LYNWOOD UNIFIED SCHOOL DISTRICT

Bid No. 14MOT26

Firebaugh High School HVAC Units Replacement at Administration/Library and Gym Buildings – DSA #03-125870

TECHNICAL SPECIFICATIONS

1) TECHNICAL SPECIFICATIONS

2) CARRIER EQUIPMENT PURCHASED SUBMITTAL

3) THERMOSTAT CUT SHEET

4) DSA-103-V2

5) DRAWINGS – V2

Lynwood Unified School District
11321 Bullis Road
Lynwood, CA 90262

SPECIFICATIONS MANUAL

App No: 03-125870

FIREBAUGH HIGH SCHOOL HVAC REPLACEMENT

5246 Martin Luther King Jr Blvd
Lynwood, CA 90262

FEBRUARY 23, 2026

DOCUMENT 00 01 07 - SEALS PAGE

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SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The furnishing of all labor, materials, equipment, services, and incidentals necessary for the HAVC unit replacement at Building 2A and 5A at Firebaugh High School in the Lynwood Unified School District

Firebaugh High School
5246 Martin Luther King Jr Blvd
Lynwood, CA 90262

Work scope includes replacement of 6 roof top HVAC units, 3 units on Bldg 2A and 3 units on Bldg 5A. total weight of units on each building to be less than original. Work includes the electrical, mechanical, and structural components necessary to accommodate the new replacement equipment.

1.02 RELATED REQUIREMENTS:

1. Section 01 0450: Cutting and Patching.
2. Section 01 2000: Project Meetings.
3. Section 01 3000: Project Submittals.
4. Section 01 4050: Tests and Inspections.
5. Section 01 5000: Construction Facilities and Temporary Controls.
6. Section 01 6300: Substitutions
7. Section 01 7000: Contract Closeout

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 USE OF PREMISES

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

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

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

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

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

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

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

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

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

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

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

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

3.02 PROPERTY INVENTORY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

END OF SECTION 01 11 00

SECTION 01 14 50 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.1 SUBMITTALS

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

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

1. Describe the extent of cutting and patching required. Denote how it will be performed and indicate why it cannot be avoided.
2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building’s appearance or other significant visual elements.
3. List products to be used and firms or entities that will perform this Work.
4. Indicate dates when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching operations will disturb or affect. List utilities to be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.
7. Review by Architect and/or DSA prior to proceeding with cutting and patching does not waive Architect right to later require complete removal and replacement of defective Work.

3.2 QUALITY ASSURANCE

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

1. Obtain approval from Owner and/or Architect and the Division of the State Architect of the cutting and patching proposal before cutting and patching the following structural elements unless specifically detailed on the approved plans:

a. Foundation construction
b. Bearing and retaining walls
c. Structural concrete
d. Structural steel
e. Lintels

f. Timber and primary wood framing
g. Structural decking
h. Stair systems
i. Miscellaneous structural metals
j. Exterior curtain-wall construction
k. Equipment supports
l. Piping, ductwork, vessels, and equipment

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

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

a. Primary operational systems and equipment
b. Air or smoke barriers
c. Water, moisture, or vapor barriers
d. Membranes and flashings
e. Fire protection systems
f. Noise and vibration control elements and systems
g. Control systems
h. Communication and/or data systems
i. Conveying systems
j. Electrical wiring systems

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

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

a. Acoustical ceilings
b. Acoustical panels
c. HVAC enclosures, cabinets, or covers
d. Gypsum board

3.3 WARRANTY

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

3.4 INSPECTION

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

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

3.5 PREPARATION

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

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

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

3.6 PERFORMANCE

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

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

1. In general, where cutting, provide hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine, such as a carborundum saw or a diamond-core drill. Saw cut reinforcing bars and paint ends with bituminous paint except where bonded into new concrete or masonry. Cut and remove concrete paving from control joint to control joint.
4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating, backfill, or re-compaction.
5. Sheet Metal: Remove back to joint, lap, or connection. Secure loose or unfastened ends or edges and seal watertight.
6. Plaster: Cut back to sound plaster on straight lines, and back bevel edges of remaining plaster. Trim existing lath and prepare for new lath.

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

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation. Verify conditions of existing substrates prior to executing Work.
2. Restore exposed finishes of patched areas and extend finish restoration into retaining adjoining construction in a manner that will eliminate all evidence of patching and refinishing.
3. Concrete: Maintain cut edges in a moist condition for twenty four (24) hours prior to the placement of new concrete. In lieu of this an epoxy adhesive may be provided. Finish placed concrete to match existing unless noted otherwise. Concrete shall provide a compressive strength 3,000 psi where installed to repair and/or match existing improvements, unless noted otherwise.
4. Metal Fabrications: Items to remain exposed shall have their edges cut and ground smooth and rounded.
5. Lath and Plaster: Install new lath materials to match existing and fasten to supports at 6"centers. Provide a 6" lap where new lath to adjoins existing lath. Fasten new lath as required for new Work.

Restore paper backings as required. Apply a bonding agent on cut edges of existing plaster. Apply three coat plaster of the type, thickness, finish, texture, and color to match existing.

6. Gypsum Wallboard: Fasten cut edges of wallboard. Install patches with at least two opposite edges centered on supports and secure at 6" centers. Tape and finish joints and fastener heads. Patching shall be non-apparent when painted and/or finished.
7. Painting: Prepare areas to be patched, patch and paint as specified under related sections of the Contract Documents.

3.7 CLEANING

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

END OF SECTION 01 04 50

SECTION 01 20 00 - PROJECT MEETINGS

GENERAL

1.1 SECTION INCLUDES

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

1. Job start meeting.
2. Pre-installation conferences.
3. Progress meetings.
4. Meetings as required by the Owner and/or Owner's Representative.

1.2 RELATED SECTIONS

A. Section 01 30 00: Submittals

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION CONFERENCE

A. The Pre-construction conference shall take place no more than 10 days after the Notice of Award in accordance with General Condition, Owner's Representative will schedule a job start meeting before starting the Work, at a time and date determined by Owner's Representative. Meeting shall be held at the Project site or another location as determined by Owner's Representative. Meeting will be held in order to review responsibilities, procedures, and other administrative requirements contained within the Contract Documents.

B. Owner, Owner's Representative, Contractor, all major subcontractors and other interested parties shall attend the meeting. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.

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

1. Introduction and Identification of Owner's Representative, IOR, Owner's consultants, Contractor, Contractor's major subcontractors.
2. Construction schedule and updating frequency (establish schedule for progress meetings)
3. Critical work sequencing
4. Designation of responsible personnel: persons authorized to represent and sign documents for the Owner, Owner's Representative, Contractor, and major subcontractors, with examples of official signature of each. (list names, addresses and telephone numbers of those persons authorized to act for the Contractor in emergencies, include a 24 hour cell or phone number)
5. Modification Procedures and forms (i.e. RFI, Bulletins, etc.)
6. Contractor reports and frequency i.e. Daily site report, RFI log, Submittal log, Construction photograph log, etc.

7. Procedures and forms for processing Applications for Payment, including handling of retention, on site stored material payments, withholding payments, rejection of and/or modification of payment request, etc.
8. Owner supplied Contractor installed materials.
9. Testing and Inspections, Surveys and Layout.
10. Submittal schedules of Shop Drawings, Product Data, Material Lists, Samples. Etc.
11. Procedures and maintenance of project record documents.
12. Use of the Project site and/or premises: Contractors use of premises including location of office, construction and storage areas, equipment deliveries, parking availability and parking areas, and routes for construction traffic.
13. Owners site usage, school schedules, etc.
14. Safety and first aid procedures including designation of Contractors safety officer. Review safety program.
15. Security procedures
16. Housekeeping, project site clean up procedures
17. Normal working hours

D. Owner's Representative shall prepare and issue meeting minutes to attendees and interested parties. Response and/or to meeting minutes due to Owner's Representative no later than two (2) calendar days after the meeting date.

3.2 PRE-INSTALLATION CONFERENCES

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

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

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

a. Contract Documents
b. Options
c. Related Construction Directives and Change Orders
d. Purchases
e. Deliveries
f. Shop Drawings, Product Data, and quality-control samples
g. Review of mockups
h. Possible conflicts
i. Compatibility problems
j. Time schedules
k. Weather limitations
l. Manufacturer's recommendations
m. Warranty requirements
n. Compatibility of materials
o. Acceptability of substrates
p. Temporary facilities, barricades, utilities, sanitary facilities, signs and other temporary facility requirements.

q. Space and access limitations
r. Governing regulations
s. Safety
t. Inspecting and testing requirements
u. Required performance results
v. Recording requirements
w. Protection

C. Contractor shall record significant discussions and directives received from each conference. Contractor shall, within three (3) calendar days after the meeting date, distribute the minutes of the meeting to all concerned parties, including but not limited to, Owner's Representative, IOR, and Architect.

3.3 PROGRESS MEETINGS

A. Progress meetings will be held at the Project site at regular weekly intervals, or as determined by the Owner's Representative and/or Owner.

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

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

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

1. Interface requirements
2. Construction Schedule
3. Sequence and coordination
4. Status of submittals / RFI's
5. Deliveries
6. Off-site fabrication
7. Access
8. Site utilization
9. Temporary Construction Facilities and Controls
10. Hours of work
11. Hazards and risks
12. Housekeeping
13. Quality and workmanship
14. Unforeseen conditions
15. Testing and Inspection
16. defective Work
17. Construction Directive
18. Request for Proposal
19. Change Order Proposals and Change Orders
20. Documentation of information for payment requests
21. Application for Payment

22. Other items as required or as brought forth.

E. No later than five (5) calendar days after each progress meeting, Owner's Representative will prepare and distribute minutes of the meeting to each present and absent party. Include a brief summary, in narrative form, of progress, decisions, directives, actions taken, and all other issues since the previous meeting and report.

3.4 ADDITIONAL MEETINGS

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

END OF SECTION 01 20 00

SECTION 01 30 00 - SUBMITTALS

GENERAL

1.1 SECTION INCLUDES

A. Procedures for submitting to the Architect/Engineer, schedules, shop drawings, product data, samples, material lists, manuals, warranties and certificates, etc., required by individual Specification Section and procedures for submitting finish hardware schedule and segregation of contract costs to the District.

B. Wherever possible, throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined by the name and catalog number of a manufacturer and by reference of recognized industry standards.

C. To ensure that specified products are furnished and installed in accordance with the design intent, procedures have been established for advance submittal of design data and for its review by the Architect.

1.2 RELATED SECTIONS

A. The General Conditions and Division 1 are part of this Section and the Contract for this Work and apply to this Section as if repeated fully herein.

B. Other Sections requiring submittals.

1.3 PROCEDURES

A. Contractor shall secure and submit Shop drawings, manufacturer's catalogs, samples, warranties, operating and instruction manuals, etc. to the Architect/Engineer for review and approval.

B. After the Architect has date-stamped, signed and reviewed submittals, with corrections noted, if any, the Architect will transmit submittals to Contractor.

1.4 SUBMITTALS

A. Approval of Submittals: Contractor shall clearly identify any deviations from the Contract Drawings and Specifications on submittals. Prior approval of any deviation by the District Architect/Engineer or his representative is required. Any deviation without said prior approval, even though stamped approved, is not acceptable.

1. Approval stamp is for design and quality only. No deviations. No quantities.

B. Deliver submittals to the Owner’s Representative. Identify project name and address, telephone number of Contractor, subcontractor and supplier. Identify, as appropriate, pertinent drawing sheets, detail numbers and Specification Section numbers. Clearly identify any deviations from Contract Documents.

C. Make submittals in accordance with the approved Construction Schedule, and approved Shop Drawing Submission Schedule, in sequence that avoids delaying work and progress of other Contractors.

D. CONTRACTOR SHALL THOROUGHLY REVIEW SUBMITTALS PRIOR TO SUBMISSION TO THE ARCHITECT/ ENGINEER.

E. Timing of Submittals:

1. In accordance with General Conditions, Contractor shall submit to Owner's Representative those Shop Drawings, Product Data, diagrams, materials lists, Samples and other submittals required by the Contract Documents.
2. The Contractor shall submit within ten (10) Days of the Award of Contract, a itemized listing of required submittals with a scheduled date for each submittal. The schedule of submittals shall provide adequate time between submittals in order to allow for proper review without negative impact to the Construction Schedule.
3. Schedule of submittals shall be related to Work progress, and shall be so organized as to allow sufficient time for transmitting, reviewing, corrections, resubmission, and re-reviewing.
4. Contractor shall coordinate submittal of related items and Owner's Representative reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received by Owner's Representative.
5. Contractor shall revise, update and submit submittal schedule to Owner's Representative on the first of each month, or as required by Owner's Representative.
6. Contractor shall allow in the Construction Schedule, at least sixteen (16) days for Owner's Representative review following Owner's Representative receipt of submittal. For mechanical, plumbing, electrical, and other submittals requiring joint review with CMR, and/or others Contractor shall allow a minimum of eighteen (18) days following Owner's Representative receipt of submittal.
7. No adjustments to the Contract Time and/or Milestones will be authorized because of a failure to transmit submittals to Owner's Representative sufficiently in advance of the Work to permit review and processing.

F. In case of product substitution, Shop Drawing preparation shall not commence until such time Owner's Representative reviews said submittal relative to the General Conditions. Each submittal shall be accompanied by a letter of transmittal containing a complete itemized and numbered list of submitted materials. Separate letters of transmittal shall accompany each submittal from different subcontractors.

G. Resubmission: If requested, resubmit submittals in a timely manner. Resubmit as specified for initial submittal but identify as such. Indicate any changes which have been made other than those requested by the Architect.

1.5 SHOP DRAWINGS

A. Shop Drawings are original drawings prepared by Contractor, subcontractor, supplier, or distributor which illustrate some portion of work by showing fabrication, layout, setting, or erection details.

B. Draw shop drawings to an accurate scale that is large enough to indicate all pertinent features and methods.

C. Copies Required and Distribution: Unless otherwise indicated in individual specification sections, submit 6 sets of blueline prints.

1.6 PRODUCT DATA

A. Manufacturer's Standard Schematic Drawings:

1. Delete information which is not applicable to Project.
2. Supplement standard Drawings to provide additional information applicable to Project.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data:

1. Clearly mark each copy to identify pertinent materials, products, or models.
2. Indicate dimensions and clearances required.
3. Indicate performance characteristics and capacities.
4. Indicate wiring diagrams and controls.

C. Copies Required and Distribution: Submit 3 copies.

1.7 SAMPLES

A. Samples:

1. Submit samples of sufficient size and quantity to clearly illustrate:

a. Functional characteristics of product or material, with integral parts and attachment devices.
b. Full range of colors, textures, and patterns.

2. Provide permanent identification for each sample.
3. Color and Pattern: Whenever a choice of color or pattern is available in a specified product, submit accurate color chips and pattern charts to the Architect/Engineer for review and selection.
4. Number Required: Submit 3 of each.

B. Field Samples: When specified, erect field samples and mock-ups at project site to illustrate materials, equipment, or workmanship and to establish standards by which completed work shall be judged.

C. After return of office samples or review of field samples, these items may be used in construction of project with approval of the Architect/Engineer.

1.8 MANUALS

A. Where Manuals are required to be submitted covering items included in Work, prepare Manuals in durable binders, approximately 8-1/2" by 11" in size, and provide following information:

1. Identification on, or readable through, front cover stating general nature of manual.
2. Neatly typewritten index at front of Manual, furnishing immediate information as to location in Manual of data or equipment involved.
3. Complete instructions regarding operation and maintenance of equipment involved.
4. Complete nomenclature of replaceable parts, their part numbers, current cost, and name and address of nearest vendor of parts.
5. Copy of all Guarantees and Warranties issued.
6. Copy of approved Shop Drawings with data concerning changes made during construction.

B. Extraneous Data: Where contents of Manuals include manufacturers' catalog pages, clearly indicate precise items included in this installation and delete, or otherwise clearly indicate, manufacturers' data which is not part of this installation.

C. Number of Copies Required: Deliver 6 copies to the Architect/Engineer for review, approval and distribution. The Architect/Engineer will return 3 copies to Contractor.

1.9 CERTIFICATES

A. Submit in triplicate, in accordance with requirements of each Specification Section.

1.10 COLOR SCHEDULES

A. The District shall review and approve color schedules prepared by the Architect/Engineer and distribute the approved schedules to Contractor.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION 01 30 00

SECTION 01 40 50 - TESTING AND INSPECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Testing and inspection services to meet requirements of the California Building Code (CBC), Title 24, Parts 1 and 2, as indicated on the Drawings.

C. Tests of materials are required by a DSA certified testing AGENCY as set forth in Section 4-335 of the California Building Standards Administrative Code.

1.02 RELATED SECTIONS

Provisions of the General Conditions, Supplemental Conditions and Division 01 apply to this Specification. Specifications that are referenced or related may include:

A. Section 01 04 50: Cutting and Patching

B. Section 01 10 00: Construction Documents

C. Section 01 30 00: Submittals

D. Section 01 50 00: Construction Facilities and Temporary Controls

E. Section 01 70 00: Contract Closeout

F. Section 01 74 00: Warranties and Guarantees

PART 2 – PRODUCTS (Not used)

PART 3 – EXECUTION

3.01 TESTS

A. OWNER will select and provide an independent DSA approved certified testing agency (AGENCY) to conduct tests, sampling, and testing of materials. AGENCY shall have DSA Laboratory Evaluation and Acceptance (LEA) Program acceptance. Selection of material to be tested shall be by the AGENCY and not by CONTRACTOR. Lab to be approved by Architect of record/Structural Engineer (where applicable) DSA.

B. Any material shipped from the source of supply prior to having satisfactorily passed such testing and inspection, or prior to the receipt of notice from IOR such testing and inspection is not required, shall not be incorporated into the Work.

C. OWNER will select, and directly reimburse, the AGENCY for costs of all DSA required tests and inspections; however, the OWNER may be reimbursed by CONTRACTOR for such costs for re-testing of deficient Work.

D. The independent testing AGENCY is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.

E. The AGENCY shall not perform any duties of CONTRACTOR.

F. CONTRACTOR shall provide an insulated curing box with the capacity for twenty (20) concrete cylinders and will relocate said box and cylinders as rapidly as required in order to provide for progress of the Work.

3.02 TEST REPORTS

A. Test reports shall include all tests performed, regardless of whether such tests indicate the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations, when and as required, shall also be reported. Reports shall indicate the material (or materials) was sampled and tested in accordance with requirements of CBC, Title 24, Parts 1 and 2, as indicated on the Drawings. Test reports shall indicate specified design strength and specifically state whether or not the material (or materials) tested comply with the specified requirements.

3.03 VERIFICATION OF TEST REPORTS

A. Each testing AGENCY shall submit to the Division of the State Architect, in duplicate, a verified report covering all tests required to be performed by that AGENCY during the progress of the Work. Such report, covering all required tests, shall be furnished prior to Substantial Completion and/or, when construction on the Work is suspended, covering all tests up to the time of Work suspension.

3.04 INSPECTION BY OWNER

A. OWNER, and its representatives, shall have access, for purposes of inspection, at all times to all parts of the Work and to all shops wherein the Work is in preparation. CONTRACTOR shall, at all times, maintain proper facilities and provide safe access for such inspection.

B. OWNER, and its representatives, shall have the right to reject materials and/or workmanship deemed defective Work and to require correction. Defective workmanship shall be corrected in a satisfactory manner and defective materials shall be removed from the premises and legally disposed of without charge to OWNER. If CONTRACTOR does not correct such defective Work within a reasonable time, fixed by written notice and in accordance with the terms and conditions of the Contract Documents, OWNER may correct such defective Work and proceed in accordance with related Articles of the Contract Documents.

C. CONTRACTOR is responsible for compliance to all applicable local, state, and federal regulations regarding codes, regulations, ordinances, restrictions, and requirements.

3.05 INSPECTOR OF RECORD

A. An Inspector of Record (IOR) shall be employed by OWNER, and approved by ARCHITECT, STRUCTURAL ENGINEER and DSA in accordance with requirements of Title 24 of the California Code of Regulations with their duties specifically defined therein. Additional DSA certified inspectors may be employed and assigned to the Work by OWNER in accordance with the requirements of California Building Standards Administrative Code with their duties as specifically defined in Section 4-333(b).

B. Inspection of Work shall not relieve CONTRACTOR from any obligation to fulfill all terms and conditions of the Contract Documents.

C. CONTRACTOR shall be responsible for scheduling times of inspection, tests, sample taking, and similar activities of the Work.

3.06 TESTS AND INSPECTIONS

The following tests and inspections do not limit inspection of the Work but are required by DSA, other agencies, or are required in related Sections of the Contract Documents.

1. Concrete - CBC, Chapter 19A:

    a. Materials:

        1) Test of Materials: 1705A.3, ACI 318-14 Sections 26.12 & 26.13
        2) Portland Cement Tests: ACI 318, ASTM C 150.
        3) Concrete Aggregate: 1903A.5, ACI 318 Section 26.4.1.2, ASTM C 33.

Reinforcing Bars: 1910A.2, ACI 318-14 Section 26.6.1.2

        5) Mix Designs: Table 1705A.3 Item 5, 1910A.1
        6) Admixtures: 1903A.6 ACI 318 Section 26.4.2.2 (b) and Table 26.4.2.2 (b)

    b. Quality:

        1) Proportions of Concrete: 1910A.1
        2) Mixing and Placing: Table 1705A.3 Item 5, 1910A.1
        3) Concrete Testing: 1905A.1.16, ACI 318-14 Section 26.12

Inspection:

        1) Project Site Inspection: 1905A.7, 1705A.3.5
        2) Batch Plant: 1705A.3.3
        3) Weigh-Master Inspection: 1705A.3.3.1

Reinforcing Bar Welding Inspection: 1705A.3.1 1903A.4.

2. Steel - CBC, Chapters 17A and 22A:

    a. Materials:

        1) Structural Steel: 2205A.1.
        2) Material Identification: 2203.A.1.

    b. Inspection and Tests:

        1) Test of Structural Steel: 1705A.2.
        2) Shop Fabrication Inspection: 1704A.2.5.
        3) Welding Inspection: 1705A.2.5.

END OF SECTION 01 40 50

SECTION 01 50 00 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Description of temporary utilities and protection of construction facilities which are to be provided and maintained by Contractor.

1.2 RELATED SECTIONS

A. General Conditions

1.3 TEMPORARY UTILITIES

A. Water:

1. Water used on work will be furnished and paid for by the Contractor. Contractor shall provide necessary temporary piping and temporary water meters from distribution point to points on site where water is necessary to carry on work, and upon completion of work shall remove temporary piping.
2. Provide suitable drainage system, subject to approval of the District Inspector, to carry construction waste water from site to an approved disposal location.

B. Electricity:

1. The Contractor will furnish and pay for electrical power necessary for construction purposes at site. The Contractor shall meter and pay for electrical utilities that are from sources installed temporarily for the project. Contractor shall provide necessary temporary wiring and lighting and shall remove all temporary wiring and lighting at the completion of the Work. Temporary wiring and lighting shall comply with requirements of the National Electrical Code. Contractor shall be responsible for all damage caused by overloading or other causes and the installation shall be satisfactory to the District Inspector.
2. Furnish and install area distribution boxes, so located that individual trades may use 100'-0" maximum length extension cords to obtain adequate power and artificial lighting, at points where required for work, for inspection and for safety.
3. Provide electricity needed for construction including connections for construction equipment requiring power.

C. Gas: Contractor shall provide and install gas equipment, gas meters and piping necessary to perform his work, and shall remove same upon completion of work. District shall pay for only the gas used in work which is drawn from existing meter sources.

D. Heating and Ventilation:

1. Provide, maintain, and pay for temporary heat sources needed for proper installation of work and to protect materials and finishes from damage due to weather.
2. Provide ventilation of enclosed areas to cure materials, to disperse humidity, and to prevent accumulation of dust, fumes, or gases.

E. Temporary Telephone: Contractor shall provide and pay all costs for all cellular telephones, business telephones, telephone, fax and data telephone lines at site for his use. Use of school telephones will not be permitted. The Contractor shall provide and pay all costs for two (2) telephone lines (1 voice, 1 fax) for the District Inspector.

F. Use means necessary to maintain temporary facilities and controls in proper and safe condition throughout progress of work.

G. Make required connections to existing utility systems with minimum disruption to services in existing utility systems. When disruption of existing service is required, do not proceed without the District Inspector's approval and, when required, provide alternate temporary service.

1.4 CONTRACTOR'S FACILITIES

A. Temporary Offices:

1. Contractor shall provide and maintain a trailer(s) on site for duration of project.

    a. Trailer(s) shall have ample headroom; shall be properly lighted, heated and ventilated. Contractor shall provide an electric drinking fountain or bottled water.

2. Trailer(s), equipment and furniture shall remain Contractor's property. Contractor shall remove such property upon completion of work.

3. District's Inspector: The Contractor shall provide on site at the Contractor's sole expense, a temporary office structure of no less than 200 square feet and the said structure shall be utilized by the Inspector and Inspector shall be separate from space utilized by Contractor or construction personnel. All equipment and furnishings described herein shall remain the property of the Contractor and be maintained in good working order by the Contractor. Office is to be located as approved by the District Inspector and to be adequately maintained in fully operational condition until final acceptance of the project by the Board of Education. This office shall be of substantial waterproof construction with adequate natural light and ventilation. The door shall have a key-type lock and a deadbolt key lock. Equipment shall be as follows:

    a. One office desk, a table satisfactory for the study of plans, one chair on wheels with arms, and two standard chairs, a lockable one 2-drawer filing cabinet with key, one plan rack and one large bookshelf.

B. Storage Units:

1. Provide secure and waterproof storage units where required for the temporary storage of furniture, equipment and other items.
2. Storage Unit Construction: Walls, roof and doors minimum 16 gage steel; floors 1" tongue and groove hardwood or 3/4" minimum exterior type plywood, with undercarriage designed to accommodate forklift blades 42" to 60" long; doors at one end of storage unit, double wide swing out with waterproof gaskets and lockable steel locking bars.

3. Pay all charges and set the storage unit where directed by the District Inspector.
4. Remove storage unit from the site after removal of all the items that were temporarily stored and when directed by the District Inspector.

C. Sanitary Facilities:

1. Contractor shall provide temporary toilet facilities including which may consist of portable chemical toilets. Number of toilets shall be provided according to Cal OSHA requirement. Handwash facilities shall be provided according to Cal OSHA requirements.
2. Toilet facilities shall be kept supplied with toilet paper and kept in a clean and sanitary condition until completion of work, and then be removed from work site. Upon removal, that portion of site shall be properly cleaned and graded.

D. Contractor's Security Barricade:

1. Contractor shall erect temporary security barricade as required for safety and as specified. New or used material may be used.
2. Unless otherwise indicated or specified, barricade shall be constructed of 6'-0" high chain link fencing. Space posts not to exceed 10'-0" on centers. Posts shall be of following nominal pipe dimensions: terminal, corner, and gate posts 2-1/2", line posts 2". Chain link mesh shall be not less than #13 gage, 2" mesh, and in one width. Posts, mesh and accessories shall be galvanized. Contractor shall provide a durable green fabric screening in one width at all temporary security barricades.

    a. Mesh shall be attached to posts with #14 gage tie wire at 16" centers. A #6 gage steel tension wire with turnbuckles shall be installed at top and bottom of barricade fencing. Wire tie mesh to tension wires at 18" centers.
    b. Fabric shall be attached to mesh at top and bottom with wire ties at 2’0” centers.

3. Chain link fencing shall be free from barbs, icicles or other projections resulting from galvanizing process. Fence mesh and fabric having such defects will be rejected even though it has been erected.
4. Gates shall be fabricated of steel pipe with welded corners, and bracing as required. Mesh to be attached to frame at 12" centers. Provide all gate hardware of a strength and quality to perform satisfactorily until barricade is removed upon completion of work.
5. At completion of work, remove barricade and concrete post footings from site; backfill and compact fence footing holes. Existing surface paving that is cut into or removed shall be patched and sealed to match surrounding areas.

E. Other Enclosures:

1. Provide lockable, temporary weather-tight enclosures at openings in exterior walls to create acceptable working conditions, to allow for temporary heating and for security.
2. Provide protective barriers around trees, plants and other improvements designated to remain.

F. Storage Yards and Sheds:

1. Contractor shall fence and maintain storage yards in an orderly manner.
2. Storage for materials that cannot be stored outside may be stored within building.
3. Exact location, size and access of storage yards shall be approved by District Inspector.
4. Remove storage yards and sheds as rapidly as progress of work will permit.

G. Contractor's Parking: Contractor is responsible for parking offsite at his expense and in locations acceptable to the District and local governing authorities.

1.5 GENERAL ITEMS

A. Staging areas for delivery of materials and equipment will be at locations designated by the Project Manager.

B. Safety and Security Lighting: Provide the foot candles minimum inside building(s) and the foot candles outside that comply with Cal OSHA requirements..

C. Noise Control: Contractor shall comply with all noise ordinances of the local authorities. Additionally the Contractor shall provide suspend all operations during District testing of students, two (2) separate days anticipated.

1.6 TRENCHES

A. Open trenches for installation of utility lines (water, gas, electrical and similar utilities) and open pits outside barricaded working areas shall be barricaded at all times. Barricades, such as traffic safety type saw horses or post should be used. High visibility orange netting shall be strung between horses or posts. Trenches shall be backfilled and patch-paved within 72 hours after approval of installation by the District Inspector, or shall have "walk plates" installed.

B. Open trenches deeper than 3'-0", and not located within a public street access, shall be enclosed within an 6'-0" high chain-link fence.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION 01 50 00

SECTION 01 63 00 - SUBSTITUTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Procedures for submittal of requests for substitution for materials.

B. Related Documents: General Conditions and Division 1 are a part of this Section and the Contract for this Work and apply to this Section as if repeated fully herein.

1.2 GENERAL REQUIREMENTS

A. Submit a written request for proposed substitutions to the District's Representative according to the General Conditions.

B. Where materials or items of manufacturer are specified in groups and are made or furnished by one manufacturer, no substitution will be considered that is not made or furnished similarly by one manufacturer. Where the Contractor proposes to use a system of equipment other than that specified or detailed on the Drawings the substitution shall be proposed as a complete system.

1.3 REQUIREMENTS FOR SUBMITTING SUBSTITUTIONS:

A. Changes to approved drawings and specifications shall be made by Addenda or Construction Change Document (CCD) and approved by the Division of the State Architect as required by CCR, Title 24, Part 1, Section 4-338 (C), IR-A-6. Prior to fabrication and installation.

1. Construction Change Documents must be signed by all of the following:

    a. Architect of Record
    b. Structural Engineer (where applicable)
    c. Designated Design Professional (where applicable)
    d. DSA

B. Submit written request for each proposed substitution on form shown at the end of this Section. Provide data substantiating request as well as a "Certificate of Suitability" certifying that the proposed substitution is equal or better in all respects to that specified and that it will, in all respects perform the function for which it is intended. Include with request all required samples. Submit 3 copies of all written requests and data for proposed substitutions.

C. Submit complete information to the Owner's Representative so that proper evaluation can be made. The burden of proof of equality of the substituted item shall be on the Contractor. Acceptance of such substitutions is entirely at the discretion of the Owner's Representative and District. All materials or items of manufacturer, which the Contractor proposes to substitute for those specified, must be accepted by the Owner's Representative before they may be ordered.

D. The Owner's Representative will issue to the Contractor a list setting forth those items for which substitutions are accepted. No substitution will be accepted for any materials or item of manufacture

called for in the Contract Documents which is not of equal quality and utility and which does not possess equal design or color characteristics to those of the specified material or item.

E. If, in the opinion of the Owner's Representative or District, the proposed substitution is not equal or better in every respect to that so indicated or specified, or was not submitted for acceptance in the manner outlined above, the Contractor shall furnish the specified materials.

F. It shall be the responsibility of the Contractor, in proposing a substitution for any item herein specified, to inform all other trades, vendors, and subcontractors of effects said substitution will have upon their construction activities or products. Failure to so notify shall require that the Contractor make all payments arising from alterations in specified materials or methods necessary to complete the Work in an approved and acceptable manner.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 63 00

SUBSTITUTION REQUEST FORM

Re:

Project Name

Project Manual Section Number

Item

To:

Owner's Representative

From:

General Contractor

We hereby submit for your consideration the following product comparisons of the specified item and the proposed substitution:

A.	Comparison	Specified Item	Substitution
1.	Product Name/Model	_____	
2.	Manufacturer	_____	
	Address	_____	
	Phone Number	_____	
3.	Product Cost	_____	
	Installation/Labor Cost	_____	
4.	Delivery Time	_____	
	Installation Time	_____	
5.	Product Characteristics	_____	
		_____	
		_____	
		_____	
6.	Dimensions	_____	
	Effects	_____	
		_____	
7.	Guarantee/Warranty	_____	

8. ICC-ES No. _____

9. UL Rating _____

B. Substantiating Data:

Attach manufacturer's literature for both specified item and substitution.

C. Samples:

Provide samples for both specified item and substitution, if applicable.

D. Similar Projects

1. _____
Name Date

Address

2. _____
Name Date

Address

E. What Effect does this substitution have on applicable code requirements?

F. Change Data:

Attach complete information as to whether the proposed substitution:

1) Is equal in quality/service/ability to the Specified Item;
2) Will entail no changes in detail, construction, and scheduling of related work;
3) Will be acceptable in consideration of the required design and artistic effect;
4) Will provide no cost disadvantage to the District;
5) Will require no excessive or more expensive maintenance, including adequacy and availability of replacement parts; and
6) Will require no change of the construction schedule.

Submitted by:

_____
Signature Name
Title

_____
Firm Date

Address

Signature must be by persons having authority to legally bind his firm to the above terms. Failure to provide legally binding signature will result in retraction of approval.

* * * * * * *

For Use by Owner's Representative:

_____ Accepted _____ Not Accepted

Owner's Consultant:

By:

Date:

_____ Accepted _____ Not Accepted

School District:

By:

Date:

* * * * * * *

SECTION 01 70 00 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1. Inspections.

B. Closeout requirements for specific Work activities are included in the appropriate Sections in Divisions 01 through 16.

1.2 REQUIREMENTS FOR PREPARATORY TO FINAL INSPECTION

A. Remove temporary facilities from the Project site.

B. Thoroughly clean the Buildings and Project site.

C. All plumbing and mechanical equipment shall operate quietly and free from vibrations. Properly adjust, repair, balance, or replace equipment producing objectionable noise or vibration in the occupied areas of the buildings. Provide additional brackets, bracing, or other methods to prevent objectionable noise or vibration. All systems shall operate without humming, surging, or rapid cycling.

D. Properly mount all operation instructions for equipment and post as specified in their respective Sections.

E. Job Record specifications and prints “as builts” shall be completed, signed, and submitted to the Owner’s Representative as specified in respective Specification Sections.

F. Submit to the Owner’s Representative, the material and equipment maintenance instructions, as specified in the body of the Specification Sections.

G. Submit to the Owner’s Representative, all warranties, guarantees, and bonds, as specified in the body of the Specification Sections.

H. When requested, submit certificates indicating payment of all debts and Claims arising from the Work.

I. Deliver all tools which are a permanent part of equipment installed in the Work to the Owner.

J. Deliver all keys, construction and permanent, properly identified, to the Owner.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.1 SUBSTANTIAL COMPLETION

A. Inspection Procedures: On receipt of a request for a certificate of Substantial Completion, Owner's Representative and/or Owner will either authorize commencement of inspection or advise Contractor of unfilled requirements. IOR, Owner's Representative, and/or Owner and Contractor will inspect the Work and Owner's Representative shall prepare a comprehensive punch list of items to be completed.

1. IOR will repeat inspection when requested by the Contractor and assure the Work is complete.
2. Results of the completed inspection will form a partial basis of the requirements for Final Completion.

B. Re-inspection Procedures: IOR, Contractor and Owner's Representative will inspect the Work upon notice the Work, including final inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to Owner's Representative.

1. Upon completion of inspection, OWNER'S REPRESENTATIVE will recommend Final Completion. If the Work is incomplete, OWNER'S REPRESENTATIVE will advise Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for Final Completion.
2. If necessary, re-inspection will be repeated, but may be assessed against Contractor if Owner is subject to additional professional service and or additional costs of inspection.

C. After all requirements preparatory to the final inspection have been completed as herein specified in the Specification Sections, the Contractor will notify the Owner's Representative and IOR to perform the final inspection.

END OF SECTION 01 70 00

SECTION 01 74 00 - WARRANTIES AND GUARANTEES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers and/or installer's standard warranties on products and special product warranties.

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

1.2 RELATED SECTIONS

A. Section 01 0450: Cutting and Patching

B. Section 01 3000: Submittals

C. Section 01 7000: Contract Closeout

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.1 WARRANTY REQUIREMENTS

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

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

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

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

E. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement with the reinstated warranty equal to the original warranty.

F. Replacement Cost: Upon determination the Work covered by a warranty has failed and/or is defective, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether Owner has benefited from use of the Work through a portion of its anticipated useful service life.

G. Owner Recourse: Expressed warranties made to Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which Owner can enforce such other duties, obligations, rights, or remedies.

H. Rejection of Warranties: Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

I. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, Owner reserves the right to refuse to accept the Work until Contractor presents evidence the entities required to countersign such commitments have done so.

3.2 SUBMITTALS

A. Submit written warranties to Owner's Representative prior to Final Completion of the Work. If the certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, submit written warranties as set forth in the certificate of Substantial Completion.

B. When a designated portion of the Work is partially used and/or occupied by Owner, submit properly executed warranties to OWNER'S REPRESENTATIVE within fifteen (15) days of the Partial Use or Occupancy of the designated portion of the Work.

C. When the Contract Documents require Contractor (s), or Contractor and a Subcontractor, installer, supplier or manufacturer to execute a special warranty, prepare a written document containing appropriate terms and identification, ready for execution by the required parties. Submit a draft to Owner, through the Owner's Representative, for approval fifteen (15) days in advance prior to final execution.

D. Refer to Divisions 02 through 16 for specific content requirements and particular requirements for submitting special warranties.

E. Form of Submittal: Prior to Final Completion of the Work, compile two copies of each required warranty properly executed by Contractor, or by Contractor and Subcontractor, installer, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the Specifications.

F. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½ by 11" (115 by 280 mm) paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the item or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the installer.
2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title and/or name, and name of Contractor.
3. When warranted Work requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

END OF SECTION 01 74 00

SECTION 01 74 50 - CLEANING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The CONTRACTOR shall be solely responsible for the cleaning of the Project site.
B. Keep premises, and adjacent private and public properties free from accumulation of waste, debris and rubbish caused by construction process.
C. At completion of Work, remove waste materials, rubbish, tools, equipment, machinery and surplus material, and clean all exposed surfaces. Remove remaining mock-ups and samples.
D. Leave Project clean and ready for occupancy.

1.2 ELATED SECTIONS

A. Section 01 5000: Construction Facilities and Temporary Control.
B. Section 01 7000: Contract Closeout

1.3 SAFETY

A. The CONTRACTOR shall be solely responsible for cleaning safety.
B. Standards: Maintain Project in accord with Federal, State, Local safety regulations, ordinances, anti-pollution laws and insurance standards.
C. Hazard Control: Maintain Project in accord with Federal, State, Local safety regulations, ordinances, anti-pollution laws and insurance standards.
D. Conduct cleaning and disposal operations to comply with Federal, State, Local safety regulations, ordinances, and anti-pollution laws.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 DURING CONSTRUCTION

A. The CONTRACTOR is solely responsible for the cleaning of all public and private property.
B. Keep premises, and adjacent private and public properties free from accumulations of waste materials and rubbish. Remove debris and dirt from public property promptly; clean sidewalks and adjacent streets daily when soiled by work performed under this Contract.
C. As often as necessary, and/or as required the CONTRACTOR shall clean site and dispose of waste materials, debris, and rubbish off the site in a legal manner. Remove all combustible materials in a legal manner.
D. Provide on-site containers for collection of waste materials, debris, and rubbish. Provide a collection can at each location used as an eating area. Pick-up and dispose of all garbage daily.
E. Remove waste materials, debris, and rubbish from site and legally dispose of at legal public or private dumping areas or recycling center off OWNER'S property.
F. Do not allow debris and combustible materials to accumulate in voids, cavities, and plenums created by wall partition, and ceiling construction. These areas must be thoroughly cleaned out before being sealed or closed off by installation of finish materials.
G. Do not allow debris to clog drains. Keep roof drains, scuppers, floor drains and area drains clean and free of debris.

H. Vacuum clean interior areas when ready to be painted, installation of carpet, installation of floor tile, etc. Refer to Sections for other provisions on preparations of finish surfaces.
I. Handle materials in a controlled manner with as few handling as possible; do not drop or throw materials from heights.
J. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on newly finished surfaces.
K. Wet down materials and rubbish to lay dust and prevent it form blowing.

3.2 FINAL CLEANING

A. Complete cleaning operations before requesting inspection for a certificate of Substantial Completion.
B. Employ experienced workers, or professional cleaners, for all final cleaning.
C. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
D. Remove labels that are not permanent labels.
E. Clean transparent materials, including mirrors and glass in doors and windows. Remove misplaced glazing compound and other substances. Replace chipped or broken mirrors, glass and other damaged transparent materials.
F. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors, walkways, and the like broom clean. Vacuum carpeted surfaces.
G. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
H. Clean the site, including landscaped areas, of rubbish litter and other foreign substances.

1. Contaminated earth:

a. Final clean-up operation includes the removal and disposal of earth contaminated or unsuitable for support of plant life in planting areas, and filling of resulting excavations with suitable soil.
b. Contaminated areas include those used for disposal of waste concrete, mortar, plaster, masonry, and similar materials, areas in which washing out of concrete and plaster mixers or washing of tools and like cleaning operations have been performed, and areas that have been oiled, paved, or chemically-treated.

2. Sweep paved areas broom clean; remove stains, spills and other foreign deposits.

3. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

I. The CONTRACTOR is to keep Project clean until it is occupied by OWNER.

END OF SECTION 01 74 50

SECTION 01 78 00 - OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SUMMARY

A. Principal work in this Section:
   1. Compilation of product data and related information appropriate for OWNER'S maintenance and operation of products furnished under the Contract.
   2. Instructions of OWNER'S personnel in the maintenance of products and in the operation of equipment and systems.

B. Related work:
   1. Submittals of shop drawings, product data and samples
   2. Contract closeout submittals
   3. Submittals of warranties

1.2 RELATED SECTIONS

A. Section 01 70 00: Contract Close Out
B. Section 01 74 00: Warranties and Guarantees
C. Section 01 78 50: Project Record Documents

1.3 SUBMITTALS

A. Preliminary:
   1. Submit three (3) copies of proposed manual or manuals to the CMR, for review by ARCHITECT seven (7) days prior to request for final inspection, start-up of systems, and/or training, which ever comes first. Allow enough time for corrections and final review.
   2. Show general arrangement, nature of contents in each portion or section, proposed method of binding, and covering for the manual or manuals.

B. Final:
   1. Following instruction of operation and maintenance personnel, make all necessary revisions of the manual.
   2. Submit specified number of copies of approved data in final form at final inspection or acceptance.
   3. Distribution of final copies with be to CMR who will distribute to the OWNER.

1.4 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel trained and experienced in maintenance and operation of the described products.

1.5 FORMAT

A. Prepare data in the form of an instruction manual for use by OWNER'S personnel.

B. Text: 20 lbs. white bond paper, 8 – 1/2 in. by 11 in.
C. Drawing:
   1. Provide reinforced punched binder tab. Bind drawings with text.
   2. Fan-fold larger drawings to size of text pages.
D. Fly-leaf: For each separate product or each piece of operating equipment provide the following.
   1. Brief description of product, and major component parts of equipment.
   2. Indexed tabs.
E. Cover: Identify each volume with typed or printed title **OPERATION AND MAINTENANCE INSTRUCTIONS.** List the following:
   1. Title of Project.
   2. Identity of separate structures as applicable
   3. A brief and general identification of the subject matter covered in the manual.
F. Binders:
   1. Commercial quality D-ring type three (3) ring binders with durable vinyl covers.
   2. When multiple binders are used, correlate the date into related groupings.
G. Labels
   1. Provide front and end spine labels for each manual clearly indentified with the following information.

OPERATING AND MAINTENANCE INSTRUCTION
Name of school site
Address
City, CA. zip code

Name of Contractor
General subject of the manual
Space for approval date

1.6 CONTENT OF MANUAL

A. Table of contents:
   1. List of each product required to be included, indexed to the content of the volume.
   2. List, with each product, the name, address and telephone number of ;
      a. subcontractor and installer
      b. maintenance contractor, as appropriate
      c. local source of supply of parts, and replacements.
B. Product data:
   1. Include only those sheets which are pertinent to the specific product.
   2. Annotate each sheet to clearly identify the data applicable to the installation. Delete references to inapplicable information.
C. Drawings: Supplement product data with drawings as necessary to illustrate:
   1. Relations of components parts of equipment and systems.
   2. Project record drawings shall not be used as maintenance drawings.
D. Instructions:
   1. Written text as required to supplement product data for the particular installation.
E. Warranties
   1. Provide a copy of each warranty, guaranty, bond, and service contract issued.
   2. Provide information sheet for OWNER'S personnel, giving the following information:
      a. Proper procedures in the event of failure or emergency.
      b. Instances which might affect the validity of warranties, guaranties, or bonds.

3. Warranties will be addressed to each Building in particular method for assurance of operations as if owned by one entity.

1.7 MANUAL FOR MATERIALS AND FINISHES

A. Instructions for care and maintenance including:
1. Manufacturer's recommendation for types of cleaning agents and methods.
2. Cautions against cleaning agents and methods which may be detrimental to the product.
3. Recommended schedule for cleaning and maintenance.

1.8 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Content, for each unit of mechanical equipment and system, as appropriate:
1. Description of unit and component parts:
a. Function, normal operating characteristics, and limiting conditions.
b. Performance curves, engineering data and tests.
c. Complete nomenclature and commercial number of all replaceable
d. parts.
2. Operating procedures:
a. Start-up, break-in, routine, and normal operating instructions
b. Regulation, control, stopping, shut-down, and emergency instructions.
c. Summer and winter operating instructions.
3. Maintenance procedures:
a. Routine operations.
b. Guide to "trouble-shooting".
c. Disassembly, repair, and reassembly.
d. Alignment, adjusting, and checking.
4. Servicing and lubrication:
a. Schedule for maintaining equipment.
b. List of manufacturer approved lubricants.
5. Manufacturer's printed operating and maintenance instructions.
6. Description of sequence of operation by control manufacturer.
7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
a. Predicted life of parts subject to wear.
b. Items recommended to be stocked as spare parts.

8. Control diagrams by manufacturer on controls as installed in Project.
9. Coordination drawings of color-coded piping diagrams as installed by each subcontractor.
10. Charts of valve tag numbers with the location and function of each valve.
11. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.

B. Content, of each electric and electronic system, appropriate:

1. Description of system and component parts.

a. Function, normal operating characteristics, and limiting conditions.
b. Performance curves, engineering data and test results.
c. Complete nomenclature and commercial number of replacement parts.

2. Circuit directories of panel boards.
    a. Electrical service
    b. Controls
    c. Communications.
3. As-installed color coded wiring diagrams.
4. Operating procedures.
    a. Routine and normal operating instructions.
    b. Sequences required.
    c. Special operating instructions.
5. Maintenance procedures:
    a. Routine operations.
    b. Guide to “trouble-shooting”.
    c. Disassembly, repair, and reassembly.
    d. Adjustment and checking.
6. Manufacturer’s printed operating and maintenance instructions.

C. Prepare and include additional date when the need for such data becomes apparent during instruction of OWNER’S personnel.

1.9 INSTRUCTION OF OWNER’S PERSONNEL

A. Prior to final inspection of acceptance, instruct OWNER’S designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment, and systems installed in Project.
B. Provide services on factory-trained instructors from the manufacturer of each major item of equipment of system.
C. Operating and maintenance manual shall constitute the basis of instruction.
D. Review contents of manual(s) with personnel in full detail to explain all aspects of operations and maintenance.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

END OF SECTION 01 78 00

SECTION 01 78 50 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements governing Project Record Documents.

1.2 RELATED SECTIONS

A.	Section 01 1000:	Construction Documents
B.	Section 01 3000:	Submittals
C.	Section 01 4050:	Testing and Inspection
D.	Section 01 7000:	Contract Closeout
E.	Section 01 700:	Warranties and Guarantees
F.	Section 01 78 00:	Operating and Maintenance Manuals

1.3 SUMMARY

A. Maintain one copy of the following in the CONTRACTOR'S field office at the site.
   1. Contract Drawings, including DSA stamped set.
   2. Complete Set of Specifications and Addenda.
   3. Reviewed shop drawings.
   4. Bulletins, change orders, field change authorization, request of information, and all other modifications to Contract.
   5. Approved submittal.

B. File record documents apart from construction documents and maintain in clean, dry, legible condition. Make record documents available for review by IOR, ARCHITECT, OWNER, and OWNER'S representatives during regular business hours. The CONTRACTOR will use all means necessary to protect "Project Record Documents" set from deterioration, loss or damage until completion of work.

C. Do not use record documents for construction purpose.

D. Record documents will be subject to a monthly review by the OWNER'S representatives prior to approval of each progress payment.

1.4 PAYMENTS

A. The OWNERS representative's approval of current status of "Project record Documents" will be a prerequisite to the OWNER'S representative's approval of requests for progress payments and request for final payment
   1. Progress Approvals: Prior to submitting each request for progress payments, secure the IOR approval of status of "Project Record Documents".

B. Final Payment: Prior to submitting request for final payment and final inspection, CONTRACTOR shall submit "Project Record Documents" set to the OWNER'S Representative and/or OWNER, with transmittal letter, in duplicate, containing date, Project title and number, CONTRACTOR'S name and address, title and number of each record document.

C. CONTRACTOR shall certify that the "Project Record Documents" are complete and accurately reflect all changes or modifications to the original Construction Documents.

D. Transmittal letters with signature of CONTRACTOR or its authorized representative shall be notarized by state authorized agent.

1.5 RECORDING

A. Promptly following Contract Award, CONTRACTOR shall secure from the OWNER'S Representative or OWNER one complete set of Specifications and Contract Drawings and clearly mark them as "Project Record Documents".
B. CONTACTOR shall keep record documents current.
C. CONTACTOR shall be responsible for maintaining and recording changes on "Project Record Documents".
D. Do not use "Project Record Documents" set for any other purpose except entry of new data and for review by the OWNERS' representatives, IOR, ARCHITECT, and/or OWNER. Maintain separate job sets for subcontractors and workers daily use.
E. CONTRACTOR shall record entries and properly dimension deviations on the record drawing within 24 hours after receipt of information of work in affected area.
F. Making entries on "Project Record Documents"
    1. Use erasable colored pencils, other than blue or colors not easily seen, not ink or indelible pencil.
    2. Clearly describe change by note and by graphic line as required.
    3. Date all entries.
    4. Call attention to entry by a "cloud" around area or areas affected.
    5. In event of overlapping changes, different colors may be used for each entry.
    6. RFI submissions shall be referenced on each affected sheet, Drawing and/or Shop Drawing.

1.6 RECORD DRAWINGS

A. Maintain a clean, undamaged set of blue or black line white prints of Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which Drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Drawings. Provide detailed and accurate field dimensions for concealed elements that would be difficult to measure and record at a later date.
    1. Utility location and depth below finished grade and/or above ceilings and attic spaces shall be fully dimensioned and indicated on record drawings. Dimensions shall be measured from building lines or permanent landmarks and shall be triangulated to those features.
    2. Dimensions shall be taken to building lines or permanent landmarks.
    3. Horizontal and vertical location of underground utilities are appurtenances referenced to permanent surface improvements. Cut-off points and points of connection of utilities.
    4. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
    5. Details not on original Contract Drawing.
    6. Do not permanently conceal any work until required information has been recorded.
B. Prior to Final Completion of the Work, and review of the project record drawings by ARCHITECT, the CONTRACTOR shall prepare a final set of project record drawings using reproducible Mylar (5 mil.) and electronic CAD files on CD's of all Contract Drawing. Submit final set of transparencies and CD's to OWNER'S Representative who will then forward the project record drawings to the ARCHITECT.
    1. Incorporate on transparencies and AUTO CAD files all changes noted on record set. This requirement applies to all disciplines. Work shall be performed by experienced, competent draftsmen. AUTO CAD work shall be performed in the same protocol as the files provided. Identify documents as "**RECORD DRAWINGS".**

1.7 RECORD SPECIFICATIONS

A. Maintain two complete copies of the Specifications, including Addenda. Include with the Specifications two copies of other written Contract Documents, such as Change Orders and/or Construction Directives issued during construction.
   1. Mark these record documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
   2. Give particular attention to substitutions and selection of options and information on concealed Work that cannot otherwise be readily discerned later by direct observation.
   3. Note related record document information with Product Data.
   4. Prior to Final Completion of the Work, submit record Specifications to OWNER'S representative for ARCHITECT review, and for OWNER'S records.

1.8 RECORD PRODUCT DATA

A. Maintain two copies of each Product Data submittal. Note related Change Orders and Construction Directives and mark-up of record drawings and Specifications.
   1. Mark these documents to illustrate significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the Project site and from the manufacturer's installation instructions and recommendations.
   2. Provide detailed and accurate information regarding concealed products and portions of Work that cannot otherwise be readily discerned later by direct observation. The CONTRACTOR should give particular attention to concealed areas of Work.
   3. Prior to Final Completion of the Work, submit complete set of record Product Data to the OWNER'S Representative for the ARCHITECT'S review and for OWNER records.

1.9 RECORD SAMPLES

A. Immediately prior to Substantial Completion, CONTRACTOR shall meet with OWNER'S representative and/or OWNER, ARCHITECT at the Project site to determine which Samples are to be transmitted to OWNER for record purposes. Comply with OWNER'S representative for OWNER instructions regarding delivery to OWNER storage area.

1.10 MISCELLANEOUS RECORDS

A. Refer to other Specification sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date of Final Completion, complete and compile miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to OWNER'S representative for ARCHITECT review and for OWNER records.

1.11 SUBMITTALS

A. Deliver all "Project Record Documents" to OWNER'S representative at completion of Project as specified in Specification Sections.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

END OF SECTION 01 78 50

SECTION 05 50 00 – MISCELLANEOUS METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Completion of miscellaneous metal fabrications such as angles, plates, sheet goods, castings, railings, nosings, ladders, and stairs as indicated on the drawings and specified herein.
B. Substrates to which fabrications are to be attached or embedded.
C. Related Sections:
1. Finish painting, Section 09 9000.

1.02 REFERENCE STANDARDS (LATEST EDITION UNLESS NOTED OTHERWISE)

A. In addition to mandatory compliance with governing bodies and codes having jurisdiction over the project, provide materials complying with the following standards and industry recommendations: ASTM A36, A47, A48, A53, A108, A223, A283, A296, A307, A312, A314, F3125 Grade A325, A366, A475, A500, A525, A526, A554, A569, B108, B209, B221, SSPC, NAAMM, AND AA.
B. Materials shall conform to California Building Code (CBC), Title 24, Part 2, Chapter 22A.

