PROJECT MANUAL

FOR

TOVASHAL ELEMENTARY SCHOOL HVAC REPLACEMENT

OWNER

MURRIETA VALLEY UNIFIED SCHOOL DISTRICT
41870 McALBY COURT
MURRIETA, CA 92562-7036

ARCHITECT

WLC ARCHITECTS, INC.
8163 ROCHESTER AVENUE, SUITE 100
RANCHO CUCAMONGA, CA 91730
(909) 987-0909

PROJECT 1726200
FEBRUARY 2021

PROJECT MANUAL
FOR

TOVASHAL ELEMENTARY SCHOOL HVAC REPLACEMENT

PROJECT 1726200

FEBRUARY 2021

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 04-119843 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 08/26/2022

Murrieta Valley Unified School District
41870 McAlby Court
Murrieta, CA 92562-7036

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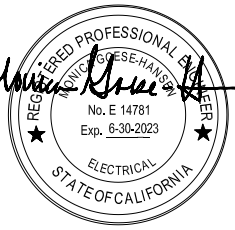

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SECTION 01 11 00

SUMMARY OF WORK

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Work Included.

B. Work under separate contracts.

C. Work by Owner.

D. Owner furnished products.

E. Contractor use of site and premises.

F. Work Sequence.

G. Owner occupancy.

H. Work restrictions.

1.2 WORK INCLUDED

A. Work of this Contract comprises general construction including demolition and replacement of the rooftop packaged HVAC units and installation of carbon monoxide detection equipment located at Tovashal Elementary School, 23801 Saint Raphael Drive, Murrieta, CA 92562 for Murrieta Valley Unified School District, Owner.

B. Construct the work under a single lump sum contract.

1.3 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

B. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1.4 CONTRACTOR USE OF SITE AND PREMISES

A. Limit use of site and premises to allow:

1. Owner occupancy.

2. Work by others and Work by Owner.

1.5 OWNER OCCUPANCY

A. Partial Owner Occupancy: Owner will occupy the entire site and premises during entire construction period, with the exception of areas under construction.

B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

C. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.

D. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.

E. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

F. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage.

G. Perform the Work so as not to interfere with Owner's day-to-day operations.

H. Maintain existing exits, unless otherwise indicated.

I. Provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.

1.6 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed during normal business working hours, Monday through Friday, except as otherwise indicated or required to conform to construction schedule and labor codes.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted to do so and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Architect not less than 5 days in advance of proposed utility interruptions. Do not proceed with utility interruptions without Architect’s permission.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cash allowances.

B. Contingency allowances.

C. Schedule of Values.

D. Application for Payment.

E. Defect assessment.

F. Non-payment for rejected work.

G. Change procedures.

H. Alternates.

I. Unit prices.

1.2 CASH ALLOWANCES

A. Include in the contract sum all cash allowances stated herein.

B. Items covered by cash allowances shall be supplied for such amounts and by such persons as the Owner may direct, but the Contractor shall not be required to employ persons or entities against which the Contractor makes reasonable objection.

C. Costs Included in Cash Allowances: Cost of Product to Contractor or Subcontractor, less applicable trade discounts; delivery to site and applicable taxes.

D. Costs Not Included in the Cash Allowance: Product handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; labor for installation and finishing; and overhead profit and other expenses contemplated. These expenses shall be included in the contract sum and not in the allowance.

E. Funds will be drawn from cash allowance amount only by written authorization of the Owner.

F. At closeout of contract, funds remaining in cash allowance amount will be credited to Owner by change order.

G. Whenever costs are more than cash allowance amount, the contract amount will be adjusted accordingly by change order.

H. Contractor Responsibilities:

1. Assist Architect in selection of products and suppliers.

2. Obtain proposals from suppliers and offer recommendations.

3. On notification of selection by Owner, execute agreement with designated supplier.

4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery and product handling at site.

5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for damage.

1.3 CONTINGENCY ALLOWANCE:

A. Include in the contract sum and base bid all contingency allowances stated herein.

B. Costs included in contingency allowance: Cost of work to Contractor or subcontractor, less applicable trade discounts; delivery to site and applicable taxes; product handling, including unloading, uncrating, and storage; protection of products from damage; labor for installation and finishing; reasonable overhead and profit and other expenses required by work.

C. Funds will be drawn from contingency allowance amount only by written authorization of Owner.

D. At closeout of Contract, funds remaining in contingency allowance amount will be credited to Owner by Change Order.

E. Whenever costs are more than contingency allowance amount, the Contract amount will be adjusted accordingly by Change order.

F. Contractor Responsibilities:

1. Assist Architect in selection of products and suppliers.

2. Obtain proposals from suppliers and offer recommendations.

3. On notification of selection by Owner, execute agreement with designated supplier.

4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery of product to site.

5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for damage.

G. Contingency Allowance: A stipulated sum of $50,000.00.

1.4 SCHEDULE OF VALUES

A. Submit Schedule of Values for approval in duplicate within fourteen days after receipt of Notice to Proceed.

B. Format: Submit typed schedule based upon the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section.

C. Include in each line item, the amount of Allowances specified in this Section.

D. Include within each line item, a directly proportional amount of Contractor's overhead and profit.

E. Revise schedule to list approved Change Orders, on continuation sheet, with each Application For Payment.

1.5 APPLICATIONS FOR PAYMENT

A. Submit six copies of each application on AIA Form G702 - Application and Certificate for Payment and AIA Form G703 Continuation Sheet.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Payment Application Times: The date for each progress payment is indicated in the General Conditions of the Contract.

D. Payment Application Periods: The period of construction covered by each application for payment is the period indicated in the General Conditions of the Contract.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents. Architect will return incomplete applications without action.

F. Waiver of Stop Notices: With each application for payment, submit waivers of stop notices from subcontractors for construction period covered by previous application.

G. Final Payment: As specified in the General Conditions of the Contract and in Section 01 77 00 - Closeout Procedures.

H. Refer to the General Conditions of the Contract for additional payment provisions.

1.6 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Architect, it is not practical to remove and replace the Work, the Architect will direct one of the following remedies:

1. The defective Work may remain, but the listed schedule of value will be adjusted to a new value at the discretion of the Architect.

2. The defective Work will be partially repaired to the instructions and satisfaction of the Architect and the listed schedule of value will be adjusted to reflect a new value at the discretion of the Architect.

1.7 NON-PAYMENT FOR REJECTED WORK

A. Payment will not be made for any of the following:

1. Products wasted or disposed of in a manner that is not acceptable.

2. Products determined to be unacceptable before or after placement.

3. Products not completely unloaded from the transporting vehicle.

4. Products placed beyond the lines and levels of the required work.

5. Products remaining on hand after completion of the work.

6. Loading, hauling and disposing of rejected products.

1.8 CHANGE PROCEDURES

A. The Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by General Conditions on AIA Form G710 Architect's Supplemental Instructions.

B. The Architect may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications. Proposal Requests are for information only and are not to be considered instructions to stop the work or to execute the proposed change. Contractor will prepare and submit a detailed estimate within 14 days.

C. Any change in the Work which involves the adjustment to contract sum/price or contract time shall be properly certified by the Contractor as indicated in the General Conditions of the contract.

D. The Contractor may propose a change by submitting a Change Order Request to the Architect, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors.

E. Stipulated Sum Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's Change Order Request as approved by Architect.

F. Time and Material/Force Account Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in the General Conditions of the Contract.

G. Maintain detailed records of work done on Time and Material/Force Account basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work as indicated in the General Conditions of the Contract.

H. Construction Change Directive: Architect may issue a directive, signed by the Owner and Architect, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum or Contract Time. Promptly execute the change.

I. Allowance Adjustment: Adjustment of allowance amounts shall be based upon a properly documented and detailed Change Order Request which substantiates distribution of allowance amounts and actual costs of work in place.

J. Change Order Forms: AIA G701 Change Order.

K. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the General Conditions of the Contract.

L. All addenda (changes and/or revisions prior to award of contract) and construction changes (changes and revisions after award of contract) shall be approved by the Architect and the Division of the State Architect prior to start of construction covered by those changes and/or revisions in accordance with the requirements of Title 24 of the California Code of Regulations, Part 1, Section 4-338.

M. 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.

N. Promptly revise progress schedules to reflect any changes in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change and resubmit.

O. Promptly enter changes in Project Record Documents.

1.9 UNIT PRICES

A. A unit price is an amount proposed by the bidder and stated on the Bid Form as a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by change order in the event the estimated quantities of work required by the Contract Documents are increased or decreased.

B. Unit prices shall include all necessary material, overhead, profit and applicable taxes.

C. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established prices, and to have this work measured by an independent surveyor acceptable to the Contractor at the Owner's expense.

D. Refer to individual specification sections for construction activities requiring the establishment of unit prices.

E. Specification sections referenced in the Schedule of Unit Prices contain requirements for materials and methods described under each unit price.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SCHEDULE OF VALUES FORMAT*

Project: Tovashal Elementary School HVAC Replacement

Contractor: _____

Date: _____

Item Description	**Amount**

1. Mobilization and initial expenses

2. General Conditions
   - Temporary Utilities
   - Engineering Layout
   - Temporary Construction/Dust Control
   - General Clean Up/Trash Removal
   - Project Manager/Supervision/Truck
   - Rental Equipment

3. Bonds and Insurance

4. SITE WORK

   Demolition/Removal
   - Site
   - Building(s)

   Site Preparation
   - General Brush and Tree Clearing
   - Earthwork

   Site Improvements
   - Termite/Weed Treatment
   - AC Paving/Base/Striping
   - Concrete Curb/Gutters
   - Concrete Retaining Walls
   - Concrete Paving
   - Concrete Site Stairs
   - Masonry Garden Walls
   - Chain Link Fences/Gates
   - Wrought Iron Fences/Gates
   - Irrigation
   - Planting
   - Site Equipment (misc)

   Site Utilities
   - Fire Hydrants
   - Fire Lines
   - Storm Drainage
   - Site Water
   - Site Gas
   - Site Sewer
   - Electrical Site Service/Lighting

Item Description	Amount

Off-site Work
- AC Paving/Base
- Concrete Curb/Gutters
- Irrigation
- Planting
- Fire Hydrants
- Fire Lines
- Storm Drainage
- Site Water
- Site Gas
- Site Sewer
- Street Lights

Other

5. FOUNDATIONS

Wall Foundations
Column Foundations
Special Foundations
Other

6. SUBSTRUCTURE

Slab on Grade
Trenches/pits/bases
Basement Excavation/Walls
Subgrade Moisture Protection
Other

7. SUPERSTRUCTURE

Columns and Beams
- Concrete Columns/Beams
- Masonry Columns
- Steel Columns/Beams
- Wood Columns/Beams
- Glue Laminated Beams

Structural Walls
- Concrete Walls
- Masonry Walls
- Wood Framed Walls

Floor Construction
- Concrete Cast in Place
- Steel Deck/Framing
- Trusses
- Wood Framed Floors

Roof Construction
- Concrete Cast in Place
- Steel Deck/Framing

Trusses
- Wood Framed Roofs

Stairs
Other

Item Description	Amount

8. EXTERIOR CLOSURE

- Exterior Walls/Soffits
  - Sandblast Concrete Seal/Paint
  - Sandblast Masonry Seal/Paint
  - Glass Block
  - Metal Studs
  - Wood Studs
  - Exterior Plaster
  - Exterior Insulation
- Windows/Frames/Glazing
  - Steel Windows/Glazing
  - Aluminum Windows/Glazing
  - Store Front/Glazing

- Doors
  - Metal Doors/Frames
  - Wood Doors/Frames
  - Aluminum Doors/Frames/Glazing
  - Sectional Doors/Frames
  - Roll Up Doors/Frames
  - Store Front
- Frames
- Hardware
- Insulation
  - Thermal Wall
  - Sound Wall
- Sealants/Caulking
- Other

9. ROOFING
- Roof Coverings and Flashing
  - Built Up Roofing
  - Single Ply
  - Preformed Metal
  - Asphalt Shingle
  - Clay/Concrete Tile
  - Roof Walkway System
- Roof Insulation and Fill
  - Lightweight Concrete
  - Insulating Concrete Fill
  - Rigid Insulation
- Flashing and Trim
- Roof Openings
  - Roof Hatches
  - Smoke Hatches
  - Skylights
  - Skyroofs/Walls
  - Ladders to Roof
- Other

Item Description	Amount

10. INTERIOR CONSTRUCTION

- Fixed Partitions
  - Metal Studs
  - Wood Studs
  - Gypsum Board
  - Interior Plaster
- Movable Partitions
- Compartments & Cubicles
- Toilet Partitions
- Interior Doors
  - Wood Doors
  - Metal Doors
  - Aluminum Doors
  - Roll Up Doors
  - Special Doors
- Frames
- Interior Finishes
  - Painting
  - Walls
  - Ceiling
  - Vinyl Wall Coverings
  - Ceramic Tile
  - Fiberglass Reinforced Panels
  - Concrete Sealer
  - Vinyl Sheet/Tile
  - Rubber Flooring
  - Carpet
  - Wood Flooring
  - Suspended Acoustical Ceiling System
  - Suspended Gypsum Ceiling System
- Specialties
  - Chalkboard/Markerboard/Tackboards
  - Cabinets
  - Toilet Room Accessories
  - Graphics and Signage
  - Other

11. CONVEYING SYSTEMS

- Elevators
- Moving Stairs and Walks
- Pneumatic Tube Systems
- Lifts, Hoists, and Cranes
  - Wheel Chair Lift
  - Dock Leveler/Bumpers
  - Automotive Hoists (single)
  - Two Post Hoist (twin)
- Other

Item Description	Amount

12. EQUIPMENT

- Library
  - Book Theft System
  - Fixed Book Shelves
  - Rolling Book Shelves
- Multipurpose/Stage
  - Fireproof Curtain
  - Projection Screen(s)
  - Folding Tables/Benches
- Athletic
  - Steel Athletic Lockers
  - Basketball Backstops
  - Bleachers
  - Pool
- Classroom
  - Window Coverings
  - Book Lockers
- Food Service
  - Kitchen Equipment
  - Walk in Freezer/Refrigerator
- Other

13. MECHANICAL

- Plumbing
  - Supply Service
  - Disposal Service
  - Rainwater Service
  - Gas Service
  - Finish Fixtures
- Fire Protection
  - Sprinklers
  - Fire Extinguishers
- HVAC System
  - Equipment
  - Ductwork/Distribution
  - System Controls
  - Testing and Balancing
- Other

14. ELECTRICAL

- Distribution
- Lighting and Power
- Special Systems
  - Alarm System
  - Communications
  - Emergency System
- Other

Item Description	Amount
15. SPECIAL CONSTRUCTION	
Miscellaneous Special Construction	
TOTAL COST	$_____

*The above categories may be subdivided and items added if the overall order remains the same and the subtotal cost for each category complies with the format as shown. Items not applicable to a particular job may be deleted from this list. Overhead and profit shall be a combined mark up and added proportionally to each line item.

SECTION 01 25 13

PRODUCT SUBSTITUTION PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Product options.

B. Substitution procedures.

1.2 DEFINITIONS

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

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

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

1.3 PRODUCT OPTIONS

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

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

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

1.4 LIMITATIONS ON SUBSTITUTIONS SUBMITTED PRIOR TO THE RECEIPT OF BIDS

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

B. The opportunity to request a substitution is not for the convenience of the Bidder to request acceptance of equipment and/or materials which may be more familiar or have a lesser cost.

C. Architect may consider requests for substitutions of specified equipment and/or materials only when requests are received by Architect prior to the date established for the receipt of bids as stipulated in Document 00 21 13 - Instructions to Bidders.

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

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

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

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

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

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

1.5 LIMITATIONS ON SUBSTITUTIONS SUBMITTED AFTER THE AWARD OF THE CONTRACT

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

B. The opportunity to request a substitution is not for the convenience of the Contractor to request acceptance of equipment and/or materials which may be more familiar or have a lesser cost.

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

1. Specified item fails to comply with regulatory requirements.

2. Specified item has been discontinued.

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

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

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

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

D. Notwithstanding the provisions of Article 1.4 of this section and the above, the Architect may consider a substitution request after the date of the receipt of bids or contract award, if in the sole discretion of the Architect, there appears to be just cause for such a request. The acceptance of such a late request does not waive any other requirement as stated herein.

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

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

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

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

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

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

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

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

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

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

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

1.6 REGULATORY REQUIREMENTS

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

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

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

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

1.7 SUBSTITUTION REPRESENTATION

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

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

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

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

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

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

1.8 SUBMITTAL PROCEDURE

A. Submit each Substitution Request in conformance with the requirements of this section.

B. Assemble complete Substitution Request into a single bookmarked Portable Document Format (PDF) file.

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

D. Limit each request to one proposed substitution.

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

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

1. Statement of cause for substitution request.

2. Identify product by specification section and article number.

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

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

5. List availability of maintenance services and replacement materials.

6. Documented or confirmation of regulatory approval.

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

8. Fabrication and installation procedures.

9. Samples of proposed substitutions.

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

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

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

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

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

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

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

1.9 ARCHITECT'S REVIEW

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

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

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

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

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

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination.

B. Preconstruction conference.

C. Progress meetings.

D. Request for Information (RFIs).

E. Preinstallation conferences.

F. Commissioning.

G. Closeout conference.

H. Post construction dedication.

1.2 DEFINITIONS

A. RFI - Request from Contractor seeking additional information, interpretation or clarification of the Contract Documents.

1.3 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Coordinate construction operations of the different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.

C. Prior to commencement of a particular type or kind of work examine relevant information, contract documents and subsequent data issued to the project.

D. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. 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.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. In locations where several elements of mechanical and electrical work must be sequenced and positioned with precision in order to fit into available space, prepare coordination drawings showing the actual conditions required for the installation. Prepare coordination drawings prior to purchasing, fabricating or installing any of the elements required to be coordinated.

H. Closing up of walls, partitions or furred spaces, backfilling and other covering up operations shall not proceed until all enclosed or covered work and inspections have been completed. Verify before proceeding.

I. Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owners partial occupancy.

J. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

K. Coordinate all utility company work in accordance with the General Conditions.

L. Coordinate field engineering with the provisions of Section 01 73 00.

1.4 PRECONSTRUCTION CONFERENCE

A. Architect will schedule a conference immediately after receipt of fully executed contract documents prior to project mobilization.

B. Mandatory Attendance: Owner, Owner's Resident Inspector, Owner's Testing Laboratory Representative, Architect, Contractor, Contractor's Project Manager and Contractor's Job Superintendent.

C. Optional Attendance: Architect's consultants, subcontractors and utility company representatives.

D. Architect will preside at conference, record minutes and distribute copies.

E. Agenda:

1. Execution of Owner-Contractor Agreement.

2. Issue Notice to Proceed.

3. Submission of executed bonds and insurance certificates.

4. Distribution of Contract Documents.

5. Federal and State labor law requirements applicable to Contract.

6. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.

7. Designation of responsible personnel representing the parties.

8. Procedures and processing of RFIs, field decisions, submittals, substitutions, applications for payments, proposal requests, Change Orders and Contract closeout procedures.

9. Procedures for testing and inspection.

10. Temporary facilities and controls.

11. Procedures for moisture and mold control.

12. Procedures for disruptions and shutdowns.

13. Scheduling.

14. Critical work sequence and long lead items.

15. Work restrictions and working hours.

16. Progress meetings.

17. Use of site and premises.

18. Storage.

19. Authorities having jurisdiction over project.

20. Owner occupancy requirements.

21. Commissioning.

22. Construction waste management.

23. Preparation of Record Drawings.

24. Security.

25. Parking availability.

26. Progress cleaning.

1.5 PROGRESS MEETINGS

A. Architect will schedule and administer meetings throughout progress of the Work at maximum monthly intervals.

B. Architect will make arrangements for meetings, prepare agenda, preside at meetings, record minutes (Field Reports), and distribute copies.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Owner's Inspector, and Architect, as appropriate to agenda topics for each meeting.

D. Agenda:

1. Review minutes of previous meetings. (Field Reports)

2. Review of Work progress.

3. Field observations, problems, and decisions.

4. Identification of problems which impede planned progress.

5. Review of submittals schedule and status of submittals.

6. Requests For Information (RFIs).

7. Status of Proposal Requests (PRs).

8. Status of Change Order Requests (CORs).

9. Status of Change Orders (Cos).

10. Status of corrective or deficient items.

11. Review of off-site fabrication and delivery schedules.

12. Maintenance of construction schedule.

13. Corrective measures to regain projected schedules.

14. Planned progress during succeeding work period.

15. Coordination of projected progress.

16. Maintenance of quality and work standards.

17. Effect of proposed changes on progress schedule and coordination.

18. Temporary facilities and controls.

19. Progress cleaning.

20. Other business relating to Work.

1.6 REQUEST FOR INFORMATION (RFI'S)

A. Procedure: Immediately on discovery of the need for additional information, interpretation of the Contract Documents, and if not possible to request interpretation at Progress Meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

3. Each RFI shall address only one subject matter.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. Date.

2. Project name.

3. Owner’s name.

4. Name of Contractor.

5. Name of Architect.

6. RFI number, numbered sequentially.

7. Specification Section number and title and related paragraphs, as appropriate.

8. Drawing number and detail references, as appropriate.

9. Field dimensions and conditions, as appropriate.

10. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

11. Contractor's signature.

12. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Hard-Copy RFIs: Identify each page of attachments with the RFI number and sequential page number.

D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above. Attachments shall be electronic files in a format that will allow electronic editing by the Architect.

E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow fifteen days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day. If the RFI is required to be forwarded to a consultant, subconsultant, or Owner for a response, the response time will be twenty five days.

1. The following RFIs will be returned without action:

(a) Requests for approval of submittals.

(b) Requests for approval of substitutions.

(c) Requests for information already indicated in the Contract Documents.

(d) Requests for coordination information which is the responsibility of the Contractor.

(e) Requests for adjustments in the Contract Time or the Contract Sum.

(f) Requests for interpretation of Architect's actions on submittals and substitutions.

(g) Incomplete RFIs or RFIs with numerous errors.

2. Architect's action may include a request for additional information, in which case Architect's allowable time for response will start again.

3. Architect's review of or response to RFIs shall not constitute an approval, direction, or procedure related to construction means, methods, techniques, sequences, or procedures of Contractor.

4. Architect's review of or response to RFIs shall not constitute an approval, direction, or procedure related to the construction site safety precautions, procedures or methodology of Contractor.

5. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Order Request according to Division 01 Section 01 20 00 - Price and Payment Procedures.

(a) If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within five days of receipt of the RFI response.

(b) Under no circumstances is the Architect's review of or response to RFIs to be considered an authorization to depart from the Contract Documents or an authorization to perform extra work.

F. On receipt of Architect's action immediately distribute the RFI response to affected parties.

G. Review response and notify Architect within three days if Contractor disagrees with response.

1.7 COMMISSIONING

A. This project will have selected building systems commissioned.

B. The equipment and systems to be commissioned are specified in Section 01 91 13 - General Commissioning Requirements.

C. The commissioning process will be directed by a commissioning authority whose services will be provided by the Owner.

1.8 PREINSTALLATION CONFERENCES

A. When required in individual specification Section, convene a preinstallation conference prior to commencing work of the Section. Refer to individual specification section for timing requirements of conference.

B. Require attendance of parties directly affecting, or affected by, work of the specific Section.

C. Notify Architect a minimum of seven days in advance of meeting date.

D. Preinstallation conference to coincide with regularly scheduled progress meeting.

E. Prepare agenda, preside at conference, record minutes, and distribute copies within two days after conference to participants.

F. Agenda:

1. Review of Contract Documents.

2. Manufacturer’s recommendations.

3. Status of submittals.

4. Related RFIs.

5. Related Change Orders.

6. Schedule of work activities.

7. Deliveries of materials and equipment.

8. Sequence of operation.

9. Acceptable substrates.

10. Interface requirements.

11. Possible conflicts.

12. Access.

13. Site utilization.

14. Tests and inspections.

15. Review of Mockups.

16. Temporary facilities and controls.

17. Quality and work standards.

18. Weather limitations.

1.9 PROJECT CLOSEOUT CONFERENCE

A. Architect will schedule a project closeout conference, at a time convenient to Owner and Contractor, but no later than 90 days prior to the scheduled date of Substantial Completion.

B. Mandatory Attendance: Owner, Owner’s Resident Inspector, Owner’s Testing Laboratory, Architect, and Contractor.

C. Architect will preside at conference, record minutes, and distribute copies.

D. Refer to Section 01 77 00 for additional closeout requirements.

E. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

1. Submittal procedures for closeout documents.

2. Preparation of Record Documents.

3. Procedures required prior to review for Substantial Completion and for final review for acceptance.

4. Submittal of written warranties.

5. Procedures for completing the Commissioning process.

6. Requirements for preparing operations and maintenance data.

7. Requirements for delivery of material samples, attic stock, and spare parts.

8. Requirements for demonstration and training.
9. Preparation of Contractor's punch list.
10. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
11. Coordination of separate contracts.
12. Owner's partial occupancy requirements.
13. Installation of Owner's furniture, fixtures, and equipment.
14. Responsibility for removing temporary facilities and controls.
15. DSA closeout and certification process.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 32 17

CONSTRUCTION SCHEDULE - BAR CHART

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. References.

B. Performance requirements.

C. Qualifications.

D. Quality Assurance.

E. Project record documents.

F. Submittals.

G. Review and evaluation.

H. Format.

I. Cost and schedule reports.

J. Early work schedule.

K. Construction schedule.

L. Short interval schedule.

M. Requested time adjustment schedule.

N. Recovery schedule.

O. Updating schedules.

P. Distribution.

1.2 REFERENCES

A. Construction Planning and Scheduling Manual - A Manual for General Contractors and the Construction Industry, The Associated General Contractors of America (AGC).

B. National Weather Service - Local Climatological Data.

1.3 PERFORMANCE REQUIREMENTS

A. Ensure adequate scheduling during construction activities so work may be prosecuted in an orderly and expeditious manner within stipulated Contract Time.

B. Ensure coordination of Contractor and subcontractors at all levels.

C. Ensure coordination of submittals, fabrication, delivery, erection, installation, and testing of materials and equipment.

D. Ensure on-time delivery of Owner furnished materials and equipment.

E. Ensure coordination of jurisdictional reviews.

F. Assist in preparation and evaluation of applications for payment.

G. Assist in monitoring progress of work.

H. Assist in evaluation of proposed changes to Contract Time.

I. Assist in evaluation of proposed changes to Construction Schedule.

J. Assist in detection of schedule delays and identification of corrective actions.

1.4 QUALIFICATIONS

A. Scheduler: Personnel with 3 years minimum experience in scheduling construction work of a complexity and size comparable to this Project.

B. Administrative Personnel: 3 years minimum experience in using and monitoring schedules on comparable projects.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with Construction Planning and Scheduling Manual published by the AGC.

B. In the event of discrepancy between the AGC publication and this section, provisions of this section shall govern.

1.6 PROJECT RECORD DOCUMENTS

A. Submit record documents under provisions of Section 01 77 00.

B. Submit one electronic file and three copies of final Record Construction Schedule which reflects actual construction of this Project.

C. Record schedule shall be certified for compliance with actual way project was constructed.

D. Receipt of Record Construction Schedule shall be a condition precedent to any retainage release or final payment.

1.7 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Within 7 days from the Notice of Award submit proposed Early Work Schedule and preliminary Cost Report defining activities for first 60 days of Work.

C. Within 45 days from the Notice of Award submit proposed Construction Schedule and final Cost Report.

D. Submit updated Construction Schedule at least 10 days prior to each Application for Payment.

E. Submit Short Interval Schedule at each Construction Progress Meeting.

F. Submit Time Adjustment Schedule within 10 days of commencement of a claimed delay.

G. Submit Recovery Schedules as required by completion of work.

H. Submit one electronic file and three copies of each schedule and cost report.

1.8 REVIEW AND EVALUATION

A. Early Work Schedule shall be reviewed during Preconstruction Conference with Owner and Architect.

B. Within 5 days of receipt of Owner and Architect's comments provide satisfactory revision to Early Work Schedule or adequate justification for activities in question.

