. Provide stranded conductor for #8 AWG and larger or when making flexible connections to vibrating machinery. Use compression "fork" type connectors or transition to solid conductors when connecting to switches, receptacles, etc.
- C. Wire shall be single conductor type THHN or THWN insulated with polyvinyl chloride (PVC) and covered with a tough protective sheath of nylon, rated at 600 volts. The wire may be operated at 90° C. maximum continuous conductor temperature in dry locations and 75° C. in wet locations and shall be listed by Underwriters Laboratories under Standard 83 for Thermoplastic Insulated Wires. Conductors shall be solid copper for #10 AWG and smaller conductors and stranded copper for #8 AWG and larger conductors. Each conductor shall be insulated with PVC and sheathed with nylon. Each wire shall be identified by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol, type designations and optional rating. Wire shall be tested in accordance with the requirements of UL Standard for types THWN or THHN.

- C. Conductors shall be solid Class B or stranded Class C, annealed uncoated copper per UL Standards 83 or 1063.
- D. Wire and cable shall be new, manufactured not more than six (6) months prior to installation, shall have size, type of insulation, voltage rating and manufacturer's name permanently marked on outer covering at regular intervals.
- E. Wire and cable shall be factory color-coded by integral pigmentation with a separate color for each phase and neutral. Each system shall be color-coded and it shall be maintained throughout.
- F. Systems Conductor Color Coding:
1. Power 208/120V, 3PH, 4W:
 - (a) Phase A = Black
 - (b) Phase B = Red
 - (c) Phase C = Blue
 - (d) Neutral = White
 - (e) Switchlegs = Purple (Switchlegs shall also be identified separately by numerical tags).
 - (f) Travelers = Purple with Black stripe.
 2. Power 480/277V, 3PH, 4W:
 - (a) Phase A = Brown
 - (b) Phase B = Orange
 - (c) Phase C = Yellow
 - (d) Neutral = Grey
 - (e) Switch legs = Purple (Switchlegs shall also be identified separately by numerical tags).
 - (f) Travelers = Purple with black stripe.
 3. Color Code for Clocks, Program Bells, Program Selector and Fire Alarm System Devices.
 4. Color Code, Signal Systems: Wires for signal systems shall be color coded and shall be installed under direction of the District's Electrical Inspector. Except where otherwise specified, color coding shall be as follows:

SYSTEM
Clocks

COLOR CODE
Pink, Gray and Orange

Program Bells (Elementary Schools)

White (Common)
Black

Program Bells (Secondary Schools)

White (120 volt common)
Black (C.R. Program)
Blue (Shop Program)
Brown (Gym Program)
Yellow (Aud. Fire Alarm)

Fire Alarm Bells or Horns

Black (-) and Red (+)

Fire Alarm Strobe	Brown and Yellow
Fire Alarm System Feeder or Service	Black and White
Fire Alarm Pull Stations (Non-Addressable)	Orange and Blue
Smoke Detectors, Heat Detectors (Non-Addressable)	Red (+) and Yellow (-)
Duct Smoke Detectors (Non-Addressable)	Red (+) and Yellow (-)
Fire Sprinkler Flow Switch (Non-Addressable)	Red (+) and Purple (-)
Fire Sprinkler Tamper Switch (Non-Addressable)	Red (+) and Brown (-)
White Visual Program Signal	Yellow with White Stripes, White (common)
Program Switching Unit	Blue (Hot) White (common) 4 - Black (C.R. Program) 4 - Yellow (Shop Program) 4 - Blue (Gym Program) Blue ("All" Button) 2 - Black (Spares)
Spare Wires	Black

5. Ground Conductors: Green
6. Isolated Ground Conductors: Green with continuous yellow stripe.
7. Fire Alarm System: As recommended by the manufacturer.

- G. All color-coding for #12 thru #6 AWG conductor shall be as identified above. Conductors #4 AWG and larger shall be identified with utilizing phase tape at each termination.
- H. No conductors carrying 120 volt or more shall be smaller than #12 AWG.
- I. Aluminum conductors shall not be used.
- J. Wire-pulling compounds used as lubricants in installing conductors in raceways shall only be "Polywater J". No oil, grease, graphite, or similar substances may be used. Pulling of #1/0 or larger conductors shall be done with an approved cable pull machine. Other methods; e.g. using vehicles and block and tackle to install conductors are not acceptable.
- K. Connectors and terminal lugs shall be used for terminating stranded conductors #8 and larger shall be T&B, ILSCO, or equal, solderless connectors.

PART 3 – EXECUTION

3.1 COPPER, 600 VOLTS

- A. Connectors and terminal lugs shall be used for terminating stranded conductors #8 and larger.
- B. All branch circuit and fixture wiring joints, splices and taps for conductors #10 and smaller shall be made with UL approved connectors listed for 600 volts. Connector bodies shall consist of a cone shape expandable coil spring insert, insulated with Teflon or plastic shell.
- C. Make all connections and splices necessary to properly install and complete the work, and all splices shall be taped. All tape shall be 3M "Scotch" #33 plastic electrical tape. All connections and splices shall be electrically and mechanically perfect, and in strict accordance with all code requirements.
- D. Bolt type solderless connectors shall be tightened and then retightened after 24 to 48 hours before taping. DSA Inspector shall be informed of this procedure during the waiting period and shall witness the act of retightening.
- E. All debris and moisture shall be removed from the conduits, boxes and cabinets.
- F. No oil, grease, or similar substances shall be used to facilitate the pulling in of conductors. Use mineralac, linseed soap or specifically approved wire pulling compound.
- G. Wire in panel cabinets, pull boxes and wiring gutters shall be neatly grouped, taped together with 3M "Scotch" #33 plastic electrical tape, T&B Model Ty-Rap cable strap or laced with #12 standard lacing twine and fanned out to the terminals.
- H. No splices shall be allowed in any cast iron or concrete pull box, unless it is specifically called for on the drawings or it is with the specific written approval of the Architect. When splices are allowed a Thomas & Betts No. HS-LR series watertight heat shrink process jacket over the splice shall be used.
- I. See paragraphs under "Panelboards" as hereinafter specified for branch circuit wiring color code.

END OF SECTION 26 05 19

**SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

PART 1 – GENERAL**1.1 SECTION INCLUDES**

- A. Basic definitions of conduit types and raceway applicable to this project
- B. All raceways shall comply with the requirements of the Underwriter's Laboratories and shall be delivered to the site in standard lengths with each length bearing the manufacturer's trademark or stamp and the Underwriters' label of approval.
- C. Where conduit is mentioned in this Specification, this shall be interpreted as rigid, standard weight steel conduit. Intermediate metal conduit (IMC), electrical metallic tubing, aluminum, polyvinyl-chloride or flexible metallic conduit shall be used only where specified herein or noted on the drawings.
- D. Raceways other than conduit (in the general sense) such as wireways, cable tray, etc., shall only be used when, where and as allowed by the drawings and this Specification and in compliance with the CEC.

PART 2 – PRODUCTS**2.1 CONDUIT**

- A. Galvanized Rigid Conduit (GRC) shall be full weight threaded type steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metallizing, or sherardizing process. All couplings, etc., shall be of the threaded type only.
- B. Intermediate Metal Conduit (IMC), shall be hot-dipped galvanized in accordance with UL 1242 and meeting Federal Specification WWC-581 (latest revision). Couplings, locknuts and bushings for IMC shall be threaded, comparable to those specified for standard weight rigid steel conduit.
- C. Electrical metallic tubing shall be galvanized or sherardized. Couplings and connectors shall be galvanized or cadmium plated, steel or die cast, insulated throat and shall be of the compression type. Approved devices are:

<u>Manufacturer</u>	<u>Connector</u>	<u>Coupling</u>
Appleton	TW-CSI Series	TWC-CS Series
Appleton	86T Series	95T Series
Bridgeport	250-DCI Series	260-DC Series
Regal	601S-606S Series	611-616 Series

- D. Flexible metallic conduit shall be standard or intermediate weight hot dipped galvanized steel and shall have all fittings hot dipped galvanized or sherardized. Fittings shall be the squeeze type. Fittings which use a screw to bind against tubing will not be accepted. Screw-in "Jake" connectors will be accepted only if the conduit is cut "square". Aluminum flexible conduit is not acceptable under this specification.

- D. Neoprene jacketed flexible metallic conduit shall be UL listed, Type UA, liquid tight (sealtite). See this Section under "Execution" for mandatory application of liquid tight flexible conduit. Fittings shall be equal to Appleton "STN" series.
- F. Factory assembled, or off-site assembled wiring systems (such as Metal Clad (MC) Cable, Type AC Cable, Type NM Cable, Type BX Cable, etc...) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing.
- G. When approved for use in the Allowed Specification Deviations Section, generally located on the symbols list drawing, MC cables shall be allowed for lighting branch circuits (homeruns shall be EMT), receptacle branch circuits (homeruns shall be EMT) and poke-thru fed systems furniture homeruns. MC shall not be used where exposed, except for a maximum 6' length for final connections to light fixtures, or terminate in electrical panelboards or distribution boards. Equipment ground conductor shall be green. Isolated ground conductor shall be green with yellow stripe. Provide 600V rated aluminum or lightweight steel interlocking armor Metal Clad (MC) cable with copper conductors, THHN (90 degree C) insulation, and integral equipment grounding conductor and isolated grounding conductor as required. Type AC cable listed for use in patient care areas per NEC or CEC where adopted, Article 517.13 shall be required in such areas in lieu of MC cable. MC cable shall be manufactured to UL Standard 1569. See Execution section of this specification for additional installation requirements.
- H. Nonmetallic Flexible Tubing (ENT) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing. Use of ENT, if allowed, is strictly limited to use in CMU walls and parking structures decks or as directed in writing by the Engineer. See Execution section of this specification for additional installation requirements.
- I. Non-Metallic Conduit:
1. Polyvinyl chloride (PVC) rigid conduit, Schedule 40, Type II for underground installation only with solvent welded joints, conforming to Underwriters Laboratories, Inc. (U.L.) requirements, listed for exposed and direct burial application.
 2. Conduit and fittings shall be produced by the same manufacturer.
- J. Bushings for standard weight rigid steel conduit shall be nonmetallic for 1" and smaller. For conduits 1-1/4" and larger, insulated metallic bushings shall be used. Bushings shall be O. Z. Electrical Mfg. Co., Type "B" regular type or Type "BL" grounding type.
- M. Electrical metallic tubing shall be galvanized or sherardized. Couplings and connectors shall be galvanized or cadmium plated, steel or die cast, insulated throat and shall be of the compression type. Approved devices are:

<u>Manufacturer</u>	<u>Connector</u>	<u>Coupling</u>
Appleton	TW-CSI Series	TWC-CS Series
Appleton	86T Series	95T Series
Bridgeport	250-DCI Series	260-DC Series
Regal	601S-606S Series	611-616 Series

- N. Polyvinyl-chloride (PVC) conduit shall be rigid heavyweight type, Schedule 40, Underwriters' approved, complete with PVC fittings.
- O. Rigid aluminum conduit shall not be used.

