PROJECT MANUAL

October 11, 2016

SIERRA RIDGE MIDDLE SCHOOL MODERNIZATION for POLLOCK PINES ELEMENTARY SCHOOL DISTRICT 2701 Amber Trail Pollock Pines, CA 95726

Job No.: 1324

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# TABLE OF CONTENTS

**PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP**

**DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS**
Not included at this time

**SPECIFICATIONS GROUP**

**GENERAL REQUIREMENTS SUBGROUP**

**DIVISION 01 - GENERAL REQUIREMENTS**

- 01 11 00 Summary of Work
- 01 23 00 Alternates
- 01 25 00 Substitution Procedures
- 01 26 00 Contract Modification Procedures
- 01 26 31 Information Request Procedure
- 01 29 00 Payment Procedures
- 01 31 00 Project Management and Coordination
- 01 32 14 Progress Schedule
- 01 33 10 Submittals
- 01 35 16 Alteration Project Procedures
- 01 42 00 References
- 01 43 00 Quality Assurance
- 01 45 23 Testing and Inspection Services
- 01 50 00 Temporary Facilities and Controls
- 01 60 00 Product Requirements
- 01 73 10 Execution Requirements
- 01 73 29 Cutting and Patching
- 01 74 19 Construction Waste Management
- 01 77 00 Closeout Procedures

**DIVISION 02 - EXISTING CONDITIONS**

- 02 41 00 Demolition

**DIVISION 03 - CONCRETE**
Not Used

**DIVISION 04 - MASONRY**
Not Used

**DIVISION 05 - METALS**
Not Used

**DIVISION 06 - WOOD, PLASTICS AND COMPOSITES**

- 06 05 00 Common Work Results for Wood, Plastics and Composites
- 06 10 00 Rough Carpentry
- 06 17 23 Parallel Strand Lumber
- 06 20 00 Finish Carpentry
- 06 41 17 Plastic Laminate Veneer Casework
- 06 83 16 Fiberglass Reinforced Panels

**DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

- 07 92 10 Joint Sealers

**DIVISION 08 - OPENINGS**

- 08 11 13 Hollow Metal Doors and Frames
- 08 71 00 Door Hardware
C. SPECIFICATION LANGUAGE: These Specifications are written in the imperative mood, as defined in the Construction Specifications Institute's Manual of Practice. Imperative language is directed to the Contractor. The indicative mood is employed on occasion when such sentence structure is necessary to convey the intended meaning in a more accurate or understandable form. The text is streamlined, with the colon (:) employed as a symbol for the words "shall be", "shall have", "shall conform with", "shall comply with", or "shall meet the requirements of". The colon is also used to separate a paragraph title or heading from the text that follows.

* End 00 01 08 *
DIVISION 24 - NOT USED
N/A

DIVISION 25 - INTEGRATED AUTOMATION
Not Used

DIVISION 26 - ELECTRICAL
26 01 00 Electrical Work General Requirements
26 05 19 Low Voltage Electrical Power Conductors and Cables
26 05 26 Grounding and Bonding for Electrical Systems
26 05 33 Raceway and Boxes for Electrical Systems
26 05 48 Vibration and Seismic Controls for Electrical Systems
26 27 26 Wiring Devices
26 28 16 Switchboards, Panelboards, Enclosed Switches, and Circuit Breakers
26 51 13 Interior/Exterior Lighting Fixtures, Lamps and Ballasts

DIVISION 27 - COMMUNICATIONS
27 20 00 Data/Telephone Structured Cabling System
27 32 00 Telecommunications System
27 51 00 Sound/Communication System

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY
28 31 00 Fire Alarm System

DIVISION 29 to 30 - NOT USED
N/A

SITE AND INFRASTRUCTURE SUBGROUP

DIVISION 31 - EARTHWORK
31 20 10 Earthwork

DIVISION 32 - EXTERIOR IMPROVEMENTS
32 12 16 Asphalt Paving
32 13 13 Concrete Paving

DIVISION 33 - UTILITIES
Not Used

DIVISION 34 to 49 - NOT USED
N/A

* End 00 01 10 *
DIVISION 09 - FINISHES
09 29 00 Gypsum Board
09 65 00 Resilient Flooring
09 65 66 Resilient Athletic Flooring
09 67 15 Slip Resistant Epoxy Flooring
09 68 02 Carpeting
09 72 00 Wall Coverings
09 91 00 Painting

DIVISION 10 - SPECIALTIES
10 11 45 Vinyl Covered Tackboards
10 14 00 Signage
10 21 14 Plastic Toilet Compartments
10 26 00 Wall and Door Protection
10 28 13 Toilet Accessories

DIVISION 11 - EQUIPMENT
11 53 00 Laboratory Equipment
11 61 43 Stage Curtains

DIVISION 12 - FURNISHINGS
12 56 51 Wood Library Furniture

DIVISION 13 - SPECIAL CONSTRUCTION
Not Used

DIVISION 14 - CONVEYING SYSTEMS
14 42 13 Inclined Wheelchair Lift

DIVISION 15 to 20 NOT USED
N/A

FACILITY SERVICES SUBGROUP

DIVISION 21 - FIRE SUPPRESSION
Not Used

DIVISION 22 - PLUMBING
22 00 00 Plumbing General Conditions
22 05 00 Common work Results for Plumbing
22 05 23 General Valves for Plumbing
22 07 00 Plumbing Insulation
22 11 00 Facility Water Distribution
22 13 00 Facility Sanitary Sewerage
22 34 00 Fuel Fired Domestic Water Heaters
22 42 00 Commercial Plumbing Fixtures

DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING
23 00 00 HVAC General Conditions
23 05 00 Common Work Results for HVAC
23 05 93 Testing, Adjusting and Balancing for HVAC
23 07 00 HVAC Insulation
23 11 23 Natural Gas Piping
23 31 00 Ductwork
23 33 00 Air Duct Accessories
23 34 00 Exhaust Fans
23 37 00 Air Outlets and Inlets
23 81 13 Ducted Split System AC Units
1. SUMMARY:

A. GENERAL: This Guide is provided as a basis for understanding the organization and use of this Project Manual.

B. DEFINITIONS:

1. Construction Documents: Defined as the written and graphic documents prepared or assembled by the Architect for communicating the design of the project and administering the contract for its construction. These include the Bidding Requirements (Advertisement for Bids, Instructions to Bidders, and Bid Forms) and the Contract Documents.

2. Contract Documents: Defined as the legally enforceable requirements that become part of the contract when the agreement is signed, these include the Contract Forms, Conditions of the Contract, Specifications, Drawings, Addenda, and Contract Modifications. They describe the proposed construction (referred to as the "Work") that results from performing services, furnishing labor, and supplying and incorporating materials and equipment into the construction.

3. Contract Forms: Include the agreement, bonds and certificates.

4. Conditions of the Contract: Define the basic rights, responsibilities, and relationships of the parties involved in the construction process.

5. Specifications: Divided into 50 Divisions, the Specifications define the qualitative requirements for products, materials, and systems and the standards of workmanship required for installation. Division 01 sections constitute the GENERAL REQUIREMENTS necessary for the Project; Divisions 02 through 49 comprise the Technical Specifications portion of the Project Manual.

6. Drawings: Graphic representations of the Work, which show the materials and their relationships to one another, including sizes, shapes, fit, location, and connections.

7. Addenda: Written or graphic documents issued to clarify, revise, add to, or delete information in the original bidding documents or in previous addenda.

8. Contract Modifications: Written instruments used to add to, delete from or otherwise modify the Work after the construction agreement has been signed.

C. DIVISION 01 - GENERAL REQUIREMENTS: Division 01 of the Specifications expands on certain of the broad provisions of the Conditions of the Contract and governs the execution of all Technical Sections of the Specifications. Sections included in Division 01 specify the administrative and procedural requirements, as well as temporary facilities, required for the Project. All requirements stated in Division 01 apply to and will be in force for all subsequent Sections included in Divisions 02 through 49.

D. PRODUCT REFERENCES: Specification Section numbers and titles follow the latest recommendations of MasterFormat™ 2010 Edition published by the Construction Specifications Institute (CSI). The Section titles represent work results and may be stated in the singular or plural without regard to the actual quantity used on the project. The organization of specifications by Section is not meant to define subcontracts or other divisions of work by trades.

E. MANUAL FORMAT:

1. General: The first page of each Section appears as a facing (right-hand) page and is graphically defined with very large and boldfaced Section number and title. Succeeding pages of each Section are printed back-to-back, with header in normal-sized boldface type that has the Section number and page number appearing in the upper outside corner of the page.

2. Underlined and Boldface Type: Underlining and bolding have been used in different combinations throughout the Project Manual to highlight significant text. These devices have been used to assist the user in finding items of information or to emphasize the importance of certain information. No other meaning is attached to the use of boldface and underlined text.

3. Dates: The official date of issue of the Project Manual appears on the cover sheet of this Project Manual. Dates subsequent to that date on individual Section pages indicate reissue of entire Sections for clarification.

1.2 DEFINITIONS AND INTERPRETATIONS:

A. WORDS AND TERMS: Those which are frequently used, with special meanings, in this Project Manual are defined in Section 01 42 00 - REFERENCES.

B. GOVERNING DICTIONARY: The definitions of words used in these Specifications, which are not defined in Section 01 42 00 - REFERENCES, the General Conditions, or in referenced standards, are as given in "The American Heritage Dictionary of the English Language".

Sierra Ridge Middle School Modernization
Kirk S. Brainerd, Architect
Job No. 1324
March 15, 2016
SUMMARY OF WORK

1. GENERAL:
   A. SUMMARY: Project is Sierra Ridge Middle School Modernization, located at 2700 Amber Trail, Pollock Pines, CA 95726, for Pollock Pines Elementary School District. Project consists of modernization of main building and classroom wing, all in conformance with drawings and specifications prepared by Kirk S. Brainerd, Architect, Placerville, California.
   B. RESPONSIBLE PARTIES: Construction of this Project is governed by the agreement between the Owner and the Contractor. Statements in the specifications are directed to this contractor, who has overall responsibility for the subcontractors.
   C. COMMUNICATIONS: Written or graphic communications during construction shall be documented using PDF technology.
   D. PARTICULAR PROJECT REQUIREMENTS:
      1. Existing Site Conditions and Restrictions: Notify Architect of existing conditions different from those indicated on the drawings. Do not remove or alter structural components without prior written approval.
      2. Requirements for Sequencing or Scheduling: Begin work as identified in the OWNER-CONTRACTOR AGREEMENT, proceed as shown in the Progress Schedule as required under Section 01 32 14 - PROGRESS SCHEDULE, and complete work within the limits designated in the OWNER-CONTRACTOR AGREEMENT. Coordinate work to accommodate the Owner's operations and use of premises during construction period; coordinate construction schedule and operations with Owner's Representative; indicate all special requirements in the Progress Schedule as specified.
      3. Occupancy of Adjacent Facilities: Students and faculty may occupy facilities during the period of construction.

2. PRODUCTS:
   A. HAZARDOUS MATERIALS: No asbestos or products containing asbestos have been knowingly specified for this Project. If materials containing asbestos are brought to the site for use or installation in the Work; or if such materials are encountered in existing work upon which new work is being performed, notify the Architect immediately so that appropriate action may be taken. A statement certifying that no new materials containing asbestos have been included in the Work is required at the completion of the Project.

3. EXECUTION:
   A. CONTRACTOR'S USE OF PREMISES: Confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents; do not unreasonably encumber the site with materials or equipment. Do not interfere with Owner's activities in and about existing facilities. Disruption of Owner's operations will be acceptable only with prior agreement with the Owner. Ten (10) days minimum notice will be required, including establishment of a firm schedule for operations. Roads for access to and from building site, loading areas and parking space shall be as indicated. Confine traffic and materials delivery to these roads and locations. Contractor is responsible for protection and safekeeping of products stored on the site. Specific areas for storage of materials and site fabrication shall be as indicated by the Architect.
   B. PROTECTION: Erect temporary barricades, warning signs and substantial handrails to protect persons in and around the work areas and observe safety precautions. Conform to applicable OSHA rules and regulations and State Safety Regulations and Orders.

ALTERNATES

1. GENERAL:
   A. SUMMARY: Additive or deductive alternates will be accepted at option of Owner; the Base Bid, including Alternates accepted by Owner, will be an element considered in the award of the Contract.
2. PRODUCTS:
   A. SCHEDULE OF ALTERNATES:
      1. Alternate No. 1 - Exercise Room - West of the Gym: Convert locker rooms into one exercise
         classroom.
      2. Alternate No. 2 - Gym: Renovate existing multipurpose room.

3. EXECUTION:
   A. MODIFICATIONS TO WORK: Modify or adjust affected adjacent Work as required to completely
      and fully integrate accepted alternates into the Project.

   * * *

SUBSTITUTION PROCEDURES

1. GENERAL:
   A. REQUEST: Changes in products, materials, equipment, and methods of construction required by
      the Contract Documents that are proposed by the Contractor after award of the Contract are
      considered to be requests for substitutions. Obtain a "Substitution Request Form" from the Architect.
      Submit electronic copy (PDF) of completed and signed Substitution Request with required
      substantiating data.
   B. SUBSTANTIATING DATA:
      1. Information: Provide product identification; manufacturer's name and address; manufacturer's
         literature including product description, performance and test data and all reference standards;
         samples; and name and address of similar projects using the product, including dates of
         installation and names of architect and owner.
      2. Comparison and Effect: Submit a side-by-side, item-by-item comparison of all characteristics
         of the specified product and the proposed product. Submit cost data comparing proposed
         substitution with specified product and amount of net change to contract sum. Provide statement
         of effect of substitution on construction schedule.
      3. Representation: By making requests for substitutions the Contractor represents to have
         personally investigated the proposed substitute product and determined that it is equal or
         superior in all respects to that specified; that the Contractor will provide the same warranty for
         the substitution as for the product specified; that the cost data presented is complete and
         includes all related costs under this contract except the Architect's redesign costs, and waives
         all claims for additional costs related to the substitution which subsequently become apparent;
         and will coordinate the installation of the accepted substitute, making such changes as may be
         required for the work to be complete in all respects.

2. PRODUCTS:
   Not Used

3. EXECUTION:
   A. ARCHITECT'S ACTION: If necessary, the Architect will request additional information or
      documentation for evaluation within one (1) week of receipt of a request for substitution. The
      Architect will notify the Contractor of acceptance or rejection of the substitution within two (2)
      weeks of receipt of the request, or one (1) week of receipt of additional information or documentation,
      whichever is later. Acceptance of request for substitution will be in the form of a Change Order.
   B. COORDINATION: Architect's acceptance of product as "equal" or as a substitution does not relieve
      Contractor from responsibility for compliance with requirements of any portion of Contract
      Documents; Contractor shall be responsible, at Contractor's own expense, for any changes in other
      parts of the Work which may be caused by such substitution.

   * * *
1. GENERAL:
   A. SUMMARY: Changes in the work shall be accomplished in accordance with applicable codes and the Conditions of the Contract.
   B. CHANGE PROCEDURES: Architect may issue a Proposal Request on AIA Document G709 - Proposal Request, which includes a detailed description of a proposed change in the Work; Contractor shall prepare and submit an estimate within ten (10) days. Contractor may propose a change by submitting a written request to the Architect, describing the proposed change and its full effect on the Work, including a statement describing the reason for the change, the effect on the Contract Sum/Price and Contract Time with full documentation, and a statement describing the effect on work by separate or other contractors.
   C. CHANGE DOCUMENTS: Change Orders will be issued by Architect on AIA Document G701 - Change Order, signed by Architect, Owner and Contractor, to order changes to the work which involve a change in Contract Price and/or Contract Time. Changes that affect Structural Safety, Access Compliance, or Fire & Life Safety portions of the project shall be submitted on form DSA-140 for approval by DSA. Construction Change Directive will be issued by Architect, signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Supplemental Instructions will be issued by Architect for minor changes in the Work not involving an adjustment to Contract Price or Contract Time.

2. PRODUCTS:
   A. CALCULATION: The cost or credit to the Owner resulting from a change in the work shall be determined in one or more of the following ways:
      1. By mutual acceptance of a lump sum amount, properly itemized and substantiated.
      2. By unit prices stated in the contract documents or subsequently agreed upon.
      3. By actual cost and a mutually acceptable fixed or percentage fee.
      4. If none of the preceding methods is agreed upon then the total cost of such work shall be based on the contractor's expenditure or savings and a percentage for overhead and profit.

3. EXECUTION:
   A. CORRELATION OF CONTRACTOR SUBMITTALS: Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum/Price. Revise progress schedules to reflect any change in Contract Time. Record authorized changes in Project Record Documents.

* * *

INFORMATION REQUEST PROCEDURE
Section 01 26 31

1. GENERAL:
   A. DESCRIPTION: Submit request for information, interpretation and/or clarification to the Architect promptly upon identification of need, and in reasonable time so as not to affect the progress of the Work.

2. PRODUCTS:
   A. SUBMISSION REQUIREMENTS: Submit electronic copy (PDF) of original, signed copy of RFI to the Architect on AIA Document G716 - Request for Information. Allow fourteen (14) calendar days after receipt by Architect for review. If more than ten (10) requests are received within one (1) calendar week, the Architect will specifically schedule and extend response time as required to accomplish the reviews.

3. EXECUTION:
   A. DISTRIBUTION: The Architect will distribute copies of requests for information to project consultants, as required for their participation. A PDF with the official response will be returned to the Contractor; direct communication and response between project consultants and Contractor will

Sierra Ridge Middle School Modernization
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Job No. 1324
October 11, 2016
be considered informational only. The Contractor will make and distribute copies of the official response to subcontractors and suppliers, as required.

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PAYMENT PROCEDURES  Section 01 29 00

1. GENERAL:
   A. SCHEDULE OF VALUES: Submit PDF of Schedule of Values to the Architect at least ten (10) days prior to submitting first Application for Payment. Schedule of Values will be used as basis for, and review of, Contractor's Applications for Payment.
   B. PROGRESS PAYMENTS: Submit applications for payment to the Architect at intervals stipulated in the Owner-Contractor Agreement and the Conditions of the Contract.

2. PRODUCTS:
   A. FORM OF SUBMITTAL FOR SCHEDULE OF VALUES: Submit typed schedule on AIA Document G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form of electronic media printout will be considered as an alternative. Use the Table of Contents of this Project Manual as the basis for format for listing costs of work specified in Divisions 02 through 49.
   B. FORM OF SUBMITTAL FOR PAYMENT: Prepare itemized applications typed on AIA Document G702 - Application and Certificate for Payment and AIA Document G703 - Continuation Sheet. Use data from approved Schedule of Values; provide dollar value in each column for each line item for portion of work performed and for stored products. List each authorized Change Order as an extension on AIA Document G703 - Continuation Sheet, listing Change Order number and dollar amount as for an original item of work.

3. EXECUTION:
   A. PREPARATION OF SCHEDULE OF VALUES: Identify each line item with the number and title of its specification section. Break down installed costs into the delivered cost of product, with taxes paid, and the total installed cost, with overhead and profit. For each line item which has an installed value of more than $10,000, break down the costs to list major products or operations under each item. Itemize separate line item costs for each of the following: Performance and payment bonds; field supervision and layout; scheduling; and temporary facilities and controls.
   B. PREPARING SCHEDULE OF UNIT MATERIAL VALUES: Submit a separate schedule of unit prices for materials to be stored on which progress payments will be made. Make the form of submittal parallel to the Schedule of Values, with each line item identified the same as the line item in the Schedule of Values. Include in the unit prices only the cost of material, delivery and unloading at site, and sales taxes.
   C. REVIEW AND RESUBMITTAL OF SCHEDULE OF VALUES: After review by the Architect, revise and resubmit the schedule (and the Schedule of Unit Material Values) as required. Revise schedule to list approved Change Orders, with each Application for Payment.
   D. PROCEDURE FOR PROGRESS PAYMENTS: Submit PDF of notarized original of each Application for Payment.

* * *

PROJECT MANAGEMENT & COORDINATION  Section 01 31 00

1. GENERAL:
   A. SUMMARY: Coordinate scheduling, submittals, and Work of the various sections of these Specifications to assure the efficient and orderly sequence of installation of each part of the Work. Coordinate construction operations included under different sections that depend on each other for proper installation, connection, and operation.
   B. SUBMITTALS: Submit written procedures for Project communications including submittals, reports and records, schedules, coordination drawings, and recommendations. Communications between the Owner, Contractor and Inspector shall be through the Architect.
C. MEETINGS: Schedule and administer meetings throughout progress of the Work at biweekly intervals with job superintendent, major subcontractors and suppliers, and the Architect, as appropriate to agenda topics for each meeting. Prepare agenda with copies for participants, preside at meetings, and distribute copies of minutes within two (2) days to the participants and those affected by decisions made.

2. PRODUCTS:
   A. MATERIALS: Refer to Section 01 60 00 - PRODUCT REQUIREMENTS.

3. EXECUTION:
   A. PERFORMANCE: Refer to Section 01 73 10 - EXECUTION REQUIREMENTS.

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PROGRESS SCHEDULE

Section 01 32 14

1. GENERAL:
   A. DESCRIPTION: Within fifteen (15) days after award of the Contract, submit to the Architect estimated construction progress schedules for the Work in PDF form, with sub-schedules of related activities essential to its progress.

2. PRODUCTS:
   A. CONTENT: Prepare Schedule as a horizontal bar chart with separate bar for each major portion of Work or operation, identifying first work day of each week. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction. Comply with procedures contained in AGC's "Construction Planning & Scheduling." Identify each item of work by specification section number. Indicate delivery dates for Owner-Furnished Products.

3. EXECUTION:
   A. REVISIONS TO SCHEDULES: Submit revised progress schedules periodically. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes. Report corrective action taken, or proposed, on problem areas or anticipated delays.

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SUBMITTALS

Section 01 33 10

1. GENERAL:
   A. DESCRIPTION: Submit certifications, shop drawings, product data/material lists, manufacturer's instructions, and samples to the Architect for review as required.
   B. SUBMISSION PROCEDURES: Submit listed submittals for products of specified manufacturers and named acceptable alternate manufacturers, as well as for requests for acceptance of products as "equal" or as substitution. The latter shall satisfy requirements of the Substitution Request, and be submitted within the time frames specified in Section 01 25 00 - SUBSTITUTION PROCEDURES.
   C. SUBMITTALS SCHEDULE: Prepare schedule for submission of submittals requiring action by the Architect; arrange in a tabular format including scheduled date for first submittal, specification Section number and title, submittal category (action or informational), name of subcontractor, description of the Work covered and scheduled date for Architect's final release or approval. Schedule submissions a minimum three (3) weeks before required for use and no later than the following number of calendar days after issuance of Notice to Proceed, unless specified otherwise in individual specification Section: early start and/or long lead-time items: 30; color selection items: 30; electrical, mechanical and equipment items: 60; all other items: 90.
2. PRODUCTS:
   A. SUBMITTALS: Submit electronic copy (PDF) of submittal schedule, certifications, shop drawings, product data/material lists and manufacturer's instructions; for samples, submit as identified in individual specification section. Submit with cover sheet giving the Project name and number; submission date and revision dates; names of Architect, Contractor and Subcontractor. Identify product or material with manufacturer's name, product name or model number and supplier.

3. EXECUTION:
   A. SUBMITTAL REVIEW: Make submittals as required to cause no delay in the orderly progress of work, layout or fabrication under Contract, due allowance being made for checking by the Architect and for such corrections, resubmission and rechecking as may be necessary. Do not commence work requiring submittals until review by Architect has been completed.

ALTERATION PROJECT PROCEDURES

1. GENERAL:
   A. DESCRIPTION: In addition to work as specified in Section 02 41 00 - DEMOLITION, Section 01 73 29 - CUTTING AND PATCHING and that specifically shown, cut, move or remove items as necessary to provide access or to allow alterations and new work to proceed. Include such items as repair and/or removal of hazardous and unsanitary conditions; removal of abandoned items and items serving no useful purpose, such as abandoned piping, conduit and wiring; removal of unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals and deteriorated concrete; and cleaning of surfaces and removal of surface finishes as needed to install new work and finishes. Remove minimum necessary, and in a manner to avoid damage to adjacent work. Cut finish surfaces such as masonry, tile, plaster or metals, by methods to terminate surfaces in straight line at natural point of division. Protect existing finishes, equipment, and adjacent work which is scheduled to remain, from damage. Patch, repair and refinish, to the specified condition for each material, with a workmanlike transition to adjacent new items of construction.

2. PRODUCTS:
   A. PRODUCTS FOR PATCHING, EXTENDING AND MATCHING: Provide same products or types of construction as that in existing structure, as needed to patch, extend or match existing work. The Contract Documents do not specifically define the products or standards of workmanship present in existing work. Identify such products by inspection and testing; and workmanship by use of selected existing work as a sample for comparison.

3. EXECUTION:
   A. PERFORMANCE: Patch and extend existing work to level of quality specified for new work. Where partitions are removed, patch floors, walls, and ceilings, with finish materials to match existing. Where removal of partitions results in adjacent spaces becoming one, rework floors and ceilings to provide smooth planes without breaks, steps, or bulkheads. Where extreme change of plane of two inches or more occurs, request instructions from Architect as to method of making transition. Trim and refinish existing doors as necessary to clear new floors.
   B. DAMAGED SURFACES: 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. Provide adequate support of substrate prior to patching finish. Refinish patched portions of painted or coated surfaces in manner to produce uniform color and texture over entire surface. When existing surface finish cannot be matched, refinish entire surface to nearest intersections of surfaces.
   C. TRANSITION FROM EXISTING TO NEW WORK: When new work abuts or finishes flush with existing work, make smooth and workmanlike transition. Patched work shall match existing adjacent work in texture and appearance so that patch or transition is invisible at distance of five feet (5'-0")]. When finished surfaces are cut in such a way that smooth transition with new work is not possible, terminate existing surface in neat manner along straight line at a natural line of division, and provide trim appropriate to finished surface.
REGULATORY REQUIREMENTS

1. GENERAL:
   A. SUMMARY: Work of this project shall conform to California Building Code (CBC), current edition
      with applicable amendments, and jurisdictional requirements as adopted by enforcing agencies.
      Comply with Americans with Disabilities Act (ADA), Latest Edition, Civil Rights Division, Office on
      the Americans with Disabilities Act, U.S. Department of Justice; U. S. Environmental Protection
      Agency (EPA), Laws and regulations; California Environmental Protection Agency (CalEPA); State
      regulations and standards; and California State Water Resources Control Board (SWRCB); SWPPP
      Standards.

2. PRODUCTS:
   Not Used

3. EXECUTION:
   Not Used

REFERENCES

1. GENERAL:
   A. SUMMARY: References are to various standard specifications, codes, practices, and requirements
      for materials, work quality, installation, inspections and tests, which are published and issued by the
      organizations, societies and associations listed in individual specification Sections by abbreviation
      and name. Obtain copies of referenced standards directly from publication sources as needed for
      proper performance and completion of the Work. References to established Standards mean and
      include the latest edition of such Standards, as of the date of issue of this Specification.
   B. DEFINITIONS:
      1. Words and Terms: The following are used in addition to those defined in the General
         Conditions, and are defined as follows:
         a. Accepted Equal: Reviewed and accepted by the Architect as being equal in quality, utility
            and appearance.
         b. Approved: As accepted by the Architect.
         c. As Required: As required by regulatory requirements, referenced standards, existing
            conditions, or by the Contract Documents.
         d. Directed: As instructed by the Architect in writing.
         e. Furnish: Supply and deliver to the site.
         f. Indicated: As shown, noted, or scheduled on the Drawings.
         g. Install: Anchor, fasten, or connect in place and adjust for use; place or apply in proper
            position and location; establish in place for use or service.
         h. Provide: Furnish and install.
         i. Site: Area to be occupied by the Project. Use of the word "jobsite" or "site" shall be
            interpreted to be synonymous with "site of the Work" or "Work Site".
      2. Abbreviations: Definition of abbreviations and symbols used on the Drawings are identified on
         the Drawings. Definitions of words and abbreviations used in these Specifications are given in
         "The American Heritage Dictionary of the English Language".

2. PRODUCTS:
   Not Used

3. EXECUTION:
   Not Used
QUALITY ASSURANCE

Section 01 43 00

1. GENERAL:
   A. DESCRIPTION: Products or workmanship specified in the Project Manual by association, trade, or other consensus standards shall conform to the requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

2. PRODUCTS:
   A. GENERAL: Refer to Section 01 60 00 - PRODUCT REQUIREMENTS to assure a consistent quality of products furnished by suppliers and manufacturers as indicated throughout the Project Manual.

3. EXECUTION:
   A. PERFORMANCE: Refer to Section 01 73 10 - EXECUTION REQUIREMENTS. Perform work in accordance with the Drawings, reviewed and accepted shop drawings, and the Specifications, with quality of work conforming to the highest established standards and practices of the various trades involved. Installers specializing in the work of the various sections shall be manufacturer-approved and have minimum three (3) years documented work experience in procedure required. Install and erect Work plumb, level, square, and true, or true to indicated angle, and in proper alignment and relationship to other work. Unless otherwise indicated or specified, manufactured materials, products, processes, equipment, systems, and assemblies will be required to be erected, installed, or applied in accordance with the manufacturers' latest instructions, directions, or specifications applicable to conditions similar to those at the project site. Finished Work shall be free from defects and damage as specified and to the satisfaction of the Architect. The Architect reserves the right to reject materials and work quality which does not meet accepted standards. Rejected material or work quality will be repaired or replaced, as directed, at no additional cost to the Owner.
   B. FIELD SAMPLES AND MOCK-UPS: When specified, apply field samples and erect mock-ups as directed at Project site in location as directed by Architect. Construct each sample or mock-up complete, including work of trades required in finished work. After review, if accepted, samples and mock-ups may be used in construction of Project.
   C. INSTALLATION: Conduct quality control in concert with suppliers, products, services, site conditions, and workmanship, to produce work of specified quality. Follow manufacturer's instructions, including each step in progression of installation; if manufacturer's instructions conflict with Contract Documents, request clarification from Architect before commencing Work. Coordinate with manufacturer of a product, system, or assembly which requires special knowledge and skill for proper application/installation of the product, system, or assembly to obtain field service, consultation and inspection as required for the application/installation work, at no additional cost to the Owner.
   D. TOLERANCES: Adjust products to appropriate dimensions; position before securing in place. Monitor and control tolerances of installed products to produce acceptable Work. Finish wall surfaces plumb; maximum variation of 1/8 inch in 8'-0" when a straightedge is laid on the surface in any direction, and no measurable variation in any 2'-0" direction. Finish ceiling surfaces true and level; maximum variation of 1/8 inch in 8'-0" when a straightedge and water level are laid on the surface in any direction, and no measurable variation in any 2'-0" direction. Finish floors level to within plus or minus 1/8 inch in 10'-0" for resilient floor coverings.

* * *

TESTING AND INSPECTION SERVICES

Section 01 45 23

1. GENERAL:
   A. TESTING LABORATORY: Owner will employ and pay for services of an independent testing laboratory to perform specified testing. Testing laboratory shall be approved by the Architect and DSA. Coordinate the sequence of activities to accommodate required services with a minimum of delay and to avoid the necessity of removing and replacing construction to accommodate inspections and tests. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities and to cooperate with laboratory to facilitate required services. Employment of laboratory does not relieve Contractor's obligations to perform work of Contract.
   B. INSPECTION SERVICES: Inspection shall be provided as required under CCR, Title 24, current edition. Inspection costs will be paid for by the Owner. Inspector will be employed by the Owner, and approved by the Architect, Structural Engineer and the Division of the State Architect. The Work

Sierra Ridge Middle School Modernization  
Kirk S. Brainerd, Architect  
Job No. 1324  
October 11, 2016
shall be liable to inspection and the Inspector shall have full access to review work during working times. The Contractor shall furnish the Inspector with information necessary to fully inform Inspector of conditions. Inspection does not relieve the Contractor from fulfilling the requirements of the contract.

C. REQUIREMENTS: Testing laboratory inspection, sampling and testing is required under Sections 03 33 10 - CONCRETE.

2. PRODUCTS:
   A. SUBMITTALS: Testing laboratory will be required to submit an electronic copy (PDF) of the certified written report of each inspection, test, or similar service.

3. EXECUTION:
   A. LABORATORY DUTIES: Comply with ASTM E329 "Standard Specification for Agencies Engaged in Construction Inspection, Testing or Special Inspection". Cooperate with Architect, Engineer and Contractor; provide qualified personnel after due notice. Perform specified inspections, sampling and testing of materials and methods of construction; verify compliance with specified standards. Ascertain compliance of specified materials with requirements of Contract Documents. Promptly inform Architect and Engineer of observed irregularities or deficiencies of work or products. Submit reports as required. Perform additional tests as required by Architect or Owner. Laboratory is not authorized to release, revoke, alter or enlarge on requirements of Contract Documents, or perform any construction duties of Contractor.

   B. CONTRACTOR'S RESPONSIBILITIES: Cooperate with laboratory personnel, providing access to Work, and to manufacturer's operations. Secure and deliver to laboratory adequate quantities of representative samples of materials proposed for use and that require testing. Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Refer to Section 01 73 29 - CUTTING AND PATCHING.

* * *

TEMPORARY FACILITIES AND CONTROLS  Section 01 50 00

1. GENERAL:
   A. DESCRIPTION: Provide such temporary facilities and controls, construction equipment and aids, scaffolding, staging, runways, hoists, barricades, and similar equipment, temporary utilities and services, sanitary facilities, field office and sheds, fences, security, fire protection, and miscellaneous facilities as required for construction, the safety of personnel, property, and the public and as specified. Include installation, maintenance, and removal of all such temporary facilities and controls. Assure conformance with applicable requirements of Associated General Contractors of America (AGC); "Manual of Accident Prevention in Construction", and California Code of Regulations; "Title 8 - (CAL-OSHA) Construction Safety Orders"; obtain approval by appropriate authorities and regulatory agencies, including insurance companies, for safety precautions, operation and fire hazard. Protect and maintain temporary facilities and controls in proper and safe condition throughout progress of work. Immediately repair or replace lost or damaged temporary facilities or controls; remove as rapidly as progress of work will permit.

2. PRODUCTS:
   A. TEMPORARY UTILITIES:
      1. Temporary Water: Owner will provide and pay for water from existing source(s) on site, as shown. Provide connections to source and sufficient hose or pipe to carry water to all required locations.
      2. Temporary Electrical Facilities: Owner will provide temporary power free of charge from existing service, as shown. Provide temporary electrical power and facilities necessary to supply lighting for work operations and power for power driven tools and testing. Provide and maintain interior lighting at a minimum level of two (2) watts per square foot, as required.
      3. Temporary Heat and Ventilation: Provide heat and ventilation as required to protect work and materials and reduce humidity to extent required to prevent corrosion of metal, dampness or mildew that may damage materials and finishes; fuel, equipment and method of heating and ventilating shall be acceptable to Architect. Maintain building temperature of not less than 60° F after finishing is complete and until final acceptance or occupancy by Owner.
4. Temporary Telecommunications: Provide telephone for use of the Contractor, Architect, subcontractors and suppliers. Provide and pay service charges for a cellular telephone and/or pager for use of Contractor's Superintendent. Provide internet access and e-mail capability at the job site.

5. Temporary Fire Protection: Until fire protection is supplied by permanent facilities, install and maintain temporary fire protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with requirements of jurisdictional authority.

B. FIELD OFFICE: Provide acceptable temporary office, weather tight, well lit and ventilated including separate office space of sufficient size for Architect and Inspector; equip with shelves, desks, filing cabinet, chairs, and such other items of equipment needed, with adequate provisions for power, heating and cooling.

C. SANITARY FACILITIES: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

D. CONSTRUCTION EQUIPMENT: Erect, equip, operate, and maintain construction equipment per applicable statutes, laws, ordinances, rules, and regulations of jurisdictional authorities and insurance companies regarding safety, operation and fire hazard. Provide and maintain scaffolding, staging, runways, and similar equipment, as required. Coordinate furnishing and use with subcontractors. Provide and maintain hoists per Safety Orders of State of California, Division of Industrial Safety, until work is completed or until no longer required under this Contract.

E. ENCLOSURES, FENCING AND BARRICADES: Provide and maintain barricades, fencing, shoring, pedestrian walkways including lights and other safety precautions to guard against personal injury and property damage as prescribed by jurisdictional authorities, including insurance companies.

F. TEMPORARY SIGNS: Provide project sign as shown, in location as directed. Other signs are not permitted; Contractor's name may be placed on field office and equipment.

G. SITE CONTROLS AND PARKING:
   1. Vehicular Access and Parking: Use identified entrances, access roads, and parking, as shown, or as directed. Maintain roads in satisfactory condition during Contract; repair damage resulting from work of this Project, as required, to leave in condition equal to that existing at start of Work.
   2. Site Storage and Work Areas: On-site storage and work areas will be identified by the Architect, for the Contractor's use, subject to change as necessary as job progresses. Enclose with fences and gates as required for security.
   3. Debris Control: Keep work and storage areas clean and free of debris. Dispose of debris off site as it accumulates; pay required fees for use of dumps. Burning or burying on site is prohibited.
   4. Dust Controls: Use sprayed water to control dust from outdoor operations, as required. Control dust from indoor operations by using temporary partitions, curtains, or other means to prevent its spread beyond immediate work area. Use temporary means of closure for ducts and other openings communicating with other parts of building.
   5. Noise Control: Minimize noise caused by work operations. To extent possible, schedule accomplishment of noisy construction operations to hours during which adjacent building occupants will be least inconvenienced.
   6. Security: Contractor is responsible for security of areas of Work during entire time of Contract. Repair damage to Work and replace materials lost due to vandalism or theft.
   7. Temporary Tree and Plant Protection: Install temporary fencing located as shown to protect vegetation and outside the drip line of trees to protect from construction damage. Protect tree root systems from damage, flooding, and erosion.
   8. Drainage: As required by the State of California Water Resources Control Board, only rainwater is permitted in storm drain system. Do not permit water resulting from washing of equipment or other construction activities to be discharged into the storm drainage system. Provide temporary containment, sediment traps, and/or gravel filters to prevent discharge of non-storm water into storm drain system.

3. EXECUTION:
   A. MAINTENANCE AND REMOVAL: Maintain temporary facilities and controls as long as required for safe and proper completion of Work; remove temporary facilities and controls as rapidly as progress of Work will permit.

* * *
PRODUCT REQUIREMENTS

1. GENERAL:
   A. DESCRIPTION: Provide products as shown and specified per Contract Documents. Within fifteen (15) days after award of contract, submit complete list of products for which contractor has selected an option or proposes a substitution. Provide name of manufacturer, trade name, and model number or catalog designation of each product. For products specified by reference standards, provide name of manufacturer, trade name, model or catalog designation, and reference standards.

2. PRODUCTS:
   A. PRODUCT OPTIONS:
      1. Products Specified by Reference Standards: Contractor may select any product which meets the standards, by any manufacturer.
      2. Specified Products and Alternate Manufacturers: Wherever catalog numbers and specific brand or trade names are used in conjunction with a designated material, product, thing or service mentioned in these specifications, they are used to establish the standards of quality, utility and appearance required. The "specified product" shall be understood to be the basis for the project design. Comparable products of named "alternate manufacturers" shall be considered equal in quality, utility and appearance. Contractor has the option of selecting from products and manufacturers named and must satisfy submittal requirements specified in Section 01 33 10 - SUBMIT TALS.
      3. Accepted Equal: Where specification includes the designation "or accepted equal", Contractor may request acceptance as "equal" any material, process, or product of unnamed manufacturer through use of substitution request as specified in Section 01 25 00 - SUBSTITUTION PROCEDURES.
      4. Required Products: Where use of one named product and manufacturer is required to match others in use or because only one brand or trade name is known, there is no option, and no substitution will be allowed.

3. EXECUTION:
   A. PRODUCT HANDLING: Assure that Work is manufactured and/or fabricated in ample time so as to not delay construction progress. Transport, handle, store and protect products in accordance with manufacturer's instructions.

EXECUTION REQUIREMENTS

1. GENERAL:
   A. DESCRIPTION: Schedule delivery of materials to the site at such time as required for proper coordination of the work. Receive materials in manufacturer's unopened packages and bearing manufacturer's label. Handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions. Store materials in a dry and well-ventilated place, adequately protected from damage and exposure to the elements.

2. PRODUCTS:
   A. MATERIALS: Refer to Section 01 60 00 - PRODUCT REQUIREMENTS.

3. EXECUTION:
   A. PREPARATION: Verify existence and location of site improvements and other construction indicated as existing and the location and points of connection of utility services. Coordinate the use of the site and facilities. Allocate mobilization areas of site; allow for field offices and sheds, access, traffic, and parking facilities.
   B. SITE CONDITIONS: Carefully examine sub-surfaces and take field measurements; report defects and discrepancies between plan and field dimensions to Architect. Starting of work implies acceptance of conditions as they exist. Obtain templates, patterns, and setting instructions as required; verify dimensions. Verify that ambient temperature and moisture content are within limits of material and equipment manufacturers' instructions. Perform interior finish work only after building is closed and temperature can be maintained above 50 degrees F.
C. PROTECTION: Provide temporary protection and enclosures for floor and roof openings, stairways, and similar conditions. Provide adequate temporary centering, bracing, and shoring for protection of structure during construction. Protect non-ferrous metal work throughout construction period; protect materials from damage during adjacent construction activities. Provide protection of wood materials and products, whether or not installed, including erected and installed wood framing and sheathing, from water and moisture of any kind until completion and acceptance of the Project.

D. INSTALLATION: Install products in conformance with referenced standards, manufacturer's written directions, as shown, and as specified. Coordinate delivery and placement of items embedded in work. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate Work of various contractors having interdependent responsibilities for installing, connecting to, and placing in service, such equipment. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

E. COMPLETION: Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest. Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion. Comply with manufacturer's written instructions for temperature and relative humidity.

* * *

CUTTING AND PATCHING

1. GENERAL:
   A. DESCRIPTION: Provide all cutting, fitting and patching, including excavation and backfill as required, to complete the Work or to accomplish the following: make several parts fit together properly; uncover portions of the Work to provide for installation of work not installed in the proper sequence of construction; remove and replace defective and non-conforming work; remove samples of installed work for testing, and as identified in individual sections of the specifications; provide penetrations of non-structural surfaces for installation of piping and conduit; install specified work in existing construction.
   B. SUBMITTALS: Submit written request to the Architect in advance of executing any cutting or alteration to the following affected items: work process of the Owner or any separate contractor; structural value or integrity of any element of the Project; integrity or effectiveness of weather-exposed or moisture-resistant elements or systems; efficiency, life, maintenance or safety of operational elements; visual qualities of sight-exposed elements.

2. PRODUCTS:
   A. MATERIALS: Match existing materials for cutting and patching work with new materials conforming to project requirements.

3. EXECUTION:
   A. INSPECTION: Inspect existing conditions; include elements subject to damage or movement during cutting and patching. After uncovering work, inspect conditions affecting the installation of products, or performance of work. Report unsatisfactory or questionable conditions; do not proceed with work until Architect has provided further instructions.
   B. PREPARATION: Provide temporary support as necessary to assure structural value or integrity of affected portion of Work. Provide protection from elements for that portion of the Project which may be exposed by cutting and patching, and maintain excavations free from water.
   C. PERFORMANCE: Prevent damage to other work; provide proper surfaces to receive installation of repairs. Perform work with workers skilled in the trades involved; make patches, seams and joints durable and inconspicuous. Execute fitting and adjustment of products to provide a finished installation complying with specified products, functions, tolerances and finishes. Restore work which
has been cut or removed; install new products to provide completed work as shown and specified. Refinish entire surfaces as necessary to provide even finish to match adjacent finishes: continuous surfaces to nearest intersection; entire unit of assembly.

* * *

CONSTRUCTION WASTE MANAGEMENT  Section 01 74 19

1. GENERAL:
   A. DESCRIPTION: Provide Construction Waste Management including salvaging, recycling, and disposing of nonhazardous construction waste, as shown and specified per Contract Documents.

2. PRODUCTS:
   A. WASTE MANAGEMENT PLAN: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis, including separate sections for demolition and construction waste to re-use and recycle minimum 50% by weight of construction waste materials generated by the Work. Indicate quantities by weight or volume; use same units of measure throughout waste management plan.
   B. QUALITY REQUIREMENTS: Refer to Section 01 42 00 - REFERENCES for reference standards, applicable codes and definitions, and to the following:
      2. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers standard specifications.
      5. California Department of Resources Recycling and Recovery (CalRecycle):
      7. Qualifications:
         b. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
      8. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

3. EXECUTION:
   A. PREPARATION: Review Waste Management Plan procedures and identify locations established for salvage, recycling, and disposal. Designate and label specific areas on the site for separating materials to be salvaged, recycled, reused, donated, and sold.
   B. IMPLEMENTATION:
      1. Recycled Materials: Separate recyclable waste from other waste materials, trash, and debris. Provide properly marked containers or bins for controlling recyclable waste until they are removed from Project site. Store materials away from construction area, off the ground and protect from the weather; do not store within drip line of remaining trees. Transport recyclable waste off Owner's property to recycling receiver or processor.
      2. Disposal: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas. Burning and burying of
materials is not allowed. Transport waste materials off Owner's property and legally dispose of them.

* * *

CLOSEOUT PROCEDURES

Section 01 77 00

1. GENERAL:
   A. DESCRIPTION: Perform operations necessary for and incidental to closing out the Contract and assisting in obtaining Project acceptance.
   B. FINAL CLEANING: Remove surplus materials, rubbish, and debris. Thoroughly clean all exposed surfaces per manufacturer's instructions; remove marks, stains, fingerprints, dust, dirt, and paint drippings resulting from work of this Project. Leave work bright, clean and polished.
   C. REQUIREMENTS PREPARATORY TO PROJECT ACCEPTANCE: Deliver statement certifying that no materials containing asbestos have been installed in the Work, and that materials used in construction operations and installed in the Work comply with the volatile organic compound (VOC) requirements. Remove temporary facilities from site per Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS. Complete thorough building and site cleaning per Owner-Contractor Agreement. Submit affidavits of release of liens, payment of debts and claims and all applicable taxes.

2. PRODUCTS:
   A. RECORD DOCUMENTS: Submission of accurate record drawings is required for release of final payment. Architect will furnish digital media or reproducible transparencies to the Contractor. Record installed locations of underground, drainage, plumbing and electrical work, including storm drain grate and invert elevations. Locate work, including stubs for future connections, with reference to permanent landmarks or buildings and indicate depth below finish grade. Emphasize changes by drawing "clouds" around changed items. Use same symbols and designations as shown on Contract Documents. Note Construction Change Directive numbers, Change Order numbers, Alternate numbers, and similar identification where applicable. Completed Record Drawings shall be signed by Contractor as complete and accurate records of the Project, as built.
   B. OPERATION AND MAINTENANCE INSTRUCTIONS: Incorporate in Maintenance/Operating Manual(s), brochures, manufacturer's catalogs and written instructions for equipment and materials needing regular care or maintenance; i.e., carpets, resilient flooring, architectural finishes, mechanical and electrical equipment, etc. Provide name and address of nearest vendor for replacement of parts or repair services. Provide one (1) complete copy of each manual required and electronic copy (PDF) of contents.
   C. GUARANTEES: Unless otherwise state in individual sections, duration of guarantees shall be one (1) year from date of final acceptance of the Project by the Owner. Submit required Guarantees as electronic copies (PDFs) using the following format on subcontractor's letterhead, countersigned by Contractor:
   "GUARANTEE FOR ______________________ (WORK). We hereby guarantee that the workmanship and materials that we installed in the ______________________ (Project) have been in accordance with the drawings and specifications and that the work as installed will fulfill the requirements of the specified guarantee. We agree to repair or replace any or all work, together with any other adjacent work that we may displace in so doing, that may prove to be defective in its workmanship or material within a period of _____________ ( ) year(s) from date of acceptance of by the Owner, without any expense whatsoever to Owner, ordinary wear and tear and unusual abuse or neglect excepted. In the event of our failure to comply with the above-mentioned conditions within ten (10) days after being notified in writing by the Owner, we collectively or separately do hereby authorize the Owner to proceed to have said defects repaired and made good at our expense, and we will honor and pay the cost and charges therefor upon demand.

SIGNED AND DATED:  
SUBCONTRACTOR: __________________________________________________________

CONTRACTOR:  __________________________________________________________

Sierra Ridge Middle School Modernization  
Kirk S. Brainerd, Architect

Job No. 1324  
October 11, 2016
3. **EXECUTION:**
   
   A. **PROJECT ACCEPTANCE:** After requirements preparatory to project acceptance have been completed, Contractor shall notify Architect in writing that the Work is ready for final inspection; provide minimum three (3) days' advance notice of desired date for inspection. Contractor shall accompany the Architect on the final inspection.

   * End Division 01 *
DEMOlITION

Section 02 41 00

1. GENERAL:
   A. SUMMARY:
      1. General: Provide Demolition, as shown and specified per Contract Documents.
      2. Retained Items: Carefully remove items to remain property of Owner and be reinstalled in the work.
   B. REFERENCES:
      3. California Occupational Safety and Health Administration (CalOSHA): Title 8 - Construction Safety Orders.
      6. Occupational Safety and Health Administration (OSHA): Standards.
   C. SUBMITTALS:
      1. Schedule: Submit a detailed sequence of demolition and removal work, including dates for shut off, capping, and continuance of utility services. Arrange schedule to not interfere with Owner's operations.
      2. Procedures: Submit written procedures documenting the proposed methods to be used to control dust and noise.
      3. Project Record Documents: Submit under provisions of Section 01 77 00 - CLOSEOUT PROCEDURES.

2. PRODUCTS:
   Not Used

3. EXECUTION:
   A. PREPARATION:
      1. General: Refer to Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT.
      2. Scheduling:
         a. General: Coordinate and schedule demolition work as required by the Owner and as necessary to facilitate construction progress. Conduct demolition to minimize interference with adjacent and occupied building areas.
         b. Existing Utilities:
            1. General: Coordinate disconnection and capping of existing gas, water, sewer, electrical, telephone, cable and security system utilities; verify work is complete before starting demolition work affecting these utilities. Do not interrupt existing utility service to operating facilities, except when authorized in writing by Owner. Provide not less than 72 hours' notice to Owner if shutdown of service is required. Make provision for temporary service during interruption of existing utility service, acceptable to Owner.
            2. Plumbing: Refer to Division 22 - PLUMBING; disconnecting, removing and capping existing gas, water, and sewer utilities.
            3. Electrical: Refer to Division 26 - ELECTRICAL; disconnecting, removing, and capping existing electrical utilities. Owner will make arrangements with telephone company concerning their equipment and lines.
      3. Examination:
         a. General: Examine conditions of work in place before beginning work; report existence of hazardous materials or unsafe structural conditions.
         b. Hazardous Materials:
            1. General: Identify chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations, and notify such jurisdictional agencies as may be required. Collect and legally dispose of such materials at official disposal locations away from the site.
            2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact the Owner. Do not proceed with demolition until directed by Owner.
      4. Measurements: Take field measurements; report variance between plan and field dimensions.
      5. Protection:
         a. General: Refer to Division 01 - GENERAL REQUIREMENTS.
b. Safety Precautions: Prevent damage to existing elements identified to remain or to be salvaged, and prevent injury to the public and workmen engaged on site. Do not allow demolition debris to accumulate on site. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends.

c. Dust: Contain and control dust produced by operations as required by jurisdictional agencies.

d. Selective Demolition:
   1. General: Prevent movement of structure; provide required bracing and shoring.
   2. Watertight Barriers: Provide and maintain as required to prevent water intrusion and damage.
   3. Temporary Partitions: Erect and maintain to prevent spread of dust, odors and noise to permit continued Owner occupancy.
   4. Egress: Do not close or obstruct route or required width to exits.

B. DEMOLITION:
   1. General: Perform demolition as shown and remove from the site. Use methods required to complete Work within limitations of governing regulations.
   2. Surface Preparation: Prepare surfaces to remain for application of subsequent materials as specified in Section 01 73 29 - CUTTING AND PATCHING.
   3. Explosives: Use not permitted.
   4. Utilities: Disconnect, remove, cap and identify designated utilities within demolition areas.
   5. Selective Demolition:
      a. General: Protect existing supporting structural members and materials.
      b. Cutting and Removal: Remove existing work as shown; cut in neat straight lines, parallel to adjacent elements or plumb to vertical surfaces; grind smooth saw cut edges of concrete slabs or walks. Neatly remove existing finish materials back to clean straight line on nearest support to facilitate installation of new materials, patches or repairs. Use methods that prevent damage to other work, and provide proper surfaces for installation of repairs and new work. Upon completion of work, leave areas in clean condition.

   6. Salvaged Items:
      a. Items Removed and Retained by Owner: Appliances, equipment and portable furniture to be retained by the Owner, will be identified, removed and stored by the Owner before the beginning of demolition operations.
      b. Items Removed by Contractor and Retained by Owner: Remove items as shown on the drawings, without damage; coordinate with Owner for delivery to designated storage area.
      c. Items Removed, Stored and Relocated by Contractor:
         1. General: Remove from existing building without damage items listed below and as shown on drawings to be re-installed; provide storage in a covered, protected building off site until re-installed.
         2. Partial List of Items to be Re-installed:
            a) Plumbing Fixtures Noted: As specified in Division 22 - PLUMBING.
            b) Electrical Items Noted: As specified in Division 26 - ELECTRICAL.

   7. Disposal:
      a. General: Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.
      b. Burning and Burying of Materials: NOT ALLOWED.
      c. Haul Routes:
         1. General: Obtain permits as required by jurisdictional agencies. Establish haul routes in advance; post flagmen for the safety of the public and workmen.
         2. Maintenance: Keep streets free of mud, rubbish, etc.; assume responsibility for damage resulting from hauling operations; hold Owner free of liability in connection therewith.

* End Division 02 *
COMMON WORK RESULTS FOR WOOD, PLASTICS AND COMPOSITES

Section 06 05 00

1. GENERAL:
   A. SUMMARY: Provide Common Work Results for Wood, Plastics and Composites, as shown and specified per Contract Documents.
   B. REFERENCES:
         a. General: Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
   C. SUBMITTALS:
      1. General: Submit product data and samples if specifically requested.
      2. Certificates: Submit mill certificate verifying pressure treatment compliance as specified, for each shipment received, in addition to a stamp on each piece of lumber, from an approved independent inspecting agency operating under the overview of the American Lumber Standard Committee, Inc. (ALS C).

2. PRODUCTS:
   A. MATERIALS:
      1. Hangers, Clamps, Straps and Anchors:
         a. General: Manufactured by Simpson Strong Tie Co., Inc.; types as shown.
         b. Alternate Manufacturers: Comparable products with current ICC ES approval and equal or greater rated load capacity, manufactured by USP Lumber Connectors, or accepted equal. Submit ICC ES Report for review for all alternate products.
      2. Anchors and Fasteners:
         a. General: Comply with ASTM F2329 where connector may be exposed to moisture.
         b. Nails: ASTM F1667, common wire; hot-dipped galvanized for pressure preservative treated and exterior work; electro-galvanized for other work.
         c. Bolts and Nuts: ASTM A307, Grade A, including supplementary requirement S1; galvanized for exterior work.
         d. Washers: Malleable iron or standard cut steel; galvanized for exterior work.
         e. Screws: Wood and lag screws per ANSI/ASME B18.2.1; galvanized for exterior work.
         f. Specialty Fasteners:
            1. General: Manufactured by Hilti, Inc.; galvanized for exterior work.
            2. Alternate Manufacturers: Comparable products with current ICC ES Report and equal or greater rated load capacity, manufactured by the US Anchor Corp., or accepted equal.
            3. Expansion Bolts: Kwik Bolt TZ.
            4. Concrete Screws: Kwik Con II; galvanized for exterior work.
            5. Powder Actuated Fasteners: Type as shown; galvanized for exterior work.
            6. Screw Anchors: Type HUD (plastic), HFP self drilling or HPS impact, as shown.
      3. Adhesives: CS 35-61, Type II, water-resistant.
      4. Wood Preservative:
         a. General: Manufactured by J. H. Baxter Co.; factory applied treatment, unless otherwise noted.
         b. Alternate Manufacturers: Comparable products manufactured by the California Cascade Industries, or accepted equal.
         c. Pressure Treatment: Per AWPA Standards using water borne preservative.
         d. Surface Application: Per AWPA Standards; Clear Type.
         e. Fire Retardant: Per AWPA Standards, Exterior Type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25.

3. EXECUTION:
   A. PREPARATION:
      1. Examination: Examine conditions of work in place before beginning work; report defects.
      2. Measurements: Take field measurements; report variance between plan and field dimensions.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
2. Placement: Refer to Section 06 10 00 - ROUGH CARPENTRY, 06 17 23 - PARALLEL STRAND LUMBER, 06 20 00 - FINISH CARPENTRY, and 06 41 17 - PLASTIC LAMINATE VENEER CASEWORK.

* * *
1. GENERAL:
   A. SUMMARY:
      1. General: Provide Rough Carpentry, as shown and specified per Contract Documents.
      2. Framing: Lumber, plywood, wood treatments and sheathing.
      3. Framing: Floor, wall, roof, post and columns.
   B. REFERENCES:
      4. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
      7. National Institute of Standards and Technology (NIST):
         a. NIST PS 1: Construction and Industrial Plywood.
         b. NIST PS 2: Performance Standard for Wood-Based Structural-Use Panels.
   C. SUBMITTALS:
      1. General: Submit product data and samples if specifically requested.
      2. Certificates:
         a. Pressure Treatment: Refer to Section 06 05 00 - COMMON WORK RESULTS FOR WOOD, PLASTICS AND COMPOSITES.
         b. Lumber Grades: Where lumber and plywood is exposed to view and clear finished, provide Certificates in lieu of grade stamping and trade marks.
      3. Closeout: Submit maintenance data.

2. PRODUCTS:
   A. MATERIALS:
      1. Grading:
         a. General: NIST PS-20 and applicable lumberman's association rules, as approved by DSA, under which each lumber species is produced.
         b. Grade Marking:
            1. Lumber: CBC Standard 23-1; each piece of lumber, factory marked with official grade mark of grading agency or independent agency operating under the umbrella of ALSC.
            2. Plywood: CBC Standard 23-2 and PS 1; each panel legibly identified for type, grade and species by APA grade mark.
      2. Lumber:
         a. General: Sizes dressed as shown, surfaced four (4) sides; 19 percent maximum moisture content; air or kiln dried. Boxed heart will not be permitted in lumber 3x or thicker.
         b. Lumber Grades:
            1. General: Douglas fir-larch; to 4 inch thickness - No. 2; 6 inch thickness and larger - No. 1.
            2. Sills:
               a) General: Pressure treated douglas fir-larch - No. 2 or better; AWPB marked.
               b) Non-bearing Stud Walls: Redwood, where specifically shown.
            4. Miscellaneous Framing:
               a) Douglas Fir-Larch: Blocking, nailers, furring, bridging and stripping; No. 2 grade.
               b) Redwood: Where specifically shown; Foundation Grade, unless otherwise noted.
      3. Plywood: PS 1 or PS 2; APA CD, with exterior glue; sizes as shown.
      4. Wood Treatment: Refer to Section 06 05 00 - COMMON WORK RESULTS FOR WOOD, PLASTICS AND COMPOSITES.
      5. Hangers, Clamps, Straps, Anchors and Fasteners: Refer to Section 06 05 00 - COMMON WORK RESULTS FOR WOOD, PLASTICS AND COMPOSITES.
      6. Caulking: Provided under Section 07 92 10 - JOINT SEALERS.
3. EXECUTION:
A. PREPARATION:
1. Scheduling: Coordinate work specified elsewhere that affects the work of this Section.
2. Examination: Examine conditions of work in place before beginning work; report defects.
3. Measurements: Take field measurements; report variance between plan and field dimensions.
4. Protection:
   a. General: Per Section 01 43 00 - QUALITY ASSURANCE.
   b. Security and Safety: Provide temporary protection and enclosures as required.
   c. Temporary Bracing: Provide bracing adequate to keep structure stable, plumb and in line; keep in place until permanent framing is completed. Provide bracing capable of supporting loads imposed by stockpiled material, erection equipment and other loads, during construction.
B. INSTALLATION:
1. General: Install in conformance with referenced standards, manufacturer’s written directions, as shown, and as specified.
2. Erection:
   a. General:
      1. Coordination: Coordinate placement of anchors, inserts, etc., in concrete and masonry. Establish locations, lines, levels and provide cutting, patching and fitting as required to accommodate built-in Work specified in other Sections.
      2. Lumber: Use new lumber; re-use not permitted unless authorized in writing by the Architect. Select lumber in a manner that allowable knots and obvious minor defects do not interfere with placement of bolts, nailing or structural connections.
      3. Layout: As shown; set plates, nailing blocks, anchors, grounds, etc., as required.
   4. Wood Treatment:
      a) General: Refer to Section 06 05 00 - COMMON WORK RESULTS FOR WOOD, PLASTICS AND COMPOSITES.
      b) Site Applied: Brush apply two (2) coats of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashing, and framing within 18 inches of finish grade. Treat site-sawn cuts. Allow preservative to dry prior to erecting members.
   5. Hangers, Clamps, Straps, Anchors and Fasteners:
      a) General: Refer to Section 06 05 00 - COMMON WORK RESULTS FOR WOOD, PLASTICS AND COMPOSITES.
      b) Nails: Per CBC Table 23A-II-B-1 unless otherwise noted. Space groups of nails no closer together than required penetration and not closer than 1/2 required penetration from cut ends or edges of lumber. Prevent splitting due to nailing drill holes for nails no more than .75 diameter of nail. Where nails of normal length may penetrate through exposed work, use nail of specified diameter and shorter length. Use of nailing gun is subject to written approval of the Architect [and DSA] per CBC 2315A.3.3.
      c) Bolts and Nuts: Use steel pieces as template for location of holes; drill holes 1/32 inch larger than diameter of bolts; tighten nuts or rods and bolts at time of installation. Re-tighten before covering up and just before final inspection and acceptance of the work; at exposed work, cut protruding bolt ends off to within 1/8 inch of nut and file off burrs.
      d) Washers: Install at bolts, nuts or lag screws bearing on wood; not required under heads of carriage bolts.
      e) Screws:
         1) General: Hammering or driving in place not permitted. Use soap to lubricate screw threads, if required.
         2) Lag Screws: Drill holes of same diameter and depth as shank; drill holes for threaded portion of screw no larger than 3/4 shank diameter.
         3) Wood Screws: Drill lead holes for shank and threaded portions, hole diameter 7/8 of shank or thread root diameter.
      f) Powder Actuated Fasteners:
         1) General: Install where shown or required; DO NOT install in structural connections required to carry computed stresses.
         2) Application: Per Article 27, Powder-Actuated Tools, Paragraph 1685, of Title 8, CCR.
b. Installation:
   1. General:
      a) Structural Members:
         1) General: Set level and plumb, in correct position; place horizontal members
            level, with crown side up.
         2) Fabricated Wood Beams: Provided under Section 06 17 23 - PARALLEL
            STRAND LUMBER. Cutting shall conform to manufacturer's requirements.
      b) Framing Members: Construct full length without splices; notching permitted only with
         approval of the Architect.
      c) Blocking: Provide as shown and where necessary to obtain required lines and levels
         in finished surface and to provide solid nailing. Secure blocking plumb and rigid; use
         wood shims wherever necessary to form true and even plane for finish materials.
   2. Wall Framing:
      a) General: Wood studs as shown; frame openings with multiple studs at sides and
         headers as shown.
      b) Plates: Provide continuous sill plates, pressure treated when in contact with
         concrete, and double top plates. Lap top plate splices 4'-0" minimum; lap at wall
         corners and intersections.
      c) Studs: Continuous lengths without splices; provide solid blocking at plywood joints.
      d) Framing for Piping: Provide proper clearances; furr partitions as required. At pipe
         1-1/2 inch diameter, or less, set pipe in center of plate using neat holes; no notching
         allowed. Holes in plates less than 5-1/2 inches in width, not allowed.
      e) Headers: Continuous members as shown.
      f) Corner Bracing: Continuous members as shown.
      g) Sheathing:
         1) Orientation: Secure with long dimension parallel to studs, with joints located
            over studs or solid blocking and end joints staggered; nailing as shown.
         2) Joints: Minimum 1/16 inch space at end joints and 1/8 inch at edge joints.
         3) Penetrations: Penetration of structurally required sheathing to accommodate
            electrical or mechanical requirements must be approved in writing by the
            Architect.
   3. Posts and Columns: As shown, straight, plumb and level; brace as required.
   4. Miscellaneous Framing:
      a) General: Provide nailers, backing, and stripping as necessary to obtain required
         lines and levels in finished surface. Secure plumb and rigid; use wood shims where
         required. Provide backing required for wall or ceiling hung fixtures and equipment.
      b) Caulking:
         1) General: Per Section 07 92 10 - JOINT SEALERS.
         2) Energy Compliance: Apply during framing operations as required by CBC.
      c) Mechanical and Electrical: Provide curbs, backing and blocking, as required for
         mechanical and electrical fixtures and equipment.

3. Tolerances: Per Section 01 43 00 - QUALITY ASSURANCE. Install to allow application of
   subsequent finish materials within specified tolerances.
4. Protection: During inclement weather, protect exposed roof sheathing and wood decking with
   protective waterproof covering until roofing has been installed.

* * *
PARALLEL STRAND LUMBER

Section 06 17 23

1. GENERAL:
   A. SUMMARY: Provide Parallel Strand Lumber, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. Standards:
         a. American Society for Testing and Materials (ASTM): Materials and testing standards as
            identified throughout this Section or within referenced manufacturers’ standard specifications.
      2. Reports:
         b. State of California, Division of the State Architect, Department of General Services (DSA):
            IR 23-1.
   C. SUBMITTALS:
      1. General: Submit product data and samples.
      2. Shop Drawings: Submit manufacture, and installation details, including size, type, location and
         fastenings of members, for review. Show erection plans, sizes, types and location of SCL
         members. Drawings shall also indicate sizes and location of blocking, hangers, etc., with
         sufficient detailing to ensure correct installation.
      3. Closeout: Submit maintenance data and guarantee in required form for a period of one (1) year
         from date of final acceptance by Owner.
   D. QUALITY ASSURANCE:
      1. Tests and Inspections:
         a. General: Manufacturing facility shall be approved by an independent ICC approved
            inspection agency.
         b. Structural Composite Lumber: Bear a stamp indicating the grade, plant number, independent
            inspection agency, logo and report number.
      2. Qualifications: Manufacturer specializing in the work of this Section with minimum five (5) years
         documented experience.

2. PRODUCTS:
   A. MATERIALS:
      1. Parallel Strand Lumber:
         a. General: Structural Composite Lumber manufactured by Trus Joist, a Weyerhauser
            Company.
         b. Alternate Manufacturers: Products in compliance with these Specifications, having
            equivalent properties and dimensions, with structural capacities equivalent to ASTM D2559
            and established by independent structural testing.
         c. Sizes and Types: As shown.
         d. Species: Douglas fir, southern pine or western hemlock.
         e. Grade: 1.9 E minimum, unless otherwise shown.
         f. Beams: Parallam PSL; size as shown.
         g. Studs: Timberstrand LSL Studs; grade as shown.
         h. Adhesive: Exterior type per ASTM D2559.
      2. Accessories: As shown; Refer to Section 06 05 00 - COMMON WORK RESULTS FOR WOOD,
         PLASTICS AND COMPOSITES.
      3. Fasteners: As shown.
   B. FABRICATION:
      1. General: Fabricate in compliance with specified standards, specifications and requirements.
      2. Moisture Content of Components: Not less than 7 percent or more than 16 percent at time of
         gluing.

3. EXECUTION:
   A. PREPARATION:
      1. Examination: Examine conditions of work in place before beginning work; report defects.
      2. Measurements: Take field measurements; report variance between plan and field dimensions.
      3. Delivery:
         a. Handling: Use equipment and methods that avoid damages that may impair strength of SCL
            members. Sharp instruments and unprotected wire rope, chain slings and the like shall not
            be permitted.
         b. Storage: Store in a vertical position off the ground, covered and protected from the weather.
      4. Site Preparation: Coordinate placement of bearing and support items.
B. INSTALLATION:
   1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
   2. Parallel Strand Lumber:

* * *
1. GENERAL:
   A. SUMMARY:
      1. General: Provide Finish Carpentry, as shown and specified per Contract Documents.
      2. Lumber: Softwood and hardwood.
   B. REFERENCES:
   C. SUBMITTALS:
      1. General: Submit product data, shop drawings and samples.
      2. Certificates: WI Certified Compliance Certificate for fabrication and installation of millwork in grade specified.
      3. Closeout: Submit maintenance data and guarantee.
   D. QUALITY ASSURANCE: Company specialized in the products specified in this Section with a minimum of three (3) years documented experience.

2. PRODUCTS:
   A. MATERIALS:
      1. Lumber:
         a. General:
            1. Grading: NIST PS-20 and applicable association rules under which each lumber species is produced.
            2. Moisture Content: Per WI standards; not greater than 19 percent maximum for lumber and 15 percent for plywood; air-dry or klin-dry.
         b. Exposed Softwood:
            1. Douglas Fir: WI Custom Grade.
            2. Redwood: WI Custom Grade.
      3. Wood Preservative Treatment: Refer to Section 06 05 00 - COMMON WORK RESULTS FOR WOOD, PLASTICS AND COMPOSITES.
      4. Adhesive: CS 35-61, Type II, water-resistant.
      5. Fasteners:
         a. General: Of size and type to suit application; hot dipped galvanized at concealed locations; bright finish in exposed locations; refer to Section 06 05 00 - COMMON WORK RESULTS FOR WOOD, PLASTICS AND COMPOSITES.
      6. Caulking Compound: Per Section 07 92 10 - JOINT SEALERS.
   B. FABRICATION:
      1. General: Comply with WI requirements for moisture content at time of fabrication.
      2. Millwork:
         a. General: Manufacture to AWS Custom Grade standards, except where specifically noted otherwise. Mill to dimensions and profiles shown; match existing where indicated. Provide long lengths for field cutting and fitting.
         b. Exterior: Per Architectural Woodwork Standards (AWS), Section 6 - Interior and Exterior Millwork.
         c. Interior: Per Architectural Woodwork Standards (AWS), Section 6 - Interior and Exterior Millwork. Mill reverse side of material ("back-out") when lumber is over 5/8 inch thick and more than 1-5/8 inch wide.