C. Acceptance by Owner of corrected Early Work Schedule shall be a condition precedent to making any progress payments for first 60 days of Contract.

D. Cost loaded values of Early Work Schedule shall be a basis for determining progress payments during first 60 days of Contract.

E. Participate in joint review of Construction Schedule and Reports with Owner and Architect.

F. Within 7 days of receipt of Owner and Architect's comments provide satisfactory revision to Construction Schedule or adequate justification for activities in question.

G. In the event that an activity or element of work is not detected by Owner or Architect review, such omission or error shall be corrected by next scheduled update and shall not affect Contract Time.

H. Acceptance by Owner of corrected Construction Schedule shall be a condition precedent to making any progress payments after first 60 days of Contract.

I. Cost-loaded values of Construction Schedule shall be basis for determining progress payments.

J. Review and acceptance by Owner and Architect of Early Work Schedule or Construction Schedule does not constitute responsibility whatsoever for accuracy or feasibility of schedules nor does such acceptance expressly or impliedly warrant, acknowledge or admit reasonableness of activities, logic, duration, or cost loading stated or implied on schedules.

1.9 FORMAT

A. Shall be fully developed horizontal bar-chart-type schedule prepared under concepts and methods outlined in AGC Construction Planning and Scheduling Manual.

B. Provide separate bar for each activity or operation.

C. Activity shall not have a duration longer than 14 days or a value over $20,000.00 except non-construction activities for procurement and delivery.

D. Prepare schedule on sheet of sufficient width to clearly show data.

E. Provide continuous heavy vertical line identifying first day of week.

F. Provide continuous subordinate vertical line identifying each day of week.

G. Identify activities by number, description, and cost.

H. Show each activity in proper sequence.

I. Indicate graphically sequences necessary for related activities.

J. Provide legend of symbols and abbreviations used.

1.10 COST AND SCHEDULE REPORTS

A. Activity Analysis: Tabulate each activity and identify for each activity:

1. Description.

2. Interface with outside contractors or agencies.

3. Duration.

4. Start date.

5. Finish date.

6. Actual start date.

7. Actual finish date.

8. Monetary value keyed to Schedule of Values.

9. Responsibility.

10. Percentage complete.

11. Variance positive or negative.

B. Cost Report: Tabulate each activity and identify for each activity:

1. Description.

2. Total cost.

3. Percentage complete.

4. Value prior to current period.

5. Value this period.

6. Value to date.

1.11 EARLY WORK SCHEDULE

A. Shall establish scope of work to be performed during the first 60 days of Contract.

B. Shall contain the following phases and activities:

1. Procurement activities to include mobilization, shop drawings and sample submittals.

2. Identification of key and long-lead elements and realistic delivery dates.

3. Construction activities in units of whole days limited to 14 days for each activity except non-construction activities for procurement and delivery.

4. Approximate cost and duration of each activity.

C. Shall contain seasonal weather considerations. Seasonal rainfall shall be 10 year average for the month as evidenced by Local Climatological Data obtained from U.S. National Weather Service.

D. Activities shall be incorporated into Construction Schedule.

E. No application for payment will be evaluated or processed until Early Work Schedule has been submitted and reviewed.

F. Shall be updated on a monthly basis while Construction Schedule is being developed.

G. Failure to submit an adequate or accurate Early Work Schedule or failure to submit on established dates will be considered a substantial breach of Contract.

1.12 CONSTRUCTION SCHEDULE

A. Shall include Early Work Schedule as first 60 days of Construction Schedule.

B. Shall be a fully developed horizontal bar-chart-type schedule.

C. Shall indicate a completion date for project that is no later than required completion date.

D. Conform to mandatory dates specified in the contract documents.

E. Should schedule indicate a completion date earlier than any required completion date, Owner or Architect shall not be liable for any costs should project be unable to be completed by such date.

F. Seasonal weather shall be considered in planning and scheduling of all work. Seasonal rainfall shall be 10 year average for the month as evidenced by Local Climatological Data obtained from U.S. National Weather Service.

G. Provide sub-schedules to define critical portions of entire schedule.

H. Indicate procurement activities, delivery and installation of Owner furnished material and equipment.

I. Level of detail shall correspond to complexity of work involved.

J. As developed shall show sequence of activities required for complete performance of Work.

K. Shall be logical and show a coordinated plan of Work.

L. Show order of activities. Include specific dates of completion.

M. Duration of activities shall be coordinated with subcontractors and suppliers and shall be best estimate of time required.

N. Failure to include any activity shall not be an excuse for completing all work by required completion date.

O. An activity shall meet the following criteria:

1. Any portion or element of work, action, or reaction that is precisely described, readily identifiable, and is a function of a logical sequential process.

2. Descriptions shall be clear and concise. Beginning and end shall be readily verifiable. Starts and finishes shall be scheduled by logical restraints.

3. Responsibility shall be identified with a single performing entity.

4. Additional codes shall identify building, floor, bid item and CSI classification.

5. Assigned dollar value (cost-loading) of each activity shall cumulatively equal total contract amount. Mobilization, bond and insurance costs shall be separate. General requirement costs, overhead, profit, shall be prorated throughout all activities. Activity costs shall correlate with Schedule of Values.

P. For major equipment and materials show a sequence of activities including:

1. Preparation of shop drawings and sample submissions.

2. Review of shop drawings and samples.

3. Finish and color selection.

4. Fabrication and delivery.

5. Erection or installation.

6. Testing.

Q. Include a minimum of 15 days prior to completion date for punch lists and clean up. No other activities shall be scheduled during this period.

1.13 SHORT INTERVAL SCHEDULE

A. Shall be fully developed horizontal bar-chart-type schedule directly derived from Construction Schedule.

B. Prepare schedule on sheet of sufficient width to clearly show data.

C. Identify activities by same description as Construction Schedule.

D. Show each activity in proper sequence.

E. Indicate graphically sequences necessary for related activities.

F. Indicate activities completed or in progress for previous 2 week period.

G. Indicate activities scheduled for succeeding 2 week period.

H. Further detail may be added if necessary to monitor schedule.

1.14 REQUESTED TIME ADJUSTMENT SCHEDULE

A. Updated Construction Schedule shall not show a completion date later than the Contract Time, subject to any time extensions processed as part of a Change Order.

B. If an extension of time is requested a separate schedule entitled "Requested Time Adjustment Schedule" shall be submitted to Owner and Architect.

C. Indicate requested adjustments in Contract Time which are due to changes or delays in completion of work.

D. Extension request shall include forecast of project completion date and actual achievement of any dates listed in Agreement.

E. To the extent that any requests are pending at time of any Construction Schedule update, Time Adjustment Schedule shall also be updated.

F. Schedule shall be a fully developed horizontal bar-chart-type schedule.

G. Accompany schedule with formal written time extension request and detailed impact analysis justifying extension.

H. Time impact analysis shall demonstrate time impact based upon date of delay, and status of construction at that time.

I. Activity delays shall not automatically constitute an extension of Contract Time.

J. Failure of subcontractors shall not be justification for an extension of time.

K. Extensions will be granted only to extent that time adjustments extend Contract completion date.

L. Owner shall not have an obligation to consider any time extension request unless requirements of Contract Documents, and specifically, but not limited to these requirements are complied with.

M. Owner shall not be responsible or liable for any construction acceleration due to failure of Owner to grant time extensions under Contract Documents should requested adjustments in Contract Time not substantially comply with submission and justification requirements of Contract for time extension requests.

N. In the event a Requested Time Adjustment Schedule and Time Impact Analysis are not submitted within 10 days after commencement of a delay it is mutually agreed that delay does not require a Contract time extension.

1.15 RECOVERY SCHEDULE

A. When activities are behind Construction Schedule a supplementary Recovery Schedule shall be submitted.

B. Form and detail shall be sufficient to explain and display how activities will be rescheduled to regain compliance with Construction Schedule.

C. Maximum duration shall be one month and shall coincide with payment period.

D. Ten days prior to expiration of Recovery Schedule verification to determine if activities have regained compliance with Construction Schedule will be made. Based upon this verification the following will occur:

1. Supplemental Recovery Schedule will be submitted to address subsequent payment period.

2. Construction Schedule will be resumed.

1.16 UPDATING SCHEDULES

A. Review and update schedule at least 10 days prior to submitting an Application for Payment.

B. Approved change orders which affect schedule shall be identified as separate new activities.

C. Change orders of less than $20,000.00 value or less than 3 days duration need not be shown unless completion date is affected.

D. Maintain schedule to record actual prosecution and progress.

E. No other revisions shall be made to schedule unless authorized by Owner.

F. Provide narrative Progress Report at time of schedule update which details the following:

1. Activities or portions of activities completed during previous reporting period.

2. Actual start dates for activities currently in progress.

3. List of major construction equipment used during reporting period and any equipment idle.

4. Number of personnel by craft engaged on Work during reporting period.

5. Progress analysis describing problem areas.

6. Current and anticipated delay factors and their impact.

7. Proposed corrective actions for Recovery Schedule.

8. Proposed modifications, additions, deletions and changes in Construction Schedule.

G. Schedule update will form basis upon which progress payments will be made.

H. Owner will not be obligated to review or process Application for Payment until schedule and Progress Report have been submitted.

1.17 DISTRIBUTION

A. Following joint review and acceptance of updated schedules distribute copies to Owner, Architect, and all other concerned parties.

B. Instruct recipients to promptly report in writing any problem anticipated by projections shown in schedule.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Related submittals.

B. Architect's digital data files.

C. Proposed products list.

D. Processing time.

E. Submittal review.

F. Submittal procedures - paper submittals.

G. Shop drawings - paper submittals.

H. Submittal procedures - electronic submittals.

I. Shop drawings - electronic submittals.

J. Product data.

K. Samples.

L. Manufacturers' instructions.

M. Manufacturers' certificates.

N. Submittal schedule.

1.2 RELATED SUBMITTALS

A. Progress Payments: Section 01 20 00 - Price and Payment Procedures.

B. Schedule of Values: Section 01 20 00 - Price and Payment Procedures.

C. Substitutions: Section 01 25 13 – Product Substitution Procedures.

D. Coordination Drawings: Section 01 31 00 - Project Management and Coordination.

E. Construction Schedule: Section 01 32 17 - Construction Schedule - Bar Chart.

F. Tests and Inspections: Section 01 45 29 – Testing Laboratory Services.

G. Certified Final Property Survey: Section 01 73 00 – Execution Requirements.

H. Waste Reduction Progress Reports: Section 01 74 19 - Construction Waste Management and Disposal.

I. Closeout Procedures: Section 01 77 00 – Closeout Procedures.

J. Commissioning Submittals: Section 01 91 13 - General Commissioning Requirements.

K. The General Conditions set forth additional requirements for submittals.

1.3 ARCHITECT'S DIGITAL DATA FILES

A. Upon written request, and if asked nicely, the Architect’s electronic CAD files will be provided for use in connection with preparation of shop drawings subject to the acceptance of the Architect’s standard terms and conditions for electronic file transfer.

1.4 PROPOSED PRODUCTS LIST

A. Within fourteen days after date of Notice to Proceed, submit complete list of major products proposed for use, with name of manufacturer, trade name, model number, and designated specification section of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PROCESSING TIME

A. Time period for review of submittals will commence upon receipt of submittal by Architect.

B. Initial Review: Allow ten working days for each submittal.

C. Resubmittal Review: Allow ten working days for each resubmittal.

D. Sequential Review: Allow fifteen working days for initial and resubmittal review of each submittal where review is required by Architect’s consultant’s, Owner or other parties indicated.

1.6 SUBMITTAL REVIEW

A. The Architect’s review is only for general conformance with design concept and Contract requirements. Contractor is responsible for compliance with Contract Documents, dimensions, quantities, fit and coordination with other Work. Review does not authorize substitutions, exclusions and limitations to Contract requirements unless specifically requested by Contractor and acknowledged by Architect.

B. Definitions for submittal review:

1. Review Completed - Do Not Resubmit: The Work covered by the submittal has been reviewed by the Architect and may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.

2. Revise as Noted - Do Not Resubmit: The Work covered by the submittal has been reviewed by the Architect and may proceed provided it complies both with Architect's notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.

3. Revise as Noted - Resubmit for Record: The Work covered by the submittal has been reviewed by the Architect and the submittal is to be revised according to the Architect's notations and corrections and a new submittal is to be made. Do not proceed with the Work covered by the submittal. Once the revised submittal is received it will be reviewed again by the Architect and retained as the record submittal. Once reviewed, the Work may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.

4. Not Acceptable - Make New Submittal: Do not proceed with the Work covered by the submittal. Prepare a new submittal that complies with the Contract Documents. Once the revised submittal is received it will be reviewed again by the Architect. Once reviewed, the Work may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.

5. Comment Box / Line: This line is for the Architect to take other action as may be appropriate for the actual submittal made. Notations may include a request for additional items or a statement regarding the submittal. This area can also be used in conjunction with other boxes that have been marked.

1.7 SUBMITTAL PROCEDURES - PAPER SUBMITTALS

A. Transmit each submittal in conformance with requirements of this section.

B. Sequentially number the transmittal forms. Resubmittals to have original number with an alphanumeric suffix.

C. Identify Project and Architect's project number, Contractor, Subcontractor or supplier; pertinent Drawing and detail number(s), and specification Section number, as appropriate.

D. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. Submittals without Contractor's stamp and signature will be returned without review.

E. Schedule submittals to expedite the Project, and deliver to Architect at 8163 Rochester Avenue, Suite 100, Rancho Cucamonga, CA 91730. Coordinate submission of related items.

F. Make submittals in groups containing associated and related items to make sure that information is available for checking each item when it is received.

G. Submittals for all items requiring color selection must be received before any will be selected.

H. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

I. Make submittals in advance of scheduled dates for installation to allow specified time for review, revisions, and resubmission prior to final review and subsequent placement of orders.

J. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit proper processing.

K. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

L. Provide space for Contractor and Architect review stamps.

M. Revise and resubmit submittals as required, identify all changes made since previous submittal.

N. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

O. Partial submittals will be considered non responsive and will be returned without review.

P. Submittals not requested will not be recognized or processed. Submittals not requested will be returned without review.

Q. Architect will not review submittals that contain material safety data sheets (MSDS) and will return them for resubmittal.

R. Substitutions will not be considered when they are indicated or implied on submittals without separate written request as required by provisions of Section 01 25 13 - Product Substitution Procedures.

1.8 SHOP DRAWINGS - PAPER SUBMITTALS

A. Submit six prints of each drawing. Four copies will be retained by Architect.

B. Review comments will be shown on returned print. Contractor will make and distribute copies as required for his purpose.

C. After review, distribute in accordance with article on procedures stated above and provide copies for Record Documents described in Section 01 77 00 - Closeout Procedures.

D. Do not reproduce Contract Documents or copy standard information and submit as shop drawings.

E. Standard information prepared without specific reference to project requirements will not be considered a shop drawing.

F. Do not use or allow others to use shop drawings which have been submitted and have been rejected.

1.9 SUBMITTAL PROCEDURES - ELECTRONIC SUBMITTALS

A. Transmit each electronic submittal in conformance with requirements of this section.

B. Submittals for all items requiring color selections will not be accepted as an electronic submittal.

C. Assemble complete submittal package into a single indexed Portable Document Format (PDF) file. File format licensed by Adobe Systems.

D. Transmit electronic submittals as PDF files via Architect's Project Collaboration Site address or designated email address.

E. Transmittal form for submittals shall be an electronic form acceptable to the Architect which identifies the Project, the Architect's project number, the Contractor, the Subcontractor or material supplier; pertinent Drawing and detail number(s), and specification Sections, as appropriate.

F. Provide links enabling navigation to each item of submittal package.

G. Name electronic submittal file with consistent project identifier composed of Architect's project number, Architect's alpha numeric file designation, and specification section number followed by sequential number. (e.g., 1930700-56-SUB - 064116-01.pdf)

H. Resubmittals shall include an alphabetic suffix after initial point number. (e.g., 1930700-56-SUB – 064116-01-A.pdf)

I. Resubmittals shall identify all changes made since previous submittal.

J. Insert Contractor's review stamp to permanently record Contractor's action.

K. Contractor's stamp shall be signed or initialed certifying that review, verification of Products required, field dimensions, adjacent work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

L. Submittals without Contractor's stamp and signature will be returned without review.

M. Provide space for Architect's electronic review stamp.

N. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

O. Make submittals in advance of scheduled dates for installation to allow specified time for review, revisions, and resubmission prior to final review and subsequent placement of orders.

P. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit proper processing.

Q. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

R. Contractor shall reproduce and distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

S. Partial submittals will be considered non responsive and will be returned without review.

T. Submittals not requested will not be recognized or processed. Submittals not requested will be returned without review.

U. Architect will not review submittals that contain material data safety sheets (MSDS) and will return them for resubmittal.

V. Substitutions will not be considered when they are indicated or implied on submittals without separate written request as required by provisions of Section 01 25 13 - Product Substitution Procedures.

1.10 SHOP DRAWINGS - ELECTRONIC SUBMITTALS

A. Submit electronic copy of shop drawings in PDF format as specified in this section.

B. Review comments will be indicated on reviewed document.

C. After review, distribute in accordance with article on procedures stated above and provide copies for Record Documents described in Section 01 77 00 - Closeout Procedures.

D. Do not reproduce Contract Documents or copy standard information and submit as shop drawings.

E. Standard information prepared without specific reference to project requirements will not be considered a shop drawing.

F. Do not use or allow others to use shop drawings which have been submitted and have been rejected.

1.11 PRODUCT DATA

A. When specified in individual specification sections, submit copies of data for each product which Contractor requires.

B. Submit six copies of product data made in paper format. Four copies will be retained by Architect.

C. Electronic submittals for product data will comply with Article for electronic submittal procedures stated in this section.

D. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to this Project.

E. Manufacturer's standard product data or catalogs that do not indicate materials or products that are specific to project will be returned without review.

F. After review, distribute in accordance with article on procedures stated above and provide copies for Record Documents described in Section 01 77 00 - Closeout Procedures.

1.12 SAMPLES

A. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

B. Include identification on each sample, with full Project information.

C. Submit the number of samples which Contractor requires, plus two which will be retained by Architect.

D. Reviewed samples which may be used in the Work are indicated in individual specification Sections.

E. Submittals for all items requiring color selection must be received before any will be selected.

F. If a variation in color, pattern, texture or other characteristic is inherent within the material or product submitted, sample shall approximate limits of variation.

1.13 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

B. Identify conflicts between manufacturer's instructions and Contract Documents.

1.14 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification Sections, submit manufacturer's certificate to Architect for review, in quantities specified for Product Data.

B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

3.1 SUBMITTAL SCHEDULE

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
03 52 16	Lightweight Insulating Concrete		6	
03 54 16	Hydraulic Cement Underlayment		6	
04 05 13	Masonry Mortar	2		
04 20 00	Unit Masonry	4	6	
04 20 13	Veneer Masonry System	4	6	
04 20 19	Adhered Masonry Veneer	2	6	
04 23 00	Glass Masonry Units	2	6	
04 40 00	Stone Assemblies	4		
04 72 00	Cast Stone Masonry	2		6
04 73 00	Manufactured Stone Veneer	2	6	
05 12 00	Structural Steel Framing			6
05 21 00	Steel Joist Framing			6
05 31 13	Steel Floor Decking		6	6
05 31 23	Steel Roof Decking		6	6
05 40 00	Cold Formed Metal Framing		6	6
05 50 00	Metal Fabrications			6

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
05 51 00	Metal Stairs			6
05 51 33	Metal Ladders			6
05 52 00	Metal Railings	2		6
05 53 00	Metal Gratings	2		6
06 10 00	Rough Carpentry		6	
06 17 33	Wood I-Joists		6	6
06 17 36	Metal-Web Wood Joists			6
06 17 53	Shop-Fabricated Wood Trusses		6	6
06 18 00	Glue Laminated Construction		6	6
06 20 00	Finish Carpentry	2		6
06 41 13	Wood-Veneer-Faced Architectural Cabinets	2		6
06 41 16	Plastic-Laminate-Clad Architectural Cabinets	2		6
07 12 00	Built-Up Bituminous Waterproofing		6	
07 13 53	Elastomeric Sheet Waterproofing	2	6	6
07 17 00	Bentonite Waterproofing	2	6	6
07 18 00	Traffic Coating	2	6	6
07 19 00	Water Repellents		6	
07 21 13	Rigid Wall Insulation		6	
07 21 15	Continuous Wall Panel Insulation		6	
07 21 16	Blanket Insulation		6	
07 21 19	Foamed-In-Place Insulation		6	
07 21 26	Blown Insulation		6	
07 22 00	Roof and Deck Insulation		6	6
07 22 19	Nailable Insulated Sheathing		6	
07 25 00	Fiberglass Mat Gypsum Board and Air Barrier System	2	6	6
07 27 26	Fluid Applied Membrane Air-Barriers	2	6	6
07 31 13	Asphalt Shingles	2	6	6
07 32 00	Roof Tiles	2	6	
07 42 49	Fiber Cement Cladding System	2	6	6
07 46 23	Wood Siding	2		

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
07 51 00	Built-Up Bituminous Roofing		6	
07 52 00	Modified Bituminous Membrane Roofing		6	
07 54 19	Polyvinyl-Chloride Roofing	2	6	6
07 54 23	Thermoplastic-Polyolefin Roofing	2	6	6
07 61 00	Sheet Metal Roofing	2	6	6
07 62 00	Sheet Metal Flashing and Trim	2	6	6
07 71 23	Manufactured Gutters and Downspouts	2	6	6
07 72 33	Roof Hatches		6	
07 81 00	Applied Fireproofing		6	
07 81 23	Intumescent Fireproofing	2	6	
07 84 00	Firestopping		6	
07 92 00	Joint Sealants	2	6	
07 95 13	Expansion Joint Cover Assemblies		6	6
08 11 13	Hollow Metal Doors and Frames	2	6	6
08 12 13	Hollow Metal Frames		6	6
08 14 00	Wood Doors	2	6	6
08 14 23	Clad Wood Doors	2	6	6
08 31 00	Access Doors and Frames		6	
08 32 00	Sliding Glass Doors	2	6	6
08 33 23	Overhead Coiling Doors		6	6
08 36 13	Sectional Overhead Doors	2	6	6
08 41 13	Aluminum-Framed Entrances and Storefronts	2	6	6
08 43 13	Fire-Rated Aluminum Storefront	2	6	6
08 43 23	Fire-Rated Steel Framed Storefront	2	6	6
08 45 00	Translucent Wall and Roof Assemblies		6	6
08 51 13	Aluminum Windows	2	6	6
08 51 23	Steel Windows	2	6	6
08 52 00	Wood Windows	2	6	6
08 62 00	Unit Skylights		6	6
08 71 00	Door Hardware		6	6
08 80 00	Glazing	2	6	

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
09 21 16	Gypsum Board Assemblies	1		
09 22 16	Metal Stud Framing System		6	6
09 24 00	Cement Plastering	2	6	
09 30 11	Ceramic Tile Floor Finishing	2	6	6
09 30 12	Ceramic Tile Wall Finishing	2	6	6
09 30 13	Fiber Reinforced Porcelain Panels	2	6	6
09 30 14	Porcelain Tile Floor Finishing	2	6	6
09 30 15	Porcelain Tile Wall Finishing	2	6	6
09 30 16	Quarry Tile Floor Finishing	2	6	6
09 51 13	Acoustical Panel Ceilings	2	6	6
09 51 33	Direct Applied Acoustical Ceiling	2	6	6
09 62 23	Bamboo Flooring	2	6	6
09 64 56	Wood Stage Flooring	2	6	6
09 64 66	Wood Athletic Flooring	2	6	6
09 64 69	Wood Athletic Floor Restoration	2	6	
09 65 00	Resilient Flooring	2	6	6
09 65 16	Linoleum Flooring	2	6	6
09 65 17	Linoleum Tile Flooring	2	6	6
09 65 56	Resilient Dance Flooring	2	6	6
09 65 66	Resilient Athletic Flooring	2	6	6
09 65 70	Textile Tile Flooring	2		6
09 65 71	Textile Sheet Flooring	2		6
09 66 13	Portland Cement Terrazzo Flooring	2	6	6
09 66 23	Thin-Set Epoxy Terrazzo Flooring	2	6	6
09 67 26	Quartz Flooring	2	6	
09 68 13	Tile Carpeting	2	6	
09 68 16	Sheet Carpet	2	6	6
09 72 00	Wall Coverings	2	6	
09 72 06	Digital Wall Covering Graphic	2		6
09 77 33	Fiber Reinforced Plastic Panels	2	6	
09 84 13	Fabric Covered Sound-Absorbing Panels	2		3

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
09 84 33	Sound-Absorbing Wall Panels	2		6
09 90 00	Painting	2	6	
09 96 23	Graffiti Resistant Coating	2	6	
10 11 17	Glass Marker Boards	2	6	6
10 11 19	Markerboards and Tackboards	2	6	6
10 11 43	Tackable Wallboard Systems	2	6	
10 14 00	Signage	2	6	6
10 21 11	Metal Toilet Compartments	2	6	6
10 21 12	Stainless Steel Toilet Compartments	2	6	6
10 21 14	Plastic Laminate Toilet Compartments	2	6	6
10 21 15	Plastic Toilet Compartments	2	6	6
10 21 19	Phenolic Toilet Compartments	2	6	6
10 21 20	Solid Color Reinforced Composite Toilet Compartment	2	6	6
10 22 39	Folding Panel Partitions	2	6	6
10 22 41	Folding Glass Partitions		6	6
10 28 13	Toilet Accessories		6	
10 44 00	Fire Protection Specialties		6	
10 51 13	Metal Lockers	2	6	6
10 56 26	Mobile Storage Shelving	2	6	6
10 75 00	Flag Poles	2	6	6
10 82 00	Grilles and Screens	2	6	6
11 13 13	Dock Bumpers		6	6
11 13 19	Dock Levelers		6	6
11 13 21	Hydraulic Dock Lifts		6	6
11 40 00	Food Service Equipment		6	6
11 61 43	Stage Curtains	2	6	
11 66 23	Gymnasium Equipment	2	6	6
11 66 43	Interior Scoreboards	2	6	6
11 68 33	Athletic Field Equipment		6	6
11 90 00	Miscellaneous Equipment		6	

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
12 21 13	Horizontal Louver Blinds	2	6	6
12 21 16	Vertical Louver Blinds	2	6	6
12 24 13	Roller Shades	2	6	6
12 48 43	Floor Mats	2	6	
12 61 00	Fixed Audience Seating	2	6	6
12 66 13	Telescoping Bleachers	2	6	6
13 34 23	Pre-Engineered Metal Shade Canopies	2	6	6
14 21 23	Electric Traction Elevators - Passenger	2	6	6
14 24 23	Hydraulic Passenger Elevators	2	6	6
14 42 00	Wheelchair Lifts	2	6	6
32 12 16	Asphalt Paving		6	
32 12 23	Stamped Asphalt Pavement		6	6
32 12 33	Solar Reflective Pavement Coating		6	6
32 13 13	Concrete Paving		6	
32 13 14	Pervious Concrete Paving		6	
32 18 13	Synthetic Grass Surfacing	2	6	6
32 18 16	Resilient Play Area Surfacing	2	6	
32 18 17	Fiber Playground Surfacing	2	6	6
32 18 23	Synthetic Running Track Surface	2	6	6
32 18 24	Synthetic Running Track Resurfacing	2	6	
32 31 13	Chain Link Fences and Gates	2	6	6
32 31 19	Decorative Metal Fences and Gates	2	6	6
32 31 30	Automatic Gates		6	6
32 80 00	Irrigation		6	

SUBMITTAL SCHEDULE				
SPEC. SECTION	TITLE	*SAMPLE	**CATALOG SHEET	**SHOP DRAWING
32 90 00	Planting		6	
33 10 00	Water Utilities		6	
33 30 00	Sanitary Utilities		6	
33 40 00	Storm Drainage Utilities		6	
33 51 00	Natural Gas Distribution		6	

* Samples are required for Architect's "color and material board". To expedite approval, Contractor shall expedite the submittal of these items. Color selections will not be made until all such items are received.

