SPECIFICATIONS FOR
THE
VENTURA COMMUNITY COLLEGE DISTRICT

HVAC REPLACEMENT PROJECT

AT

MOORPARK COLLEGE LM BUILDING
7075 Campus Road,
Moorpark California 93021

Prepared by:

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838 Front Street
Ventura California 93001

FOR OWNER:

VENTURA COMMUNITY COLLEGE DISTRICT
761 East Daily Drive,
Camarillo, California 93010

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DSA Application # 03-125525
DSA File # 56-C1

SPECIFICATIONS MANUAL for the construction of:

MOORPARK COLLEGE

LM BUILDING HVAC REPLACEMENT PROJECT

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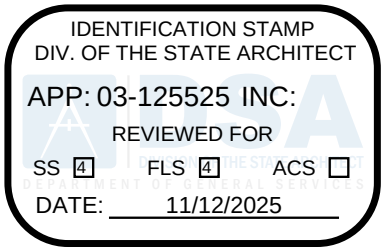
DIVISION OF THE STATE ARCHITECT
APPL. #03-12525

STATE OF CALIFORNIA - DEPARTMENT OF GENERAL SERVICES
DIVISION OF THE STATE ARCHITECT
LOS ANGELES BASIN REGIONAL OFFICE



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SECTION 00 0115

BASIC CONTRACT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF WORK

A. This work includes the demolition and disposal of existing three rooftop multi-zone air handlers. This work includes the installation of three new triple deck multi-zone heat pump air handlers. Included, but not limited to, in the work are demolition, steel and welding, controls, air balancing, and electrical connections. All work shall conform to 2022 Title 24 California Code of Regulations (CCR).

1.02 SELECTIVE DEMOLITION

A. Coordinate demolition with all trades and protect areas not involved with the installation of the new equipment. Demolish and remove existing equipment only to the extent required for the new construction. Legally dispose of all demolished materials. Recycle to the greatest extent possible.

1.03 CUTTING AND PATCHING

A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction.
Closely match texture and finish of existing adjacent surfaces. Extend final coat of paint to a logical stopping point such as door frame or wall corner. Employ qualified workers to perform cutting and patching. Replace any damaged ceiling tiles with similar style.

B. Do not cut any structural member without prior notification to the Engineer.

C. Substitution shall be approved by the Engineer prior to the construction of the change.

1.04 INSPECTION

A. Contractor is responsible for scheduling inspection and maintaining permitted construction plans at the site.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION – NOT APPLICABLE

END OF SECTION 00 0115

SECTION 00 1040

PROJECT COORDINATION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Coordination of Work of all trades.

1.02 RELATED REQUIREMENTS

A. Section 01700 - Contract Closeout: Closeout Submittals.

1.03 DESCRIPTION

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

B. Coordinate sequence of work to accommodate Owner occupancy.

1.04 MEETINGS

A. City will schedule and administer the pre-construction conference and project meetings for execution of the City – Contractor Agreement.

B. Contractor shall hold coordination meetings and pre-installation conferences with personnel and sub-contractors to assure coordination of work.

1.05 COORDINATION OF SUBMITTALS

A. Schedule and coordinate submittals.

B. Provide a complete list of submittals, indicating specified sections, sub-contractors, numbering system, etc.

C. Coordinate work of various sections having independent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate requests for substitutions to assure compatibility of space, of operating elements, and effect on work of other sections.

E. The first submittal shall be comprehensive and complete. Product specifics such as color, voltage, options, etc. shall be clearly marked. A copy of the submittal with review shall be kept on the jobsite.

1.06 COORDINATION OF SPACE

A. Coordinate use of project space and sequence of installation of mechanical and electrical work which is indicated diagrammatically on Drawings. Follow routings shown for pipes, ducts, and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

B. In finished areas except as otherwise shown conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

C. Existing building will have to accommodate new material installation. Provide all required furring, anchors, finishes, etc. necessary for new material installation.

1.07 COORDINATION OF CONTRACT CLOSEOUT

A. Coordinate completion and cleanup of work of separate sections in preparation for Substantial Completion.

B. Coordinate correction of defective work and work not in accordance with Contract Documents, to minimize disruption of City’s activities.

C. Assemble and coordinate closeout submittals.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION – NOT APPLICABLE

END OF SECTION 00 1040

SECTION 00 1300

SUBMITTALS AND MANUALS

PART 1 GENERAL

1.01 WORK INCLUDED

A. To ensure that the specified products are furnished and installed in accordance with design intent, procedures have been established for advance submittal of design data, and for review and acceptance or rejection by the Engineer.

1.02. REQUIREMENTS INCLUDED

A. Procedures.

B. Construction Progress Schedules.

C. Schedule of Values.

D. Manufacturer's Instructions.

E. Manufacturer's Certificates.

1.03 RELATED REQUIREMENTS

A. Section 01700 – Contract Closeout: Warranties and Manufacturers Certificates.

1.04 PROCEDURES

A. Deliver submittals to Engineer of Record.

B. Transmit each item under Engineer–accepted form, Identify Project, Contractor, subcontractor, major supplier. Identify pertinent Drawing sheet and detail number, and Specification Section number, as appropriate. Identify deviations from Contract Documents. Provide space for Contractor and Engineer review stamps.

C. Submit initial progress schedules and schedule of values promptly after the Notice to Proceed is issued. After review by Engineer and owner revise and resubmit as required. Submit revised schedules if there are changes to the schedule..

D. Comply with progress schedule for submittals related to Work progress. Coordinate submittal of related items.

E. After Engineer review of submittal, revise and resubmit as required, identifying changes made since previous submittal.

F. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.

PART 2 PRODUCTS

2.01 SHOP DRAWINGS

A. Submit shop drawings in accordance with Section 2-5.3.2 of the Standard Specifications.

2.02 SUBMITTALS

A. Submit submittals in accordance with Section 2-5.3.2 of the SSWPC.

2.03 AIR BALANCE REPORTS AND CONTROLS COMMISSIONING REPORT

A. Provide air balance report and controls commissioning report to engineer within one week of completion of task.

2.04 OPERATION AND MAINTENANCE DATA

A. Submit PDF copies of Operation and Maintenance Manuals promptly after completion of work for review by the engineer in accordance with Section 01700.

1. Preparation of data shall be done by personnel trained and experienced in maintenance and operation of the described products, skilled in technical writing to the extent required to communicate essential data, and draftsmen shall be competent to prepare the required drawings.

PART 3 EXECUTION

3.01 SUBMITTALS

A. Submittals shall be provided in via email as flatten PDF documents. Products to be used shall be clearly identified on each sheet. If variations are shown on the product sheet then the contractor shall clearly identify which product is being submitted for review. All options and electrical information where shown shall be clearly identified as to which is being submitted for review. Location of manufacturer shall be provided when specifications or notes require USA origin.

END OF SECTION 00 1300

SECTION 00 1630

SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Contractor's options in selection of products.

B. Products list.

C. Requests for substitution of products.

D. Substitution Request Form.

1.02 OPTIONS

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

B. Products Specified by Naming Two or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named.

C. Products Specified by Naming Only One Manufacturer: No option: no substitution allowed.

1.03 PRODUCTS LIST

A. Within 15 days after date of Owner-Contractor Agreement, transmit three copies of a list of major products which are proposed for installation, including name of manufacturer.

B. Tabulate products by Specifications section: number, title, and article number.

C. Products specified only by reference standards, give manufacturer, trade name, model or catalog designation and reference standards.

D. Engineer will reply in writing stating whether there is reasonable objection to listed items. Failure to object to a listed item shall not constitute a waiver of requirements of Contract Documents.

1.04 LIMITATIONS ON SUBSTITUTIONS

A. During Bidding period, no substitutions shall be considered.

B. Requests for substitutions of products will be considered only within 35 days after date of Owner-Contractor Agreement. Subsequent requests will be considered only in case of product unavailability or other conditions beyond control of Contractor.

C. Substitutions will not be considered when indicated on shop drawings or product data submittals without separate formal request, when requested directly by subcontractor or supplier, or when acceptance will require substantial revision of Contract Documents.

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

E. Only one request of substitution for each product will be considered. When substitution is not accepted, provide specified product.

F. City will determine acceptability of substitutions.

1.05 REQUEST FOR SUBSTITUTIONS

A. Requirements as stated on Substitution Request Form at the end of this section.

1.06 CONTRACTOR REPRESENTATION

A. Requirements as stated on Substitution request Form at the end of this section.

1.07 SUBMITTAL PROCEDURES

A. Submit three copies of request for substitution of the Substitution Request Form at the end of this section.

B. Engineer will review Contractor’s requests for substitutions with reasonable promptness.

C. For accepted products, submit shop drawings, product data, and samples.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION – NOT APPLICABLE

SECTION CONTINUED ON NEXT PAGE

SUBSTITUTION REQUEST FORM

PAGE 1 OF 2

Include this form with each request for substitution.

_____

DATE OF REQUEST

General
Contractor's _____

_____

Initials SPECIFICATION SECTION PRODUCT

_____ Contractor acknowledges and certifies that this substitution request is with all limitations of paragraph 1.05 LIMITATIONS ON SUBSTITUTIONS

REQUESTS FOR SUBSTITUTIONS

_____A. Submit separate request for each substitution. Document each request with complete data substantiating compliance of proposed substitution with requirements of Contract Documents.

_____B. Identify product by Specifications section and Article numbers. Provide manufacturer's name and address, trade name of product, and model or catalog number. List fabricators and suppliers as appropriate.

_____C. Attach product data as specified in Section 01340.

_____D. List similar projects using product, dates of installation, and names of Engineer and Owner.

_____E. Give itemized comparison of proposed substitution with specified product, listing variations, and reference to Specifications section and Article numbers.

_____F. Give quality and performance comparison between proposed substitution and the specified product.

_____G. Give cost data comparing proposed substitution with specified product, and amount of net change to Contract Sum.

_____H. List availability of maintenance services and replacement materials.

_____I. State effect of substitution on construction schedule, and changes required in other work or products.

continued on next page

SUBSTITUTION REQUEST

PAGE 2 OF 2

General
Contractor's

Initials

_____

CONTRACTOR REPRESENTATION

_____A. Request for substitution constitutes a representation that Contractor has investigated proposed product and has determined that it is equal to or superior in all respects to specified product or that the cost reduction offered is ample justification for accepting the offered substitution.

_____B. Contractor will provide same warranty for substitution as for specified product.

_____C. Contractor will coordinate installation of accepted substitute, making such changes as may be required for Work to be complete in all respects.

_____D. Contractor certifies that cost data presented is complete and includes all related costs under this Contract.

_____E. Contractor waives claims for additional costs related to substitution which may later become apparent.

END OF SECTION 00 1630

SECTION 00 1700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Closeout Procedures.

B. Final Cleaning.

C. Project Record Documents.

D. Operation and Maintenance Data.

E. Warranties and Bonds.

F. Spare Parts and Maintenance Materials.

1.02 CLOSEOUT PROCEDURES

A. When Contractor considers Work has reached final completion, 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 Engineer’s inspection.

B. In addition to submittals required by the conditions of the Contract, provide submittals required by governing authorities, and submit a final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remain due.

1.03 FINAL CLEANING

A. Execute prior to final inspection.

B. Clean interior and exterior surfaces exposed to view: remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment.

C. Clean site; sweep paved areas, rake clean other surfaces.

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

1.04 PROJECT RECORD DOCUMENTS

A. Store documents separate from those used for construction.

B. Keep documents current; do not permanently conceal any work until required information has been recorded.

C. At Contract closeout, submit documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

1.05 OPERATION AND MAINTENANCE DATA

A. Provide data for:

1. Mechanical equipment and controls – Division 15.
2. Electrical equipment and controls – Division 16.

B. Submit two sets prior to final inspection, bound in 8-1/2 x 11 three-ring binders with durable plastic covers.

C. Provide a separate volume for each system, with a table of contents and index tabs for each volume.

D. Part 1: Directory, listing names, addresses, and telephone numbers of: Engineer, Contractor, and Subcontractors.

E. Part 2: Operation and maintenance instructions, arranged by system. For each system, give names addresses, and telephone numbers of subcontractors and suppliers. List:

1. Appropriate design criteria.
2. List of equipment.
3. Parts list.
4. Operating instructions.
5. Maintenance instructions, equipment.
6. Maintenance instructions, finishes.
7. Shop drawings and product data.
8. Warranties.

1.06 WARRANTIES AND BONDS

A. Provide duplicate, notarized copies. Execute Contractor's submittals and assemble documents executed by subcontractors, suppliers, and manufacturers. Provide Table of Contents and assemble in binder with durable plastic cover.

B. Submit material prior to final application for payment. For equipment put into use with Owner's permission during construction, submit within 10 days after first operation. For items of Work delayed materially beyond Date of

Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.07 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, and maintenance materials in quantities specified in each Section, in addition to that used for construction of Work. Coordinate with Owner, deliver to Project site and obtain receipt prior to final payment.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION – NOT APPLICABLE

END OF SECTION 00 1700

SECTION 00 2220

SELECTIVE DEMOLITION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Selective demolition which meets the certification goals as established by the Ventura County Community College District for the individual Project requirements.