2.2 FITTINGS

- A. Condulet type fittings shall be smooth inside and out, taper threaded with integral insulating bushing and of the shapes, sizes and types required to facilitate installation or removal of wires and cables from the conduit and tubing system. These fitting shall be of metal, smooth inside and out, thoroughly galvanized, and sherardized cadmium plated.
- B. Metallic condulet covers shall have the same finish as the fitting and shall be provided for the opening of each fitting where conductors do not pass through the cover.
- C. Connector, coupling, locknut, bushings and caps used with rigid conduit shall be steel, threaded and thoroughly galvanized. Bushings shall be insulated.
- D. U.O.N. all EMT fittings, connectors and couplings installed in concealed locations, areas not considered to be wet or damp locations by the AHJ, or areas not subject to physical damage, shall be steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. Where suitable for use, steel set screw fittings are allowed for trades sizes of 2" and smaller. Insulated throat is not required for fittings, connectors and couplings 1" and smaller.
- E. All interior and exterior EMT fittings, connectors and couplings, 2" and smaller, installed in exposed or concealed locations that are considered by the AHJ to be wet or damp locations, shall be raintite-listed, steel zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. If raintite-listed, steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. If raintite-listed, EMT fittings, connectors and couplings are unavailable for a given trade size or if conduit is installed in an area subject to damage – provide rigid metallic or intermediate metallic conduits, fittings, connectors and couplings as required.
- F. Flexible steel conduit connectors shall be a malleable iron clamp or squeeze type or steel twist-in type with insulated throat. The finish shall be zinc or cadmium plating.
- G. Conduit unions shall be "Erickson" couplings, or approved equal. The use of running threads will not be permitted.

PART 3 – EXECUTION

3.1 CONDUIT INSTALLATION

- A. Rigid Steel and Intermediate Metal Conduit (IMC):
 - 1. Rigid steel conduit shall be used where subject to mechanical injury, where installed in concrete, where used exposed on exterior work and where installed exposed on interior work below 8 feet or where suspended. IMC may be used in lieu of standard weight rigid steel conduit in all cases except for above ground conduits containing conductors operating at over 600 volts.
 - 2. Only rigid steel conduit shall be used above grade for 601 volt and higher circuits.

B. Electrical Metallic Tubing (Steel Tube):

1. Electrical metallic tubing may be used for all interior above ground applications except where noted to be rigid steel or flexible conduit in these Specifications or as noted otherwise on the drawings. All EMT shall have UL label.
2. EMT may be used where installed in floor slab of multi-story construction other than in slab on grade.

C. Flexible Steel Conduit:

1. Flexible steel conduit shall be used only where noted on the drawings, where required for connection to motors, etc., or with the approval of the Architect, where absolutely necessary due to structural conditions.
2. Plastic coated flexible metallic conduit (Sealtite), complete with proper fittings, shall be used in lieu of regular flexible conduit in all areas subject to moisture, dampness, rain; in excessively dusty or dirty areas; where subjected to constant personnel contact; for connections to all kitchen equipment; for connections to all shop equipment and where specifically called for on the drawings.
3. Flexible aluminum conduit shall not be used.

D. PVC Conduit:

1. PVC conduit shall not be used above grade except where it is specifically indicated otherwise herein, or noted on the drawings. All riser ells (as well as all conduit extensions) from PVC systems exposed or extended into masonry walls shall be rigid steel. All other riser ells extending into concealed areas above grade from underground PVC may be EMT or rigid steel at the Contractor's option. The underground portion of all steel ells shall be encased in concrete.
2. Connections, bending, cutting and installation shall be as recommended by the manufacturer.

E. Rigid Aluminum Conduit shall not be used.

F. All conduit of every type, used for electrical systems of 110 volts to ground or higher, shall have a copper ground wire installed therein. See Section under Grounding for sizing of ground wire. Conduit fill shall include the ground wire in all cases. See Section 16450.

G. Conduit shall be concealed, unless otherwise indicated. All conduit runs exposed to view, except those in attic spaces, shall be installed parallel, or at right angles to structural members, walls, or lines of the building.

H. Conduit shall be kept at least 6" from the covering on hot water and steam pipes, and 18" from the covering on flues and breaching. The open ends of all conduit shall be kept closed with approved conduit seals during the construction of the building. Use approved conduit unions where union joints are necessary. Running threads will not be permitted.

- I. Conduit bends, other than factory ells, shall have radius of not less than 10 times the internal diameter of the conduit.

END OF SECTION 26 05 33

SECTION 26 09 23
NETWORK LIGHTING CONTROLS

PART 1 – GENERAL

1.1 SUMMARY

- A. The lighting control system specified in this section shall provide sensor-based (both occupancy and daylight), and manual lighting control.
- B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)
- C. All system devices shall be networked together enabling digital communication and shall be individually addressable.
- D. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.
- E. The system shall not require any centrally hardwired switching equipment.

1.2 SUBMITTALS

- A. Product Datasheets (general device descriptions, part numbers, dimensions, wiring details, nomenclature).
- B. Riser Diagrams – typical per room type (provide detailed drawings showing device interconnectivity of total quantity of devices).
- C. Other Diagrams – as needed for special operation or interaction with other system(s).
- D. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up.
- E. Hardware and Software Operation Manuals.
- F. Other operational descriptions as needed

1.3 QUALITY ASSURANCE

- A. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.
- B. All components and the manufacturing facility where product was manufactured must be ROHS compliant.
- C. The sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.

- D. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

1.4 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
- B. Coordinate lighting controls with BAS where noted on bid documents either through IP based intercommunication of system or hardwired auxiliary relay outputs.
- C. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.5 WARRANTY

- A. All devices in lighting control system shall have a 5 year warranty.

1.6 COMMISSIONING

- A. Provide factory-certified field service engineer to ensure proper system installation and operation under following parameters:
 - 1. Qualifications for factory-certified field service engineer:
 - a. Minimum experience of 2 years training in the electrical/electronic field.
 - b. Certified by the equipment manufacturer on the system installed.
 - 2. Site visit activities:
 - a. Verify connection of power feeds and load circuits.
 - b. Verify connection of controls.
 - c. Verify system operation control by control, circuit by circuit.
 - d. Obtain sign-off on system functions.
 - e. Demonstrate and educate Owner's representative on system capabilities, operation and maintenance

1.7 MAINTENANCE

- A. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.
- B. Make new replacement parts available for minimum of ten years from date of manufacture.
- C. Provide factory direct technical support hotline 24 hours per day, 7 days per week.
- D. Provide on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.
- E. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system commissioning.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. This specification is based on the nLight® Network Control System from Sensor Switch, an Acuity Brands Company (800-727-7483, www.sensorswitch.com).

2.2 SYSTEM REQUIREMENTS

- A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network backbone for remote or time based operation.
- B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.
- C. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.
- D. Devices within a lighting control zone shall be connected with CAT-5e low voltage cabling in any order.
- E. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.
- F. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.
- G. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone "bus power supplies" shall not be required in all cases.
- H. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.
- I. Individual lighting zones shall be capable of being segmented into several "local" channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.
- J. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.
1. Auto-On / Auto-Off (via occupancy sensors)
- Zones with occupancy sensors automatically turn lights on when occupant is detected.

- Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
 - Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.
2. Manual-On / Auto-Off (also called Semi-Automatic)
- Pushing a switch will turn lights on.
 - Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
3. Manual-On to Auto-On/Auto-Off
- Pushing a switch will turn lights on.
 - After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.
 - Sequence can be reset via scheduled (ex. daily each morning) events
4. Auto-to-Override On
- Zones with occupancy sensors automatically turn lights on when occupant is detected.
 - Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
 - Sequence can be reset via scheduled (ex. daily each morning) events
5. Manual-to-Override On
- Pushing a switch will turn lights on.
 - Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
 - Sequence can be reset via scheduled (ex. daily each morning) events
6. Auto On / Predictive Off
- Zones with occupancy sensors automatically turn lights on when occupant is detected.
 - Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
 - If switch is pressed, lights turn off and a short "exit timer" begins. After timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.

- K. System shall provide the option of having pre-terminated plenum rated CAT-5 cabling supplied with hardware.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

- A. Networked System Occupancy Sensors
1. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
 2. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
 3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
 4. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens

for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.

5. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
 - a. Sensors shall be available in multiple lens options which are customized for specific applications.
 - b. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
 - c. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.
 - d. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue
 - e. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
 - f. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
 - g. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
 - h. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
 - i. Fixture mount sensors shall be capable of powering themselves via a line power feed.
 - j. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
 - k. Sensors shall be the following Sensor Switch model numbers, with device options as specified:

Model # Series	Occupancy Poles	# of Relays	Lens Type	Detection Technology
nCM PDT 9	1	-	Standard	Dual
nCM PDT 10	1	-	Extended	Dual
nWV PDT 16	1	-	Wide View	Dual

Note: Recessed

Note: Recessed mount versions of the above ceiling(fixture) mount versions also shall be available (e.g. nCM PDT 9 => nRM PDT9)

- B. Networked System Daylight (Photocell and or Dimming) Sensors
 1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
 2. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
 3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

4. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).
5. Photocell and dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)
6. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
7. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.
8. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.
9. Sensor shall be the following Sensor Switch model numbers, with device options as specified:

nCM PC (on/off))

Note: Recessed mount versions of the above ceiling(fixture) mount versions also shall be available (e.g. nCM PC => nRM PC)

C. Networked System Power (Relay) Packs

1. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
2. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
3. All devices shall have two RJ-45 ports.
4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
6. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
7. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all lighting load types.
8. Power (Relay) Packs and Supplies shall be the following Sensor Switch model Series:
nPP16 (Power Pack w/ 16A relay)

D. Networked System Wall Switches & Dimmers

1. Devices shall recess into single-gang switch box and fit a standard GFI opening.

2. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
3. All sensors shall have two RJ-45 ports.
4. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
5. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
6. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
7. Devices with mechanical push-buttons shall be made available with custom button labeling
8. Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.
9. Wall switches & dimmers shall be the following Sensor Switch model numbers, with device options as specified:
 - nPODM (single on/off, push-buttons, LED user feedback)
 - nPODM 2P (dual on/off, push-buttons, LED user feedback)
 - nPODM 4P (quad on/off, push-buttons, LED user feedback)

E. Networked System Scene Controllers

1. Device shall have two to four buttons for selecting programmable lighting control profiles or acting as on/off switches.
2. Device shall recess into single-gang switch box and fit a standard GFI opening.
3. Devices shall provide LED user feedback.
4. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
5. All sensors shall have two RJ-45 ports.
6. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.
7. Device shall be capable of selecting a lighting profile be run by the system's upstream Gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).
8. Device shall have LEDs indicating current selection.
9. Scene Selector device shall be the following Sensor Switch model number:
 - nPODM 2S (2 Scene, push-button)
 - nPODM 4S (4 Scene, push-button)

2.4 START-UP & SUPPORT FEATURES

- A. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.
- B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.
- C. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.
- D. All system devices shall be capable of being given user defined names.

- E. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.
- F. All sensor devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's installation instructions.
- B. Provide complete installation of system in accordance with Contract Documents.
- C. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.
- D. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.