* * Number of Catalog Sheets and Shop Drawings are for submittals made in paper form.

END OF SECTION

SECTION 01 35 16

ALTERATION PROJECT PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products and installation for altering, patching and extending Work.

B. Transition and adjustments.

C. Repair of damaged surfaces, finishes, and cleaning.

D. Fire prevention.

1.2 DEFINITIONS

A. Protect and Maintain: To remove deteriorating corrosion, reapply protective coatings, and install protective measures such as temporary guards; to provide the least degree of intervention.

B. Repair: To stabilize, consolidate, or conserve; to retain existing materials and features while employing as little new material as possible. Repair includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials. Repair also includes limited replacement to match existing, rehabilitation, and reconstruction, with compatible substitute materials for deteriorated or missing parts of features when there are surviving prototypes.

C. Replace: To duplicate and replace entire features with new material to match existing. Replacement includes the following conditions:

1. Duplication: Includes replacing elements damaged beyond repair or missing. Original material is indicated as the pattern for creating new duplicated elements.

2. Replacement with New Materials: Includes replacement with new material when original material is not available as patterns for creating new duplicated elements.

3. Replacement with Substitute Materials: Includes replacement with compatible substitute materials. Substitute materials are not allowed, unless otherwise indicated.

D. Remove: To detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

E. Remove and Salvage: To detach items from existing construction and deliver them to Owner.

F. Remove and Reinstall: To detach items from existing construction, repair and clean them for reuse, and reinstall them where indicated.

G. Existing to Remain or Retain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled.

H. Match Existing: Material that matches existing materials, as much as possible, in species, cut, color, grain, and finish.

I. Refinish: To remove existing finishes to base material and apply new finish to match original.

1.3 SUBMITTALS

A. If alternate methods and materials to those indicated are proposed for any work, provide written description of proposed methods and comparable products.

B. Where existing conditions may be misconstrued as damage caused by alteration procedures submit evidence of adjacent construction before work begins.

1.4 QUALITY ASSURANCE

A. Qualifications: An experienced firm regularly engaged in similar alteration Work specified in this Section.

B. Lead Paint: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40CFR 745, Subpart E, and shall use only workers that are trained in lead-safe work practices.

C. Dust and Noise Control: Provide temporary dust and noise-control partitions when required by alteration operations. Do not block means of egress from occupied spaces.

D. Debris Hauling: Define hauling routes and provide temporary protective coverings.

E. Fire-Prevention: Comply with NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations. Prepare a written plan for preventing fires during prosecution of the Work. Indicate placement of fire extinguishers, rag buckets, and other fire-control devices. Coordinate with Owner's fire-protection equipment. Include fire-watch personnel when required by alteration operations.

F. Safety and Health Standard: Comply with ANSI/ASSE A10.6, Safety and Health Program Requirements for Demolition Operations.

1.5 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of preconstruction photographs.

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Contract Documents before proceeding with the Work.

C. Owner's Removal: Before beginning alteration Work, verify with Owner that all items of importance to them have been removed.

D. Size Limitations of Existing Space: Materials, products, and equipment used for performing Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms and openings.

1.6 PEDESTRIAN AND VEHICULAR CIRCULATION

A. Coordinate alteration Work with circulation paths.

B. Circulation patterns cannot be closed off entirely and can only be redirected around small areas.

C. Plan and execute the Work accordingly.

2. PART 2 PRODUCTS

2.1 PRODUCTS FOR PATCHING AND EXTENDING WORK

A. New Materials: As specified in product Sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspection and testing products where necessary, referring to existing Work as a standard.

3. PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that demolition is complete, and areas are ready for installation of new Work.

B. Beginning of alteration Work means acceptance of existing conditions.

3.2 FIRE PREVENTION

A. Comply with NFPA 241 requirements.

B. Remove and keep area free of combustible rubbish, paper, waste, and chemicals.

C. Heat-Generating Activities: Comply with the following procedures while performing heat-generating procedures including welding, torch-cutting, soldering, brazing, removing paint by heat, or other procedures with open flames.

1. As far as practical, restrict heat generating activities to area outside the building.

2. Do not perform heat generating activities in or near rooms that contain flammable liquids or explosive vapors.

3. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature materials from reaching surrounding combustible materials.

4. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings and roofs.

5. Fire Watch: Before working with heat generating activities, employ personnel to serve as fire watch at each location where such work will be performed. Fire watch procedures shall be implemented according to NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work and NFPA 241.

(a) Prohibit fire watch personnel from other work that would distract them from fire-watch duties.

(b) Cease work for heat generating activities whenever fire-watch personnel are not present.

(c) Fire-watch personnel shall perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of heat generating activities.

(d) Fire-watch personnel shall maintain their duties at each area of heat generating activities until 60 minutes after conclusion of daily work.

6. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids.

7. Fire Sprinklers: Where fire sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. Protect sprinklers from damage by operations. Remove protection when operations are complete.

3.3 PREPARATION

A. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

C. Remove debris and abandoned items from area and from concealed spaces.

D. Prepare surface and remove surface finishes to provide for proper installation of new work and finishes.

E. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

3.4 INSTALLATION

A. Coordinate work of alterations and renovations to expedite completion and to accommodate Owner occupancy.

B. Remove, cut, and patch Work in a manner to minimize damage and to provide a means of restoring products and finishes to original or specified condition.

C. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.

D. Install products as specified in individual Sections.

3.5 TRANSITIONS

A. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patched Work to match existing adjacent Work in texture and appearance.

B. When finished surfaces are cut so that a smooth transition with new work is not possible, request instructions from Architect.

3.6 ADJUSTMENTS

A. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

B. Where a change of plane of 1/8 inch or more occurs, request instructions from Architect.

C. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

D. Fit work at penetrations of surfaces as specified in Section 01 73 29.

3.7 REPAIR OF DAMAGED SURFACES

A. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.

B. Repair substrate prior to patching finish.

3.8 FINISHES

A. Finish surfaces as specified in individual Product Sections.

B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.9 CLEANING

A. Match samples of existing materials that have been cleaned and identified for acceptable cleaning levels.

B. Avoid over cleaning to prevent damage to existing materials.

END OF SECTION

SECTION 01 42 19

REFERENCE STANDARDS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions.

B. Specification format and content.

C. Industry standards.

D. Codes and standards.

E. Governing regulations/authorities.

1.2 DEFINITIONS

A. General: Basic contract definitions are included in the General Conditions.

B. Regulations: Includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the work.

1.3 SPECIFICATION FORMAT AND CONTENT

A. Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 50-Division Master Format 2018 numbering system.

B. The sections are placed in the Project Manual in numeric sequence; however, this sequence is not complete and the Table of Contents of the specifications must be consulted to determine the total listing of sections.

C. The section title is not intended to limit the meaning or content of the section, nor to be fully descriptive of the requirements specified therein.

D. The organization of the specifications shall not control the division of the work among subcontractors or establish the extent of work to be performed by any trade.

E. Specifications use certain conventions regarding style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are:

1. Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable to maintain the context of the Contract Document indicated.

2. Imperative and streamlined language is generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. Subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

3. The words "shall be" are implied wherever a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

A. Except where Contract Documents include more stringent requirements, applicable construction industry standards shall apply as if bound into the Contract Documents to the extent referenced. Such standards are made part of Contract Documents by reference.

B. Conform to reference standard by date of issue current on date for receiving bids except when a specific date is indicated.

C. Where compliance with 2 or more standards is specified and where standards may establish different or conflicting requirements for quantities or quality levels, the more stringent, higher quality and greater quantity of work shall apply.

D. The quantity or quality level shown or specified shall be the minimum provided or performed. Indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements.

E. Each entity engaged in construction of the work is required to be familiar with industry standards applicable to its construction activity.

F. Copies of applicable standards are not bound with the Contract Documents. Where copies of standards are needed to perform a required activity, Contractor shall obtain copies directly from publication source.

G. Trade associations names and titles of general standards are frequently abbreviated. Where such abbreviations are used in the Specifications or other Contract Documents, they shall mean the recognized trade association, standards-generating organization, authority having jurisdiction, or other entity applicable to the content of the text provision. Refer to the "Encyclopedia of Associations", published by Gale Research Co., available in most libraries.

H. Refer to individual specification sections and related drawings for names and abbreviations of trade associations and standards applicable to specific portions of the work. In particular, refer to Division 23 for names and abbreviations applicable to mechanical work, and refer to Division 26 for names and abbreviations applicable to electrical work.

I. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.5 CODES AND STANDARDS

A. Latest edition of pertaining ordinances, laws, rules, codes, regulations, standards, and others of public agencies having jurisdiction of the work are intended wherever reference is made in either the singular or plural to Code or Building Code except as otherwise specified, including but not limited to latest edition of those in the following listing.

1.	2019 California Building Standards Administrative Code (CBSAC), California Code of Regulations (CCR), Title 24, Part 1	
2.	2019 California Building Code (CBC) California Code of Regulations (CCR) Title 24, Part 2	(2018 International Building Code (IBC) with California amendments)
3.	2019 California Electrical Code (CEC) California Code of Regulations (CCR) Title 24, Part 3	(2017 National Electric Code (NEC) with California amendments)
4.	2019 California Mechanical Code (CMC) California Code of Regulations (CCR) Title 24, Part 4	(2018 Uniform Mechanical Code (UMC) with California amendments)
5.	2019 California Plumbing Code (CPC) California Code of Regulations (CCR) Title 24, Part 5	(2018 Uniform Plumbing Code (UPC) with California amendments)
6.	2019 California Energy Code, California Code of Regulations (CCR) Title 24, Part 6	

7.	2019 California Fire Code (CFC) California Code of Regulations (CCR) Title 24, Part 9	(2018 International Fire Code (IFC) with California Amendments)
8.	1990 State Fire Marshal Regulations California Code of Regulations (CCR) Title 19 (As amended to date)	
9.	2019 California Existing Building Code (CEBC) California Code of Regulations (CCR) Title 24, Part 10	(2018) International Existing Building Code (IEBC) with California Amendments)
10.	2019 State Referenced Standards Code (CRSC) California Code of Regulations (CCR) Title 24, Part 12	
11.	2010 Americans with Disabilities Act (ADA) Standards for Accessible Design. (ADAS)	

1.6 GOVERNING REGULATIONS/AUTHORITIES

A. Authorities having jurisdiction have been contacted where necessary to obtain information for preparation of Contract Documents. Contact authorities having jurisdiction directly for information having a bearing on the work.

B. Comply with all federal, state and local laws, ordinances, rules and regulations indicated and which bear on the conduct of the work.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 43 00

QUALITY ASSURANCE

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interpretation of requirements.

B. Quality assurance and control of installation.

C. Tolerances.

D. Field samples.

E. Manufacturers' field services and reports.

1.2 INTERPRETATION OF REQUIREMENTS

A. If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement.

B. The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation shall comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits.

C. Where codes or specified standards indicate higher standards, more stringent tolerances or more precise workmanship than levels shown or specified, comply with most stringent requirements.

D. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

1.3 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and - control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

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

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

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

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

1.4 TOLERANCES

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

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

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

1.5 FIELD SAMPLES

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

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

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

1.6 MANUFACTURERS' FIELD SERVICES AND REPORTS

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

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

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

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

3.1 GENERAL INSTALLATION

A. Comply with requirements specified in Section 01 73 00.

3.2 EXAMINATION

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

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

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

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

3.3 PREPARATION

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

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

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

END OF SECTION

SECTION 01 45 29

TESTING LABORATORY SERVICES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Selection and payment.

B. Contractor submittals.

C. Laboratory responsibilities.

D. Laboratory reports.

E. Limits on testing laboratory authority.

F. Contractor responsibilities.

G. Schedule of inspections and tests.

H. Test and inspection form.

1.2 REFERENCES

A. ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

B. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

C. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

D. CBC - California Building Code, Title 24, Part 2 of the California Code of Regulations (CCR).

E. DSA - Division of the State Architect, Office of Regulation Services, Structural Safety Section.

F. IR - Interpretation of Regulation Documents, Division of the State Architect.

1.3 SELECTION AND PAYMENT

A. Owner will employ and pay for services of an independent testing laboratory to perform specified inspection and testing as specified by Owner's testing laboratory.

B. Owner will pay cost of testing and inspection except the following for which the Contractor shall reimburse the Owner through deductive change order:

1. Any retesting and sampling required due to failure of original test.

2. Any testing and inspection required to be performed that requires testing laboratory or agency to perform services outside the state of California.

3. Concrete design mix.

4. Additional testing expenses caused by failure of the Contractor to adhere to construction schedule or caused by failure of the Contractor to give proper advanced notice or caused by Contractor delay.

C. Contractor shall employ and pay for services required to perform specified inspection and testing specified as Contractor responsibility.

D. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.4 QUALITY ASSURANCE

A. Comply with requirements of ASTM E329 and ASTM D3740.

B. Laboratory Staff: Maintain a full time registered engineer on staff to review services.

C. Testing Equipment: Capable of performing tests required calibrated at reasonable intervals with devices acceptable to the National Bureau of Standards.

D. All testing agency management, laboratory, and field supervisory personnel shall have at least five years experience in the inspection and testing of work and materials of construction.

E. Testing laboratory shall maintain a current letter of acceptance issued by the Division of the State Architect (DSA) demonstrating that it has met the criteria established by the Division of the State Architect for performance of inspection work and testing of materials. Laboratory to furnish copy of acceptance letter upon request.

1.5 OWNER'S TESTING LABORATORY RESPONSIBILITIES

A. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.

B. Perform specified inspection, sampling, and testing of products in accordance with specified standards.

C. Ascertain compliance of materials and mixes with requirements of Contract Documents.

D. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.

E. Perform additional inspections and tests required by Architect.

F. Attend preconstruction conferences and progress meetings when requested by Architect.

1.6 LABORATORY REPORTS

A. After each inspection and test, promptly submit within no more than 14 days of the date of the inspection or test one copy of laboratory report to Architect, Engineer, Owner's Resident Inspector, Division of the State Architect and to Contractor. Reports of test results of materials and inspections found not to be in compliance with the requirements of the Contract Documents shall be forwarded immediately to the Architect, Engineer, Owner's Resident Inspector, Division of the State Architect and the Contractor.

B. Include:

1. Date issued.

2. Project title and number.

3. Name of inspector.

4. Date and time of sampling or inspection.

5. Identification of product and Specifications section.

6. Location in the Project.

7. Type of inspection or test.

8. Date of test.

9. Ambient conditions at time of test or sample-taking.

10. Results of tests and interpretation of test results.

11. Professional opinion as to whether tested work is in conformance with Contract Documents.

12. Recommendations on retesting.

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

1.7 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop the Work.

1.8 CONTRACTOR RESPONSIBILITIES

A. Submit proposed mix designs to Architect for review in accordance with Section 03 30 00.

B. Cooperate with laboratory personnel, and provide access to the Work and to manufacturer's facilities.

C. Notify Architect, Owner's Resident Inspector and testing laboratory 48 hours prior to expected time for operations requiring inspection and testing services.

1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to the Contractor's negligence.

2. The Contractor shall notify the Owner's representative a sufficient time in advance of the manufacture of material to be supplied by him under the Contract Documents, which must by terms of the Contract be tested, in order that the Owner may arrange for the testing of same at the source of supply.

3. Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required shall not be incorporated in the job.

D. Employ and pay for services of Owner's testing laboratory to perform additional inspections, sampling and testing required when initial tests indicate work does not comply with contract documents.

1.9 SCHEDULE OF INSPECTIONS AND TESTS BY CONTRACTOR

A. Contractor Responsibility:

1. Statement of Responsibility - 1704A.4 Refer to listed special inspections under Article 1.9.

B. Heating, Ventilating and Air Conditioning:

1. Testing as specified in Division 21 shall include, but not be limited to: Ductwork tests, cooling tower tests, boiler tests, controls testing, piping tests, water and air systems, and test and balance of heating and air conditioning systems.

C. Electrical

1. Testing as specified in Division 26 including, but not limited to: Equipment testing, all electrical system operations, grounding system and checking insulation after cable is pulled.

1.10 INSPECTION BY THE OWNER

A. An Inspector employed by the Owner in accordance with the requirements of the California Code of Regulations Title 24, Part 1 will be assigned to the work. His duties are specifically defined in Section 4-342 of Title 24, Part 1.

B. The Owner and his representatives shall at all times have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.

C. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Inspector. He shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract. The presence of an Inspector shall in no way change, mitigate or alleviate the responsibility of the Contractor.

D. The Inspector is not authorized to change, revoke, alter, enlarge or decrease in any way any requirement of the Contract Documents, drawings, specifications or subsequent change orders.

E. Whenever there is insufficient evidence of compliance with any of the provisions of Title 24, Part 2 of the California Code of Regulations or evidence that any material or construction does not conform to the requirements of Title 24, Part 2 of the California Code of Regulations, the Division of the State Architect may require tests as proof of compliance. Test methods shall be as specified herein or by other recognized and accepted test methods determined by the Division of the State Architect. All tests shall be performed by a testing laboratory accepted by the Division of the State Architect.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, heat, ventilation, telephone service, communication service, water, and sanitary facilities.

B. Temporary Controls: Barriers, enclosures and fencing. Water, erosion, pollution, noise and fire protection control.

C. Construction Facilities: Access roads, parking, progress cleaning, project signage, and temporary buildings.

1.2 SUBMITTALS

A. Moisture-Protection Plan:

1. Submit Moisture - Protection Plan under provisions of Section 01 33 00.

2. Describe procedures and controls for protecting materials and construction from moisture absorption and damage, including delivery, handling, and storage provisions for materials subject to moisture absorption or moisture damage, discarding moisture-damaged materials, protocols for mitigating moisture intrusion into completed Work, and replacing moisture damaged Work.

3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, sawing and grinding, and describe plans for dealing with water and moisture from there operations.

4. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.3 TEMPORARY ELECTRICITY

A. Connect to existing power service at location as directed. Power consumption shall not disrupt Owner's need for continuous service. Owner will pay for cost of energy used. Exercise measures to conserve energy.

B. Provide power outlets for construction operations, with branch wiring and distribution boxes. Provide flexible power cords as required.

C. Provide main service disconnect and over current protection at convenient location.

D. Comply with NECA, NEMA, and UL standards and regulations for temporary electric service.

E. Permanent convenience receptacles may be utilized during construction.

1.4 TEMPORARY LIGHTING

A. Provide and maintain lighting for construction operations, observations, inspections, and traffic conditions.

B. Provide and maintain lighting to exterior staging and storage areas after dark for security purposes.

C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

D. Maintain lighting and provide routine repairs.

E. Permanent building lighting may be utilized during construction.

1.5 TEMPORARY HEATING/COOLING

A. Provide and pay for devices as required to maintain specified thermal conditions for construction operations.

B. Only electric or indirect fired combustion heaters shall be used. No direct fired space heaters will be allowed.

C. Heaters will be equipped with controls to automatically turn off heater if airflow is interrupted or internal temperature exceeds design temperature.

D. Do not use permanent equipment for temporary purposes.

E. Maintain minimum ambient temperature of 50 degrees F and maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

F. Maintain temperature above dew point of enclosed space based upon relative humidity of enclosed area.

G. Continuously monitor temperature of enclosed space(s) using an electronic monitoring device (s). Place devices in locations that will record average temperature of building(s). Provide print out to Architect upon request.

1.6 TEMPORARY VENTILATION

A. Ventilate enclosed areas to assist cure of materials and to prevent accumulation of dust, fumes, vapors, or gases.

B. Do not use permanent equipment for temporary ventilation purposes.

C. Ventilate enclosed spaces to dissipate humidity. Maintain a maximum relative humidity level of less than 60 percent. Avoid pockets of high humidity.

D. Continuously monitor humidity of enclosed space(s) using an electronic monitoring device(s). Place devices in locations that will record average humidity of building(s). Provide print out to Architect upon request.

1.7 TEMPORARY HUMIDITY CONTROL

A. Provide temporary ventilation during construction activities to protect installed construction from adverse effects of high humidity and moisture.

B. Select equipment that will not have a harmful effect on completed installations or elements being installed.

C. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

D. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

E. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

1.8 ELECTRONIC COMMUNICATION SERVICE

A. Provide minimum DSL electronic communication service, including electronic mail, in primary field office.

1.9 TEMPORARY WATER SERVICE

A. Connect to existing water source for construction operations. Owner will pay cost of water used. Exercise measures to conserve water. Water consumption shall not disrupt Owner's need for continuous service.

B. Extend branch piping with outlets located so water is available by hoses with threaded connections.

1.10 TEMPORARY SANITARY FACILITIES

A. Provide temporary chemical type toilet facilities and enclosures.

B. Maintain temporary toilet facilities in a sanitary manner.

C. Existing facilities shall not be used.

D. Facilities shall comply with the accessibility requirements of the CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 11B-201.4.

1.11 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide protection for plant life and trees designated to remain and for soft and hardscape areas adjacent to work, replace damaged materials in kind.

C. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.12 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks. Post fences and gates with no trespassing signs.

1.13 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Provide water barriers as required to protect site from running water.

1.14 EROSION AND SEDIMENT CONTROL

A. Conform to Best Management Practices for erosion and sediment control and non-storm water management as defined in Sections 3 and 4 of the Construction Activity Handbook published by the Storm Water Quality Association.

B. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

C. Minimize amount of bare soil exposed at one time.

D. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

E. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

1.15 TEMPORARY FIRE PROTECTION

A. Maintain temporary fire protection facilities of the types needed until permanent facilities are installed.

B. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations".

C. Fire safety during construction shall comply with CFC - California Fire Code (CCR) California Code of Regulations, Title 24, Part 9, Chapter 33.

D. Store combustible materials in containers in fire-safe locations.

E. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes.

F. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

G. Refer to Section 01 35 16 Alteration Project Procedures for additional requirements for operations in existing buildings.

1.16 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise produced by construction operations.

1.17 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

B. Conform to Best Management Practices for waste management and material controls as defined in Section 4 of the Construction Activity Handbook published by the Storm Water Quality Association.

1.18 EXTERIOR ENCLOSURES

A. Provide temporary weather-tight closure of exterior openings to accommodate acceptable working conditions and protection for materials, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification Sections, and to prevent entry of unauthorized persons.

B. Provide access doors with self-closing hardware and locks.

1.19 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as required to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.

1.20 SECURITY

A. Provide security and facilities to protect Work from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.21 ACCESS ROADS

A. Construct and maintain temporary roads accessing public thoroughfares to serve construction area. Extend and relocate as Work progress requires. Provide detours necessary for unimpeded traffic flow.

B. Stabilize temporary vehicle transportation routes and construction entrances to prevent erosion and control dust immediately after grading in accordance with best management practice techniques defined in Section 3 of the Construction Activity Handbook published by the Storm Water Quality Association.

C. Maintain stabilization techniques as work progresses.

D. Provide and maintain access to fire hydrants, free of obstructions.

E. Designated existing on-site roads may be used for construction traffic.

1.22 PARKING

A. Existing on-site parking areas may be used for construction personnel.

1.23 TRAFFIC CONTROL

A. Comply with requirements of authorities having jurisdiction.

B. Obtain all permits, provide all materials and maintain controls as required of authorities having jurisdiction.

C. Maintain access for fire-fighting equipment and access to hydrants.

1.24 PROGRESS CLEANING

A. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

B. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

C. Provide walk-off mats at each building entry.

1.25 WASTE DISPOSAL

A. Provide waste collection containers in sizes adequate to handle waste from construction operations.

B. Maintain building areas free of waste materials, debris, and rubbish.

C. Remove waste materials, debris, and rubbish from site periodically and legally dispose of off site.

D. Maintain site area in a clean and orderly condition.

1.26 FIELD OFFICES

A. Office: Weather-tight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture drawing rack and drawing display table.

B. Maintain daily janitorial service for offices. Maintain approach to office free of mud and water.

C. Provide space for Project meetings, with table and chairs to accommodate 8 persons.

D. When permanent facilities are enclosed with operable utilities, relocate offices into building, with written agreement of Owner, and remove temporary buildings.

E. Facilities shall comply with the accessibility requirements of the CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, Section 11B-201.4.

1.27 STORAGE AREAS AND SHEDS

A. Size to storage requirements for products of individual Sections. Allow for access and orderly provision for maintenance and for inspection of products.

1.28 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Maintain temporary equipment, facilities and controls until Substantial Completion or when use is no longer required.

B. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Substantial Completion review.

C. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

D. Clean and repair damage caused by installation or use of temporary work.

E. Materials and facilities that constitute temporary facilities are property of the Contractor.

F. Restore existing facilities used during construction to original condition.

G. Restore permanent facilities used during construction to specified condition.

H. Replace construction that cannot be satisfactorily restored.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 61 00

PRODUCT REQUIREMENTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

D. Damage and restoration.

1.2 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work.

B. Products may also include existing materials or components required for reuse that were obtained from this project.

C. Products specified or recycled from other projects are not considered new products.

D. Provide interchangeable components of the same manufacturer, for similar components.

E. Provide products that comply with the Contract Documents, that are undamaged and are unused at the time of installation.

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

G. Where a specific manufacturer's product is specified as the basis of design, the designation shall establish the qualities relating to type, function, dimension, in-service performance, physical properties, appearance and other characteristics for comparable products of other named manufacturers.

H. Where products are specified by name or by manufacturer provide the product or manufacturer specified. No substitutions will be permitted unless made under the provisions of Section 01 25 13.

I. Where specifications only describe a product or assembly by listing exact characteristics required, provide a product or assembly that provides the characteristics.

J. Where specifications only require compliance with performance requirements, provide products that comply with those requirements.

K. Where the specifications only require compliance with an imposed code, standard or regulation, provide a product that complies with the standards, codes or regulations specified.

L. Where specifications require review and acceptance of a sample, the Architect's decision will be final on whether a proposed product sample is acceptable or not.

M. Provide materials and products specified in the full range of color, texture and pattern for selection by Architect. Range shall include standard stocked color/texture/pattern, standard color/texture/pattern not stocked, but available from manufacturer as advertised in product data and brochures. Unless otherwise indicated in individual specification sections, Architect may select from any color range at no additional cost to Owner.

N. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

O. Where product is designated to match an existing product, provide product that matches in size, profile, finish, dimension and other characteristics the existing product identified.

1.3 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Schedule delivery to minimize long-term storage at site to prevent overcrowding of construction spaces.

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

D. Deliver products in manufacturer’s original sealed container or packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

E. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

F. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 STORAGE

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.

B. Store sensitive products in weather-tight, climate controlled enclosures.

C. Store products in a manner that will not damage or overload project structure.

D. For exterior storage of fabricated products, place on sloped supports, above ground.

E. Provide off-site storage when site does not permit on-site storage .

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

I. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

J. Prevent the discharge of pollutants to storm water from storage of materials on-site using best management practice techniques defined in Chapter 4 of the Construction Activity Handbook published by the Storm Water Quality Task Force.

1.5 PROTECTION

A. Protect installed Work and provide special protection where specified in individual specification Sections.

B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Provide humidity and temperature control for installed products as recommended by materials manufacturer.

G. Prohibit traffic from landscaped areas.

1.6 DAMAGE AND RESTORATIONS

A. Damage to existing or new work whether accidental or not shall be restored or replaced as specified or directed by Architect.

B. Restoration shall be equal to structural performance of original work.

C. Finish shall match appearance of existing adjacent work.

D. Work not properly restored or where not capable of being restored shall be removed and replaced.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 73 00

EXECUTION REQUIREMENTS

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. General procedural requirements governing execution of the Work.

1. Construction layout.

2. Field engineering and surveying.

3. General installation of products.

1.2 SUBMITTALS

A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

B. Certified Surveys: Submit two copies signed by land surveyor.

C. Final Property Survey: Submit 2 copies showing the Work performed and record survey data.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

3.1 EXAMINATION

A. Existing Conditions: Existence and location of site improvements and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify existence and location of construction affecting the Work.