B. Section includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.
4. Protecting existing work to remain.
5. Cleaning soiled materials that are to remain.
6. Disconnecting and capping utilities.
7. Removing debris and equipment.
8. Removal of items indicated on Drawings.
9. Salvageable items to be retained by the Owner as indicated on the Drawings and during the pre-construction job walk.

1.03 DEFINITIONS

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

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

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

1.04 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Ownership of Materials: Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposing at the Contractor's option.

1.05 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure on-site operations of Owner, staff, and students are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

D. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.06 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.07 QUALITY ASSURANCE

A. Carefully perform demolition work, by skilled workers experience din building demotion procedures, using appropriate tools and equipment. Perform work, at all times under the direct supervision of a supervisor approved by the Owner Inspector.

B. Coordinate demolition with other trades to ensure correct sequence, limits, and methods of proposed demolitions. Schedule work to create the least possible inconvenience to the public and to facility operations.

PART 2 – PROJECTS

2.01 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

E. Survey of Existing Conditions: Record existing conditions by use of measured drawings.

3.02 GENERAL

A. Protection:

1. Do not begin demolition until safety partitions, barricades, warning signs and other forms of protection are installed.
2. Provide safeguards, including warning signs, lights and barricades, for protection of occupants and the general public during demolition.
3. Provide and maintain fire extinguishers. Comply with requirements of governing authorities.
4. Maintain existing utilities which are to remain in service and project from

damage during operations.

B. Safety: If at any time safety of existing construction appears to be endangered, take immediate measures to correct such conditions; cease operations and immediately notify the Owner Inspector. Do not resume demolition until directed by the Owner Inspector. Provide safety personnel for guidance and people control when vehicles are accessing the campus.

C. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations. Do not create hazardous or objectionable conditions, such as flooding and pollution, when using water.

D. Debris Removal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grades level.

E. Progress Cleaning: Clean adjacent buildings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to the condition existing before start of demolition.

3.03 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/ systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

3.04 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 “Temporary Facilities and Controls.”

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

C. Temporary shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or

uncontrolled movement or collapse of construction being demolished.

3.05 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations.

B. Removed and Salvaged Items:

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.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by City, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.06 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS.

A. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weather tight.

B. Air Handling Equipment: Cap existing chilled and hot water systems at each air handler or fan coil so that the rest of the system remains operational.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill. Recycle materials to the greatest extent possible.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.08 PATCHING AND RESTORATION

A. Patching: Where removals leave holes and damaged surfaces that will be exposed in the completed construction, such holes and damaged surfaces shall

be patched and resorted to match adjacent finished surfaces.

B. Restoration of Building Finishes: Touch up scratched finishes as recommended by manufacturer of original finish.

3.09 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 00 2220

SECTION 05 50 00

METAL FABRICATIONS

PART 1 – GENERAL

1.1 Related Documents

A. Drawing and general provisions of the Contract, including General and Supplementary conditions, apply to this section.

1.2 Summary

A. Section includes:

1. Steel braces for HVAC Curbs

1.3 Submittals

A. Mill certificates

B. Welding procedures

C. Welder qualifications.

1.4 Quality Assurance

A. Qualify procedures and personnel according to AWS D1.1/D1.1M “ Structural Welding Code – Steel.”

B. All work shall conform to 2022 Title 24, California Code of Regulations and the ACSE code.

1.5 Project Conditions

A. Field Measurements: Verify existing conditions and dimensions before fabrication.

PART 2 – PRODUCTS

A. Steel Shapes - Provide steel per ASTM A36/A36M.

B. Steel fasteners (ITW Teks Screws) – Steel fasteners shall conform to ASTM A510 and be installed per ICC-ES ESR-1976.

C. Welding Rods and bare electrodes: All welding shall be performed with E70XX electrodes conforming to AWS D1.1 latest edition.

D. Cut metals cleanly and accurately. Remove burrs and ease edges.

PART 3 EXECUTION

A. Use methods that minimize distortion and develop strength. Obtain fusion without undercut or overlap. Remove welding flux immediately.

B. Cutting, Fitting, and Placement: Perform cutting and fitting required for metal fabrications. Set metal fabrications accurately in location, alignment, and elevation.

C. All welding shall be specially inspected by an AWS-CWI qualified inspector approved by the California Division of State Architect.

D. Structural steel shall be detailed, fabricated, and erected in accordance with the “Specifications for the and erection of structural steel for buildings by the AISC latest edition.

E. All shop welding shall be done by certified welders in the shop of a fabricator approved by the Division of the State Architect. For shops not approved, welding shall be continuously inspected by a licensed deputy inspector per section 1704A.2 of the California Building Code.

F. Bolt holes shall be 1/16” larger than the bolt diameter. Bolt holes shall be punched or drilled. Burned holes are not permitted. Machine bolts shall conform to ASTM A-307.

END OF SECTION 05 50 00

SECTION 23 0500

COMMON WORK RESULTS FOR HVAC

GENERAL

1.1 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Division 23 Sections, in addition to the General Requirements.

B. Mechanical work includes the following: furnish and install all mechanical equipment shown on the mechanical, plumbing, architectural, electrical, and civil engineering drawings and described in these specifications. Contractor shall furnish and install, make operable, and test all mechanical equipment shown on the plans. In connection therewith, contractor shall also furnish and install all necessary work, devices, hardware and systems required to make said equipment properly and safely operable, including but not limited to, mounting hardware and framing, insulation, vibration control devices, duct systems, flashing, piping, valves, systems, energy management systems, cutting and patching.

PART 1 - 1.2 WORK SEQUENCE

A. Install work in phases to accommodate Owner's construction requirements. Refer to Mechanical and Electrical Drawings for the construction details and coordinate the work of this division with that of other divisions. Order the work of this division so that progress will harmonize with that of other divisions and all work will proceed expeditiously. During the construction period, coordinate mechanical schedule and operations with General Contractor and any other related subcontractor.

1.3 ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work as required.

1.4 SUBMITTALS

A. Submit the following:

B. Proposed Products List: Include Products specified in the following Sections:

1. Section 23 - Mechanical.

2. Project Drawings

C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal. Submittals shall be specific to the fixtures/device/unit being submitted; the data shall be highlighted or marked to be quite clear as to the fixtures/devices/units that shall be provided.

D. Equipment and materials shall be ordered only after satisfactory review by Owner and Engineer.

E. The following statement applies to all items reviewed. "Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for dimensions which shall be confirmed at the job site; fabrication processes and techniques of construction; coordination of his work with that of other trades; and the satisfactory performance of his work."

F. Contractor shall clearly mark the submittal sheet as to which model number, size, color, etc. when there is more than one choice available.

G. Maintain a complete set of the most current reviewed submittal and shop drawings on site during construction.

H. PDF submittals shall have table of contents organized by specification section and shall clearly identify electrical characteristics, options provided, color, model number and equipment tag as indicated on the drawings.

1.5 REGULATORY REQUIREMENTS

A. Conform to 2022 California Building Code.

B. Fire Protection: Conform to 2022 California Fire Code, and California State Fire Marshall Regulations, Title 19, Public Safety.

C. Plumbing: Conform to 2022 California Plumbing Code.

D. Mechanical: Conform to 2022 California Mechanical Code.

E. Electrical: Conform to 2022 California Electrical Code.

F. Obtain approved inspections from authority having jurisdiction.

G. Conflicts: Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.6 PROJECT/SITE CONDITIONS

A. Install work in locations shown on drawings, unless prevented by project conditions.

B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of owner before proceeding.

C. Piping locations: Piping locations shown are diagrammatic only. Contractor shall verify locations of all lateral stubs, offsets, etc. required in the field. The actual locations of lines, cleanouts and connections may vary provided that complete systems are installed in compliance with codes. It is not the intent of the drawings to show necessary offsets required to avoid structure or other trades. It is the intent of this paragraph that all costs associated with this paragraph be borne by the contractor.

D. Construction observation: In addition to the requirement for obtaining inspections by the local jurisdiction, contractor shall notify Engineer at appropriate times during the construction process so that Engineer can visit site to become generally familiar with the progress and quality of contractor's work and to determine if the work is proceeding in general accordance with the contract documents.

E. Scaling of drawings: In no case shall working dimensions be scaled from plans, sections, or details from the working drawings. If no dimension is shown on the architectural drawings, the prime contractor shall request in writing that the architect or engineer provide clarification or the specific dimension.

F. As equal: For an item to be substituted "as equal" the contractor must provide to the engineer a complete submittal no later than 7 days prior to the bid opening. Contractor shall be responsible for any cost associated with the change including architectural design, mechanical, structural and electrical engineering and changes in any element of the building.

G. Unit and duct locations: Heating and air conditioning unit and duct locations shown are approximate only. Contractor shall verify locations of all structural members, other trades, and existing conditions in the field, and locate units and ductwork to avoid interference. All clearances required by unit manufacturer shall be maintained. Entire installation shall be in accordance with codes and the recommended installation procedures published by the manufacturers. It is not the intent of the drawings to show necessary offsets and transitions required to avoid structure or other trades. It is the intent of this paragraph that all costs associated with this paragraph be borne by the contractor.

H. Proceed with roofing work only when existing and forecasted weather conditions will permit a unit of work to be installed in accordance with manufacturer’s recommendations and warranty requirements.

I. Flashings and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Complete flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

1.7 QUALITY ASSURANCE

A. Qualification of Manufacturer: Products used in work shall be produced by manufacturers regularly engaged in the manufacture of similar items.

B. Qualification of Installer: Use adequate number of skilled workman, thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements contained in the plans and specifications. Engage an experienced installer to perform work who has specialized in installing roofing similar to that required for this project; who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive the standard roofing manufacturer's warranty.

C. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.

D. Provide products and materials that are new, clean, free from defects, damage, and corrosion.

E. Provide name/data plates on major components with manufacturer's name, model number, serial number, date of manufacturer, capacity data, and electrical characteristics permanently attached in a conspicuous location on the equipment.

F. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards. Power using equipment shall be meet the California energy efficiency standards as defined in the current Title 24 requirements.

1.8 DRAWINGS AND SPECIFICATIONS

A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or specifications, immediately and before commencing work, request clarification from Engineer.

B. The Engineer shall interpret the drawings and the specifications, and the Engineer's decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished thereunder shall be accepted as final and conclusive.

C. In case of conflicts not clarified prior to Bidding deadline, use the most costly alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful Bidder as soon as feasible after the Award and if appropriate a deductive change order will be issued.

D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".

E. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades. Report any discrepancies to the architect. Install and coordinate the work in cooperation with the other trades.

PART 2 – NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all equipment per the manufacturer’s instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.

B. Adjust pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interferences.

1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. Lines whose elevations cannot change have right-of-way over lines whose elevations can be changed.

2. Provide offsets, transitions, and changes in directions of pipes and ducts as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required.

C. All equipment shall be firmly anchored to building structural elements.

D. Install all equipment to permit proper service of equipment. Arrange pipes, ducts, conduits, etc to allow accessibility to equipment.

E. Do not install equipment, pipes, or ducts above electrical room

F. Install accessible plumbing fixtures at height shown on architectural drawings. Report any discrepancies or layout issues to Architect promptly.

3.2 COORDINATION OF WORK

A. The contract documents establish scope, materials, and quality but are not detailed installation instructions. Drawings are diagrammatic.

B. The contract documents show the general arrangement of equipment, ductwork, piping, and accessories. Provide offsets, fittings, and accessories which may be required but are not shown on the drawings. Investigate the site and review the other trades installation locations and requirements to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.

C. Whenever work interconnects with the work of other trades, coordinate to insure that all parties concerned have the necessary information required for a proper installation.

D. Provide access doors as required to allow service and accessibility to valves, dampers, coils, etc. Install fire rated access doors in rated assemblies. Coordinate with framing and ceiling contractors.

E. Furnish and set sleeves for passage of pipes, ducts, and conduits that pass through structural masonry and concrete walls, roofs, floors and elsewhere as required for the proper protection of each item passing through the building elements. See structural drawings for further details.

F. Install UL Approved firestopping around all pipes, conduits, ducts, etc which pass through rated walls, partitions, and floors in strict accordance with manufacturer's listing and element rating.

3.3 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

A. Provide two copies of all operating and maintenance manuals to owner. Include parts lists and suppliers' names and phone numbers.

B. Provide two hours of training to the owner for the proper operation (start-up, operation, and shutdown) and servicing of the installed equipment. Provide three weeks notice to the owner, architect and engineer of the date of the training. Arrange for subcontractors to attend and participate where applicable.

3.4 COMMISSIONING

A. At the conclusion of the installation the contractor shall convene a pre-commissioning meeting to review the implementation of the commissioning process.

B. Contractor shall verify that all building services, gas, electric, water, sewer, and information technologies are functional prior to beginning commissioning.