3. EXECUTION:
   A. PREPARATION:
      1. Environmental Requirements: Do not install interior finish work until building is closed, temperature can be maintained above 50 degrees F and plaster is dry.
      2. Examination: Examine conditions of work in place before beginning work; report defects.
      3. Measurements: Take field measurements; report variance between plan and field dimensions.
      4. Protection: Per Section 01 43 00 - QUALITY ASSURANCE.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
2. Millwork:
   a. General: Do not install millwork until wet operations are complete, with concrete, masonry
      and plaster work thoroughly dry, and millwork has been primed or sealed under Section
      09 91 00 - PAINTING. Reseal cut edges, surfaces and ends as required.
   b. Exterior:
      1. General: Exposed surfaces shall be free from tool marks, torn grain, cross sanding, or
         workmanship defects that cannot be concealed by specified painter's finish.
      2. Plywood: Install with grain texture vertical; edges and ends occurring only over bearings.
   c. Interior:
      1. General: Install plumb, square and true, securely wedged and anchored to structure.
         Countersink face nails.
      2. Softwood Plywood: Install with joints bearing on studs or solid backing. Slightly bevel
         adjoining panel edges by sanding before installation. Finish nail around perimeter and
         at studs; set nails.
   d. Trim Members:
      1. General: Install level, plumb and true, with members neatly and accurately scribed in
         place. Install standing trim in single lengths, running trim in as long lengths as practical
         for species specified. Butt joints beveled together, exterior angles mitered, interior
         angles coped.
      2. Exterior: Redwood, unless otherwise shown.
      3. Interior: Douglas fir where shown.
   e. Nailing:
      1. Exterior:
         a) Trim: 10d nails or less, use finish nails set 1/16 inch without putty; 10d nails or over,
            use galvanized common nails driven flush without hammer marks or putty.
         b) Plywood: Nails long enough to penetrate structure per CBC requirements. Use
            galvanized nails, driven flush without hammer marks.
      2. Interior:
         a) Trim: Set nails 1/16 inch, minimum; no putty where clear finish is scheduled.
         b) Plywood: As shown, set nails 1/16 inch, minimum.
   f. Site Applied Wood Treatment: Apply preservative treatment in accordance with
      manufacturer's instructions. Brush apply two (2) coats of preservative treatment on wood in
      contact with cementitious materials and roofing and related metal flashings. Treat site-sawn
      cuts and drilled holes. Allow preservative to dry prior to erecting members.
PLASTIC LAMINATE VENEER CASEWORK  Section 06 41 17

1. GENERAL:
   A. SUMMARY: Provide Plastic Laminate Veneer Casework, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
   C. SUBMITTALS:
      1. General: Submit product data and samples.
      2. Shop Drawings: Submit manufacture and installation details, including fastenings, for review. Provide WI Certified Compliance Certificate.
      3. Certificates: Submit WI Certified Compliance Certificate for fabrication and installation of all casework in grade specified.
      4. Closeout: Submit maintenance data and guarantee in required form for a period of one (1) year from date of final acceptance by Owner.
   D. QUALITY ASSURANCE: Fabricator and installer specializing in the work of this Section with minimum five (5) years documented experience.

2. PRODUCTS:
   A. MATERIALS:
      1. Plastic Laminate:
         a. General: Class I high-pressure decorative laminate plastic manufactured by Wilsonart International; UBC Class II flame spread.
         b. Alternate Manufacturers: Comparable products manufactured by the Formica Corp., or accepted equal.
         c. Plastic Veneer: NEMA Standard .039 inch postforming grade and .045 inch general purpose grade; satin finish.
         d. Backing Sheets: .020 inch thick standard laminate.
         e. Colors and Patterns: Selected by Architect; more than one per cabinet may be requested.
      2. Polyvinyl Chloride (PVC) Banding: Resilient, minimum .024 inch thick x appropriate width.
      3. Lumber: AWS Custom Grade standards; particleboard and MDF not permitted.
      4. Casework Hardware:
         a. General: Per AWS, BHMA A156.9, and as follows:
         b. Finish: Exposed hardware; dull chromium (US26D).
         c. Hinges:
            2. Alternate Manufacturers: Comparable products manufactured by the Stanley Hardware Division of the Stanley Works, or accepted equal.
         d. Door and Drawer Pulls:
            2. Alternate Manufacturers: Comparable products manufactured by Häfele America Co., or accepted equal.
         e. Elbow Catch:
            1. General: No. 2 manufactured by Ives Division of IR Security & Safety.
            2. Alternate Manufacturers: Comparable products manufactured by the Stanley Hardware Division of the Stanley Works, or accepted equal.
         f. Silencers:
            1. General: Battalion Door Silencer manufactured by W.W. Grainger, Inc.
            2. Alternate Manufacturers: Comparable products manufactured by North American Door Corp. (NADCO), or accepted equal.
         g. Locks:
            1. General: Small Pin manufactured by the Olympus Lock, Inc.; provide unit for cylinders as specified in Section 08 71 00 - DOOR HARDWARE.
            2. Alternate Manufacturers: Comparable products manufactured by National Cabinet Lock, or accepted equal.
         h. Drawer Guides:
2. Alternate Manufacturers: Comparable products manufactured by the Knape and Vogt Manufacturing Co. or accepted equal.
3. Small Drawer: Model No. 2037; 75 lbs.
4. Medium Drawer: Model No. 7432; 100 lbs.
5. Large Drawer: Model No. 4032; 150 lbs.
   i. Adjustable Shelf Hardware:
   2. Alternate Manufacturers: Comparable products manufactured by the Stanley Hardware Division of the Stanley Works, or accepted equal.
   j. Hole Plugs:
      2. Alternate Manufacturers: Comparable products manufactured by the Stanley Hardware Division of the Stanley Works, or accepted equal.
5. Fasteners and Adhesives: Per WI requirements; refer to Section 06 05 00 - COMMON WORK RESULTS FOR WOOD, PLASTICS AND COMPOSITES.

B. FABRICATION:
1. General: Manufacture per Architectural Woodwork Standards (AWS), Section 10 - Casework, to AWS Custom Grade standards, except where specifically noted otherwise, per AWS. Provide WI Certified Compliance Label for grade specified, to each elevation of casework.
2. Construction:
   a. General: Completely face exposed and semi-exposed surfaces, with plastic laminate. As far as practical, fabricate casework complete as a unit in the shop; backs required.
   b. Type: Style A Frameless.
   c. Door and Drawer Fronts: Cabinet door Interface Style 1- Overlay.
   e. Filler Panels: As required; to match cabinets as shown.
3. Countertops:
   a. Plastic Laminate: Fabricate per Architectural Woodwork Standards (AWS), Section 11 - Countertops, Assembly 2 - Deck Mount, manufacturer assembled, as shown. Provide in longest practicable length; minimize number of joints. Make joints neat and watertight; abutting ends splined and adjoining surfaces flush; ease exposed edges. Provide backing sheet on bottom side of countertops where plumbing fixtures are to be installed or where exposed to moisture. Core thickness as shown; not less than 3/4 inch. Provide 1 inch radius at outside corners.
   b. Acid Resistant Countertops: Fabricate epoxy resin countertops per AWS, as shown.
4. Casework Hardware:
   a. General: Prefit; remove for application of finish. Keep hardware with casework to which it has been prefitted, reinstall after casework is anchored in place, as shown.
   b. Hinges: Four (4) No. 8 screws into end panel and door panel; 1-1/2 pair on 7'-0" high cabinet doors; tall cabinet doors must swing 180 degrees when adjacent to low cabinets without interference from counter top.
   c. Drawer and Door Pulls: Comply with CBC 11B-811.4.
   d. Magnetic Catches: One catch on cabinet doors up to 48 inches high; two catches (top and bottom) on cabinet doors over 48 inches high.
   e. Locks: As shown.

3. EXECUTION:
   A. PREPARATION:
      1. Scheduling: Coordinate placement of blocking and reinforcement in walls supporting casework.
      2. Environmental Requirements: Relative humidity 50% or less; temperature 70 degrees F minimum.
      3. Examination: Examine conditions of work in place before beginning work; report defects. Verify the placement of plumbing and electrical service required by built-in equipment and accessories shown.
      4. Measurements: Take field measurements prior to fabrication; report variance between plan and field dimensions.
      5. Delivery: Use clean, nonstaining materials for blocking and packing. Carefully load and cover for shipment; do not transport during inclement weather.
B. INSTALLATION:
   1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified. Provide WI Certified Compliance Certificate for installation.
   2. Casework:
      a. General: Install level, with tight joints between units; scribe edges to fit adjacent structure. Use concealed joint fasteners to align and secure adjoining cabinet units, counter tops and support brackets. Secure to blocking or plates in wall or to casework carriers with lag bolts with washers to permit removal; screw penetration of not less than 1 inch into 2 inch nominal blocking or framing is required.
      b. Filler Panels: Scribe to cabinets and abutting structure.
   3. Countertops:
      a. General: Install level, using concealed fasteners, with tight joints; scribe to fit wall surfaces.
      b. Acid-Resistant Countertops: Install per Architectural Woodwork Standards (AWS), Section 11 - Countertops.
   4. Hardware:
      a. General: Check hardware upon delivery to site; store in an orderly manner. Fit and install in place without marring or injuring either hardware or casework.
      b. Seismic Restraint: As shown.
C. ADJUSTMENT: Prior to acceptance, adjust moveable parts to assure smooth operation.
D. CLEANING: Immediately following installation, clean casework to remove dirt, stains, scratches, and abrasions. Protect casework against damage by other trades; repair or replace damaged and defaced material at no cost to Owner.
E. JOBBOING: Six (6) months after final acceptance of the building, and at any time within a year after acceptance when so directed, examine casework doors, drawers, fittings, etc., and perform such fitting and adjustment as necessary to put items in good condition and working order.

*   *   *
1. GENERAL:
   A. SUMMARY: Provide Fiberglass Reinforced Panels, as shown and specified per Contract Documents.
   B. REFERENCES:
      2. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
   C. SUBMITTALS:
      1. General: Submit product data, shop drawings, color and texture samples.
      2. Closeout: Submit maintenance data and guarantee in required form for a period of one (1) year from date of final acceptance by Owner.

2. PRODUCTS:
   A. MATERIALS:
      1. F.R.P. (Fiberglass Reinforced Polyester) Panels:
         a. General: Standard integral color FRP Panels with pebbled gloss finish manufactured by the Marlite Corp.; ASTM E84, Class 1/A flame spread of 25 and smoke generation of 450, maximum; color as selected by the Architect.
         b. Alternate Manufacturers: Comparable products manufactured by Glasteel, Inc., or accepted equal.
         c. Moldings and Trim: Manufacturer's standard Inside Corner, Outside Corner, Division and Edge Aluminum trim as required for condition as shown.
         d. Adhesive and Sealant: As recommended by the manufacturer for substrate shown.
      2. Fasteners: Concealed type as recommended by the manufacturer; refer to Section 06 05 00 - COMMON WORK RESULTS FOR WOOD, PLASTICS AND COMPOSITES.

3. EXECUTION:
   A. PREPARATION:
      1. Environmental Requirements: Relative humidity of 50% or less; minimum temperature of 70 degrees F.
      2. Examination: Examine conditions of work in place before beginning work; report defects.
      3. Measurements:
         a. General: Take field measurements; report variance between plan and field dimensions.
         b. Stud Spacing: Verify that backing is installed as required.
      4. Product Handling: Deliver F.R.P. Panels flat, on skids; store inside, out of weather and exposure to sunlight. Re-stack panels 24 hours prior to installation, on solid flat surface to minimize package distortion.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
      2. F.R.P. Panels:
         a. General: Adhesive apply per manufacturer's instructions; apply sealant as required.
         b. Moldings and Trim: Install as shown.

* * *
1. GENERAL:
   A. SUMMARY: Provide Joint Sealers, as shown and specified per Contract Documents.
   B. REFERENCES:
         a. General: Materials and testing standards as identified throughout this Section or within
            referenced manufacturers’ standard specifications.
         b. ASTM C1472: Standard Guide for Calculating Movement and Other Effects When
            Establishing Sealant Joint Width.
   C. SUBMITTALS:
      1. General: Submit product data, samples, and certification that sealants proposed for use comply
         with the Contract Documents.
      2. Certifications: Submit SWRI Liquid Sealant Validation for all liquid products.
      3. Closeout: Submit maintenance data and guarantee in required form for a period of ten (10) years
         from date of final acceptance by Owner.
   D. QUALITY ASSURANCE:
      1. Qualifications:
         a. General: The manufacturer of the sealant used shall have been in the business of
            manufacturing the specified types of such sealants for not less than 10 years.
         b. Applicator: Installer specializing in the work of this Section with minimum five (5) years
            documented experience.
         c. Volatile Organic Compounds (VOC): Use only products in compliance with VOC content
            limits required by Federal and State EPA regulations.
      2. Compatibility with Substrate: Verify that caulking and sealants used are compatible with joint
         materials.

2. PRODUCTS:
   A. MATERIALS:
      1. Joint Sealers:
         a. General: Manufactured by Tremco, Inc.
         b. Alternate Manufacturers: Comparable products manufactured by the Pecora Chemical
            Corp., or accepted equal.
         c. Color:
            1. Concealed Joints: Manufacturer’s standard color as selected by the Architect having
               best overall performance characteristics for indicated application.
            2. Exposed Joints: Custom color selected by Architect.
      2. Exterior Joints:
         a. Vertical Surfaces: Non-sag polyurethane; Dymonic FC.
         b. Sealing Tape: TremGlaze GT400 Tape.
      3. Interior Joints:
         b. Plumbing Fixture Joints: Proglaze silicone rubber.
         c. Firestop Caulking: TremStop Firestopping System.
      4. Joint Cleaner: Provide cleaner recommended by sealant manufacturer for specific joint surface
         and condition.
      5. Joint Primer and Sealer: Non-corrosive and non-staining type as recommended by sealant
         manufacturer for each condition.
      6. Joint Backing: Round, open cell non-gassing polyurethane foam rod or closed cell polyethylene
         foam as recommended by the manufacturer, oversized 30 percent larger than joint width.
      7. Bond Breaker: Pressure sensitive tape as recommended by sealant manufacturer to suit
         application.
      8. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces
         adjacent to joints.
      9. Other Materials: Manufacturer’s standard for items required or type best suited for proper
         execution of the work.
3. EXECUTION:
   A. PREPARATION:
      1. Environmental Requirements: Do not apply materials when temperature is below 40 degrees F, or under extreme temperature conditions when joint width is expanded or contracted beyond normal conditions.
      2. Examination:
         a. General: Carefully examine before beginning work; report defects.
         b. Substrate: Inspect surfaces to ensure that no previously installed bond-breaker materials contaminate the surface to which the sealant is to adhere. Require repair of unsound substrates. Commencement of work constitutes acceptance of substrate.
      3. Storage: Per manufacturer's recommendations for proper precautions for shelf life, temperature, humidity and similar storage factors to ensure the fitness of the material when installed.
      4. Surface Preparation:
         a. General: Prepare joints in accordance with manufacturer's instructions to ensure maximum adhesion. Remove loose materials and foreign matter that might impair adhesion of sealant.
         b. Masking: Tape as required to prevent contact of sealant with adjoining surfaces to prevent permanent staining, damage by contact, or by cleaning methods required to remove sealant smears.
         c. Sealants: Prepare as required, including proper mixing of multi-component sealants.
      5. Protection: Protect surfaces adjacent to joints to receive sealant. Cover joints in walking surfaces with heavy duty, non-staining tape, until material has dried.

   B. APPLICATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
      3. Installation:
         a. General: Install per manufacturer's instructions, within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within recommended ranges.
         b. Joint Cleaner: Apply per manufacturer's instructions.
         c. Primer: Apply as required; protect adjacent exposed surfaces.
         d. Backing: Install to achieve a neck dimension no greater than 1/3 of the joint width, unless otherwise shown. Use blunt or rounded tools to ensure uniform (+ or - 1/8 inch) depth without puncturing material. Use oversize backer rod; minimum of 33% for closed cell type; minimum of 50 percent for open cell type, unless otherwise required by the manufacturer.
         e. Bond Breaker: Install where joint backing is not used.
         f. Sealant: Install free of air pockets, foreign embedded matter, ridges, and sags; prevent three sided adhesion. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios, unless otherwise noted. Provide sealant depth of one half (1/2) joint width; minimum depth of 1/4 inch; maximum of 1/2 inch, unless otherwise required by the manufacturer.
         g. Sound Transmission: Install sealant per manufacturer's instructions to obtain STC Values shown.
         h. Firestopping: Apply as required to comply with fire ratings shown.
         i. Masking: Remove tape immediately after tooling without disturbing joint seal.

* End Division 07 *
HOLLOW METAL DOORS AND FRAMES  Section 08 11 13

1. GENERAL:
   A. SUMMARY: Provide Hollow Metal Doors and Frames, as shown and specified per Contract Documents.
   B. REFERENCES:
         a. General: Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
         b. ANSI A250.8: Recommended Specifications for Standard Steel Doors and Frames.
      3. Americans with Disabilities Act (ADA):
      5. Intertek Testing Services (ITS): Certification listings for fire doors.
      6. Hollow Metal Manufacturers Association Division of NAAAMM (HMMA):
         a. HMMA 802: Manufacturing Hollow Metal Doors and Frames.
         b. HMMA 810: Hollow Metal Doors.
         c. HMMA 820: Hollow Metal Frames.
         d. HMMA 830: Hardware Preparation and Locations for Hollow Metal Doors and Frames.
         e. HMMA 840: Installation and Storage of Hollow Metal Doors and Frames.
         f. HMMA 850: Fire Rated Doors and Frames.
   C. SUBMITTALS:
      1. General: Submit product data, and samples.
      2. Shop Drawings: Show details of each condition shown at 3 inch scale.
      3. Test Reports: Refer to Section 01 45 23 - TESTING AND INSPECTION SERVICES.
      4. Closeout: Submit maintenance data and guarantee in required form for a period of one (1) year from date of final acceptance by Owner.
   D. QUALITY ASSURANCE:
      1. Labeled Doors and Frames: Conform to requirements of State Fire Marshal and Underwriters Laboratory.
      2. Design Requirements: Exterior glazed frame members designed to withstand a wind load of 24 lbs. per square foot, minimum.
      3. Qualifications: Installer specializing in the work of this Section with minimum three (3) years documented experience.

2. PRODUCTS:
   A. MATERIALS:
      1. Steel:
         a. Sheet: ASTM A1008 and ASTM A1011, uncoated, pickled, and free from pits and defects. Use cold-rolled or hot-rolled for frames; stretcher-leveled for 18 gage and lighter.
         b. Galvanized Steel Sheets: Zinc-coated carbon steel complying with ASTM A653, commercial quality.
      2. Fasteners:
         a. General: Galvanized or cadmium plated.
         b. Bolts and Nuts: ASTM A307, Grade A.
         c. Machine Screws: FS FF-S-92, Type III cross-recessed, Design I or II recess, Style 2c flat head; carbon steel.
   4. Sealant: Refer to Section 07 82 10 - JOINT SEALERS.
   5. Primer: Refer to Section 09 91 00 - PAINTING.
   B. MANUFACTURE:
      1. General: Alpha (Stiffened Steel Core) Doors manufactured by Stiles Custom Metal, Inc., unless otherwise noted.
      2. Alternate Manufacturers: Comparable products manufactured by the Titan Metal Products, Inc., or accepted equal.
3. Hardware Requirements: Prepare doors and frames at factory to receive template hardware per final schedule; locate as specified under Section 08 71 00 - DOOR HARDWARE. Provide reinforcements of specified thicknesses and sizes recommended by hardware manufacturer; hinge reinforcements not less than 7 gage and at least 9 inches long; mortised and countersunk items not less than 12 gage; surface applied items not less than 14 gage; other reinforcing per ANSI A250.6.

4. Hollow Metal Doors:
   a. General: Fabricate to size, type and design shown, 1-3/4 inch thick unless otherwise shown.
   b. Door Construction:
      1. Face: 18 gage steel sheet in per ANSI A250.8.
      2. Core:
         a) Unrated: Fabricate per HMMA 810.
         b) Fire Rated: Fabricate per HMMA 850.
         c) Thermal Insulated: Total insulation R value of 11, measured in accordance with ASTM C1363 under ASTM C1199.
   c. Accessories:
      1. General: Manufactured by the Air Louvers, Inc.
      2. Alternate Manufacturers: Comparable products manufactured by Anemostat Door Products, a Mestek Company, or accepted equal.
      3. Louvers: Model No. 900; fire rated as shown.
      4. Fasteners: Manufacturer's standard; tamperproof.
   d. Astragals: 1/8 inch x 2 inch steel, as shown, specifically for double doors. Secure with tamperproof bolts at 6 inches on center and 1 inch from each end.

5. Metal Frames:
   a. General: Fabricate per HMMA 820.
   b. Fire Rated: Fabricate per HMMA 850.
   c. Exterior: 16 gage; 14 gage for frames OVER 3'-0" wide.
   d. Interior Frames: 18 gage; 16 gage for frames OVER 3'-0" wide or fire rated.


C. FABRICATION:
   1. Metal Doors:
      a. General: Fabricate to sizes and shapes shown.
      b. Flush Doors: Fabricate doors with hardware reinforcement welded in place. Close top and bottom edge of exterior doors with flush end closure. Seal joints watertight.
      c. Fire Rated Doors: Permanently attach fire rating label to each door unit.
      d. Accessories: Door louver, as shown.
      e. Door Clearances: Provide 1/8 inch maximum clearance at jamb, heads, and meeting stiles; threshold clearances as specified under Section 08 71 00 - DOOR HARDWARE.
      f. Electrical Requirements: Make provisions for installation of electrical items specified under Section 08 71 00 - DOOR HARDWARE and other applicable Sections.

   2. Metal Frames:
      a. Standard Frames: Fabricate frames as welded unit.
      b. Fire-Rated Frames: Fabricate as specified for standard metal frames; permanently attach fire rating label to frame, in addition to the manufacturer's name, labels for fire-rated door frames must also identify the third-party inspection agency per 2013 CBC Section 716.5.7.
      c. Reinforcement:
         1. General: Reinforce frames wider than 48 inches with roll-formed steel channels fitted tightly into frame head, flush with top.
         2. Hardware: Fabricate frames with reinforcing plates welded in place. Provide mortar guard boxes, where required.
      d. Silencers:
         1. Single Doors: Provide three (3) single silencers equally spaced on strike side.
         2. Frame Head at Double Doors: Provide two (2) single silencers equally spaced.

   3. Anchors:
      a. General: Fabricate 16 gage x 2 inch wide anchors of same material used for door frames.

3. EXECUTION:
   A. PREPARATION:
      1. Examination: Examine conditions of work in place before beginning work; report defects.
      2. Measurements: Take field measurements; report variance between plan and field dimensions.
      3. Protection: Protect metal surfaces after installation; any indication of deterioration, use or damage will be unacceptable.
B. INSTALLATION:
   1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
   2. Fire Rated Openings: As shown; make manufacturer's installation instructions available to inspecting authorities.
   3. Anchors:
      a. Jambs:
         1. General: Position one (1) anchor above top butt reinforcement and one (1) anchor below bottom butt reinforcement; minimum four (4) anchors per door jamb, 24 inches on center maximum.
         2. Frames Set in Wood Stud Partitions: Weld anchors to frames; secure to wood studs with two (2) fasteners per anchor. Use two (2) No. 12 x 2-1/2 inch flathead screws, or two (2) 12d nails (wire anchors not acceptable).
      b. Head: Provide minimum of two (2) anchors at frames over 2'-6" wide; 24 inches on center, maximum.
   4. Metal Frames:
      a. General: Set frames plumb, straight and square; align and securely brace until permanent anchors are set; use shims where required. Remove temporary braces after wall construction is completed.
      b. Door Frames: Where shown, provide overhead frame bracing; securely anchor to structure. Install roll-formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.
      c. Sealant: Seal perimeter of frames and adjoining material per Section 07 92 10 - JOINT SEALERS.
   5. Metal Doors:
      a. General: Match doors into their respective frames; install plumb, straight and square.
      b. Hardware: Refer to Section 08 71 00 - DOOR HARDWARE.
      c. Maximum Diagonal Distortion: 1/8 inch measured with straight-edge, corner to corner.
   6. Finish: Touch-up factory applied baked primer; refer to Section 09 91 00 - PAINTING.
C. ADJUSTMENT: Prior to acceptance, adjust moveable parts to assure smooth operation.

* * *
1. GENERAL:
   A. SUMMARY: Provide Door Hardware, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. Americans with Disabilities Act (ADA):
      3. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers’ standard specifications.
      7. Door and Hardware Institute (DHI): Hardware standards.
      9. Underwriters Laboratories, Inc. (UL):
         a. UL 10B: Fire Test for Door Assemblies.
         b. UL 305: Panic Hardware.
   C. SUBMITTALS:
      1. General:
         a. General: Submit product data, test reports, certificates and as follows:
         b. Shop Drawings:
            1. General: Submit detailed finish hardware schedule in vertical format as follows:
            2. List groups and suffixes in proper sequence.
            3. Completely describe door and list architectural door number.
            4. Provide name of manufacturer, product name, catalog number, function, type, style, size and finish of each item.
            5. Show mounting locations.
            6. Explain abbreviations and symbols used in schedule.
            7. Provide detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment, and access control equipment, and door and frame rough-ins required for specific opening.
         c. Samples:
            1. General: If specifically requested for specified products; required for alternate products.
            2. Substitution Requests: Refer to Section 01 25 00 - SUBSTITUTION PROCEDURES. Submit schedule and sample of each item proposed for substitution. Clearly mark each sample indicating type of item, manufacturer's name, catalog number and item for which it is proposed to be substituted.
            3. Disposition: Accepted samples may be used in work; rejected samples will be returned.
      2. Closeout:
         a. Maintenance Data: Provide manufacturer's instructions and special maintenance tools and accessories as required. Provide three copies of the lock service manual.
         b. Guarantee:
            1. General: Provide in required form for a period of one (1) year from date of final acceptance by Owner and as follows:
            2. Manufacturer's Warranty:
               a. Locksets: "ND" Ten (10) years.
               b. Electronic: One (1) year.
               c. Closers: Thirty (30) years.
               d. Exit devices: Three (3) years.
               e. All other hardware: Two (2) years.
   D. QUALITY ASSURANCE:
      1. Manufacturers: Specializing in production of institutional and commercial door hardware for a minimum of five (5) years.
      2. Supplier:
         a. General: A firm specializing in the supply and servicing of institutional and commercial door hardware for at least five (5) years.
         b. Personnel: Employ an Architectural Hardware Consultant (AHC or DAHC), accredited by the Door and Hardware Institute (DHI), to supervise detailing and supply of material for the Project. If requested, inspect final installation and report problems and suggested corrective measures to the Architect.
3. Coordination:
   a. General: Apply hardware to aluminum or metal doors and frames, and factory prepared wood doors and frames, to template; provide two (2) copies of accepted Finish Hardware Schedule for use by door and frame suppliers.
   b. Distribution: Furnish two (2) copies of each template to manufacturers who are not listed as current template book holders; furnish two (2) copies of each template for items whose manufacturers do not provide registered template book.

4. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.
   a. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".

2. PRODUCTS:
   A. MANUFACTURERS:
      | Item            | Manufacturer | Acceptable Substitutes     |
      |-----------------|-------------|---------------------------|
      | Hinges          | Ives        | Hager, Stanley, McKinney  |
      | Locks, Latches  | Schlage     | None – District Standard  |
      | & Cylinders     | Von Duprin  | None – District Standard  |
      | Exit Devices    | LCN         | None – District Standard  |
      | Closers         |             |                           |
      | Push, Pulls     |             |                           |
      | & Protection Plates | Ives        | Trimco, BBW, DCI         |
      | Flush Bolts     | Ives        | Trimco, BBW, DCI         |
      | Dust Proof Strikes | Ives        | Trimco, BBW, DCI         |
      | Coordinators    | Ives        | Trimco, BBW, DCI         |
      | Stops           | Ives        | Trimco, BBW, DCI         |
      | Overhead Stops  | Glynn-Johnson | Or Approved Equal      |
      | Thresholds      | National Guard | Pemko, Zero            |
      | Seals & Bottoms | National Guard | Pemko, Zero            |

   B. MATERIALS:
   1. Hinges: Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.
      a. Hinges shall be sized in accordance with the following:
         1. Height: 
            a) Doors up to 42" wide: 4-1/2" inches.
            b) Doors 43" to 48" wide: 5 inches.
         2. Width: Sufficient to clear frame and trim when door swings 180 degrees.
         3. Number of Hinges: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
      b. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.
   2. Continuous Hinges: As manufactured by Ives, an Allegion Company. UL rated as required.
   3. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Rhodes" design, fastened with through-bolts and threaded chassis hubs.
      a. Locksets to comply with ANSI A156.2, Series 4000, Grade 1; tested to exceed 3,000,000 cycles. Locksets shall meet "2015 CBC Accessible Code."
      b. Chassis: One piece modular assembly and multi-functional allowing function interchange without disassembly of lockset.
      c. Spindle shall be deep-draw manufactured not stamped. Spindle and spring cage to be one-piece integrated assembly.
      d. Anti-rotation plate to be interlocking to the lock chassis. Lock design utilizing bit-tabs are not acceptable.
      e. Lever Trim: Accessible design, bi-directional, independent assemblies.
      f. Locks shall be of such construction that when locked, the door may be opened from within by using lever and without the use of a key or special knowledge.
      g. Thru-bolts to secure anti-rotation plate without shear line. Fully threaded thru-bolts are not acceptable.
h. Spring cage to have double compression springs. Manufacturers utilizing torsion springs are not acceptable.

i. Latchbolt to be steel with minimum ½” throw deadlatch on keyed and exterior functions; ¾” throw anti-friction latchbolt on pairs of doors.

j. Strikes: ANSI curved lip, 1-1/4” x 4-7/8”, with 1” deep dust box (K510-066). Lips shall be of sufficient length to clear trim and protect clothing.


5. Exit devices: Von Duprin as scheduled.

a. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 2001 standards.

b. All internal parts shall be of cold-rolled steel with zinc dichromate coating.

c. Mechanism case shall have an average thickness of .140”.

d. Compression spring engineering.

e. Non-handed basic device design with center case interchangeable with all functions.

f. All devices shall have quick return fluid dampeners.

g. All latchbolts shall be deadlocking with ¾” throw and have a self-lubricating coating to reduce friction and wear.

h. Device shall bear UL label for fire and or panic as may be required.

i. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.

j. Lever Trim: "Breakaway" design, forged brass or bronze escutcheon with a minimum of .130” thickness, match lockset lever design.

k. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.

l. Furnish glass bead kits for vision lites where required.

m. All Exit Devices to be sex-bolted to the doors.

n. Panic Hardware shall comply with CBC Section 11B.404.2.7 and shall be mounted between 34” and 44” above the finished floor surface.

1. Provide exit devices UL certified to meet maximum 5 pound requirements according to the California Building Code section 11B-309.4, and UL listed for Panic Exterior Fire Exit Hardware.

6. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.

a. Door closer cylinders shall be of high strength cast iron construction with double heat treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.

b. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16 inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.

c. All parallel arm closers shall incorporate one piece solid forged steel arms with bronze bushings. 1-9/16” steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.

d. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.

e. Closers shall be installed to permit doors to swing 180 degrees.

f. All closers shall utilize a stable fluid withstand temperature range of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door.

g. Provide the manufacturers drop plates, brackets and spacers as required at narrow head rails and special frame conditions. NO wood plates or spacers will be allowed.

h. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal. All closers shall be adjusted to operate with the minimum amount of operating force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed
position. Door shall take at least 5 seconds to move from an open position of 90 degrees to a position of 12 degrees from the latch jamb.

i. Provide sex-bolted or through bolt mounting for all door closers.

7. Flush Bolts & Dust Proof Strikes: Automatic Flush Bolts shall be of the low operating force design. Utilize the top bolt only model for interior doors where applicable and as permitted by testing procedures.
   a. Manual flush bolts only permitted on storage or mechanical openings as scheduled.
   b. Provide dust proof strikes at openings using bottom bolts.

8. Door Stops:
   a. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
   b. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 11B-307).
   c. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

9. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges. Provide kick plates 10" high and 2" LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.

10. Thresholds: As Scheduled and per details.
    a. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
    b. Set thresholds in a full bed of butyl-rubber or polysobutylene mastic sealant complying with requirements in Division 7 “Thermal and Moisture Protection”.
    c. Use 1/4" fasteners, red-head flat-head sleeve anchors (SS/FHSL).
    d. Thresholds shall comply with CBC Section 11B-204.1.

11. Seals: Provide silicone gasket at all rated and exterior doors.
    a. Fire-rated Doors, Resilient Seals: UL10C Classified complies with NFPA 80 & NFPA 252. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
    b. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C Classified complies with NFPA 80 & NFPA 252. Where required, intumescent seals vary in requirement by door type and door manufacture – careful coordination required.
    c. Smoke & Draft Control Doors: Provide UL10C Classified complies with NFPA 80 & NFPA 252 for use on “S” labeled Positive Pressure door assemblies.

12. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.

13. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

C. KEYING:

1. Furnish a Proprietary Schlage masterkey system as directed by the owner or architect. Key system to be designed and scheduled by the Schlage Master Key Department even if pinned by the Authorized Key Center, Authorized Security Center or a local authorized commercial dealer.

2. A detailed keying schedule is to be prepared by the owner and/or architect in consultation with a representative of Allegion or an Authorized Key Center or Authorized Security Center. Each key cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.

3. Extend the original Schlage masterkey system established for the project.

4. Required keyway to be verified by PPESD.

5. Furnish all cylinders in the Schlage conventional style except the exit device and removable mullion cylinders which will be supplied in Schlage Full Size Interchangeable Core (FSIC). Pack change keys independently (PKI).

6. Furnish construction keying for doors requiring locking during construction.

7. Furnish all keys with visual key control.
   a. Stamp key “Do Not Duplicate”.
   b. Stamp (BHMA) key symbol on key.

8. Furnish all cylinders with visual key control.
   a. Stamp (BHMA) key symbol on face of cylinder plug (VKC).

9. Furnish mechanical keys as follows:
   a. Furnish 2 cut change keys for each different change key code.
   b. Furnish 1 uncut key blank for each change key code.
   c. Furnish 6 cut masterkeys for each different masterkey set.
d. Furnish 3 uncut key blanks for each masterkey set.

e. Furnish 2 cut control keys cut to the top masterkey for permanent I/C cylinders.

f. Furnish 1 cut control key cut to each SKD combination.

10. Furnish Key System Management Software (SM01-287 Windows on CD)

11. Furnish Schlage Padlocks and the cylinders to tie them into the masterkey system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.
   a. Furnish KS43D2220 padlock for use with non-I/C Schlage cylinders. Furnish 47-413 (conventional) or 47-743-XP (PrimusXP) with above.
   b. Furnish KS43G3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (Classic / Everest) or 20-740 (PrimusXP) with above.
   c. Furnish KS41D1200 padlock for use with SFIC Schlage cylinders. Furnish 80-037 (Everest-B) with above.

12. Furnish one Schlage cabinet lock for each cabinet door or drawer so designated on the drawings or keying schedule to match the masterkey system.
   a. Furnish CL100PB for use with non-I/C Schlage cylinders.
   b. Furnish CL77R for use with FSIC Schlage cylinders.
   c. Furnish CL721G for use with SFIC Schlage cylinders.

D. FINISHES:
   1. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.
   2. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.
   3. Door closer shall be powder-coated to match other hardware, unless otherwise noted.
   4. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

E. FASTENERS:
   1. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
   2. Screws for butt hinges shall be flathead, countersunk, full-thread type.
   3. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
   4. Provide expansion anchors for attaching hardware items to concrete or masonry.
   5. All exposed fasteners shall have a phillips head.
   6. Finish of exposed screws to match surface finish of hardware or other adjacent work.
   7. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

3. EXECUTION:

A. PREPARATION:
   1. Examination: Examine conditions of work in place before beginning work; report defects.
   2. Measurements: Take field measurements; report variance between plan and field dimensions.
   3. Fire-Rated Door Assembly Inspection: Upon completion of the installation, all fire door assemblies shall be inspected to confirm proper operation of the closing device and latching device and that only the manufacturer's furnished fasteners are used for installation and that it meets all criteria of a fire door assembly per NFPA 80 (Standard for Fire Doors and Other Opening Protectives) 2013 Edition. A written record shall be maintained and transmitted to the Owner to be made available to the Authority Having Jurisdiction (AHJ). The inspection of the swinging fire doors shall be performed by a certified FDAI (Fire Door Assembly Inspector) with knowledge and understanding of the operating components of the type of door being subjected to the inspection. The record shall list each fire door assembly throughout the project and include each door number, an itemized list of hardware set components at each door opening, and each door location in the facility.
   4. Delivery:
      a. Packaging: Identify door number, hardware type, location and hand of door on each package.
      b. Keys: Label and deliver keys by registered mail or personal messenger directly to Architect.

4 APPLICATION:
   1. General: Install in strict conformance with referenced standards, the manufacturer's written directions, as shown, and as herein specified.
2. Hardware Placement:
   a. General: Except for hinges, do not install hardware until completion of painting and
      finishing work. Unless otherwise shown, place hardware at following height above finish
      floor:
   b. Strike (Centerline) for Locks and Latches: Between 40 inches and 42 inches.
   c. Hinges: Manufacturer's standard.
   d. Door Pull (Centerline): 42 inches.
   e. Push Plate (Centerline): 44 inches.
   f. Deadlocks (Centerline of Cylinder): 44 inches.

3. Floor Clearances:
   a. Labeled Doors: 3/8 inch maximum over floor or threshold.
   b. No Threshold: 3/4 inch maximum for metal doors; 5/8 inch maximum for wood doors.
   c. Threshold: 1/8 inch typical.
   d. Carpet: 1/8 inch over top of nap, unless otherwise shown.

4. Installation:
   a. General: Install hardware in precise manner; door clearance and hardware placement as
      specified. Predrill pilot holes in wood for screws. Drill and tap for surface mounted
      hardware on metal.
   b. Hinges: Set hinge leaves snug and flat in mortises; turn screws to flat seat (do not drive).
      Drive hinge pins down and tighten set screws.
   c. Closers: Mount door closers for maximum swing of door before setting stops.
   d. Silencers: Set in place before adjusting strikes.
   e. Locksets: Install locks with keyways in proper position; levers, roses and escutcheons
      firmly attached.
   f. Thresholds: Set in waterproof sealant; secure with lead shields and countersunk screws
      of same finish as threshold.

B. ADJUSTMENT AND MAINTENANCE:
   1. General: Prior to acceptance, adjust moveable parts to assure smooth operation.
   2. Door Closers: Adjust for closing speed, latching speed, back checking, and hold-open
      devices for full control of door. Adjust operation of doors to require a maximum of 5.0 lbs. for
      exterior doors; 5.0 lbs. for interior doors; and 15 lbs. for fire doors.

C. HARDWARE GROUPS

Manufacturers Abbreviations (Mfr.)

GLY = Glyn-Johnson Corporation
IVE = Ives
LCN = LCN
NGP = National Guard Products
SCH = Schlage Lock Company
VON = Von Duprin

Overhead Door Stops
Hinges, Pivots, Bolts, Coordinators, Dust Proof
Strikes, Push Pull & Kick Plates, Door Stops &
Silencers
Thresholds, Gasketing & Weather-stripping
Locks, Latches & Cylinders
Exit Devices

GROUP NO. 01

| 1 EA | CONT. HINGE | 224HD | 628 | IVE |
| 1 EA | PANIC HARDWARE | CD-AX-98-NL | 626 | VON |
| 1 EA | RIM CYLINDER | 20-057 | 626 | SCH |
| 1 EA | MORTISE CYLINDER | 26-091 XQ11-948 | 626 | SCH |
| 1 EA | SURFACE CLOSER | 4040XP EDA | 689 | LCN |
| 1 EA | FLOOR STOP | FS18S | BLK | IVE |
| 1 EA | DRIP CAP | 17 (DW+4") | AL | NGP |
| 1 SET | JAMB SEAL | 162S | AL | NGP |
| 1 SET | HEAD SEAL | 700SA | CL | NGP |
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Sierra Ridge Middle School Modernization
Kirk S. Brainerd, Architect
March 22, 2016
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* * *
1. GENERAL:
   A. SUMMARY: Provide Gypsum Board, as shown and specified per Contract Documents.
   B. REFERENCES:
         a. General: Materials and testing standards as identified throughout this Section or within
            referenced manufacturers’ standard specifications.
      2. Gypsum Association (GA):
         a. GA-214: Recommended Levels of Gypsum Board Finish.
         b. GA-216: Recommended Specifications for the Application and Finishing of Gypsum Board.
   C. SUBMITTALS:
      1. General: Submit product data and samples.
      2. Closeout: Submit maintenance data and guarantee in required form for a period of two (2) years
         from date of final acceptance by Owner.
   D. QUALITY ASSURANCE:
      1. Fire Rated Assemblies: Provide materials and construction identical to those tested in assembly
         indicated per ASTM E119 by an independent testing laboratory and acceptable to the
         jurisdictional authorities.
      2. Qualifications: Installer specializing in the work of this Section with minimum three (3) years
         documented experience.

2. PRODUCTS:
   A. MATERIALS:
      1. Manufacture:
         a. General: Products manufactured by the Gold Bond Building Products Division of the National
            Gypsum Corp., unless otherwise indicated.
         b. Alternate Manufacturers: Comparable products manufactured by the PABCO Gypsum
            Division of PABCO Building Products, LLC, or accepted equal.
      2. Gypsum Wallboard:
         a. General: Gold Bond Gypsum Wallboard conforming to ASTM C1396; tapered edge where
            joint finish is required; 5/8 inch thickness, unless otherwise shown.
         b. Surface Paper: 100% recycled content paper on front, back and long edges.
         c. Fire-resistant: Gold Bond Gypsum Fire-Shield “Type X” fire-rated, with UL label; use
            throughout unless otherwise shown.
         d. Moisture and Mold Resistant: e2XP Extended Exposure Interior Extreme conforming to
            ASTM C1658 and applicable sections of ASTM C1396.
      3. Corner Beads and Casing: Manufacturer’s standard galvanized steel at exterior corners and L-
         shaped casing without back flange.
      4. Joint System Materials:
         b. Tape: ProForm Paper Joint Tape.
         c. Joint Compound: ProForm All Purpose Ready Mix Joint Compound.
         d. Joint Finishing Compound: ProForm Ready Mix Topping Joint Compound.
         e. Texture: As recommended by manufacturer for type of use and level of finish specified.
      5. Fasteners:
         a. Screws:
            1. General: ASTM C954, Type W drywall screws; provide a minimum of ¾ inch penetration
               into wood framing.
            2. Metal Studs and Furring Channels: ASTM C1002, phillips, flat head, recessed, bugle
               shaped, self drilling, self tapping, rust inhibitive coated steel screws.
         b. Nails:
            1. General: ASTM C514; phosphate etched, concave head, steel wire nails, specially made
               for attachment of gypsum board.
            2. ½ Inch Board: 1-3/8 inches long, 14 gage.
            3. 5/8 Inch Board: 1-7/8 inches long, 13 gage.
            4. Double Layer ½ Inch Board: 2-1/4 inches long, 12 gage.
      6. Adhesive: ASTM C1396 as recommended by manufacturer.
7. **Interior Wall Sealant:**
   a. **General:** Acoustical Sealant as manufactured by the Sealant/Weatherproofing Division, Tremco, Inc.
   b. **Alternate Manufacturers:** Comparable products manufactured by the Pecora Corp., or acceptable equal.

3. **EXECUTION:**
   **A. PREPARATION:**
   1. **Environmental Requirements:** Do not install wallboard or joint compounds if building temperature is below 55 degrees F. Provide proper ventilation to eliminate excessive moisture from building.
   2. **Examination:**
      a. **General:** Examine conditions of work in place before beginning work; report defects.
      b. **Framing:** Verify accurate spacing and alignment; refer to Section 06 10 00 - ROUGH CARPENTRY.
   3. **Measurements:** Take field measurements; report variance between plan and field dimensions.
   4. **Delivery:** Stack wallboard flat, off the ground, properly supported and protected from weather; use protective covering.
   5. **Protection:** Protect edges and surfaces from construction damage and soiling.
   **B. INSTALLATION:**
   1. **General:** Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
   2. **Gypsum Wallboard:**
      a. **General:** Apply per ASTM C840 and manufacturers instructions.
      b. **Sheet Arrangement Layout:** Install as shown; use long sheets to restrict joints to minimum.
      c. **Cutting and Scribing:**
         1. **General:** Cut neatly to fit around outlets, switch boxes and other protrusions.
         2. **Moisture Resistant Gypsum Board:** Treat cut edges and holes with sealant.
         d. **Joints:** Butt sheets loosely together with tapered edges placed together; butt edges placed next to tapered edges are not acceptable. Sand or kerf cut edges and mill ends to provide smooth jointing on exposed face. Stagger end joints. Shim wallboard as required to provide even joints, without offsets.
      e. **Fasteners:**
         1. **General:** Place not less than 3/8 inch from edges of board, with heads dimpled slightly below surface; do not cut through paper.
         2. **Ceilings, Non-rated:** Nails, 7 inches on center; screws, 12 inches on center.
         3. **Walls, Non-rated:** Nails, 8 inches on center; screws, 12 inches on center.
         4. **Ceilings, One-hour Rated:** As shown.
         5. **Walls, One-hour Rated:** As shown.
      f. **Trim:** Place control joints consistent with lines of building; corner beads at exterior corners; and casing beads where wallboard abuts other materials, and as shown.
      g. **Interior Wall Sealant:** Install double bead of sealant at floor, wall intersections, where walls abut other materials, electrical boxes and any other penetrations of interior partitions.
      h. **Partitions:**
         1. **General:** Place boards with long dimensions either vertical or horizontal on studs; stagger vertical joints on opposite sides of partitions; keep end joints to minimum. Locate joints a minimum of 12 inches from jambs of openings.
         2. **Deflection:** Where gypsum board is carried full height of wall to the structure above, undercut the board by 3/8 inch and seal the top edge of the board to structure with continuous bead of sealant.
      i. **Ceilings:** Install boards with long dimension at right angles to supports; end joints, perimeter of ceiling and edge of openings over solid bearing members.
      j. **Fire Rated Assemblies:**
         1. **General:** Per UL and applicable code requirements. Use only one manufacturer's products in the fabrication of each assembly, unless otherwise permitted by code.
         2. **One (1) Hour:** As shown.
      k. **Gypsum Board Attachment:** Place the long edge of gypsum board panel parallel with and centered on channels; hold back 1/4 inch at all intersecting surfaces. Screw attach to channels; do not allow screws to penetrate framing, must only be screwed to the channels and never come in contact with framing or other structure behind the channels.
      l. **Acoustical Insulation:** Refer to Section 07 21 00 - THERMAL INSULATION.
   3. **Finishing:**
      a. **General:** Finish joints, fastener depressions, applied metal trim and surface blemishes per manufacturer's directions.
b. Finished Wallboard: Sand as necessary to provide flat, smooth surface ready for decoration.

C. Concealed Wallboard: Wallboard covered by panels or wall-fastened casework, and wallboard above level of finished ceiling, does need to be sanded smooth.

d. Existing Wallboard: Where existing and new wallboard join, finish remaining gypsum board and sand as necessary to provide flat, smooth surface.

e. Textured Surfaces:
   1. General: Finish gypsum board in compliance with GA 214 requirements. Apply Level 3 finish followed by a spray applied "Medium Orange-peel" finish, unless otherwise noted.
   2. Food Preparation Spaces, Toilet and Janitor Rooms: Level 5 Smooth finish.
   3. Walls scheduled to receive wall coverings: Level 4 - Smooth finish.

f. Tolerances:
   1. General: Refer to Section 01 43 00 - QUALITY ASSURANCE.
   2. Maximum Variation: 1/8 inch in 10'-0" in any direction.

* * *
1. GENERAL:
   A. SUMMARY:
      1. General: Provide Resilient Flooring, as shown and specified per Contract Documents.
   B. REFERENCES:
      2. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers’ standard specifications.
   C. SUBMITTALS:
      1. General: Submit product data.
      2. Samples: Submit manufacturer’s standard colors.
      3. Closeout: Submit maintenance data, extra stock and guarantee in required form for a period of two (2) years from date of final acceptance by Owner.
   D. QUALITY ASSURANCE:
      1. Qualifications: Installer specializing in the work of this Section with minimum three (3) years documented experience.

2. PRODUCTS:
   A. MATERIALS:
      1. Resilient Flooring:
         a. General: Marmoleum Collection manufactured by Forbo Linoleum Co., Inc.
         b. Alternate Manufacturers: Comparable products manufactured by Tarkett USA, Inc., or accepted equal.
         c. Tile: Marmoleum Modular; color and style selected by Architect.
      2. Resilient Base:
         a. General: BurkeBase Rubber Wall Base Type TS manufactured by the Burke/Mercer Flooring Products Division of Burke Industries, Inc.; 4 inch high top-set base, with matching preformed end stops and molded corners; color as selected by Architect.
         b. Alternate Manufacturers: Comparable products manufactured by Johnsonite, Inc., or accepted equal.
      3. Transition Strips:
         a. General: Transitional Moldings manufactured by the Burke/Mercer Flooring Products Division of Burke Industries, Inc; type for condition as shown, color as selected by the Architect.
         b. Alternate Manufacturers: Comparable products manufactured by Johnsonite, Inc., or accepted equal.
      4. Adhesives: Moisture and alkali resistant, as recommended by flooring manufacturer.
      5. Patching and Leveling Compounds: As recommended by manufacturer.
      6. Wax: ASTM D4078, 16 percent concentration; slip-resistant, water emulsion base.

3. EXECUTION:
   A. PREPARATION:
      1. Scheduling: Do not lay flooring until other work that might cause damage to flooring is complete.
      2. Environmental Requirements:
         a. General: Minimum temperature of building and materials maintained at 65 degrees F for 24 hours prior to and during installation, and until adhesives have cured.
         b. Moisture: Do not apply materials on wet or damp surfaces.
      3. Examination:
         a. General: Examine conditions of work in place before beginning work; report defects.
         b. Concrete Subfloors: Verify that slabs comply with ASTM F710. No extra payment for work additional to that shown and/or specified, for complete application of resilient flooring, will be allowed if such additional work is apparent from inspection of existing premises and conditions.
      4. Measurements: Take field measurements; report variance between plan and field dimensions.
      5. Surface Preparation:
         a. General: Clean subfloors; patch and level cracks, holes, depressions and other imperfections per manufacturer’s directions.
         b. Moisture Testing: Per ASTM F1869; proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lbs. of water per1000 square feet in 24 hours.
         c. Existing Subsurfaces: Prepare existing subfloors as required to receive resilient flooring; remove existing flooring and adhesive.
B. INSTALLATION:

1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
2. Tolerances: Refer to Section 01 43 00 - QUALITY ASSURANCE.
3. Adhesive Application: Per adhesive manufacturer's directions; do not exceed working area or time limits stated by manufacturer.
4. Linoleum:
   a. General: Install wall to wall and to fixed cabinets and casework and under freestanding equipment; cut neatly to and around permanent fixtures.
   b. Layout: Lay from centerline, square and parallel, with straight unbroken joint lines; install partial tiles of equal width at opposite sides of room, as required; less than half-tile width not acceptable.
   c. Pattern: Alternate direction of tile pattern for each abutting tile in line. Fit tightly and accurately to vertical surface, thresholds and edging strips with clean cuts.
5. Resilient Base:
   a. General: Install on surfaces as scheduled, including cabinet bases and other equipment. Provide cove base typically, carpet base at carpeted floors.
   2. Application: Set straight and level, joints closely fitted and flush; top and bottom edges in firm, full contact with floor and back bonded to wall. At masonry, v-joints in concrete, or similar irregular surfaces, fill voids at top edge of base with adhesive filler material as recommended by base manufacturer. Protect adjacent surfaces from adhesive staining.
6. Transition Strips: Provide at transitions of floor covering material.

* * *
RESILIENT ATHLETIC FLOORING  Section 09 65 66

1. GENERAL:
   A. SUMMARY: Provide Resilient Gymnasium Flooring, as shown and specified per Contract Documents.
   B. REFERENCES:
   C. SUBMITTALS:
      1. General: Submit product data.
      2. Shop Drawings: Submit manufacture and installation details, including fastenings and court markings, for review. Submit copy of flooring profile, as required.
      3. Samples: Submit standard finish and line striping colors.
      4. Closeout: Submit maintenance data and guarantee in required form for a period of one (1) year from date of final acceptance by Owner.
   D. QUALITY ASSURANCE: Installer specializing in the work of this Section with minimum five (5) years documented experience.

2. PRODUCTS:
   A. MATERIALS:
      1. Resilient Gymnasium Flooring:
         a. General: Mondoflex[Mondoflex II] manufactured by Mondo USA, Inc.
         b. Alternate Manufacturers: No known equal.
      2. Floor Sealant:
         b. Alternate Manufacturers: No known equal.
      3. Patching and Leveling Compounds: As recommended by manufacturer.
      4. Adhesive: Manufacturer's standard.

3. EXECUTION:
   A. PREPARATION:
      1. Scheduling: Coordinate placement of threshold cover plate anchorages and gymnasium equipment anchorage devices for placement of anchor plates and floor faceplates.
      2. Environmental Requirements: Deliver materials after building is closed in and dry, and has been maintained at 70 degrees F with a relative humidity range of 35 percent to 50 percent for minimum of 7 days.
      3. Examination:
         a. General: Examine conditions of work in place before beginning work; report defects.
         b. Concrete Slab: Verify for preparation of flooring profile that surface variations do not exceed 1/8 inch in 10'-0" radius or 1/4 inch from finished floor elevation, with instrument readings taken at 5'-0" on center in 2 directions. Coordinate with Section 03 30 10 - CONCRETE.
      4. Measurements: Take field measurements; report variance between plan and field dimensions.
      5. Delivery: Store flooring in immediate area of installation at least three (3) days before laying. Stack to provide at least 4 inches of ventilation space around and under bundles.
      6. Protection: Protect adjacent surfaces from damage; repair or replace damaged surfaces as required.
      7. Surface Preparation: Verify that moisture content does not exceed 8%. Clean dust and debris from subfloor before beginning installation of flooring.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
      2. Floor Sealant: Apply in strict conformance with manufacturer's instructions.
      3. Flooring:
         a. General: Lay parallel to long dimension of room per manufacturer's directions.
         b. Cutouts: Provide holes and necessary reinforcement for anchorage of standards and inserts as shown.
         c. Line Striping: Mark game lines, court lines and other markings as shown and in approved colors, as recommended by flooring manufacturer.
      4. Installation of Anchors and Plates:
         a. General: Install the following items when finishing has been completed; repair finish as required after installation.
b. Apparatus Inserts: Anchorage devices for equipment furnished under Section 11 66 23 - GYMNASIUM EQUIPMENT.

* * *
SLIP RESISTANT EPOXY FLOORING Section 09 67 15

1. GENERAL:
   A. SUMMARY: Provide Slip Resistant Epoxy Flooring, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
   C. SUBMITTALS:
      1. General: Submit product data and samples.
      2. Closeout: Submit maintenance data, and guarantee in required form for a period of three (3) years from date of final acceptance by Owner.
   D. QUALITY ASSURANCE: Installer specializing in the work of this Section with minimum three (3) years documented experience.

2. PRODUCTS:
   A. MATERIALS:
      1. Slip Resistant Epoxy Flooring:
         a. General: Dex-O-Tex Decor Floor manufactured by the Dex-O-Tex Division of the Crossfield Products Corp.
         b. Alternate Manufacturers: Comparable products manufactured by Gaco Western, Inc., or accepted equal.
         c. Matrix: Epoxy with colored mineral filler.
         d. Non-slip Surfacing: Mineral, color as selected by Architect.
      2. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
      3. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

3. EXECUTION:
   A. PREPARATION:
      1. Environmental Requirements: Maintain ambient temperature required by manufacturer three days prior to, during, and 24 hours after installation of materials.
      2. Examination: Examine conditions of work in place before beginning work; report defects. Verify concrete floors have cured a minimum 28 days, are dry to a maximum moisture content of seven (7) percent, and exhibit negative alkalinity, carbonization, or dusting.
      3. Measurements: Take field measurements; report variance between plan and field dimensions.
      4. Delivery: Store materials for three days prior to installation in area of installation to achieve temperature stability.
      5. Protection: Cover and protect adjacent construction and equipment from damage during installation of resinous flooring material.
      6. Surface Preparation: Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
      2. Subfloor Filler: Fill and level all areas of floor to receive flooring material.
      3. Primers and Adhesives: Apply as recommended by flooring manufacturer.
      4. Slip Resistant Epoxy Flooring: Apply to a minimum thickness of 1/8 inch; finish to smooth level surface. Prohibit traffic on floor finish for 48 hours after installation.

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Sierra Ridge Middle School Modernization
Kirk S. Brainerd, Architect
March 18, 2016

Job No. 1324
1. GENERAL:
   A. SUMMARY: Provide Carpeting, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Association of Textile Chemists and Colorists (AATCC):
         a. AATCC 16: Colorfastness to Light.
         b. AATCC 134: Electrostatic Propensity of Carpets.
         c. AATCC 165: Colorfastness to Crocking: Carpets - AATCC Crockmeter Method.
      2. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
   C. SUBMITTALS:
      1. General: Submit product data and shop drawings.
      2. Samples:
         a. Colors: Submit manufacturer's standard colors.
         b. Carpet: 24 inches x 30 inches, for testing, when required.
      3. Closeout:
         a. General: Submit maintenance data and guarantee in required form for a period of one (1) year from date of final acceptance by Owner.
         b. Extra Stock: Deliver one (1) percent, or not less than ten (10) yards of each kind and type of carpet installed, in shape and size acceptable to the Architect, wrapped in kraft paper.
   D. QUALITY ASSURANCE: Installer specializing in the work of this Section with minimum three (3) years documented experience.

2. PRODUCTS:
   A. MATERIALS:
      1. Carpeting:
         a. General: Faculty IV Broadloom[Faculty IV Modular] manufactured by Lees Carpets Division of the Mohawk Group.
         b. Alternate Manufacturers: Comparable products manufactured by Tandus, or accepted equal.
         c. Color: Selected by the Architect.
         d. Performance Characteristics:
            1. Critical Radiant Flux Classification: Provide products with not less than 0.45 W/sq. cm classification, as determined by testing identical products per ASTM E648.
            2. Dry Breaking Strength: Not less than 100 lbf per ASTM D2646.
            4. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC-165.
            5. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) per AATCC-16.
            6. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC-174.
         e. Pile Height: ASTM D6859; manufacturer's standard for product specified.
         g. Grounding: Integrelly constructed for dispersion of static electricity to below level of human sensitivity (2500-3000 volts) per CRI Test for Determining Static Propensity of Carpets. Surface applied grounding not acceptable.
         h. Stain Resistance: Manufacturer's standard.
         i. Bacterial Agent: Manufacturer's standard.
      2. Filler: White premix latex as recommended by manufacturer.
      3. Edging Strips:
         a. General: Transitional Moldings manufactured by Burke/Mercer Flooring Products Division of Burke Industries, Inc.; color as selected by the Architect.
         b. Alternate Manufacturers: Comparable products manufactured by the Johnsonite Division of Duramax Inc., or accepted equal.
      4. Primer and Adhesive:
         a. General: As recommended by manufacturer for this type of installation.
b. Seam Cement: Hot melt tape or similar material recommended by manufacturer.

3. EXECUTION:
   A. PREPARATION:
      1. Scheduling: Do not install until building is completely closed and wet operations have been completed.
      2. Environmental Requirements: Maintain minimum temperature of 60 degrees.
      3. Examination:
         a. General: Examine conditions of work in place before beginning work; report defects.
         b. Subfloors:
            1. Concrete:
               a) General: Verify that slabs comply with ASTM F710.
               b) Slab: Dry and free of materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
               c) Finish: Refer to Section 03 30 10 - CONCRETE.
      4. Measurements: Take field measurements; report variance between plan and field dimensions.
      5. Delivery: Deliver carpet to job site with manufacturer's register number tags attached and intact. Submit tags and an accompanying sample cut from each bale to Inspector.
      6. Protection: Protect adjacent surfaces from damage.
      7. Surface Preparation: Per CRI; confirm that floor areas to receive carpet are smooth, broom clean and dry prior to beginning installation.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
      2. Layout: Wall to wall, with continuous lengths and as broad of widths as possible. Do not place seams in doorways or in areas of change of direction of foot traffic; minimize placement of seams in traffic lanes. End or cross seams permitted only when approved by Architect.
      3. Application:
         a. General: Apply per CRI Carpet Installation Standards; maintain uniformity of carpet direction and lay of pile, with pattern parallel to walls and borders. At doorways, center seams under the door in closed position. Bevel adjoining border edges. Fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer. Extend carpet into toe spaces, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
         b. Carpet Tile: CRI 104, Section 13 - Carpet Modules (Tiles).
      4. Edges: True cut edges and treat to form invisible, non-raveling joints where exposed.
      5. Edge Strips: Provide at transitions of floor covering material.

* * *
WALL COVERINGS

1. GENERAL:
   A. SUMMARY: Provide Wall Coverings, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
      2. Chemical Fabrics and Film Association, Inc. (CFFA): Standards.
   C. SUBMITTALS:
      1. General: Submit product data and samples.
      2. Closeout: Submit maintenance data and guarantee in required form for a period of one (1) year from date of final acceptance by Owner.
      3. Extra Stock: Deliver ten (10) percent or a minimum of one full roll of each kind, type and color of wallcovering installed.
   D. QUALITY ASSURANCE: Installer specializing in the work of this Section with minimum three (3) years documented experience.

2. PRODUCTS:
   A. MATERIALS:
      1. Wall Covering:
         a. General: Specified products are manufactured by the Koroseal Wallcoverings Division of the R.J.F International Corp.
         b. Alternate Manufacturers: Comparable products manufactured by Tower Wallcoverings Division of OmNova Solutions, or accepted equal.
         c. Type: "Harborweave" minimum 21 ounces per linear yard, 54 inches wide, with delustered acrylic resin top coating; colors selected by Architect.
         d. Fire Requirements: Per ASTM E84 with a flame spread rating of 15; smoke density 5 maximum.
      2. Filler: As recommended by wall covering manufacturer for application surface.
      3. Primer and Sealer: As recommended by manufacturer for type of installation required.
      4. Adhesive: Manufacturer's standard.

3. EXECUTION:
   A. PREPARATION:
      1. Environmental Requirements: Maintain a constant temperature not less than 60 degrees F in installation areas for a minimum of ten (10) days before and ten (10) days after installation.
      2. Examination: Examine conditions of work in place before beginning work; report defects.
      3. Measurements: Take field measurements; report variance between plan and field dimensions.
      4. Protection: Provide drop cloths at areas where wall covering is to be installed; protect floors and adjacent work from damage.
      5. Surface Preparation:
         a. General: Fill holes, depressions and cracks; scrape off other surface imperfections; leave surface completely smooth.
         b. Sealing: Prime, seal, neutralize or otherwise treat surfaces on which wall covering materials are to be applied as recommended by manufacturer of wall covering.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
      2. Cutting and Trimming: Overlap and double cut materials using straight edge so that seams will butt without gaps and will form straight plumb lines.
      3. Application:
         a. General: Remove wall covering from packaging not less than 24 hours before installation. Install securely, in firm contact with substrate; remove air bubbles, wrinkles, blisters, and other defects.
         b. Pasting: Apply adhesive evenly to back surface of wall covering; scrape material to remove air pockets and wrinkles; remove excess paste immediately from other surfaces.
         c. Seams:
            1. General: Set seams vertical and plumb, with no gaps or overlaps. Horizontal seams not allowed.
            2. Corners: Set 6 inches from outside corners and 6 inches from inside corners, minimum.
         d. Concealed Spaces: Wall covering is not required behind cabinets or tackboards.

* * *
1. GENERAL:
   A. SUMMARY:
      1. General: Provide Painting, as shown and specified per Contract Documents.
   B. REFERENCES:
         a. General: Materials and testing standards as identified throughout this Section.
         b. ASTM D16: For interpretation of terms used in this Section.
         b. SCS SP-01: Environmentally Preferable Product Specification for Architectural and Anti-Corrosive Paints
      7. Steel Structures Painting Council (SSPC): Steel Structures Painting Manual.
   C. SUBMITTALS:
      1. General: Submit product data and a certificate stating compliance with federal, state and local VOC regulations.
      2. Samples: Submit manufacturer's standard colors for each surface finishing product specified.
      3. Closeout:
         a. General: Submit maintenance data.
         b. Extra Stock: Deliver one percent (1%) or a minimum of one (1) gallon of each color, type and surface texture of paint installed. Label each container with color, type, texture and room locations.
         c. Guarantee:
            1. General: Provide in required form for a period of one (1) year from date of final acceptance by Owner.
            2. Criteria: Color and finish appearance shall remain unchanged throughout entire guarantee period.
   D. QUALITY ASSURANCE:
      1. Applicator: Specializing in performing the work of this Section with minimum three (3) years documented experience.
      2. Volatile Organic Compounds (VOC): Use only products in compliance with VOC content limits required by state and local jurisdictional regulations.

2. PRODUCTS:
   A. MATERIALS:
      1. Manufacture:
         a. General: Specified products are premium grade products of the Kelly-Moore Paint Co., Inc., unless otherwise indicated.
         b. Alternate Manufacturers: Comparable products manufactured by the Frazee Paint Co., or accepted equal.
         c. Container Label: Identify with manufacturer's name, and include description of type of paint, brand name, lot number, brand code and color designation.
      2. Paint Materials:
         a. General: Provide manufacturer's standard ready mixed products, except field catalyzed coatings. Provide accessory materials such as linseed oil, shellac, thinners, cleaners and other materials not specifically indicated but required to achieve finishes specified.
         b. Patching Material: Latex type as recommended by manufacturer.
         c. Primer:
            1. General:
               a) Multi-Surface: 250 Color Shield.
               b) Metal (Zinc Chromate): 1725 Acry-Shield.
               c) Metal (Galvanized): 1725 Acry-Shield.
               d) Metal (UnGalvanized): 1710 Kel-Guard.
            2. Exterior:
               a) Wood: 255 Acry-Shield.
            3. Interior:
               a) Wall P.V.A. (Wall Sealer): 970 Acry-Plex.
b) Wood (Enamel): 985 Flo-Cote.

d. Paints:
   1. Exterior:
      a) Housepaint, Flat: 1200 Color Shield.
      b) Housepaint, Semi-Gloss: 1250 Acry-Shield.
      c) Elastomeric Paint: 1128 Kel-Seal (smooth).
   2. Interior:
      a) Wallpaint, Flat: 550 Acryl-Plex.
      b) Enamel, Semi-Gloss: 1650 Acryl-Plex.

B. MIXING:
   1. General: Mix paints at the factory; do not alter or reduce materials except as directed by manufacturer.
   2. Colors: As selected by Architect from manufacturer's full range of submitted samples; factory mix match. No tinting of finish coats will be allowed at job site unless specifically approved by Architect.
   3. Mildew Resistance: Add fungicidal agent to paint per manufacturer's recommendations; approximately 4 oz. per gallon. Add agent at the factory; clearly indicate on label that paint is mildew resistant.

3. EXECUTION:
   A. PREPARATION:
      1. Environmental Requirements:
         a) General: Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the manufacturer.
         b) Temperature:
            1. General: Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the manufacturer.
            2. Exterior Paints: 50 degrees F minimum during and for 48 hours after application; do not apply when temperature is over 85 degrees F, except in protected or shaded areas.
            3. Interior Paints: 65 degrees F for minimum of 48 hours before, during and for 48 hours after application.
         c) Ventilation: Provide adequate ventilation of all interior spaces during application and curing of all painting products.
         d) Lighting Level: Provide minimum 80 foot candles measured at mid-height of room.
      2. Examination:
         a) General: Examine conditions of surfaces in place before beginning work; report defects.
         b) Shop Applied Primer: Test for compatibility with subsequent cover materials.
         c) Moisture Content:
            1. General: Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
            2. Plaster and Gypsum Wallboard: 12 percent.
         d) Acceptance:
            1. General: Application of first coat of painting process constitutes acceptance of surface.
            2. Gypsum Board: Inspect after application of seal coat; application of subsequent coat of painting process constitutes acceptance of surface.
      3. Storage:
         a) General: Store in properly ventilated separate structure not less than 50'-0" from any other structure on the site.
         b) Temperature: Maintain minimum of 45 degrees F and a maximum of 90 degrees F.
         c) Fire Prevention: Take necessary precautions to prevent fire; remove paint-soiled rags and waste from building each day or store in metal containers with covers in the paint storage structure.
      4. Protection: Protect adjacent surfaces not scheduled for paint finish from damage resulting from painting operations.
      5. Surface Preparation:
         a) General: Clean surfaces free of dust, grease, wax, oil, rust and other foreign matter. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing. Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface conditions. Use Shellac to seal marks which may bleed through surface finishes.
b. Impervious Surfaces: Remove mildew by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow surface to dry.

c. Gypsum Board Surfaces: Fill minor defects with filler compound; spot prime defects after repair.

d. Galvanized Surfaces: Remove surface contamination and oils; spot prime defects after repair.

e. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

f. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand/power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

g. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Verify compatibility of specified primer and paint with shop applied primer.

h. Exterior Wood: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caking compound after prime coat has been applied.

i. Interior Wood: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

j. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

k. Existing Surfaces: Wash clean with solution of trisodium phosphate in water and thoroughly rinse or wash with approved self-neutralizing detergent. Spackle, patch, sand, repair, spot prime for finish coats of paint and properly prepare surfaces, reasonably equal to new, for application of paints.

6. Existing Fixtures: Remove or mask existing building detail accessories not to be painted such as building signage, outlet and switch plates, HVAC grilles, etc.; reinstall at completion of painting operations.

B. APPLICATION:

1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

2. Performance:

   a. General: Apply each coat to uniform finish, slightly darker than preceding coat unless otherwise approved. Sand wood and metal lightly between coats to achieve required finish. Vacuum clean surfaces free of loose particles; use tack cloth just prior to applying next coat. Allow applied coat to dry before next coat is applied.

   b. Woodwork: Prime concealed surfaces of woodwork; where scheduled to receive stain or varnish, finish with gloss varnish reduced 25 percent with mineral spirits.

