LYNWOOD UNIFIED SCHOOL DISTRICT

Bid No. 01MOT27

Will Rogers Elementary School – HVAC Replacement
Building H – DSA #03-125978

TECHNICAL SPECIFICATIONS

1) TECHNICAL SPECIFICATIONS

2) CARRIER EQUIPMENT PURCHASED SUBMITTAL

3) THERMOSTAT CUT SHEET

4) DSA-103-25

5) DSA APPROVED DRAWINGS SET

1) Technical Specifications

SPECIFICATIONS

WILL ROGERS ELEMENTARY SCHOOL
- BLDG H -
HVAC REPLACEMENT PROJECT

DIVISION 0 – INTRODUCTORY PAGES

SECTION 00 00 02 - PROJECT DIRECTORY

PART 1 - GENERAL

School Site:
310-603-1542 PHONE
None FAX

Will Rogers Elementary School
11220 Duncan Ave
Lynwood, CA 90262

Owner:
310-886-1601 PHONE
emorales@mylusd.org

Lynwood Unified School District
11321 Bullis Road
Lynwood, California 90262
Sr. Director of Facilities: *Eric Morales*

Structural Engineering:
949-404-3351 PHONE
None FAX
psarkis@petrastructural.com

Petra Structural Engineers
17981 SkyPark Circle, Suite O,
Irvine, CA 92614
Principal-in-Charge: *Peter Sarkis*

Mechanical Engineering:
714-693-2277 PHONE
None FAX
abanerjee@oed-inc.com

Optimum Energy Design
5200 E. La Palma Ave
Anaheim, CA 92807
Principal-in-Charge: *Abby Banerjee*

Electrical Engineering:
909-941-3008 PHONE
909-941-8211 FAX
leflores@oed-inc.com

Optimum Energy Design
5200 E. La Palma Ave
Anaheim, CA 92807
Principal-in-Charge: *Rolando E. Sotelo*
Contact: *Luis E. Flores*

PART 2 - PRODUCTS…… …….Not applicable—this section

PART 3 – EXECUTION……Not applicable –this section

-END OF SECTION-

DIVISION 0 – INTRODUCTORY PAGES

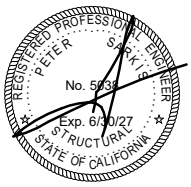
SECTION 00 00 03 – ARCHITECT AND ENGINEERS PROFESSIONAL STAMPS

Whittier Elementary School – HVAC Modernization Project
1800 Whittier Avenue
Costa Mesa, CA 92627

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1. **Structural Engineer:** Peter Sarkis
   Petra Structural Engineers
   17981 SkyPark Circle, Suite O
   Irvine, CA 926140
   (949) 404-3351

   Seal:



2. **Electrical Engineer:** Rolando E. Sotelo
   Optimum Energy Design
   5200 E. La Palma Ave
   Anaheim, CA 92807
   (714)693-2277

   Seal:

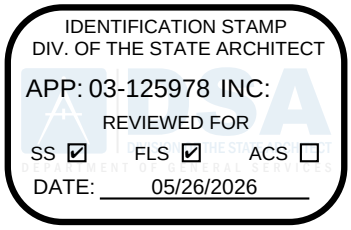


3. **Mechanical Engineer:** Abby Banerjee
   Optimum Energy Design 5200
   E. La Palma Ave Anaheim,
   CA 92807
   (714)693-2277

   Seal:



Division of State Architect:



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END OF SECTION

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 26 00 - REQUESTS FOR INFORMATION

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division One apply to this section.

B. Section Includes: Procedures for requesting clarification or information about the intent of the contract documents.

1.02 DEFINITIONS

A. Request for information: A request for information, clarification or interpretation is a formal means for the Contractor to verify or clarify the intent of the documents. Requests are presented in writing on a pre-approved form and answered in writing on the same form. Request is prepared by the Contractor, and submitted to the Engineer, to request clarifications or interpretations of the intent of the Contract Documents, or to notify the Engineer of potential conflicts in Contract Documents or between the Contract Documents and field conditions.

1.03 PROCEDURES FOR REQUESTING INFORMATION

A. The Engineer's response is an interpretation or clarification of the Contract Documents. Such request does not authorize changes in the work that impact Contract Sum or Contract Time.

B. When possible, request such clarification either verbally or in writing at the next scheduled Project meeting. When the information request is answered at the project meeting, number the request and enter the response into the meeting minutes. When the urgency or complexity requires more timely communication between meetings, prepare and submit a formal written information request to the Engineer, without delay.

C. Submit information requests within 3 days so as not to impede the progress of the work.

1. When an answer to an information request has an effect on cost or time, notify the Engineer in accordance with the Contract Documents. Do not perform such work until a Change Order has been reviewed by the Engineer and approved by the District.

2. When submitting an information request, indicate the time available for the Engineer to respond without causing an impact to the Contract Time.

D. When a request for information involves clarification of coordination issues, lay out Contractors' suggested solutions using scaled sketches, and submit with the request. If the request is such that choices of several logical solutions are apparent to the Contractor, include the logical solutions on the form.