C. The commissioning team shall comprise the general, mechanical, electrical, controls and plumbing contractors, the project manager, test and balance company, and the mechanical engineer. Provide sample forms for review to the mechanical engineer prior at pre-commissioning meeting.

D. The commissioning process shall be including function testing all equipment, controls, and electrical systems. All testing shall be documented in an item by item report with dates of test, test parameters and results.

E. Provide commissioning report to project manager within two weeks of completion.

3.5 ROOF PATCHING AND PROTECTION

A. Protect existing roof assembly during construction including paths of travel. Repair any damage to existing roofing.

B. Roof and curb waterproofing shall be performed by licensed commercial roofing contractor and repair shall be of similar type to existing roof. Patch shall be warrantied for 5 years from the date of installation.

3.6 TESTING AND INSPECTION

1. Testing and Inspections are required for this project. Coordinate with Project Inspector to schedule special and regular inspections. See project specific DSA 103-22 for additional information.
   a. Special inspection is required for all post-installed anchors. Review and implement the requirements for testing contained in the relevant ICB ICC reports. Code reference CBC 1617A1.19 Table 1705A.3 Item 4a (continuous) and 4b (periodic).
   b. All welding shall be specially inspected by an AWS-CW1 qualified inspector approved by the California Division of the Architect.
   c. Steel and aluminum stock products require periodic material identification. Provide mill certificates that indicate the material properties that comply with the requirements.

END OF SECTION 23 0500

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

GENERAL

1.1 RELATED DOCUMENTS

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. Section Includes:

Balancing Air Systems:

Constant-volume air systems.

1.3 DEFINITIONS

B. AABC: Associated Air Balance Council.

NEBB: National Environmental Balancing Bureau.

TAB: Testing, adjusting, and balancing.

TABB: Testing, Adjusting, and Balancing Bureau.

TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

C. Certified TAB reports.

Sample report forms.

Instrument calibration reports, to include the following:

Instrument type and make.
Serial number.
Application.
Dates of use.
Dates of calibration.

1.5 QUALITY ASSURANCE

D. TAB Contractor Qualifications: Engage an independent TAB entity certified by AABC, NEBB, or TABB.

TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB or TABB.
TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB or TABB as a TAB technician.

TAB Conference: Meet with Engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

Agenda Items:

The Contract Documents examination report.
The TAB plan.
Coordination and cooperation of trades and subcontractors.
Coordination of documentation and communication flow.

Certify TAB field data reports and perform the following:

Review field data reports to validate accuracy of data and to prepare certified TAB reports.
Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.

Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 COORDINATION

E. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PRODUCTS (Not Applicable)

EXECUTION

3.1 EXAMINATION

Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

Examine the approved submittals for HVAC systems and equipment.

Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

Examine equipment performance data including fan and pump curves.

Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

Examine test reports specified in individual system and equipment Sections.

Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

Examine operating safety interlocks and controls on HVAC equipment.

Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

F. Prepare a TAB plan that includes strategies and step-by-step procedures.

Complete system-readiness checks and prepare reports. Verify the following:

Permanent electrical-power wiring is complete.
Hydronic systems are filled, clean, and free of air.
Automatic temperature-control systems are operational.
Equipment and duct access doors are securely closed.
Balance, smoke, and fire dampers are open.
Isolating and balancing valves are open and control valves are operational.
Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

G. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems – Testing, Adjusting, and Balancing" and in this Section.

Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

H. 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.

Determine the best locations in main ducts for accurate duct-airflow measurements.

Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

Verify that motor starters are equipped with properly sized thermal protection.

Check dampers for proper position to achieve desired airflow path.

Check for airflow blockages.

Check condensate drains for proper connections and functioning.

Check for proper sealing of air-handling-unit components.

Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

I. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

Measure total airflow.

Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

Measure fan static pressures as follows to determine actual static pressure:

Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.

Measure static pressure directly at the fan outlet or through the flexible connection.

Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.

Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and –treating equipment.

Report the cleanliness status of filters and the time static pressures are measured.

Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

Measure airflow of submain and branch ducts.

Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

Measure air outlets and inlets without making adjustments.

Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

Manufacturer's name, model number, and serial number.
Motor horsepower rating.
Motor rpm.
Efficiency rating.
Nameplate and measured voltage, each phase.
Nameplate and measured amperage, each phase.
Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.8 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the

adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.9 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer’s name and address.
7. Contractor’s name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.

Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

Summary of contents including the following:

Indicated versus final performance.
Notable characteristics of systems.
Description of system operation sequence if it varies from the Contract Documents.

Nomenclature sheets for each item of equipment.
Data for terminal units, including manufacturer's name, type, size, and fittings.
Notes to explain why certain final data in the body of reports vary from indicated values.
Test conditions for fans and pump performance forms including the following:

Settings for outdoor-, return-, and exhaust-air dampers.
Conditions of filters.
Cooling coil, wet- and dry-bulb conditions.
Face and bypass damper settings at coils.
Fan drive settings including settings and percentage of maximum pitch diameter.
Inlet vane settings for variable-air-volume systems.
Settings for supply-air, static-pressure controller.
Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Terminal units.
5. Balancing stations.
6. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.

g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
Center-to-center dimensions of sheave, and amount of adjustments in inches.
Number, make, and size of belts.
Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
Return-air damper position.
Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.

i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
Refrigerant suction temperature in deg F.
Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.

f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Instrument Calibration Reports:

Report Data:

Instrument type and make.
Serial number.
Application.
Dates of use.
Dates of calibration.

3.10 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
Measure water flow of at least 5 percent of terminals.
Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
Verify that balancing devices are marked with final balance position.
Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Engineer.
3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as “FAILED.”
5. If the number of “FAILED” measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor’s final payment.

D. Prepare test and inspection reports.

END OF SECTION 23 0593

SECTION 23 7000

AIR HANDLING EQUIPMENT

PART 1 GENERAL

1.01 WORK INCLUDED

A. The work under this Section shall include furnishing all materials, equipment and performing all operations necessary for the complete production, packaging, factory testing and delivery of the air handling equipment as specified.

B. This section covers only the units indicated as "CUSTOM" on the Air Handling Equipment Schedule.

1.02 WORK NOT INCLUDED

A. Rigging, installation, controls, control panels, control valves, variable frequency drives, control panels, actuators, commissioning and commissioning support will be provided by others unless otherwise specified.

1.03 QUALITY ASSURANCE

A. Manufacture shall conduct a full cooling and heating operational test on the units, before it leaves the factory. A written test report shall be prepared by the manufacturer and submitted to the owner

B. Custom air-handling units shall be obtained through one source from a single manufacturer.

C. Fabricated units shall conform to all information documented in approved submittal package and construction notes (approved by owner or owner's representative).

1.04 SUBMITTALS

A. Shop drawings:

1. Drawings shall indicate to scale assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

2. Drawings shall include cross-sections and details of casing construction, dimensions, details of typical panel joint construction, insulation, components installation, etc.

3. Detailed shop drawings showing all control dampers, access doors, removable access panels, fans & motors, coils, drains, filters, lights, electrical components, pipe connections, air terminals, and configurations of components.

Product Data:

1. Provide literature that indicates dimensions, capacities, ratings, performances, gauges and finishes of materials, and electrical characteristics and connection requirements.
2. Provide data of filter media, performance, framing and assembly.
3. Provide fan curves with specified operating point clearly plotted.
4. Provide coil selection with performance data.
5. Provide pressure drop calculation report indication the internal pressure loss and available external loss.
6. Submit sound power level data for fan outlet and inlet.
7. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
8. Submit performance, noise and vibration test results of the air handling unit as required by specifications. Provide test results for review prior to any air handling unit shipment to the job site.
9. All equipment components to be provided in a unit shall be submitted together as a single package. Equipment descriptive literature and component performance data shall be submitted.
10. Detailed manufacturer's descriptive literature of installation and operating instructions, parts lists, etc. required to demonstrate compliance with specifications shall be submitted for review of bid and for approval prior to fabrication.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site with factory installed shipping skids and lifting lugs.

B. Handle carefully to avoid damage to components, enclosures, and finish.

C. Units shall be stored outdoors until installed. Manufacturer shall provide adequate protection of all openings to prevent dirt, insects, etc. from entering the unit. Indoor unit(s) method of protection will be shrink wrap applied at the factory before shipping.

D. Refer to manufacturer’s Installation, Operation and Maintenance Manual for recommendations for long term storage.

PART 2 PRODUCTS

2.01 PRODUCT ACCEPTABILITY

A. Throughout the specification and submittal process, types of products may be specified by manufacturer's name and catalog numbers to establish standards of quality and performance however products of equal performance may be submitted depending on availability and lead time.

2.02 MATERIAL

A. Steel: Galvanized, G-90 hot dipped or finished.

B. Stainless Steel: Type 304

2.03 PERFORMANCE REQUIREMENTS

A. Refer to the equipment schedules for the performance characteristics of all fans, coils, humidifiers, filters and related components as required.

B. Design data on the equipment schedules refer to conditions at job site elevation and the criteria the unit is to perform

C. Design fan total static pressures to include all losses, internal and external to the unit.

2.04 GENERAL CONSTRUCTION REQUIREMENTS

A. Air handling equipment shall be factory assembled as a single unit or multiple modules Units that include modules will be disassembled to ship then reassembled in the field by the contractor.

B. Casing construction shall not rely on the casing panels for structural integrity.

C. Unit casing to withstand 8" WG positive or negative internal pressure, or fan shut-off static pressure, whichever is greater. Leakage shall be less than 0.5% of design airflow.

D. Wall, roof, and door panel deflection shall not exceed L/240 (L is the panel Span length) when operating at 1.5 times schedule fan pressure or a maximum of 8 inches WG of positive and negative static pressure.

E. Floor deflection shall not exceed 1/16“at 1.5 times schedule fan pressure or a maximum of 8 inches WG static pressure with a live load of 250 pounds per sqft.

F. Units require only external connection of electrical power, ductwork, chilled water, hot water, steam, drain and condensate piping.

1. For motor power connections, provide a non-fused service disconnect switch on the exterior wall of the unit. Completely wire service disconnect back to motor connection box with conduit.

2. For floor and condensate drains, provide a recessed floor drain piped and extended through base perimeter of the equipment.

3. Extend piping connections for each coil, or humidifier (if required) 3 inches through panel casing.

4. Terminate piping with either a flange or a threaded connection at full size and cap.

D. Factory shall install all internal electrical components, conduits, electrical conductors, junction boxes, control tubing and piping.

a. All conduits shall be EMT and shall be properly supported and securely attached to units.

b. Where unit requires splits, junction boxes shall be furnished on each section to allow the electrical contractor to make final connections in the field.

c. Wiring shall be clearly labeled to allow ease in final interconnections.

d. After wire is pulled, conduit shall be sealed so that air cannot be transferred into or out of the unit through conduits

E. Internal components shall be serviceable through access doors or removable panels.

F. Provide floor drains in sections as shown on the layout drawings. Floor drains shall be sloped to drain with no standing water.

G. Water-tight piping sleeves shall be provided for all pipes, instrument lines and conduit passing through the unit floor.

K. Units to be supplied with lifting lugs. Each section must have a minimum of four lifting lugs.

2.05 UNIT CONSTRUCTION

A. WALLS AND ROOF

a. Equipment casing shall be double wall insulated standing seam modular panel
construction.

b. For the walls, doors and roof the insulation shall be min 2-inch with thermal resistance of R-13. The insulation system shall be fully encapsulated and resistant to mold growth in accordance with a standardized test method such as UL 181 or ASTM C 1338.

c. For outdoor units, roof shall be sloped with a pitch of ¼” per foot minimum.

d. To ensure water and air tightness all panel connection seams shall use low VOC Sealant between the panels and be attached to each other, to the roof and the floor using mechanical hardware without causing casing leakage.

B. FLOORING

a. Equipment floor shall be double wall and supported by intermediate and structural members on maximum of 24” centers. All seams shall be supported underneath by structural supports. Floor shall be attached to base structure by welding from underneath on maximum 6” centers.

b. Removable safety grates that provide a walking surface shall be provided across all bottom air openings.

C. FRAME AND/OR BASE

a. Base perimeter shall be constructed from formed or structural steel “C” channel. Internal supports shall consist of formed or structural rectangular tubing on minimum 24” centers. All fans and coils shall be supported on a minimum ¼” thick structural tubular steel. The equipment base shall be fully welded. Height and selection of structural members shall consider internal loading, equipment height, length, width and number of split sections as to limit base deflection to 1/200 of span.

b. Curb mounted equipment shall be provided with a curb attachment angle welded on the inside of the base perimeter steel.

c. To ensure proper rigging, provide each section with a minimum of four removable or welded lifting lugs per shipping section attached to the base along the longest length of the equipment. Removable type lifting lugs shall be provided with welded attachments.