B. Existing Utilities: Existence and location of underground and other utilities indicated as existing are not guaranteed. Before beginning work, investigate and verify existence and location of underground utilities affecting the Work.

1. Before construction, verify location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and electrical services.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where conditions detrimental to performance of the Work are encountered, provide a written report listing the following:

(a) Description of the Work.

(b) List of detrimental conditions, including substrates.

(c) List of unacceptable installation tolerances.

(d) Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers.

3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of need for clarification of Contract Documents, submit a Request For Information (RFI) to Architect. Include a detailed description of problem encountered, together with recommendations for resolution of the item discovered.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.

2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

4. Maintain maximum headroom clearance in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.

2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

1. PART 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore surfaces to original or specified conditions after installation of other work.

1.3 REGULATORY REQUIREMENTS

A. Unless specifically shown on the drawings, no structural member shall be cut, drilled, or notched without prior written authorization from the Architect and the Division of the State Architect.

1.4 SUBMITTALS

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

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

B. Include in request:

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

1.5 QUALITY ASSURANCE

A. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Do not cut or patch operating elements that would reduce their capacity to perform or that would result in increased maintenance or decreased operational life or safety.

C. Do not cut or patch construction that would result in visual evidence of cutting or patching.

D. Remove and replace construction that has been cut or patched in a visually unsatisfactory manner.

2. PART 2 PRODUCTS

2.1 MATERIALS

A. Primary Products: Those required for original installation.

B. Substitutions: Under provisions of Section 01 25 13.

3. PART 3 EXECUTION

3.1 EXAMINATION

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

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

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

3.2 PREPARATION

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

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

3.3 CUTTING AND PATCHING

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

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

C. Uncover work to install ill timed work.

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

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

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

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

3.4 PERFORMANCE

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

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

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

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

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

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

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

3.5 CLEANING

A. Clean areas and spaces where cutting and patching was performed.

B. Completely remove paint, mortar, oils, sealant, and similar materials.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Administrative and procedural requirements for the following:

1. Recycling nonhazardous demolition and construction waste.

2. Disposing of nonhazardous demolition and construction waste.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE GOALS

A. Salvage/Recycle Goals: Salvage and recycle as much nonhazardous demolition and construction waste as possible.

1.4 SUBMITTALS

A. Submit waste management plan and progress reports under the provisions of Section 01 33 00.

B. Waste Management Plan: Submit plan within 14 days of date established for the Notice of Award.

C. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit reports. Include separate reports for demolition and construction waste. Include the following information:

1. Material category.

2. Generation point of waste.

3. Total quantity of waste in tons.

4. Quantity of waste salvaged, both estimated and actual in tons.

5. Quantity of waste recycled, both estimated and actual in tons.

6. Total quantity of waste recovered (salvaged plus recycled) in tons.

7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

D. Forms: Prepare waste reduction progress reports on forms included at end of Part 3.

E. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

F. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

G. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

H. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

I. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

J. Qualification Data: For refrigerant recovery technician.

K. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.5 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.6 WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis.Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.

2. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.

3. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

4. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Forms: Prepare waste management plan on forms included at end of Part 3.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within 3 days of submittal return.

2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

2. Comply with Division 01 Section 01 50 00 - Temporary Facilities and Controls, for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Sale: Not permitted to be sold on Project site.

B. Salvaged Items for Donation: Permitted on Project site.

C. Salvaged Items for Owner's Use:

1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to Owner.

4. Transport items to Owner's storage area designated by Owner.

5. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: Licensed entity normally engaged in the business of receiving, recycling, and processing waste materials with a minimum of 5 years of documented experience with the types of waste products to be processed under the provisions of this section.

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

2. Inspect containers and bins for contamination and remove contaminated materials if found.

3. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

4. Stockpile materials away from construction area. Do not store within drip line of remaining trees.

5. Store components off the ground and protect from the weather.

6. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

B. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.

2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

C. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

D. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

E. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.

2. Polystyrene Packaging: Separate and bag materials.

3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.

2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

(a) Comply with requirements in Division 32 Section 32 90 00 - Planting for use of clean sawdust as organic mulch.

3.6 DISPOSAL OF WASTE

A. General: 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.

B. 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.

C. Burning: Do not burn waste materials.

D. Disposal: Transport waste materials off Owner's property and legally dispose of them.

3.7 FORMS

A. Waste Management Plan Forms Attached:

1. Construction Waste Reduction Progress Report.

2. Demolition Waste Reduction Progress Report.

3. Construction Waste Identification.

4. Demolition Waste Identification.

5. Construction Waste Reduction Work Plan.

6. Demolition Waste Reduction Work Plan.

7. Cost/Revenue Analysis of Construction Waste Reduction Work Plan.

8. Cost/Revenue Analysis of Demolition Waste Reduction Work Plan.

END OF SECTION

CONSTRUCTION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D/Ax100)
			ESTIMATED TONS	ACTUAL TONS (B)	ESTIMATED TONS	ACTUAL TONS (C)		
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

DEMOLITION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (D=B+C)	TOTAL QUANTITY OF WASTE RECOVERED % (D/Ax100)
			ESTIMATED TONS	ACTUAL TONS (B)	ESTIMATED TONS	ACTUAL TONS (C)		
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mechanical Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panel boards								
Transformers								
Other:								

CONSTRUCTION WASTE IDENTIFICATION							
MATERIAL CATEGORY	**GENERATION POINT**	**EST. QUANTITY OF MATERIALS RECEIVED (A)**	**EST. WASTE - % (B)**	**TOTAL EST. QUANTITY OF WASTE* (C=AxB)**	**EST. VOLUME CY**	**EST. WEIGHT TONS**	**REMARKS AND ASSUMPTIONS**
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

* Insert units of measure.

DEMOLITION WASTE IDENTIFICATION				
MATERIAL DESCRIPTION	**EST. QUANTITY**	**EST. VOLUME CY**	**EST. WEIGHT TONS**	**REMARKS AND ASSUMPTIONS**
Asphaltic Concrete Paving				
Concrete				
Brick				
CMU				
Lumber				
Plywood and OSB				
Wood Paneling				
Wood Trim				
Miscellaneous Metals				
Structural Steel				
Rough Hardware				
Insulation				
Roofing				
Doors and Frames				
Door Hardware				
Windows				
Glazing				
Acoustical Tile				
Carpet				
Carpet Pad				
Demountable Partitions				
Equipment				
Cabinets				
Plumbing Fixtures				
Piping				
Piping Supports and Hangers				
Valves				
Sprinklers				
Mechanical Equipment				
Electrical Conduit				
Copper Wiring				
Light Fixtures				
Lamps				
Lighting Ballasts				
Electrical Devices				
Switchgear and Panelboards				
Transformers				
Other:				

CONSTRUCTION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTATION PROCEDURES
			EST. AMOUNT SALVAGED TONS	EST. AMOUNT RECYCLED TONS	EST. AMOUNT DISPOSED TO LANDFILL TONS	
Packaging: Cardboard						
Packaging: Boxes						
Packaging: Plastic Sheet or Film						
Packaging: Polystyrene						
Packaging: Pallets or Skids						
Packaging: Crates						
Packaging: Paint Cans						
Packaging: Plastic Pails						
Site-Clearing Waste						
Masonry or CMU						
Lumber: Cut-Offs						
Lumber: Warped Pieces						
Plywood or OSB (scraps)						
Wood Forms						
Wood Waste Chutes						
Wood Trim (cut-offs)						
Metals						
Insulation						
Roofing						
Joint Sealant Tubes						
Gypsum Board (scraps)						
Carpet and Pad (scraps)						
Piping						
Electrical Conduit						
Other:						

DEMOLITION WASTE REDUCTION WORK PLAN						
MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS	DISPOSAL METHOD AND QUANTITY			HANDLING & TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS	EST. AMOUNT RECYCLED TONS	EST. AMOUNT DISPOSED TO LANDFILL TONS	
Asphaltic Concrete Paving						
Concrete						
Brick						
CMU						
Lumber						
Plywood and OSB						
Wood Paneling						
Wood Trim						
Miscellaneous Metals						
Structural Steel						
Rough Hardware						
Insulation						
Roofing						
Doors and Frames						
Door Hardware						
Windows						
Glazlng						
Acoustical Tile						
Carpet						
Carpet Pad						
Demountable Partitions						
Equipment						
Cabinets						
Plumbing Fixtures						
Piping						
Supports and Hangers						
Valves						
Sprinklers						
Mechanical Equipment						
Electrical Conduit						
Copper Wiring						
Light Fixtures						
Lamps						
Lighting Ballasts						
Electrical Devices						
Switchgear and Panelboards						
Transformers						
Other:						

COST/REVENUE ANALYSIS OF CONSTRUCTION WASTE REDUCTION WORK PLAN								
MATERIALS	**TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)**	**EST. COST OF DISPOSAL (B)**	**TOTAL EST. COST OF DISPOSAL (C = A x B)**	**REVENUE FROM SALVAGED MATERIALS (D)**	**REVENUE FROM RECYCLED MATERIALS (E)**	**LANDFILL TIPPING FEES AVOIDED (F)**	**HANDLING AND TRANSPORTATION COSTS AVOIDED (G)**	**NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)**
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Ofts								
Lumber: Warped Pieces or OSB								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-ofts)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

COST/REVENUE ANALYSIS OF DEMOLITION WASTE REDUCTION WORK PLAN								
MATERIALS	**TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)**	**EST. COST OF DISPOSAL (B)**	**TOTAL EST. COST OF DISPOSAL (C= A x B)**	**REVENUE FROM SALVAGED MATERIALS (D)**	**REVENUE FROM RECYCLED MATERIALS (E)**	**LANDFILL TIPPING FEES AVOIDED (F)**	**HANDLING AND TRANSPORTATION COSTS AVOIDED (G)**	**NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)**
Asphaltic Concrete Paving Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mech. Equipment								
Electrical Conduit								
Conner Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								
Other:								

SECTION 01 77 00

CLOSEOUT PROCEDURES

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout Procedures.

B. Final Cleaning.

C. Pest Control.

D. Adjusting.

E. Demonstration and Instructions.

F. Project Record Documents.

G. Operation and Maintenance Data.

H. Warranties.

I. Spare Parts and Maintenance Materials.

J. Commissioning.

K. DVBE Participation Report.

1.2 PROJECT CLOSEOUT CONFERENCE

A. As specified under Section 01 31 00.

1.3 CLOSEOUT PROCEDURES

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

B. Prepare and submit to Architect a list of items to be completed or corrected, the value of the items on the list, and reasons why the Work is not complete.

C. Submit written request to Architect for review of Work.

D. Submit warranties, bonds, service agreements, certifications, record documents, maintenance manuals, receipt of spare parts and similar closeout documents.

E. Make final changeover of permanent locks and deliver keys to Owner.

F. Terminate and remove temporary facilities from Project site.

G. Advise Owner of change over in heat and other utilities.

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

I. Submit affidavit of payment of debts and claims, AIA Document G706.

J. Submit affidavit of release of liens, AIA Document G706A.

K. Submit consent of contractors surety to final payment, AIA Document G707.

L. Owner will occupy portions of the building as specified in Section 01 11 00.

1.4 REGULATORY REQUIREMENTS

A. Provide final verified reports required by Section 39151 and 81141 of the Education Code in the manner prescribed by Title 24, Part 1, Section 4-336 and 4-343 in compliance with DSA Procedure: Project Certification Process PR 13-02.

1.5 FINAL CLEANING

A. Execute final cleaning prior to final review by Architect.

B. Employ experienced professional cleaners for final cleaning.

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

D. Vacuum carpeted and soft surfaces. Shampoo if visible stains exist.

E. Clean equipment and plumbing fixtures to a sanitary condition.

F. Clean exposed surfaces of grilles, registers and diffusers.

G. Replace filters of operating mechanical equipment.

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

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

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

K. Clean light fixtures and replace burned out lamps and bulbs.

L. Relamp all lamps and bulbs in lighting fixtures.

M. Replace defective and noisy ballasts and starters in fluorescent fixtures.

N. Leave project clean and ready for occupancy by Owner.

1.6 PEST CONTROL

A. Engage an experienced, licensed exterminator to make final inspection and rid Project of rodents, insects, and other pests. Submit final report to Architect.

1.7 ADJUSTING

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

1.8 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products, systems, and equipment to Owner's personnel two weeks prior to date of final review.

B. For each demonstration submit list of participants in attendance.

C. Provide two copies of video tape of each demonstration and instructions session.

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

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

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

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

1.9 PROJECT RECORD DOCUMENTS

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

1. Contract Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other Modifications to the Contract.

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

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

C. Record information concurrent with construction progress.

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

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

2. Supplier and installer’s name and contact information.

3. Changes made by Addenda and Modifications.

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

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

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

3. Field changes of dimension and detail.

4. Details not on original Contract Drawings.

5. Revisions to electrical circuitry and locations of electrical devices and equipment.

6. Note change orders, alternate numbers, and similar information, where applicable.

7. Identify each record drawing with the written designation of “RECORD DRAWING” located in prominent location.

F. Record Digital Data Files: Immediately before inspection for Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file with comment function enabled.

2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.

3. Refer instances of uncertainty to Architect for resolution.

4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

   (a) Refer to Section 01 33 00 “Submittal Procedures” for requirements related to use of Architect's digital data files.

   (b) Architect will provide data file layer information. Record markups in separate layers.

G. Final Property Survey: Under the provisions of Section 01 73 00.

H. Record Construction Schedule: Under the provisions of Section 01 32 17.

I. Submit documents to Architect at time of Substantial Completion.

1.10 OPERATION AND MAINTENANCE DATA

A. Summary:

1. Organize operation and maintenance data with directory.

2. Provide operation and maintenance manuals for products, systems, subsystems, and equipment.

3. Refer to Divisions 02 thru 49 for specific operation and maintenance manual requirements for the Work in those Divisions.

B. Submit two sets prior to final review, bound in 8-1/2 inch x 11 inch, three ring D size binders with durable vinyl covers.

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

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

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

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

1. Performance and design criteria.

2. List of equipment.

3. Parts list for each component.

4. Start-up procedures.

5. Shutdown instructions.

6. Normal operating instructions.

7. Wiring diagrams.

8. Control diagrams.

9. Maintenance instructions for equipment and systems.

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

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

1. Shop drawings and product data.

2. Air and water balance reports.

3. Certificates.

4. Warranties.

H. Refer to Section 01 91 13 - General Commissioning Requirements, for additional requirements.

1.11 WARRANTIES

A. Commencement of warranties shall be date of Substantial Completion.

B. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

C. Provide duplicate notarized copies in operation and maintenance manuals.

D. Execute and assemble documents from subcontractors, suppliers, and manufacturers.

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

F. Submit prior to final Application for Payment.

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

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

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

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

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

1.12 SPARE PARTS AND MAINTENANCE MATERIALS

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

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

C. Obtain signed receipt for delivery of materials and submit prior to request for final review by Architect.

1.13 COMMISSIONING

A. All commissioning work as specified in Section 01 91 13 must be complete prior to Substantial Completion.

B. Exceptions to commissioning work being complete prior to Substantial Completion are planned control system training performed after occupancy and any required seasonal testing or deferred testing.

C. Commissioning activities are non-compensable and cannot be a cause for a delay claim.

1.14 DISABLED VETERAN BUSINESS ENTERPRISE (“DBVE”) PARTICIPATION

A. Submit DVBE Participation Report as stipulated by Document 00 65 73.

B. Provide supplemental report to substantiate non-compliance with District goal of three percent (3%) participation if required.

2. PART 2 PRODUCTS

Not Used

3. PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 23 05 00

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS SECTION INCLUDES

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

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Pipe flashing hood.
5. Sealants.
6. Electrical wire.
7. Access doors.
8. Delivery and storage of materials.
9. Cooperation with other contractors.
10. Coordination of work.
11. Incidental work.
12. Electrical wiring.
13. Laying out of work.
14. Data and measurements.
15. Position of outlets.
16. Protection of apparatus.
17. Access to equipment.
18. Examination of premises.
19. Roadways, curbs and walks.
20. Frames.
21. Finished surfaces penetrations.
22. Firestopping penetrations.
23. Sealing of exterior openings.
24. Piping systems – common requirements.
25. Labeling and identifying.
26. Field-fabricated metal equipment supports.
27. Installation requirements common to equipment specification sections.
28. Painting and finishing.

B. Pipe and pipe fitting materials are specified in Division 15Division 23 piping system Sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Pipe flashing hood.

B. Welding certificates.

C. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

D. Samples: Of color, lettering style, and other graphic representation required for each identification material and device.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, “Structural Welding Code—Steel”.

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, “Welding and Brazing Qualifications”.

1. Comply with provisions in ASME B31 Series, “Code for Pressure Piping”.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Manufactured Sleeves:

    a. Pipe Shields
    b. Proset
    c. Shamrock Crete-Sleeve

2. Rooftop Pipe Flashing Hoods:

    a. Kees

3. Sealants:

    a. Dow Corning
    b. Pecora
    c. Sonneborn
    d. Tremco

4. Access Doors:

    a. J. L. Industries
    b. Karp Associates, Inc.
    c. Larsons Mfg. Co.
    d. Milcor, Inc.
    e. Miller Limited Partnership
    f. Nystrom, Inc.

5. Firestopping Materials:

    a. Dow Corning
    b. Metacaulk
    c. Specified Technologies, Inc.
    d. 3M Fire Protection Products
    e. Tremco Sealants & Coatings

6. Motor Starters:

    a. Allen Bradley.
    b. General Electric.
    c. Square D.

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

F. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

2.4 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated “wall pipe” equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.6 PIPE FLASHING HOOD

A. Constructed of galvanized steel; all seams welded; interior insulated with metal liner; removable pitched cover; pipes exiting through permanently flexible grommet seals. Furnish with curb for roof application.

2.7 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.8 SEALANTS

A. Polyurethane Sealant: Single component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non-sagging type for application in vertical joints and in horizontal joints, color as selected; manufactured by Pecora, Tremco, Sonneborn, or approved equal.

B. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

C. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

D. Joint Backing: ANSI/ASTM D1056; round, closed cell, polyethylene foam rod; oversized 30% to 50% larger than joint width; manufactured by Sonneborn or approved equal.

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

2.9 MOTOR STARTERS

A. Motor starters shall be fused combination type minimum NEMA Size 1, and conform to appropriate NEMA standards for the service required. Provide NEMA type 3R gasketed enclosures in outdoor or wet locations. Provide all starters with appropriately sized overload protection and heater strips provided in each phase, hand/off auto switches, a minimum of 2 NO and NC auxiliary contacts as required, and an integral disconnecting means. For ½ horsepower motors and below, when control requirements do not dictate the use of a starter, a manual motor starter switch with overload protection in each phase may be provided.

2.10 ELECTRICAL WIRE

A. All wiring materials covered by this section shall be in accordance with the latest revision of the National Electrical Code and applicable local codes and shall carry the UL label where applicable. All wiring running exposed in return air plenums shall be plenum-rated cable for fire and smoke spread.

2.11 ACCESS DOORS

A. Prime coated 14 gauge steel, flush, with screwdriver operated cam lock, frame to accommodate construction type; size as indicated on plans or in this specification. Milcor style M or DW, or equivalent.

PART 3 - EXECUTION

3.1 GENERAL

A. Fabrication, erection and installation of the complete mechanical system shall be done by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project. The Mechanical Contractor shall check all areas and surfaces where mechanical equipment or materials are to be installed and report any unsatisfactory conditions before starting work. Commencement of work signifies the Contractor’s acceptance of the conditions as fit and proper for the execution of the mechanical work.

B. Equipment and systems shall be installed in accordance with manufacturer’s instructions, requirements or recommendations.

3.2 DELIVERY AND STORAGE OF MATERIALS

A. Each Contractor shall make provisions for the delivery and safe storage of materials and shall make the required arrangements with other Contractors for the introduction into the building of equipment too large to pass through finished openings. Materials shall be delivered at such stages of the work as will expedite the work as a whole and shall be marked and stored in such a way as to be easily checked and inspected.

B. The Contractor shall be responsible for adequately protecting all supplies and equipment during cold weather. All items subject to cold weather damage shall be protected by covering, insulating or storing in a heated space.

3.3 COOPERATION WITH OTHER CONTRACTORS

A. Perform the mechanical work in conformance with the construction called for by other trades and afford other contractors reasonable opportunity for the execution of their work. Properly connect and coordinate the mechanical work with the work of other contractors at such time and in such a manner as not to delay or interfere with their work.

B. Examine the contract documents for the General, Mechanical and Electrical work and the work of other trades. Coordinate mechanical work accordingly.

C. Promptly report to the Architect/Engineer any delay or difficulties encountered in the installation of the mechanical work which might prevent prompt and proper installation of work required from other trades.

D. Systems Test and Balance Contractors or personnel shall coordinate their work with the contractors who installed the systems being tested or balanced. The Temperature Control Contractor or personnel shall be present during systems test and balance.

3.4 COORDINATION OF WORK

A. The Mechanical Contractor shall plan all work so it proceeds with a minimum of interference with other trades. It shall also be the responsibility of the Mechanical Contractor to inform the General Contractor of all openings required in the building construction for the installation of the mechanical work. The Mechanical Contractor shall cooperate with all other contractors in furnishing material and information, in proper sequence, for the correct location of all sleeves, inserts, foundations, wiring, etc. Provisions shall be made for all special frames, openings and sleeves as required.

B. The Mechanical Contractor shall pay for extra cutting and patching made necessary by his failure to properly direct such work at the correct time.

3.5 ELECTRICAL WIRING

A. All wiring and conduit shall be run parallel to, or at right angles to, the building structure and shall be concealed in finished spaces.

B. All electric wiring shall be done in accordance with the National Electrical code. All line voltage and low voltage wire shall be installed in flexible conduit or electrical metallic tubing. Conduit may be run exposed in mechanical rooms or in areas where other piping is exposed.

C. Low voltage wiring in equipment rooms or concealed in walls shall be in one of the metal raceways mentioned above. Final connection shall be made with exposed wiring which shall be protected by a suitable protective grommet and the end of the metal container shall be securely fastened. Jacketed harnesses may be used where a number of wires are run together.

3.6 LAYING OUT WORK

A. The Contractor shall carefully lay out all work in advance of installation using data and measurements from the site, the appropriate architectural and structural drawings, and shop drawings. Equipment layout and all system layouts shall confirm adequate clearances for installation, operation, maintenance and code required clearances from the structure or other equipment and systems. The layout shall not cause problems of operation, maintenance or clearance for items installed by other contractors.

B. Prior to installation of any work, make certain the location does not conflict with other items in or near the same location. If the layouts so prepared indicate that the required conditions cannot be met in the space provided, the Contractor shall so inform the Architect/Engineer prior to installation and shall request clarification.

C. Failure to properly coordinate and lay out the work will require correction by the Contractors at their own expense.

3.7 DATA AND MEASUREMENTS

A. The data given herein and on the drawings is as accurate as could be secured; absolute accuracy is not guaranteed. The Contractors shall obtain exact locations, measurements, levels, etc., at the site and shall adapt their work to actual conditions. The Contractor shall examine the General Construction, Mechanical, Electrical, and other applicable drawings and the Specifications. Plans and specifications are available for examination at the office of the Architect/Engineer. Only Architectural drawings, Structural drawings, and site measurements may be utilized in calculations. Mechanical and Electrical drawings are diagrammatic or schematic.

3.8 POSITION OF DEVICES

A. Locate devices mounted on finished surfaces with regard to paneling, furring, trim, etc. Where several devices occur in a room, they shall be symmetrically arranged as reviewed by the Architect/Engineer. Devices improperly located or installed shall be repaired, replaced or relocated at the Contractor's expense. Devices shall be set plumb or horizontal and shall extend to the finished surface of the wall, ceiling or floor without projecting beyond the surface.

B. Devices shown on wood trim, cases or other fixtures shall be installed symmetrically and, where necessary, shall be set with the long dimension of the plate horizontal.

C. All Contractors shall coordinate their respective devices so as not to destroy the aesthetic effect of the surface in which the devices are mounted. Coordinate the locations of all mechanical items with work furnished by other trades to avoid interference. If the required coordination is not done, the outlets or devices shall be removed and relocated if so directed by the Architect/Engineer and the damaged surfaces repaired at the Contractor's expense.

D. Devices shall be installed at the height shown below unless otherwise noted. All heights of devices are measured from finished floor to centerline of device. Heights may be adjusted to correspond to nearest masonry course or as necessary to clear wall-mounted cabinets, fin tube convectors, unit heaters, etc.

1.	Temperature control panels	60 inches
2.	Thermostats	48 inches

3.9 PROTECTION OF APPARATUS

A. Take such precautions as necessary to properly protect all apparatus, fixtures, appliances, material, equipment and installations from damage of any kind. Failure to provide such protection to the satisfaction of the Architect/Engineer shall be sufficient cause for the rejection of any particular piece(s) of material, apparatus, equipment, etc., concerned.

3.10 ACCESS TO EQUIPMENT

A. All motors, terminal boxes, valves, control devices, specialties, etc., shall be located to provide for easy access for operation, repair and maintenance; if concealed, access doors shall be provided.

B. Access doors (AD) required for access to equipment requiring inspection or service shall be provided. This Contractor shall provide all access doors not already furnished by other contractors but which are required for access to mechanical equipment. Doors shall be 12 inches by 12 inches unless shown otherwise. Person access doors shall be 18 inches by 18 inches minimum.

3.11 EXAMINATION OF PREMISES

A. The Contractor shall examine the premises and al conditions thereon and/or therein. The bid proposal shall take into consideration all such conditions which may affect the work under this contract.

3.12 FRAMES

A. Ducts passing through masonry walls shall be installed in steel angle iron frames and sleeves. All sleeves and frames shall be securely fastened to the walls. Provide for structural lintels in masonry wall openings. Ducts passing through openings in poured concrete walls and floors need not have frames.

3.13 FINISHED SURFACES PENETRATIONS

A. All piping and ductwork penetrations of finished surfaces shall have escutcheons and/or closure plates.

B. Openings shall be cut only as large as required for the installation, sleeves and/or frames installed flush with finished surfaces and grouted in place.

C. Surfaces around openings shall be left smooth and finished to match surrounding surface.

D. Duct frames and pipe sleeves through floors in concealed locations and in unfinished spaces such as mechanical rooms, etc., shall extend 2 inches above finished floor level and shall be caulked watertight. All other sleeves shall extend approximately 1/4 inch above finished floor but shall allow placement of escutcheons.

3.14 FIRESTOPPING PENETRATIONS IN FIRE-RATED WALL / FLOOR ASSEMBLIES

A. Contractors shall provide proper sizing when providing sleeves or core-drilled holes to accommodate their work through penetrating items. All voids between sleeve or core-drilled hole and pipe passing through shall be firestopped to meet the requirements of ASTM E814. Install all materials complete, attached securely and permanently in place in accordance with manufacturers' printed directions.

3.15 SEALING OF EXTERIOR OPENINGS

A. Openings around pipes, ducts, conduits, etc., in exterior walls above grade shall be sealed with polyurethane sealant.

B. Preparation:

1. Clean and prepare joints in accordance with manufacturer's instructions.
2. Remove loose materials and foreign matter which might impair adhesion of sealant.
3. Verify that joint backing and release tapes are compatible with sealant.
4. Perform preparation in accordance with ASTM C804 for solvent release sealants.
5. Protect elements surrounding the work of this Section from damage or disfiguration.
6. Installation:

    a. Perform installation in accordance with ASTM C804 for solvent release sealants.
    b. Install sealant in accordance with manufacturer's instructions.
    c. Measure joint dimensions and size materials to achieve required width/depth ratios.
    d. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
    e. Install bond breaker where joint backing is not used.
    f. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
    g. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
    h. Tool joints concave.