3.2 CLEANING

- A. Clean all work under provisions of Division 01.
- B. Remove all dust and debris.

3.3 DEMONSTRATION

- A. Provide complete systems demonstration to District personnel for a minimum of two (2) 6 hour demonstrations on different days as dictated by the District.

3.4 AS-BUILT DOCUMENTATION

- A. Provide complete As-built documentation per 260010, 1.3 minimum.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Panel board description, minimum sheet steel, requirements and electrical characteristics.
- B. Panel boards shall be flush or surface mounting as indicated with sub-breakers as shown on panel schedules, hinged lockable doors, index card holders, engraved nameplates and proper bussing. Where indicated on the drawings, panelboards shall be furnished with subfeed breakers and/or lugs, split bussing, contactors, time switches, relays, etc., as required. Each panel shall be complete with a main breaker or a molded case switch of sufficient interrupting capacity.

PART 2 – PRODUCTS

2.1 STEEL GAUGE AND FINISH

- A. All panelboards shall be finished with one coat of zinc chromate and coat of primer sealer after a thorough cleaning where exposed to public view (e.g., corridors, covered passages, offices, etc.) and baked gray enamel in switchboard, janitor's, heater and storage rooms. Primer coated panelboards shall be painted to match surroundings after installation. Panelboards shall be fabricated of sheet steel of the following minimum gauges: Door and trim #12; Enclosure - code gauge steel.

2.2 KEYING

- A. All panelboards shall be furnished with flush locks using the manufacturer's standard lock and key. Door handles which extend beyond face of panel with integral locks will not be accepted for flush mounted panels but will be allowed on surface mounted panels.

2.3 CIRCUIT BREAKER WIRE TEMPERATURE RATING

- A. All circuit breakers shall be U.L. labeled as suitable for use with 60 degree/75 degree C or 75 degree C rated conductors.

2.4 CIRCUIT BREAKER FEATURES AND AUXILIARIES

- A. Where two or three pole breakers occur in the panels, they shall be common trip units. Single pole breakers with tie-bar between handles will not be accepted.

2.5 CIRCUIT BREAKER ARRANGEMENT

- A. Circuit breakers shall be arranged in the panels so that the breakers of the proper trip settings and numbers correspond to the numbering in the panel schedules on the drawings. Circuit numbers of breakers shall be black-on-white micarta tabs or other

previously approved method. Circuit number tabs which can readily be changed from front of panel will not be accepted. Circuit number tabs shall not be attached to or be a part of the breaker.

2.6 PANELBOARD AND CIRCUIT BREAKER IDENTIFICATION

- A. In addition to the engraved bakelite nameplate hereinbefore specified, panelboard manufacturer shall stencil the panel number or letter on inside of panel door to correspond with panel designation on drawings.
- B. Provide a red and white bakelite nameplate with 1/2" high letters in each 277/480 volt panel fastened to face of dead front plate, to read "WARNING 480 VOLTS."

2.7 BUSSING

- A. Bussing shall be rectangular cross section copper or full length silver or tin plated aluminum.
- B. Each panelboard shall be equipped with a ground bus secured to the interior of the enclosure of sufficient size for the panel being used and shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

2.8 SHORT CIRCUIT CAPACITY AND SERIES RATING

- A. All panelboards shall have bus bracing and circuit breaker fault interrupting capability to withstand and interrupt the available rms symmetrical fault currents indicated on the drawings. In no case, however, shall this capability be less than for 10,000 amperes at 208 volts and 14,000 amperes at 480 volts.
- B. When so indicated on the drawings or when not indicated but required to comply with paragraph "A" preceding the panelboard main breaker (or the feeder breaker ahead of the panel if so indicated) and the branch circuit breakers shall be U.L. approved and tested "SERIES RATED". The shop drawing submittal shall document this rating and its suitability based on the available fault currents shown or specified.
- C. When series rating is being applied to panelboards with main breakers (or feeder breakers if applicable) greater than 250 amperes, the branch circuit breakers shall be rated 22,000 amperes interrupting capacity, minimum or higher if required to coordinate under the series rating and for the available fault current indicated.

2.9 MANUFACTURER

- A. Lighting and appliance panelboards for 120/208 volt, three phase, 4 wire S/N shall be as hereinafter specified. Refer to AIC calculation and individual panelboard schedules for panelboard and circuit breaker AIC requirements.

SECTION 26 24 16
PANELBOARDS

General Electric.....Type AQ
Square D..... Type NQOD

- B. Distribution panelboards for 120/208 volt, three phase, 4 wire shall be as hereinafter specified. Refer to AIC calculation and individual panelboard schedules for panelboard and circuit breaker AIC requirements.

General Electric.....Type CCB
Square D..... Type I-Line

- C. Lighting panelboards for 277/480 volt, three phase, 4 wire S/N shall be as hereinafter specified. Refer to AIC calculation and individual panelboard schedules for panelboard and circuit breaker AIC requirements.

Square D..... Type NEHB
General Electric.....Type AE

- D. Distribution panelboards for 480/277 volt, three phase, 4 wire shall be as hereinafter specified. Refer to AIC calculation and individual panelboard schedules for panelboard and circuit breaker AIC requirements.

General Electric.....Type CCB
Square D..... Type I-Line

PART 3 – EXECUTION

3.1 COLOR CODING

- A. Wiring for branch circuits shall be color coded and shall be so noted on the directory in panels. The 277/480 volt wiring shall be color coded differently from the 120/208 volt wiring. The same color coding system shall be used throughout the entire job. Color coding shall be as follows:

120/208 Volt

Phase A hot leg black
Phase B hot leg red
Phase C hot legblue
Neutral..... white
Switch legspurple
or other appropriate color.

277/480 Volt

Phase A hot legyellow
Phase B hot legbrown
Phase C hot leg orange
Neutral..... white

3.2 DIRECTORY

- A. Each panel shall have a neatly typewritten directory with the name and number of the room, area or the equipment served by each circuit breaker which shall correspond with the final circuit arrangement, including all addenda and change orders. Where rooms are provided with room numbers and/or nameplates, these same numbers and

names shall be used in lieu of those shown on the drawings. Spaces in directories for spare circuit breakers shall be neatly marked "Spare" in pencil. The directory shall also indicate the panel designation, voltage and phase at the top. Each directory shall be mounted in the index card holder behind a clear plastic window.

END OF SECTION 26 24 16

**SECTION 26 51 00
LIGHTING FIXTURES**

PART 1 – GENERAL

1.1 SECTIONS INCLUDES

- A. Fixture descriptions, electrical and operating characteristics and installation requirements.
- B. Lighting fixtures shall have all parts and fittings necessary to completely and properly install the fixture. All fixtures shall be completely wired with conductors meeting applicable Underwriters' Laboratories requirements. All fixtures shall be equipped with lamps of size and type specified.
- C. All fixtures shall be complete with accessories, end caps, plaster frames, yokes, hangers, etc., which are required for the specific installations and physical conditions encountered in this project.
- D. The catalog numbers included in the description of the various types of lighting fixtures shall be basically considered to establish the type or class of the fixture with a particular manufacturer only. The fixture length, number of lamps, component materials, accessories and all other features required to fulfill the total description of the fixture based on all drawing and specification information shall be complied with regardless of whether or not the catalog number specifically includes these features. If any conflict exists between the catalog number and the description, the Contractor shall either resolve the conflict with the Architect prior to submittal of his bid or furnish the fixture to meet the intent as later interpreted by the Architect without change in contract price.

PART 2 – PRODUCTS

2.1 PENDENT FIXTURES

- A. All pendent stem mounting fixtures shall be supplied with swivel hanger and canopy assemblies providing 45 degree swiveling at top in any direction from plumb and meeting all other requirements of the Office of the State Architect and Table 23-P Part 2, Title 24, California Code of Regulations. Swivel and canopy assemblies shall also have approved hinged connection at bottom which shall be able to withstand at least 100% seismic longitudinal load without any permanent distortion or damage of metal. Hangers with the proper degree of swivel and labeled by the Los Angeles City Testing laboratory are acceptable to the Department of the State Architect.
- B. All swivel and canopy assemblies shall be suitable for the type of conduit mounting (surface or concealed) or the type of ceiling construction employed.
- C. For pendent fixtures, individual fixtures shall be suspended on two swivel assemblies, and continuous rows shall be suspended on one more hanger assembly than the number of fixtures.
- D. Each pendent mounted lighting fixture shall be with a safety cable or wire inside of each stem securely attached to the building structure at the top and to the fixture body at the bottom. The installed safety cable or wire shall be capable of supporting at least 4 times the fixture weight and shall be so tested, and the fixture shall be able to swing the full 45 degrees with this cable or

wire installed. The Inspector shall verify this test and shall so state in his report.

2.2 SURFACE MOUNTED FIXTURES

- A. All surface mounted fixtures shall be suitable for mounting on low density material.

2.3 RECESSED FIXTURES

- A. All fixtures mounted in plastered ceilings shall be equipped with plaster frame.
- B. Recessed fixtures must have Underwriters' Laboratories labeling for through wiring.
- C. Recessed fixtures shall have Underwriters' Laboratories approved thermal protection (TP).

2.4 CONTINUOUS ROW FIXTURES

- A. Fixture catalog numbers called out hereinafter are for individual units. Where two or more units are combined for continuous row installation, the Contractor shall furnish and install the necessary accessories for the indicated requirements.

2.5 DIFFUSERS

- A. Unless noted otherwise, all lighting fixture diffuser shall be virgin acrylic plastic.
- B. All flat plastic diffusers shall be clear with male conical prisms and manufactured from clear virgin acrylic. Lens shall be as manufactured by Rohm & Haas Co., KSH or Continental Polymers. Nominal 2' x 4' or smaller lenses shall have a minimum unpenetrated depth of 0.1045" and a minimum overall thickness of 0.1875".
- C. Shaped acrylic lenses shall be manufactured from Rohm & Haas Plexiglas V, V Type 920 or VM, or approved equal using injection molding or extrusion.

PART 3 – EXECUTION

3.1 GENERAL

- A. Unless specifically indicated otherwise, all lighting fixtures and/or fixture stems shall be placed symmetrically with respect to the ceiling tile pattern or other architectural ceiling and wall modules.
- B. All fixtures of one type shall be of one manufacture and of identical finish and appearance.

END OF SECTION 26 51 00

SECTION 28 00 00 –

INTELLIGENT FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Manual and automatic fire alarm and smoke detection system.