D. ACCESS DOORS

a. Access doors shall be provided full height (50”) where unit height permits, and shall be 24” wide where section length permits, otherwise minimum of 18” shall be used.

b. Doors shall be same thickness and material as the section casing. Door frames shall be provided with one-piece, closed cell, replaceable gasket seal.

c. Door hinges shall be die-cast zinc with provision for adjustment or industrial style stainless steel piano type. Hinges shall permit 180 degree of door swing.

d. Zinc alloy or glass reinforced nylon door latches and handles, shall be rated to meet 500 hrs salt-spray requirements. The latching mechanism shall be of conical roller design to provide proper sealing.

e. When required viewing windows shall have double thermal pane with wire reinforced safety glass.

2.05 UNIT COMPONENTS

A. PLENUM FANS

a. All plenum fans shall be of the single width, single inlet type with backwardly inclined wheels w/ airfoil blades.

b. The fan shall be unhoused and incorporate, heavy gauge steel frame and inlet cone with painted finish.

c. Each fan wheel shall be dynamically balanced at the factory before shipping. All fans are balanced per AMCA-204 to balance grade category G6.3.

d. Fans with AC motors shall be installed on a structural steel base frame assembly isolated from outer casing with factory-installed, seismically braced spring isolators of required deflection.

e. Each motor shall be tested to IEEE Standard 112, test method B, and NEMA MG 1 Article 12.58.2 and 12.59 Table 12-10 and bear a factory certification run test label to verify compliance.

f. Motors shall be premium efficiency, inverter duty rated., with minimum 90 percent efficiency for motors greater than 3 horsepower

g. ECM fans shall be mounted directly on fan wall without spring isolator nor flexible connection.

h. Optional airflow measuring station shall consist of total pressure taps located in the inlet cone of each fan, with static pressure tap located near fan inlet panel. Any flow measuring device which creates an obstruction in the fan inlet is not acceptable.

B. COILS - GENERAL

a. Drain Pans:

1. Intermediate drain pans: Provide 16 gauge 304 stainless steel drain pans under all cooling coils as indicated. Cross brake pan to drain connection. Drain piping that is exposed to air stream shall be Type M Copper.

2. Condensate drain pans shall be double sloped to allow proper drainage. The condensate drainpipe shall be 304SS and welded into

the deep end of the sloped drain pan. Drain pipe to be extended 3” outside of the unit cabinet and capped.

b. Coils shall be easily removable from side of units. Where 2 or more coils are installed in a coil bank, 304 stainless steel intermediate drain pans that extend a minimum of 6 inches from coil face shall be provided and condensate shall be piped to bottom drain pan. The bottom coil shall not serve as a drain path for upper coil.

C. DX Coils

a. Factory shall test DX coils with 600 psig compressed air under water. DX coils shall be dehydrated and sealed prior to installation.

b. Tubes shall be round, seamless copper tubes, 3/8” or 1/2" O.D.

c. DX coils shall be heat pump rated

d. Plate-type aluminum or copper fins shall be die-formed with full fin collars for maximum fin-tube contact. Flanged tube sheets shall have extruded tube holes to prevent raw edges of tube sheets cut into copper tubes because of thermal expansion of tubes in tube holes. Tube holes with raw sheet metal edges are not acceptable.

e. Casings to be 304 stainless steel with 16 gauge formed end supports and top and bottom channels. One 16 gauge 304 stainless steel center tube support on lengths over 48"; Two or more supports on ordering lengths over 96.

D. AIR FILTERS

a. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2

b. Access for filter maintenance shall be through a full height service door on the side of the unit

c. Filter sections shall be fabricated as part of the air-handling unit. Filters shall be arranged for upstream, downstream or side loading as specified.

d. Provide filters that match the rating, size and type that are specific to the project. Initial filter shall be 2” Merv 8 pleated with interlaced glass, synthetic, or cotton fibers coated with nonflammable adhesive.

e. Provide filter-holding frames to accommodate scheduled filters. Frames shall be constructed of galvanized steel and equipped with foam gaskets to seal filters against frames and minimize the air leakage

f. Differential pressure gauge with static pressure tips shall be provided to indicate the pressure drop across the filter bank.

E. RETURN, OUTSIDE AND EXHAUST AIR

a. Outside air intake shall have drainable louvers or hoods sized to prevent entrainment of rainwater into the unit and must include an aluminum or stainless steel bird screen.

b. Low leak galvanized or aluminum dampers shall have overlapping airfoil blades, extruded vinyl edge seals, and flexible metal compressible jamb seals.

c. Linkage hardware shall be installed outside of the frame and constructed of corrosion resistant aluminum and zinc plated steel.

d. Dampers shall have a maximum leakage rate of 4 CFM/square foot at 1" w.g. and shall comply with ASHRAE 90.1.

e. Optional air flow measuring station for outside air intake shall include transmitter with digital readout and analog output for BMS.

f. Exhaust dampers shall be motorized control damper type with hood or louver.

g. Through-roof openings, shall be provided with grating of sufficient thickness and strength to support a minimum weight of 300 pounds

2.06 ELECTRICAL / CONTROL

A. Electrical

a. The units shall be factory pre-wired for a single point electrical power connection. Optional factory furnished and wired step-down transformer with a fused disconnect for 120 Volt 20 Amp service.

b. Optional duplex GFCI convenience outlet shall be provided in the control compartment.

c. Main disconnect switch shall be provided for each unit.

d. Provide motor Starters for constant volume units or VFD's for variable volume units. On multiple fan configurations, a separate NEMA Variable Frequency Drive (VFD) shall be provided for each motor. Drives shall be factory mounted and wired to motor.

e. The unit shall be furnished with vapor-proof LED light fixtures with guard for each accessible compartment.

f. Lights shall be controlled by one light switch mounted by the fan section door or in the control compartment.

g. Approved VFD manufacturers are Eaton and ABB

h. All wiring shall be run in EMT conduit, (or flexible when connecting to a motor), raceways are not acceptable

i. All panels shall be supplied with a proper ventilation with openings/filters suitable for the enclosure NEMA type.

B. Control

a. All control diagrams, sequence of operation, controls and operators shall be provided by the AHU manufacturer

PART 3 EXECUTION

3.01 INSTALLATION

A. Unit manufacturer shall provide the option for a qualified supervisor to instruct and supervise the Contractor in rigging, erecting, pre-operation checkout and starting of each unit as necessary. The price for such services shall be indicated in the unit manufacturer's quote. Manufacturer's supervisor shall be a senior service technician trained in the startup of industrial HVAC Systems.

3.02 TESTS AT THE JOB SITE

A. Equipment and material certified as being successfully tested by manufacturer, in accordance with referenced Specifications and standards, will not require re-testing before installation. Equipment and materials not tested at the place of manufacture shall be tested after installation, by an independent testing/balancing contractor, to determine compliance with reference Specifications, standards, and schedules.

B. Equipment manufacturer shall provide an option for a qualified technician to instruct the Owner's personnel on maintenance and operation of the air handling units for a minimum of one day after installation. It is the responsibility of the unit manufacturer to coordinate with the Owner or Owner's Representative to establish a schedule for the events previously described.

3.03 FINAL CLEANING

A. The outside and particularly the inside of each air handling unit shall be thoroughly cleaned. Industrial grade cleaners can be used to remove construction dust. Any sheet metal mil finish or grease can be removed with an environmentally safe and non-toxic C9-C12 Propanol Hydrocarbon. Unpainted and/or any required unit shall be wrapped with shrink wrap to maintain unit cleanliness standards for shipping.

3.04 UNIT SHIPMENT AND TRAINING

A. All units must be shipped by the AHU manufacturer to the destination provided by the owner. Dates are to be determined and agreed upon by both parties.

B. Equipment manufacturer shall provide an option for a 4-hour on-site training by a certified instructor specialized in installed air handler, to maintenance personnel for adjusting, operating, and maintenance of the air-handling units.

C. Training shall include, but not be limited to, procedures and schedules related to performance, safety, startup and shut down, troubleshooting, servicing, preventive maintenance, and how to obtain replacement parts

3.3 SHIPPING AND INSTALLATION

A. Electronic or paper copies of the OIM shall be sent to the owner prior to unit's arrival.

B. Manufacturer shall provide detail shipping information including the carrier contact and the list of unit and section tags to the contractor immediately after the shipments are loaded.

C. The Mechanical Contractor is responsible for providing a level mounting surface, and overall readiness of the space for the unit installation.

D. The Mechanical Contractor shall be responsible to coordinate ALL of his installation requirements with the Owner and the Owner's selected Mechanical Contractor to ensure that a complete installation for each unit is being provided. Coordination efforts shall include such items as unloading and hoisting requirements, field wiring requirements, field piping

requirements, field ductwork requirements, requirements for assembly of field-bolted or -welded joints, and all other installation and assembly requirements.

4.0 Air Handling Unit (AHU) Sequence of Operations

A General System Description

This document outlines the sequence of operations for a multizone Air Handling Unit (AHU) serving 11 individual zones. The unit is equipped with two EC supply fans and two EC exhaust fans. Air treatment is accomplished via a three-deck system: a main deck, a shoulder deck, and a neutral deck.

● Main Deck: Features a large heat pump coil connected to two (2) Samsung AM240BXVGJH/AA condensers operating in tandem.

● Shoulder Deck: Features a smaller heat pump coil connected to a Samsung AM096XVGJH/AA condenser.

● Neutral Deck: Allows for bypass air circulation.

Each conditioned deck is equipped with an airflow monitoring station.

B Hand-Off-Auto (HOA) Control

All major equipment, including supply fans, exhaust fans, and heat pump compressors, shall have a Hand-Off-Auto (HOA) switch accessible through the Building Automation System (BAS).

● HAND: Forces the equipment to run continuously, overriding all control logic. This mode is for service and testing purposes only. An alarm will be generated if any equipment is left in HAND for more than 60 minutes.

● OFF: Forces the equipment off, disabling it completely. It will not operate under any conditions.

● AUTO: The equipment is under the full control of the BAS and will operate based on the sequences described below. This is the normal operating mode.

C System Mode Determination (Heat « Cool Switch-Over)

The AHU's operating mode (Heating or Cooling) is dynamically determined based on total zone demand and deck capacity monitoring. Upon initial start up the system will check outdoor air temperature. If less than 45 Degrees F the system will start in the heating mode as the primary deck mode other wise the system will start in cool mode as primary deck

This logic ensures a reliable switchover that avoids unnecessary cycling and maximizes efficiency.

- *Primary Switch-Over Criteria*

1. Zone Load Threshold

- The system evaluates the *effective zone demand* by calculating a virtual tonnage load per zone.
- For example, if *Zone 1 damper* is at 100% delivering *5 tons* of airflow in full cooling, that value is accumulated across all 11 zones.
- If the *aggregate zone cooling demand* exceeds the shoulder deck capacity for a preset duration (e.g.,5 minutes), the system will initiate switchover to Cooling Mode.

- Similarly, if the *aggregate zone heating demand* exceeds the shoulder deck heating capacity for a preset duration, the system will switch to Heating Mode.
2. Deck Airflow Analysis
- The *Shoulder Deck* airflow is monitored against its rated capacity.
- If the airflow approaches 100% of capacity and *shoulder deck DAT remains at max cooling (e.g.,55°F)* for a sustained period, it indicates full load and triggers a mode change.
3. Outdoor Air Temperature Biasing
- An *OAT sensor* is used to bias mode transitions:
- Cooling Mode Lockout if OAT < 55°F
- Heating Mode Lockout if OAT > 75°F
- This prevents premature or unnecessary mode changes due to mild ambient conditions.
4. Minimum Mode Duration Timer
- A *minimum mode lock-in duration* (e.g., 15 minutes) prevents frequent mode switching due to temporary load fluctuations.
- This applies during and after a mode switch.

- *Fail-Safe Deadband Operation*

- If *net zone demand* is inconclusive (i.e., neither mode is dominant), the unit defaults to Ventilation

- Mode using the Neutral Deck.

- Heat pumps remain disabled and only fans run to provide neutral ventilation.

- Indoor Air Quality.

- Air flow monitoring on the outside air damper will modulate the OSA damper open or closed to a pre-determined air flow setpoint to maintain air quality in the space.

D Cooling Mode Sequence of Operation

Upon entering Cooling Mode:
1. Fan Activation: The supply and exhaust fans will be commanded to run. (See Section 6.0 for fan control logic).
2. Main Deck Heat Pumps (2x Samsung AM240):

○ The BAS sends an Enable and Cooling Mode command to the Samsung interface modules for both main deck condensers.
○ The BAS writes a Main Deck Discharge Air Temperature (DAT) setpoint of 55°F to both interface modules.
○ The native Samsung controllers will then modulate their respective compressors and Electronic Expansion Valves (EEVs) in unison to achieve and maintain the single DAT setpoint.

3. Shoulder Deck Heat Pump (Samsung AM096):

○ The BAS sends an Enable and Cooling Mode command to the Samsung

interface module.
○ The BAS writes a Shoulder Deck Discharge Air Temperature (DAT) setpoint of 12.5°C (55°F) to the interface module.
○ The native Samsung controller will then modulate its compressor and EEVs to achieve and maintain the DAT setpoint.