1.03 SUBMITTALS

A. Submit fabrication shop drawings on items to be provided.
B. Where other than mill finishes are specified, provide samples of required finish which will be reviewed for color, texture, style, and finish.
C. Submit mill test reports and chemical analyses of materials bearing heat numbers not required to be tested, in accordance with other sections of these specifications.
D. Submit testing results in accordance with other sections of these specifications.
1. Provide one tensile, and elongation test, and one bend or flattening test for each five tons or fraction, of each shape and size, for unidentified material.
2. The Owner reserves the right to reject materials, installed or not, which exhibit defects or do not pass inspections or tests.
E. Scrap collection and recycling plan: Contractor shall prepare and submit a scrap collection and recycling plan for all miscellaneous and structural steel.

1.04 SOURCE QUALITY CONTROL

A. Inspection and Testing:
1. Testing for steel, welding and fabrication shall be in accordance with California Building Code (CBC), Title 24, Part 2, Section 1705A.2.
2. Welding inspection shall be in accordance with Title 24, Part 2, Section 1705A.2.5.
3. Shop Welding: Ensure that shop welding is performed in an approved, licensed shop. Continuous inspection shall be required as noted in DSA 103.
4. Field Welding: Stress-carrying welds are to be inspected by a qualified welding inspector. Inspections will be paid for by Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Structural steel shall comply with ASTM A6 and requirements of Title 24, Part 2, Chapter 22A.
B. Steel Plates, Shapes and Bars: ASTM A36.
C. Steel Plates to be Bent or Cold-Formed: ASTM A283, Grade C.
D. Steel Bars and Bar-Sized Shapes: ASTM A36.
E. Steel Tubing (Cold-Formed, Welded or Seamless): ASTM A500, Grade B.
F. Cold-Finished Steel Bars: ASTM A108, grade selected by fabricator.
G. Cold-Rolled Carbon Steel Sheets: ASTM A569.
H. Galvanized Carbon Steel Sheets: ASTM A526, with ASTM A525, G90 zinc coating.
I. Gray Iron Castings: ASTM A48, Class 30.
J. Malleable Iron Castings: ASTM A47, grade as selected.

K. Steel Pipe: ASTM A53, type as selected, Grade B, black finish, standard weight Schedule 40.
L. Steel Wire Rope: ASTM A475, zinc coated steel wire strand, size and number of wires required, common grade with Class B zinc coating.
M. Expanded Aluminum Grating: ASTM B209, alloy 5052.
N. Aluminum Extrusions: ASTM B221, alloy 6063-T5 except alloy 6063-T6 for pipe.
O. Aluminum Sheet or Plate: ASTM B209, alloy 6061-T6, mill finish.
P. Aluminum Castings: ASTM B108, alloy 214.
Q. Stainless Steel Castings: ASTM A296, CF8 or CF20.
R. Stainless Steel Pipe: ASTM A312.
S. Stainless Steel Tube: ASTM A554, Type 302/304.
T. Stainless Steel Bars: ASTM A314, Type 302/304.
U. Shop Primer: Tnemec 10-99, or other approved.
V. Field Galvanizing: Provide ZRC Chemical, or other approved.
W. Arc Welding Electrodes: ASTM A233 or 3-70
X. Bolts and Nuts: ASTM A307

2.02 FABRICATION

A. Verify actual field dimensions prior to fabrication.
B. Fabricate items with joints neatly fitted and properly secured.
C. Fit and shop assemble in largest practical sections for delivery to site.
D. Welding shall comply with California Building Code (CBC) Title 24, Part 2, Section 1704A.3. Employ certified welders in accordance with UBC Std. 27-6. Grind exposed welds smooth and flush with adjacent finished surfaces. Defective welds must be cut out and replaced per AWS D1.1.
E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts unobtrusively located, consistent with design of structure, except where specifically noted otherwise.
F. Make exposed joints flush butt type hair-line joints where mechanically fastened.
G. Supply components required for proper anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, unless otherwise specified or shown.
H. Thoroughly clean surfaces of rust, scale, grease and foreign matter prior to prime painting and galvanizing.
I. Galvanize miscellaneous ferrous metal fabrications exposed to view and prime paint other items. Do not shop prime surfaces in direct contact with concrete or other cementitious materials, or requiring field welding. Shop prime in two coats. Provide minimum G90 galvanized coating where galvanizing is required.

2.03 MANUFACTURED UNITS

A. Ladders: Meet or exceed State Industrial Construction Safety Orders and OSHA.
    1. Steel: As Detailed on Drawings - 2 1/2-inches by 3/8-inch side rails and braces; 3/4-inch round rungs. Galvanized after fabrication.
B. Galvanized Railings for Stairs and Ramps: Provide nominal diameter extra strong steel, galvanized 1-1/4" inch diameter with actual 1.66" inch outside diameter unless otherwise noted per American Institute of Steel Construction. (Wall handrail and guardrail mounted 1-1/2" clear from side walls.)
    1. All welded joints and surfaces shall be ground smooth, no sharp or abrasive corners, edges or surfaces. Wall surfaces adjacent to handrail shall be smooth.
    2. Handrail brackets shall mount to the bottom of the handrail. The vertical arm of the bracket shall provide a minimum 1-1/2 inches (38 mm) clearance from the top surface of the horizontal surface of the bracket that attaches to the wall.
C. Bollards: Galvanized extra heavy weight (Schedule 80) steel pipe set in a concrete foundation and filled solid with 2000 psi concrete.
D. Stair Nosing:
    1. Design is based on Spectra Safety Treads manufactured by Wooster Products, Inc., or equal. Profiles and types shall be as detailed, or as follows:
        a. Solid Concrete Stair: Type WP3C with blanked-out anchor Steel Pan Concrete Filled Stairs: Type WP3J, or, other Architect approved product for type of construction.
    2. Provide at exterior stairs not scheduled to receive other finish.
    3. Treads and Nosings: Provide 2 inch contrasting color warning stripe 1 inch maximum from edge of nosing of each exterior stair and top and bottom nosing only at interior stairs. Color shall be as selected by the Architect.
    4. Install nosings flush with top of traffic surface. Nosings shall terminate no more than 4-inches from ends of steps for poured concrete stairs and full length of steps less 1/8-inch clearance at

concrete filled steel pan stairs.

E. Trench Covers, Expansion and Seismic Joint Covers:
   1. Acceptable Manufacturers:
      a. Construction Specialties, Inc., a member of the C/S Group, Los Angeles.
      b. MM Systems Corporation, Tucker, Georgia.
      c. Balco/Metalines, Inc., Wichita, Kansas
   2. Joint Covers: Equal to C/S AFW Series extruded aluminum finished to match predominant adjacent material. Provide compatible shapes and configurations at intersecting floor, wall, and ceiling conditions where required.
   3. Trench Cover: Equal to MM Systems, Model No. TF-2812(R). Trench cover plate recessed for VCT Flooring.
   4. Install work in accordance with manufacturer's recommendations. Runs shall be in continuous lengths without butt joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Surface Conditions: Inspect surfaces and work in place by others, and verify that such work is in a condition appropriate to receive work of this section. Do not apply or install work of this section until unsatisfactory work of others is in a condition which will ensure the correct installation of materials and products of this section.

3.02 INSTALLATION

A. Obtain approval of Architect prior to site cutting or making adjustments which are not part of intended work, or are not shown on shop drawings.
B. Install items square and level, accurately fitted and free from distortion and defects.
C. Make provisions for erection stresses by temporary bracing. Keep work in alignment.
D. Replace items damaged during installation.
E. Perform field welding in accordance with AWS D1.1.
F. After installation, touch-up field welds and scratched and damaged paint, or coated surfaces. Use primer and paint consistent with shop finish.
G. Supply and assist with setting items requiring to be cast into concrete, or embedded in masonry, complete with necessary setting templates.
H. Stairs:
   1. Ensure that stair stringer supports are square or rectangular steel tubing or steel channels.
   2. Unless shown otherwise, treads are to be pan type, with galvanized coating.
   3. Where required, provide support sleeves for handrails.
   4. Provide adequate strength and stiffness to limit deflection on every stair tread and landing such that when a 300-pound person places entire weight on stair tread or landing, deflection is limited to 1/8-inch maximum at point.
   5. Prime paint surfaces of stair assembly after fabrication, and grind smooth welds as specified.
   6. Secure handrails to stair and steel supports where shown, at top or bottom with screws or welds, and achieve a lateral resistance as required by California Building Code (CBC).

3.03 CLEANING

A. Clean site after work of this section.
B. Remove weld splatters.
C. Use galvanizing repair coating specified, then re-prime areas of materials damaged during installation and other construction activities, and leave in condition for subsequent finish painting or application of additional finish materials provided by others.

END OF SECTION 05 50 00

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07 01 50.73 - REHABILITATION OF MODIFIED BITUMINOUS ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Roof rehabilitation and coating preparation for penetrations or duct supports as identified by architect.

2. Application of coating on modified bituminous membrane roofing for penetrations or duct supports as identified by architect.

1.2 MATERIALS OWNERSHIP

A. Demolished materials shall become Contractor's property and shall be removed from Project site.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 "Standard Terminology Relating to Roofing and Waterproofing" and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" for definition of terms related to roofing work in this Section.

B. Existing Roofing System: Modified bituminous roofing, and components and accessories between deck and roofing membrane.

C. Roofing Coating Preparation: Existing roofing that is to remain and be prepared to accept restorative coating application.

D. Patching: Removal of a portion of existing membrane roofing system from deck or removal of selected components and accessories from existing membrane roofing system and replacement with similar materials.

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

F. Existing to Remain: Existing items of construction that are not indicated to be removed.

G. Manufacturer: Manufacturer of roofing rehabilitation products, unless otherwise indicated.

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

I. Demolition Waste: Building and site improvement materials resulting from re-roofing preparation, demolition or selective demolition operations.

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

1.4 ROOFING CONFERENCES

A. Roofing Rehabilitation Preinstallation Conference: Conduct conference at Project site to review methods and procedures related to roofing system.

1. Meet with Owner; roofing re-coating materials manufacturer's representative; roofing re-coating Installer including project manager and foreman; and installers whose work interfaces with or affects re-coating including installers of roof accessories and roof-mounted equipment requiring removal and replacement as part of the Work.

2. Review methods and procedures related to coating preparation, including membrane roofing system manufacturer's written instructions.

3. Review temporary protection requirements for existing roofing system that is to remain, during and after installation.

4. Review temporary protection requirements for existing roofing system that is to remain, during and after installation.

5. Review roof drainage during each stage of coating and review roof drain plugging and plug removal procedures.

6. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

7. Review base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect re-coating.

8. Review HVAC shutdown and sealing of air intakes.

9. Review shutdown of fire-suppression, -protection, and -alarm and -detection systems.

10. Review existing conditions that may require notification of Owner before proceeding.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product specified.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, Manufacturer, and Roofing Inspector.

1. Letter written for this Project indicating manufacturer approval of Installer to apply specified products and provide specified warranty.

B. Manufacturer's Certificate: Provide manufacturer's UL listing certificate for roofing system.

C. Contractor's Product Certificate: Submit original signed letter on Contractor's letterhead, indicating products intended for Work of this Section, including product names and numbers and manufacturers' names, with statement indicating that products to be provided meet the requirements of the Contract Documents.

D. Product Test Reports: Upon request, submit reports based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing rehabilitation system.

E. Warranties: Unexecuted sample copies of special warranties.

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

G. Existing Conditions Photographs: Show existing conditions of adjoining construction and site improvements, including exterior finish surfaces adjacent to the Work, which might be misconstrued as having been damaged by re-coating operations. Submit before Work begins.

H. Inspection Reports: Reports of Roofing Inspector. Include weather conditions, description of work performed, tests performed, defective work observed, and corrective actions required and carried out.

1. Submit report within 48 hours after inspection.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

B. Warranties: Executed copies of approved warranty forms.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of five years' experience installing products comparable to those specified, able to communicate verbally with Contractor, Architect, and employees, and the following:

1. Installer qualified by the manufacturer to install manufacturer's products and furnish warranty of type specified.

B. Manufacturer Qualifications: Primary product manufacturer that is UL-listed for roofing system identical to that specified for this Project with minimum five years' experience in manufacture of comparable products in successful use in similar applications, and able to furnish warranty with provisions matching specified requirements.

C. Roofing Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

1. An authorized full-time technical employee of the manufacturer.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with rehabilitation work only when existing and forecasted weather conditions permit Work to proceed without water entering into existing roofing system or building.

1. Store all materials prior to application at temperatures recommended by manufacturer.

2. Apply coatings within range of ambient and substrate temperatures recommended by manufacturer.

3. Do not apply roofing in snow, rain, fog, or mist.

B. Protect building to be rehabilitated, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from rehabilitation operations.

C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

D. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

E. Owner will occupy portions of building immediately below re-coating area. Conduct re-coating so Owner's operations will not be disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.

1.10 WARRANTY

A. Installer Warranty: Installer's warranty signed by Installer, as follows.

1. Form of Warranty: Form acceptable to Roofing Manufacturer and Owner.

2. Scope of Warranty: Work of this Section.

3. Warranty Period: 2 years from date of completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: The roof system specified in this Section is based upon products of Tremco, Inc., Beachwood, OH, (800) 562-2728, www.tremcoroofing.com that are named in other Part 2 articles. Provide specified products.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Rehabilitated roofing shall withstand exposure to weather without failure or leaks due to defective manufacture or installation.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Exterior Fire-Test Exposure: Roofing system exterior fire-test exposure performance following application of rehabilitation coating shall be not be less than that of the pre-rehabilitated roof performance when tested in accordance with ASTM E 108, based upon manufacturer's tests of identical applications.

2.3 MATERIALS, GENERAL

A. General: Roof rehabilitation coating materials recommended by roofing system manufacturer for intended use and compatible with components of existing membrane roofing system.

B. Temporary Roofing Materials: Selection of materials and design of temporary roofing is responsibility of Contractor.

C. Temporary Roof Drainage: Design and selection of materials for temporary roof drainage are responsibilities of the Contractor.

D. Infill Materials: Where required to replace test cores and to patch existing roofing, use infill materials matching existing membrane roofing system materials, unless otherwise indicated.

2.4 POLYURETHANE COATINGS

A. Polyurethane Roof Coating System Base Coat: Bio-based, low-odor low-VOC two-part, for use with a compatible top coat.

1. Basis of design product: Tremco, AlphaGuard BIO Base Coat.

2. Combustion Characteristics, UL 790: Maintains combustion characteristics of existing roof system.

3. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 1 g/L.

4. Accelerated Weathering, 5000 hours, ASTM G154: Pass.

5. Hardness, Shore A, minimum, ASTM D2240: 80.

6. Solids, by volume, ASTM D2697: 100 percent.

7. Bio-Based Content, Minimum: 70 percent.

8. Minimum Thickness, Base Coat reinforced over Granular Surfaced MB: 64 mils (1.62 mm) wet.

B. Polyurethane roof coating system top coat, bio-based low-odor low-VOC two-part, for application over compatible base coat.

1. Basis of design product: Tremco, AlphaGuard BIO Top Coat.

2. Combustion Characteristics, UL790: Maintains combustion characteristics of existing roof system.

3. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 6 g/L.

4. Solar Reflectance Index (SRI), ASTM E1980: For white, not less than 103.

5. Accelerated Weathering, 5000 hours, ASTM G 154: Pass.

6. Hardness, Shore A, minimum, ASTM D2240: 81.

7. Solids, by volume, ASTM D2697: 100 percent.

8. Bio-Based Content, Minimum: 60 percent.

9. Minimum Thickness, reinforced system: 32 mils (0.81 mm) wet.

10. Color: White.

C. Primer for Non-Porous Surfaces: Single-part, water based primer to promote adhesion of urethanes to metals, PVC and other non-porous surfaces.

1. Basis of design product: Tremco, AlphaGuard M-Prime.

2. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 22 g/L.

3. Nonvolatile Content, minimum, ASTM D2369: 5 percent.

4. Density at 77 deg F (25 deg C): 8.3 lb/gal (1kg/L).

2.5 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with existing roofing system.

B. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.

C. Seam Sealer: Waterproof seam and patching material compatible with applied coating.

1. Seam Sealer: Aliphatic polyurethane sealer, single-component, moisture curing, high solids, low-VOC, formulated for compatibility and use with specified roofing substrates.

a. Basis of design product: Tremco, SOLARGARD Seam Sealer.

b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 75 g/L.

c. Tensile Strength, ASTM D412: 270 psi (1860 kPa).

d. Tear Strength, ASTM D412: 35 pli (6 kN/m).

e. Elongation, ASTM D412: 700 percent.

f. Color: White.

D. Reinforcing Fabric:

1. Polyester Reinforcing and Protection Fabric: 100 percent stitch-bonded mildew-resistant polyester fabric intended for reinforcement of compatible fluid-applied membranes and flashings and as a protection layer under pavers or stone aggregates.

a. Basis of design product: Tremco, Permafab.

b. Tensile Strength, Minimum, ASTM D1682: 50 lbf (23 kg) avg..

c. Elongation, Minimum, ASTM D1682: 60 percent.

d. Tear Strength, Minimum, ASTM D1117: 16 lbf (7.3 kg) avg..

e. Weight: 3 oz./sq. yd (102 g/sq. m).

E. Joint Sealant: Elastomeric joint sealant compatible with applied coating, with movement capability appropriate for application.

1. Joint Sealant, Polyurethane: ASTM C920, Type S, Grade NS, Class 50 single-component moisture curing sealant, formulated for compatibility and use in dynamic and static joints; paintable.

a. Basis of design product: Tremco, TremSEAL Pro.

b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 40 g/L.

c. Hardness, Shore A, ASTM C661: 40.

d. Adhesion to Concrete, ASTM C794: 35 pli.

e. Tensile Strength, ASTM D412: 350 psi (2410 kPa).

f. Color: White.

F. Fasteners: Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FM 4470; designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength; and acceptable to roofing system manufacturer.

G. Metal Flashing Sheet: Provide metal flashing sheet matching type, thickness, finish, and profile of existing metal flashing and trim.

H. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.6 WALKWAYS

A. Slip Resistant Fluid-Applied Walkways:

1. Polyurethane roof coating system top coat, bio-based low-odor low-VOC two-part, for application over compatible base coat.

a. Basis of design product: Tremco, AlphaGuard BIO Top Coat.

b. Combustion Characteristics, UL790: Maintains combustion characteristics of existing roof system.

c. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 6 g/L.

d. Solar Reflectance Index (SRI), ASTM E1980: For white, not less than 103.

e. Accelerated Weathering, 5000 hours, ASTM G 154: Pass.

f. Hardness, Shore A, minimum, ASTM D2240: 81.

g. Solids, by volume, ASTM D2697: 100 percent.

h. Bio-Based Content, Minimum: 60 percent.

i. Minimum Thickness, Slip-Resistant Coat: 24 mils (0.60 mm) wet.

j. Color: As selected from manufacturer's standard color.

B. Rubber Blocks: 100% rubber blocks with steel channels and reflective strips designed for supporting conduit. In areas where rubber blocks cannot be installed, use new redwood blocks on walkpads.

PART 3 - EXECUTION

3.1 PREPARATION

A. Pollution Control: Comply with environmental regulations of authorities having jurisdiction. Limit spread of dust and debris.

1. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

2. Remove debris from building roof by chute, hoist, or other device that will convey debris to grade

B. Shut down air intake equipment in the vicinity of the Work in coordination with the Owner. Cover air intake louvers before proceeding with re-coating work that could affect indoor air quality or activate smoke detectors in the ductwork.

1. Verify that rooftop utilities and service piping affected by the Work have been shut off before commencing Work.

C. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

1. Do not permit water to enter into or under existing membrane roofing system components that are to remain.

3.2 ROOFING COATING PREPARATION

A. Existing Flashing and Detail Preparation: Repair flashings, gravel stops, copings, and other roof-related sheet metal and trim elements. Reseal joints, replace loose or missing fasteners, and replace components where required to leave in a watertight condition.

1. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings of same metal, weight or thickness, and finish.

2. Roof Drains: Remove drain strainer and clamping ring. Grind metal surfaces down to clean, bare, metal.

B. Membrane Surface Preparation:

1. Remove loose granular aggregate from granular aggregate-surfaced built-up bituminous roofing using a power broom.

2. Remove blisters, rides, buckles, protruding fastener buttons, and other substrate irregularities from existing membrane that would inhibit application of uniform waterproof coating.

3. Broom clean existing substrate.

4. Substrate Cleaning: Clean substrate of contaminants such as dirt, debris, oil, and grease that can affect adhesion of coating by power washing at maximum 2,000 psi.

   a. Dispose of waste water in accordance with requirements of authorities having jurisdiction.

5. Verify that existing substrate is dry before proceeding with application of coating. Spot check substrates with an electrical capacitance moisture-detection meter.

C. Verify adhesion of products before proceeding with application. Primer may need to be used on existing roofing to promote adhesion. If primer promotes adhesion, proceed with primer.

D. Metal Surface Priming: Prime surfaces to receive coating using coating manufacturer's recommended product for surface material. Apply at application rate recommended by manufacturer.

1. Ensure primer does not puddle and substrate has complete coverage.

2. Allow to cure completely prior to application of coating.

E. Membrane Repair: Repair membrane at locations with irregularities using seam sealer mastic and reinforcing fabric.

F. Membrane Seam Reinforcement: Reinforce membrane seams using seam sealer mastic and reinforcing fabric overlapping onto field of existing membrane not less than width required by roof coating manufacturer.

3.3 ROOF COATING APPLICATION

A. Coating, Polyurethane Base Coat and Finish Coats: Once seam reinforcement mastic has adequately cured, coat prepared roof membrane and flashing surfaces with polyurethane base and finish coats in number of coats and thickness of application recommended in writing by manufacturer for application. Allow to cure between coats.

B. Joint Sealant: Apply joint sealant at terminations and penetrations of coatings as required to maintain weathertight application.

3.4 WALKWAY INSTALLATION

A. Install walkways following application of coating. Locate as indicated, or as directed by Owner.

B. Fluid-Applied Slip-Resistant Walkway Topcoat: Apply walkway second topcoat following application of polyurethane top coat, in accordance with manufacturer's written instructions. Locate as indicated on Drawings.

1. Protect adjacent surfaces.

2. Prime top coat if walkway top coat is not applied within 72 hours of the top coat application, using manufacturer's recommended primer.

3. Apply walkway top coat and back roll to achieve minimum wet mil thickness of 20 mils.

4. Broadcast Slip-Resistant Top Coat Aggregate in wet top coat in application amount specified in Part 2 product listing.

a. Back roll aggregate and top coat creating even dispersal of aggregate.

3.5 DISPOSAL

A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

1. Storage or sale of demolished items or materials on-site is not permitted.

B. Transport and legally dispose of demolished materials off Owner's property.

3.6 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

B. Correct deficiencies in or remove coating that does not comply with requirements, repair substrates, and reapply coating.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 070150.7

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 07 51 23– GLASS FIBER REINFORCED ASPHALT EMULSION ROOFING

@BUILDING 5A GYM BUILDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Seamless Fluid Applied Composite Roof Systems.

B. Roof Flashings.

C. Roof Accessories.

1.2 RELATED SECTIONS

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

1.3 REFERENCES

A. National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual.

B. American Society of Civil Engineers (ASCE) - ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM):
1. ASTM C 728 - Standard Specification for Perlite Thermal Insulation Board.
2. ASTM C 1153 - Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging.
3. ASTM D 570 - Standard Test Method for Water Absorption of Plastics.
4. ASTM D 1079 - Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials.
5. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Damp proofing, and Waterproofing.
6. ASTM D 1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
7. ASTM D 2523 - Standard Practice for Testing Load-Strain Properties of Roofing Membranes.
8. ASTM D 3019 - Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, and Fibered.
9. ASTM D 3909 - Standard Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules.
10. ASTM D 4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
11. ASTM D 4830 - Standard Test Methods for Characterizing Thermoplastic Fabrics Used in Roofing and Waterproofing.
12. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.
13. ASTM E 548 - Standard Guide for General Criteria Used for Evaluating Laboratory Competence.
14. ASTM E 1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

D. Underwriters Laboratories (UL):
1. TGFU - Roofing Systems and Materials Guide.
2. UL 790 - Standard Test Methods of Roof Coverings.
3. UL 2218 - Impact Resistance of Prepared Roof Covering Materials

E. CRRC - Cool Roof Rating Council.

F. California Building Standards Code - Title 24.

G. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) - Architectural Sheet Metal Manual.

1.4 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to Work in this Section.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide watertight roofing membrane and flashing system that does not permit the passage of water, resists uplift pressures specified in this section, and is capable of withstanding thermally induced movement and exposure to weather without failure.

B. Energy Performance:
   1. Low-Slope Roofs: Provide a roofing system with Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
   2. Roof membrane finish must comply with current California Title 24 Part 6 requirements:
      a. Minimum three (3) year aged solar reflectance: 0.63.
      b. Minimum Thermal Emittance: 0.75.

C. Wind Resistance: Provide roofing membrane, base flashings and component materials that comply with requirements in FMG 4450, FMG 4470, UL 580 or UL 1897 as part of a membrane roofing system.
   1. Wind Load Resistance: 45 psf (1-90).

D. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings from the applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A in accordance with ASTM E 108 for application and roof slopes indicated.

1.6 SUBMITTALS

A. Submit in accordance with Section 01 30 00 - Administrative Requirements.

B. Product Data: For each product note in this section, submit printed or digital copies of the manufacturer’s product information including the following:
   1. Printed affirmation of performance characteristics.
   2. Roofing system design.
   3. Application Instructions.
   4. Technical Data Sheets.
   5. Material Safety Data Sheets.

C. LEED Submittals:
   1. Product Data for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.
   2. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

D. Warranty Documents: Provide sample copies of the Manufacturer’s standard form outlining the terms and conditions of the warranty specified for the Work in this section.

E. Shop Drawings: Provide plan, elevation, section, and isometric drawings outlining waterproofing conditions at transitions, terminations, penetrations and attachments to adjacent work.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of the roofing system.

G. Thermographic Roof Evaluation Reports: Where existing roofs are to remain in place and be encapsulated or “re-roofed”, submit evaluation reports provided by a Certified Infrared Thermographer.

H. Research & Evaluation Reports: For components of the roofing system.
   1. Include reports from UL, ICC, FMG or another testing and inspecting agency acceptable to authorities having jurisdiction, stating entire system meets fire-test-response characteristics listed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Installer must be authorized by roofing system manufacturer to perform all Work specified in this section and provide an executed manufacturer's warranty.

B. Manufacturer Qualifications: A qualified manufacturer that has UL listing for roofing system identical to that used for this project.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

D. Moisture Analysis: Where existing roofs are to remain in place and be encapsulated or “re-roofed”, it is the responsibility of the contractor to perform a moisture analysis in accordance with ASTM C 1153 to determine suitability.

1.8 PRE-INSTALLATION CONFERENCE

A. Prior to commencement of Work, conduct a conference at project site. Comply with the requirements of Section 01 31 00 - Project Management and Coordination. Review and affirm methods and procedures related to the work specified in this section, including but not limited to the following:

1. Meet with owner, architect, owner's insurer if applicable, testing and inspecting agency representative, roofing installer, roofing system manufacturer’s representative, deck installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including the manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates, if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in original containers, with seals unbroken, and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage. For bulk-delivered materials, identify manufacturer’s name and product designation with delivery receipts and material manifests.

B. Protect roofing materials from physical damage and from deterioration due to sunlight, moisture, soiling and other sources. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

C. Store liquid materials in their original, undamaged containers in a clean, dry, and protected location, between 50 degrees F to 80 degrees F (10 degrees to 26.7 degrees C). Ensure jobsite storage is in a shaded and well-ventilated area, away from open flame or welding sparks. Indoor Storage is recommended.

D. Do not stockpile materials on roof without first obtaining acceptance from the Architect.

E. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit the roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer for optimum results. Do not install products under environmental conditions outside Manufacturer's absolute limits.

C. The minimum temperature for application of Emulsion and Acrylic Coating is 50 degrees F (10 degrees C) and rising.

D. When ambient temperatures are above 100 degrees F (37 C), membrane application should be performed in two equal passes to ensure premature skinning does not occur.

E. Product application must not be performed when rain or other ambient moisture conditions such as fog or heavy dew are possible within 72-hours of completion. Roof surface must be a minimum of 6 degrees F (3 C) above the dew point and rising.

F. Safety Data Sheets (SDS) must be on location during transportation, storage, and application of materials.

G. Schedule and phase work such that new roofing materials are not subject to construction traffic. Protect new roof sections and inspect for damage upon completion.

H. When applying materials with spray equipment, take precautions to prevent overspray and/or solvents from damaging or defacing surrounding walls, building surfaces, vehicles, or other property.

I. The surface on which the roof system is applied must be clean, smooth, dry, and free of projections or contaminants that could prevent proper application of or be incompatible with the new installation. Correct all sharp edges, foreign materials, oil, and grease.

J. Take precautions to ensure that materials do not freeze.

K. Protect completed roof sections from foot traffic for a period of at least 48 hours at 75 degrees F (24 degrees C) and 50 percent relative humidity or until fully cured.

1.11 WARRANTY

A. No Dollar Limit (NDL) Warranty: Provide Manufacturer's written and signed No Dollar Limit (NDL) warranty document, affirming coverage in the event of a leak in the roofing membrane or base flashings applied within the scope of work outlined in this section.
   1. Warranty Period: Forty (40) years from date of Substantial Completion.
   2. Coating Warranty: Twelve (12) years from date of Substantial Completion.

B. Project Warranty: Submit roofing installer's signed and executed warranty document affirming coverage of all work of this Section, including but not limited to insulation, cover board, fasteners, base sheet, roofing membrane, base flashings, and walkway products.
   1. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer(s): _____.

2.2 COMPOSITE MEMBRANE SYSTEM

A. General:
   1. Roofing system must comply with 2022 CBC, Chapter 15.
   2. Subject to compliance with requirements, provide the specified membrane configuration, applied over existing low slope roofs.

B. Basis of Design: Insulated composite roof applied over approved substrates with CA Title 24 compliant cool roof surface coating.
   1. Physical Properties:
      a. Total Weight: 2.2 pounds per square foot (1.0 kg) dry.
      b. Nominal Thickness: 350 mil Dry Film Thickness (DFT).
      c. Minimum Strength: 600 psi (4136 kN/m2) per ASTM D 2370.
      d. Minimum Elongation: 10% per ASTM D 4830.
      e. Minimum Puncture Resistance: 700 lb. (318 kg) per ASTM D 4830.
      f. Water Absorption: 1% max by weight per ASTM D 570.
      g. Fire Rating: UL Class “A” assembly.
   2. Thermal Protection:
      a. Insulation: Rigid polyisocyanurate insulation. Attachment method in accordance with requirements for each deck type. Thickness and thermal resistance as specified in this section.
      b. Cover Board: Gypsum roof board adhered to insulation with low rise foam. Thickness as specified in this section.
   3. System Configuration:
      a. Base Sheet: Self-adhering base sheet fully adhered to coverboard and backrolled.
      b. Fiberglass Roving: 16 lbs. per 100 square feet.
      c. Asphalt Emulsion: 30 gallons per 100 square feet.
      d. Acrylic Base Coating: 1.5 Gallons per 100 square feet.
      e. CA Title 24 Cool Roof Reflective Coating: 1.5 Gallons per 100 square feet.

2.3 THERMAL PROTECTION

A. Insulation: Rigid polyisocyanurate board, with a fibrous glass facer meeting or exceeding the requirements of ASTM C 1289.
   1. Thickness / Thermal Resistance: As required to meet CA Title 24 requirements.
   2. Tapered Slope: As required to ensure positive drainage throughout the roof surface.

B. Substrate Board: Underlayment board with a water-resistant gypsum core and glass fiber facers embedded on both sides. Pre-primed on one side.
   1. Board Thickness: 1/2 inch (13 mm).

2.4 COMPOSITE MEMBRANE MATERIALS

A. Asphalt Emulsion: Asphalt Emulsion meeting or exceeding the requirements of ASTM D 1227;.
   1. VOC Content (Maximum): 0 g/l.
   2. Wet Weight: 8.7 Lbs./Gal. (1041 g/l).
   3. Dry Weight: 4.35 Lbs./Gal. (521 g/l).
   4. Solids Content by Volume: 49-53%.

B. Fiberglass Reinforcement (Type E): Multi-end continuous fiberglass roving designed for spray operations;.
   1. Yield: 207 yd/lb.
   2. Tex: 2400 g/km.
   3. Spool Weight: 41.9 LB (19kg).

C. Cool Roof Reflective Acrylic Coating:
   1. Basecoat: Elastomeric base coating as supplied by the manufacturer of the membrane system.
      a. Solids Content by Volume: 50%.
      b. VOC Content (maximum): <50 g/l.

c. Weight: 10.4 lbs./Gal. (1246 g/l).
d. Color: Grey.

2. Topcoat: CA Title 24 Cool Roof Reflective Coating as supplied by the manufacturer of the membrane system.
   a. Solids Content by Volume: 50%.
   b. VOC Content (maximum): <50 g/l.
   c. Weight: 10.4 lbs./Gal. (1246 g/l).
   d. Color: White.
   e. Solar Reflectance:
      1) Initial: 0.83.
      2) 3 Year Aging: 0.72.
   f. Thermal Emittance:
      1) Initial: 0.86.
      2) 3 Year Aging: 0.88.
   g. Solar Reflectance Index (SRI):
      1) Initial: 104.
      2) 3 Year Aging: 88.

D. Aluminum Coating: Asphalt / solvent-based coating blended with aluminum pigment.
   1. Solids Content by Volume: 37%.
   2. VOC Content (maximum): 50 g/l.
   3. Weight: 9.1 - 9.5 lbs. per Gal. (1090 – 1140 g/l).
   4. Solar Reflectance:
      a. Initial: 0.51.
      b. 3 Year Aging: 0.50.
   5. Thermal Emittance:
      a. Initial: 0.55.
      b. 3 Year Aging: 0.53.
   6. Solar Reflectance Index (SRI)
      a. Initial: 47.
      b. 3 Year Aging: 44.

2.5 SHEET MATERIALS

A. Self-Adhering Base Sheet: Sanded/ granule surfaced, self-adhering base sheet, meeting or exceeding the requirements of ASTM D 1970.

B. Detailing Membrane: with adhesive backing.
   1. Elongation: 85%.
   2. Thickness: 75 mils.
   3. Weight: 3 oz/ sq. yd.
   4. Roll Width: 6 inch and 12 inch.

2.6 ADHESIVES AND SEALANTS

A. Insulation Adhesive: Two-component, low-rise polyurethane foam adhesive designed to secure insulation to roof decks.

B. Flashing Cement: Trowel grade SBS-modified flashing cement made from heavy-bodied asphalt reinforced with organic fibers.
   1. VOC Content (Maximum): 290 g/l.
   2. Weight per Gallon: 8.25 – 9.25 Lbs (988 – 1107 g/l).

C. Asphalt Primer: Asphalt based surface primer suitable for application on metal, masonry and concrete surfaces. Meets or exceeds the requirements of ASTM D 41.

D. Polyurethane Sealant: Moisture-cured, single-component, polyurethane-based, non-sag elastomeric sealant. Meets ASTM C 920, Type S, Grade NS, Class 35.

2.7 SHEET METAL, FLASHING AND TRIM

A. Metal Flashing Sheet: 24 ga. galvanized sheet metal flashing.

B. Pre-Formed Edge Flashing: 24 ga. galvanized sheet metal flashing with a 1/2 inch (13mm) vertical “gravel stop” lip and. minimum 4 inch (102mm) roof mounting flange.

C. Flashing Collar: Pre-formed 24 Ga. galvanized sheet metal boot and collar for sealing single or multiple pipe penetrations.

D. Plumbing Stacks: 24 Ga. galvanized sheet metal flashing, or 4 lb (1.8kg) sheet lead formed, rolled and soldered.

E. One-Way Breather Vents: Heavy gauge spun aluminum vents which allow moisture and air to escape but not enter the roofing system.

F. Pitch Pans: 24 gauge galvanized sheet or 20oz (567gram) copper.

G. Drain Flashings: 24 gauge galvanized sheet, 20oz (567gram) copper, or 4 lb (1.8kg) sheet lead, formed and rolled,

H. Fabricated Flashings:
   1. Fabricated flashings and trim may be specified in Section 07 62 00.
   2. Fabricated flashings and trim must conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the NRCA "Roofing and Waterproofing Manual" as applicable.

I. Manufactured Roof Specialties:
   1. Manufactured copings, fascia, gravel stops, control joints, expansion joints, joint covers and related flashings and trim may be specified in Section 07 71 00.
   2. Manufactured roof specialties must conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the NRCA "Roofing and Waterproofing Manual" as applicable.

2.8 WALKWAYS

A. Foot Traffic Walkway Coating:
   1. Acrylic Coating: Fluid applied, single-component, 100% Acrylic, waterproof walking surface with ceramic granules designed to enhance the traffic resistance of the roof surface.
      a. Coating Properties:
         1) Tensile Strength: 350 psi when tested in accordance with ASTM D 412.
         2) Elongation: 174% when tested in accordance with ASTM D 412.
         3) Solids Content: 95% when tested in accordance with ASTM D 2369.
         4) VOC: <50 g/l.
         5) Flash Point: 141 degrees F min. (60.6 degrees C) when tested in accordance with ASTM D 93.
         6) Color: Safety Yellow.
      b. Granule Properties:
         1) Specific Gravity 2.65 when tested in accordance with ASTM C 128,
         2) Bulk Density: 90-100 lbs./Cu. Ft. when tested in accordance with ASTM C 29.
         3) Color: Yellow.

2.9 ACCESSORIES

A. General: Roofing accessories recommended by manufacturer for intended use and compatible with membrane roofing.

B. Fasteners:
   1. Screws and Plates: Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate and acceptable to roofing system manufacturer.
   2. Cap Head Nails: Galvanized steel nails with a ring or deformed shank and a minimum 1 in. cap head for fastening base sheets to wood decks.
   3. Base Sheet Fasteners: Pre-assembled G-90 galvanized fastener with 1 in by 1 1/4 in head and 2.75 in diameter galvalume plate. For use attaching anchoring base sheets directly to lightweight concrete and poured gypsum decks.

C. Cant Strips: 4” angled wood fiber strips meeting the requirements of ASTM C 728.

D. Tapered Edge Strips: Tapered wood fiber strips meeting the requirements of ASTM C 728.

E. Wood Nailers: Comply with requirements in Division 06 Section “Miscellaneous Carpentry."

F. Anti-Skid Granules: Granules specifically designed for anti-skid purposes and compatible with all coatings specified in this section.
   1. Specific Gravity 2.65 when tested in accordance with ASTM C 128,
   2. Bulk Density: 90-100 lbs./Cu. Ft. when tested in accordance with ASTM C 29.
   3. Color: As selected by Owner.

PART 3 EXECUTION

3.1 EXAMINATION

A. Compatibility, verify all materials including existing roof are compatible.
   1. Verify existing roof systems to be recovered are NOT coated with silicone style coatings.
   2. Verify existing roof systems to be recovered are NOT PVC single ply membrane.
   3. Verify the following for installations over lightweight insulating concrete (LWIC):
      a. Decks must be a minimum of 2 inches (51 mm) thick with a compressive strength of no less than 125 psi (0.86 MPa) and a density of 22 pcf (352 kg/sm).
      b. Slopes must not exceed 1 inch per foot (83 mm/m).

c. Membrane and insulation may not be applied directly to lightweight concrete. Mechanically attach an approved specified base sheet prior to application of subsequent insulation or membrane.

B. Examine substrates, work areas and field conditions for compliance with the following requirements and other conditions which may affect the performance of the roofing system. Verify the following conditions:
1. Surfaces are clean, rigid, dry, smooth, and free from cracks, holes, blisters, debris and sharp changes in elevation greater than 1/4 inch (6mm).
2. The deck is free of depressions, waves or projections and properly sloped to drains, valleys, eaves, scuppers, or gutters.
3. Roof openings and penetrations are adequately installed, and that roof drains are securely clamped in place.
4. Cant strips, blocking, curbs and nailers are securely anchored and installed in accordance with manufacturers requirements.
5. Drains and scuppers are free of ruptures and sealed on all four sides on the exterior face of walls.
6. Surface plane flatness and fastening of roof deck complies with manufacturers requirements.
7. Concrete curing compounds and any chemicals that may impair adhesion of roofing components have been removed.
8. Existing roof assemblies are dry, confirmed by conducting infrared thermal scans.
9. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method in accordance with ASTM D 4263.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. If substrate preparation is the responsibility of another installer, notify Owner or Architect of unsatisfactory conditions before proceeding.

3.2 PREPARATION

A. Do not begin installation until all substrates have been properly prepared.

B. Prior to application, clean waterproof application surfaces with water. Where wash water must be reclaimed due to contamination concentrations, roof water collection design of the building or local ordinances. Conform to local requirements for disposal of wash water.

C. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation in accordance with the roofing system manufacturer's written instructions.

D. Remove or correct all sharp projections which may interfere with the integrity of the membrane.

E. Provide traffic paths, and erect barriers, fences, guards, rails, enclosures, chutes, and other measures to protect personnel, roofs and structures, vehicles and utilities.

F. Protect roof drains and edges during construction to prevent materials from entering roof drains and conductors or migrating onto surfaces of adjacent construction. Remove roof drain plugs when no work is taking place or when rain is forecast.

G. Protect adjacent materials and lower paving, prior to starting work, in accordance with roofing system Manufacturer’s instructions.

3.3 ROOF DECK PREPARATION

A. Metal Roof Deck:
1. Metal roof decks must be a minimum 22 gauge (0.8 mm) with a G-90 galvanized finish.
2. Prior to installation, remove any surface corrosion, oxidization, or rust. Repair or replace any panels with substantial corrosion. Fasten all loose or poorly secured decking.
3. Ensure that all panels achieve the required fastener pull-out resistance.
4. Comply with local building codes where requirements exceed those listed here.

3.4 INSULATION INSTALLATION

A. General Requirements:
1. Comply with roofing, system and insulation manufacturers’ written instructions and applicable recommendations of NRCA for installing roof insulation.
2. Attach insulation in accordance with the requirements of local codes as necessary to achieve the required uplift pressure resistance within the field, perimeter, and corner zones of each roof section.
3. Install one or more layers of insulation and/or cover board to achieve specified thickness and thermal resistance. Where overall insulation thickness exceeds 2 inches (51mm), install two or more layers, staggering joints of each succeeding layer a minimum of 6 inches (152mm) in each direction.
4. Install insulation with long edges in a continuous straight line, staggering end joints between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6mm) with insulation.
5. Cut and fit insulation within 1/4 inch (6mm) of nailers, projections, and penetrations.

6. Where necessary, install tapered insulation under areas of roofing to conform to slopes indicated.
7. Taper insulation at roof drains so completed surface is flush and does not restrict the flow of water.
8. Where areas of ponding water are present, tapered insulation crickets must be installed to improve drainage.
9. Install and secure preformed 45 degree cant strips at transitions between roofing membrane system and vertical surfaces or angle changes greater than 45 degrees.

B. Attachment – Base Layer Fastened:
1. Secure the base layer of insulation to substrates using the appropriate size and type mechanical fastener for attaching the specified roof insulation to the substrate type.
2. Install fasteners at a density of 1 every 2 square feet.
3. Install subsequent layers with specified insulation adhesive.

C. Attachment - Simultaneously Fastened:
1. Secure all layers of insulation to approved decks using the appropriate size and type mechanical fastener for attaching roof insulation to the deck type.
2. Butt insulation joints together tightly and pin each layer to ensure movement does not occur prior to simultaneous fastening of the top layer of insulation.
3. Install fasteners at a density of 1 every 2 square feet.

D. Attachment - Adhered: apply
1. At areas where structural concrete decks are present, adhere each layer of insulation to the pre-primed substrate with adhesive approved for use by the insulation manufacturer for substrates found on this project.
2. Apply adhesive in ribbons, spaced 6 inches (152mm) apart, in accordance with the adhesive manufacturer’s recommendations. Immediately bond cover board to insulation.

3.5 SUBSTRATE BOARD INSTALLATION

A. Placement: Loosely abut and install cover boards with long joints in continuous and straight lines, with end joints staggered between rows.
1. Install with a nominal 1/4 inch (6mm) gap at vertical surfaces and a 1/8 inch (3mm) gap at board edges.
2. Offset joints 6 inches (152mm) in each direction from joints of insulation below.
3. Apply adhesive in ribbons, spaced 6 inches (152mm) apart, in accordance with the adhesive manufacturer’s recommendations. Immediately bond cover board to insulation.

3.6 BASE SHEET INSTALLATION

A. Self-Adhering Base Sheet:
1. Apply base over specified coverboard, parallel the lower edge of the roof with granule side up. Allow for minimum 3 inch (75mm) head laps and minimum 6 inch (152mm) side laps.
2. Prior to placement, align sheet at the lower edge of the roof and cut sheet to length.
3. Positioned above the sheet on the roof deck, remove top half of release film from the sheet and apply firm even pressure from the center to the outer edges. Remove the release film from the remaining half of the sheet applying firm even pressure.
4. Using a 70 lb. roller, backroll entire membrane surface, end laps and side laps to ensure bonding of adhesive.
5. When applied at lower temperatures, adhesion to deck and at laps will occur as ambient temperature increases and after a return to warmer weather.

3.7 ROOF MEMBRANE INSTALLATION - GENERAL

A. Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations of ARMA and NRCA.

B. Commence installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Cooperate with testing and inspecting agencies engaged or required to perform services during roofing system installation.

D. Coordinate installation to ensure that materials that will not be permanently exposed are protected from moisture and covered at the end of each workday.
1. Provide tie-offs at the end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Substrate Joint Penetrations: Where exceeding 1/4 inch in width (6mm), tape joints with detailing membrane to inhibit roofing materials from penetrating substrate, entering building, or damaging roofing system components or adjacent building construction.

3.8 FLASHING INSTALLATION

A. General:
1. Refer to the manufacturer’s application manual for flashing specific details.
2. All flashings must have a minimum of 536 mil of fiberglass composite upon completion of the installation.
3. Fabricated flashings and trim must conform to the requirements found in the current SMACNA "Architectural Sheet Metal Manual".
4. Manufactured Roof Specialties: Manufactured copings, fascia, control joints, and related flashings and trim must conform to the requirements found in the SMACNA "Architectural Sheet Metal Manual" and/or the National Roofing Contractors Association "Roofing and Waterproofing Manual".

B. Surface Preparation:
1. All wood surfaces must have a base sheet installed prior to flashing application. Fasten base sheet following the same method and pattern as the field application.
2. All metal, concrete and masonry surfaces must be primed with ASTM D 41 primer prior to flashing application.
3. Any joint in the structure intended to allow for movement must be divorced from the seamless reinforcement composite.
   a. Install an 18 inch (457mm) wide slip sheet consisting of inverted (mineral-side down) cap sheet, laid dry over the joint and extending 36 inches (914mm) at each end.
   b. Over the slip sheet, solidly adhere a 36 inch (914mm) polyester ply in 4 gallons per 100 square feet (1.63 L/m2) of emulsion and reinforce with 536 mil of seamless composite.
4. Cant Strips: Minimum 3 inch (76mm) cant strips must be installed at base flashings, walls, and curbs. Miter cants at ends to provide a smooth transition and set in adhesive.

C. Perimeter Conditions
1. Metal Drip Edges:
   a. Inspect nailers for proper attachment and configuration.
   b. Install the specified base sheet, extending and turning 1 inch (51mm) down the edge.
   c. Install continuous cleat and fasten at 6 inches (152 mm) on center.
   d. In recover applications where base sheet is not specified, adhere a continuous strip of self-adhering membrane to the eaves, 1 inch (25mm) down the vertical face and extending 5 inches (126 mm) onto the roof surface.
   e. Attach new metal edge to cleat, with 3/8” head roofing nails located less than 1 inch (25mm) from the interior edge of the flange, spaced every 3 inches (76 mm) on center.
   f. Apply primer to metal edges at a rate of 100 square feet per gallon and allow to dry.
   g. Adhere a continuous strip of self-adhering membrane to the metal flange 2 inches (51mm) from the interior edge, extending 4 inches (102mm) onto the roof surface.
   h. Coordinate placement to ensure membrane laps do not coincide with metal laps.
   i. Reinforce with 500 mil of seamless composite. Extend the field application of composite to the outside edge of the metal flashing.
   j. Apply composite flush with the edge to ensure that water does not pond.
2. Coping Caps:
   a. Attach tapered nailer to top of wall with a minimum slope of 1/4 per foot.
   b. Cover nailer and all exposed wood with detailing membrane, extending 2 inches (50mm) over edges.
   c. Reinforce with 500 mil of seamless composite. Extend field application of composite to the outside edge of wall.
   d. Install continuous cleat and fasten at 6 inches (152 mm) on center to outside wall.
   e. Install new metal coping cap hooked to continuous cleat.
   f. Overlap joints a minimum of 4 inches (101 mm) and install in a 1/4 inch (6 mm) bed of polyurethane sealant.
   g. Install 6 inch (152mm) strips of self-adhering membrane, extending 3 inches (76mm) onto each side of joint. Extend down front and back face of coping.
   h. Fasten interior vertical face of coping cap 24 inches (609 mm) on center with approved fasteners and neoprene washers.
3. Surface Mounted Counterflashings:
   a. Set counterflashing in adhesive and fasten at 8 inches (203 mm) on center with approved fasteners and neoprene washers.
   b. Install sealant at top of counterflashing.
4. Recessed Counterflashings:
   a. Cut a receiver groove into concrete masonry unit wall located at the first horizontal grout joint above base flashing termination.
   b. Secure recessed “Reglet” type counterflashing with expansion fasteners.
   c. Install sealant at top of counterflashing.
5. Skirted Counterflashings:
   a. Skirted counterflashings must be approved by the Manufacturer prior to application.
   b. Where existing counterflashing does not adequately cover finished base flashings, a “skirt flashing” may be installed.
   c. Flashing must extend at least 1 1/2 inches (39mm) behind existing counterflashing and project no greater than 3 inches (76mm) past the bottom edge. Vertical seams must overlap a minimum of 6 inches (152mm).

d. All metal edges which may come in contact the base flashing must be hemmed to protect the installed membrane.
e. Mechanically fasten skirt flashing to existing counterflashing using self-tapping screws with neoprene washers.

D. Penetrations
1. Pipe Penetrations:
a. Embed the prepared and primed galvanized pipe boot in a bed of asphalt roof cement, centering it over the pipe. Fasten at corners where insulation is not present.
b. Adhere a continuous strip of self-adhering membrane to the metal flange 2 inches (51mm) from the edge, extending 4 inches (102mm) onto the roof surface.
c. Reinforce with 500 mil of seamless composite, extending to the top of the pipe boot.
d. Apply sealant at gap between roof membrane and pipe.
e. Install storm collar approximately one inch (25mm) above the top of the flashing and secure with a draw band and approved sealant.
f. Where lead pipe flashings are specified, omit the storm collar and sealant, turning the metal downward and into the top of the pipe by at least 2 inches (51mm). Solder all joints
2. Pitch Pockets:
a. Place the pitch pocket over the penetration and prime all flanges.
b. Apply strips of self-adhering membrane around all sides of pitch pocket, extending 6 inches (152 mm) onto the field of the roof.
c. Fill pitch pocket halfway with non-shrink grout.
d. Encapsulate entire pitch pocket with 500 mil of seamless composite.
e. Apply caulk joint between roof system and pitch pocket with roof cement.
f. Place a water shedding bonnet over the top of the pitch pocket, clamp the top with a drawband, and apply sealant.
3. One-Way Relief Vents:
a. On recover applications or where lightweight concrete roof decks are present, locate one-way aluminum moisture vents every 1000 sq ft.
b. Remove existing roof to expose the uppermost substrate and allow a clean work area at least 6 inches from the edge of the flange.
c. Core a 3 inch (76mm) hole through roof layers and insulation. Do not puncture any vapor barriers which may be present.
d. Prime the flange and embed the vent in a bed of asphalt roof cement, centering it over the opening.
e. Adhere a continuous strip of self-adhering membrane to the metal flange 2 inches (51mm) from the edge, extending 4 inches (102mm) onto the roof surface.
f. Apply 500 mils of seamless composite to aluminum flange extending to the base of the vent, turning upward by at least 2 inches (51mm).
4. Heat Stacks:
a. Apply roof system over the entire surface of the roof, sealing the base of the stack with sealant approved for use with high temperatures.
b. Prime flange of new sleeve. Install properly sized sleeves set in 1/4 inch (6 mm) bed of roof cement.
c. Adhere a continuous strip of self-adhering membrane to the metal flange 2 inches (51mm) from the edge, extending 4 inches (102mm) onto the roof surface.
d. Reinforce with 500 mil of seamless composite.
e. Install new storm collar. Weld or install stainless steel draw brand and caulk.

E. Roof Drainage:
1. Roof Drains:
a. Prior to commencing flashing work, plug drains to prevent debris from entering plumbing.
b. Thoroughly clean all drains to receive roof membrane; prime with ASTM D 41 primer.
c. Taper insulation towards drains to create a sump 24 inches (609 mm) from center of drain.
d. Form 12 inch (305mm) detailing membrane into the drain bowl, extending from 3 inches (76mm) into the bowl, extending outward onto the prepared work surface.
e. Set primed metal flashings (30 inch square minimum) in 1/4 inch bed of roof cement. Extend flashing into drain a minimum of 2 inches (50 mm).
f. Reinforce with 500 mil of seamless composite extending down walls of drain bowl and allow to cure.
g. Install clamping ring, remove drain plug and attach strainer.
2. Scuppers:
a. Inspect nailers for proper attachment and configuration.
b. Apply detailing membrane 1 inch (25mm) over the edge and assure coverage of all wood nailers.
c. Install pre-formed and primed scupper in a 1/4 inch (6mm) bed of roof cement. All seams and corners must be soldered, and scupper must have a minimum 4 inch (101 mm) flange.
d. Fasten scupper flange to nailers every 3 inches (76mm) on center.
e. Adhere a continuous strip of detailing membrane to the metal flange approximately 2 inches (51mm) from the edge and 4 inches (152mm) onto the existing roof surface.

f. Coordinate placement to ensure membrane laps do not coincide with metal laps.
g. Reinforce with 500 mil of seamless composite. Extend the field application of composite to the outside edge of the metal flashing.
h. Apply composite flush with the edge to ensure that water does not pond.
i. scupper edge must be turned downward a minimum of 1 inch (25mm) at outside edge of wall and sealed.

F. Raised Curbs:
1. Mechanical Equipment Curbs:
a. Install base sheet over all wood surfaces and prime all metal, concrete or masonry surfaces.
b. Reinforce with 500 mil of seamless composite. Extend field application of composite to the top of the curb.
c. Install rooftop mechanical unit in accordance with its Manufacturers' recommendations.
d. Where equipment is not self-flashing, install pre-manufactured counterflashing with fasteners and neoprene washers 6 inches (152mm) on center, embedded in a bead of sealant.
2. Skylights, Smoke Vents and Roof Hatches:
a. Install base sheet over all wood surfaces and prime all metal, concrete or masonry surfaces.
b. Reinforce with 500 mil of seamless composite. Extend field application of composite to the top of the curb.
c. Install pre-manufactured unit in accordance with its Manufacturers' recommendations.
d. Where required by local code, install OSHA compliant, compression mounted skylight protection screens per skylight manufacturers' written instructions.

G. Rooftop Equipment and Accessories:
1. Pipe and Equipment Supports: Install supports in accordance with Manufacturers' guidelines. Traffic pads must be installed under pipe supports and fasteners must not penetrate the roofing membrane.
a. All pipes 2 inches (51mm) in diameter or less may be supported with polymer pipe supports spaced no greater than 8 feet (2438mm) on center.
b. All pipes over 2 inches (51mm) in diameter must be supported with movable pipe hangers or other support system approved by the roofing system Manufacturer.