3. Finishing Mechanical and Electrical Equipment: Refer to Division 21 - FIRE SUPPRESSION; 22 - PLUMBING; 23 - HEATING, VENTILATING AND AIR CONDITIONING; and 26 - ELECTRICAL for schedule of color coding and identification banding of equipment, duct work, piping, and conduit. Paint shop-primed equipment. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are pre-finished. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint. Paint dampers exposed behind louvers and grilles to match face panels. Paint exposed conduit and electrical equipment occurring in finished areas. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

4. Exterior Surfaces:

   a. Wood; Painted: One (1) coat primer sealer; two (2) coats enamel, semi-gloss.

   b. Steel; Unprimed: One (1) coat primer; two (2) coats of enamel, semi-gloss.

   c. Steel; Shop Primed: Touch-up with primer (zinc chromate); two (2) coats enamel, semi-gloss.

   d. Steel; Galvanized: One (1) coat primer (galvanized); two (2) coats enamel, semi-gloss.

5. Interior Surfaces:

   a. Wood; Painted: One (1) coat primer sealer; two (2) coats enamel, semi-gloss.

   b. Steel; Unprimed: One (1) coat primer; two (2) coats of enamel, semi-gloss.

   c. Steel; Primed: Touch-up with primer; two (2) coats enamel, semi-gloss.

   d. Steel; Galvanized: One (1) coat primer (galvanized); two (2) coats of enamel, semi-gloss.

   e. Gypsum Board: One (1) coat of primer sealer; two (2) coats wallpaint, flat; 2 coats semigloss where shown.
f. Wall Surfaces Under Vinyl Wall Covering: One (1) coat primer sealer.
g. Insulated Coverings; Canvas and Cotton: One (1) coat primer sealer; two (2) coats enamel, semi-gloss.

C. CLEANING:
1. General: Upon completion, remove masking materials, reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing, and thoroughly clean all exposed surfaces per manufacturer's instructions. Keep premises free from accumulation of waste and rubbish. At the completion of work remove surplus materials, rubbish, and debris.
2. Touch-up: After detailed inspection of paint work, touch up or refinish abraded, stained or otherwise disfigured work, as required by the Architect.
3. Cleaning: Remove containers, rags and debris from the site; observe special care in control or disposal of flammable materials.

* * *
VINYL COVERED TACKBOARDS

1. GENERAL:
   A. SUMMARY: Provide Vinyl Covered Tackboards, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers’ standard specifications.
      3. Chemical Fabrics and Film Association (CFFA): Standards.
   C. SUBMITTALS:
      1. General: Submit product data, shop drawings, and samples.
      2. Closeout: Submit maintenance data, extra stock (10 percent or a minimum of one full roll of each kind and type of vinyl wall covering installed) and guarantee in required form for a period of two (2) years from date of final acceptance by Owner.

2. PRODUCTS:
   A. MATERIALS:
      1. Vinyl Covered Tackboards:
         a. General: Vinyl Tackboard Panels manufactured by Chatfield-Clarke Co., Inc.
         b. Alternate Manufacturers: Comparable products manufactured by Lamvin, Inc., or accepted equal.
         c. Vinyl Wallcovering:
            1. General: Manufactured by the Koroseal Wallcoverings Division of RJF International Corporation.
            2. Type: "Harborweave" minimum 18 ounces per linear yard, 54 inches wide, with delustered acrylic resin top coating; colors selected by Architect.
            3. Fire Requirements: Per ASTM E84 Class B.
            4. Primer and Sealer: As recommended by manufacturer for type of installation required.
         d. Wood Fiber Board: N.C.F.R., Class A fire rated, ½ inch thick, manufactured from 100% recycled ingredients, treated for protection against termites, rot, fungus, and moisture absorption, and compressed into high density building board.
         e. Metal Framing Clips: Manufacturer’s standard metal frame clips for mounting to walls without using exposed nails.
         f. Filler: As recommended by wall covering manufacturer for application surface.
         g. Adhesive: Manufacturer’s standard.

3. EXECUTION:
   A. PREPARATION:
      1. Environmental Requirements: Maintain a constant temperature not less than 60 degrees F in installation areas for a minimum of ten (10) days before and ten (10) days after installation.
      2. Examination: Examine conditions of work in place before beginning work; report defects.
      3. Measurements: Take field measurements; report variance between plan and field dimensions.
      4. Protection: Provide drop cloths at areas where wall covering is to be installed; protect floors and adjacent work from damage.
      5. Surface Preparation: Fill holes, depressions and cracks; scrape off other surface imperfections; leave surface completely smooth.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer’s written directions, as shown, and as specified.
      2. Cutting and Trimming: Overlap and double cut materials using straight edge so that seams will butt without gaps and will form straight plumb lines.

* * *
1. GENERAL:
   A. SUMMARY: Provide Signage, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
      2. Americans with Disabilities Act (ADA):
   C. SUBMITTALS:
      1. General: Submit product data, shop drawings and samples.
      2. Closeout: Submit maintenance data, extra stock and guarantee in required form for a period of one (1) year from date of final acceptance by Owner.

2. PRODUCTS:
   A. MATERIALS:
      1. Signage Requirements:
         a. General: Conform to the requirements of California Title 24 Accessibility Requirements and the Americans with Disabilities Act.
         b. Tactile Character Type: Tactile characters on signs shall be raised 1/32 inch minimum and shall be sans serif uppercase characters accompanied by Contracted Grade 2 Braille (see note below) CBC Section 11B-703.3.
         c. Tactile Character Size: Raised characters shall be a minimum of 5/8 inch and a maximum of 2 inches. CBC Section 11B-703.2.
         d. Finish and Contrast: Contrast between character, symbols and their background must be 70% minimum and have a non-glare finish. CBC Section 11B-703.2 and 11B-703.5.
         e. Proportions: Characters on signs shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke width-to-height ratio of between 1:5 and 1:10. CBC Section 11B-703.2. All letters measured must be uppercase. After choosing a type style to test, begin by printing the letter I, X, and O at 1 inch high. Place the template's 1:1 square over the X, or O, whichever is narrower. If the character is not wider than 1 inch, nor narrower than the 3:5 rectangle, the proportions are correct. Use the 1:5 rectangle to determine if the stroke of the I is too broad, and the 1:10 rectangle to see if it is too narrow. If all the tests are passed, the type style is compliant with proportion requirement.
         f. Braille: California (Contracted) Grade 2 Braille shall be used wherever Braille is required in other portions of these standards. Dots shall be 1/10 inch on center in each cell with 2/10 inch space between cells, measured from the second column of dots in the first cell to the first column of dots in the second cell. Dots shall be raised a minimum of 1/40 inch above the background. Braille dots shall be domed or rounded. CBC Section 11B-703.3 and Figure 11B-703.6.
      2. Signs:
         a. General:
            1. Material: Acrylic sheet per ASTM D4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
            2. Sign: 1/8 inch thick, unless otherwise noted, engraved laminated plastic, color as selected by Architect; engraving 1/32 inch deep in contrasting background color; non-glare finish.
         b. Room Identification: Per CBC 11B-703.4.
         c. Capacity Signs:
            1. General: Per CBC; Typical 1/8 inch thick; number of occupants to be determined by the Architect for each room, where required.
            2. Maximum Number - General: "The number of people permitted in this room shall not exceed ____ by order of the State Fire Marshal." Number of occupants as shown on the Drawings.
         d. Toilet Room Door Signs:
            1. General: Per CBC Section 11B-703.6; 1/4 inch thick with eased edges, with raised letters and braille, as shown. Background color to contrast with door color.
            2. Women: 12 inch diameter circle; international symbol for women with the word "WOMEN" below symbol.
            3. Men: Equilateral triangle with sides 12 inches long, vertex up; international symbol for men with the word "MEN" below symbol.
4. Girls: 12 inch diameter circle; international symbol for girls with the word "GIRLS" below symbol.
5. Boys: Equilateral triangle with sides 12 inches long, vertex up; international symbol for boys with the word "BOYS" below symbol.

   e. Entrance and Exit Signs:
      1. General: Per CBC Section 11B-703.7; 9 inches high x 6 inches wide, 1/4 inch thick, with eased edges.
      2. Entrance: International symbol of accessibility with the word "ENTRANCE" below symbol.
      3. Exit: International symbol of accessibility with the word "EXIT" below symbol, and directional arrow pointing to required exit, where required.
      4. Tactile Exit Signage: As shown.

3. Fasteners: As recommended by manufacturer; tamper-proof screws; anchors where required.
4. Adhesives: As recommended by manufacturer.

3. EXECUTION:
   A. PREPARATION:
      1. Environmental Requirements: Do not install signs when temperature is below 70 degrees F.
      2. Examination: Examine conditions of work in place before beginning work; report defects.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified. Mounting location shall be determined so that a person may approach within 3 inches of signage without encountering protruding objects or standing within the swing of the door. CBC Section 11B-703.4.
      2. Locations: As shown, or as directed by the Architect.
      3. Surface Mounted:
         a. Room Identification: As directed, per CBC 11B-703.
         b. Capacity Signs: As directed, per CBC.
         c. Toilet Room Signs: As directed, per CBC Section 11B-703.4.
         d. Entrance and Exit Signs:
            1. General: Per CBC Section 11B-703.4.
            2. Entrance: Provide at each accessible entrance to the building.
            3. Exit: Provide at accessible exits where shown.
            4. Tactile Exit Signage: As shown.
      4. Exit Signs: As required; for illuminated exit signs refer to Division 26 - ELECTRICAL.

* * *
PLASTIC TOILET COMPARTMENTS  Section 10 21 14

1. GENERAL:
   A. SUMMARY: Provide Plastic Toilet Compartments, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Society for Testing and Materials (ASTM): Hardware standards for handicapped access and materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
      2. Americans with Disabilities Act (ADA):
   C. SUBMITTALS:
      1. General: Submit product data, shop drawings and samples.
      2. Closeout: Submit maintenance data, extra stock and guarantee.

2. PRODUCTS:
   A. MATERIALS:
      1. Manufacture:
         a. General: Manufactured by Scranton Products, Inc.
         b. Alternate Manufacturers: Comparable products manufactured by Bobrick Washroom Equipment, Inc.
         d. Fire Resistance: Per ASTM E 84; smoke developed not to exceed 450, flame spread not to exceed 75
         e. Color: As selected By the Architect.
      2. Panels:
         a. General: Manufacturer's standard 1 inch solid plastic; sizes as shown. Prepare panels as required for grab bars and accessories specified under Section 10 28 13 - TOILET ACCESSORIES.
         b. Pilasters: Manufacturer's standard.
         c. Doors: 24 inches wide, unless otherwise shown; 36 inches wide, minimum, at accessible stalls.
         d. Finishes: Manufacturer's standard; color as selected by Architect.
      3. Fastenings: Manufacturer's standard; provide exposed fasteners with tamperproof heads.
      4. Fittings and Hardware:
         a. General: Manufacturer's standard.
         b. Wall Brackets: Manufacturer's standard, full height of panel.
         c. Hinges: Manufacturer's standard integral hinge system with self closer; hook/door stop mounted minimum 48 inches above finish floor.
         d. Door Latch: Slide bolt type with u-shape or wire pulls both sides of door, below the latch. Mount pulls at 30 to 44 inches above finish floor. Refer to CBC Section 11B-604.1.
         e. Finishes:
            1. Aluminum: Clear anodized high luster finish.
            2. Stainless Steel: Type 304; polished.
      5. Anchors: As recommended by the manufacturer.

3. EXECUTION
   A. PREPARATION:
      1. Examination: Examine conditions of work in place before beginning work; report defects.
      2. Measurements: Take field measurements; report variance between plan and field dimensions.
      3. Protection: Protect partitions until final acceptance. Repair scratches and defects in original finish; replace work damaged beyond repair.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
      2. Wall Brackets: Align brackets at pilasters with brackets at walls.
      3. Pilasters: Erect in a rigid manner; straight and plumb, and with horizontal lines level. Conceal field drilling, cutting, and fitting into finished work. Anchor to structure; set floor anchors in full bed of mastic; 1 inch clearance at walls, maximum; conceal pilaster anchoring devices with a pilaster trim, as required.
      4. Panels:
         a. General: Fasten to walls and pilasters at not less than 2 points; 1 inch clearance at walls and pilasters, maximum.
b. Screens:
   1. Urinal: Anchor to floor as specified for pilasters and to walls with brackets.
   2. Entrance: Anchor to structure.
   5. Fittings and Hardware: Install per manufacturer's instructions.

C. ADJUSTMENT: Prior to acceptance, adjust and lubricate moveable parts to assure smooth operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

* * *
1. GENERAL:
   A. SUMMARY: Provide Wall and Corner Guards, as shown and specified per Contract Documents.
   B. REFERENCES:
      2. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
   C. SUBMITTALS:
      1. General: Submit product data and samples.
      2. Closeout: Submit maintenance data and guarantee in required form for a period of one (1) year from date of final acceptance by Owner.

2. PRODUCTS:
   A. MATERIALS:
      1. Wall and Corner Guards:
         a. General: Specified products are manufactured by Alpar Architectural Products, LLC.
         b. Alternate Manufacturers: No known equal.
         c. Corner Guard: Model No. CG2-S; height as shown.
         d. Fire Rating: UL-723; flame spread 0, smoke developed 75 or less.
         e. Colors: As selected by the Architect.
      2. Fasteners: Manufacturer's standard, and as shown.
      3. Adhesive: Manufacturer's standard.

3. EXECUTION:
   A. PREPARATION:
      1. Scheduling: Coordinate the work with wall or partition sections for installation of concealed blocking or anchor devices.
      2. Examination: Examine conditions of work in place before beginning work; report defects.
      3. Measurements: Take field measurements; report variance between plan and field dimensions.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer’s written directions, as shown, and as specified.
      2. Corner Guards: Install components per manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members.

* * *
1. GENERAL:
   A. SUMMARY: Provide Toilet Room Accessories, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
      3. Americans with Disabilities Act (ADA):
         c. ADA Accessibility Guidelines for Buildings and Facilities (ADAAG):
   C. SUBMITTALS:
      1. General: Submit product data and samples.
      2. Closeout:
         a. General: Submit maintenance data.
         b. Guarantee:
            1. General: Submit in required form for a period of one (1) year from date of final acceptance by Owner.
            2. Welded Stainless Steel Framed Mirrors: Fifteen-year (15) year guarantee against silver spoilage.
   2. PRODUCTS:
      A. MATERIALS:
         1. Manufacture:
            a. General: Classic Series manufactured by Bobrick Washroom Equipment, Inc., unless otherwise indicated; key lockable accessories alike.
            b. Alternate Manufacturers: Comparable products manufactured by American Specialties, Inc., or accepted equal.
            c. Finishes: Type 304 stainless steel; No. 4 satin finish, unless otherwise specified.
            d. Templates and Backplates: Furnish to applicable trades as required for each accessory together with location and mounting height.
         2. Toilet Accessories:
            a. Mirrors:
               1. General: Mirror glass per ASTM C1036, Type 1 transparent flat, Class 1 clear, Quality q1 mirror select, 1/4 inch thick; sizes as shown.
               2. Safety Backing: Clear vinyl backing conforming to ANSI Z97.1-1975 and CPSC 16 CFR 1201 Category II; manufactured by Buckmin Industries, or accepted equal.
               3. Framed Mirrors:
                  a) General: Stainless steel, with countersunk "theftproof" screws.
                  b) Frame: Model No. B-290; size as shown.
                  c) Backs: Resilient filler and galvanized steel or hardboard backing plate, without filler; attach with "theftproof" concealed hangers. Corrugated cardboard or other moisture absorbent filler not acceptable.
            b. Soap Dispensers: Wall mounted Model No. B-2112; capacity 1 quart, 8 fluid oz. liquid soap.
            d. Grab Bars: Series No. B-5806; 18 gage 1-1/4 inch o.d. stainless steel tubing; size as shown.
            e. Toilet Tissue Dispensers: Surface mounted Model No. B-2888, 2 roll capacity.
            3. Fasteners: As recommended by manufacturer; non-corrosive, tamperproof type.
   3. EXECUTION:
      A. PREPARATION:
         1. Examination: Examine conditions of work in place before beginning work; report defects.
         2. Measurements: Take field measurements; report variance between plan and field dimensions.
B. INSTALLATION:

1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified. Conceal evidence of drilling, cutting, and fitting to room finish under accessory.

2. Toilet Room Accessories: Install at locations and heights shown, with concealed vandal-proof fasteners where mountings are made without back plates and where accessories are recessed or fastener is exposed to view. Where possible, mount accessories back-to-back. Attach accessories securely to walls or toilet partitions as recommended by manufacturer for each item and each condition; adhesive installation not permitted.

3. Grab Bars:
   a. General: Anchor grab bars to withstand minimum downward pull of 500 lbs. Secure grab bars to preset mounting plates screwed to studs or backing plate, using brass or stainless steel vandal proof fastenings. Where mounted on toilet partitions, provide back-to-back sleeves per manufacturer's recommendations.
   b. At Toilets: Install per CBC 11B-609.1; accessories shall not be located closer than 1-1/2 inch clear from the tangent point of the grab bar.

4. Owner Furnished Items: Verify type and location of items furnished by Owner to ensure proper preparation for attachment to structure.

* * *
1. GENERAL:
   A. SUMMARY: Provide Laboratory Equipment, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers’ standard specifications.
      7. Underwriters Laboratories, Inc. (UL):
         b. UL 3101: Electrical Equipment for Laboratory use.
      8. State of California, Department of Industrial Relations (Cal/OSHA): CAL/OSHA 5154.1 – Ventilation Requirements for Laboratory-Type Hood Operations.
   C. SUBMITTALS:
      1. General: Submit product data, shop drawings and samples.
      2. Closeout: Submit maintenance data, and guarantee in required form for a period of one (1) year from date of final acceptance by Owner.
   D. QUALITY ASSURANCE: Installer specializing in the work of this Section with minimum three (3) years documented experience.

2. PRODUCTS:
   A. MATERIALS:
      1. Fume Hood:
         a. General: Model No. 13692 UniFlow CE AireStream Hood with Vapor Proof Light and Built-In Exhaust as manufactured by the HEMCO Corp.
         b. Alternate Manufacturers: Comparable products manufactured by Labconco Corp., or accepted equal.
         c. Fume Chamber: Standard white 3/16 inch molded non-conducting HiPel resin.
         d. Sash Glass: 3/16 inch clear tempered safety glass per ASTM C1048.
         e. Work Surface: 1-1/4 inch thick grey composite resin molded to contain chemical spillage, dished section not less than 1/4 inch thick.
         f. Lighting: manufacturers standard.
         g. Service Fixture Finish: Manufacturers standard.
      2. Glassware Washer:
         a. General: Model No. 4400420 Freestanding SteamScrubber Glassware Washer manufactured by the Labconco Corp.
         b. Alternate Manufacturers: Comparable products manufactured by the Cole-Parmer Instrument Co., LLC., or accepted equal.
      3. Fasteners: As recommended by manufacturer.

3. EXECUTION:
   A. PREPARATION:
      1. Examination: Examine conditions of work in place before beginning work; report defects.
      2. Measurements: Take field measurements; report variance between plan and field dimensions.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
      2. Fume Hood: Install per manufacturers instructions; place unit in full operation and test range of operation to meet manufacturer's requirements.
      4. Anchorage: Set in place and anchor as recommended by manufacturer.
5. Services: Connect per Division 22 - PLUMBING, Division 23 - HEATING, VENTILATING AND AIR CONDITIONING and Division 26 - ELECTRICAL per manufacturers instructions and as required.

* * *
STAGE CURTAINS

Section 11 61 43

1. GENERAL:
   A. SUMMARY: Provide Stage Curtains, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers’ standard specifications.
   C. SUBMITTALS:
      1. General:
         a. Submit product data, shop drawings, samples, test reports, and certificates.
         b. Samples: Submit manufacturer’s standard fabric swatches.
         c. Fireproofing: Submit two (2) samples of fabric treated with proposed flameproofing.
         d. Certificates: Submit certificate verifying compliance with requirements of State Fire Marshal for fireproofing of stage curtain fabric.
      2. Closeout: Submit maintenance data and guarantee in required form for a period of one (1) year from date of final acceptance by Owner.
   D. QUALITY ASSURANCE: Installer specializing in the work of this Section with minimum five (5) years documented experience and at least five (5) installations of similar size and type.

2. PRODUCTS:
   A. MATERIALS:
      1. Stage Curtains:
         a. General: Material distributed by Rose Brand Textiles; color as selected by Architect.
         b. Alternate Manufacturers: Comparable products manufactured by Grosh Backdrops and Drapery, or accepted equal.
      2. Fabric:
         b. Velour:
            1. General: "Memorable" cotton velour; treated with fire retardant chemical and passes flame resistance tests, including California Administrative Code Title 19, Paragraph 1237.1 and NFPA 701, small & large scale.
            2. Lining: "Ranger", permanently flame-resistant heavy weight denim. Fully lined front curtain at proscenium opening; edge lined at rear of platform.
         c. Accessories:
            1. Grommets: No. 2 Brass Washer Grommets.
            2. Tie Lines: 3/4 inch bias tape.
            3. Weights: No. 8 jack chain.
      3. Curtain Track:
         b. Alternate Manufacturers: Comparable products manufactured by Grosh Backdrops and Drapery, or accepted equal.
         c. Track: Length sufficient to take curtain completely out of proscenium opening, or length as shown for rear curtain. Aluminum track will not be accepted. Supporting pipe batten not required, but support from each unistrut is required. Provide accessories required for traverse operation including carriers, hand lines, etc.
         d. Valance Support: 1-1/2 inch black iron pipe batten with capped ends.
      4. Fasteners:
         a. General: As recommended by manufacturer, and as shown.
         b. Chain: 2-0 welded link chain with repair links.
         c. Cable: 1/4 inch plow steel cable.
   B. FABRICATION:
      1. Stage Curtains:
         a. General: Each set made as pair, including side curtains, masking borders and back curtains, as shown. Provide 2'-6" center lap, 3'-0" jamb lap each side and 24 inch head lap, approximately 14'-0" high. Turn back leading edges 1/2 full width.
         b. Valance: Width of proscenium plus 3'-0", approximately 4'-0" high.
         c. Sewing: Sewn by professional theatrical seamspersons, experienced in this type of work. Provide pieces containing minimum of 50 percent more fabric than required for covering spaces or dimensions given; fullness shirred or box pleated in by triple stitching to 3-1/2 inch webbing. Provide 6 inch wide on-stage and bottom hems; 2 inch wide off-stage hems. Install grommets and tie lines of bias tape at 12 inches on center. Where required, sew weights in separate pockets inside bottom hem; set weight above bottom of curtain to prevent unnecessary wear.
3. EXECUTION:
   A. PREPARATION:
      1. Scheduling: Coordinate trades whose work affects stage curtain and track installation, including placement of switches, lighting, etc., under Division 16 - ELECTRICAL.
      2. Examination: Examine conditions of work in place before beginning work; report defects.
      3. Measurements: Take field measurements; report variance between plan and field dimensions.
      4. Protection: Secure from moisture, soiling or damage; replace damaged materials.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
      2. Stage Curtains:
         a. General: Install plumb, level and aligned with lines of adjacent structure; tape cables; hang curtains straight and true, without puckers, to proper distance off stage floor.
         b. Overhead Support: Suspend all items from overhead ceiling structure and attach as shown. Provide suitable and safe anchorage to building with chain and/or steel cable as required.
   C. ADJUSTMENT: Prior to acceptance, adjust moveable parts to assure smooth operation.
   D. FIELD QUALITY CONTROL: Demonstrate hanging and operation of stage curtains, fittings and devices, and test working parts at time convenient to Architect and Owner.

* * *
WOOD LIBRARY FURNITURE

Section 12 56 51

1. GENERAL:
   A. SUMMARY: Provide Wood Library Casework, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
   C. SUBMITTALS:
      1. General: Submit product data, shop drawings and samples.
      2. Closeout: Submit maintenance data and guarantee in required form for a period of one (1) year from date of final acceptance by Owner.
   D. QUALITY ASSURANCE: Installer specializing in the work of this Section with minimum five (5) years documented experience; manufacturer approved.

2. PRODUCTS:
   A. MATERIALS:
      1. Wood Library Casework:
         a. General: Traditional Collection manufactured by the Contract Library Furniture Division of the Brodart Co.
         b. Alternate Manufacturers: Comparable products manufactured by Fischer Hamilton, Inc., or accepted equal.
         c. Casework Units: As shown.
         d. Shelving: As shown.
         e. Finish: As selected by the Architect.
      2. Fasteners: As recommended by the manufacturer.

3. EXECUTION:
   A. PREPARATION:
      1. Environmental Requirements: Relative humidity 50 percent or less; temperature 70 degrees F minimum.
      2. Examination: Examine conditions of work in place before beginning work; report defects.
      3. Measurements: Take field measurements; report variance between plan and field dimensions.
      4. Delivery: Use clean, nonstaining materials for blocking and packing. Carefully load and cover for shipment; do not transport during inclement weather.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

* * *
1. GENERAL:
   A. SUMMARY: Provide Inclined Wheelchair Lift, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. Americans with Disabilities Act (ADA):
      3. American Society of Mechanical Engineers (ASME):
         a. ASME A17.5: Elevator and Escalator Electrical Equipment.
      4. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
      5. State of California:
         c. California Occupational Safety and Health Administration (CalOSHA): California Code Regulations - Title 8.
   C. SUBMITTALS:
      1. General: Submit product data and shop drawings.
      2. Samples: Submit manufacturer's standard colors.
      3. Closeout:
         a. General: Submit guarantee in required form for a period of two (2) years from date of final acceptance by Owner.
         b. Maintenance Data: Manufacturer's instructions. Provide maintenance program required by CBC Art 7-15, Part 7, Title 24, Section 7-3094.5(a).
   D. QUALITY ASSURANCE:
      1. Permits and Inspections: Provide all inspections, tests, licenses and permits as required.
      2. Qualifications: Installer specializing in the work of this Section with minimum five (5) years documented experience.

2. PRODUCTS:
   A. MATERIALS:
      1. General: Refer to Section 01 60 00 - PRODUCT REQUIREMENTS. Comply with accessibility code requirements, CBC Part 7, Title 24, Section 7-3094.1, 7-3094.2, f., p., 3; ADAAG 4.1.3 (5).4; CBC 11B-402.2, 11B-207.1.
      2. Inclined Wheelchair Lift:
         b. Alternate Manufacturers: Comparable products manufactured by Garaventa Lift, or accepted equal.
         c. Application: Outdoor operation.
         e. Travel Speed: 20 fpm.
         f. Platform:
            1. General: ADA Compliant; 30-1/2 inches wide by 49.25 inches long with manufacturers standard nonslip finish.
            g. Platform Operation:
               1. Controls: Manufacturer's standard.
               2. Automatic Fold: Folded and unfolded electrically from the call station.
               3. Emergency Manual Fold: When unit is left in the open position, platform may be manually folded and retained in closed position.
               4. Under Platform Obstruction Sensing: Manufacturer's standard under platform sensing device to stop the platform from traveling in the downward direction when encountering 15 lbs. of pressure.
            h. Controls:
               1. General: Manufacturer's standard; keyed operation.
3. Call Stations: Wireless; surface mounted at landings.
4. Battery Operation: Provide for normal up/down lift operation during a power failure for a minimum of five (5) trips with rated load.
   i. Finish: Manufacturer's standard electrostatically applied and baked powder coat for outdoor use; color selected by the Architect.
   j. Anchors and Fasteners: As recommended by manufacturer.

3. EXECUTION:
   A. PREPARATION:
     1. Examination: Examine conditions of work in place before beginning work; report defects.
     2. Measurements: Take field measurements; report variance between plan and field dimensions.
   B. INSTALLATION:
     1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
     2. Lines and Levels: Set unit in place plumb and level; anchor securely. Confirm floor level compliance to CBC accessibility requirements.
     3. Electrical Service: Per Division 26 - ELECTRICAL.
   C. FIELD QUALITY CONTROL:
     1. General: Load platform to rated capacity; demonstrate operation to Architect and Inspector.
     2. Retesting: Make necessary corrections to non-conforming work; retest at Contractor's expense.
     3. Adjustment: Prior to acceptance, adjust moveable parts to assure smooth operation.

* * *
1.01 GENERAL:

A. This Section specifies the Division 22 Work coordination requirements with general work provisions.

B. For convenience and reference the Division 22 Specifications are separated into Divisions and Sections. Such separations shall not operate to make the Engineer an arbitrator to establish subcontract limits between the Prime Contractor and his Subcontractors. In any case, the Prime Contractor is responsible to the owner for a complete job.

C. This section consists of General Requirements and Standard Specifications covering certain parts of work under Division 22 and is supplemented by other Division 22 sections covering additional work, requirements, and materials specifically applicable to the work of each section.
   1. Requirements of subsequent sections of the specifications, if in conflict with these General Requirements, shall govern.

D. No material installed as part of this WORK shall contain asbestos in any form.

1.02 CONDITIONS OF THE CONTRACT

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

B. This section is a Division-22 Basic Materials and Methods section and is a part of each Division -22 section.

1.03 DESCRIPTION OF REQUIREMENTS

A. Provide finished work, tested and ready for operation including apparatus, appliances, materials, and work. Provide incidental accessories necessary to make the work complete and ready for operation without additional expense to the Owner.

B. Before beginning work or ordering materials, consult Architect for clarification of discrepancies between, or questionable intent, of the Contract Documents.

C. Contractor shall visit the site and field survey the existing site conditions prior to bid. Any site conditions which may cause significant deviation from the design drawings shall be brought to the attention of the Owner's representative for clarification prior to bid.

1.04 REQUIREMENTS OF REGULATORY AGENCIES:

A. Provide work and materials in full accordance with the latest rules and regulations of the following:
   1. California Code of Regulations - Title 24 - Parts 2, 3, 4.5, and 9
   2. California Code of Regulations - Title 22 - Chapter 7
   9. California Green Building Standards 2013
11. National Fire Protection Association
12. CAL-OSHA
13. Occupational Safety and Health Administration
14. State Fire Marshal, Title 19 CCR
15. Other applicable state laws

B. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes.

C. Conform to State of California Energy Conservation Standards for all systems, equipment, and construction.

D. The above Codes and Standards define minimum requirements required for the project. Where Contract Documents differ from governing codes, furnish and install higher standard.

1.05 FEES, PERMITS, AND UTILITY SERVICES:

A. Arrange for required inspections and permits required in installation of the work.

B. The Owner will pay charges for permits required.

C. Arrange for utility connections and pay charges incurred, including excess service charges, if any.

D. Obtain the first permits to operate any compressed air tanks that are required to be furnished under this work, pay all costs, and perform all tests required to obtain permits. Post permits under glass in a conspicuous place on or near the tanks, as required by these authorities.

1.06 SITE EXAMINATION:

A. Examine site, verify dimensions and locations against Drawings, and inform self of conditions under which work is to be done before submitting proposal. No allowance will be made for extra expense on account of error.

B. Information shown relative to existing services is based upon available records and data but is approximate only. Make minor deviations found necessary to conform with actual locations and conditions without extra cost. Verify location and elevation of utilities prior to commencement of excavation for new piping or its installation.

C. Exercise care in excavating near existing utilities to avoid any damage thereto. This Contractor is responsible for any damage caused by his operations.

1.07 MATERIAL LIST AND SUBSTITUTIONS:

A. Prior to commencement of work, and within 35 days after award of Contract, submit to Architect for review electronic copies of a complete list of equipment and materials to be furnished, including all substitutions. All submittals to be in electronic format as follows:
   1. Submittals to be in PDF Format.
   2. Individual PDF cut sheets shall be inserted into a single file for review.
   3. All sheets to be “unprotected” and writable.

B. Provide submittal information for all materials proposed for use as part of this project. Provide standard items on specified equipment at no extra cost to the contract regardless of disposition of submittal data. Other material or methods shall not be used unless approved in writing by the
Architect. The Architect’s review will be required even though “or equal” or synonymous terms are used.

C. It is the responsibility of the Contractor to assume all costs incurred because of additional work and/or changes required to incorporate the proposed substitute into the project including possible extra compensation due to the Architect. Refer to Division 1 for complete instructions.

D. Contractor to provide complete Submittal packages for each system. At a maximum, submittals to be broken into the following packages:
   1. Plumbing – Fixtures, Trim, Piping, Equipment, Accessories, etc.
      a. When required by schedule, a separate Plumbing Underground submittal package will be reviewed upon request.

E. Identify each item by manufacturer, brand, trade name, model number, size, rating, or whatever other data is necessary to properly identify and review materials and equipment.
   1. Where submittal sheets indicate more than one product, Contractor to clearly identify product being submitted. Contractor to cross-out information not being submitted for review.
   2. Submittals that do not clearly identify submitted item will be returned to the Contractor un-reviewed.

F. Identify each submitted item by reference to specification section number and paragraph in which item is specified. Cross reference submittals by equipment ID where applicable.

G. Quantities are the Contractor’s responsibility and will not be reviewed.

H. If Contractor desires to make a substitution, he shall submit complete information or catalog data to show equality of equipment or material offered to that specified.
   1. Only one request for substitution will be considered on each item of material or equipment.
      No substitutions will be considered thereafter.
   2. Scheduled Products and first named manufacturer/product forms basis of design. All other manufacturers’ products are substitutions.
   3. No substitutions will be allowed unless requested and reviewed in writing.
   4. The Architect shall review and take appropriate action on shop Drawings, product data, samples, and other submittals required by the Contract Documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the Contract Documents. It shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor.
   5. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component. The Architect shall not be required to review and shall not be responsible for any deviations from the Contract Documents not clearly noted by the Contractor, nor shall the Architect be required to review partial submissions or those for which submissions for correlated items have not been received. Architect reserves right to require originally specified item.

I. Installation of reviewed substitution is Contractor’s responsibility. Any changes required for installation of reviewed substituted equipment must be made without additional cost to the owner. Review by the Architect of the substituted equipment and/or dimensional Drawings do not waive these requirements.

1.08 MAINTENANCE AND OPERATING INSTRUCTIONS:

A. Instruct the Owners’ authorized representatives in the operation, adjustment, and maintenance of all mechanical equipment and systems. Provide 3 copies of certificate signed by Owner’s representatives attesting to their having been instructed.
B. Furnish Architect with three complete sets of operating and maintenance (O&M) instructions.
   1. O&M manuals to be bound in hardboard binder and indexed.
   2. O&M manuals to include: descriptive literature, catalog cuts, and diagrams covering all items
      of operation and maintenance for each and every mechanical system and piece of equipment
      furnished under these specifications.
   3. Include in each set a copy of the air balance test report specified hereinafter.

C. Contractor must start compiling the above data (including obtaining operating and maintenance
   instruction data and catalog cuts and diagrams from the manufacturer of the reviewed equipment)
   immediately upon review of his list of materials, so as not to delay the final installation of the
   work.

D. Bind and index each set in a durable, hardboard binder. Final observation will not be made until
   booklets are submitted and have been reviewed by the Architect.

E. O&M manuals to incorporate the following:
   1. Complete operating instructions for each item of plumbing equipment.
   2. Test data and system balancing reports as specified.
   3. Manufacturer’s bulletins with parts numbers, instructions, etc. for each item of equipment. 
      Remove information not applicable to project.
   4. Typewritten maintenance instructions for each item of equipment listing in detail the
      lubricants to be used, frequency of lubrications, inspections required, adjustment, etc.
   5. A complete list and/or schedule of all major valves giving the valve ID, location of valve, and
      the rooms or area controlled by the valve.
   6. Provide copies of start-up reports for each piece of equipment provided as part of this work.
   7. Name, address, and phone number of contractors involved in work under this Division.
   8. Detailed step-by-step instructions for starting, summer operation, winter operation, and
      shutdown of each system.
   9. Detailed maintenance instructions for starting, summer operation, winter operation, and
      shutdown of each system.
   10. Spare parts list.
   11. Full size Record as built shop drawings in hard copies and in AutoCad 2013 CAD files.
       a. Contractor to incorporate field mark-ups into record drawings. Mark-up shop drawings
          not acceptable.

1.09 COORDINATION SHOP DRAWINGS

A. General:
   1. Prepare and submit for review coordination drawings where work by separate entities
      requires fabrication of products and materials which must accurately interface or for which
      space provided is limited.
   2. Coordination drawings shall indicate how the work will interface and installation will be
      sequenced. It is the intent of this provision to find, bring forth, and resolve potential
      constructability problems prior to actual construction, thereby allowing for the resolution of
      issues before construction cost and schedule are impacted.

B. The General Contractor shall oversee preparation of coordination drawings, assign priority space,
   and bring to the attention of the Architect any conflicts or interferences of an unresolved nature
   found during preparation of coordination drawings. Expedite conflict or interferences and submit
   solutions/recommendations for approval review.

C. Drawings: Shop drawings shall include but are not necessarily limited to the following:
   1. Submit 1/4" = 1'-0" minimum scale, a combined, comprehensive mechanical coordination
      drawing. Coordination drawing shall include all ductwork, mechanical piping, plumbing,
sprinkler systems, and ceiling systems overlaid on structural frame and architectural plan. Shop drawings are to be coordinated with all electrical and Telecom systems.

2. Criteria: Ductwork, mechanical piping, plumbing, and sprinkler system components shall be sized as shown on Drawings. Seismic restraints shall be shown where required. Nonconforming Mechanical work installed within designated coordination areas is subject to removal and replacement by the installing contractor at no additional cost to Owner.

3. Provide sections for congested areas.

4. Identify typical areas, start preparation of coordination drawings for such areas first.

D. Coordination drawings shall be signed and dated by individual trade contractors. By act of signature and submittal of singular combined coordination drawing, each trade contractor acknowledges their coordinated portion of the work with all other mechanical, electrical, telecom, architectural, and structural work contractors.

E. After completion of coordination shop drawings signed by individual trade contractors. Submit copies to the architect for review. Once approved, provide copy at the job site for reference. No work shall be performed without the complete coordination shop drawings.

F. No request for information regarding the routing of pipes, ductwork and placement of equipment will be reviewed and responded to without a completed shop drawings.

1.10 SITE CONDITIONS

A. Information of the drawings relative to existing conditions is approximate only. Deviations found necessary during progress of construction to conform to actual conditions as approved by the Architect shall be made without additional cost to the Owner. The Contractor shall be held responsible for any damage caused to existing services. Promptly notify the Architect if services are found which are not shown on the Drawings.

2.01 GENERAL:

A. Mention herein or on Drawings requires that this Contractor provide each item listed of quality noted or equal. Refer to subsequence division 22 specification sections for specific equipment and system materials and accessories.

B. All material shall be new, full weight, standard in all respects, and in first-class condition.

C. Provide materials of the same brand or manufacture throughout for each class of material or equipment wherever possible.

D. The grade or quality of materials desired is indicated by the trade names or catalog numbers stated herein.

E. Dimensions, sizes, and capacities shown are a minimum and shall not be changed without permission of the Architect.

F. Conform to the State Energy Conservation Standards for all material and equipment.

2.02 MATERIALS FURNISHED:

A. Identify all materials and equipment by manufacturer's name and model number. Remove unidentified materials and equipment from site.

B. Equipment specified by manufacturer's number shall include all accessories, controls, etc. listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.
C. Equipment or material damaged during transportation, installation, or operation is considered as totally damaged. Replace with new equipment. Variance from this permitted only with written consent of the Architect.

D. Deliver, Protection, and Care:
   1. Deliver materials or equipment to the Project in the manufacturer’s original, unopened, labeled containers.
   2. Added costs associated with reordering, expediting orders, or project delays due to rejected materials shall be borne by the Contractor.
   3. Protect from damage which may be caused by theft, weather, and building operations. Failure to protect materials and apparatus adequately shall be sufficient cause for rejection of any damaged material or equipment.
   4. Close pipe and equipment openings to prevent intrusion of obstructions and damage.
   5. Owner or Architect will require removal and replacement of such material or work from the premises which is not in accordance with Contract Documents. Replace unsatisfactory work without delay, at no additional cost to the Owner.
   6. All material and equipment shall be protected against moisture, dirt and damage. Protective coverings shall be provided for bearings, open connections to pumps and tanks, coils, ducts, pipes and similar equipment that is vulnerable to grit and dirt.
   7. The interior of the pipes and ducts shall be kept clean at all times.

3.01 GENERAL:

A. General arrangement and location of piping, equipment, etc. are shown on Drawings or herein specified. Carefully examine other work that may conflict with this work. Install this work in harmony with other crafts and at proper time to avoid delay of work. Provide all offsets as required to avoid other trades at no additional cost to the owner.

B. In advance of construction, work out minor changes and relocations to suit actual conditions and work of other trades to avoid conflict therewith. This shall not be cause for additional cost.

C. Execute any work or apparatus shown on the Drawings and not mentioned in the specifications, or vice versa, the same as if specifically mentioned by both. Omission from Drawings or specifications of any minor details of construction, installation, materials, or essential specialties does not relieve this Contractor from furnishing same in place complete.

D. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.
   1. Minor piping associated with instrumentation and control is generally not shown. Interconnection of sensors, transducers, control devices, instrumentation panels, combustion control panel, burner control panels is the responsibility of the contractor. Small piping associated with water cooling, drips, drains and other minor piping may not be shown to avoid confusion in the plan presentation but shall be provided as part of contract work. Drains shall be piped to the nearest floor drains.

E. Furnish materials and work at proper time to avoid delay of the work.

F. Coordinate with testing and balancing contractor to review drawings for proposed additional balancing components required for proper system testing and balancing.

3.02 ACCESS:
A. Continuously check Architectural Drawings for clearance and accessibility of equipment specified herein to be placed. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing his equipment into proper position.

3.03 CLOSING IN OF UNINSPECTED WORK:

A. Do not allow or cause work installed to be covered up or enclosed before it has been inspected and tested. Should work be enclosed or covered up before it has been inspected and tested, uncover work at own expense. After it has been inspected and tested, make repairs necessary to restore work of other contractors to condition in which it was found at time of cutting.

3.04 PROJECT MODIFICATIONS:

A. During the progress of construction, if such conditions arise that require revisions, modifications, or relocations to any mechanical equipment or materials incorporated in this project, such alterations shall be immediately called to the attention of the Architect. Contractor shall then prepare necessary Drawings showing proposed changes. Submit proposed changes for review by the Architect prior to actual revision work in the field.

B. Two sets of Drawings showing all revisions shall be immediately presented to Architect for his records. Maintain additional copies on the project as necessary to comply with "RECORD DRAWINGS" requirement of the General Requirements.

C. Incorporate all revisions into record Drawings.

3.05 FORMING, CUTTING AND PATCHING:

A. Coordinate with other contractors as necessary to provide any special forming, recesses, chases, etc., and provide wood blocking, backing, and grounds as necessary for proper installation of mechanical work.

B. If this Contractor fails to coordinate with other contractors at proper time or fails to locate items properly, resulting in extra work, then this Contractor is responsible.

C. This Contractor is responsible for proper placement of pipe sleeves, hangers, inserts, and supports for work.

D. Cutting, patching, and repairing of existing (old) construction to permit installation of piping, etc. is responsibility of this Contractor. Repair or replace damage to existing work with skilled mechanics for each trade involved in first-class manner.

E. Cut existing construction in a neat and workmanlike manner by the use of a concrete saw. Use of pneumatic devices will not be allowed.

F. Core openings through existing construction as required for the passage of new piping and conduits. Cut holes of the minimum diameter to suit size of pipe installed and associated insulation.

3.06 DEMOLITION AND SALVAGE:

A. Provide demolition of plumbing work under this SECTION as indicated on Drawings.

B. Removed materials which will not be re-used and which are not claimed by the owner shall become the property of the Contractor and shall be removed from the premises. Consult Owner
before removing any material from the premises. Carefully remove materials claimed by the owner to prevent damage. Coordinated delivery of such items to owner.

C. Removed materials which are to be reused are to be removed, cleaned, and stored in a safe location. If such items are lost or damaged by the Contractor, item shall be replaced with new item at no added cost to owner. If item is found to be damaged prior to removal, inform Architect prior to removal so that item may be examined by Architect and owner for further instructions.

3.07 WELDING FOR MECHANICAL WORK

A. All mechanical welding and inspection requirement shall be in accordance with the California Mechanical Code.

B. Qualify welding procedures, welders and operators shall be in accordance with ASME boiler and pressure vessel code, section IX, welding and brazing qualifications. Welding procedures and testing shall comply with ANSI standard B31.9 - standard code for pressure piping, and the American Welding Society (AWS) welding handbook.

C. Soldering and brazing procedures shall conform to ANSI B9.1 standard safety code and NFPA 99.

D. All welders shall be certified by a state approved welding bureau. Fabricator shall have current and valid certificated registration by the building official for the types of welds required by the project. Prior to start of the project, the fabricator shall submit a copy of certificate of registration for approval. Prior to project close out, the fabricator shall submit a certificate of compliance that the work was performed in accordance with the approved plans and specifications to the building official and to the Engineer or Architect of record.

3.08 EXISTING SERVICES:

A. Provide and install all required connections to existing systems as required by the Drawings and specifications.

B. Integrate existing systems with all new work to provide a complete working system.

C. Provide minimum 72 hour notice to Owner of service interruptions. All service interruptions shall be kept to the minimum possible time. When requested by Owner service interruptions shall occur outside of normal working hours at no additional cost to owner.

3.09 ASBESTOS ABATEMENT:

A. Existing systems within the area of this scope of work may have asbestos-bearing materials. Testing, encapsulation, removal, treatment, or correction of existing asbestos-bearing materials is not a part of this scope of work and is not the responsibility of the mechanical contractors.

3.10 STRUCTURAL DESIGN OF EQUIPMENT AND SEISMIC RESTRAINTS:

A. All mechanical equipment supports shall be designed by a licensed Structural Engineer and shall comply with the 2013 California Building Code, Section 1616A.1.18 through 1616A.1.26 and ASCE 7-10. Chapters 6 and 30.

B. Provide seismic sway bracing for all suspended piping and ductwork in accordance with the OSHPD anchorage pre-approval OPA-0349, the "Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork, and Electrical Systems".
1. Badger, B-Line, Superstrut, or equal systems bearing current OPA numbers shall also be acceptable.

3.11 WARRANTY

A. Be responsible for work done and material installed under these plans and specifications. Repair or replace, as may be necessary, any defective work, material, or part which may show damage to itself or other materials, furnishing, equipment, or premises caused by such defects during this period, if in the opinion of the Architect said defect is due to imperfection of material or workmanship. Provide all such work and materials at no cost to Owner.

B. Be responsible for damage to any part of premises during guarantee period caused by leaks or breaks in work furnished and/or installed under this section. Replace refrigerant, lubricants, or gasses lost as result of defects, breaks, or leaks in work.

C. Provide manufacturer's written warranties covering defects in material and workmanship of products and equipment utilized for the project.

D. Warranties shall be for a period of 1 year from the date of substantial completion unless more stringently specified within individual Sections of this Division.

3.12 START-UP PROVISIONS FOR PLUMBING WORK

A. General: Major equipment (such as air booster pumps) start-up shall be performed by the equipment manufacturer or authorized representative.

B. Adjusting and Aligning Equipment: Adjust all equipment. Check all motors for proper rotation.

C. Lubrication:
   1. Extend grease fittings on bearings to points of ready and easy accessibility.
   2. Lubricate fan bearings, etc., before operation of any equipment.
   3. Provide a final lubrication to equipment immediately before turning over to Owner.

D. Provide training and orientation of Owners operating staff in proper care and operation of equipment, systems and controls.

E. During test period, make final adjustments and balancing of equipment, systems, controls, and circuits so that all are placed in first-class operating condition.

F. Mark final positions of balancing valves after balancing is complete.

G. Final observation will not be made until all of the above have been completed and a preliminary copy of the balance report has been submitted and reviewed.

3.13 PLUMBING RECORD AS-BUILT DRAWINGS:

A. During the course of Project Construction, Mechanical Contractor shall maintain recorded “AS-built” information by distinctively marking up approved shop drawings prints to depict all actual work installed on a daily basis form but not limited to field conditions, addendums, architectural supplemental instructions (ASIs), instruction bulletins (IBs), change orders (COs), responses to Request For Information (RFIs), and approved product substitutions.

B. The marked-up shop drawings will be made available at the Construction Site to the Architect upon request, at any time.
C. The marked up shop drawings with the recorded information shall then be used to create Record As-built drawings at the completion of the project. Contractor shall submit the Record As-built drawings in full size hard copies and also in CAD files format using the AutoCAD 2013 or later version.
   1. Hand marked shop drawings are not acceptable.
   2. Provide 2 complete sets of full size drawings on 20 pound white bond paper.
   3. Provide 1 CD (compact disc) with Record drawings in either AutoCAD, version 2004 or later version.
   4. Record as-built drawings are to be full size drawings (same size as Contract Documents) and all plans are to be to standard engineering scale. The minimum drawing scale to match those provided within the Contract Documents.

D. Record As-built drawings shall include the followings:

   1. General:
      a. Work on Record As-built drawings shall be provided with horizontal and vertical dimensions. Underground work shall be provided with invert elevations. All dimensions shall be references to permanent building fixed points and/or column lines.
      b. Provide sufficient details and sections to depict actual installations.
      c. Equipment identifications and system labeling nomenclatures shall match the Project Design Documents.
      d. Identification of main shut-off valves shall be based on the approved valve tag list and as actually installed in field.

   2. Plumbing:
      a. Piping mains and branches, size and location with pipe elevation information and invert elevations for underground piping. All risers shall be clearly identified.
      b. Location of plumbing fixtures, including but not limited to clean outs, floor drains, floor sinks, storm drains, catch basins, valve boxes and equipment connections.
      c. Locations of all manual and automatic valves, pipe strainers, backflow preventers, water hammer arrestors, expansion joints and compensators, pipe guides and anchor points.
      d. Equipment locations with dimensions from prominent building lines and requires service access.
      e. Seismic bracing information for plumbing system, piping and equipment

3.14 CLEANING UP:

A. Remove tools, scaffolding, surplus materials, barricades, temporary walks, debris, and rubbish from the Project promptly upon completion of the work of each Section. Leave the area of operations completely clean and free of these items.

END OF SECTION
1.01 PART 1 – GENERAL

A. SUMMARY

1. This section includes general mechanical materials and methods required within the project.
   Items included within this specification section include:
   a. Access Doors
   b. Valve Boxes
   c. Roof Flashing
   d. Dielectric Unions
   e. Thermometers
   f. Gauges
   g. Pipe and Equipment Identification
   h. Fireproofing
   i. Painting
   j. Concrete
   k. Excavating And Backfill
   l. Electrical Work
   m. Commissioning and preliminary operational tests

1.02 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacturer of plumbing piping
   systems products, of types, materials, and sizes required whose products have been in
   satisfactory use in similar service for not less than 5 years.

B. Contractor’s Qualifications: Firm with at least 5 years of successful installation experience on
   projects with piping systems work similar to that required of project.

1.03 SUBMITTALS:

A. Product data: submit complete data of materials proposed including:
   1. Manufacturer and model number
   2. Clearly indicate all options, trim, and accessories.
   3. Cross reference manufacturer’s cut sheet to specification section on submittal sheet.

B. Operation and Maintenance Data: where applicable, submit complete O&M data including:
   1. Maintenance data and parts lists for each component.
   2. Provide "trouble- shooting" maintenance guide
   3. Include this data within maintenance manual

PART 2 - PRODUCTS

2.01 VALVE BOXES:

A. Provide at each valve or cock in ground a Christy, Brooks, or equal valve box with cover marked
   for service.

B. Valve boxes in traffic areas: Provide Christy No. G5 traffic valve box, 10-3/8” inside diameter with
   extensions to suit conditions, with cast iron locking cover.

C. Valve Boxes in non-traffic areas: Provide Christy No F22, 8” inside diameter by 30” long with cast
   iron locking cover. Cut bottom of plastic body for operation of valve as required.

D. Extension Handles
1. Handle to be Alhambra Foundry Co., or equal, model A-3008 extension handle.
2. Furnish 2 extension handles per project for underground valves.

2.02 ACCESS DOORS:

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14-inch by 14-inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 18-inch by 24-inch minimum usable opening.
   1. All access doors less than 7'-0" above finished floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 8 in all respects, except as noted herein.

C. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.

D. Provide insulated doors where located in internally insulated ducts or casings.

E. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.

F. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the architect when access is required within these areas.

G. Available Manufacturers:
   1. Milcor
   2. Karp
   3. Nystrom
   4. Cesco

H. Access doors to be equivalent to the following Milcor access doors:
   1. Style M (plaster)
   2. Style A (A/C tile, gypsum board)
   3. Style M (Masonry)
   4. Style "Fire Rated" where required.

2.03 ROOF FLASHING:

A. Flashings in metal deck or membrane type roofing:
   1. Flashing for penetrations of the roof for mechanical items such as flues, ducts, and pipes will be furnished and installed under other sections of these specifications. The work of this section shall include layout, sizing, and coordination of penetrations required for the mechanical work.
   2. Furnish and install counterflashings above each flashing required in the mechanical work. Flues and ducts shall have 24-gauge galvanized sheet metal storm collar securely clamped to the flue or duct above the flashing.
   3. Sewer vents and other piping extending through roof structure shall have flashing provided and installed as part of the roofing work. This contractor shall coordinate his Work accordingly.

B. Flashing in built-up roofing assemblies:
   1. Where flashing is not provided and installed as part of other Work, furnish and install a waterproof flashing and counterflashing for pipe, duct, and flue passing through roof. The
flashing shall extend a minimum of 9 inches in all directions from the outside of the pipe, flue, or duct.

2. Sewer vents and other piping extending through roof structure shall have four-pound sheet lead flashings and Semco, Smith, or equal to Semco #1100-4, counterflashing sleeves installed as detailed.
   a. Provide Hydroseal at underside of counterflashings as recommended in Semco installation instructions.

3. Flues shall have 24-gauge galvanized steel flashings on all roofs. Securely clamp a storm collar (counterflashing) around the flue above the flashing. Storm collars shall be of same material as flashing.

4. Seal all pipes, flues, or ducts passing through exterior walls in an approved, watertight manner.

2.04 DIELECTRIC UNIONS:

A. Furnish and install dielectric unions at all locations described herein, whether shown on Drawings or not, and except as noted herein. Construct couplings and flanges so that the two pipes being connected are completely insulated from each other with no metal-to-metal contact. Heavily line the couplings with a hard, insulating, phenolic plastic threaded in standard pipe sizes. Make up the flanges with insulating components consisting of a hard, phenolic gasket, bolt sleeves, and bolt washers. Supplement the insulating gasket with neoprene faces to form a seal.

B. Acceptable Manufacturers:
   1. Watts Regulator Co.
   2. Eclipse, Inc.
   3. Perfection Corp.

2.05 THERMOMETERS:

A. General:
   1. Thermometers shall be furnished at all locations shown on the Drawings and in accordance with these specifications, whether shown on the Drawings or not
   2. All thermometers, unless shown otherwise, shall be of the bimetal helix or liquid-filled type.
   3. All thermometers shall be round, stainless steel case construction with glass front.
   4. Accuracy to be within plus or minus one of the smallest scale divisions throughout the entire range.
   5. The thermometer scales shall have a minimum of 2 degrees between graduations and a maximum of 20 degrees between figures.
   6. The thermometers shall be located so as to be easily read and shall be furnished with adjustable angle pattern so as to be rotated to any position.
   7. Liquid thermometers for tanks and similar equipment shall have a minimum 5-inch diameter face.
   8. Thermometers for piping shall have a minimum face diameter of 3 inches.
   9. Thermometers installed on insulated tanks or piping shall be provided with an extension neck well to compensate for the thickness of the insulation.
   10. Thermometers shall be provided with stainless steel stems and steel wells.
   11. Thermometers used for air temperature in ductwork, plenum boxes, etc., unless specified or shown otherwise, shall have a minimum scale face of 5 inches and shall have an adjustable mounting flange so that scale may be set at any angle up to 45 degrees to facilitate reading.
      a. The thermometers shall have a perforated guard over stem suitable for sensing air temperature.
      b. Length of stem shall be a minimum of 8 inches.
   12. Thermometer wells with chain and cap shall be provided where wells are indicated on the Drawings.
B. Provide Pete's Plug II, Sisco P/T, or equal test plug with Nordel core where indicated on drawings.

C. Acceptable Manufacturers:
   1. Weston
   2. Marsh
   3. Taylor
   4. Or Equal

2.06 GAUGES:

A. General:
   1. Gauges and gauge connections shall be furnished at all locations shown on the Drawings and in accordance with these specifications, whether shown on the Drawings or not.
   2. Accuracy to be within 1 percent in the middle third of the dial range and equipped with front calibration.
   3. Dials to be white with black numerals.
   4. Normal reading to be mid-scale.
   5. Provide a needle valve on each gauge connection.
   6. Gauge to have bronze bushed movement and front recalibration.
   7. Gauges shall have a minimum dial size of 3-1/2 inches.

B. Provide Pete's Plug II, Sisco P/T, or equal test plug with Nordel core where indicated on drawings.

C. Acceptable Manufacturers:
   1. Marsh; Series J
   2. U.S. Gage
   3. Danton 800

2.07 PIPING AND EQUIPMENT IDENTIFICATION:

A. Pipe Identification:
   1. Each piping system furnished and installed under this work shall be identified and the direction of flow indicated by a prefabricated coiled plastic colored label.

   2. Labels shall comply with ASME A13.1 with regard to color, letter height, and marker size. The labels shall have black or white lettering and flow arrows on colored backgrounds and shall not require adhesive. The background colors shall conform to the color schedule shown in this Article.

   3. For use indoors use 20 mil vinyl labels, MSI model MS-970, or equal. For piping with an outside diameter greater than 6 inches provide the label manufacturers nylon straps to secure label to piping.

   4. For use outdoors use Polyester/Tedlar laminated material, MSI model MS-977, or equal. For piping with OD greater than 6" provide the label manufacturers stainless steel straps to secure label to piping.

   5. The size of the lettering and label shall be such that the lettering can be easily read from the floor and the colors easily discernible.

   6. Acceptable Manufacturers:
a. Marking Services Incorporated (MSI)
b. Idento Metal Products Co., Idento Bands
c. Setmark

B. Equipment Identification:

1. Provide white lamacoid plate for each and every piece of equipment installed in this work.
   a. Lettering on plate shall be black, with size of lettering to suit equipment.
   b. Lettering shall be minimum of 3/8-inch in height.
   c. Plates shall be riveted or bolted to equipment.

2. Equipment to include, but not limited to:
   a. Pumps
   b. Water Heaters
   c. Air Compressors
   d. Vacuum Pumps
   e. Etc.

C. Acceptable Manufacturers:
   1. Marking Services Incorporated, (MSI)
   2. LEM Products
   3. Seton
   4. Craftmark

2.08 ELECTRIC MOTORS:

A. General:
   1. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

B. Electric Motors:
   1. All electric motors shall comply with requirements of NEMA, UL, ANSI/IEEE 112 and NEC, suitable for intended load, voltage, phase, frequency, service, and location.

   2. Limit maximum motor speeds to 1750 rpm, unless otherwise specified.

   3. Motors 1/2 HP and larger shall be 3 phase, 60 Hz, squirrel cage induction motors unless specifically specified to the contrary in subsequent Sections of this Division.
      a. Refer to Drawings for voltage requirements.
      b. Totally enclosed motors rated 3/4 HP, 1200 rpm, or 1 HP and larger, and all drip-proof motors shall have a 1.15 continuous-duty service factor at 40°C ambient temperature.
      c. Insulation system shall be NEMA Class F or better.
      d. Provide double-shielded, grease-lubricated ball bearings with grease pockets on each side for regreasng in service.
      e. Provide inlet and outlet grease connections in 7.5 HP and larger motor housings for each bearing.
      f. Motors 5 HP and smaller and all roof-mounted equipment motors shall be provided with factory sealed, permanently lubricated ball bearings.

   4. Motors smaller than 1/2 HP shall be single phase, 110 volt permanent split-capacitor type with integral thermal overload protection. Bearings shall be factory sealed, permanently lubricated ball type.
5. Provide totally enclosed motors, or suitable protection per NEMA Standards, in locations exposed to the weather or dripping water and in air handling units downstream of cooling coils and heat recovery coils. Other motors shall be open drip-proof.

6. Multi-speed motors shall be provided where specifically scheduled.

7. Motors feed by variable frequency drives (VFD) shall be specifically designed by motor manufacturers for variable frequency drive application.

8. Minimum Efficiency and Power Factor: Minimum Power Factor shall be 85 percent minimum, in all sizes, and minimum efficiency shall be as follows, for 1,750 rpm motors as tested in accordance with NEMA Table 12-6D. The minimum efficiencies shall be guaranteed.

   Motor HP ................................ Efficiency Percent
   1 .................................................. 85.5
   1-1/2 ............................................. 86.5
   2 ................................................. 86.5
   3 and 5 ......................................... 89.5
   7-1/2 and 10 .................................... 91.0
   15-20 ............................................. 92.4
   25-30 ............................................ 93.6
   40 and 50 ....................................... 94.1
   60 .................................................. 94.5
   75 .................................................. 95.0
   100-125 ......................................... 95.4
   150 and larger .................................. 95.8

9. Overload protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.


11. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

C. Acceptable Manufacturers:
   1. Reliance
   2. Baldor
   3. US Motors
   4. Westinghouse
   5. Lincoln
   6. General Electric

2.09 MOTOR STARTERS, ELECTRICAL DEVICES, AND WIRING

A. Motor Starters:

1. Magnetic motor starters for equipment provided under the Mechanical Work shall be furnished by the Mechanical Contractor and turned over to the Electrical Contractor for installation, unless otherwise noted.
   a. Magnetic motor starters shall be provided as part of motor control centers shall be provided and installed by Electrical Contractor

2. Unless otherwise noted, magnetic motor starters shall be furnished in NEMA 4 enclosure for outside installation and NEMA 1 enclosure for inside installation, with three thermal overloads
for three-phase motors and one overload element for single-phase motors. All overloads shall be ambient compensated.


4. Furnish 3-phase motors with full voltage, magnetic across-the-line starters unless noted otherwise.

5. Provide thermal overload protection for all 3-phase legs. Provide motor starters with single phase protection.

6. Provide fail-open auxiliary contacts, pre-wired to a terminal strip, for future remote alarm wiring and run-time totalization. Refer to Division 16.

7. Provide equipment starters with an adequate control transformer, complete with fuse protection, to supply 120 volt source for control circuit, regardless of line voltage.

8. Provide hand-off-automatic selector switches in cover.

9. Variable Frequency Drive Controllers: Provided under Section 15190 - Variable Frequency Drive Controllers.

B. Manual switches shall have pilot lights and extra positions for multi-speed motors.

C. Overload protection: Melting alloy type thermal overload relays.

D. 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, pneumatic switches, electric relays and similar devices as required for coordination with control requirements of Division 15 Controls Sections.
   4. Externally operated manual reset.
   5. Under-voltage release or protection.

E. Motor connections:
   1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

2.10 FIREPROOFING

A. Fireproofing to be installed at all pipe and duct penetrations of rated assemblies.

B. Fireproofing to be UL Rated fire stop material.

C. Acceptable Manufacturers:
   1. Hilti
   2. 3M Pro-Set
   3. Or Equal

PART 3 - EXECUTION

3.01 ACCESS DOORS:
A. Access doors shall be furnished and installed wherever valves, balance valves, damper operating mechanisms, air terminal boxes, fans, and similar items normally requiring adjustment or servicing are installed in concealed or inaccessible spaces. Coordinate with access doors shown on architectural Drawings.

B. Comply with manufacturer's instructions for installation of access doors.

C. Where access panels are detailed on architectural or mechanical Drawings, sizes indicated thereon shall be used.

D. Keyed access doors shall be keyed alike.
   1. Provide owner with 4 copies of keys for access doors.

3.02 VALVE BOXES:

A. Provide valve box for all buried valves. Install per manufacturer's written instructions with top of box flush with finished grade.

B. Clean all valve boxes of debris.

3.03 ROOF FLASHING:

A. Provide pipe flashings as noted on the Drawings.

B. Flue and duct flashings and storm collars shall be securely clamped around flue or duct storm collar or counterflashing, above flashing.

3.04 DIELECTRIC UNIONS:

A. Install dielectric unions in the following locations:
   1. In all metallic water and gas service connections into the building within 5 feet of the building wall. Install adjacent to the shut-off valve or cock and above ground where possible.
   2. At points of connections where copper water lines connect to steel domestic water heater tanks and other equipment.
   3. At points in piping where dissimilar metal pipes are connected together.
   4. Any special applications shown on the Drawings.
   5. Where steel or cast-iron pipe in the ground connects to copper or brass piping above the ground, the transition from steel or cast-iron pipe to the copper or brass pipe shall be made above ground in all cases and in an accessible location where practicable.
   6. Where copper or brass piping is connected to steel or cast-iron piping and the connection is buried in the ground, the connection shall be covered with coal tar protective tape extending outward a minimum of 5 feet on all pipes, from the point of connection. The tape shall have a minimum thickness of 10 mils and a maximum thickness of 12 mils and shall be applied so as to provide at least two full thicknesses of the tape over the piping. A primer, specifically designed for use with the tape, shall be used. The piping shall be thoroughly cleaned before any tape or primer is applied.

3.05 THERMOMETERS:

A. Liquid thermometers for piping systems shall be installed so that the liquid flows completely around the bulb.

B. Enlarge pipes smaller than 2 1/2'' for installation of thermometer wells.

C. Apply thermal grease in thermowells prior to installation of thermometers.
D. Where shown on the temperature control diagram, the temperature control subcontractor shall furnish and install remote, bulb, panel-mounted, pneumatic-type thermometers. Duct-mounted thermometers may be omitted at these locations.

E. Locations: Thermometers shall be placed at all locations shown on the Drawings and at locations specified below. Ranges shall be as specified below.

<table>
<thead>
<tr>
<th>Location</th>
<th>Range (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In supply from tank and return of domestic hot water systems near circulating pump</td>
<td>30 to 180 °F</td>
</tr>
</tbody>
</table>

F. In such cases where the above described thermometers cannot be located so as to be easily read, a remote reading type of thermometer shall be installed, as approved by the Architect.

G. Thermometers provided as part of the temperature control work and located on a control panel, etc. need not be duplicated by above requirements.

3.06 GAUGES:

A. Gauges shall have indication of 0 to 160 psi where indicated pressure will be greater than 40 PSI and 0 to 60 psi for lesser pressures.

B. Provide gauge connections at the following locations:
   1. Inlet and outlet of butterfly-type balancing valves.
   2. Suction and discharge of circulating pump.
   3. Elsewhere as may be shown on the Drawings.

C. Gauges shall be provided in an convenient location within approximately 5 feet of the flanges or connections and elsewhere as may be shown on the Drawings.

D. A needle-point globe valve, similar to Crane No. 88, shall be supplied at each gauge and gauge connection.

E. A gauge siphon located adjacent to the gauge shall be applied with each hot water gauge.

3.07 PIPE AND EQUIPMENT IDENTIFICATION:

A. Identification shall be applied to all piping, except piping located in furred spaces without access to permit entrance of personnel, and piping buried in the ground or concrete.

B. Underground pipe identification shall consist of a buried, continuous, preprinted, bright colored, plastic ribbon cable marker provided for each underground pipe.

C. The legend and flow arrow shall be applied at the following locations:
   1. All valve locations,
   2. All points where piping enters or leaves a wall, partition, cluster of piping, or similar obstruction
   3. All exposed locations
   4. At approximately 20-foot intervals on pipe runs.
D. Practical variations or changes in locations and spacing may be made with the specific approval of the Architect to meet specific conditions.

E. Wherever two or more pipes run parallel, the printed legend and other markings shall be applied in the same relative location so that all piping is easily identified.

F. The marking shall be located so as to be readily conspicuous at all times from any reasonable point of vantage.

G. Where different equipment, such as fire sprinklers, are supplied from a common main, such as domestic water, the main should be identified as "Domestic Water" and each respective branch takeoff as "Fire Water," etc.

H. The non-potable water plumbing piping shall be marked with the legend "Danger - Unsafe Water". This legend shall be applied to both hot and cold water systems along the length of the pipe in fluorescent orange at a maximum of five foot intervals.

I. Lettering size and label colors are to be per ASME/ANSI A13.1 Pipe Marking Standards.

3.08 MOTORS:

A. Motors furnished in the Mechanical Work shall be furnished by the Mechanical Contractor, but such equipment shall be delivered to the Electrical Contractor for mounting and connecting to power wiring. Coordinate all motor starter requirements with Electrical Contractor.

3.09 MOTR STARTERS SWITCHES, AND WIRING:

A. Starters located in motor control centers will be provided under the Electrical Work. Contractor is referred to electrical drawings for motors served by motor control centers.

B. Starters furnished by the Mechanical Contractor to be delivered to the Electrical Contractor for mounting and connecting to power wiring. Coordinate all motor starter requirements with Electrical Contractor.

3.10 FIREPROOFING:

A. Pack the annular space between the pipe sleeves and the pipe and between duct openings and ducts through all floors and walls with UL listed fire stop.

B. Fireproofing system to be installed in strict accordance with manufacturer’s written instructions and details.

3.11 PAINTING:

A. Perform all priming and painting on the equipment and materials as specified herein.

B. Exposed piping and unfinished portions of equipment to be painted shall be cleaned of grease, oil, rust, or dirt in preparation for painting.

C. Where applicable, remove pipe clamps prior to painting so that entire pipe is painted. Provide temporary support as required. Re-install clamps after priming/painting is complete.

D. Priming:
1. Contractor to prime all exposed ferrous metals, including piping, which are not galvanized or factory-finished.
   a. Black steel pipe exposed to weather shall be cleaned and primed with one coat of Rust-Oleum, or equal, #1069 primer. Color to be Grey.

E. See Painting Section for detailed requirements.

3.12 CONCRETE

A. Where specifically indicated on the Drawings or specified as part of Mechanical Work, this Contractor shall furnish and install concrete work, such as thrust blocks or spring isolator bases.

B. Concrete and reinforcing steel shall be equal to that specified for General Construction.

C. Except as noted above, concrete work will be furnished and installed under General Work. This Contractor shall coordinate requirements accordingly.

3.13 EXCAVATING AND BACKFILL

A. Perform all excavating required for work of this Section. Do excavating required for installation of piping and service lines and other work that applies as indicated on Drawings. Verify location and elevation of all existing utilities prior to excavation for installation of new piping. Provide the services of a pipe/cable locating service prior to excavating activates to determine location of existing utilities.