E. Zone Damper Control:

○ Each of the zone dampers (see schedule for quantity)will modulate to maintain its specific zone temperature setpoint.
○ To cool the zone, the damper will modulate to allow more air from the Main Deck and/or Shoulder Deck.
○ If the zone is satisfied or requires less cooling, the damper will modulate towards the Neutral Deck, mixing the cold supply air with untreated bypass air.

F. Heating Mode Sequence of Operation
Upon entering Heating Mode:
1. Fan Activation: The supply and exhaust fans will be commanded to run. (See Section 6.0 for fan control logic).
2. Main Deck Heat Pumps (2x Samsung AM240):

○ The BAS sends an Enable and Heating Mode command to the Samsung interface modules for both main deck condensers.
○ The BAS writes a Main Deck Discharge Air Temperature (DAT) setpoint of 95°F to both interface modules.
○ The native Samsung controllers will then modulate their respective compressors, reversing valves, and EEVs in unison to achieve and maintain the single DAT setpoint.

3. Shoulder Deck Heat Pump (Samsung AM096):

○ The BAS sends an Enable and Heating Mode command to the Samsung interface module.
○ The BAS writes a Shoulder Deck Discharge Air Temperature (DAT) setpoint of 100°F to the interface module to provide a "trim" or boost heating capability.
○ The native Samsung controller will then modulate its compressor, reversing valve, and EEVs to achieve and maintain the DAT setpoint.

Zone Damper Control:

○ Each of the 11 zone dampers will modulate to maintain its specific zone temperature setpoint. Each zone will use existing Analog signal for a zone sensor to produce zone temperature, zone setpoint, occupancy override.
○ To heat the zone, the damper will modulate to allow more air from the Main Deck

and/or Shoulder Deck.

○ If the zone is satisfied or requires less heating, the damper will modulate towards the Neutral Deck, mixing the warm supply air with untreated bypass air.

F Fan Control Sequence

1. Supply Fans (SF-1, SF-2):

○ The two EC supply fans run in parallel.
○ The BAS will modulate the fan speed (0-100%) to maintain a Duct Static Pressure setpoint of 1.5" w.c.. The sensor for this is located approximately two-thirds of the way down the main supply duct.
○ If one fan fails, the other fan will attempt to maintain the setpoint. An alarm will be generated.

2. Exhaust Fans (EF-1, EF-2):

○ The two EC exhaust fans run in parallel.
○ The fan speed is controlled to maintain an exhaust airflow rate that is 90% of the total supply airflow rate. Return fan speed will be adjusted and trimmed too maintain building pressure at a slight positive pressure.
○ Total supply airflow is calculated by summing the readings from the Main Deck and Shoulder Deck Airflow Monitoring Stations.

F Points List (Sensors & Controls) Point Name	Point Type	Device	Location	Purpose
AHU General				
Supply Fan 1	Binary Input	Fan Controller	SF-1	Proof of

7.0 Points List (Sensors & Controls)

Point Name	Point Type	Device	Location	Purpose
AHU General				
Supply Fan 1	Binary Input	Fan Controller	SF-1	Proof of
Status				operation
Supply Fan 1 HOA Status	Analog Input	HOA Switch	Control Panel	Monitor HOA position

Supply Fan 1 Command	Binary Output	Fan Controller	SF-1	Start/Stop command
Supply Fan 1 Speed	Analog Output	Fan Controller	SF-1	0-100% speed control
Supply Fan 2 Status	Binary Input	Fan Controller	SF-2	Proof of operation
Supply Fan 2 HOA Status	Analog Input	HOA Switch	Control Panel	Monitor HOA position
Supply Fan 2 Command	Binary Output	Fan Controller	SF-2	Start/Stop command
Supply Fan 2 Speed	Analog Output	Fan Controller	SF-2	0-100% speed control
Exhaust Fan 1 Status	Binary Input	Fan Controller	EF-1	Proof of operation
Exhaust Fan 1 Command	Binary Output	Fan Controller	EF-1	Start/Stop command
Exhaust Fan 1 Speed	Analog Output	Fan Controller	EF-1	0-100% speed control
Exhaust Fan 2 Status	Binary Input	Fan Controller	EF-2	Proof of operation
Exhaust Fan 2 Command	Binary Output	Fan Controller	EF-2	Start/Stop command
Exhaust Fan 2 Speed	Analog Output	Fan Controller	EF-2	0-100% speed control
Duct Static Pressure	Analog Input	Pressure Sensor	Main Supply Duct	Feedback for supply fan speed control
Main Deck (2x Samsung				
AM240)				
Main Deck DAT	Analog Input	Temp. Sensor	Downstream of Coil	Feedback for BAS control loop

Main Deck Airflow	Analog Input	Airflow Station	Main Deck	Monitoring & Exhaust Fan Control
Main HP 1 Enable Cmd	Binary Output	Samsung Interface	Control Panel	Enable/Disable unit 1
Main HP 1 Mode Cmd	Analog Output	Samsung Interface	Control Panel	Set Mode for unit 1
Main HP 1 DAT Setpoint	Analog Output	Samsung Interface	Control Panel	Write setpoint to unit 1
Main HP 1 Alarm Status	Binary Input	Samsung Interface	Control Panel	General fault/alarm for unit 1
Main HP 1 Defrost Status	Binary Input	Samsung Interface	Control Panel	Indicates unit 1 is in defrost
Main HP 2 Enable Cmd	Binary Output	Samsung Interface	Control Panel	Enable/Disable unit 2
Main HP 2 Mode Cmd	Analog Output	Samsung Interface	Control Panel	Set Mode for unit 2
Main HP 2 DAT Setpoint	Analog Output	Samsung Interface	Control Panel	Write setpoint to unit 2
Main HP 2 Alarm Status	Binary Input	Samsung Interface	Control Panel	General fault/alarm for unit 2
Main HP 2 Defrost Status	Binary Input	Samsung Interface	Control Panel	Indicates unit 2 is in defrost
Shoulder Deck (Samsung AM096)				
Shoulder Deck DAT	Analog Input	Temp. Sensor	Downstream of Coil	Feedback for BAS control loop

Shoulder Deck Airflow	Analog Input	Airflow Station	Shoulder Deck	Monitoring & Exhaust Fan Control
Shoulder HP Enable Cmd	Binary Output	Samsung Interface	Control Panel	Enable/Disable unit
Shoulder HP Mode Cmd	Analog Output	Samsung Interface	Control Panel	Set Mode (Cool/Heat/Fan)
Shoulder HP DAT Setpoint	Analog Output	Samsung Interface	Control Panel	Write setpoint to Samsung controller
Shoulder HP Alarm Status	Binary Input	Samsung Interface	Control Panel	General fault/alarm status
Shoulder HP Defrost Status	Binary Input	Samsung Interface	Control Panel	Indicates unit is in defrost cycle
Zones (x11)				
Zone Temperature	Analog Input	Temp. Sensor	Each Zone (x11)	Primary input for zone damper control
Zone Temp. Setpoint	Analog Value	BAS Variable	Each Zone (x11)	User-adjustable setpoint
Zone Damper Position	Analog Input	Actuator	Each Zone Damper (x11)	Feedback on current damper position
Zone Damper Command	Analog Output	Actuator	Each Zone Damper (x11)	0-100% position command

END OF SECTION 23 7000

SECTION 26 0000

GENERAL PROVISIONS

PART 1 - GENERAL

A. The general contract provisions apply to this section and take precedent over this section in case of conflict.

1.01 GENERAL PROVISIONS

A. This division supplements the applicable requirements of other divisions.

1.02 DEFINITIONS

A. For the purposes of Division 260000, the following definitions apply:

1. Provide: Furnish and install.

2. Indicated: As shown on the drawings or specified herein.

3. Circuit Designation: Panel designation and circuit number, i.e., LA-13.

4. Approved equal: Approved by the engineer of record as equal in his sole determination.

1.03 SCOPE OF WORK

A. The Specifications for Work of Division 260000 include, but are not limited to the following sections:

26 0000–General Provisions
26 0050–Basic Electrical Materials and Methods
26 0060–Minor Electrical Demolition for Remodeling
26 0111–Conduits
26 0120–Conductors
26 0130–Electrical Boxes
26 0142–Nameplates and Warning Signs
26 0164–Branch Circuit Panelboards
26 0190–Support Devices

B. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this division, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all divisions for related work required to be included as work under this division.

2. General provisions for electrical work.

3. Site observation including existing conditions.

C. Related Work Specified Elsewhere but included in the scope of work:

1. Motors and their installation.

2. Control wiring and conduit for heating, ventilating and air conditioning.

D. Work Not In Contract (N.I.C.):

1. Telephone instruments.

E. Coordination

1. The following supplements are additional General Requirements pertaining to work of this Division. Provisions of Division 1 - General Requirements shall remain in effect.

a. Coordinate work of various sections of Division 26 and 27.

b. Coordinate work of this Division 26 with work of Divisions 2 through 25.

1.04 REFERENCE STANDARDS

A. American National Standards Institute (ANSI).

B. Association of Edison Illuminating Companies (AEIC).

C. Electrical Testing Laboratories (ETL).

D. Illuminating Engineering Society (IES).

E. Institute of Electrical and Electronic Engineers (IEEE).

F. Insulated Cable Engineers Association (ICEA).

G. National Electrical Manufacturers Association (NEMA).

H. National Fire Protection Association (NFPA).

I. Underwriters Laboratories, Inc. (UL).

J. California State Fire Marshal (CSFM).

K. California Energy Commission (CEC) Title 24.

1.05 QUALITY ASSURANCE

A. Regulations: All the electrical equipment and materials, including their installations, shall conform to the following applicable latest codes and standards:

1. California Electric Code, Latest Adopted Edition (CEC)

2. Local and State Fire Marshal.

3. Occupational Safety and Health Act (OSHA).

4. Requirements of the Serving Utility Company.

5. State Codes Amendments.

6. Requirements of the Office of the California State Architect (OSA).

7. California Administrative Code, Title 8, Chapter 4, Industrial Safety Orders.

8. California Administrative Code, Title 24.

9. County of Ventura Codes and Regulations.

B. Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply. In instances where plans and specifications are at variance or conflict the most restrictive requirement shall apply. Contractor shall be responsible for all his associated work and materials and also the work and materials of related or affected trades.

C. Contractor's Expense: Obtain and pay for all required bonds, insurance, licenses, and pay for all taxes, fees and utility charges required for the electrical work.

D. Testing and Adjustment:

1. Perform all necessary tests required to ascertain that the electrical system has been properly installed, that the power supply to each item of equipment is correct, and that the system is free of grounds, ground faults, and open circuits, that all motors are rotating in the proper directions, and such other tests and adjustments as may be required for the proper completion and operation of the electrical system. Contractor shall provide a copy of all test reports to prove these tests have been performed.

2. If, during the course of testing, it is found that system imbalance is in excess of 20%, rearrange single-pole branch circuit in lighting and receptacle panels to bring system balance to within 20% on all phases. Record all such changes on the typewritten panelboard schedule and submit a summary of changes to the Engineer on the record drawings.

1.06 SUBMITTALS

A. Procedure: In accord with the Submittal Section.

B. Shop drawings: Detailed shop drawings for the following equipment:

1. Branch circuit panelboards.

C. Product data: Detailed manufacturer's data for:

1. Disconnects.

2. Conduit and conductors

3. Low voltage cabling systems.

D. Test results for the following:

1. Fire alarm system.

2. Cables/conductors

E. Include sufficient information to indicate complete compliance with Contract Documents. Include illustrations, catalog cuts, installation instructions, drawings, and certifications. On each sheet show manufacturer's name or trademark.

F. Operating, maintenance, and instruction data for:

N/A

G. Instruction materials:

1. Provide at the time of personnel instruction period three bound copies of instruction manuals for the systems as listed in Subparagraph 1.04.A.4.f.

2. Include the following (minimum) information in each copy of instruction manual:

a. Manufacturers' names and addresses including phone numbers.

b. Serial numbers of items furnished.

c. Catalog cuts, exploded views and brochures, complete with technical and performance data for all equipment, marked to indicate actual items furnished and intended use.

d. Recommended spare parts.

1.07 OWNER'S PERSONNEL INSTRUCTIONS

A. Prior to completion of the contract, and at the Owner's convenience, instruct verbally and demonstrate to the Owner's personnel, the operation of the systems as listed under operating, maintenance, and instructional data and/or emergency generator, automatic transfer switch and fire alarm annunciator panel.

1.08 CLEANING

A. Clean exterior surfaces and interiors of equipment and remove all dirt, cement, plaster and other debris. Protect interior of equipment from dirt during construction and clean thoroughly before energizing.

B. Clean out cracks, corners and surfaces on equipment to be painted. Remove grease and oil spots so that paint may be applied without further preparation.

1.09 PROJECT RECORD DOCUMENTS - Prepare the following and submit to the engineer before final acceptance:

A. Mark Project Record Documents daily to indicate all changes made in the field.

1. In addition to general requirements of Project Record Drawings, indicate on drawings, changes of equipment locations and ratings, trip sizes, and settings on circuit breakers, alterations in raceway runs and sizes, changes in wire sizes, circuit designations, installation details, one-line diagrams, control diagrams and schedules.