H. Roof Transitions and Area Dividers
1. Steep-Sloped Roof Transitions: Remove roofing material a minimum of 24 inches (610mm) onto adjacent steep-slope roofs which drain onto the roof in this section.
a. Install self-adhering base sheet, extending 12 inches (304mm) onto low slope roof and 24 inches (609mm) onto steep slope roof.
b. Reinforce with 500 mil of seamless composite.
c. Install steep slope roofing material beginning no less than 12 inches (305mm) from the center of the roof join, in accordance with Roofing Manufacturer's recommendations and requirements.
d. Solidly adhere with adhesive approved by the steep slope roofing manufacturer the first two courses of steep slope roofing material, ensuring that fasteners do not penetrate within 18 inches (458mm) of the roof join.
2. Area Dividers:
a. Install base sheet over all wood surfaces and prime all metal, concrete or masonry surfaces.
b. Reinforce with 500 mil of seamless composite. Extend application of composite to the top of area divider curbs.
c. Install fabricated metal cover. Fasten sides at 12 inches (609 mm) on center with fasteners and neoprene washers. Furnish all joint cover laps with sealant between metal covers.
3. Expansion Joints:
a. Install base sheet over all wood surfaces and prime all metal, concrete or masonry surfaces.
b. Reinforce with 500 mil of seamless composite. Extend application of composite to the top of the support curb.
c. Install pre-manufactured expansion joint cover in accordance with Manufacturer's recommendations.
d. Fasten sides as noted by expansion joint manufacturer with fasteners and neoprene washers. Furnish all joint cover laps with sealant between metal covers.
e. Set equipment on neoprene pads and fasten as required by equipment manufacturer.

3.9 FIELD MEMBRANE INSTALLATION

A. Apply one layer of the composite roofing at the following ratio:
1. Asphalt Emulsion (undiluted): 30 gal. per 100 square feet (12.2 l/m2).
2. Fiberglass Reinforcement: 16 lb. per 100 square feet (0.78 Kg/m2).

B. In accordance with the roofing system manufacturer's flashing details, apply seamless composite to the entire roof surface, terminating at the following locations:
1. Tops of base flashings and curbs
2. Outside edges of perimeter metal flashings.
3. Outside edges of walls.
4. Insides of drain bowls.

C. No water or other material may be added to the emulsion to thin or extend pot life.

D. Fiberglass must be disbursed from the applicator in varying intertwined lengths, up to 24 inches (610mm).

E. Thoroughly mix fiberglass and emulsion prior to application on prepared roof substrates.

F. Any loose strands must be brushed by hand, removed or filled-in with emulsion to create a solid surface.

G. Upon completion, no area may be less than 250 mil dry film thickness (DFT).

H. Areas such as base flashings and penetrations, where application exceeds 500 mils wet, must be brushed by hand to prevent surface crazing.

I. Where required due to project phasing or when ambient temperatures exceed 100 degrees F (37C), apply seamless composite membrane in two passes of half the recommended wet mil thickness.

3.10 REFLECTIVE COATING INSTALLATION

A. Prior to reflective coating application, wash the roof surface with water. Do not commence application until the system has thoroughly dried, as registered by a reading of zero with a calibrated moisture meter.

B. Where Title 24 compliant roof coatings are specified, apply both base coat and top coat to the entire roof surface, each at a minimum of 1 1/2 gal. per 100 square feet (0.6 L/m2) to total 3 gallons per 100 square feet. (1.2 L/m2). Allow the base coat to dry before proceeding, and backroll to ensure even coverage throughout.

C. Apply specified aluminum roof coating to the entire roof surface at a minimum of 2 gal. per 100 square feet (0.8 L/m2). Backroll to ensure even coverage throughout.

3.11 WALKWAY APPLICATION

A. Embedded Granule Traffic Surfacing:
   1. Where specified in the Owner or Architect's RFP, granules may be broadcast into the membrane to provide a slip resistant foot traffic surfacing.
   2. Immediately following the application of the field, mineral granules may be broadcast into the wet acrylic membrane in areas where traffic is likely to occur. Backroll granules with a suitable roller immediately.
   3. Apply granules at a rate of 20 Lbs. (9 kg) per 100 square feet.

3.12 FINAL ROOF INSPECTION

A. At completion of roofing installation and associated Work, schedule a conference to include the Architect, Contractor, roof membrane installer, installers of associated work, roofing system Manufacturers' representative and others directly concerned with performance of roofing system.

B. Perform a site walk of roof surface, inspecting perimeter edges and flashings. Identify all items requiring correction or completion and furnish copy of list to each party in attendance.

C. Should roof core testing verify the presence of damp or wet materials, it is the responsibility of the installer to replace the damaged areas at their expense.

D. The repair or replacement of defective work found during inspection is required to produce an installation that is free of damage and deterioration at time of Substantial Completion and is required to execute the Manufacturer's warranty.

E. Notify Architect upon completion of corrections.

F. Upon a successful final inspection and fulfillment of administrative terms, the contractor will provide an executed copy of the Manufacturer's warranty and written acceptance of the installation.

3.13 PROTECTION

A. Prior to allowing any traffic on a newly installed roof membrane, authorization in writing must be obtained from the roof system Manufacturer.

B. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roof for deterioration and damage. Where any defects or damage are identified describe their nature and extent in a written report, with copies to architect and owner.

C. Protect exposed surfaces of finished walls with tarps to prevent damage.

D. Plywood required for material movement and traffic over existing roofs must be a nominal 5/8 inch (16 mm) thick or greater.

3.14 CLEANING

A. Clean-up and remove daily from the site all wrappings, empty containers, paper, loose particles, and other debris resulting from these operations.

B. Remove coating markings from finished surfaces.

C. Repair or replace defaced or disfigured finishes caused by Work of this section.

D. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07 54 16 - KETONE ETHYLENE ESTER (KEE) ROOFING

@BUILDING 2A ADMIN/LIBRARY BLDG

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. New curb flashings associated with HVAC installations.

1.2 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 "Standard Terminology Relating to Roofing and Waterproofing" and applicable edition of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" and NRCA's Glossary for definition of terms related to roofing work in this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review drawings and specifications.

3. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

5. Examine substrate conditions and finishes for compliance with requirements, including flatness and fastening.

6. Review structural loading limitations of roof deck during and after roofing.

7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

8. Review temporary protection requirements for roofing system during and after installation.

9. Review roof observation and repair procedures after roofing installation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, Manufacturer and Roofing Inspector.

1. Include letter from Manufacturer written for this Project indicating approval of Installer.

B. Manufacturer Certificates:

1. Submit evidence of compliance with specified requirements in "Performance Requirements" Article.

2. Product Compatibility: Indicate manufacturer has verified compatibility of roofing system components, including but not limited to: Roofing membrane, flashing sheets, adhesives, and sealants.

C. Warranties: Unexecuted sample copies of special warranties.

D. Inspection Reports: Reports of Roofing Inspector. Include weather conditions, description of work performed, tests performed, defective work observed, and corrective actions taken to correct defective work.

1. Submit reports within 48 hours after inspection.

1.5 CLOSEOUT SUBMITTALS

A. Executed copies of warranties.

B. Maintenance Data: To include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of five years' experience installing products comparable to those specified, able to communicate verbally with Contractor, and employees, and qualified by the manufacturer to install manufacturer's product and furnish warranty of type specified.

B. Manufacturer Qualifications: Approved manufacturer with roofing systems comparable to that specified for this Project, with minimum five years' experience in manufacture of thermoplastic roof membrane products in successful use in similar applications.

C. Roofing Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:

1. An authorized full-time technical employee of the manufacturer.

2. An independent party certified as a Registered Roof Observer by the International Institute of Building Enclosure Consultants (formerly the Roof Consultants Institute) retained by the Contractor or the Manufacturer and approved by the Manufacturer.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site access to manufacturer's written recommendations and instructions for installation of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT / FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing and insulation with a course of roofing sheet securely in place with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.

3. Remove temporary plugs from roof drains at end of each day.

4. Remove and discard temporary seals before beginning work on adjoining roofing.

1.9 WARRANTY

A. Installer Warranty: Installer's warranty signed by Installer, as follows.

1. Form of Warranty: Form acceptable to Roofing Manufacturer and Owner.

2. Scope of Warranty: Work of this Section.

3. Warranty Period: 2 years from date of completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: The roof system specified in this Section is based upon products of Tremco CPG Inc, Beachwood, OH, (800) 562-2728, www.tremcoroofing.com that are named in other Part 2 articles. Provide specified products.

B. Source Limitations: Obtain components for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 10,000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency in accordance with ANSI/FM 4474, UL 580, or UL 1897, and to resist uplift pressures calculated in accordance with ASCE-7 and applicable code.

C. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to ANSI/SPRI ES-1.

D. Flashings and Fastening: Provide base flashings, perimeter flashings, detail flashings and component materials and installation techniques that comply with requirements and recommendations of the following:

1. FM Global 1-49: Loss Prevention Data Sheet for Perimeter Flashings.

2. FM Global 1-29: Loss Prevention Data Sheet for Above Deck Roof Components.

3. NRCA Roofing Manual (Sixth Edition) for construction details and recommendations.

4. SMACNA Architectural Sheet Metal Manual (Seventh Edition) for construction details.

E. Exterior Fire-Test Exposure: ASTM E108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

F. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E1980, based on testing identical products by a qualified testing agency.

G. Energy Performance: Roofing system shall have an initial solar reflectance index of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

2.3 MATERIALS, GENERAL

A. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

2.4 THERMOPLASTIC MEMBRANE MATERIALS

A. KEE Roof Membrane:

1. Thermoplastic Ketone Ethylene Ester (KEE) coated polyester fabric-reinforced fleece-backed sheet, ASTM D6754.

a. Basis of design product: Tremco, TremPly KEE FB Single Ply Roof Membrane.

b. Breaking Strength, minimum, ASTM D751: Machine direction, 500 lbf (87 kN/m); Cross machine direction 400 lbf (70 kN/m).

c. Tear Strength, minimum, ASTM D751: Machine direction, 125 lbf (22 kN/m); Cross machine direction (145 lbf (25 kN/m).

d. Elongation at Break, ASTM D751: 20 percent.

e. Dynamic Impact/Puncture Resistance, ASTM D5635: 30 J, minimum.

f. Minimum Membrane Thickness, nominal, less backing, ASTM D751: 60 mils (1.5 mm).

g. Thickness over fiber, optical method: 0.016 inches (0.406 mm).

h. Accelerated Weathering, ASTM G155 and ASTM G154: Not greater than 15,000 hr., no cracking or crazing.

i. Abrasion Resistance, ASTM D3389: Not greater than 2,000 cycles, H-18 wheel, 1,000 g load.

j. Color: White.

k. Solar Reflectance Index (SRI), ASTM E1980: 110 (White, initial), 86 (White, 3-yr aged).

B. Sheet Flashing: Manufacturer's standard, smooth-backed, sheet flashing of same material, type, reinforcement, thickness and color as KEE roof membrane.

2.5 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Plastic Foam Adhesives: 50 g/L.

b. Single-Ply Roof Membrane Sealants: 450 g/L.

c. Nonmembrane Roof Sealants: 300 g/L.

d. Sealant Primers for Nonporous Substrates: 250 g/L.

e. Sealant Primers for Porous Substrates: 775 g/L.

3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Membrane Bonding Adhesive:

1. Bonding adhesive, waterborne low-VOC, for bonding KEE fleece-backed single ply membranes and flashings to substrates.

a. Basis of design product: Tremco, TremPly KEE FB WBII Bonding Adhesive.

b. VOC, maximum, ASTM D3960: 153 g/L.

C. Flashing Membrane Adhesive:

1. Bonding adhesive, solvent based fast drying, VOC-compliant, for bonding KEE smooth-backed single ply membranes and flashings to substrates.

a. Basis of design product: Tremco, TremPly KEE LV Bonding Adhesive.

b. VOC, maximum, ASTM D 3960: 200 g/L.

D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 mm by 3 mm) thick; with anchors.

E. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch (25 mm wide by 1.3 mm) thick, prepunched.

F. Joint Sealant: Elastomeric joint sealant compatible with roofing materials, with movement capability appropriate for application.

1. Joint Sealant, Polyurethane: ASTM C920, Type S, Grade NS, Class 50 single-component moisture curing sealant, formulated for compatibility and use in dynamic and static joints; paintable.

a. Basis of design product: Tremco, TremSEAL Pro.

b. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 40 g/L.

c. Hardness, Shore A, ASTM C661: 40.

d. Adhesion to Concrete, ASTM C794: 35 pli.

e. Tensile Strength, ASTM D412: 350 psi (2410 kPa).

f. Color: White.

G. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.6 ROOF INSULATION MATERIALS

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from insulation manufacturer's standard sizes, suitable for application, and of thicknesses indicated.

1. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where needed for sloping to drain. Fabricate to slopes indicated, not less than two times the roof slope.

B. Roof Insulation: Provide roof insulation product in thicknesses indicated in Part 3 as follows:

1. Board Insulation, Polyisocyanurate: CFC- and HCFC- free, with recycled content glass-fiber mat facer on both major surfaces, ASTM C1289 Type II Class 1.

a. Basis of design product: Tremco, Trisotech Insulation.

b. Compressive Strength, ASTM D1621: Grade 2: 20 psi (138 kPa).

c. Conditioned Thermal Resistance at 75 deg. F (24 deg. C): 14.4 at 2.5 inches (50.8 mm) thick.

2.7 ROOF INSULATION ACCESSORIES

A. Cover Board:

1. Gypsum panel, glass-mat-faced, primed, ASTM C1177/C1177M.

a. Basis of design product: Tremco/GP Gypsum DensDeck Prime.

b. Thickness: 1/4 inch (6 mm).

B. Roof Insulation Adhesive:

1. Urethane adhesive, bead-applied, low-rise two-component solvent-free low odor, formulated to adhere roof insulation to substrate.

a. Basis of design product: Tremco, Low Rise Foam Insulation Adhesive.

b. Flame Spread Index, ASTM E84: 10.

c. Smoke Developed Index, ASTM E84: 30.

d. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 0 g/L.

e. Tensile Strength, minimum, ASTM D412: 250 psi (1720 kPa).

f. Peel Adhesion, minimum, ASTM D903: 17 lbf/in (2.50 kN/m).

g. Flexibility, 70 deg. F (39 deg. C), ASTM D816: Pass.

C. Metal Coating: ASTM D 6083, solar-reflective acrylic elastomer emulsion coating.

D. Metal Primer: Water based acrylic metal primer that provides a tough, flexible film for the protection of steel against corrosion. Must be VOC compliant.

E. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

F. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

G. Substrate Joint Tape: 6- or 8-inch- (150- or 200-mm-) wide, coated, glass fiber.

2.8 WALKWAY MATERIALS

A. Walkway Material:

1. Protection walkway roll, reinforced KEE membrane roll with diamond-tread, slip-resistant surface, fabricated for heat welding to compatible KEE membrane surface.

a. Basis of design product: Tremco, TremPly KEE Protection Walkway Roll.

b. Roll Size: 30 inches by 100 ft (760 mm by 25.4 m).

c. Thickness: 0.060 inch (1.5 mm).

d. Breaking strength: 450 lbs (77 kN/m).

e. Color: Gray.

B. Rubber blocks: 100% rubber blocks with steel channels and reflective strips designed for supporting conduit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.

2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

3. Verify that substrate is sound and dry.

4. Existing Concrete Roof Deck:

a. Verify that concrete substrate is visibly dry and free of moisture. Test for moisture according to ASTM F2659 or other recognized test method utilizing non-destructive, electronic moisture meter.

b. Verify adhesion of new roofing components to concrete.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSTALLATION, GENERAL

A. Install roofing system in accordance with manufacturer’s written instructions and approved details.

B. NRCA Installation Details: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations; modify as required to comply with manufacturer's approved details and perimeter fastening requirements of FM references if applicable.

3.4 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Tapered Insulation and Crickets: Install insulation under area of roofing to conform to existing heights current if applicable. Install crickets and saddles as needed to slope water to drain as needed.

1. Where crickets are indicated or required to provide positive slope to drain, make slope of crickets minimum of two times the roof slope, not less than 1/4 inch in 12 inches (1:48).

2. Install crickets on the high side of all curbs.

D. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

F. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

G. Cover Boards: Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together.

1. Secure cover boards Secure cover boards to resist uplift pressure at corners, perimeter, and field of roof.

2. Adhere cover boards by setting in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining cover board in place.

3.5 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Water-Based Bonding Adhesive: Apply to substrate at rate required by manufacturer. Install membrane immediately into adhesive, avoiding any air entrapment; do not allow adhesive to dry. Roll membrane into wet adhesive. Do not apply adhesive to splice area of membrane.

E. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

F. Welded Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.

2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

G. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.6 FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Raise curbs lower than 6” off the finished roof surface. Wrap solid topped curbs with new KEE membrane and install new 24 gauge sheet metal pans.

F. Install skirt metal counterflashing at units and where counterflashing does not extend at least two inches over the top of the base flashing.

G. Seal all duct, pan, HVAC to pan, and other sheet metal seams with acrylic sealer and polyester reinforcement. Surface all galvanized metal and roof rings and screens with metal coating system. Properly prepare and prime surfaces prior to coating which includes rust inhibitor and other primers as recommended by manufacturer.

H. SURFACING AND COATING INSTALLATION (DUCTING)

1. Acrylic Emulsion Coating:

a. Prime substrate as recommended by manufacturer.

b. Coat roofing membrane surface with cold-applied adhesive surfacing adhesive applied at rate required by roofing manufacturer.

c. Apply acrylic emulsion coating to prepared roofing membrane and base flashings, all metal components including but not limited to duct work, metal pans, roof hatch etc., with number of coats, thickness of application, and application method as recommended in writing by coating manufacturer.

3.7 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

B. Install new rubber blocks to replace all wood blocks. Add additional blocks to insure at least one every 8 feet and support at conduit changes in direction. Install oversized walkpad sections under all blocks. Use pipe support extenders to support high conduit and provide proper slope for condensate. For conduit runs close to the roof surface where the rubber blocks will not fit use new redwood blocks set on KEE walkpad section.

3.8 FIELD QUALITY CONTROL

A. Roofing Inspector: Contractor shall engage a qualified roofing inspector to perform roof tests and inspections and to prepare test reports.

1. Engage a qualified roofing inspector for a minimum of 1 full-time days on site, per 40-hour crew week, to perform roof tests and inspections and to prepare start up, interim, and final reports. Roofing Inspector's quality assurance inspections shall comply with applicable criteria established in NRCA's "Quality Control and Quality-assurance Guidelines for the Application of Membrane Roofing Systems."

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075416

DIVISION 23 – HEATING, VENTILATING & AIR CONDITIONING

SECTION 23 01 30.51 - HVAC EQUIPMENT & DUCT CLEANING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections:
1. Section 01 33 00 Submittal
2. Section 23 30 00 Heating, Ventilation and Air Conditioning

1.03 GENERAL CONDITIONS

A. General Conditions of the construction contract shall be a part of these specifications, and shall govern the HVAC Systems Rehabilitation Contractor. All work shall be done in accordance with requirements of the Owner and the construction contractor.

1. Contractor's License: The Contractor shall be licensed in the State of California. This License shall be a C-61 Specialty License in the D-64 Duct Cleaning Sub-Division.

2. "National Air Duct Cleaners Association (NADCA): The contractor shall be a Certified Member in good standing with NADCA.

3. Contractor shall visit the site prior to bid and make himself thoroughly familiar with the site and existing conditions. By submitting a bid for HVAC equipment and duct cleaning, Contractor declares that he is familiar with existing conditions and is capable of executing work detailed herein at no additional cost(s) to the Owner.

1.04 QUALLITY ASSURANCE

A. Contractor shall have thorough knowledge and experience in the rehabilitation and cleaning of projects of similar type, size, and degree of difficulty completed within the last two years. Contractor agrees:

1. All work shall be supervised by a foreman having thorough knowledge and experience in the cleaning of air conditioning systems. Experienced, qualified personnel shall perform the work.

2. Contractor shall be fully covered by Workmen's Compensation, Public Liability and Property Damage Insurance, and certificates of these coverage's and limits shall be provided to the Owner upon request.

3. Any mechanical problems discovered during the course of cleaning will be reported in writing within 24 hours to the project coordinator

4. Contractor shall leave area of work in same condition as when work started (on a day-to-day basis and from project start to finish).

5. Contractor shall keep work area free of all surplus material and debris. Upon completion of each shift, all tools, equipment, debris, etc. shall be moved to a designated area selected by the Owner.

6. Contractor shall take all necessary measures to minimize the migration of dust and other air borne particles during the cleaning process. ALL outlets and inlets leading to (or from) occupied spaces must be covered with a leak-proof catch basin. At no time shall dust and/or other air borne particles be blown or dispersed into any space within the building.

7. Contractor shall at all times be in compliance with Cal OSHA and EPA regulations.

8. Unless otherwise noted, Contractor shall be responsible for cleaning all existing supply, return, exhaust, and outside air intake duct to remain as indicated on plans. Any deviations from said section must be approved in writing by the Owner.

B. Photo Documentation: Documentation shall include the use of a digital camera and a fiber optic borescope, where required. Contractor shall take photos of conditions before and after cleaning for inclusion in a project report to be presented to the Owner at the conclusion of the work.

1.05 LABOR AND MATERIALS

A. Contractor shall furnish all labor, materials, supplies, tools, equipment, supervision, transportation and any other services or items necessary to accomplish the work.

B. Safety Procedures and Policy: Contractor shall provide adequate and necessary management personnel to ensure that all safety policies and project requirements are met.

1. Maintain safe and healthy employee working conditions and establish safe operating procedures at each job site.

2. Comply with the safety standards of all federal and state regulatory agencies as a minimum requirement for safety performance at each job site.

3. Comply with all of the safety requirements of the job site and safety requirements mandated by the Owner.

4. Contractor shall provide all necessary safety devices and personal protective equipment for employee use, and shall require their use when needed.

5. The work in progress shall be subject to random unannounced inspections by a representative of Owner.

6. Upon total completion of the project, representatives of Owner will do a quality control inspection. Any area that does not meet the standards of this specification shall be redone at no additional cost.

7. Electrical equipment, sensors and control devices shall be masked, or blocked off where required for protection for water or chemicals.

8. Disinfectant, when used, shall be applied in accordance with the manufacturer instructions, and may be used prior to coating application. System shall be dried after application of disinfectant.

9. HVAC coating shall be applied according to manufacturer instructions. Coating shall be sprayed, brushed, or rolled directly into interior ductwork surface. A continuous film of coating must be achieved. (Provide supplemental ventilation as required.)

10. All ducts too small to allow direct entrance shall have access openings installed approximately every 10-15 feet as required, and at each elbow and vertical riser. Each access opening shall be recovered with a panel made of the same gauge metal, and installed in such a manner as to insure an airtight job. All sheet metal ductwork shall be in accordance with SMACNA Standards, unless otherwise noted.

PART 2 - PRODUCTS

2.01 MATERIALS AND PRODUCTS

A. Material Safety Data sheets for all materials and products used by Contractor shall be provided to Owner prior to start-up of cleaning operations.

B. Degreaser: Maintex 7-11 Armex Baking Soda Blasting Crystals or equal as approved by Owner.

C. Sanitizer Oxine BBJ Microblocide or other EPA registered equal as approved by Owner.

D. Re-Surfacing Treatments: Schuller Superseal Edgecoat Fosters 40-20 Vac-Systems Tough Coat Porta Sept by Porter Paints, containing EPA registered anti-microbial Swamp Cooler Repair condensate drain pan sealant or other EPA registered equal as approved by Owner.

E. Paint: Styletone Series 8 19 Machinery Grey Zynolite Spray Paint.

F. Insulating Lining Material: To match existing or Certainteed Tough Gard Certainteed Ultra-Lite Armaflex Astro-Foil or equal as approved by Owner.

G. Adhesives: Armstrong 520 DPIO/20 Super 77 Spray Adhesive or equal as approved by Owner.

H. Duct Sealant: DP 10/10 Top 12000 Silicone Sealant or equal as approved by Owner

PART 3 – EXECUTION

3.01 METHODOLOGY

A. Cleaning of Ductwork

1. All registers and diffusers shall be removed and cleaned with a mild detergent.

2. All ductwork (not accessible to personnel) shall be cleaned by compressed air, light brush agitation, or vibration agitation, or a combination of any of the above. All duct to be opened so the interior is as visible as possible.

3. Large ductwork shall be cleaned by manual brushing, or vibration agitation. All duct to be opened so as to visually observe the cleaning process.

4. All agitation of contaminants shall be accompanied by negative air pressure created by a negative air machine using a HEPA filter.

5. Access needed for proper cleaning shall be cut into rigid metal ducts at elbows and approximately every 15 feet. Holes shall be sized as appropriate to allow cleaning and visual inspection inside duct.

6. All flexible ducts shall be disconnected at joints and registers for cleaning. Flexible duct lengths of over 15 feet shall be cut at intervals not exceeding 15 feet.

7. Contractor shall provide access in existing ceilings and walls as required. Where openings are made for cleaning purposes, Contractor shall repair such ceilings and walls as required to give a uniform surface. Match existing materials, color and texture.

8. All interior dampers and turning vanes shall be cleaned with a stiff bristle brush and then vacuumed.

9. The surface of all unreplaced liner shall be coated. Any small tears in fiberglass will be repaired with lagging materials and then encapsulated.

10. All access holes made in ducts for cleaning purposes shall be sealed with galvanized sheet panels of the same of heavier gauge metal as the duct. Panels shall be installed with duct sealant and screwed into the duct at four-inch maximum on center, all around as required to maintain an airtight seal. Proof will be required.

11. All flexible ducts disconnected for the purpose of cleaning shall be reattached in the same manner as originally installed.

12. Clean all duct serving remodeled areas, including supply duct and transfer duct. Do not clean main return ductwork at the central air conditioning unit.

B. Hazardous Materials

1. When asbestos or other hazardous materials are encountered, Contractor shall document concern and forward to Owner forthwith.
2. Respiratory protection shall be OSAH/NIOSH approved with HEPA cartridges, or cartridges designed for specific contaminants.
3. No material that is not approved by regulatory authorities shall be introduced to the project as means for accomplishing work outlined herein.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING & AIR CONDITIONING

SECTION 23 05 53 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide marking and identification required on all mechanical piping systems, ducts, controls, valves, apparatus, etc., as specified in this Section or any related Sections.

B. Related Sections:

1. Plumbing: Section 22 00 00.

2. Heating, Ventilating, and Air Condition: Section 23 30 00.

1.02 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

B. Submit samples of materials.

1.03 QUALITY ASSURANCE

A. Comply with provisions of Section 01 40 00.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: All piping systems, controls, valves, apparatus, etc., except those that are installed in inaccessible locations in partitions, walls, and floors, and those buried underground, shall be permanently identified.

2.02 VALVES

A. Use existing chart or diagram for each piping system, indicating thereon by identifying letter or number each valve in the system, its location, and function.

B. Existing color chart is Per District.

C. Bind copies of each chart in Operating Instructions Manual.

D. Provide each valve with brass, aluminum or plastic disc, not less than 1-1/4" diameter bearing engraved numbers corresponding to those indicated on chart. Fasten discs to valve with No. 14 brass wire.

E. Provide an additional tag for all safety valves and other valves that could be hazardous to safety and health of occupants. Distinguish these tags from regular valve tags by color (such as yellow with black letters, and marked "Danger") submit sample tag to the District Inspector.

2.03 INSTRUMENTS AND CONTROLS

A. Identify all panel-mounted instruments and controls with engraved bakelite nameplates permanently affixed to Panel boards.

B. Identify all alarm indicating devices and alarm reset devices by nameplates.

C. Identify all damper motors and automatic valves, flow switches, pressure switches, etc., with embossed aluminum or plastic tape affixed to controller, indicating service and setting.

2.04 EQUIPMENT

A. Identify each major piece of equipment with stenciled designation corresponding to its designation on the Contract Drawings.

2.05 PIPELINES IDENTIFICATION

A. Identify all pipes by means of colored labels with directional arrows as indicated in schedule. (Contractor shall use District colors to distinguish equipment and/or piping use.)

B. Materials: Waterproof plastic cloth, all-temperature, self-adhering, or markers similar to Western "Tel-A-Pipe", Type I, or equal by W.H. Bradley Co.

C. Size: For pipes up to 3" diameter, 2-1/4" x 9" minimum, with 1/2" letters; for pipes over 3" diameter, 2-1/4" x 9" minimum, with 1-1/2" letters.

D. Colors:

1. Backgrounds: As indicated in schedule.

2. Letters: White on red background; black on all other backgrounds.

E. Locations:

1. On all accessible piping, whether insulated or not (including mechanical rooms, attic and ceiling spaces); except that labels shall be omitted from piping where use is obvious due to its connection to fixtures (such as faucets, water closets, etc.).

2. Near each valve and branch connection in such accessible piping.

3. At each pipe passage through wall or floor.

4. At not more than 40'-0" spacing on straight pipe run between bands required in 2 and 3 above.

5. At each change in direction.

F. Application: Apply on clean surfaces free of dust, grease, oil or any material that will prevent proper adhesion. Replace all non-adhering or curling labels with new labels, as approved by the District Inspector.

1. Use spray adhesive on insulated pipes in addition to adhesive on marker.

2. Finish all exposed markers with one coat of lacquer.

G. Schedule:

Content of Pipe	Legend	Color	Note
Domestic cold water	Dom. c.w.	G	*
Non-potable cold water	NP c.w.	G (1)	*

Domestic hot-water 140 F	Dom h.w. 140F	Y	*
Indirect drain	Ind drain	G (1)	*
Sump pump discharge	Pump discharge	G	*
Chilled water supply	Chill water supply	G	*
Chilled water return	Chill water return	G	*
Hot water	Hot Water Supply	Y	*
Hot water	Hot Water Return	Y	*
Condensate	CD		*

**Contractor shall verify all colors and verbiage with District prior to labeling.

H. Notes on Schedule:

1. Symbol * indicates flow arrow required.

2. Symbol (1) indicates 2-1/4" x 1" yellow label with 1/2" letters reading UNSAFE WATER at one end of primary label.

3. Hyphen between words indicates 2 separate stock labels are required, although a single special label with all lettering is equally acceptable.

4. Background colors: Symbol Y indicates yellow background color. Symbol G indicates green background color. Symbol R indicates red background color.

2.06 UNDERGROUND PIPE MARKERS

A. Pipe markers shall be furnished to grade at each horizontal change in direction for all non-metallic underground pipes. Markers shall be concrete plaque inscribed with the appropriate word "gas", "water", "sewer", "air", etc. Cleanouts to grade may serve as direction markers for waste lines. An electrically continuous #14 plastic covered copper tracer wire, Type TW, shall be run in trench along pipe. Wire shall be fastened to pipe at not greater than 20'-0" intervals. Wire shall terminate above ground with a 12" lead taped around each riser. Straight line transitions of metallic to non-metallic pipe shall have lead brought to grade under a marker.

B. Tracer wires for non-metallic pipe shall be color-coded as follows:

1. Gas: Yellow

2. Domestic Water: Blue

3. Fire Sprinkler: Red

4. Irrigation: Green

2.07 IDENTIFICATION OF AIR CONDITIONING EQUIPMENT

Identify location of air conditioning equipment above Tee Bar Ceilings. Install 3/4" to 1" diameter colored self adhesive dots to Tee Bar Ceiling grid showing access. Please note that the following identification shall be included on as built control drawings.

A	Fire Damper	Red
B	Manual Volume Dampers	Blue
1.	Supply Air	Full Dot
2.	Return Air	Half Dot.
C	Fan coil unit	Green
D	Filter Location if separate from fan coil	Yellow

PART 3 - EXECUTION

3.01 INSTALLATION

A. Report any conditions detrimental to proper and timely completion of work. Apply markers and identification tags as specified using approved materials and installation procedures recommended by manufacturer.

END OF SECTION

DIVISION 23 – HEATING, VENTILATING & AIR CONDITIONING

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.
b. Multizone systems.

2. Duct leakage tests.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. TAB: Testing, adjusting, and balancing.

D. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

E. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site. Insert after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Needs for coordination and cooperation of trades and subcontractors.
d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine installed systems for 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 applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

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

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

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

H. Examine test reports specified in individual system and equipment Sections.

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

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine operating safety interlocks and controls on HVAC equipment.

M. 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

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

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

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 30 00.
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 30 00 "Duct Insulation."

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

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

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

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

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

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

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

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

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

L. Verify that air duct system is sealed as specified in Section 23 30 00 – 2.4 Ductwork and Accessories.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

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

1. Measure total airflow.

   a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
   b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
   c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
   d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

   a. Measure static pressure directly at the fan outlet or through the flexible connection.
   b. Measure static pressure directly at the fan inlet or through the flexible connection.
   c. Measure static pressure across each component that makes up the air-handling system.
   d. Report artificial loading of filters at the time static pressures are measured.

3. 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.
4. Obtain approval from Architect/Engineer of Record for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

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

1. Measure airflow of submain and branch ducts.

2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.7 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.8 TOLERANCES

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

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10.
2. Air Outlets and Inlets: Plus or minus 10 percent.

3. Contractor to provide the necessary sheaves, pulleys and other accessories needed to meet the tolerance requirements.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.9 PROGRESS 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 monthly 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.

3.10 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.
3. Certify validity and accuracy of field data.

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

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; 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 specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

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

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

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

D. System Diagrams: Include schematic layouts of air 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. Terminal units.
4. 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 (mm), and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

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

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm (L/s).
    b. Total system static pressure in inches wg (Pa).
    c. Fan rpm.
    d. Discharge static pressure in inches wg (Pa).
    e. Filter static-pressure differential in inches wg (Pa).
    f. Preheat-coil static-pressure differential in inches wg (Pa).
    g. Cooling-coil static-pressure differential in inches wg (Pa).
    h. Heating-coil static-pressure differential in inches wg (Pa).
    i. Outdoor airflow in cfm (L/s).

j. Return airflow in cfm (L/s).
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch (mm) o.c.
f. Make and model number.
g. Face area in sq. ft. (sq. m).
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Water flow rate in gpm (L/s).
i. Water pressure differential in feet of head or psig (kPa).
j. Entering-water temperature in deg F (deg C).
k. Leaving-water temperature in deg F (deg C).
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig (kPa).
n. Refrigerant suction temperature in deg F (deg C).
o. Inlet steam pressure in psig (kPa).

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 (kW).
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 (mm), and bore.
n. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

2. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm (L/s).
    b. Entering-air temperature in deg F (deg C).
    c. Leaving-air temperature in deg F (deg C).
    d. Air temperature differential in deg F (deg C).
    e. Entering-air static pressure in inches wg (Pa).
    f. Leaving-air static pressure in inches wg (Pa).
    g. Air static-pressure differential in inches wg (Pa).
    h. Low-fire fuel input in Btu/h (kW).
    i. High-fire fuel input in Btu/h (kW).
    j. Manifold pressure in psig (kPa).
    k. High-temperature-limit setting in deg F (deg C).
    l. Operating set point in Btu/h (kW).
    m. Motor voltage at each connection.
    n. Motor amperage for each phase.
    o. Heating value of fuel in Btu/h (kW).

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 (mm), and bore.
    h. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

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 (mm), and bore.
    f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
    g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm (L/s).
    b. Total system static pressure in inches wg (Pa).
    c. Fan rpm.
    d. Discharge static pressure in inches wg (Pa).
    e. Suction static pressure in inches wg (Pa).

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 (deg C).
    d. Duct static pressure in inches wg (Pa).

e. Duct size in inches (mm).
f. Duct area in sq. ft. (sq. m).
g. Indicated airflow rate in cfm (L/s).
h. Indicated velocity in fpm (m/s).
i. Actual airflow rate in cfm (L/s).
j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft. (sq. m).

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm (L/s).
b. Air velocity in fpm (m/s).
c. Preliminary airflow rate as needed in cfm (L/s).
d. Preliminary velocity as needed in fpm (m/s).
e. Final airflow rate in cfm (L/s).
f. Final velocity in fpm (m/s).
g. Space temperature in deg F (deg C).

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm (L/s).
b. Entering-water temperature in deg F (deg C).
c. Leaving-water temperature in deg F (deg C).
d. Water pressure drop in feet of head or psig (kPa).
e. Entering-air temperature in deg F (deg C).
f. Leaving-air temperature in deg F (deg C).

L. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.

d. Dates of use.
e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.

B. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. 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."

D. 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.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall 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 specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, Owner may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

DIVISION 23 – HEATING, VENTILATING & AIR CONDITIONING

SECTION 23 09 24 – WIRELESS HVAC CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes

1. System description.
2. Operator interface.
3. Controllers.
4. Controller software.
5. HVAC control programs.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 23 30 00 – Heating, Ventilating, and Air Conditioning

1.3 REFERENCES

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:
1. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
2. Indicate description and sequence of operation of operating, user, and application software.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.

F. Operation and Maintenance Data:
   1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
   2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
   3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70

B. The Climate Management System (CMS) Contractor shall be a dealer that is regularly engaged in the engineering, programming, installation and service of similar systems.

C. See Part 3, Installation Requirements, for additional installer requirements

1.6 TRAINING

A. Provide a competent instructor who is factory trained and has comprehensive knowledge of system components and operations to provide full instructions to designated personnel in the system operation, maintenance, and programming. Training shall be specifically oriented to installed equipment and systems.

B. Provide (8) hours of onsite owner familiarization and training for the installed system. Training shall include system overview, time schedules, emergency operation, and programming and report generation.

C. Owner employees attending this training session shall be provided with the following documentation:
   1. System layout point to point connection diagram.
   2. System components cut sheets.
   3. Operations and maintenance data.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. DDC Equipment Carrier ClimaVision controls. No substitutions will be accepted.

B. The local manufacturer representative will operate a free 40-hour-a-week, toll-free customer support hotline for additional user support service that are required.

2.2 SYSTEM DESCRIPTION

A. System architecture shall be a hybrid consisting of a cloud computing Web Service connected to a set of central controllers, wireless terminal equipment controllers and wireless auxiliary devices. The Web Services shall provide machine learning capability with weather forecast for optimal daily performance while the on-site devices provide automation of mechanical systems with on-board computation and non-volatile memory capabilities. The on-site devices shall be capable of stand-alone operation in case of a failure to communicate with the Web Service.

B. Web Services shall provide a digital twin of all equips in the system and adhere to Project Haystack tagging standards and Haystack Domain Modeler, a Project Haystack-based data modeling tool for creating mapped logical, physical, or conceptual data models of various equipment in the CMS. It is meant to be the comprehensive repository for Project Haystack equips and a modeling tool for creating models specific for each physical equipment type needed.

C. Basis of Design: Carrier ClimaVision.

2.3 ACRCHITECTURE/COMMUNICATION

A. Wireless equipment controllers and auxiliary control devices shall conform to:
1. IEEE 802.15.4 radios to minimize risk of interference and maximize reliability, and range.
2. Communication between equipment controllers shall be a wireless mesh network operating in the 900 MHz frequency band.
3. Operating range shall be a minimum of 100 feet between two hops; open range shall be 500 ft. (152 m) with less than 2% packet error rate to ensure reliable operation.
4. To maintain robust communication, mesh networking and two-way communications shall be used to optimize the wireless network health.
5. Wireless communication shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications.

B. The Climate Management System Supervisory Controllers shall be the Central Control Unit (CCU). All terminal mechanical equipment and auxiliary devices shall be wirelessly tied into the CCU. CCUs will connect to the suppliers Web Service via customer Internet connection and must support Wi-Fi and Wired Ethernet network.

2.4 OPERATOR INTERFACE

A. Web interface
1. The solution shall provide an online web portal that is accessible via the Internet.

B. Mobile Apps
1. The solution shall provide access to the facility manager remote access via native apps on iOS and Android.

C. Local User Operation
1. User app – The Climate Management System shall provide a mobile app that allows the occupants to control their own space. In order to support energy conservation measures, the app shall allow use of geofencing detect proximity to their office and set the occupied temperature. The app shall also allow the user to set vacations for their own zones.
2. Wall Space Interface – The Climate Management System shall provide a local space sensor and interface that allows the occupant to adjust the desired temperature from within the space. To support use by the physically impaired, the wireless space sensor shall be a minimum font size of 12 points, and the LCD model shall be readable in low light conditions.

D. Wireless Space Sensors
1. To check for proper operation, wireless space temperature sensors shall include a signal strength on the Central Control Unit (CCU).
2. To allow local troubleshooting without specialized tools, error codes shall be displayed on the digital display.
3. Relative humidity sensors shall provide RH readings at all temperature locations for humidity control applications.

E. SERVICE TOOLS
1. To support network setup and troubleshooting, service tools shall display link quality for each wireless device.
2. Service tool access via a mobile app native to both iOS and Android shall be provided to minimize installation and troubleshooting labor.

2.5 APPLICATIONS AND CONTROL SOFTWARE

A. Online Operator Interface
1. The Web browser client shall be set up to support, at a minimum, the following functions:
   a. User log-on identification and password shall be required. If an unauthorized user attempts access, notice of access failure shall be displayed. Security using authentication and a minimum of 128 bit SSL encryption techniques to prevent unauthorized access shall be implemented.
   b. Real-time values displayed on a web page shall have the ability to update automatically without requiring a manual “refresh” of the web page.
   c. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following at either a single site or multiple sites:
      1) Modify schedules and setpoints in a graphical manner.
      2) View logs and charts.
      3) View alarms.
      4) Modify parameters that tune algorithm execution such as Deadbands and hold-down timers

B. Alarms
1. Alarm feature shall allow user configuration of criteria to create, route, and manage alarms and events. It shall be possible for specific alarms to be routed to specific alarm recipients via email, text message or notification via mobile app. The alarm management portion of the user interface shall, at the minimum, provide the following functions:
   a. Generate alarm records that contain a minimum of a timestamp, the values generating the alert, acknowledged state, alarm class and priority.
   b. Allow a user, with the appropriate security level, to manage alarms - including sorting and acknowledging.

C. Reports and Summaries
1. Reports and Summaries shall be generated and directed to the user interface displays. As a minimum, the system shall provide the following reports:
   a. All points relevant to a specific profile(equipment) in the CMS such as current/desired temperatures, airflow temperatures, equipment operation etc.
   b. All CMS schedules

D. Schedules
1. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:

a. Zone level schedules that allow occupant preferences for temperature to be captured via local interface and made permanent.
b. Building level schedules that allow occupant preferences for temperature to be captured via local interface and temporarily followed till the end of the current scheduled time.
c. Vacation Schedules with multiple named entries for the future.

2. Weekly schedules shall be provided for each group of equipment (zone) with a specific time use schedule.
3. There shall exist a mechanism to allow assigning of a single schedule to an arbitrary named group of zones across multiple sites. This grouping of zones can be edited and reused on an ongoing basis.

E. Password
1. Multiple-level password access protection shall be provided to allow the system manager to assign user interface control, display, setup and configuration capabilities on the building supervisory controller as deemed appropriate for each user based on an assigned password.
2. For remote access, each user shall have the following: a user name, a password, and access levels.
3. The system shall provide the capability to require a password of minimum length and require a combination of characters and numerical or special characters.
4. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
5. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.

F. Dynamic Floorplan Graphics
1. The graphics application program shall be supplied as an integral part of the User Interface
2. The graphics applications shall include a create/edit function and a runtime function for editing of the floor plan.
3. The floor graphics shall by default display a color-coded plan representing how close the temperatures are being maintained to the desired values.
4. The floor graphics shall show pertinent trend data from the equipment upon hovering over a specific zone. Clicking on a zone shall allow for greater detailed trend data and the ability the edit the relevant setpoints directly from the modal popup.
5. The floor plan graphics shall include the ability to add custom widgets that are able to display color coded real-time data that is acquired, derived, or entered on each zone on the floor plan.
6. Floor plan graphics runtime functions -Each graphic application including the widgets shall be capable of the following functions:
a. The graphics shall support a maintained aspect ratio.
b. Unique background shall be assignable on a per floor basis.
7. Operation from graphics - It shall be possible to change values (setpoints) and states in systems controlled equipment within the Web browser interface.
8. A floor plan graphic editing tool shall be provided that allows for the mapping of zones w.r.t. a plan view of the building floor via a web based WYSIWYG click and drag interface. No coding or other special tools shall be required.

G. Historical Data Collection
1. All numeric, binary or data points in the system database shall allow their values to be logged over time (trend log). Each historical record shall include the point's name, a time and the point's value.
2. The data shall be stored on a provided cloud service that is backed up automatically.
3. The historical data collection shall allow for recording data every minute.
4. A historical data viewing utility shall be provided with access to all history records. This utility shall allow historical data to be viewed in a chart format.
5. The historical data chart view shall allow different point histories to be displayed simultaneously, and provide panning and zooming capabilities.

H. Audit Log

1. For each log entry, provide the following data;
   a. Time and date
   b. User ID
   c. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

I. Database Backup and Storage
1. The Supervisory Controller configuration databases shall automatically get backed up to a cloud storage service that is included in the offering every night. In addition, the user shall have the ability to back up the databases manually.

J. Cloud Services Tiers
1. Cloud Services tiers shall be available as a subscription model and shall include the features as described in the subsequent sections.
2. Basic Tier (Standard):
   a. Include the features listed in sections 2.05A thru 2.05I
   b. One Week Historical Data Retention
   c. Be free of charge for the life of the system
3. Plus Tier:
   a. Include all the features in the Basic Tier
   b. Equipment Visualization
   c. Notifications via Email and desktop Web UI
   d. Summary Tables
   e. Custom Filters, Analytics, Point Summaries, Custom Alerts
   f. Up to 6 Dashboards
   g. Audit Trails and Reporting
   h. Remote Session to CCU
   i. Inbuilt Online Support with Chat Assistant
   j. Two Years of Historical Data Retention
   k. Shall be included for the first twelve months after system installation
4. Pro Tier:
   a. Include all the features in the Basic and Plus Tiers
   b. Notifications via Text
   c. AI-Powered Interface with Chatbot, Alert Insights, Dashboards, Auto Commissioning Tool
   d. Available Open APIs for Integrations Add-On
   e. Unlimited Dashboards
   f. Site Manager and Sequencer for advanced mapping, monitoring, and control
   g. Commissioning Diagnostics and Reports
   h. Lifetime Historical Data Retention
   i. Shall be included for the first three months after system installation

2.6 SYSTEMS CONTROLLERS

A. Central Control Unit
1. The Central Control Unit (CCU) shall be a wall mounted gateway for the wireless terminal equipment modules in the building.
2. The CCU shall use an Android or equivalent operating system and a control node with inputs and outputs for controlling a range of HVAC and lighting equipment.
3. To minimize the power wiring, the CCU shall be capable of being powered from standard HVAC supplied 24VAC
4. The CCU shall not consume more than 15VA of power to not require dedicated power installations.

2.7 SENSORS

A. Space sensors for use in Heating, Ventilating, and Air Conditioning (HVAC) systems

1. Temperature and Humidity Range
   a. The ambient operating temperature range for the wireless space sensor shall be 32 to 122°F (0 to 50°C).
   b. The ambient storage temperature range for the space sensor shall be -40 to 185°F (-40 to 85°C).
   c. The ambient operating and storage humidity range for the wireless space sensor shall be 5 to 95%, non-condensing.
2. Components
   a. Space sensors shall be available as:
      1) Wall mount version with temperature and with integrated 2% humidity. The surface of this sensor shall be paintable to blend in with the décor.
      2) Ceiling mount version with temperature and integrated 2% humidity. The mounting mechanism shall allow the drop of the sensor to be adjusted from the ceiling between 3-10". This will allow for better temperature sensing in case of stratification near the top of the ceiling.
      3) An optional specifiable model with digital display and local user interface. The sensor shall be wall mount with temperature and with integrated 2% humidity and. The digital display model shall allow local interface control without a field service tool. Configuration options include: set point and override capacitive touch controls.
   b. Installation and replacement of failed sensors shall be accomplished automatically after power up.
   c. The space sensor shall not expose any screws or obvious attachment mechanism to protect against theft.
   d. Wireless space sensor component certifications shall include:
      1) TFP-13651127 - Canada Compliance
      2) UL 60730 - Automatic Electrical Controls
3. Accuracy
   a. To ensure proper system performance, the space sensors shall automatically determine the space temperature even if it is rapidly changing. The space temperature shall be transmitted at least once each second to the equipment controller. Space temperature sensing accuracy shall be +/- 0.5F (+/- 0.28C).
4. Power Requirements
   a. To conserve labor, no separate power cables should need to be run. The space sensor is powered via a single communications and power cable to the HVAC equipment controller.

2.8 SMART NODE.

A. General
   1. The Smart Node equipment controller shall allow flexibility in software-defined configurations which can control a range of equipment, from zone dampers to reheat coils to economizer controls.
   2. Unit to operate off a 24V power source and shall be designed for use with a "daisy chain" power supply that allows powering of several smart nodes off one power source.
   3. The Smart Node shall have multiple input and outputs, plus be capable of 900 MHz mesh communication and 2.4 GHz Bluetooth wireless communication to control a range of control sensors and control equipment.
   4. The equipment controller shall not require a wired connection back to the central supervisory controller. This will result in significant labor savings and troubleshooting.
   5. Software shall allow improvements to the control sequences to be included with every software update.
   6. The wireless controller addresses shall be held in non-volatile memory to ensure operation through system voltage disturbances.
   7. The 'pairing' or association of the controller address to a zone shall follow a wireless process and include a token exchange and confirmation of a unique identification number that shall be generated dynamically to minimize the risk of incorrect association. Two position DIP switches are not acceptable.

8. During the association the name of the zone should be transferred to the equipment controller and displayed on the main screen to validate correct pairing.

B. General purpose programmable controllers: Smart Node (SN)
1. The Smart Node (SN) shall be a fully user-programmable, digital controller that communicates via wireless mesh network.
2. The SN shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences.
3. The SN shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
4. The SN shall include an OLED or LCD display screen.
5. To assist in troubleshooting the controller shall display the following conditions:
   a. A main screen showing information pertinent to the controllers configured equipment operation including the name of the zone and wireless signal strength.
   b. An inputs screen showing the status and current voltage/resistance of all inputs and attached sensors via the sensor bus.
   c. An outputs screen allowing for temporary overrides of all outputs. The overrides should revert to normal operation after 15 minutes if left unattended.
   d. A screen showing the version of the software running on the controller.
6. The SN shall accommodate the direct wiring of analog and binary I/O field points.
7. The SN shall support the following types of inputs and outputs:
   a. Binary Inputs - shall be configured to monitor either of the following:
      1) Dry Contact Maintained Mode
   b. Analog Outputs - shall be configured to output either of the following.
      1) Analog Output, Voltage Mode
      2) Analog Output, current Mode
   c. Binary Outputs - shall output the following:
      1) Normally Open (N/O) relay contacts capable of at least 1A current at 24V AC/DC or 120VAC.
   d. Thermistor Inputs
      1) Analog Input, Resistive Mode with profile for 10K, type 2 resistor built in.
8. The SN shall have the ability to reside on the mesh network.
   a. The wireless mesh network shall support communications between the SNs and the CCU.
9. The SN shall have the ability to monitor and control sensors and actuators.
10. The SN shall have dedicated damper outputs to directly drive servo motor based balancing dampers. For such dampers, the SN shall have an automatic calibration sequence to detect speed and motor drive current. Parameters discovered during such calibration shall be displayed on the screen.
11. The SN shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices.

2.9 FUNCTIONAL PROGRAMMING

A. The SN shall support, but not be limited to, backup functional programming sequences for operations on the equipment using local sensors/controls in case communication to the central supervisory controller is lost.

2.10 INPUT DEVICE CHARACTERISTICS

A. General Requirements
1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

B. Temperature and Humidity Sensors
1. General Requirements:

a. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.

2. Room Temperature Sensors with local input
   a. Room sensors shall be constructed for either surface or wall box mounting.
   b. Room sensors shall have the following options when specified:
      1) Setpoint adjustment providing a +3 degree (adjustable) range
      2) Dial adjustment for setpoint value or warmer or cooler requests. The dial shall also initiate temporary occupancy during unoccupied times.
      3) A momentary override request for activation of after-hours operation
      4) Backlit LCD or OLED temperature display shall display temperature and setpoint with units.

3. Outside Air Sensors
   a. The airflow temperature sensor shall be of the resistance type 2 RTD with nominal resistance of 10K at 77 °F.
   b. temperature sensing accuracy shall be +/- 0.5F (+/- 0.28C).
   c. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
   d. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
   e. The sensors shall be provided with plenum rated wiring harness.
4. Duct Mount Sensors
   a. The airflow temperature sensor shall be of the resistance type 2 RTD with nominal resistance of 10K at 77 °F or digital solid-state semiconductor with I2C bus interface.
   b. temperature sensing accuracy shall be +/- 0.5F (+/- 0.28C).
   c. Duct mount sensors shall mount in a hole in the duct, and be easily accessible from outside the duct for repair or replacement.
   d. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
   e. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.
5. Humidity Sensors
   a. The sensor shall be a solid-state type, relative humidity sensor with digital I2C bus interface. The sensor element shall resist service contamination.
   b. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 5% and 95% RH @ 77 °F unless specified elsewhere.
   c. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.
   d. The sensor be shipped factory pre-calibrated and require no field calibration.

C. Differential Pressure Transmitters
1. General Air and Water Pressure Transmitter Requirements:
   a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
   b. Pressure transmitters shall transmit a 0 to 10 VDC, or 4 to 20 mA output signal or digital sensor compatible with industry standard 1-wire bus protocol.
   c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device.
   d. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.
2. Building Differential Air Pressure Applications (-1” to +1” w.c.)

a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA, 0-10V output or digital sensor compatible with industry standard 1-wire bus protocol in response to variation of differential pressure or air pressure sensing points.
b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
   1) -1.00 to +1.00 w.c. input differential pressure ranges. (Select range appropriate for system application)
   2) 4-20 mA or 0-10V output
   3) Maintain accuracy up to 20 to 1 ratio turndown.
   4) Reference Accuracy: +0.2% of full span.

D. Current Transformers
1. The current transformers shall be self-powered with solid-state circuitry and a 0-10V output with adjustable measuring range. The range shall be adjustable from 10A, 20A, 50A full scale output. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its max range.

E. Status and Safety Switches
1. General Requirements
   a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the CMS when a failure or abnormal condition occurs.
   b. Current Sensing Switches
      1) The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
      2) Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
      3) Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

2.11 OUTPUT DEVICE CHARACTERISTICS

A. Actuators
1. General Requirements
   a. Damper and valve actuators shall be electronic and/or pneumatic, as specified in the System Description section.
2. Electronic Damper Actuators
   a. Electronic damper actuators shall be direct shaft mount.
   b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations.
   c. All actuators shall have external adjustable stops to limit the travel in either direction and a gear release to allow manual positioning.
   d. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA. If specified per sequence of operations the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one

damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for troubleshooting purposes.

e. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as “quick acting,” shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.

f. Acceptable manufacturers: Johnson Controls, Schneider Electric, Belimo, and Mamac.