1.02 CONTRACTOR QUALIFICATIONS

- A. All work specified in Section 28 00 00 shall be performed (furnished, installed and connected) by a Siemens Systems Company (*NESCO*). The fire alarm system contractor shall provide the following documentation to demonstrate compliance with the contract documents and qualifications. Documents shall be bound, indexed in the order listed below and provided during the submittal process. Equipment order, release or installation of any system components shall not occur without stamped approvals from the Project Architect.
 - 1. Contractor's License: A copy of the electronics contractor's valid State of California License.
 - 2. Proof of Experience: Proof that the fire alarm contractor has been regularly engaged in the business of fire alarm contracting consisting of, but not limited to, engineering, fabrication, installation, and servicing of fire alarm systems of the type specified herein for at least the past ten (10) consecutive years. Provide a statement summarizing any pending litigation involving any officer or principal of/or the company, the nature of the litigation and what effect the litigation may carry as it relates to this work in the worst case scenario. Non-disclosure of this item, if later discovered, may result, at the Owner's discretion, in the contractor bearing all costs and any cost related to associated delays in the progress of the work.
 - 3. Insurance Certificates: Copy of fire alarm contractor's current liability insurance and state industrial insurance certificates in conformance with the contract documents.
 - 4. Project List: A List containing at least ten (10) California installations completed within the last five (5) years by the fire alarm contractor that are comparable in scope and nature to that specified in the contract document.
 - 5. Service Capability: Documentation indicating in detail that the fire alarm contractor has competent engineering, installation, service personnel and facilities with reasonable stock of service parts within 100 air miles of the job site.
 - 6. Authorization Letters: Letters from the fire alarm equipment manufacturer stating that the fire alarm contractor is the Factory Authorized Distributor, and is trained and certified for the equipment he proposes to use on this project, and is licensed to purchase and install that software required to provide the specified functions.
 - 7. Certification:

- a. Proof that the fire alarm contractor is Underwriters Laboratories, Inc. (UL) listed under the classification of "PROTECTIVE SIGNALING SERVICES-LOCAL, AUXILIARY, REMOTE STATION AND PROPRIETARY (UUJS).
- b. Copy of the following (NICET) Certificates. Proof that the certificate holders are a part of the fire alarm contractor's local facility servicing this project and will be actively involved in this project.
 - 1) Certified Technologist or Registered Fire Protection Engineer.
 - 2) Technician Level 4 minimum of (1)
- 8. Proof of Trained Personnel: Documentation that the fire alarm contractor has on staff personnel factory-trained and certified for the equipment proposed for this project. Also, a statement that personnel meeting these qualifications are in the local facility, and will be maintained at that facility throughout the project and the warranty period.
- 9. Copy of state of California issued Fire Alarm Certificate cards for all employees working on the project site. These shall be kept up to date at all times with the site / field construction manager.

1.03 DESCRIPTION

- A. This section of the specification includes the furnishing, installation, and connection of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings and specified herein.
- B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premised signaling systems, except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
- C. The system is that of Silent Knight Company, substitutions will not be considered.

1.04 CODES

- A. The installation shall be made in accordance with the drawings, specification and the following:
 - 1. National Electrical Code, Article 760
 - 2. National Fire Protection Association Standards
 - 3. California State Fire Marshall
 - 4. U.L. 1971
 - 5. Local Codes and Authorities having jurisdiction
 - 6. Codes as listed on the drawings.
- B. The system including all components shall be listed by the California State Fire Marshal (CSFM) and Underwriters Laboratories (UL) Inc. for use as a fire protective signaling system.

1.05 APPROVALS

- A. The system must have proper listing and/or approval from the following nationally recognized agencies:
 - UL Underwriters Laboratories, Inc.
 - CSFM California State Fire Marshal
 - FM Factory Mutual
 - ISO International Standards Organization
- B. The Fire Alarm Contractor shall submit shop drawings to the Project Architect prior to the commencement of any fire alarm system work. Reference section 1.08 of this specification for submittal requirements.

1.06 RELATED WORK AND SPECIFICATIONS

- A. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and sections of Divisions 1 and 16 of these specifications.
- B. Basic Electrical Materials Section.
- C. Mechanical and Fire Protection Sections.
- D. Interface to Special Extinguishing Systems.

1.07 SCOPE

- A. Provide a new intelligent reporting, microprocessor controlled fire detection system. It shall be installed in accordance with the specifications and drawings.
- B. Provide all hardware, software, programming tools and documentation necessary to replace, modify or install new, the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site.
 - 1. The contractor shall have System Program Labels approved by District's Electronic Supervisor prior to programming the system.
 - 2. The contractor shall make, and include in his bid, all necessary provisions to maintain all existing fire alarm system warranties that are in place on this project site. Existing fire alarm system expansions completed by this contractor shall not void said warranties and this contractor shall warrant his work as defined under the descriptions of system warranties and guarantees of this specification.
- C. All required special programming equipment shall be furnished by the fire alarm contractor, turned over to the District and shall remain on site and shall be covered during the warranty period.
- D. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto a (Class B) signaling line circuit.
 2. Initiation device circuits shall be wired (Class B).
 3. Indication appliance circuits shall be wired (Class B).
 4. Digitized electronic signals shall employ check digits or multiple polling.
 5. A Single ground or open on any system signaling line circuit, initiating device circuit, or indicating appliance circuit shall indicate a trouble condition at the control panel.
 6. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
- E. Basic System Functional Operation: When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
1. The system Alarm LED shall flash.
 2. A local signal in the control panel shall sound.
 3. Network annunciators shall display and indicate all information associated with the Fire Alarm condition, including the type of alarm point and its location within the protected premises.
 4. Printing and history storage equipment shall log the information associated with Fire alarm Control Panel condition, along with time and date of occurrence.
 5. All system output programs assigned via control by event equations to be activated by the particular point in alarm shall be executed, and the associated System Outputs (alarm indicating appliances and/or relays) shall be activated.
- F. Circuiting Guidelines:
1. All system smoke detectors shall be of the Addressable Analog type. Although each individual device point number and message shall be displayed on the LCD, the initiating devices shall be zoned as follows to provide the appropriate indication on the LED Annunciator.
 2. Provide one alarm initiating zone per device as shown on the plans and annunciator(s).
 - a. Manual stations per floor and building.
 - b. Area smoke detectors, heat detectors and beam detectors per floor and building.
 - c. Duct mounted smoke detectors, combination smoke/fire dampers and door hold devices per floor and building.

- d. Special Extinguishing Systems.
- e. Elevator recall and power disconnect.

1.08 SUBMITTALS

- A. Coordination Drawings: Prepare coordination drawings in accordance with the provisions in Section 01300.
- B. The construction documents have been designed based on School District Standards. The system shown on the drawings is a Silent Knight networked system.
- C. Submittal package shall be as follows
 - 1. Within thirty-five (35) calendar days after the date of award of the Contract, the Contractor shall submit eight (8) copies of the complete submission to the Architect for review.
 - 2. The submission shall consist of five (5) major sections with each section separated with index tabs. Each page in the submission shall be numbered chronologically and shall be summarized in the index.
 - 3. The first section shall be the "index" which shall include the project title and address, name of the firm submitting the proposal and name of the Architect.
 - 4. The second section shall include the following items:
 - a. As indicated in Section 1.02 of this specification.
 - 5. The third section shall contain the comparative specification listing, including a complete listing of the characteristics of the equipment to be furnished next to all of the specified equipment's features and functions as stated in the specifications and data sheets. Include CSFM listing sheet for each component.
 - 6. The fourth section shall contain an original factory data sheet for every component in the specifications.
 - 7. The fifth section shall contain a designation schedule for each Fire Alarm System device / component location and complete 1/8" = 1'-0" scale drawing showing system wiring plans.
 - a. Riser Diagram.
 - b. Typical Device Wiring Diagram.
 - c. Wire Legend.
 - d. Battery calculation for each control panel, power supply, field power supply and network annunciator.
 - e. Voltage drop for each notification circuit type per building.

- f. Floor Plans showing all conduits, sizes and quantity of conductors.
 - g. Mounting Height of each devices and back box requirement.
 - h. Zoning and address description legend.
- D. Failure to comply with all of the requirements listed above will result in the rejection of the entire submittal package.
- E. The Contractor shall provide two (2) copies of an "Operating and Servicing Manual" for the system. The manuals shall be bound in flexible binders. All data shall be printed material or typewritten. Each manual shall include the following: Instructions necessary for the proper operation and servicing of the system; complete as-built installation drawings of the system; a wiring destination schedule for each circuit leaving for each piece of equipment; a schematic diagram of major components with all transistor and IC complements and replacement numbers. Manual shall also include manufacturer's data sheets and installation manuals/instructions for all equipment supplied and installed

1.09 INSTALLATION COMPANY

- A. The fire alarm contractor shall be a UL listed company under the UL classification of (UUJS). The installation company shall UL certify this installation.
- B. The fire alarm contractor shall have a NICET Certified Engineering Technologist and Technicians on staff in their facility directly involved with this project to ensure technical expertise to this project and adherence with these specifications.
- C. The fire alarm contractor shall maintain sufficient stock on hand and have a fully equipped service organization capable of guaranteeing response time within eight (8) hours of service calls, twenty four (24) hours a day, seven (7) days a week to service completed systems.
- D. Equipment, wire and materials shall only be installed by the fire alarm contractor.
- E. The fire alarm contractor shall provide, install and test all equipment related to this section.

PART 2 - PRODUCTS

2.01 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

- A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on contract drawings and installation specifications shall be the best suited for the intended use and shall be provided by a single manufacturer. If provided by different manufacturers, system devices shall be recognized as compatible by both manufacturers and shall both receive equivalent warranties.

2.02 EQUIPMENT MANUFACTURERS

- A. The Fire Alarm System shall be limited to the following manufacturers and suppliers:
 - 1. Siemens.

- B. To ensure that compatibility and continuity is maintained throughout the existing School District, no other manufacturers or system suppliers will be considered.
- C. Fire alarm system manufacturer shall be ISO 9001 certified.

2.03 EQUIPMENT MANUFACTURERS

- A. Description: Provide a Silent Knight Intelligent Fire Detection and Alarm System as indicated on the plans.
- B. Mechanical Design:
 - 1. The control panel shall be housed in a UL cabinet designed for mounting directly to a wall or vertical surface. The back box shall be suitable for surface or flush mounting.
 - 2. The door shall provide a key lock and shall include a transparent opening for viewing of all indicators.
- C. System Capacity and General Operation:
 - 1. Control panel shall be capable of accommodating all devices shown on the drawing and additional 50% initiating and alarm devices.
 - 2. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display, individual, color coded system status LED's, and an alphanumeric keypad for the Field Programming and Control of the Fire Alarm System.
 - 3. All programming or editing of the program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.
 - 4. The FACP shall provide the following features: Drift Compensation to extend detector accuracy over life. Sensitivity Test, meeting requirements of NFPA 72, Maintenance Alert Verification, with verification counters. PAS pre-signal, meeting NFPA 72 requirements. Rapid manual station reporting (under 2 seconds). Non-Alarm points for general (non-fire) control. Periodic Detector Test, conducted automatically by software. Pre-alarm for advanced fire warning. Counting "cross-zone" options. March time and temporal coding options. Walk Test, with check for two detectors set to same address. Security Monitor Points, meeting requirements of UL 1076. Control By Time for non-fire operations, with holidays. Day/Night automatic adjustment of detector sensitivity. Device Blink Control for sleeping areas.
- D. Central Microprocessor:
 - 1. The Microprocessor unit shall communicate with, monitor, and control all external interfaces with the control panel. It shall include EPROM for system program storage; non-volatile memory for building-specific program storage; and a "watch dog" timer circuit to detect and report microprocessor failure.
 - 2. The Microprocessor unit shall contain and execute all control by event programs for specific action to be taken if an alarm condition is detected by the system. Such

control by event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

3. The Microprocessor Unit shall also provide a Real Time Clock for time annotation of system displays, printer, and history file. The Time of Day and date shall not be lost if system primary and secondary power supplies fail. The Real Time Clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

E. Display:

1. The Display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
2. The Display shall include status information and custom alphanumeric labels for all Intelligent Detectors, Addressable Modules, and Software zones.
3. The Display shall provide an 80 character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide Light Emitting Diodes (LED's), that will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, SIGNAL SILENCED, SUPERVISORY, and PRE -ALARM.
4. The Display shall provide key touch keypad with control 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.
5. The Display shall include the following operator functions: SIGNAL SILENCE, RESET, DRILL, and ACKNOWLEDGE.