B. Use green to indicate deletions and red to indicate additions.

1. Use the same symbols and follow the same drafting procedures used on the Contract Drawings.

C. Locate dimensionally off of contract drawings all underground conduit stubbed-out for future use, underground feeder conduits, and feeder pull box locations using building lines by indicating on the Project Record Drawings.

D. At the completion of underground conduit installation provide underground conduit record documents to owner’s representative.

E. Two copies, in binder form, of all test results as required by these specifications - 260030.

F. Two copies of local and/or state code enforcing authorities final inspection certificates.

G. Two copies, in binder form, of electrical equipment cut sheets, manufacturer's installation instructions, warranty certificates, and product literature for all products utilized on project.

1.10 SERVICE INTERRUPTIONS AND UTILITY

A. Coordinate with the Owner the interruption of services necessary to accomplish the work.

B. Coordinate with the utility company all work associated with power and communications distribution systems and service entrance equipment.

C. Electrical contractor shall supply temporary power for all trades.

1.11 MINIMUM SPECIFICATION REQUIREMENTS (ALL WORK OF DIVISION 260000)

A. As a minimum Specification requirement, all materials and methods shall comply with applicable governing codes.

1.12 PENETRATION SEALING

A. Seal penetration through exterior walls and fire rated walls, floors, ceilings, and roofs with 3M Firestopping materials of fire rating capacity rated per architectural plans and UBC or prevailing building code requirements.

1.13 PLACING EQUIPMENT IN SERVICE

A. Do not energize or place electrical equipment in service until all interested parties have been duly notified and are present or have waived their rights to be present. Where equipment to be placed in service involves service or connection from another contractor of the owner, notify the owner in writing when the equipment will be ready for final testing/connection and schedule to the owner's satisfaction of this service connection. Notify the owner two weeks in advance of the date the various items of equipment will be complete.

1.14 OWNER-FURNISHED ITEMS

A. Pick up Owner-furnished items and handle, deliver, install, and make all final connections.

1. Assume responsibility for the items when consigned at the storage facility or in the field in accord with requirements of the Contract Documents.

1.15 ELECTRIC ITEM LOCATION

A. Electrical drawings are generally diagrammatic. Verify equipment sizes with shop drawings and manufacturers' data and coordinate location layout with

other trades. Notify owner and engineer of any changes of location requirements prior to installation and obtain engineer's written acceptance for all changes/revisions.

1.16 DEMOLITION

A. Scope: Provide and perform demolition, preparatory and miscellaneous work as indicated and specified, complete.

B. Principle Items of Work:

1. Demolition and removal of existing electrical conduit, wiring and equipment required to complete the project.

2. Preparation of the existing building to receive or connect the new work.

3. Miscellaneous demolition, cutting, alteration, and repair work in and around the existing building necessary for the completion of the entire project.

4. Disconnecting and reconnection of electrical equipment as required by the construction modifications.

C. Existing Conditions: Make a detailed survey of the existing conditions pertaining to the work. Check the locations of all existing structures, equipment and wiring (branch circuiting and controls). Provide at bid time any exclusions for existing conditions work.

D. Salvage and Disposal: All removed material other than items to be reused shall be returned to the owner or disposed of in accordance with instructions from the owner's representative. Disposal shall be done in accordance with EPA and governing body requirements and regulations. Contractor shall pay all fees and charges for disposal.

1.17 ELECTRICAL WORKMANSHIP REQUIREMENTS

A. It is required that all electrical construction of this Contract be performed by journeyman electricians. All journeyman electricians shall have a minimum of 4 years of apprenticeship training and hold a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards. This is intended to mean that a person who does not hold a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards will not be permitted to do electrical work of any kind that involves new construction, nor make repairs, alterations, additions, or changes of any

kind to any existing system of electrical wiring, apparatus, equipment, light, heat, or power.

B. Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under direct and constant personal supervision of a journeyman electrician holding a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards.

1. Each journeyman electrician will be permitted to be responsible for quality of workmanship for a maximum of eight helpers or apprentices during any same time period, provided the nature of work is such that good supervision can be maintained and quality of workmanship achieved is the best, as expected by Owner and as implied by the latest edition of the California Electrical Code (National Electrical Code with State of California amendments).

2. Before each journeyman electrician commences work, deliver to Owner at project site a photocopy of journeyman's valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards.

C. All electrical systems shall be installed in a neat and workmanlike manner per National Electrical Code requirements and ANSI approved NEIS National Electrical Installation Standards.

1.18 DESIGN CHANGES AFTER AWARD OF BID

A. When a change in the quantity or size of conductors is made, the conduit size will remain in accordance with that indicated in the original contract drawings rather than the drawing symbol conduit table. When code permits, provide conductor insulation 'THWN' where required to maintain conduit fill conformance with the National Electrical Code.

1.19 MATERIAL AND EQUIPMENT SUBSTITUTION

A. Where two or more trade names or manufacturers are mentioned, selection shall be made from the group listed for use in the base bid. The order in which names are listed is not intended to be any indication of preference.

B. Where a single manufacturer, product or trade name is stated, that manufacturer, product or trade name shall be used in the base bid. The use of other manufacturers, products or trade names will be considered by the engineer of record (unless that product is indicated for no substitution) only if submitted as alternate items at the time of bidding, with evidence of equality and a statement of net price difference as compared to the specified item. After approval by the

engineer of record, the architect and owner reserve the right to review such submittals and to determine the acceptability for use.

C. Equipment other than that specified will be accepted only when written approval is given by the engineer of record and architect, in accordance with Division 1.

D. The contractor shall be held responsible for all physical changes in piping, equipment, etc. resulting from equipment substitution and likewise bear any increased cost of other trades in making said substitution. Approval by the architect of equipment other than that specified does not relieve this contractor of this responsibility.

1.20 REQUESTS FOR INFORMATION

A. The contractor shall submit all requests for information (RFI's) typewritten on the attached form.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END OF SECTION

SECTION 26 0050

BASIC ELECTRICAL MATERIALS & METHODS

PART 1 - GENERAL

1.01 DESCRIPTION: Division 1 applies to this Section. This Section contains general requirements for the Sections in Division 26.

A. Related Work Not in Division 26: Refer to individual Division 26 Sections.

1.02 QUALITY ASSURANCE:

A. Codes: Entire installation shall comply with requirements of authorities having jurisdiction.

B. Permits: Contractor shall pay for all permits required by work under this Division.

C. Inspections: Contractor shall arrange for all inspections and correct non-complying installations.

1.03 SUBMITTALS: Refer to Division 1 for procedures.

A. Material and Equipment: Prior to start of work, 6 copies of a list of all materials and equipment covered by Division 26 shall be submitted for approval. Contractor shall allow ample time for checking and processing and shall assume responsibility for delays incurred due to rejected items. No installation of material concerned shall be made until such written approval has been obtained. Approval of materials and equipment shall in no way obviate compliance with the Contract Documents. Each item proposed shall be referenced to the applicable Section, Page, and Paragraph of Division 26. For each item proposed, give name of manufacturer, trade name, catalog data, and performance data.

B. Equipment Layout Drawings: Submit "Equipment Layout Drawings" for each equipment room or area containing equipment items furnished under this Division. Layout Drawings shall consist of plan view of room, to scale, showing projected outlines of all equipment, complete with dotted line indication of all required clearances including all those needed for removal or service. Location of all conduit and pull boxes shall be indicated.

C. Service Manuals: Refer to Submittal Section. Indexed Service Manuals shall be submitted which shall include test reports, service instructions, and renewal parts lists of all equipment.

1. Submission and Information: Service Manuals shall be submitted for approval at least 30 days before final inspection. The following information together with any pertinent data, shall be included in Service Manual:

a. Renewal part numbers of all replaceable items.

b. Manufacturer's cuts and rating data.

c. Serial numbers of all principal pieces of equipment.

d. Supplier's name, address, and phone number.

2. Copies: Four (4) copies of approved Service Manual shall be delivered on or before date required.

D. Record Drawings: Prepare and submit in accordance with requirements. Contractor shall make notations, neat and legible, daily as the work proceeds. Drawings shall be available for inspection at all times and kept at the job site. All buried conduit and/or indicated future connections outside any building shall be located both by depth and by accurate measurement from a permanently established landmark such as a building or structure.

E. Seismic Calculation: Refer to Article 3.01 herein.

F. Spare Parts: Conform to the Submittal Section. Deliver following spare parts to Owner and obtain receipts. Submit at same time as Operating Instructions:

1. Spare fuses; 1 set for each combination fuse breaker.

2. Spare pilot light lamps of each type used on project, in quantity of 10%, but not less than 2%.

3. Overload heater elements; 2 sets for each size used on project.

G. Special Tools: If any part of the equipment furnished under Division 26 requires a special tool for assembly, adjustment, resetting, or maintenance thereof and such tool is not readily available on the commercial tool market, it shall be furnished with the equipment as a standard accessory and delivered to the Owner.

H. Maintenance Paint: One (1) can of touch-up paint shall be delivered to Owner for each different color factory finish which is to be the final finished surfaces of the product.

1.04 DRAWINGS:

A. Diagrammatic Drawings: For purposes of clarity and legibility, drawings are essentially diagrammatic although size and location of equipment is drawn to scale wherever possible, Contractor shall make use of data in all the Contract Documents and verify information at building site.

B. Routing of Conduit and Piping: The drawings indicate required size and termination of conduits and raceways. It is not intent to indicate all necessary offsets and it shall be the responsibility under this Division to install conduit in such a manner as to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and make all equipment requiring inspection, maintenance and repair accessible without extra cost to the Owner.

C. Coordination with Other Trades: Check with other Divisions of the Specifications so that no interference shall occur and in order that elevations may be established for the work. Installed work which interferes with the work of other trades shall be removed and rerouted at the discretion of the Architect.

1.05 DAMAGE AND REPAIRS:

A. Emergency Repairs: Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding Contractor's warranty or relieving Contractor of his responsibility during warranty period.

B. Responsibility for Damage: Contractor shall be responsible for damage to grounds, buildings, or equipment due to work furnished or installed under this Division 26.

1.06 PROTECTION, CARE, AND CLEANING:

A. Protection: Provide adequate protection for finished parts of materials and equipment against physical damage from any cause during progress of work and until final completion. Sensitive electrical equipment shall not be installed until major construction is completed.

B. Care: During entire construction, properly cap all lines and equipment to prevent entrance of sand and dirt. Protect equipment against moisture, plaster, cement, paint or work of other trades by covering with polyethylene sheets.

C. Cleaning: After installation is completed, clean all systems as follows in addition to requirements specified:

1. Field Painted Items: Clean exterior of conduits, raceways, piping and equipment exposed in completed structure; removing all rust, plaster, cement and dirt by wire brushing. Remove grease oil and similar materials by wiping with clean rags and suitable solvents.

2. Factory Finished Items: Remove grease and oil on all factory finished items such as cabinets and controllers, and leave surfaces clean and polished.

D. Connection: Prior to energizing, check all electrical connection hardware and torque where necessary.

PART 2 - PRODUCTS

2.01 PRODUCTS: Products and materials shall be as specified in the pertinent Sections of Division 26.

2.02 MATERIALS AND EQUIPMENT: Wherever possible, all materials and equipment used in installation of this work shall be of same manufacturer throughout for each class of material or equipment. Materials shall be new and bear UL label, wherever subject to such approval. Comply with ANSI, IEEE and NEMA standards, where applicable.

PART 3 - EXECUTION

3.01 SEISMIC REQUIREMENTS: Electrical equipment for emergency systems shall be braced to withstand the lateral forces that result from earthquakes. Under Work of Division 26, submit seismic calculations stamped and signed by a registered California structural engineer confirming size, number, and location of required anchoring hardware. Electrical equipment vendors shall furnish weights together with dimensions and the center of gravity location for all emergency electrical equipment for this purpose.

3.02 GENERAL LATERAL BRACING REQUIREMENTS: As shown on Drawings. Additional bracing requirements shall conform to specific requirements shown on Drawings or in other Sections of Division 26. Anchorages for equipment subject

to thermal expansion and movement shall conform to manufacturer's recommendation and intent of general bracing requirements. When general and specific bracing requirements enumerated above are in conflict with referenced standards, the most stringent requirements shall govern.

3.03 EXCAVATION AND BACKFILL: Perform all excavation and back fill required to install Work of Division 26, both inside and outside. Perform all excavation and backfilling in accordance with Division 2.

A. Excavation: Bury conduits outside building to a depth of not less than 24" (or as required by Code) below finish grade, unless noted otherwise.

B. Backfilling: Do not backfill until after final inspection and approval of conduit installation by all legally constituted authorities and recording of the buried items on the Record Drawings.