3. Electronic Valve Actuators

a. Electronic valve actuators shall be manufactured by the valve manufacturer.

b. Each actuator shall have current limiting circuitry incorporated in its design to prevent damage to the actuator.

c. Modulating and two-position actuators shall be provided as required by the sequence of operations. Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required application. The valve actuator shall be sized based on valve manufacturer’s recommendations for flow and pressure differential.

d. All actuators shall fail in the last position unless specified with mechanical spring return in the sequence of operations. The spring return feature shall permit normally open or normally closed positions of the valves as required. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.

e. Modulating actuators shall accept 24 VAC or VDC and 120 VAC power supply and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal, and may be used to parallel other actuators and provide true position indication. The feedback signal of each valve actuator (except terminal valves) shall be wired back to a terminal strip in the control panel for troubleshooting purposes.

f. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Butterfly isolation and other valves, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop the associated pump or chiller.

2.12 SYSTEM TOOLS

A. Wireless Space Sensor Installation and Configuration Tools

1. To enable installation and servicing when specialized tools are required, site survey and installation tools as well as software shall be provided to the contractor use for system installation and commissioning for the duration of the warranty period.

2. To enable installation and servicing when specialized tools are required, site survey and installation tools as well as software shall be provided to the owner for permanent possession for ongoing system maintenance and trouble shooting.

2.13 OPERATED EQUIPMENT

A. Bypass Dampers

1. General:

a. Bypass dampers are communicating dampers and include an integrated fully modulating 24 VAC electric actuator.

b. Dampers are nominally rated up to 1800-2400 fpm at 1.75" of static pressure.

c. Round damper shall have a heavy gage galvanized steel cylinder with a rolled bead for high structural integrity and positive shut off. Damper blade shall be of the butterfly type with an elastomeric seal to provide quite operation and tight shutoff for low leakage.

d. Rectangular dampers shall be formed from heavy gage galvanized steel frame, mechanically joined with linkage concealed in the side channel. Damper blades shall be of the opposed blade design and shall be constructed of 18 gage galvanized steel.

e. Dampers shall be either round or rectangular configuration as noted on the plans

B. Zone Dampers
1. General:
a. Zone dampers are fully-modulating, pressure dependent VAV devices.
b. Dampers control zone temperature by varying the volume of air flowing into a space.
c. Each zone damper to have a smart node and actuator enclosed.
2. Damper Construction
a. Round damper shall have a heavy gage galvanized steel cylinder with a rolled bead for high structural integrity and positive shut off. Damper blade shall be of the butterfly type with an elastomeric seal to provide quiet operation and tight shutoff for low leakage.
b. Rectangular dampers shall be formed from heavy gage galvanized steel frame, mechanically joined with linkage concealed in the side channel. Damper blades shall be single ply, heavy gage G60 galvanized steel blades with a glass fiber filled nylon crank bearings connected by a metal drive link.
c. Dampers shall be either round or rectangular configuration as noted on the plans
3. Smart Dampers
a. Smart Dampers shall include the damper and associated drive mechanism in one unit
b. Smart dampers motor drive shall be a direct shaft mount servo motor type
c. The dampers shall include a blade type damper that folds radially so that static pressure does not affect its operation.
d. The damper shall retain is position once positioned and power is removed to the servo motor.
e. The damper system shall include a 10K type 2 RTD sensor as part of the assembly

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

3.2 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
B. Install software in control units. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 0993.
C. Provide conduit and electrical wiring in accordance with Section 26 2717. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.
D. Coordinate with Owners IT Department to obtain gateway out of Owners internet access point in such a manner that the security of the Owners network is not at risk of being breached due to the control system gateway.
E.

3.3 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

- END OF SECTION -

DIVISION 23 – HEATING, VENTILATING & AIR CONDITIONING

SECTION 23 30 00 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work under this section includes all labor, equipment, material, services, transportation, etc. required for and reasonably incidental to the complete and satisfactory installation of all of the HVAC Systems as indicated on the Drawings or specified herein.

1.2 WORK INCLUDED IN THIS SECTION

A. Package Roof Top Heat Pump Units

B. Ductwork and Accessories

C. Grilles, Registers and Diffusers

D. Duct Cleaning

E. Test and Balance

F. Submittals and Shop Drawings

G. Record Drawings

H. Operation and Maintenance Manuals

I. Guarantee

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Electrical supply to units. See Electrical Drawings.

B. Cutting and Patching. See Division 1 and 7, and Mechanical Drawings.

C. Equipment Pads and Support. See Structural Drawings.

1.4 GENERAL REQUIREMENTS

A. This section of the specification shall be considered as a part of the entire specification and all applicable portions of General Conditions, Special Conditions, and Division 1 shall apply.

B. Before commencement of work this contractor shall determine the exact location, size, elevation, and availability of all utilities relevant to the mechanical work and immediately notify the District with written notification of any discrepancies. In addition, this Contractor shall contact all involved utility companies, make all necessary arrangements for service, and pay all fees incurred due to connection of services.

C. Erection: The Contractor shall furnish the services of an experienced superintendent, who shall be constantly in charge of the erection of the work, together with all necessary journeymen, helpers, and laborers required to properly unload, erect, connect, adjust, start of operate and test the work involved.

1.5 REFERENCES

A. AABC - National Standards for Field Measurement and Instrumentation, Total System Balance.

B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

C. AMCA 300 - Test code for sound rating air-moving devices.

D. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilation System.

E. ARI 270 - Sound rating of Outdoor Unitary Equipment.

F. ASHRAE 52.2-2017 - Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency By Particle Size

G. ASTM A90 - Weight of Coating on Zinc - Coated (Galvanized) Iron or Steel Articles

H. ASTM A120 - Black and Galvanized Steel Pipe

I. ASTM B88 - Seamless Copper Water Tube

J. ASTM C518 - Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

K. ASTM C553 - Mineral Fiber Blanket and Felt Insulation

L. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation

M. ASTM E84 - Surface Burning Characteristics of Building Materials

N. ASTM E96 - Water vapor Transmission of Materials

O. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems

P. NFPA 255 - Surface Burning Characteristics of Building Materials

Q. SMACNA - Low Pressure Duct Construction Standards

R. UL 181 - Factory Made Air Ducts and Connectors

S. UL 723 - Surface Burning Characteristics of Building Materials

T. California Mechanical Code - 2025 Edition

U. California Building Code - 2025 Edition

V. CEC Title-24 – 2025 Edition

1.6 SUBMITTALS AND SHOP DRAWINGS

A. Contractor agrees that shop drawings submittals processed by the District do not become Contract Documents and are not Change Orders; that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the Contractor's convenience in organizing his work and to permit the District to monitor the Contractor's progress and understanding of the design. The process of review of the Contractor's submittals is not of testing the District's perception. If deviations, discrepancies or conflicts between shop drawings submittals and the Contract Documents are discovered either prior to or after the shop drawing submittals are processed by the District, the Contractor agrees that the Contract Documents shall control and shall be followed.

B. Prepare and furnish fully coordinated shop drawings showing ductwork and piping on separate drawings.
1. The drawings shall be minimum 1/4" = 1'-0" scale and shall show dimensioning of piping and ductwork from gridlines, bottom of elevation marks for ductwork and piping and fittings, valves, dampers, devices, etc. with labels.
2. In addition, coordinate with related work and reference on the same drawings major plumbing piping, structural steel, fire protection piping, conduit runs and cable trays.
3. Review and sign these drawings to verify coordination of related equipment.
4. Conflicts, which occur, shall be brought to the attention of the District Representative prior to issuance of the drawings.

C. Materials and Equipment:
1. As soon as possible and within 14 days after award of the contract, and before their purchase, the Contractor shall submit to the District electronic format submittals for approval containing a complete list of materials, specialties and equipment he is to furnish for the installation.
2. Literature shall be standard manufacturer's catalog cuts and items to be installed shall be clearly indicated.
3. All submittals shall be made at one time.

D. Each item shall be identified by manufacturer, brand and trade name, number, size, rating and whatever other data is necessary to properly identify and check the materials and equipment. The words: "as specified" will not be considered sufficient identification.

E. Accessories, controls, finish, etc., not submitted or identified with the submitted equipment shall be furnished and installed as specified.

F. 1 Sets of complete electronic format shop drawings shall be submitted for approval indicating all piping, equipment and ductwork. These drawings shall indicate sizes, locations and elevations of ductwork, equipment and equipment pads, piping and controls including transitions, valves etc.

G. Shop drawings shall be approved only to extent of information indicated. Approval of an item of equipment shall not be construed to mean approval for components for that item for which Contractor has provided no information.

H. Approval of shop drawings shall not relieve Contractor of responsibility for providing all controls, wiring, components, etc. which are shown or specified, or all additional controls, wiring, components, etc. required to provide complete and correctly operating mechanical systems.

I. Submit product data for the following manufactured products, assemblies, personnel and testing agencies required for this project.

1. Power Exhaust
2. VVT dampers
3. Duct Cleaning Guidelines
4. Diffusers, registers and grilles

5. Ductwork and Accessories
6. Insulation Materials
7. Filters
8. Controls

1.7 SUBSTITUTIONS

A. Should the Contractor desire to substitute any material, equipment or other items for those specified, he shall submit a complete list, including detailed equipment layouts and performance characteristics within 14 calendar days after the scheduled Start of Construction. Said data shall be submitted in 1 electronic format set, assembled in individual brochures.

B. The entire cost of all changes of any type due to substitution for materials specified shall be born by the Contractor at no extra cost to the District.

C. Unsolicited and voluntary deducts, on the part of the Contractor for substituting unapproved systems and/or equipment, shall not be considered for the purpose of awarding the Contract.

D. The contractor shall submit the amount of cost credit to the Contract in the event the proposed substitution is accepted.

E. In all cases where substitutions are proposed after bids are received, the Contractor shall bear the cost of evaluation on the basis of 2-1/2 times technical salaries of engineering personnel involved.

1.8 AVAILABILITY OF SPECIFIED EQUIPMENT

A. Verify prior to bidding that all specified equipment is available and can be obtained in time for installation during orderly and timely progress of the work.

B. In the event that specified items will not be so available, notify the District prior to receipt of bids.

C. Costs of delays because of non-availability of specified items, when such delays could have been avoided by proper investigation on the part of the Contractor, will be back-charged as necessary and shall not be born by the District.

1.9 RECORD DRAWINGS

A. The contractor shall arrange and pay for one set of white prints of the HVAC drawings, which he shall alter in red to show all changes made to the original layout. These drawings shall be kept current.

B. The contractor shall deliver these completed to the District when the job is finished and accepted prior to final payment, and provide copies of approved shop drawings in ACAD format to MEOR.

C. Contractor shall provide 1 complete set of electronic format drawings per District standard on BOX.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit one (1) electronic format set prior to final inspection including cover sheet and table of contents. Prepare submittal with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", and title of

project. Internally subdivide the section contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

B. Contents: Prepare a Table of Contents with each Product or system description identified.
   1. Part 1:
      a. Directory listing names, addresses, and telephone numbers of District, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2:
      a. Operation and maintenance instructions, arranged by system.
      b. Identify the following:
         1) Significant design criteria
         2) List of equipment
         3) Parts list for each component
         4) Operating instructions
         5) Maintenance instructions for equipment and systems
         6) Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

C. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with District comments. Revise content of documents as required prior to final submittal.

D. Submit final volumes (revised) within ten days after final inspection.

1.11 GUARANTEES

A. The Contractor, in accepting this contract, binds himself to replace or repair at his own expense any defect in workmanship or material which may appear within a period of one year from the date of the final acceptance of the building, and to pay for all resulting damage which shall appear within the said period; provided always that the Contractor shall not be liable for anything attributable to acts of the agents of the District, or for ordinary wear. Also, given date of work performed by the Contractor be accepted as complete, he shall agree to correct any deficiencies or omissions in respect to the plans or specifications which may appear in the afore-mentioned twenty-four month period.

B. The Contractor guarantees that all piping as provided in this specification will be free from all obstructions, and that all piping will be tight and drip free.

C. All refrigerant compressors shall carry a seven-year manufacturer's warranty with additional extended three -year manufacturer's warranty by providing required documents to manufacturer within 90 days from installation date.

1.12 LOCAL CONDITIONS

A. The Contractor and trade submitting tenders on this work shall visit and will be deemed to have visited the site to ensure that they are familiar with all conditions relating to the work. Failure to visit the site will in no way relieve the successful Contractor of the necessity of furnishing any material or performing any work that may be required to complete the work in accordance with the drawings and specifications without additional cost to the District.

1.13 RULES, REGULATIONS AND CODES

A. All work and materials shall be in full accordance with the latest California Mechanical Code, California Plumbing Code, California Building Code State regulations, State Fire Marshal regulations, the safety orders of the Division of Industrial Safety; the California Electric Code; the standards of the National Fire Protection Association; American Gas Association; Occupation and Safety Act; American National Standards Institute; American Society of Mechanical Engineers; American Society for Testing and Materials; Installation Standards published by the International Association of Plumbing And Mechanical officials (IAPMO) and other applicable laws, codes, or regulations. Nothing in these specifications shall be construed to permit work not conforming to these codes.

B. Electrical Work: Motors, electrical apparatus and wiring specified in this section shall conform to the National Electrical Manufacturer's Standards and the California Electric Code and bear the Underwriter's label of approval.

C. The Contractor shall furnish, without extra charge, any additional material and labor when and where required to comply with these rules and regulations, though the work be not mentioned in these Specifications or shown on the Drawings. When these Specifications or Drawings call for or describe materials or construction of a better quality or larger sizes than required by the above mentioned rules and regulations, the provisions of these specifications and accompanying drawings shall take precedence.

1.14 FEES AND PERMITS

A. The Contractor must obtain and pay all fees for permits, licenses, inspections, etc., which are required by any legally constituted authority. Coordinate exact requirements with the District prior to bid.

1.15 COORDINATION

A. Following the general arrangement indicated on the Drawings as closely as possible, the Contractor shall coordinate with the architectural, structural, plumbing, electrical and all other trades prior to installation of the materials and equipment to verify adequate space available for installation of the work shown. The District shall be immediately notified if an area of conflict occurs between trades.

B. The Contractor shall bear all costs incurred for work that must be relocated due to conflicts between trades.

C. The Mechanical Contractor shall coordinate all requirements for all points of connection with the General Contractor and other trades prior to bid.

1.16 DRAWINGS

A. The work shall be installed as indicated on Drawings, however, changes to accommodate installation of this work with other work, or in order to meet Architectural or structural conditions, shall be made without additional cost to the District.

B. For the purpose of clarity and legibility, the Drawings are essentially diagrammatic to the extent that many offsets, bonds, unions, special fittings and exact locations are not indicated. The Contractor shall make use of all data in all of the Contract Documents, and shall verify this information at the site.

1.17 INSPECTION

A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities have jurisdiction, and until Project Record drawings have been properly annotated.

B. Should any of his work be covered up or closed in before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.18 DELIVERY, STORAGE AND PROTECTION OF PROPERTY

A. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. If any materials or equipment are not ordered in time, additional charges made by equipment manufacturers to complete their equipment in time to meet construction schedule, together with any special handling charges, shall be borne by the contractor.

B. Materials shall be delivered in ample quantities from time to time as may be necessary for the uninterrupted progress of the work. They shall be stored as to cause the least obstruction to the premises and distributed so as to prevent overloading to any portion of the structure.

C. The Contractor shall provide temporary storage and shop areas that are required at the site for the safe and proper storage of materials, tools, and other items used in the performance of this work. These areas shall be constructed only in approved locations and shall not interfere with the work of any other Contractor.

D. All work, equipment and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his own workmen. The Contractor shall also protect his own work from damage. He shall close all pipe and duct openings with caps or plugs during installation. He shall protect all of his equipment and materials against dirt, water, chemical, and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

1.19 DAMAGE BY LEAKS, ETC.

A. The Contractor shall be responsible for all damage to any part of the premises or work of other Contractors, caused by leaks or breaks in the piping or equipment furnished and/or installed under this section, during the construction and guarantee period.

1.20 ACCESS TO EQUIPMENT FOR MAINTENANCE

A. Install all equipment, piping, etc. to permit access for normal maintenance. Maintain easy access to filters, motors, etc. Install all such equipment and accessories to facilitate maintenance. Perform any relocation of pipes, etc. required to permit access at request of District at no additional cost to District.

B. Furnish and install access doors or panels in walls, floors, and ceilings to permit access to equipment, dampers, and all other items requiring service. Coordinate location of access doors with other trades as required.

C. Size access panels to allow inspection and removal of all items served.

D. Use Milcor style as required for material in which door is installed. Where door is installed in fire rated construction, provide door bearing UL label required for condition.

1.21 QUALITY ASSURANCE

A. Abbreviations:

1. AABC - Associate Air Balance Council
2. ADC - Air Diffusion Council - Test Code
3. AGA - American Gas Association
4. AMCA - Air Moving and Conditioning Association
5. ANSI - American National Standards Institute
6. ARI - Air Conditioning and Refrigeration Institute
7. ASA - American Standards Association
8. ASC - Adhesive and Sealant Council
9. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
10. ASME - American Society of Mechanical Engineers
11. ASTN - American Society for Nondestructive Testing
12. ASSE - American Society of Sanitary Engineering
13. ASTM - American Society for Testing and Materials
14. AWS - American Welding Society
15. AWWA - American Water Works Association
16. CAC - California Administration Code
17. 2025 CBC - California Building Code
18. 2025 CEC - California Electrical Code
19. 2025 CMC - California Mechanical Code
20. California Fire Code with California Amendments.
21. MSS - Manufacturers' Standardization Society
22. NBS - National Bureau of Standards
23. NCWB - National Certified Piping Welding Bureau
24. NEMA - National Electrical Manufacturer's Association
25. NFPA - National Fire Protection Association
26. PDI - Plumbing and Drainage Institute
27. SMACNA - Sheet Metal and Air Conditioning Contractor's National Association, Inc.
28. UL - Underwriters Laboratories, Inc.

B. Rulings and interpretations of authorities shall be considered a part of the regulations.

C. Nothing in this document is to be construed to permit Work not conforming to these codes and regulations.

D. Should there be any direct conflict between the above rules, the most stringent shall govern.

E. The Contractor shall recognize that the design is based upon the equipment and material specified by name or construction and accept full responsibility for assuring that the quality, utility and performance of a substitution equals or exceeds that of the specified item.

F. Testing: Provide the services of a qualified testing laboratory/agency to perform the specified field tests. Notify the District Representative 48 hours in advance of performance of Work requiring testing. Provide all materials required for testing.

G. Factory and Field Testing:
1. See each Section for the required testing and their procedures.
2. Test reports shall include description of equipment tested, description of test procedures, test results, and names and signatures of witnesses of tests.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and equipment shall be new and of the best of their respective grades, free from all defects and of the make, brand or quality herein specified or as accepted by the District.

B. All materials and equipment shall be identified by manufacturer's name or nameplate data. Unidentified material or equipment shall be removed from the site.

C. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in the catalog as standard with the equipment. Optional or additional accessories shall be furnished as specified.

D. Where no specific make of material or equipment is mentioned, any first class product of a reputable manufacturer may be used, provided it conforms to the requirements of the system and meets with the approval of the District.

E. Equipment and materials damaged during transportation, installation and operation shall be considered as "totally damaged" and shall be replaced with new. Any variance from this clause shall be made only with written approval of the District.

2.2 MANUFACTURER

A. Air Distribution
1. Titus
2. Krueger
3. Price

2.3 DUCTWORK AND ACCESSORIES

A. General:
1. Non-combustible or conforming to requirements for Class 1 air duct materials, or UL 181.

B. Steel Ducts:
1. ASTM A653 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz per sq ft for each side in conformance with ASTM A90.
2. Round duct shall be spiral seam construction.

C. Flexible Ducts:
1. Interlocking spiral of galvanized steel or aluminum construction; rated to (2 inches WG positive and 1.5 inches WG negative for low pressure ducts) (and 15 inches WG positive or negative for medium high pressure ducts.)

D. Insulated Flexible Ducts:
1. Flexible duct wrapped with flexible glass fiber insulation, enclosed by Pressure Ductwork: seamless aluminum pigmented plastic vapor barrier jacket; maximum 0.23 K value at 75 degrees F w/metal connectors.

E. Fasteners:
1. Rivets, bolts, or sheet metal screws.

F. Sealant:

1. Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

G. Hanger Rod:
1. Steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

H. Low Pressure Ducts:
1. Fabricate and support in accordance with 2025 CMC, SMACNA Low Pressure Duct Construction Standards and ASHRAE handbooks, except as indicated. Gages for galvanized steel ducts for low pressure systems where velocities do not exceed 2000 FPM shall be as follows and per 2025 CMC (most stringent shall apply):
a.

RECTANGULAR DUCT		ROUND DUCT	
Dimension of Largest Side (L) in Inches	Gage	Diameter (D) in Inches	Ga.
$L \leq 12$	26	$D < 9$	26
$12 \leq L \leq 30$	24	$9 \leq D < 14$	24
$30 < L \leq 54$	22	$14 \leq D < 23$	22
$54 < L \leq 84$	20	$23 \leq D < 37$	20
$84 < L$	18	$37 \leq D < 51$	18
		$51 \leq D < 61$	16
		$61 \leq D < 84$	14

b. All joints and seams as indicated in the 2025 CMC are acceptable.
2. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.
3. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide turning vanes.
4. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
5. Use double nuts and lock washers on threaded rod supports.

I. I. Volume Control Dampers:
1. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.
2. Opposed blade dampers shall have factory-fabricated blades, with factory assembled linkages, mounted in frames.
a. Blades shall have interlocking edges and ends.
b. Rectangular dampers 6" or more wide shall be the multi-blade type.
c. Blades on multi-blade type dampers must not be over 6" wide.
d. Dampers shall be of the opposed blade type.
e. Dampers shall have bar or channel frames and corner bracing.
f. All blade and linkage bearings shall be self-lubricating plastic.
g. Damper assembly leakage not to exceed 1% with 4.0 W.C. static pressure.
3. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
4. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

J. Duct Test Holes:

1. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

K. Ceiling Diffusers & Supply Registers and, Return Registers:
1. Fabricate of steel with steel or aluminum frame and baked enamel off-white finish.
2. Provide opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face as indicated on the drawings.
3. Ceiling Diffusers (CD): Titus 300R and Titus MCD or equal, or approved equal.
4. Return grilles shall be Titus 350 RL series or equal perforated.

2.4 INSULATION

A. General:
1. All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation) fire smoke hazard ratings as tested by procedure ASTM E84, NFPA 255 and UL 723 not exceeding:
   a. Flame Spread: 25
   b. Smoke Developed: 50
2. All products or their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed above requirements. Any treatment of jackets or facings to impart flame and smoke safety shall meet the above requirements.
3. The Contractor shall certify that all products used have met the above criteria.
4. The insulation values shown are a minimum. If the requirements of Title 24 exceed these values, the amount of and/or type must be increased to meet the Title 24 requirements.

B. Duct Insulation:
1. Fiberglass Duct Wrap:
   a. Insulation: ASTM C553; flexible, noncombustible blanket.
      1) 'K' value: ASTM C518, 0.48 at 75 degrees F.
      2) Maximum service temperature: 250 degrees F.
      3) Density: 0.75 lb/ ft3.
   b. Vapor Barrier Jacket:
      1) Kraft paper reinforced with glass fiber yarn and bonded to aluminized film vinyl.
      2) Moisture vapor transmission: ASTM E96; 0.5 perm.
      3) Secure with pressure sensitive tape.
   c. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
   d. Tile Wire: Annealed steel, 16 gage.
2. Glass Fiber Duct Liner, Flexible:
   a. Insulation: ASTM C553; flexible, noncombustible blanket.
      1) 'K' value: ASTM C518, 0.24 at 75 degrees F.
      2) Maximum service temperature: 250 degrees F.
      3) Density: 1.5 to 3.0 lb/ft3.
      4) Maximum Velocity on Coated Air Side: 4,000 ft/min.
   b. Adhesive: Waterproof (fire-retardant) type.
   c. Liner Fasteners: Galvanized steel, self-adhesive pad.
3. Glass Fiber Duct Liner, Rigid:
   a. Insulation: ASTM C612; semi-rigid, noncombustible.
      1) 'K' value: ASTM C518, 0.24 at 75 degrees F.
      2) Maximum service temperature: 250 degrees F.
      3) Density: 1.5 to 3.0 lb/cu ft.
      4) Maximum Velocity on Coated Air Side: 4,000.
4. Adhesive: Waterproof (fire-retardant) type.

C. Pipe Insulation:

1. See specification 23 07 19 for more details. Should there be any direct conflict between the above rules, the most stringent shall govern.
2. Insulation and covering on pipe and tubing shall have flame spread rating not to exceed 25 and a smoke density not to exceed 50 when tested in accordance with UL 723 and ASTM E84.
   a. Aluminum Jacket:
      1) All outdoor exposed insulation piping and insulated piping exposed indoors in occupied areas and equipment rooms to be protected by covering with .016 inch thick aluminum weather-proof jacket with vapor barrier liner of laminated asphalt covered kraft paper.
      2) Lap jacket at all joints and seams two inches (2"), cinched with staples and straps and finished with two (2) coats of asphalt base aluminum paint in strict accordance with manufacturer's recommendations.

2.5 Package Rooftop Heat Pump Units.

A. INSTALLATION
1. Install in strict accordance with manufacturer’s requirements, shop drawings, and Contract Documents.

B. START-UP
1. Factory Start-Up Services: Start-up is to be supervised by the unit manufacturer or a manufacturer-certified service organization. Physical connections and start-up are provided by the installing contractor. Provide for as long a period of time as is necessary to ensure proper operation of the unit but in no case for less than 2 full working days. The start-up engineer shall conduct such operating tests as required to ensure that the unit is operating in accordance with design. Complete testing of all safety and emergency control devices shall be made. The start-up engineer shall submit a written report to the owner and manufacturer containing all test data recorded as required above and a letter certifying that the unit is operating properly.
2. Operation and Maintenance Manuals: Provide complete with descriptive literature, model, and serial number of all equipment, performance data, manufacturer’s instructions for operating and maintenance, lubrication recommendation and schedule, and winter shutdown procedure.

C.

2.6 CONTROLS

A. The Mechanical Contractor shall be responsible for the proper coordination of all control work and electrical work in connection therewith. He shall also be responsible for the proper operation of the entire system.

B. The Electrical Contractor shall furnish and install all line voltage control wiring, and in conduit. Wire sizing and length of run shall be coordinated with the manufacturer and Electrical Engineer. All Energy Management Controls, wiring, and conduit shall be by Controls Contractor.

C. Electrical Work: All electric relays, hand off automatic switches and all electrical wiring and all conduits will be provided under the Electrical Section, except as otherwise specified. Furnish and install additional conduit, wiring, relays, hand off automatic switches made necessary by the use of approved substituted equipment under this Section with no additional cost to the Owner.

D. Refer to drawings for control diagrams and additional requirements.

E. Calibration of Controls: The Controls Contractor shall carefully calibrate and adjust all controls as required to maintain comfort conditions and maximum energy conservation.

F. Thermostats and temperature sensors shall be by Venstar and Mitsubishi or approved equal.

G. Where stand-alone controls are indicated, mechanical contractor shall be responsible for low voltage controls conduit, wiring, and thermostat.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Installation:
   1. All equipment provided under this section of the specifications shall be installed in strict accordance with the manufacturer's recommendations.
   2. Should the drawings or specifications indicate the equipment is to be installed in a manner not in accordance with the manufacturer's recommendations; the Contractor shall obtain direction from the Engineer prior to proceeding with the installation. If the Contractor proceeds with the installation without obtaining direction from the Engineer, the Contractor shall be required to make all required corrections to the installation at no additional cost to the contract.
   3. Space Consideration:
      a. Certain equipment and ductwork will have to be installed within the limited space available as indicated on the drawings.
      b. Exact field measurements of existing conditions will be the responsibility of this Contractor to assure that the equipment and ductwork to be installed under this Section of the specifications can be installed as indicated.
      c. Contractor shall submit shop drawings for approval prior to installation.
      d. These field verified dimensions shall be made prior to purchase of equipment or fabrication of ductwork.
   4. Line all duct as indicated on mechanical sheets. Line ductwork as per General Notes, including but not limited to all ductwork at Bypass Damper connection locations.

B. The Mechanical Contractor shall level all unit sections in accordance with the unit manufacturer's instructions. The Mechanical Contractor shall provide and install all necessary permanent shim material to ensure individual sections and entire assembled units are level.

C. Roof and Wall Flashings:
   1. Ducts penetrating roof shall have twenty-two (22) gauge sheet metal flashing with a minimum of ten inches (10") of the base extended on to the roof, or roof curb, as indicated on the drawings.
   2. Ducts through walls shall be sealed with galvanized angle iron on all sides.
   3. Where required or indicated, a weather hood constructed of galvanized sheet metal with galvanized birdscreen shall be provided.
   4. Refrigerant piping penetrating roof shall be provided with 4 pound lead flashing and counter flashing.

D. Openings through Walls and Roof:
   1. Framed openings in walls and roof for ductwork to be coordinated in advance of the work. Installer shall furnish shop drawings showing the correct dimensions and locations of the required openings.
   2. The Contractor shall provide and install "line-seals" where pipes pass through masonry walls or floors.
   3. All pipes passing through walls, floors, ceilings, and partitions in finished portions of the buildings shall be provided with chromium plated, cast brass, set screw plates.
   4. Where sleeves and plates are installed around insulated pipes, they shall be of sufficient size to allow the insulation to go through them, presenting a neat finish.

E. Sleeves and Seals: (Provide for pipes passing through walls or floor slabs).

1. Sheet-Metal Sleeves (above grade): 10 gauge, galvanized sheet metal, round tube closed with welded longitudinal joint.
2. Steel Sleeves (below grade): 10 gauge, galvanized sheet metal, round tube closed with welded longitudinal joint.
3. Polyethylene Sleeves (above grade): Manufacturer's standard product.
4. Mechanical Sleeve Seals (install where indicated on drawings): Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
5. Isolate pipes through ground floor sleeves with Kraft paper, plastic tape or similar materials.
6. Pack space between pipe and sleeve with ceramic fiber and Dow Fire Stop No. UL827U sealant so as to absolutely fireproof and watertight.

F. Ductwork and Accessories:
1. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
2. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
3. Install accessories in accordance with manufacturer's instructions and per seismic note on mechanical sheet M-0.1.
4. Provide balancing dampers at points on low-pressure supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Use splitter dampers only where indicated.
5. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
6. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.
7. Provide duct test holes where indicated and required for testing and balancing purposes.
8. Check location of outlets and inlets and make necessary adjustments in position to conform to Architectural features, symmetry, and lighting arrangement.
9. Install diffusers to ductwork with airtight connection.
10. Provide balancing dampers on duct take-off to diffusers and registers, regardless of whether dampers are specified as part of the diffuser, or register assembly.
11. Paint ductwork visible behind air outlets and inlets matte black.
12. Hanger straps to turn under bottom of rectangular ducts and shall attach with sheet metal screws at this point as well as minimum two (2) additional screws into sides of duct for sizes eighteen inches (18") and under three (3) screws for sizes above eighteen inches (18). (Typical for each strap). Ducts in sizes above forty-eight inches (48") shall run continuous under bottom of duct. Straps for round duct shall run completely around underside of duct and shall be secured in place with minimum of two (2) sheet metal screws each side.
    a. Strap Installation: In general, provide in accordance with SMACNA duct installation standards. Contractor may request approval of alternate support methods to type specified. Shop drawings will be required.
    b. Concrete: Secure supports to concrete with concrete inserts. Branch ductwork in sizes eighteen inch (18") and smaller may be secured by power actuated fasteners. Contractor shall submit sizes and maximum loading data.
    c. Bracing all ductwork laterally to structural framing to prevent swaying or lateral movement per bracing details on plans per seismic note on mechanical sheet M-01.
13. Turning Vanes: All elbows having a centerline radius less than the width of the duct shall be square elbows with turning vanes, or proper radius and spacing. These turning vanes shall be multi-vane type and shall be carefully installed in accordance with the manufacturer's instructions. Provide turning vanes for duct widths of 18 inches or greater. Provide single thickness vanes for ducts of less than 18 inches. Contractor may submit for approval shop fabricated vanes conforming to SMACNA Duct Manual Standard. Where required or indicated on drawings, provide

acoustic turning vanes constructed of air foil shaped aluminum extrusion with perforated faces and fiberglass fill.

14. Flexible Duct Connections: Shall be provided where indicated as required and shall be "Vent-glass", "Ventbestos", or Duro-Dyne Durolan super metal-fab.
15. Duct Tape and Sealer:
    a. All longitudinal snap lock joints shall be made airtight with high pressure duct sealant TREMCO J.S. 773, GREY A.F., and transverse joints sealed with Hardcast AFG No. 1402 foil grip instant tape sealant for rectangular ducts and round ducts, all U.L. classified. At contractor's option, all round duct transverse joints may be made with MIRACLE D-619 water based, duct sealant U.L. classified 309U as manufactured by MIRACLE ADHESIVES CORP.
    b. Exposed outdoor ductwork shall be sealed as described herein and, in addition, all transverse joints shall be covered with Glenkote "Seal-Flex".

G. Thermostats and over-ride switches:
1. Install at 48" above finished floor unless otherwise stated.
2. Coordinate with other trades.
3. All thermostats and over-ride switches shall be by Siemens.
4. Controls Contractor shall be responsible for verifying, furnishing all controls and wiring for tie-in of thermostats to new building energy management system and shall co-ordinate all requirements with other trades including notifying electrical contractor of necessary conduit and power requirements.
5. All costs for scope of work shall be submitted for final bid.
6. All control conduits shall be by Controls Contractor.

H. Insulation:
1. Duct Insulation:
    a. Unless specifically indicated on the drawings the Contractor may line or wrap ductwork to meet insulation requirements.
    b. Fiberglass duct wrap:
        1) Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
        2) Secure insulation without vapor barrier with staples, tape, or wires.
        3) Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
        4) Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
        5) Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
    c. Duct (and Plenum) liner Application:
        1) Install as indicated (sound lining) on the drawings.
        2) Adhere insulation with adhesive for 100 percent coverage. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing. Seal and smooth joints. Seal liner surface penetrations with adhesive.
        3) Duct dimensions indicated are outside dimensions required for airflow.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.

c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
d. Remake leaking joints using new materials and retest until satisfactory results are achieved.

4. Comply with bracing details on plans per seismic note on mechanical sheet M-01.

B. Prepare test and inspection reports.

3.3 SOUND AND VIBRATION ISOLATION

A. All vibrating equipment shall be sound isolated from the structure.
B. The Contractor shall submit all necessary data for each vibration isolator, including static deflection and weight loading, for equipment in operation.
C. Vibration isolators shall have a valid OSHPD approval number.

3.4 JOB COMPLETION

A. Equipment Identification:
1. All equipment furnished under this section shall be provided with the manufacturer's metal identification labels securely attached and showing all pertinent data, including performance characteristics, size, model, and serial number. Labels shall not be obscured in any manner.
2. Identification name plates shall be provided on all equipment and control components, including room thermostat numbers coded to their respective automatic zone damper, valve, or air conditioning unit. Name plates shall be constructed of black bakelite with white center engraved letters three-sixteenth inch (3/16") high and shall be cemented to equipment with an epoxy resin. The Contractor shall submit to the Architect, a complete list of name plate titles for approval prior to installation.
3. Each valve shall be identified by a number brass tag with hole and brass chain mounted on valve stem or handle. Tag shall be a minimum of one and one-half inch (1-1/2") in diameter and numbers shall be at least one-fourth inch (1/4") high stamped into the tag.

B. Identification:
1. See Specification Section 23 05 53 for requirements.

C. Final Operation: Upon completion of the installation of the equipment and after all systems have been tested, cleaned, the Contractor shall place a competent person in charge who shall operate the equipment for a period of three eight-hour days. During this period of operation, all safety and operating controls shall be actuated to demonstrate proper operation. During this operating period, the Owner's representative shall be instructed in all details of operation and maintenance. All required instructions from the equipment manufacturer's representative shall be given during the period.

D. The Automatic Temperature Control (Building Direct Digital Control) Contractor shall be scheduled to be at the job site at the time of the equipment start up

E. Operation Instructions:
1. Prepare a diagram of the entire control system with a full description of the heating, ventilating and air conditioning systems.
2. After approval by the Engineer, the control diagram and complete operating instructions shall be mounted under glass and installed where directed.
3. Prepare two (2) maintenance manuals which shall include all the necessary or pertinent data, such as:
a. Names, addresses and emergency phone numbers of all suppliers and manufacturers.
b. Part numbers of all replaceable items.
c. Oiling and lubrication instructions.
d. Air balance report.
e. Control diagram and operation sequence, together with labeling of controls and instruments to match the diagram.

f. A maintenance schedule which shall list all required maintenance on all equipment furnished under this section of the specifications and the intervals of which the items are to be performed.

4. An identification chart indicating valve operating in the piping system shall be installed as located by the Owner. Identification charts shall be mounted behind glass in a frame.

F. Clean-Up:

1. After all heating, ventilating and air conditioning work has been tested and approved, the Contractor shall thoroughly clean all parts of the equipment installation. Exposed parts which are to be painted are to be thoroughly cleaned of cement plaster and other materials and all greases and oil spots removed with solvent. Exposed rough metal work to be carefully brushed down with steel brushes to remove rust and other spots and left in proper condition to receive painter's finish.
2. Remove all debris from the job site, all cartons, boxes, packing crates, excess materials not used occasioned by the work and to the satisfaction of the Owner.
3. If the above requirements of clean-up are not to the satisfaction of the Owner, the Owner reserves the right to order the work done and the cost of which shall be borne by the Contractor.
4. The Contractor shall remove on a daily basis all debris from the job site, to the satisfaction of the Owner.
5. If the above requirements of clean-up are not to the satisfaction of the Owner, the Owner reserves the right to order the work done by a third party and the cost of which shall be borne by the Contractor.

- END OF SECTION -

DIVISION 26 – ELECTRICAL

SECTION 26 00 00 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

A. Work of this section includes everything necessary for or incidental to completing the electrical work, to provide a complete and operable electrical system, except as herein specifically excluded.

1.2 GENERAL REQUIREMENTS

A. Electrical System Characteristics: 480/277V. 3PH, 4W., 208/120V. 3PH, 4W.

B. Guarantee: Furnish a written guarantee for a period of one-year from date of acceptance.

C. Codes and Regulations: Work done under this Section shall comply with the latest adopted edition of the following: California Electrical Code, State of California Title 24, State Building Standards, Occupational Safety and Health Administration (CAL / OSHA) requirements, State of California Title 17 and to all local codes having jurisdiction. In the case where the codes have different levels of requirements, the most stringent rule shall apply.

D. Wherever a discrepancy in quantity or size of conduit, wire, equipment, devices, circuit breakers, etc., (all materials), arises on the Drawing and/or Specifications, the Contractor shall be responsible for providing and installing all material and services required by the strictest condition noted on Drawings and/or in Specifications to insure complete and operable systems as required by the Owner and Engineer.

E. The General and Supplementary Conditions, as well as Special Conditions apply in addition to items in the Electrical Section. Special attention is directed to the following sections:

1. Drawings and Specifications at the site.

2. Shop drawings and samples.

3. Record drawings.

4. Cutting and Patching.

5. Cleaning up.

6. Guarantee.

7. Tests.

F. Additional Work: Refer to Mechanical and Plumbing drawings and specifications for additional Electrical requirements.

G. Testing:

1. Scan:
   a. Infrascan test for new distribution and branch circuit panels shall be required.
   b. Infrascan test of existing switchboards, distribution and branch circuit panels modified as part of the scope of work shall be required.
   c. Infrascan certified reports shall be submitted on completion to the Owner and Engineer.
   d. Scans shall be performed by an independent testing laboratory with total connected loads in operation.

2. Megger:
   a. New branch circuit - phase, neutral and ground conductors.
   b. New circuits from existing panels.
   c. New insulated bonding conductors.

3. All circuits shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.

4. Grounding System: Shall be tested by an independent testing laboratory to meet resistance specified in Part 3.1, D.3 of these Specifications. It shall be this Contractor's responsibility to make adjustments, as required, to upgrade non-complying systems to proper and safe operation.

5. All certified testing reports shall be submitted to the Owner at completion of project.

H. All Core Cutting, Drilling, and Patching:

1. For the installation of work under this Section, the aforementioned shall be performed under this Section of the Specifications and the Concrete section of the Specifications.

2. No holes will be allowed in any structural members without the written approval of D.S.A. or the Structural Engineer.

3. For penetrations of concrete slabs or concrete footings, the work will be as directed in the Concrete Section of Specifications.

4. The contractor shall be responsible for patching and repairing surfaces where he is required to penetrate for work under this contract.

5. Penetrations shall be sealed to meet the rated integrity of the surface required to be patched and repaired. The patched surface shall be painted or finished to match the existing surface.

I. Verifying Drawings and Job Conditions:

1. This Contractor shall examine all Drawings and Specifications in a manner to be fully cognizant of all work required under this Section.

2. This Contractor shall visit the site and verify existing conditions. Where existing conditions differ from Drawings, adjustment shall be made and allowances included for all necessary equipment to complete all parts of the Drawings and Specifications.

J. Shop Drawings:

1. Drawings shall be submitted in six (6) bound sets accompanied by Letter of Transmittal, which shall give a list of the number and dates of the drawings submitted. Drawings shall be complete in every respect and bound in sets.

2. The Drawings submitted shall be marked with the name of the project, numbered consecutively and bear the approval of the Contractor as evidence that the Drawings have been checked by the Contractor. Any Drawings submitted without this approval will be returned to the Contractor for resubmission.

3. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in his letter of transmittal. If the substitution is accepted, the Contractor shall be responsible for proper adjustment which may be caused by the substitution. Samples shall be submitted when requested.

4. Shop drawings shall be submitted on the following but not limited to:

    a. Branch Circuit panels.

    b. Circuit breakers. Submit mounting hardware for new circuit breakers installed in existing panels.

    c. Safety/Disconnect switches.

    d. Receptacles.

    e. Fuses.

    f. Pull boxes, junction boxes, outlet boxes, covers and wall plates.

    g. Wire/Cable.

    h. Conduit and fittings.

    i. Conduit supports.

K. Drawings of Record: The Contractor shall provide and keep up-to-date, a complete record set of blueprints. These shall be corrected daily and show every change from the original Drawings. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case. Upon completion of the work, a set of reproducible Contract Drawings shall be obtained from the General Contractor and all changes as noted on the record set of prints shall be incorporated thereon with black ink in a neat, legible, understandable and professional manner. Refer to the Supplementary General Conditions for complete requirements.

1.3 WORK IN COOPERATION WITH OTHER TRADES

A. Examine the Drawings and Specifications and determine the work to be performed by the electrical, mechanical, plumbing, building contractor and other trades. Provide the type and amount of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested and ready for use. This shall include all conduit, wire, disconnects, relays, and other devices for the required operation sequence of all electrical, mechanical and other systems or equipment.

B. Provide power and control circuits, conduit and wire as indicated on the Mechanical and Plumbing drawings as required for complete and operable systems.

1.4 TESTING AND ADJUSTMENT

A. Upon completion of all electrical work, this Contractor shall test all circuits, switches, motors, breakers, motor starter(s) and their auxiliary circuits and any other electrical items to insure perfect operation of all electrical equipment.

B. Equipment and parts in need of correction and discovered during such testing shall be immediately repaired or replaced with all new equipment and that part of the system shall then be retested. All such replacement or repair shall be done at no additional cost to the Owner.

C. All circuit shall be tested for continuity and circuit integrity. Adjustments hall be made for circuits not complying with testing criteria.

D. All certified testing reports shall be submitted to the Engineer at completion of project.

1.5 IDENTIFICATION

A. Identification nameplates shall be Micarta 1/8" thick and of approved size, with bevelled edges and engraved white letters 1/4" high minimum on black background. Nameplates shall be provided for all circuits in the distribution switchboards, and selector switches. Inscriptions on equipment shall be identical to those indicated in panels and/or motor control centers and other similar devices. Each nameplate shall be provided with drillings and suitable mounting screws corresponding to finish of the nameplate. The inscriptions in each nameplate shall be as indicated on the Drawings.

B. Identification of Air Conditioning Equipment: Equipment to be so identified shall include, but shall not be limited to: Pressure and temperature controllers; switches; equipment motors and boxes or cans housing other control items. Mechanical equipment nameplates shall have letters a minimum of 3/8" high.

1.6 MAINTENANCE, SERVICING, INSTRUCTION MANUALS AND WIRINGDIAGRAMS

A. Prior to final acceptance of the job, the Electrical Contractor shall furnish to the Owner at least four (4) copies of operating and maintenance and servicing instructions, as well as four (4) complete wiring diagrams for the following item(s) or equipment:

1. Panels.
2. Disconnect switches.
3. Circuit breakers.
4. Receptacles.

B. All wiring diagrams shall specifically cover the system supplied. Typical drawings will not be accepted. Two (2) copies shall be presented to the Electrical Engineer and four (4) copies to the Owner.

1.7 ELECTRICAL CONTRACTOR'S RESPONSIBILITY

A. It shall be the Electrical Contractor's responsibility to obtain a complete set of Drawings and Specifications. He shall check the Drawings of the other trades and shall carefully read the entire Specifications and determine his responsibilities.

B. The contractor shall be responsible for reviewing the plans and specifications to ensure each room, where electrical line or low voltage equipment is to be installed, has sufficient space to accommodate the system cabinets, equipment and terminations while maintaining code mandated clearances about said equipment. The contractor shall identify problem areas prior to bid, include all costs required for corrective measures in his bid and submit alternate equipment and materials suitable for the installation to the Architect/Engineer for acceptance as part of the product submittal process.

1.8 FINAL INSPECTION AND ACCEPTANCE

A. After all requirements of the Specifications and/or the Drawings have been fully completed, representatives of the Owner will inspect the work. Contractor shall provide competent personnel to demonstrate the operation of any item or system to the full satisfaction of each representative.

B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.

1.9 RECORD DRAWINGS

A. Contractor shall furnish one set of reproducible record drawings before final payment of retention.

1.10SUBSTITUTIONS

A. Substitution to specified equipment shall be submitted and received by the Engineer fifteen (15) days after the bid date for review and approval. Obtain D.S.A. approval for all substitutions.
B. To receive consideration, requests for substitutions must be accompanied by documentary proof of its

equality with the specified material. Documentary proof shall be in letter form and identify the specified values/materials alongside proposed equal values/materials. In addition, catalog brochures and samples must be included in the submittal.

C. In the event that authorization is given for a substitute equal to bid, after award of contract the Contractor shall submit to the Engineer certified quotations from suppliers of both the specified and proposed equal material for price comparison and delivery dates.

D. In the event of cost reduction, the Owner will be credited with 100 percent of the reduction, arranged by Change Order.

E. The Contractor warrants that substitutions proposed for specified items will fully perform the functions required.

F. Substitutions or requests for substitution shall not be accepted and rejected for failure to comply with items A-E above.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and Equipment: All electrical materials and equipment shall be new and shall be listed by Underwriter's Laboratories and bear their label, or listed and certified by a nationally recognized testing authority where UL does not have an approval. Custom made equipment must have complete test data submitted by the manufacturer attesting to its safety. In addition, the materials and equipment shall comply with the requirements of the following:

1. American Society of Testing Materials (ASTM).

2. Insulated Cable Engineers Association (ICEA).

3. National Electrical Manufacturer's Association (NEMA).

4. National Fire Protection Association (NFPA).

5. American National Standard Institute (ANSI).

B. Panelboards – Branch Circuit:

1. Branch circuit panelboards shall be of the dead front safety type equipped with thermal-magnetic bolt-on type 40 deg C. circuit breakers. Enclosure shall be minimum 20" wide and 5-3/4" deep unless otherwise noted on plan. Refer to panel schedule for ratings and quantity of circuits to be provided. Panels shall be provided with copper busses. Branch circuit panelboards shall be Eaton or approved equal Siemens, Square D or General Electric. Equipment manufactured by third party OEM is not acceptable.

2. Circuit breakers shall be fully AIC rated. Circuit breakers shall be the number of poles and current capacity as indicated on the panel schedule with terminals/lugs UL listed for 75˚C. Circuit breakers shall be fully coordinated to ensure a local fault does not trip any upstream circuit breaker.

3. Trims shall have doors equipped with flush type combination lock and catch, two milled type keys supplied with each panel. All locks shall be keyed alike and each door shall have a plastic covered directory frame with a typed identification card of all circuit and panel numbers for branch circuit panelboards and engraved lamacoid nameplates for power distribution panelboards.

4. Provide nameplate for all panelboards, 1/8" thick, Micarta or Lamacoid plate of approved size, with bevelled edges and engraved white letters on black background. Install nameplates on exterior trim of panel, above the panel door. Provide Arc-Fault warning labels on panel fronts.

5. All wiring shall be neatly arranged and laced together.

6. All circuit breakers shall be provided with a device for locking circuit breaker in "OFF" position.

7. Refer to Painting Section of these Specifications for all panel finish. Panel shall be primered for painting.

8. Neutral and Ground bus bars shall be full size, rectangular in cross section constructed of copper and interconnections.

9. Refer to Section 26 05 73 for additional requirements. Panelboards and the overcurrent protective device coordination study must be submitted concurrently. A Panelboard submittal that does not include the overcurrent protective device coordination study will be considered incomplete and returned as “rejected”.

C. Conduit:

1. Rigid conduit shall be full weight threaded type aluminum or steel, except where specifically required to be steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metallizing or sherardizing process.

2. Galvanized Rigid Conduit (GRC), shall be full weight threaded type aluminum or steel, except where specifically required to be steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metallizing, or sherardizing process.

3. Intermediate Metal Conduit (IMC), shall be hot-dipped galvanized in accordance with UL 1242 and meeting Federal Specification WWC-581 (latest revision).

4. Electrical Metallic Tubing (EMT), shall be zinc-coated steel with baked enamel or plastic finish on inside surfaces.

5. Flexible metal conduit shall be constructed of aluminum or hot-dipped galvanized steel strips wound spirally with interlocking edges to provide greatest flexibility with maximum strength. Interior surfaces shall be smooth and offer minimum drag to pulling in conductors. Used only as directed by the Engineer.

6. Liquid-tight conduit (Seal-Tite) shall be galvanized steel flexible conduit as above except with moisture and oil-proof jacket, pre-cut lengths and factory installed fittings. For outdoor installations and motor connection.

D. Fittings:

1. Condulet type fittings shall be smooth inside and out, taper threaded with integral insulating bushing and of the shapes, sizes and types required to facilitate installation or removal of wires and cables from the conduit and tubing system. These fitting shall be of metal, smooth inside and out, thoroughly galvanized, and sherardized cadmium plated.

2. Metallic condulet covers shall have the same finish as the fitting and shall be provided for the opening of each fitting where conductor do not pass through the cover.

3. Connector, coupling, locknut, bushings and caps used with rigid conduit shall be steel, threaded and thoroughly galvanized. Bushings shall be insulated.

4. EMT fittings, connectors and couplings, shall be steel, zinc or cadmium plated, raintight, threadless, compression or tap-on multiple point, steel locking ring type with insulated throat.

5. Flexible steel conduit connectors shall be or malleable iron clamp or squeeze type or steel twist-in type with insulated throat. The finish shall be zinc or cadmium plating.

6. Die cast, set screw or indenter type fittings are not acceptable.

7. Conduit unions shall be "Erickson" couplings, or approved equal. The use of running threads will not be permitted.

E. 600 Volt Conductors - Wire and Cable:

1. All conductors shall be copper. Simpull or equal.

2. Type THHN/THWN thermoplastic, 600 volt, UL approved, dry and wet locations, for conductor sizes up to and including #4 AWG.

3. Type XHHW cross-linked synthetic polymer, 600 volt, UL approved, for dry and wet locations, for conductor sizes #2 AWG. and above.

4. Cross-linked synthetic polymer, XHHW, 600 volts, UL approved, for installation underground, in concrete or masonry.

5. Wire and cable shall be new, manufactured not more than six (6) months prior to installation, shall have size, type of insulation, voltage rating and manufacturer's name permanently marked on outer covering at regular intervals.

6. Wire and cable shall be factory color coded by integral pigmentation with a separate color for each phase and neutral. Each system shall be color coded and it shall be maintained throughout.

7. Systems Conductor Color Coding:

   a. Power 480/277V, 3PH, 4W:
      (1) Phase A = Brown
      (2) Phase B = Orange
      (3) Phase C = Yellow
      (4) Neutral = White

   b. Power 208/120V, 3PH, 4W:
      (1) Phase A = Black
      (2) Phase B = Red
      (3) Phase C = Blue
      (4) Neutral = White

   c. Ground Conductors:
      (1) Green

8. All color coding for #8 conductor and above shall be as identified above, utilizing phase tape at each termination.

9. No conductors carrying 120 volt or more shall be smaller than #12 AWG.

F. Junction and Pullboxes:

1. For outside, damp or interior/exterior surface mounted locations, boxes shall be heavy cast aluminum or cast iron with removable, gasketed, non-ferrous machine screw secured covers.

2. All boxes shall be sized for the number and sizes of conductors and conduits entering the box and equipped with plaster rings where required. Each conductor shall be terminated at an insulated, barriered terminal connector and completely identified with an engraved fiber identification marker, Electrovert or Underwriter's Safety Device Company.

G. Outlet Boxes:

1. For surface mounting, wet or damp locations, outlet boxes shall be heavy cast aluminum or cast iron with threaded hubs, covers shall be watertight with gaskets and non-ferrous screws.

2. For locations where standard boxes are not suitable due to number and size of conduit to be terminated, special boxes shall be designed to fit space or meet other requirements and submitted for approval.

H. Switches:

1. Switches controlling or disconnecting single phase motor loads in excess of 1/3HP shall be horsepower rated and approved or motor control service. Switches shall be complete with overload device of proper motor nameplate rating, where required.

2. Disconnect (safety) switches shall be fused, heavy duty type meeting NEMA Specifications. Switches shall be provided with rejection type fuse blocks. Provide switches with the number of poles, the voltage, current and horsepower ratings as required. Provide externally operable, quickmake, quick-break type mechanism with cover interlock and padlockable in either the open or closed position. Unless indicated otherwise, provide switches indoors in NEMA Type 1 enclosure and in NEMA Type 3R rain-tight enclosure where indicated to be outdoors or weatherproof. Provide nameplate indicating equipment served. Provide unit as manufactured by Challenger or approved equal Siemens or Westinghouse.

3. Disconnect switches located outdoors/aboveground shall be Nema 4X stainless steel.

I. Receptacles:

1. Receptacles shall consist of duplex convenience receptacle mounted in a surface/cast box on the wall, and shall be complete with plate/cover.

2. Receptacles for convenience outlets, unless otherwise indicated, shall be industrial heavy duty type, duplex 3W grounding type, 20A, 125V, Hubbell-Bryant #5362-*. (*) color as selected by Architect.

3. Indoor receptacle located in damp/wet locations shall be industrial heavy duty type, ground fault interrupter, 20 ampere, three wire grounding type, 120 volt, Hubbell-Bryant # GF-5362-I.

4. Receptacles located outdoors shall be industrial heavy duty type, ground fault interrupter, 20 ampere, three wire grounding type, 120 volt, Hubbell-Bryant # GF-5362-I mounted in PVC coated box with lockable lift cover U.L. listed for “wet” locations when in operation.

5. Specialty receptacles, identified on plans, for use with Owner furnished equipment shall be provided complete with outlet box, wall plate and receptacle to match the configuration of the plug being provided with the subject equipment.

J. Painting:

1. Junction boxes, pull boxes, etc., and conduit installed exposed/surface mounted indoors and in public view shall be painted with colors selected by the Owner to match the subject surface. Refer to painting section of the specifications for additional requirements.