B. Excavations shall be of open vertical construction of sufficient width to provide free working space at both sides of trench and around pipe as required for caulking, joining, backfilling, and compacting. Unless shown otherwise, provide a minimum of 2'-6" cover above top of pipe to finished grade for all service piping unless otherwise noted. Trim trench bottom by hand or provide a minimum of 4" deep sand bed to provide a uniform grade and firm support throughout entire length of pipe. For PE gas pipe, bed the pipe in a 4" sand bed.

C. Dig trenches straight and true to line and grade with holes for bells for bell-and-spigot pipe. Evenly support piping for its entire length upon outside periphery of lower one-third of pipe. Where rock is encountered, undercut trenches 3 inches and fill with well-tamped, clean sand and pea gravel to correct pipe elevation.

D. After pipe lines in excavation have been installed and tested, backfill excavation to point 6 inches above pipe using sand, fine earth, or other materials free of rocks and large lumps. Proceed evenly on both sides of pipe and continuously tamp. Except as hereinafter noted, backfill above 6 inches above top of pipe shall be made by using earth from excavation placed in layers of 8-inch maximum depth. Compaction of each successive layer will be made with mechanical compactor.

E. Take special care in backfilling over wrapped piping to prevent damage to protective wrapping.

F. Bed sewers under pavements, wrapped piping, and PVC piping in sand prior to backfilling. Backfill to point 6 inches above pipe with sand.

G. This Contractor shall replace sod, concrete, asphalt paving, curbs, pavement, walks, and any other type of existing work or surface disturbed by excavation, using workmen skilled in trade involved.

H. When pipe or underground conduit with a protective wrapping is to be placed in the trench, sand only shall be used for bedding the pipe or conduit. The sand used shall be certified to have a
minimum resistance of 5000 ohms per cubic centimeter when wetted to any moisture content with distilled water and shall consist of clean, natural, washed-sand, hard, and durable particles varying from fine particles to particles of such size that all will pass through a 3/8-inch screen, not less than 90 percent will pass through a 1/4-inch screen, and not more than 25 percent will pass through a No. 50 screen.

I. Any backfill placed under this contract which subsides or settles below the adjacent finished grade or paving level during the guarantee period shall be brought to grade by the Contractor by adding compacted backfill or additional paving in paved areas.

3.14 ELECTRICAL WORK:

A. Adequate working space shall be provided around electrical equipment in compliance with the National Electric Code and other applicable codes or ordinances. The mechanical work shall be coordinated with the Electrical Work in order to comply with these requirements. Any work which does not conform to these regulations shall be properly corrected without additional cost to the Owner.

B. Furnish and install all line voltage and low-voltage temperature control wiring in the Mechanical Work by the Temperature Control SubContractor, including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Unless noted otherwise, this does not include primary control wiring between starters and push button or other manual starter switch or branch power circuits required for temperature control systems.

C. Temperature control equipment, including relays shown on control diagram, shall be furnished and installed by the Temperature Control Subcontractor.

D. Electrical devices with piping connections, such as solenoid valves, insertion thermostats, strap-on aquastats, and similar items which are to be wired under the Electrical Work or by the Temperature Control Subcontractor, shall be installed by the Mechanical Contractor.

E. Equipment furnished in this work that is factory wired but requires modification to internal wiring to meet specifications or drawing requirements shall have such internal modifications made at factory before shipment.

F. All electrical work and equipment, including internal wiring, must comply with applicable codes and applicable portions of electrical specifications. Run line and low-voltage control wiring in conduit. Conduit for temperature control wiring shall be responsibility of Mechanical Contractor and shall be of type specified in electrical specifications.

3.15 DEMOLITION

A. Refer to Division 1 sections for general demolition requirements and procedures.

B. Disconnect, dismantle, and remove plumbing systems, equipment, and components indicated to be removed. Coordinate with all other trades
   1. Piping to be removed: Remove portion of piping indicated to be removed. Cap or plug remaining piping with same or compatible piping material.
   2. Piping to be abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material. Refrigerant system to be evacuated per EPA requirements.
   3. Equipment to be removed: Drain down and cap remaining services and remove equipment.
   4. Equipment to be removed and re-installed: Disconnect and cap services and remove, clean, and store equipment. When appropriate, re-install, reconnect, and make equipment operational.
a. If existing equipment which is to be re-installed is damage, contact architect prior to removal. Contractor to take pictures of any damaged equipment prior to its removal and submit pictures to Architect.
b. Equipment damaged during removal, storage, or re-installation shall be the Contractor's responsibility and is to be replaced with new at no additional cost to the owner.

5. Equipment to be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, removed damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. Non-Destructive Testing Of Existing Concrete Slabs:
   1. When drilling or saw cutting existing reinforced concrete, use care and caution to avoid cutting or damaging the existing reinforcing bars, conduit, or tendons. Use a non-destructive method to locate metals poured into the slab prior to doing any work.

3.16 CARE AND CLEANING:

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition.

B. Drain and flush piping to remove grease and foreign matter. Thoroughly clean out flush valves, traps, strainers, and pressure-reducing valves.

C. Keep the interior of all ductwork free of dirt, dust, loose insulation, and other foreign materials at all times.

D. Clean out and remove surplus materials and debris resulting from the work, including surplus excavated material.

3.17 OPERATION TEST:

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.18 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION
1.01 SUMMARY

A. This section includes plumbing accessories including the following:
   1. Valves
   2. Miscellaneous piping products
   3. Backflow Preventors
   4. Thermostatic Mixing Valves
   5. Miscellaneous Drains
   6. Cleanouts
   7. Floor Drains and Floor Sinks

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of plumbing piping systems products, of types, materials, and sizes required whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with piping systems work similar to that required of project.

C. Requirements of Regulatory Agencies: Contractor to conform to the publications listed below. Requirements of these publications are to be considered as a minimum standard. If details and specifications which require more stringent work are indicated within project, Contractor to provide the more stringent.

   1. California Plumbing Code (CPC) Compliance: Comply with applicable portions of the California Plumbing Code pertaining to selection and installation of plumbing materials and products. Fabricate and install natural gas systems in accordance with CPC.
   4. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company requirements.
   5. ASME B31.9 for building services piping valves.
   6. NSF Compliance: NSF 61 for valve materials for potable-water service.

D. All plumbing components intended to dispense water for human consumption shall comply with requirements of California Assembly Bill AB1953. Components to include (but not limited to): piping, faucets, angle stops, valves, bubblers, drinking fountains, piping, etc.

1.03 SUBMITTALS

A. Product data: submit complete data of materials proposed including:
   1. Manufacturer and model number
   2. Clearly indicate all options, trim, and accessories.
   3. Cross reference manufacturer's cut sheet to fixture callout ID on submittal sheet.

B. Operation and Maintenance Data: submit complete O&M data including:
   1. Maintenance data and parts lists for each component.
   2. Provide "trouble-shooting" maintenance guide
   3. Include this data within maintenance manual

2.01 Valves
A. General:

1. Similar valves to be by the same manufacturer.

2. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

3. Bronze Valves: 2"Ø and smaller with threaded ends, unless otherwise indicated.

4. Ferrous Valves: 2 ¼" Ø and larger with flanged ends, unless otherwise indicated.

5. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

6. Valve Sizes: Same as upstream piping unless otherwise indicated.

7. Valve Actuator Types:
   a. Handwheel: For valves other than quarter-turn types.
   b. Hand-lever: For quarter-turn valves 6"Ø and smaller, except for plug valves.
   c. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.
   d. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
   e. Valves in Insulated Piping: With 2" stem extensions and the following features:
      - Gate Valves: With rising stem.
      - Ball Valves: With extended operating handle of non-thermal-conductive material and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
      - Butterfly Valves: With extended neck.

8. Valve-End Connections:
   a. Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.
   b. Grooved: With grooves according to AWWA C606.
   c. Valve solder-joint connections are common in smaller sizes of plumbing piping. Soldering and brazing methods used to achieve required pressure-temperature ratings may damage internal valve parts. Special installation requirements for soldered valves may make threaded valves more cost-effective.
   d. Threaded: With threads according to ASME B1.20.1.
   e. Valve Bypass and Drain Connections: MSS SP-45.

B. Acceptable Manufacturers:

1. Ball, gate, butterfly, and check valves:
   a. Nibco
   b. Milwaukee
   c. Hammond

2. Plug Valves:
   a. Rockwell
   b. Homestead
   c. Nordstrom Valves, Inc

3. Balance Valves:
   a. Bell and Gosset Circuit Setter
b. Armstrong  
c. Nibco

4. Gas Pressure Reducing Valves:  
   a. American Meter Company  
   b. Fisher  
   c. Or equal

5. Seismic Valve  
   a. Kos/Ca Seismic Valves  
   b. Or equal

C. Ball Valves - ≤ 1 ½"Ø:  
   1. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:  
   2. NIBCO Model S-585-70-66 or equal.  
      a. SWP Rating: 150 psig  
      b. CWP Rating: 600 psig  
      c. Body Design: Two piece steel with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.  
      e. Ends: Threaded or Solder.  
      f. Seats: PTFE or TFE.  
      g. Stem: Stainless.  
      h. Ball: Stainless steel, vented.  
      i. Port: Full.

D. Ball Valves – 2"Ø ≤ 2 ½"Ø:  
   1. Three Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:  
   2. NIBCO Model S-585-70-66 or equal.  
      a. SWP Rating: 150 psig  
      b. CWP Rating: 600 psig  
      c. Body Design: Three piece steel with threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing.  
      e. Ends: Threaded or Solder.  
      f. Seats: PTFE or TFE.  
      g. Stem: Stainless.  
      h. Ball: Stainless steel, vented.  
      i. Port: Full.

E. Gate Valves- ≤ 2 ½"Ø:  
   1. Union Bonnet, Rising Stem, Solid Wedge, Class 150 Bronze Gate Valve  
   2. NIBCO Model T-134 or equal.  
      a. SWP Rating: 150 psig  
      b. CWP Rating: 300 psig  
      c. Body Material: Bronze ASTM B62  
      d. Wedge Material: Bronze ASTM B62  
      e. Bonnet Material: Bronze ASTM B62  
      f. Bonnet Bronze ASTM B62  
      g. Packing Material: Synthetic Fibers with graphite  
      h. Packing nut: Bronze ASTM B62 or ASTM B584  
      i. Handwheel: Malleable Iron ASTM A 47  
      j. End Connections: Threaded

F. Gate Valves- 3"Ø and larger:  
   1. Bolted Bonnet, Non-Rising Stem, Solid Wedge, Class 125 Iron Body Gate Valve  
   2. NIBCO Model F-619 or equal for above ground use, Model F-619-SON for below grade use.  
      a. SWP Rating: 125 psig
b. CWP Rating: 200 psig

c. Stem Material: Brass ASTM B16 Alloy C36000

d. Bonnet Material: Cast Iron ASTM A 126 Class B

e. Body Material: Cast Iron ASTM A 126 Class B

f. Wedge Material: Cast Iron ASTM A 126 Class B

g. Packing Material: Synthetic Fibers with graphite

h. Hand-wheel: Cast Iron ASTM A 126 Class B

i. End Connections: Flanged

j. Provide with square operating nut for use below grade

k. Provide with 1 operating wrench per nut sizes.

G. Check Valves -- <= 3"Ø:

1. Horizontal Swing, Re-grinding type, Y-patter, Renewable seat and disc bronze check valve

2. NIBCO Model T-413 or equal.

   a. SWP Rating: 125 psig

   b. CWP Rating: 200 psig


   d. Ends: Threaded

   e. Seats: Buna-N.

   f. Hinge: Bronze ASTM B140 Alloy

H. Check Valves - <= 2"Ø:

1. Inline lift type bronze ring check valve

2. NIBCO Model T-480 or equal.

   a. WWP Rating: 250 psig


   c. Stem: Stainless Steel

   d. Spring: Stainless Steel

   e. Disc Holder: Stainless Steel

   f. Disc: Buna-N

I. Butterfly Valves- 3"Ø and larger:

1. Extended neck, geometric drive, molded-in seat liner, sug and wafer style butterfly valve.

2. NIBCO Model T-480 or equal

3. Valves shall be lug or I.P.S. grooved body style manufactured in accordance with MSS-SP67;

   a. CWP Rating: 200 psig

   b. Body: Ductile Iron ASTM A536

   c. Disc Aluminum Bronze ASTM B148 Alloy 954/955

   d. Stem: Stainless Steel

   e. Stem and Body Seal: EPDM Rubber

   f. Body to have 2" extended neck for insulating

   g. Body: ductile iron. Valve to have aluminum bronze alloy

J. Plug Valves:

1. Screwed Gland-Type Iron Plug Valve.

2. Nordstrom Figure 114 or equal - for sizes up to 2 ½"

3. Nordstrom Figure 115 or equal -- for sizes 3" to 4"

4. Valves to be as follows:

   a. CWP Rating: 200 psig

   b. Body: Steel Body

   c. Lubricated Type Plug valve

K. Lever handle Gas Cock:

1. Gas Ball valve, with Tee Handle

2. Valve to be rated for ½ psi for indoor appliance connections per ANSI Z21.15 & CGA 9.2

3. Valve to be rated for 5 psi indoor shut off per CGA 91-002 and ASME B16.44

4. Nibco, Model GB 30 or equal
a. CWP Rating: 400 psig
b. Body: Forged Brass ASTM B283
c. Ball: Chrome Plated Brass ASTM B16 Alloy
d. Screw: Plated Steel
e. Stem: Brass ASTM B16

L. Balance Valves:
   1. Bell and Gosset Circuit setter or equal
      a. CWP Rating: 300 psig
      b. Body: Bronze
      c. Seat Rings: Caron Filled
      d. Valve to have differential pressure read-out ports across valve area. Read out ports to
         be fitted with internal EPT insert and check valve. Valve bodies to have ¼" tapped
         drain/purge port.
      e. Valve to have memory stop feature.

   2. Provide owner with one Bell and Gossett Circuit Setter #RO-2 meter.

M. Gas pressure Reducing Valve:
   1. American Meter Company, Series 1200 or equal
      a. Size and capacity as scheduled.
      b. Meter to have full internal relief.

N. Seismic Gas Valve:
   1. Koso/California Seismic Valve or equal
      a. Size to match adjacent piping.
      b. Valve to be rated for gas service pressure.
      c. Valve to be in compliance with California Standard for Earthquake Actuated Automatic
         Gas Shutoff Systems.

2.02 MISCELLANEOUS PIPING PRODUCTS

A. Backwater Valves
   1. Provide flapper type backwater valve where indicated on drawings.
   2. Valve to be a Zurn, model Z-1090 or equal
   3. Provide with Christy Model B16 or equal utility box, 12" by 22".

B. Trap Primers
   1. Provide trap primers as indicated, 1/2-inch size, with built-in air gap. Provide with 1/2-inch
      shut-off valve.
   2. Where one trap primer will be used for more than one trap, provide a distribution unit (DU-2
      through DU-4 as required) with feeder piping for a maximum of four traps.
   3. Acceptable Manufacturers:
      a. Precision Plumbing Products “Prime Rite”
      b. Sioux Chief Manufacturing Company “Prime Perfect”
      c. MiFab “M-500 Series”

C. Water Hammer Arrestors
   1. Provide water branch lines at single fixtures with a manufactured water hammer arrestor.
      Water hammer arrestors shall be sized per Plumbing Drainage Institute Standard PDI-
      WH201 “Water Hammer Arrestors.”
   2. Water hammer arrestor to be with nesting type bellows contained within a casing having
      sufficient displacement volume to dissipate the calculated kinetic energy generated in piping.
system. Both casing and bellows constructed of Type 304 stainless steel. Arrestor to have a threaded connection.

3. Where multiple fixtures are located in a row or battery a single or multiple water hammer arrestors, as required, may be used. Multiple fixture installations shall have the arrestor sized and located per standard PDI-WH201 and the manufacturer’s installation instructions.
   a. Provide Access door for water hammer arrestors in restrooms containing more than 1 flush valve type fixture.

4. All water hammer arrestors shall have male pipe thread connections.

5. Water hammer arrestor to be a Zurn model Z1700 or equal.

6. Acceptable Manufacturers:
   a. Zurn
   b. J.R. Smith
   c. Wade
   d. Amtrol Inc.

D. Piping Escutcheons:
   1. Provide chrome plated brass pipe escutcheons with inside diameter closely fitting pipe outside diameter or outside of pipe insulation where pipe is insulated.

2. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, ceilings, or pipe sleeve extension, if any.

3. Furnish pipe escutcheons with nickel or chrome finish and screw or spring clamping device with concealed hinge

E. Pipe Sleeves:
   1. Where pipes pass through concrete floors or walls, install galvanized metal or plastic sleeves having not less than 1/2-inch or more than 1-inch clearance around sides of the pipe or pipe covering for the full thickness of the concrete.

2. After piping has been installed, fill annular space with fireproof safeing.

3. Acceptable Manufacturers:
   a. Adjustocrete
   b. Sperzel "Crete-Sleeve"
   c. Or equal

F. Sleeve Seals:
   1. Provide sleeve seals for sleeves located in foundation walls below grade or in exterior walls as follows:
      a. Foundations: Lead and oakum, caulked between sleeve opening and pipe.
      b. Walls Below Grade: 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. Acceptable Manufacturers:
   a. Link-Seal Corporation
   b. Or equal
2.03 BACKFLOW PREVENTORS

A. Provide reduced-pressure principle backflow preventers consisting of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Seats and seat discs shall be replaceable in both check modules and the relief valve.
   1. There shall be no threads or screws in the waterway exposed to line fluids. Service of all internal components shall be through a single access cover secured with stainless steel bolts.

B. The assembly shall meet the requirements of: USC Manual 8th Edition; ASSE Std. 1013; AWWA Std. C511; CSA B64.4.

C. Provide substantial padlock and chain to lock valves in open position, and turn key over to Project Inspector. Provide capped connections at each test cock.

D. Backflow preventor to be a Watts Regulator Co. Series 009.
   1. Provide with optional quarter turn ball valves: -QT
   2. Provide with optional air gap drain fitting.

E. Acceptable Manufacturer's
   1. Watts Regulator Company
   2. Febco Sales, Inc.
   3. Or Equal

2.04 MISCELLANEOUS DRAINS

A. Fixed Air Gap: Zurn model Z-1025 or equal. Fixed air gap to have a dura-coated cast iron body with slip joint inlet and no-hub outlet.

B. Hopper Drain:
   1. Zurn model Z-325-DB, 7"Ø indirect waste funnel with dura-coated cast iron body, plastic ball float, bronze backwater valve bushing and a replaceable neoprene seat. Provide with optional dome strainer.

2.05 CLEANOUTS

A. Provide cleanouts of same diameter as pipe shall be installed in all horizontal soil and waste lines where indicated and at all points of change in direction. Cleanouts shall be located a minimum of 18" from building construction so as to provide sufficient space for rodding.

B. Cleanouts shall have cast iron ferrules and bronze plugs.

C. Cleanouts extending to floor level shall be provided with membrane flange and clamping collar, bronze raised head plug, and nonslip scrotared top.

D. Cleanouts to be as follows:
   1. Cleanouts in cast-iron soil or waste lines: Zurn Z-1440A-BP.
   3. Cleanouts on exterior of building: Zurn Z-1440.
      a. Provide stainless steel cover and vandal-proof screw where located in wall. Zurn Z-1446-A
      b. Where located at grade, provide 18- by 18- by 6-inch concrete pad and Zurn Z-1474 heavy duty cover. Provide Z-1440-A cleanout.
   4. Cleanouts in floor to be a Zurn ZN-1400 with the following options:
      a. Where located in terrazzo floor, provide -T, square top option.
      b. Where located in carpet, provide -T square top option and -CM carpet marker option.
2.06 FLOOR DRAINS AND FLOOR SINKS

A. Provide floor drains and floor sinks of size as indicated on Drawings, and type, including features, as specified herein. Provide flashing ring and clamp at floors with waterproofing membrane. Set top of drain slightly below floor to insure drainage unless noted otherwise. Install vented P-trap below each drain.

B. Provide with trap primer connections at trap where required.

C. General Service Floor Drains: Zurn Z-415 or equal. Drain to have a dura-coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with seepage slots.
   1. Provide with "Type B" strainer where installed in concrete.
   2. Provide with "Type S" strainer where installed in tile
   3. Provide with "Type SL" strainer where installed in composition type floor.
   4. Provide with "Type L" strainer where used at indirect drain locations
   5. Provide with "Type B" strainer and optional —DP decorative polished top where installed at a shower.

D. Floor Drains in Mechanical Rooms: Zurn Z-450-Y or equal. Drain to have a dura-coated cast iron body with bottom outlet, seepage pan and combination membrane flashing clamp and frame, sediment bucket, and a medium duty cast iron slotted grate.

E. Floor Drains in Mechanical Rooms: Zurn Z-550-Y or equal. Drain to have a dura-coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with seepage slots

F. Floor Sinks in Kitchens: Zurn ZN-1900-K-2 or equal. Floor sink to be a 12"x12"x6" deep floor sink with a cast iron body and square slotted light duty ½ grate with white acid resisting porcelain enamel interior and top. Complete with a white A.R.E anti-splash interior bottom dome strainer.

G. Floor Sinks in Mechanical Room: Zurn Z-566-Y or equal. Floor sink to be a 12"x12" square floor sink with a dura-coated cast iron body with bottom outlet and loose set cast iron secondary strainer. Provide with half grate and sediment bucket.

H. Floor Sinks in Boiler Room: Zurn Z-568-Y or equal. Floor sink to be a 16"x16" square floor sink with a dura-coated cast iron body with bottom outlet and loose set cast iron secondary strainer. Provide with half grate and sediment bucket.

I. Acceptable Manufacturers:
   1. Zurn
   2. J.R. Smith
   3. Wade

3.01 Installation of Valves:

A. Valve Applications:
   1. Domestic Water:
2. Natural Gas
   a. At entrance to building: Lubricated Plug Valve
   b. At connection to equipment: Lever handle Gas Cock

3. Check Valves:
   a. Piping in horizontal orientation: Swing Check Valve
   b. Piping in vertical orientation: Lift Check Valve

B. General:

1. Install valves with stems upright or horizontal. Valves stem position to be arranged to allow access for maintenance.

2. Do not install swing check valves in vertical position.

3. Provide gas cocks for gas service.

4. Provide lubricated plug valve at gas entrance to building.

5. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

6. Operate valves in positions from fully open to fully closed prior to installing within system.

7. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

8. Locate valves for easy access and provide separate support where necessary.

9. Install valves in horizontal piping with stem at or above center of pipe.

10. Install valves in position to allow full stem movement.

11. Install check valves for proper direction of flow and as follows:
   a. Swing Check Valves: In horizontal position with hinge pin level.
   b. Lift Check Valves: With stem upright and plumb.

12. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of plumbing. Locate valves so as to be accessible and so that separate support can be provided when necessary.

13. Provide union at each connection to equipment and downstream of each valve. Provide unions at both ends of valves when valves can not be turned due to an obstruction.


15. After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks; replace valve if leak persists.

16. Tag each valve and provide a complete listing of valve locations and functions.

17. Provide additional tag at each valve noted below. Tag shall be black plastic with white lettering, 3-ply, 125 mil thick. Minimum 3" square.
### 3.02 PIPE ESCUTCHEONS:

A. Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view and on exterior of building.

B. Tighten escutcheon to pipe or insulation so escutcheon covers penetration hole and is flush with adjoining surface.

### 3.03 SLEEVES:

A. Secure sleeves to metal or wood forms in such a manner that they will not become displaced during pouring of concrete. Fill sleeves on deck with sand.

B. After forms have been removed from concrete, the sleeves shall be removed from the openings.

C. Core drill properly sized holes in the concrete to replace metal sleeves that are crushed or knocked out of position during pouring of concrete.

D. Provide piping passing through concrete fire walls with sleeves of standard black steel pipe nominally one size larger than pipe enclosed, but in the case of insulated pipe, large enough for insulation to pass through. Caulk space between pipe and sleeve with fire-rated wicking, and provide metal retainer plates at both sides of the wall.

E. Sleeve Seals: Install in accordance with the following:
   1. Lead and Oakum: Fill and pack annular space between sleeve opening and pipe with oakum; caulk with lead on both sides.
   2. Mechanical Sleeve Seals: Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve opening and center. Tighten bolts until links have expanded to form watertight seal.

### 3.04 INSTALLATION OF Y-TYPE STRainers:

A. Install Y-type strainers full size of pipeline in accordance with manufacturer's installation instructions.

B. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2 inches and smaller installed ahead of control valves feeding individual terminals.
   1. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow-down connection.

C. Locate Y-type strainers in supply line ahead of the following equipment and elsewhere as indicated if integral strainer is not included in equipment:
   1. Pumps
   2. Temperature control valves
   3. Pressure-reducing valves
D. Contractor to clean all pipeline strainers after their respective system has been flushed.

3.05 INSTALLATION OF UNIONS AND FLANGES:

A. Install unions and flanges so that piping can be easily disconnected for removal of tanks, equipment, and valves. Provide a minimum of two unions at each three-way valve.

3.06 INSTALLATION OF INTERCEPTORS:

A. Install interceptors per manufacturers written instructions. Verify adequate clearance is provided for removal of strainers and for cleaning.

B. Contractor to remove and clean all strainers after flushing of system and prior to project completion.

3.07 CARE AND CLEANING:

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work.
B. At completion of work, carefully clean and adjust equipment and trim installed as part of this work.
C. Leave systems and equipment in satisfactory operating condition.

3.08 OPERATION TEST:

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

End of Section
PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes insulation types and thickness for plumbing piping and equipment.

1.02 REFERENCES

B. California Building Code, California Electric code, NFPA, and UL
C. ASTM
D. ASHRAE
E. MAIMA
F. NFPA
G. SMACNA – Sheet Metal and Air Conditioning Contractor’s National Association, Inc.
H. Underwriter’s Laboratories
I. GREENGUARD

1.03 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firm specializing in manufacturing of mechanical insulation products applicable to project whose products has been in satisfactory use in similar services for a minimum of 3 years.

B. Installer’s Qualifications: Company specializing in piping insulation application with a minimum of 3 years experience.

C. Flame/Smoke Ratings: Insulation materials, including but not limited to insulation, jackets, coverings, sealers, adhesives, etc., to have flame-spread rating of 25 or less and smoke-developed index of 50 or less when tested in accordance with ASTM E84.

D. Insulating products to be installed in accordance with manufacturer’s written instructions and in accordance with recognized industry practices.

1.04 SUBMITTALS

A. Submit complete data of materials proposed.
   1. Indicate individual services for each system.
   2. Indicate proposed insulation thickness for each system
   3. Indicate proposed R-values, densities, etc. for each product.

B. Provide Manufacturer’s installation instructions for each product.

2.01 GENERAL
22 07 00 – Plumbing Insulation

A. For purposes of this specification, fittings, joints, strainers, flexible piping, valves, etc. shall be considered as piping and shall be insulated with same material and thickness as adjoining piping unless noted otherwise.

B. Acceptable Manufactures
   1. Knauf
   2. Johns Manville
   3. Certainteed
   4. Owens-Corning

2.02 MATERIALS

A. Fiberglass Piping Insulation:
   1. Insulation to be heavy density glass fiber insulation.
   2. Insulation to have factory-applied self-sealing vapor barrier.
   3. Maximum K-Value at 75°F = 0.23 Btu-in/hr-FT²-°F.
   4. Rigid segment of insulation to be provided at all pipe hangers
   5. Fittings and valves to be insulated with John Manville Zeston 2000 Series 25/50 Smoke-Safe PVC pre-molded insulated covering secured with standard fasteners.
   6. Insulation to be Johns Manville Micro-Lok or equal.

B. Flexible Closed Cell Insulation:
   1. Flexible elastomeric thermal closed-cell structure insulation.
   2. Maximum K-Value at 75°F = 0.27 Btu-in/hr-FT²-°F.
   3. Joints to be sealed with Armstrong 520 Adhesive
   4. Insulation to be Armstrong Armaflex 22 or equal

2.03 PIPING INSULATION:

A. Domestic Hot Water Supply and Return/ Tempered Water Supply and Return:
   1. Insulate exposed piping with fiberglass piping insulation with thicknesses as follows:
      a. Pipes 2" □ and smaller- 2" thick insulation.
      b. Pipes 2 1/2" □ and larger – 2 1/2" thick insulation.
      c. Exposed pipes installed within 9'-0" of the finished floor to be provided with ASJ-SSL jacket.
   2. Insulate concealed piping with fiberglass piping insulation with thicknesses as follows:
      a. Pipes 1" □ and smaller with 3/4" of fiberglass piping insulation.
      b. Pipes 1 1/4" □ and larger – insulate with 1 1/2" of fiberglass piping insulation.
   3. Do not insulate unions, valves, and exposed run-outs to fixture.

B. Domestic Cold Water:
   1. Insulate exposed piping with 3/4" fiberglass piping insulation.
   2. Insulate concealed piping with 1/2" fiberglass piping insulation.
   3. Wrap valves and fittings with mastic and z-tape.

C. Condensate Drain Piping:
   1. Insulated exposed condensate drain piping within building with 3/4" closed-cell pipe insulation.
   2. Seal with Armstrong 520 adhesive.

3.01 GENERAL

A. Insulation to be stored on jobsite in clean / dry location. Any insulation exposed to water must be discarded immediately and removed from jobsite.
3.02 INSTALLATION OF PIPING INSULATION

A. Install piping insulation products in accordance with manufacturer's written instructions and in accordance with recognized industry practices.

B. Installation to be installed after installation of heat tracing, testing, acceptance of testing, and cleaning of pipe.

C. Insulate each continuous run of piping with full-length units of insulation. Cut pieces to size as required. Do not use multiple cut pieces and/or scraps abutting each other.

D. Clean and dry piping surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and type fit over surface to be covered.

E. Install piping insulation without interruption through walls and floors except where otherwise indicated.

F. Taper raw ends of insulation and seal with canvas and sealant as noted for fittings.

G. Install pipe hangers on the outside of the insulation.

3.03 INSTALLATION OF EQUIPMENT INSULATION:

A. Clean and dry all surfaces prior to insulating.

B. Install insulation materials with smooth and even surfaces. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting in poor workmanship.

C. Do not apply insulation to equipment breechings or stacks while hot.

D. Do not insulate manholes, handholds, cleanouts, nameplate, ASME stamp. Provide beveled edge at interruptions of insulation.

3.04 INSULATION REPAIR:

A. Repair damaged sections of existing and/or new mechanical insulation where damaged occurred during this construction period. Use insulation of same thickness as existing insulation. Install new jacket lapping and seal over existing.

3.05 CARE AND CLEANING:

A. Repair and/or replace broken, damaged and or other wise defective insulation. Work to be completed to the satisfaction of the Architect. At completion of work, clean materials installed as part of this work and leave systems and equipment in satisfactory operating condition.

B. Upon completion of work remove materials, equipment, tools from premises. Leave project area neat, clean and orderly.

END OF SECTION
PART 1 – GENERAL

1.01 SUMMARY

A. This section includes piping and supports as required for the plumbing system.

1.02 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacturer of plumbing piping systems products, of types, materials, and sizes required whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor’s Qualifications: Firm with at least 5 years of successful installation experience on projects with piping systems work similar to that required of project.

C. Requirements of Regulatory Agencies: Contractor to conform to the publications listed below. Requirements of these publications are to be considered as a minimum standard. If details and specifications which require more stringent work are indicated within project, Contractor to provide the more stringent.

   1. California Plumbing Code (CPC) Compliance: Comply with applicable portions of the California Plumbing Code pertaining to selection and installation of plumbing materials and products. Fabricate and install natural gas systems in accordance with CPC.

D. Welding materials and labor shall comply with ASME Code and applicable state labor regulations.

E. Welders shall be fully qualified and certified by a state approved welding bureau for the types of welds required for the project.
   1. Each welder shall identify their work with a marking stamped on each weld joint of pipe, valve, or fitting.


G. All plumbing components intended to dispense water for human consumption shall comply with requirements of California Assembly Bill AB1953. Components to include (but not limited to): piping, faucets, angle stops, valves, bubblers, drinking fountains, piping, etc.

1.03 SUBMITTALS

A. Submit manufacturer’s catalog cut sheets, specifications, installation instructions, and dimensioned drawings for each type of pipe, support, anchor, and seal indicated within this section that is applicable to the project. Clearly indicate item being submitted.
   1. Indicate pipe schedules, pressure classes, etc.
   2. Indicate all options being submitted.

B. Provide Welding and Brazing Certifications. Submit reports as required for piping work applicable to the project.
   1. Welders that do not have current Certifications shall not be permitted to weld and/or braze on the project.

PART 2 – GENERAL

2.01 GENERAL:
A. Provide piping materials and factory fabricated piping products of sizes, types, pressure and
temperature ratings, and capacities as indicated. Materials and products to comply with the
California Plumbing Code.

B. Where more than one type of material is indicated, selection is the Contractors option.
1. Contractor to provide submittal information on material which is to be installed.
2. Where more than one material is indicated, the Contractor shall only install one material per
system and materials shall not be mixed within the same system.

C. Malleable Iron Threaded Fittings: ANSI B16.3; plain or galvanized to suit piping. For use above
grade only, except where indicated otherwise.

D. Malleable-Iron Threaded Unions: ANSI B16.39; selected by Contractor for proper piping
fabrication and service requirements, including style, end connections, and metal-to- metal seats
(iron, bronze, or brass); plain or galvanized as indicated.

E. Forged-Steel Socket Welding and Threaded Fittings: ANSI B16.11, except MSS SP-79 for
threaded reducer inserts; rated to match schedule of connected pipe.

F. Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows
and returns; rated to match connected pipe.

G. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less
than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2 inches and where
pipe size is less than 1-1/2 inches, and do not thread nipples full length (no close-nipples).

H. Welding Materials: Except as otherwise indicated, provide welding materials as determined by
Contractor to comply with installation requirements. Comply with Section II, Part C, ASME Boiler
and Pressure Vessel Code for welding materials.

I. Soldering Materials: Joints in copper tubing for all installations shall be made with brazing alloy
sil-fos, or equal. Clean surfaces to be jointed shall be free of oil, grease, rust, and oxides.
1. Harris Stay-Safe 50 solder, or equal, may be permitted on plumbing lines above slab or
ground only with prior review for piping sizes 2 inches and smaller only. Solders used shall
contain no lead.

J. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal
materials.

K. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast- iron flanges; raised-face for steel
flanges, unless otherwise indicated.

2.02 PIPING AND FITTINGS:

A. Domestic Water Piping (cold water, hot water, tempered water, and hot water return):
1. Copper Tube: ASTM B 88, Type L, hard-drawn temper, except as otherwise indicated.

2. Interior Water Piping:
   a. Copper tube, Type L, hard-drawn temper, wrought copper fittings.
   b. Pipe sizes 2" and smaller to have solder joints.
   c. Pipe sizes 2 ½" and larger to have brazed joints.

3. Under Slab Water Piping:
a. Pipe sizes 1 ¼” and smaller: Type K, soft Copper tubing with smoothly formed bends. Runs to be made without joints except where runs are longer than the standard length of tubing role.
   b. Pipe sizes 2” and larger: Same as exterior water piping.

4. Exterior Water Piping:
   a. Copper tube, Type L, hard-drawn temper, wrought copper fittings.
   b. All pipe sizes to have brazed joints.

B. Pressure and temperature relief valve discharge piping:
   1. Provide materials as specified for domestic water piping.

2.03 PIPING SUPPORTS:

A. All mechanical equipment supports shall be designed by a licensed Structural Engineer and shall comply with the 2013 California Building Code, Section 1616A.1.18 through 1616A.1.26 and ASCE 7-10. Chapters 6 and 30.

B. Mechanical equipment supports shall be designed by a licensed Structural Engineer.


D. Acceptable Manufacturer:
   1. Mason
   2. B-Line
   3. Superstrut
   4. Unistrut
   5. Tolco
   6. Or Equal

E. Vertical Piping:
   1. Support vertical piping risers securely with riser clamps, B-Line B3373, or equal. Attach clamps to the pipe above each concrete floor slab, with the arms of the clamp resting on the slab or the structural supports. Provide Superstrut B3373C, or equal clamp when used on copper piping.
   2. Support pipe lines passing up through the building at each floor of the building.

F. Horizontal Piping:
   1. Use B-Line B3100, or equal, steel strap hanger for uninsulated steel or cast-iron pipe through 8-inch size, and for insulated steel or cast-iron pipe through 4-inch size.
   2. Use Superstrut C-710 or equal, steel hanger in pipe sizes where suitable. Use saddle shield as specified for insulated pipes.
   3. For uninsulated copper tubing, use B-Line B3100F, or equal, felt lined hanger.

G. Pipe Saddles:
   1. Use B-Line B3153, or equal, protective insulation shield with "loc" tabs.

H. Concrete Inserts: Provide B-Line B2500, or equal, concrete inserts.

PART 3 - EXECUTION

3.01 GENERAL
A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

B. Comply with ANSI B31 Code for Pressure Piping.

C. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak-proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.

D. Locate piping runs, unless detailed otherwise, vertically and horizontally (pitched to drain). Install piping parallel and perpendicular to adjacent building walls/structure and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations. Hold piping close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building; limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping; locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction, or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

E. Electrical Equipment Spaces: Do not run piping through transformer vaults, elevator equipment rooms, Data closets or other electrical or electronic equipment spaces or enclosures.

F. Should structural difficulties or work of other contractors prevent the running of pipes or the setting of equipment at the points shown, Contractor to make the necessary deviations to the piping system, as determined by the Contractor, with the Architect's review, without additional cost to Owner.

G. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on pipe or obstructions in pipes and fittings.

H. Installation Of Protective Pipe Wrap:

1. Protect all steel pipe buried in ground from corrosion by the application of protective pipe wrap. Clean and prime pipe before application of the wrapping material.

I. Installation Of Detectable Underground Warning Tape:

1. Provide all non-metallic pipes, including but not limited to plastic piping, glass piping, and vitrified clay piping with detectable underground warning tape.
2. Detectable underground warning tape shall consist of 4.5 mil foil tape printed with pipe service, (i.e. “CAUTION WATER LINE BELOW,” etc.).
3. Tape shall be buried approximately one-half of the pipes buried depth except medical gas piping shall be as required by NFPA 99.
4. Tape buried up to 24” deep shall be a minimum of 3” wide.
5. Tape buried greater than 24” deep shall be a minimum of 6” wide.

3.02 INSTALLATION OF WATER PIPING:

A. Run all water piping generally level, free of traps or unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work. No piping shall be installed so as to cause unusual noise from the flow of water therein under normal conditions.
B. Water lines shall not be installed in the same trench with non-metallic sewer lines unless the bottom of the water pipe at all points is at least 12 inches above the top of the sewer line and the water line is placed on a solid shelf excavated at one side of the common trench.

C. Where water and waste piping cross, the pipes shall have no fittings within 10 feet of the crossing, and the water line shall be run above the waste line. Comply with any local codes or requirements.

D. Close open ends of water piping each day to prevent contamination or foreign matter entering pipe during construction. Thoroughly flush out piping to remove any dirt or foreign matter. Remove and clean all aerators at end of project and prior to sterilization.

3.03 DOMESTIC WATER SYSTEM STERILIZATION:

A. Water line disinfections are to be performed by a licensed contractor with training in potable water line disinfections or a D-1 water operator licensed by the state of California and trained in water line disinfections.

B. Water lines shall be cleaned by following guidelines provided by the AWWA standard C-651 for water mains and guidelines provided by DP Disinfection for building water lines.

C. Prior to system sterilization, provide warning signs at all outlets while chlorinating the system. Provide sign at all outlets, which reads “Water Sterilization in Progress – Do not operate”. Remove signs at conclusion of test.

D. Disinfection Procedures / 3 Hour Disinfection (Chemical pump Method / Building side of Double Check Valve Assembly):

1. Clean and disinfect all hot and cold water systems connected to the domestic water system in accordance with AWWA Standard C-651 for water mains, DP Disinfection guide lines for building water lines, and as prescribed by the local Building and Health department codes. This procedure shall be performed by a Licensed Contractor trained in the disinfection of water systems or by a state certified Water Operator with a minimum of a D-1 license.

2. Preliminary Preparation:
   a. Locate the injection point. Install an injection hose bib to the system at a point within 10'-0" of its junction with the water supply line. When the project is complete, with all the fixtures connected and operable and ready for use and when, by test, the system is proved to be free from leaks, it shall be thoroughly flushed by fully opening every outlet and operating every fixture until clear water flows from all of them. Take a Sample, test for Free chlorine content and record it on the work sheet.
   b. Use (LR) Low Range Disinfection test strips. A Normally reading will be 2mg/L or less. This is the "Bench Mark" reading.

3. Disinfecting Agent:
   a. The chlorine shall be a registered product with Cal-EPA for use in California in potable water lines, such as Bacticide, Cal-EPA Registration No. 37982-20001. Use liquid Sodium Hypochlorite conforming to ANSI/AWWA B300.

4. Disinfecting Procedure (Chemical Pump Method):
   a. Connect the chemical pump to the injection hose bibb. If the existing pressure exceeds 50psi use a DP Disinfection Backflow / Regulator Injection Assembly.
   b. With system completely full of water and supply valve open, adjust every faucet of system so that a trickle of water flows from each. Find the furthest fixture and trickle at a higher rate until you obtain your first reading. Then work backwards.
c. Inject disinfectant until a test at each branch outlet shows a chlorine residual concentration of 200 parts per million (ppm).

d. Close all outlets and valves. Shut down the pump. Close the valve connected to the fresh water supply line. Close the injection hose bib. Maintain condition for 3 hours at 200ppm.

e. When the above procedure has been completed, flush out entire system with fresh water until a test at any outlet shows a residual of not more than the original "Bench Mark" reading taken in the preliminary preparation.

(1) When flushing, pay attention to any special requirements. Never flush highly chlorinated water into storm drains, creeks, rivers or septic tanks. De-chlorinate the discharge water with Ascorbic Acid.

E. Disinfection Procedures / 24 Hour Disinfection (Chemical pump Method / Building side of Double Check Valve Assembly):

1. Clean and disinfect all hot and cold water systems connected to the domestic water system in accordance with AWWA Standard C-651 for water mains, DP Disinfection guide lines for building water lines, and as prescribed by the local Building and Health department codes. This procedure shall be performed by a Licensed Contractor trained in the disinfection of water systems or by a state certified Water Operator with a minimum of a D-1 license.

2. Preliminary Preparation:

   a. Locate the injection point. Install an injection hose bib to the system at a point within 10'-0" of its junction with the water supply line. When project is complete, with all fixtures connected and operable and ready for use and when, by test, the system is proved to be free from leaks, it shall be thoroughly flushed by fully opening every outlet and operating every fixture until clear water flows from all of them. Take a Sample, test for Free chlorine content and record it on the work sheet.

      (1) Use a L/R (low range) Disinfection test strip or a chlorine meter. A Normally reading will be 2mg/L or less. This is the "Bench Mark" reading.

3. Disinfecting Agent:

   a. The chlorine shall be a registered product with Cal-EPA for use in California in potable water lines, such as Bacticide, Cal-EPA Registration No. 37982-20001. Use liquid Sodium Hypochlorite conforming to ANSI/AWWA B300.

4. Disinfecting Procedure (Chemical Pump Method):

   a. Connect the chemical pump to the injection hose bib. If existing pressure exceeds 50psi use a DP Disinfection Backflow / Regulator Injection Assembly.

   b. With system completely full of water and supply valve open, adjust every faucet of system so that a trickle of water flows from each. Find the furthest fixture and trickle at a higher rate of speed until you obtain your first reading. Then work backwards.

   c. Inject disinfectant until a test at each branch outlet shows a chlorine residual concentration of 50 parts per million (ppm).

   d. Close all outlets and valves. Close Fresh water hose bib. Shut off pump. Close injection hose bib. Maintain condition for 24 hours and chlorine residual of at least 25 ppm must be retained in system for this 24 hour period. If, after 24 hours, tests indicate that chlorine residual concentration has decreased below 25ppm. The disinfection procedure must be repeated until an approved result is obtained.

   e. When the above procedure has been completed, flush out entire system with fresh water until a test at any outlet shows a residual of not more than the original "Bench Mark" readings taken in the preliminary preparation.

      (1) When flushing, pay attention to any special requirements. Don't flush highly chlorinated water into storm drains, creeks, rivers or septic tanks. De-chlorinate the discharge water with Ascorbic Acid.
F. Chemical and bacteriological tests shall be conducted by a state-certified laboratory and approved by the local authorities having jurisdiction.

G. Submit written report to Health Department as required by State Regulations. Provide a copy of report to Architect prior to completion of project.

3.04 INSTALLATION OF HANGERS AND SUPPORTS:

A. Fasten all piping securely to structure with hangers, supports, guides, anchors, or sway braces to maintain pipe alignment, to prevent any sagging, and to prevent noise or excessive strain on the piping due to uncontrolled movement under operating conditions. Relocate hangers as necessary to correct unsatisfactory conditions that may become evident when system is put into operation.

B. Follow drawing requirements and details where special pipe support requirements are detailed on the Drawings.

C. Do not support piping by perforated tape, wire, rope, wood, nails, or other makeshift devices.

D. Design hangers and supports to support the weight of the pipe, weight of fluid, and weight of the pipe insulation with a minimum factor of safety of five based on the ultimate tensile strength of the material used.

E. Burning or welding on any structural member under load shall not be attempted. Field welding not called for on the Drawings or reviewed shop Drawings may only be done with consent and advice of the Architect and after proper provisions have been made to relieve the stress on the member. The boring of holes in beam flanges or narrow members will not be allowed.

F. Install hanger on insulated piping in a manner which will not produce damage to insulation. Provide steel pipe saddles as required to protect pipe covering. Install pipe hangers on piping covered with insulation on the outside of the insulation and not in contact with the pipe.

G. Fasten hanger rods to concrete structural members with concrete inserts set flush with surface. Install a reinforcing rod through the opening provided in the concrete inserts. Fasten hanger rods to structural members with suitable beam clamps, and provide beam clips to lock clamp securely to beam.

H. Use of powder-actuated fasteners will not be permitted for the support of any overhead piping.

I. Turnbuckles, if used, shall have a load-carrying capacity at least equal to that of the pipe hanger with which they are being used.

J. All threaded parts of pipe hanger assemblies shall have full length of thread in service while in use.

K. Hanger material shall be reviewed by the Architect before installation.

L. Pipe Hanger or Support Spacing:
   1. Provide pipe hangers or supports at 6-foot maximum spacing on steel pipe 3/4-inch diameter and smaller and for copper pipe 1-1/2 inches and smaller.
   2. Support steel piping 1" and larger and copper larger than 1-1/2 inches at 10-foot maximum spacing.

M. Provide continuous support channel for all polypropylene piping, and provide 6-foot maximum spacing for hangers, with a minimum of one hanger per length of pipe.
3.10 PIPING SYSTEM JOINTS:

A. General: Provide joints of type indicated in each piping system.

B. Cut all steel pipe and hard copper tubing by power hacksaw, a circular cutting machine using an abrasive wheel or in square end vise by means of hand hacksaw. Wheel cutters may be used for steel pipe provided that pipe shall have ends reamed to full inside diameter and beveled before being made up into fittings. Pipe shall have round edges or burrs removed so that a smooth and unobstructed flow will be obtained.

C. Thread pipe 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 compound, Rector-Seal #5, on male threads at each joint and tighten joint to leave not more than 3 threads exposed. Teflon tape may be used on piping smaller than 2 inches.

D. Use joint compound, same as specified for threaded pipe joints, on all cleanout plugs.

E. Braze copper tube-and-fitting joints where indicated, in accordance with ASME B32.

F. Solder copper tube and fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Solder shall be 95 percent tin, 5 percent antimony and shall be used above grade only. Wipe excess solder from joint before it hardens.

G. Mechanically Formed Tee Connections: In lieu of providing tee fittings in copper tubing, Contractor may, as an option, provide mechanically formed tee connections, providing they are in accordance with the following:
1. Size and wall thickness of both run tube and branch tube are listed by manufacturer of forming equipment as "Acceptable Application."
2. Height of drawn collar is not less than three times the wall thickness of run tubing.
3. End of branch tube is notched to conform to inner curve of run tube and dimpled to set exact penetration depth into collar.
4. Resulting joint is minimum of three times as long as thickness of thinner joint member, and brazed using B-CuP series filler metal.

H. Mechanically Formed Couplings: In lieu of providing couplings in copper tubing, Contractor may, as option, provide mechanically formed couplings, provided they are in accordance with the following:
1. Form couplings by first annealing area at end of tube where expansion will occur. Insert tube expander to die size required and expand tube end to accept tubing of same size.
2. Resulting joint is minimum of three times as long as thickness of tube and brazed using B-CuP series filler metal.

I. Weld pipe joints in accordance with recognized industry practice and as follows:
1. Welding shall be done by qualified welders in a first-class, workmanlike manner, conforming to the American Standard Code for Pressure Piping USA B-31-1 and B-31-1A.
2. Bevel pipe ends at a 37.5 degree angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
3. Do not weld-out piping system imperfections by tack-welding procedures; re-fabricate to comply with requirements.

J. At Contractor's option, install forged branch-connection fittings wherever branch pipe of two pipe sizes smaller than main pipe is indicated; or install regular "T" fitting.
K. Flanged Joints: Match flanges within piping system and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.


M. Make joints between cast-iron and steel pipe same as above with special adapter as required.

N. Make joints in PVC pipe with PVC-type couplings and rubber rings.

O. Check final location of rubber rings within the couplings with gage or as recommended by the manufacturer. Make joints between PVC pipe and cast iron pipe or fittings using cast iron adapter fittings, installed as recommended by the manufacturer.

3.11 TEST OF PIPING:

A. Test piping at completion of roughing in, in accordance with the following schedule. Show no loss in pressure or visible leaks after a minimum duration of 4 hours at the test pressures indicated. Tests to be verified by Inspector of Record.

<table>
<thead>
<tr>
<th>System Tested</th>
<th>Test Pressure Psig</th>
<th>Test With</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot, Cold, Tempered, and Hot Water Return Piping</td>
<td>150 lbs. rough-in 100 lbs. after equipment connection</td>
<td>Water</td>
</tr>
</tbody>
</table>

B. Testing equipment, materials, and labor shall be furnished by this Contractor.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

3.12 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

- End of Section -
PART 1 – GENERAL

1.01 SUMMARY

A. This section includes piping and supports as required for the plumbing system.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of plumbing piping systems products, of types, materials, and sizes required whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with piping systems work similar to that required of project.

C. Requirements of Regulatory Agencies: Contractor to conform to the publications listed below. Requirements of these publications are to be considered as a minimum standard. If details and specifications which require more stringent work are indicated within project, Contractor to provide the more stringent.

1. California Plumbing Code (CPC) Compliance: Comply with applicable portions of the California Plumbing Code pertaining to selection and installation of plumbing materials and products. Fabricate and install natural gas systems in accordance with CPC.

D. Welding materials and labor shall comply with ASME Code and applicable state labor regulations.

E. Welders shall be fully qualified and certified by a state approved welding bureau for the types of welds required for the project.
   1. Each welder shall identify their work with a marking stamped on each weld joint of pipe, valve, or fitting.


G. All plumbing components intended to dispense water for human consumption shall comply with requirements of California Assembly Bill AB1953. Components to include (but not limited to): piping, faucets, angle stops, valves, bubblers, drinking fountains, piping, etc.

1.03 SUBMITTALS

A. Submit manufacturer's catalog cut sheets, specifications, installation instructions, and dimensioned drawings for each type of pipe, support, anchor, and seal indicated within this section that is applicable to the project. Clearly indicate item being submitted.
   1. Indicate pipe schedules, pressure classes, etc.
   2. Indicate all options being submitted.

B. Provide Welding and Brazing Certifications. Submit reports as required for piping work applicable to the project.
   1. Welders that do not have current Certifications shall not be permitted to weld and/or braze on the project.

PART 2 – GENERAL

2.01 GENERAL:
A. Provide piping materials and factory fabricated piping products of sizes, types, pressure and
temperature ratings, and capacities as indicated. Materials and products to comply with the
California Plumbing Code.

B. Where more than one type of material is indicated, selection is the Contractors option.
   1. Contractor to provide submittal information on material which is to be installed.
   2. Where more than one material is indicated, the Contractor shall only install one material per
      system and materials shall not be mixed within the same system.

C. Malleable Iron Threaded Fittings: ANSI B16.3; plain or galvanized to suit piping. For use above
   grade only, except where indicated otherwise.

D. Malleable-Iron Threaded Unions: ANSI B16.39; selected by Contractor for proper piping
   fabrication and service requirements, including style, end connections, and metal-to- metal seats
   (iron, bronze, or brass); plain or galvanized as indicated.

E. Forged-Steel Socket Welding and Threaded Fittings: ANSI B16.11, except MSS SP-79 for
   threaded reducer inserts; rated to match schedule of connected pipe.

F. Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows
   and returns; rated to match connected pipe.

G. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less
   than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2 inches and where
   pipe size is less than 1-1/2 inches, and do not thread nipples full length (no close-nipples).

H. Welding Materials: Except as otherwise indicated, provide welding materials as determined by
   Contractor to comply with installation requirements. Comply with Section II, Part C, ASME Boiler
   and Pressure Vessel Code for welding materials.

I. Soldering Materials: Joints in copper tubing for all installations shall be made with brazing alloy
   sil-fos, or equal. Clean surfaces to be jointed shall be free of oil, grease, rust, and oxides.
   1. Harris Stay-Safe 50 solder, or equal, may be permitted on plumbing lines above slab or
      ground only with prior review for piping sizes 2 inches and smaller only. Solders used shall
      contain no lead.

J. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal
   materials.

K. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast- iron flanges; raised-face for steel
   flanges, unless otherwise indicated.

2.02 PIPING AND FITTINGS:

A. Sanitary Sewer Piping:
   1. Cast iron, no-hub soil pipe. Provide with neoprene sleeve gaskets and stainless steel 4 band
      couplings.
   2. Cast Iron Hub and Spigot Soil Pipe and Fittings: CISPI Standard 301 (Latest Edition) and
      ASTM A 74.
   3. Sanitary Sewer couplings to be super-duty type in conformance with Factory Mutual Standard
      1680, Class I and/or ASTM C 1540.
a. Couplings to be as follows: "Husky" SD4000, Orange Shield coupling as manufactured by Husky Technologies, or equal. Minimum Shield thickness to be 0.015".
b. No-Hub Cast-Iron Soil Pipe Couplings: Couplings for use in connection with no-hub Cast Iron Soil Pipe and Fittings shall comply with CISPI 310. Shield and clamp assembly shall consist of a 300 series stainless steel corrugated shield, stainless steel bands (4-bands minimum), and sealing sleeve in conformance with ASTM C564.

4. At Contractor's option, Type DWV hard drawn copper tubing with cast bronze solder joint fittings and lead free solder may be used above ground in lieu of cast iron drainage fittings. Provide test tees as specified.

5. Acceptable manufacturer's
   a. Tyler pipe
   b. AB&I
   c. Or Equal

B. Sanitary Vent Piping:


2. Vent Couplings to be heavy-duty type in conformance with Factory Mutual Standard 1680, Class I and/or ASTM C 1540.
   a. Couplings to be as follows: "Husky" HD2000, White Shield coupling as manufactured by Husky Technologies, or equal. Minimum Shield thickness to be 0.010".
   b. No-Hub Cast-Iron Soil Pipe Couplings: Couplings for use in connection with no-hub Cast Iron Soil Pipe and Fittings shall comply with CISPI 310. Shield and clamp assembly shall consist of a 300 series stainless steel corrugated shield, stainless steel bands (4-bands minimum), and sealing sleeve in conformance with ASTM C564.

3. At Contractor's option, Type DWV hard drawn copper tubing with cast bronze solder joint fittings and lead free solder may be used above ground in lieu of galvanized steel vent piping and cast iron drainage fittings. Provide test tees as specified.

C. Acid Waste Piping:

1. All Sizes to be polypropylene schedule 40 pipe. Pipes to be flame retardant.
   a. At Contractor's option, pipes below grade can be non-flame retardant.

2. Dimensions and tolerances to be per ASTM F1412.

3. Pipe to be manufactured with chemically resistant polypropylene material conforming to ASTM D4101.

4. Provide mechanical fitting at connections to equipment/fixtures. All other fittings to be socket-welded electro-fusion fittings.

5. Acceptable manufacturer's
   a. GSR Fuseal
   b. Orion
   c. Enfield

2.03 PIPING SUPPORTS:
A. All mechanical equipment supports shall be designed by a licensed Structural Engineer and shall comply with the 2013 California Building Code, Section 1616A.1.18 through 1616A.1.26 and ASCE 7-10. Chapters 6 and 30


C. Acceptable Manufacturer:
   1. Mason
   2. B-Line
   3. Superstrut
   4. Unistrut
   5. Tolco
   6. Or Equal

D. Vertical Piping:
   1. Support vertical piping risers securely with riser clamps, B-Line B3373, or equal. Attach clamps to the pipe above each concrete floor slab, with the arms of the clamp resting on the slab or the structural supports. Provide Superstrut B3373C, or equal clamp when used on copper piping.
   2. Support pipe lines passing up through the building at each floor of the building.

E. Horizontal Piping:
   1. Use B-Line B3100, or equal, steel strap hanger for uninsulated steel or cast-iron pipe through 8-inch size, and for insulated steel or cast-iron pipe through 4-inch size.
   2. Use Superstrut C-710 or equal, steel hanger in pipe sizes where suitable. Use saddle shield as specified for insulated pipes.
   3. For uninsulated copper tubing, use B-Line B3100F, or equal, felt lined hanger.

F. Pipe Saddles:
   1. Use B-Line B3153, or equal, protective insulation shield with "lo" tabs.

G. Concrete Inserts: Provide B-Line B2500, or equal, concrete inserts.

PART 3 - EXECUTION

3.01 GENERAL

A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

B. Comply with ANSI B31 Code for Pressure Piping.

C. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak-proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.

D. Locate piping runs, unless detailed otherwise, vertically and horizontally (pitched to drain). Install piping parallel and perpendicular to adjacent building walls/structure and avoid diagonal runs
wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations. Hold piping close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building; limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping; locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction, or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

E. Electrical Equipment Spaces: Do not run piping through transformer vaults, elevator equipment rooms, Data closets or other electrical or electronic equipment spaces or enclosures.

F. Should structural difficulties or work of other contractors prevent the running of pipes or the setting of equipment at the points shown, Contractor to make the necessary deviations to the piping system, as determined by the Contractor, with the Architect’s review, without additional cost to Owner.

G. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on pipe or obstructions in pipes and fittings.

H. Installation Of Protective Pipe Wrap:
   1. Protect all steel pipe buried in ground from corrosion by the application of protective pipe wrap. Clean and prime pipe before application of the wrapping material.

I. Installation Of Detectable Underground Warning Tape:
   1. Provide all non-metallic pipes, including but not limited to plastic piping, glass piping, and vitrified clay piping with detectable underground warning tape.
   2. Detectable underground warning tape shall consist of 4.5 mil foil tape printed with pipe service, (i.e. "ACID WASTE LINE BELOW").
   3. Tape shall be buried approximately one-half of the pipes buried depth except medical gas piping shall be as required by NFPA 99.
   4. Tape buried up to 24" deep shall be a minimum of 3" wide.
   5. Tape buried greater than 24" deep shall be a minimum of 6" wide.

3.02 INSTALLATION OF SANITARY DRAINAGE SYSTEMS:

A. Make joints between PVC pipe and cast iron pipe or fittings using cast iron adapter fittings, installed as recommended by the manufacturer.

B. Sewer Piping: Run all horizontal sanitary drain piping inside of building on a uniform grade of not less than 1/4-inch per foot, unless otherwise noted on the plans. Piping shall have invert elevations as shown and slope uniformly between given elevations.

C. Run all drainage piping as straight as possible and provide easy bends with long turns; make all offsets at an angle of 45 degrees or less.

D. Grade all vent piping so as to free itself quickly of any water condensation.

E. Hubless Cast-Iron Joints: Comply with coupling manufacturer’s installation instructions and in accordance with CISPI Pamphlet No. 310, latest edition.

F. Cleanouts: Install in piping as indicated, as required by California Plumbing Code, at each change in direction of piping greater than 45 degrees, at minimum intervals of 50 feet for piping 4 inches and smaller and 100 feet for larger piping, and at base of each conductor.
G. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through waterproof membrane.

H. Install drains in accordance with manufacturer's written instructions and in locations indicated. Unless detailed otherwise, install floor drains and floor sinks withlip of drain slightly below finished floor to ensure drainage. Coordinate with other Contractors to ensure that floor slopes to drain.

3.03 INSTALLATION OF HANGERS AND SUPPORTS:

A. Fasten all piping securely to structure with hangers, supports, guides, anchors, or sway braces to maintain pipe alignment, to prevent any sagging, and to prevent noise or excessive strain on the piping due to uncontrolled movement under operating conditions. Relocate hangers as necessary to correct unsatisfactory conditions that may become evident when system is put into operation.

B. Follow drawing requirements and details where special pipe support requirements are detailed on the Drawings.

C. Do not support piping by perforated tape, wire, rope, wood, nails, or other makeshift devices.

D. Design hangers and supports to support the weight of the pipe, weight of fluid, and weight of the pipe insulation with a minimum factor of safety of five based on the ultimate tensile strength of the material used.

E. Burning or welding on any structural member under load shall not be attempted. Field welding not called for on the Drawings or reviewed shop Drawings may only be done with consent and advice of the Architect and after proper provisions have been made to relieve the stress on the member. The boring of holes in beam flanges or narrow members will not be allowed.

F. Install hanger on insulated piping in a manner which will not produce damage to insulation. Provide steel pipe saddles as required to protect pipe covering. Install pipe hangers on piping covered with insulation on the outside of the insulation and not in contact with the pipe.

G. Fasten hanger rods to concrete structural members with concrete inserts set flush with surface. Install a reinforcing rod through the opening provided in the concrete inserts. Fasten hanger rods to structural members with suitable beam clamps, and provide beam clips to lock clamp securely to beam.

H. Use of powder-actuated fasteners will not be permitted for the support of any overhead piping.

I. Turnbuckles, if used, shall have a load-carrying capacity at least equal to that of the pipe hanger with which they are being used.

J. All threaded parts of pipe hanger assemblies shall have full length of thread in service while in use.

K. Hanger material shall be reviewed by the Architect before installation.

L. Pipe Hanger or Support Spacing:
   1. Provide pipe hangers or supports at 6-foot maximum spacing on steel pipe 3/4-inch diameter and smaller and for copper pipe 1-1/2 inches and smaller.
   2. Support steel piping 1" and larger and copper larger than 1-1/2 inches at 10-foot maximum spacing.
M. Provide hangers or supports for horizontal and vertical cast-iron drainage pipe at every other joint, except that when the developed length between hangers or supports exceeds 4 feet, provide hangers or supports at each joint. Provide adequate sway bracing to prevent shear.

3.04 TEST OF PIPING:

A. Test piping at completion of roughing in, in accordance with the following schedule. Show no loss in pressure or visible leaks after a minimum duration of 4 hours at the test pressures indicated. Tests to be verified by Inspector of Record.

<table>
<thead>
<tr>
<th>SYSTEM TESTED</th>
<th>TEST PRESSURE PSIG</th>
<th>TEST WITH</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Soil, Waste Drain &amp; Vent Piping;</td>
<td>Fill with water to top of standpipe of highest vent.</td>
<td>Water</td>
</tr>
<tr>
<td>All Storm Drains Within Buildings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum height of standpipe shall be</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 feet above piping being tested.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A. Testing equipment, materials, and labor shall be furnished by this Contractor.

B. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

C. Drain test water from piping systems after testing and repair work has been completed.

3.05 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

End of Section
PART 1 – GENERAL

1.01 SUMMARY

A. This specification section includes plumbing equipment, including:
   1. Gas Fired Water Heater
   2. Potable Water Expansion Tanks

1.02 QUALITY ASSURANCE

A. Plumbing Fixture Standards: Comply with applicable portions of the following codes and
   requirements for all work in this section:
   1. California Plumbing Code – CPC
   2. American National Standards Institute – ANSI
   3. Federal Standards - F.S.

B. Manufacturers: Firms regularly engaged in manufacture of plumbing equipment of type and sizes
   required, whose products have been in satisfactory use in similar service for not less than 5
   years.

C. Grade or quality of materials desired is indicated by trade names or catalog numbers stated
   herein.

D. Dimensions, sizes, and capacities shown are minimum and shall not be changed without
   permission of Architect.

E. UL and NEMA Compliance: Provide electric motors and electrical components required as part
   of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and
   comply with NEMA standards.

F. Water heaters to Comply with ANSI/ASHRAE/IES 90A for energy efficiency.

G. NEC Compliance: Comply with National Electrical Code (ANSI/NFPA 70) as applicable to
   installation and electrical connections of ancillary electrical components of plumbing equipment.

H. California Energy Commission Compliance: Provide written confirmation of listing of all water

1.03 SUBMITTALS

A. Product data: submit complete data of materials proposed including:
   1. Manufacturer and model number
   2. Clearly indicate all options, trim, and accessories.
   3. Cross reference manufacturer’s cut sheet to fixture callout ID on submittal sheet.

B. Operation and Maintenance Data: submit complete O&M data including:
   1. Maintenance data and parts lists for each type of fixture.
   2. Provide “trouble-shooting” maintenance guide
   3. Include this data within maintenance manual

PART 2 - PRODUCTS
2.01 GAS FIRED WATER HEATERS

A. Acceptable Manufacturers:
   1. Lochinvar
   2. A.O. Smith
   3. PVI

B. General:
   1. Provide commercial gas-fired water heater of size, capacity, recovery rate and electrical characteristics as scheduled on Drawings. Provide UL Listing and NSF approval.
   2. Heater shall be design certified by A.G.A.
   3. Heater(s) shall be provided with an automatic gas shutoff device and safety shutoff in event pilot flame is extinguished; a gas pressure regulator set for the type of gas supplied; anapproved draft diverter, and extruded anode rod rigidly supported for cathodic protection.

C. Tank:
   1. All internal surfaces of the tank shall be glass-lined with an alkaline borosilicate composition that has been fused-to-steel.
   2. Tank shall be cathodically protected with adequate extruded magnesium rod.
   3. ASME tank construction for 125 psi working pressure.

D. Heater:
   1. Working pressure of 150 psi, magnesium anode rod, glass lining on internal surfaces exposed to water.

E. Heating Elements:
   1. Heavy-duty, medium watt density, with incoloy sheath, thermostat stepped through magnetic contactors

F. Safety Controls:
   1. Double-pole, manual-reset, high-limit, probe- type electric water flow cutoff, both factory wired

G. Jacket:
   1. Equip with full-size control compartments with front panel opening.
   2. Insulate tank with vermin-proof glass fiber insulation.
   3. Provide outer steel jacket with bonderized undercoat and baked enamel finish.

H. Accessories:
   1. Provide brass drain valve.
   2. Provide ASTM temperature and pressure relief valve, minimum size = ¾"Ø.

I. Controls:
   1. Adjustable immersion thermostat; power circuit fusing
   2. Control compartment to be hinged and shall house the following:
      a. 120 volt control circuit transformer
      b. Transformer fusing
      c. Magnetic contactor(s)
      d. Immersion style operating thermostat(s)
      e. High limit thermostat(s)
      f. Element fusing per N.E.C.
      g. Commercial grade incoloy sheathed flange mounted elements with prewired terminal leads

J. Flue:
   1. Furnish and install "Metalbestos" or equal, UL-Listed all-steel chimney. Furnish complete with roof support flashing, Briedert Type "L", stainless steel stack cap and all supports and accessories required for a complete installation
2. Seal all joints as recommended by the manufacturer for pressure-tight joints.

K. Warranty:
1. Furnish three-year limited warranty on tank leakage.

2.02 GAS FIRED WATER HEATERS

A. General:
1. Provide 94% efficient commercial gas-fired water heater of size, capacity, recovery rate and electrical characteristics as scheduled on Drawings. Provide UL Listing and NSF approval.
2. Heater shall be design certified by A.G.A.
3. Heater(s) shall be provided with an automatic gas shutoff device and safety shutoff in event pilot flame is extinguished; a gas pressure regulator set for the type of gas supplied; an approved draft diverter, and extruded anode rod rigidly supported for cathodic protection.
4. This heater shall be listed by SCAQMD Rule 1146.2 Low NOx.

B. Tank:
1. All internal surfaces of the tank shall be glass-lined with an alkaline borosilicate composition that has been fused-to-steel.
2. Tank shall be cathodically protected with adequate extruded magnesium rod.
3. ASME tank construction for 125 psi working pressure.

C. Heater:
1. Submerged combustion chamber in a spiral action.

D. Heating Elements:
1. Heavy-duty, medium watt density, with incoloy sheath, thermostat stepped through magnetic contactors.

E. Safety Controls:
1. Double-pole, manual-reset, high-limit, probe-type electric water flow cutoff; both factory wired.

F. Jacket:
1. Equip with full-size control compartments with front panel opening.
2. Insulate tank with vermin-proof glass fiber insulation.
3. Provide outer steel jacket with bonderized undercoat and baked enamel finish.

G. Accessories:
1. Provide brass drain valve.
2. Provide ASTM temperature and pressure relief valve, minimum size = ¾"Ø.

H. Controls:
1. The control shall be an integrated solid state temperature and ignition control device with integral diagnostics, LED fault display capability and a digital display of temperature settings.

I. Flue:
1. Furnish and install "Heat-fab" Saf-T Vent CI flue. Flue to be AL 29-4C stainless-steel inner wall double-wall venting system designed for use with any listed Category I, II, III, or IV gas-fired appliance. Furnish complete with roof support flashing, stack, rain cap, and all supports and accessories required for a complete installation.
2. Seal all joints as recommended by the manufacturer for pressure-tight joints.
3. Control compartment to be hinged and shall house the following:

J. Warranty:
1. Furnish three-year limited warranty on tank leakage.
K. Acceptable Manufacturers:
   1. Lochinvar
   2. A.O. Smith
   3. PVI

2.03 POTABLE WATER EXPANSION TANK

A. Provide potable water expansion tank at domestic hot water heater as detailed within drawings.

B. Potable water expansion tank shall be of drawn steel construction. Tank to have a Butyl diaphragm separating the air chamber from the water containing chamber. Inlet connector shall be brass or stainless steel. Materials of manufacture for the diaphragm shall be FDA approved.