3.04 CUTTING AND PATCHING:

A. Cutting of Existing Structural Work: Holes in existing slabs and concrete walls shall be cored to the minimum size required. The Contractor shall submit Drawings showing dimensioned sizes and locations for all such holes to Architect for approval before cutting. Where required for conduit installation, slabs on grade shall be saw-cut to minimum required width; submit cutting Drawings to the Architect for approval before cutting.

B. Patching: Holes or chases shall be patched to match adjacent surfaces.

3.05 CONCRETE WORK: Concrete construction required for the Work of Division 26 shall be provided under the Work of Division 26.

3.06 PAINTING: Finish painting of electrical equipment will be as specified in Division 9, unless equipment is herein specified to be furnished with factory applied finish coats. Equipment to be field painted shall be furnished with a factory applied prime coat.

A. Touch-Up: If factory finish on any equipment furnished under Division 26 is damaged in shipment or during construction of building, the equipment shall be refinished by Contractor to satisfaction of Architect.

B. Concealed Equipment: Uncoated cast-iron or steel that will be concealed, or will not be accessible when installations are completed, shall be given one heavy coat of black asphaltum before installation.

3.07 OPERATING INSTRUCTIONS: Contractor to provide services of an experienced Engineer to instruct Owner in operation of entire installation. Instructional period shall be during normal work day hours. This instruction period may be simultaneous with compliance tests.

3.08 COMPLIANCE TESTS: Conduct such tests of all portions of installation as may be necessary to ensure full compliance with the Drawings and Specifications. Tests shall be made in the presence of the Owner. Costs of test shall be borne by Contractor and Contractor shall provide all instruments, equipment, labor and materials to complete all the tests. Tests may be required on any item between installation of Work and the end of 1 year warranty period. Should these tests develop any defective materials, poor workmanship or variance with requirements

of Specifications, Contractor shall make any changes necessary and remedy any defects at his expense.

A. All Feeders: Measure and record as follows:

1. 600 volt conductors shall be tested with 500 volt megger to ground on each phase. megger to be on test for one minute before any readings are taken. The minimum values on all feeders shall be 100,000 OHMS.

2. Copies of the certified test readings shall be transmitted to Owner.

3.09 SYSTEM ACCEPTANCE:

A. Final Review: The Contractor shall request a final review prior to system acceptance after:

1. Completion of installation of all systems required under the Contract Documents.

2. Submission and acceptance of operating and maintenance data.

3. Completion of identification program.

B. Acceptance: Is contingent on:

1. Completion of final review and correction of all deficiencies.

2. Satisfactory completion of acceptance tests demonstrating compliance with all performance and technical requirements of Contract Documents.

3. Satisfactory completion of training program and submission of manuals and Drawings required by Contract Documents.

3.10 PRELIMINARY OPERATION: The Owner reserves the right to operate portions of the electrical system on a preliminary basis without voiding the warranty or relieving the Contractor of his responsibilities.

3.11 CLEAN-UP: Conform to the Submittal Section. Upon completion and at other times during progress or Work, when required, remove all surplus materials, rubbish, and debris resulting from Work of Division 26.

END OF SECTION

SECTION 26 0060

MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner and Architect/Engineer before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect and make safe all electrical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Owner's representative.

C. Provide temporary wiring and connections to maintain required existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary

connections to maintain service in areas adjacent to work area when outage affects business operation.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service and new system is accepted. Disable system only to make switchovers and connections. Notify Owner and Telephone Utility Company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

G. Existing Security System: Maintain existing system in service until new system is complete and ready for service and new system is accepted. Disable system only to make switchovers and connections. Obtain permission from the Owner and security company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply and re-label devices as spares.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Disconnect and remove abandoned conduit.

J. Repair adjacent construction and finishes damaged during demolition and extension work.

K. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

L. Extend existing installations using materials and methods compatible with existing electrical installations, and in compliance with new project specifications.

M. Modify existing as-built drawings to note changes.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.

3.05 INSTALLATION

A. Install relocated materials and as required by this section and Owner's representative.

END OF SECTION

SECTION 26 0111

CONDUITS

PART 1 - GENERAL

A. The general provisions apply to this section.

1.01 WORK INCLUDED

A. Conduits; including:

1. Rigid steel conduit.
2. Intermediate metal conduit (IMC).
3. Electrical metallic tubing (EMT).
4. Rigid aluminum conduit.
5. Polyvinyl chloride conduit (PVC).
6. Flexible metal conduit.
7. Liquid-tight flexible metal conduit.

1.02 DEFINITION

A. Conduit: This term shall be construed to mean conduit and conduit fittings; and tubing and tubing fittings.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Support material: Section 260190.

PART 2 - PRODUCTS

2.01 MATERIAL AND FABRICATION - ALL MATERIALS SHALL BE MANUFACTURED IN THE USA.

A. Rigid Steel Conduit: Hot-dipped galvanized or sherardized including the threads, manufactured in accordance with ANSI C80.1 and UL6.

1. Threaded, hot-dipped galvanized or sherardized fittings manufactured in accordance with ANSI C80.4.

B. Intermediate Metal Conduit: Hot-dipped galvanized including the threads, manufactured in accordance with UL 1242.

C. Electrical Metallic Tubing: Manufactured in accordance with ANSI C80.3 and UL 797.

1. Provide compression fittings in walls, ceiling spaces or exposed construction areas.

2. Provide compression (water tight) fittings in damp areas or areas exposed to weather.

D. Rigid Aluminum Conduit: Manufactured in accordance with ANSI C80.5.

1. Threaded fittings, manufactured in accordance with ANSI C80.4.

E. Polyvinyl Chloride Conduit: Schedule 40 and schedule 80, manufactured in accordance with ANSI C33.91, UL 651, and Nema TC-2.

1. Cemented type fittings of the same manufacturer as the conduit.

F. Polyvinyl Chloride Conduit: Type EB, heavy wall, manufactured in accordance with ANSI C33.91, UL651, and Nema TC-8.

1. Cemented fittings of the same manufacturer as the conduit.

G. Flexible Metal Conduit: Hot-dipped galvanized steel, manufacturer in accordance with UL 1.

1. Squeeze type, malleable iron, cadmium plated, straight and angle connectors for all sizes and twist-in connectors for 1/2-inch and 3/4-inch flexible metal conduit.

H. Liquid-Tight Flexible Conduit: Hot-dipped galvanized with liquid-tight vinyl jacket.

1. Liquid-tight fittings.

PART 3 - EXECUTION

3.01 USE

A. EMT for all exposed and concealed work except as indicated in Paragraphs B, C, D, E, F, and G.

B. Rigid steel, IMC, or rigid aluminum conduit in areas where exposed conduit could be subject to physical damage or where conduit is exposed and conductor phase to ground voltage exceeds 300 volts.

C. Rigid aluminum conduit may be used for all feeder runs exposed or concealed in stud walls and spaces above suspended ceilings.

D. PVC Conduit:

1. Schedule 40 for runs below grade in direct contact with earth.

2. Schedule 40 in concrete floors, walls or roofs.

E. Flexible Conduit (steel only permitted):

1. For connection to equipment subject to vibration, maximum length 18 inches. In wet locations use liquid-tight flexible conduit.

2. For connection to lighting fixtures above suspended ceilings. Lengths limited to 72 inches.

3. Install ground conductors in all flexible conduits.

F. Where 3/4-inch conduit runs are concealed in walls or ceilings and these runs are through wood studs and wood joists, flexible steel conduit may be used up to a maximum length of 6'0".

G. All risers shall be PVC coated RGS with bushings.

H. In concrete or below grade use conduit not smaller than 1 inch. Maximum size in concrete slab: 1 inch. Run larger sizes under slab.

I. Use long sweep elbows with minimum radius 10 times nominal conduit diameter for all telephone and communication runs.

3.02 INSTALLATION

A. Provide conduit support and bracing in accordance with the latest published SMACNA guidelines.

B. Perform excavating, trenching, backfilling, and compacting as specified in Division 2.

C. Minimum cover for runs below finished grade outside buildings: 24 inches except where noted or required by the serving utility. Minimum cover for conduit in concrete floors, walls or roof: 1/3 thickness of slab. Minimum cover under building slabs is 12-inches.

D. Minimum separation from uninsulated hot water pipes, steam pipes, heater flues or vents: 6 inches. Avoid running conduit directly under water lines.

E. Protect inside of conduit from dirt and rubbish during construction by capping all openings with plastic caps intended for the purpose.

F. Provide conduit bodies for exposed conduit runs at junctions, bends or offsets where required. Do not use elbows or bends around outside corners of beams, walls or equipment. Make conduit body covers accessible.

G. Make conduit field cuts square with saw and ream out to full size. Shoulder conduits in couplings.

H. Run a minimum of one 3/4-inch empty conduit for every three single pole spare circuit breakers, spaces or fraction thereof and not less than two 3/4-inch conduits from every flush mounted panel to an accessible space above the ceiling and below the floor.

I. Make conduit projections from covered areas to areas exposed to the weather watertight by proper flashing. Extend flashing a minimum of 6 inches in all directions from conduit.

J. Where conduit is to remain empty, install polypropylene or nylon pull-line 3/16" minimum diameter from end to end with tag at each end designating opposite terminations.

K. Run conduit parallel and at right angle to building lines, when visible in finished construction.

L. Cap conduits indicated to be stubbed-out underground using glued-on PVC caps intended for this purpose.

M. Install a coupling flush with the floor on all conduits stubbed up through floors on grade.

N. Make no bends with a radius less than 12 times the diameter of the cable it contains nor more than 90 degrees. Make field bends with tools designed for conduit bending. Heating of metallic conduit to facilitate bending is not permitted.

O. Where conduit installed in concrete or masonry extends across building construction joints, provide expansion fittings as manufactured by O.Z.; Crouse-Hinds; Appleton; or equal, with approved ground straps and clamps.

P. Concrete Wall or Slab Penetrations: All core drilling, sleeves, blockouts or other penetrations must be approved by the Structural Engineer prior to installation.

1. Space sleeves and core drills to insure a minimum dimension of 3 times the nominal trade diameter of the largest adjacent conduit between sleeves or core drills.

2. Use blockouts for concentrations of conduits in a confined area.

Q. Do not penetrate walls with flexible conduit where subject to physical damage. Use recessed box with extension ring for transition from interior to exterior of wall.

R. All homeruns shown shall be run to the panel indicated independently of all other homeruns. Provide pull points so as not to exceed total bends of 360 degrees between them unless otherwise indicated.

S. At switchboards, manholes and floor standing distribution panelboards, provide insulated throat bushings or bell ends on all non-metallic conduit entries and bushings on all metallic conduit entries.

T. Provide bushings on all conduit terminations sized 1" and larger.

U. Provide weatherproof boxes and connectors for all exposed parking structure raceways and boxes.

V. Provide bell ends on all conduits into pullboxes and manholes, seal all conduits after conductors are pulled.

W. Cap all unused conduits with end cap. Do not tape.

X. All Fire Alarm Conduits shall be painted red.

END OF SECTION

SECTION 26 0120

CONDUCTORS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Conductors; for power, lighting, sound, communication and control, including conductors for general wiring, flexible cords and cables, and ground conductors.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260000.

PART 2 - PRODUCTS

2.01 MATERIAL AND FABRICATION

A. Conductors for General Wiring: Thermoplastic insulated rated for 600V manufactured in accordance with UL 83.

1. Provide 3/4 hard drawn copper conductors. Provide solid conductor for #12 AWG and smaller. Provide stranded conductors for #10 AWG and larger.

B. Conductor Connectors for General Wiring:

1. Sizes No. 14 to No. 8: Splice with insulated spring wire connectors.

a. Ideal No. 451, 455 and 453.

b. Minnesota Mining: Types Y, R, G, and B.

c. Buchanan No. B1, B2 and B4.

2. Size No. 6 or Larger, Copper: Splice and terminate with compression or pressure type connectors and terminal lugs.

C. Provide connector sealing packs for all area lighting and exterior box splices which require complete protection from dampness and water.

1. Scotchlok No.’s 3576, 3577 and 3578, by 3M Company.

PART 3 - EXECUTION

3.01 USE

A. Conductors for General Wiring:

1. Minimum 75 degrees C temperature rated insulation on conductors, except use minimum 90 degrees C temperature rated insulation on conductors in conduits exposed on roof, or where required due to ambient temperature.

2. Stranded conductors at motors, audio video and other applications where subject to vibration.

3. Minimum size conductors for power and lighting #12 AWG, except where noted.

4. Minimum size conductors for control circuits #14 AWG stranded with THHN/THWN insulation.

B. Use flexible cords and cables for connection of special equipment as indicated. Length not to exceed 72 inches.

C. Ground Conductors:

1. Provide an insulated green ground conductor for all branch circuit wiring where indicated.

2. Bare copper conductor may be used.

a. Install ground conductors in all non-metallic conduits as required by code. Install ground conductors in all motor branch circuits and all feeders. Where ground conductor size is not indicated, provide size as required for an equipment ground conductor by the National Electrical Code.

b. Install ground conductors in all flexible metal conduits.