- F. SLC Loop Interface: The SLC Interface shall provide power to, and communicate with, all of the Intelligent/Addressable Detectors and Addressable Modules over a single pair of wires. This SLC Loop shall be capable of operation as NFPA Style 4, Style 6, or Style 7.

G. Serial Interfaces:

1. An EIA-232 interface between the Fire Alarm Control Panel and UL Listed Electronic Data Processing (EDP) peripherals shall be provided (1AM-WF).
2. The EIA-232 interface shall allow the use of printers, CRT monitors, and PC compatible computers.
3. The EIA 485 port for the serial connection of the optional Annunciators and remote LCD displays shall be provided.
4. The EIA-485 interface may be used for network connection to a Proprietary Receiving Unit.

- H. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.

1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 24-hour standby.
2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two Style Y) shall be available for connection to the Notification devices.
3. The Field Charging Power Supply shall include the ability to delay the AC fail delay per 1996 NFPA requirements.
4. Provide quantity sufficient for a complete and operable system with no voltage drop to a signal device exceeding 8%.

I. Printer:

1. Printers shall be of the automatic type, printing code, time, date, location, category, and condition.
2. The Printer shall provide hard copy printout of all changes in status of the system and shall time stamp such printouts with the current time of day and date. The printer shall be standard carriage with 80 characters per line and shall use standard pin feed paper.
3. The printer shall be enclosed in a separate cabinet suitable for placement on a desk top or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA 232D. Power to the printer shall be 120 VAC 60 Hz.

J. Field Programming:

1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
2. All programming may be accomplished through the standard FACP keypad.
3. All field defined programs shall be stored in non volatile memory.
4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disabled or manual on/off commands. A second (higher-level) is used for actual change of program information.
5. A special program check function shall be provided to detect common operator errors.
6. An Auto-Program (self-learn) function shall be provided to quickly program initial functions and make the system operational.

7. An off-line programming function, with batch upload/download, shall also be provided.

2.04 SYSTEM COMPONENTS

A. Main Fire Alarm Control Panel (FACP)

1. Silent Knight (New IFP-2100ECS)
2. Silent Knight New Control Panel Enclosure

B. Programmable Electronic Horns: (Indoor/Outdoor)

1. Electronic horns shall operate on 24 VDC nominal.
2. Shall be suitable for mounting on the wall or ceiling.
3. Shall be semi-flush or surface mounted as shown on plans.
4. Devices mounted on the exterior of buildings shall be installed as follows:
 - a. Flush mount device in a soundolier #193-8-6 backbox with a Soundolier VP-161 cover for all stud wall applications.
 - b. Surface mount devices with manufacturer's listed weatherproof backbox for locations where flush mounting can not be utilized (such as concrete, block, brick or similar). Contractor shall notify Architect and engineer of record should such locations exist prior to mounting device. Surface mounted device shall be red in color.
5. Manufacturer: Wheelock AH series

C. Strobe Lights:

1. Shall operate on 24 VDC nominal.
2. Shall meet the requirements of the ADA and UL 1971.
 - a. The maximum pulse duration shall be 2/10ths of one second
 - b. Intensity shall be as specified on the drawings.
 - c. The flash rate shall be one flash per every second.
 - d. The appliance shall be placed 80 inches to bottom of device above the highest floor level within the space, or 6 in below the ceiling, which ever is the lower.
 - e. Candela rating shall be as required per each space.

D. Audible/Visual Combination Devices:

1. Shall meet the applicable requirements of section B listed above for audibility.
2. Shall meet the requirements of section C listed above for visibility.
3. Audible and visual devices shall operate on separate circuits for the expansion of existing systems in order to match existing site conditions. All new system components for audible and visual devices shall operate on a single notification circuit.

E. Addressable Manual Stations:

1. Addressable Manual Stations shall be provided to connect to the Fire Alarm Control Panel Signaling Line Circuit (SLC) Loops.
2. All operated stations shall have a positive, visual indication of operation that cannot be reset without the use of a key.
2. Stations shall be suitable for surface mounting, or semiflush mounting as shown on the plans, and shall be installed at 48 inches above the finished floor.
3. Shall comply with CBC Sections 1117B.6 and 1118b.

F. Intelligent Photoelectric Smoke Detectors: (Low Profile)

1. Smoke detectors shall be intelligent and addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel Signaling Line Circuit loops.
2. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control pane, send data to the panel representing the analog level of smoke density.
3. The detector shall be ceiling mount and shall include a twist lock base.
4. The detector sensitivity shall be set through the Fire Alarm Control Panel, and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.
4. Detectors located above finished ceiling or in areas which are not readily visible shall be provided with remote indicator LED's.

G. Intelligent Heat Detectors

1. Heat Detectors shall be Intelligent and Addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel Signaling Line Circuits.
2. The detectors shall use and electronic sensor to measure thermal conditions caused by a fire.
3. The detectors shall be ceiling mount and shall include a twist lock base.
4. Detectors located above finished ceiling or in areas which are not readily visible shall be provided with remote indicator LED's.

H. Duct Smoke Detectors:

1. In-Duct Smoke Detector Housing shall be completed with an Intelligent Photoelectric Sensor, that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, and alarm signal is initiated at the FACP, and appropriate action taken to shut down air handling systems.
3. Detectors located above finished ceiling or in areas which are not readily visible shall be provided with remote indicator LED's.

I. Monitor Module:

1. Addressable Monitor modules shall be provided to connect one supervised IDC zone of conventional Alarm Initiating Devices (any NO. dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit (SLC) Loops.
2. The Monitor Module shall mount in a 4-inch square, 2 1/8" deep electrical box.

J. Control Module:

1. Addressable Control Modules shall be provided control functions with Form "C" contracts.
2. The Control Module shall mount in a 4-inch square 2 1/8" deep electrical box.

K. Network Annunciator:

1. Furnish and install an alphanumeric, liquid crystal display, annunciators.
2. Shall be capable of displaying each individual addressable point. Minimum point capacity shall be not less than 200,000 points.
3. Provide a separate power supply and battery system for this annnunciator.

2.05 BATTERIES

A. Battery:

1. Shall be Gel-Cell type.
2. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus five minutes of alarm upon a normal AC power failure.
3. The batteries are to be completely maintenance free.

2.06 CONDUIT AND SURFACE RACEWAY

- A. All conduit, surface raceways, outlet boxes, junction boxes, pull boxes, terminal cabinets, and similar devices required in this section of the work shall be provided under Division 16000 and as shown on drawings.

- B. Conduit and surface raceways shall comply with the requirements of Sections as described in the applicable specification sections.
- C. Conduit shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backbox, except where conduit entry is specified by the FACP manufacturer.
- D. All fire alarm related conduits and shall be clearly marked as "Fire Alarm System" and be painted red in color to indicate such system. Paint conduits with 6" red stripe every 36 inches minimum.

2.07 WIRE

- A. All low voltage wire required in this section shall be furnished and installed by the fire alarm contractor.
- B. All wire shall be installed in conduit. Wiring installed in underground conduits shall be approved for wet applications in accordance with the National Electric Code.
- C. All fire alarm system wiring shall be new.
- D. Wiring shall be in accordance with local stated and national codes (e.g., CEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 14 AWG for Initiating Device Circuits and Signaling Line Circuits, and 12 AWG for Indicating Appliance Circuits.
- E. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
- F. Wiring used for the multiplex communication loop shall be 18AWG twisted and shielded and installed in conduit. The system shall permit use of IDC and IAC wiring in the same conduit with the communication loop.
- G. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

2.08 TERMINAL CABINETS AND JUNCTION BOXES

- A. All boxes and cabinets shall be UL listed for their use and purpose.
- B. Terminal cabinets shall comply with the requirements of Section 16160 Terminal Cabinets.
- C. Provide terminal blocks for all conductors entering and/or exiting each terminal cabinet.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the contractor shall notify the architect before making any changes. It shall be the responsibility of the factory-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.
- B. Furnish all conduit, junction boxes, conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.
- C. The cables within the rack or cabinets shall be carefully cabled and laced with no. 12 Cord waxed linen lacing twine or ty-raps. All cables shall be numbered for identification.
- D. Splices of conductors in underground pull boxes is not permitted.
- E. The labor employed by the contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the owner and architect to engage in the installation and service of this system.
- F. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc., The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., Caused by the performance of this work.
- G. The system must meet all local and other prevailing codes.
- H. All cabling installations shall be performed by qualified technicians.
- I. All cabling shall be splice free.
- J. In order to ensure the least amount of cable untwisting, it is required that all cables shall be stripped using a special tool.
- K. The use of lubricants (i.e. Yellow 77) to facilitate the installation of cables in conduits is highly discouraged. If such a lubricant must be used, the contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant.
- L. Under no circumstance are "channel locks" or other pliers to be used.
- M. All firewalls penetrated by structured cabling shall be sealed by use a non-permanent fire blanket or other method in compliance with the current edition of National Fire Protection Association (NFPA) and the National Electric Code (NEC) or other prevailing code. The contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wireways or conduits. Contractors who use this method will be required to replace all cables affected and provide the original specified access to each effected area.
- N. Contractor shall furnish and install access panels, as required, for devices that require servicing, trouble shooting, testing, etc. Contractor shall coordinate all access panel sizes and locations with architect and other trades prior to rough in.

3.02 SPECIFIC INSTALLATION REQUIREMENTS

- A. The entire system shall be installed in a workmanlike manner in accordance with approved manufacturer's manuals and wiring diagrams. The contractor shall furnish all wiring, conduit, outlet boxes, junction boxes, terminal cabinets and similar devices necessary for the completed installation.
- B. Installation of conduit, outlet boxes, junction boxes, terminal cabinets, special back boxes and similar devices shall comply with the requirements of Division 16000 sections.
- C. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detector heads shall not be installed prior to the system programming and test period. If construction is on going during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- D. 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. Verify with the Project Architect prior to any surface mounted installations.
- E. All penetrations of floor slabs and fire walls shall be sleeved (1" conduit minimum) and fire stopped in accordance with the electrical specifications.
- F. Duct mounted Smoke Detectors shall be furnished and wired by this Contractor and installed by the Mechanical Contractor. All shutdown and interface wiring shall be performed by the Electrical Contractor. All air pressure differential testing shall be performed by the Mechanical/Air Balance Contractor.
- G. Sprinkler flow and tamper switches shall be furnished, installed and adjusted by the sprinkler contractor, wired and tested by this Contractor.