K. Seismic Design and Anchoring of Electrical Equipment:

1. Seismic anchorage of electrical equipment shall conform to C.C.R. Title 24, 2022 CBC. Anchorage details for roof/floor mounted equipment shall be as shown on plans.

PART 3 - EXECUTION

3.1 PREPARATION AND INSTALLATION

A. Installation of Conduit and Outlet Boxes:

1. All interior conduit run exposed shall be galvanized rigid steel conduit (GRC), or intermediate metal conduit (IMC). Exterior exposed conduit shall be PVC coated steel.

2. Rigid conduit may be installed under floor slabs, under concrete sidewalls an as noted on the Drawings. Rigid conduit installed under slabs shall be 1" trade size minimum and shall be wrapped with 20 mil. polyvinyl chloride plastic tape.

3. All conduit except as hereinafter specified, installed in concrete/masonry, damp locations, hazardous locations, surface mounted up to 8’-0” above finished floor or subject to mechanical injury shall be heavy wall, threaded, galvanized rigid steel conduit (GRC), or intermediate metal conduit (IMC).

4. Flexible steel conduit shall only be permitted to be used at light fixture outlets and connections to vibrating electrical equipment. All flexible steel conduit runs shall be less than 6'-0". All outdoor installation shall be made using liquid-tight flex with approved fittings. Use of flexible conduit shall be as approved by the Engineer.

5. Intermediate metal conduit (IMC), is approved for use in all locations as approved for GRC or EMT and in accordance with Article 345 of CEC and UL Information card #DYBY.

6. All conduit installed in the dry walls or ceilings of the building shall be steel tube (EMT), Galvanized Rigid Steel (GRC), or Intermediate Metal Conduit (IMC).

7. Conduit shall be run so as not to interfere with other piping fixtures or equipment.

8. The ends of all conduit shall be cut square, carefully reamed out to full size and shall be shouldered in fitting.

9. No running threads will be permitted in locations exposed to the weather, in concrete or underground. Special union fittings shall be used in these locations.

10. PVC conduit shall not be run in walls or above grade.

11. Where conductors enter a raceway in a cabinet, pull box, junction box, or auxiliary gutter, the conductors shall be protected by a plastic bushing type fitting providing a smoothly rounded insulating surface.

12. Where conduit extends through roof to equipment on roof area, this Contractor shall provide 24 gauge galvanized sheet metal flashing cones with 4" flanges on roof surface. This flashing shall be delivered to the roofing contractor for installation. The actual location of all such roof penetrations and outlet shall be verified by the Contractor.

13. All conduit shall be supported at intervals not less than 10'-0" and within 12" from any outlet and at each side of bends and elbows. Conduit supports shall be galvanized, heavy stamped, two hole conduit clamp properly secured to structure.

14. Where conduit racks are used the rack shall consist of two piece conduit clamps attached to galvanized steel slotted channels, properly secured via threaded rods attached directly to the building structure.

15. Nail-in conduit supports will not be allowed. One piece set-screw type conduit clamps or perforated iron for supporting conduit will not be permitted.

16. Seismic Conduit Support:

    a. All conduit shall be supported in such a manner that it is securely attached to the structure of the building. Attachment is to be capable of supporting the tributary weight of conduit and contents in any direction. Maximum spacing of support and braces are to be as follows:

CONDUIT SIZE	MAXIMUM SPACING
EMT, IMC	10'-0"
GRC (3/4" thru 1 ½")	10'-0"
GRC (2" thru 2½")	16'-0"
GRC (3" and larger)	20'-0"

17. All conduit runs shall be installed parallel or perpendicular to walls, structural members, or intersection of vertical planes and ceilings. Field made bends and offset shall be avoided where possible. Crushed or deformed raceway shall not be installed.

18. Open knockouts in outlet boxes only where required for inserting conduit.

19. All boxes shall be covered with outlet box protector, Appleton SB-CK. Keep dirt from entering box or panels. If dirt does get in, it shall be removed prior to pulling wires.

20. Exterior conduits installed on building walls shall be provided with a painted sheet metal cover to conceal the conduit from public view. Sheet metal cover shall be rectangular, 4" deep maximum, width required to conceal the conduits and the conduit supports, full height of wall, secured to the building with ½" anchors and painted with weatherproof paint to match building finish/color.

21. All conduit entries to outdoor mounted panels, cabinets, boxes, etc., shall be made using Myers "SCRU-TITE" hubs Series ST.

22. All conduit shall have a 200 lb test poly-propylene pull line left in place for future use in all runs tagged with a plastic tag at terminating end indicating the location of the opposite end of the conduit.

23. All rotating electrical equipment shall be supplied with flexible, liquid-tight conduit with appropriate slack and shall not exceed thirty-six (36) inches.

24. All multiple conduit runs within suspended ceilings shall be suspended from building structure by means of unistrut hangers/rack, see note 14. Refer to note 13 for support of single conduit runs within suspended ceilings. Conduit shall not be allowed to lay on ceiling or be supported from ceiling suspension wires or other suspension system.

25. Provide conduit only for routing of HVAC control wiring. Refer to Mechanical drawings for conduit requirements.

B. Installation of 600 Volt Conductors:

1. All line voltage wire, including control circuits, shall be installed in conduit.

2. All circuits and feeder wires for all systems shall be continuous from the service point to terminal or farthest outlet. No joints shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.

3. Thoroughly clean all conduit and wire-ways and see that all parts are perfectly dry before pulling any wires. No joint shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.

4. Install UL approved, fixture wire from all lighting fixture lamp sockets into fixture outlet or junction box.

C. Joints in 600 Volt Conductors:

1. Joints in 600 volt conductors smaller than No. 4 AWG shall be made with Scotchlok spring type connectors. Wires No 4 AWG and larger shall be joined together with approved type of pressure connector and taped with #33 3M tape, three (3) layers minimum to provide insulation not less than that of conductor. Connections to switch or busbar shall be made with one-piece copper lugs. Splicing of all 600 volt or less in-line connections #2 AWG through 350 MCM shall be made with 3M brand PST connector.

2. Joints/splices shall be done in junction or pull boxes.

D. Grounding:

1. Provide grounding for entire electric installation as shown on plans and as required by applicable codes. Included as requiring grounding are:

   a. Conduit.
   b. Neutral or identified conductors of interior wiring system.
   c. Non-current carrying metal parts of fixed equipment.
   d. Branch circuit panelboards.

2. Grounding and bonding conductors shall be sized per the latest edition of the California Code of Regulations, Title 24, State of California and CEC.

3. Provide and install an equipment grounding conductor in all feeder and branch circuit conduits.

4. Grounding resistance to ground shall not exceed 25 ohm.

E. Prefabricated Equipment: Installation of all prefabricated items and equipment shall conform to the requirements of the manufacturer's specifications and installation instruction pamphlets. Where code requirements affect installation of materials and equipment, the more stringent requirements, code or manufacturer's instructions and/or specifications, shall govern the work.

END OF SECTION

DIVISION 26 – ELECTRICAL

SECTION 26 05 73 – OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes arc flash study and short circuit and protective device coordination study encompassing portions of electrical distribution system from normal power source or sources up to and including breakers in service entrance switchboard, main breaker in sub-distribution panels, main breaker in each panelboard. The study shall be limited to the portion of the electrical power distribution system affected by the scope of work indicated on the plans, up to and including, the main service switchboard.

B. Adjustable circuit breaker settings and non-adjustable circuit breaker selections shall be based on the results of the coordination study to ensure a local fault does not trip any upstream circuit breaker. Refer to 26 05 73 Item 1.7 for additional requirements.

C. Device Coordination study and Arc Flash study shall be performed by a third party professional Engineer licensed in the State of California. The engineer performing the study shall be responsible for contacting the serving utility company and obtaining the available short circuit at the service entrance equipment. The available short circuit current provided by the serving utility company shall serve as the basis for the study.

D. The engineer performing the study shall be responsible for field verifying the manufacturer, type, rating and characteristics of existing electrical equipment.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).

B. National Fire Protection Association:
   1. NFPA 70 - California Electrical Code.

1.3 DESIGN REQUIREMENTS

A. Complete Short Circuit and Protective Device Coordination Study to meet requirements of NFPA 70.

B. Report Preparation:
   1. Prepare study prior to ordering distribution equipment to verify equipment ratings required.
   2. Perform study with aid of computer software program.
   3. Obtain actual settings for packaged motor characteristics for equipment incorporated into Work.
   4. Calculate short circuit interrupting and, when applicable, momentary duties for assumed 3-phase bolted fault short circuit current and phase to ground fault short circuit current at each of the following:
      a. Utility supply bus.
      b. Automatic transfer switch.
      c. Engine generator.
      d. Low-voltage switchgear.
      e. Switchboards.

f. Distribution panelboards.
g. Branch circuit panelboards.
h. Each other significant equipment location throughout system.

C. Report Contents:
1. Include the following:
a. Calculation methods and assumptions.
b. Base per unit value selected.
c. One-line diagram.
d. Source impedance data including power company system available power and characteristics.
e. Typical calculations.
1) Fault impedance.
2) X to R ratios.
3) Asymmetry factors.
4) Motor fault contribution.
5) Short circuit kVA.
6) Symmetrical and asymmetrical phase-to-phase and phase-to-ground fault currents.
7) Tabulations of calculation quantities and results.
f. One-line diagram revised by adding actual instantaneous short circuits available.
g. State conclusions and recommendations.
2. Prepare time-current device coordination curves graphically indicating coordination proposed for system, centered on conventional, full-size, log-log forms.
3. Prepare with each time-curve sheet complete title and one-line diagram with legend identifying specific portion of system covered by that particular curve sheet.
4. Prepare detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
5. Plot device characteristic curves at point reflecting maximum symmetrical fault current to which device is exposed. Include on curve sheets the following:
a. Power company relay characteristics.
b. Power company fuse characteristics.
c. Low voltage equipment circuit breaker trip device characteristics.
d. Low voltage equipment fuse characteristics.
e. Cable damage point characteristics.
f. Pertinent transformer characteristics including:
1) Transformer full load current.
2) Transformer magnetizing inrush.
3) ANSI transformer withstand parameters.
4) Significant symmetrical fault current.
g. Pertinent motor characteristics.
h. Other system load protective device characteristics.

1.4 SUBMITTALS

A. Qualifications Data: Submit the following for review prior to starting study.
1. Submit qualifications and background of firm.
2. Submit qualifications of Professional Engineer performing study.

B. Software: Submit for review information on software proposed to be used in performing study.

C. Product Data: Submit the following:
1. Report: Summarize results of study in report format including the following:
a. Descriptions, purpose, basis, and scope of study.
b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.

c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
d. Fault current calculations including definition of terms and guide for interpretation of computer printout.

D. Submit copies of final report signed by professional engineer. Make additions or changes required by review comments.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with CEC requirements.

B. Maintain one copy of each document on site.

C. Use commercially available software, designed specifically for short circuit and protective device coordination studies with minimum of five years documented availability.

D. Perform study in accordance with IEEE 242.

1.6 QUALIFICATIONS

A. Study Preparer: Company specializing in performing work of this section with minimum five years documented experience and having completed five projects of similar size and complexity within the past two years.

B. Perform study under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of California with minimum of five years experience in power system analysis.

C. Demonstrate company performing study has capability and experience to provide assistance during system start up.

1.7 SEQUENCING

A. Submit short circuit and protective device coordination study to Architect/Engineer prior to receiving final approval of distribution equipment shop drawings and prior to releasing equipment for manufacturing.

B. When formal completion of study will cause delay in equipment manufacturing, obtain approval from Architect/Engineer for preliminary submittal of study data sufficient in scope to ensure selection of device ratings and characteristics will be satisfactory.

1.8 SCHEDULING

A. Schedule work to expedite collection of data to ensure completion of study for final approval of distribution equipment shop drawings prior to release of equipment for manufacturing.

1.9 COORDINATION

A. Coordinate work with local power company.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Provide assistance to electrical distribution system equipment manufacturer during start up of electrical system and equipment.

3.2 ADJUSTING

A. Perform field adjustments of protective devices and modifications to equipment to place equipment in final operating condition. Adjust settings in accordance with approved short circuit and protective device coordination study.

END OF SECTION

Carrier
turn to the experts

Sigler

COMMERCIAL HVAC DIVISION

S U B M I T T A L

Contractor: **Lynwood Unified School District** **Job Name:** Lynwood USD Firebaugh HS
Date: 10/18/2024

Mark For	Qty	Model Number	Description
All Units Include Sigler Pass Services			
Admin/Library			
AC-72-73	2	48FCDM28AJM6-3U0A0	Nominal 25 Ton Cooling GE RTU, 460-3-60 ♦ *Low Gas heat* ♦ *Two-Stage Cooling single circuit* ♦ *"ULTRA LOW LEAK EconoMi$er X, temperature economizer, barometric relief and W7220 economizer controller . Vertical & Horizontal Air, Flow"* ♦ *High Static, Horiz Supply* ♦ *"Round Tube Plate Fin (RTPF) Al/Cu Condenser Coil, Al/Cu Evaporator Coil with Louvered Hail Guard"* ♦ *SystemVu Controller*
	2	♦ *PCC-MRT69CA-D-4L6*	♦ *Modulating Power Exhaust, 6HP, 460-3-60 *Field Installed*
AC-74	1	48FCDM20AJM6-3U0A0	Nominal 17.5 Ton Cooling GE RTU, 460-3-60 ♦ *Low Gas heat* ♦ *Two-Stage Cooling single circuit* ♦ *"ULTRA LOW LEAK EconoMi$er X, temperature economizer, barometric relief and W7220 economizer controller . Vertical & Horizontal Air, Flow"* ♦ *High Static, Horiz Supply* ♦ *"Round Tube Plate Fin (RTPF) Al/Cu Condenser Coil, Al/Cu Evaporator Coil with Louvered Hail Guard"* ♦ *SystemVu Controller*
	1	♦ *PCC-MRT69CA-D-4L4*	♦ *Modulating Power Exhaust, 4HP, 460-3-60 *Field Installed*
GYM			
AC 58 and 59	2	48K4AG50-5-6A0B0A0	Nominal 50 Ton Cooling GE RTU, 460-3-60 ♦ *Standard Efficiency, Low Sound, Digital Compressor* ♦ *R454B* ♦ *Low Gas Heat, 2-Stage* ♦ *SAV, Horizontal Supply, Horizontal Return* ♦ *Single Wall* ♦ *Standard [Standard SCCR, Terminal Block]* ♦ *30 HP ODP Motor, Variable Frequencey Drive (VFD)* ♦ *Standard [Hinged Doors, DX Pressure Sensors]* ♦ *Ultra Low Leak Economizer* ♦ *Standard [SmartVu, OAT, RAT, DX LAT Sensors]* ♦ *Galvanized DP, Al/Cu Evap, MCHX Cond* ♦ *2" Pre-Filter Rack with 2 Throwaway Filter*
	2	♦ *1090-3104-LA910*	♦ *Modulating Power Exhaust, 12HP, 460-3-60 *Field Installed*
AC-60	1	48FCDM12A3M6-3A0A0	Nominal 10 Ton Cooling GE RTU, 460-3-60 ♦ *Low gas heat* ♦ *Single circuit, two stage cooling* ♦ *Direct drive, EcoBlue, high static fan* ♦ *Al/Cu cond. Coil – Al/Cu evap coil hail guard*

			♦ *SystemVu Controller*
	1	♦ *PECH-SRT34CB-D0DB-4L2-4*	♦ *Horizontal Discharge Economizer, No Controls, Belimo Actuator, w/ Modulating Power Exhaust, 2HP, 460-3-60 *Field Installed*

CONTENTS OF SUBMITTAL:

- PRODUCT DESCRIPTION, PERFORMANCE DATA, DIMENSIONAL DATA, AND ACCESSORY DATA.

REGARDING UNITS WITH POWER EXHAUST

SOME OF THE UNITS SUBMITTED FOR THIS PROJECT HAVE NON-FACTORY POWER EXHAUST MODULES. WHILE THE PACKAGE UNIT AND POWER EXHAUST ARE INDIVIDUALY APPROVED BY ETL OR UL, THE COMBINATION OF THE TWO IS NOT. LOCAL CODES PERMITTING, POWER EXHAUST WIRING CAN BE ROUTED TO THE PACKAGE UNIT'S TERMINAL STRIP. SEPARATE POWER SOURCE FOR POWER EXHAUST MAY BE REQUIRED DEPENDING ON LOCAL CODES.

NOTES:

- ONE APPROVED COPY OF SUBMITTAL MUST BE RETURNED MARKED "APPROVED" OR "APPROVED AS NOTED" FOR EQUIPMENT TO BE RELEASED FOR FABRICATION TO THE FACTORY.
- **THE INFORMATION CONTAINED HEREIN IS PROVIDED FOR INFORMATIONAL PURPOSES ONLY FOR THE DESIGNER OF RECORD'S EVALUATION. IT DOES NOT CONSTITUTE OR IMPLY ANY OPINION, REPRESENTATION, OR WARRANTY WHATSOEVER, INCLUDING BUT NOT LIMITED TO THE SYSTEM DESIGN'S FITNESS FOR ITS INTENDED PURPOSE.**

SUBMITTALS RETURNED REQUIRING ADDITIONAL, OR MODIFIED, DATA WILL BE RE-SUBMITTED BY SIGLER. RELEASE FOR FABRICATION WILL COMMENCE WHEN AN "APPROVED" SUBMITTAL IS RETURNED TO OUR OFFICES.

REVISION: ORIGINAL

SUBMITTED BY: Travon Chadwick

PREPARED BY: Alex Chang

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SECTION I. ROOFTOP UNITS

SECTION II. ROOFTOP ACCESSORIES

Sigler

COMMERCIAL HVAC DIVISION
205 S. Puente Street
Brea, CA. 92821

SECTION I. ROOFTOP UNITS

Sigler

COMMERCIAL HVAC DIVISION
205 S. Puente Street
Brea, CA. 92821

AC-72-73

Tag Cover Sheet
Unit Report
Certified Drawing
Performance Report

Unit Report For AC-72-73

Project: Lynwood USD Firebaugh HS
Prepared By:

10/17/2024
06:30PM

Unit Parameters

Unit Model: **48FCDM28AJM6-3U0A0**
Unit Size: **28 (25 Tons)**
Volts-Phase-Hertz: **460-3-60**
Heating Type: **Gas**
Heat Control: **Low Heat**
Duct Cfg: **Horizontal Supply / Horizontal Return**
DX Options: **Two Stage Cooling/Single Circuit**

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **11' 9.5"**
Unit Width: **7' 2.375"**
Unit Height: **3' 11.75"**
Total Operating Weight: **2394** lb

*** Weights and Dimensions are approximate. Weight does not include unit packaging. Approximate dimensions are provided primarily for shipping purposes. For exact dimensions and weights, refer to appropriate product data catalog.

Lines and Filters

Gas Line Size: **3/4**
Condensate Drain Line Size: **3/4**
Return Air Filter Type: **Throwaway**
Return Air Filter Quantity: **9**
Return Air Filter Size: **20 x 25 x 2**

Selection includes construction throwaway filter into the base fan curve.

Unit Configuration

High Static Option - Horizontal Models
Al/Cu - Al/Cu - Louvered Hail Guard
SystemVu Controller
Temperature Ultra Low Leak Economizer w/Baro Relief, Vertical and Horizontal Airflow
Standard Packaging

Warranty Information

1-Year parts(std.)
5-Year compressor parts(std.)
10-Year heat exchanger - Aluminized(std.)
3-Year SystemVu Controller

No optional warranties were selected.

NOTE: Please see Warranty Catalog 500-089 for explanation of policies and ordering methods.

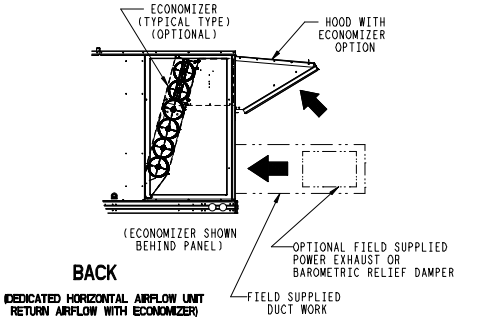
Ordering Information

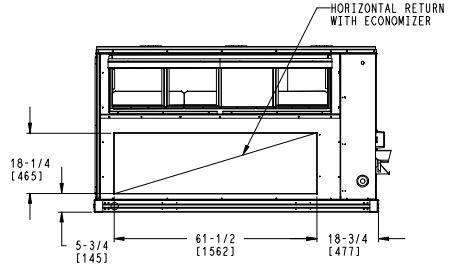
Part Number	Description	Quantity
48FCDM28AJM6-3U0A0	Rooftop Unit	2
	Base Unit	
	Al/Cu - Al/Cu - Louvered Hail Guard	
	SystemVu controller, ULTRA LOW LEAK EconoMi$er2 temperature economizer with barometric relief. Syst	

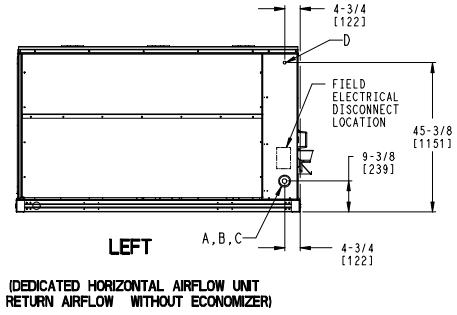
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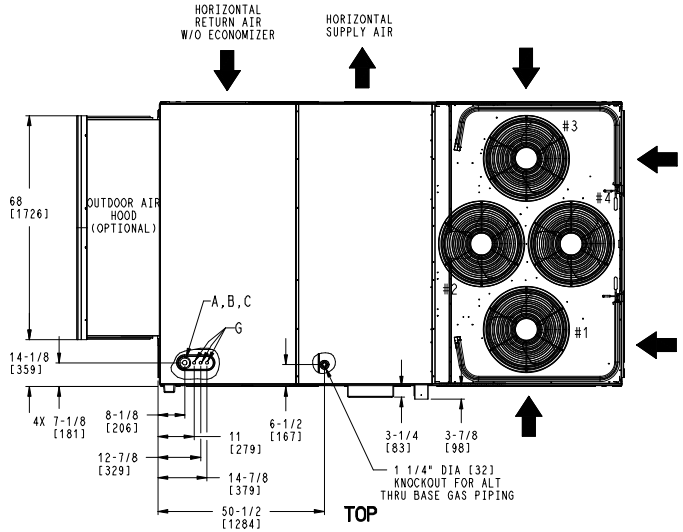
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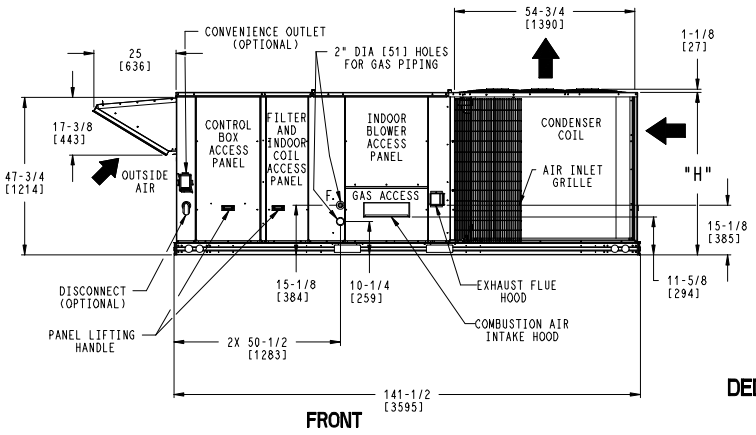


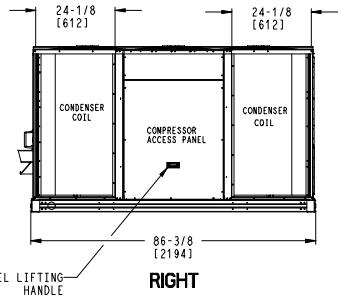
	CONNECTION SIZES
A	1 3/8" DIA [35] FIELD POWER SUPPLY KNOCKOUT
B	3" DIA [76] FIELD POWER SUPPLY KNOCKOUT
C	3 5/8" DIA [92] FIELD POWER SUPPLY KNOCKOUT
D	7/8" DIA [22] FIELD CONTROL WIRING HOLE
F	3/4"-14 NPT GAS CONNECTION (NOT SHOWN)
G	7/8" DIA [22] FIELD CONTROL WIRING KNOCKOUT

UNIT	H
24 SIZE	49-3/8 [1253]
28 SIZE	57-3/8 [1456]

NOTES:

1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY
3. DIRECTION OF AIR FLOW
4. ALL VIEW DRAWN USING 3RD ANGLE





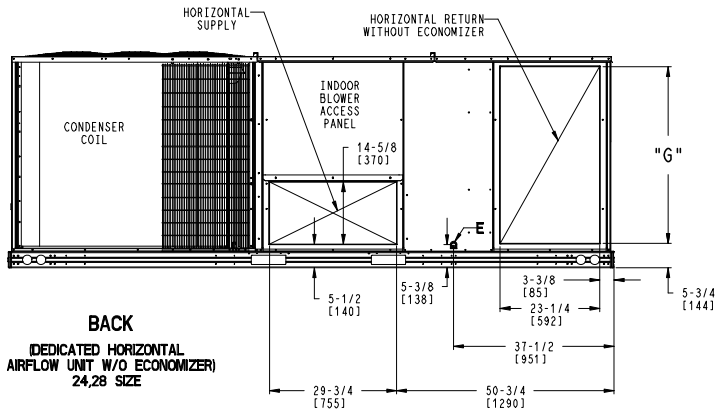
DEDICATED HORIZONTAL AIRFLOW UNIT 24,28 SIZE

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	48FC 24,28 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT		REV
U.S. ECCN:NSR	2 OF 5	02/10/22	-		50HE003872	-

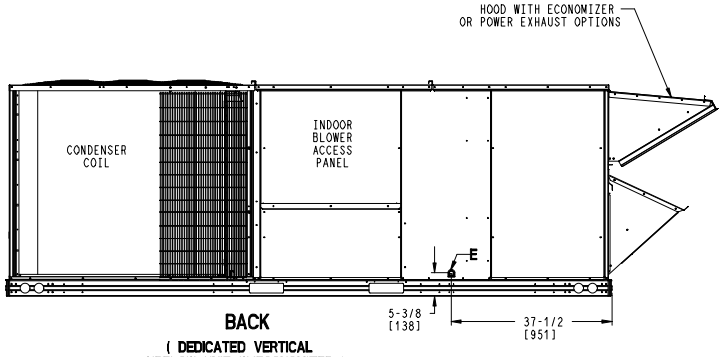
	CONNECTION SIZES
E	3/4"-14 NPT CONDENSATE DRAIN

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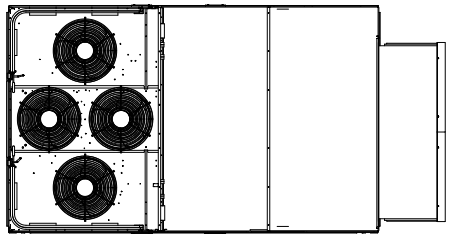
UNIT	G
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28 SIZE	49-1/4 [1251]



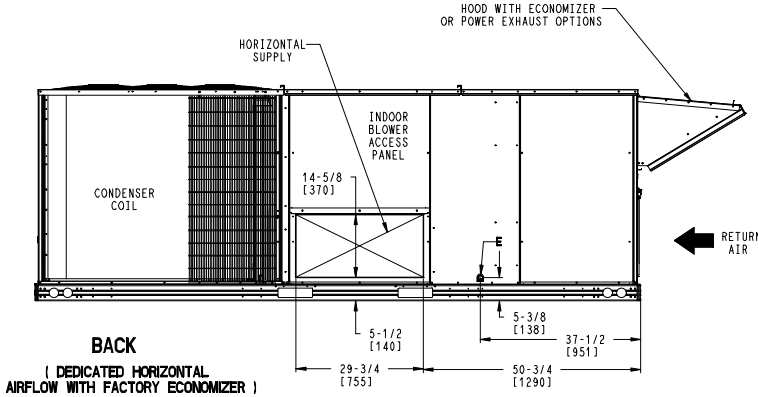
BACK
(DEDICATED HORIZONTAL AIRFLOW UNIT W/O ECONOMIZER) 24,28 SIZE



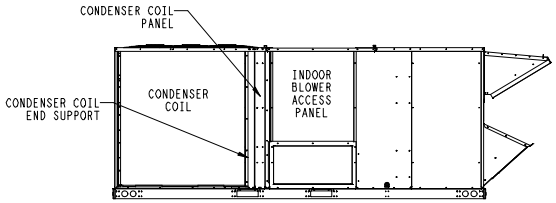
BACK
(DEDICATED VERTICAL AIRFLOW UNIT W/ECONOMIZER) 24,28 SIZE



28 SIZE CONDENSER COIL TOP VIEW



BACK
(DEDICATED HORIZONTAL AIRFLOW WITH FACTORY ECONOMIZER) 24,28 SIZE



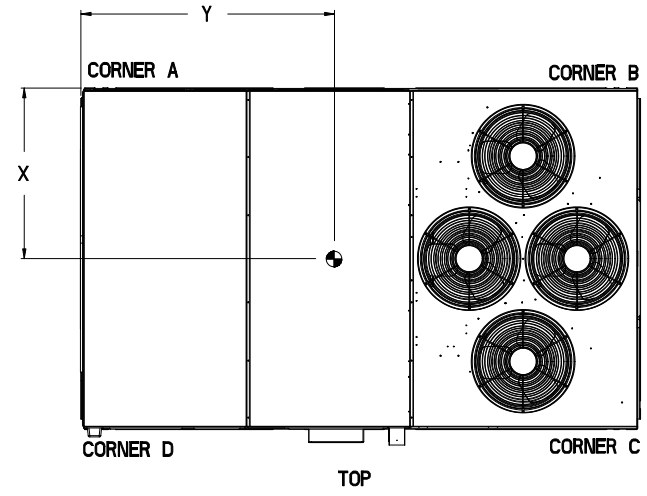
28 SIZE CONDENSER COIL END BRACKET SUPPORT

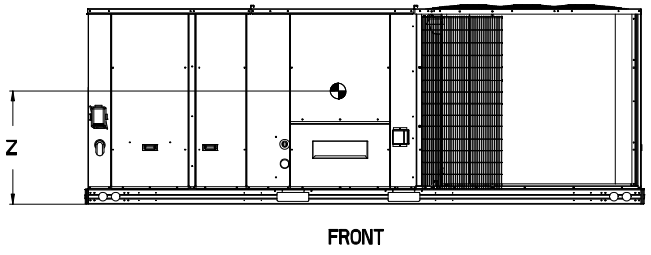
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
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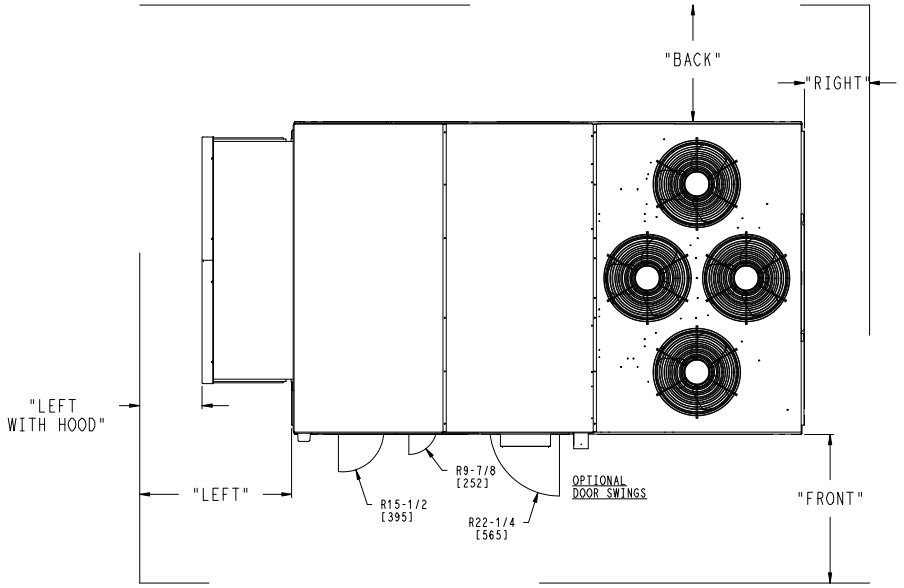
UNIT	STD UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48FC24	2000	907	429	195	505	229	576	261	489	222	76 1/2 [1943]	46 [1168]	16 1/2 [419]
48FC28	2174	986	458	208	583	264	634	288	498	226	79 1/4 [2013]	45 [1143]	19 [483]

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* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.







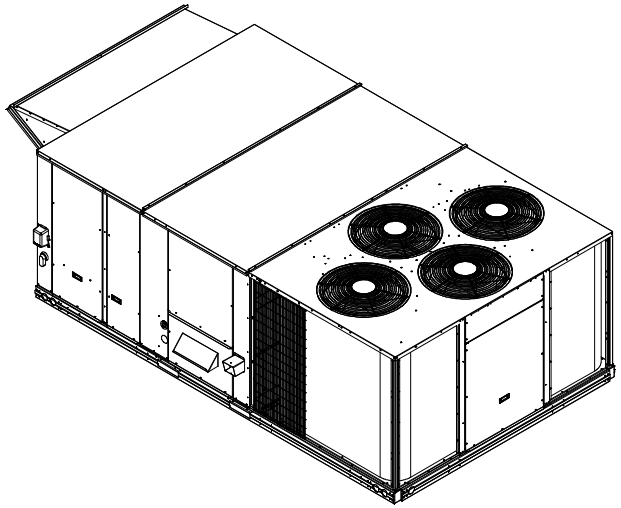
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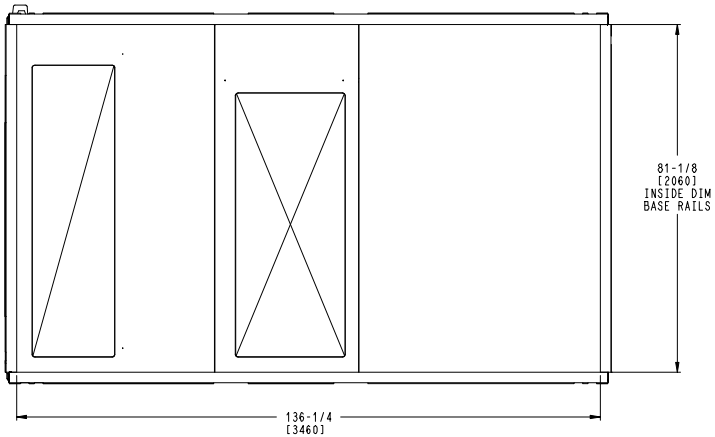
1. CLEARANCE ABOVE THE UNIT TO BE 72"
2. FOR ALL MINIMUM CLEARANCES LOCAL CODES OR JURISDICTIONS MAY PREVAIL.

CLEARANCE			
	SERVICE WITH:	SERVICE WITH:	OPERATING
SURFACE	CONDUCTIVE BARRIER	NONCONDUCTIVE BARRIER	CLEARANCE
FRONT	48 [1219mm]	36 [914mm]	18 [457mm]
LEFT	48 [1219mm]	42 [1067mm]	18 [457mm]
BACK	42 [1067mm]	36 [914mm]	18 [457mm]
LEFT WITH HOOD	36 [914mm]	36 [914mm]	18 [457mm]
RIGHT	36 [914mm]	36 [914mm]	18 [457mm]
TOP	72 [1829mm]	72 [1829mm]	72 [1829mm]

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	4 OF 5	02/10/22	-	48FC 24,28 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	50HE003872	-

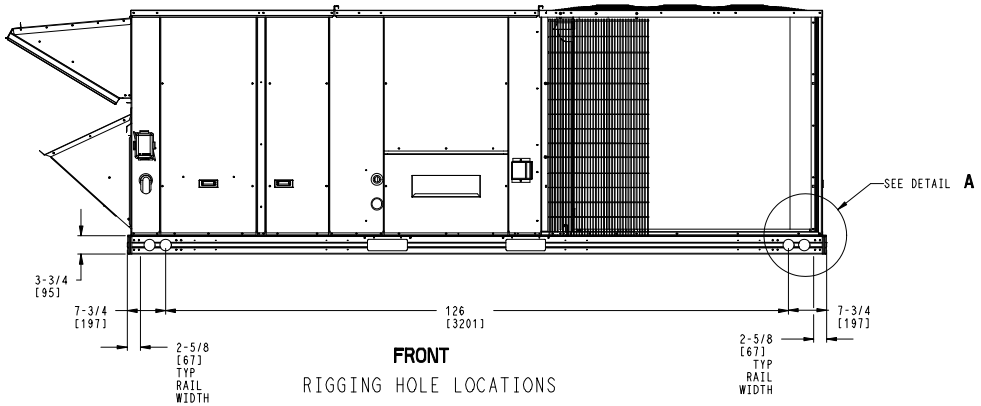
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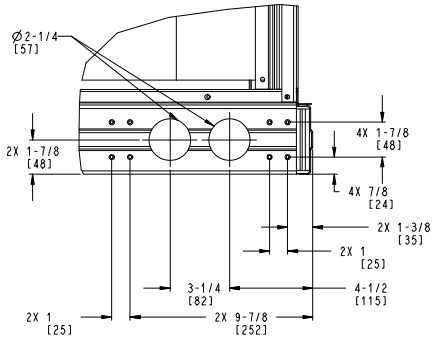
BOTTOM

INSIDE BASERAIL DIMENSIONS



FRONT

RIGGING HOLE LOCATIONS



DETAIL **A**
TYP 4 PLCS

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	48FC 24,28 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	50HE003872	REV
U.S. ECCN:NSR	5 OF 5	02/10/22	-			-

Part Number:48FCDM28AJM6-3U0A0

ARI EER:	**9.80**	
IEER:	**14.0**	

Base Unit Dimensions

Unit Length:	**141.5**	in
Unit Width:	**86.4**	in
Unit Height:	**47.8**	in

Operating Weight

Base Unit Weight:	**2047**	lb
Al/Cu - Al/Cu - Louvered Hail Guard:	**100**	lb
SystemVu Controller:	**2**	lb
Temperature Ultra Low Leak Economizer w/Baro Relief, Vertical and Horizontal Airflow:	**245**	lb
Total Operating Weight:	**2394**	lb

Unit

Unit Voltage-Phase-Hertz:	**460-3-60**	
Air Discharge:	**Horizontal**	
Fan Drive Type:	**Vane Axial**	
Actual Airflow:	**10000**	CFM
Site Altitude:	**0**	ft

Cooling Performance

Condenser Entering Air DB:	**95.0**	F
Evaporator Entering Air DB:	**80.0**	F
Evaporator Entering Air WB:	**67.0**	F
Entering Air Enthalpy:	**31.44**	BTU/lb
Evaporator Leaving Air DB:	**59.6**	F
Evaporator Leaving Air WB:	**57.7**	F
Evaporator Leaving Air Enthalpy:	**24.86**	BTU/lb
Gross Cooling Capacity:	**295.97**	MBH
Gross Sensible Capacity:	**220.47**	MBH
Compressor Power Input:	**23.89**	kW
Coil Bypass Factor:	**0.174**	

Heating Performance

Heating Airflow:	**10000**	CFM
Entering Air Temp:	**70.0**	F
Leaving Air Temp:	**86.5**	F
Gas Heating Input Capacity:	**176.0 / 220.0**	MBH
Gas Heating Output Capacity:	**142.0 / 178.0**	MBH
Temperature Rise:	**16.5**	F
Thermal Efficiency (%):	**81.0**	

Supply Fan

External Static Pressure:	**0.50**	in wg
Options / Accessories Static Pressure		
Economizer:	**0.10**	in wg
Application External Static (ESP + Unit Opts/Acc.):	**0.60**	in wg
Fan RPM:	**2030**	
Fan Power:	**6.27**	BHP
NOTE:	**Selected IFM RPM Range: 250 - 2170**	

Selection includes construction throwaway filter into the base fan curve. This filter is not MERV Rated.

Electrical Data

Voltage Range:	**414 - 506**	
Compressor #1 RLA:	**18.6**	

Compressor #1 LRA:	**125**
Compressor #2 RLA:	**18.6**
Compressor #2 LRA:	**125**
Indoor Fan Motor Type:	**HIGH-HORZ**
Indoor Fan Motor FLA (Total):	**5.6**
Combustion Fan Motor FLA (ea):	**0.3**
Power Supply MCA:	**56.7**
Power Supply MOCP (Fuse or HACR):	**70**
Disconnect Size FLA:	**60**
Disconnect Size LRA:	**274**
Electrical Convenience Outlet:	**None**
Outdoor Fan [Qty / FLA (ea)]:	**4 / 0.9**

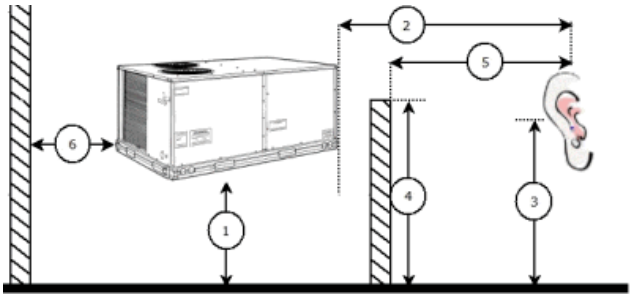
Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

Acoustics

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	84.9	83.8	97.1
125 Hz	86.2	82.9	88.3
250 Hz	87.8	77.0	84.4
500 Hz	82.7	74.7	83.3
1000 Hz	82.7	74.0	80.7
2000 Hz	81.4	69.2	77.4
4000 Hz	76.6	59.8	73.4
8000 Hz	70.1	52.4	67.3
A-Weighted	87.9	78.0	86.0

Advanced Acoustics



Advanced Accoustics Parameters

1. Unit height above ground:	**30.0**	ft
2. Horizontal distance from unit to receiver:	**50.0**	ft
3. Receiver height above ground:	**5.7**	ft
4. Height of obstruction:	**0.0**	ft
5. Horizontal distance from obstruction to receiver:	**0.0**	ft
6. Horizontal distance from unit to obstruction:	**0.0**	ft

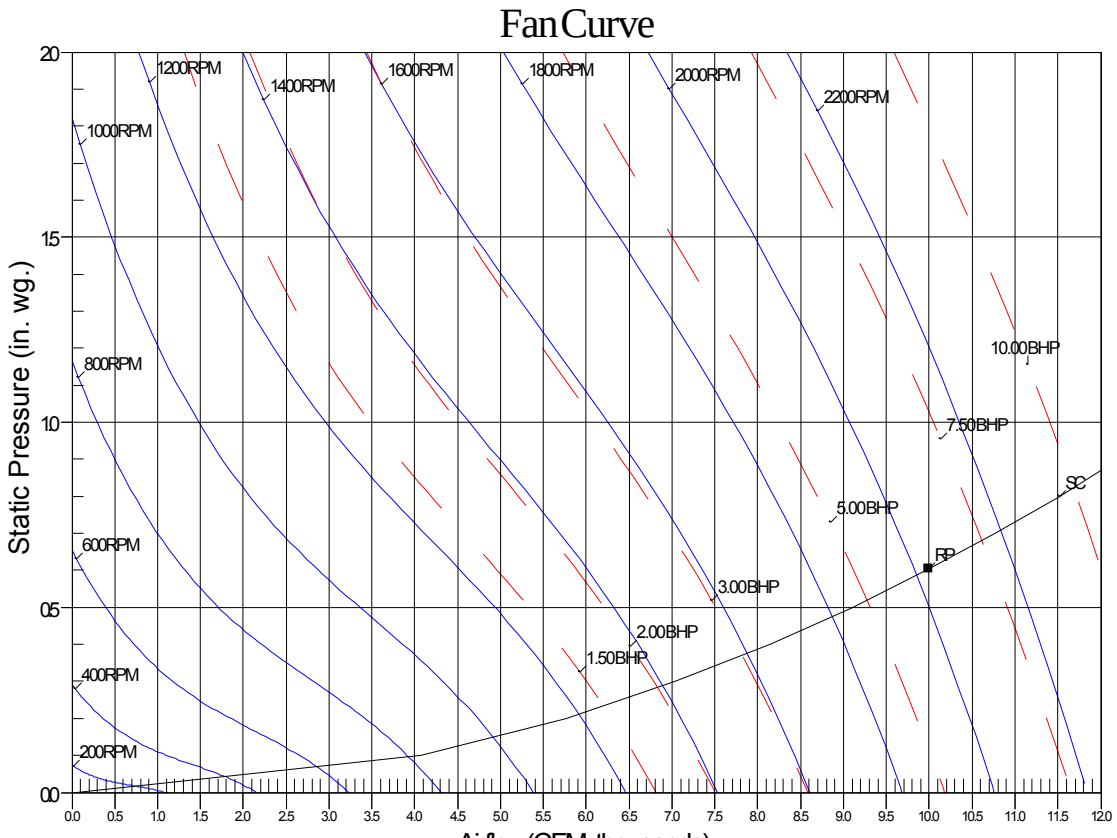
Detailed Acoustics Information

Octave Band Center Freq. Hz	63	125	250	500	1k	2k	4k	8k	Overall
A	97.1	88.3	84.4	83.3	80.7	77.4	73.4	67.3	98.1 Lw
B	70.9	72.2	75.8	80.1	80.7	78.6	74.4	66.2	85.9 LwA

C	64.7	55.9	52.0	50.9	48.3	45.0	41.0	34.9	65.7 Lp
D	38.5	39.8	43.4	47.7	48.3	46.2	42.0	33.8	53.5 LpA

Legend
A Sound Power Levels at Unit's Acoustic Center, Lw
B A-Weighted Sound Power Levels at Unit's Acoustic Center, LwA
C Sound Pressure Levels at Specific Distance from Unit, Lp
D A-Weighted Sound Pressure Levels at Specific Distance from Unit, LpA

Calculation methods used in this program are patterned after the ASHRAE Guide; other ASHRAE Publications and the AHRI Acoustical Standards. While a very significant effort has been made to insure the technical accuracy of this program, it is assumed that the user is knowledgeable in the art of system sound estimation and is aware of the tolerances involved in real world acoustical estimation. This program makes certain assumptions as to the dominant sound sources and sound paths which may not always be appropriate to the real system being estimated. Because of this, no assurances can be offered that this software will always generate an accurate sound prediction from user supplied input data. If in doubt about the estimation of expected sound levels in a space, an Acoustical Engineer or a person with sound prediction expertise should be consulted.



RPM=2030 BHP=6.27 Maximum RPM=2200 Maximum BHP=8.10
SC-System Curve RP-Rated Point

AC-74

Tag Cover Sheet
Unit Report
Certified Drawing
Performance Report

Unit Report For AC-74

Project: Lynwood USD Firebaugh HS
Prepared By:

10/17/2024
06:30PM

Unit Parameters

Unit Model: **48FCDM24AJM6-3U0A0**
Unit Size: **24 (20 Tons)**
Volts-Phase-Hertz: **460-3-60**
Heating Type: **Gas**
Heat Control: **Low Heat**
Duct Cfg: **Horizontal Supply / Horizontal Return**
DX Options: **Two Stage Cooling/Single Circuit**

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **11' 9.5"**
Unit Width: **7' 2.375"**
Unit Height: **3' 11.75"**
Total Operating Weight: **2240** lb

*** Weights and Dimensions are approximate. Weight does not include unit packaging. Approximate dimensions are provided primarily for shipping purposes. For exact dimensions and weights, refer to appropriate product data catalog.

Lines and Filters

Gas Line Size: **3/4**
Condensate Drain Line Size: **3/4**
Return Air Filter Type: **Throwaway**
Return Air Filter Quantity: **6**
Return Air Filter Size: **20 x 25 x 2**

Selection includes construction throwaway filter into the base fan curve.

Unit Configuration

High Static Option - Horizontal Models
Al/Cu - Al/Cu - Louvered Hail Guard
SystemVu Controller
Temperature Ultra Low Leak Economizer w/Baro Relief, Vertical and Horizontal Airflow
Standard Packaging

Warranty Information

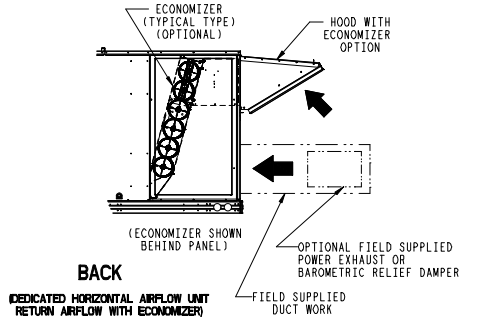
1-Year parts(std.)
5-Year compressor parts(std.)
10-Year heat exchanger - Aluminized(std.)
3-Year SystemVu Controller

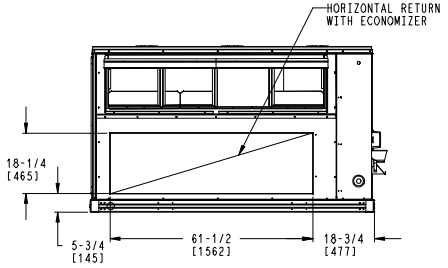
No optional warranties were selected.

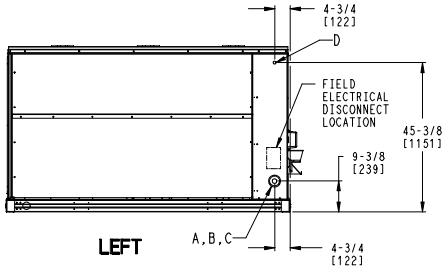
NOTE: Please see Warranty Catalog 500-089 for explanation of policies and ordering methods.