C. The potable water expansion tank shall be a Bell and Gossett HFT, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF GAS-FIRED HOT WATER HEATERS:

A. Install power gas-fired heaters as indicated, in accordance with manufacturer's installation instructions and in compliance with applicable codes.

B. Furnish wiring diagram to Electrical Installer. Refer to Division 16 for wiring of units, not work of this section.

C. Connect hot and cold water piping to units with shutoff valves and dielectric unions. Connect drain and relief piping as noted on Drawings.

D. Start-up, test, and adjust water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.

3.02 POTABLE WATER EXPANSION TANK

A. Install potable water expansion tank per manufacturer's written instructions. Secure tank to structure with strut-material and steel strap.

3.03 CARE AND CLEANING:

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.04 OPERATION TEST:

1. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.05 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

End of Section
PART 1 – GENERAL

1.01 SUMMARY

A. This submittal section describes plumbing fixtures and trim.

1.02 QUALITY ASSURANCE

A. Plumbing Fixture Standards: Comply with applicable portions of the following codes and requirements for all work in this section:
   1. California Plumbing Code – CPC
   2. American National Standards Institute – ANSI
   3. Federal Standards - F.S.

B. All plumbing components within the waterways shall comply with the Safe Drinking Water Act (SDWA) "No-Lead" restrictions of ANSI/NSF Standard 61 Section 9.

A. All plumbing components intended to dispense water for human consumption shall comply with requirements of California Assembly Bill AB1953. Components to include (but not limited to): piping, faucets, angle stops, valves, bubblers, drinking fountains, piping, etc.

1.02 SUBMITTALS

A. Product data: submit complete data of materials proposed including:
   1. Manufacturer and model number
   2. Clearly indicate all options, trim, and accessories.
   3. Cross reference manufacturer's cut sheet to fixture callout ID on submittal sheet.

B. Operation and Maintenance Data: submit complete O&M data including:
   1. Maintenance data and parts lists for each type of fixture.
   2. Provide "trouble-shooting" maintenance guide
   3. Include this data within maintenance manual

PART 2 - PRODUCTS

2.01 GENERAL:

A. All fixtures shall be first class in every respect. Accurately line up finished plumbing. Take special care with the roughing-in and finished plumbing where batteries of fixtures occur.

B. Consult Architectural Drawings, as well as Plumbing Drawings, for locations, dimensions and mounting height of plumbing fixtures.
   1. Take location and mounting heights for roughing-in from Architectural Drawings.

C. Follow Plumbing fixture rough-in schedule on Drawings for roughing-in connections. Set roughing-in for all fixtures exactly as per measurements furnished by the manufacturers of the fixtures used.

D. Roughing-in for sinks and lavatories shall be brought in through the wall under the centerline of the drain from the fixture wherever possible and as close to the fixture as possible.

E. Provide all water supplies to fixtures with compression shut-off stops. Stops to be as follows:
   1. IPS inlets with threaded brass nipples at pipe connection
2. Lock shield-loose key.
3. Provide combination fixtures with compression stop on each water supply fitting.
   a. Provide loose key handle for each stop.

F. Provide 1/2 inch rigid risers for all fixtures, unless otherwise noted.

G. Unless noted otherwise, all finish for exposed metal trim on fixture shall be polished chromium plated.
   1. This also applies to wall flanges, nuts, and washers.
   2. Trim exposed under sinks shall be considered exposed and to be chromium plated.
   3. Handles on all faucets and stops shall be all-metal chromium plated.

H. Make connection between fixtures and flanges on soil pipe gastight and watertight with neoprene-type gaskets (wall-hung fixtures) or bowl wax (floor outlet fixtures).
   1. Rubber gaskets or putty will not be permitted.

I. P-Traps
   1. Provide fixtures not having integral traps with chromium plated P-trap connected to concealed waste within wall and sanitary fittings. Trap to be:
      a. Cast Brass
      b. 17-gauge
   2. Provide ADA fixtures waste offsets.
   3. Acceptable Manufacturers:
      a. McGuire Manufacturing
      b. Dearborn Brass
      c. Or equal

J. Unions on waste pipes on fixture side of traps may be slip or flange joints with soft rubber or lead gaskets.

2.02 PLUMBING FIXTURE HANGERS AND SUPPORTS:

A. Install and support plumbing fixtures as required and specified herein.

B. Carriers and supports
   1. Provide as recommended by fixture manufacturer for the particular installation and type of fixture being installed.
   2. Residential-type fixture supports are not acceptable.
   3. Install wall-mounted water closets with combination support and waste fittings, with feet of support securely anchored to floor.
   4. Install floor-mounted water closets with J.R. Smith or equal government pattern cast iron closet flanges with brass bolts, nuts, washers, and porcelain caps secured with spackle.
   5. Install the following fixtures on concealed support with feet of support securely anchored to floor. Anchor top of support to wall construction in an approved manner.
      a. Wall mounted urinals
      b. Drinking fountains / Electric water coolers
   6. Install wall-hung lavatories in stud walls with concealed arms and floor support, with feet of support securely anchored to floor.
      a. In addition, anchor top of support to wall construction in an approved manner.
   7. Acceptable Manufacturers:
a. Zurn  
b. J.R. Smith  
c. Josam  
d. Wade  
e. By Fixture manufacturer

2.03 WATER CLOSET SEATS:

A. Provide seats for all water closets as scheduled. Seats to be Olsonite model 10SSC or equal as follows:
   1. Heavy Duty injected molded high impact solid plastic
   2. Elongated bowls
   3. Open Front, less cover
   4. Self sustaining check hinges
   5. Stainless steel posts
   6. White color.

B. Acceptable Manufacturers:
   1. Olsonite
   2. Bemis
   3. or equal

2.04 PLUMBING FIXTURES:

A. Fixtures to be as scheduled on drawings.

B. Provide stops for all concealed supplies.

C. Insulate domestic hot water, cold water, and waste piping below ADA plumbing fixtures with
   Provide ADA Sinks and Lavatories with protective covers "Truebro" Lav Guard Protective Pipe
   Covers. Protective covers to be:
   1. Molded closed cell vinyl pipe covers,
   2. Have vandal resistant snap-clip fasteners
   3. ASTM E-84 smoke test rating of 0.

D. Similar fixtures to be by same manufacturer.

E. Acceptable Manufacturers to be as follows:

1. Water Closets, Urinals, and Lavatories:
   a. Sloan
   b. American Standard
   c. Kohler
   d. Eljer

2. Mop Sinks:
   a. Florestone
   b. American Standard
   c. Kohler
   d. Fiat Products

3. Stainless Steel Sinks:
   a. Just
   b. Elkay
   c. Or equal
4. Flush Valves:
   a. Sloan "Royal"
   b. Zurn
   c. Delta Commercial
   d. Or equal

5. Faucets:
   a. Chicago
   b. Moen Commercial
   c. Delta Commercial
   d. Speakman

6. Drinking Fountains / Electric Water Coolers
   a. Haws
   b. Elkay
   c. Halsey Taylor

7. Bubblers
   a. Haws
   b. Elkay
   c. Halsey Taylor

8. Eye Washes / Safety Showers
   a. Haws
   b. Guardian Equipment
   c. Or equal

9. Shower Trim
   a. Symmons
   b. Leonard
   c. Moen Commercial
   d. Delta Commercial
   e. Or equal

10. Garbage Disposers
    a. InSinkErator
    b. Hobart
    c. Waste King

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION:

A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors, substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install plumbing fixtures of types indicated where shown and at mounting height indicated on Architectural Drawings in accordance with fixture manufacturer’s written instructions, roughing-in Drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with
requirements and serve intended purposes. Comply with applicable requirements of the Uniform Plumbing Code pertaining to installation of plumbing fixtures.

B. In all cases where plumbing fixtures are mounted on or against building walls of concrete or other materials having relatively rough or non-planar surfaces, it shall be the responsibility of this Contractor to provide any necessary grout or backing materials required to facilitate fixture mounting and eliminate void spaces between fixtures and wall to ensure adequate bearing contact.

C. On completion of installation, provide silicone sealer at all points of fixture contact with walls or floors.

D. Any fixture broken, cracked, or otherwise damaged during installation must be replaced by Contractor at his own expense.

3.03 TRAPPING AND VENTING OF FIXTURES:

A. Trap and vent all plumbing fixtures in accordance with Uniform Plumbing Code adopted by the Western Plumbing Officials Association and local plumbing codes, whether or not shown on Drawings. Strictly adhere to any local codes. Only exceptions to above will be those fixtures which are specially noted herein or on Drawings to be provided with special wastes.

B. No vent shall intersect another vent at a point less than 6" above extreme overflow level of highest fixture served.

C. Take vents off top half of horizontal runs and grade so as to free vents quickly of any water or condensation.

3.04 ADJUSTMENT OF PLUMBING PIPING SYSTEM:

A. Test and adjust fixtures so that each fixture receives the proper amount of water.
   1. Adjust flush valves so that each fixture receives the proper amount of water.
   2. Regulate all faucets, drinking fountains, etc. to the approval of the Architect so that the entire system is left in first-class condition.
   3. Adjust all slow-off valves to turn off between 12-15 seconds.
   4. Adjust sensitivity of sensor faucets to the satisfaction of the owner.

3.05 CLEAN AND PROTECT:

A. Clean plumbing fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during the remainder of the construction period.

C. Clean fixtures, equipment, and materials installed under this contract. Remove cement, plaster, paint and/or rust, etc. Also remove all manufacturers' stickers.
   1. Dirt, rubbish, paint spots, or grease on walls or fixtures for which this Contractor is responsible must be removed by him.

D. Fixtures to not be used by Contractors during construction.

3.06 FIELD QUALITY CONTROL:

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements.
1. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. If damaged, cracked, or dented, remove fixture and replace with new unit.

3.07 OPERATION TEST:

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.08 EXTRA STOCK:

A. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one device for every 10 units.

3.09 TRAINING:

A. Train owner on operation and adjustment of all sensor valves.

3.010 CLEANING UP:

A. After installation and testing but prior to acceptance, Contractor to clean fixtures with mild detergent and water solution, rinse with clean water, and wipe dry.

B. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

- End of Section -
PART 1 – GENERAL

1.01 GENERAL:

A. This Section specifies the Division 23 Work coordination requirements with general work provisions.

B. For convenience and reference the Division 23 Specifications are separated into Divisions and Sections. Such separations shall not operate to make the Engineer an arbitrator to establish subcontract limits between the Prime Contractor and his Subcontractors. In any case, the Prime Contractor is responsible to the owner for a complete job.

C. This section consists of General Requirements and Standard Specifications covering certain parts of work under Division 23 and is supplemented by other Division 23 sections covering additional work, requirements, and materials specifically applicable to the work of each section.
   1. Requirements of subsequent sections of the specifications, if in conflict with these General Requirements, shall govern.

D. No material installed as part of this WORK shall contain asbestos in any form.

1.02 CONDITIONS OF THE CONTRACT

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

B. This section is a Division-23 Basic Materials and Methods section and is a part of each Division -23 section.

1.03 DESCRIPTION OF REQUIREMENTS

A. Provide finished work, tested and ready for operation including apparatus, appliances, materials, and work. Provide incidental accessories necessary to make the work complete and ready for operation without additional expense to the Owner.

B. Before beginning work or ordering materials, consult Architect for clarification of discrepancies between, or questionable intent, of the Contract Documents.

C. Contractor shall visit the site and field survey the existing site conditions prior to bid. Any site conditions which may cause significant deviation from the design drawings shall be brought to the attention of the Owner’s representative for clarification prior to bid.

1.04 REQUIREMENTS OF REGULATORY AGENCIES:

A. Provide work and materials in full accordance with the latest rules and regulations of the following:
   1. California Code of Regulations - Title 24 - Parts 2, 3, 4, 5, and 9
   2. California Code of Regulations - Title 22 - Chapter 7
   9. California Green Building Standards 2013
11. National Fire Protection Association
12. CAL-OSHA
13. Occupational Safety and Health Administration
14. State Fire Marshal, Title 19 CCR
15. Other applicable state laws

B. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes.

C. Conform to State of California Energy Conservation Standards for all systems, equipment, and construction.

D. The above Codes and Standards define minimum requirements required for the project. Where Contract Documents differ from governing codes, furnish and install higher standard.

1.05 FEES, PERMITS, AND UTILITY SERVICES:

A. Arrange for required inspections and permits required in installation of the work.

B. The Owner will pay charges for permits required.

C. Obtain the first permits to operate any compressed air tanks that are required to be furnished under this work, pay all costs, and perform all tests required to obtain permits. Post permits under glass in a conspicuous place on or near the tanks, as required by these authorities.

1.06 SITE EXAMINATION:

A. Examine site, verify dimensions and locations against Drawings, and inform self of conditions under which work is to be done before submitting proposal. No allowance will be made for extra expense on account of error.

B. Information shown relative to existing services is based upon available records and data but is approximate only. Make minor deviations found necessary to conform with actual locations and conditions without extra cost. Verify location and elevation of utilities prior to commencement of excavation for new piping or its installation.

C. Exercise care in excavating near existing utilities to avoid any damage thereto. This Contractor is responsible for any damage caused by his operations.

1.07 MATERIAL LIST AND SUBSTITUTIONS:

A. Prior to commencement of work, and within 35 days after award of Contract, submit to Architect for review electronic copies of a complete list of equipment and materials to be furnished, including all substitutions. All submittals to be in electronic format as follows:
   1. Submittals to be in PDF Format.
   2. Individual PDF cut sheets shall be inserted into a single file for review.
   3. All sheets to be “unprotected” and writable.

B. Provide submittal information for all materials proposed for use as part of this project. Provide standard items on specified equipment at no extra cost to the contract regardless of disposition of submittal data. Other material or methods shall not be used unless approved in writing by the Architect. The Architect’s review will be required even though “or equal” or synonymous terms are used.
C. It is the responsibility of the Contractor to assume all costs incurred because of additional work and/or changes required to incorporate the proposed substitute into the project including possible extra compensation due to the Architect. Refer to Division 1 for complete instructions.

D. Contractor to provide complete Submittal packages for each system. At a maximum, submittals to be broken into the following packages:
   1. Mechanical – Dry Side package including: Ductwork, Source Equipment, Accessories, etc.
   2. Mechanical – Wet Side package including: Piping, valves, source equipment, pumps, accessories, etc.
      a. When required by schedule, a separate Mechanical Underground submittal package will be reviewed upon request.
   3. Mechanical – Building Automation System

E. Identify each item by manufacturer, brand, trade name, model number, size, rating, or whatever other data is necessary to properly identify and review materials and equipment.
   1. Where submittal sheets indicate more than one product, Contractor to clearly identify product being submitted. Contractor to cross-out information not being submitted for review.
   2. Submittals that do not clearly identify submitted item will be returned to the Contractor unreviewed.

F. Identity each submitted item by reference to specification section number and paragraph in which item is specified. Cross reference submittals by equipment ID where applicable.

G. Quantities are the Contractor’s responsibility and will not be reviewed.

H. If Contractor desires to make a substitution, he shall submit complete information or catalog data to show equality of equipment or material offered to that specified.
   1. Only one request for substitution will be considered on each item of material or equipment. No substitutions will be considered thereafter.
   2. Scheduled Products and first named manufacturer/product forms basis of design. All other manufacturers’ products are substitutions.
   3. No substitutions will be allowed unless requested and reviewed in writing.
   4. The Architect shall review and take appropriate action on shop Drawings, product data, samples, and other submittals required by the Contract Documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the Contract Documents. It shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor.
   5. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component. The Architect shall not be required to review and shall not be responsible for any deviations from the Contract Documents not clearly noted by the Contractor, nor shall the Architect be required to review partial submissions or those for which submissions for correlated items have not been received. Architect reserves right to require originally specified item.

I. Installation of reviewed substitution is Contractor’s responsibility. Any changes required for installation of reviewed substituted equipment must be made without additional cost to the owner. Review by the Architect of the substituted equipment and/or dimensional Drawings do not waive these requirements.

1.08 MAINTENANCE AND OPERATING INSTRUCTIONS:
A. Instruct the Owners' authorized representatives in the operation, adjustment, and maintenance of all mechanical equipment and systems. Provide 3 copies of certificate signed by Owner's representatives attesting to their having been instructed.

B. Furnish Architect with three complete sets of operating and maintenance (O&M) instructions.
   1. O&M manuals to be bound in hardboard binder and indexed.
   2. O&M manuals to include: descriptive literature, catalog cuts, and diagrams covering all items of operation and maintenance for each and every mechanical system and piece of equipment furnished under these specifications.
   3. Include in each set a copy of the air balance test report specified hereinafter.

C. Contractor must start compiling the above data (including obtaining operating and maintenance instruction data and catalog cuts and diagrams from the manufacturer of the reviewed equipment) immediately upon review of his list of materials, so as not to delay the final installation of the work.

D. Bind and index each set in a durable, hardboard binder. Final observation will not be made until booklets are submitted and have been reviewed by the Architect.

E. O&M manuals to incorporate the following:
   1. Complete operating instructions for each item of heating, ventilating and air conditioning equipment and associated piping and ductwork systems.
   2. Test data and system balancing reports as specified.
   3. Temperature control diagrams and literature.
   4. Manufacturer's bulletins with parts numbers, instructions, etc. for each item of equipment. Remove information not applicable to project.
   5. Typewritten maintenance instructions for each item of equipment listing in detail the lubricants to be used, frequency of lubrications, inspections required, adjustment, etc.
   6. A complete list and/or schedule of all major valves giving the valve ID, location of valve, and the rooms or area controlled by the valve.
   7. Provide copies of start-up reports for each piece of mechanical equipment provided as part of this work.
   8. Name, address, and phone number of contractors involved in work under this Division.
   9. Detailed step-by-step instructions for starting, summer operation, winter operation, and shutdown of each system.
   10. Detailed maintenance instructions for starting, summer operation, winter operation, and shutdown of each system.
   11. Spare parts list.
   12. Full size Record as built shop drawings in hard copies and in AutoCad 2004 CAD files.
      a. Contractor to incorporate field mark-ups into record drawings. Mark-up shop drawings not acceptable.

1.09 COORDINATION SHOP DRAWINGS

A. General:
   1. Prepare and submit for review coordination drawings where work by separate entities requires fabrication of products and materials which must accurately interface or for which space provided is limited.
   2. Coordination drawings shall indicate how the work will interface and installation will be sequenced. It is the intent of this provision to find, bring forth, and resolve potential constructability problems prior to actual construction, thereby allowing for the resolution of issues before construction cost and schedule are impacted.

B. The General Contractor shall oversee preparation of coordination drawings, assign priority space, and bring to the attention of the Architect any conflicts or interferences of an
unresolved nature found during preparation of coordination drawings. Expedite conflict or interferences and submit solutions/recommendations for approval review.

C. Drawings: Shop drawings shall include but are not necessarily limited to the following:
1. Submit 1/4" = 1'-0" minimum scale, a combined, comprehensive mechanical coordination drawing. Coordination drawing shall include all ductwork, mechanical piping, plumbing, sprinkler systems, and ceiling systems overlaid on structural frame and architectural plan. Shop drawings are to be coordinated with all electrical and Telecom systems.
2. Criteria: Ductwork, mechanical piping, plumbing, and sprinkler system components shall be sized as shown on Drawings. Seismic restraints shall be shown where required. Nonconforming Mechanical work installed within designated coordination areas is subject to removal and replacement by the installing contractor at no additional cost to Owner.
3. Provide sections for congested areas.
4. Identify typical areas, start preparation of coordination drawings for such areas first.

D. Where required for coordination purposes, Contractor to modify duct shape to an equivalent flattened size at no additional cost to the owner. Contractor to limit duct aspect ratio to 3:1 unless provided special written permission by the Architect.

E. Coordination drawings shall be signed and dated by individual trade contractors. By act of signature and submittal of singular combined coordination drawing, each trade contractor acknowledges their coordinated portion of the work with all other mechanical, electrical, telecom, architectural, and structural work contractors.

F. After completion of coordination shop drawings signed by individual trade contractors. Submit copies to the architect for review. Once approved, provide copy at the job site for reference. No work shall be performed without the complete coordination shop drawings.

G. No request for information regarding the routing of pipes, ductwork and placement of equipment will be reviewed and responded to without a completed shop drawings.

1.10 SITE CONDITIONS

A. Information of the drawings relative to existing conditions is approximate only. Deviations found necessary during progress of construction to conform to actual conditions as approved by the Architect shall be made without additional cost to the Owner. The Contractor shall be held responsible for any damage caused to existing services. Promptly notify the Architect if services are found which are not shown on the Drawings.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Mention herein or on Drawings requires that this Contractor provide each item listed of quality noted or equal. Refer to subsequence division 23000 specification sections for specific equipment and system materials and accessories.

B. All material shall be new, full weight, standard in all respects, and in first-class condition.

C. Provide materials of the same brand or manufacture throughout for each class of material or equipment wherever possible.

D. The grade or quality of materials desired is indicated by the trade names or catalog numbers stated herein.
E. Dimensions, sizes, and capacities shown are a minimum and shall not be changed without permission of the Architect.

F. Conform to the State Energy Conservation Standards for all material and equipment.

2.02 MATERIALS FURNISHED:

A. Identify all materials and equipment by manufacturer's name and model number. Remove unidentified materials and equipment from site.

B. Equipment specified by manufacturer's number shall include all accessories, controls, etc. listed in catalog as standard with equipment. Furnish optional or additional accessories as specified.

C. Equipment or material damaged during transportation, installation, or operation is considered as totally damaged. Replace with new equipment. Variance from this permitted only with written consent of the Architect.

D. Deliver, Protection, and Care:
   1. Deliver materials or equipment to the Project in the manufacturer's original, unopened, labeled containers.
   2. Added costs associated with reordering, expediting orders, or project delays due to rejected materials shall be borne by the Contractor.
   3. Protect from damage which may be caused by theft, weather, and building operations. Failure to protect materials and apparatus adequately shall be sufficient cause for rejection of any damaged material or equipment.
   4. Close pipe and equipment openings to prevent intrusion of obstructions and damage.
   5. Owner or Architect will require removal and replacement of such material or work from the premises which is not in accordance with Contract Documents. Replace unsatisfactory work without delay, at no additional cost to the Owner.
   6. All material and equipment shall be protected against moisture, dirt and damage. Protective coverings shall be provided for bearings, open connections to pumps and tanks, coils, ducts, pipes and similar equipment that is vulnerable to grit and dirt.
   7. The interior of the pipes and ducts shall be kept clean at all times.

PART 3 - EXECUTION

3.01 GENERAL:

A. General arrangement and location of piping, ductwork, equipment, etc. are shown on Drawings or herein specified. Carefully examine other work that may conflict with this work. Install this work in harmony with other crafts and at proper time to avoid delay of work. Provide all offsets as required to avoid other trades at no additional cost to the owner.

B. In advance of construction, work out minor changes and relocations to suit actual conditions and work of other trades to avoid conflict therewith. This shall not be cause for additional cost.

C. Execute any work or apparatus shown on the Drawings and not mentioned in the specifications, or vice versa, the same as if specifically mentioned by both. Omission from Drawings or specifications of any minor details of construction, installation, materials, or essential specialties does not relieve this Contractor from furnishing same in place complete.

D. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.
   1. Minor piping associated with instrumentation and control is generally not shown. Interconnection of sensors, transducers, control devices, instrumentation panels,
combustion control panel, burner control panels is the responsibility of the contractor. Small piping associated with water cooling, drips, drains and other minor piping may not be shown to avoid confusion in the plan presentation but shall be provided as part of contract work. Drains shall be piped to the nearest floor drains.

E. Furnish materials and work at proper time to avoid delay of the work.

F. Coordinate with testing and balancing contractor to review drawings for proposed additional balancing components required for proper system testing and balancing.

3.02 ACCESS:

A. Continuously check Architectural Drawings for clearance and accessibility of equipment specified herein to be placed. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing his equipment into proper position.

3.03 CLOSING IN OF UNINSPECTED WORK:

A. Do not allow or cause work installed to be covered up or enclosed before it has been inspected and tested. Should work be enclosed or covered up before it has been inspected and tested, uncover work at own expense. After it has been inspected and tested, make repairs necessary to restore work of other contractors to condition in which it was found at time of cutting.

3.04 PROJECT MODIFICATIONS:

A. During the progress of construction, if such conditions arise that require revisions, modifications, or relocations to any mechanical equipment or materials incorporated in this project, such alterations shall be immediately called to the attention of the Architect. Contractor shall then prepare necessary Drawings showing proposed changes. Submit proposed changes for review by the Architect prior to actual revision work in the field.

B. Two sets of Drawings showing all revisions shall be immediately presented to Architect for his records. Maintain additional copies on the project as necessary to comply with "RECORD DRAWINGS" requirement of the General Requirements.

C. Incorporate all revisions into record Drawings.

3.05 FORMING, CUTTING AND PATCHING:

A. Coordinate with other contractors as necessary to provide any special forming, recesses, chases, etc., and provide wood blocking, backing, and grounds as necessary for proper installation of mechanical work.

B. If this Contractor fails to coordinate with other contractors at proper time or fails to locate items properly, resulting in extra work, then this Contractor is responsible.

C. This Contractor is responsible for proper placement of pipe sleeves, hangers, inserts, and supports for work.

D. Cutting, patching, and repairing of existing (old) construction to permit installation of piping, etc. is responsibility of this Contractor. Repair or replace damage to existing work with skilled mechanics for each trade involved in first-class manner.

E. Cut existing construction in a neat and workmanlike manner by the use of a concrete saw. Use of pneumatic devices will not be allowed.
F. Core openings through existing construction as required for the passage of new piping and conduits. Cut holes of the minimum diameter to suit size of pipe installed and associated insulation.

3.06 DEMOLITION AND SALVAGE:

A. Provide demolition of mechanical work under this SECTION as indicated on Drawings.

B. Removed materials which will not be re-used and which are not claimed by the owner shall become the property of the Contractor and shall be removed from the premises. Consult Owner before removing any material from the premises. Carefully remove materials claimed by the owner to prevent damage. Coordinated delivery of such items to owner.

C. Removed materials which are to be reused are to be removed, cleaned, and stored in a safe location. If such items are lost or damaged by the Contractor, item shall be replaced with new item at no added cost to owner. If item is found to be damaged prior to removal, inform Architect prior to removal so that item may be examined by Architect and owner for further instructions.

3.07 WELDING FOR MECHANICAL WORK

A. All mechanical welding and inspection requirement shall be in accordance with the California Mechanical Code.

B. Qualify welding procedures, welders and operators shall be in accordance with ASME boiler and pressure vessel code, section IX, welding and brazing qualifications. Welding procedures and testing shall comply with ANSI standard B31.9 - standard code for pressure piping, and the American Welding Society (AWS) welding handbook.

C. Soldering and brazing procedures shall conform to ANSI B9.1 standard safety code and NFPA 99.

D. All welders shall be certified by a state approved welding bureau. Fabricator shall have current and valid certificated registration by the building official for the types of welds required by the project. Prior to start of the project, the fabricator shall submit a copy of certificate of registration for approval. Prior to project close out, the fabricator shall submit a certificate of compliance that the work was performed in accordance with the approved plans and specifications to the building official and to the Engineer or Architect of record.

3.08 EXISTING SERVICES:

A. Provide and install all required connections to existing systems as required by the Drawings and specifications.

B. Integrate existing systems with all new work to provide a complete working system.

C. Provide minimum 72 hour notice to Owner of service interruptions. All service interruptions shall be kept to the minimum possible time. When requested by Owner service interruptions shall occur outside of normal working hours at no additional cost to owner.

3.09 ASBESTOS ABATEMENT:

A. Existing systems within the area of this scope of work may have asbestos-bearing materials. Testing, encapsulation, removal, treatment, or correction of existing asbestos-bearing
materials is not a part of this scope of work and is not the responsibility of the mechanical contractors.

3.10 STRUCTURAL DESIGN OF EQUIPMENT AND SEISMIC RESTRAINTS:

A. All mechanical equipment supports shall be designed by a licensed Structural Engineer and shall comply with the 2013 California Building Code, Section 1616A.1.18 through 1616A.1.26 and ASCE 7-10, Chapters 6 and 30.

B. Provide seismic sway bracing for all suspended piping and ductwork in accordance with the OSHPD anchorage pre-approval OPA-0349, the “Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork, and Electrical Systems”.
   1. Badger, B-Line, Superstrut, or equal systems bearing current OPA numbers shall also be acceptable.

3.11 WARRANTY

A. Be responsible for work done and material installed under these plans and specifications. Repair or replace, as may be necessary, any defective work, material, or part which may show damage to itself or other materials, furnishing, equipment, or premises caused by such defects during this period, if in the opinion of the Architect said defect is due to imperfection of material or workmanship. Provide all such work and materials at no cost to Owner.

B. Be responsible for damage to any part of premises during guarantee period caused by leaks or breaks in work furnished and/or installed under this section. Replace refrigerant, lubricants, or gasses lost as result of defects, breaks, or leaks in work.

C. Provide manufacturer’s written warranties covering defects in material and workmanship of products and equipment utilized for the project.

D. Warranties shall be for a period of 1 year from the date of substantial completion unless more stringently specified within individual Sections of this Division.

3.12 TEMPORARY HEAT:

A. The General Contractor will provide for all temporary heat at such times as may be required or directed by the Architect and pay all fuel and energy costs incurred. Temporary heating facilities proposed for use by the General Contractor will be subject to review of the Architect.

B. The permanent heating, ventilating, and air conditioning (HVAC) system shall not be operated or used to provide air to the space during construction. Start-up of this system shall not commence until the building is cleaned.
   1. If the permanent HVAC system is required to operate during the course of construction and prior approval of owner and architect is obtained, the Contractor shall provide 2" thick, MERV 8 filters at all return, exhaust, and transfer grilles. Filters shall also be provided at all return air ducts open to the plenum. Filter shall completely cover opening and be sealed tight as to not allow dirt/debris into the system. Filters to be provided at no additional cost to the owner and are to be removed upon completion of project. Filters to be inspected daily prior to the start of the HVAC system. Dirty filters are to be replaced.
      a. Failure to comply with the above shall result in a complete cleaning of the duct system at no additional cost to the owner.

3.13 START-UP PROVISIONS FOR MECHANICAL WORK

A. General: Major equipment (such as air handling units, boilers, and chillers) start-up shall be performed by the equipment manufacturer or authorized representative.
B. Adjusting and Aligning Equipment: Adjust all equipment. Check all motors for proper rotation.

C. Lubrication:
   1. Extend grease fittings on bearings to points of ready and easy accessibility.
   2. Lubricate fan bearings, etc., before operation of any equipment.
   3. Provide a final lubrication to equipment immediately before turning over to Owner.

D. Upon completion of the mechanical work, or at such time prior to completion as may be determined by the Architect, operate and test all mechanical equipment and systems to demonstrate the satisfactory overall operation of the building or project as a complete unit. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install new air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests. Test equipment and systems for a minimum as follows:
   1. Packaged AC Units (under 20 tons), ductless split systems: 2 consecutive 8-hour days
   2. Boilers, chillers, hydronic systems: 5 consecutive 8-hour days.
   3. Water Heaters, Air compressors, Vacuum Pumps: 2 consecutive 8-hour days

E. Provide training and orientation of Owners operating staff in proper care and operation of equipment, systems and controls.

F. Neatly tabulate and deliver to the Architect complete operational data, including air flows, room temperatures, fan speeds, motor currents, plenum and duct static pressures, and other data as required. The Architect reserves the right to spot check results, and if discrepancies or errors are noted, Contractor will be required to redo balancing tests and tabulations entirely.

G. During test period, make final adjustments and balancing of equipment, systems, controls, and circuits so that all are placed in first-class operating condition.

H. Mark final positions of balancing valves after balancing is complete.

I. All areas of building shall receive proper flow of hot and chilled water to assure adequate and uniform temperatures throughout.

J. Final observation will not be made until all of the above have been completed and a preliminary copy of the balance report has been submitted and reviewed.

3.14 POST-CONTRACT COMPLETION TESTS:

A. If the required full-load operation conditions cannot be obtained at the time of the Project Completion Tests due to outdoor seasonal temperatures, return to the job site when requested by the Architect and complete proper loading of equipment and systems as required. Changing of any air filters will not be required under these tests. Contractor will be allowed seven calendar days after notification to begin tests.

3.15 PRE-SEASON START UP:

A. When requested by the Owner within one year of the filing of Notice of Completion, and when full-load tests required under Project Completion Tests and Post Contract Completion Tests have not been performed, start up any equipment or systems required for heating or cooling season operation by the Owner when such equipment and systems have remained shut down immediately after the Project Completion Tests. Make proper assurance that all equipment and systems are operating properly before being turned over for the first operational use of the Owner within one year of filing of Notice of Completion. The changing of any air filters will not
be required under these start-up requirements. The Contractor will be allowed seven calendar
days after notification, to begin test.

3.16 MECHANICAL RECORD AS-BUILT DRAWINGS:

A. During the course of Project Construction, Mechanical Contractor shall maintain recorded “AS-
built” information by distinctively marking up approved shop drawings prints to depict all actual
work installed on a daily basis form but not limited to field conditions, addendums,
arhitectural supplemental instructions (ASIs), instruction bulletins (IBs), change orders
(COs), responses to Request For Information (RFIs), and approved product substitutions.

B. The marked-up shop drawings will be made available at the Construction Site to the Architect
upon request, at any time.

C. The marked up shop drawings with the recorded information shall then be used to create
Record As-built drawings at the completion of the project. Contractor shall submit the Record
As-built drawings in full size hard copies and also in CAD files format using the AutoCAD 2004
or later version.
   1. Hand marked shop drawings are not acceptable.
   2. Provide 2 complete sets of full size drawings on 20 pound white bond paper.
   3. Provide 1 CD (compact disc) with Record drawings in either AutoCAD, version 2004 or
      later version.
   4. Record as-built drawings are to be full size drawings (same size as Contract Documents)
      and all plans are to be to standard engineering scale. The minimum drawing scale to
      match those provided within the Contract Documents.

D. Record As-built drawings shall include the followings:

   1. General:
      a. Work on Record As-built drawings shall be provided with horizontal and vertical
dimensions. Underground work shall be provided with invert elevations. All
dimensions shall be references to permanent building fixed points and/or column
lines.
      b. Provide sufficient details and sections to depict actual installations.
      c. Equipment identifications and system labeling nomenclatures shall match the
         Project Design Documents.
      d. Identification of main shut-off valves shall be based on the approved valve tag list
         and as actually installed in field.

   2. HVAC:
      a. Ductwork mains and branches, size and location with duct elevation information.
      b. Locations of all dampers, including but not limited to balancing dampers, fire
         dampers, combination fire and smoke, air inlets and outlets, terminal units reheat
         coils, humidifiers, duct access doors and ceiling access panels.
      c. Piping mains and branches, size and location with pipe elevation information and
         invert elevations for underground piping.
      d. Locations of all manual and automatic valves, pipe strainers, expansion joints and
         compensators, pipe guides and anchor points, steam traps and air vents.
      e. Equipment locations with dimensions from prominent building lines and required
         service access.
      f. Seismic bracing information for ductwork, piping and equipment.
      g. Locations of control system panels, control power transformer panels miscellaneous
         relay panels, control workstations, routing of control system communication loops.
      h. Locations of all installed instruction and control field devices in occupied space and
         above ceiling including but not limited to thermometers, pressure gauges, flow
meters, airflow stations, temperature sensors, differential pressure sensors, thermostats and humidistats.

3.17 CLEANING UP:

A. Remove tools, scaffolding, surplus materials, barricades, temporary walks, debris, and rubbish from the Project promptly upon completion of the work of each Section. Leave the area of operations completely clean and free of these items.

END OF SECTION
PART 1 – GENERAL

1.01 Summary

A. This section includes general mechanical materials and methods required within the project. Items included within this specification section include:
   1. Access Doors
   2. Valve Boxes
   3. Roof Flashing
   4. Dielectric Unions
   5. Thermometers
   6. Gauges
   7. Pipe and Equipment Identification
   8. Motors
   9. Motor Starter, Switches, And Wiring
   10. Fireproofing
   11. Painting
   12. Concrete
   13. Excavating And Backfill
   14. Electrical Work
   15. Commissioning and preliminary operational tests

1.02 Quality Assurance

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacturer of plumbing piping systems products, of types, materials, and sizes required whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor’s Qualifications: Firm with at least 5 years of successful installation experience on projects with piping systems work similar to that required of project.

1.03 SUBMITTALS:

A. Product data: submit complete data of materials proposed including:
   1. Manufacturer and model number
   2. Clearly indicate all options, trim, and accessories.
   3. Cross reference manufacturer’s cut sheet to specification section on submittal sheet.

B. Operation and Maintenance Data: where applicable, submit complete O&M data including:
   1. Maintenance data and parts lists for each component.
   2. Provide "trouble-shooting" maintenance guide
   3. Include this data within maintenance manual

PART 2 - PRODUCTS

2.01 VALVE BOXES:

A. Provide at each valve or cock in ground a Christy, Brooks, or equal valve box with cover marked for service.

B. Valve boxes in traffic areas: Provide Christy No. G5 traffic valve box, 10-3/8" inside diameter with extensions to suit conditions, with cast iron locking cover.
C. Valve Boxes in non-traffic areas: Provide Christy No F22, 8" inside diameter by 30" long with cast iron locking cover. Cut bottom of plastic body for operation of valve as required.

D. Extension Handles
   1. Handle to be Alhambra Foundry Co., or equal, model A-3008 extension handle.
   2. Furnish 2 extension handles per project for underground valves.

2.02 ACCESS DOORS:

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14-inch by 14-inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 18-inch by 24-inch minimum usable opening.
   1. All access doors less than 7'-0" above finished floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 8 in all respects, except as noted herein.

C. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.

D. Provide insulated doors where located in internally insulated ducts or casings.

E. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.

F. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the architect when access is required within these areas.

G. Available Manufacturers:
   1. Milcor
   2. Karp
   3. Nystrom
   4. Cesco

H. Access doors to be equivalent to the following Milcor access doors:
   1. Style M (plaster)
   2. Style A (A/C tile, gypsum board)
   3. Style M (Masonry)
   4. Style "Fire Rated" where required.

2.03 ROOF FLASHING:

A. Flashings in metal deck or membrane type roofing:
   1. Flashing for penetrations of the roof for mechanical items such as flues, ducts, and pipes will be furnished and installed under other sections of these specifications. The work of this section shall include layout, sizing, and coordination of penetrations required for the mechanical work.
   2. Furnish and install counterflashings above each flashing required in the mechanical work. Flues and ducts shall have 24-gauge galvanized sheet metal storm collar securely clamped to the flue or duct above the flashing.
   3. Sewer vents and other piping extending through roof structure shall have flashing provided and installed as part of the roofing work. This contractor shall coordinate his Work accordingly.
B. Flashing in built-up roofing assemblies:
   1. Where flashing is not provided and installed as part of other Work, furnish and install a
      waterproof flashing and counterflashing for pipe, duct, and flue passing through roof. The
      flashing shall extend a minimum of 9 inches in all directions from the outside of the pipe, flue,
      or duct.
   2. Sewer vents and other piping extending through roof structure shall have four-pound sheet
      lead flashings and Semco, Smith, or equal to Semco #1100-4, counterflashing sleeves
      installed as detailed.
      a. Provide Hydroseal at underside of counterflashings as recommended in Semco
         installation instructions.
   3. Flues shall have 24-gauge galvanized steel flashings on all roofs. Securely clamp a storm
      collar (counterflashing) around the flue above the flashing. Storm collars shall be of same
      material as flashing.
   4. Seal all pipes, flues, or ducts passing through exterior walls in an approved, watertight
      manner.

2.04 DIELECTRIC UNIONS:
A. Furnish and install dielectric unions at all locations described herein, whether shown on Drawings
   or not, and except as noted herein. Construct couplings and flanges so that the two pipes being
   connected are completely insulated from each other with no metal-to-metal contact. Heavily line
   the couplings with a hard, insulating, phenolic plastic threaded in standard pipe sizes. Make up
   the flanges with insulating components consisting of a hard, phenolic gasket, bolt sleeves, and
   bolt washers. Supplement the insulating gasket with neoprene faces to form a seal.

B. Acceptable Manufacturers:
   1. Watts Regulator Co.
   2. Eclipse, Inc.
   3. Perfection Corp.

2.05 THERMOMETERS:
A. General:
   1. Thermometers shall be furnished at all locations shown on the Drawings and in accordance
      with these specifications, whether shown on the Drawings or not
   2. All thermometers, unless shown otherwise, shall be of the bimetal helix or liquid-filled type.
   3. All thermometers shall be round, stainless steel case construction with glass front.
   4. Accuracy to be within plus or minus one of the smallest scale divisions throughout the entire
      range.
   5. The thermometer scales shall have a minimum of 2 degrees between graduations and a
      maximum of 20 degrees between figures.
   6. The thermometers shall be located so as to be easily read and shall be furnished with
      adjustable angle pattern so as to be rotated to any position.
   7. Liquid thermometers for tanks and similar equipment shall have a minimum 5-inch diameter
      face.
   8. Thermometers for piping shall have a minimum face diameter of 3 inches.
   9. Thermometers installed on insulated tanks or piping shall be provided with an extension neck
      well to compensate for the thickness of the insulation.
   10. Thermometers shall be provided with stainless steel stems and steel wells.
   11. Thermometers used for air temperature in ductwork, plenum boxes, etc., unless specified or
       shown otherwise, shall have a minimum scale face of 5 inches and shall have an adjustable
       mounting flange so that scale may be set at any angle up to 45 degrees to facilitate reading.
       a. The thermometers shall have a perforated guard over stem suitable for sensing air
          temperature.
b. Length of stem shall be a minimum of 8 inches.

12. Thermometer wells with chain and cap shall be provided where wells are indicated on the drawings.

B. Provide Pete's Plug II, Sisco P/T, or equal test plug with Nordel core where indicated on drawings.

C. Acceptable Manufacturers:
   1. Weston
   2. Marsh
   3. Taylor
   4. Or Equal

2.06 GAUGES:

A. General:
   1. Gauges and gauge connections shall be furnished at all locations shown on the Drawings and in accordance with these specifications, whether shown on the Drawings or not.
   2. Accuracy to be within 1 percent in the middle third of the dial range and equipped with front calibration.
   3. Dials to be white with black numerals.
   4. Normal reading to be mid-scale.
   5. Provide a needle valve on each gauge connection.
   6. Gauge to have bronze bushed movement and front recalibration.
   7. Gauges shall have a minimum dial size of 3-1/2 inches.

B. Provide Pete's Plug II, Sisco P/T, or equal test plug with Nordel core where indicated on drawings.

C. Acceptable Manufacturers:
   1. Marsh, Series J
   2. U.S. Gage
   3. Danton 800

2.07 PIPING AND EQUIPMENT IDENTIFICATION:

A. Pipe Identification:
   1. Each piping system furnished and installed under this work shall be identified and the direction of flow indicated by a prefabricated coiled plastic colored label.
   2. Labels shall comply with ASME A13.1 with regard to color, letter height, and marker size. The labels shall have black or white lettering and flow arrows on colored backgrounds and shall not require adhesive. The background colors shall conform to the color schedule shown in this Article.
   3. For use indoors use 20 mil vinyl labels, MSI model MS-970, or equal. For piping with an outside diameter greater than 6 inches provide the label manufacturers nylon straps to secure label to piping.
   4. For use outdoors use Polyester/Tedlar laminated material, MSI model MS-977, or equal. For piping with OD greater than 6" provide the label manufacturers stainless steel straps to secure label to piping.
5. The size of the lettering and label shall be such that the lettering can be easily read from the floor and the colors easily discernible.

6. Acceptable Manufacturers:
   a. Marking Services Incorporated (MSI)
   b. Idento Metal Products Co., Idento Bands
   c. Setmark

B. Equipment Identification:

1. Provide white lamacoid plate for each and every piece of equipment installed in this work.
   a. Lettering on plate shall be black, with size of lettering to suit equipment.
   b. Lettering shall be minimum of 3/8-inch in height.
   c. Plates shall be riveted or bolted to equipment.

2. Equipment to include, but not limited to:
   a. Air Handling Units
   b. Exhaust Fans
   c. VAV / CAV Boxes
   d. Split Systems AC Units
   e. Boilers
   f. Chillers
   g. Pumps
   h. Air Compressors
   i. Etc.

C. Acceptable Manufacturers:
   1. Marking Services Incorporated, (MSI)
   2. LEM Products
   3. Seton
   4. Craftmark

2.08 ELECTRIC MOTORS:

A. General:
   1. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

B. Electric Motors:
   1. All electric motors shall comply with requirements of NEMA, UL, ANSI/IEEE 112 and NEC, suitable for intended load, voltage, phase, frequency, service, and location.

   2. Limit maximum motor speeds to 1750 rpm, unless otherwise specified.

   3. Motors 1/2 HP and larger shall be 3 phase, 60 Hz, squirrel cage induction motors unless specifically specified to the contrary in subsequent Sections of this Division.
      a. Refer to Drawings for voltage requirements.
      b. Totally enclosed motors rated 3/4 HP, 1200 rpm, or 1 HP and larger, and all drip-proof motors shall have a 1.15 continuous-duty service factor at 40°C ambient temperature.
      c. Insulation system shall be NEMA Class F or better.
      d. Provide double-shielded, grease-lubricated ball bearings with grease pockets on each side for regreasing in service.
      e. Provide inlet and outlet grease connections in 7.5 HP and larger motor housings for each bearing.
f. Motors 5 HP and smaller and all roof-mounted equipment motors shall be provided with factory sealed, permanently lubricated ball bearings.

4. Motors smaller than 1/2 HP shall be single phase, 110 volt permanent split-capacitor type with integral thermal overload protection. Bearings shall be factory sealed, permanently lubricated ball type.

5. Provide totally enclosed motors, or suitable protection per NEMA Standards, in locations exposed to the weather or dripping water and in air handling units downstream of cooling coils and heat recovery coils. Other motors shall be open drip-proof.

6. Multi-speed motors shall be provided where specifically scheduled.

7. Motors feed by variable frequency drives (VFD) shall be specifically designed by motor manufacturers for variable frequency drive application.

8. Minimum Efficiency and Power Factor: Minimum Power Factor shall be 85 percent minimum, in all sizes, and minimum efficiency shall be as follows, for 1,750 rpm motors as tested in accordance with NEMA Table 12-6D. The minimum efficiencies shall be guaranteed.

<table>
<thead>
<tr>
<th>Motor HP</th>
<th>Efficiency Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>85.5</td>
</tr>
<tr>
<td>1-1/2</td>
<td>86.5</td>
</tr>
<tr>
<td>2</td>
<td>86.5</td>
</tr>
<tr>
<td>3 and 5</td>
<td>89.5</td>
</tr>
<tr>
<td>7-1/2 and 10</td>
<td>91.0</td>
</tr>
<tr>
<td>15-20</td>
<td>92.4</td>
</tr>
<tr>
<td>25-30</td>
<td>93.6</td>
</tr>
<tr>
<td>40 and 50</td>
<td>94.1</td>
</tr>
<tr>
<td>60</td>
<td>94.5</td>
</tr>
<tr>
<td>75</td>
<td>95.0</td>
</tr>
<tr>
<td>100-125</td>
<td>95.4</td>
</tr>
<tr>
<td>150 and larger</td>
<td>95.8</td>
</tr>
</tbody>
</table>

9. Overload protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.


11. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

C. Acceptable Manufacturers:
   1. Reliance
   2. Baldor
   3. US Motors
   4. Westinghouse
   5. Lincoln
   6. General Electric

2.09 **MOTOR STARTERS, ELECTRICAL DEVICES, AND WIRING**

A. Motor Starters:
1. Magnetic motor starters for equipment provided under the Mechanical Work shall be furnished by the Mechanical Contractor and turned over to the Electrical Contractor for installation, unless otherwise noted.
   a. Magnetic motor starters shall be provided as part of motor control centers shall be provided and installed by Electrical Contractor

2. Unless otherwise noted, magnetic motor starters shall be furnished in NEMA 4 enclosure for outside installation and NEMA 1 enclosure for inside installation, with three thermal overloads for three-phase motors and one overload element for single-phase motors. All overloads shall be ambient compensated.


4. Furnish 3-phase motors with full voltage, magnetic across-the-line starters unless noted otherwise.

5. Provide thermal overload protection for all 3-phase legs. Provide motor starters with single phase protection.

6. Provide fail-open auxiliary contacts, pre-wired to a terminal strip, for future remote alarm wiring and run-time totalization. Refer to Division 16.

7. Provide equipment starters with an adequate control transformer, complete with fuse protection, to supply 120 volt source for control circuit, regardless of line voltage.

8. Provide hand-off-automatic selector switches in cover.

9. Variable Frequency Drive Controllers: Provided under Section 15190 - Variable Frequency Drive Controllers.

B. Manual switches shall have pilot lights and extra positions for multi-speed motors.

C. Overload protection: Melting alloy type thermal overload relays.

D. 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, pneumatic switches, electric relays and similar devices as required for coordination with control requirements of Division 15 Controls Sections.
   4. Externally operated manual reset.
   5. Under-voltage release or protection.

E. Motor connections:
   1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

2.10 FIREPROOFING

A. Fireproofing to be installed at all pipe and duct penetrations of rated assemblies.

B. Fireproofing to be UL Rated fire stop material.

C. Acceptable Manufacturers:
   1. Hilti
   2. 3M Pro-Set
   3. Or Equal
PART 3 - EXECUTION

3.01 ACCESS DOORS:

A. Access doors shall be furnished and installed wherever valves, balance valves, damper operating mechanisms, air terminal boxes, fans, and similar items normally requiring adjustment or servicing are installed in concealed or inaccessible spaces. Coordinate with access doors shown on architectural Drawings.

B. Comply with manufacturer’s instructions for installation of access doors.

C. Where access panels are detailed on architectural or mechanical Drawings, sizes indicated thereon shall be used.

D. Keyed access doors shall be keyed alike.
   1. Provide owner with 4 copies of keys for access doors.

3.02 VALVE BOXES:

A. Provide valve box for all buried valves. Install per manufacturer’s written instructions with top of box flush with finished grade.

B. Clean all valve boxes of debris.

3.03 ROOF FLASHING:

A. Provide pipe flashings as noted on the Drawings.

B. Flue and duct flashings and storm collars shall be securely clamped around flue or duct storm collar or counterflashing, above flashing.

3.04 DIELECTRIC UNIONS:

A. Install dielectric unions in the following locations:
   1. In all metallic water and gas service connections into the building within 5 feet of the building wall. Install adjacent to the shut-off valve or cock and above ground where possible.
   2. At points of connections where copper water lines connect to steel domestic water heater tanks and other equipment.
   3. At points in piping where dissimilar metal pipes are connected together.
   4. Any special applications shown on the Drawings.
   5. Where steel or cast-iron pipe in the ground connects to copper or brass piping above the ground, the transition from steel or cast-iron pipe to the copper or brass pipe shall be made above ground in all cases and in an accessible location where practicable.
   6. Where copper or brass piping is connected to steel or cast-iron piping and the connection is buried in the ground, the connection shall be covered with coal tar protective tape extending outward a minimum of 5 feet on all pipes, from the point of connection. The tape shall have a minimum thickness of 10 mils and a maximum thickness of 12 mils and shall be applied so as to provide at least two full thicknesses of the tape over the piping. A primer, specifically designed for use with the tape, shall be used. The piping shall be thoroughly cleaned before any tape or primer is applied.

3.05 THERMOMETERS:
A. Liquid thermometers for piping systems shall be installed so that the liquid flows completely around the bulb.

B. Enlarge pipes smaller than 2 1/2" for installation of thermometer wells.

C. Apply thermal grease in thermowells prior to installation of thermometers.

D. Where shown on the temperature control diagram, the temperature control subcontractor shall furnish and install remote, bulb, panel-mounted, pneumatic-type thermometers. Duct-mounted thermometers may be omitted at these locations.

E. Locations: Thermometers shall be placed at all locations shown on the Drawings and at locations specified below. Ranges shall be as specified below.

<table>
<thead>
<tr>
<th>Location</th>
<th>Range (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air inlet and outlet of each bank of heating and cooling coils.</td>
<td>30 to 120 °F</td>
</tr>
<tr>
<td>Adjacent to each insertion type thermostat installed (Hot Water) under &quot;Temperature Control.&quot;</td>
<td>+50 to 250 °F</td>
</tr>
<tr>
<td>Thermometer bulb to be installed adjacent to bulb (Chilled Water) of insertion thermostat.</td>
<td>+25 to 125 °F</td>
</tr>
<tr>
<td>In both the water inlet and water outlet of each bank of Hot water and chilled water coils and heat exchangers</td>
<td>+50 to 250 °F</td>
</tr>
<tr>
<td>In both the water inlet and water outlet of cooling tower</td>
<td>+50 to 250 °F</td>
</tr>
</tbody>
</table>

F. In such cases where the above described thermometers cannot be located so as to be easily read, a remote reading type of thermometer shall be installed, as approved by the Architect.

G. Thermometers provided as part of the temperature control work and located on a control panel, etc. need not be duplicated by above requirements.

3.06 GAUGES:

A. Gauges shall have indication of 0 to 160 psi where indicated pressure will be greater than 40 PSI and 0 to 60 psi for lesser pressures.

B. Provide gauge connections at the following locations:
   1. Inlet and outlet of butterfly-type balancing valves.
   2. Inlet and outlet of water chiller.
   3. Suction and discharge of circulating pump.
   4. Elsewhere as may be shown on the Drawings.

C. Gauges shall be provided in an convenient location within approximately 5 feet of the flanges or connections and elsewhere as may be shown on the Drawings.

D. A needle-point globe valve, similar to Crane No. 88, shall be supplied at each gauge and gauge connection.
E. A gauge siphon located adjacent to the gauge shall be applied with each hot water gauge.

3.07 PIPE AND EQUIPMENT IDENTIFICATION:

A. Identification shall be applied to all piping, except piping located in furred spaces without access to permit entrance of personnel, and piping buried in the ground or concrete.

B. Underground pipe identification shall consist of a buried, continuous, preprinted, bright colored, plastic ribbon cable marker provided for each underground pipe.

C. The legend and flow arrow shall be applied at the following locations:
   1. All valve locations,
   2. All points where piping enters or leaves a wall, partition, cluster of piping, or similar obstruction
   3. All exposed locations
   4. At approximately 20-foot intervals on pipe runs.

D. Practical variations or changes in locations and spacing may be made with the specific approval of the Architect to meet specific conditions.

E. Wherever two or more pipes run parallel, the printed legend and other markings shall be applied in the same relative location so that all piping is easily identified.

F. The marking shall be located so as to be readily conspicuous at all times from any reasonable point of vantage.

G. Where different equipment, such as fire sprinklers, are supplied from a common main, such as domestic water, the main should be identified as "Domestic Water" and each respective branch takeoff as "Fire Water," etc.

H. The non-potable water plumbing piping shall be marked with the legend "Danger - Unsafe Water". This legend shall be applied to both hot and cold water systems along the length of the pipe in fluorescent orange at a maximum of five foot intervals.

I. Lettering size and label colors are to be per ASME/ANSI A13.1 Pipe Marking Standards.

3.08 MOTORS:

A. Motors furnished in the Mechanical Work shall be furnished by the Mechanical Contractor, but such equipment shall be delivered to the Electrical Contractor for mounting and connecting to power wiring. Coordinate all motor starter requirements with Electrical Contractor.

3.09 MOTR STARTERS SWITCHES, AND WIRING:

A. Starters located in motor control centers will be provided under the Electrical Work. Contractor is referred to electrical drawings for motors served by motor control centers.

B. Starters furnished by the Mechanical Contractor to be delivered to the Electrical Contractor for mounting and connecting to power wiring. Coordinate all motor starter requirements with Electrical Contractor.

3.10 FIREPROOFING:

A. Pack the annular space between the pipe sleeves and the pipe and between duct openings and ducts through all floors and walls with UL listed fire stop.
B. Fireproofing system to be installed in strict accordance with manufacturer's written instructions and details.

3.11 PAINTING:

A. Perform all priming and painting on the equipment and materials as specified herein.

B. Exposed piping and unfinished portions of equipment to be painted shall be cleaned of grease, oil, rust, or dirt in preparation for painting.

C. Where applicable, remove pipe clamps prior to painting so that entire pipe is painted. Provide temporary support as required. Re-install clamps after priming/painting is complete.

D. Priming:
   1. Contractor to prime all exposed ferrous metals, including piping, which are not galvanized or factory-finished.
      a. Black steel pipe exposed to weather shall be cleaned and primed with one coat of Rust-Oleum, or equal, #1069 primer. Color to be Grey.

E. See Painting Section for detailed requirements.

3.12 CONCRETE

A. Concrete and reinforcing steel shall be equal to that specified for General Construction.

B. Except as noted above, concrete work will be furnished and installed under General Work. This Contractor shall coordinate requirements accordingly.

3.13 EXCAVATING AND BACKFILL

A. Perform all excavating required for work of this Section. Do excavating required for installation of piping and service lines and other work that applies as indicated on Drawings. Verify location and elevation of all existing utilities prior to excavation for installation of new piping. Provide the services of a pipe/cable locating service prior to excavating activates to determine location of existing utilities.

B. Excavations shall be of open vertical construction of sufficient width to provide free working space at both sides of trench and around pipe as required for caulking, joining, backfilling, and compacting. Unless shown otherwise, provide a minimum of 2'-6" cover above top of pipe to finished grade for all service piping unless otherwise noted. Trim trench bottom by hand or provide a minimum of 4" deep sand bed to provide a uniform grade and firm support throughout entire length of pipe. For PE gas pipe, bed the pipe in a 4" sand bed.

C. Dig trenches straight and true to line and grade with holes for bells for bell-and-spigot pipe. Evenly support piping for its entire length upon outside periphery of lower one-third of pipe. Where rock is encountered, undercut trenches 3 inches and fill with well-tamped, clean sand and pea gravel to correct pipe elevation.

D. After pipe lines in excavation have been installed and tested, backfill excavation to point 6 inches above pipe using sand, fine earth, or other materials free of rocks and large lumps. Proceed evenly on both sides of pipe and continuously tamp. Except as hereinafter noted, backfill above 6 inches above top of pipe shall be made by using earth from excavation placed in layers of 8-inch maximum depth. Compaction of each successive layer will be made with mechanical compactor.
E. Take special care in backfilling over wrapped piping to prevent damage to protective wrapping.

F. Bed sewers under pavements, wrapped piping, and PVC piping in sand prior to backfilling. Backfill to point 6 inches above pipe with sand.

G. This Contractor shall replace sod, concrete, asphalt paving, curbs, pavement, walks, and any other type of existing work or surface disturbed by excavation, using workmen skilled in trade involved.

H. When pipe or underground conduit with a protective wrapping is to be placed in the trench, sand only shall be used for bedding the pipe or conduit. The sand used shall be certified to have a minimum resistance of 5000 ohms per cubic centimeter when wetted to any moisture content with distilled water and shall consist of clean, natural, washed-sand, hard, and durable particles varying from fine particles to particles of such size that all will pass through a 3/8-inch screen, not less than 90 percent will pass through a 1/4-inch screen, and not more than 25 percent will pass through a No. 50 screen.

I. Any backfill placed under this contract which subsides or settles below the adjacent finished grade or paving level during the guarantee period shall be brought to grade by the Contractor by adding compacted backfill or additional paving in paved areas.

3.14 ELECTRICAL WORK:

A. Adequate working space shall be provided around electrical equipment in compliance with the National Electric Code and other applicable codes or ordinances. The mechanical work shall be coordinated with the Electrical Work in order to comply with these requirements. Any work which does not conform to these regulations shall be properly corrected without additional cost to the Owner.

B. Furnish and install all line voltage and low-voltage temperature control wiring in the Mechanical Work by the Temperature Control SubContractor, including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Unless noted otherwise, this does not include primary control wiring between starters and push button or other manual starter switch or branch power circuits required for temperature control systems.

C. Temperature control equipment, including relays shown on control diagram, shall be furnished and installed by the Temperature Control Subcontractor.

D. Electrical devices with piping connections, such as solenoid valves, insertion thermostats, strap-on aquastats, and similar items which are to be wired under the Electrical Work or by the Temperature Control Subcontractor, shall be installed by the Mechanical Contractor.

E. Equipment furnished in this work that is factory wired but requires modification to internal wiring to meet specifications or drawing requirements shall have such internal modifications made at factory before shipment.

F. All electrical work and equipment, including internal wiring, must comply with applicable codes and applicable portions of electrical specifications. Run line and low-voltage control wiring in conduit. Conduit for temperature control wiring shall be responsibility of Mechanical Contractor and shall be of type specified in electrical specifications.

3.15 DEMOLITION

A. Refer to Division 1 sections for general demolition requirements and procedures.
B. Disconnect, dismantle, and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.
   1. Piping to be removed: Remove portion of piping indicated to be removed. Cap or plug remaining piping with same or compatible piping material.
   2. Piping to be abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material. Refrigerant system to be evacuated per EPA requirements.
   3. Ducts to be removed: Remove portion of duct indicated to be removed. Cap remaining ducts with same or compatible ductwork material and seal cap air-tight.
   4. Ducts to be abandoned in Place: Cap ducts with same or compatible ductwork material.
   5. Equipment to be removed: Drain down and cap remaining services and remove equipment.
   6. Equipment to be removed and re-installed: Disconnect and cap services and remove, clean, and store equipment. When appropriate, re-install, reconnect, and make equipment operational.
      a. If existing equipment which is to be re-installed is damage, contact architect prior to removal. Contractor to take pictures of any damaged equipment prior to its removal and submit pictures to Architect.
      b. Equipment damaged during removal, storage, or re-installation shall be the Contractor’s responsibility and is to be replaced with new at no additional cost to the owner.
   7. Equipment to be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, removed damaged or unserviceable portions and replace with new products of equal capacity and quality.

D. Non-Destructive Testing Of Existing Concrete Slabs:
   1. When drilling or saw cutting existing reinforced concrete, use care and caution to avoid cutting or damaging the existing reinforcing bars, conduit, or tendons. Use a non-destructive method to locate metals poured into the slab prior to doing any work.

3.16 CARE AND CLEANING:

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition.

B. Drain and flush piping to remove grease and foreign matter. Thoroughly clean out flush valves, traps, strainers, and pressure-reducing valves.

C. Keep the interior of all ductwork free of dirt, dust, loose insulation, and other foreign materials at all times.

D. Clean out and remove surplus materials and debris resulting from the work, including surplus excavated material.

3.17 OPERATION TEST:

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.18 CLEANING UP:
A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION
PART 1 – GENERAL

1.01 SUMMARY

A. This section includes total system balance, as defined by AABC, which constitutes the process of testing, adjusting, and balancing each system component so that the entire system produces the results for which it was designed. Testing results of total system balance shall be accepted by the Mechanical Engineer of Record and Owner.

1.02 QUALITY ASSURANCE

A. Balance agency shall be a member of Associated Air Balance Council (AABC), or National Environmental Balancing Bureau (NEBB).
   1. Company shall be a member of AABC or NEBB for a minimum of 5 years.

B. Work shall be done by qualified engineering technicians and trained personnel, using instruments certified accurate to limits used in standard practice for testing and balancing of hydronic and air distribution for heating-cooling systems. Agency shall field test air and hydronic flows in accordance with methods set up by Associated Air Balance Council, National Standard Volume 1, latest edition.

C. Approved Balancing Firms: Obtain service from one of the following firms (No others will be considered):
   1. RS Analysis
   2. Raglen System Balance
   3. MESA 3

D. AABC Compliance: Comply with AABC's "National Standards," Volume 1, as applicable to mechanical air and hydronic distribution systems and associated equipment and apparatus.

E. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments and testing, adjusting and balancing, except as otherwise indicated.

F. Reference Standards: Comply with the following Standards:
   2. ASHRAE - American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.
   4. ASHRAE HVAC Applications Handbook, Chapters 34 and 42 as applicable.
   5. ADC Test Code No. 1062, "Equipment Test Code."

1.03 WORK INCLUDED

A. Test and balance of existing and new air distribution system, and associated equipment.

B. Setting and adjusting speed and volume of systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required by contract documents.

C. Component types of testing, adjusting, and balancing specified in this section includes the following as applied to mechanical equipment:
1. Fans
2. Air handling units
3. Ductwork systems
4. Pumps
5. Coils and heat exchangers
6. Piping systems
7. Terminal units
8. Relief vent and/or power exhaust section of economizers.

D. TAB agency shall perform the following during installation phase of systems:
1. Study design specifications and engineering Drawings and prepare schedule to physically inspect mechanical equipment for hydronic and air distribution systems to be tested and balanced.
   a. Contractor shall provide TAB agency with one copy of Contract Drawings and specifications, mechanical equipment submittals, and change orders necessary for proper balancing of air distribution systems.
2. TAB agency shall make periodic field inspections prior to closing in portions of systems to be balanced. Agency shall verify to its satisfaction that all work, fittings, dampers, balancing devices, etc. are properly fabricated and installed as shown or specified and that Agency will be able to properly balance system.
3. Prepare test and balancing schedule, test record forms, and necessary technical information about hydronic and air distribution systems for installed heating-cooling equipment.
4. Recommend adjustments and/or corrections to mechanical equipment and hydronic and air distribution systems that are necessary for proper balancing of systems.
   a. Corrections required based on TAB Contractor field inspections shall be made at no additional cost to the owner.

1.04 SUBMITTALS:

A. Contractor data:
   1. Provide TAB Contractor company information.

B. Duct Leakage Reports:
   1. TAB Contractor to provide TAB report for duct leakage tests.

C. Field Inspection Report:
   1. TAB Contractor to provide written verification of field inspections.
      a. Include date of inspection and list of all items to be corrected prior to balance.

D. TAB Contractor to provide Test Reports as follows:
   1. Submit data on printed report forms published by AABC.
   2. Include identification and types of instruments used and their most recent calibration date with submission of final test report.
   3. Reports to have computer generated drawings. Drawings to include: general building layout, ductwork and piping layout, HVAC equipment, and air inlet/outlet locations.
      a. Hand drawn/numbered drawings shall not be accepted.
   4. Reports to be stamped and signed licensed TAB Contractor.
   5. Submit three copies of complete test report prior to final acceptance of project.

E. Balance agency shall submit the results of tests in this SECTION for review by the Architect.

PART 2 - PRODUCTS

2.01 PATCHING MATERIALS:
A. Except as otherwise indicated, use same products as used by original installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.
   1. At tester's option, plastic plugs with retainers may be used to patch drilled holes in ductwork and housings.

2.02 TEST INSTRUMENTS:

A. Utilize test instruments and equipment for test and balance work required, of type, precision, and capacity as recommended in the following test and balance standards:

PART 3 - EXECUTION

3.01 BALANCING OF EXISTING AIR HANDLING SYSTEMS:

A. Prior to any other Work being started on this project, test all existing air handling systems indicated on the drawings. Provide report indicating fan RPM and CFM, air velocity and air volume for all air inlets and outlets, and any recommended repairs or alterations to the existing system.

B. Prior to completion of the Work, rebalance all existing air inlets and outlets to conditions at start of Work.

3.02 BALANCING:

A. Upon completion of hydronic and air handling systems, balance agency shall complete tests, analysis, and balance of hydronic and air handling systems for heating-cooling equipment.

B. This report shall include as minimum, but not be limited to, following design and actual information:

1. Air-Moving Equipment Data:
   a. Fan or unit number.
   b. Location.
   c. Area served.
   d. Manufacturer.
   e. Model number and serial number
   f. Design and actual air-flow measurements:
      1) Total CFM.
      2) Return air CFM
      3) Outdoor air CFM
      4) Relief air CFM
      5) Total/external static pressure in w.g.
      6) Approximate suction static pressure in w.g.
      7) Approximate discharge static pressure in w.g.
      8) Fan rpm

2. Rated and Actual Motor Data:
   a. Horsepower / Break-horsepower
   b. Phase
   c. Voltage.
   d. Amperage.

3. Duct Velocity Traverse Data:
a. Fan or unit number
b. Design and actual CFM
c. Duct division signs and area.
d. Design and actual average velocity
e. Duct static pressure average velocity
f. Traverse location
g. Traverse measurements in fpm (show grid pattern)

4. Individual Outlet and Inlet Data:
   a. Identify each outlet for location, area, and fan or unit system
   b. Outlet or inlet manufacturer and type
   c. Outlet or inlet size, effective area or $A_e$ factor
   d. Design and actual velocity in feet per minute (FPM)
e. Design and actual CFM

5. Water Equipment Data Compilation:
   a. Installed Circulating Pump, Boiler, Chiller Data:
      1) Identification and location
      2) Service
      3) Manufacturer
      4) Model number and serial number
      5) Type drive, pump rpm
   b. Rated and actual motor data:
      1) Horsepower / Break-horsepower
      2) Phase
      3) Voltage
      4) Amperage
   c. Discharge and suction pressure (psig) and differential pressure (feet)
   d. Design and actual TDH (feet) and GPM

6. Terminal HVAC Units:
   a. Identification and location
   b. Service
   c. Manufacturer
d. Model number and serial number
e. Design GPM and pressure differential
f. Actual entering and leaving temperatures
g. Actual GPM
h. Operating temperatures - entering and leaving

7. Flow Indicator Data:
   a. Identification and location
   b. Service
c. Manufacturer
d. Model number and serial number
e. Pipe size
f. Design GPM and meter indication
g. Actual GPM and meter indication
h. Type of meter used

8. Reheat Coils
   a. Identification and location
   b. Service
c. Design GPM
d. Actual GPM
e. Pressure drop
9. Other information required to establish completely balanced systems.

3.03 BALANCE REQUIREMENTS:

A. Make allowance for air filter resistance at time of tests. Balance main air supplies at design air quantities and at an air resistance across filter bank midway between design specifications for clean and dirty filters.

B. Balance work within the following tolerances:
   1. Supply, Return, Exhaust inlets/outlets: balance within -5% / +10% of design CFM.
   2. Outside Air Inlets: balance within -0% / +10% of design CFM.
   3. Coils: balance within -5% / +10% of design GPM.

C. Rooms with positive or negative pressure requirements to maintain a minimum of 15% differential pressure regardless of the above tolerances.

D. Provide a room or building pressure test for each system. Maximum building pressure shall not exceed 0.03" inches of pressure.