3.03 TESTING REQUIREMENTS

- A. Provide all instruments for testing and demonstrating in the presence of the owner's inspector that the frequency response is as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds.
- B. All fire alarm testing shall be in accordance with NFPA 72.
- C. The system shall be pre-tested and documented prior to the final inspection by the AHJ. The owner shall be notified of the pretest 48 hours in advance and shall witness this test if desired.
- D. The pre-test shall include the following
 - 1. All intelligent analog addressable devices shall be tested for current address, sensitivity and user defined message.
 - 2. All wiring shall be tested for continuity, shorts and grounds before the system is activated.
 - 3. Proper operation and execution of all its sequences.

- E. At the final test and inspection, a factory-trained representative of the system manufacturer shall demonstrate to the Owner, his representative and the local fire inspector all its sequence of operations and any additional tests required by the AHJ. In the event the system does not operate properly, the test may be terminated. Corrections shall be made and the testing procedure shall be repeated until it is acceptable to the Owner, his representatives and the fire inspector.
- F. Provide all instruments for testing and demonstrating in the presence of the owner's inspector that the frequency response is as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds.
- G. Contractor shall provide all DSA required testing and certification at no cost to the Owner.

3.04 TRAINING

- A. The contractor shall include in his bid, all costs and charges (including travel, lodging, meals, etc...) required to provide factory certification, equal to that of a Factory Authorized Distributor for two (2) selected Owner's representatives. This training shall occur at the primary factory of the manufacturer and shall allow the selected Owner's representatives to provide any and all Factory / manufacturer Approved repairs, services, software upgrades, etc. without affecting any available or applicable Manufacturer Warranties.
- B. The contractor shall provide not less than eight (8) hours for site instruction of personnel in the operation and maintenance of the installed systems. Instruction shall be documented and formalized for the Owner and/or Owner's representative. This instruction time shall be divided as directed by the Owner and made available at the completion of the project. This instruction is separate from that indicated in above Section 3.04.A.
 - 1. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.
 - 2. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance and testing procedures recommended by the system manufacturer and / or the Division of the State Architect (DSA).
 - 3. Instruction shall be made available to the Local Municipal Fire Department if requested by the Local Authority having Jurisdiction.
- C. Contractor shall provide, and turn over to the Owner at the time of training, one (1) new lap top computer, complete with all hardware and software for the maintenance and testing of the installed fire alarm system. Contractor shall include in his training the use of these programs.

3.05 FINAL ACCEPTANCE

- A. The Owner or Owner's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.

- B. The Owner or Owner's representative will conduct a final job review once the contractor has finished the job. This review will take place within one week after the contractor notifies the owner.
- C. Two (2) copies of all certification data, as-built drawings and maintenance and operation manuals for all identifications shall be provided to the Owner before the owner's review.
 - 1. Maintenance and Operation manual shall contain
 - a. A detailed narrative description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, sequence of operations, expansion capability, application considerations and limitations.
 - b. Manufacturer's data sheets and installation manuals for all equipment supplied.
 - 2. As Built Project Drawings and Data
 - a. Drawings consisting of a scaled plan of each building showing the placement of each individual item of the Integrated Life Safety System equipment as well as raceway size and routing, junction boxes, and conductor size, quantity and color in each raceway.
 - b. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the Owner unless device addressing is electronically generated and automatically graphically self-documented by the system.
 - c. All drawings shall be provided in standard .dxf or AutoCAD format in addition to the (2) hard copies to be provided.
- D. The Owner or Owner's representative will review the installation and certification data prior to the system acceptance.
- E. The Owner or Owner's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the Owner reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the contractor.
- F. In the event that repairs or adjustments are necessary, the contractor shall make these repairs at his own expense. All repairs shall be completed within 10 days from the time they are discovered.
- G. The contractor shall hand to the owner a copy of any applicable installation specific software configurations in disk format.
- H. THE END-USER SHALL RETAIN COMPLETE RIGHTS AND OWNERSHIP TO ALL SOFTWARE RUNNING IN THE SYSTEM AT ALL TIMES. The application program listing (database) for the system, as installed at the time of acceptance by the building owner and/or local AHJ, shall be provided (disk and hard copy printout).

- I. A filled out Record of Completion, similar to the sample provided in NFPA 72, 2002, shall be turned over to the owner at the time of acceptance.

END OF SECTION 28 00 00

**SECTION 31 10 00
SITE CLEARING**

PART 1 - GENERAL

1.01 SUMMARY

- A. SECTION INCLUDES:
 - 1. Clearing.
 - 2. Removing above- and below-grade site improvements.
 - 3. Disconnecting, capping, or sealing site utilities.
 - 4. Temporary erosion- and sedimentation-control measures.

1.02 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.03 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated by Owner's direction.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion- and sedimentation- control is in place.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Not applicable

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.03 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Owner and Engineer not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Engineer's written permission.

3.04 CLEARING AND GRUBBING

- A. Fill depressions caused by clearing with satisfactory soil material unless further excavation or earthwork is indicated.
 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.05 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Existing signs and sign poles to be salvaged shall be removed and stored on the project site in a secure area.

3.06 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

SECTION 31 22 00 GRADING

PART 1 - GENERAL

1.01 SUMMARY

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
 - 1. General exterior grading, cutting and filling, including grading for building area, paving, planting areas, banks and hillsides.
- C. Related Sections:
 - 1. Section 32 11 23 – Base Course.

1.02 SYSTEM DESCRIPTION

- A. General:
 - 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.
 - 4. Before grading, contact Underground Service Alert of Southern California (USASC) for information on buried utilities and pipelines.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials shall conform to requirements specified in this and related sections.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect and maintain installed stakes until their removal is required for the Work. Provide replacement grade or location stakes lost or disturbed.
- B. Install grade stakes and compare to indicated grades. If discrepancies are found between existing grades and grades indicated on Drawings, do not proceed until discrepancies are resolved.

3.02 ROUGH AND FINE GRADING

- A. Rough grade area sufficiently high to require cutting by fine grading:
 - 1. Grade area for bituminous surfacing and other paving to the indicated grades, equal to the section of the indicated base and pavement.
 - 2. Slope banks to required finish grades as cut progresses or leave cuts full and finish grade by mechanical equipment to provide grades and soil densities indicated on the Drawings.
 - 3. Rough grade, fill and compact banks beyond indicated finish grades. Finish grade banks and slopes to indicated grades and specified soil densities.
 - 4. Grade Only Areas: In areas not indicated to receive pavement, rough grade to approximate finish grades and then scarify, moisten, and roll to obtain required density and indicated finish grades.
 - 5. Tolerances: Finish grades shall be within a tolerance of 0.05 inch per foot above or below grades indicated. Provide an average grade as indicated.
- B. Base or Subgrade:
 - 1. After subgrade has been constructed to approximate required grades, scarify to a depth of at least 6 inches:
 - a. After scarifying, process loosened material to a finely divided condition and adjust moisture content to optimum condition by addition of water, addition and blending of dry suitable material, or by drying of existing material.
 - b. Subgrade material shall be compacted by tamping, sheepsfoot rollers or pneumatic tire rollers. Required relative compaction shall be 95 percent minimum for the top 6

inches below subgrade.

- c. Install base course in accordance with Section 02319: Base Course.
- 2. Tolerance of completed grades of base or subgrade shall not vary more than 0.03 inch per foot from grades indicated. Provide an average grade as indicated.

3.03 SHORING

- A. Provide shoring as necessary to support earth sides of excavations properly and safely, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.
- B. Design and Calculations: Provide in accordance with requirement of governing California Building Code and Safety Orders of State of California, Division of Industrial Safety; Title 8, Subchapter 4, Article 6, Sections 1530 and 1541.
- C. Remove shoring upon completion of the Work of this section or when no longer needed unless required otherwise by authorities having jurisdiction.

3.04 EXCESS MATERIAL DISPOSAL

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

3.05 PROTECTION

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

END OF SECTION

**SECTION 32 10 00
PAVEMENT REPAIR**

PART 1 - GENERAL

1.01 SUMMARY

- A. Provisions of Division 01 apply to this section.
- B. 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. Concrete Pavement Repair: Areas heaved by tree roots, cracked areas, holes and trenches, and areas around new structures.

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. Materials specified in Section 31 11 23: Base Course.
- B. Materials specified in Section 32 12 16: Asphaltic Paving.
- C. Materials specified in Section 32 12 17: Site Concrete 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.

2.03 HEADERS AND STAKES

- A. Headers: Redwood, size 2 x 6, unless otherwise indicated on Drawings.
- B. Stakes: redwood, Construction Grade.
- C. Nails: Common, galvanized, 12d minimum.

2.04 SLURRY

- A. Cement-sand slurry; minimum one sack of cement per cubic yard of mixture.

PART 3 - EXECUTION

2.05 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 inches 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.

2.06 EXCAVATING, BACKFILLING AND COMPACTING

- A. Conform to requirements in Section 31 23 00: Excavating, Backfilling and Compacting; Section 31 23 16: Excavating, Backfilling and Compacting for Pavement; Section 31 23 17: Excavating, Backfilling and Compacting for Structures.
- 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.

2.07 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 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. Stakes are to be installed on the asphalt side of the header. Provide a minimum of 2-12d 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.

2.08 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.
- B. Fill grade and compact as specified in Section 31 22 00: Grading.

2.09 RESURFACING

- A. Holes and Trenches: Remove loose dirt and backfill with cement-sand slurry allowing for surfacing one inch thicker than existing. Unless otherwise indicated on Drawings, 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.

2.10 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 1/2 inch wide and less with RS-1 emulsion and silica sand or other required material. Cracks larger than 1/2 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 PI. 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 12 16.

2.11 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.

2.12 PROTECTION

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

END OF SECTION

**SECTION 32 11 23
BASE COURSE**

PART 1 - GENERAL

1.01 SUMMARY

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
 - 1. Installation of base material.
- C. Related Sections:
 - 1. Section 31 10 00: Site Clearing.
 - 2. Section 31 22 00: Grading.
 - 3. Section 32 10 00: Pavement Repair
 - 4. Section 32 12 16: Asphaltic Paving
 - 5. Section 32 12 17: Site Concrete Paving

1.02 SUBMITTALS

- A. Prior to import, Contractor shall submit written certification to OAR that crushed Miscellaneous Base (CMB) does not contain Polychlorinated biphenyls (PCB) above laboratory detection limits when tested in accordance with EPA Method 8082, and obtain written approval from OAR and FUSD prior to import at the subject site, refer to article 2.02 for sampling frequency.,
- B. Crushed aggregate base (CAB) shall consist of native rock without naturally occurring asbestos or recycled materials. The Contractor shall submit written documentation, which identifies the source, volume, and proposed transport date of the material for review and approval by OAR and FUSD prior to importing the material. A statement on company letterhead from the source, stamped by either a California Professional Geologist or Engineer, which states that the subject materials are native rock, do not contain any recycled materials and that the source does not mine ultramafic materials, a source of natural occurring asbestos shall be
- C. included in the submittal to OAR and FUSD. The Contractor may request
 - 1. variance from testing by Section 01 40 00 for CAB. To be considered for a variance, the Contractor shall submit a documentation package, which includes all of the aforementioned information at least 48 hours in advance of planned import.
 - 2. Frequently used suppliers:
 - a. Hansen Aggregates, Irwindale, California.
 - b. Vulcan Materials, Reliance Company, Irwindale, California.
 - c. Vulcan Materials Durbin, Irwindale, California.
- D. Product Data: Submit material source, technical information and test data for base materials. Gradation and quality certifications shall be dated within 30 days of the submittal.
- E. Sample: Submit Sample of proposed base course material.