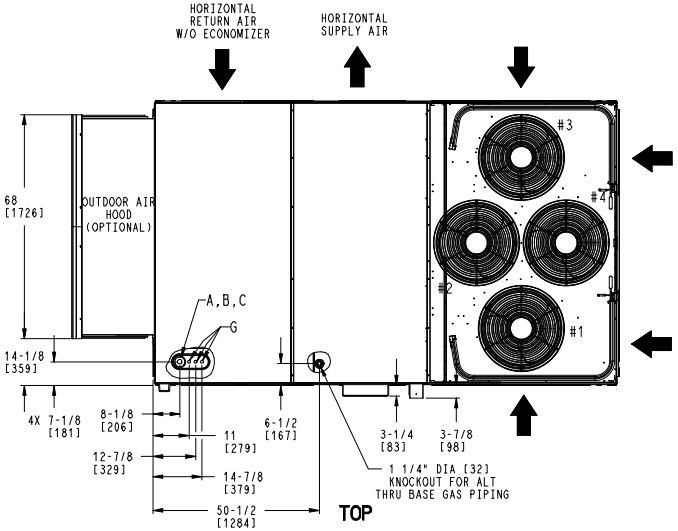
Ordering Information

Part Number	Description	Quantity
48FCDM24AJM6-3U0A0	Rooftop Unit	1
	Base Unit	
	Al/Cu - Al/Cu - Louvered Hail Guard	
	SystemVu controller, ULTRA LOW LEAK EconoMi$er2 temperature economizer with barometric relief. Syst	





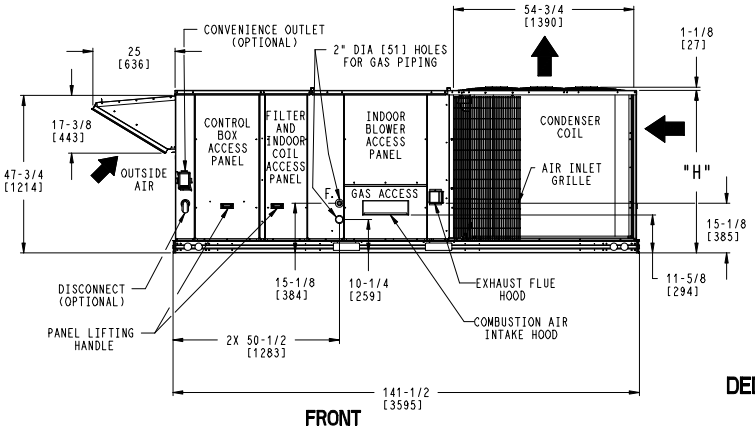


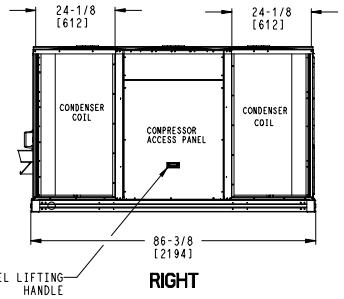


	CONNECTION SIZES
A	1 3/8" DIA [35] FIELD POWER SUPPLY KNOCKOUT
B	3" DIA [76] FIELD POWER SUPPLY KNOCKOUT
C	3 5/8" DIA [92] FIELD POWER SUPPLY KNOCKOUT
D	7/8" DIA [22] FIELD CONTROL WIRING HOLE
F	3/4"-14 NPT GAS CONNECTION (NOT SHOWN)
G	7/8" DIA [22] FIELD CONTROL WIRING KNOCKOUT

UNIT	H
24 SIZE	49-3/8 [1253]
28 SIZE	57-3/8 [1456]

NOTES:
1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY
3. DIRECTION OF AIR FLOW
4. ALL VIEW DRAWN USING 3RD ANGLE





DEDICATED HORIZONTAL AIRFLOW UNIT 24,28 SIZE

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	48FC 24,28 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT		REV
U.S. ECCN:NSR	2 OF 5	02/10/22	-		50HE003872	-

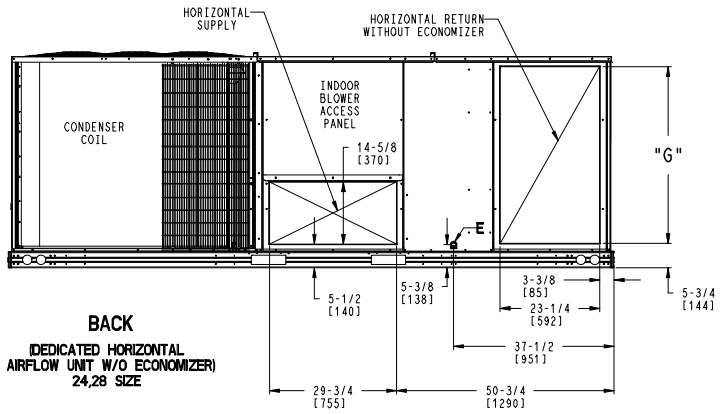
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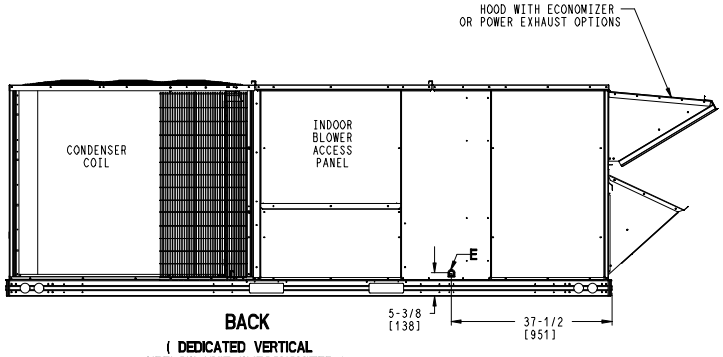
	CONNECTION SIZES
E	3/4"-14 NPT CONDENSATE DRAIN

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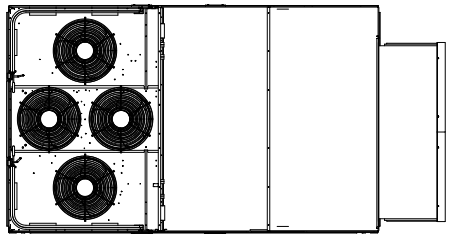
UNIT	G
24 SIZE	41-3/8 [1049]
28 SIZE	49-1/4 [1251]



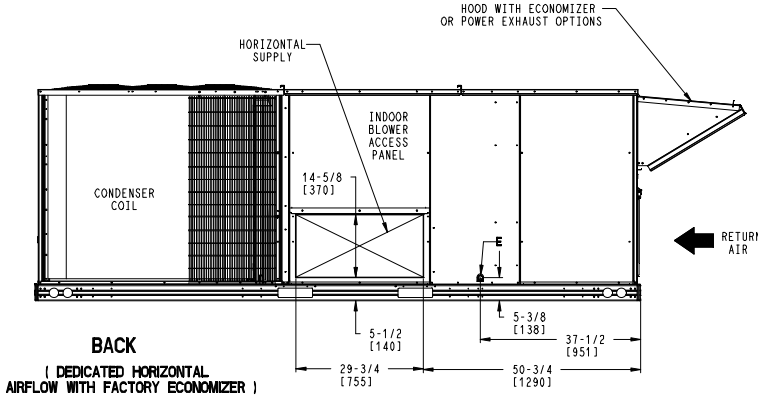
BACK
(DEDICATED HORIZONTAL AIRFLOW UNIT W/O ECONOMIZER)
24,28 SIZE



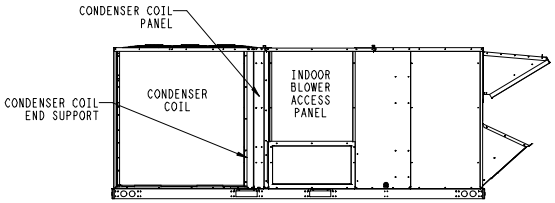
BACK
(DEDICATED VERTICAL AIRFLOW UNIT W/ECONOMIZER)
24,28 SIZE



28 SIZE CONDENSER COIL TOP VIEW



BACK
(DEDICATED HORIZONTAL AIRFLOW WITH FACTORY ECONOMIZER)
24,28 SIZE



28 SIZE CONDENSER COIL END BRACKET SUPPORT

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	3 OF 5	02/10/22	-	48FC 24,28 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	50HE003872	-

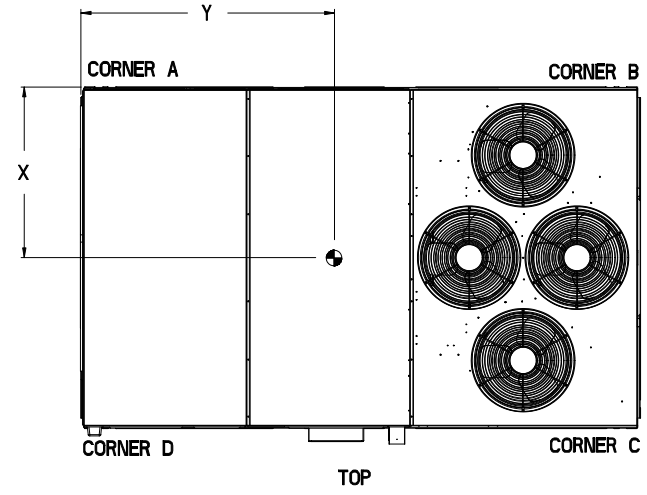
UNIT	STD UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48FC24	2000	907	429	195	505	229	576	261	489	222	76 1/2 [1943]	46 [1168]	16 1/2 [419]
48FC28	2174	986	458	208	583	264	634	288	498	226	79 1/4 [2013]	45 [1143]	19 [483]

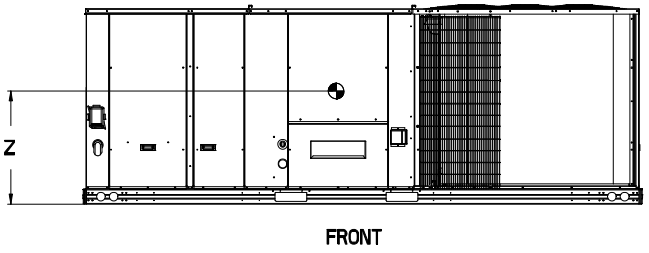
Carrier

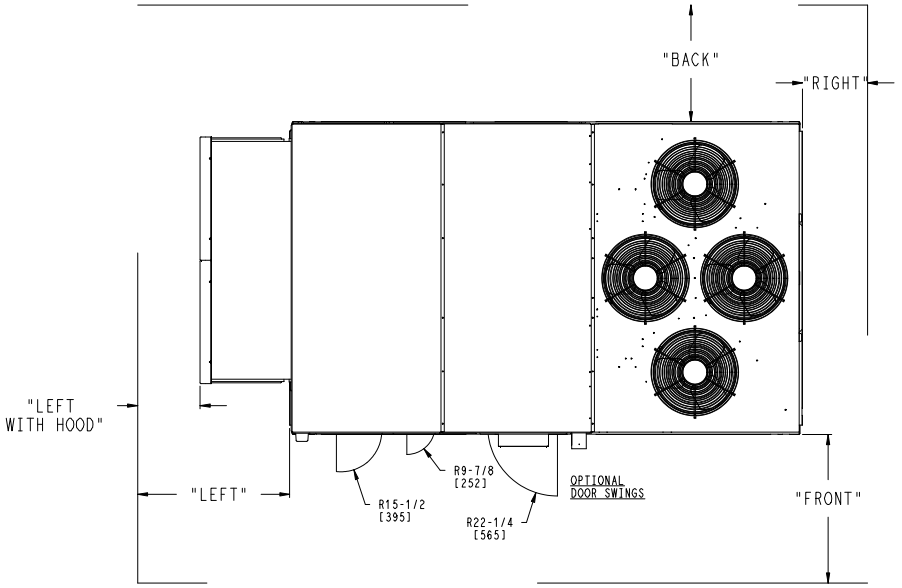
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FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.







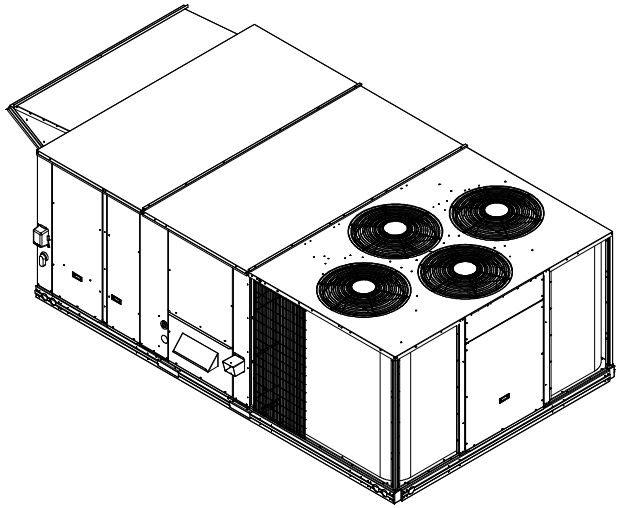
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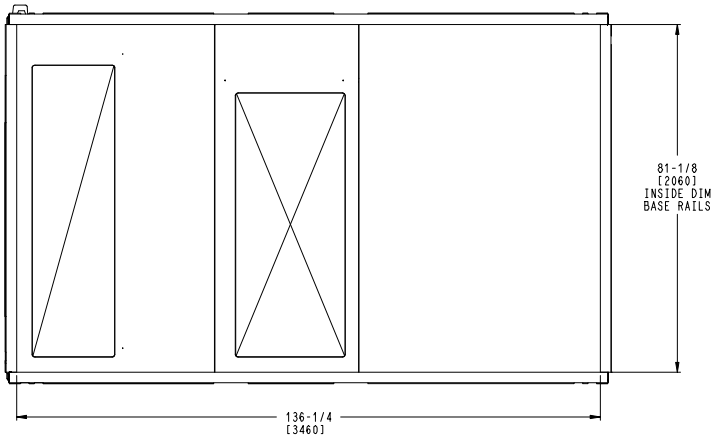
1. CLEARANCE ABOVE THE UNIT TO BE 72"
2. FOR ALL MINIMUM CLEARANCES LOCAL CODES OR JURISDICTIONS MAY PREVAIL.

CLEARANCE			
	SERVICE WITH:	SERVICE WITH:	OPERATING
SURFACE	CONDUCTIVE BARRIER	NONCONDUCTIVE BARRIER	CLEARANCE
FRONT	48 [1219mm]	36 [914mm]	18 [457mm]
LEFT	48 [1219mm]	42 [1067mm]	18 [457mm]
BACK	42 [1067mm]	36 [914mm]	18 [457mm]
LEFT WITH HOOD	36 [914mm]	36 [914mm]	18 [457mm]
RIGHT	36 [914mm]	36 [914mm]	18 [457mm]
TOP	72 [1829mm]	72 [1829mm]	72 [1829mm]

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	4 OF 5	02/10/22	-	48FC 24,28 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	50HE003872	-

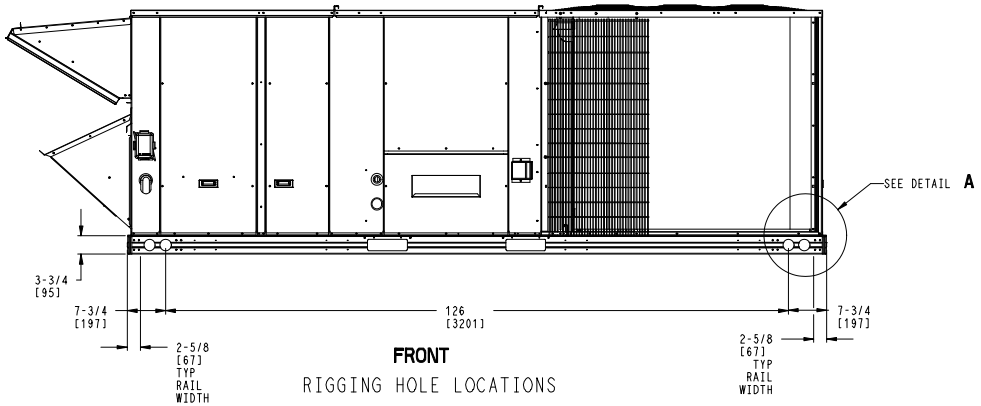
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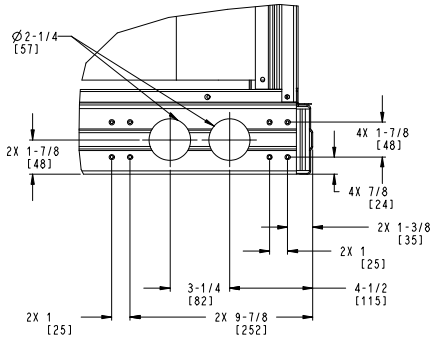
BOTTOM

INSIDE BASERAIL DIMENSIONS



FRONT

RIGGING HOLE LOCATIONS



DETAIL **A**
TYP 4 PLCS

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	48FC 24,28 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT		REV
U.S. ECCN:NSR	5 OF 5	02/10/22	-		50HE003872	-

Part Number:48FCDM24AJM6-3U0A0

ARI EER:	**10.00**	
IEER:	**14.5**	

Base Unit Dimensions

Unit Length:	**141.5**	in
Unit Width:	**86.4**	in
Unit Height:	**47.8**	in

Operating Weight

Base Unit Weight:	**1873**	lb
High Static Option - Horizontal Models:	**30**	lb
Al/Cu - Al/Cu - Louvered Hail Guard:	**90**	lb
SystemVu Controller:	**2**	lb
Temperature Ultra Low Leak Economizer w/Baro Relief, Vertical and Horizontal Airflow:	**245**	lb
Total Operating Weight:	**2240**	lb

Unit

Unit Voltage-Phase-Hertz:	**460-3-60**	
Air Discharge:	**Horizontal**	
Fan Drive Type:	**Vane Axial**	
Actual Airflow:	**8000**	CFM
Site Altitude:	**0**	ft

Cooling Performance

Condenser Entering Air DB:	**95.0**	F
Evaporator Entering Air DB:	**80.0**	F
Evaporator Entering Air WB:	**67.0**	F
Entering Air Enthalpy:	**31.44**	BTU/lb
Evaporator Leaving Air DB:	**58.6**	F
Evaporator Leaving Air WB:	**56.9**	F
Evaporator Leaving Air Enthalpy:	**24.32**	BTU/lb
Gross Cooling Capacity:	**256.07**	MBH
Gross Sensible Capacity:	**184.89**	MBH
Compressor Power Input:	**20.65**	kW
Coil Bypass Factor:	**0.113**	

Heating Performance

Heating Airflow:	**8000**	CFM
Entering Air Temp:	**70.0**	F
Leaving Air Temp:	**90.6**	F
Gas Heating Input Capacity:	**176.0 / 220.0**	MBH
Gas Heating Output Capacity:	**142.0 / 178.0**	MBH
Temperature Rise:	**20.6**	F
Thermal Efficiency (%):	**81.0**	

Supply Fan

External Static Pressure:	**0.50**	in wg
Options / Accessories Static Pressure		
Economizer:	**0.08**	in wg
Application External Static (ESP + Unit Opts/Acc.):	**0.58**	in wg
Fan RPM:	**1898**	
Fan Power:	**3.81**	BHP
NOTE:	**Selected IFM RPM Range: 250 - 2200**	

Selection includes construction throwaway filter into the base fan curve. This filter is not MERV Rated.

Electrical Data

Voltage Range:	**414 - 506**	

Compressor #1 RLA: **16**
Compressor #1 LRA: **140**
Compressor #2 RLA: **16**
Compressor #2 LRA: **140**
Indoor Fan Motor Type: **HIGH-HORZ**
Indoor Fan Motor FLA (Total): **5.6**
Combustion Fan Motor FLA (ea): **0.3**
Power Supply MCA: **50.8**
Power Supply MOCP (Fuse or HACR): **60**
Disconnect Size FLA: **54**
Disconnect Size LRA: **304**
Electrical Convenience Outlet: **None**
Outdoor Fan [Qty / FLA (ea)]: **4 / 0.9**

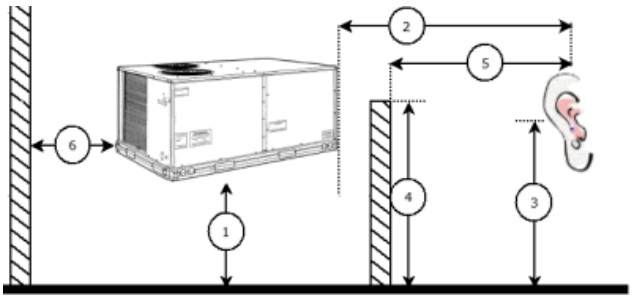
Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

Acoustics

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	82.6	82.1	95.6
125 Hz	83.7	78.0	87.5
250 Hz	86.1	73.1	84.2
500 Hz	80.0	70.2	84.2
1000 Hz	79.7	70.8	81.7
2000 Hz	77.2	65.1	77.9
4000 Hz	72.4	56.1	73.2
8000 Hz	65.0	47.9	66.3
A-Weighted	84.7	74.2	87.0

Advanced Acoustics



Advanced Accoustics Parameters

1. Unit height above ground: **30.0** ft
2. Horizontal distance from unit to receiver: **50.0** ft
3. Receiver height above ground: **5.7** ft
4. Height of obstruction: **0.0** ft
5. Horizontal distance from obstruction to receiver: **0.0** ft
6. Horizontal distance from unit to obstruction: **0.0** ft

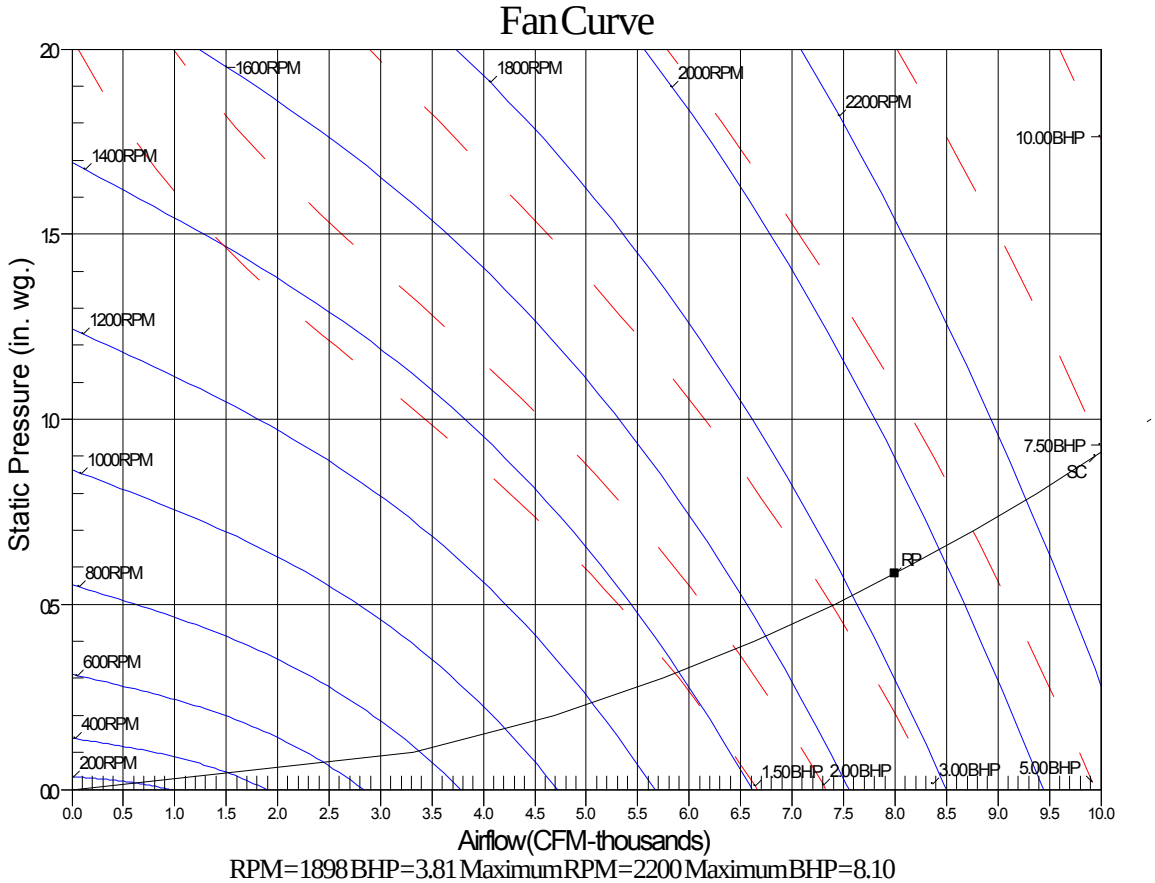
Detailed Acoustics Information

Octave Band Center Freq. Hz	63	125	250	500	1k	2k	4k	8k	Overall
A	95.6	87.5	84.2	84.2	81.7	77.9	73.2	66.3	96.9 Lw

B	69.4	71.4	75.6	81.0	81.7	79.1	74.2	65.2	86.5 LwA
C	63.2	55.1	51.8	51.8	49.3	45.5	40.8	33.9	64.5 Lp
D	37.0	39.0	43.2	48.6	49.3	46.7	41.8	32.8	54.1 LpA

Legend
A Sound Power Levels at Unit's Acoustic Center, Lw
B A-Weighted Sound Power Levels at Unit's Acoustic Center, LwA
C Sound Pressure Levels at Specific Distance from Unit, Lp
D A-Weighted Sound Pressure Levels at Specific Distance from Unit, LpA

Calculation methods used in this program are patterned after the ASHRAE Guide; other ASHRAE Publications and the AHRI Acoustical Standards. While a very significant effort has been made to insure the technical accuracy of this program, it is assumed that the user is knowledgeable in the art of system sound estimation and is aware of the tolerances involved in real world acoustical estimation. This program makes certain assumptions as to the dominant sound sources and sound paths which may not always be appropriate to the real system being estimated. Because of this, no assurances can be offered that this software will always generate an accurate sound prediction from user supplied input data. If in doubt about the estimation of expected sound levels in a space, an Acoustical Engineer or a person with sound prediction expertise should be consulted.



RPM=1898 BHP=3.81 Maximum RPM=2200 Maximum BHP=8.10
SC-System Curve RP-Rated Point

AC-60

Tag Cover Sheet
Unit Report
Certified Drawing
Performance Report

Unit Parameters

Unit Model: **48FCDM12A3M6-3A0A0**
Unit Size: **12 (10.0 Tons)**
Volts-Phase-Hertz: **460-3-60**
Heating Type: **Gas**
Heat Control: **Low Heat**
Duct Cfg: **Horizontal Supply / Horizontal Return**
DX Options: **Single Circuit, Two Stage Cooling**

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **7' 4.125"**
Unit Width: **4' 11.5"**
Unit Height: **4' 1.375"**
Total Operating Weight: **927** lb

*** Weights and Dimensions are approximate. Weight does not include unit packaging. Approximate dimensions are provided primarily for shipping purposes. For exact dimensions and weights, refer to appropriate product data catalog.

Lines and Filters

Gas Line Size: **3/4**
Condensate Drain Line Size: **3/4**
Return Air Filter Type: **Throwaway**
Return Air Filter Quantity: **4**
Return Air Filter Size: **20 x 20 x 2**

Selection includes construction throwaway filter into the base fan curve.

Unit Configuration

High Static (EcoBlue)
Al/Cu - Al/Cu - Louvered Hail Guards
SystemVu Controls
Standard Packaging

Warranty Information

1-Year parts(std.)
5-Year compressor parts(std.)
10-Year heat exchanger - Aluminized(std.)
3-Year SystemVu

No optional warranties were selected.

NOTE: Please see Warranty Catalog 500-089 for explanation of policies and ordering methods.

Ordering Information

Part Number	Description	Quantity
48FCDM12A3M6-3A0A0	Rooftop Unit	1
	Base Unit	
	High Static (EcoBlue)	
	Al/Cu - Al/Cu - Louvered Hail Guards	
	SystemVu controller, No intake or exhaust option. SystemVu controller meets California Title 24 Sect	

NOTES:

1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY
3. DIRECTION OF AIR FLOW
4. ALL VIEW DRAWN USING 3RD ANGLE

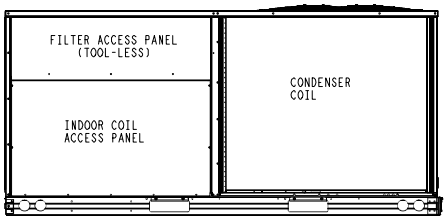
UNIT	OUTDOOR COIL TYPE	J	K	H
48FC-M08	RTPF	41 1/4 [1048]	33 3/4 [857]	15 7/8 [403]
48FC-M09	RTPF	49 3/8 [1253]	36 3/8 [925]	15 7/8 [403]
48FC-M12	RTPF	49 3/8 [1253]	36 3/8 [925]	15 7/8 [403]

RTPF - ROUND TUBE, PLATE FIN (COPPER/ALUM)

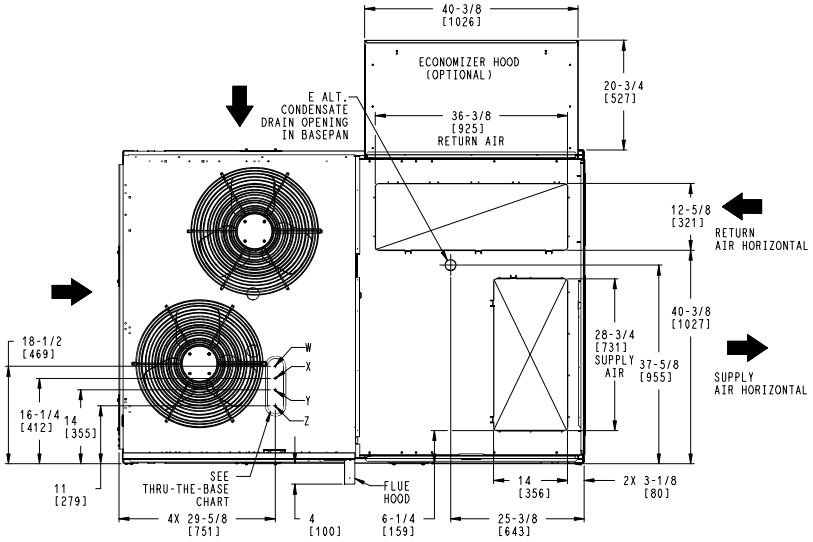
Carrier

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BACK



TOP

	CONNECTION SIZES
A	1 3/8" [35] DIA FIELD POWER SUPPLY HOLE
B	2 1/2" [64] DIA POWER SUPPLY KNOCKOUT
C	1 3/4" [51] DIA GAUGE ACCESS PLUG
D	7/8" [22] DIA FIELD CONTROL WIRING HOLE
E	3/4"-14 NPT CONDENSATE DRAIN
F	1/2"-14 NPT GAS CONNECTION 3/4"-14 NPT GAS CONNECTION
G	2 " [51] DIA POWER SUPPLY KNOCK-OUT

THRU-THE-BASE CHART (FIELD INST)

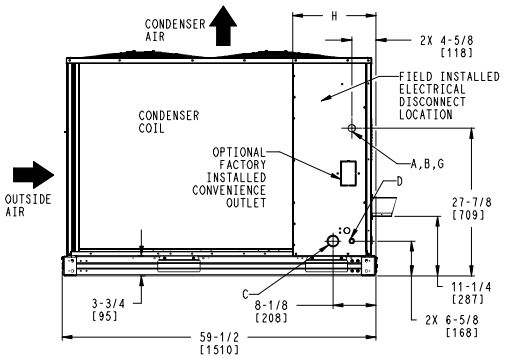
THESE HOLES REQUIRED FOR USE WITH ACCY KITS:
CRBTMPWR002A01: GAS THRU CURB
CRBTMPWR004A01: GAS THRU BASEPAN

	THREADED CONDUIT SIZE	WIRE USE	REQ'D HOLE SIZES (MAX.)
W	1/2"	ACC.	7/8" [22.2]
X	1/2"	24V	7/8" [22.2]
Y	1 1/4" (002,004)	POWER	1 3/4" [44.4]
Z *	(004) 3/4" FPT	GAS	1 3/4" [44.4]
*	(002) PROVIDES 3/4" FPT THRU CURB FLANGE & FITTING. HOLE SIZE: 2" [50.8]		

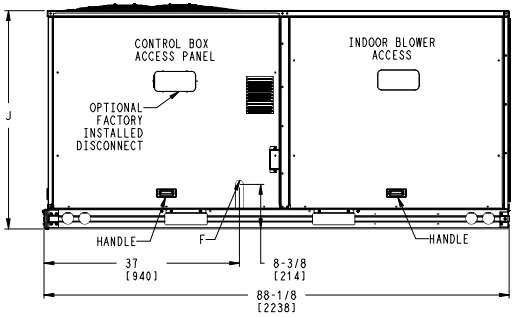
THRU-THE-BASE CHART (FIOP)

FOR "THRU-THE-BASEPAN" FACTORY OPTION, FITTINGS FOR ONLY X, Y, & Z ARE PROVIDED. **

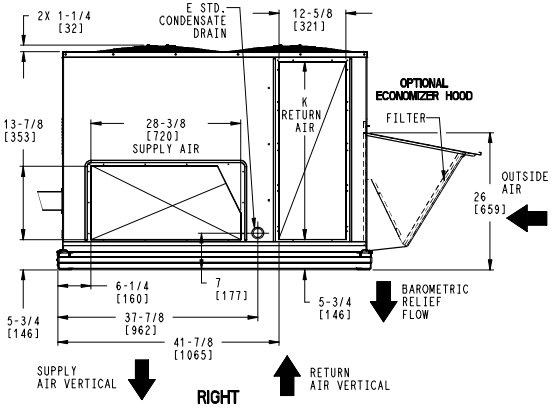
**	FOR BELOW LISTED MODELS, A FIELD SUPPLIED 1/2" ADAPTER IS REQUIRED BETWEEN BASE PAN FITTING AND GAS VALVE: 48FCD,S*08,09



LEFT



FRONT

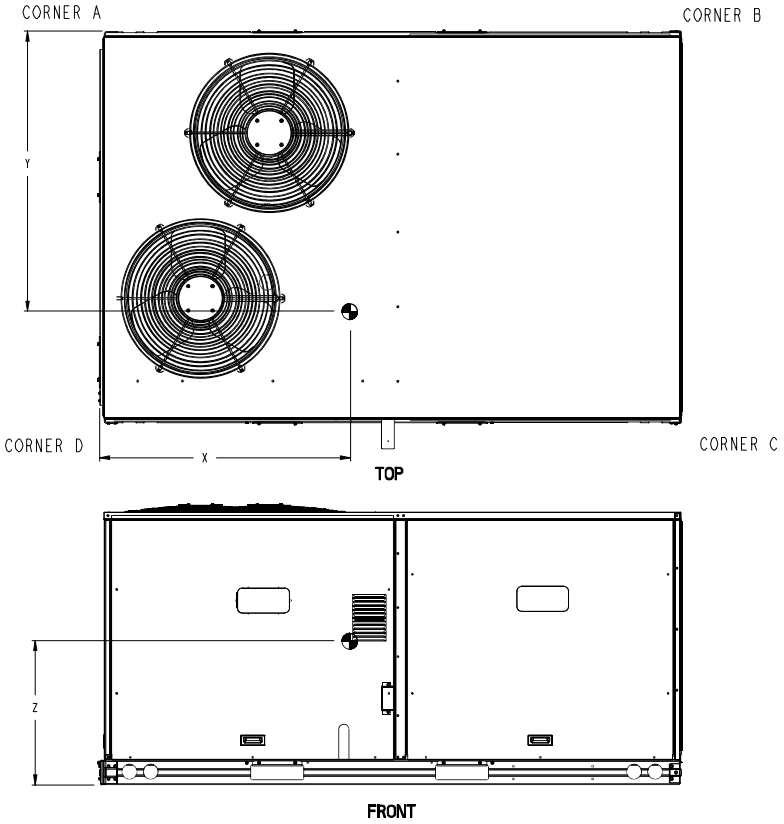


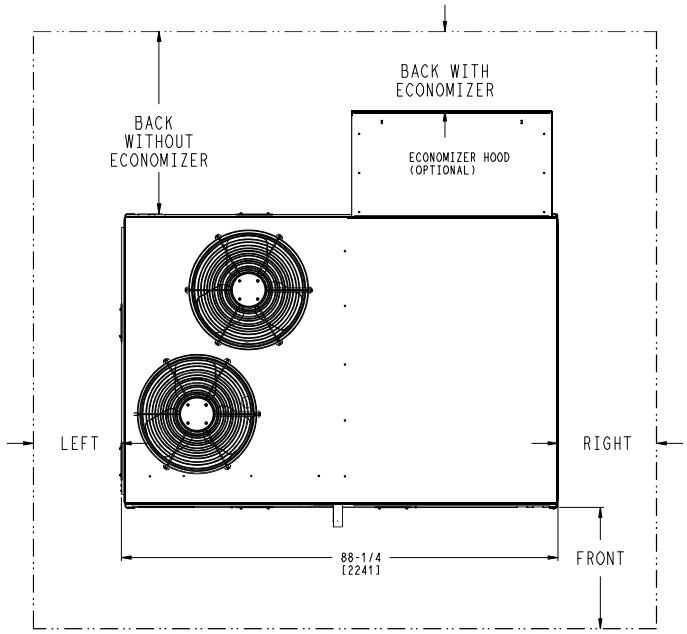
RIGHT

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	1 OF 3	03/12/21	-	48FC 08-12 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	48TM006295	-

UNIT	OUTDOOR COIL TYPE	STD. UNIT WEIGHT ***		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
		LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48FC-M08	RTPF	787	357	181	82	150	68	207	94	249	113	40 [1016]	34 1/2 [876]	19 3/8 [492]
48FC-M09	RTPF	868	394	197	89	160	73	229	104	282	128	39 1/2 [1003]	35 [889]	18 5/8 [473]
48FC-M12	RTPF	878	398	213	97	175	80	221	100	268	121	39 7/8 [1013]	33 1/4 [841]	18 1/2 [470]
RTPF - ROUND TUBE, PLATE FIN (COPPER/ALUM)														

*** STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.





NOTE:

1. FOR ALL MINIMUM CLEARANCES LOCAL CODES OR JURISDICTIONS MAY PREVAIL.

	CLEARANCE		
	SERVICE WITH:	SERVICE WITH:	OPERATING
SURFACE	CONDUCTIVE BARRIER	NONCONDUCTIVE BARRIER	CLEARANCE
FRONT	48 [1219mm]	36 [914mm]	18 [457mm]
LEFT	48 [1219mm]	42 [1067mm]	18 [457mm]
BACK W/O ECON	48 [1219mm]	42 [1067mm]	18 [457mm]
BACK W/ECON	36 [914mm]	36 [914mm]	18 [457mm]
RIGHT	36 [914mm]	36 [914mm]	18 [457mm]
TOP	72 [1829mm]	72 [1829mm]	72 [1829mm]

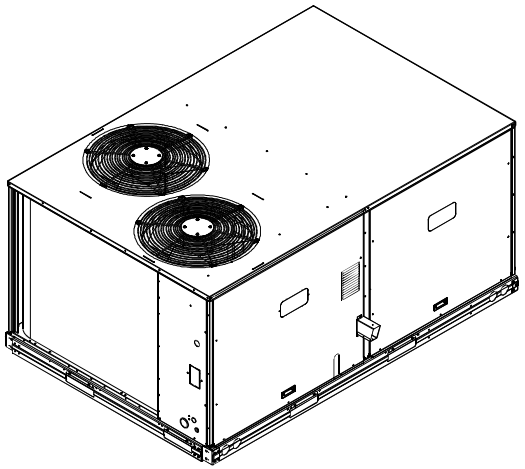
Carrier

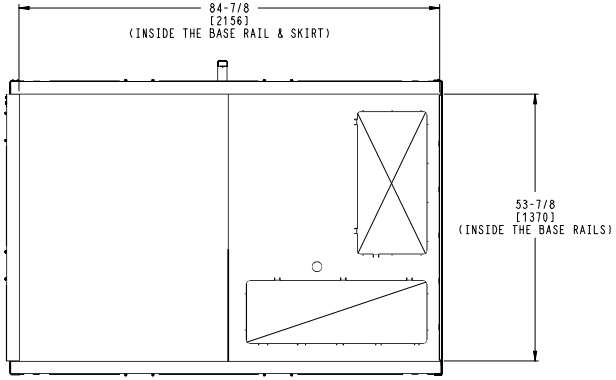
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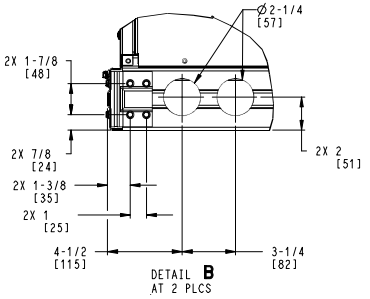
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	2 OF 3	03/12/21	-	48FC 08-12 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	48TM006295	-

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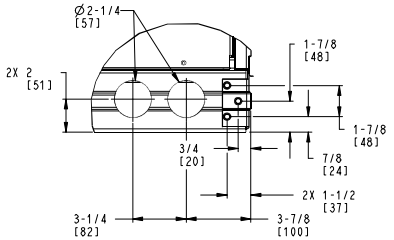




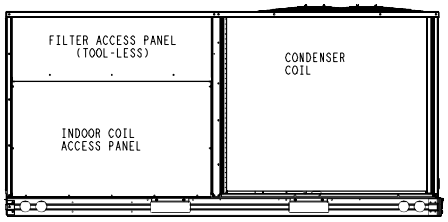
INSIDE BASERAIL DIMENSIONS
BOTTOM



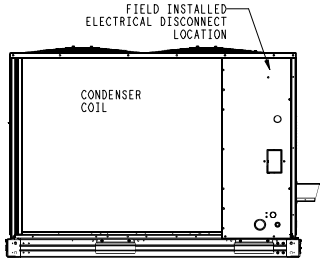
DETAIL **B**
AT 2 PLCS



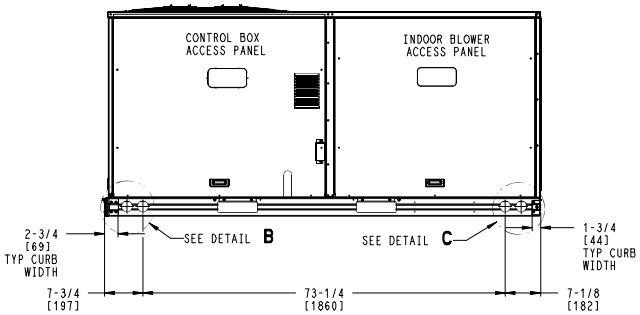
DETAIL **C**
AT 2 PLCS



BACK



LEFT



FRONT

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN: NSR	3 OF 3	03/12/21	-	48FC 08-12 SINGLE ZONE ELECTRICAL COOLING WITH GAS HEAT	48TM006295	-

Part Number:48FCDM12A3M6-3A0A0

ARI EER:	**11.00**	
IEER:	**15.0**	

Base Unit Dimensions

Unit Length:	**88.1**	in
Unit Width:	**59.5**	in
Unit Height:	**49.4**	in

Operating Weight

Base Unit Weight:	**878**	lb
High Static (EcoBlue):	**30**	lb
Al/Cu - Al/Cu - Louvered Hail Guards:	**17**	lb
SystemVu Controls:	**2**	lb
Total Operating Weight:	**927**	lb

Unit

Unit Voltage-Phase-Hertz:	**460-3-60**	
Air Discharge:	**Horizontal**	
Fan Drive Type:	**Vane Axial**	
Actual Airflow:	**4000**	CFM
Site Altitude:	**0**	ft

Cooling Performance

Condenser Entering Air DB:	**95.0**	F
Evaporator Entering Air DB:	**80.0**	F
Evaporator Entering Air WB:	**67.0**	F
Entering Air Enthalpy:	**31.44**	BTU/lb
Evaporator Leaving Air DB:	**57.7**	F
Evaporator Leaving Air WB:	**57.1**	F
Evaporator Leaving Air Enthalpy:	**24.45**	BTU/lb
Gross Cooling Capacity:	**125.75**	MBH
Gross Sensible Capacity:	**96.22**	MBH
Compressor Power Input:	**9.17**	kW
Coil Bypass Factor:	**0.052**	

Heating Performance

Heating Airflow:	**4000**	CFM
Entering Air Temp:	**70.0**	F
Leaving Air Temp:	**104.3**	F
Gas Heating Input Capacity:	**120.0 / 180.0**	MBH
Gas Heating Output Capacity:	**98.0 / 148.0**	MBH
Temperature Rise:	**34.3**	F

Supply Fan

External Static Pressure:	**0.50**	in wg
Fan RPM:	**1619**	
Fan Power:	**1.41**	BHP
NOTE:	**Selected IFM RPM Range: 1201 - 2200**	

Selection includes construction throwaway filter into the base fan curve. This filter is not MERV Rated.

Electrical Data

Voltage Range:	**414 - 506**
Compressor #1 RLA:	**7.7**
Compressor #1 LRA:	**60**
Compressor #2 RLA:	**7.7**
Compressor #2 LRA:	**60**
Indoor Fan Motor Type:	**HIGH**

Indoor Fan Motor FLA (Total): **5.6**
Combustion Fan Motor FLA (ea): **0.25**
Power Supply MCA: **25**
Power Supply MOCP (Fuse or HACR): **30**
Disconnect Size FLA: **26**
Disconnect Size LRA: **132**
Electrical Convenience Outlet: **None**
Outdoor Fan [Qty / FLA (ea)]: **2 / 0.8**

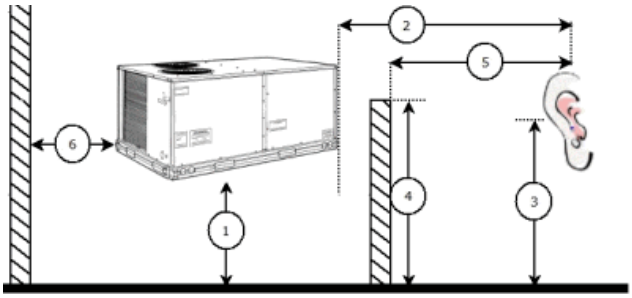
Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

Acoustics

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	84.5	81.3	85.6
125 Hz	81.2	75.4	84.7
250 Hz	76.8	69.7	80.5
500 Hz	73.7	66.2	76.0
1000 Hz	75.0	66.7	72.4
2000 Hz	71.1	60.4	68.0
4000 Hz	66.4	52.6	62.8
8000 Hz	57.3	46.9	59.3
A-Weighted	78.8	70.3	79.0

Advanced Acoustics



Advanced Accoustics Parameters

1. Unit height above ground: **30.0** ft
2. Horizontal distance from unit to receiver: **50.0** ft
3. Receiver height above ground: **5.7** ft
4. Height of obstruction: **0.0** ft
5. Horizontal distance from obstruction to receiver: **0.0** ft
6. Horizontal distance from unit to obstruction: **0.0** ft

Detailed Acoustics Information

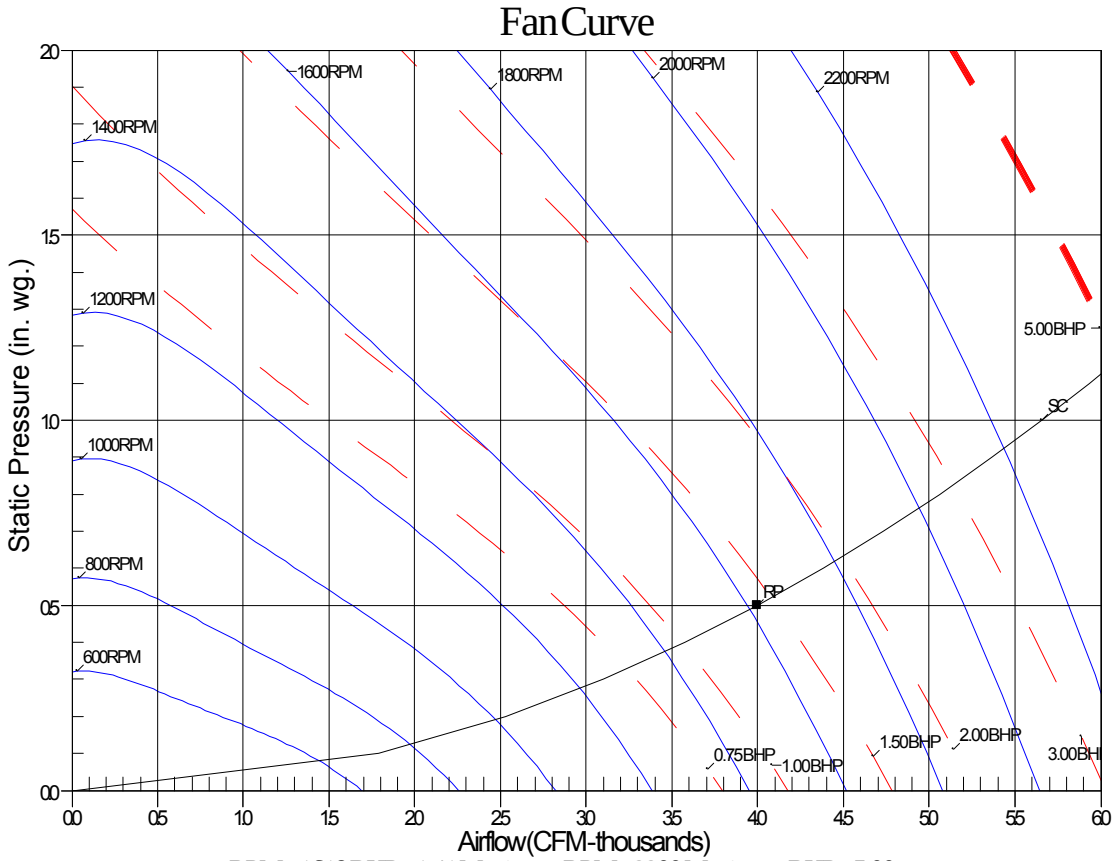
Octave Band Center Freq. Hz	63	125	250	500	1k	2k	4k	8k	Overall
A	85.6	84.7	80.5	76.0	72.4	68.0	62.8	59.3	89.2 Lw
B	59.4	68.6	71.9	72.8	72.4	69.2	63.8	58.2	78.5 LwA
C	53.2	52.3	48.1	43.6	40.0	35.6	30.4	26.9	56.8 Lp
D	27.0	36.2	39.5	40.4	40.0	36.8	31.4	25.8	46.1 LpA

Performance Summary For AC-60

Project: Lynwood USD Firebaugh HS 10/17/2024
Prepared By: 06:30PM

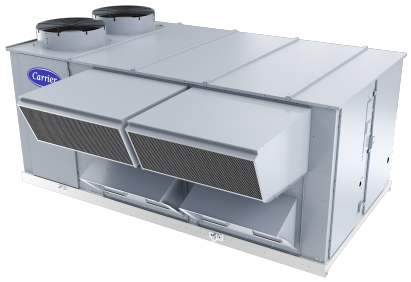
Legend
A Sound Power Levels at Unit's Acoustic Center, Lw
B A-Weighted Sound Power Levels at Unit's Acoustic Center, LwA
C Sound Pressure Levels at Specific Distance from Unit, Lp
D A-Weighted Sound Pressure Levels at Specific Distance from Unit, LpA

Calculation methods used in this program are patterned after the ASHRAE Guide; other ASHRAE Publications and the AHRI Acoustical Standards. While a very significant effort has been made to insure the technical accuracy of this program, it is assumed that the user is knowledgeable in the art of system sound estimation and is aware of the tolerances involved in real world acoustical estimation. This program makes certain assumptions as to the dominant sound sources and sound paths which may not always be appropriate to the real system being estimated. Because of this, no assurances can be offered that this software will always generate an accurate sound prediction from user supplied input data. If in doubt about the estimation of expected sound levels in a space, an Acoustical Engineer or a person with sound prediction expertise should be consulted.



RPM=1619 BHP=1.41 Maximum RPM=2200 Maximum BHP=5.00
SC-System Curve RP-Rated Point

Tag Name: AC 58 and 59



Shipping Dimensions		
Unit Length	ft and in	18' 0"
Unit Width	ft and in	7' 10"
Unit Height	ft and in	6' 7"
Unit Operating Weight	lb	5316
Unit Shipping Weight	lb	5366

***Shipping weights and dimensions are approximate for shipping purposes. Shipping dimensions include OA hoods. See certified drawing for operating dimensions.
** Operating and shipping weights and dimensions do not include curbs, accessories, or special order options.

Exhaust/Outdoor Air	
OA Intake/Return	Ultra-Low Leak Economizer

Unit Parameters		
Unit Size		050 (50 Tons)
Unit Voltage	V-Ph-Hz	460-3-60
Supply/Return		Horizontal / Horizontal
Configuration		SAV
Heating Capacity		Low Heat - 400 MBH Input
Heat Option		2 Stage Gas Heat
Heat Type		Gas Heat

Condenser Coil	
Cond. Coil Fin Coating	MCHX Cond, Al/Cu Evap

Filtration	
Pre-Evaporator Filter Type	2" Throwaway

Factory Installed Options	
Application Type	Staged Air Volume
Terminal Block	Selected
Low Sound	Selected
Digital Compressor	Selected
30 HP Indoor Fan Motor with VFD	Selected

Ordering Information

Part Number	Description	Quantity
48K4AG50-5-6A0B0A0	Rooftop Unit	2
	Base Unit	
	Ultra-Low Leak Economizer	
	Low Sound Package	
	Digital Compressor	
	30 HP Indoor Fan Motor with VFD	

Warranty Information

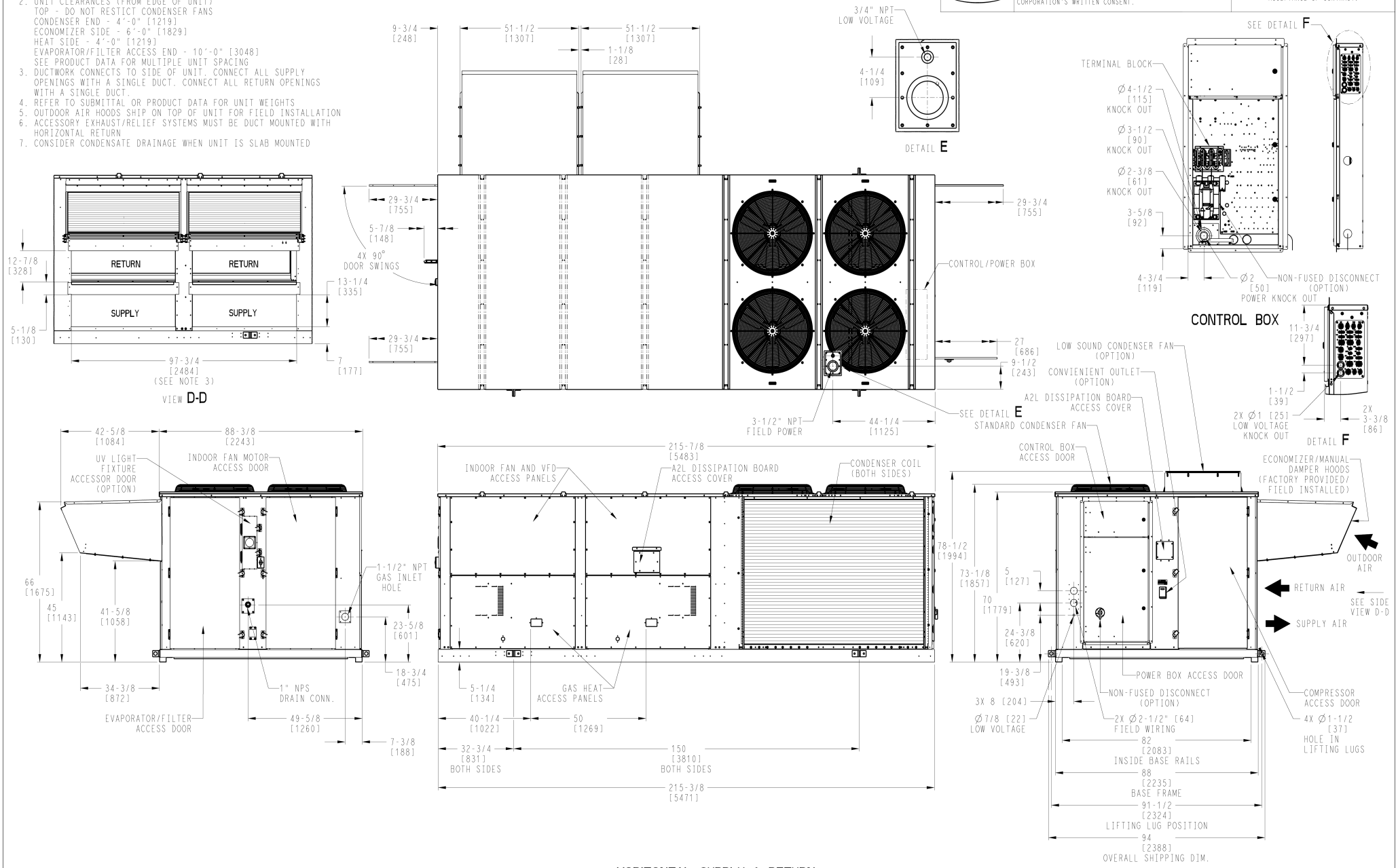
Warranty
First year - Parts only (standard)
Complete Unit 1st Year Carrier CCS Labor

Startups

Startup Part #	Description	Quantity
4850K-STC1	Start-up, First Unit Cooling	1
4850K-STH1	Start-up, First Unit Heating	1

NOTES:
1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE IN MILIMETERS.
2. UNIT CLEARANCES (FROM EDGE OF UNIT)
   TOP - DO NOT RESTICT CONDENSER FANS
   CONDENSER END - 4'-0" [1219]
   ECONOMIZER SIDE - 6'-0" [1829]
   HEAT SIDE - 4'-0" [1219]
   EVAPORATOR/FILTER ACCESS END - 10'-0" [3048]
   SEE PRODUCT DATA FOR MULTIPLE UNIT SPACING
3. DUCTWORK CONNECTS TO SIDE OF UNIT. CONNECT ALL SUPPLY OPENINGS WITH A SINGLE DUCT. CONNECT ALL RETURN OPENINGS WITH A SINGLE DUCT.
4. REFER TO SUBMITTAL OR PRODUCT DATA FOR UNIT WEIGHTS
5. OUTDOOR AIR HOODS SHIP ON TOP OF UNIT FOR FIELD INSTALLATION
6. ACCESSORY EXHAUST/RELIEF SYSTEMS MUST BE DUCT MOUNTED WITH HORIZONTAL RETURN
7. CONSIDER CONDENSATE DRAINAGE WHEN UNIT IS SLAB MOUNTED

Carrier
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HORIZONTAL SUPPLY & RETURN

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	48K SIZE 40-50	48VA006062	REV
U.S. ECCN: EAR99	2 OF 2	08/03/23	-			-

Project Name: Lynwood USD – Firebaugh High School

Tag Name: AC 58 and 59

Shipping Dimensions		
Unit Length	ft and in	18' 0"
Unit Width	ft and in	7' 10"
Unit Height	ft and in	6' 7"
Unit Operating Weight	lb	5316
Unit Shipping Weight	lb	5366

***Shipping weights and dimensions are approximate for shipping purposes. Shipping dimensions include OA hoods. See certified drawing for operating dimensions.
** Operating and shipping weights and dimensions do not include curbs, accessories, or special order options.

Performance Information		
Part Number		48K4AG50-5-6A0B0A0
Unit Refrigerant		R454B
EER		9.8
IEER		13.0
Heat Type		Gas Heat
Supply/Return		Horizontal / Horizontal
Application Type		Staged Air Volume
Voltage		460-3-60
Cooling Airflow	CFM	20000.0
Altitude	ft	0
Condenser Entering Air Temperature	F	95.0
Entering Air Temperature Dry Bulb	F	80.0
Entering Air Temperature Wet Bulb	F	67.0
Entering Air Enthalpy	BTU/lb	31.44
Leaving Air Temperature Dry Bulb	°F	58.3
Leaving Air Temperature Wet Bulb	°F	57.9
Leaving Air Enthalpy	BTU/lb	24.96
Gross Cooling Capacity	MBH	575.95
Gross Sensible Cooling Capacity	MBH	463.2
Compressor Power	kW	59.78276
Coil Bypass Factor		0.040
Refrigerant Charge, Circuit A	lb	23.5
Refrigerant Charge, Circuit B	lb	22.5

Gas Heating Data		
Heating Airflow	CFM	20000.0
Heating Entering Air Temperature	F	70.0
Gas Input		300 / 400
Heating Control		2 Stage Gas Heat
Gas Input (min)		300
Gas Input (max)		400
Gas Output		324
Heating Leaving Air Temperature	°F	85.0
Steady State Efficiency	%	81.00
Temperature Rise	°F	15.0

Electrical Data	
Voltage Range	414 - 506
Indoor Fan Motor HP	30
Power Supply MCA	130
Power Supply MOCP (Fuse or HACR)	150
Outdoor Fan Drive	LOW
Minimum Non-Fused Disconnect Amperage	138
Outdoor Fan [Qty / FLA (ea)]	4 / 2.8
Indoor Fan Motor [Qty / Hp(ea) / FLA(ea)]	1 / 30 / 40.2
Power Exhaust	NO
Control Load	2.4
Compressor 1 (Qty / RLA / LRA)	2 / 13.5 / 130
Compressor 2 (Qty / RLA / LRA)	2 / 19.4 / 147
Electrical Convenience Outlet	None

Note: Factory -installed non-fused disconnect is nominally sized.Check power wire size and disconnecting size.