E. HVAC systems shall be balanced at normal "minimum outside air" condition. Where such systems are required to deliver 100-percent return air or a variable amount of outside air, as indicated in specifications for automatic temperature control sequences, total CFM test shall be repeated for 100-percent return air and maximum outside air shall agree with conditions found under maximum outside air operation before system is considered to be in balance. Adjustments of proper dampers shall be made to achieve balance and marked so that control systems contractor may set damper motors accordingly.

F. After final air and hydronic balance of systems, make adjustments to obtain uniform temperatures as required by actual occupancy.

G. Take static pressure readings with inclined manometer. Take air velocity readings with instruments of recent calibration. Take final velocity readings with Alnor Velometer, Anemotherm or Vane Type Anemometer, calibrated prior to test and recalibrated at end of test. Include certified correction curves for each calibration as part of record. Certify instruments accurate to standards currently used in common practice for system balance work. Use test cones for diffusers.

H. Run tests with supply, return, and exhaust systems operating and doors, windows, etc. closed or under regular traffic. If possible, make final readings with cooling coils under load to ensure that static pressures are at maximum.

I. Adjust deflection of supply outlets to ensure proper and uniform air distribution throughout area served by such outlets.

J. Work with temperature Control Subcontractor in adjustment of automatic dampers, valves, thermostats, etc. required to maintain proper temperatures in all portions of building.

K. Contractor responsible for installing heating, cooling, and ventilating equipment shall make any changes, additions, or modifications to dampers, fan drives and motor sheaves, pump impellers, motors, and other equipment necessary for proper air and hydronic balance.

L. Balance of systems shall be reviewed by Architect and during this review Mechanical Contractor shall furnish men, materials, ladders, etc. to enable Architect to take all readings as he may direct. If errors are found, Balancing Agency shall readjust system to satisfaction of Architect.
PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes insulation types and thickness for mechanical and plumbing piping, ductwork, and equipment.

1.02 REFERENCES

B. California Building Code, California Electric code, NFPA, and UL
C. ASTM
D. ASHRAE
E. MAIMA
F. NFPA
G. SMACNA – Sheet Metal and Air Conditioning Contractor’s National Association, Inc.
H. Underwriter’s Laboratories
I. GREENGUARD

1.03 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firm specializing in manufacturing of mechanical insulation products applicable to project whose products has been in satisfactory use in similar services for a minimum of 3 years.

B. Installer’s Qualifications: Company specializing in piping insulation application with a minimum of 3 years experience.

C. Flame/Smoke Ratings: Insulation materials, including but not limited to insulation, jackets, coverings, sealers, adhesives, etc., to have flame-spread rating of 25 or less and smoke-developed index of 50 or less when tested in accordance with ASTM E84.

D. Insulating products to be installed in accordance with manufacturer’s written instructions and in accordance with recognized industry practices.

1.04 SUBMITTALS

A. Submit complete data of materials proposed.
   1. Indicate individual services for each system.
   2. Indicate proposed insulation thickness for each system
   3. Indicate proposed R-values, densities, etc. for each product.

B. Provide Manufacturer’s installation instructions for each product.

PART 2 - PRODUCTS
2.01 GENERAL

A. For purposes of this specification, fittings, joints, strainers, flexible piping, valves, etc. shall be considered as piping and shall be insulated with same material and thickness as adjoining piping unless noted otherwise.

B. Acceptable Manufactures
   1. Knauf
   2. Johns Manville
   3. Certainteed
   4. Owens-Corning

2.02 MATERIALS

A. Fiberglass Piping Insulation:
   1. Insulation to be heavy density glass fiber insulation.
   2. Insulation to have factory-applied self-sealing vapor barrier.
   3. Maximum K-Value at 75°F = 0.23 Btu-in/hr-FT²°F.
   4. Rigid segment of insulation to be provided at all pipe hangers
   5. Fittings and valves to be insulated with John Manville Zeston 2000 Series 25/50 Smoke-Safe PVC pre-molded insulated covering secured with standard fasteners.
   6. Insulation to be Johns Manville Micro-Lok or equal.

B. Flexible Closed Cell Insulation:
   1. Flexible elastomeric thermal closed-cell structure insulation.
   2. Maximum K-Value at 75°F = 0.27 Btu-in/hr-FT²°F.
   3. Joints to be sealed with Armstrong 520 Adhesive
   4. Insulation to be Armstrong Armalflex 22 or equal

C. Fiberglass Ductwork Insulation:
   1. Duct wrap to be blanket-type thermal and acoustical insulation made from glass fibers, bonded with white formaldehyde-free resin.
   2. Labeled K-Value to equal 0.29 Btu-in/hr-FT²°F.
   3. Compressed K-Value to equal 0.27 Btu-in/hr-FT²°F.
   4. Insulation to be Johns Manville Microlite XG or equal.

2.03 PIPING INSULATION:

A. Refrigerant Piping:
   1. Insulate both liquid and suction lines with closed-cell pipe insulation.
   2. Insulation to be a minimum of 3/4" thick.
   3. Seal all joints with Armstrong 520 adhesive.
   4. Insulation exposed to weather to be finished with two coats of RBX 374 UV protective coating.

B. Condensate Drain Piping:
   1. Insulated exposed condensate drain piping within building with ¾" closed-cell pipe insulation.
   2. Seal with Armstrong 520 adhesive.

2.04 DUCTWORK INSULATION:

A. Wrap all concealed unlined supply and return ductwork, with duct wrap insulation as follows:
   1. Where installed over unconditioned spaces, wrap ductwork with type 75, 3" thick duct wrap. Minimum installed R-value to equal 8.3 (hr-ft²°F)/BTU.
2. Where installed over or within conditioned concealed ceilings, wrap ductwork with type 75, 2” thick duct wrap. Minimum installed R-value to equal 5.6 (hr-ft²-OF)/BTU.
3. Duct wrap to have FSK vapor barrier facing.
4. Duct wrap to be Johns Manville Microlite XG or equal.

2.05 DUCTWORK EXPOSED TO WEATHER:

A. Wrap all unlined supply and return ductwork exposed to weather with flexible, closed-cell elastomeric insulation in tubular or sheet form. Armstrong AP Armaflex, or equal.
1. Provide 2-layers of ¾” thick material.

B. Cover insulation with 0.024” thick aluminum jacket of ducting with ½” wide stainless steel bands at 12” on center.

PART 3 - EXECUTION

3.01 GENERAL

A. Insulation to be stored on jobsite in clean / dry location. Any insulation exposed to water must be discarded immediately and removed from jobsite.

3.02 INSTALLATION OF PIPING INSULATION

A. Install piping insulation products in accordance with manufacturer’s written instructions and in accordance with recognized industry practices.

B. Installation to be installed after installation of heat tracing, testing, acceptance of testing, and cleaning of pipe.

C. Insulate each continuous run of piping with full-length units of insulation. Cut pieces to size as required. Do not use multiple cut pieces and/or scraps abutting each other.

D. Clean and dry piping surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and type fit over surface to be covered.

E. Install piping insulation without interruption through walls and floors except where otherwise indicated.

F. Taper raw ends of insulation and seal with canvas and sealant as noted for fittings.

G. Install pipe hangers on the outside of the insulation.

3.03 INSTALLATION OF CONCEALED DUCTWORK INSULATION:

A. Install ductwork insulation products in accordance with manufacturer’s written instructions and in accordance with recognized industry practices.

B. Prior to applying duct wrap, sheet metal duct shall be clean, dry and tightly sealed at all joints and seams.

C. Wrap insulation around duct with facing to the outside so the 2” flap completely overlaps facing and insulation at the other end of stretch out. Insulation shall be snugly butted.

D. Secure seams with outward clinching staples on 6” centers.
E. Neatly cut insulation at all volume control dampers.

F. Tape all seams and loose edges with scrim backed foil tape.

G. For ducts which are greater than 24" wide, provide mechanical fasteners at bottom of duct spaced at a maximum of 18" on center.
   a. Fasteners to be weld pins or clinch pins. Adhesive type pins shall not be used.

3.04 INSTALLATION OF DUCTWORK INSULATION WHERE EXPOSED TO WEATHER:

A. Install ductwork insulation products in accordance with manufacturer's written instructions and in accordance with recognized industry practices.

B. Adhere duct insulation to ductwork with Armstrong 520 Adhesive per manufacturer's recommendations.

C. Armaflex Sheet Insulation shall be adhered directly to clean, oil free surfaces with full coverage of 520 adhesive.

D. The duct insulation shall be constructed for the bottom up, with the top insulation sized to extend over the side insulation. This will for a water shed.

E. Butt-edge seams shall be adhered using 520 Adhesive by the compression fit method to allow for expansion/contraction. Leave a ½" wide uncoated border at the but-edge seams on the duct surface. Overlap the insulation ¼" at the but-edges and compress the edges into place. Apply 520 Adhesive to the butt-edges of the insulation.

F. Standing metal duct seams shall be insulated with the same insulation thickness as installed on the duct surface. Seams may be covered using strips of Armaflex Sheet Insulation or half sections of tubular pipe insulation with miter-cut ends. Standing seams shall be adhered using 520 adhesive.

G. Seams shall be staggered when applying multiple layers of insulation.

H. Duct Insulation Finish:
   1. Proved 0.024" thick aluminum jacket over ducting with ½" wide stainless steel bands at 12" on center.
   2. Longitudinal seams shall be on the bottom sides of duct only.
   3. Seal all seams with duct sealant approved for outdoor use and approved for aluminum.
   4. System shall be water-tight.

3.05 INSTALLATION OF EQUIPMENT INSULATION:

A. Clean and dry all surfaces prior to insulating.

B. Install insulation materials with smooth and even surfaces. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting in poor workmanship.

C. Do not apply insulation to equipment breechings or stacks while hot.

D. Do not insulate manholes, handholds, cleanouts, nameplate, ASME stamp. Provide beveled edge at interruptions of insulation.
3.06 INSULATION REPAIR:

A. Repair damaged sections of existing and/or new mechanical insulation where damaged occurred during this construction period. Use insulation of same thickness as existing insulation. Install new jacket lapping and seal over existing.

3.07 CARE AND CLEANING:

A. Repair and/or replace broken, damaged and or other wise defective insulation. Work to be completed to the satisfaction of the Architect. At completion of work, clean materials installed as part of this work and leave systems and equipment in satisfactory operating condition.

B. Upon completion of work remove materials, equipment, tools from premises. Leave project area neat, clean and orderly.

END OF SECTION
PART 1 – GENERAL

1.01 SUMMARY

A. This section includes piping and supports as required for the natural gas piping.

1.02 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacturer of plumbing piping systems products, of types, materials, and sizes required whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor’s Qualifications: Firm with at least 5 years of successful installation experience on projects with piping systems work similar to that required of project.

C. Requirements of Regulatory Agencies: Contractor to conform to the publications listed below. Requirements of these publications are to be considered as a minimum standard. If details and specifications which require more stringent work are indicated within project, Contractor to provide the more stringent.

1. California Plumbing Code (CPC) Compliance: Comply with applicable portions of the California Plumbing Code pertaining to selection and installation of plumbing materials and products. Fabricate and install natural gas systems in accordance with CPC.


4. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company requirements.

D. Welding materials and labor shall comply with ASME Code and applicable state labor regulations.

E. Welders shall be fully qualified and certified by a state approved welding bureau for the types of welds required for the project.

1. Each welder shall identify their work with a marking stamped on each weld joint of pipe, valve, or fitting.


G. All plumbing components intended to dispense water for human consumption shall comply with requirements of California Assembly Bill AB1953. Components to include (but not limited to): piping, faucets, angle stops, valves, bubbler, drinking fountains, piping, etc.

1.03 SUBMITTALS

A. Submit manufacturer’s catalog cut sheets, specifications, installation instructions, and dimensioned drawings for each type of pipe, support, anchor, and seal indicated within this section that is applicable to the project. Clearly indicate item being submitted.

1. Indicate pipe schedules, pressure classes, etc.

2. Indicate all options being submitted.

B. Provide Welding and Brazing Certifications. Submit reports as required for piping work applicable to the project.
1. Welders that do not have current Certifications shall not be permitted to weld and/or braze on the project.

PART 2 – GENERAL

2.01 GENERAL:

A. Provide piping materials and factory fabricated piping products of sizes, types, pressure and temperature ratings, and capacities as indicated. Materials and products to comply with the California Plumbing Code.

B. Where more than one type of material is indicated, selection is the Contractors option.
   1. Contractor to provide submittal information on material which is to be installed.
   2. Where more than one material is indicated, the Contractor shall only install one material per system and materials shall not be mixed within the same system.

C. Malleable Iron Threaded Fittings: ANSI B16.3; plain or galvanized to suit piping. For use above grade only, except where indicated otherwise.

D. Malleable-Iron Threaded Unions: ANSI B16.39; selected by Contractor for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze, or brass); plain or galvanized as indicated.

E. Forged-Steel Socket Welding and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.

F. Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns; rated to match connected pipe.

G. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2 inches and where pipe size is less than 1-1/2 inches, and do not thread nipples full length (no close-nipples).

H. Welding Materials: Except as otherwise indicated, provide welding materials as determined by Contractor to comply with installation requirements. Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

I. Soldering Materials: Joints in copper tubing for all installations shall be made with brazing alloy sil-fos, or equal. Clean surfaces to be jointed shall be free of oil, grease, rust, and oxides.
   1. Harris Stay-Safe 50 solder, or equal, may be permitted on plumbing lines above slab or ground only with prior review for piping sizes 2 inches and smaller only. Solders used shall contain no lead.

J. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.

K. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges, unless otherwise indicated.

2.02 PIPING AND FITTINGS:

A. Natural Gas Piping:
   1. Site Piping:
      a. Polyethylene Pipe, PE2406; pipe and tubing shall meet requirements of ASTM D2513.
b. Fittings and accessories shall be as manufactured and furnished by the pipe supplier. Fittings shall meet the requirements of ASTM D2513, as mandated by CFR 49 Part 192.59 and is so marked, according to Part 192.63.

2. Piping within building:
   a. Black Steel Pipe: ASTM A53, A106, or A120; except comply with ASTM A53 or A106 where close coiling or bending is required.
   b. Pipe Size 2 inches and Smaller: Black steel pipe; Schedule 40; malleable-iron threaded fittings.
   c. Pipe Size 2-1/2 inches and Larger: Black steel pipe; Schedule 40; wrought-steel buttwelding fittings.

3. Piping exposed to weather:
   a. Galvanized Steel Pipe: ASTM A53 or A120; except comply with ASTM A53 where close coiling or bending is required.
   b. Pipe Size 2 inches and Smaller: Galvanized steel pipe; Schedule 40; malleable-iron threaded fittings.
   c. Pipe Size 2-1/2 inches and Larger: Black steel pipe; Schedule 40; wrought-steel buttwelding fittings.
   d. Clean and paint all non-galvanized steel piping exposed to weather.

B. Liquid Petroleum Gas Piping (LPG):
   1. Site Piping:
      a. Polyethylene Pipe, PE2406; pipe and tubing shall meet requirements of ASTM D2513.
      b. Fittings and accessories shall be as manufactured and furnished by the pipe supplier. Fittings shall meet the requirements of ASTM D2513, as mandated by CFR 49 Part 192.59 and is so marked, according to Part 192.63.

2. Piping within building:
   a. Black Steel Pipe: ASTM A53, A106, or A120; except comply with ASTM A53 or A106 where close coiling or bending is required.
   b. All Pipe sizes: Black steel pipe; Schedule 40; wrought-steel buttwelding fittings.
      • Clean and paint all piping exposed to weather.

2.03 PIPING SUPPORTS:

A. All mechanical equipment supports shall be designed by a licensed Structural Engineer and shall comply with the 2007 California Building Code, Section 1614A1.13 and ASCE 7-05 Sections 13.3, 13.4, 13.6, and Chapter 6.

B. Mechanical equipment supports shall be designed by a licensed Structural Engineer.


D. Acceptable Manufacturer:
   1. Mason
   2. B-Line
   3. Superstrut
   4. Unistrut
   5. Tolco
   6. Or Equal

E. Vertical Piping:
1. Support vertical piping risers securely with riser clamps, B-Line B3373, or equal. Attach clamps to the pipe above each concrete floor slab, with the arms of the clamp resting on the slab or the structural supports. Provide Superstrut B3373C, or equal clamp when used on copper piping.
2. Support pipe lines passing up through the building at each floor of the building.

F. Horizontal Piping:
1. Use B-Line B3100, or equal, steel strap hanger for uninsulated steel or cast-iron pipe through 8-inch size, and for insulated steel or cast-iron pipe through 4-inch size.
2. Use Superstrut C-710 or equal, steel hanger in pipe sizes where suitable. Use saddle shield as specified for insulated pipes.
3. For uninsulated copper tubing, use B-Line B3100F, or equal, felt lined hanger.

G. Pipe Saddles:
1. Use B-Line B3153, or equal, protective insulation shield with "loc" tabs.

H. Concrete Inserts: Provide B-Line B2500, or equal, concrete inserts.

PART 3 - EXECUTION

3.01 GENERAL

A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

B. Comply with ANSI B31 Code for Pressure Piping.

C. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak-proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance.

D. Locate piping runs, unless detailed otherwise, vertically and horizontally (pitched to drain). Install piping parallel and perpendicular to adjacent building walls/structure and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations. Hold piping close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building; limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping; locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction, or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

E. Electrical Equipment Spaces: Do not run piping through transformer vaults, elevator equipment rooms, Data closets or other electrical or electronic equipment spaces or enclosures.

F. Should structural difficulties or work of other contractors prevent the running of pipes or the setting of equipment at the points shown, Contractor to make the necessary deviations to the piping system, as determined by the Contractor, with the Architect's review, without additional cost to Owner.

G. Inspect each piece of pipe and each fitting to see that there is no defective workmanship on pipe or obstructions in pipes and fittings.
H. Installation Of Protective Pipe Wrap:

1. Protect all steel pipe buried in ground from corrosion by the application of protective pipe wrap. Clean and prime pipe before application of the wrapping material.

I. Installation Of Detectable Underground Warning Tape:

1. Provide all non-metallic pipes, including but not limited to plastic piping, glass piping, and vitrified clay piping with detectable underground warning tape.
2. Detectable underground warning tape shall consist of 4.5 mil foil tape printed with pipe service, (i.e. "CAUTION GAS LINE BELOW").
3. Tape shall be buried approximately one-half of the pipes buried depth except medical gas piping shall be as required by NFPA 99.
4. Tape buried up to 24" deep shall be a minimum of 3" wide.
5. Tape buried greater than 24" deep shall be a minimum of 6" wide.

3.02 INSTALLATION OF NATURAL GAS PIPING:

A. Run piping generally level, free of unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work

B. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.

C. Connect gas piping to each gas-fired equipment item, with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions.
   1. Appliance fuel connectors, as indicated in 1202 of the California Plumbing Code, are not acceptable for connection of equipment, except where specifically indicated on the Contract Documents.

D. Install Polyethylene Pipe, where defined, in accordance with ASTM D2774 "Standard Recommended Practice for Underground Installation of Thermoplastic Pressure Piping", and as required by Manufacturer's Installation Instructions.
   1. Polyethylene Pipe fittings shall be joined in accordance with pipe manufacturers instructions.
   2. Connection of plastic pipe with metal pipe shall be only outside underground with ASTM D2513 category I transition fittings.
   3. Gas pipe risers to above grade, shall be metallic and shall be wrapped or coated to a point at least six inches above grade.
   4. When riser connects underground to plastic pipe, the underground horizontal metallic portion of the riser shall extend at least 30 inches before connecting to the plastic pipe.
   5. Heat-fusion joints shall be made in accordance with qualified procedures that have been established and proven by test to produce gas tight joints at least as strong as the pipe or tubing being joined. Joints shall be made with the joining method recommended by the pipe manufacturer.
   6. Plastic pipe shall be buried with an electrically continuous corrosion resistant tracer wire (Min. AWG. 14) and tape to facilitate locating. One end shall be brought above ground at a riser.

E. Install exposed polished or enameled connections from fixtures or equipment with special care, showing no tool marks or threads at fittings.

F. Cap or plug openings in pipe and fittings immediately to exclude all dirt until fixtures are installed or final connections made.

G. Use reducing fittings where any change in pipe size occurs. Bushings shall not be used.
H. Couplings shall not be used except where required pipe runs between fittings are longer than a standard length of the type of pipe being used and except where their use is specifically reviewed by the Architect.

I. Conceal piping in finished portions of building, above the floor line, except where otherwise shown or noted. Cutting of walls and floors shall be held to the minimum possible to secure the proper installation.

J. Install piping subject to expansion or contraction in a manner permitting strains to be evenly distributed and alleviated by expansion loops installed as required.

K. Sleeves for branches through walls from adjacent mains shall be of sufficient size to allow for free side motion of covered pipe in sleeve.

L. Remove cutting and threading burrs before assembling piping.

M. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped, or damaged.

N. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping or equipment connections are completed.

O. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection. Provide listed isolation fitting above grade prior to entry into building. Provide independent ground systems for above ground and below grade.

P. Install drip-legs in gas piping where indicated and where required by code or regulation.

Q. Install piping parallel to other piping and walls unless detailed otherwise.

R. Maintain minimum of 12-inch clearance between gas piping and steam piping above 200 °F.

S. Contractor to use extreme care when working with galvanized fittings as to not damage galvanized finish. If finish is damaged, contractor to paint damaged area with “Brite Zinc” paint by “Brite Products” or equal. Follow requirements as outlined in ASTM A780.

3.03 INSTALLATION OF HANGERS AND SUPPORTS:

A. Fasten all piping securely to structure with hangers, supports, guides, anchors, or sway braces to maintain pipe alignment, to prevent any sagging, and to prevent noise or excessive strain on the piping due to uncontrolled movement under operating conditions. Relocate hangers as necessary to correct unsatisfactory conditions that may become evident when system is put into operation.

B. Follow drawing requirements and details where special pipe support requirements are detailed on the Drawings.

C. Do not support piping by perforated tape, wire, rope, wood, nails, or other makeshift devices.

D. Design hangers and supports to support the weight of the pipe, weight of fluid, and weight of the pipe insulation with a minimum factor of safety of five based on the ultimate tensile strength of the material used.

E. Burning or welding on any structural member under load shall not be attempted. Field welding not called for on the Drawings or reviewed shop Drawings may only be done with consent and
advice of the Architect and after proper provisions have been made to relieve the stress on the member. The boring of holes in beam flanges or narrow members will not be allowed.

F. Install hanger on insulated piping in a manner which will not produce damage to insulation. Provide steel pipe saddles as required to protect pipe covering. Install pipe hangers on piping covered with insulation on the outside of the insulation and not in contact with the pipe.

G. Fasten hanger rods to concrete structural members with concrete inserts set flush with surface. Install a reinforcing rod through the opening provided in the concrete inserts. Fasten hanger rods to structural members with suitable beam clamps, and provide beam clips to lock clamp securely to beam.

H. Use of powder-actuated fasteners will not be permitted for the support of any overhead piping.

I. Turnbuckles, if used, shall have a load-carrying capacity at least equal to that of the pipe hanger with which they are being used.

J. All threaded parts of pipe hanger assemblies shall have full length of thread in service while in use.

K. Hanger material shall be reviewed by the Architect before installation.

L. Pipe Hanger or Support Spacing:
   1. Provide pipe hangers or supports at 6-foot maximum spacing on steel pipe 3/4-inch diameter and smaller and for copper pipe 1-1/2 inches and smaller.
   2. Support steel piping 1" and larger and copper larger than 1-1/2 inches at 10-foot maximum spacing.
   3. Support steel piping used for gas at the following lengths:
      a. 1/2-inch diameter at 6-feet maximum
      b. 3/4-inch and 1-inch at 8-feet maximum
      c. 1-1/4-inch and larger at 10-feet maximum spacing

3.04 PIPING SYSTEM JOINTS:

A. General: Provide joints of type indicated in each piping system.

B. Cut all steel pipe and hard copper tubing by power hacksaw, a circular cutting machine using an abrasive wheel or in square end vise by means of hand hacksaw. Wheel cutters may be used for steel pipe provided that pipe shall have ends reamed to full inside diameter and beveled before being made up into fittings. Pipe shall have round edges or burrs removed so that a smooth and unobstructed flow will be obtained.

C. Thread pipe 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 compound, Rector- Seal #5, on male threads at each joint and tighten joint to leave not more than 3 threads exposed. Teflon tape may be used on piping smaller than 2 inches.

D. Use joint compound, same as specified for threaded pipe joints, on all cleanout plugs.

E. Braze copper tube-and-fitting joints where indicated, in accordance with ASME B32.

F. Solder copper tube and fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of
joint. Solder shall be 95 percent tin, 5 percent antimony and shall be used above grade only. Wipe excess solder from joint before it hardens.

G. Weld pipe joints in accordance with recognized industry practice and as follows:
1. Welding shall be done by qualified welders in a first-class, workmanlike manner, conforming to the American Standard Code for Pressure Piping USA B-31-1 and B-31-1A.
2. Bevel pipe ends at a 37.5 degree angle where possible, smooth rough cuts, and clean to remove slag, metal particles, and dirt.
3. Do not weld-out piping system imperfections by tack-welding procedures; re-fabricate to comply with requirements.

3.05 TEST OF PIPING:

A. Test piping at completion of roughing in, in accordance with the following schedule. Show no loss in pressure or visible leaks after a minimum duration of 4 hours at the test pressures indicated. Tests to be verified by Inspector of Record.

<table>
<thead>
<tr>
<th>System Tested</th>
<th>Test Pressure Psig</th>
<th>Test With</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Gas Piping</td>
<td>100 lbs.</td>
<td>Air</td>
</tr>
<tr>
<td>Polyethylene Gas Pipe</td>
<td>60 lbs.</td>
<td>Air</td>
</tr>
</tbody>
</table>

B. Testing equipment, materials, and labor shall be furnished by this Contractor.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

3.06 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

- End of Section -
PART 1 – GENERAL

1.01 SUMMARY

A. This section includes sheet metal materials, fasteners, supports, and duct construction classifications for:
   1. Supply, return, and exhaust systems.
   2. Fume hood exhaust systems
   3. Kitchen grease hood exhaust systems
   4. Clothes dryer exhaust duct

1.02 REFERENCES


B. ANSI – American National Standard Institute


E. CBC – California Building Code

F. CFC – California Fire Code

G. CMC – California Mechanical Code

H. Local Codes

I. SMACNA – Sheet Metal and Air Conditioning Contractor’s National Association, Inc.
   1. Duct Construction Standards
   2. Fire damper and heat stop guide.
   3. HVAC Systems testing adjusting and balancing.

J. UL – Underwriters’ Laboratory Standards for Safety: referred to as UL 181, UL 555, etc.

1.03 QUALITY ASSURANCE

A. Contractor to comply with all the above referenced standards.

B. The above referenced standards may be superseded by notes and details on Drawings and in specification.

C. Where two or more references are in conflict, the most stringent, as determined by the Architect, shall take precedence.

D. Flame-Smoke Ratings: All products used in ductwork system to comply with flame-spread index of 25 or less, fuel-contributed index of 50 or less, and smoke-developed index of 50 or less.
E. Installer: A firm with at least three years of successful installation experience on projects similar to that required for this work.

F. Fabricate all ductwork with sheet metal. Fiberglass ductwork will not be accepted.

G. Duct liner to be certified by Greenguard: Greenguard Environmental Institute, independent testing of products for emissions of respirable particles and Volatile Organic Compounds (VOCs), including formaldehyde and other specific product-related pollutants. Provides independent, third-party certification of IAQ performance. Certification is based upon criteria used by EPA, OSHA and WHO.

1.04 SUBMITTALS

A. Submit typical shop standards and/or SMACNA details for each class of duct specified. Indicate the following for each standard:
   1. Gauge sizes and joint details
   2. Pressure Class
   3. Seam Construction
   4. System type (e.g. supply air, return air, etc.)

B. Submit shop drawings for ductwork including elevations and showing all terminal units and air devices connections. Drawings shall be a minimum scale of ¼"=1'-0" and be coordinated with all other trades.

C. Record Drawings: At project closet-out, submit Record Drawings of installed ductwork, duct accessories, and inlets / outlets in accordance with the requirements of Division 1.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufactured Round and Oval Ductwork:
   1. United McGill Sheet Metal
   2. Omni Duct
   3. Or equal

B. Duct Connection Systems:
   1. Ductmate Industries, Inc.
   2. Travers Duct Connection (TDC)
   3. or equal

C. Flexible Ductwork
   1. Flexmaster
   2. Thermaflex
   3. or equal

D. Duct Sealants
   1. United McGill Corp.
   2. Ductmate Proseal
   3. Or Equal

E. Duct Liner
   1. Johns Manville - Linacoustic
   2. Owens Corning Fiberglas Corporation – Aeroflex Plus
   3. Certainteed Corporation - Toughgard
F. Duct adhesives
   1. Fosters Adhesive – 85-462
   2. Swifts Adhesive – 7336
   3. Or Equal

2.02 DUCT CONSTRUCTION CLASSIFICATIONS:

   A. General: Construct and seal ductwork in accordance with SMACNA pressure classifications and
      seal classes listed for ductwork systems involved.
      1. Minimum duct gauge for concealed ductwork to be 26 gauge.
      2. Provide 20 gauge minimum for ductwork exposed within occupied areas.

   B. Rectangular Ductwork:
      1. +2" W.G. Class ductwork:
         a. Supply air Ductwork downstream of terminal boxes.
         b. Constant volume supply air ductwork in systems without terminal boxes

      2. -2" W.G. Class ductwork:
         a. General exhaust ductwork.
         b. Return Air Ductwork

      3. +4" W.G. Class ductwork:
         a. Supply air ductwork between source equipment and terminal box

      4. -6" W.G. Class ductwork:
         a. Laboratory exhaust ductwork

   C. Rectangular or oval ductwork: Same as rectangular ductwork

2.03 GENERAL:

   A. All duct sizes listed on drawings are external sizes.

   B. Galvanized Sheet Steel to be lock-forming quality, ASTM A924 and ASTM. Coating to be
      Designation G90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to
      view.
      1. Provide mill certification for galvanized material at request of IOR.

   C. Tapers to be as follows:
      1. Limit diverging tapers to a maximum of 30 degrees.
      2. Limit expanding tapers to a maximum of 20 degrees.

   D. Run ductwork parallel to adjacent walls unless shown otherwise on plans.

   E. Ductwork exposed to weather to be cross-broken to shed water.
      1. At contractor's option, ductwork can be manufactured with a sloped top, with a minimum
         angle of 5 degrees.

   F. Joint Sealing:
      1. Seal all concealed ductwork within the building, all ductwork within mechanical rooms, and all
         ductwork exposed to weather air tight. Seal all standing seams, transverse joints,
         manufactured joints and seams with duct sealant. Duct Sealant to be rated for indoor and
         outdoor use. Sealant to be as follows:
         a. Ductmate Proseal
b. McGill Airflow Uni-Coat
   c. Or Equal
2. Seal punched holes, corner cracks, and all sheet metal screws.
3. After testing, reseal joints found to be leaking.
4. At ductmate joints, in addition to ductmate gaskets, seal all bolted corners to eliminate air leakage at corners.
5. Pressure sensitive tapes shall not be considered.

G. Provide sheet metal angle frame at all duct penetrations to wall, floor, roof, or ceiling.
   1. Ducts to penetrate perpendicular to walls, ceilings and floors.

H. Internal Duct Liner:
   1. Provide internal duct liner as follows:
      a. All Transfer air ducts.
      b. Supply air ductwork downstream of VAV Boxes – minimum length to be 8’-0” unless noted or shown otherwise.
      c. All supply and return air ductwork exposed to weather.
      d. Concealed supply air ductwork downstream of fan, fan casing, or unit casing – minimum length to be 12’-0”.
      e. Concealed return air ductwork upstream of fan, fan casing, or unit casing – minimum length to be 12’-0”.
      f. Elsewhere as indicated on the drawings.

2. Internal duct liner within building installed over conditioned spaces to be as follows:
   a. 1” thick, 1.5-pound density (minimum) with matt facing.
   b. Thermal Performance - C Value – 0.24 BTU / (h * FT² * °F) – minimum
   c. Thermal Performance - R Value – 4.2 (h * FT² * °F) / BTU – minimum
   d. Minimum Acoustical Performance shall be as follows:
      | Absorption Coefficients @ Octave Band Frequencies (Hz) |
      | 125 | 250 | 500 | 1000 | 2000 | 4000 | NRC |
      |-----|-----|-----|------|------|------|-----|
      | 0.10 | 0.32 | 0.66 | 0.84 | 0.91 | 0.91 | 0.70 |
   e. Liner to be CertainTeed, ToughGard R Duct Liner, Type 150, or equal.

3. Internal duct liner exposed to weather or installed over un-conditioned space to be as follows:
   a. 2” thick, 1.5-pound density (minimum) with matt facing.
   b. Thermal Performance - C Value – 0.14 BTU / (h * FT² * °F) – minimum
   c. Thermal Performance - R Value – 8.3 (h * FT² * °F) / BTU – minimum
   d. Minimum Acoustical Performance shall be as follows:
      | Absorption Coefficients @ Octave Band Frequencies (Hz) |
      | 125 | 250 | 500 | 1000 | 2000 | 4000 | NRC |
      |-----|-----|-----|------|------|------|-----|
      | 0.24 | 0.79 | 1.09 | 1.05 | 1.02 | 1.01 | 1.00 |
e. Liner to be CertainTeed, ToughGard R Duct Liner, Type 150, or equal.

4. Cement duct liner in place with nonflammable, non-hardening duct adhesive. Seal up all raw edges of insulation inside ductwork with adhesive.

5. Provide sheet metal weld pin fasteners and washers on all duct work on 12-inch intervals with the first row within 3 inches of the leading edge of each piece of insulation and 4 inches from corners. No substitutions on fastening method will be allowed.

6. Duct liner and adhesive shall not exceed flame-spread rating of 25 and smoke-developed rating of 50, all in conformance with NFPA 90A.

7. Provide metal nosing at all locations where liner is preceded by unlined metal.

I. Ductwork Support: Provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim, and angles for support of ductwork, unless noted otherwise.

J. Miscellaneous Ductwork Materials:

1. Duct Joints: Install duct sealers, pop rivets, or sheet metal screws at each fittings and joint. Use a minimum of #10 galvanized sheet metal screws.

2.04 2" W.G. RECTANGULAR DUCT CONSTRUCTION/FABRICATION:

A. Shop fabricate ductwork of gauges and reinforcement complying with the more stringent of the following standards, except as noted herein.
1. California Mechanical Code (CMC)

B. Fabricate Ducts with minimum gauges and joint reinforcement as follows:

<table>
<thead>
<tr>
<th>Duct Dimension</th>
<th>Minimum Gauge</th>
<th>Joint Reinforcement per CMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up through 12&quot;</td>
<td>26</td>
<td>Not Required</td>
</tr>
<tr>
<td>13&quot; through 18&quot;</td>
<td>24</td>
<td>Not Required</td>
</tr>
<tr>
<td>19&quot; through 30&quot;</td>
<td>24</td>
<td>C/4</td>
</tr>
<tr>
<td>31&quot; through 42&quot;</td>
<td>22</td>
<td>E/4</td>
</tr>
<tr>
<td>43&quot; through 54&quot;</td>
<td>22</td>
<td>F/2</td>
</tr>
<tr>
<td>55&quot; through 60&quot;</td>
<td>20</td>
<td>G/4</td>
</tr>
<tr>
<td>61&quot; through 84&quot;</td>
<td>20</td>
<td>I/2</td>
</tr>
<tr>
<td>85&quot; through 96&quot;</td>
<td>20</td>
<td>J/2</td>
</tr>
<tr>
<td>Over 96&quot;</td>
<td>18</td>
<td>K/2</td>
</tr>
</tbody>
</table>

C. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Fabricate elbows with center-line radius equal to 1.5 times associated duct width. Fabricate to include single thickness turning vane in elbows where space does not permit the above radius or where square elbows are shown.

D. Fabricate round supply connections at rectangular, plenum type fittings using spin-in type fittings, complete with extractor and volume control damper.

E. Provide drive slip or equivalent flat seams for ducts exposed in the condition space or where necessary due to space limitations. On ducts with flat seams, provide standard reinforcing on inside of duct. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.
2.05 ROUND/oval Duct Construction:

A. Spiral lock seam prefabricated factory-built round and oval duct and fittings shall be used wherever possible. Shop fabricated ducts shall be used only where rectangular shaped ducts are shown on plans or where transitions and special fittings cannot be prefabricated by factory. Provide couplings to join each length of duct.

B. Fabricate duct fittings to match adjoining ducts and comply with duct requirements as applicable to fittings. Except as noted otherwise, fabricate elbows as follows:
   1. Center-line radius to be equal to 1.5 times associated duct width.
   2. Provide two-piece, die stamped, 45 degree to 90 degree elbows for sizes up to 12 inches.
   3. Provide 5 piece 90 degree elbows for sizes 12" and above, conical tees, and conical laterals.
   4. All reducers to be located after tap. Reducers shall be long-taper style. Reducing tees shall not be allowed.

C. Round Ductwork: Construct of galvanized sheet metal complying with ANSI/ASTM A527 by the following methods and in minimum gauges listed.

<table>
<thead>
<tr>
<th>Duct Diameter</th>
<th>Minimum Gauge</th>
<th>Method of Manufactured</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;Ø - 14&quot;Ø</td>
<td>26</td>
<td>Spiral Lockseam</td>
</tr>
<tr>
<td>15&quot;Ø - 23&quot;Ø</td>
<td>24</td>
<td>Spiral Lockseam</td>
</tr>
<tr>
<td>24&quot;Ø - 36&quot;Ø</td>
<td>22</td>
<td>Spiral Lockseam</td>
</tr>
<tr>
<td>37&quot;Ø - 50&quot;Ø</td>
<td>20</td>
<td>Spiral Lockseam</td>
</tr>
<tr>
<td>51&quot;Ø - 60&quot;Ø</td>
<td>18</td>
<td>Spiral Lockseam</td>
</tr>
<tr>
<td>Over 60&quot;Ø</td>
<td>14</td>
<td>Longitudinal Seam</td>
</tr>
</tbody>
</table>

D. Fittings and Couplings:
   1. Construct of same minimum gauges listed for ductwork.
   2. Provide continuous welds along seams.
   3. At Contractors option, provide spot welded fittings sealed inside and out.

E. All 4" WG supply air ductwork on roof shall be internally insulated in accordance with the following requirements:
   1. Ductwork and fittings: Construct with outer pressure shell, 2-inch thick, 3 PCF insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ANSI/ASTM 527, of spiral lockseam and construction (use longitudinal seam for over 59 inches), in minimum gauges listed.

<table>
<thead>
<tr>
<th>Duct Diameter</th>
<th>Outer Shell</th>
<th>Inner Liner</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot;Ø - 12&quot;Ø</td>
<td>26 gauge</td>
<td>24 gauge</td>
</tr>
<tr>
<td>13&quot;Ø - 24&quot;Ø</td>
<td>24 gauge</td>
<td>24 gauge</td>
</tr>
<tr>
<td>25&quot;Ø - 34&quot;Ø</td>
<td>22 gauge</td>
<td>24 gauge</td>
</tr>
<tr>
<td>35&quot;Ø - 48&quot;Ø</td>
<td>20 gauge</td>
<td>24 gauge</td>
</tr>
<tr>
<td>49&quot;Ø - 58&quot;Ø</td>
<td>18 gauge</td>
<td>24 gauge</td>
</tr>
<tr>
<td>Over 59&quot;Ø</td>
<td>14 gauge</td>
<td>20 gauge</td>
</tr>
</tbody>
</table>

2. Inner Liner: Perforate with 3/32-inch holes for 22 percent open area. Provide metal spacers welded in position to maintain spacing and concentricity.

3. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams of outer shell.
2.06  KITCHEN HOOD EXHAUST DUCTWORK:

A. Fabricate kitchen exhaust ducts and supports used for smoke and vapor removal from cooking equipment as follows:
   1. Concealed locations – provide 16 gauge minimum galvanized steel
   2. Exposed locations – provide 18 gauge minimum stainless steel with Number 4 finish.

B. All ductwork to be of welded construction in accordance with Section 507 of California Mechanical Code. For duct construction, comply with SMACNA HVAC Duct Construction Standards and ANSI/NFPA 96 Vapor Removal from Commercial Cooking Equipment.

C. Polish exposed stainless steel ductwork to match adjacent material at all weld locations.

D. Coat galvanized steel with Regalv, or equal, galvanizing repair at all weld locations.

E. Provide cleanouts in ductwork at all changes in direction as required by code.

2.07  DISHWASHER EXHAUST DUCTWORK:

A. Fabricate dishwasher exhaust ducts and supports used for removal from dishwasher of 18-ga. minimum stainless steel where concealed and of 18-ga. minimum stainless steel with #4 finish where exposed. All ductwork shall be of welded construction in accordance with Chapter 20 of Uniform Mechanical Code. For duct construction, comply with SMACNA "HVAC Duct Construction Standards," latest edition, and ANSI/NFPA 96 "Vapor Removal from Commercial Cooking Equipment." Provide cleanouts in ductwork at all changes in direction and as required by code.

2.08  CLOTHES DRYER EXHAUST DUCTWORK:

A. Fabricate ducts and supports of 24 gauge minimum aluminum duct.

B. Provide 3-1/4-inch by 10-inch duct and fittings in wall to ceiling as indicated on Drawings. Provide wall connection for dryer duct, capped with removable fitting for connection in future.

C. Provide wall cap complete with backdraft damper, and install on outside wall where indicated on Drawings.

2.09  FLEXIBLE DUCTWORK:

A. Flexible ducts may be used in concealed areas where detailed and as specified.

B. Flexible ducts from rigid run-outs to registers shall be Flexmaster USA, Inc., Type 1M Acoustical Insulated flex duct, or equal.

C. Flexible ducts shall be as follows:
   1. Minimum Operating Pressure:
      a. Positive = 10" w.g. for all sizes
      b. Negative = 5" w.g. for sizes thru 16" and 1" w.g. for sizes 18 & 20"
2. Rated Velocity = 5,500 FPM
3. Minimum Burst Pressure = 2 1/2 times working pressure
4. Minimum R Value = 6.0 (h * FT² * °F) / BTU
5. Duct to be ETL Class 1 Air duct.
6. Flame spread to be less than 25 and smoke developed less than 50.
7. Flex duct to consist of an exterior reinforced metalized vapor barrier, fiberglass insulation, mechanical lock wire helix, and polyethylene inner film. Inner liner to be mechanically locked without adhesives.
8. Minimum Acoustical Performance shall be as follows:

<table>
<thead>
<tr>
<th>Insertion Losses (DB) / Octave Band Center Frequency (Hz)</th>
<th>8&quot;Ø Straight Duct – 3 Feet Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>250</td>
</tr>
<tr>
<td>2.8</td>
<td>5.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insertion Losses (DB) / Octave Band Center Frequency (Hz)</th>
<th>8&quot;Ø Straight Duct – 6 Feet Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>250</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insertion Losses (DB) / Octave Band Center Frequency (Hz)</th>
<th>12&quot;Ø Straight Duct – 3 Feet Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>250</td>
</tr>
<tr>
<td>3.5</td>
<td>5.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insertion Losses (DB) / Octave Band Center Frequency (Hz)</th>
<th>12&quot;Ø Straight Duct – 6 Feet Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>250</td>
</tr>
<tr>
<td>8</td>
<td>17</td>
</tr>
</tbody>
</table>

Provide acoustical submittal data for 8"Ø and 12"Ø ducts within submittal package.

D. Minimum length of three feet and a maximum length of five feet to be installed at each air terminal. Flexible duct shall have no bends greater than 45 degrees unless shown otherwise. Specifications and any applicable drawings or details will be strictly enforced. Submittals to provide acoustical characteristics of flexible ductwork.

E. Make connections to rigid ductwork with Panduit style draw band. Provide one draw-band at inner liner and a second draw band over the outer vapor barrier material.

PART 3 - EXECUTION

3.01 INSTALLATION OF DUCTWORK:
A. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (leakage class 12 for 2-inch pressure class and leakage class 3 for 4-inch pressure class) and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8- inch 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.


C. Paint inside of duct visible through grille dull black.

D. Duct Supports:

1. Support ductwork in manner complying with SMACNA "HVAC Duct Construction Standards," latest edition, hangers and supports sections. Where special hanging of ductwork is detailed or shown on Drawings, Drawings shall be followed.
   a. Except where modified in individual paragraphs in this section or detailed on drawings, provide hanger support with minimum 18 gauge straps, 1 inch wide. Fold duct strap under bottom of duct.
   b. Install duct supports to retangular ducts with sheet metal screws. Provide one screw through strap at top of duct and one screw through strap at bottom of duct.

2. Upper Connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

<table>
<thead>
<tr>
<th>Duct Size</th>
<th>Fastener Size/Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>P/2 ≤ 30&quot;</td>
<td>#10 x 1 ½&quot; wood screw</td>
</tr>
<tr>
<td>31&quot; ≤ P/2 ≤ 72&quot;</td>
<td>1/4&quot; x 1 ½&quot; lag screw</td>
</tr>
<tr>
<td>P/2 &gt; 73&quot;</td>
<td>3/8&quot; x 1 ½&quot; lag screw</td>
</tr>
</tbody>
</table>

   a. Upper connection in tension shall not be used unless absolutely necessary. Where deemed necessary, the Contractor shall submit calculations to show the size fastener and penetration required to support loads in tension from wood in accordance with the following schedule:

<table>
<thead>
<tr>
<th>Duct Size</th>
<th>Load per hanger</th>
</tr>
</thead>
<tbody>
<tr>
<td>P/2 ≤ 30&quot;</td>
<td>260 pounds per hanger</td>
</tr>
<tr>
<td>31&quot; ≤ P/2 ≤ 72&quot;</td>
<td>320 pounds per hanger</td>
</tr>
<tr>
<td>73&quot; ≤ P/2 &lt; 96&quot;</td>
<td>460 pounds per hanger</td>
</tr>
<tr>
<td>P/2 &gt; 96&quot;</td>
<td>Not Allowed</td>
</tr>
</tbody>
</table>

E. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus- insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1/2 inches.

F. Where ductwork is exposed, Contractor to paint ductwork, supports, and air inlets and outlets to match adjacent architectural surfaces, or as directed by Architect.

3.02 INSTALLATION OF FLEXIBLE DUCTWORK
A. Provide flexible ducts with supports at or near mid-length with 2-inch wide, 26-gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.

B. Make connections to rigid ductwork with Panduit style draw band. Provide one draw-band at inner liner and a second draw band over the outer vapor barrier material.

C. Bends in flexible ductwork shall be kept to a minimum. When required, the minimum bend radius shall be 1.5 times the duct diameter. Duct offsets to be limited to 45 degree turns.

3.03 INSTALLATION OF KITCHEN, DISHWASHER, AND FUME HOOD EXHAUST DUCTS:

A. Fabricate joints and seams with continuous welds for water-tight construction. Provide for thermal expansion of ductwork through 2000 degrees F temperature range. Install without dips or traps which may collect residues. Provide access openings at each change in direction located on sides of duct 1-1/2 inches minimum from bottom and fitted with grease-tight covers of same material as duct.

3.04 TESTING FOUR-INCH PRESSURE CLASS DUCTWORK:

A. Care shall be used in fabrication and installation of ductwork to ensure that it will be airtight. All ductwork shall be tested for leaks in sections as work progresses and as directed by Architect. Section to be tested shall have all open ends sealed off and shall then be tested by one of the following methods:

1. Time Leakage Test: Section being tested shall be placed under an air pressure of 4 inches of water. Test pressure shall be held for a period of 5 minutes after air supply to section being tested has been shut off. Air pressure in duct at end of 5-minute test period shall be not less than 4 inches of water.

2. Orifice Flow Test: Equipment required for this testing comprises a high-pressure blower, orifice test pipe assembly, and manometer with necessary valves and tubing. All testing shall be in conformance with SMACNA "HVAC Air Duct Leakage Test Manual," latest edition, except as noted hereinafter. Ductwork section being tested shall be held under a constant pressure of 4 inches of water with blower while any leakage flow through orifice is measured on manometer. Manometer readings shall be converted to CFM from a calibrated test curve. Leakage shall not exceed one percent of design air flow with a maximum allowable of 500 CFM. If this method of testing is used, complete information and data on equipment to be used must be submitted to Architect for approval before any tests are made.

B. Testing of any completed section of ductwork must be made prior to installation of finished ceiling, if any, or before ductwork is furred in inaccessible spaces. Testing to be witnessed by IOR or Architect's representative. Any leaks found must be properly repaired or joints remade, and section retested until tight. Leaks which cause any objectionable noise must be repaired, regardless of amount of leakage.

C. Upon completion of testing, the Contractor shall complete the test report forms provided by SMACNA "HVAC Air Duct Leakage Test Manual." These forms shall be made in triplicate and forwarded to the Architect for review.

3.05 CLEANING AND PROTECTION
A. Ductwork being stored on site to be covered and protected from elements. Internally lined ductwork to be stored on jobsite in clean / dry location. Any insulation exposed to water must be discarded immediately and removed from jobsite.

B. Clean ductwork internally, unit by unit as it is installed, of dust, dirt, and debris.

C. Clean external surfaces of dirt and foreign substances which might cause corrosive deterioration of metal or where ductwork is to be painted.

D. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

E. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

F. If HVAC System is operated prior to the completion of construction, Contractor to provide temporary filters at all return air and exhaust air grilles. Filters to be 2" thick, MERV 8 filters. Contractor to secure filters in place with tape or wiring. Filters to completely cover grille opening.

3.06 OPERATION TEST:

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.07 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, and tools, and leave premises clean, neat, and orderly.

END OF SECTION
PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes requirements for the following duct accessories:
   1. Volume Control Dampers
   2. Fire/Smoke Dampers
   3. Fire Dampers
   4. Turning Vanes
   5. Duct Access Doors
   6. Flexible Connections

1.02 QUALITY ASSURANCE

A. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) HVAC Duct Construction Standards (Metal and Flexible), latest edition, for all work in this section.

B. ASHRAE Standards: Comply with American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE) recommendations, latest edition, for all work in this section.


D. Compliance: Construct, test, install and label fire dampers and fire doors in accordance with Underwriters Laboratories (U.L.) Standard 555, "Fire Dampers and Ceiling Dampers."

E. The Diffuser, Register, Grille manufacturer shall provide published performance data for all air inlets/outlets. Performance tests shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

F. Combination Fire smoke Dampers:
   1. Manufacturer: Test and qualify with UL a complete range of damper sizes covering dampers specified. Testing 1 size only is not acceptable.
   2. Damper Capacity: Demonstrate damper capacity to open and close under HVAC system operating conditions in accordance with UL 555S.
      a. Closed Position: Maximum pressure of 4" w.g.
      b. Open Position: Maximum air velocity of 3,000 feet per minute.

1.03 SUBMITTALS

A. Product data: submit complete data of materials proposed including:
   1. Manufacturer and model number
   2. Clearly indicate all options, trim, and accessories.
   3. Cross reference manufacturer's cut sheet to fixture callout ID on submittal sheet.

B. Operation and Maintenance Data: submit complete O&M data including:
   1. Maintenance data and parts lists for each type of fixture.
   2. Provide "trouble- shooting" maintenance guide
   3. Include this data within maintenance manual

C. Sound Traps:
1. Furnish sound data for dynamic insertion losses for the 2\textsuperscript{ND} through 7\textsuperscript{TH} octave bands as tested in strict accordance with ADC standards. Sound levels shall not exceed those of units scheduled on the Drawings.

PART 2 - PRODUCTS

2.01 VOLUME CONTROL DAMPERS:

A. General:
1. Provide dampers throughout the duct system where indicated on the drawings to facilitate complete balancing.
2. Provide any dampers not shown on drawings but requested by Test and Balance Contractor add no additional charge to the owner.
3. Locate volume control dampers within 18" of the branch duct take off. Dampers shall not be located at or near the end of the duct branch run.
4. Provide for each damper quadrant lock device on one end of shaft and end-bearing plate on other end.
   a. Quadrant lock device to be Ventlock 641, or equal.
   b. End bearing plate to be Ventlok 607, or equal.
5. Provide extended quadrant locks and extended bearing plates for externally insulated ductwork.

B. Identification:
1. Provide 1" wide identification nylon ribbon for each damper with color as follows:
   a. Supply air – Red
   b. Return Air – Blue
   c. Exhaust Air – Yellow
2. Tie identification ribbon through hole at each end of damper quadrant. Ribbons to have a minimum of 12" of ribbon hanging free. Install ribbon at the time each damper is installed.

C. Inaccessible Ceilings:
1. Where volume control dampers are located in inaccessible ceilings, or where noted otherwise, furnish cable operated remote controlled volume damper. Reference architectural drawings for locations of gypsum board ceilings.
2. Dampers are to be adjustable with standard tools at the ceiling line through a self supporting 2" round Ceiling Cup.
3. Powder painted steel box cover plate shall be fastened with standard countersunk (Option: tamperproof countersunk) screws providing a secure, unobtrusive appearance flush with the ceiling surface.
4. Galvanized steel, square-shafted damper shall be worm gear actuated via a brass plated rotary cable meeting Mil-spec I-45208 and supported at the damper end by a self lubricating bearing integral to the worm gear assembly.
5. Additional cable retainer supports shall be factory furnished as required by the cable length. Rotary cable shall have a minimum torque service factor of 200% when installed in accordance with manufacturer furnished instructions.
6. Ceiling Cup, rotary cable, and worm gear shall be furnished as one piece for installation with no linkage adjustment required or small parts to get lost on site. Positive, direct, two-way damper control shall be provided with no sleeves, springs, or screw adjustments.
7. Cable operated dampers shall be Metropolitan Air Technology, or equal Model #RT-250 with model RT-CCR ceiling cup.

D. Rectangular Dampers with either height or width less than 16 inches:
1. Butterfly type damper with 18-gauge steel or duct casing angle reinforced as required.
2. Provide single thickness 16-gauge minimum, galvanized steel blades, welded or permanently bolted to continuous solid 3/8" minimum square shaft. Permanently mark end shaft to
indicate blade position and fit with a locking quadrant mounted on outside of frame. Bearings shall be pressed into frame and designed for dynamic requirements.

E. Rectangular Dampers with either height or width greater than or equal to 16 inches:
1. Frame with 5” by 1”, 16-gauge galvanized steel channel. Blades to be 8” maximum width, extruded aluminum, airfoil blade, opposed blade, having shafts/bearings designed to meet dynamic requirements, positively locked to shafts.
2. Control shafts to be 3/8” square, plated steel, permanently marked to indicate blade position and fitted with locking quadrant mounted on outside of frame.
3. Provide single thickness 16-gauge minimum, galvanized steel blades, welded or permanently bolted to ½” minimum diameter through shaft. Permanently mark end shaft to indicate blade position and fit with a locking quadrant mounted on outside of frame. Bearings shall be pressed into frame and designed for dynamic requirements.

F. Round Dampers:
1. Frame shall be 20 gauge galvanized steel or duct casing reinforced.
2. Provide single thickness 18 gauge galvanized steel blade, welded or permanently bolted to 3/8” minimum diameter through shaft. Permanently mark end shaft to indicate blade position and fit with a locking quadrant mounted on outside of frame. Damper to be provided with end bearing plates.

G. Backdraft Dampers:
1. Provide dampers with parallel blades, constructed of 16-ga. aluminum; provide 1/2-inch diameter ball bearings, 1/2-inch diameter steel axles spaced on 9-inch centers. Construct frame of 2 inches by 1/2-inch by 1/8-inch steel channel for face areas 25 sq. ft. and under; 4 inches by 1-1/4 inches by 16-ga. channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up.

H. Acceptable Manufacturers:
1. Air Balance Inc.
2. Ruskin Manufacturing Company
3. Greenheck

2.02 COMBINATION FIRE/SMOKE DAMPERS

A. Acceptable Manufacturers:
1. Ruskin
2. Greenheck
3. Nailor
4. Air Balance

B. General:
1. Provide combination fire/smoke dampers at fire rated/smoke partitions and walls in accordance with NFPA 90A and NFPA 101. Refer to Drawings and diagrams.
2. Each combination fire/smoke damper shall be 1-1/2 hour fire rated under UL 555S, and further classified by Underwriter’s Laboratories as a leakage rated damper for use in smoke control systems under the latest version of UL 555S, and bear a UL label attesting to same.
3. Damper manufacturer shall have tested, and qualified with UL and CSFM a complete range of damper sizes. Having a single damper size tested and UL qualified is not acceptable. The leakage rating under UL 555 S shall be no higher than Leakage Class II (10 CFM/sq ft at 1” w.g.).
4. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operating conditions, with pressures of at least 4” inches w.g. in the closed position, and 3,000 fpm air velocity in the open position.
5. Dampers and their operators shall be qualified under UL 555 S to an elevated temperature of 250 degrees F with electric operators. Damper operators shall be installed by the damper
manufacturer at time of fabrication. The assembly shall meet UL 555 S qualifications for dampers and operators.

6. Provide with manufacturer's electronic actuator. Actuator shall be electric type 120V/1Ø. Provide spring-return, fail closed type operators that close damper upon power interruption. Damper operators shall be UL listed as fire damper operators, and shall bear the appropriate UL operator label.

7. Provide each combination fire/smoke damper with a factory sleeve of length and gauge required for satisfactory installation, with damper operator. Mount operator and switch outside the duct and outside of the fire wall to prevent interference with rated installation retaining angles.

8. Equip each combination fire/smoke damper with an electric re-settable link causing damper to close and lock in a closed position at 165°F. Fusible links that melt are not acceptable.

9. Pressure drop for smoke dampers shall not exceed that listed by manufacturer by 10% and shall be not more than 0.1” sp at 2,000 fpm.

10. Provide controlled closure and locking of damper to occur in 3 to 15 seconds. Instantaneous closure is not acceptable.

11. Provide with Ruskin model SP 100, or equal, Switch Package: Two position indicator switches linked directly to damper blade to remotely indicate damper blade position.

C. Rectangular Dampers:
   1. Provide airfoil-shaped, double skin blades, with 14 gauge equivalent thickness, maximum 6 inches wide, having shafts/bearings designed to meet temperature requirements. Provide 5 inches by 16 gauge galvanized channel frame. Seal blade edges with silicone rubber and jamb with flexible metal compression.

   2. Dampers shall be Ruskin FSD60 or equal with dynamic rating.

   3. Dampers installed in vertical shafts shall have vertical blades similar to Ruskin FSD60V, or equal.

D. Round Dampers:
   1. Construct dampers similar to rectangular dampers except with sleeve and connection for round ducts.

   2. Dampers shall be Ruskin FSDR true round up to 24 diameter with dynamic rating.

E. Ceiling Fire/Smoke Damper
   1. Damper shall be Ruskin FSD36C with dynamic rating.

2.03 FIRE DAMPERS

A. Acceptable Manufacturers:
   1. Ruskin
   2. Greenheck
   3. Nailor
   4. Air Balance

B. Provide Ruskin model DIBD2, or equal, series dynamic curtain type fire damper.

C. General:
   1. Fire dampers shall have a rating of 1½ hours in accordance with UL 555.
   2. Dynamic Closure Rating: Dampers shall be classified for dynamic closure to 2,000 fpm and 4” w.g.

D. Construction:
   1. Frame: Maximum 5 inch (127 mm) roll formed, galvanized steel channel.
   2. Sleeves: Damper shall be supplied as a single assembly with an integral factory sleeve.
   3. Retaining Angles: Damper shall be supplied with factory retaining angles sized to provide installation overlap in accordance with manufacturer's UL listing.
4. Blades: Galvanized curtain type.
5. Closure Springs: Type 301 stainless steel, constant force or spring clip type.
6. Temperature Release Device: 165 degrees F fusible link unless noted otherwise.

E. Damper to be capable of being mounted in either a vertical or horizontal orientation.
F. Duct Transition Connection, Damper Style to be provided as required.

2.04 TURNING VANES


B. Acceptable Manufacturers:
   1. Duro-Dyne Corporation
   2. Ductmate
   3. Or equal

2.05 DUCT ACCESS DOORS

A. Acceptable Manufacturers:
   1. Nailor
   2. Ductmate
   3. Vent Fabrics

B. General:
   1. Provide airtight access doors in ducts and plenums for cleaning and repairs for volume and fire dampers for control devices within such ductwork and where shown on the Drawings.
   2. Access doors into 2" w.g. pressure class ductwork shall be made of No. 24 gauge galvanized steel minimum, reinforced with angle iron stiffeners. Doors shall be hinged and provided with latches and gasket around entire edge to provide an airtight fit. Reinforce openings for doors with structural steel.
   3. Access doors into ductwork greater than 2" w.g. pressure class shall be side-mounted equal to Nailor Series 0800 for rectangular ducts and Nailor Series 0895 for round ducts. Access doors shall be tested at 8-inch static pressure. Access door height shall not be less than 75% of duct height.
   4. Access doors shall be sandwich-type construction, consisting of three layers of .030" galvanized steel. The inside door shall combine two layers of metal spot welded together at rim and encapsulating high density fiberglass insulation –UL classified FHC 25/50. Doors shall have a minimum R-value of 4.0 total. Access doors shall be pressure rated for 20" WG positive and 10" WG negative with no leakage.
   5. Access doors into ductwork greater than 2" w.g. pressure class shall be side-mounted equal to Nailor Series 0800 for rectangular ducts and Nailor Series 0895 for round ducts. Access doors shall be tested at 8-inch static pressure. Access door height shall not be less than 75% of duct height.
   6. Identification: Access doors shall be permanently identified on the exterior by a label with letters not less than 1/2 inch in height reading: SMOKE/FIRE DAMPER or FIRE DAMPER.

C. 2" w.g. pressure class or less:
1. Un-insulated round ducts: Nailor model 0890, or equal.
   a. 16-gauge galvanized steel.
   b. Door hinge with Strike and catch, zinc plated steel and gasket.

2. Insulated round ducts: Nailor model 0890, or equal.
   a. 16-gauge galvanized steel.
   b. Door hinge with Strike and catch, zinc plated steel and gasket.

3. Rectangular ducts: Nailor model 08SH, or equal.
   a. 16-gauge galvanized steel.
   b. Door hinge with Strike and catch, zinc plated steel and gasket.
   c. Where space does not allow hinged access door, provide Nailor model 08SCL, or equal.

D. Ductwork with pressure class greater than 2" w.g.:
   1. Rectangular Ductwork: Nailor model 0895, or equal.
   2. Round Ductwork: Nailor model 0800, or equal.
   3. Access doors shall be tested at 8-inch static pressure.
   4. Access door height shall not be less than 75% of duct height.

2.06 FLEXIBLE CONNECTIONS

A. Furnish and install flexible connections at following locations:
   1. Duct connection of supply fan
   2. Duct connection of return fan
   3. Duct connection of exhaust fan
   4. Elsewhere as shown on Drawings
      a. Flexible connections will not be required for curb-mounted, roof-type exhaust fans or packaged downflow AC Units.

B. Flexible duct connections shall be preassembled flexible connectors constructed of coated glass fabric applied in accordance with manufacturer's recommendations.

C. Install sheet metal band completely around duct or fan outlet, at end of flexible connection. Fasten with metal screws through band and coated glass fabric. Space screws approximately 4" apart.
   1. Provide with TDC/TDF connectors where connecting to like ductwork.

D. Flexible Connections to be as follows:
   1. For all equipment: Duro-Dyne Model Metal Fab, or equal.
      a. Provide with Neoprene (commercial/specification grade) fabric.
         • Neoprene to be 30 oz./square yard,
      b. Provide with 4" fabric with 4" metal connectors on each end.
      c. Minimum 24 gauge.

E. Provide galvanized sheet metal sun shield over flexible connections located outdoor.

F. Acceptable Manufacturers:
   1. Duro-Dyne Corporation
   2. Ventfabrics, Inc.
   3. Ductmate PROflex
   4. Or Equal

2.07 SOUND ATTENUATORS:
A. Sound Attenuators: Construct in accordance with NFPA 90A standards. Provide outer casings and internal perforated sheet metal not less than 22 gauge and comply with high velocity ductwork recommendations of the current ASHRAE Guide.

B. Acoustical Fill Materials: Acoustical quality glass fiber packed behind partitions to eliminate voids caused by material settling. Provide airtight construction, leak proof against a differential pressure of 8" w.g. Provide polyethylene or other material coating to eliminate air contact with acoustical fill material.

C. Losses: Refer to Drawings for minimum insertion loss, maximum static pressure loss, and maximum self-generated noise schedule.

D. Testing: A fully independent testing firm shall provide documentation and test results certifying compliance with specifications herein. Standard module testing shall be conducted in accordance with industry standards. The sound attenuator shall be acoustically tested with metal inlet and outlet duct sections while under the rated air flow conditions. The noise reduction data shall include the effects of flanking paths and vibration transmission. Test results shall be certified by the testing agency and be made available to the Architect for approval. The test results shall include a complete description of test conditions and measurement procedure.

E. Packaging: Sound attenuators shall be blown clean, bagged, and sealed for shipment. Do not remove attenuators from original cartons until ready for installation.

F. Acceptable Manufacturers:
   1. IAC, Industrial Sound Control Company
   2. Aircoustat
   3. or equal

PART 3 - EXECUTION

3.01 GENERAL:

A. Install duct 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.

3.02 INSTALLATION OF VOLUME CONTROL DAMPERS:

A. Provide volume control dampers at all supply, return, and exhaust branch ductwork and elsewhere where shown on the drawings.

B. Locate volume control dampers at or near branch take off. Volume Control dampers shall not be located at the end of branch duct.

3.03 INSTALLATION OF FIRE DAMPERS AND FIRE/SMOKE DAMPERS:

A. Install fire dampers, smoke dampers, and combination fire/smoke dampers in accordance with manufacturer's printed installation instructions including provisions for any supplementary framing and blocking of metal or wood studs in drywall partitions. Install dampers at locations indicated on the drawings and in accordance with manufacturer's UL approved installation instructions. Coordinate requirements for this work with Division 9. Costs of all such supplemental framing shall be borne by this Contractor. Placement of framing units shall remain work of Division 9.
B. Install dampers square and free from racking with blades running horizontally. Do not compress or stretch damper frame into duct or opening. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jackshaft.

C. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

D. Upon completion of this work, the installing contractor shall test all fire/smoke dampers in the presence of the IOR and local fire department. Complete testing to the complete satisfaction of the IOR and local fire department.

E. Provide spare fusible links as required to complete testing to the complete satisfaction of the local fire department

3.04 INSTALLATION OF TURNING VANES:

A. Install turning vanes in square or rectangular 90-degree elbows in supply, return, and exhaust air systems and elsewhere as indicated.

3.05 INSTALLATION OF DUCT ACCESS DOORS:

A. Provide for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, smoke dampers, combination fire/smoke dampers, before humidifiers and duct heating coils, and at turning vanes, splitter dampers. In addition, provide access doors at minimum 50 feet on center in duct runs to facilitate cleaning. Review locations prior to fabrication. Doors shall be square, sized to 3/4 of the larger of the duct width or height, but no smaller than 8” x 8” nor no larger than 24” x 24”.

B. 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.

C. Coordinate with other work as necessary to interface installation of duct accessories properly with other work.

D. Field Quality Control: Operate installed duct 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 leakproof performance.

3.06 INSTALLATION OF FLEXIBLE CONNECTIONS:

A. Install flexible connection in accordance with manufacturer's installation instructions.

B. Furnish and install flexible connections at following locations:
   1. Duct connection of supply fan.
   2. Duct connection of return fan.
   3. Duct connection of exhaust fan
   4. Duct connection of factory-built fan unit
   5. Elsewhere as shown on Drawings
      a. Flexible connections will not be required for curb-mounted, roof- type exhaust fans or downflow packaged AC Units.

3.07 INSTALLATION OF SOUND ATTENUATORS:
A. Sound attenuators shall be installed as shown on Drawings and supported from structural members in accordance with manufacturer's recommendations. No rigid connection shall exist between sound attenuators and partitions, walls, ceilings, etc.

3.08 CARE AND CLEANING:

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.09 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

- End of Section -
PART 1 – GENERAL

1.01 Summary

A. This section includes exhaust systems including:
   1. Roof Exhaust Fans
   2. Kitchen exhaust fans
   3. Fly Fans
   4. Roof Curbs

1.02 References

A. AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
B. AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings.
C. AMCA 99 – Standards Handbook
D. ACMA 210 – Laboratory Methods of Testing Fans for Rating Purposes
E. ACMA 300 – Test Code for Sound Rating Air Moving Devices
F. AMCA 301 – Method of Calculating Fan Sound Ratings form Laboratory Test Data
G. ANSI B3.15
H. California Electrical Code (C.E.C.)
I. SMACNA – HVAC Duct Construction Standards

1.03 Quality Assurance

A. Conform to AMCA bulletins regarding construction and testing. Fans shall bear AMCA certified rating seal.
B. Fans of similar type shall be by the same manufacturer.

1.04 Submittals

A. Product Data: Submit complete data of materials proposed including the following:
   1. Manufacturer.
   2. Model.
   3. Fan Type
   4. Wheel type
   5. Fan Construction Class
   6. Fan size and arrangement
   7. Dimensional data including bolt hole locations
   8. Fan Weight
      a. Were fans are mounted on vibration isolators, provide corner operating weight data for each fan.
   9. Air flow capacity, fan curves, and efficiency data
   10. Static pressure
   11. Fan motor drive
12. Motor HP and Fan bHP
13. Sound Power: discharge and inlet for each octave band.

B. In cases of Substitution, equivalent fan shall not (when compared to basis of design fan):
   1. Increase motor horsepower
   2. Increase bHP by more than 5%
   3. Increase noise level
   4. Increase tip speed by more than 10%
   5. Increase air inlet velocity by more than 20%

C. Maintenance Data: Submit operations and maintenance data and parts list for each fan type.
   Include this data in Maintenance Manual.

PART 2 - PRODUCTS

2.01 Acceptable Manufactures

   A. General Exhaust Fans, Inline Centrifugal Fans, Roof Exhaust fans, and Cabinet Fans:
      1. Greenheck
      2. Loren Cook
      3. Twin Cities Fan and Blower

   B. Fly Fans
      1. Mars Air Door
      2. Or Equal

   C. Roof Curbs
      1. By Fan Manufacturer
      2. Or Equal

2.02 General

   A. Provide motors so that they cannot be overloaded above nameplate rating throughout the full
      speed range of the adjustable pitch driving sheave.