1.03 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition.

1.04 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition.

PART 2 - PRODUCTS

2.01 UNTREATED BASE MATERIALS

- A. The following base materials shall conform to the requirements of the Greenbook: Standard Specifications for Public Works Construction: Section 200 - Rock Materials.
 - 1. Crushed Aggregate Base.
 - 2. Crushed Miscellaneous Base.

- a. CMB meeting requirements of article 1.02, A, may be used on-site for pavement base only.
- b. CMB may be used off-site when in accordance to the Greenboook.
- c. Materials generated on site shall not be used as a base course material.

2.02 SOURCE QUALITY CONTROL

- A. Sampling and testing of imported and/or exported crushed miscellaneous base (CMB) shall be performed in accordance with the following Table 1 schedule:

VOLUME (CY)	SAMPLING FREQUENCY
0 - 500	1 PER 100 CY
501 - 1,000	1 PER 250 CY
1,001 – 5,000	1 PER 250 CY FOR FIRST 1,000 CY 1 PER 500 CY THEREAFTER
5,001 – 20,000	12 SAMPLES FOR FIRST 5,000 CY 1 PER 1,000 CY THEREAFTER
> 20,000	1 PER 2,000 CY FOR FIRST 20,000 CY 1 PER 2,500 CY

2.03 MATERIAL APPROVAL

- A. Base material shall be inspected by the PI for gradation and material content prior to installation. The owner may choose to have additional tests performed by a geotechnical engineer, retained by the Owner, before installation.

PART 3 – EXECUTION

4.01 INSTALLATION

- A. Install base course material in layers not exceeding 4 inches in thickness, unless required otherwise. Grade and compact to indicated levels or grades, cut and fill, water and roll until the surface is hard and true to line, grade and required section. Provide a relative compaction of at least 95 percent, unless otherwise required.
- B. Grade base course to elevations indicated on Drawings, ready to receive surfacing, in accordance with Section 31 22 00: Grading.

4.02 PROTECTION

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

4.03 CLEANUP

- A.

END OF SECTION

SECTION 32 12 16
ASPHALTIC PAVING

PART 1 GENERAL

1.01 REQUIREMENT

- A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work as indicated in the Contract Documents and specified herein.
- B. The following types of pavement shall be covered in this Section:
 - 1. Paving for utility trenching, playgrounds, areas between buildings, adjacent to planting and turf areas, and as indicated on Construction Documents.
- C. Related Sections:
 - 1. Section 31 22 00: Grading.

1.02 QUALITY ASSURANCE

- A. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction ("GREENBOOK"), Latest Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications".
- B. The Owner's inspector shall test the temperature of each batch of asphaltic concrete prior to placement. At the time of delivery to the work site, the temperature of mixture shall not be lower than 260 degrees F or higher than 320 degrees F, the lower limit to be approached in warm weather and the higher in cold weather. If asphaltic concrete temperature is not within these tolerances the affected batch shall be rejected. Any and all costs due to the rejected asphaltic concrete shall be the responsibility of the paving contractor.

1.03 ESTABLISHMENT OF GRADES

- A. The Contractor's Surveyor will set grade stakes. The Surveyor shall be a California registered land surveyor or licensed Civil Engineer. The Surveyor shall be hired and paid by the Contractor and shall be subject to the approval of the Owner. Contractor shall notify the Owner at least 48 hours before staking is to be started. The Owner will determine if work is ready for staking.
- B. All work shall conform to the lines, elevations, and grades shown on the Construction Plans. Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.
- C. Protect and maintain stakes in place until their removal is approved by the Owner. Grade or location stakes lost or disturbed by Contractor, shall be reset by the Surveyor at the expense of Contractor.
- D. Areas having drainage gradients of 2 percent or more shall have elevation stakes, set with instrument, at grid intervals of 25 feet. Intermediate stakes may be set by using a tightly-drawn string line over the tops of adjacent stakes. Grade stakes must be set at all grade breaks, grade changes, etc.
- E. Areas having drainage gradients of less than 2 percent shall have elevation stakes, set with instrument, at 10-foot intervals. Grade stakes must be set at all grade breaks, grade changes, etc.

1.04 SUBMITTALS

- A. Mix Designs: The CONTRACTOR shall formulate a job-mix formula using the Hveem method in accordance with Standard Specifications Section 203-6.2 and submit it to the ENGINEER for approval. The resultant mixture shall have Hveem properties conforming to Standard Specifications Section 203-6.4.3.

- B. Samples:
 - 1. Prior to the delivery of specified aggregate to the site, the CONTRACTOR shall submit samples of the material for the INSPECTOR's acceptance in accordance with Standard Specifications Section 4-1.4. Samples shall be typical of materials to be furnished from the proposed source and in conformance with the specified requirements.
 - 2. Aggregate base gradation and quality certifications shall be dated within 30 days of the submittal.
- C. Certificates
 - 1. Ten days prior to the delivery of aggregates, asphalt materials, and paving mixes to the project site, the Contractor shall submit to the Engineer certificates and test results of compliance of such materials with these specifications.
 - 2. Submit certificates of compliance from the supplier for bituminous materials for paint binder, asphaltic concrete, and seal coat.
 - 3. Submit weigh master's certificates or certified delivery tickets for each truck load of asphaltic material delivered to the project site.
 - 4. Upon completion of the weed control treatment, and as a condition for final acceptance, furnish a written certificate stating the brand name of the sterilant and the manufacturer, and that the sterilant used had at least the minimum required concentration, and that the rate and method of application complied in every respect with the conditions and standards contained herein.

1.05 QUALITY CONTROL

- A. Asphaltic Concrete Producers Qualifications: Use only materials furnished by a bulk asphaltic concrete producer regularly engaged in production of hot mix, hot laid bituminous concrete.
- B. Applicator Qualifications: Paving machine and roller operators shall be fully trained and experienced in the installation of asphaltic concrete paving on projects of similar size and complexity.
- C. Regulatory Requirements: The quantity of volatile organic compounds (V.O.C.) used in weed killer, seal coat, primer and other materials shall not exceed the limits permitted under the current regulations of the local authorities having jurisdiction.

1.06 ENVIRONMENTAL LIMITATIONS

- A. Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:
 - 1. Tack Coats: Minimum surface temperature of 60 deg F.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

1.07 PAVEMENT MARKING PAINT

- A. Refer to section 32 17 23.13: Painted Pavement Markings.
- B. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Base Course Material: Crushed base material shall consist of materials that meet the provisions of Specifications Section 31 22 00 Grading, Part 2.01F.
- B. Asphalt Surfacing Materials: Furnish asphalt surfacing meeting the following requirement, furnished from a commercial asphalt central mixing plant.
 - 1. Paint Binder/Tack Coat: Asphalt emulsion shall be CSS-1 or CSS-1h and shall conform to the requirements of Standard Specifications Section 203-3 Emulsified Asphalt.
 - 2. Asphalt Concrete Composition & Grading:

- a. Playground area surface course asphalt concrete shall conform to Standard Specification Section 203-6.4.3, Type D2, with asphalt content of 4.8% to 6.5%.
 - b. Parking lots surface course asphalt concrete shall conform to Standard Specification Section 203-6.4.3, Type C2, with asphalt content of 4.6% to 6.0%.
 - c. Base course asphalt concrete, in all areas, shall conform to Standard Specification Section 203-6.4.3, Type B, with asphalt content of 4.5% to 5.8%.
 - d. Asphalt performance grade shall be PG-64-10.
 - e. At least two courses of asphalt shall be laid when Type D2 asphalt pavement is greater than 1-1/2 inches. The surface course shall be a minimum thickness of one inch (1") and a maximum of 1-1/2 inches.
 - f. At least two courses of asphalt shall be laid when Type C2 asphalt pavement is greater than 3 inches. The surface course shall be a minimum thickness of one inch (1") and a maximum of two inches (2").
- C. Weed Control:
1. The soils sterilant shall be in accordance with current EPA acceptable standard and the California Department of Pesticide Regulations for soils sterilant. Sterilant shall be selected as appropriate for the environment in which it is to be placed. Contractor shall be licensed with the State of California to apply sterilant. Sterilant shall be commercial grade for commercial application. Payment for soil sterilization will include full compensation for application and all materials and incidental work required.
 2. Apply Dow Elanco Spike 80DF, or approved equal, to subgrade prior to asphalt paving. Spike 80DF weed control should be applied at the rate of seven pounds per acre. If another manufacturer is used follow their recommendations.
- D. Headers and Stakes:
1. Headers: Redwood, Construction Heart Grade, size 2 x 6, unless otherwise indicated on construction drawings
 2. Stakes: 2 x 4 redwood or 2 x 3 Douglas fir, Construction Grade.
 3. Nails: Common, galvanized, 12d minimum.

PART 1 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. 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 centers with top of stakes set one inch below top of header. Provide a minimum of 2-12d 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 SUBGRADE PREPARATION

- A. It is required that areas of asphalt pavement be underlain by a layer of aggregate base material which meets the requirements of Specification Section 31 22 00, Part 2.01F. Thickness of base layer is as shown on the Construction Documents.
 1. See soils report for recommendations.
- B. Subgrade tolerances: Subgrade for pavement shall not vary more than 0.02' from the specified grade and cross section established by the Engineer. Subgrade for subbase or base material

shall not vary more than 0.04' from the specified grade and cross section. Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.

- C. Correct irregularities by dressing down or filling as may be required, to bring areas to true subgrade elevations.
- D. Where filling is required, scarify the subgrade to bond the new material to the in place material; use additional material as required, subject to the approval of the Architect, and provided by the Contractor.
- E. Remove excess material from the site to a legal disposal area.

3.03 APPLICATION GENERAL

- A. Finish elevations, extent of asphalt paving and locations of type of asphalt and class of base shall be as indicated and specified herein and on the Construction Documents. Bring subgrade elevations sufficiently below the finish elevations of the paving so as to accommodate the thickness of paving and base.

3.04 STERILANT APPLICATION

- A. Place herbicide below base course in all areas of new asphalt pavement. Meet the applicable environmental control requirements. Apply as directed by the manufacturer's printed instructions just before application of the base course. Sterilant shall not be applied within two feet of planting areas.