E. Information requests may be returned with a stamp or notation "Not Reviewed", if, in the opinion of the Engineer:

1. The interpretation requested is ambiguous or unclear to the Engineer.

2. The answer is obvious and clear by researching the Contract Documents.

3. The Contractor has not reviewed the request prior to submittal to the Engineer.

4. The Contractor has not offered potential solutions to answer coordination issues or offered logical solutions.

F. Allow a minimum of 4 days for review and response time, after receipt by the Engineer. It is the responsibility of the Contractor to verify receipt by the Engineer. The response time may be increased if:

1. More information is required.

2. The information request is submitted out of sequence.

3. In the opinion of the Engineer, more time is needed to answer the information requests.

G. Do not use information requests for:

1. Submitting substitutions for consideration.

2. Requesting changes or additions of scope to the work.

3. Requesting “value engineering” cost-saving or time-saving changes.

H. If the Contractor believes that a clarification by the Engineer may result in a change, Contractor shall not proceed with the work indicated by the request until a change is approved by the District.

1. If the Contractor believes that a clarification by the Engineer results in additional cost, identify the basis of the Contractor’s bid in the information requests.

2. Answered information requests shall not be construed as an authorization to perform extra work.

I. Form: Submit requests in writing on a form approved by District.

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 32 13 - CONSTRUCTION SCHEDULE - CPM

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division One apply to this section.

B. Section Includes: Construction Schedule procedures, preparation, submittals, reviews, updates, and revisions.

C. Related Sections:

1. Section 01 33 00: Submittals.

2. Section 01 78 39: Project Record Documents.

1.02 SUBMITTALS

A. Approved Schedule: Submit 6 copies, one electronic format and one reproducible of approved Construction Schedule, signed by District and Contractor.

1.03 PROCEDURES

A. Within 15 days after Award of Contract, but not more than 7 days after Notice to Proceed, Contractor shall submit, for review, to the District, a detailed Construction Schedule setting forth requirements for complete execution of work. Construction schedule shall include, but not be limited to specific days, night work, description of work, anticipated completion date(s), phasing, unit building ‘down time’, mechanical system start-up and turnover date.

B. The District will review and return Contractor's Construction Schedule, with summary comments, within 7 days. If revisions are required, Contractor shall resubmit Construction Schedule within 3 days.

C. After approval, changes to Construction Schedule shall not be made unless mutually agreeable to District and Contractor.

D. Include in initial schedule a written summary narrative sufficiently comprehensive to explain basis of Contractor's approach to work.

E. If a Construction Schedule is considered by the District to be in non-compliance with any requirement of the Contract, Contractor will be notified to review and revise Construction Schedule and bring it into compliance. Failure of Contractor to submit a Construction Schedule in full compliance with the Contract may result in a delay in the processing of progress payments, since Construction Schedule will be used in evaluating progress for payment approval.

F. Simultaneously with each submittal of Progress Payment Request, Contractor shall deliver to the District an updated Construction Schedule reflecting work progress as of end of previous reporting period. Each such Construction Schedule shall show actual progress to date in execution of work, together with a projected schedule for completion of work. No changes in logic will be permitted unless agreed upon with District.

G. Scheduled submittals are subject to review and acceptance by the District. The District retains the right to withhold progress payments until Contractor submits a Construction Schedule acceptable to the District.

1.04 PREPARATION GUIDELINES

A. Construction Schedule shall be prepared using Critical Path Method (CPM) of scheduling.

B. Construction Schedule shall be computer-based, in a format acceptable to the District. Level of detail indicated in schedule shall be equal to or greater than the breakdown outlined in Table of Contents of the project manual.

C. Durations and events indicated on schedule shall conform to phasing set forth in the Contract and shall indicate any area or building within a particular phase. Schedule shall indicate Contract "milestone events" and other milestones agreed to by the District; no other milestone dates will be accepted unless approved as a change.

D. Construction Schedule shall represent a practical plan to complete work within time requirements of the Contract.

1. Schedule extending beyond limits of Contract time will not be acceptable.

2. Indicate "float" (plus or minus) in schedule milestone dates.

3. Schedule is subject to approval by the District. Revise and resubmit until approved.

E. Construction schedule shall clearly indicate sequences of construction activities and specifically indicate:

1. Start and completion of all items of work, their major components, and interim milestone completion dates as determined by Contractor and District.

2. Activities for procurement, delivery, installation of equipment, materials and other supplies, including:

a. Time for submittals, resubmittals, and reviews. Include decision dates for selection of finishes.

b. Time for fabrication and delivery of manufactured products for work.

c. Interdependence of procurement and construction activities.

d. Dates for testing and balancing equipment, and final inspection.

F. Schedule shall be in sufficient detail to assure adequate planning and execution of work.

1. Each activity shall range in duration from 1 to 5 workdays, with exception of fabrication and procurement activities, unless directed otherwise by the District. Activity duration shall be total of actual days required to perform and complete that activity and shall not include consideration of weather impact on activity.