3.16 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 23 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

F. Install piping to allow application of insulation plus 1-inch clearance around insulation.

G. Locate groups of pipes parallel to each other, spaced to permit insulation and valve servicing.

H. Install fittings for changes in direction and branch connections.

I. Keep all pipe and equipment openings closed during construction except when actual work is being performed on that item or system.

J. Conceal piping in walls, pipe chases, utility chases, above ceilings, below grade or floors, unless otherwise noted.

K. Install piping free of sags or bends with ample space between piping to permit proper insulation applications.

L. Install piping tight to slabs, beams, joists, columns, walls and other permanent elements of the building unless otherwise indicated. Provide space to permit insulation applications with 1 inch clearance outside the insulation. Allow sufficient space above ceiling panels to allow for ceiling panel removal.

M. Install piping to allow for expansion and contraction without stressing pipe, adjacent building structure or connecting equipment. Install expansion loops or compensators where indicated.

N. During construction, avoid any undue loads, forces or strains on valves, equipment, pumps flanges, or building elements with piping connections or piping systems.

O. Branch takeoffs shall be fabricated using standard manufactured welding or threaded tees. Branch welds reinforced with welding saddles or by forged steel reinforcement fittings such as weldolets, threadolets and sockolets will be allowed on 2 inch and smaller branch connections. On 3 inch and larger pipes, main lines two or more pipe sizes larger than the branch must be for forged steel reinforcement fitting connections.

P. Leaking joints shall be remade using new materials.

Q. Drill and deburr all openings which are made after erection of the piping system.

R. Joints in steel pipe 2 inches and smaller shall be threaded in accordance with ANSI B1.1. Ream threaded ends to remove burrs and restore full inside diameter. Utilize pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint. Tighten joints to leave not more than three threads exposed.

S. Pipe joints and steel pipe larger than 2 inches shall be welded in accordance with ASME Code for Pressure Piping B31.

T. Flanges on steel pipe larger than 2” shall be welded in accordance with ASME B31. Clean flange faces and install gaskets. Tighten bolts to torques specified by the manufacturer of the flange and flange bolts to provide uniform compression of gaskets.

U. Joints in non-ferrous pipe shall be brazed or soldered. Braze joints in accordance with ANSI B31.9 or B31.5. Thoroughly clean tube surface and inside surface of the fitting using emery cloth. Clean tube and fittings and apply flux. Flux shall not be used for cleaning tube and fitting surfaces.

V. Joints for other piping systems are specified within the respective piping system specifications.

W. Pipe hangers for insulated pipe with vapor barrier jackets shall be installed around the outside of the insulation and a metal insulation support shield provided to prevent crushing of the insulation.

X. Install couplings according to manufacturer's written instructions.

Y. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
    b. Build sleeves into new walls and slabs as work progresses.
    c. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

        1) Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
        2) Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
        3) Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.

            a) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

    d. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
    e. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

2. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping" for materials. Install in accordance with manufacturer’s written instructions.
3. Verify final equipment locations for roughing-in.
4. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
5. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

    a. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
    b. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
    c. Soldered Joints: Construct joints according to AWS's "Soldering Manual", Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook”.
    d. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

        1) Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
        2) Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
        3) Align threads at point of assembly.
        4) Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.

5) Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

e. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
f. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

6. Piping Connections: Make connections according to the following, unless otherwise indicated:

a. Install unions, in piping 2-inch NPS and smaller, adjacent to each control valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
b. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

3.17 PAINTING AND FINISHING

A. General: Clean and prepare surfaces and apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
7. Do not paint piping specialties which are factory finished.
8. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.18 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.19 ADJUSTING

A. Use adjustable motor mounting bases for belt-driven motors.

B. Align pulleys and install belts.

C. Tension according to manufacturer's written instructions.

3.20 LUBRICATION

A. Contractor shall run in all bearings and, after they are run in, shall drain and flush bearings and refill with a new oil charge. Equipment shall be so arranged that tools (screwdrivers, wrenches, etc.) will not be required to make lubrication points accessible. Extensions on grease or oil fittings shall be provided where required for access to lubricate.

3.21 FILTER REPLACEMENT

A. Prior to beginning systems testing, adjusting and balancing, replace all filter media with new media.

3.22 INCIDENTAL WORK

A. The following incidental work shall be furnished by the designated contractor under the supervision of the Temperature Contractor:

1. The Piping Contractor shall provide all necessary valved pressure taps, water, drain, and overflow connections and piping.
2. The Air Distribution Contractor shall install all automatic dampers furnished by the Temperature Control Contractor.
3. The Air Distribution Contractor shall provide necessary blank-off plates (safing) required to install dampers that are smaller than duct size.
4. The Air Distribution Contractor shall provide access doors or other approved means of access through ducts for service to control equipment.
5. Supply and return air motorized smoke dampers shall be provided by the Air Distribution Contractor on all air handling units 15,000 cfm and larger, as required by NFPA 90A, and shall be controlled by the Temperature Control Contractor. Dampers shall close when fan stops and open when fan starts.

3.23 TEST REPORTS

A. Upon completion of the work, the entire system shall be tested and proven for capacity of equipment, balance of system, proper operation of controls, and comfort of conditioned spaces. Contractor shall take air and water flow readings and submit copy of same to demonstrate proper flow according to the performances shown on the plans and noted in the specifications. All motors shall be checked for overload and belts adjusted. Lubricate all moving parts and clean or replace filters.

B. Submit three (3) copies of all tests to the Architect/Engineer for review prior to date of substantial completion.

C. All equipment and systems discrepancies shall be corrected prior to final acceptance.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 RELATED DOCUMENTS SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

B. Definitions

C. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

D. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems and system contents. Comply with 2013 CBC and SMACNA 3rd Edition 2008 (Seismic Hazard Level A).

B. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.4 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Welding Certificates: Copies of certificates for welding procedures and operators.

1.5 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Duct and Piping Support Systems:

a. Miro

B. Duct Supports: Dual bases supporting “H” frame strut assembly to support duct. Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
2. Base Material: Polycarbonate resin, stainless steel or hot-dip galvanized.

C. Support Pads: 1/8 inch thick, flexible PVC with carbon black additive for UV stabilization.

D. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

PART 3 - EXECUTION

3.1 DUCT ROOF SUPPORT INSTALLATION

A. Determine that roof structure, roof insulation, and roof membrane are structurally adequate to support weight of pipe, duct, conduit, and supports and hangers.

B. Install supports and hangers in accordance with manufacturer’s recommendations.

C. Install supports at maximum spacing of 10 feet unless closer spacing is required due to weight of system or greater spacing is specifically allowed by manufacturer; space and adjust to support an equal amount of weight; do not exceed manufacturer’s recommended load limits.

D. Remove roofing aggregate from area 2 inches larger than support base; comply with roofing manufacturer’s requirements to maintain roofing warranty.

E. Install an additional sheet of roofing material, support pad, or deck plate beneath each support base.

F. Support Pads:

1. Remove rock, aggregate, dirt and excess dust from area to be covered by pad.
2. Apply support pad on cleaned area.
3. Center bases on top of support pads.

G. Metal fabrication

H. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

I. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

J. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.2 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments.

3.3 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 RELATED DOCUMENTS SUMMARY

A. This Section includes the following:

1. Restrained vibration isolation roof-curb rails.
2. Definitions

B. Av: Effective peak velocity related acceleration coefficient.

C. Performance requirements

D. Refer to Structural Drawings General notes for performance requirements and design criteria.

E. Entire mechanical system shall be submitted through shop drawing process and be compliant with Division of State Architect (DSA) prior to commencement of work.

1.3 SUBMITTALS

A. Product Data: Include load deflection curves for each vibration isolation device.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:

1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
4. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y, and z planes.

C. Welding certificates.

D. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 QUALITY ASSURANCE

A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD/DSA and shall bear anchorage preapproval "OPA" number, from OSHPD/DSA or another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 23 “Basic Mechanical Materials and Methods.”

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

A. Manufacturers:

1. Amber/Booth Company, Inc.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. Vibration Eliminator Co., Inc.
5. Vibration Mountings & Controls/Korfund.

B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand 125-mph wind impinging laterally against side of equipment.

C. Lower Support Assembly: Sheet-metal "Z" section containing adjustable and removable steel springs that support upper floating frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind and seismic forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

    a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
    b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
    c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
    d. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
    e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel base plates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

    a. Material: Standard neoprene.
    b. Durometer Rating: 45.
    c. Number of Layers: 2.

E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

G. FACTORY FINISHES

H. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be electrogalvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install roof curbs, equipment supports, and roof penetrations.

B. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.

C. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

D. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

E. FIELD QUALITY CONTROL

F. Testing: Perform the following field quality-control testing:

1. Isolator seismic-restraint clearance.
2. Isolator deflection.
3. Snubber minimum clearances.

3.3 ADJUSTING

A. Adjust isolators after piping systems have been filled and equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.

D. Adjust active height of spring isolators.

E. Adjust snubbers according to manufacturer's written recommendations.

F. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

G. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

3.4 CLEANING

A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Submittals

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

C. Samples: For color, letter style, and graphic representation required for each identification material and device.

D. Quality assurance

E. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.3 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:

a. Manufacturer, product name, model number, and serial number.
b. Capacity, operating and power characteristics, and essential data.
c. Labels of tested compliances.

2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

B. Execution

2.2 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 22 and 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

2.3 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Packaged HVAC central-station and zone-type units.

B. Adjusting

C. Relocate mechanical identification materials and devices that have become visually blocked by other work.

2.4 CLEANING

A. Clean faces of mechanical identification devices.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
2. Adjusting total HVAC systems to provide indicated quantities.
3. Measuring electrical performance of HVAC equipment.
4. Setting quantitative performance of HVAC equipment.
5. Verifying that automatic control devices are functioning properly.
6. Measuring sound and vibration.
7. Reporting results of the activities and procedures specified in this Section.

B. Related Sections include the following:

C. List below only products and equipment for this Project that the reader might expect to find in this Section but are specified elsewhere.

D. Division 01 Section “General Commissioning Requirements”.

E. Division 23 Section “HVAC Commissioning Requirements”.

F. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.

G. Definitions

H. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

I. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

J. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

K. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

L. Report Forms: Test data sheets for recording test data in logical order.

M. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

N. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

O. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

P. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

Q. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

R. Test: A procedure to determine quantitative performance of a system or equipment.

S. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

T. AABC: Associated Air Balance Council.

U. AMCA: Air Movement and Control Association.

V. NEBB: National Environmental Balancing Bureau.

W. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.3 SUBMITTALS

A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.

B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.

C. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.

D. Certified Testing, Adjusting, and Balancing Reports: Submit 4 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

E. Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.

F. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

1.4 QUALITY ASSURANCE

A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB.

B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect/Engineer's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

a. Submittal distribution requirements.
b. Contract Documents examination report.
c. Testing, adjusting, and balancing plan.
d. Work schedule and Project site access requirements.
e. Coordination and cooperation of trades and subcontractors.
f. Coordination of documentation and communication flow.

C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.

D. Testing, Adjusting, and Balancing Reports: Use testing, adjusting, and balancing Agent's standard forms approved by the Architect/Engineer.

E. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.5 PROJECT CONDITIONS

A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire testing, adjusting, and balancing period. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

B. COORDINATION

C. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

D. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

E. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.6 WARRANTY

A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

C. The certified Agent has tested and balanced systems according to the Contract Documents.

D. Systems are balanced to optimum performance capabilities within design and installation limits.

\\ NOTUSED

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine project record documents described in Division Division 01 Section "Project Record Documents."

D. Examine Architect/Engineer's and Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine automatic valves for proper installation for their intended function of diverting or mixing fluid flows.

L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

M. Examine equipment for installation and for properly operating safety interlocks and controls.

N. Examine automatic temperature control system components to verify the following:

1. Dampers, valves, and other controlled devices operate by the intended controller.
2. Dampers and valves are in the position indicated by the controller.

3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to design values.

O. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

2.2 PREPARATION

A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Windows and doors can be closed so design conditions for system operations can be met.

2.3 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC or NEBB national standards and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

2.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

D. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling unit components.

2.5 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures are required for variable-air-volume, multizone, dual-duct, induction-unit supply-air systems and process exhaust-air systems. These additional procedures are specified in other articles in this Section.

B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

    a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each air-handling unit component.

    a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers under final balanced conditions.
4. Adjust fan speed higher or lower than design with the approval of the Architect/Engineer. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

    a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.

D. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.

E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.

1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

2.6 MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating if high-efficiency motor.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

C. TEMPERATURE TESTING

D. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.

E. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

F. Measure outside-air, wet- and dry-bulb temperatures.

2.7 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Verify free travel and proper operation of control devices such as damper and valve operators.

F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.

G. Confirm interaction of electrically operated switch transducers.

H. Confirm interaction of interlock and lockout systems.

I. Verify main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

2.8 TOLERANCES

A. Set HVAC system airflow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: Minus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.
3. Reporting

B. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

C. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

2.9 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of the instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to the certified field report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of testing, adjusting, and balancing Agent.
3. Project name.
4. Project location.
5. Architect/Engineer's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of testing, adjusting, and balancing Agent who certifies the report.
10. Summary of contents, including the following:

a. Design versus final performance.
b. Notable characteristics of systems.
c. Description of system operation sequence if it varies from the Contract Documents.

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer, type size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from design values.
14. Test conditions for fans performance forms, including the following:

    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Fan drive settings, including settings and percentage of maximum pitch diameter.
    e. Settings for supply-air, static-pressure controller.
    f. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air distribution systems. Present with single-line diagrams and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Terminal units.
5. Balancing stations.

F. Roof-Mounted Air-Handling Units Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Sheave dimensions, center-to-center and amount of adjustments in inches.
    j. Number of belts, make, and size.
    k. Number of filters, type, and size.

2. Motor Data: Include the following:

    a. Make and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Sheave dimensions, center-to-center and amount of adjustments in inches.

3. Test Data: Include design and actual values for the following:

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Filter static-pressure differential in inches wg.
    f. Cooling coil static-pressure differential in inches wg.
    g. Outside airflow in cfm.
    h. Return airflow in cfm.
    i. Outside-air damper position.
    j. Return-air damper position.
    k. Fan Test Reports: For supply, return, and exhaust fans, include the following:

4. Fan Data: Include the following:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.
    g. Sheave make, size in inches, and bore.
    h. Sheave dimensions, center-to-center and amount of adjustments in inches.

5. Motor Data: Include the following:

    a. Make and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Sheave dimensions, center-to-center and amount of adjustments in inches.
    g. Number of belts, make, and size.

6. Test Data: Include design and actual values for the following:

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Suction static pressure in inches wg.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data: Include the following:

    a. System and air-handling unit number.
    b. Location and zone.
    c. Traverse air temperature in deg F.
    d. Duct static pressure in inches wg.
    e. Duct size in inches.
    f. Duct area in sq. ft.
    g. Design airflow rate in cfm.
    h. Design velocity in fpm.
    i. Actual airflow rate in cfm.
    j. Actual average velocity in fpm.
    k. Barometric pressure in psig.

H. Instrument Calibration Reports: For instrument calibration, include the following:

1. Report Data: Include the following:

    a. Instrument type and make.
    b. Serial number.
    c. Application.
    d. Dates of use.
    e. Dates of calibration.

2.10 ADDITIONAL TESTS

A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 SUMMARY

A. This Section includes semi rigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Submittals

C. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

D. Quality assurance

E. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

F. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

G. Delivery, storage, and handling

H. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.3 COORDINATION

A. Coordinate clearance requirements with duct Installer for insulation application.

1.4 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mineral-Fiber Insulation:

a. CertainTeed Manson.
b. Johns Manville Corp.
c. Knauf FiberGlass GmbH.
d. Owens-Corning Fiberglas Corp.

2. Flexible Elastomeric Thermal Insulation:

a. Armacell LLC.
b. Rubatex Corp.

B. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with FSK jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

C. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with FSK jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

D. Accessories and attachments

E. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd..

1. Tape Width: 4 inches.

F. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Aluminum: 0.007 inch thick.
2. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

G. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface.

H. Vapor retarders

I. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with longitudinal and end seams staggered.

E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

F. Keep insulation materials dry during application and finishing.

G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

H. Apply insulation with the least number of joints practical.

I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

L. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Seal insulation to roof flashing with vapor-retarder mastic.

P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

R. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.

1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
    c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.

4. Impale insulation over anchors and attach speed washers.
5. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
7. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.
8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Space anchor pins as follows:

    a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
    c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not over compress insulation during installation.

4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.6 FINISHES

A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket. See Division 23 Section “Materials and Methods.”

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect/Engineer. Vary first and second coats to allow visual inspection of the completed Work.

3.7 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

C. Insulate the following plenums and duct systems:

1. Indoor concealed supply-, return-, and outside-air ductwork.
2. Indoor exposed outside-air ductwork.
3. Outdoor exposed supply and return ductwork.
4. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
5. Fibrous-glass ducts.
6. Metal ducts with duct liner.
7. Factory-insulated flexible ducts.
8. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
9. Flexible connectors.
10. Vibration-control devices.
11. Testing agency labels and stamps.
12. Nameplates and data plates.

3.8 Access panels and doors in air-distribution systemsSupply and return ducts exposed in finished spaces unless indicated to be insulated in application schedule.INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Rectangular and round, supply and return air ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 1-1/2 inches.
3. Number of Layers: One.
4. Jacket: FSK.
5. Vapor Retarder Required: Yes.

B. Service: Round, outside-air ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 1-1/2 inches].
3. Number of Layers: One.
4. Jacket: FSK.
5. Vapor Retarder Required: Yes.

C. Service: Rectangular, outside-air ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 1-1/2 inches.
3. Number of Layers: One.
4. Jacket: FSK.
5. Vapor Retarder Required: Yes.

D. Outdoor duct roof application schedule

E. Service: Rectangular, supply-air ducts.

1. Material: Lined galvanized ductwork.
2. Thickness: 2 inches.
3. Number of Layers: One.
4. Jacket: None.
5. Vapor Retarder Required: Yes.

F. Service: Rectangular, outside-air and return-air ducts.

1. Material: Lined galvanized ductwork.
2. Thickness: 2 inches.
3. Number of Layers: One.
4. Jacket: None.
5. Vapor Retarder Required: Yes.

END OF SECTION

SECTION 23 11 23

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping and tubing joining materials.
3. Valves.
4. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: .

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

D. ACTION SUBMITTALS

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

F. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

2.2 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

2.3 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

B. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lee Brass Company.
b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.4 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller.

2.5 DIELECTRIC UNIONS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.

c. Hart Industries International, Inc.
d. Jomar International Ltd.
e. Matco-Norca, Inc.
f. McDonald, A. Y. Mfg. Co.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.6 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Install fittings for changes in direction and branch connections.

C. INDOOR PIPING INSTALLATION

D. Comply with NFPA 54 for installation and purging of natural-gas piping.

E. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

F. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

G. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

J. Locate valves for easy access.

K. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and branch connections.

N. Verify final equipment locations for roughing-in.

O. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

P. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

Q. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

R. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

S. Connect branch piping from top or side of horizontal piping.

T. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.

U. Do not use natural-gas piping as grounding electrode.

3.2 VALVE INSTALLATION

A. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.3 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.

2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.4 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements for pipe hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

3.5 CONNECTIONS

A. Install piping adjacent to appliances to allow service and maintenance of appliances.

B. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

C. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.6 LABELING AND IDENTIFYING

A. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for piping and valve identification.

3.7 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

B. Natural-gas piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 OUTDOOR PIPING SCHEDULE

A. Aboveground natural-gas piping shall be the following:

1. Painted with appropriate paint type for steel pipe with malleable-iron fittings and threaded joints.

3.9 INDOOR PIPING SCHEDULE

A. Aboveground, distribution piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

3.10 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:

1. Bronze plug valve.

B. Valves in branch piping for single appliance shall be one of the following:

1. Bronze plug valve.

END OF SECTION

SECTION 23 31 13

METAL DUCT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS ECTION INCLUDES

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

1.2 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg. Metal ducts include the following:

1. Rectangular ducts and fittings.
2. Single-wall, round spiral-seam ducts and formed fittings.
3. Duct liner.

B. Related Sections include the following:

C. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

D. Comply with 2013 CBC and SMACNA 3rd Edition 2008 (Seismic Hazard Level A) for Seismic Requirements.

E. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C168. In this Section, these values are the result of the formula Btu x in./h x sq. ft. x deg F or W/m x K at the temperature differences specified. Values are expressed as Btu or W.

1. Example: Apparent Thermal Conductivity (k-Value): 0.25 or 0.037.

F. Pressure – Velocity Classification for Ductwork: As defined by SMACNA Duct Construction Standards – Metal and Flexible (latest edition), and applicable codes. Pressure classification for this specification:

1. Low Pressure: Maximum 2500 FPM velocity; maximum 2.0 inches WG positive or -2.0 inches WG negative static pressure class.
2. Medium Pressure: Maximum 4000 FPM velocity; maximum 4 inches WG positive or -3.0 inches WG or greater negative static pressure class.
3. Gauge:
4. Steel Sheet: U.S. Standard gauge.
5. Aluminum Sheet: Brown & Sharpe schedule.
6. Steel Wire: Washburn & Moen gauge.

G. Concealed Insulated Surfaces: Piping, ductwork and equipment located in walls, partitions, floors, chases, shafts, alleyways, and above ceilings.

H. Exposed Insulated Surfaces: Piping, ductwork and equipment located in mechanical rooms, tunnels and rooms without suspended ceilings.

1.3 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect/Engineer. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.4 SUBMITTALS

A. Other systems installed in same space as ducts.

B. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.

C. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Welding certificates.

E. Duct leakage test reports.

1.5 QUALITY ASSURANCE

A. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 DUCT LINER

A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.

1. Manufacturers:

a. CertainTeed Corp.; Insulation Group.
b. Johns Manville International, Inc.
c. Knauf Fiber Glass GmbH.
d. Owens Corning.

2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.

a. Thickness: 1 inch.
b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
e. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

B. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems. Comply with ASTM C665, ASTM C1138 and ASTM G21 for Fungi Resistance. Comply with ASTM G22 for bacteria resistance.

2.4 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

C. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

D. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.

E. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

F. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Hanger Materials: Galvanized sheet steel or threaded steel rod.
2. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
3. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
4. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

B. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

C. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

2.6 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Prefabricated Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Nexus Inc.
c. Ward Industries, Inc.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Lockformer.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

E. Low Pressure Ductwork: Construct all ductwork using galvanized steel except as indicated.

1. Seams and Joints: Longitudinal seams shall be Pittsburgh lock, grooved seams or button punch snap lock. Transverse joints shall be drive slip. Joints 36-inch size and larger shall be manufactured duct joining system with downset corners, no-bolt design, or SMACNA T-25 formed on flanges with corner and cleat. Contractor option on smaller sizes.

F. Medium Pressure Duct: Construct all ductwork using galvanized steel except as indicated.

G. Seams and Joints: Longitudinal seams shall be grooved seam type with sealant and center punched at 12-inch maximum intervals or Pittsburgh lock with sealant. Transverse joints shall be flanged and gasketed manufactured duct joining system with downset, bolted corner.Round duct and fitting fabrication

H. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

I. Round, Longitudinal- and Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

J. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

    a. Manufacturers:

        1) Lindab Inc.

K. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

L. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

M. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:

    a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
    b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
    c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
    d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
    e. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
    f. Ducts 3 to 26 Inches in Diameter: 0.034 inch.
    g. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
    h. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
    i. Ducts 62 to 84 Inches in Diameter: 0.064 inch.

j. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.

3. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
4. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
5. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
6. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
7. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
8. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION

A. Field measure to determine exact conditions.

B. Coordinate routing with all other trades to establish space requirements for each.

C. Determine that equipment and ductwork will fit available space.

D. DUCT APPLICATIONS

E. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Supply Ducts: 2-inch wg.
2. Return Ducts (Negative Pressure): 1-inch wg.
3. Exhaust Ducts (Negative Pressure): 2-inch wg.
4. Duct installation

F. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.

G. Construct and install each duct system for the specific duct pressure classification indicated.

H. Install round and flat-oval ducts in lengths not less than 12 feet, unless interrupted by fittings.

I. Install ducts with fewest possible joints.

J. Install fabricated fittings for changes in directions, changes in size and shape, and connections.

K. Install couplings tight to duct wall surface with a minimum of projections into duct.

L. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.

M. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

N. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

O. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.

P. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

Q. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

R. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.

S. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Firestopping."

T. Verify location of air outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement. Refer to reflected ceiling plans, finish schedule, material finish specification, and shop drawings.

U. Coordinate routing with all other trades to establish space requirements for each.

V. Contractor may vary route and shape of ductwork and make offsets during progress of work if required to meet structural or other interferences. Where such changes impair the system performance, the changes will be corrected at Contractor’s expense.

W. All ductwork shall be substantially and neatly supported on galvanized steel straps or angles riveted or bolted to duct flanges and properly anchored to the construction so that horizontal ducts are without sag or sway, vertical ducts are without buckle, and all ducts are free from the possibility of deformation, collapse or vibration. Supports in corrosive environments shall be stainless steel except aluminum ductwork shall have aluminum supports.

X. Openings required for ductwork through structural elements in new construction shall be coordinated with the General Contractor. Shop drawings locating such openings shall be prepared in ample time to meet the construction schedule.

Y. Provide sleeves at all duct penetrations through walls, floors and roofs. Openings through sound-rated partitions shall have annular space stuffed with fiberglass insulation for full thickness of wall.

Z. HVAC Instrumentation and ControlsPrevent passage of unfiltered air around filters with felt, rubber, neoprene gaskets, or other approved safing material.

AA. Provide openings in ductwork to accommodate thermometers and controllers. Provide pitot tube openings for testing of systems, complete with metal cap with spring device or screw to prevent air leakage.

BB. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

CC. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system. Keep openings covered until ready for continuing duct run or final connections.

DD. Change duct sizes gradually, not exceeding 30 degrees (15 degrees ideally) divergence and 45 degrees (30 degrees ideally) convergence.

EE. Use crimp joints with or without bead for joining round duct sizes 8 inches and smaller and install with crimp in direction of air flow.

FF. Provide closure flanges around exposed ductwork at wall and ceiling penetrations, 1-1/4 inches wide minimum.

GG. Provide light baffle plate above all ceiling-mounted plenum return air grilles. Plate to be 6 inches larger than the grille on all sides and shall be supported 6 inches above grille. Paint underside matte black.

HH. Provide flexible connect between ductwork and all moving equipment.

II. Provide enclosure of two layers of 5/8 inch drywall around supply and return ductwork, leaving rooftop air conditioner. Enclosure shall extend 3 feet beyond roof penetration and shall be supported independent of ductwork.

JJ. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems".

KK. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction".

LL. Incidental work:

1. The following incidental work shall be furnished by the Contractor under the supervision of the Temperature Control Contractor:

   a. The Air Distribution Contractor shall install all automatic dampers furnished by the Temperature Control Contractor.
   b. The Air Distribution Contractor shall provide necessary blank-off plates (safing) required to install dampers that are smaller than duct size.
   c. The Air Distribution Contractor shall assemble multiple section automatic dampers, furnished by the Temperature Control Contractor, with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper actuators.
   d. The Air Distribution Contractor shall provide necessary sheet metal baffle plates to eliminate stratification while providing air volumes specified. Locate baffles by experimentation and affix and seal permanently in place only after stratification has been eliminated.
   e. The Air Distribution Contractor shall provide access doors or other approved means of access through ducts for service to control equipment.

3.2 SEAM AND JOINT SEALING

A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible".

B. Ducts shall be sealed as follows:

1. Low Pressure Ductwork: SMACNA Seal Class "C"
2. Medium Pressure Ductwork: SMACNA Seal Class "B"

3.3 HANGING AND SUPPORTING

A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

C. Support vertical ducts at a maximum interval of 16 feet and at each floor.

D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

E. Install concrete inserts before placing concrete.

F. Connections

G. Connect equipment with flexible connectors according to Division 23 Section "Duct Accessories."

H. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible".