   B. Fan wheels shall be balanced statically and dynamically near operating speed.

   C. Provide drives and guards conforming to the requirements hereinbefore specified.

   D. Fan construction, speed, noise level, tip speeds, outlet velocities and efficiencies will be taken
      into consideration in approval of fans offered. Fans shall be as scheduled on drawings, or
      approved equal.

2.03 Rooftop centrifugal exhaust fan – Upblast – direct drive.

   A. Roof exhaust fans shall be upblast centrifugal direct drive type. The fan wheel shall be centrifugal
      backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to
      the inlet cone for precise running tolerances. Wheels shall be statically and dynamically
      balanced.

   B. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support
      structure. Windbands shall have a rolled bead for added strength and shall be joined to curb
      caps with a leak proof continuously welded seam.
C. Motors shall be mounted out of the air-stream on vibration isolators. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance.

D. A disconnect switch shall be factory installed and wired from the fan motor to a junction box within the motor compartment. A conduit chase shall be provided through the curb cap to the motor compartment for ease of electrical wiring.

E. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

F. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

G. Provide with the following Options and Accessories:
   1. Aluminum Birdscreen
   2. Gravity backdraft Dampers
   3. UL/cUL 705 Electrical
   4. Drain connection
   5. Speed Controls
   6. NEMA 3R and EXP Disconnect Switches

2.04 Rooftop centrifugal exhaust fan – Upblast – belt drive.

A. Roof exhaust fans shall be upblast centrifugal belt driven type. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. Windbands shall have a rolled bead for added strength. Windband shall be welded to curbcaps with a leak proof continuous seam.

B. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.

C. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.

D. Motor pulleys shall be adjustable for final system balancing. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment. A conduit chase shall be provided through the curb cap to the motor compartment for ease of electrical wiring.

E. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

F. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

G. Provide with the following Options and Accessories:
   1. Aluminum Birdscreen
   2. Gravity backdraft Dampers
23 34 00 – Exhaust Fans

3. UL/cUL 705 Electrical
4. Drain connection
5. Speed Controls
6. NEMA 3R and EXP Disconnect Switches

2.05 Kitchen Rooftop centrifugal exhaust fan – Upblast – belt drive.

A. Roof exhaust fans shall be upblast centrifugal belt driven type. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. Windbands shall have a rolled bead for added strength. Windband shall be welded to curb caps with a leak proof continuous seam.

B. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.

C. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.

D. Motor pulleys shall be adjustable for final system balancing. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment. A conduit chase shall be provided through the curb cap to the motor compartment for ease of electrical wiring.

E. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

F. Each fan shall bear a permanently affixed manufacturer’s nameplate containing the model number and individual serial number for future identification.

G. Provide with the following Options and Accessories:
   1. Aluminum Birdscreen
   2. Gravity backdraft Dampers
   3. UL/cUL 705 Electrical
   4. Drain connection
   5. Speed Controls
   6. NEMA 3R and EXP Disconnect Switches
   7. Vented Curb Extensions
   8. Heat Baffles
   9. UL/cUL 762 Grease
   10. Non-Stick Wheel
   11. Clean Out Port
   12. Grease Trap w/Drain Connection
   13. Hinged Curb Cap Kit w/Cable
   14. High Temp Grease Bearings

2.06 Fly Fans
A. Provide air doors of sizes and arrangement as scheduled.

B. Ratings: Test and rate fans in accordance with ASHRAE Standards.

C. Fan Units: Provide factory-assembled and tested fan units consisting of housing, wheel, fan shaft, bearings, and fan drive. Clean, condition, and prime paint sheet metal parts prior to final assembly. Apply final coat of enamel to exterior surfaces after assembly.

D. Wheels: Balance wheels statically and dynamically near operating speed.

E. Provide micro-switch operation for each fan, for automatic on/off control.

F. Provide with accessories as scheduled.

2.07 Roof Curbs

A. Provide manufacturer's standard shop-fabricated units, modified if necessary to comply with project requirements.

B. Fabricate structural framing for units of structural quality sheet steel formed to manufacturer's standard profiles for coordination with roofing, insulation and deck construction. Include 45 degree cant strips and deck flanges with offsets to accommodate roof insulation. Weld corners and seams to form watertight units.

C. Sloping Roof Decks: For deck slopes of 1" per foot and more slope, fabricate support units to form level top edge.

D. Unless scheduled otherwise, curbs height to be 14”.

E. Unless scheduled otherwise, curbs to be fabricated of 14 gauge metal.

F. Provide pressure treated wood nailer, not less than 1-5/8" thick and of not less than width of support wall assembly. Anchor nailer securely to top of metal frame unit.

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.

PART 3 - EXECUTION

3.01 General

A. Install fans and ventilators in accordance with equipment manufacturer's installation instructions, and with recognized industry practices, to ensure that equipment complies with requirements and serves intended purposes.

B. Install flexible connections between fan inlet and discharge ductwork. Metal bands of connectors are to be parallel with 1" (minimum) flex between ductwork and fan while running.

C. Flexible connections located outdoors shall be provided with a sheet metal sun shield.

D. Install fan with vibration isolation as indicated. Adjust isolators to prevent tension in flexible connectors when fan is operating.
E. Supply and install sheaves as necessary for final air balancing.

F. Ensure air distribution equipment is wired properly, with rotation in direction indicated and intended for proper performance.

3.02 ROOF CURBS:

A. Furnish roof curbs to roofing installer for installation.

3.03 START UP

A. Inspect equipment after installation to verify installation is in accordance with specifications and manufacturers installation guidelines. Verify equipment is lubricated, proper belt tension, and that equipment is otherwise ready to operate.

B. Perform air side test and balance as applicable.

3.04 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like and leave premises clean, neat and orderly.

- End of Section -
PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes requirements for the following duct accessories:
   1. Air Inlets and Outlets

1.02 QUALITY ASSURANCE

A. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) HVAC Duct Construction Standards (Metal and Flexible), latest edition, for all work in this section.

B. ASHRAE Standards: Comply with American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE) recommendations, latest edition, for all work in this section.


D. Compliance: Construct, test, install and label fire dampers and fire doors in accordance with Underwriters Laboratories (U.L.) Standard 555, "Fire Dampers and Ceiling Dampers."

E. The Diffuser, Register, Grille manufacturer shall provide published performance data for all air inlets/outlets. Performance tests shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

1.03 Submittals

A. Product data: submit complete data of materials proposed including:
   1. Manufacturer and model number
   2. Clearly indicate all options, trim, and accessories.
   3. Cross reference manufacturer's cut sheet to fixture callout ID on submittal sheet.

B. Operation and Maintenance Data: submit complete O&M data including:
   1. Maintenance data and parts lists for each type of fixture.
   2. Provide "trouble- shooting" maintenance guide
   3. Include this data within maintenance manual

PART 2 - PRODUCTS

2.01 AIR INLETS AND OUTLETS

A. Acceptable Manufacturers:
   1. Titus
   2. Price
   3. Nailor
   4. Krueger

B. General:
1. Provide manufacturer's standard inlets and outlets where indicated on Contract Drawings. Provide size, shape, capacity, type, and throw patterns as indicated. Construct of materials and components as indicated and as required for complete installation.

2. Furnish and install sponge rubber gaskets between grilles and grounds of finished surfaces. Wood grounds will be furnished by others. Metal grounds shall be furnished by this Contractor.

3. All supply diffusers, registers, and grilles located at ceiling shall have factory- applied, bone-white finish unless noted otherwise.

4. All diffusers, registers, and grilles to be steel construction unless noted otherwise.

C. Supply Air Diffusers:

1. Ceiling:
   a. Titus Modular Core, model MCD or equal.
   b. Provide 24”x24” Module with Border Type 3 for lay-in ceilings.
   c. Provide Border Type 6 for gyp. board ceilings.

2. Sidewall:
   a. Titus sidewall grille, model 300RS or equal.
   b. 3/4” blade spacing
   c. Double Deflection
   d. Front blades parallel to the short dimension
   e. Blades to be individually adjustable.

3. Sidewall - Gymnasiums:
   a. Titus sidewall grille, model 300RS-HD or equal.
   b. Heavy duty construction with 14-gauge blades and 16-gauge border.
   c. 1/2” blade spacing
   d. Double Deflection
   e. Front blades parallel to the short dimension
   f. Blades to be individually adjustable.

4. Exposed Round Ductwork:
   a. Titus Spiral Duct-mounted Grille, model S300FS or equal.
   b. 3/4” blade spacing
   c. Double Deflection
   d. Front blades parallel to the short dimension
   e. Blades to be individually adjustable.
   f. Provide with model ASD-Air Scoop damper/extractor.

D. Return and/or Exhaust Air Grilles:

1. Ceiling:
   a. Titus return grille, model 355RS or equal.
   b. 1/2” blade spacing
   c. 35° Fixed Deflection Blades
   d. Provide with full 24”x24” ceiling module and #3 border.
   e. Provide with type #1 border for surface mount.

2. Ceiling – Shower areas:
   a. Titus return grille, model 355FS or equal.
   b. Aluminum
   c. 1/2” blade spacing
   d. 35° Fixed Deflection Blades
   e. Provide with type #1 border for surface mount.
3. Sidewall:
   a. Titus return grille, model 355ZRL or equal.
   b. 1/2” blade spacing
   c. 0º Fixed Deflection Blades
   d. Provide with blades parallel to the long dimension.
   e. Provide with type #1 border for surface mount.

4. Sidewall - Gymnasiums:
   a. Titus return grille, model 30RL or equal.
   b. Heavy duty construction with 14-gauge blades and 16-gauge border.
   c. 3/8” blade spacing
   d. 0º Fixed Deflection Blades
   e. Provide with blades parallel to the long dimension.
   f. Provide with type #1 border for surface mount.

5. Filter Return Grille:
   a. Titus return grille, model 350RLF2.
   b. 3/4” blade spacing
   c. 35º Fixed Deflection Blades
   d. Filter to have a 2” filter frame
   e. Provide hinge at top.
   f. Provide with blades parallel to the long dimension.
   g. Provide with type #1 border for surface mount.

E. Transfer Air Grilles:

1. Ceiling:
   a. Titus return grille, model 350RS or equal.
   b. 3/4” blade spacing
   c. 35º Fixed Deflection Blades
   d. Provide with full 24”x24” ceiling module and #3 border.
   e. Provide with type #1 border for surface mount.

2. Sidewall:
   a. Titus return grille, model 350ZRL or equal.
   b. 3/4” blade spacing
   c. 0º Fixed Deflection Blades
   d. Provide with blades parallel to the long dimension.
   e. Provide with type #1 border for surface mount.

3. Sidewall - Gymnasiums:
   a. Titus return grille, model 30RL or equal.
   b. Heavy duty construction with 14-gauge blades and 16-gauge border.
   c. 3/8” blade spacing
   d. 0º Fixed Deflection Blades
   e. Provide with blades parallel to the long dimension.
   f. Provide with type #1 border for surface mount.

PART 3 - EXECUTION

3.01 GENERAL:

A. Install duct 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.
3.02 INSTALLATION OF AIR INLETS AND OUTLETS:

A. Locate ceiling air diffusers, registers, and grilles as indicated on general construction "Reflected Ceiling Plans." Unless otherwise indicated, locate units in center of acoustical ceiling modules.

B. Install outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that products serve intended functions.

C. Examine areas and conditions under which outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

D. Ceiling-mounted air terminals or services shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.

E. Terminals or services weighing 56 pounds or less shall have two No. 12 gauge hangers connected from the terminal or service to the structure above. These wires may be slack.

F. Terminals or services weighing more than 56 pounds shall be supported directly from the structure above by approved hangers.

G. Paint visible ductwork behind grilles, registers, and diffusers dull black.

3.03 CARE AND CLEANING:

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.04 CLEANING UP:

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

- End of Section -
PART 1 – GENERAL

1.01 Summary

A. This section provides requirements for packed ducted air conditioning units.

1.02 QUALITY ASSURANCE:

A. Flame-Smoke Ratings: Except as otherwise indicated, provide air conditioning unit thermal insulation with flame-spread index of 25 or less, fuel-contributed index of 50 or less, and smoke-developed index of 50 or less.

B. AMCA Standards: Comply with Air Movement and Control Association (AMCA) Standards as applicable to testing and rating fans.

C. SMACNA Compliance: Comply with Sheet Metal and Air Conditioning Contractors National Association (SMACNA) ductwork construction standards as applicable to air conditioning units.

D. AGA Certification: Gas fired equipment shall be AGA certified.

E. ARI Certification: Coils shall comply with ARI Standard 410.

F. UL Compliance: Provide electric components for air conditioning units which have been listed and labeled by Underwriters Laboratories or by a testing organization of equal standing.

G. Only Manufacturer’s Authorized Commercial and Industrial Equipment Suppliers shall be allowed to supply equipment for this project. Equipment suppliers who’s primary business is residential and are not a Manufacturer’s Authorized Commercial and Industrial Equipment Supplier shall not be accepted on this project due to lack of a service company capable of proper support on a commercial quality project.

1.03 SUBMITTALS:

A. Submit the following information for each packaged unit:
   1. Manufacturer’s product data and cut sheet for each unit.
   2. Submit manufacturer’s specifications for air conditioning units showing dimensions, weights, capacities, ratings, certified fan performance with operating point clearly indicated on a fan curve, motor electrical characteristics, gauges, finishes of materials, and installation instructions.

B. Maintenance Data:
   1. Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, and spare parts lists.
   2. Include this data in maintenance manuals only.

PART 2 - PRODUCTS

2.01 Outdoor Unit:

A. General
   1. The outdoor unit shall be fully charged from the factory for matched indoor section and up to 15 feet of piping. This unit must be designed to operate at outdoor ambient temperatures as
high as 115°F. Cooling capacities shall be matched with a wide selection of air handlers and furnace coils that are ARI certified. The unit shall be UL listed. Exterior must be designed for outdoor application.

B. Casing
1. Unit casing is constructed of heavy gauge, galvanized steel and painted with a weather-resistant powder paint. Corrosion and weatherproof CMBP-G30 DuraTuff™ base.

C. Refrigerant Controls:
1. Refrigeration system controls include condenser fan and compressor contactor. High and low pressure controls are inherent to the compressor. Another standard feature is the liquid line dryer.

D. Compressor
1. The compressor features internal over temperature and pressure protector, total dipped hermetic motor and thermostatically controlled sump heater. Other features include: roto lock suction and discharge refrigeration connections, centrifugal oil pump, and low vibration and noise. The compressor is standard with a 5 year limited warranty.

E. Condenser Coil
1. The coil shall be continuously wrapped, corrosion resistant all aluminum with minimum brazed joints.
2. This coil is 3/8 inch O.D. seamless aluminum glued to a continuous aluminum fin.
3. Coils are lab tested to withstand 2,000 pounds of pressure per square inch.
4. The outdoor coil provides low airflow resistance and efficient heat transfer.
5. The coil is protected on all four sides by louvered panels and has a 5 year limited warranty.

F. Low Ambient Cooling
1. Provide unit with evaporator defrost control and TXV valve to permit low ambient cooling to 30°F.

G. Thermostats — Heating/Cooling
1. Sub-base to match thermostat and locking thermostat cover.

2.02 Indoor Unit:

A. General:
1. Blower coil units shall be completely factory assembled including coil, condensate drain pan, fan, motor, filters and controls in an insulated casing that can be applied in horizontal or vertical configuration. The “F” model indicates an “Air-Tite™” model with 4.2 “R” value insulation and additional sealing systems.
2. Units shall be UL listed.

B. Casing
1. Units shall have a rugged sheet metal and steel frame construction and shall be painted with an enamel finish.
2. Casing shall be insulated and knockouts for electrical power and control wiring.

C. Refrigerant Circuits
1. The 2/4TEH3F units have a single refrigerant circuit.
2. Refrigerant circuit shall be controlled by a factory-installed non-bleed thermal expansion valve.

D. Coil
1. Aluminum fin surface shall be mechanically bonded to 3/8-inch OD copper tubing. Coils are factory pressure and leak tested.
E. Fan
   1. Forward curved, dynamically balanced and statically balanced with 4-speed direct drive shall be standard, fan motor bearing shall be permanently lubricated.

F. Controls
   1. Low voltage pig tails, fan contactor, and plug-in module for accessory electric heat control shall be included.

G. Filters:
   1. Filters shall be included as standard, one-inch low velocity semi-permanent type.
   2. Provide with 2 sets of spare filters.

2.03 REFRIGERATION PIPING:

A. Copper Tubing: ASTM B 280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.

B. Copper Tubing: ASTM B 88, Type L, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing.


D. Joints: Use silver solder and non-corrosive flux.

E. Valves and Sight Glasses: Alco or Henry.

F. Oil Loops and Double Risers: Provide to assure successful operation.

PART 3 - EXECUTION

3.01 GENERAL:

A. Examine areas and conditions under which air conditioning units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Warranty:
   1. Unit manufacturer shall provide 2 year parts and labor warranty on entire unit including any accessories provided for field installation on the unit.
   2. This warranty period shall begin at upon signoff of substantial completion of the project.

3.02 INSTALLATION OF AIR CONDITIONING UNITS:

A. Install air conditioning units where indicated in accordance with equipment manufacturer's written instructions and with recognized industry practices to ensure that units comply with requirements and serve intended purposes.

3.03 TEST OF PIPING:

A. Test piping at completion of roughing in, in accordance with the following:
   1. Pressurize with dry nitrogen to 300 psig and test all joints with an electronic detector or halide torch.
2. Release the pressure and attach a high vacuum pump. Evacuate to 4,000 microns and hold for 30 minutes.
3. Break vacuum with dry nitrogen and pressurize to 5 psig. Hold pressure in system for 10 minutes.
4. Evacuate to 2,000 microns and hold for 30 minutes.
5. Use a mercury manometer or electronic vacuum gauge to measure pressures. Do not start timing until recommended vacuum range is reached.
6. Show no loss in pressure or visible leaks after each test at the test pressures indicated. Tests to be verified by Inspector of Record.

B. Testing equipment, materials, and labor shall be furnished by this Contractor.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

3.04 TESTING AND STARTUP:

A. Equipment manufacturer’s commercial and industrial local service company shall conduct check, test, and start-up of units and shall complete one startup form for each unit listing the refrigerant suction line pressure and temperature, liquid line pressure and temperature, charge in pounds of refrigerant, charge in pounds of refrigerant as required by the unit nameplate, supply blower rpm and supply blower amps drawn. Startup forms shall be submitted to the Architect and Mechanical Engineer for approval upon completion. If necessary, units shall be field charged with refrigerant for proper operation. Startup by installing contractor or others shall not be acceptable.

- End of Section -
1. GENERAL:
   A. WORK INCLUDED:
      1. Requirements of Divisions 00 and 01 apply to all work of this Section.
      2. Contractor shall provide all materials, labor, and the means and methods to complete the
         installation defined by the plans and these specifications.
   B. REQUIREMENTS:
      1. Other Divisions: Requirements of other divisions shall apply to this division as if repeated
         herein, and should work under this division require any carpentry, backfill, masonry, etc., the
         appropriate division requirements shall apply. This includes work required for construction of
         proper stands, bases, and supports for electrical materials and equipment.
      2. Rules and Regulations: All work and materials shall be in full accordance with the latest rules
         and regulations of the following:
         c. California Code of Regulations, Title 8, Electrical Safety Orders
         Nothing in these drawings or specifications is to be construed to permit work not conforming
         to the above codes, rules, and regulations.
         Whenever indicated, material, workmanship, arrangement, or construction is of higher quality
         or capacity than that required by the above rules and regulations, the drawings and/or
         specifications shall take precedence. Should there be any direct conflict between the rules
         and regulations and the drawings and/or specifications, the rules shall govern.
      3. Inspections: All work and materials covered by these specifications and accompanying
         drawings shall at all times be subject to inspection by the Architect or his representative. Any
         material not in accordance with the plans and specifications, or not installed in a neat and
         workmanlike manner, shall, upon order from the Architect, be removed from the premises or
         corrective action taken within three (3) days; and if material in question has been installed,
         the entire expense for removing and reinstalling shall be borne by the Contractor.
         On completion of the work, satisfactory evidence shall be furnished to the Architect to show
         that all work has been installed in accordance with the Codes.
      4. Specifications and Contract Drawings: Accuracy of data given herein and on the drawings is
         as exact as could be secured, but their extreme accuracy is not guaranteed. The drawings
         and specifications are for the assistance and guidance of the Contractor and exact locations,
         distances, levels, etc., will be governed by the construction and existing conditions and the
         Contractor shall accept same with this understanding.
         Layouts of equipment, accessories and wiring systems are diagrammatic (not pictorial and
         not exact), but shall be followed as closely as possible. Architectural, structural, mechanical,
         and other drawings shall be examined noting all conditions that may affect this work. Where
         connections to equipment provided by other divisions are shown on electrical drawings, refer
         to drawings of respective division for exact locations and electrical requirements of
         equipment. Report conflicting conditions to the Architect for adjustment before proceeding
         with work. Should Contractor proceed with work without reporting conflict(s), he does so on
         his own responsibility, and shall alter work if directed by the Architect, at his own expense.
         Right is reserved to make minor changes in locations of equipment and wiring systems
         shown, providing change is ordered before conduit runs and/or work directly connected to
         same is installed and no extra materials are required.
         Drawings and specifications may be superseded by later detail specification and detail
         drawings prepared by the Architect, and the Contractor shall conform to them and to such
         reasonable changes in the contract drawings as may be called for by these revised drawings
         without extra cost to the Owner. Contractor may request additional detail(s) and such shall be
         conformed to, without additional cost. Contractor may offer alternate detail(s), but such
         detail(s) shall be approved by Architect and authority having jurisdiction.
5. Structural Requirements: Installation under this Section shall comply with the California Building Code. Obtain the Architect's approval before performing any cutting or patching of concrete, masonry, or wood structure in the building.

6. Examination of Site: The Contractor shall be held to have visited the site prior to bidding and satisfied himself as to the conditions under which the work is to be performed. He shall check existing conditions which may affect his work. Where signal systems exist, and services of other firms are required, Contractor shall instruct those firms to investigate existing systems and determine labor and materials needed to add devices or modify systems. Where new conduits are to be run underground at existing sites, contractor shall visit site prior to bidding and walk routes of new underground conduits, note areas of concrete and asphalt being crossed, and include in bid all costs for cutting and patching. No allowances shall subsequently be made in Contractor's behalf for any extra expense to which he or his "subs" may be put due to failure or neglect to discover conditions affecting the work.

7. Underground Utilities: Existing underground utilities, services, circuits, piping, irrigation piping, etc., are present, but their exact locations are not known. Contractor shall locate and protect before trenching or excavating in any area. Consult utility companies, "as-built drawings" and Owner's maintenance personnel for location of existing underground work. If existing piping or utilities are damaged during construction, Contractor shall repair immediately at own expense. New underground work shall be modified as necessary to conform to existing conditions.

8. Shop Drawings, Substitutions, Materials, and Submittals:
   a. Shop drawings and all supporting data shall be submitted as instruments of the Contractor who shall certify on his transmittal form that the submittals meet all requirements of the contract documents and conform to structural and space conditions. Contractor shall mark each page of each copy of submittal to clearly identify materials, products, or models being proposed. All extraneous information shall be marked out or page pulled if no item(s) on page are being proposed. Submittals which do not clearly identify items being proposed will be returned without review.
   b. When specific names are used in connection with materials, they are used as standards only, but this implies no right upon the part of the Contractor to use other materials or methods unless approved as equal in quality and utility by the Architect in writing.
   c. Whenever an item of equipment or system is described herein or on the drawings in a descriptive, functional, or operational manner as opposed to catalog number or type, then the Contractor's submittal shall include all such descriptive, functional, or operational features to prove full equality to specified item or system.
   d. Panelboard submittals shall be arranged to show bussing and circuit numbers with respective branch circuit protective device similar to schedules on Drawings. Device ratings, circuit numbers, and nameplates shall be in table form.
   e. Within 30 days after award of the contract, submit seven bound copies of brochures containing complete information and catalog cuts on all equipment, including that which is to be furnished as specified. The brochures shall be bound as complete volumes or bound according to classifications of equipment such as power, fixtures, signals, and miscellaneous. Incomplete submittals (such as signal system product data submitted without system shop drawings) will be returned without review.
   f. Approval of a substitution does not authorize any deviation from the utility, size, or function of the specified item unless specifically pointed out and approval requested in the letter of submittal. Responsibility for conflicts due to space limitations is not relieved by approval of a substitution. If revision of wiring, piping, or arrangement of other equipment is required by substitutions, prepare drawings showing such revisions, and after approval, furnish seven copies for file and future reference.
   g. Should the Contractor's first submittal fail to meet approval, or should the Contractor fail to submit the specified items within the time schedule, then the right is reserved by the Architect to select any or all items in question, which selection shall be final and binding upon the Contractor. The materials selected or approved by the Architect shall be used in the work at no additional cost to the Owner.
   h. Unless otherwise shown or specified, material shall be new, full weight, standard, the best quality of its kind, and satisfactory to the Architect. Unless otherwise shown or
specified, major equipment shall be the product of a manufacturer who has, for a period of not less than five years, been in successful manufacture of the equipment, and who has a nationally distributed catalog covering ratings and specifications of said equipment.

i. Electrical materials shall bear the label of, or be listed by, the Underwriters Laboratories unless of a type for which label or listing service is not provided.

j. Materials and components shall conform to Industry Standard, including:
   NEMA National Electrical Manufacturer's Association
   ANSI American National Standards Institute
   ASTM The American Society for Testing and Materials
   ICEA Insulated Cable Engineer's Association
   USA United States of America Standards

k. Samples of fixtures, materials, and equipment shall be submitted for approval if requested.

9. Identification of Equipment: Nameplate shall be installed on electrical equipment. Nameplates shall adequately describe the item and its function or use of the particular equipment involved. Equipment to be labeled shall include the following:
   a. Individual enclosures for equipment such as time switches, push buttons, contactors, relays, etc.
   b. Group mounted equipment such as panelboards, terminal cabinets, etc.
   c. Wall switches for lighting or other use where the control function is not self-evident.
   d. Disconnect switches mounted remote from equipment and unit served is not self-evident.
   e. Terminal backboards (locate centered at top).
   f. Terminal strips at terminal backboards and cabinets (located centered above terminal block for each system). At terminal strips, the following abbreviations may be used:
      CLK Clock
      DATA Data Communications
      FA Fire Alarm
      IC Intercom
      IA Intrusion Alarm
      TEL Telephone
      LTG Outside Lighting Control
      TV Television

Nameplate material shall be laminated phenolic plastic, black front and back with white core. Engraving shall be through the outer layer. Embossed plastic pressure sensitive labels are not acceptable.

In lieu of plastic plates, typed pasteboard inserted behind clear plastic protector in a metal holder inside door may be used to identify circuit breakers in panelboards.

In lieu of plastic plates, device plates shall be engraved directly with lettering filled with black enamel.

Nameplates shall be securely fastened to the equipment with #4 Phillips round head cadmium plated steel self-tapping screws or brass bolts or riveted to equipment.

10. Cutting of Structural Members: Unless specifically detailed on the structural drawings, cutting of joists and similar structural members is limited to cuts and bored holes located and sized in accordance with the requirements of Title 24. Cutting of structural mullions is prohibited except as specifically shown.

11. Record Drawings: The Contractor's foreman shall keep in his possession a minimum of two copies of DSA approved plans. One set shall be marked as the work is installed, showing the work that has been installed, with deviations. The other set shall be marked showing deviations for the work shown and the locations of major items of equipment and feeders, dimensioned from curbs, foundations, or other landmarks. Obtain inspector's progressive approval of these marked sheets. Upon completion of the work, all work installed shall be drafted by the Contractor to reproducible drawings, which shall be the as-built drawings. Coordinate with General Contractor on requirements for reproducible record drawings.

12. Cleaning and Cleanup: After all work has been accomplished such as sanding, painting, etc., lighting fixtures, panelboards, and other electrical work shall be cleaned to remove all dust, dirt, grease, paint, or other marks. All electrical equipment shall be left in a clean condition inside and out, satisfactory to the Architect. Keep buildings and premises free from
accumulated waste materials, rubbish, and debris resulting from work herein, and, upon completion of said work, remove tools, appliances, surplus materials, waste materials, rubbish, debris, and accessory items used in or resulting from said work and legally dispose of off the site.

13. Protection: The Contractor shall protect from damage during construction the work and materials of other trades as well as the electrical work and material. Electrical equipment stored and installed on the job site shall be protected from dust, water, or any other damage.

14. Interruption of Service: Services (power, telephone, fire alarm and other signal services) to existing building(s) and their related circuits which are to remain in operation shall not be interrupted except by specific approval of the Owner. If it is deemed necessary to shut down circuits for the installation of new work, such shut down shall be scheduled with the Owner who may, at his option, have a representative present. Any accidental interruption of service to circuits or equipment as a result of work performed by the Contractor shall, at the Contractor's expense, be restored in a manner acceptable to the Owner.

a. Fire Alarm and Intrusion Alarm Systems:
   1) Existing fire alarm system must be kept operational during work of this contract. If operation of existing system or portion of existing system is disrupted for connections into system or cutoff for any reason by work of this project, Contractor must provide fire watch. Fire watch must occur 24 hours per day and every day system is down. Fire watch proposed by Contractor must be acceptable to local fire authority and Owner. All costs for fire watch shall be Contractor's responsibility.
   2) Existing intrusion alarm system must be kept operational during unoccupied hours. In the event that the system or portion of system in nonoperational during off-hour periods as a result of work of this contract, the Contractor must provide guard(s) to patrol the campus. Guard(s) and guard duties proposed by Contractor must be acceptable to District and District Police (local enforcement if District does not have its own Police Services). All costs for security guard(s) shall be Contractor's responsibility.

15. Cooperation and Coordination: Cooperate and coordinate with other crafts in putting the installation in place at a time when the space required by this installation is accessible. Work done without regard to other crafts shall be moved at the Contractor's expense.

16. Electrical Work for Equipment Furnished by Others: Contractor shall make electrical connections to all equipment furnished and installed by others. Specific requirements shall be obtained from contractor providing the equipment and used to perform electrical work. Contractor's responsibility is limited to having correctly installed and connected electrical work in accordance with diagrams and specifications furnished him by the appropriate equipment contractor.

a. Heating, Ventilating, and Plumbing Equipment: All temperature control wiring, both line and low voltage, conduit and wire included, is part of the Mechanical Work. Conduits for mechanical loop wiring conductors from building to building are part of Electrical Work where shown on Electrical Drawings. All power wiring is part of the Electrical Work. For the purpose of this specification, power wiring is the branch circuit from panel or switchboard to the motor or heater via the starter or switch which opens or closes the circuit. All wiring which acts to open or close the starter or switch is temperature control. All automatic motor starters, except in motor control centers, are furnished by others and installed by Electrical Contractor, who will make power wiring connections only. All control items which are furnished by others and are in power wiring circuits shall be installed by Electrical Contractor.

Provide disconnect switch for all mechanical equipment to disconnect power wiring only. Opening the disconnect shall de-energize all power wiring within the unit. Disconnects for control wiring are provided by others. Provide fused disconnects where shown on plans and for all units with compressors, whether shown on plans or not. Fuse ratings shall be in accordance with manufacturer’s nameplate data. Fuse size shall be maximum required, but shall not be less than indicated. Coordinate with Division 23 Contractor. Disconnects for 120-Volt equipment shall be manual motor starters with thermal overloads properly sized. Disconnect location shall be coordinated with unit manufacturer and installed to provide working clearance required by Code and these specifications, but
not to inhibit maintenance of the unit. If disconnect cannot be mounted to unit, provide
galvanized formed steel channel (Unistrut, B-Line) support.
b. Equipment or Systems Other Than HVAC or Plumbing: This contractor shall provide all
conduit, conductors, disconnects, and connections for power and controls for equipment
requiring electrical services.
c. Provide duplex, weatherproof convenience receptacle at each HVAC unit mounted on
roof or on grade if not shown on Drawings. Connect to nearest convenience receptacle
circuit, unless shown otherwise. All receptacles shall be GFI type.

17. Inspection: The Contractor shall cooperate with the Architect and shall provide assistance at
all times for the inspection of the electrical work performed under this contract. He shall
remove covers, operate machinery, or perform any reasonable work which, in the opinion of
the Engineer, will be necessary to determine the quality and adequacy of the work.

18. Manufacturer's Directions: Follow manufacturer’s directions where these directions cover
points not included on the drawings or in the specifications. When equipment is provided by
other divisions, obtain directions from respective supplier.

19. Workmanship: Good workmanship shall be evidenced in the installation of all electrical
materials and equipment. Equipment shall be level, plumb and true with the structure and
other equipment. All materials shall be firmly secured in place and adequately supported and
permanent. The recommendations of the National Electrical Contractors Association
Standard of installation shall be followed except where otherwise specifically directed.

20. Operating Test: After the installation is complete, and at such time as the Engineer and other
authorities having jurisdiction may request, the Contractor shall conduct an operating test for
approval.

21. Manuals: In addition to the catalog data and Shop Drawings submitted for approval as
required hereinbefore, the Contractor shall furnish to the Architect three final corrected sets of
all data applicable to the equipment furnished.
   a. All data shall be delivered not less than 30 days before the start of operation by the
      Owner or any demonstration period hereinafter specified and before finalizing
      construction work.
   b. Each set of data per system shall be bound in one or more volumes. A top quality
      three-ring binder with vinyl or hard cover will be acceptable in lieu of binding; however, all
      insert data must be properly punched and reinforced. Each volume shall have permanent
      identification information on the spine.
   c. Identification information shall include the building name, address, and location, system
      or systems included, and titled "Maintenance Manual".
   d. All data shall be assembled in an orderly sequence with tabbed dividers to correspond
      with the table of contents.
   e. Manufacturer's catalog data, Shop Drawings, etc., shall be marked clearly to identify the
      items applicable only to this project. Make and model numbers of each item installed
      shall be marked clearly in catalog data and identified with symbol used on the Drawings.
   f. Each set of data shall contain the following:
      1) Table of Contents, listing orderly indexed names of items.
      2) Descriptive literature.
      3) Rating data, including rating tables, performance curves, etc.
      4) Dimension data.
      5) Spare Parts Lists.
      6) Manufacturer’s operation and maintenance instructions and manuals.
      7) Shop Drawings.
      8) Copies of posted instructions and diagrams.
      9) Control diagrams and descriptions of sequence of operation.
     10) Copies of warranties, guarantees, certificates, etc.
   g. Complete data, including component parts, shall be provided on each item listed below:
      1) Fire Alarm Equipment.
      2) Lighting Fixtures.
      3) Lighting Control Equipment.
      4) Panelboards.
      Submit copy to Architect for approval before delivery to Owner.
h. In addition to the requirements above, contractor shall provide final programming information to District on disk for all systems requiring programming.

22. Contractor's Supervision: The Electrical Contractor shall personally, or through an authorized and competent representative, constantly supervise the work from its beginning to its completion and acceptance. He shall, as far as possible, keep the same foreman and workers on the work from its commencement to its completion.

23. Temporary Work: All temporary electrical equipment and materials installed for construction and safety operations shall remain the property of the Contractor and shall be removed when permanent connections have been completed. No wire, bus, or electrical equipment which is part of any of the permanent electrical systems may be used for temporary electrical service. Temporary connections shall be safe and in accordance with accepted practices. The Contractor shall be responsible for any damage or injury to equipment, materials, or personnel caused by improperly protected temporary installations. All costs for materials and installation for temporary electrical facilities and energy for their operation shall be at the expense of the Contractor. The hours of operation, level of illumination, and coverage for safety of personnel shall meet the minimum requirements of the Owner (Division of Industrial Safety).

24. Scheduling of Work:
   a. Due to its nature, this work will have to proceed with a definite sequence of operations to minimize outages and to continue facilities to certain areas. The building(s) will remain in operation during the work and the Contractor shall make every effort to maintain required services (power and signal).
   b. Wherever the work makes it necessary to cut off a feeder, branch circuit or signal circuit and it stands to remain out of service for some time, or longer than building operations will permit, the Contractor shall make temporary connections so the required outlets, devices, or loads will continue to be operational. Some outlets, devices and wiring in the area will remain undisturbed. The Contractor shall reconnect these circuits, extending where necessary, so all circuits will operate satisfactorily upon completion of the work.
   c. Where power or signal system outages are unavoidable, such outages shall be scheduled with the Owner and shall occur at such times deemed least disruptive by the Owner.
   d. Special precautions shall be taken to insure safety of school staff and students during construction. No trenches shall be left open and no equipment left unsupervised.

25. Existing Work: Existing conduits in alteration, extension, and remodeling areas which are required to be extended, altered, or reconnected shall be accomplished as shown or as directed. Where existing conduits which are indicated to be revised or which will be essential to the functioning to the particular system are cut or exposed due to construction changes, new connections shall be made in the most expeditious manner as directed or indicated. Where wiring is involved, new wires shall be "pulled-in" between the nearest available, accessible, reused outlets. In all cases where new wires are required, indicated, or specified to be installed in existing conduits, if same cannot be installed, new conduits shall be provided therefore as directed. Attention is called to the fact that all new conduit, wiring, and apparatus shown on drawings or specified shall be connected to the existing systems so as to function as complete units. All conduits and electrical apparatus, etc., in place and not shown or specified to be reused or which will not be essential to the functioning of the various systems when the work is complete, shall be removed and stored where directed. No old material shall be reinstalled or reused unless so indicated on drawings or so specified. Concealed conduits which are not indicated or specified to be reused and become exposed due to construction changes shall be removed to the nearest available, accessible, reused outlets.

26. Equipment at Existing Walls and Ceilings Being Removed: Remove all electrical equipment at walls and ceilings being removed. Remove conduit and conductors back to last active remaining outlet. If conduit is routed from floor, cut below surface and patch to match existing. If conduit is routed from ceiling slab, cut flush with surface.

27. Copies of codes, safety orders, submittals, specifications, drawings, addenda, and as built shall be on the job and in possession of person responsible for electrical work (foreman or general foreman).
28. Guarantee: Acceptance of the contract for this work includes this guarantee: The Contractor guarantees that he has performed the work in accordance with the contract documents. Contractor also agrees to replace or repair, as new, any defective work, materials, or part which may appear within one year of final payment if in the opinion of the Architect or the Owner the defect is due to workmanship or material.

29. Warranties, guarantees, certificates, etc. that are furnished and are available for equipment and materials furnished and installed under this section shall be properly filled out as of the date of final payment and shall be delivered to the Engineer.

* * *
1. **GENERAL:**
   A. **WORK INCLUDED:**
      1. Requirements of Divisions 00 and 01 and Section 26 01 00 apply to all work of this Section.

2. **PRODUCTS:**
   A. **CONDUCTORS:**
      1. Conductors for power, lighting, control, and signals shall be in raceway and shall be as follows:
         a. #10 AWG and smaller shall be solid copper, 98% conductivity except for signal and control cables which may be stranded. (Stranded conductors may be used for #10 and smaller if wiring devices [switches, receptacles, etc.] are equipped with terminals specifically designed to accommodate stranded wire.)
         b. #8 AWG and larger shall be stranded copper, 98% conductivity.
         c. Minimum size branch circuit shall be #12 AWG.
         d. Signal and control circuits shall be as indicated on Drawings or as required by equipment manufacturers. Where specialty cables are required for signal systems (such as for fire alarm, intrusion alarm), Contractor must coordinate cable types with system supplier to insure proper cable type is provided (shielded, non-shielded, etc.).
         e. Branch circuit conductors within fixtures shall be type RHH or THHN except as noted.
         f. Fixture tap conductors shall be #14 AWG minimum type RHH or THHN except as noted.
         g. All insulation shall be 600 volt THHN/THWN except for low voltage control and signal cable.
         h. Conductors shall be color coded. Refer to Part 3 of this section.
         i. Conductor markers - T&B vinyl, Brady Permasheild, or equal.
         j. Control wiring smaller than #12 AWG shall be type TFF or THWN.
   2. **Terminals:**
      a. Use lugs or socket type terminals furnished with equipment.
      b. For #10 and smaller, T&B Sta-Kon, Buchanan "Termend", or equal, self-insulated forked tongue lug.
      c. #8 to #4/0 - Single Hex head screw or bolt clamp type with double hole tongue, T&B locktite, Burndy Qiklug type QA, or equal.
      d. #250 MCM and larger - Double Hex head screw or bolt clamp type with double hole tongue, T&B locktite tandem, Burndy Qiklug type QQA, or equal.
   3. **Splices:**
      a. #10 and smaller, including fixture taps - pre-insulated coiled-spring type connectors, 3M Scotchlocks, T&B Piggys, or equal.
      b. #8 to #4, Split bolt service connectors, T&B locktite, Burndy Servit, or equal, insulated with Scotch #88, Okoweld four purpose tape, or equal.
      c. #2 and larger, bolted pressure connectors, OZ ST, Burndy OKLIP, or equal, insulated with "Scotchfill" and Scotch #88 or Okoweld four purpose tape.
      d. Splice sealing kits - Scotchlock sealing packs for wire size to #10 and Scotchcast kits for larger splices as recommended by 3M Co. Engineer knows of no equal to Scotch kits.
   4. Lubricant for conductor installation shall be powdered soapstone, Y-er EAS, Minercollac "Pull-In" compound, or other U.L. approved lubricant.

3. **EXECUTION:**
   A. **WIRING SYSTEMS:**
      1. Tests: Test all wiring and connections for continuity and grounds before any fixtures or equipment are connected, and where such tests indicate faulty insulation or other defects, they shall be located, repaired, and retested at the Contractor's expense. Rotation of all motors shall be checked and corrected, if necessary, after final connections are made. Motor rotation corrections shall be made at the motor or equipment lugs, not in equipment disconnect.
B. CONDUCTORS:

1. Phasing: Terminals in panelboards, switchboards, and other equipment shall be phased A, B, C, reading left to right or top to bottom looking into the front of the equipment.

2. Conductors shall be coded to conform to existing color coding which exists.
   Color coding shall be permanently posted using nameplates affixed at each panelboard and other equipment. Refer to Section 26 01 00 for nameplate requirements.
   Direct current - positive is red, negative is black.
   Control conductors, other than branch circuits, shall be black.
   Conductors in sizes up through #6 AWG shall have solid color finish as listed above. #4 AWG and larger shall be coded by application of phase tape for minimum of 6" length on conductor.
   Coding shall occur at all splices, terminations, and pullboxes.
   Color coding shall be continuous and consistent throughout the work. Do not use different colors for switch legs, fixture taps, travelers, etc.

3. Circuit Identification: Each branch circuit, control, and signal conductor shall be labeled with the circuit number or terminal it is connected to. Use T&B vinyl, Brady Permashield mylar markers, or equal. Conductors shall be labeled at each panelboard, switchboard, control center, terminal cabinet, pullbox, and at each point of utilization such as fixtures, motors, speakers, etc. Labeling shall correspond to control diagrams where applicable.

4. Connections to terminals shall be as follows: Refer to 2.A.2. of this Section.

5. Splices:
   a. Refer to 2.A.3. of this Section.
   b. Splices in underground pullboxes or in other areas subject to moisture shall be provided with cast resin kits. Use Scotchlock sealing packs for wire size to #10 and Scotchcast kits for larger splices as recommended by 3M Co. All splices to be prepared as hereinbefore specified before resin kits are applied. Engineer knows of no equal to Scotch kits. (Note: No signal splices are allowed in underground pullboxes or areas subject to moisture.

   c. Wire splicing devices shall be sized according to manufacturer's recommendation.

6. Conductors in panels, etc., shall be laced with T&B Ty-raps, Dennison "Bar-loks", or equal.

* * *
1. GENERAL:
   A. WORK INCLUDED:
      1. Requirements of Divisions 00 and 01 and Section 26 01 00 apply to all work of this Section.
      2. Contractor shall provide all materials, labor, and the means and methods to complete the installation defined by the plans and these specifications.
      3. Grounding and Bonding: Grounding and bonding shall be installed as required by the applicable codes, rules, and regulations, and as follows:
         a. Each panel shall have its own grounding electrode.
         b. All raceway systems, supports, cabinets, panelboards, control equipment, motor frames, lighting fixtures, and utilization apparatus shall be permanently and effectively grounded.
         c. Where the raceway is used as the grounding conductor, good contact shall be made between conduit or tubing and panels, cabinets, outlet boxes and equipment, lighting fixtures, etc., to maintain continuity of ground. Where it is not possible to obtain good contact, additional bonding shall be provided. Supplemental bonding shall be provided between raceway and enclosure and at conduit knockouts and at reducing washers.
         d. All non-metallic power raceways shall contain a code size copper conductor, green insulated, properly bonded to equipment at each end, and to metallic portions of the same raceway.
         e. All grounding type receptacles shall have grounding contact connected to a grounding conductor. Grounding conductor may be code size green insulated copper conductor installed in circuit raceway or may be metallic raceway. If metallic raceway is used as grounding conductor, a green insulated copper conductor must connect receptacle grounding contact to lug or screw terminal in outlet box or to grounding bushing at raceway. Isolated grounding type receptacles shall have code sized green insulated copper conductor installed in circuit raceway.
         f. Provide bonding jumper around flexible metallic conduit. Bonding jumper shall be inside flex.
         g. Raceway size shall be increased if necessary to accommodate bonding or grounding conductors and shall be based on raceway fill tables.
         h. Where cabinets are furnished with grounding bus, all required bonding conductors shall connect thereto, each with separate lug.
         i. Unless detailed otherwise on drawings, grounding electrode(s) shall be concrete encased ground consisting of 25' length of #4/0 soft drawn bare copper conductors installed at bottom of trench with 2'' of concrete between conductors and earth, encased in concrete their entire length exclusive of tails for connections to equipment. Tails for connection to equipment where shown or called for on drawings shall provide not less than 24'' length above finished floor level. Protect all tails against damage.
         j. Each grounding electrode installed shall be tested prior to connection to equipment. Ground resistance tests shall be performed by an independent testing agency using a Megger Earth Tester or equivalent and test results shall be forwarded to the Architect for approval.

   * * *
1. **GENERAL:**
   A. **WORK INCLUDED:**
   1. Requirements of Divisions 00 and 01 and Section 26 01 00 apply to all work of this Section.
   2. Contractor shall provide all materials, labor, and the means and methods to complete the installation defined by the plans and these specifications.

2. **PRODUCTS:**
   A. **RACEWAY:**
   1. All wiring shall be run in raceway.
   2. The size of each raceway shall be largest of the following:
      a. Minimum size to be 1/2".
      b. Underground conduits to be 3/4" minimum.
      c. Telephone and data communications conduits to be 3/4" minimum.
      d. The size required by code fill table for THW to accommodate the number, size, and type of wires shown or specified or recommended by the manufacturer of the equipment served and also ground conductor.
      e. The size noted on the Drawings.
   3. Conduit Fittings: Except where otherwise noted, conduit fittings shall be Appleton, Crouse-Hinds, or equal. Uniliets, condulets, etc., shall be malleable iron and fitted with cover and gasket.
   4. Conduit Supports: Kindorf, Unistrut, T&B, or equal. All multiple hanger and support parts shall be zinc coated by hot dipping or electroplating or otherwise protected against corrosion.
   5. Conduit Straps: T&B, Gedney, or equal, one or two-hole malleable iron or snap type steel with ribbed back, galvanized or cadmium plated.
   6. Acceptable raceway systems and their limitations of use are as follows:
      a. **Rigid Steel Conduit (RSC):**
         1) Standard weight, zinc coated on outside by hot dipping with either zinc coating or other U.L. approved corrosion-resistant coating on inside.
         2) Fittings shall be threaded and finished similar to conduit. Threadless fitting shall not be used. All joints shall be coated with conductive antiseize compound, T&B "Kopr-Shield" or approved equal, except where conduit is run in permanently dry locations. Engineer knows of no equal to "Kopr-Shield".
         3) Where installed in contact with earth or fill material, conduit shall be wrapped with net four layers of Scotchrap #50, Schuller VID-10, or equal, or encased in 3" of concrete. In lieu of hand wrapping, Contractor may provide PVC coated galvanized conduit and fittings. The thickness of the PVC coating shall be a minimum of .040" (40 mil) on all pipe and fittings (except where part shape demands less thickness). PVC coated elbows shall be Ocal, Inc. Engineer knows of no equal.
         4) Conduits connected to boxes and cabinets shall be fitted with two locknuts and insulated bushings, OZ B Series, Appleton BU Series, or equal, U.L. approved and bonded. Grounding bushings shall be used whenever grounding conductors are installed.
         5) Conduit stubs shall be capped with coupling, nipple, coupling and plug.
         6) Conduits connected to top and sides of boxes, cabinets, or any exterior enclosure exposed to weather or in areas subject to excessive moisture shall be fitted with watertight sealing hubs of steel or malleable iron with sealing ring and insulated throat, T&B 370 Series, EFCOR 40-50B Series, or equal.
      b. **Intermediate Metal Conduit (IMC):** Requirements for IMC are same as specified for RSC.
      c. **Electric Metallic Tubing (EMT):**
         1) Rolled steel, zinc coated outside with either zinc coating or other approved corrosion-resistant coating on the inside.
         2) Couplings shall be compression type - Appleton 95-T Series, T&B 5123 Series, or equal. (Contractor may use concrete tight steel set screw couplings, Appleton TWC-5
Series, T&B TK-120 Series, or equal. When using set screw fittings, a green insulated bonding conductor shall be provided in raceway.)

3) Connectors shall be compression type with insulated throat - Appleton 86-T Series, T&B 5123 Series, or equal. (Contractor may use concrete tight steel set screw couplings, Appleton TW50-SI Series, T&B TC-720 Series, or equal. When using set screw fittings, a green insulated bonding conductor shall be provided in raceway.)

4) May be used:
   a) Concealed in stud partitions.
   b) Concealed in non-grouted masonry walls.
   c) Concealed above furred ceilings.
   d) Exposed above 8' elevations, indoors.
   e) Exposed in electrical rooms, telephone rooms, data communication rooms and mechanical rooms.

   d. Flexible Metal Conduit:
      1) Minimum trade size, 1/2", unless specified otherwise in other sections of these specifications. Flexible conduit shall be steel.
      2) Connectors - T&B "Tite Bite" insulated. Engineer knows of no equal. Where used for connection of recessed fixtures, connectors may be of the type that screw into inside of conduit, Eforc 1100 Series, Steel City XC-840 Series, or equal.
      3) May be used only for connection of recessed fixtures, controls and mechanical equipment, and devices mounted to T-bar ceilings. Use Liquid Tight Flexible Metal Conduit, as specified hereinafter, where exposed to weather or other wet or corrosive conditions.

      4) Length shall be a practical minimum but to allow for movement of equipment connected without restricting flexibility of conduit.

   e. Liquid Tight Flexible Metal Conduit:
      1) Minimum trade size, 1/2".
      2) Connectors - Appleton STB Series, insulated. Appleton, Crouse-Hinds, or equal may be used.
      3) Length shall be a practical minimum but to allow for movement of equipment connected without restricting flexibility of conduit.

   f. PVC Conduit, Schedule 40: U.L. listed and labeled for direct burial.
      1) Minimum trade size, 3/4".
      2) Use only underground. All conduit shall be encased with 3" concrete envelope or clean sand. Concrete shall be two sack mix with 3/4" maximum aggregate. Conduit separation for concrete encased conduits shall be provided using plastic conduit spacers specifically designed for the purpose. Place spacers maximum of 4'0" on center. Sand encased conduits shall be installed in layers to maintain vertical separation and horizontal separation shall be maintained using rebar stakes. Drawings indicate depth of burial required for the options.

      3) A copper bonding conductor shall be pulled in each power raceway and bonded to equipment at each end with approved lugs.

      4) Continuation of run above grade, slab, or into building interior shall be with RSC, IMC, or EMT as per conduit specification.

      5) "Hot box" or field heated bends and elbows are not acceptable. Bends, elbows, and risers shall be made with rigid galvanized steel conduit using threaded adapters. At each end of conduit run, bond metallic portions of raceways to each other and to equipment connected at each end of conduit run. Protect metal portions from corrosion as specified for rigid steel conduit.

      In lieu of providing RSC bends in PVC duct banks, contractor may provide long radius PVC elbows with a minimum radius of 24" for 3/4" to 2" conduits and a minimum radius of ten times the conduit trade size for conduits larger than 2". (Note: As an example, a 2-1/2" conduit will require an elbow with a minimum radius of 30".) Pull rope used when PVC elbows are provided must be of a material and diameter that will not cause damage to inside surface of elbow when wire is pulled. Contractor will be required to replace any underground elbow determined to be damaged.
(grooved, cracked, etc.). Elbows under concrete floor slabs or rising up into footings must be RSC as specified hereinbefore.

6) All joints and fittings shall be glued using appropriate PVC cement.

g. Surface Raceway (Wiremold):
1) Provide surface raceway as specified on the Drawings. Raceway shall be Wiremold or approved equal.
2) Raceway shall be provided with all supports, adapters, clips, elbows, fittings, and other hardware as required for a complete installation. Provide B-Line "transition" boxes to clear offset surfaces. Supports shall be concealed type. Exposed straps will not be allowed. Anchor raceway to structural members using screws.
3) Steel raceway and associated transition boxes and exposed hardware shall be spray painted with two coats of semi-gloss acrylic enamel paint, color as directed by Architect. Aluminum raceway shall be provided with factory finish, color as directed. Plastic raceway shall be provided in manufacturer's color as directed by Architect. Coordinate colors with Architect before ordering.
4) Raceway shown on plans is schematic. Contractor must coordinate exact routing and installation with building conditions and provide all parts, pieces, elbows, transition boxes, and other items as required for a complete, closed, and professionally installed installation.

B. BOXES AND ENCLOSURES:
1. All boxes and enclosures shall be suitable for the environment in which they are installed.
   This includes enclosures for switchboards, panels, control cabinets, terminal cabinets, disconnect switches, signal devices, and the like.
2. Outlet Boxes:
   a. Outlet boxes shall be of welded construction or one piece deep-drawn steel, galvanized gang type. Octagon concrete rings may be folded type. Sectional boxes shall not be used. Boxes installed in any exterior location, where exposed to rain or where exposed to moisture laden atmosphere shall be cast screw hub type with gasketed weatherproof covers. Where installed in finished areas, exposed boxes shall be cast screw joint type or other type that does not have unused knockouts.
   b. Each box shall be large enough to accommodate the required number and sizes of conduits, wires, splices, and devices but not smaller than size shown or specified. Unless otherwise specified or shown on Drawings, boxes shall be flush mounted with front edge of box or ring flush with wall or ceiling finish. Use plaster ring in plastered or gypsumboard applications. Examine Architectural Drawings for wall construction and finishes, and set box with appropriate plaster ring as required for flush installation.
   c. Switch and receptacle boxes shall be not less than 4" square by 1-1/2" deep for single devices, 4-11/16" by 1-1/2" deep for two devices. Telephone and signal boxes shall be not less than 4-11/16" square x 2-1/8" deep.
   d. Outlet boxes mounted in cabinets shall be rectangular in shape with square corners and straight sides, and installed without plaster rings. Such boxes shall be 3-11/16" high x 2-1/4" wide x 3-1/2" deep for a single device, or shall have suitable tile or masonry ring for larger box.
   e. Lighting outlets shall be 4" octagon, minimum, fitted with 3/8" malleable iron fixture stud.
   f. Boxes for special devices such as clocks, speakers, fire alarm, television, and the like shall be particularly suited for intended use.
   g. Provide blank cover plates on all outlet boxes which are installed as part of an empty conduit system. Refer to finish material.
3. Junction Boxes and Pullboxes:
   a. Boxes having an internal volume less than 100 cubic inches shall be as specified for outlet boxes. Boxes having internal volume greater than 100 cubic inches shall be of panelboard type construction except that covers shall be secured by screws or bolts.
   b. Boxes exposed to rain or installed in wet locations shall be specifically designed for the purpose.
   c. All boxes shall be installed so that covers are accessible after completion of the installation.
d. Boxes shall not be installed in finished areas unless specific approval for such installation is granted by Architect.

4. Box Mounting: Boxes shall be independently and securely supported in place by wood blocking spanning stud space or manufactured adjustable channel type hanger, Steel City, Raco, or approved equal. Use wood screws to fasten to wood blocking or sheet metal screws to attach to metal channel. Side strap mounting shall not be used. Attach blocking or channel to studs using wood screws. Sheetrock screws or deck screws shall not be used. Boxes installed in masonry, tile, or concrete block shall be secured with auxiliary plate or bar and be grouted in place. Surface boxes shall be supported with expansion screws, bolts, or anchors. Suspended boxes shall be supported with threaded rods or strut assemblies attached directly to structural members by means of bolts or anchors.

5. Box Extensions: At rooms being remodeled and where existing walls are to receive new finish material, replace existing plaster rings with new rings with depth required to bring box flush with new finish. Contractor shall review Architectural drawings prior to bid to note walls receiving new finishes (tackboards, sheetrock, etc.) and include the necessary work in bid.

6. Precast Concrete Boxes:
   a. Boxes: Precast high-density reinforced concrete, rated for H/20 vehicular traffic loading, unless shown otherwise on Drawings.
   b. Extensions: At sectional type boxes, provide a minimum of two precast extensions. Provide additional extensions as required to provide space in box for code required cable bending.
   c. Covers: Unless noted otherwise on drawings, covers shall be H/20 vehicular traffic rated, steel checker plate, galvanized, with hold-down bolts. Covers shall be factory marked as follows:
      
      | SYSTEM                  | MARKING     |
      |-------------------------|-------------|
      | Power 600 volts or less | Electrical  |
      | Telephone               | Telephone   |
      | Data Communications      | Data        |
      | Clock, Signal, etc.     | Signal      |
      | Fire Alarm              | Fire Alarm  |
      | Grounding               | Ground      |
      
      Where two or more low voltage systems (such as clock, fire alarm, telephone, etc.) occupy the same box or vault, cover shall be factory marked “Signal”.
   d. Size: Provide size shown on Drawings. If sizes are not shown, provide boxes sized per Codes. (Note: Minimum size may be indicated in Symbol List on Drawings.)

C. ELECTRICAL COMPONENTS ACCESS DOORS:
   1. KARP, Milcor, Newman, or approved equal, with concealed hinges, prime coated with rust inhibitive paint, screwdriver locks at interior and key operated cylinder locks at exterior locations. Style of door shall suit ceiling or wall construction, including fire rating. Doors shall be 14 gauge C.R. steel minimum.

3. EXECUTION:
   A. RACEWAY SYSTEMS:
      1. Excavating and Trenching: Perform all excavations as required for the installation of the work included under this Section, including shoring of earth banks to prevent cave-ins and to protect workmen and equipment. Restore all surfaces, roadways, walks, curbs, walls, existing underground installation, etc., damaged or cut as a result of the excavations to their original condition in a manner approved by the Architect. Stop machine excavation for trenches, in solid ground, several inches above required grade line, then trim trench bottom by hand to accurate grade so that a firm and uniform bearing throughout entire length of duct is provided. In lieu of above hand excavation in bottom of trench, Contractor may excavate to depth no less than 6" below required grade line and place a bed of sand or granular soil, properly compacted to provide a uniform grade and to provide a firm support for duct throughout its entire length. Minimum conduit depth of pipe crown shall be 20" below finished or natural grade, unless detailed otherwise on Drawings. Conduits under parking lots, roadways, driveways, fire truck access routes, and other areas subject to vehicular traffic shall be installed a minimum of 24" below grade.
2. Backfilling: No backfilling operations shall begin until the required tests and inspection has been made. Should any of the work be enclosed or covered up before it has been approved, Contractor shall, at his expense, uncover the work. After it has been inspected, tested, and approved, he shall make all repairs necessary to restore the work of other contractors to the condition in which it was found at the time of uncovering. Except under existing paved area, walks, roads, or similar surfaces, and in cases where rock is encountered, backfill more than 12" above the top of the pipe shall be made using suitable excavated material placed in 6" layers measured before compaction, and tamped by machine. Surface work shall be replaced to match the existing. Entire backfill for bored excavations under existing pavement, walks, roads, or similar surfaces, shall be made with clean sand compacted by flooding.

The contractor shall install a marking tape 6" below grade and directly above all electrical conduits. The tape shall consist of a 4 mil insert plastic film specifically formulated for prolonged use underground. It shall be highly resistant to alkalis, acids and other destructive agents found in the soil. Tape shall have a minimum tensile strength of 20 lbs. per 3" with strips and a minimum elongation of 500%. Tape shall bear a continuous painted message repeated every 16" to 36" warning of the installation buried below. The message shall read "CAUTION – ELECTRICAL POWER LINE BURIED BELOW" or "CAUTION – ELECTRICAL SIGNAL LINES BURIED BELOW" as applies. Installation instruction for the tape shall be printed with each message along the entire length. The tape shall be as that manufactured by Reef Industries, Inc., or approved equal. For those installations involving non-metallic pipe, tape shall be aluminum foil encased in two layers of inert plastic film enabling the tape to be inductively located. Terre Tape "D" Warning Tapes are acceptable. When conduit below is plastic, tape shall have metallic content and shall respond to metal detectors. Do not exclude this. It will be required to verify the installation of this tape.

3. Flashing and Sealing: Flash and counterflash roof and wall penetrations in manner described under applicable sections of this Specification and as approved by the Architect. Conduits, ducts, etc., passing through finished walls and ceilings shall be fitted with steel escutcheon plates, chrome or paint finish as directed. Conduits which penetrate floor slabs or concrete or masonry walls shall be grouted and sealed watertight at penetration. Conduits penetrating exterior walls other than concrete or masonry shall be sealed watertight with Vulikem 116 polyurethane sealant. Underground conduits stubbing up into a room shall be sealed around cables or pullstring with foam sealant. All flashing and sealing shall be provided by this Contractor.

4. Unless otherwise specified, all raceway shall be installed concealed. Raceway may be run exposed on unfinished walls, in attics and roof spaces, and in electrical rooms when run to surface cabinets, panels, or gutters. Conduit shall not be installed in concrete slabs.

5. Individual horizontal raceways not larger than 1-1/2" size shall be supported by means of straps or individual hangers. Individual horizontal raceways larger than 1-1/2" size shall be supported by individual hangers. Above accessible ceilings, spring steel fasteners, clips, or clamps specifically designed for supporting exposed single conduits up to 1" size may be used in lieu of straps or hangers. Hanger rods used in connection with spring steel fasteners, clips, and clamps shall be either 1/4" diameter or larger galvanized steel rods.

6. Where two or more horizontal raceways run parallel and at the same elevation, they shall be supported on multiple hangers. Each raceway shall be secured to the horizontal hanger member with a U-bolt, strap, or other specially designed and approved bolted fastener. Hanger rods used in conjunction with multiple hangers shall be 3/8" diameter or larger, galvanized steel rods.

7. Multiple conduit hangers shall consist of two or more steel hanger rods, a steel horizontal member, and all U-bolts, clamps, and other attachments necessary for securing hanger rods and conduits. Hanger rods shall be threaded either full length or for a sufficient distance at each end to permit at least 1-1/2" of adjustment. Horizontal members shall be standard structural steel shapes such as angles or channels or 1-1/2" x 1-1/2", No. 12 gauge, cold formed, lipped channels designed to accept special spring-held hardened steel nuts for securing hanger rods and other attachments. Two or more channels may be welded together to form horizontal members of greater strength than single channels.

8. Straps and hanger rods shall be fastened to concrete by means of inserts or expansion bolts, to brickwork by means of expansion bolts, to hollow masonry by means of toggle bolts, to
metal surfaces with machine screws, and to wood construction with wood screws. Expanders and shields shall be steel or malleable iron. Sizes of shields and bolts shall be such that the proof test load will not be less than four times the actual working load. Deck screws or sheetrock screws shall not be used. Wooden plugs and lead shields shall not be used for fastening. Perforated strap iron or nail straps shall not be used. Straps shall be screw fastened.

9. Raceways above suspended ceilings shall be supported from roof structure above, except that conduits 3/4" and smaller serving equipment installed in the ceiling may be supported from hanger wires (separate from ceiling hanger wires) by use of approved spring steel clips or fasteners. Hanger wires must be attached to roof structure above and clips mounted to T-bar for a positive means of support. Clips shall be Caddy Series 528P or equal. Outlet boxes with devices shall not be supported from hanger wires or from conduit supported from hanger wires. Boxes with devices shall be mounted directly to structure or blocking as described in Part 2.

10. In any raceway run, the number of 1/4 bends, or the equivalent, between terminations at cabinets, outlet boxes, junction boxes, and pullboxes, shall not exceed the number of 1/4 bends indicated below, and the total length of run shall not exceed 150’. Straight runs of conduit shall not exceed 250’ in length between terminations at cabinets, outlet boxes, junction boxes, and pullboxes.

<table>
<thead>
<tr>
<th>Conduit Size - Inches</th>
<th>Number of 1/4 Bends</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 to 1-1/4</td>
<td>4</td>
</tr>
<tr>
<td>1-1/2 to 2-1/2</td>
<td>3</td>
</tr>
<tr>
<td>3 to 4</td>
<td>2</td>
</tr>
</tbody>
</table>

11. The size of each run of raceway shall be largest of the following:
   a. Minimum size to be 1/2”.
   b. Underground conduits to be 3/4” minimum.
   c. Telephone and data communications conduits to be 3/4” minimum.
   d. The size required by code fill table for THW to accommodate the number, size, and type of wires shown or specified or recommended by the manufacturer of the equipment served and also ground conductor.
   e. The size noted on the Drawings.

12. The Contractor’s attention is directed to check the size of all raceways to determine that the green equipment ground conductor, specified, shown or required, can be installed in the same raceway with phase and neutral conductors in accordance with the percentage of fill requirements of codes. If necessary, the Contractor shall increase the raceway sizes shown or specified to accommodate all conductors without additional cost to the Owner.

13. Conduit caps shall be installed during construction.

14. Pull ropes shall be provided in all empty conduits and shall be 3/16” diameter polypropylene. (Note: This pull rope is not for pulling cable but for pulling in pull rope for cable pulling.)

15. Interior conduit for data and telephone cables must be run in ceilings and walls.

16. Plates and Grouting: Conduits, ducts, etc., passing through finished walls shall be fitted with steel escutcheon plates, chrome or paint finish as directed. Conduits which penetrate floor slabs and concrete or masonry walls shall be grouted and sealed watertight at penetration.

17. All joints of RSC and IMC raceways shall be coated with conductive anti-seize compound, as specified hereinbefore, unless conduit is run in permanently dry locations. Remove couplings of factory joined conduit and coupling assemblies and coat joints.

18. Flexible conduit shall be used to cross seismic joints.

19. Plastic Conduit Expansion and Contraction: Contractor shall take precautions to allow for expansion and contraction of plastic conduit due to temperature changes. Exercise care in storing materials to avoid warping and deterioration. Protect from direct exposure to sunlight.

20. Conduit penetrations through fire rated assemblies shall be protected as required by CBC Chapter 7.

21. Underground Conduits and Duct Banks:
   a. Conduit runs shown on site plan are shown for general routing. Conduit installation shall comply with applicable codes, specifications, and details on the drawings. Exact location of runs shall be coordinated to comply with structural details at and near building footings.
b. Where conduits run under or through building foundations, crossings shall conform to
details shown on structural drawings. Where conduits run parallel to foundations, conform
to structural requirements.

c. Prior to any excavation, layout duct routing. Routing shown on drawings is diagrammatic
(not pictorial). Coordinate closely with underground work of other trades. Adjust routing
and excavation to avoid conflict with other trades and utilities.

d. At existing sites, underground utilities, services, circuits, piping, irrigation systems, etc.
are present, but their exact locations are not known. Contractor shall locate and protect
before trenching or excavating in any area. Consult utility companies, "as-built drawings",
and Owner’s maintenance personnel for location of existing underground work. If existing
piping or utilities are damaged during construction, contractor shall repair immediately at
own expense. New underground shall be modified as necessary to conform to existing
conditions.

22. Surface Raceway (Wiremold):
   a. Supports shall be concealed. Exposed straps are not allowed.
   b. Anchor raceways to structural members. Spacing of screws shall be in accordance with
      manufacturer’s recommendations as a minimum. Stricter requirements shall be
      conformed to when specified on drawings.
   c. Coordinate exact routing of surface raceway with Architect prior to installation.

B. BOXES:
   1. Boxes shall be accurately placed as shown on Drawings or as close thereto as possible.
      Contractor shall refer to Drawings, specifications, and submittals covering work of the other
      trades to coordinate outlet location. In the event of conflict between planned locations of
      outlet and other equipment or furnishing, Contractor shall not proceed until direction has been
given by Architect.

   2. Unless otherwise specified or shown on Drawings, boxes shall be flush mounted with front
      edge of box or ring flush with wall or ceiling finish where finish material is combustible. At
      non-combustible finish materials, front edge of box or plaster ring shall not be set back more
      than 1/4". Use plaster ring of appropriate depth in plastered or gypboard applications.
      Contractor shall review architectural drawings and note wall and ceiling construction and
      finishes for each wall. Boxes/rings set too far back shall be equipped with plastic, non-
      combustible, non-conductive extenders, Arlington BE Series or equal.

   3. Boxes shall not be installed back-to-back in walls. To prevent sound transfer, outlets,
      switches, etc. shown on opposing sides of the same wall shall be installed in separate stud
      spaces, except that outlets installed at different elevations may occupy the same stud space
      when box separation exceeds 18". Where these requirements cannot be met, Contractor
      shall provide insulation material between boxes.
   a. Outlet Boxes at Fire Rated Walls:
      1) Outlet boxes on opposite sides of fire rated walls shall be separated by horizontal
         distance of not less than 24".
      2) Total area of outlet boxes in fire rated walls shall not exceed 100 square inches for
         any 100 square feet of wall area.
      3) If a. and/or b. are not met, penetrations in fire rated walls shall be protected by an
         approved penetration firestop system installed and tested in accordance with CBC
         Standard 7-5 and shall have F rating of not less than the required rating of the wall
         penetrated.

   4. Mounting height of wall mounted outlet means height from finished floor to horizontal
      centerline of outlet or cover plate or top of box as indicated below. Heights shall be as follows
      unless specifically noted otherwise on Drawings:
   a. Receptacles: +16" except as noted. Outlets in wall above counter or backsplash shall be
      arranged for horizontal device installation. Outlet shall be located such that device plate
      will be 4" above counter (or backsplash where provided).
   b. Switches: +40", to top of box.
   c. Desk Telephone: +16", except as noted.
   d. Wall Telephone: +40", to top of box.
   e. Fire Alarm Manual Station: +40", to top of box.
C. Where receptacles or outlets are shown in cabinetry, coordinate location of boxes and routing of raceway with cabinetry contractor. Route raceway concealed (limited use of flex is permissible).