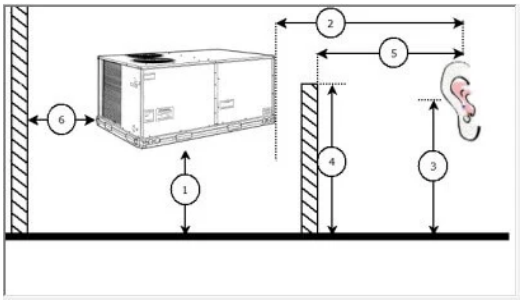
Supply Fan Information		
External static pressure	in wg	1.00
Supply Fan RPM	RPM	1284
Supply Fan BHP	BHP	32.42
Selection Static Pressure	in wg	1.00

Unit data, performance, and ratings are preliminary and are subject to change

Acoustic Information

Frequencies	Hz	63	125	250	500	1000	2000	4000	8000
Discharge	Lw	0	0	0	0	0	0	0	0
Inlet	Lw	0	0	0	0	0	0	0	0
Outdoor	Lw	0	0	0	0	0	0	0	0

Discharge / Inlet Duct Sound Power test data rated in accordance with the AHRI 260 Standard.



Advanced Acoustics Parameters

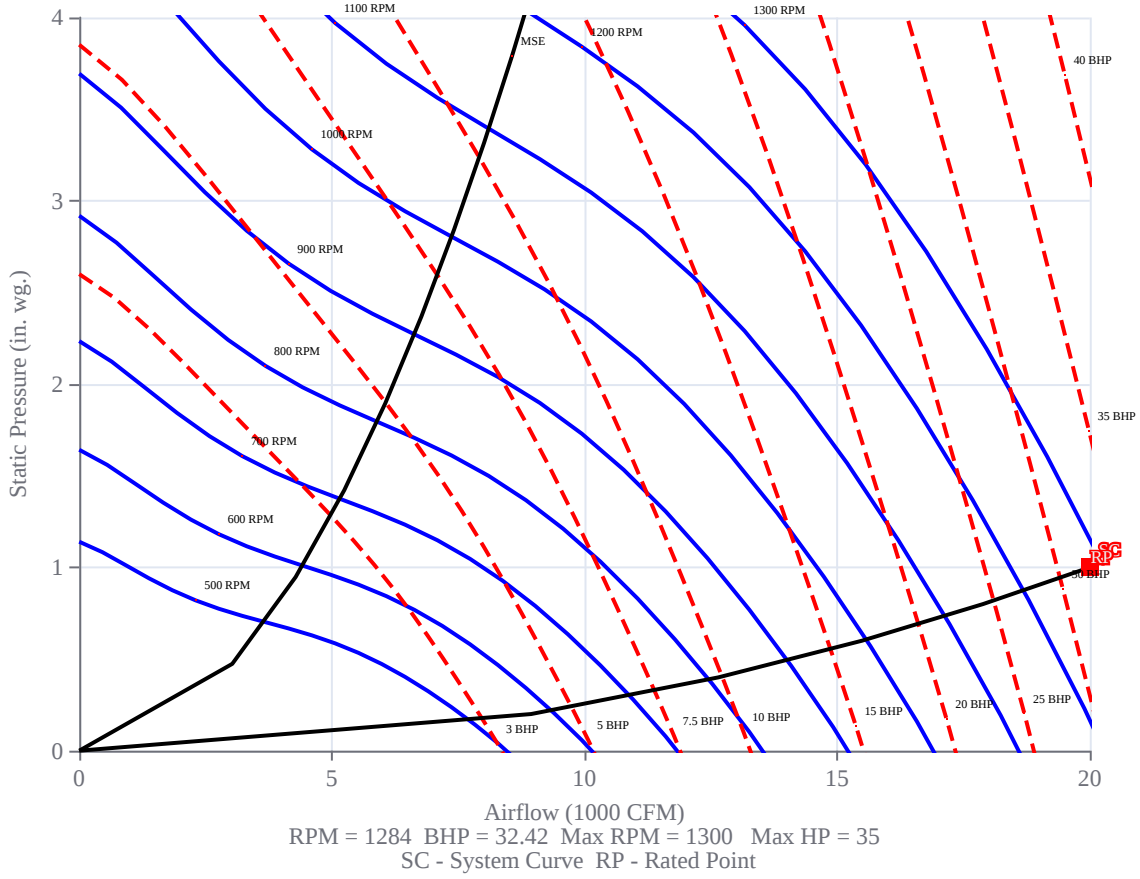
Unit height above ground	ft	30.0
Horizontal distance from unit to receiver	ft	50.0
Receiver height above ground	ft	5.7

Detailed Acoustic Information

Octave Band Center Freq.	Hz	63	125	250	500	1000	2000	4000	8000	Overall
A	Lw	0	0	0	0	0	0	0	0	9.542
B	LwA	-26.20	-16.10	-8.600	-3.200	0	1.200	1.000	-1.100	6.987
C	Lp	0	0	0	0	0	0	0	0	9.542
D	LpA	-26.20	-16.10	-8.600	-3.200	0	1.200	1.000	-1.100	6.987

Legend
A - Sound Power Levels at Unit's Acoustic Center
B - A-Weighted Sound Power Levels at Unit's Acoustic Center
C - Sound Pressure Levels at Specific Distance from Unit
D - A-Weighted Sound Pressure Levels at Specific Distance from Unit

Supply Fan Curve



RPM = 1284 BHP = 32.42 Max RPM = 1300 Max HP = 35
SC - System Curve RP - Rated Point

SECTION II. ROOFTOP ACCESSORIES

Sigler

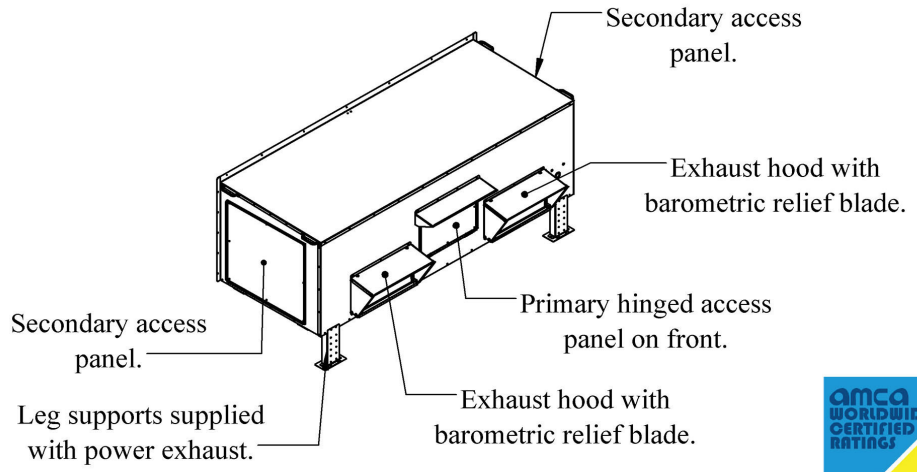
COMMERCIAL HVAC DIVISION

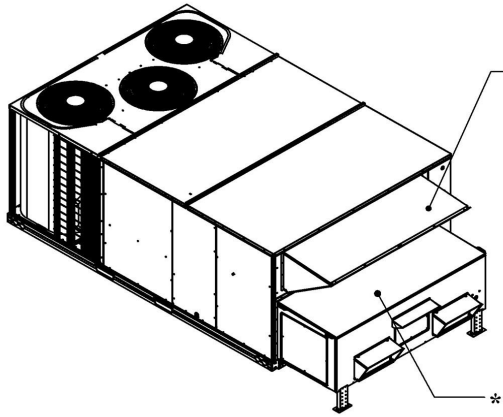
205 S. Puente Street
Brea, CA. 92821

AC-72-73

MicroMetl	Date:	Weight: 323lbs (US) 146.51kg (Metric)	Part Number: PCC-MRT69CA-D-4L6
	RTU:		
Submitted to:		Approved by:	Notes:

Power Exhaust - Power Exhaust - Modulating Speed, Centrifugal Exhaust Type, Convertible Orientation, 460 Volt Three Phase Voltage. Designed To Operate At 10318 CFM @ 1/2" - 6 HP. Painted To Match RTU. DOES NOT INCLUDE ECONOMIZER. Compatible With MicroMetl & Carrier Factory Economizers. Mounted On Return Air Ductwork In The Horizontal Application. Electrical junction box provided. High voltage cable to be field supplied and installed. BacNet Compatible.

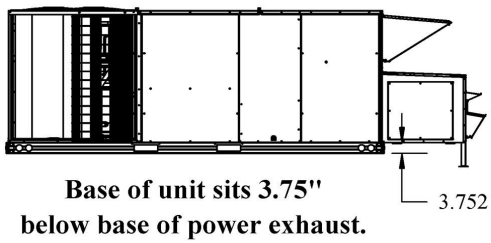




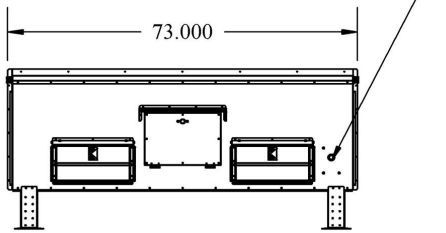
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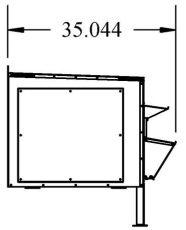
Power entry point.
1/2" and 3/4" knockouts.
(.875" and 1.125" actual)

****FIELD SUPPLIED DISCONNECT IS NEEDED FOR POWER EXHAUST****



Base of unit sits 3.75" below base of power exhaust.





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Compliant Economizer:

1. **Title 24:** Economizers meet California Energy Commission Title 24-2013 / 2016 prescriptive section 140.4 (damper leakage etc.), and mandatory section 120.2.i for Fault Detection and Diagnostic controls (JADE HJW10).
2. **ASHRAE 90.1:** Economizers meet ASHRAE 90.1-2013 / 2016 damper leakage requirements as stated in Table 6.4.3.4.3., and meet 2016 Fault Detection and Diagnosis requirements in section 6.4.3.12.
3. **IECC:** Economizers meet IECC 2012 section C402.4.5.2 and, IECC 2015 sections C403.2.4.3 and C403.3.3.5 for outside air, return air, and relief damper (when provided) leakage requirements, and IECC 2015 section c403.2.4.7 for Fault Detection and Diagnostic requirements, Note: IECC 2015 section C403.2.4.7.1 requires differential return air sensor, which is included in some models (i.e. -DYXB) and must be ordered separately on others (i.e. -DYDB, -DYEB).
4. **AMCA:** Outside air and return air (volume) dampers are AMCA Class 1A rated 1" w.g. Refer to MicroMetl NS1 catalog sheet on web site for details. Relief air dampers (when provided) are also AMCA rated. Refer to GR1 series catalog sheet on web site for details.

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- 2HP Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
2V2	208-230/240	3	Constant Volume	2.0	7.6-7.2	9.5-9.0	12.4-11.7	N/A
2L2 or 2T2	208-230/240	3	Modulating	2.0	13.6*	17	30.6	25 Amp
4V2	460/480	3	Constant Volume	2.0	3.8	4.8	6.2	N/A
4L2 or 4T2	460/480	3	Modulating	2.0	6.5*	8.1	14.6	10 Amp

- 4HP Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
2V4	208-230/240	3	Constant Volume	4.0	11.2-10.8	14.0-13.5	18.2-13.1	N/A
2L4 or 2T4	208-230/240	3	Modulating	4.0	20.6*	25.8	46.4	40 Amp
4V4	460/480	3	Constant Volume	4.0	5.4	6.8	8.8	N/A
4L4 or 4T4	460/480	3	Modulating	4.0	10.5*	13.1	23.6	20 Amp

- 6HP Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
2V6	208-230/240	3	Constant Volume	6.0	18.4-17.2	23.0-21.5	29.9-28.0	N/A
2L6 or 2T6	208-230/240	3	Modulating	6.0	28.8*	36	64.8	40 Amp
4V6	460/480	3	Constant Volume	6.0	8.6	10.8	14.0	N/A
4L6 or 4T6	460/480	3	Modulating	6.0	14.3*	17.9	32.2	25 Amp

*VFD Input Current

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MicroMetl	Date:	Weight: 323lbs (US) 146.51kg (Metric)	Part Number: PCC-MRT69CA-D-4L6
	RTU:		
Submitted to:		Approved by:	Notes:

Power Exhaust - Power Exhaust - Modulating Speed, Centrifugal Exhaust Type, Convertible Orientation, 460 Volt Three Phase Voltage. Designed To Operate At 10318 CFM @ 1/2" - 6 HP. Painted To Match RTU. DOES NOT INCLUDE ECONOMIZER. Compatible With MicroMetl & Carrier Factory Economizers. Mounted On Return Air Ductwork In The Horizontal Application. Electrical junction box provided. High voltage cable to be field supplied and installed. BacNet Compatible.

Data provided by blower manufacturer

"2 HP" Airflow & Sound Data - Assumes .5 Internal Exhaust Cabinet Static.

CFM	ESP	RPM	Freq. (Hz)	63	125	250	500	1000	2000	4000	8000	Blower Outlet dBA @ 5ft.
6916	0.1	712	dBA	84.0	80.0	75.0	73.0	71.0	69.0	66.0	63.0	66.0
6652	.25	756		86.0	80.0	76.0	74.0	72.0	70.0	66.0	63.0	67.0
6548	.3	775		87.0	81.0	77.0	75.0	73.0	70.0	67.0	64.0	67.0
6358	.4	804		88.0	82.0	77.0	75.0	73.0	70.0	67.0	64.0	68.0
6136	.5	837		89.0	84.0	79.0	77.0	74.0	72.0	69.0	66.0	69.0
5884	.6	869		89.0	87.0	81.0	79.0	75.0	74.0	71.0	68.0	71.0

"4 HP" Airflow & Sound Data - Assumes .5 Internal Exhaust Cabinet Static.

CFM	ESP	RPM	Freq. (Hz)	63	125	250	500	1000	2000	4000	8000	Blower Outlet dBA @ 5ft.
9188	0.1	836	dBA	90.0	89.0	83.0	80.0	77.0	76.0	72.0	69.0	73.0
9010	.25	859		90.0	88.0	83.0	80.0	76.0	76.0	72.0	69.0	72.0
8942	.3	868		90.0	88.0	83.0	80.0	76.0	75.0	72.0	69.0	72.0
8814	.4	886		90.0	88.0	83.0	80.0	76.0	75.0	72.0	69.0	72.0
8676	.5	907		91.0	88.0	83.0	80.0	76.0	75.0	72.0	69.0	72.0
8272	.75	970		92.0	89.0	84.0	81.0	77.0	76.0	73.0	70.0	73.0
7880	1.0	1033		92.0	91.0	86.0	82.0	78.0	77.0	74.0	71.0	74.0
7594	1.1	1055		93.0	93.0	87.0	84.0	78.0	78.0	75.0	72.0	76.0

"6 HP" Airflow & Sound Data - Assumes .5 Internal Exhaust Cabinet Static.

CFM	ESP	RPM	Freq. (Hz)	63	125	250	500	1000	2000	4000	8000	Blower Outlet dBA @ 5ft.
10732	0.1	939	dBA	93.0	93.0	88.0	85.0	80.0	80.0	77.0	73.0	77.0
10574	.25	954		92.0	93.0	88.0	84.0	79.0	80.0	76.0	73.0	76.0
10506	.3	959		92.0	93.0	88.0	84.0	79.0	79.0	76.0	73.0	76.0
10428	.4	973		92.0	93.0	88.0	84.0	79.0	79.0	76.0	73.0	76.0
10318	.5	987		92.0	93.0	87.0	84.0	79.0	79.0	76.0	72.0	76.0
9964	.75	1027		93.0	93.0	87.0	84.0	79.0	79.0	75.0	72.0	76.0
9670	1.00	1080		93.0	94.0	88.0	85.0	80.0	79.0	76.0	73.0	77.0
9394	1.25	1137		94.0	95.0	89.0	85.0	81.0	80.0	77.0	74.0	78.0
8800	1.50	1186		95.0	96.0	91.0	87.0	82.0	81.0	78.0	75.0	79.0

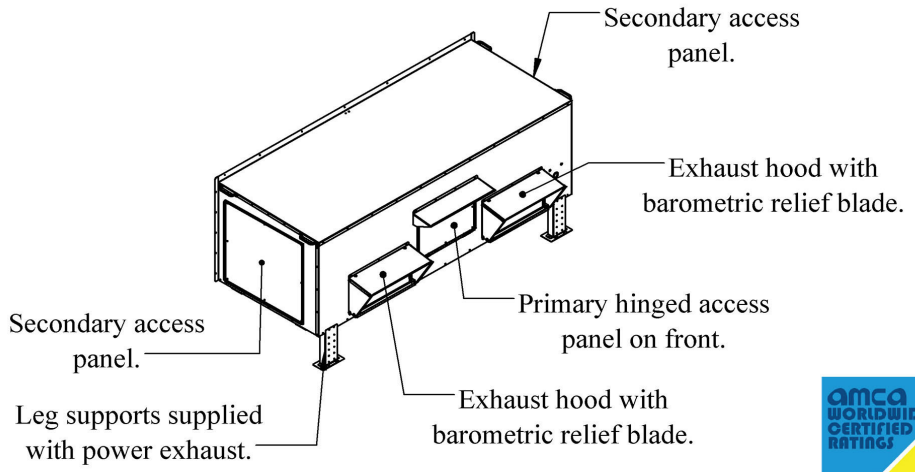
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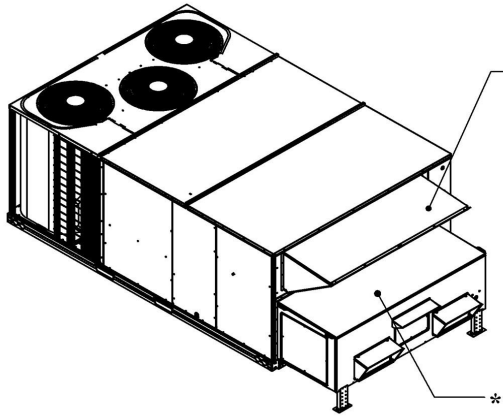
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AC-74

MicroMetl	Date:	Weight: 323lbs (US) 146.51kg (Metric)	Part Number: PCC-MRT69CA-D-4L4
	RTU:		
Submitted to:		Approved by:	Notes:

Power Exhaust - Power Exhaust - Modulating Speed, Centrifugal Exhaust Type, Convertible Orientation, 460 Volt Three Phase Voltage. Designed To Operate At 8676 CFM @ 1/2" - 4HP. Painted To Match RTU. DOES NOT INCLUDE ECONOMIZER. Compatible With MicroMetl & Carrier Factory Economizers. Mounted On Return Air Ductwork In The Horizontal Application. Electrical junction box provided. High voltage cable to be field supplied and installed. BacNet Compatible.

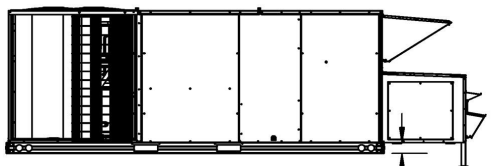




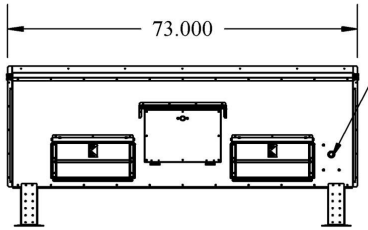
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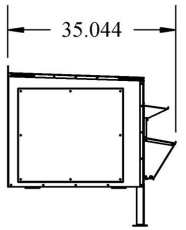
Power entry point.
1/2" and 3/4" knockouts.
(.875" and 1.125" actual)

****FIELD SUPPLIED DISCONNECT IS NEEDED FOR POWER EXHAUST****



Base of unit sits 3.75" below base of power exhaust.





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Master Revision 0001A

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	RTU:		
Submitted to:		Approved by:	Notes:

Power Exhaust - Power Exhaust - Modulating Speed, Centrifugal Exhaust Type, Convertible Orientation, 460 Volt Three Phase Voltage. Designed To Operate At 8676 CFM @ 1/2" - 4HP. Painted To Match RTU. DOES NOT INCLUDE ECONOMIZER. Compatible With MicroMetl & Carrier Factory Economizers. Mounted On Return Air Ductwork In The Horizontal Application. Electrical junction box provided. High voltage cable to be field supplied and installed. BacNet Compatible.

Compliant Economizer:

1. **Title 24:** Economizers meet California Energy Commission Title 24-2013 / 2016 prescriptive section 140.4 (damper leakage etc.), and mandatory section 120.2.i for Fault Detection and Diagnostic controls (JADE HJW10).
2. **ASHRAE 90.1:** Economizers meet ASHRAE 90.1-2013 / 2016 damper leakage requirements as stated in Table 6.4.3.4.3., and meet 2016 Fault Detection and Diagnosis requirements in section 6.4.3.12.
3. **IECC:** Economizers meet IECC 2012 section C402.4.5.2 and, IECC 2015 sections C403.2.4.3 and C403.3.3.5 for outside air, return air, and relief damper (when provided) leakage requirements, and IECC 2015 section c403.2.4.7 for Fault Detection and Diagnostic requirements, Note: IECC 2015 section C403.2.4.7.1 requires differential return air sensor, which is included in some models (i.e. -DYXB) and must be ordered separately on others (i.e. -DYDB, -DYEB).
4. **AMCA:** Outside air and return air (volume) dampers are AMCA Class 1A rated 1" w.g. Refer to MicroMetl NS1 catalog sheet on web site for details. Relief air dampers (when provided) are also AMCA rated. Refer to GR1 series catalog sheet on web site for details.

MicroMetl Corporation certifies that the models GR1 and NS1 shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with requirements of the AMCA Certified Ratings Programs. The AMCA Certified Ratings Seal applies to Air Leakage and Air Performance ratings.

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Master Revision 0001A

Page Revision 0001A

MicroMetl	Date:	Weight: 323lbs (US) 146.51kg (Metric)	Part Number: PCC-MRT69CA-D-4L4
	RTU:		
Submitted to:		Approved by:	Notes:

Power Exhaust - Power Exhaust - Modulating Speed, Centrifugal Exhaust Type, Convertible Orientation, 460 Volt Three Phase Voltage. Designed To Operate At 8676 CFM @ 1/2" - 4HP. Painted To Match RTU. DOES NOT INCLUDE ECONOMIZER. Compatible With MicroMetl & Carrier Factory Economizers. Mounted On Return Air Ductwork In The Horizontal Application. Electrical junction box provided. High voltage cable to be field supplied and installed. BacNet Compatible.

- 2HP Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
2V2	208-230/240	3	Constant Volume	2.0	7.6-7.2	9.5-9.0	12.4-11.7	N/A
2L2 or 2T2	208-230/240	3	Modulating	2.0	13.6*	17	30.6	25 Amp
4V2	460/480	3	Constant Volume	2.0	3.8	4.8	6.2	N/A
4L2 or 4T2	460/480	3	Modulating	2.0	6.5*	8.1	14.6	10 Amp

- 4HP Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
2V4	208-230/240	3	Constant Volume	4.0	11.2-10.8	14.0-13.5	18.2-13.1	N/A
2L4 or 2T4	208-230/240	3	Modulating	4.0	20.6*	25.8	46.4	40 Amp
4V4	460/480	3	Constant Volume	4.0	5.4	6.8	8.8	N/A
4L4 or 4T4	460/480	3	Modulating	4.0	10.5*	13.1	23.6	20 Amp

- 6HP Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
2V6	208-230/240	3	Constant Volume	6.0	18.4-17.2	23.0-21.5	29.9-28.0	N/A
2L6 or 2T6	208-230/240	3	Modulating	6.0	28.8*	36	64.8	40 Amp
4V6	460/480	3	Constant Volume	6.0	8.6	10.8	14.0	N/A
4L6 or 4T6	460/480	3	Modulating	6.0	14.3*	17.9	32.2	25 Amp

*VFD Input Current

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MicroMetl	Date:	Weight: 323lbs (US) 146.51kg (Metric)	Part Number: PCC-MRT69CA-D-4L4
	RTU:		
Submitted to:		Approved by:	Notes:

Power Exhaust - Power Exhaust - Modulating Speed, Centrifugal Exhaust Type, Convertible Orientation, 460 Volt Three Phase Voltage. Designed To Operate At 8676 CFM @ 1/2" - 4HP. Painted To Match RTU. DOES NOT INCLUDE ECONOMIZER. Compatible With MicroMetl & Carrier Factory Economizers. Mounted On Return Air Ductwork In The Horizontal Application. Electrical junction box provided. High voltage cable to be field supplied and installed. BacNet Compatible.

Data provided by blower manufacturer

"2 HP" Airflow & Sound Data - Assumes .5 Internal Exhaust Cabinet Static.

CFM	ESP	RPM	Freq. (Hz)	63	125	250	500	1000	2000	4000	8000	Blower Outlet dBA @ 5ft.
6916	0.1	712	dBA	84.0	80.0	75.0	73.0	71.0	69.0	66.0	63.0	66.0
6652	.25	756		86.0	80.0	76.0	74.0	72.0	70.0	66.0	63.0	67.0
6548	.3	775		87.0	81.0	77.0	75.0	73.0	70.0	67.0	64.0	67.0
6358	.4	804		88.0	82.0	77.0	75.0	73.0	70.0	67.0	64.0	68.0
6136	.5	837		89.0	84.0	79.0	77.0	74.0	72.0	69.0	66.0	69.0
5884	.6	869		89.0	87.0	81.0	79.0	75.0	74.0	71.0	68.0	71.0

"4 HP" Airflow & Sound Data - Assumes .5 Internal Exhaust Cabinet Static.

CFM	ESP	RPM	Freq. (Hz)	63	125	250	500	1000	2000	4000	8000	Blower Outlet dBA @ 5ft.
9188	0.1	836	dBA	90.0	89.0	83.0	80.0	77.0	76.0	72.0	69.0	73.0
9010	.25	859		90.0	88.0	83.0	80.0	76.0	76.0	72.0	69.0	72.0
8942	.3	868		90.0	88.0	83.0	80.0	76.0	75.0	72.0	69.0	72.0
8814	.4	886		90.0	88.0	83.0	80.0	76.0	75.0	72.0	69.0	72.0
8676	.5	907		91.0	88.0	83.0	80.0	76.0	75.0	72.0	69.0	72.0
8272	.75	970		92.0	89.0	84.0	81.0	77.0	76.0	73.0	70.0	73.0
7880	1.0	1033		92.0	91.0	86.0	82.0	78.0	77.0	74.0	71.0	74.0
7594	1.1	1055		93.0	93.0	87.0	84.0	78.0	78.0	75.0	72.0	76.0

"6 HP" Airflow & Sound Data - Assumes .5 Internal Exhaust Cabinet Static.

CFM	ESP	RPM	Freq. (Hz)	63	125	250	500	1000	2000	4000	8000	Blower Outlet dBA @ 5ft.
10732	0.1	939	dBA	93.0	93.0	88.0	85.0	80.0	80.0	77.0	73.0	77.0
10574	.25	954		92.0	93.0	88.0	84.0	79.0	80.0	76.0	73.0	76.0
10506	.3	959		92.0	93.0	88.0	84.0	79.0	79.0	76.0	73.0	76.0
10428	.4	973		92.0	93.0	88.0	84.0	79.0	79.0	76.0	73.0	76.0
10318	.5	987		92.0	93.0	87.0	84.0	79.0	79.0	76.0	72.0	76.0
9964	.75	1027		93.0	93.0	87.0	84.0	79.0	79.0	75.0	72.0	76.0
9670	1.00	1080		93.0	94.0	88.0	85.0	80.0	79.0	76.0	73.0	77.0
9394	1.25	1137		94.0	95.0	89.0	85.0	81.0	80.0	77.0	74.0	78.0
8800	1.50	1186		95.0	96.0	91.0	87.0	82.0	81.0	78.0	75.0	79.0

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Master Revision 0001A

Page Revision 0001A

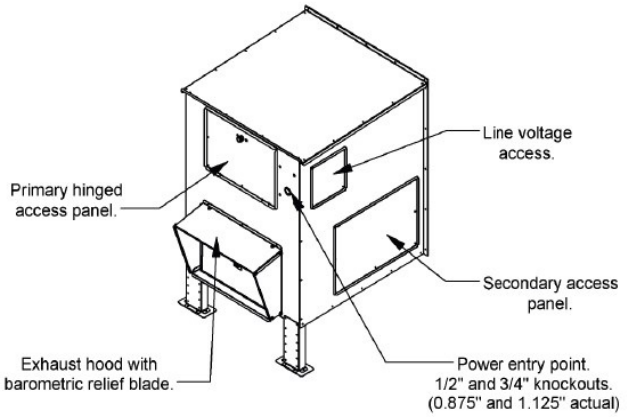
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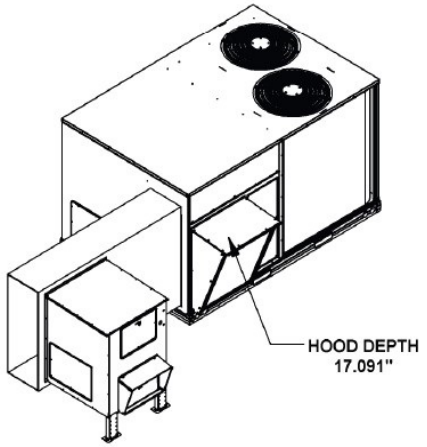
MicroMetl	Date: 10/18/2024	Weights: 285lbs/129.28kg	Units:	Part Number: PECH-SRT34CB-D0DB-4L2-4
Submitted To: achang@siglers.com	Job:	Notes:		

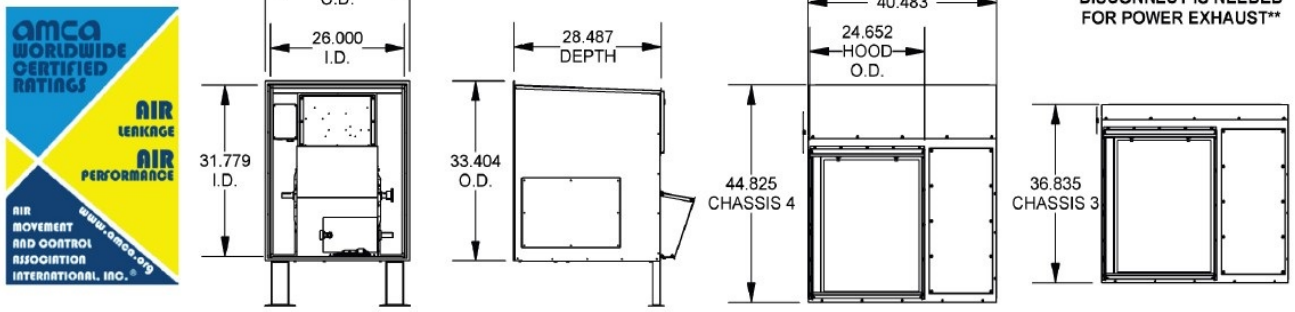
Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Horizontal with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 4400 CFM @ 1/2" - 2 HP. Power Exhaust Painted To Match RTU, All Necessary Panels And Hardware Included. Electrical junction box provided. High voltage cable to be field supplied and installed. Power Exhaust VFD is BacNet Compatible..

FEATURES:

- Includes ECH-SRT34CB series economizer.
- External gear driven dampers with roll formed blades.
- Designed for horizontal applications only.
- Factory assembled rain hood, with aluminum water entrainment filters.
- Filter access door supplied with RTU.
- Hinged filter access door is NOT currently available.
- Rain hood is sloped for water run off.
- All harnesses and plugs needed are supplied.
- Economizer is class 1A & AMCA certified.
- Relief blades are AMCA certified.
- Uses filter rack with unit.
- Field supplied and installed disconnect is required.
- Blower is forward curved, double inlet, with pre-lubricated ball bearings, have a dynamically balanced wheel, and are mounted on rubber isolators.
- Thermally protected motors.
- Adjustable motor pulleys.
- Ships with adjustable legs - 8" - 14".
- See page 2 for PE performance and electrical data.







Compliant Economizer:

1. **Title 24:** Economizers meet California Energy Commission Title 24-2013 / 2016 prescriptive section 140.4 (damper leakage etc.), and mandatory section 120.2.i for Fault Detection and Diagnostic controls.
2. **ASHRAE 90.1:** Economizers meet ASHRAE 90.1-2013 / 2016 damper leakage requirements as stated in Table 6.4.3.4.3., and meet 2016 Fault Detection and Diagnosis requirements in section 6.4.3.12.
3. **IECC:** Economizers meet IECC 2012 section C402.4.5.2 and, IECC 2015 sections C403.2.4.3 and C403.3.3.5 for outside air, return air, and relief damper (when provided) leakage requirements, and IECC 2015 section c403.2.4.7 for Fault Detection and Diagnostic requirements, Note: IECC 2015 section C403.2.4.7.1 requires differential return air sensor, which is included in some models (i.e. -D2XH) and must be ordered separately on others (i.e. -D2DH, -D2EH).
4. **AMCA:** Outside air and return air (volume) dampers are AMCA Class 1A rated at 1" w.g. Refer to MicroMetl NS2 catalog sheet on web site for details. Relief air dampers (when provided) are also AMCA rated. Refer to GR1 series catalog sheet on web site for details.

Control Types	
-D2DH	W7220 controller, 2-Speed, Sylk Bus actuator, Adjustable Drybulb controls
-D2EH	W7220 controller, 2-Speed, Sylk Bus actuator, Enthalpy controls
-D2XH	W7220 controller, 2-Speed, Sylk Bus actuator, Dual Adjustable Drybulb controls
-D2ZH	W7220 controller, 2-Speed, Sylk Bus actuator, Dual Enthalpy controls
-D0DB-4	RTU Open - Premier Link - System VU, No Controller, Adjustable dry bulb, Belimo
-D0DB-X	Comfortlink - No controller, Adjustable dry bulb, Belimo MFT with 500 ohm resistor
-D00B	2-10Vdc Belimo only actuator with feedback and end switch
-D00H	2-10Vdc Honeywell non-communication actuator only
-D00H-H	Honeywell communicating Sylk Bus actuator only
PE Options	
-2V1 or -2V2 or -2V3	208/230V 3PH, Constant Volume, 1HP or 2HP or 3HP
-2L1 or -2L2 or -2L3	208/230V 3PH, Modulating, BACNet ready, 1HP or 2HP or 3HP
-2T1 or -2T2 or -2T3	208/230V 3PH, 3rd Party Controls, BACNet ready, 1HP or 2HP or 3HP
-4V1 or -4V2 or -4V3	460V 3PH, Constant Volume, 1HP or 2HP or 3HP
-4L1 or -4L2 or -4L3	460V 3PH, Modulating, BACNet ready, 1HP or 2HP
-4T1 or -4T2 or -4T3	460V 3PH, 3rd Party Controls, BACNet ready, 1HP or 2HP or 3HP

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MicroMetl	Date: 10/18/2024	Weights: 285lbs/129.28kg	Units:	Part Number: PECH-SRT34CB-D0DB-4L2-4
Submitted To: achang@siglers.com		Job:		Notes:

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Horizontal with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 4400 CFM @ 1/2" - 2 HP. Power Exhaust Painted To Match RTU, All Necessary Panels And Hardware Included. Electrical junction box provided. High voltage cable to be field supplied and installed. Power Exhaust VFD is BacNet Compatible..

Compliant Economizer:

1. **Title 24:** Economizers meet California Energy Commission Title 24-2013 / 2016 prescriptive section 140.4 (damper leakage etc.), and when used with Carrier Comfortlink, RTU Open, System Vu, or I/O Flex 6126 control systems, meet mandatory section 120.2.i for Fault Detection and Diagnostic requirements. 5 Year Warranty for parts and components only.
2. **ASHRAE 90.1:** Economizers meet ASHRAE 90.1-2013/2016 damper leakage requirements, and meet 2016 Fault Detection and Diagnosis requirements when used with Carrier Comfortlink, RTU Open, System Vu, or I/O Flex 6126 control systems.
3. **IECC:** Economizers meet IECC 2012, IECC 2015, and IECC 2018 for outside air, return air, and relief damper (when provided) leakage requirements, and when used with Carrier Comfortlink, RTU Open, System Vu, or I/O Flex control systems meet IECC 2015 and IECC 2018 for Fault Detection and Diagnostic requirements. Note: IECC 2015 and IECC 2018 requires differential return air sensor, which must be ordered separately.
4. **AMCA:** Outside air and return air (volume) dampers are AMCA Class 1A rated at 1" w.g. Refer to MicroMetl NS2 catalog sheet on web site for details. Relief air dampers (when provided) are also AMCA rated. Refer to GR1 series catalog sheet on web site for details.

Features:

- Includes **ECH-SRT34CA** Series Economizer (less barometric relief hood). See economizer submittal for economizer details.
- Designed specifically for horizontal discharge applications.
- Includes assembled rainhood with aluminum water entrainment filters in the outside air section.
- Rainhood is sloped for water run-off.
- All harnesses and plugs needed are provided.

Notes:

1. Control systems include DDC actuator mounted on the outside air damper, and some models include 500 OHM resistor and outside air temperature sensor.
2. Differential return air sensor if required can be ordered from OEM unit factory, and is field installed in return duct.
3. ASHRAE, IECC, and Title 24 require the economizer controller be capable of reporting faults to a fault management application accessible by day-to-day operating or service personnel, or annunciated locally on zone thermostats or in some codes other devices are acceptable. Refer to applicable code requirements and to DDC controller for options.



MicroMetl Corporation certifies that the models GR1 and NS2 shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with requirements of the AMCA Certified Ratings Programs. The AMCA Certified Ratings Seal applies to Air Leakage and Air Performance ratings.

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MicroMetl	Date: 10/18/2024	Weights: 285lbs/129.28kg	Units:	Part Number: PECH-SRT34CB-D0DB-4L2-4
Submitted To: achang@siglers.com	Job:	Notes:		

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Horizontal with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 4400 CFM @ 1/2" - 2 HP. Power Exhaust Painted To Match RTU, All Necessary Panels And Hardware Included. Electrical junction box provided. High voltage cable to be field supplied and installed. Power Exhaust VFD is BacNet Compatible..

- 1/2HP Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
1VH	208-230/240	1	Constant Volume	0.5	4.1-4.3	5.1-5.4	9.2-9.7	N/A
2VH	208-230/240	3	Constant Volume	0.5	2.3-2.2	2.9-2.8	5.2-5.0	N/A
1LH or 1TH	208-230/240	1	Modulating	0.5	5.7*	7.1	12.8	10 Amp
2LH or 2TH	208-230/240	3	Modulating	0.5	3.9*	4.9	8.8	10 Amp
4VH	460/480	3	Constant Volume	0.5	1.1	1.4	2.5	N/A
4LH or 4TH	460/480	3	Modulating	0.5	1.5*	1.9	3.4	10 Amp

- 1HP Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
2V1	208-230/240	3	Constant Volume	1.0	3.8-3.6	4.8-4.5	8.6-8.1	N/A
1L1	208-230/240	1	Modulating	1.0	10.0*	12.5	22.5	20 Amp
2L1 or 2T1	208-230/240	3	Modulating	1.0	6.4*	8.0	14.4	12 Amp
4V1	460/480	3	Constant Volume	1.0	1.9	2.4	4.3	N/A
4L1 or 4T1	460/480	3	Modulating	1.0	2.8*	3.5	6.3	10 Amp

*VFD Input Current

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MicroMetl	Date: 10/18/2024	Weights: 285lbs/129.28kg	Units:	Part Number: PECH-SRT34CB-D0DB-4L2-4
Submitted To: achang@siglers.com		Job:		Notes:

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Horizontal with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 4400 CFM @ 1/2" - 2 HP. Power Exhaust Painted To Match RTU, All Necessary Panels And Hardware Included. Electrical junction box provided. High voltage cable to be field supplied and installed. Power Exhaust VFD is BacNet Compatible..

- Series Medium Static Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
2V1	208-230	3	Constant Volume	1.0	3.8-3.6	4.8-4.5	8.6-8.1	N/A
2L1 or 2T1	230	3	Modulating	1.0	6.4*	8	14.4	12 Amp
4V1	460	3	Constant Volume	1.0	1.9	2.4	4.3	N/A
4L1 or 2T1	460	3	Modulating	1.0	2.8*	3.5	6.3	10 Amp

- Series High Static Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
2V2	208-230	3	Constant Volume	2.0	5.6-5.4	7.0-6.8	12.6-12.2	N/A
2L2 or 2T2	230	3	Modulating	2.0	9.5*	11.9	21.4	15 Amp
4V2	460	3	Constant Volume	2.0	2.7	3.4	6.1	N/A
4L2 or 4T2	460	3	Modulating	2.0	4.5*	5.6	10.1	10 Amp

General Table

- Series Ultra High Static Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provide Fuses
2V3	208-230	3	Constant Volume	3.0	9.2-8.6	11.5-10.8	20.7-19.4	N/A
2L3 or 2T3	230	3	Modulating	3.0	13.6*	17	30.6	25 Amp
4V3	460	3	Constant Volume	3.0	4.3	5.4	9.7	N/A
4L3 or 4T3	460	3	Modulating	3.0	6.5*	8.1	14.6	10 Amp

*VFD Input Current

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MicroMetl	Date: 10/18/2024	Weights: 285lbs/129.28kg	Units:	Part Number: PECH-SRT34CB-D0DB-4L2-4
Submitted To: achang@siglers.com	Job:	Notes:		

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Horizontal with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 4400 CFM @ 1/2" - 2 HP. Power Exhaust Painted To Match RTU, All Necessary Panels And Hardware Included. Electrical junction box provided. High voltage cable to be field supplied and installed. Power Exhaust VFD is BacNet Compatible..

"1 HP" Sound Data - Assumes .3125 Internal Exhaust Cabinet Static.

CFM	ESP	RPM	Freq. (Hz)	63	125	250	500	1000	2000	4000	8000	Blower Outlet dBA @ 5ft.
3575	0.1	667	dBA	80	77	72	69	68	66	63	60	63
3450	.25	702		81	76	72	70	68	66	62	59	63
3400	.3	717		81	76	72	70	68	66	62	59	63
3300	.4	745		82	77	73	71	69	66	63	60	63
3200	.5	778		84	78	74	71	70	67	64	61	64
3100	.6	809		85	78	74	72	70	67	64	61	65
2925	.75	859		86	83	78	75	72	70	67	64	67

"2 HP" Sound Data - Assumes .3125 Internal Exhaust Cabinet Static.

CFM	ESP	RPM	Freq. (Hz)	63	125	250	500	1000	2000	4000	8000	Blower Outlet dBA @ 5ft.
4650	0.1	812	dBA	87	86	80	78	74	74	70	67	70
4550	.25	827		87	85	79	77	74	73	69	66	70
4525	.3	834		87	85	79	77	74	73	69	66	70
4450	.4	850		87	85	79	77	73	72	69	66	70
4400	.5	867		87	84	79	77	73	72	69	65	70
4350	.6	888		87	85	79	77	73	72	69	66	70
4250	.75	924		88	85	80	77	73	72	69	66	70

"3 HP" Sound Data - Assumes .3125 Internal Exhaust Cabinet Static.

CFM	ESP	RPM	Freq. (Hz)	63	125	250	500	1000	2000	4000	8000	Blower Outlet dBA @ 5ft.
5400	0.1	922	dBA	90	90	85	82	77	77	74	71	74
5325	.25	934		90	90	85	81	77	77	73	70	74
5300	.3	938		90	90	85	81	77	77	73	70	74
5250	.4	946		89	90	84	81	76	76	73	70	74
5200	.5	957		89	90	84	81	76	76	73	69	74
5150	.6	971		89	89	84	81	76	76	73	69	74
5050	.75	993		89	89	84	81	76	75	72	69	74

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AC 58 and 59

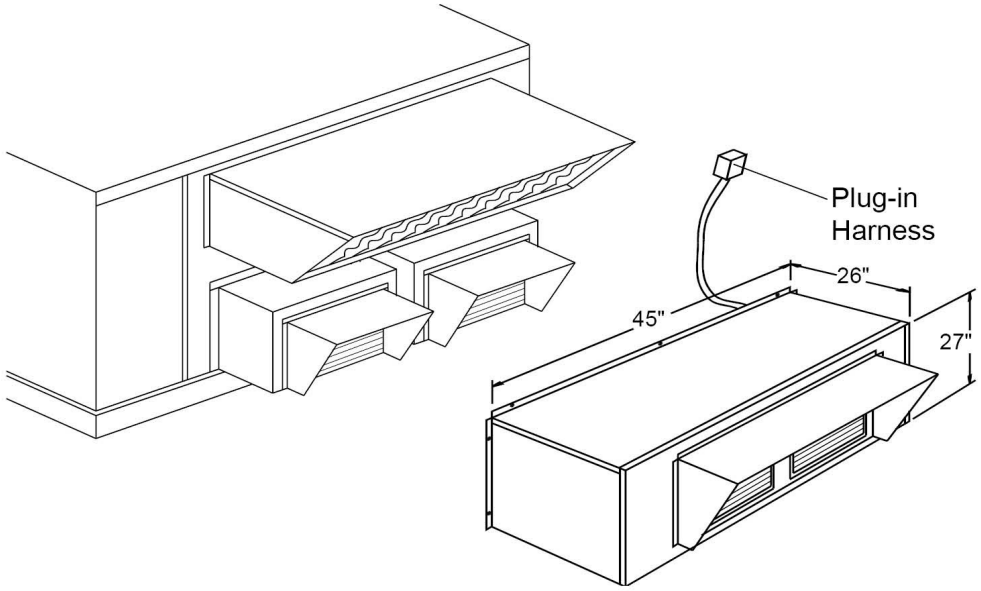
MicroMetl	Date:	Weight: 300lbs (US) 136.08kg (Metric)	Part Number: 1090-3104-LA910
	RTU:		
Submitted to:		Approved by:	Notes:

Power Exhaust - Power Exhaust - Modulating Speed, Centrifugal Exhaust Type, Convertible Orientation, 460 Volt Three Phase Voltage. Designed To Operate At 20907 CFM @ 1/2" - 12 HP. Painted To Match RTU. DOES NOT INCLUDE ECONOMIZER. Compatible With Carrier Factory Economizers. Mounted On Return Air Ductwork In The Horizontal Application. BacNet Compatible

MicroMetl Advantages

1. Blowers are forward curbed double inlet with pre-lubricated ball bearings and with a dynamically balanced wheel.
2. Thermally protected motors.
3. Relief dampers have gasketed blades.
4. Fans mounted on rubber isolator.
5. Adjustable motor pulley.
6. Large, full size front access door for easy service.
7. Motor and pulley are up front for easy adjusting.
8. Housing is painted and insulated with 1” - 1.5lb. density insulation.
9. Power Cord is SEOW/SOW 14-4.

1 Module - 1090-110*						
ESP	0.25	0.375	0.5	0.625	0.75	1
Max CFM	8147	7011	6969	7186	7070	3193
2 Module - 1090-210*						
ESP	0.25	0.375	0.5	0.625	0.75	1
Max CFM	16294	14022	13938	14372	14140	6386
3 Module - 1090-310*						
ESP	0.25	0.375	0.5	0.625	0.75	1
Max CFM	24441	21033	20907	21558	21210	9579



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Master Revision 0001A

Page Revision 0001A

MicroMetl	Date:	Weight: 300lbs (US) 136.08kg (Metric)	Part Number: 1090-3104-LA910
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Applicable to the following part numbers:
CRPWREXH071A00 (2M4 & 4M4 only)
CRPWREXH072A00(2M4 & 4M4 only)
1090-1***

- Series Single Module Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses per each module
2V4	208-230/240	3	Constant Volume	4.0	11.2-10.8	14.0-13.5	18.2-13.1	N/A
2L4 or 2T4	208-230/240	3	Modulating	4.0	20.6*	25.8	46.4	40 Amp
4V4	460	3	Constant Volume	4.0	5.4	6.8	8.8	N/A
4L4 or 4T4	460	3	Modulating	4.0	10.5*	13.1	23.6	20 Amp

Applicable to the following part numbers:
CRPWREXH074A00 (2M4 & 4M4 only)
CRPWREXH075A00 (2M4 & 4M4 only)
1090-2***

- Series Double Module Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses per each module
2V4	208-230/240	3	Constant Volume	4.0	22.4-21.6	28.0-27.0	29.4-28.4	N/A
2L4 or 2T4	208-230/240	3	Modulating	4.0	41.2*	51.5	67.0	40 Amp
4V4	460	3	Constant Volume	4.0	10.8	12.5	14.2	N/A
4L4 or 4T4	460	3	Modulating	4.0	21.0*	26.3	34.1	20 Amp

Applicable to the following part numbers:
CRPWREXH077A00 (2M4 & 4M4 only)
CRPWREXH078A00 (2M4 & 4M4 only)
1090-3***

- Series Triple Module Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses per each module
2V4	208-230/240	3	Constant Volume	4.0	33.6-32.4	42.0-40.5	40.6-39.2	N/A
2L4 or 2T4	208-230/240	3	Modulating	4.0	61.8*	77.3	87.6	40 Amp
4V4	460	3	Constant Volume	4.0	16.2	20.3	19.6	N/A
4L4 or 4T4	460	3	Modulating	4.0	31.5*	39.4	44.6	20 Amp

*VFD Input Current

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Indianapolis_3035 N. Shadeland Ave., Indianapolis, IN 46226_800.MMC.HVAC •• Sparks_905 Southern Way, Sparks, NV 89431_800.884.4MMC •• Longview_201 Kodak Blvd., Longview, TX 75602_903.248.4800

REFERENCE

Building	Mark For	Exisiting unit Model	Orentation	Tonnage	Voltage	Replacement
Library	AC-72	YCH301CALFCA	Horizontal	25	460-3-60	48FCDM28AJM6-3U0A0
Library	AC -73	YCH301CALFCA	Horizontal	25	460-3-60	48FCDM28AJM6-3U0A0
Library	AC-74	YCH241CALFCA	Horizontal	20	460-3-60	48FCDM20AJM6-3U0A0
~~Library~~	~~Mini Split 1~~	~~MUH24WN~~	~~Split~~	~~2~~	~~208/230-1-60~~	~~38MARBQ24AA3~~
GYM	AC-59	YCH600A4LR0A4NC1ABCOEOOH00000	Horizontal	50	460-3-60	48A8D050-SM65AEE
GYM	AC-60	YHC120A4RLA1T00000	Horizontal	10	460-3-60	48FCDM12A3M6-3A0A0
GYM	AC-58	YCH600A4LR0A4NC1ABCOEOOH00000	Horizontal	50	460-3-60	48A8D050-SM65AEE

PRODUCT DATA SHEET

ClimaVision HyperStat

All-in-one commercial thermostat and humidistat for superior IAQ management and localized temperature control



HyperStat | Part # 7C-HS-C2W-X

- Occupancy, temperature, light, humidity, sound, CO_2 and optional VOC and particulate matter (PM2.5 and PM10)(7C-SE-K1X-X)
- TFT LCD display with touch slider and user buttons
- (6) Onboard relays
- (3) Analog outputs
- (2) Thermistor inputs
- (2) Analog inputs

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ClimaVision HyperStat

Give your occupants the power of IAQ management and localized temperature control with the ClimaVision HyperStat, an all-in-one thermostat and humidistat thoughtfully crafted to support healthy, comfortable spaces. Each stat has up to eight on-board sensors for a complete picture of IAQ in your zone and has control capabilities for up to three-stage equipment to fine-tune sequences for optimal building health.

The HyperStat works out of the box with the ClimaVision intelligent building solution. Replacing non-connected thermostats with the HyperStat's cloud-enabled capabilities is as easy as swapping out the wires. The sleek, contemporary design will look right at home in any space.



Part # 7C-HS-C2W-X

OVERVIEW

The HyperStat is an all-in-one IAQ sensing station, thermostat and humidistat. It brings HVAC equipment online for secure remote management from any smartphone or connected device. Occupants can make temperature adjustments within predefined limits from a touch slider or buttons. The TFT Display provides valuable insights to users or technicians.

This device supports the WELL Building standard for healthy buildings and tracks occupancy, temperature, dedicated CO2, humidity, light, sound, and optional VOC and particulate matter measurements every 60 seconds.

KEY FEATURES

- Built-in sequences for occupancy detection mean your HyperStat prioritizes health and comfort when it matters most and saves valuable energy when spaces are empty.
- Pre-loaded equipment profiles allow for interfacing to a wide variety of staged and fully modulating equipment.
- Facility directors have real-time access to sensor data and remote control over building parameters through the HyperStat's integration with ClimaVision's building intelligence suite of web and mobile apps.
- ClimaVision's secure encrypted 900Mhz mesh network allows for lightweight, reliable communications between devices and the ClimaVision Central Control Unit, eliminating the need for running wires throughout a facility.