3.4 DUCT LEAKAGE TESTING

A. General: Perform duct leakage testing to assure that duct construction and joint sealing methods have been followed. Submit leakage test on SMACNA "Air Duct Leakage Test Summary" report form as found in SMACNA "HVAC Air Duct Leakage Test Manual, First Edition, 1985". Form shall be completed in full, signed by individual performing the test, and witnessed by the Project Inspector.

B. Conduct tests at static pressure equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

C. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Disconnect flexible ducts as needed for cleaning and inspection.
2. Remove and reinstall ceiling sections to gain access during the cleaning process.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
2. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
3. Coils and related components.
4. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
5. Supply-air ducts, dampers, actuators, and turning vanes.

E. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

1. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
2. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
3. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

F. Where contaminants are discovered, re-clean and re-inspect ducts.

3.5 FILTER REPLACEMENT

A. All air filters shall be replaced with new prior to balancing.

3.6 ADJUSTING

A. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.

B. Refer to Division 23 Section “Testing, Adjusting, and Balancing” for detailed procedures.

END OF SECTION

SECTION 23 33 00

DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 SUMMARY

A. This Section includes the following:

1. Back draft dampers.
2. Volume dampers.
3. Turning vanes.
4. Duct-mounting access doors.
5. Flexible connectors.
6. Duct accessory hardware.

B. Submittals

C. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Turning vanes.
4. Duct-mounting access doors.
5. Flexible connectors.
6. Duct accessory hardware.

D. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.
2. Manual-volume damper installations.
3. Wiring Diagrams: Power, signal, and control wiring.

E. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.4 EXTRA STOCK

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

D. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. Duro Dyne Corp.
3. Greenheck.
4. Penn Ventilation Company, Inc.
5. Ruskin Company.

B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners and mounting flange.

D. Blades: 0.025-inch- thick, roll-formed aluminum.

E. Blade Seals: Vinyl.

F. Blade Axles: Nonferrous.

G. Bearings: Synthetic.

H. Tie Bars and Brackets: Galvanized steel.

I. Return Spring: Adjustable tension.

2.4 VOLUME DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. McGill AirFlow Corporation.
3. Nailor Industries Inc.
4. Ruskin Company.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Bearings: Oil-impregnated bronze.
5. Tie Bars and Brackets: Galvanized steel.

D. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: U-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Bearings: Oil-impregnated bronze thrust or ball.
5. Blade Seals: Vinyl.
6. Jamb Seals: Cambered stainless steel.
7. Tie Bars and Brackets: Galvanized steel.

E. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.

1. Manufacturers:

   a. Ductmate Industries, Inc.
   b. Duro Dyne Corp.
   c. METALAIRE, Inc.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.6 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Manufacturers:

   a. Flexmaster U.S.A., Inc.
   b. McGill AirFlow Corporation.
   c. Nailor Industries Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

   a. Less Than 12 Inches Square: Secure with two sash locks.
   b. Up to 18 Inches Square: Two hinges and two sash locks.
   c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
   d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.

1. Manufacturers:

   a. Flexmaster U.S.A., Inc.

2. Frame: Galvanized sheet steel, with spin-in notched frame.

2.7 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Duro Dyne Corp.
2. Ventfabrics, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.8 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, UV Resistant, waterproof, and resistant to gasoline and grease.

2.9 ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, UV Resistant, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

C. Provide test holes at fan inlet and outlet and elsewhere as indicated and required for testing and balancing purposes.

D. Final connections to diffusers, troffer boots, and terminal units may be made with flexible ductwork. Expanded length of flexible ductwork shall not exceed 36 inches. Path of flexible ductwork shall not exceed 45 degrees.

E. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

F. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

G. Provide fire and smoke dampers at locations indicated and where required by applicable codes. Install with required perimeter mounting angels, sleeves, breakaway duct connections, corrosion-resistant springs, bearings, bushings and hinges per NFPA 90A. Follow manufacturer's installation instructions to meet UL listing requirements for damper manufacturer, damper type and application. Coordinate dampers with Electrical/Fire Alarm Contractor who will wire smoke and combination fire and smoke dampers.

H. Provide supply and return smoke dampers on air handling units 15,000 cfm and larger as required by NFPA 90A. Dampers shall be controlled by Temperature Control Contractor.

I. Provide flexible connections to motor driven air moving equipment. Secure fabric to duct or fan collar with 3/16-inch rivets spaced not more than 5 inches o.c. Provide thrust restraints and other devices so that connections are not in tension with equipment running or off. Air handling units with internally isolated fans need not have flexible connections.

J. Provide duct access doors for inspection and cleaning before filters, coils, fans, at automatic control dampers, fire dampers, smoke dampers, and as indicated. Doors shall allow adequate access to inspect and maintain equipment and devices, minimum 12-inch by 12-inch size unless conditions do not allow; 18 inches by 18 inches for shoulder access. Do not obstruct path to access doors with piping, etc. Provide ceiling access doors in ceilings other than lay-in type.

    1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
    2. Install access panels on side of duct where adequate clearance is available.

K. On air handling units 15,000 cfm and larger, provide positive pressure relief door between supply fan and supply smoke damper and negative pressure relief door between return smoke damper and air handling unit. Doors shall be sized for one square foot per 4,000 cfm supply volume.

L. Volume dampers located above non-removable ceilings shall be installed vertically with Young Regulator No. 301 or equal concealed damper regulators.

M. Provide turning vanes in all mitered duct turns.

N. Provide volume dampers at branch duct take-off to diffusers and registers.

O. Label access doors according to Division 23 Section "Identification for HVAC".

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION

SECTION 23 41 00

AIR FILTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARYSECTION INCLUDES

A. This Section includes factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications.

1.3 SUBMITTALS

A. Product Data: Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

B. Shop Drawings: Include plans, elevations, sections, and details to illustrate component assemblies and attachments.

1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air filters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Comply with all Division of State Architect Requirements.

C. Comply with ARI 850.

D. Comply with ASHRAE 52.2 for method of testing and rating air-filter units.

E. Comply with NFPA 90A and NFPA 90B.

1.5 EXTRA MATERIALSSTOCK

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide one complete set of filters for each filter bank or individual rooftop unit.
2. Products

1.6 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Filters, Electrostatic Air Cleaners, and Filter-Holding Systems:

a. Farr Co.
b. Flanders/CSC Corp.
c. International Air Filtration Corporation.
d. Extended-surface, disposable panel filters

C. Description: Factory-fabricated, dry, extended-surface filters with holding frames.

D. Media: 100 % synthetic electrostatically charged material formed into deep-V-shaped pleats and held by self-supporting wire grid.

E. Media and Media-Grid Frame: Nonflammable cardboard.

F. Execution

1.7 INSTALLATION

A. Install filter frames according to manufacturer's written instructions.

B. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

C. Install filters in position to prevent passage of unfiltered air.

D. Cleaning

E. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION

SECTION 23 81 19

ROOFTOP AIR CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following rooftop air conditioners:

1. Cooling and heating units 6 tons and smaller.
2. Cooling and heating units 7-1/2 to 20 tons.
3. Cooling and heating units larger than 20 tons.

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Prepare the following by or under the supervision of a qualified professional engineer:

1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that rooftop air conditioners, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For rooftop air conditioners to include in emergency, operation, and maintenance manuals, as specified in Division 23 Section “Basic Mechanical Materials and Methods”.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of rooftop air conditioners and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

D. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

E. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

F. Comply with NFPA 54 for gas-fired furnace section.

G. ARI Certification: Units shall be ARI certified and listed.

H. ARI Compliance for Units with Capacities Less Than 65,000 Btuh: Rate rooftop air-conditioner capacity according to ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment."

1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

I. ARI Compliance for Units with Capacities from 65,000 to 250,000 Btuh : Rate rooftop air-conditioner capacity according to ARI 340/360, "Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment."

1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in 23 Section “Basic Mechanical Materials and Methods”.

C. Coordinate size, location, and installation of rooftop air-conditioner manufacturer’s roof curbs and equipment supports with roof installer.

1. Coordinate installation of restrained vibration isolation roof-curb rails.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of rooftop air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.
5. Warranty Period for Variable-Speed Fan Motors: Manufacturer's standard, but not less than three years from date of Substantial Completion.
6. Warranty Period for Electronic Thermostats: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set for each belt-drive fan.
2. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 ROOFTOP AIR CONDITIONERS 6 TONS AND SMALLER

A. Manufacturers:

1. Trane Corp.

B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.

C. Casing: Galvanized-steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch- thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.

D. Indoor Fan: Forward curved, centrifugal, directly driven by multispeed or belt driven by single-speed motor based on scheduled performance.

E. Outside Coil Fan: Propeller type, directly driven by motor.

F. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

G. Compressor: Scroll compressor with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief, and crankcase heater.

H. Refrigeration System:

1. Compressor.
2. Outside coil and fan.
3. Indoor coil and fan.
4. Expansion valve with replaceable thermostatic element.
5. Refrigerant dryer.
6. High-pressure switch.
7. Low-pressure switch.
8. Thermostat for coil freeze-up protection during low-ambient temperature operation or loss of air.
9. Low-ambient switch.
10. Brass service valves installed in discharge and liquid lines.
11. Charge of refrigerant.

I. Filters: 2-inch- thick, fiberglass, pleated, throwaway filters in filter rack complying with all DSA Requirements.

J. Demand Control Ventilation: Units shall be provided with unit mounted CO2 sensors and all necessary hardware to provide in conjunction with economizer function fully operable DCV (Demand Control Ventilation System). As required, unit manufacturer will provide remote sensors in classroom only if unit cannot be equipped with return duct mounted CO2 sensors and control capability. Otherwise field wiring by mechanical contractor as required.

K. Heat Exchanger: Stainless-steel construction for natural-gas-fired burners with the following controls:

1. Redundant single or dual gas valve with manual shutoff.
2. Direct-spark pilot ignition.
3. Electronic flame sensor.
4. Induced-draft blower.
5. Flame rollout switch.

L. Economizer: Return- and outside-air dampers with neoprene seals, outside-air filter, and hood.

1. Damper Motor: Fully modulating spring return with adjustable minimum position.
2. Control: Electronic-control system uses mixed-air temperature and selects between outside-air and return-air enthalpy to adjust mixing dampers.
3. Relief Damper: Gravity actuated with bird screen and hood.

M. Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker, remote power exhaust shall be powered independent, coordinate all requirement with electrcial contractor to include full necessary scope of work for installation.

N. Unit Controls: Solid-state control board and components contain at least the following features:

1. Indoor fan on/off delay.
2. Default control to ensure proper operation after power interruption.
3. Service relay output.
4. Unit diagnostics and diagnostic code storage.
5. Field-adjustable control parameters.
6. Economizer control.
7. Gas valve delay between first- and second-stage firing.
8. Indoor-air quality control with carbon dioxide sensor.
9. Low-ambient control, allowing operation down to 0 deg F.
10. Minimum run time.
11. Night setback mode.
12. Return-air temperature limit.
13. Smoke alarm with smoke detector installed in supply and return air.
14. Low-refrigerant pressure control.
15. Digital display of outside temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

O. DDC: On units provided with Carrier Premiere Link System, the unit shall be provided with stand alone DDC control module. Contractor shall remove from replaced unit Carrier Premiere Link module and rewire completely to the new unit and to existing DDC Network. Control module provided with unit shall be fully programmed and compatible with temperature-control system at the existing campus. Rewire all new wiring between unit and existing replaced thermostats within building, at each unit. Systems shall be fully functional.

P. Thermostats:

1. On units provided with Carrier Premiere Link System, interface shall be provide to replacement thermostats provided by mechanical contractor and rewired to new systems with all integral or field mounted control boards required to communicate between RTU manufacturer and building Carrier Systems.

2. On units not connected to the Carrier Premiere Link Systems, mechanical contactor shall provide all new WIFI 2.4 Ghz Venstar 2900SCH Classroom thermostat. Contractor shall configure all new thermostats to communicate on District local WIF system.

Q. Optional Accessories:
1. Service Outlets: Two, 115-V, ground-fault, circuit-interrupter type.
2. Condensate drain trap.
3. Dirty-filter switch.

R. Roof Curb: Roof curb is existing to re-use. Unit may require special adapter. See plans for individual unit requirements.

S. Horizontal Discharge Roof Curb (Where Required): Steel with corrosion-protection coating, insulation, gasketing, and factory-installed wood nailer, and configured to convert from downflow to horizontal airflow; complying with NRCA standards; minimum height of 26 inches. Isolation Curb: Rigid upper and lower steel structure with vibration isolation springs having 2-inch static deflection and vertical and horizontal restraints; with elastomeric waterproof membrane.

2.2 ROOFTOP AIR CONDITIONERS 7-1/2 TO 25 TONS

A. Manufacturers:

1. Trane Corp.

B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.

C. Casing: Galvanized-steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch- thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.

D. Indoor Fan: Forward curved, centrifugal, belt driven with adjustable motor sheaves, grease-lubricated ball bearings, and motor.

E. Outside Coil Fan: Propeller type, directly driven by permanently lubricated motor.

F. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

G. Compressor(s): One or two scroll compressors with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief, and crankcase heater(s).

H. Refrigeration System:

1. Compressor(s).
2. Outside coil and fan.
3. Indoor coil and fan.
4. Check valves.
5. Expansion valves with replaceable thermostatic elements.
6. Refrigerant dryers.
7. High-pressure switches.
8. Low-pressure switches.
9. Thermostats for coil freeze-up protection during low-ambient temperature operation or loss of air.
10. Independent refrigerant circuits.
11. Brass service valves installed in discharge and liquid lines.
12. Charge of refrigerant.
13. Timed Off Control: Automatic-reset control shuts compressor off after five minutes.

I. Filters: 2-inch- thick, fiberglass, pleated, throwaway filters in filter rack complying with all DSA Requirements.

J. Demand Control Ventilation: Units shall be provided with unit mounted CO2 sensors and all necessary hardware to provide in conjunction with economizer function fully operable DCV (Demand Control Ventilation System). As required, unit manufacturer will provide remote sensors in classroom only if unit cannot be equipped with return duct mounted CO2 sensors and control capability. Otherwise field wiring by mechanical contractor as required.

K. Heat Exchanger: Stainless-steel construction for natural-gas-fired burners with the following controls:

1. Redundant single or dual gas valve with manual shutoff.
2. Direct-spark pilot ignition.
3. Electronic flame sensor.
4. Induced-draft blower.
5. Flame rollout switch.

L. Economizer: Return- and outside-air dampers with neoprene seals, outside-air filter, and hood.

1. Damper Motor: Fully modulating spring return with adjustable minimum position.
2. Control: Electronic-control system uses mixed-air temperature and selects between outside-air and return-air enthalpy to adjust mixing dampers.
3. Relief Damper: Gravity actuated with bird screen and hood.

M. Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.

N. Unit Controls: Solid-state control board and components contain at least the following features:

1. Indoor fan on/off delay.
2. Default control to ensure proper operation after power interruption.
3. Service relay output.
4. Unit diagnostics and diagnostic code storage.
5. Field-adjustable control parameters.
6. Economizer control.
7. Gas valve delay between first- and second-stage firing.
8. Indoor-air quality control with carbon dioxide sensor.
9. Low-ambient control, allowing operation down to 0 deg F.
10. Minimum run time.
11. Night setback mode.
12. Return-air temperature limit.
13. Smoke alarm with smoke detector installed in supply and return air.
14. Low-refrigerant pressure control.

15. Digital display of outside temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

O. DDC: Unit shall be provided with stand alone DDC control module. Contractor shall remove from replaced unit Carrier Premiere Link module and rewire completely to the new unit and to existing DDC Network. Control module provided with unit shall be fully programmed and compatible with temperature-control system at the existing campus. Rewire all new wiring between unit and existing replaced thermostats within building, at each unit. Systems shall be fully functional.

P. Thermostats:

1. On units provided with Carrier Premiere Link System, interface shall be provide to replacement thermostats provided by mechanical contractor and rewired to new systems with all integral or field mounted control boards required to communicate between RTU manufacturer and building Carrier Systems.

2. On units not connected to the Carrier Premiere Link Systems, mechanical contactor shall provide all new WIFI 2.4 Ghz Venstar 2900SCH Classroom thermostat. Contractor shall configure all new thermostats to communicate on District local WIF system.

Q. Optional Accessories:

1. Service Outlets: Two, 115-V, ground-fault, circuit-interrupter type.
2. Condensate drain trap.
3. Dirty-filter switch.
4. Power exhaust fan. See plans for individual unit requirements.

R. Roof Curb: Roof curb is existing to re-use. Unit may require special adapter curb. See plans for individual unit requirements.

S. Horizontal Discharge Roof Curb (Where Required): Steel with corrosion-protection coating, insulation, gasketing, and factory-installed wood nailer, and configured to convert from downflow to horizontal airflow; complying with NRCA standards; minimum height of 26 inches. Isolation Curb: Rigid upper and lower steel structure with vibration isolation springs having 2-inch static deflection and vertical and horizontal restraints; with elastomeric waterproof membrane.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances. Install according to ARI Guideline B.

B. Curb Support: . Install and secure rooftop air conditioners on the existing roof curbs and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts. Unit may require special roof curb adapter. See plans for individual unit requirements.

C. Isolation Curb Support: Install units on the existing isolation curbs according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." In the case of unit may require special roof curb adapter, the existing spring isolation base will be removed. See plans for individual unit requirements

3.2 CONNECTIONS

A. Install piping adjacent to machine to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in Division 23 Section "Fuel Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

B. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination in roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to rooftop unit with flexible duct connectors specified in Division 23 Section “Duct Accessories.”
4. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- thick, acoustic duct liner.
5. Provide flexible connection between ductwork and rooftop unit.

C. Electrical System Connections: Comply with applicable requirements in Division 23 Sections for power wiring, switches, and motor controls.

D. Ground equipment according to Division 26 Section "Grounding and Bonding."

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field quality-control tests and inspections and prepare test reports:

1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove malfunctioning units, replace with new units, and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.

8. Verify that filters are installed.
9. Clean outside coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Adjust vibration isolators.
13. Inspect operation of barometric dampers.
14. Lubricate bearings on fan.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system in summer only.
    b. Complete startup sheets and attach copy with Contractor's startup report.

18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency. Adjust pilot to stable flame.

    a. Measure gas pressure on manifold.
    b. Measure combustion-air temperature at inlet to combustion chamber.
    c. Measure flue-gas temperature at furnace discharge.
    d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outside-air, dry-bulb temperature.
    d. Outside-air-coil, discharge-air, dry-bulb temperature.

25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outside-air intake volume.

27. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through outside coil or from outside coil to outside-air intake.

28. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:

    a. High-limit heat exchanger.
    b. Warm-up for morning cycle.
    c. Freezestat operation.
    d. Economizer to limited outside-air changeover.
    e. Alarms.

29. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners. Refer to Division 23 Section “General Mechanical Requirements”.

END OF SECTION

SECTION 26 01 00

ELECTRICAL GENERAL PROVISIONS

ARTICLE 1 SUMMARY

1.1 This Division of the specification outlines the provisions of the contract work to be performed under this Division.

1.2 This Section applies to and forms a part of each section of specifications in Division 26 and all work performed under the electrical and communications contracts.

1.3 In addition, work in this Division is governed by the provisions of the bidding requirements, contract forms, general conditions and all sections under general requirements.

1.4 These specifications contain statements which may be more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions.

1.5 Where the words 'provide' or 'provision' are used, it shall be definitely interpreted as 'furnishing and installing complete in operating condition'. Where the words 'as indicated' or 'as shown' are used, it shall mean as shown on contract drawings.

1.6 Where items are specified in the singular, this Division shall provide the quantity as shown on drawings plus any spares or extras mentioned on drawings or specifications. All specified and supplied equipment shall be new.

ARTICLE 2 CONTRACTOR QUALIFICATIONS

2.1 The Contractor shall have a current California C-10 Electrical Contractor’s license and all individuals working on this project shall have passed the Department of Industrial Relations Division of apprenticeship Standards – “Electrician Certification Program.”

ARTICLE 3 CODES, PERMITS AND FEES

3.1 Comply with all applicable laws, ordinances, rules, regulations, codes, or rulings of governmental units having jurisdiction as well as standards of NFPA, and serving utility requirements.

3.2 Obtain permits, fees, inspections, meter and the like, associated with work in each section of this Division.

3.3 Installation procedures, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Act (OSHA).

ARTICLE 4 EXAMINATION OF PREMISES

4.1 Examine the construction drawings and premises prior to bidding. No allowances will be made for not being knowledgeable of existing conditions.

ARTICLE 5 STANDARDS

5.1 The following standard publications of the latest editions enforced and supplements thereto shall form a part of these specifications. All electrical work must, as a minimum, be in accordance with these standards.

5.1.1 2019 California Electrical Code (CEC), Part 3 Title 24 CCR.
5.1.2 National Fire Protection Association.
5.1.3 Underwriters' Laboratories, Inc. (UL).
5.1.4 Certified Ballast Manufacturers' Association (CBM).
5.1.5 National Electrical Manufacturers' Association (NEMA).

5.1.6 Institution of Electrical & Electronics Engineers (IEEE).
5.1.7 American Society for Testing & Materials (ASTM).
5.1.8 National Board of Fire Underwriters (NBFU).
5.1.9 National Board of Standards (NBS).
5.1.10 American National Standards Institute (ANSI).
5.1.11 Insulated Power Cable Engineers Association (IPECS).
5.1.12 Electrical Testing Laboratories (ETL).
5.1.13 National Electrical Safety Code (NESC).
5.1.14 2019 California Building Code (CBC), Part 2, Title 24 CCR.
5.1.15 2019 California Fire Code (CFC), Part 9, Title 24, CCR.
5.1.16 2016 NFPA 72 with California State Amendments
5.1.17 National Electrical Testing Association (NETA), 2010 or most current

ARTICLE 6 DEFINITIONS

6.1 Concealed: Hidden from sight, as in trenches, chases, hollow construction, or above furred spaces, hung ceilings - acoustical or plastic type, or exposed to view only in tunnels, attics, shafts, crawl spaces, unfinished spaces, or other areas solely for maintenance and repair.

6.2 Exposed, Non-Concealed, Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel, a room noted on the 'finish schedule' with exposed and unpainted construction for walls, floors, or ceilings or specifically mentioned as 'unfinished'.

6.3 Finish Space: Any space ordinarily visible, including exterior areas.

ARTICLE 7 WORK AND MATERIALS

7.1 Unless otherwise specified, all materials must be new and of the best quality. Materials previously incorporated into other projects, salvaged, or refurbished are not considered new. Perform all labor in a thorough and workmanlike manner.

7.2 All materials provided under the contract must bear the UL label where normally available. Note that this requirement may be repeated under equipment specifications. In general, such devices as will void the label should be provided in separate enclosures and wired to the labeled unit in proper manner.

ARTICLE 8 SHOP DRAWINGS AND SUBMITTALS

8.1 Submit shop drawings and all data in accordance with Division 1 of these specifications and as noted below for all equipment provided under this Division.

8.2 Shop drawings submittals demonstrate to the Architect that the Contractor understands the design concept. The Contractor demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods of material and equipment he intends to use. If deviations, discrepancies, or conflicts between submittals and specifications are discovered either prior to or after submittals are processed, notify the Architect immediately.

8.3 Manufacturer’s data and dimension sheets shall be submitted giving all pertinent physical and engineering data including weights, cross sections and maintenance instructions. Standard items of equipment such as receptacles, switches, plates, etc., which are cataloged items, shall be listed by manufacturer.

8.4 Index all submittals and reference them to these specifications. All submittal items shall be assembled and submitted, one for each specification section. (Multiple specification sections may be grouped together in one common submittal binder, as long as each individual section is clearly identified.) Partial or incomplete submittal sections will not be reviewed.

ARTICLE 9 EQUIPMENT PURCHASES

9.1 Arrange for purchase and delivery of all materials and equipment within 20 days after approval of submittals. All materials and equipment must be ordered in ample quantities for delivery at the proper time. If items are

not on the project in time to expedite completion, the Owner may purchase said equipment and materials and deduct the cost from the contract sum.

9.2 Provide all materials of similar class or service by one manufacturer.

ARTICLE 10 COOPERATIVE WORK

10.1 Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration.

10.2 Cooperative work includes: General supervision and responsibility for proper location and size of work related to this Division, but provided under the other sections of these specifications, and installation of sleeves, inserts, and anchor bolts for work under each section in this Division.

ARTICLE 11 VERIFICATION OF DIMENSIONS

11.1 Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions, etc., and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

11.2 Drawings are essentially diagrammatic, and many offsets, bends, pull boxes, special fittings, and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact location, routes, building obstructions, etc. and install apparatus and equipment in manner and locations to avoid obstructions, preserve headroom, keep openings and passageways clear, and maintain proper clearances.

ARTICLE 12 CUTTING AND PATCHING

12.1 All cutting and patching shall be in accordance with Division 1 of these specifications and as noted below.

12.2 Cut existing work and patch as necessary to properly install new work. As the work progresses, leave necessary openings, holes, chases, etc., in their correct location. If the required openings, holes, chases, etc., are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members including wall framing without the consent of the Architect.

ARTICLE 13 CLOSING-IN OF UNINSPECTED WORK

13.1 Cover no work until inspected, tested, and approved by the Architect. Where work is covered before inspection and test, uncover it and when inspected, tested, and approved, restore all work to original proper condition at no additional cost to Owner.

ARTICLE 14 EXCAVATION AND BACKFILL

14.1 All excavation and backfill shall be in accordance with Division 1 of these specifications and as noted below.

14.2 Perform all necessary excavation, shoring, and backfilling required for the proper laying of all conduits inside the building and premises, and outside as may be necessary.

14.3 Excavate all trenches open cut, keep trench banks as nearly vertical as practicable, and sheet and brace trenches where required for stability and safety. Excavate trenches true to line and make bottoms no wider than necessary to provide ample work room. Grade trench bottoms accurately. Machine grade only to the top line of the conduits, doing the remainder by hand. Do not cut any trench near or under footings without first consulting the Architect. All trenches shall be done in accordance with OSHA standards and regulations.

14.4 Backfilling shall be done with each layer compacted before another layer is added. No stones or coarse lumps shall be laid directly on a conduit or conduits.

14.5 Trenches shall be filled with the specified material. Sod, if any, shall be removed in cut sections and replaced in same manners.

14.6 Provide pumps and drainage of all open trenches for purposes of installing electrical duct and wiring.

14.7 Perform all backfilling in accordance with the requirements of and under the direction of the Geotechnical Engineer.

14.8 Where new underground trenching is required on sites or in any area where existing underground utilities exist, the Contractor shall provide an independent professional utility locating service to locate exact vertical and horizontal locations of all existing utilities. Where existing utilities are found the Contractor shall hand dig those areas to avoid disruption. The Contractor shall be responsible for immediate repairs to existing underground utilities damaged during construction. The Contractor shall repair all existing asphalt, concrete and landscape surfaces damaged or removed during construction to match their original conditions. Where trenching extends through public streets or roadways, the Contractor shall notify underground service alert in addition to the independent locating service 48 hours before start of construction to determine location of existing utilities by calling (800) 422-4133.

ARTICLE 15 CONCRETE

15.1 Where used for structures to be provided under the contract such as bases, etc., concrete work, and associated reinforcing shall be as specified under Division 3 of these specifications.

15.2 See other sections for additional requirements for underground vaults, cable ducts, etc.

ARTICLE 16 ACCESSIBILITY

16.1 Install all control devices or other specialties requiring reading, adjustment, inspection, repairs, removal, or replacement conveniently and accessibly throughout the finished building.

16.2 All required access doors or panels in walls and ceilings are to be furnished and installed as part of the work under this Section. Refer to Division 1 of these specifications and as noted below.

16.3 Where located in fire rated assemblies, provide doors which match the rating of the assembly and are approved by the jurisdictional authority.

16.4 Refer to 'finish schedule' for types of walls and ceilings in each area and the architectural drawings for rated wall construction.

16.5 Coordinate work of the various sections to locate specialties requiring accessibility with others to avoid unnecessary duplication of access doors.