D. Blank covers of all junction boxes shall be marked to show use, such as Fire Alarm, Telephone, Intrusion Alarm, Signal, etc. Power box covers shall be marked to show circuit numbers contained in box. Use permanent black marker.

E. Outlet and device boxes mounted in fire rated assemblies shall be protected as required by CBC.

F. Where floor boxes are shown on drawings, contractor shall review approximate locations with Owner and Project Inspector prior to rough-in and obtain exact locations for proper placement.

G. Precast Concrete Boxes:
1. Sectional Boxes without Precast Floor: Unless detailed otherwise on drawings, provide poured concrete footing formed inside with 6" gravel in bottom of box to facilitate drainage. Conduits shall rise in bottom of box. Provide box extensions to allow ample clearance in box between conduit and box cover for cable bending radius.
2. Where boxes are installed at concrete or paved areas, box lid shall be flush with finish grade.
3. Size: Provide size shown on Drawings. If sizes are not shown, provide boxes sized per Codes. (Note: Minimum size may be indicated in Symbol List on Drawings.)

H. ACCESS DOORS:
1. Furnish and install access doors wherever required whether shown or not for easy maintenance of electrical systems; for example, at fire alarm detectors above ceilings, etc. Access doors shall be sized to allow access to equipment for complete removal and replacement of equipment or device.

* * *
1. GENERAL:
   A. WORK INCLUDED:
      1. Requirements of Divisions 00 and 01 and Section 26 01 00 apply to all work of this Section.
      2. Contractor shall provide all materials, labor, and the means and methods to complete the installation defined by the plans and these specifications.
   B. REQUIREMENTS:
      1. Seismic Restraint Requirements: All electrical equipment and materials shall be braced against seismic forces in accordance with California Building Code, Chapter 16A. Provide lateral bracing as required. The field installation shall be subject to the review and approval of the DSA Structural Safety engineer.
      2. Light Fixture Seismic Bracing: All lighting fixtures suspended from ceiling or structure shall be braced to comply with California Building Code Part 2.
         a. Suggested bracings and attachments are detailed on drawings. Bracing methods shown are general and may need to be modified to suit a particular location and other differing conditions.
      3. Electrical Distribution System Bracing: Electrical distribution systems shall be braced to comply with the forces and displacements prescribed in ASCE 7-10 Section 13.3, as defined in ASCE 7-10 Section 13.6., 13.6.8 and 13.6.5.6, and 2013 CBC Section 1616A.1.23.
         a. The bracing and attachments to the structure shall be detailed on the approved drawings or they shall comply with one of the OSHPD pre-approvals (OPA#) as modified to satisfy anchorage requirements of ACI 318, Appendix D.
         b. Copies of the manual shall be available on the jobsite prior to the start of hanging and bracing of the electrical distribution system.
         c. The Structural Engineer of Record shall verify the adequacy of the structure to support the hanger and brace loads.
      4. Equipment Anchorage:
         a. All electrical equipment components shall be anchored and installed per the details on the DSA approved construction documents. Where detail is not indicated, the following components shall be anchored or braced to meet the force and displacement requirements prescribed in the 2013 CBC, Section 1616A.1.23 and ASCE 7-10 Chapters 13, 26 and 29.
            1) All permanent equipment and components.
            2) All temporary or moveable equipment that is permanently attached (e.g. hard wired) to the building utility services such as electricity, etc.
            3) Moveable equipment which is stationed in one place for more than eight hours and heavier than 400 pounds is required to be anchored with temporary attachments.
         b. The attachment of the following electrical components shall be positively attached to the structure, but will not be detailed on the plans. The components shall have flexible connections provided between the component and associated conduit.
            1) Components weighing less than 400 pounds and having a center of mass located 4’ or less above the adjacent floor or roof level that directly supports the component.
            2) Components weighing less than 20 pounds, or in the case of distributed systems, less than 5 pounds per foot, which are suspended from a roof or floor or hung from a wall.

For those elements that do not require details on the approved drawings, the installation shall be subject to the approval of the Structural Engineer of Record and the DSA District Structural Engineer. The Project Inspector will verify that all components and equipment have been anchored in accordance with the above requirements.

* * *
1. GENERAL:
   A. INTRODUCTION:
      1. Requirements of Divisions 00 and 01 and Section 26 01 00 apply to all work of this Section.
      2. Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system.
      3. Contractor shall actively participate with the Owner's Commissioning Authority or Agent.
   B. SYSTEM DESCRIPTION:
      1. Install a lighting control system consisting of control panel(s), control switches, photocell, and other controlling devices connected by low voltage and network wiring. The general operation of lighting and controlled loads shall include:
         a. Occupancy Sensors: Dual technology, in most cases, for all areas except gymnasium.
         b. Daylighting: Automatic shut off and daylighting control for affected fixtures.
      Requirements are indicated elsewhere in the specifications for work including, but not limited to, raceways and electrical boxes and fitting required for installation of control equipment and wiring.
   C. QUALITY ASSURANCE:
      1. Manufacturers: Firms regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five years.
      2. Component Pre-Testing: All components and assemblies are to be factory pre-tested prior to installation.
      3. System Support: Factory applications engineers shall be available for telephone support during construction. Factory technician shall participate at site for system startup. Factory applications engineer shall provide training to Owner, at site.
      4. CEC Compliance: Comply with CEC as applicable to electrical wiring work.
      5. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
      6. UL Approvals: Remote panels are to be UL listed under UL 508 Industrial Control Panels.
      7. FCC Emissions: All assemblies are to be in compliance with FCC emissions Standards specified in Part 15 Subpart J for Class A application.
   D. SUBMITTALS:
      1. Incomplete submittals (such as product data submitted without shop drawings, etc.) will be returned without review. Submittals shall be complete and include catalog data, shop drawings, one-line diagrams, and scaled plan drawings. Building plans shall be 1/8"=1'0", and site plans shall be no smaller than 1"=40'. Provide two cross reference lists: (1) items of equipment with specified system function each item provides, and (2) specified system function with item of equipment which perform that function. Contractor shall also submit name of firms he proposes to do work under this Section, addresses, phone numbers, and name of firm's contact, for approval. Such firms shall be factory authorized representatives of the equipment specified, who shall furnish all equipment and specialty cables, make all connections to same, and place the systems in operation. Such firms shall have offices and service departments within a 150-mile radius of project and shall have been in business of this type for at least five years. Also, refer to requirement for shop drawings, substitutions, materials, and submittals in Section 26 01 00. Two submittal reviews will be made by the Architect's representative. Subsequent reviews will be charged to the Contractor. A rejection of a submittal or review of a partially presented submittal constitutes one submittal review.
      2. Shop Drawings: Submit dimensional drawings of all lighting control system components and accessories.
      3. One Line Diagram: Submit a one-line diagram of the system configuration proposed if it differs from that illustrated in the riser diagram included in the contract drawings.
      4. Typical Wiring Diagrams: Submit typical wiring diagrams for all components including, but not limited to, lighting control panels, relays, contactors, photocells, switches, occupancy sensors, and daylighting controls.
   E. MANUFACTURERS:
1. The basis of the specified system is the automatic control panel and automatic relay pack system manufactured by The Watt Stopper. Any other manufacturer wishing to be considered must submit descriptive information in accordance with submittal requirements and provide samples, lists of similar completed projects with name and phone number of contacts, and any other items or information requested by Engineer. The contractor shall be completely responsible for providing a system meeting this specification in its entirety. All deviations from this specification must be listed and individually signed off by the Engineer.

F. INSTRUCTIONS AND MANUALS:

1. Equipment supplier of systems to demonstrate operation of systems to satisfaction of Owner and furnish Owner three wiring schematics for all items of equipment, installation instructions, and details of all routine maintenance and servicing which must be given systems by Owner. Manuals shall be provided in 3-ring binders, with title page, list of contents, and conspicuous label on cover and shall be delivered to District. Refer to Section 26 01 00 for additional requirements. Submit copy to Architect for approval before delivering to Owner.

2. Supplier shall demonstrate operation of systems and provide training to all end users, administrative staff, and system administrator. Coordinate times of instruction with District, at District's convenience. Supplier shall provide a minimum of four hours of user instructions to clerical staff and 16 hours of user/maintenance instructions to District maintenance personnel. Instruction periods shall not coincide and shall be scheduled with District, not school staff.

G. RECORD DRAWING:

1. Refer to General Conditions. Final Inspection will not be made until drawings are received and approved. Record Drawings shall include "As-Built" one-line and wiring diagrams, with terminations identified, wire color coding schedule, pullbox locations, and conduit routing plans.

H. GUARANTEE:

1. One firm to assume full responsibility for performance on all work of this section. Guarantee all equipment against defects in material and workmanship for two years, and provide on-the-premises service during normal working hours for two years, at no cost to Owner if trouble is not caused by misuse, abuse, or accident, or at current labor rates if so caused. Provide manufacturer's written guarantee for equipment and parts to Owner.

2. Service shall normally be available within 24 hours from service department of authorized distributor of manufacturer by factory trained servicemen.

3. On-the-premises service at other than normal working hours to also be available, but labor charges for such calls to be paid by Owner at current labor rates.

2. PRODUCTS:

A. OCCUPANCY SENSORS:

1. Provide occupancy sensors and related equipment and materials to automatically switch lighting off when respective room is not in use. Occupancy sensor symbol shown on plans represents rooms requiring occupancy sensing and does not represent sensor quantity in each room or location.

2. Contractor shall provide manufacturer's catalog data and scaled shop drawings in equipment submittals. Shop drawings shall show sensor locations and quantities, types, transformer/relay locations, and typical wiring diagrams.

3. Unless noted otherwise on drawings, sensors shall be Wattstopper W-2000A (and W-2000H in Hallways) or equal. Power packs with transformer and relay shall be Wattstopper BXXXX-P (XXX=voltage) or equal.

4. Installation:
   a. Install devices at locations shown on equipment manufacturer's shop drawings.
   b. Adjust each sensor for maximum time delay.
   c. Adjust sensitivity setting so that occupancy is accurately detected with minimum of false triggers.

B. DAYLIGHTING CONTROLS:

1. Provide automatic single zone daylighting control for fixtures located in daylit areas. Refer to drawings for areas requiring daylighting control.
2. Contractor shall provide manufacturer’s catalog data and scaled shop drawings in equipment submittals. Shop drawings shall show photosensor locations and quantities, types, sensor orientation, transformer/relay locations, and typical wiring diagrams.

3. Unless noted otherwise on drawings, sensors shall be Wattstopper LS-301 for control of 0-10VDC electronic dimming ballasts. Each photosensor shall be capable of controlling up to 50 ballasts.

4. Fixtures within daylighting zones shall be equipped with 0-10VDC electronic dimming ballasts, Advance Mark 7, program start, or equal, compatible for lamps specified.

3. EXECUTION AND SUPPORT SERVICES:
   A. INSTALLATION:
      1. All switches, occupancy sensors, photocells, low voltage relay packs, etc. shall be mounted as indicated on the plans and as required by the equipment manufacturer. All wiring shall be labeled clearly indicating which lighting control panel or device it connects to. Use only properly color-coded, stranded wire as indicated on the drawings. All relays and switches shall be tested after installation to confirm proper operation, and all connected loads shall be recorded on the lighting control schedule for each panel.
      2. The lighting control cabinets/panels shall be mounted where indicated on the drawings. Low voltage relay packs are generally located in the ceiling of the space they control, typically above the switches connected to the relay pack. The devices shall be wired to control the power of each load as indicated on the lighting control panel schedules included in the drawings. All power wiring will be identified with the circuit breaker number controlling the load. If multiple circuit breaker panels are feeding into a relay panel, wires shall clearly indicate the originating panel’s designation.
   
   B. CONTRACTOR PROVIDED INFORMATION:
      1. Contractor shall provide system documentation after the equipment has been installed:
         a. Lighting control panel schedule.
         b. Lighting operation schedule.
         c. System installation and operation manual shipped with lighting control system shall be provided to the Owner.
   
   C. SYSTEM STARTUP:
      1. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all system components.
   
   D. TRAINING:
      1. Manufacturer shall provide factory authorized application engineer to train Owner personnel in the operation and programming of the lighting control systems. Owner shall provide list of authorized personnel for training sessions.
   
   E. DOCUMENTATION:
      1. Manufacturer shall provide system documentation including:
         a. System one-line diagram showing all panels, number and types of switches, and sensors.
         b. Lighting control panel schedules.
         c. Lighting channel schedule.
         d. Typical wiring diagrams for each component.
   
   F. WARRANTY:
      1. Manufacturer shall provide a one-year warranty for all system components.
   
   G. COMMISSIONING AND TESTING:
      1. The contractor’s responsibility shall be to fully test, calibrate, and then demonstrate in the presence of the Owner’s representative that all interior and exterior lighting controls work as intended and control the circuits specified for all modes and expected conditions.
      2. Testing: Perform testing to minimally verify the following issues, modes, and functions. Test the lighting controls during “live” conditions:
         a. All specified features and functions are set up, calibrated, debugged, and fully operable.
         b. Occupant override functions and duration setting.
         c. Sensors accurately detect occupancy per specification to turn lights on and off whether HVAC is on or off.
         d. Scheduling features, including holidays.
         e. Date and time setting in central computer.
f. The sequence of operation for all features and modes.
g. All and only, specified light fixtures are switching.
h. The controls and sensors are not easily overridden or disabled by occupants.
i. The photo sensors for system are in an adequate location and are not being affected by
direct sunlight, uplight from the lighting fixtures, or architectural obstructions.
j. Lights on daylighting system to stage off and on based on an average foot-candle level of
40fc.
k. The photo sensors for exterior lighting and for any clerestory uplight accurately detect
outside dark and light conditions.

3. The equipment and systems referenced in this section are to be formally commissioned per
Division 01 Commissioning Section. The formal commissioning process requires the active
participation and cooperation of all contractors performing work and/or supplying materials for
this project. The contractor may have specific contract requirements for scheduling,
coordination, startup, test development, testing, demonstration, training, and related
documentation. The contractor shall review Division 01 of the bid documents to determine
specific contract requirements related to commissioning. The contractor shall coordinate all
commissioning activities with the Commissioning Authority.

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Sierra Ridge Middle School Modernization
Kirk S. Brainerd, Architect

Job No. 1324
March 30, 2016
1. GENERAL:
   A. WORK INCLUDED:
      1. Requirements of Divisions 00 and 01 and Section 26 01 00 apply to all work of this Section.
      2. Contractor shall provide all materials, labor, and the means and methods to complete the installation defined by the plans and these specifications.

2. PRODUCTS:
   A. FINISH MATERIAL:
      1. Plates: Leviton, Hubbell, Legrand or equal.
         b. Surface Outlet: Similar to flush outlet for finished areas, zinc-plated steel in unfinished areas.
         c. Exterior Outlets:
            1) Exterior receptacles, unless specified elsewhere, shall be provided with "while-in-use" covers, metal, Cooper WUMV-1.
   2. Switches: Gray unless otherwise directed by Architect.
      a. Wall: Legrand #20AC1, 20AC2, 20AC3, or 20AC4, Leviton #1221 Series, or equal.
      b. Keyed Switches: Hubbell #HBL1221 RKL with #S12RKL engraved stainless steel plate. Provide #HBL1222RKL for two-pole applications, #HBL1223RKL for three-way applications, and #HBL1224RKL for four-way applications.
      c. Low Voltage Switches/Dimmers: Refer to plans.
      d. Three position momentary contact, Legrand #1251, Leviton #1257, or equal.
   3. Receptacles: Gray unless otherwise directed by Architect.
      a. Duplex, Flush Interior: Legrand #26352, Leviton #16352, or equal.
      b. Duplex, Surface Mounted and Flush Exterior: Hubbell #5362, Leviton #5362, Legrand #5362, or equal.
      c. Ground Fault Interrupting (GFI): Hospital grade, tamper resistant, 20A, with lockout feature (disables receptacle when GFI protection is compromised), Legrand #2095HGTRGNY or equal. Where receptacles are shown on plans to be GFI type, each receptacle shall be GFI type. Contractor may not use standard receptacles connected for "downstream" protection from a GFI receptacle. Whether indicated on plans or not, receptacles at the following locations shall be GFI type:
         1) Within 6' of sinks. Receptacles near sinks in science labs and shown as outlets dedicated for computer use shall be isolated ground GFI type, Legrand #2095IGTRGNY, or equal.
         2) In toilet rooms.
         3) Electric drinking fountains.
         4) All 20 amp receptacles in Kitchens, regardless of location.
      d. Exterior GFI receptacles: Receptacles installed on roofs, on building exterior walls, or any location exposed to weather shall be weather resistant/tamper resistant, 20A, Legrand #2095TRWRGNY, or equal, with lock-out feature.
      e. Receptacles on Dedicated Circuit for Computer Use: Hubbell #IG5362S, Leviton #5380-IG, or equal. Where receptacles are shown on plans to be for computer use, each receptacle shall be surge suppression type. Contractor may not use standard receptacles connected for "downstream" protection from a surge suppression receptacle.
   4. Special Devices: Refer to Drawings.
   5. All finish materials of each type shall be of same manufacturer.

* * *
1. GENERAL:
   A. WORK INCLUDED:
      1. Requirements of Divisions 00 and 01 and Section 26 01 00 apply to all work of this Section.
      2. Contractor shall provide all materials, labor, and the means and methods to complete the installation defined by the plans and these specifications.
   B. REQUIREMENTS:
      1. Rules and Regulations: All work and materials shall be in full accordance with the latest rules and regulations of the following:
         c. California Code of Regulations, Title 8, Electrical Safety Orders
      Nothing in these drawings or specifications is to be construed to permit work not conforming to the above codes, rules, and regulations.
      2. Refer to Section 26 01 00 for detailed submittal requirements.

2. PRODUCTS:
   A. PANELBOARDS, TERMINAL CABINETS, ETC.:
      1. ALL (yes, ALL) circuit breakers shall be equipped with padlocking devices for locking handle in off position. Devices shall be factory installed or furnished by factory and installed by Contractor.
      2. Multiple pole circuit breakers shall have internal common trip connection. Single pole breakers shall not be tied at handles to form multiple pole breaker.
      3. All circuit breakers shall be bolt-on type.
      4. Handle "Lock On" devices shall be furnished for 10% of circuit breakers provided. Furnish in factory packaging unless noted to be installed on Drawings. (Note: These devices have different function than those specified in paragraph A. above.)
      5. Circuit breaker numbers shall be adhesive backed engraved or embossed micarta or stamped into deadfront. Snap-in plastic numbers are not acceptable.
      6. Busses shall be copper with a current density of 1000 amps per square inch, maximum.
      7. Exterior of surface mounted enclosures shall be factory finished to match fronts.
      8. Wall mounted enclosures shall be mounted with top of enclosure 6'/6" above finished floor or grade except as otherwise noted.
      9. Enclosures shall be finished in ASA 61 or Standard Factory gray enamel.
     10. Enclosures shall be fitted with copper ground bus, similar to neutral bus, not insulated from enclosure. Bus shall be complete with lugs.
     11. Directory holder shall be metal with clear acetate directory cover. Holder shall be welded to inside of door or epoxied in place by contractor.
     12. Nameplates shall be as hereinbefore specified.
     13. Busses shall extend full length of usable space of distribution sections.
     14. Modifications to existing panelboards and switchboards shall be as indicated on the Drawings. New equipment shall match existing where possible and in all cases be compatible with existing. Where new breakers are installed in existing equipment, provide all hardware and trim pieces as required for a complete closed installation. Provide new nameplates at equipment where existing breakers are identified by nameplates and provide new breaker identification in directory where existing breakers are identified in a directory.
     15. Where new breakers are indicated to be installed in existing switchboard or panel, but insufficient space exists, provide enclosed circuit breakers externally and tap existing bussing. Tap conduit and wire sizes shall be same as breaker line side conduit and wire.
     16. Main breakers, where specified as part of a combination main and distribution section or panel, shall be located above or below distribution bussing and be connected such that normal load side of breaker is disconnected when breaker is in open position. Backward connections are prohibited.
17. Where spaces are indicated on the Drawings, all required hardware and trim shall be provided to allow for future installation of breaker, switch, or combination starter of size shown.

18. Panelboards: Shall be Square D, Eaton Electrical, or equal, of type and arrangement as indicated on Drawings. Layout of equipment on Drawings is based on Square D unless indicated otherwise in details on drawings. Manufacturers who cannot meet the requirements specified or shown will not be acceptable.

B. DISCONNECT SWITCHES:
   1. For 208 Volt Equipment: Square D, GE, or equal, safety switches, heavy duty with cover/handle interlock, fused or non-fused as required. Furnish with enclosure suitable for application.
   2. For 120 Volt Equipment: Square D, GE, or equal, horsepower rated with manual starters with properly sized overloads, handle guard and lock-off, and suitable enclosure.

C. TERMINAL CABINETS:
   1. Shall be of panelboard type construction and finish.
   2. Trim shall be fitted with hinged door and flush metallic latch (National Cabinet Lock #C8070 or equal).
   3. Doors shall provide maximum size openings to cabinet interior.
   4. Signal cabinets shall be provided with 5/8" backboard having a three-coat fire retardant white paint finish.
   5. Top of cabinet shall be 6'6" above finished floor or grade.
   6. Submittal Drawing shall show layout of terminal strips and devices with individual wire terminal identification.

3. EXECUTION:
A. EQUIPMENT AND MATERIALS:
   1. General Requirements for Panelboards, Terminal Cabinets, Etc.:
      a. Wall mounted enclosures shall be mounted with top of enclosure 6'6" above finished floor or grade except as otherwise noted.
      b. Directories shall be typewritten and conform to circuit assignment at time of occupancy.
      c. Only circuit wiring which originates in a panel may be run in the wireway of that same panel. Contractor may not use a panel wireway to run conductors to or from another panel.

* * *
1. **GENERAL:**
   A. **WORK INCLUDED:**
      1. Requirements of Divisions 00 and 01 and Section 26 01 00 apply to all work of this Section.
      2. Contractor shall provide all materials, labor, and the means and methods to complete the installation of lighting fixtures as defined by the plans and these specifications.
   B. **REQUIREMENTS:**
      1. Seismic Restraint Requirements: All electrical equipment and materials shall be braced against seismic forces in accordance with California Building Code, Chapter 16A. Provide lateral bracing as required. The field installation shall be subject to the review and approval of the DSA Structural Safety engineer.
      2. Shop Drawings, Substitutions, Materials, and Submittals:
         a. When specific names are used in connection with materials, they are used as standards only, but this implies no right upon the part of the Contractor to use other materials or methods unless approved as equal in quality and utility by the Architect in writing.
         b. Materials and components shall conform to Industry Standard, including:
            - NEMA National Electrical Manufacturer's Association
            - ANSI American National Standards Institute
            - ASTM The American Society for Testing and Materials
            - ICEA Insulated Cable Engineer's Association
            - USA United States of America Standards
         c. Samples of fixtures shall be submitted for review if requested. Refer to Section 26 01 00 for detailed submittal requirements.
      3. Guarantee: Acceptance of the contract for this work includes this guarantee: The Contractor guarantees that he has performed the work in accordance with the contract documents. Contractor also agrees to replace or repair, as new, any defective work, materials, or part which may appear within two years of final payment if in the opinion of the Architect or the Owner, the defect is due to workmanship or material.
      4. Warranties, guarantees, certificates, etc. that are furnished and are available for equipment and materials furnished and installed under this section shall be properly filled out as of the date of final payment and shall be delivered to the Engineer.

2. **PRODUCTS:**
   A. **GENERAL:**
      1. Furnish and install fixtures as indicated on Drawings, including lamps, hangers, frames, supports, etc., complete and ready for operation. Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.
      2. Driver voltage shall be verified with branch circuiting requirements.

3. **PRODUCTS:**
   A. **LIGHTING FIXTURES:**
      1. Install fixtures as indicated on Drawings, including lamps, hangers, frames, supports, etc., complete and ready for operation.
         a. Ceiling spacers shall not be used when fixtures are not approved for mounting against combustible material. Material upon which fixtures are mounted shall be of noncombustible type and arranged satisfactory to the Architect.
         b. Fixtures installed at suspended ceilings, both surface and recessed, shall be supported with a minimum of four taut No. 12 G.I. wires at intermediate duty ceilings. 2x4 and smaller fixtures at heavy duty ceilings shall be supported by two slack No. 12 G.I. wires. Fixtures larger than 2x4 at heavy duty ceilings shall be supported by four slack No. 12 G.I. wires. Where fixtures are installed end-to-end, and hanger tabs of butting fixtures are in contact with each other, one wire may be shared by butting fixtures.
         c. Fixtures mounted from suspended ceilings shall have their outlets and anchors supported by rods or strut assemblies. All such hanger wires, rods, and struts shall be supported from structural members and shall be attached directly to fixture. Fixture support methods shall be approved by Architect.
d. Contractor shall submit detail of proposed methods of support for approval at time of fixture submittal. All supports for fixtures shall be provided by this contractor.
e. Fixtures, lamps, trim, and diffusers shall be clean at final acceptance.

* * *
1. **GENERAL:**
   
   **A. WORK INCLUDED:**
   
   1. Requirements of Divisions 00 and 01 and Section 26 01 00 apply to all work of this Section.
   2. Furnish and install Fire Alarm System including all wiring and connections and other materials as shown on Plans and specified herein. It is the intent that a complete operating system conforming to all applicable codes be installed and that any power supplies, relays, resistors, cards, modules, programming, or other items required to achieve this end result shall be furnished whether or not such item or items are specified herein.
   
   **B. GENERAL REQUIREMENTS:**
   
   1. **Code Requirements:** System and all its components to meet requirements for local alarm system of National Fire Protection Association Standard 72, 2013 Edition, Americans with Disabilities Act (ADA), and Article 760, California Electrical Code, and to be approved by Division of the State Architect for use as school fire alarm system.
   2. **System Requirements:** All of various equipment components to be complete with all appurtenant accessories required to provide specified facilities and perform specified functions throughout presently planned construction and space; and provisions for expanding system to provide same facilities, and perform same functions in all future planned construction, including space and mountings in control panels and terminal cabinets.
   3. **Instructions and Manuals:**
      a. Equipment supplier of systems to demonstrate operation of systems to satisfaction of Owner and furnish Owner three wiring schematics for all items of equipment, installation instructions, and details of all routine maintenance and servicing which must be given systems by Owner. Manuals shall be provided in 3-ring binders, with title page, list of contents, and conspicuous label on cover and shall be delivered to District. Refer to Section 26 01 00 for additional requirements. Submit copy to Architect for approval before delivering to Owner.
      b. Supplier shall demonstrate operation of systems and provide training to all end users, administrative staff, and system administrator. Coordinate times of instruction with District, at District’s convenience. Supplier shall provide a minimum of two hours of user instructions to clerical staff and four hours of user/maintenance instructions to District maintenance personnel. Instruction periods shall not coincide and shall be scheduled with District, not school staff. District shall provide list of authorized personnel for training sessions.
      c. Furnish to District, a printed copy of the fire alarm control panel programming upon completion of final system programming.
   4. Installation of the fire alarm system and equipment shall not be started until submittals, including State Fire Marshal listing numbers for each component of the system, have been submitted to and approved by the Architect. Fire alarm submittals must be provided.
   
   **5. Contractor Certifications:**
   
   a. Fire alarm system installer shall be State certified as a Fire/Life Safety Technician by the Division of Apprenticeship Standards.
   b. The contractor installing the fire alarm system must have NICET Certified Technicians on staff. There shall be at least one NICET Level III or IV fire alarm systems certified technician on staff at the local office to review the submittals and plans prior to submission. In addition, the on-site job supervisor for the installing contractor must be a Level II (or higher) NICET certified in fire alarm systems. A minimum of 30% of personnel on-site must be NICET certified.
   c. Certificates of all individuals must be included with the submittals. Failure to provide proof of certification will be cause for rejection of the submittals without further review. The rejection of the submittals for this reason will count as a submittal review/rejection.
   
   **6. Submittals:** Incomplete submittals (such as product data submitted without shop drawings, etc.) will be returned without review. Submittals shall be complete and include catalog data, shop drawings, one-line diagrams, scaled plan drawings, and certifications. Building plans shall be 1/8"=10", and site plans shall be no smaller than 1"=40’. Minimum text height shall be 3/32” high. Contractor shall also submit name of firm he proposes to do work under this
Section, addresses, phone numbers, and name of firm's contact, for approval. Such firms shall be factory authorized representatives of the system specified and submittal shall include manufacturer's letter of confirmation. Proposed firm shall furnish all equipment and specialty cables, make all connections to same, and place the systems in operation. Such firms shall have offices and service departments within a 100-mile radius of project and shall have been in business of this type for at least five years. Also, refer to requirement for shop drawings, substitutions, materials, and submittals in Section 26 01 00. Two submittal reviews will be made by the Architect's representative. Subsequent reviews will be charged to the Contractor. A rejection of a submittal or review of a partially presented submittal constitutes one submittal review.

a. Fire alarm system design and products have been reviewed and approved by DSA. Alterations to design and/or substitutions proposed by the contractor shall require the following to be included with the fire alarm submittal:
   1) Riser diagram.
   2) Point-to-Point diagram.
   3) Mounting detail showing elevations of wall mounted devices.
   4) List of system components, equipment, and devices, including manufacturer's model number(s) and California State Fire Marshal listing numbers.
   5) Copies of manufacturer's specification sheets for equipment and devices indicated.
   6) Voltage drop calculations -- include the following information for the worst case:
      a) Point-to-Point or ohms law calculations.
      b) Zone used in calculations.
      c) Voltage drop percent [not to exceed manufacturer's requirements]. Note: If voltage drop exceeds 10%, indicate manufacturer's listed operating voltage range(s) for equipment and devices.
   7) Battery type(s), amp hours, and load calculations -- include the following information:
      a) Normal Operation: 100% of applicable devices for 24 hours = control panel amps plus list of amps per device which draw power from the panel during standby power condition -- i.e.:
         1) Zone modules.
         2) Detectors.
         3) Other devices [identify].
      b) Alarm Condition: 100% of applicable devices for 5 minutes (15 minutes for voice evacuation) = control panel amps plus list of amps per device which draw power from the panel during alarm condition -- i.e.:
         1) Zone modules.
         2) Signal modules.
         3) Detectors.
         4) Signal devices
         5) Annunciator.
         6) Other devices [identify].
      c) Normal Operation + Alarm Condition:
         1) Total amp hours required.
         2) Total amp hours provided.

7. Record Drawings: Refer to General Conditions. Final Inspection will not be made until drawings are received and approved. Record Drawings shall include "As-Built" one-line and wiring diagrams, with terminations identified, wire color coding schedule, pullbox locations, and conduit routing plans. Record drawings shall include FINAL addresses for all devices.

8. Guarantee:
   a. One firm to assume full responsibility for performance on all work of this section. Guarantee all equipment against defects in material and workmanship for two years, and provide on-the-premises service during normal working hours for two years, at no cost to purchaser if trouble is not caused by misuse, abuse, or accident, or at current labor rates if so caused. Provide manufacturer's written guarantee for equipment and parts.
   b. Service shall normally be available within 24 hours from service department of authorized distributor of manufacturer by factory trained servicemen.

Sierra Ridge Middle School Modernization
Kirk S. Brainerd, Architect

Job No. 1324
March 30, 2016
c. On-the-premises service at other than normal working hours to also be available, but labor charges for such calls to be paid by purchaser at current labor rates.

2. DETAIL REQUIREMENTS AND PRODUCTS:

A. SYSTEM OPERATION:

1. Activation of any manual station or automatic detector shall cause the operation of all audible and visual signals. In addition to sounding local alarm signals, operation of manual stations or automatic detectors shall activate a digital communicator for telephone leased line reporting to remote SB575 compliant supervisory station. Telephone Company leased lines monitoring contract shall be arranged by the Owner. The system shall be electrically supervised against open circuits and grounds on the wiring to the alarm-initiating devices. An open or ground in the system shall cause a trouble signal to sound continuously until the system is restored to normal or until the signal is silenced by means of a cut-off switch. When the cut-off switch is thrown to the "off" position, a white pilot light shall be illuminated to show that the trouble signal is off. When the system is restored to normal operation, the trouble signal shall sound again and shall be silenced only by restoring the cut-off switch to its normal position, thereby also extinguishing the pilot light. Open and grounded circuits in the system shall not cause the sounding of false alarms. System shall be capable of initiating fire drill signal from master location. Fire drill signal shall not activate relay for remote reporting facilities.

2. Contractor to ensure synchronization of visual devices where required by NFPA 72.

B. STANDARD PRODUCTS:

1. Equipment and accessories furnished under the terms of these specifications shall be the standard products of manufacturers specified. All equipment shall be listed by U.L. and State Fire Marshal. Equipment shall be Notifier, Edwards, or equal, and Wheelock.

2. Refer to drawings for devices used.

3. Fire Alarm Control Panel (FACP):

a. The FACP Central Console shall be a Notifier Model NFS2-3030 and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, local and remote operator terminals, printers, annunciators, and other system controlled devices.

1) Function: The FACP shall perform the following functions:

a) Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.

b) Supervise all initiating signaling and notification circuits throughout the facility by way of connection to monitor and control modules and power supplies.

c) Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.

d) Visually and audibly annunciate any trouble, supervisory or alarm condition on operator's terminals, panel display, and annunciators.

b. System Capacity and General Operation:

1) The control panel shall provide, or be capable of expansion to 3,180 intelligent/addressable devices and 2048 annunciation points per system.

2) The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 80-character minimum liquid crystal display, individual color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.

3) All programming or editing of the existing 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 be able to provide the following features:

a) Block Acknowledge

b) Charger Rate Control

c) Control-By-Event

d) Control-By-Time
e) Automatic Day/Night Sensitivity Adjust  
f) Device Blink Control  
g) Drift Compensation  
h) Pre-alarm Control Panel Indication  
i) NFPA 72 Smoke Detector Sensitivity Test  
j) System Status Reports  
k) Alarm Verification, by device, with tally  
l) Multiple Printer Interface  
m) Multiple CRT Display Interface  
n) Non-Alarm Module Reporting  
o) Periodic Detector Test  
p) Trouble Reminder  
q) Upload/Download to PC Computer  
r) Alarm Verification with Tally  
s) Walk Test  
t) Smoke Detector Maintenance Alert  
u) Security Monitor Points  
v) Ability to Interface to Motorola Alert Central  

c. Central Processing Unit:  
1) The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the Central Processing Unit.  
2) The Central Processing Unit shall contain and execute all control-by-event (including ANDing, ORing, NOTing, CrossZoneing) 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 with system primary and secondary power failure.  
3) The Central Processing Unit shall also provide a real-time clock for time annotation of all system displays. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.  

d. Display:  
1) The system 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 assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.  
3) The system display shall provide an 80-character minimum back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide five Light-Emitting-Diodes (LEDs), to indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, DISPLAY TROUBLE, and SIGNAL SILENCE.  
4) The system display shall provide a 25-key touch key-pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be accessible through the display interface assembly to prevent unauthorized system control or programming.  
5) The system display shall include the following operator control switches: SIGNAL SILENCE, LAMP TEST, RESET, SYSTEM TEST, and ACKNOWLEDGE.  

e. Signaling Line Circuit (SLC) Interface Board:  
1) The SLC board shall monitor and control a minimum of 198 intelligent addressable devices. This includes 99 intelligent detectors (Ionization, Photoelectric, or Thermal) and 99 monitor or control modules.  
2) The SLC interface board shall contain its own microprocessor and shall be capable of operating in a local mode (any SLC input activates all or specific SLC outputs) in the unlikely event of a failure in the main CPU.  
3) The SLC interface board shall not require any jumper cuts or address switch settings to initialize operations.
4) The SLC interface board shall provide power and communicate with all intelligent addressable detectors and modules on a single pair of wires. This SLC Loop shall be capable of operating as a NFPA Style 4 (Class B), Style 6 or Style 7 (Class A) circuit.

5) The SLC interface board shall be able to drive two Class B (NFPA Style 4) circuits each up to 10,000 feet in length, for an effective loop distance of 20,000 feet.

6) The SLC interface board shall receive analog information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular detector. The SLC interface board software shall include software to automatically maintain the detector’s desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

f. Serial Interface Board (SIB):
1) The Serial Interface Board shall provide an EIA-232 interfaces between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
2) The SIB shall allow the use of multiple printers, CRT monitors, and other peripherals connected to the EIA-232 ports.
3) The Serial Interface Board shall provide one EIA-485 port for the serial connection to annunciation and control subsystem components.
4) The SIB shall have LEDs that will show that it is in regular communication with annunciators or other EIA-485 connected peripheral devices.
5) EIA-232 serial output circuits shall be optically isolated to assure protection from earth ground.
6) The FACP will send packets of 80 ASCII characters followed by a carriage return (ODH) and a line feed (OAH). The external monitoring computer shall recognize certain combinations of characters in certain locations within the 80-character string in order to interpolate the status of the FACP.
7) The Serial Interface Board shall be compatible to Motorola’s Alert Central software package. This interface shall be used to communicate the complete fire alarm control panel 80-character message to pocket pagers.

g. Enclosures:
1) The control panels shall be housed in a UL listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2) The back box and door shall be constructed of .060 steel with provisions for electrical conduit connections into the sides and top.
3) The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be hinged on either the right or left side (field selectable).
4) The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

h. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.

i. The CPU and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL864 standards.

j. Each peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU and peripheral devices shall be reliable and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques.

k. Power Supply:
1) The Main Power Supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
2) It shall provide 3.0 amps of usable notification appliance power, using a switching 24 VDC regulator.
3) It shall be expandable, for additional notification appliance power, in 3.0 amperre increments.
4) It shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. It shall charge up to 55 Amp Hour batteries within a 48-hour period.
5) It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults on sensitive addressable modules.
6) It shall be power-limited per UL864 requirements.
7) It shall provide meters to indicate battery voltage and charging current.
8) The power supply shall be capable of charging NICAD batteries up to 32 Amp Hours.
9) Batteries shall be sealed lead acid or gel cell. Minimum battery size shall be 25.0 Ah. Provide separate enclosure for batteries over 40.0 Ah.

i. Universal Digital Alarm Communicator Transmitter (UDACT): The UDACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station.
1) The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000' from the fire alarm control panel. The connection between the UDACT and the control panel shall be completely supervised.
2) The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA requirements. It shall include the ability for split reporting of panel events.
3) The UDACT shall be completely field programmable from a built-in keypad and 4-character red, seven segment display. UDACT shall be programmed to meet Owner's requirements.
4) The UDACT shall be capable of transmitting events in at least 9 different formats. This ensures compatibility with existing and future transmission formats. Accepted formats include:
   a) 3+1 Standard
   b) Ademco Contact ID
   c) 4+1 Standard
   d) 4+1 and 4+2 Ademco
5) Communication shall include vital system status such as:
   a) Independent Zone/Point (Alarm, trouble, non-alarm)
   b) Independent Zone/Point Supervisory Signal
   c) AC (Mains) Power Loss
   d) Low Battery and Earth Fault
   e) System Off Normal
   f) 12 and 24 Hour Test Signal
   g) Abnormal Test Signal (per UL requirements)
   h) EIA-485 Communications Failure
6) The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

m. System Circuit Supervision:
1) The FACP shall supervise all circuits to intelligent devices, annunciators and conventional peripherals and annunciate loss of communications with these devices. The CPU shall continuously scan above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate that device or devices are not responding and print the information on the printer.
2) Sprinkler system valves, standpipe control valves, PIV and main gate valves shall be supervised for off-normal position.

n. Field Wiring Terminal Blocks: For ease of service all wiring terminal blocks shall be the plug-in type and have sufficient capacity for 18 to 12 AWG wire. Terminal blocks permanently fixed are not acceptable.

o. Operators Terminal: Provide the following functions in addition to any other functions required for the system.
1) Acknowledge (ACK/STEP) Switch:
a) Activation of the control panel acknowledge switch in response to a single new alarm and/or trouble condition shall silence the local panel piezo electric signal and change the system alarm or trouble LED from flashing mode to steady-ON mode. If additional new alarm or trouble conditions exist or are detected and reported in the system, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.

b) Depression of the acknowledge switch shall silence all remote annunciator piezo sounders.

2) Signal Silence Switch: Activation of the signal silence switch shall cause all programmed notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards.

3) System Reset Switch: Activation of the system reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition. If the alarm condition(s) still exist, or if they reoccur in the system after system reset switch activation, the system shall then resound the alarm conditions.

4) System Test Switch: Activation of the system test switch shall initiate an automatic test of all Intelligent/Addressable detectors in the system. The system test shall activate the electronics in each intelligent sensor, simulating an alarm condition and causing the transmission of the alarm condition from that sensor to the fire alarm control panel. The fire alarm control panel shall interpret the data from each sensor installed in the system. A report summarizing the results of this test shall be displayed automatically on the liquid crystal display and on the CRT or printer.

5) Lamp Test Switch: Activation of the lamp test switch shall sequentially turn on all LED indicators, liquid crystal display and local piezo-electric signal, and then automatically return the fire alarm control panel to the previous condition.

p. System Expansion: Design the FACP so that the system can be expanded in the future (to include the addition of 20% more circuits or zones) without disruption or replacement of the existing control panel. This shall include hardware capacity, software capacity and cabinet space.

q. 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 shall be accomplished through the standard FACP keyboard or through the video terminal.
   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 shall be used for status level changes such as zone disable or manual on/off commands. A second (higher-level) shall be used for actual change of program information.
   5) System programming shall be "backed" up on a floppy diskette. This system back-up shall be capable of download to a replacement FACP system should the system be damaged due to fire or other event.
   6) System shall be programmed to meet Owner's requirements. Coordinate with Owner.

r. It shall be the responsibility of the equipment supplier/installer to ensure that all equipment supplied will fit in locations designated on plans and in the specifications.

s. Specific System Operations:
   1) Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the system keypad or from the keyboard of the video terminal. Sensitivity range shall be within the allowed UL window.
   2) Alarm Verification: Each of the Intelligent Addressable Smoke Detectors in the system may be independently selected and enabled to be an alarm verified detector.
The alarm verification function shall be programmable from 5 to 50 seconds and each detector shall be able to be selected for verification during the field programming of the system or any time after system turn-on. Alarm verification shall not require any additional hardware to be added to the control panel. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

3) System Point Operations:
   a) Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
   b) System output points shall be capable of being turned on or off from the system keypad or the video terminal.

4) Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
   a) Device Status.
   b) Device Type.
   c) Custom Device Label.
   d) Software Zone Label.
   e) Device Zone Assignments.
   f) Analog Detector Sensitivity.
   g) All Program Parameters.

5) System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.

6) System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 400 system output/input/control activations. Each of these activations will be stored, with time and date stamp, with the actual time of the activation, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed, one event at a time, and the actual number of activations may also be displayed and or printed.

The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.

7) Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.

If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall be no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

8) The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personnel when a detector is at 80% of its alarm threshold.

4. Administrative manual and manual alarm-initiating devices shall be for semi-flush mounting, double action, non-breakglass type, located as shown on plans. Each manual station shall have its own address. Notifier NBG-12LX. Manual stations shall conform to DSA Access Compliance requirements. Operation of the manual station shall not require grasping of the handle. Each manual station shall be provided with clear protective cover, non-locking, STI-1200 (flush mount) or STI-1230 (surface mount). Cover shall not be equipped with horn.


10. Control Modules: Shall provide a single Form-C (SPDT) dry contact. Notifier FRM-1.
11. Fault Isolator Module: Shall protect the system against wire-to-wire short circuits on the SLC loop. Notifier ISO-X. Provide one at each building where data loop first terminates (STC or STB).
12. Audible/Visual Devices: All fire alarm devices shall be UL listed and meet ADA requirements. All devices shall have a red finish. All fire alarm audible devices shall have the same basic sound and "temporal" pattern (ANSI S3.41). Piezo horns and mini-horns are not acceptable. Strobes shall be synchronized.
   a. Visual Fire Alarm Indicating Devices:
      1) Wall Mounted Strobe: Shall be semi-flush mounted, LED flasher type. Wheelock LSTR. Refer to drawings for Candela settings.
   b. Voice Evacuation Speakers:
      1) Ceiling Mounted Speaker: Shall be semi-flush mounted with field selectable 25 or 70-volt input and power taps from 1/8 watt to 2 watts. Wheelock LSPKRC.
      2) Exterior Speaker: Shall be Wheelock ET1010-R. Flush speakers shall be provided with WFP flush-mount kit. Surface mounted speakers shall be provided with WBB-R backbox.
   c. Voice Evacuation Combination Speaker/Visual Alarm Indicating Devices:
      1) Ceiling Mounted Speaker/Strobe: Shall be semi-flush mounted. Speaker shall have field selectable 25 or 70-volt input and power taps from 1/8 watt to 2 watts. Strobe shall be LED flasher type. Wheelock LSPSTRC. Refer to drawings for Candela settings.
   d. Sync Module: Shall be Wheelock DSM-12/24-R.
13. Remote Annunciator: Shall have an 80-character LCD with control switches for system acknowledge, signal silence, and system reset and have a piezo sounder with alarm/trouble resound. Notifier LCD-80 in flush backbox. Where annunciators are located outdoors, provide custom fabricated semi-flush enclosure, weatherproof, with locking door with plexiglass viewing window, Hoffman or equal, size as required to house annunciator. Submit shop drawings for approval.
14. Signal Extender Panel Remote Power Supply (Field Charging Power Supply "FCPS"): Shall provide a minimum of four output notification appliance circuits, and include 7.0 Amp hour batteries. Fire-Lite FCPS-24FS6 Label all power supplies "FCPS" with number shown on plans.
15. Voice Evacuation Panel: Shall be a single channel system capable of delivering 40 watts of supervised audio power, expandable to 5280 watts by adding audio boosters. The system shall be supplied with 8 pre-recorded messages and be capable of in-field recording. The panel shall have an internal battery charger. The panel shall be Wheelock SP40S with 12.0 Ah batteries.
16. Voice Evacuation Audio Booster (80 Watt): Shall be a single circuit system capable of delivering 80 watts of supervised audio power. Audio booster shall be Wheelock SPB-80/4 with 12.0 Ah batteries.
17. Voice Evacuation Audio Booster (160 Watt): Shall be a 2-circuit system capable of delivering 80 watts of supervised audio power per circuit. Audio booster shall be Wheelock SPB-160 with 12.0 Ah batteries.
18. Voice Evacuation Audio Booster (320 Watt): Shall be a4-circuit system capable of delivering 80 watts of supervised audio power per circuit. Audio booster shall be Wheelock SPB-320 with 12.0 Ah batteries.

3. EXECUTION
   A. INSTALLATION REQUIREMENTS:
      1. Electrical Contractor shall retain the services of the duly appointed representative as specified hereinbefore, who shall furnish all equipment, make all connections to same, and place system in operation. Technician and workman employed shall be particularly skilled in
this type of work. Technicians and workmen must have NICET certification as required
hereinbefore. Fire alarm system contractor shall possess a valid C10 California Electrical
Contractors license. Only contractors holding a valid license may perform any fire alarm work.

2. Detector locations shown on drawings are approximate only. Exact locations shall be
coordinated with lighting and mechanical equipment and shall be placed in accordance with
NFPA 72 and manufacturer's recommendations (with respect to supply air diffusers, etc.).

3. Detectors, strobes, and horn/strobes (including mini-horn/strobes) in gymnasiums, multi-
purpose rooms, locker rooms, team rooms, and student toilet rooms shall be provided with
wire guards.

4. Fire alarm circuits shall be terminated on screw terminals. Terminal blocks shall be
Allen-Bradley Bulletin 1492 with 600-volt screw terminals for #22 to #10 conductors, mounted
to type N22 channel, or approved equal. Submittal shall show internal elevation of terminal
cabinets or backboards with equipment laid out.

5. All cables entering terminal cabinet shall be identified with Brady or E-Z Code wire markers.
Upon completion of installation, six copies of one-line "as-built" wiring diagram shall be
furnished to Architect.

6. Each cable run on wiring diagram shall be identified with exact wire marker code (numerical
or alphabetical) as appears in terminal cabinets.

7. Station locations shall be identified by school's actual room numbers and system shall be
programmed accordingly. Coordinate actual room numbers with District. Coordinate final
programming with District. Contractor shall furnish a printed copy of final programming to
District.

8. End-of-line resistors shall be installed in terminal cabinets, at backboards, or as noted on
drawings.

9. Color code wiring for the system as follows:

<table>
<thead>
<tr>
<th></th>
<th>Positive (+)</th>
<th>Negative (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA Visual Indicators</td>
<td>black</td>
<td>white</td>
</tr>
<tr>
<td>FA Horns</td>
<td>black</td>
<td>white</td>
</tr>
<tr>
<td>FA Detectors</td>
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<td>blue</td>
</tr>
<tr>
<td>FA Manual Stations</td>
<td>red</td>
<td>blue</td>
</tr>
<tr>
<td>Sprinkler Riser Flow Switch</td>
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<td>blue</td>
</tr>
<tr>
<td>Sprinkler Riser Bell</td>
<td>black</td>
<td>white</td>
</tr>
</tbody>
</table>

10. No splices shall occur in pullboxes. Fire alarm system wiring shall be continuous, without
splices, from terminal cabinet to signal cabinet and signal cabinet to devices. All interior
pullboxes shall be accessible and locations shall be recorded on "As-Built" drawings.

B. DIGITAL COMMUNICATOR:
1. From communicator in FACP, provide a 1" conduit with two 4-wire, 22-gauge telephone
   cables to Main Telephone Terminal Backboard. Connect at communicator and at telephone
   backboard on surface mounted RJ31X jacks.

2. Contractor shall program the communicator to transmit alarm and trouble per device and
   module.

3. Contractor shall provide communicator zone/point information and other items listed
   hereinbefore to District's Central Station. Coordinate with District.

C. CONSTRUCTION MEETINGS:
1. The Contractor shall schedule construction meetings at the jobsite as follows:
   a. Pre-rough-in meeting shall occur before installation of any boxes, raceways, etc. Exact
      locations of all detectors and strobes shall be established as recommended by Fire Alarm
      System subcontractor.
   b. Prewire meeting shall occur after raceways are installed and prior to pulling of any wire or
cable.
   c. Pre-termination meeting shall occur after wire and cable has been installed and prior to
termination.

2. Meetings shall be scheduled by the Contractor on a building by building basis and shall
   include the Project Inspector, School's Representative, the electrical subcontractor, and the
   Fire Alarm System subcontractor as a minimum.

D. TESTS:
1. After all equipment specified herein has been installed and is in operating condition, performance tests shall be conducted by Contractor in accordance with, but not limited to, Table 14.4.3.2, NFPA 72, to verify that installation and components comply with these specifications. Contractor shall furnish competent personnel for these tests. Testing shall be scheduled with the Owner and shall occur after receipt by Architect of Contractor's written certification of completion, record one-line diagram, wiring diagrams, maintenance and operation manuals, and other "As-Built" data required by these specifications.

2. Upon completion of the installation of the fire protective signaling equipment and after satisfactory performance tests have been conducted, a satisfactory demonstration of the entire system shall be made in the presence of the Project Inspector. Contractor shall coordinate with Project Inspector and School. Demonstration shall be completed prior to occupancy by School and prior to final testing with Owner.

3. After system is completely tested, the Contractor shall take the following actions with the Owner:
   a. The Contractor will schedule a meeting with the Alarm Sub-contractors and Owner's Representatives to determine alarm zone and device nomenclature. The Contractor shall assure that the alarm zone and device nomenclature matches the actual building and room numbers used by the school. Architectural numbering shall not be used. Once confirmed, the Contractor shall demonstrate this to Owner's Representatives.
   b. The Contractor shall provide Owner's Representative with the location of the Master Fire Alarm Panel and provide training to include, but not limited to, how to silence the alarm.

E. FIRE ALARM SYSTEM CERTIFICATION:
   1. Fire Alarm Certification: Written certification on the forms found in Figures 7.8.2(a) through 7.8.2(l), NFPA 72 shall be submitted by the Contractor to Architect (with copies to Electrical Engineer and DSA) stating for himself and the equipment manufacturer that component parts are as LISTED AND APPROVED BY State Fire Marshal, that the installation conforms in all respects to requirements as set forth in the California Electrical Code, that acceptance testing has been performed in the presence of the Project Inspector. The certificate shall be signed by Contractor before submitting to Project Inspector.

   * * *
1. GENERAL:
   A. SUMMARY: Provide Earthwork, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. Local Jurisdictions: Perform work in accordance with jurisdictional agency and utility company standards and requirements.
         a. General: Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
         b. ASTM D2487: Classification of Soils for Engineering Purposes.
      6. State of California, Department of Transportation (CalTrans):
      7. California Occupational Safety and Health Administration (CalOSHA): Construction Safety Orders.
   C. SUBMITTALS: Submit product data, shop drawings, samples and test reports.
   D. QUALITY ASSURANCE:
      1. Testing:
         a. General: Refer to Section 01 45 23 - TESTING AND INSPECTION SERVICES.
         b. Retesting: Paid for by Contractor.

2. PRODUCTS:
   A. MATERIALS:
      1. Fill Materials:
         a. Engineered Fill:
            1. On-site Fill: Inorganic, no rocks larger than 6 inches, liquid limit of less than 40 and plastic index less than 15.
            2. Backfill:
               a) General: Granular, non-expansive soil; free of organic or deleterious material, no rocks larger than 6 inches, and with not more than 15 percent of the rocks or lumps larger than 2-3/8 inches in their greatest dimension.
               b) Sand: Natural river or bank sand; washed, free from organic and other foreign material.
         b. Topsoil: Excavated and reused material, graded, free of roots, rocks larger than ½ inch, debris, vegetation and foreign matter. Top 4 inches of soil below existing grade is defined as native topsoil.
      2. Water: Potable; free of deleterious materials.

3. EXECUTION:
   A. PREPARATION:
      1. Environmental Requirements: Do not place, spread or compact fill material during unfavorable weather conditions. When work is interrupted by rain, do not proceed with fill operations until field tests indicate that moisture content and density of previously placed fill is satisfactory.
      2. Examination: Verify site conditions shown, report unidentified conditions and defects to the Architect.
      3. Utilities: Should unknown active utilities be encountered during work, halt operation and promptly notify the Architect. Do not proceed until identified and instructions are received from responsible utility company.
   B. LAYOUT: Establish lines, levels and grades; locate work, including existing underground utilities; set markers and stakes.
   C. PROTECTION:
      1. General: Erect and maintain barricades and protection facilities, as required.
      2. Bench Marks: Protect survey control points from damage or displacement.
      3. Utilities: Maintain and protect existing utilities to remain.
4. Drainage: Grade off excavation top perimeter to prevent surface water run-off into excavation or to adjacent properties per California State Water Resources Control Board (SWRCB) requirements. Keep excavations and sub-grade area free from water during process of work, regardless of cause, source or nature of water.

5. Dust Control: Wet as required.

D. PERFORMANCE:

1. General: Provide all grading, excavating and cutting necessary to conform finish grade and contours as shown. Cuts shall be made to true surface of subgrade.

2. Compaction: ASTM D1557 Compaction Test method; value of optimum moisture content and density will be determined by the Testing Laboratory.

3. Demolition:
   a. General: Per Section 02 41 00 - DEMOLITION.
   b. Existing Paving: Remove demolished concrete and asphalt concrete paving from site.
   c. Other Obstructions: Remove abandoned utility lines, concrete foundations, etc. Backfill resulting holes as specified.

4. Excavation:
   a. General: Excavation is unclassified and includes excavation to sub-grade, regardless of materials encountered.
   b. Paved Areas: 1'-0" below pavement subgrade elevation, or existing grade, which ever is lower.

5. Filling and Backfilling:
   a. General: Perform fill and backfill operations; thoroughly compact to 95 percent of maximum dry density while at required moisture content. Backfill with material excavated, unless otherwise shown. Place in 6 inch layers and compact each layer to specified density.
   b. Aggregate:
      1. General: Do not place fill on soft, muddy, or frozen surfaces.
      2. Base Course: Spread aggregate over prepared subgrade to a total compacted thickness as shown.

6. Finish Grading:
   a. General: Place topsoil to tolerance of plus or minus ½ inch of finished elevations. Maintain profiles and contours of subgrade; eliminate rough or low areas. Slope grade away from building minimum of 2 percent, unless otherwise shown.
   b. Topsoil:
      1. General: Place to a depth of 6 inches in all areas where planting is shown; compact to 85 percent of maximum dry density. Place only during dry weather.
      2. Verification: Project Inspector must verify that material is uniformly spread to minimum depth specified.
   c. Paved Areas: Compact upper 6 inches of final sub-grade to 95 percent of maximum dry density.
   d. Other Fill and Backfill: Upper surface of other final sub-grades.

* * *
1. GENERAL:
   A. SUMMARY: Provide Asphalt Concrete Paving, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Society for Testing and Materials (ASTM): Materials and testing standards as identified throughout this Section or within referenced manufacturers' standard specifications.
      2. State of California, Department of Transportation (CalTrans):
   C. SUBMITTALS:
      1. General: Submit product data.
      2. Closeout: Submit maintenance data.

2. PRODUCTS:
   A. MATERIALS:
      1. Base Course:
         b. Primer: MC-70 per CalTRANS Standard Specifications, Section 93.
         c. Asphalt Binder: Steam-refined paving asphalt per CalTRANS Standard Specifications, Section 92, Grade AR-4000.
      2. Surface Course: Mineral aggregates for Type "B" asphalt concrete, per CalTRANS Standard Specifications, Section 39-2.02, Type B, 1/2 inch maximum grading.
   B. MIXES:
      1. General: Plant mixed per CalTRANS Standard Specifications, Section 39, Type B, 1/2 inch maximum grading.
      2. Temperature of Asphalt: 275 degrees F minimum; 325 degrees F maximum, when added to aggregate.
      3. Temperature of Aggregate: 250 degrees F minimum; 325 degrees F maximum, when asphalt is added.

3. EXECUTION:
   A. PREPARATION:
      1. Environmental Requirements:
         a. Base Course: Do not lay during wet weather, on muddy sub-grade, or when atmospheric temperature is below 35 degrees F.
         b. Asphalt Surfacing: Do not apply during wet weather, on wet base course, or when atmospheric temperature is below 50 degrees F.
      2. Examination: Examine conditions of work in place before beginning work; report defects.
      3. Measurements: Take field measurements; report variance between plan and field dimensions.
      4. Preparation of Subgrade: Clean, shape and compact to hard surface free from elevations or depressions exceeding 3/8 inch in 10'-0" from true plane.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
      2. Required Thickness after Compaction:
         a. Aggregate Base Course: As shown.
         b. Asphalt Concrete Surface Course: As shown.
      3. Asphalt Paving:
         a. Aggregate Base Course: Install per CalTRANS Standard Specifications, Section 26; compact to relative compaction of not less than 95%, ASTM D1557.
         b. Sterilant: Apply per manufacturer's instructions over entire base course area just prior to application of asphalt.
         c. Asphalt Binder: Apply as "tack coat" to all vertical surfaces of existing paving, curbs, walks, and construction joints in surfacing against which paving is to be placed. Apply at rate of 0.02 to 0.10 gallons per square yard of surface.
         d. Asphalt Concrete Surface Course:
            1. General: Per CalTRANS Standard Specifications, Section 39-6 except as modified below.
            2. Final Gradation: Smooth, uniform and free of ruts, humps, depressions or irregularities, with a minimum density of 95% of maximum theoretical unit weight as determined by California Test Method No. 304. Maximum variation 1/8 inch in 10'-0" when measured with steel straighedge in any one direction. Test paved areas for proper drainage by
applying water to cover area. Correct portions that do not drain properly by patching with plant mix.

4. Patching: Cut existing paving square and plumb at all edges to be joined by new paving. Prime vertical surfaces before installing new work. Warp carefully to flush surface, with seal over joints, and feather edge. Patch existing paving where cut for installation of piping or conduits under Division 22 - PLUMBING and Division 26 - ELECTRICAL.

* * *
CONCRETE PAVING  Section 32 13 13

1. GENERAL:
   A. SUMMARY: Provide Concrete Paving, as shown and specified per Contract Documents.
   B. REFERENCES:
      1. American Concrete Institute (ACI):
         b. ACI 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
         c. ACI 211.2: Recommended Practice for Selecting Proportions for Normal Weight Concrete.
         d. ACI 302.1R: Guide for Floor and Slab Construction.
         e. ACI 303R: Guide to Cast-in-Place Architectural Concrete Practice.
         f. ACI 304R: Guide for Measuring, Mixing, Transporting and Placing Concrete.
         g. ACI 305R: Hot Weather Concrete.
         h. ACI 306R: Cold Weather Concrete.
         i. ACI 308: Standard Practice for Curing Concrete.
         j. ACI 347R: Guide to Formwork for Concrete.
      a. General: Materials and testing standards as identified throughout this Section or within referenced manufacturers standard specifications.
   6. National Institute of Standards and Technology (NIST):
      a. PS-1: Construction and Industrial Plywood.

C. SUBMITTALS:
   1. General: Submit product data, samples of concrete finishes, and test reports per CBC.
   2. Shop Drawings:
      a. Submit manufacture and installation details per ACI 315, including fastenings, for review.
      b. Reinforcing: Indicate bar sizes, spacings, locations and quantities of reinforcing steel and wire fabric; bending and cutting schedules, including supporting and spacing devices and fastenings.
      c. Design Mixes: Submit concrete mix designs for review.
   3. Placement Records: Keep on job site until completion, and open to inspection, record showing time and date and accurate location of placement of concrete.
   4. Certificates:
      a. General: Submit certification stating that products used to manufacture concrete delivered to the site meet or exceed the material and testing requirements of these specifications.
      b. Reinforcement: Submit mill test and chemical analysis certificates for all reinforcing steel delivered to the site.

D. QUALITY ASSURANCE:
   1. Qualifications: Installer specializing in the work of this Section with minimum three (3) years documented experience.
   2. Testing: Tests by Testing Laboratory appointed by Owner and under directions of Architect; expense of testing borne by Owner; make tests per CBC.

2. PRODUCTS:
   A. MATERIALS:
      1. Formwork:
         a. General: Lumber per NIST PS-20 Construction grade douglas fir; plywood per PS-1, C Grade douglas fir, 5/8 inch minimum.
         b. Fasteners: As required to maintain formwork in place while placing and curing concrete; non-staining.
c. Form Release Agent: Colorless mineral oil which will not stain the concrete or impair natural bonding characteristics of coating intended for use on concrete.
e. Bars:
   1. General: ASTM A615, deformed; No. 4 Grade 40.
   2. Dowels: Same grade as bars to which dowels are connected.
f. Welded Wire Fabric: ASTM A185, Plain Type; 6x6-W1.4xW1.4, in flat sheets.
g. Chairs, Bolsters, Bar Supports, Spacers: CRSI Class 2.
h. Tie Wire: ASTM A82, as drawn.
2. Concrete:
a. Surface Treatments:
   1. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent gray aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
   2. Sealer:
      a) General: Spartan-Cote WB II manufactured by Burke/Edoco Division of Dayton Superior.
      b) Alternate Manufacturers: Comparable products manufactured by BASF Building Systems, or accepted equal.
B. FABRICATION: Fabricate per the CRSI "Manual of Standard Practice"; where specific details are not shown, fabricate per ACI 315.
C. MIXES:
1. Concrete Proportions:
   a. General: Per ACI 211.1 and ACI 301.
   b. Minimum Strength: 2,500 psi per Chapter 19A of CBC.
2. Mixing of Concrete:
   a. General: Per CBC; mix until there is uniform distribution of material and mass is uniform and homogeneous; mixer must be discharged completely before the mixer is recharged.
   b. Ready-Mix Concrete: Mix and deliver per CBC; furnish batch ticket information.
   c. Job Mixed Concrete:
      1. General: Use batch mixer of approved type, with capacity to handle one or more full sack batches, no split sack batches permitted; furnish batch ticket information. Operate mixer as recommended by manufacturer. Record approximate location of final deposit in structure.
      2. Mixer Capacity of 1 Cubic Yard or less: Mix minimum one and one half (1-1/2) minutes after all materials are in drum.
      3. Mixer Capacity of 1 Cubic Yard or More: Increase mixing time by 15 seconds for each additional 1 cubic yard, after all materials are in drum.
      4. Handling and Mixing of Concrete: Architect may order removal of any equipment which in his opinion is insufficient or in any way unsuitable.

3. EXECUTION:
   A. PREPARATION:
      1. Environmental Requirements: Per ACI 305R and ACI 306R.
      2. Examination: Examine conditions of work in place before beginning work; report defects. Verify granular sub-base materials have been placed to the depth shown.
      3. Measurements: Take field measurements; report variance between plan and field dimensions.
      4. Protection: Protect finish surfaces adjacent to locations scheduled for placement of concrete.
   B. INSTALLATION:
      1. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
      2. Earthwork: Refer to Section 31 20 10 - EARTHWORK for excavation, sub-base and backfill requirements. Conform to levels and grades shown.
      3. Formwork:
         a. Workmanship: Provide formwork required to produce smooth concrete; straight, plumb and true to plane. Concrete out of line, level or plumb will be rejected.
         b. Erection:
            1. General: Design and erect per ACI 301.
            2. Construction: Construct forms to shapes, lines, grades and dimensions shown.
3. Form Coating:
   a) General: Before placement of reinforcing steel, coat exposed face of forms to prevent moisture absorption from concrete and facilitate removal of forms; seal all cut edges.
   b) Re-use: Thoroughly clean and recoat form material acceptable for re-use.
4. Reuse of Formwork: Do not reuse split, warped, delaminated or otherwise damaged form-facing materials that require more than minor patching of contact surfaces. Clean and repair surfaces of forms to be reused in the Work. Apply new form-release agent.
4. Reinforcement:
   b. Placement:
      1. General: Install in longest practical lengths. Accurately place, support, and secure reinforcement against displacement.
      2. Wire Ties: Set with ends directed away from exposure, into concrete.
      3. Bars:
         a) Laps: Provide minimum center to center distance between parallel bars of 2-1/2 times diameter. Offset laps in adjacent bars.
         b) Splices: Lap 24 diameters, unless otherwise shown, and wire tie bars.
         c) Dowels: Place as shown; grease loose end to prevent concrete from bonding to dowel. Install through expansion joints.
   4. Welded Wire Fabric: Lap edges and ends of adjoining sheets at least one mesh spacing, unless otherwise indicated. Lace overlaps with wire.
   c. Embedded Components:
      1. General: Install straight, level and plumb prior to concrete placement; brace, anchor and support items to prevent displacement or distortion.
      2. Inserts: Coordinate work of other Sections in setting bolts, anchors, and other components, as required.
   d. Joints: Construct joints true to line with faces perpendicular to surface plane of concrete.
5. Cast-in-place Concrete:
   a. General: Maintain records for placement of all concrete. Place concrete in dry conditions; keep excavations free of water, ice, loose soil or debris.
   b. Weather Requirements: Per ACI 305R (Hot) and ACI 306R (Cold). Additionally, hot weather is defined as any period in which temperature exceeds 85 degrees F.
   c. Transportation: Handle concrete from mixer to place of deposit as rapidly as possible; using methods to prevent separation or loss of ingredients. Deposit in final position; avoid rehandling or flowing. Do not place partially hardened concrete in work. Do not wheel placement containers directly on top of reinforcing steel.
   d. Placement:
      1. General: Place concrete continuously between predetermined joints. Do not break or interrupt placement of concrete in manner that cause cold joints to occur.
      2. Concrete Slabs:
         a) General: Lay to required lines and grades, in pattern shown. Water subgrade the night before placement; dampen again immediately before placement; standing water not allowed.
         b) Joints: As shown.
         c) Flatness: Per ASTM E1155.
   3. Compacting:
      a) General: Thoroughly work concrete around reinforcement, embedded components and into corners of forms.
      b) Slabs: Consolidate concrete on grade by spading and puddling and internal vibration.
   e. Concrete Finishes:
      a) General: Uniformly spread, screed and float concrete.
      b) Contraction Joints: Mark off exposed joints, where indicated, with 1/4 inch radius edging tool. Markings to be clean cut, straight and square with respect to border.
      Tool edges of exposed expansion and control joints; border edges, and wherever concrete adjoins other material or vertical surfaces.
      c) Trowel: Apply two (2) steel troweling operations at surfaces left exposed, finished to achieve burnished surface. Follow second troweling with light brooming perpendicular to direction of traffic to form non-slip surface.
      d) Broom: Apply medium broom finish at exterior walks and stairs, perpendicular to direction of traffic flow; heavy broom finish at ramps.
e) Accessible Routes of Travel:
   1) General: Provide concrete paving and concrete finishes along accessible routes of travel at least as slip-resistant as that described as a medium salted finish for slopes of less than 6%, and slip-resistant at slopes of 6% or greater.
   2) Slip-Resistive Aggregate: Uniformly spread 25 pounds per 100 square feet of dampened slip-resistive aggregate over surface in not more than two (2) applications. Tamp aggregate flush with, but do not press below surface. Apply float finish. After curing, lightly work surface with a steel wire brush and water to expose aggregate.

f. Curing:
   1. General: Refer to ACI 308. Protect concrete from premature drying for minimum five (5) days following pour. Cover and cure with membrane curing or moist sand; upon completion wash clean.
   2. Sealer: Apply where shown.

g. Removal of Forms: Five (5) days.

h. Patching: Repair exposed concrete to match surrounding concrete finish as required by the Architect.

i. Protection: After placement, finishing and completion of required repairs, protect exposed corners, edges, and surfaces of concrete from damage, including staining and contamination during remainder of construction period.

C. FIELD QUALITY CONTROL:
   1. General: Per CBC, Section 1905.6; agency selected and paid for by Owner.
   2. Field Testing:
      a. General: Take three (3) cylinders and test, for each 50 cubic yards of each concrete mix being placed each day. Test first cylinder at the age of 7 days and the other at 28 days; cylinder for 28-day test will not be broken if cylinder for 7-day test meets 28 day strength. Hold third cylinder for 56 day test, if required.
      b. Reinforcement: Make one (1) tensile test and one (1) bend test of specimen taken from each 10 tons of steel delivered to the site.
   3. Retesting: Cost of retests or coring because of understrength, questionable or defective concrete will be paid for by Contractor.

D. CLEANING: Clean exposed surfaces after finish treatment to remove stains, markings, dust, and debris. Do not use cleaning materials or processes that could change the appearance of concrete finishes. Protect adjacent surfaces from staining or damage due to cleaning operations.

* * *