ADDITIONAL FEATURES

- Over-the-air firmware updates
- Sensor bus for power and communication
- Commissions and communicates with the CCU in just minutes with Bluetooth pairing

EQUIPMENT CONTROL

Supports staging of cooling, heating, or fan (up to 3 stages) or fully modulating:

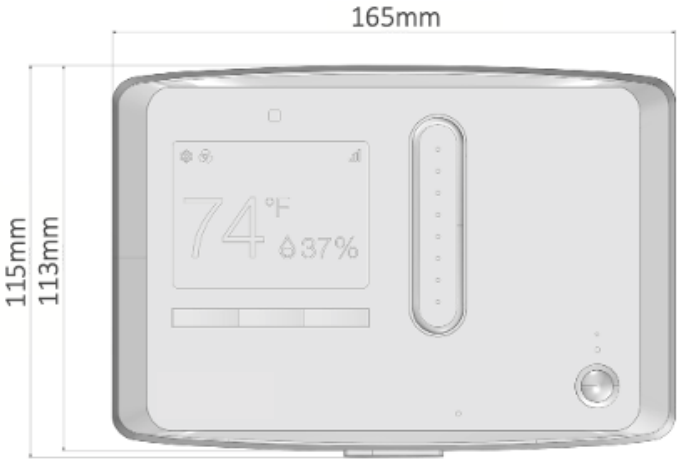
- Rooftop Units
- Water Source Heat Pumps
- Unit Heaters
- PTAC Units
- 2-Pipe Fan Coil Units
- Induction Units

INCLUDED

(1) HyperStat
(2) Mounting screws

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ClimaVision HyperStat



MECHANICAL

Dimensions	6.5” x 4.5” x 1.15” (165mm x 115mm x 29 mm)
Mounting	(2) screws in drywall
Screen	2.8” 240x320 pixel TFT LCD
Operating Range	32°F to 122°F (0°C to 50°C)

SENSORS

Temperature	Operating range between 32°F to 122°F (0°C to 50°C); typical accuracy of +/- 1°F or 0.2°C
Humidity	Operating range between 20 to 85% noncondensing; Typical accuracy of +/- 2% RH
Dedicated CO_2 Sensor	Range 0-40’000 ppm; Accuracy +/-30ppm over range of 400-10,000ppm and lifetime of 15 years
Light	Ambient light sensor; high-accuracy UV index sensor; matches erythemal curve; < 100 mix resolution
Sound	40-120dB response for 100 Hz to 10Khz
Occupancy	Passive Infra Red (PIR) with detection range of 4m with 30-degree angle
VOC	TVOC: 0-60’000 ppb. Typical Accuracy - 15% of measured value

OPTIONAL SENSOR

PM2.5, PM10 7C-SE-K1X-X	Detection range of 0-1000ug/m3 and accuracy of +/-10ug/m3 (PM2.5, 0-100 ug/m3) or +/- 25ug/m3 (PM10, 0-100ug/m3)

ELECTRICAL

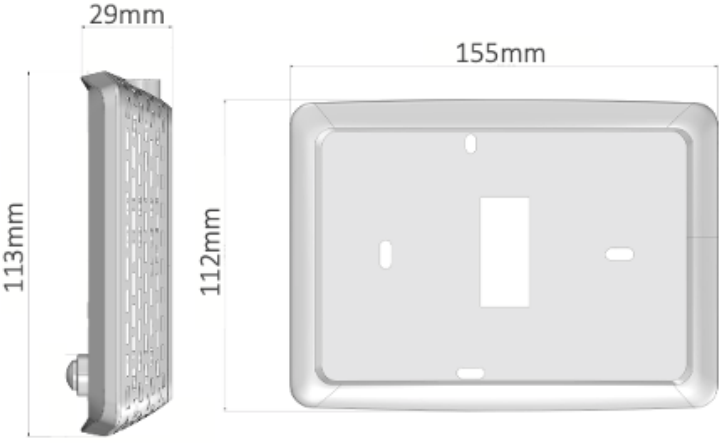
Power	24V AC/DC (+/-15%) with nominal power consumption 1.0W and maximum consumption of 2.5W

COMMUNICATIONS

Bluetooth	BLE4.1; used during commissioning
Mesh	900 MHz IEEE 802.15.4-compliant; used for device communication on mesh network
Wired	4 wire RS-485 interface 3 wire connector for low-power sensor bus

WALL PLATE

6.1” x 4.4” (155mm x 113mm)



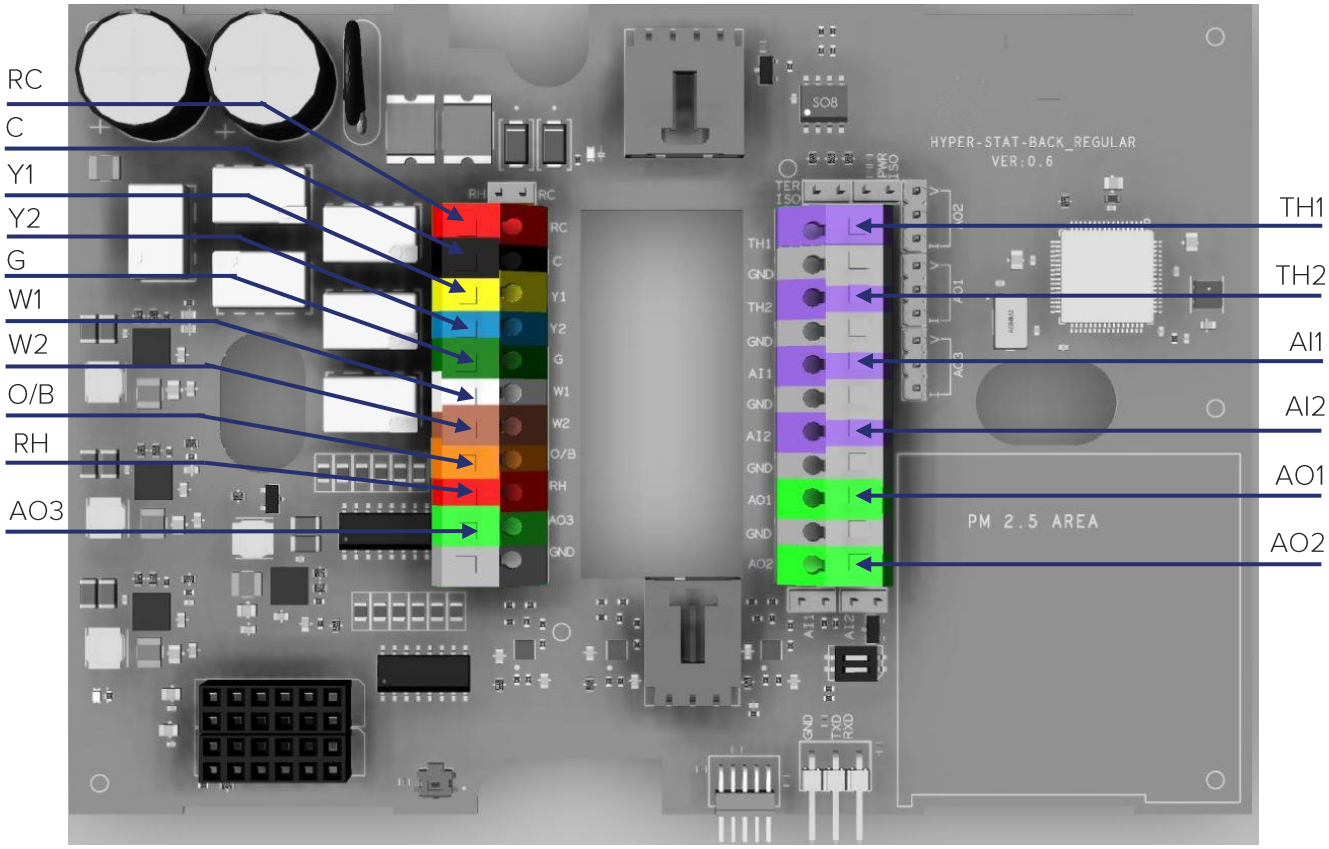
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ClimaVision HyperStat

I/O

Inputs	(2) 10k type-2 thermistor inputs with 2% accuracy (2) 0-10V analog voltage inputs with 2% detection accuracy
Outputs	(6) 24V dc/1A relays (3) 0-10V/4 -20ma (max load of 20mA per channel) analog outputs

INTERFACE PCB



DSA

103-25

LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

☐ Project has a geotechnical report or construction documents require special inspection by a geotechnical engineer.
☑ Project does NOT have and does NOT require a geotechnical report.

	TYPE	BY
S1 | SOILS - GENERAL		
☐ S1a: Site Preparation	See Notes	PI
S2 | COMPACTION AND FILL		
☐ S2a: Fill Materials	Test	LOR*
☐ S2b: Fill Placement	Continuous	LOR*
☐ S2c: Compaction	Test	LOR*
S3 | DRIVEN DEEP FOUNDATIONS (PILES)		
☐ S3a: Materials and Members	Continuous	GE*
☐ S3b: Pile Capacity	Test	LOR*
☐ S3c: Driving Operations	Continuous	GE*
☐ S3d: Pile Installation	Continuous	GE*
☐ S3e: Specialty Piles	*	*
S4 | CAST-IN-PLACE DEEP FOUNDATIONS (PIERS)		
☐ S4a: Drilling Operations	Continuous	PI
☐ S4b: Pier Construction	Continuous	PI
☐ S4c: Bearing Strata	Continuous	GE*
S5 | RETAINING WALLS		
☐ S5a: Backfill Placement	Continuous	GE*
☐ S5b: Soil Reinf. and Drainage	Continuous	GE*
☐ S5c: Segmental Retaining Walls	Continuous	GE*
S6 | OTHER SOILS		
☐ S6a: Soil Improvement Test	Test	GE*
☐ S6b: Soil Improvement Inspection	Continuous	GE*
☐ S6c: Not used.	N/A	N/A
☐ S6d: Not used.	N/A	N/A
☐ S6e: Not used.	N/A	N/A
☐ S6f: Not used.	N/A	N/A
☐ S6g: Not used.	N/A	N/A
☐ S6h: Not used.	N/A	N/A
☐ S6i: Not used.	N/A	N/A
☐ S6j: Not used.	N/A	N/A
☐ S6k: Not used.	N/A	N/A
☐ S6l: Not used.	N/A	N/A
☐ S6m: Not used.	N/A	N/A
☐ S6n: Not used.	N/A	N/A

* See Appendix for additional information.

	TYPE	BY
C1 | CAST-IN-PLACE CONCRETE		
☐ C1a: Mix Design	Continuous	SI
☐ C1b: Reinforcing Steel	Test	LOR
☐ C1c: Concrete Material	Test	LOR
☐ C1d: Strength Test	Test	LOR
☐ C1e: Batch Plant Inspection		SI
C2 | PRESTRESSED CONCRETE		
☐ C2a: Tendons and Anchorage	Test	LOR
☐ C2b: Tendon Placement	Periodic	SI
☐ C2c: Concrete Strength	Periodic	SI
☐ C2d: Stressing Operations	Continuous	SI
C3 | PRECAST CONCRETE		
☐ C3a: General Fabrication	Continuous	SI
☐ C3b: General Erection	Periodic	SI*
☐ C3c: Diaphragm Connections	Continuous	SI
☐ C3d: Diaphragm Tolerances	Periodic	SI
C4 | SHOTCRETE		
☐ C4a: Placement	Continuous	SI
☐ C4b: Shotcrete Material	Test	LOR
C5 | POST-INSTALLED ANCHORS		
☐ C5a: Inspection	See notes	SI*
☐ C5b: Test	Test	LOR
C6 | OTHER CONCRETE		
☐ C6a: Not used.	N/A	N/A
☐ C6b: Not used.	N/A	N/A
☐ C6c: Not used.	N/A	N/A
☐ C6d: Not used.	N/A	N/A
☐ C6e: Not used.	N/A	N/A
☐ C6f: Not used.	N/A	N/A
☐ C6g: Not used.	N/A	N/A
☐ C6h: Not used.	N/A	N/A
☐ C6i: Not used.	N/A	N/A
☐ C6k: Not used.	N/A	N/A
☐ C6l: Not used.		
Not used.		

* See Appendix for additional information.

Project Name: **Firebaugh High School**
School District: **Lynwood Unified School District**

Application No.: **03-125870** Increment:
File No.: **19-H31**

LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

	TYPE	BY
M1 | STRUCTURAL MASONRY f'm PSI:		
☐ M1a: Mill Certificates - Reinf.	Periodic	SI*
☐ M1b: Material Certificates	Test	LOR
☐ M1c: Strength Test	Test	LOR
☐ M1d: Mortar Proportions	Periodic	SI
☐ M1e: Grout Proportions	Periodic	SI
☐ M1f: Batch Plant Inspection		SI
☐ M1g: Core Tests	Test	LOR
☐ M1h: Prisms	Continuous	SI
☐ M1i: Dowels and Supports	Periodic	SI
☐ M1j: Reinforcement and Members	Periodic	SI
☐ M1k: Reinforcement Placement	Continuous	SI
☐ M1l: Grout Placement	Continuous	SI
☐ M1m: Unit Layup and Joints	Periodic	SI*
☐ M1n: Cold/Hot Weather Work	Periodic	SI
☐ M1o: Anchors and Embeds	Continuous	SI
☐ M1p: Grout Cavity	Continuous	SI
M2 | VENEER OR GLASS BLOCK PARTITIONS		
☐ M2a: Mortar and Grout	Periodic	SI
☐ M2b: Unit Layup and Joints	Periodic	SI
☐ M2c: Wires and Connector	Periodic	SI
☐ M2d: Anchors and Embeds	Periodic	SI
☐ M2e: Cold/Hot Weather Work	Periodic	SI*
☐ M2f: Adhered Veneer Bond	Test	LOR
M3 | POST-INSTALLED ANCHORS		
☑ M3a: Inspection	Varies*	SI*
☑ M3b: Test	Test	LOR
M4 | OTHER MASONRY		
☐ M4a: Not used.	N/A	N/A
☐ M4b: Not used.	N/A	N/A
☐ M4c: Not used.	N/A	N/A
☐ M4d: Not used.	N/A	N/A
☐ M4e: Not used.	N/A	N/A
☐ M4f: Not used.	N/A	N/A
☐ M4g: Not used.	N/A	N/A
☐ M4h: Not used.	N/A	N/A
☐ M4i: Not used.	N/A	N/A
☐ M4j: Not used.	N/A	N/A
☐ M4k: Not used.		
☐ M4l: Not used.		
☐ M4m: Not used.		
Not used.		

* See Appendix for additional information.

	TYPE	BY
S/A1 | STEEL AND ALUMINUM		
☑ S/A1a: Material Identification	Periodic	*
☑ S/A1b: Unidentified Material	Test	LOR
☑ S/A1c: Steel Fabrication	Periodic	SI
☐ S/A1d: Buckling Restrained Brace	Test*	LOR
S/A2 | HIGH-STRENGTH BOLTS		
☑ S/A2a: Product Verification	Periodic	SI
☑ S/A2b: Bolts, Nuts, and Washers	Test	LOR
☑ S/A2c: Snug Tight	Periodic	SI
☐ S/A2d: Pretensioned / Slip-Critical	*	SI
S/A3 | WELDING		
☑ S/A3a: Weld Material	Periodic	SI
☑ S/A3b: Certificate of Compliance	Periodic	SI
☑ S/A3c: WPS and Qualifications	Periodic	SI
S/A4 | SHOP WELDING		
☐ S/A4a: Weld Category A	Continuous	SI
☑ S/A4b: Weld Category B	Periodic	SI
☐ S/A4c: Stairs and Railing	Periodic	SI
☐ S/A4d: Reinf. Steel Weldability	Periodic	SI
☐ S/A4e: Reinforcing Steel	Continuous	SI
S/A5 | FIELD WELDING		
☐ S/A5a: Weld Category A	Continuous	SI
☑ S/A5b: Weld Category B	Periodic	SI
☐ S/A5c: End Welded Studs	Periodic	SI
☐ S/A5d: Deck Welds	Periodic	SI
☐ S/A5e: Cold-Formed Steel	Periodic	SI
☐ S/A5f: Stairs and Railing	Periodic	SI
☐ S/A5g: Reinf. Steel Weldability	Periodic	SI
☐ S/A5h: Reinforcing Steel	Continuous	SI
S/A6 | NONDESTRUCTIVE TESTING		
☐ S/A6a: Ultrasonic	Test	LOR
☐ S/A6b: Magnetic Particle	Test	LOR
☐ S/A6c:Not used.	N/A	N/A
☐ S/A6d:Not used.	N/A	N/A
☐ S/A6e:Not used.	N/A	N/A
S/A7 | STEEL JOISTS AND TRUSSES		
☐ S/A7a: Fabrication	Continuous	SI
S/A8 | METAL BUILDING		
☐ S/A8a: Inspection	Periodic	SI
S/A9 | SPRAYED FIRE-RESISTANT MATERIALS		
☐ S/A9a: Surface and Installation	Periodic	SI
☐ S/A9b: Density	Test	LOR
☐ S/A9c: Bond: Adhesion/Cohesion	Test	LOR

* See Appendix for additional information.

Project Name: **Firebaugh High School** Application No.: **03-125870** Increment:
School District: **Lynwood Unified School District** File No.: **19-H31**

LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

	TYPE	BY
S/A10 | ANCHOR BOLTS AND ANCHOR RODS		
☐ S/A10a: Anchor Rods and Bolts	Test	LOR
☐ S/A10b: Other Threaded Rods	Test	LOR
S/A11 | STORAGE RACK SYSTEMS		
☐ S/A11a: Material Verification	Periodic	SI
☐ S/A11b: Fabrication	Periodic	SI
☐ S/A11c: Anchorage	Periodic	SI
☐ S/A11d: Completed System	Periodic	SI*
S/A12 | OTHER STEEL AND ALUMINUM		
☐ S/A12a: Not used.	N/A	N/A
☐ S/A12b: Not used.	N/A	N/A
☐ S/A12c: Not used.	N/A	N/A
☐ S/A12d: Not used.	N/A	N/A
☐ S/A12e: Not used.	N/A	N/A
☐ S/A12f: Not used.	N/A	N/A
☐ S/A12g: Not used.	N/A	N/A
☐ S/A12h: Not used.	N/A	N/A
☐ S/A12i: Not used.	N/A	N/A
☐ S/A12j: Not used.	N/A	N/A
W1 | PREFABRICATED WOOD TRUSSES		
☐ W1a: Open Web Truss Fabrication	Continuous	SI
☐ W1b: Metal Plate Truss Fabrication	Continuous	SI
W2 | MANUFACTURED WOOD ELEMENTS		
☐ W2a: GL Timber Fabrication	Continuous	SI
☐ W2b: CLT Fabrication	Continuous	SI
☐ W2c: Mass Timber Erection	Periodic	SI
☐ W2d: Connections Type A	Periodic	SI
☐ W2e: Connections Type B	Continuous	SI
☐ W2f: Sealants	Periodic	SI
W3 | OTHER WOOD		
☐ W3a: Not used.	N/A	N/A
☐ W3b: Not used.	N/A	N/A
☐ W3c: Not used.	N/A	N/A
☐ W3d: Not used.	N/A	N/A
☐ W3e: Not used.	N/A	N/A
☐ W3f: Not used.	N/A	N/A
☐ W3g: Not used.	N/A	N/A
☐ W3h: Not used.	N/A	N/A

* See Appendix for additional information.

	TYPE	BY
X | OTHER		
☐ X01: Product Load Test*	Test	LOR
☐ X02: Non-HSB Installation Torque	Continuous	SI*
☐ X03: Not used.	N/A	N/A
☐ X04: Not used.	N/A	N/A
☐ X05: Not used.	N/A	N/A
☐ X06: Not used.	N/A	N/A
☐ X07: Not used.	N/A	N/A
☐ X08: Not used.	N/A	N/A
☐ X09: Not used.	N/A	N/A
☐ X10: Not used.	N/A	N/A

EXEMPTIONS

Those items identified on the DSA-approved construction documents with a note indicating they are not part of the DSA approval or those items checked below are exempt from test and special inspection requirements. The project inspector shall verify all construction complies with the approved construction documents.

- ☐ Soils: Eligible shallow foundation elements**.
- ☐ Soils: Eligible deep foundation elements - type 1**.
- ☐ Soils: Eligible deep foundation elements - type 2**.
- ☐ Concrete/Masonry: Eligible post-installed anchors**.
- ☐ Concrete: Batch plant inspection for items listed in and complying with CBC Section 1705A.3.3.2.
- ☐ Concrete: Epoxy shear dowels in nonstructural slab-on-grade per CBC Section 1910A.5.4, Exception #4.
- ☐ Concrete/Masonry: Reinforcing bar testing for items listed in and complying with CBC Section 1910A.2.
- ☐ Masonry: Freestanding site walls and retaining walls per DSA IR 21-1.

Concrete: Eligible precast elements**.

- ☐ Welding: Eligible fences and gates**.
- ☐ Welding: Eligible railing and ramps**.
- ☐ Welding: Eligible interior cold-formed steel framing**.
- ☑ Welding: Eligible equipment curbs**.
- ☑ Welding: Eligible components supporting MEP distribution systems**.
- ☑ Welding: Eligible mounts and recreational equipment**.
- ☐ Welding: Eligible nonstructural components**.

** See Appendix for eligibility requirements.

Project Name: **Firebaugh High School** Application No.: **03-125870** Increment:

School District: **Lynwood Unified School District** File No.: **19-H31**

LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

IMPORTANT: This form is only a summary list of structural tests and some of the special inspections required for the project. Any items indicated on the approved construction documents with a note stating that the items are not part of the DSA approval are not considered in this form. Generally, the structural tests and special inspections noted on this form are those that will be performed by the Geotechnical Engineer of Record, Laboratory of Record, or Special Inspector. The actual complete test and inspection program must be performed as detailed on the DSA approved documents. The exemption appendix at the end of this form identifies work NOT subject to DSA requirements for special inspection or structural testing. The project inspector is responsible for providing inspection of all facets of construction, including but not limited to, special inspections not listed on this form such as structural wood framing, high-load wood diaphragms, cold-formed steel framing, anchorage of nonstructural components, etc., per Title 24, Part 2, Chapter 17A.

Legend to TYPE and BY Columns:

Continuous - Indicates continuous special inspection is required.

Periodic - Indicates periodic special inspection is required.

Test - Indicates a test is required.

GE – Indicates special inspection shall be performed by a registered geotechnical engineer or his/her authorized representative, usually associated with the Laboratory of Record.

LOR – Indicates test or special inspection shall be performed by a testing laboratory accepted in the DSA Laboratory Evaluation and Acceptance (LEA) Program (i.e., the Laboratory of Record for the project). See CAC Section 4-335.

PI - Indicates special inspection may be performed by a project inspector when specifically approved by DSA.

SI - Indicates special inspection shall be performed by an appropriately qualified/approved special inspector.

Required Verified Reports:

1. Structural Testing and Inspection: Form DSA 291
2. Post-installed Anchors: Form DSA 291 or DSA 292
3. Shop Welding Inspection: Form DSA 291 or DSA 292
4. Field Welding Inspection: Form DSA 291 or Form DSA 292
5. High-Strength Bolting Inspection: Form DSA 291 or DSA 292

Verified reports are required on the following DSA forms:

DSA 291: Laboratory of Record Verified Report

DSA 292: Special Inspectors Employed Directly by the District Verified Report

DSA 293: Geotechnical Verified Report

Note: To facilitate DSA electronic mark-ups and identification stamp application, DSA recommends against using secured electronic or digital signatures.

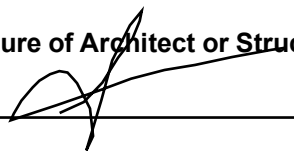
Name of Design Professional in General Responsible Charge:

Peter Sarkis S5038

Name of Structural Engineer of Record (when applicable):

Peter Sarkis S5038

Signature of Architect or Structural Engineer: **Date:**



DSA STAMP

Project Name: **Firebaugh High School**

School District: **Lynwood Unified School District**

Application No.: **03-125870** Increment:

File No.: **19-H31**

Appendix: LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

NOTE: Undefined sections and table references found in this appendix are from the CBC, or California Building Code

S1. GENERAL:	
Test or Special Inspection	**Code References and Notes**
S1a: Site Preparation | Verify that: • Site has been prepared properly prior to placement of controlled fill and/or excavations for foundations. • Foundation excavations are extended to proper depth and have reached proper material. • Materials below footings are adequate to achieve the design bearing capacity.	Refer to specific items identified in the Appendix listing exemptions for limitations. Placement of controlled fill exceeding 12" depth under foundations is not permitted without a geotechnical report.

S2. SOIL COMPACTION AND FILL:	
Test or Special Inspection	**Code References and Notes**
S2a: Fill Materials | Perform classification and testing of fill materials.	* Under the supervision of the geotechnical engineer.
S2b: Fill Placement | Verify use of proper materials, densities and inspect lift thicknesses, placement and compaction during placement of fill.	* Under the supervision of a geotechnical engineer or LOR's engineering manager. Refer to specific items identified in the end of this form listing exemptions for limitations.
S2c: Compaction | Compaction testing.	Refer to specific items identified in the Appendix listing exemptions for limitations. Placement of controlled fill exceeding 12" depth under foundations is not permitted without a geotechnical report.

S3. DRIVEN DEEP FOUNDATIONS (PILES):	
Test or Special Inspection	**Code References and Notes**
S3a: Materials and Members | Verify pile materials, sizes and lengths comply with the requirements.	* By geotechnical engineer or his or her qualified representative.
S3b: Pile Capacity | Determine capacities of test piles and conduct additional load tests as required.	* Under the supervision of the geotechnical engineer.
S3c: Driving Operations | Inspect driving operations and maintain complete and accurate records for each pile.	* By geotechnical engineer or his or her qualified representative.

S3d: Pile Installation | Verify locations of piles and their plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and record any pile damage.	* By geotechnical engineer or his or her qualified representative.
S3e: Specialty Piles | For specialty piles, perform additional inspections as determined by the registered design professional in responsible charge.	* As defined on drawings or specifications.

S4. CAST-IN-PLACE DEEP FOUNDATIONS (PIERS):	
Test or Special Inspection	**Code References and Note**
S4a: Drilling Operations | Inspect drilling operations and maintain complete and accurate records for each pier.	Continuous inspection to be provided by project inspector. Refer to specific items identified in the Appendix (end of this form) listing exemptions for limitations.
S4b: Pier Construction | Verify pier locations, diameters, plumbness, bell diameters (if applicable), lengths and embedment into bedrock (if applicable); record concrete or grout volumes.	Continuous inspection to be provided by project inspector. Refer to specific items identified in the Appendix (end of this form) listing exemptions for limitations.
S4c: Bearing Strata | Confirm adequate end strata bearing capacity.	Provide tests and inspections per CONCRETE section below.

S5. RETAINING WALLS:	
Test or Special Inspection	**Code References and Notes**
S5a: Backfill Placement | Placement, compaction and inspection of backfill.	1705A.6.1. * By geotechnical engineer or his or her qualified representative. (See section S2 above).
S5b: Soil Reinf. and Drainage | Placement of soil reinforcement and/or drainage devices.	* By geotechnical engineer or his or her qualified representative.
S5c: Segmental Retaining Walls | Segmental retaining walls; inspect placement of units, dowels, connectors, etc.	* By geotechnical engineer or his or her qualified representative. See DSA IR 18-2.

S6 | OTHER SOILS	
Test or Special Inspection	**Code References and Notes**
S6a | Soil Improvements	Submit a comprehensive report documenting final soil improvements constructed, construction observation and the results of the confirmation testing and analysis to CGS (California Geological Survey) for final acceptance. * By geotechnical engineer or his or her qualified representative.
S6b | Inspection of Soil Improvements	* By geotechnical engineer or his or her qualified representative.
S6c. | Not used.	N/A
S6d. | Not used.	N/A
S6e. | Not used.	N/A
S6f. | Not used.	N/A
S6g. | Not used.	N/A
S6h. | Not used.	N/A
S6i. | Not used.	N/A
S6j. | Not used.	N/A
S6k. | Not used.	N/A
S6l. | Not used.	N/A
S6m. | Not used.	N/A
S6n. | Not used.	N/A

Appendix: LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

C1. CAST-IN-PLACE CONCRETE	
Test or Special Inspection	**Code References and Notes**
C1a: Mix Design | Verify use of required design mix.	**Table 1705A.3 Item 5, 1903A.4, 1904A.1, 1904A.2, 1910A.1 ; ACI 318 Ch. 19, 26.4, 26.13.3.2.**
C1b: Reinforcing Steel | Identify, sample, and test reinforcing steel.	**Table 1705A.3 Item 1, 1705A.3.9, 1908A.1, 1910A.2; ACI 318 Ch. 20 and Sections 25.2, 25.3, 25.5.1, 26.6.1; DSA IR 17-10 and BU 24-02. (See Appendix (end of this form) for exemptions.)**
C1c: Concrete Material | During concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	**Table 1705A.3 Item 6, 1705A.3.9, 1905A.1.16; ASTM C31, ASTM C172; ACI 318 Sections 26.4, 26.5 & 26.12.**
C1d: Strength Test | Test concrete (f'c).	**1905A.1.16; ACI 318 Section 26.12.**
C1e: Batch Plant Inspection | Batch plant inspection: Continuous	**Default of "Continuous" per 1705A.3.3. If approved by DSA, batch plant inspection may be reduced to "Periodic" subject to requirements in Section 1705A.3.3.1, or not required per 1705A.3.3.2. See IR 17-13. (See Appendix (end of this form) for exemptions.)**

C2. PRESTRESSED / POST-TENSIONED CONCRETE (IN ADDITION TO SECTION C1):	
Test or Special Inspection	**Code References and Notes**
C2a: Tendons and Anchorage | Sample and test prestressing tendons and anchorages.	**1705A.3.4, Table 1705A.3 Item 1, 1910A.3; ACI 318 Ch. 20 and Sections 25.2, 26.6.1.**
C2b: Tendon Placement | Inspect placement of prestressing tendons.	**1705A.3.4, Table 1705A.3 Items 1 & 9; ACI 318 Ch. 20 and Sections 25.2, 26.6.1-26.6.3.**
C2c: Concrete Strength | Verify in-situ concrete strength prior to stressing of post-tensioning tendons.	**Table 1705A.3 Item 13; ACI 318 Sections 26.10.2, 26.11.2, 26.13.3.3. Special inspector to verify specified concrete strength test prior to stressing.**
C2d: Stressing Operations | Inspect application of post-tensioning or prestressing forces and grouting of bonded prestressing tendons.	**1705A.3.4, Table 1705A.3 Item 9; ACI 318 Sections 26.10.2, 26.13.1, 26.13.3.2.**

C3. PRECAST CONCRETE (IN ADDITION TO SECTION C1):	
Test or Special Inspection	**Code References and Notes**
C3a: General Fabrication | 1. Inspect fabrication of precast concrete members. * 2. Inspect reinforcement of the following precast concrete elements or system(s): a. special moment frames. b. boundary elements of special structural walls. c. coupling beams.	**1705A.3 Item 1, 7.** See Appendix for exemptions. *May be periodic where fabrication occurs in a PCI-certified plant. For underground structures, NPCA plant certification is acceptable. PCI MNL-116-21; PCI MNL-117-13; NPCA Quality Control Manual (QCM) 17th Edition. See IR A-15.

C3b: General Erection | Inspect erection of precast concrete members.	**Table 1705A.3 Item 10**.
C3c: Diaphragm Connections | For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category D, E or F, inspect such connections and reinforcement in the field for: 1. Installation of the embedded parts. 2. Completion of the continuity of reinforcement across joints. 3. Completion of connections in the field.	**Table 1705A.3 Item 11**.
C3d: Diaphragm Tolerances | Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5.	**Table 1705A.3 Item 12**

C4. SHOTCRETE (IN ADDITION TO SECTION C1):	
Test or Special Inspection	**Code References and Notes**
C4a: Placement | Inspect shotcrete placement for proper application techniques.	**1705A.3.9, Table 1705A.3 Item 7, 1908A.1, 1908A.2, 1908A.3. See ACI 506.2 Section 3.4, and ACI 506R.**
C4b: Shotcrete Material | Sample and test shotcrete (f'_c).	**1908A.1 and 1705A.3.9.**

C5. POST-INSTALLED ANCHORS:	
Test or Special Inspection	**Code References and Notes**
C5a: Inspection | Inspect installation of post-installed anchors	**1617A.1.19, Table 1705A.3 Item 4a (Continuous) & 4b (Periodic), 1705A.3.8** (See Appendix (end of this form) for exemptions). ACI 318 Sections 26.7.2, 26.13.1, 26.13.3.2, 26.13.3.3. * May be performed by the project inspector when specifically approved by DSA.
C5b: Test | Test post-installed anchors.	**1910A.5.** (See Appendix (end of this form) for exemptions.)

C6. OTHER CONCRETE:	
Test or Special Inspection	**Code References and Notes**
C6a. | Not used.	N/A
C6b. | Not used.	N/A
C6c. | Not used.	N/A
C6d. | Not used.	N/A
C6e. | Not used.	N/A
C6f. | Not used.	N/A
C6g. | Not used.	N/A
C6h. | Not used.	N/A
C6i. | Not used.	N/A
C6j. | Not used.	N/A
C6k. | Not used.	Not used.
C6l. | Not used.	Not used.

Appendix: LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

M1. STRUCTURAL MASONRY:	
Test or Special Inspection	**Code References and Notes**
M1a: Mill Certificates - Reinf. | Mill certificate indicates compliance with requirements for reinforcement, anchors, ties, fasteners and metal accessories. See item C1(b) for identification, sampling and testing of reinforcing steel.	**2103A.4**; TMS 602-16 Article 1.5B.2 & 2.4. * To be performed by qualified LOR representative. Applicable testing by LOR. See IR 17-10 for unidentified reinforcing steel.
M1b: Material Certificates | Producer's certificate of compliance for masonry units, mortar and grout materials.	**1705A.4, 2103A.2, 2103A.3, 2103A.5;** TMS 602 Articles 1.5B.2, 2.1, 2.2, 2.6A and 2.6B, and Table 7 footnote 3.
M1c: Strength Test | Test masonry (f'm).	**1705A.4. For Unit Strength: 2105A.3**; TMS 602 Articles 1.4B.2 ,1.5B.1 & 1.5B.2. **For Prism (required when f'_m > 2000 psi):2105A.2;** TMS 602 Articles 1.4B.3, 1.4B.4, 1.5B.1 & 1.5B.2.
M1d: Mortar Proportions | Verify proportions or properties of site-prepared, premixed or preblended mortar.	TMS 602, Table 3 (row 5), Table 4 Item 1a. DSA PR 20-01. (See Appendix (end of this form) for exemptions.)
M1e: Grout Proportions | Verify proportions or properties of site-prepared, premixed or preblended grout.	TMS 602, Table 3 (row 5), Table 4 Item 2d. (See Appendix (end of this form) for exemptions.)
M1f: Batch Plant Inspection | Batch plant inspection: Periodic	Default of **'Continuous'** per **1705A.3.3**. If approved by DSA, batch plant inspection may be reduced to **'Periodic'** subject to requirements in Section **1705A.3.3.1,** or not required per **1705A.3.3.2.** See IR 17-13. Refer to TMS 602 Table 3 and Table 4, Item #3a. (See Appendix (end of this form) for exemptions.)
M1g: Core Tests | Test core-drilled samples.	**2105A.4**. (See Appendix (end of this form) for exemptions.)
M1h: Prisms | Inspect preparation of prisms.	TMS 602 Articles 1.4.B.3 & 1.4.B.4 & Table 4 Item 4.
M1i: Dowels and Supports | Verify size, location and condition of all dowels, construction supporting masonry, etc.	
M1j: Reinforcement and Members | Verify size, grade and type of reinforcement, connectors, and anchor bolts. Verify size and location of structural members.	TMS 602 Table 4, Items 1c & 3c.
M1k: Reinforcement Placement | Inspect placement of reinforcement, anchor bolts, and connectors.	TMS 602 Table 4 Item 2c.
M1l: Grout Placement | Placement, consolidation, and reconsolidation of grout.	TMS 602 Table 4 Item 3h.
M1m: Unit Layup and Joints | Inspect placement of masonry units and construction of mortar joints.	TMS 602 Table 4 Item 3b.
M1n: Cold/Hot Weather Work | Verify preparation, construction and protection of masonry during cold weather (temperature below 40º F) or hot weather (temperature above 90º F).	TMS 602 Table 4 Item 3f. * May be performed by the project inspector when specifically approved by DSA.
M1o: Anchors and Embeds | Inspect type, size and location of anchors and all other items to be embedded in masonry including other details of anchorage of masonry	TMS 602 Table 4 Item 3d.

to structural members, frames and other construction.	
M1p: Grout Cavity | Inspect grout space, including mortar protrusions, prior to placement of grout.	TMS 602 Table 4 Item 2a.

M2. VENEER OR GLASS BLOCK PARTITIONS:	
Test or Special Inspection	**Code References and Notes**
M2a: Mortar and Grout | Verify proportions of site prepared mortar and grout and/or verify certification of premixed mortar.	TMS 602 Table 3 (row 5) and Table 4 Items 1a & 2d.
M2b: Unit Layup and Joints | Inspect placement of units and construction of mortar joints.	TMS 602 Table 4 Item 3b.
M2c: Wires and Connector | Inspect placement of wire, connectors and anchors	TMS 602 Table 4 Item 2c.
M2d: Anchors and Embeds | Inspect type, size and location of anchors and all other items to be embedded in masonry veneer including details of anchorage of masonry to veneer backing, frames and other construction.	TMS 602 Table 4 Item 3d.
M2e: Cold/Hot Weather Work | Verify preparation, construction and protection of masonry during cold weather (temperature below 40º F) or hot weather (above 90º F).	TMS 602 Table 4 Item 3f. * May be performed by the project inspector when specifically approved by DSA.
M2f: Adhered Veneer Bond | Test adhered veneer bond strength.	**1413.2.1 (Field-constructed mock-up using specified unit, mortar, and substrate, laboratory tested in accordance with ASTM C1823).**

M3. POST-INSTALLED ANCHORS IN MASONRY:	
Test or Special Inspection	**Code References and Notes**
M3a: Inspection | Inspect installation of post-installed anchors	**1617A.1.19, 1705A.4, Table 1705A.3 Item 4a (Continuous) & 4b (Periodic);** ACI 318 Section 26.13. * May be performed by the project inspector when specifically approved by DSA. (See Appendix (end of this form) for exemptions.)
M3b: Test | Test post-installed anchors.	**1705A.4, 1910A.5.** (See Appendix (end of this form) for exemptions.)

M4. OTHER MASONRY:	
Test or Special Inspection	**Code References and Notes**
M4a. | Not used.	N/A
M4b. | Not used.	N/A
M4c. | Not used.	N/A
M4d. | Not used.	N/A
M4e. | Not used.	N/A
M4f. | Not used.	N/A
M4g. | Not used.	N/A
M4h. | Not used.	N/A
M4i. | Not used.	N/A
M4j. | Not used.	N/A
M4k. | Not used.	Not used.
M4l. | Not used.	Not used.

Appendix: LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

S/A1. STRUCTURAL STEEL, COLD-FORMED STEEL AND ALUMINUM USED FOR STRUCTURAL PURPOSES	
Test or Special Inspection	**Code References and Notes**
S/A1a: Material Identification | Verify identification of all materials and: • Mill certificates indicate material properties that comply with requirements. • Material sizes, types and grades comply with requirements.	**Table 1705A.2.1 Item 3a–3c.** 2201A.2**;** AISI S100 Section A3.1 & A3.2, AISI S240 Section A3 & A5, AISI S220 Sections A4 & A6. *By special inspector or qualified technician when performed off-site.
S/A1b: Unidentified Material | Test unidentified materials	**2201A.2.**
S/A1c: Steel Fabrication | Verify and document steel fabrication per DSA- approved construction documents.	Not applicable to cold-formed steel light-frame construction, except for trusses (**1705A.2.5**).
S/A1d: Buckling Restrained Brace | Verify and document steel fabrication per DSA-approved construction documents.	Testing and special inspections in accordance with IR 22-4. For DSA accepted fabrication shops, BRB manufacturer's Certificate of Compliance in lieu of testing and special inspections. See IR 22-4.

S/A2. HIGH-STRENGTH BOLTS:	
Test or Special Inspection	**Code References and Notes**
S/A2a: Product Verification | Verify identification markings and manufacturer's certificates of compliance conform to ASTM standards specified in the DSA-approved documents.	**Table 1705A.2.1 Items 1a & 1b, 2201A.2;** AISC 360 Section A3.3, J3.1, and N3.2; RCSC Section 1.5 & 2.1; DSA IR 17-8 & DSA IR 17-9.
S/A2b: Bolts, Nuts, and Washers | Test high-strength bolts, nuts and washers.	**Table 1705A.2.1 Item 1c, 2216A.1**; RCSC Section 7.2; DSA IR 17-8.
S/A2c: Snug Tight | Bearing-type ("snug tight") connections.	**Table 1705A.2.1 Item 2a, 1705A.2.8, 2201 A.4**; AISC 360 J3.1, J3.2, M2.5 & N5.6; RCSC Section 9.1; DSA IR 17-9.
S/A2d: Pretensioned / Slip-Critical | Pretensioned and slip-critical connections.	**Table 1705A.2.1 Items 2b & 2c, 1705A.2.8, 2201A.4;** AISC 360 J3.1, J3.2, M2.5 & N5.6; RCSC Sections 9.2 & 9.3; DSA IR 17-9 *"Continuous" or "Periodic" depends on the tightening method used.

S/A3. WELDING:	
Test or Special Inspection	**Code References and Notes**
S/A3a: Weld Material | Verify weld filler material identification markings per AWS designation listed on the DSA-approved documents and the WPS.	**1705A.2.7, Table 1705A.2.1 Items 4 & 5**; AWS D1.1 and AWS D1.8 for structural steel; AWS D1.2 for Aluminum; AWS D1.3 for cold-formed steel; AWS D1.4 for reinforcing steel; DSA IR 17-3.
S/A3b: Certificate of Compliance | Verify weld filler material manufacturer's certificate of compliance.	DSA IR 17-3.
S/A3c: WPS and Qualifications | Verify WPS, welder qualifications and equipment.	DSA IR 17-3.

S/A4. SHOP WELDING (IN ADDITION TO SECTION S/A3):	
Test or Special Inspection	**Code References and Notes**
S/A4a: Weld Category A | Inspect groove welds, multi-pass fillet welds, single pass fillet welds > 5/16", plug and slot welds.	**Table 1705A.2.1 Items 5a.1–4;** AISC 360 & 370 (and AISC 341 as applicable); DSA IR 17-3.
S/A4b: Weld Category B | Inspect single-pass fillet welds ≤ 5/16", floor and roof deck welds.	**1705A.2.3, Table 1705A.2.1 Items 5a.5 & 5a.6;** AISC 360 & 370 (and AISC 341 as applicable); DSA IR 17-3.
S/A4c: Stairs and Railing | Inspect welding of stairs and railing systems.	**1705A.2.1**; AISC 360 & 370 (and AISC 341 as applicable); AWS D1.1 & D1.3; DSA IR 17-3.
S/A4d: Reinf. Steel Weldability | Verification of reinforcing steel weldability other than ASTM A706.	**1705A.3.1**; AWS D1.4; DSA IR 17-3. Verify carbon equivalent reported on mill certificates.
S/A4e: Reinforcing Steel | Inspect welding of reinforcing steel.	**Table 1705A.2.1 Item 5b, 1705A.3.1, Table 1705A.3 Item 2, 1903A.5;** AWS D1.4; DSA IR 17-3.

S/A5. FIELD WELDING (IN ADDITION TO SECTION S/A3):	
Test or Special Inspection	**Code References and Notes**
S/A5a: Weld Category A | Inspect groove welds, multi-pass fillet welds, single pass fillet welds > 5/16", plug and slot welds.	**Table 1705A.2.1 Items 5a.1–4;** AISC 360 & 370 (AISC 341 as applicable); DSA IR 17-3.
S/A5b: Weld Category B | Inspect single-pass fillet welds ≤ 5/16".	**Table 1705A.2.1 Item 5a.5;** AISC 360 & 370 (AISC 341 as applicable); DSA IR 17-3.
S/A5c: End Welded Studs | Inspect end-welded studs (ASTM A-108) installation (including bend test).	**2216A.2**; AISC 360 & 370 (AISC 341 as applicable); AWS D1.1; DSA IR 17-3.
S/A5d: Deck Welds | Inspect floor and roof deck welds.	**1705A.2.3, Table 1705A.2.1 Item 5a.6;** AISC 360 & 370 (AISC 341 as applicable); AWS D1.3; DSA IR 17-3.
S/A5e: Cold-Formed Steel | Inspect welding of structural cold-formed steel.	**1705A.2.7;** AWS D1.3; DSA IR 17-3. The quality control provisions of AISI S240 Chapter D shall also apply. * May be performed by the project inspector when specifically approved by DSA.
S/A5f: Stairs and Railing | Inspect welding of stairs and railing systems.	**1705A.2.1;** AISC 370 (AISC 341 as applicable); AWS D1.1 & D1.3; DSA IR 17-3. * May be performed by the project inspector when specifically approved by DSA.
S/A5g: Reinf. Steel Weldability | Verification of reinforcing steel weldability.	**1705A.3.1**; AWS D1.4; DSA IR 17-3. Verify carbon equivalent reported on mill certificates.
S/A5h: Reinforcing Steel | Inspect welding of reinforcing steel.	**Table 1705A.2.1 Item 5b, 1705A.3.1, Table 1705A.3 Item 2, 1903A.5;** AWS D1.4; DSA IR 17-3.

S/A6. NONDESTRUCTIVE TESTING:	
Test or Special Inspection	**Code References and Notes**
S/A6a: Ultrasonic | Ultrasonic	**1705A.2.1, Table 1705A.2.1 Item 4c, 1705A.2.7;** AISC 341 J6.2, AISC 360 N5.5; AWS D1.1, AWS D1.8; DSA IR 17-2.
S/A6b: Magnetic Particle | Magnetic Particle	**1705A.2.1, Table 1705A.2.1 Item 4c, 1705A.2.7;** AISC 341 J6.2, AISC 360 N5.5; AWS D1.1, AWS D1.8; DSA IR 17-2.
S/A6c: Not used.	N/A
S/A6d: Not used.	N/A
S/A6e: Not used.	N/A

S/A7. STEEL JOISTS AND TRUSSES:	
Test or Special Inspection	**Code References and Notes**
S/A7a: Fabrication | Verify size, type and grade for all chord and web members as well as connectors and weld filler material; verify joist profile, dimensions and camber (if applicable); verify all weld locations, lengths and profiles; mark or tag each joist.	**1705A.2.4, Table 1705A.2.4;** AWS D1.1; DSA IR 22-3 for steel joists only. **1705A.2.5;** AWS D1.3 for cold-formed steel trusses.

S/A8. METAL BUILDING:	
Test or Special Inspection	**Code References and Notes**
S/A8a: Inspection | Inspect: • Installation of rafter/beam flange braces and column flange braces. • Installation of purlins and girts, including specified lapping. • Purlin and girt restraint/bridging/bracing. • Installation of X-bracing, tightened to remove any sag	**1705A.2.6, Table 1705A.2.6, 1705A.2.1, 1705A.2.3, 1705A.2.4 and 1705A.2.5**

S/A9. SPRAYED FIRE-RESISTANT MATERIALS:	
Test or Special Inspection	**Code References and Notes**
S/A9a: Surface and Installation | Examine structural steel surface conditions, inspect application, take samples, measure thickness and verify compliance of all aspects of application with DSA-approved documents.	**1705A.15, 1705A.15.1, 1705A.15.2, 1705A.15.3, 1705A.15.4, 1705A.15.5, 1705A.15.6.**
S/A9b: Density | Test density.	**1705A.15.1, 1705A.15.5, ASTM E605**
S/A9c: Bond: Adhesion/Cohesion | Bond strength adhesion/cohesion.	**1705A.15.1, 1705A.15.6, ASTM E736**

S/A10. ANCHOR BOLTS AND ANCHOR RODS:	
Test or Special Inspection	**Code References and Notes**
S/A10a: Anchor Rods and Bolts | Anchor Bolts and Anchor Rods	Identify, sample and test anchor bolts and anchor rods **not** meeting exemptions identified in Section 1 of IR 17-11.
S/A10b: Other Threaded Rods | Threaded rod not used for foundation anchorage.	Identify, sample and test threaded rods **not** meeting exemptions identified in Section 1 of IR 17-11.

S/A11. STORAGE RACK SYSTEMS:	
Test or Special Inspection	**Code References and Notes**
S/A11a: Material Verification | Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents.	Table 1705A.13.7
S/A11b: Fabrication | Fabricated storage rack elements.	1704A.2.5; Table 1705A.13.7
S/A11c: Anchorage | Storage rack anchorage installation.	ANSI/MH16.1 Section 7.3.2; Table 1705A.13.7
S/A11d: Completed System | Completed storage rack system to indicate compliance with the approved construction documents.	Table 1705A.13.7; * May be performed by the project inspector when specifically approved by DSA.

S/A12. Other Steel	
Test or Special Inspection	**Code References and Notes**
S/A12a. | Not used.	N/A
S/A12b. | Not used.	N/A
S/A12c. | Not used.	N/A
S/A12d. | Not used.	N/A
S/A12e. | Not used.	N/A
S/A12f. | Not used.	N/A
S/A12g. | Not used.	N/A
S/A12h. | Not used.	N/A
S/A12i. | Not used.	N/A
S/A12j. | Not used.	N/A
S/A12k. | Not used.	Not used.
S/A12l. | Not used.	Not used.

W1. PREFABRICATED WOOD TRUSSES:	
Test or Special Inspection	**Code References and Notes**
W1a: Open Web Truss Fabrication | Inspect fabrication of manufactured open-web trusses.	**1705A.5.6;** DSA IR 23-8.
W1b: Metal Plate Truss Fabrication | Inspect fabrication of manufactured metal-plate- connected trusses.	**1705A.5.6, 1705A.5.7;** DSA IR 23-4.

W2. MANUFACTURED WOOD STRUCTURAL ELEMENTS:	
Test or Special Inspection	**Code References and Notes**
W2a: GLS Timber Fabrication | Inspect fabrication of structural glued-laminated timber.*	* See **1705A.5.5** for exceptions
W2b: CLT Fabrication | Inspect fabrication of cross-laminated timber.	**1705A.5.5**
W2c: Mass Timber Erection | Inspect erection of mass timber.	**Table 1705A.5.3**, Item 2
W2d: Connections Type A | Inspect mass timber connections with threaded fasteners, bolts, and/or adhesive anchors other than described in item e below. Inspect concealed mass timber connections.	**Table 1705A.5.3**, Items 3.1, 3.3, 3.4, 3.5. For threaded fasteners: Verify use of proper installation equipment. Verify use of pre-drilled holes where required. Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.
W2e: Connections Type B | Inspect mass timber connections with adhesive anchors installed in a horizontal or upward orientation.	**Table 1705A.5.3**, Item 3.2
W2f: Sealants | Inspect application of sealants or adhesives applied to mass timber elements.	**1705A.20**

W3. OTHER Wood:	
Test or Special Inspection	**Code References and Notes**
W3a. | Not used.	N/A
W3b. | Not used.	N/A
W3c. | Not used.	N/A
W3d. | Not used.	N/A
W3e. | Not used.	N/A
W3f. | Not used.	N/A
W3g. | Not used.	N/A
W3h. | Not used.	N/A
W3i. | Not used.	N/A
W3j. | Not used.	N/A
W3k. | Not used.	Not used.
W3l. | Not used.	Not used.

X1. OTHER:	
Test or Special Inspection	**Code References and Notes**
X01. | Load test for identified product(s):	1709A.2, 1709A.3. Testing is not required for: 1) a product with a valid evaluation service report per DSA IR A-5, or 2) a product that can be justified by structural calculation.
X02. | Installation torque for non-HS bolts on communication tower identified as essential service facility projects (ESFP).	Calibrated wrench use required, verified by SI during installation. DSA Policy PL 18-01: Communication Towers, Poles and Buildings Utilized by State Agencies for Essential Services Communications. *EXCEPTION: Non-ESFP may use PI without need for notification to DSA.
X03. | Not used.	N/A
X04. | Not used.	N/A
X05. | Not used.	N/A
X06. | Not used.	N/A
X07. | Not used.	N/A
X08. | Not used.	N/A
X09. | Not used.	N/A
X10. | Not used.	N/A

EXEMPTIONS

SOILS - EXEMPTIONS:
Soils: Eligible shallow foundation elements | Shallow foundations, are exempt from special inspections and testing by a Geotechnical Engineer for the following cases: A) buildings without a geotechnical report and meeting the exception Item #1 criteria in CBC Section 1803A.2 supported by native soil (any excavation depth) or fill soil (not exceeding 12" depth per CBC, Section 1804A.6), B) soil scarification/recompaction not exceeding 12" depth, C) native or fill soil supporting exterior non-structural flatwork (e.g., sidewalks, site concrete ramps, site stairs, parking lots, driveways, etc.), D) unpaved landscaping and playground areas, or E) utility trench backfill with depth not exceeding 12". These exempt structures shall be identified on the approved construction documents.
Soils: Eligible deep foundation elements, Type 1 | Deep foundation acting as cantilever footing with a design based on minimum allowable pressures per CBC Table 1806A.2 and without a geotechnical report are exempt from special inspection and testing by a Geotechnical Engineer for the following cases: A) free standing sign or scoreboard, B) cell or antenna towers and poles less than 35'-0" tall (e.g., lighting poles, flag poles, poles supporting open mesh fences, etc.). These exempt structures shall be identified on the approved construction documents.
Soils: Eligible deep foundation elements Type 2 | Deep foundation acting as cantilever footing with a design based on minimum allowable pressures per CBC Table 1806A.2 and without a geotechnical report are exempt from special inspection and testing by a Geotechnical Engineer for the following cases: A) single-story open fabric shade structure, or B) covered walkway structure with an apex height less than 10'-0" above adjacent grade. These exempt structures shall be identified on the approved construction documents.

CONCRETE/MASONRY - EXEMPTIONS:
Concrete/Masonry: Eligible post-installed anchors | Post-installed anchors for the following: A) exempt non-structural components (e.g., mechanical, electrical, plumbing equipment – see item 7 for "Welding" in the Appendix below) given in CBC Section 1617A.1.18 or B) interior nonstructural wall partitions meeting criteria listed in exempt item 3 for "Welding" in the Appendix below.
Concrete: Batch plant inspection for items listed in and complying with CBC Section 1705A.3.3.2. | Concrete batch plant inspection is not required for items given in CBC Section 1705A.3.3.2 subject to the requirements and limitations in that section.
Concrete: Epoxy shear dowels in nonstructural slab-on-grade per CBC Section 1910A.5.4, Exception #4. | Epoxy shear dowels in site flatwork and/or other nonstructural concrete.
Concrete/Masonry: Reinforcing bar testing for items listed in and complying with CBC Section 1910A.2. | Testing of reinforcing bars is not required for items given in CBC Section 1910A.2 subject to the requirements and limitations in that section. These exempt structures shall be identified on the approved construction documents.
Masonry: Freestanding site walls and retaining walls per DSA IR 21-1. | Freestanding and site retaining masonry walls may be exempt from certain DSA masonry testing and special inspection items as allowed per DSA IR 21-1.
Eligible precast elements | Structural tests and special inspections are not required for the following concrete precast elements. Provide a certificate of compliance at delivery. Exemptions shall be identified on the approved construction documents. 1. Underground vaults no greater than 5 feet x 5 feet x unlimited height and pipe manufactured to an ASTM standard, 5 foot or less in diameter. 2. Elements manufactured in a PCI or NPCA certified manufacturing plant:

A. Underground vaults no greater than 16 feet in both length and width, of unlimited height, not subject to loading greater than HS 20-44.
B. Pipe.
C. Stair treads, landing planks.

WELDING - EXEMPTIONS:
Welding: Eligible fences and gates | Fences, gates with maximum leaf span of 10', and gates with a maximum rolling section of 10' all having an apex height less than 8'-0" above lowest adjacent grade.
Welding: Eligible railing and ramps | Handrails, guardrails, and modular or relocatable ramps associated with walking surfaces less than 30" above adjacent grade; fillet welds shall not be ground flush.
Welding: Eligible interior cold-formed steel framing | Non-bearing non-shearwall interior cold-formed steel framing spanning less than 15'-0" in height and header less than 10'-0" in opening width, such as in interior partitions, interior soffits, etc.
Welding: Eligible equipment curbs | Manufactured support frames and curbs using hot rolled or cold-formed steel (i.e., light gauge) for mechanical, electrical, or plumbing equipment weighing less than 2000# (equipment only) (connections of such frames to superstructure elements using welding will require special inspection.)
Welding: Eligible components supporting MEP distribution systems | Manufactured components (e.g., Tolco, B-Line, Afcon, etc.) for mechanical, electrical, or plumbing hanger support and bracing (connections of such components to superstructure elements using welding will require special inspection.)
Welding: Eligible mounts and recreational equipment | TV Brackets, projector mounts with a valid listing (see DSA IR A-5) and recreational equipment (e.g., playground structures, basketball backstops, etc.) (connections of such elements to superstructure elements using welding will require special inspection.)
Welding: Eligible nonstructural components | Any support for exempt non-structural components given in CBC Section 1617A.1.18 meeting the following: A) when supported on a floor/roof, <400# or resulting composite center of mass (including component's center of mass) ≤4' above supporting floor/roof, B) when hung from a wall or roof/floor, and <20# for discrete units or <5 plf for distributed systems.