3.05 APPLICATION OF BASE COURSE

- A. Install base course material, encompassing spreading and compacting, in accordance with the S.S.P.W.C. Section 301-2, Untreated Base.
- B. After preparing the subgrade as specified in 3.5.A, all traffic on the subgrade shall be avoided. Should it be necessary to haul over the prepared subgrade, the CONTRACTOR shall drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand tamped. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.
- C. Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross-section, will not be permitted. The CONTRACTOR shall protect the prepared subgrade from all traffic.
- D. Maintain the surface in its finished condition until the succeeding layer is placed.

3.06 PLACING ASPHALT CONCRETE SURFACING:

- A. Asphalt binder (tack coat) shall be applied to all existing pavement surfaces to be overlaid and/or joined per section 302-5.4 of the Standard Specifications. Asphalt binder (tack coat) shall be applied to existing surfaces to be surfaced and between layers of asphalt concrete, except when eliminated by the Engineer. A layer of asphalt binder (tack coat) shall be applied to all vertical-cut faces and between subsequent AC lifts.
- B. Asphalt Concrete Pavement:
 - 1. All work shall be in accordance with Section 302-5 of the Standard Specifications, except as noted herein. Asphalt concrete work shall include full-depth patching and variable thick asphalt concrete transition areas. The Contractor shall, on a daily basis, provide the Inspector with copies of certificates of weight for all materials delivered to the job site and/or incorporated in the work. At no time shall the coarse aggregate that has segregated from the mix be scattered across the paved mat.
 - 2. Asphalt concrete shall not be placed on any surface, which contains ponded water or excessive moisture in the opinion of the Engineer. If paving operations are in progress and rain or fog forces a shut down, loaded trucks in transit shall return to the plant, and no compensation will be allowed therefore. The Contractor shall furnish and use canvas tarpaulins to cover all loads of asphalt from the time that the mixture is loaded until it is discharged from the delivery vehicle, unless otherwise directed in writing by the Engineer

3. The Inspector will examine the base before the paving has begun. The Contractor will correct any deficiencies before the paving is started.
4. Asphalt concrete of the class indicated in Section 2.B.2 shall be laid in courses conforming to S.S.P.W.C. Table 302-5.5(A) unless otherwise stated herein.
5. At least two courses of asphalt shall be laid when Type D2 asphalt pavement is greater than 1-1/2 inches. The surface course shall be a minimum thickness of one inch (1") and a maximum of 1-1/2 inches.
6. At least two courses shall be laid when Type C2 asphalt pavement is greater than 3 inches. The surface course shall be a minimum thickness of one inch (1") and a maximum of two inches (2").
7. Successive courses may be laid upon previously laid courses as soon as the previous course has cooled sufficiently to show no perceivable displacement under equipment or loaded material delivery trucks and a tack coat has been applied.
8. Wherever AC pavement does not terminate against a curb, gutter, or another pavement, the Contractor shall provide and install a redwood or pressure treated Douglas fir header at the line of termination.
9. Pavement at all longitudinal joints shall have a Field Density of 95%, as described in 302-5.6.2 of the Standard Specifications. When the test results of the field cores are less than 95% Relative Compaction, the Contractor shall remove a 1-foot-wide section on each side of the longitudinal joint. The Contractor shall replace the removed pavement with an asphalt mix that meets the job specification at no additional cost to the Owner.
10. Pavement tolerances: within 1/8-inch of design thickness and 1/8-inch from design elevation.

3.07 SEAL COAT

- A. Allow new asphalt pavement to cure 30 days before application of seal coat. See Project Specification Section 32 12 36: Seal Coats.

3.08 FLOOD TESTING

- A. Flood Test: Before acceptance, all pavements shall be water tested to ensure proper drainage as directed by the Inspector. The Contractor shall provide water for this purpose. The flooding shall be done by water tank truck. Depressions where the water ponds to a depth of more than 1/8-inch shall be filled or the slope corrected to provide proper drainage. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surface is invisible. No standing water shall remain 1-hour after test.

3.09 FIELD QUALITY CONTROL

- A. Replace or repair deficient and damaged asphalt paving.
- B. All paving shall drain properly before being accepted. Upon completion, the pavement shall be true to grade and cross section. When a 10 foot straightedge is laid on the finished surface parallel to the centerline of the roadway, the surface shall not vary from the edge of the straightedge more than 1/8 inch, except at intersections or at changes of grade. Any areas that are not within this tolerance shall be brought to grade immediately following the initial rolling. There shall be no variation greater than 1/4 inch plus or minus from a 10 foot straight edge, except at grade changes. The paving material in the area to be repaired shall be removed, by an approved method, to provide a minimum laying depth of 1 inch, or 2 times the maximum size aggregate, whichever is greater, of the new pavement at the join line. Repairs shall not be made to pavement surface by feather-edging at the join lines. All expenses for pavement repair up shall be borne by the Contractor at NO cost to the Owner.

3.10 PROTECTION

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

3.11 CLEAN UP

- A. Clean all debris and unused materials from the paving operation. Clean all surfaces that have been spattered or defaced as a result of the paving operation. Asphalt or asphalt stains which are noticeable upon surfaces of concrete, or materials which will be exposed to view, shall be promptly and completely removed. Cleaning shall be done in a manner that will not result in any

discharge of contaminated materials into any catch basin. All expenses for clean up shall be borne by the Contractor at NO cost to the Owner.

END OF SECTION

**SECTION 32 12 17
SITE CONCRETE PAVING**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Portland cement concrete pavement, cement walks, curbs, gutters, ramps, mowing strips, fence post footings, catch basins, pipe bedding and encasements, thrust blocks.

1.02 SUBMITTALS

- A. Shop Drawings: Submit plans, elevations and details of concrete site Work.
- B. Product Data: Submit mix designs and manufacturer's technical data for materials and products.

1.03 QUALITY ASSURANCE

- A. Comply with Standard Specifications For Public Works Construction.

1.04 REGULATORY REQUIREMENTS

- A. Portland cement concrete paving and concrete finishes:
 - 1. Portland cement concrete paving shall be stable, firm, and slip resistant and shall comply with **CBC Sections 11B-302 and 11B-403**.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Concrete, Mortar and Related Materials: Comply with applicable provisions of Standard Specifications for Public Works Construction, Section 201 - Concrete, Mortar and Related Materials:
 - 1. Concrete: 28-day compressive strength 2,500 psi, unless specified otherwise.
 - 2. Reinforcing Mesh: ASTM A 185, 4x4/W1.4 x W1.4 welded wire mesh.
 - 3. Expansion Joint Filler: Preformed expansion joint filler, bituminous type, complying with ASTM D 994.
- B. Form Materials:
 - 1. Side forms: Douglas fir, Construction Grade or Better or metal forms.
 - 2. Stakes: Douglas fir, Construction Grade or Better or metal stakes.

PART 3 - EXECUTION

3.01 CONSTRUCTION OF FORMS FOR CAST-IN-PLACE STRUCTURES

- A. Concrete Pavement: Install Portland cement concrete pavement in compliance with the Standard Specifications for Public Works Construction, Section 302- Roadway Surfacing.
- B. Miscellaneous Exposed Concrete: Install concrete curbs, walks, gutters, cross gutters, access ramps, driveways, catch basins, yard boxes, vaults and similar structures, in compliance with the Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction.
- C. Exposed Concrete Bases: Install bases, such as for post, flagpole, light standards and similar bases, in compliance with the Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction.
- D. Post, flagpole, light standard footings below grade, underground conduit bedding, encasements, thrust blocks and similar structures may be placed in excavations conforming to the required sizes.
- E. Reinforcement installation and concrete placement, surface finishes, curing and removal of forms shall be performed in compliance with applicable provisions of Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction. Provide heavy broom finish at slopes exceeding six (6) percent and medium broom finish at slopes up to six (6) percent.

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 12 18
SITE CONCRETE PAVING REINFORCEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing steel bars and accessories for cast-in-place concrete.

1.02 REFERENCES

- A. ACI 315 - Details and Detailing of Concrete Reinforcing.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ASTM A82 – Standard Specification for Steel Wire, Plain, For Concrete Reinforcement.
- D. ASTM A184 – Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
- E. ASTM A185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- F. ASTM A496 – Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
- G. ASTM A497 – Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
- H. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- I. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
- J. AWS D1.4 - Structural Welding Code for Reinforcing Steel.
- K. CRSI - Concrete Reinforcing Steel Institute Manual of Practice.
- L. Chapter 19A, California Building Code.

1.03 SUBMITTALS

- A. Shop Drawings: Submit steel reinforcement Shop Drawings in accordance with ACI 315. Include assembly diagrams, bending charts and slab plans. Indicate lengths and location of splices, size and lengths of reinforcing steel.
- B. Closeout Submittals: Record exact locations of reinforcing that vary from Shop Drawings.

1.04 QUALITY ASSURANCE

- A. Provide Testing Laboratory with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.
- B. 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. 4 CBC, Chapter 19A, Concrete
- C. 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.
- D. Certification of Welders: Shop and project site welding shall be performed by welding operators certified by AWS.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Avoid exposure to dirt, moisture or conditions harmful to reinforcing material.
- 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.

1.06 COORDINATION

- A. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Reinforcing Steel: ASTM A 615, or ASTM A706, 60 yield grade deformed low alloy steel for No. 4 bars or larger; 40 yield grade, No. 3 bars for ties and stirrups. Conform to Section 1903A, California Building Code 19A.
- B. Welding Electrodes: Low Hydrogen grade E70XX for Grade 40, E90XX for Grade 60.

2.02 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage black annealed type.
- B. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.
- C. Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.
- D. Concrete Blocks: Approximately 3 inches dimension each side.

2.03 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice and ACI 315 and ACI 318. Wherever possible, make bends to shape in fabricator's shop.
 - 1. Bars reduced in section will not be accepted.
 - 2. Bars with kinks are unacceptable.
 - 3. Bars shall not be heated to facilitate bending or for any other purpose.
 - 4. Bars with bends not indicated on drawings will not be accepted. Perform no forming in a manner which will damage bars.
- B. Weld reinforcement in accordance with AWS D1.4.
- C. Locate reinforcing splices not indicated on Drawings at point of minimum stress.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position. Install concrete blocks to support reinforcement over grade. Smooth face rocks not permitted.
- B. Do not displace or damage vapor barrier where vapor barrier is specified or indicated on drawings.
- C. Accommodate placement of formed openings.
- D. Prior to placing, thoroughly clean reinforcement of all rust, dirt, dust, oil or any other material deleterious to bonding of concrete.
- E. means of precast concrete block supports. Point wire tie ends away from the form.

- F. Unless otherwise indicated, the number, type, and spacing of supports shall conform to the ACI 315.
- G. Accurately place and securely tie reinforcement at all intersections and splices with black annealed wire and securely hold in position during placing of concrete by
- H. During placing of structural concrete slabs, provide a full-time reinforcing steel placer to repair and replace reinforcing to its proper location. Provide additional chairs of the proper size available to place under bars displaced during the concrete pouring operation.
- I. Dowels for Walls: Securely tie in place prior to placing of concrete. Do not place dowels in concrete after pour.
- J. Dowels for Slabs: Securely tie in place prior to placing concrete. Per Plans or Drawings. Do not place dowels in concrete after pour.
- K. Conform to Section 1907A, California Building Code for concrete cover over 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