D. Install XHHW – 2, 90°C copper conductors for all underground installations unless noted otherwise on the plans.

E. Install for all dimmers, stranded THHN/THWN – 2 copper 90°C conductors with dedicated neutrals.

3.02 INSPECTION

A. Check conduit system for damage and loose connections, replace damaged sections.

B. Check for caps at conduit openings. Make sure that inside of conduit is free of dirt and moisture.

C. Pull mandrel, one size smaller than the conduit, through entire length of all underground conduits prior to conductor installation.

3.03 INSTALLATION

A. Conductors for General Wiring:

1. Color code conductors insulation as follows:

CONDUCTOR	SYSTEM 208Y/120	VOLTAGE 480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow

2. For conductors #6 AWG or larger, permanent plastic colored tape may be used to mark conductor in lieu of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

a. Provide color tape on each end and at all terminal points and splices on wire enclosed in conduit.

b. Provide color tape every 3 feet on wire not enclosed in a listed wireway.

3. When pulling conductors, do not exceed manufacturer's recommended values.

4. Use polypropylene or nylon ropes for pulling conductors.

B. Insulate splices with plastic electrical tape: Scotch No. 33+, Tomic No. 1T, or equal.

C. Terminate all control wires with terminal lugs on terminal boards not designed with pressure plates. If splices are needed, use same procedure, installing a terminal board in a junction box for protection.

D. All splices or connections shall be compression type Thomas & Betts or Burndy, no split bolt connections are allowed.

3.04 IDENTIFICATION

A. Feeders: Identify with the corresponding circuit designation at over-current device and load ends, at all splices and in pull boxes.

B. Branch Circuits: Identify with the corresponding circuit designation at the over-current device and at all splices and devices.

C. Control Wires: Identify with the indicated number and/or letter designation at all terminal points and connections.

D. Alarm and Detection Wires: Identify with the indicated wire and zone numbers at all connections, terminal points, and coiled conductors within cabinets.

E. Conductors Terminated By Others: Indicate location of opposite end of conductor, i.e., Pull Box-Room 101.

F. For identification of conductors, use heat shrinkable white marking sleeves such as Brady Permasleeve with type written identification.

G. Circuit designation is construed to mean panel designation and circuit number, i.e., LA-13.

END OF SECTION

SECTION 26 0130

ELECTRICAL BOXES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Boxes; including:

1. Outlet boxes.
2. Pull and junction boxes.
3. Cabinets.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260000.

B. Support Material: Section 260190.

PART 2 - PRODUCTS

2.01 MATERIAL AND FABRICATION

A. Outlet Boxes:

1. Pressed Steel Boxes: Knockout type, hot-dipped or electro-plate galvanized.
2. Cast Iron Boxes: Hot-dipped or electro-plate galvanized with threaded hubs.
3. Cast Iron Conduit Bodies: Hot-dipped or electro-plate galvanized with threaded hubs.
4. Cast copper free aluminum conduit bodies with threaded hubs.
5. Covers for Pressed Steel Boxes: Hot dipped or electro-plate galvanized.
6. Outlet boxes manufactured in accordance with UL 514.

B. Pull and Junction Boxes:

1. Sheet steel, hot-dipped or electro-plate galvanized, or prime coated and a final coat of manufacturer's standard enamel or lacquer finish. Manufactured in accordance with UL 50.

a. Where exposed to weather, provide raintight hubs for conduits entering the boxes, top and sides only.

2. Floor Boxes:

a. Single gang, similar to Hubbell #B-2536.

b. Covers:

1) Combination, similar to Hubbell #S-2525.

2) Duplex receptacle, similar to Hubbell #S-3925.

c. Carpet flange, similar to Hubbell #S-3075 thru #S-3079.

d. Hubs: Provide hubs as required to suit the conduit arrangement.

3. Pre-Cast Concrete Pull Boxes: As manufactured by Jensen Pre-Cast or Utility Vault and shown on drawings.

4. High impact resistant PVC boxes: As manufactured by Carlon, Sedco, or R & G Sloan.

C. Cabinets: Sheet metal, prime coat and final coat of manufacturer's standard enamel or lacquer finish. Manufactured in accordance with UL 50.

1. Control Cabinet: NEMA 1 enclosure, door with butt hinges and flush handle latches.

a. Provide with removable steel back panel.

2. Terminal Cabinets: NEMA 1 enclosure, door with concealed hinges and spring catch type flush cylinder locks. Key locks alike, provide two keys with each lock.

3. Provide engraved plastic nameplates with 1/2" minimum height letters indicating designation of control and terminal cabinets as shown on the drawings.

a. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

PART 3 - EXECUTION

3.01 USE

A. Outlet Boxes:

1. Ceiling Outlet Boxes: Not less than 4" octagonal by 2" deep.

2. FDD cast iron or cast aluminum device boxes and conduit bodies with metal covers for exposed conduit installation. Provide gasket for covers in wet areas.

3. Intercom, Microphone and TV Outlet Boxes: Not less than 4-11/16" square x 2-1/8" deep.

4. Provide floor boxes with quantity of gangs as required for power, communication or control as indicated. Use boxes with barriers where required. Provide carpet flanges in carpeted areas.

B. Pull and Junction Boxes:

1. Use sheet steel boxes NEMA Type 1 for indoor and NEMA Type 3R for outdoor installation, except as follows.

2. Use pre-cast concrete boxes for boxes flush in finish grade where requiring a nominal capacity greater than 144 cubic inches, where located in vehicular traffic areas, or where indicated.

3. Use polyvinyl chloride (PVC) boxes flush in finish grade when the nominal internal volume is less than or equal to 144 cubic inches or where indicated.

4. Use cast iron boxes for boxes flush in slab on grade.

3.02 INSTALLATION

A. Provide 3/8" fixture studs in wall bracket and ceiling boxes.

B. Provide covers suitable for the fixtures or devices used.

C. Make outlet box covers flush with finished surfaces.

D. Close unused open knockouts with knockout seals.

E. Provide 1" deep plaster rings on recessed outlet boxes installed in areas where concrete will be exposed after construction is complete.

F. Where boxes are concealed in exposed concrete unit masonry, use square cornered types or boxes fitted with rings of sufficient depth for the box to be recessed completely within cavity of block or tile. Install box to insure that ring fits an opening sawed out of the masonry, so that no mortar is required to fill between ring and construction.

G. Provide a 6" base of compacted crushed rock under pre-cast concrete pull boxes.

H. Adjust floor boxes so they are level with top of finished floors.

I. Provide pull boxes and junction boxes in all branch circuit and feeder runs as indicated. Do not provide pull boxes unless they are indicated or required by the Electrical Code.

3.03 IDENTIFICATION

A. Junction Boxes: Use permanent black marker, 2" high lettering, and on each cover plate indicate the power source and circuits contained within that junction box.

END OF SECTION

SECTION 26 0142

NAMEPLATES AND WARNING SIGNS

PART 1 - GENERAL

Not Used.

PART 2 - PRODUCTS

2.01 NAMEPLATES

A. Nameplate shall be plastic laminate with 3/4" high letters in white on black background screwed onto equipment designations shall clearly state:

1. Equipment Enclosure Nameplates.

   a. Manufacturer's nameplate including equipment design rating of current, voltage, KVA, HP, bus bracing rating, or as applicable.

   b. Equipment nameplate designating system usage and purpose, system nominal voltage, equipment rating for KVA, amperes, HP and RPM as applicable. Designation data per drawings or to be supplied with shop drawings approval.

2. Device nameplates: Device usage, purpose, or circuit number; manufacturer and electrical characteristic ratings including the following:

   a. Circuit Breakers: Voltage, continuous current, maximum interrupting current and trip current.

   b. Switches: Voltage, continuous current, horsepower or maximum current switching. If fused, include nameplate stating "Fuses must be replaced with current limiting type of identical characteristics."

   c. Contactors: Voltage, continuous current, horsepower or interrupting current, and whether "mechanically-held" or "electrically-held".

   d. Motors: Rated voltage, full load amperes, frequency, phases, speed, horsepower, code letter rating, time rating, type of winding, class and temperature.

   e. Controllers: Voltage, current, horsepower and trip setting of motor running over current protection.

2.02 WARNING SIGNS

A. Warning signs shall be minimum 18 gauge steel, white porcelain enamel finish with red lettering. Lettering to read "DANGER - HIGH VOLTAGE" in 1" letters. Warning signs to be included on door or immediately above door of all electrical equipment rooms, vaults or closets containing equipment rooms, vaults or closets containing equipment energized above 150 volts to ground, except where such spaces are accessible from public areas.

2.03 WARNING SIGN DESIGNATION

A. Warning designation in 1" red letters shall be painted by stencil or pre-printed adhesive on each pull box, cabinet or 1-foot length of exposed conduit stating "DANGER" and giving voltage of enclosed conductors such as "DANGER - 480 VOLTS", for all systems over 150 volts to ground.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Nameplates shall be mounted by self-tapping or threaded screws and bolts or by rivets.

B. Signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.

END OF SECTION

SECTION 26 0164

BRANCH CIRCUIT PANELBOARDS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Branch circuit panelboards.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260000.

B. Overcurrent Protective Devices: Section 260180.

C. Control Devices: Section 264901.

PART 2 - PRODUCTS

2.01 MATERIAL AND FABRICATION

A. Provide factory assembled, enclosed panelboards in dead front cabinets, with doors, surface mounted or recessed as indicated, not less than 20" wide and 5-3/4" deep. Height will depend on the number of breakers and spaces. Front cover shall have continuous hinge to allow for the front panel to be hinged open while still being attached to the panel box enclosure.

B. Where a control compartment is indicated, provide an integral compartment with a separate hinged lockable door held with captive screws. Identify all internal control wiring with manufacturers wire numbering or control wire numbering when indicated, at all terminal points and connections.

C. Provide feeder terminal lugs for both main lugs only and main breakers rated for use with copper conductors.

D. Provide full length copper bussing including areas indicated as space only.

E. Provide full size neutral bus where neutral bus is indicated. Provide equipment ground bus and bolt-on circuit breakers.

F. Key all door locks alike.

G. 120/208V, 3 Phase, 4 Wire Panelboards: Square-D Co. Type NQOD

H. 277/480V, 3 Phase, 4 Wire Panelboards: Square-D Co. Type NF

I. All equipment shall be listed to meet or exceed the available fault current by 10%.

J. Doors shall be hinged.

K. All placards are welded steel type.

L. Provide hinged dead front doors to allow internal access to panel without totally rewiring cover panel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Secure panelboards to building structure to withstand wire pulling strains.

B. Secure surface mounted panelboards to wood studs or channel material spanning metal studs.

C. Do not use toggle bolts.

D. Contractor shall program lighting control Powerlink panelboard per owner's requirements.

3.02 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on all branch circuit panelboards shown on the single line diagram.

B. Provide panelboard and source feed designation on nameplates with 3/8" minimum height lettering for the panel name and 1/4" height lettering for the source feed designation.

EXAMPLE: Panel LA – 200A @ 120/208vac fed from Panel DB

C. Secure nameplates with at least two spaces or rivets. Cementing and adhesive installation not acceptable.

D. Provide a typewritten directory for each branch circuit panelboard, showing each circuits and its use. Provide metal directory frame with plastic window.

END OF SECTION

SECTION 26 0190

SUPPORT DEVICES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Support devices for conduit, boxes, lighting fixtures and equipment.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Hangers, Straps and Beam Clamps:

1. Efcor.
2. Raco, Inc.
3. Steel City.
4. O.Z./Gedney Co.
5. Caddy Fastening System by ERICO Products Inc.

B. Channels and Fittings:

1. Kindorf.
2. Unistrut Corp.

C. Anchors:

1. Acherman-Johnson Corp.
2. Phillips Drill Co.
3. Rawl Products Co.

2.02 MATERIAL AND FABRICATION

A. Hangers: Steel cadmium plated.

B. Straps: One-hole and two-hole malleable iron, hot-dipped galvanized or steel, cadmium or zinc plated.

C. Beam Clamps: Malleable iron, hot-dipped galvanized or cadmium plated.

D. Channels and Fittings:

1. Channels: Hot-dipped galvanized.

2. Fittings: Galvanized.

E. Anchors: Self drilling and expansion bolt types. No wood or fiber plugs or concrete nails are acceptable.

PART 3 - EXECUTION

3.01 USE

A. Use one-hole or two-hole straps for single conduit runs on walls or ceilings.

B. Use hangers with solid steel rods for hanging single conduits.

C. Use formed channel trapezes for groups of two or more conduits.

D. To fasten boxes and supports to:

1. Wood: Use wood screws or screw type nails of equal holding power.

2. Brick and Concrete: Use bolts and expansion shields.

3. Hollow Masonry Units: Use toggle bolts.

E. Support sheet metal boxes from building structure directly or by bar hangers.

F. Do not penetrate reinforced concrete beams with fastenings more than 1-1/2" or reinforced concrete joints with more than 3/4" fastenings to prevent contact with reinforcing steel.

END OF SECTION