ARTICLE 17 FLASHING

17.1 Flash and counter flash all conduits penetrating roofing membrane as shown on Architectural drawings. All work shall be in accordance with Division 7 of these specifications.

ARTICLE 18 IDENTIFICATION OF EQUIPMENT

18.1 All electrical equipment shall be labeled, tagged, stamped, or otherwise identified in accordance with the following schedules:

18.1.1 General:

18.1.1.1 In general, the installed laminated nameplates as hereinafter called for shall also clearly indicate its use, areas served, circuit identification, voltage and any other useful data.

18.1.1.2 All auxiliary systems, including communications, shall be labeled to indicate function.

18.1.2 Lighting and Local Panelboards:

18.1.2.1 Panel identification shall be with white and black micarta nameplates. Letters shall be no less than 3/8" high.

18.1.2.2 Circuit directory shall be two column typewritten card set under glass or glass equivalent. Each circuit shall be identified by the room number and/or number of unit and other pertinent data as required.

18.1.3 Distribution Switchboards and Feeders Sections:

18.1.3.1 Identification shall be with 1" x 4" laminated white micarta nameplates with black lettering on each major component, each with name and/or number of unit and other pertinent data as required. Letters shall be no less than 3/8" high.

18.1.3.2 Circuit breakers and switches shall be identified by number and name with 3/8" x 1-1/2" laminated micarta nameplates with 3/16" high letters mounted adjacent to or on circuit breaker or switch.

18.1.4 Disconnect Switches, Motor Starters and Transformers:

18.1.4.1 Identification shall be with white micarta laminated labels and 3/8" high black lettering.

18.1.5 All communication system terminal boxes including T.V., telephone/intercom, security, fire alarm, clock, and computer networking shall be provided with white micarta laminated labels and 3/8" high black lettering.

ARTICLE 19 CONSTRUCTION FACILITIES

19.1 Furnish and maintain from the beginning to the completion all lawful and necessary guards, railings, fences, canopies, lights, warning signs, etc. Take all necessary precautions required by City, State Laws, and OSHA to avoid injury or damage to any persons and property.

19.2 Temporary power and lighting for construction purposes shall be provided under this Section. All work shall be in accordance with Division 1 of these specifications.

ARTICLE 20 GUARANTEE

20.1 Guarantee all material, equipment and workmanship for all sections under this Division in writing to be free from defect of material and workmanship for one year from date of final acceptance, as outlined in the general conditions. Replace without charge any material or equipment proven defective during this period. The guarantee shall include performance of equipment under all site conditions, conditions of load, installing any additional items of control and/or protective devices, as required.

ARTICLE 21 PATENTS

21.1 Refer to the General Conditions for Contractor's responsibilities regarding patents.

ARTICLE 22 PLUMBING (DIVISION 22) / HEATING, VENTILATING, AND AIR CONDTIONING (DIVISION 23) / ELECTRICAL – COORDINATION REQUIREMENTS

22.1 All electrical work performed for this project shall conform to the California Electrical Code, to Local Building Codes and in conformance with Division 22, 23, and 26 of these specifications, whether the work is provided under the “Plumbing”, “Heating, Ventilating, and Air Conditioning”, or the “Electrical” Division of these specifications. Where the Division 22 and/or Division 23 Contractor is required to provide electrical work, he shall arrange for the work to be done by a licensed Division 26 Contractor, using qualified electricians. The

Division 22 and/or Division 23 Contractor shall be solely and completely responsible for the correct functioning of all equipment regardless of who provided the electrical work.

22.2 The work under Division 22 and/or Division 23 shall include the following:

22.2.1 All motors required by mechanical equipment.

22.2.2 All starters for mechanical equipment which are not provided under the electrical division as part of a motor control center or otherwise indicated on the electrical drawings.

22.2.3 All wiring interior to packaged equipment furnished as an integral part of the equipment.

22.2.4 All control **wiring and conduit** for mechanical control systems.

22.2.5 All control systems required by mechanical equipment.

22.3 The work under Division 26 shall include the following:

22.3.1 All power wiring and conduit; and conduit only for EMS control conductors between each building and the main control panel.

22.3.2 Electrical disconnects as shown on the electrical drawings.

22.3.3 Starters forming part of a motor control center.

22.4 All power wiring and conduit to equipment furnished under Division 22 and/or Division 23 shall be provided under Division 26. Control wiring and conduit, whether line voltage or low voltage, shall be provided under the division which furnishes the equipment.

22.5 Power wiring shall be defined as all wiring between the panelboard switchboard overcurrent device, motor control center starter or switch, and the safety disconnect switch or control panel serving the equipment. Also, the power wiring between safety disconnect switch and the equipment line terminals.

22.6 Control wiring shall be defined as all wiring, either line voltage or low voltage, required for the control and interlocking of equipment, including but not limited to wiring to motor control stations, solenoid valves, pressure switches, limit switches, flow switches, thermostats, humidistats, safety devices, smoke detectors, and other components required for the proper operation of the equipment.

22.7 All motor starters which are not part of motor control centers and which are required for equipment furnished under this Division shall be furnished and installed by the Division furnishing the equipment and power wiring connected under Division 26. Motor starters and control devices in motor control centers shall be furnished and installed under Division 26.

22.8 Division 26 Contractor shall make all final connections of power wiring to equipment furnished under this Division.

22.9 Wiring diagrams complete with all connection details shall be furnished under each respective Section.

22.10 Motor starters supplied by Plumbing and/or Heating, Ventilating and Air Conditioning shall be fused combination type minimum NEMA Size 1, and conform to appropriate NEMA standards for the service required. Provide NEMA type 3R/12 gasketed enclosures in wet locations. Provide all starters with appropriately sized overload protection and heater strips provided in each phase, hand/off auto switches, a minimum of 2 NO and NC auxiliary contacts as required, and an integral disconnecting means. For ½ horsepower motors and below, when control requirements do not dictate the use of a starter, a manual motor starter switch with overload protection in each phase may be provided. Acceptable manufacturers are Allen Bradley, General Electric, Square D, Furnas and Cutler Hammer.

ARTICLE 23 EQUIPMENT ROUGH-IN

23.1 Rough-in all equipment, fixtures, etc. as designed on the drawings and as specified herein. The drawings indicate only the approximate location of rough-ins. Mounting heights of all switches, receptacles, wall mounted fixtures and such equipment must be coordinated with the Architectural Designs. The Contractor shall obtain all rough-in information before progressing with any work for rough-in connections. Minor changes in the contract drawings shall be anticipated and provided for under this Division of the specifications to comply with rough-in requirements.

ARTICLE 24 OWNER FURNISHED AND OTHER EQUIPMENT

24.1 Rough-in and make final connections to all Owner furnished equipment shown on the drawings and specified, and all equipment furnished under other sections of the specifications.

ARTICLE 25 EQUIPMENT FINAL CONNECTIONS

25.1 Provide all final connections for the following:

25.1.1 All equipment furnished under this Division.

25.1.2 Electrical equipment furnished under other sections of the specification.

25.1.3 Owner furnished equipment as specified under this Division.

ARTICLE 26 INSERTS, ANCHORS, AND MOUNTING SLEEVES

26.1 Inserts and anchors must be:

26.1.1 Furnished and installed for support of work under this Division.

26.1.2 Mounting of equipment that is of such size as to be free standing and that equipment which cannot conveniently be located on walls, such as motor starters, etc., shall be rigidly supported on a framework of galvanized steel angle of Unistrut or B-line systems with all unfinished edges painted.

26.1.3 Furnish and install all sleeves as required for the installation of all work under all Sections of this Division and for all communication systems including any communication systems described in this Section which are bid to the General Contractor. Sleeves through floors, roof, and walls shall be as described in “Conduit and Fittings” Section 26 05 33.

ARTICLE 27 SEISMIC ANCHORING

27.1 All switchgear and other free standing electrical equipment or enclosures shall be anchored to the floor and braced at the top of the equipment to the structure. Where details have not been provided on the drawings, anchorage shall comply with CBC Section 1616A.1.12. The Contractor shall submit drawings signed by the Contractors registered structural Engineer indicating method of compliance prior installation.

27.2 All sound systems, communication, signal or data networking equipment or enclosures shall be anchored to the structure. Where details have not been provided on the drawings, anchorage shall comply with CBC Section 1616A.1.12. The Contractor shall submit drawings signed by the Contractors registered Structural Engineer indicating method of compliance prior to installation.

ARTICLE 28 RUST PROOFING

28.1 Rust proofing must be applied to all ferrous metals and shall be in accordance with Section 05500 of these specifications and as noted below.

28.1.1 Hot-dipped galvanized shall be applied and after forming of angle-iron, bolts, anchors, etc.

28.1.2 Hot-dipped galvanized coating shall be applied after fabrication for junction boxes and pull boxes cast in concrete.

ARTICLE 29 GENERAL WIRING

29.1 Where located adjacent in walls, outlet boxes shall not be placed back to back, nor shall extension rings be used in place of double boxes, all to limit sound transmission between rooms. Provide short horizontal nipple between adjacent outlet boxes, which shall have depth sufficient to maintain wall coverage in rear by masonry wall.

29.2 In those instances where outlet boxes, recessed terminal boxes, or recessed equipment enclosures are installed in a fire rated assembly, provide "Flamesafe FSD 1077" fire stopping pads or approved equal, over the outlet or box.

29.3 Complete rough-in requirements of all equipment to be wired under the contract are not indicated. Coordinate with respective trades furnishing equipment or with the Architect as the case may be for complete and accurate requirements to result in a neat, workmanlike installation.

ARTICLE 30 SEPARATE CONDUIT SYSTEMS

30.1 Each electrical and signal system shall be contained in a separate conduit system as shown on the drawings and as specified herein. This includes each power system, each lighting system, each signal system of whatever nature, telephone, standby system, sound system, control system, fire alarm system, etc.

30.2 Further, each item of building equipment must have its own run of power wiring. Control wiring may be included in properly sized conduit for equipment feeders of #6 AWG and smaller, having separate conduit for larger sizes.

ARTICLE 31 CLEANUP

31.1 In addition to cleanup specified under other sections, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any spattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

31.2 Use steel brushes on exposed metal work to carefully remove rust, etc., and leave smooth and clean.

31.3 During the progress of the work, keep the premises clean and free of debris.

ARTICLE 32 UTILITY SERVICES

32.1 The Division 26 Contractor shall contact the serving utility companies; notify the serving power, telephone and cable TV utilities of the following:

32.1.1 Name and address of Contractor.

32.1.2 Estimated times of construction start, completion and required service connections.

32.1.3 Project service voltage, phase load, and service size.

32.1.4 Provide to the Architect written verification from each utility company indicating their concurrence with the contract documents.

32.2 Contractor shall notify underground service alert 48 hours before start of construction to determine location of existing utilities by calling (800) 422-4133. All work shall be in accordance with the Division 1 Sections of these specifications.

32.3 All utility company requirements shall be complied with and approval shall be obtained from the utility company for service equipment. Such as, verification of a field test of the ground fault protection on the main service equipment, panic hardware and etc.

ARTICLE 33 PAINTING

33.1 Paint all unfinished metal, including exposed conduit in visible areas, as required in accordance with Division 1 of these specifications. (Galvanized and factory painted equipment shall be considered as having a sub-base finish.)

ARTICLE 34 GENERAL DEMOLITION REQUIREMENTS

34.1 Remove existing work and items which are required to be removed in such manner that minimum damage and disturbance is caused to adjacent and connection work scheduled to remain. Repair or replace existing work schedule.

34.2 Include preparation of existing areas to receive new materials and removal of materials and equipment to alter or repair the existing building as indicated and as specified.

34.3 Perform demolition exercising proper care to prevent injury to the public, workmen and adjoining property.

34.4 Perform the removal, cutting, drilling of existing work with extreme care and use small tools in order not to jeopardize the structural integrity of the building.

34.5 Rebuild to existing condition or better, existing work which has to be removed to allow the installation of new work as required.

34.6 Remove, protect and reinstall existing items as indicated. Replace materials scheduled for reuse which are damaged by the Contractor to the extent that they cannot be reused, with equal quality material, and installation.

34.7 Do not reuse in this project materials and items removed from existing site or building, except with specific written approval by the Architect in each case, unless such removed material or item is specifically indicated or specified to be reused.

34.8 Remove materials and equipment indicated to be salvaged for reinstallation and store to prevent damage, and reinstall as the work progresses. Do not reuse in this project, other materials and equipment removed from existing site or building, except with specific written approval by the Architect in each case.

34.9 Patch areas requiring patching, including damage caused by removing, relocating or adding fixtures and equipment, damages caused by demolition at adjacent materials.

34.10 Do not stockpile debris in the existing building, without the approval of the Architect. Remove debris as it accumulates from removal operations to a legal disposal area.

34.11 Contractor to assume existing oil filled and dry transformers, oil switches, ballasts, lamps, wooden poles, cross arms, computers, computer monitors, and conductor insulation containing materials considered hazardous. Comply with local, state and federal regulations, laws, and ordinances concerning removal, handling and protection against exposure or environmental pollution. Contractor shall be responsible for removal of the above hazardous materials where encountered. Include all costs for such removal as part of this contract.

34.12 All fluorescent, compact fluorescent, high intensity discharge, metal halide, mercury vapor, high and low pressure sodium, and neon lamps are to be disposed of as required by the California Waste Rule Regulations as described in the California Code of Regulations, Title 22, Division 4.5 and Chapter 23.

34.13 **Communication System:** Where new communication systems, (including telephone, intercom, clock, security, fire alarm, data, multimedia, CATV or lighting controls) are installed to replace existing systems, unless where otherwise directed the existing systems shall remain fully operational until the new system has been installed and tested. Demolition of the existing systems shall include removal of all equipment and associated wiring and exposed conduits and providing new blank covers for all abandoned device locations.

34.14 **Salvage Power Equipment:** The Contractor shall carefully remove all existing switchboards, panelboards, transformers, and confirm in writing which items the Owner wishes to keep. These items shall be transported to the Owner's maintenance facilities by the Contractor. All remaining items shall be disposed of by the Contractor.

34.15 **Salvage Lighting Equipment:** The Contractor shall confirm in writing which items the Owner wishes to keep. These items shall be transported to the Owner's maintenance facilities by the Contractor. All remaining items shall be disposed of by the Contractor.

34.16 **Salvage Communication Equipment:** The Contractor shall carefully remove all communication devices (telephone, intercom, clock, security, fire alarm, data, multimedia, CATV or lighting controls) and box each type of devices separately. The Contractor shall deliver all items to the Owner's maintenance facility.

ARTICLE 35 PROJECT CLOSEOUT

35.1 Prior to completion of project, compile a complete equipment maintenance manual for all equipment supplied under sections of this Division, in accordance with Division 1 of these specifications and as described below.

35.2 Equipment Lists and Maintenance Manuals:

35.2.1 Prior to completion of job, Contractor shall compile a complete equipment list and maintenance manuals. The equipment list shall include the following items for every piece of material equipment supplied under this Section of the specifications:

35.2.1.1 Name, model, and manufacturer.

35.2.1.2 Complete parts drawings and lists.

35.2.1.3 Local supply for parts and replacement and telephone number.

35.2.1.4 All tags, inspection slips, instruction packages, etc., removed from equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from.

35.3 Maintenance manuals shall be furnished for each applicable section of the specifications and shall be suitably bound with hard covers and shall include all available manufacturers' operating and maintenance instructions, together with "as-built" drawings to properly operate and maintain the equipment. The equipment lists and maintenance manuals shall be submitted in duplicate to the Architect for approval not less than 10 days prior to the completion of the job. The maintenance manuals shall also include the name, address, and phone numbers of all subcontractors involved in any of the work specified herein. Four copies of the maintenance manuals bound in single volumes shall be provided.

ARTICLE 36 RECORD DRAWINGS

36.1 The Division 26 Contractor shall maintain record drawings as specified in accordance with Division 1 of these specifications, and as noted below.

36.2 Drawings shall show locations of all concealed underground conduit runs, giving the number and size of conduit and wires. Underground ducts shall be shown with cross section elevations and shall be dimensioned in relation to permanent structures to indicate their exact location. Drawing changes shall not be identified only with referencing CORs and RFIs, the drawings shall reflect all of the actual additions or changes made. All as-built drawing information shall be prepared by the contractor in AutoCAD, updating the contract computer files as needed to reflect actual installed conditions for all site plans, lighting, power, communication, networking, audio visual, security or fire alarms systems included in the scope of work for this project.

36.3 One set of these record drawings shall be delivered to the Architect. The engineer will review documents for completeness, and will not be responsible for editing contractor computer files.

ARTICLE 37 CHANGES AND EXTRA WORK

37.1 When **changes** in work are requested, the Division 26 Contractor shall provide unit prices for the work involved in accordance with Division 1 of these specifications, and the following:

37.1.1 The material Costs shall **not exceed** the latest edition of the “Trade Service“ end column “C” price list. The materials prices may be higher only where the Contractor can produce invoices to substantiate higher material costs. The Contractor shall submit a print out copy of the trade service sheets with the change order to substantiate these values.

37.1.2 The labor Costs shall **not exceed** the latest edition of the “NECA Manual of Labor Units” **normal column**.

37.2 When **credits** in work are requested, the Division 26 Contractor shall provide unit prices for the work involved in accordance with Division 1 of these specifications, and the following:

37.2.1 The Material Costs shall **not be less than 80% of** the latest edition of the “Trade Service“ end column price list. The materials prices may be lower only where the Contractor can produce invoices to substantiate lower material costs. Restocking fees may also be included in this amount where applicable.

37.2.2 The Labor Costs shall **not be less than 80% of** the latest edition of the “NECA Manual of Labor Units” **normal column**.

37.3 Conduit pricing for conduits of all types sized 3" or smaller.

When changes in the scope of work require the Contractor to estimate conduit Installations, they shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for conduit installation represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

37.3.1 Couplings.

37.3.2 Set Screw or Compression Fittings, locknuts, Bushings and washers.

37.3.3 Conduit straps and associated screws or nails.

37.3.4 LB fittings or other specialty fittings or specialty mounting hardware may be included where needed.

37.4 Wire pricing for all types and sizes.

When changes in the scope of work require the Contractor to estimate wire installations they shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for wire installation represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

37.4.1 Locknuts, Bushings, tape, wire markers.

37.5 When changes in the scope of work require other equipment installations such as lighting fixtures, panelboards, switchboards, wiring devices, communications equipment etc. the Contractor shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for these equipment items represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

37.5.1 Associated screws, nails, bolts, anchors or supports.

37.5.2 Locknuts, washers, tape.

37.6 The total labor hours for extra work will be required to be calculated as follows:

37.6.1 Change orders with 1 to 30 total labor hours

General Laborer	10%	of total labor hours
Journeyman	10%	of total labor hours
Foreman	80%	of total labor hours

37.6.2 Change orders with 31 to 100 total labor hours

General Laborer	20%	of total labor hours
Journeyman	40%	of total labor hours
Foreman	40%	of total labor hours

37.6.3 Change orders with over 100 total labor hours

General Laborer	30%	of total labor hours
Journeyman	50%	of total labor hours
Foreman	20%	of total labor hours

37.7 When change orders are issued which allow the work to be completed in the normal sequence of construction, the labor rates shall be based on the most current "Prevailing Wage" – straight time total hourly rate. When change orders require the Contractor to work out of sequence the "Prevailing Wage" – daily overtime hourly rate shall apply. Special condition situations shall be reviewed on an individual basis for alternate hourly rate schedules.

37.8 Costs **will not** be permitted for additional supervision on site or office time for processing any change order other than the 10% overhead allowance as described in Division 1. Cost for special equipment required to install items for an individual change order are permitted and must be individually identified. Lump Sum cost for small tools or any other cost not specifically required for the change order are not permitted.

37.9 Contractor estimates shall be formatted to clearly identify each of the following:

37.9.1 Line item description of each type of material or labor item.

37.9.2 Description of quantity for each item.

37.9.3 Description of (material cost per / quantity).

37.9.4 Description of (labor cost per / quantity).

37.9.5 Description of total labor hour breakdown per Foreman, Journeyman or General Laborer as described above.

ARTICLE 38 ELECTRONIC FILES

38.1 The Contractor shall make a ***written*** request directly to Johnson Consulting Engineers for electronic drawing files. As a part of the written request, please include the following information:

38.1.1 Clearly indicate each drawing sheet needed (i.e., E1.1, E2.1, etc.).

38.1.2 Identify the name, phone number, mailing address and e-mail address of the person to receive the files.

38.1.3 Provide written confirmation and agreement with the requirements described for payment of computer files, as described below.

38.2 Detail or riser diagram sheets, or any other drawings other than floor plans or site plans, ***will not be made available to the Contractor***.

38.3 Files will only be provided in the AutoCAD format in which they were created.

38.4 Requests for files will be processed as soon as possible; a minimum of 7 working days should be the normal processing time. The Contractor shall be completely responsible for requesting the files in time for their use.

38.5 CAD files will be made available via e-mail or on disk, depending on the quantity of files requested. The Contractor requesting the files will be required to pay $50.00 per drawing plan, or $300.00 maximum, whichever is ***less***.

END OF SECTION

SECTION 26 05 19

POWER CONDUCTORS

PART 1 – GENERAL

1.1 Furnish and install wire and cable for branch circuits and feeders specified herein and as shown on the electrical drawings.

1.2 Submittals: Submit manufacturers' data for the following items:

1.2.1 All cables and terminations.

1.3 Common submittal mistakes which will result in the submittals being rejected:

1.3.1 Not including all items listed in the above itemized description.

1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining, or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.3 Not including actual manufacturer's catalog information of proposed products.

1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed

PART 2 – PRODUCTS

2.1 Wire and cable Rated 120 volt to 600 volt.

2.1.1 All wire and cable shall be new, 600 volt insulated copper, of types specified below for each application. All wire and cable shall bear the UL label and shall be brought to the job in unbroken packages. Wire insulation shall be the color as specified herein and shall be type THWN-2. Insulated conductors shall be installed in all exterior exposed raceways. Conductors for branch circuit lighting, receptacle, power and miscellaneous systems shall be a minimum of No. 12 AWG. Increase conductor size to No. 10 AWG for 120 volt circuits greater than 100 feet from the panel to the load and for 277 volt circuits greater than 200 feet from the panel to the load. Circuit home-runs indicated to be larger than No. 12 must be increased the entire length of the circuit, including equipment grounding conductor. Wire sizes No. 14 through No. 10 shall be solid. No. 8 and larger shall be stranded.

2.1.2 Aluminum conductors are not permitted.

2.1.3 MC type armored cable reference Section 26 05 33.

2.2 Wire and cable for systems below 120 volts.

2.2.1 All low voltage and communications systems cables routed underground shall be provided with a moisture resistant outer jacket, West Penn "Aquaseal" or equal, unless otherwise specified.

PART 3 - EXECUTION

3.1 Wire and cable shall be pulled into conduits without strain using powdered soapstone, mineralac, or other approved lubricant. In no case shall wire be repulled if same has been pulled out of a conduit run for any purpose. No conductor shall be pulled into conduit until conduit system is complete, including junction boxes, pull boxes, etc.

3.2 All connections of wires shall be made as noted below:

3.2.1 Connections to outlets and switches: Wire formed around binding post of screw.

3.2.2 No. 10 wire and smaller: Circuit wiring connections to lighting fixtures and other hard wired equipment shall be made with pressure type solderless connectors, Buchanan, Scotch lock, Wing Nut, or approved equal. Alternate "WAGO" #773 series or "IDEAL" #32, 33, 34 and 39 series push wire style connectors are also acceptable.

3.3 All wiring shall be continuous without splicing unless where specifically noted on the drawings or where permitted below.

3.3.1 No. 10 wire and smaller above grade: Quantities as needed, connection made with pressure type solderless connectors, Scotch lock or equal.

3.3.2 No. 10 wire and smaller below grade: Quantities as needed, connection made with 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

3.3.3 No. 8 wire and larger above grade: Quantities only where indicated, 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

3.3.4 No. 8 wire and larger below grade: Quantities only where indicated, 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).

3.4 All wiring throughout shall be color coded as follows:

	480 volt system	208 or 240 volt system
A Phase	Brown	Black
B Phase	Orange	Red
C Phase	Yellow	Blue
Neutral	Grey	White
Ground	Green	Green

3.5 Wiring must be color coded throughout its entire length, except feeders may have color coded plastic tape at both ends and any other accessible point.

3.6 All control wiring in a circuit shall be color coded, each phase leg having a separate color, and with all segments of the control circuit, whether in apparatus or conduit, utilizing the same color coding.

3.7 At all terminations of control wiring, the wiring shall have a numbered T&B or Brady plastic wire marker.

3.8 Cables when installed are to be properly trained in junction boxes, etc., and in such a manner as to prevent any forces on the cable which might damage the cable.

3.9 All conductors to be installed into a common raceway, shall be pulled into the raceway at the same time.

3.10 All conductors shall be installed in such a manner as to not exceed the manufacturers' recommended pulling tension and bending radius. The equipment used for pulling must be specifically designed for the purpose. Motorized vehicles such as pickup trucks, are not acceptable.

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 – GENERAL

1.1 Furnish and install grounding and grounding conductors and electrodes as specified herein and as shown on the drawings.

1.2 Submit catalog data for all components.

1.3 **Common submittal mistakes which will result in the submittals being rejected:**

1.3.1 Not including all items listed in the above itemized description.

1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.3 Not including actual manufacturer's catalog information of proposed products.

1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – EXECUTION

2.1 Grounding

2.1.1 All panelboard cabinets, equipment, enclosures, and complete conduit system shall be grounded securely in accordance with pertinent sections of CEC Article 250. Conductors shall be copper. All electrically operated equipment shall be bonded to the grounded conduit system. All non-current carrying conductive surfaces that are likely to become energized and subject to personal contact shall be grounded by one or more of the methods detailed in CEC Article 250. All ground connections shall have clean contact surfaces. Install all grounding conductors in conduit and make connections readily accessible for inspection.

2.1.2 Provide an insulated equipment grounding conductor in all branch circuit and feeder raceway systems, sized in accordance with CEC 250-1122.

2.1.3 Provide an additional individual insulated grounding conductor for each circuit which contains an isolated ground receptacle or surge suppression receptacle.

2.1.4 Grounding of metal raceways shall be assured by means of provisions of grounding bushings on feeder conduit terminations at the panelboard, and by means of insulated continuous stranded copper grounding wire extended from the ground bus in the panelboard to the conduit grounding bushings.

2.1.5 Except for connections which access for periodic testing is required, make grounding connections which are buried or otherwise inaccessible by exothermite type process.

2.1.6 The following ohmic values shall be test certified for each item listed. A written report signed and witnessed by the project IOR shall be provided to the engineer. If the ohmic value listed cannot be obtained additional grounding shall be installed to reach the value listed.

2.1.6.1 Service. . . . . .10 ohms.

2.1.6.2 Step down transformers and non-current carrying metal parts . . . . . 25 ohms.

2.1.6.3 Manholes, handholes, etc.
. . . . . 10 ohms.

END OF SECTION

SECTION 26 05 33

CONDUIT AND FITTINGS

PART 1 – GENERAL

1.1 Furnish and install conduit and fittings as shown on the drawings and as specified herein.

1.2 Submit Manufacturer's data on the following:

1.2.1 Conduit.

1.2.2 Fittings

1.2.3 Fire stopping Material.

1.2.4 Surface Raceways.

1.2.5 Type MC cable, provide construction details and UL "E" number.

1.3 **Common submittal mistakes which will result in the submittals being rejected:**

1.3.1 Not including all items listed in the above itemized description.

1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.3 Not including actual manufacturer's catalog information of proposed products.

1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

2.1 Rigid steel conduit, intermediate metal conduit (IMC), electrical metallic tubing (EMT) and flexible metallic conduit shall be steel, hot dipped galvanized after fabrication.

2.2 PVC conduit shall be Carlon or approved equal.

2.3 Liquid tight flexible metal conduit shall be Anaconda Sealtite type UA or approved equal. Fittings shall be Appleton, Crouse-Hinds, Steel City, T&B, or equivalent.

2.4 MC type armored cable, when utilized, shall be provided with the following:

2.4.1 Comply with UL 1479 and CEC 330-22(c).

2.4.2 90ºC, copper, THHN conductors.

2.4.3 Minimum #12 insulated grounding conductor.

2.4.4 Conductors sized No. 10 and smaller shall be solid, No. 8 and larger shall be stranded.

2.4.5 Oversized (150%) neutrals or separate neutrals shall be provided.

2.4.6 Increase phase conductors to No. 10 AWG for 120 volt circuits greater than 100 feet from panel to load and for 277 volt circuits greater than 200 feet from panel to load. Where required increase conductor sizes for entire length of circuit.

2.4.7 Interlocked armored **aluminum** sheath.

2.4.8 AC or BX type armored cable shall **not** be substituted in lieu of MC type cable.

2.4.9 Color code cable according to cable type and configuration.

2.4.10 Acceptable manufacturers are AFC and Alflex.

2.5 Fire stopping material shall provide an effective seal against fire, heat, smoke and fire gases. Fire stopping material shall be tested to comply with ASTME 814 and UL 1479. The submittal for this product shall include the UL listed system number and installation requirements for each type of penetration seal required for this project.

2.6 Each length of conduit shall be stamped with the name or trademark of the manufacturer and shall bear the UL label.

2.7 All plastic conduit shall be rigid, schedule 40, heavy wall PVC. All PVC conduit shall be UL listed. Underground utility company conduits shall comply with local utility co. requirements.

2.8 Plastic conduit shall be stored on a flat surface, and protected from the direct rays of the sun.

2.9 Where branch circuit or communication raceways cannot be concealed in ceilings or walls and are required to be exposed in interior spaces, provide nonmetallic surface raceway system sized per the manufacturer capacity requirements. A full complement of nonmetallic fittings must be available and matching device boxes and cover plates must be provided. The color of the raceway system, components and boxes shall be (white). Where data networking cabling is to be installed, all raceway fittings shall meet Category 5 radius requirements. Where specific raceway types have been noted on the drawings they shall be as follows:

2.9.1	System 'SR'	Hubbell	WALLTRAK 1 series
		Wiremold	ECLIPSE PN05series
		Panduit	LD5 series
		Hellerman-Tyton	TSR2 series
2.9.2	System 'SR2'	Hubbell	WALTRAK 22
		Wiremold	2300D Series
		Panduit	D2P10
		Hellerman-Tyton	TSR3 series
2.9.3	System 'SR3'	Hubbell	BASETRAK series
		Wiremold	5400 - series
		Panduit	70 series
		Hellerman-Tyton	MCR Infostream" series

Provide with offset boxes, inline boxes may only be used where specifically shown on the drawings.

PART 3 – FITTINGS

3.1 All metallic fittings, including those for EMT, flexible conduit, or malleable iron. Die cast fittings of any other material are not permitted.

3.2 Locknuts shall be steel or malleable iron with sharp clean cut threads.

3.3 Entrance seals shall be 0.Z. type FSK or equivalent.

3.4 Bushings and locknuts: Where conduits enter boxes, panels, cabinets, etc., they shall be rigidly clamped to the box by locknuts on the outside, and a lock nut and plastic bushing on the inside of the box. All conduits shall enter the box squarely.

3.5 Furnish and install insulated bushings as per CEC article No. 300 - 4 (F) on all conduits. The use of insulated bushings does not exclude the use of double locknuts to fasten conduit to the box.

3.6 Transition from plastic to steel conduits shall be with PVC female threaded adaptors.

3.7 Couplings and connectors for rigid steel or IMC conduit must be threaded, or compression type (set screw fittings are not permitted).

3.8 Couplings and connectors for EMT shall be compression, watertight. Set screw connectors are not acceptable, except for systems below 120 volts.

3.9 MC type armored cable shall be provided with listed clamp type die cast zinc set screw connectors. Anti-short bushings shall be provided at all cable ends.

3.10 Connectors for flexible metal conduit shall be steel or malleable iron with screw provided to clinch the conduit into the adapter body. For sizes up to ¾" a screw-in, "Jake type," fitting may be used.

3.11 Install approved expansion fittings, or liquid tight flex conduit with a minimum 6" slack for conduits passing through all expansion and seismic joints.

PART 4 - EXECUTION

4.1 All branch circuits shall be installed concealed in walls or above ceilings or in concrete floor slabs. PVC conduits installed in concrete floor slabs shall transition to PVC coated rigid steel where conduits penetrate above finished grade or finished floor.

4.2 Conduit sizes for various numbers and sizes of wire shall be as required by the CEC, but not smaller than ½" for power wiring and ¾" for communications and fire alarm systems unless otherwise noted. Conduit in slab or below grade shall be ¾" minimum trade size, unless otherwise identified.

4.3 Conduit size shall be such that the required number and sizes of wires can be easily pulled in and the Contractor shall be responsible for the selection of the conduit sizes to facilitate the ease of pulling. Conduit sizes shown on the drawings are minimum sizes in accordance with appropriate tables in the CEC. If because of bends or elbows a larger conduit size is required, the Contractor shall so furnish without further cost to the Owner.

4.4 The Contractor shall be entirely responsible for the proper protection of this work from the other trades on the job. When conduit becomes bent or holes are punched through same, or outlets moved after being roughed-in, the Contractor shall replace same, without additional cost to the Owner.

4.5 Rigid steel conduit or IMC shall be used as follows:

4.5.1 Exposed exterior locations.

4.5.2 Exposed interior locations below eight feet above floor, except in electrical rooms and closets.

4.5.3 In hazardous or classified areas as required by CEC.

4.6 EMT conduit shall be used for areas as follows:

4.6.1 All interior communications, signal, and data networking systems.

4.6.2 All interior power wiring systems where not required to be in rigid steel, IMC or flexible conduit.

4.7 Flexible conduit shall be used for areas as follows:

4.7.1 To connect motors, transformers, and other equipment subjected to vibration or where specifically detailed on the drawings.

4.7.2 Flexible conduit shall not be used to replace EMT in other locations where the conduit will be exposed.

4.7.3 Flexible metal conduit shall be ferrous. Installation shall be such that considerable slack is realized. The conduit shall contain separate code sized grounding conductor.

4.7.4 Liquid tight flexible conduit shall be used in conformance with CEC in lengths not to exceed 4'. For equipment connections, route the conduit at 90 degrees to the adjacent path for point of connection. The conduit shall contain separate code sized grounding conductor. Use liquid tight flexible conduit for all equipment connections exposed in possible wet, corrosive or oil contaminated areas, e.g., shops and outside areas.

4.8 MC armored cable may be used as follows:

4.8.1 All branch circuit wiring for lighting and power circuits where permitted and installed in compliance with UL 1569 and CEC 330.

4.9 MC armored cable shall **not** be used for the following areas:

4.9.1 Any exterior, underground or buried in concrete circuits.

4.9.2 Any circuits feeding HVAC equipment or pumps or any circuit with 30 AMPs or greater overcurrent protection.

4.9.3 Any exposed interior locations except in electrical, communication or mechanical equipment rooms.

4.9.4 Any exposed interior damp/wet locations, kitchens, science classrooms, shop areas, or concealed in science classroom casework, unless provided with approved PVC jacket.

4.9.5 Any hazardous rated area.

4.10 Plastic conduit shall be used for all exterior underground, in slab, and below slab on grade conduit installations. Install bell ends at all conduit terminations in manholes and pull boxes. Where plastic conduit transitions from below grade to above grade, no plastic conduit shall extend above finished exterior grade, or above interior finished floor level.

4.11 Plastic conduit joints shall be made up in accordance with the manufacturer's recommendations for the particular conduit and coupling selected. Conduit joint couplings shall be made watertight. Plastic conduit joints shall be made up by brushing a plastic solvent cement on the inside of a plastic fitting and on the outside of the conduit ends. The conduit and fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly.

4.12 All underground conduit depths shall be as detailed on the drawings or a minimum of 30" below finished grade (when not specifically detailed otherwise), for all exterior underground conduits. Where concrete slurry or concrete encasement is provided, include “Red” color dye in mixture.

4.13 All underground conduits for power systems (600v and higher), shall be concrete encased and a minimum of 48” below grade or as detailed on the drawings. Where concrete slurry or concrete encasement is provided, include “Red” color dye in mixture.

4.14 Conduit shall be continuous from outlet to outlet, cabinet or junction box, and shall be so arranged that wire may be pulled in with the minimum practical number of junction boxes.

4.15 All conduits shall be concealed wherever possible. All conduit runs may be exposed in mechanical equipment rooms, electrical equipment rooms, electrical closets, and in existing or unfinished spaces. No conduit shall be run exposed in finished areas without the specific approval of the Architect.

4.16 All raceways which are not buried or embedded in concrete shall be supported by straps, clamps, or hangers to provide a rigid installation. Exposed conduit shall be run in straight lines at right angles to or

parallel with walls, beams, or columns. In no case shall conduit be supported or fastened to other pipes or installed to prevent the ready removal of other trades piping. Wire shall not be used to support conduit.

4.17 It shall be the responsibility of the Contractor to consult the other trades before installing conduit and boxes. Any conflict between the location of conduit and boxes, piping, duct work, or structural steel supports, shall be adjusted before installation. In general, large pipe mains, waste, drain, and steam lines shall be given priority.

4.18 Conduits above lay-in grid type ceilings shall be installed in such a manner that they do not interfere with the "lift-out" feature of the ceiling system. Conduit runs shall be installed to maintain the following minimum spacing wherever practical.

4.18.1 Water and waste piping not less than 3".

4.18.2 Steam and steam condensate lines not less than 12".

4.18.3 Radiation and reheat lines not less than 6".

4.19 Provide all necessary sleeves and chases required where conduits pass through floors or walls as part of the work of this section. Core drilling will only be permitted where approved by the Architect.

4.20 All empty conduits and surface mounted raceways shall be provided with a ¼" polypropylene plastic pull cord and threaded plastic or metal plugs over the ends. Fasten plastic "Dymo" tape label to exposed spare conduit to identify "power" or "communication" system, and to where it goes.

4.21 The ends of all conduits shall be securely plugged, and all boxes temporarily covered to prevent foreign material from entering the conduits during construction. All conduit shall be thoroughly swabbed out with a dry swab to remove moisture and debris before conductors are drawn into place.

4.22 Bending: Changes in direction shall be made by bends in the conduit. These shall be made smooth and even without flattening the pipe or flaking the finish. Bends shall be of as long a radius as possible, and in no case smaller than CEC requirements.

4.22.1 For power conduits for conductors (600v and below), provide minimum 36” radius (vertical) and 72” radius (horizontal) bends.

4.22.2 For power conduits for conductors (greater than 600v), provide minimum 72” radius (vertical) and 72” radius (horizontal) bends.

4.23 Supports: Conduit shall be supported at intervals as required by the California Electrical Code. Where conduits are run individually, they shall be supported by approved conduit straps or beam clamps. Straps shall be secured by means of toggle bolts on hollow masonry, machine screws or bolts on metal surfaces, and wood screws on wood construction. **[No perforated straps or wire hangers of any kind will be permitted. Where individual conduits are routed, or above ceilings, they shall be supported by hanger rods and hangers.]** Conduits installed exposed in damp locations shall be provided with clamp backs under each conduit clamp, to prevent accumulation of moisture around the conduits.

4.24 Where a number of conduits are to be run exposed and parallel, one with another, they shall be grouped and supported by trapeze hangers. Hanger rods shall be fastened to structural steel members with suitable beam clamps or to concrete inserts set flush with surface. A reinforced rod shall be installed through the opening provided in the concrete inserts. Beam clamps shall be suitable for structural members and conditions. Rods shall be galvanized steel 3/8" diameter minimum. Each conduit shall be clamped to the trapeze hanger with conduit clamps.

4.25 All concrete inserts and pipe clamps shall be galvanized. All steel bolts, nuts, washers, and screws shall be galvanized or cadmium plated. Individual hangers, trapeze hangers and rods shall be prime-coated.

4.26 Openings through fire rated floors/walls and/or smoke walls through which conduits pass shall be sealed by Fire stopping material to comply with Division 1 to seal off flame, heat, smoke and fire gases. Sleeves shall be provided for power or communication system cables which are not installed in conduits, and shall be sealed inside and out to comply with manufacturers UL system design details. Where multiple conduits

and/or cable tray systems pass thru fire-rated walls at one location, the Contractor shall submit copies of the manufacturers UL system design details proposed for use on this project. All Fire stopping material shall have an hourly fire-rating equal to or higher than the fire rating of the floor or wall through which the conduit, cables, or cable trays pass.

4.27 Provide cap or other sealing type fitting on all spare conduits. Conduits stubbed into buildings from underground where cable only extends to equipment, the conduit/cable end shall be sealed to prevent moisture from entering the room or space.

4.28 All conduits which are part of a paralleled feeder or branch circuit shall be installed underground.

4.29 All conduits which are required as a part of systems specified in Divisions 27 or 28, or any other low voltage communication systems, shall be furnished and installed by the Division 26 Contractor.

4.29.1 The Contractor shall coordinate all conduit requirements with each system supplier prior to bid to determine special conduit system requirements.

4.29.2 The Contractor shall provide a pull rope in all conduits for these systems.

4.29.3 The Contractor shall provide conduit sleeves for all open cable installations thru rated walls or block walls. Provide conduit from each building main termination cabinet or backboard to the nearest accessible ceiling for access into all electrical or communications rooms.

4.30 In addition to the above requirements, the following requirements shall apply to all data networking conduits:

4.30.1 Flexible metal conduit may only be used where required at building seismic and/or expansion joints.

4.30.2 All underground conduits shall be provided with minimum 24" radius elbows (vertical) and 60” (horizontal).

4.30.3 No length of conduit above grade shall be installed to exceed 150 feet between pull boxes, or points of connection, unless where specifically detailed on the drawings.

4.30.4 No length of conduit shall be installed to exceed two 90 degree bends between pull boxes, or points of connection, unless where specifically detailed on the drawings.

4.31 Where surface raceways are installed in interior spaces, the Contractor shall take care to route in straight lines at right angles to or parallel with walls, beams, or columns. All raceways and device boxes shall be securely screwed to the finish surface with zinc screw “Auger” anchors Stk #ZSA1K by Gray Bar Electric or equal. Tape adhesive application will not be permitted.

4.32 The Contractor who installs surface raceway systems shall provide and install complete with wire retention clips, one for every (8) vertical feet or (5) horizontal feet or portion thereof. This Contractor shall also provide each raceway channel with pull strings.

4.33 It shall be the responsibility of the Contractor installing the raceway to coordinate the installation of raceway device plates and inserts with the communications or data contractors.

4.34 MC cable shall be cut using a specific metallic sheath armor stripping tool. The use of hacksaws, dikes or any other tools not specifically designed to remove the armor sheath will not be permitted.

4.35 MC cables installed in attic spaces or above lay-in ceilings shall be installed to be protected from physical damage. The cable shall be mounted along the sides or bottom of joists, rafters or studs.

4.36 Support wires used for supporting ceilings, lighting fixtures or other equipment items shall **not** be used to support MC cables. Conduits, duct work, piping or any other equipment shall not be used to support or mount MC cables.

4.37 MC cable supports, fasteners and clips shall be designed specifically for use with MC cables. Standard conduit supports, fasteners and clips, nails or other items are not permitted for installing MC cables.

END OF SECTION

SECTION 26 05 34

OUTLET AND JUNCTION BOXES

PART 1 – GENERAL

1.1 Furnish and install electrical wiring boxes as specified and as shown on the electrical drawings.

1.2 Submit manufacturer's data for all items.

1.3 Common submittal mistakes which will result in the submittals being rejected:

1.3.1 Not including all items listed in the above itemized description.

1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.3 Not including actual manufacturer's catalog information of proposed products.

1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

2.1 Boxes shall be as manufactured by Steel City, Appleton, Raco, or approved equal.

2.2 All boxes must conform to the provisions of Article 370 of the CEC. All boxes shall be of the proper size to accommodate the quantity of conductors enclosed in the box. Minimum box size shall be 4" square x 1-½" deep.

2.3 Boxes generally shall be hot dipped galvanized steel with knockouts. Boxes on exterior surfaces or in damp locations shall be corrosion resistant, cast feraloy and shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Boxes shall be Appleton Type FS, Crouse-Hinds, or the approved equal. Conduit bodies shall be corrosion resistant, cast malleable iron. Conduit bodies shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Conduit bodies shall be Appleton Unilets, Crouse-Hinds, or the approved equal. Where recessed, boxes shall have square cut corners.

2.4 Deep boxes shall be used in wall covered by wainscot or paneling and in walls or glazed tile, brick, or other masonry which will not be covered with plaster. Through the wall type boxes shall not be used unless specifically called for. All boxes shall be nongangable. Boxes in concrete shall be of a type to allow the placing of conduit without displacing the reinforcing bars. All lighting fixture outlet boxes shall be equipped with the proper fittings to support and attach a light fixture.

2.5 All light, switch, receptacle, and similar outlets shall be provided with approved boxes, suitable for their function. Back boxes shall be furnished and installed as required for the equipment and/or systems under this contract.

2.6 Pull and junction boxes shall be code gauge boxes with screw covers. Boxes shall be rigid under torsional and deflecting forces and shall be provided with angle from framing where required. Boxes shall be 4" square with a blank cover in unfinished areas and with a plaster ring and blank cover in finished areas. Covers for flush mounted oversize boxes shall extend ¾" past boxes all around. Covers for 4" square boxes shall extend ¼" past box all around.

2.7 All terminal cabinets and junction boxes or equipment back boxes which are required as a part of systems specified in Divisions 27 or 28, or any other low voltage communication systems, shall be furnished and installed by the Division 26 Contractor.

2.7.1 The Division 26 Contractor shall coordinate all box requirements with each system supplier prior to bid to determine special cabinet or back box requirements. The Contractor shall also provide stainless steel blank cover plates for all low voltage systems installed for future equipment.

2.7.2 The Contractor shall provide all plywood backboards indicated on walls or inside equipment enclosures. All backboards shall be a minimum of ¾" thick fire rated type plywood.

2.7.3 The Contractor shall coordinate exact rough in locations and requirements with each system supplier.

2.8 In addition to the above requirements, boxes for data networking wiring and equipment shall comply with the following:

2.8.1 All boxes shall be a minimum of 4-11/16" square x 2-1/8" deep.

2.8.2 Where pull boxes are required on individual conduits 1-¼" or smaller, provide 4-11/16" square x 2-1/8" deep boxes. Where pull boxes are required on conduits larger than 1-¼" for straight pull through, provide eight times the conduit trade size for box length. Where pull boxes are required on conduits larger than 1-¼" for an angle or a U-pull through installation, provide a minimum distance of six times the conduit trade size between the entering and exiting conduit run for each cable.

2.9 Recessed boxes installed in fire rated floors/walls and /or smoke walls shall be sealed by Fire stopping material to comply with Division 1 to seal off flame, heat, smoke and fire gases. The Contractor shall submit copies of the manufacturers UL system design details proposed for use on this project. All Fire stopping material shall have an hourly fire-rating equal to or higher than the fire rating of the floor or wall through which the conduit, cables, or cable trays pass.

PART 3 – EXECUTION

3.1 Boxes shall be installed where required to pull cable or wire, but in finished areas only by approval of the Architect. Boxes shall be rigidly attached to the structure, independent of any conduit support. Boxes shall have their covers accessible. Covers shall be fastened to boxes with machine screws to ensure continuous contact all around. Covers for surface mounted boxes shall line up evenly with the edges of the boxes.

3.2 Outlets are only approximately located on the plans and great care must be used in the actual location of the outlets by consulting the various detailed drawings and specifications. Outlets shall be flush with finished wall or ceiling, boxes installed symmetrically on such trim or fixture. Refer to drawings for location and orientation of all outlet boxes.

3.3 Furnish and install all plaster rings as may be required. Plaster rings shall be installed on all boxes where the boxes are recessed. Plaster rings shall be of a depth to reach the finished surface. Where required, extension rings shall be installed so that the plaster ring is flush with the finished surface.

3.4 All cabinets and boxes shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard precast inserts on concrete or solid masonry; machine screws or bolts on metal surfaces and wood screws on wood construction. All wall and ceiling mounted outlet boxes shall be supported by bar supports extending from the studs or channels on either side of the box. Boxes mounted on drywall or plaster shall be secured to wall studs or adequate internal structure.

3.5 Boxes with unused punched-out openings shall have the openings filled with factory-made knockout seals.

3.6 Where standby power and normal power are to be located in the same outlet box or 480V in a switch box, install partition barriers to separate the various systems.

3.7 All outlet boxes and junction boxes for fire alarm system shall be painted red.

END OF SECTION

SECTION 26 27 26

SWITCHES AND RECEPTACLES

PART 1 – GENERAL

1.1 Furnish and install all wiring devices as shown on drawings and as herein specified. Unless otherwise noted, device and plate numbers shown are Hubbell and shall be considered the minimum standard acceptable. Other acceptable manufacturers are Pass and Seymour, Leviton, General Electric and Bryant.

1.2 Submit manufacturers' data on all items.

1.3 **Common submittal mistakes which will result in the submittals being rejected:**

1.3.1 Not correctly indicating ampacity rating of proposed devices.

1.3.2 Not including all items listed in the above itemized description.

1.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.4 Not including actual manufacturer's catalog information of proposed products.

1.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

2.1 All switches shall be of the quiet mechanical type, Specification Grade, 20 amp, 120/277 volt AC as follows:

	HUBBELL	LEVITON	PASS & SEYMOUR
Single Pole	CS120	CS1202	CS20AC1
Two Pole	CS1222	CS2202	CSB20AC2
Three-way	CS320	CS3202	CS20AC3
Key Switch	HBL1221L	1221-2L	PS20AC1-L

2.2 All switches shall have the "on" and the "off" position indicated on the handle. If switches of higher ampere ratings are required, they shall be of similar type and quality as those shown above. Groups of switches shown at one location shall be installed under a single plate up to a maximum of six where more than six switches are shown coordinate arrangement with the Architect.

2.3 Dimmer switches for incandescent lamp loads shall be square-law type, slide control dimmer with OFF position, Lutron or Hubbell "Nova-T" Series NT-600 (0-500 watt load), NT-1000 (501-900 watt load), NT-1500 (901-1500 watt load), or equal (no known equal).

2.4 All convenience receptacles and special outlets throughout shall be grounding type. Convenience receptacles shall be side wired, parallel slot, two pole, three wire, 20 amp as follows:

	HUBBELL	LEVITON	PASS & SEYMOUR
Duplex	5352	5362	PS5362
GFCI	GFR5352A	8899	2094
Isolated Ground	IG5362	5362IG	IG6300
Tamper Proof		8300SG	TR63H

2.5 All safety or tamper proof receptacles shall have no exposed external current carrying metal parts, and shall have integral wiring leads suitable for two or three wire installations.

2.6 Special receptacles shall be as noted on the drawings.

2.7 Weatherproof plates shall be designed to meet CEC Article 410-57, wet location listed with cover "open." Where weatherproof receptacles have been identified to be provided with locking covers, the cover shall be as manufactured by Pass & Seymour #4600-8 or Cole Lighting 310 Series. Rough-in requirements vary between manufacturers. Contractor to field verify requirements prior to installation.

2.8 All plates throughout shall be stainless steel. Where wiring devices are installed in concrete block walls, provide oversized 3-1/2" x 5" coverplates.

2.9 All devices shall be white unless otherwise noted or a special purpose outlet.

2.10 Unless where specifically detailed on the drawings, floor boxes shall be PVC suitable for concrete poured floors of minimum 3-1/2" depth, with a modular design to gang two or three sections together.

2.10.1 Carlon #E976 series or approved equal

2.10.2 Provide brass cover with brass carpet flange unless otherwise detailed.

PART 3 – EXECUTION

3.1 Switches for room lighting shall be located no more than 12" center line from door jamb at plus 48" to top of control box above finished floor or +46" to top of control box where located over casework, reference CBC Figure 11B-5D.

3.2 All receptacles shall be mounted at plus 15” minimum to bottom of outlet box above finished floor unless noted or shown otherwise. All receptacles shall be installed with the ground pin up, at the top of the receptacle to comply with IEEE 602-1986.

3.3 Furnish and install wall plates for all wiring devices, and outlet boxes, including special outlets, sound, communication, signal, and telephone outlets, etc. as required. All cover plates shall be appropriate for type of device.

END OF SECTION

SECTION 26 28 16

DISCONNECTS

PART 1 – GENERAL

1.1 Furnish and install all disconnect switches as shown on the drawings and as required by the CEC.

1.2 Submit manufacturers' data for all disconnects and fuses.

1.2.1 Disconnects

1.2.2 Fuses

1.3 **Common submittal mistakes which will result in the submittals being rejected:**

1.3.1 Not including all items listed in the above itemized description.

1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.

1.3.3 Not including actual manufacturer's catalog information of proposed products.

1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

PART 2 – PRODUCTS

2.1 Acceptable manufacturers shall be Square D, Cutler Hammer, Siemens or General Electric.

2.2 Equipment manufactured by any other manufacturers not specifically listed in Section 2.1 are not considered equal, or approved for use on this project.

2.3 All switches shall be heavy-duty type, externally operated, quick-make, quick-break, rated 600 volts or 240 volts as required, with the number of poles and ampacity as noted. All switches for motors shall be HP rated. Switches shall have NEMA-Type 1 enclosures, except switches located where exposed to outdoor conditions shall have NEMA Type 3R enclosure. Switches generally shall be fused except where noted to be non-fused on the drawings.

2.4 Where fuses are indicated, fuses shall be Bussman or Littlefuse (no known equal). Fuses shall be current limiting type with time delay characteristics to suit the equipment served.

PART 3 – EXECUTION

3.1 Mount all switches to structure or U-channel support. U-channel supports shall be cleaned and painted to prevent rust.

3.2 Switches shall be accessible with proper clearances in front per CEC 110-16.

3.3 All lugs shall be torque tested in the presence of the inspector of record.

3.4 Arc Flash and Shock Hazard

3.4.1 The contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.

3.4.2 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16 Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high.

3.4.3 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department.

3.4.4 The design goal is to minimize the incident energy to which a maintenance employee may be exposed and in no case more than 8 cal./cm².

END OF SECTION

SECTION 26 90 90

ELECTRICAL CLOSEOUT

PART 1 – GENERAL

1.1 Upon completion of the electrical work, the entire installation shall be tested by the Contractor, and demonstrated to be operating satisfactorily to the Architect, Engineer, Inspector and Owner.

1.2 All testing and corrections shall be made prior to demonstration of operation to the Architect, Engineer, Inspector and Owner.

1.3 In addition to the demonstration of operation, the Contractor is also required to review the content and quality of instructions provided on items demonstrated with the Architect, Engineer, Inspector and Owner.

PART 2 – EXECUTION

2.1 Wiring shall be tested for continuity, short circuits and/or accidental grounds. All systems shall be entirely free from “grounds,” “short circuits,” and any or all defects.

2.2 Motors shall be operating in proper rotations, and control devices functioning properly. Check all motor controllers to determine that properly sized overload devices are installed, and all other electrical equipment for proper operation.

2.3 Tests and adjustments shall be made prior to acceptance of the electrical installation by the Architect, and a certificate of inspection and acceptance of the electrical installation by local inspection authorities shall be provided.

2.4 All equipment or wiring provided which tests prove to be defective or operating improperly shall be corrected or replaced promptly, at no additional cost to the Owner.

2.5 Test all motor and feeder circuits with a “megger” tester to determine that insulation values conform to Section 110-20, California Electrical Code (CED). Test reports must be submitted and approved by the engineer before final acceptance.

2.6 Test all grounding electrode connections to assure a resistance of no more than 10 ohms is achieved. Augment grounding until the ohmic value stated above is achieved. Provide certified test results to the Architect, Engineer and Inspector.

END OF SECTION