2. Schedule shall be cost and resource-loaded with total equal to Contract sum, and shall include all associated interface activities in the Contract including, but not limited to, District's Maintenance Branch activities and Interim Housing schedules, which will be provided by the District.

3. Schedule shall allow monitoring and evaluation of progress in performance of work; it shall be time-scaled in precedence diagramming method (PDM), or arrow diagramming method (ADM).

4. Activities shall include:

a. Description: what is to be accomplished and where.

b. Workday duration.

c. Responsibility code; identifying who performs each individual activity.

5. Network shall show continuous flow from left to right.

6. Identify days per week and shifts per day worked; also, non-work days and holidays.

7. Identify activities which constitute controlling operations, i.e., milestones or critical path.

G. Failure to include any element of work required for performance of this Contract shall not excuse Contractor from completing work required to comply with Contract Documents and Construction Schedule.

H. Submittal of the Construction Schedule shall be interpreted as Contractor's confirmation that schedule meets requirements of the Contract Documents, and that the work will be executed in sequence indicated in schedule.

I. Contractor shall prepare construction only after careful coordination with the District, Probation and the Engineer has been done. Schedule must reflect all suggestions and recommendations by said parties. Construction phasing shall be executed consecutively and without period(s) of intermission. Contractor shall prepare his bid such that no less than ten (10) different phases are included to complete his scope of work indicated in the project documents. Any alteration or changes to phasing and/or execution of work must be approved by Probation and the District prior to start of work.

1.05 REVIEWS, UPDATES, AND REVISIONS

A. The District will review and return Contractor's Construction Schedule, with summary comments, within 10 days. If revisions are required, Contractor shall resubmit the construction schedule within 7 days following receipt of the District's comments.

B. After Contractor and the District agree to a final schedule, it will become the Project Construction Schedule and considered part of the Contract Documents.

C. Construction Schedule Reviews and Updates:

1. Periodically review schedule for:

a. Actual completion dates for work items completed during report period.

b. Actual commencement dates for work items started during report period.

c. Estimated remaining duration for work items in progress are always to be less than original duration, unless modified by change order.

d. Estimated commencement dates for work items scheduled to start during month following report period.

e. Changes in duration of work items.

f. Identification of current and most crucial critical paths to required completion dates.

2. In the case of a schedule change, Contractor shall include a narrative report with the updated progress analysis, which shall include, but not be limited to, a description of problem areas, current and anticipated delaying factors, and any proposed revisions for a recovery plan.

3. Change Orders affecting schedule shall be clearly identified as separate, new activities.

4. Review of Construction Schedule shall not relieve Contractor of the responsibility for accomplishing work in accordance with the Contract Documents.

D. Updates: Contractor shall submit to the District, with each Bi-Weekly payment application, an up-to-date Construction Schedule to include following:

1. Work Item Report: Detailing work items and dependencies as indicated on network diagram, listed in order of ascending work item number.

2. Separate listing of activities completed during reporting period.

3. Separate listing of activities which are currently in progress, indicating their remaining duration and percentages completed.

4. Separate listing of activities which are causing delay in work progress.

5. All reports shall be arranged based on appropriate phasing, areas within a phase, or broken down by building or facility.

6. Narrative report to define problem areas, anticipated delays, and impact on Construction Schedule. Report corrective action taken, or proposed, and its effect, including effect of changes on schedules of individual contractors.

7. Resolution of conflict between actual work progress and schedule logic: when out-of-sequence activities develop in schedule because of actual construction progress, Contractor shall submit a revised schedule to conform to current job sequence and direction.

E. If, according to current updated Construction Schedule, the District determines Contractor is behind the Contract completion date or any interim milestone completion dates and taking into account time extensions to which Contractor is entitled, Contractor shall submit a revised schedule, indicating a workable plan and a narrative description to complete project on time.

1. The District may withhold progress payments until schedule changes are approved.

F. Scheduling of change or extra work orders is responsibility of Contractor.

1. Contractor shall revise Construction Schedule to incorporate all activities involved in completing change orders, or extra work orders, and submit it to the District for review.

G. If the District finds Contractor is entitled to extension of any completion date under provisions of the Contract, the District's determination of total number of days extension will be based upon current analysis of Construction Schedule and upon data relevant to extension.

H. Contractor acknowledges and agrees that delays to non-critical activities (those with "float") will not be considered a basis for a time extension unless activities become critical. Non-critical activities are those activities which, when delayed, do not affect an interim or final Contract completion date.

I. Any claim for extension of time shall be made in writing to the District not more than 24 hours after commencement of delay; otherwise, it shall be deemed finally waived for all purposes. Contractor shall provide an estimate of probable effect of such delay on progress of the work as part of the claim.

1.06 CONTRACTOR'S RESPONSIBILITY

A. Contractor shall provide sufficient skilled labor, materials, and equipment to properly carry out the work in accordance with Construction Schedule.

1.07 SUSPENSION OF PAYMENTS

A. Initial Submittal: The District has the right to withhold progress payments until Construction Schedule is approved.

B. Monthly Submittals: The District has the right to withhold progress payments if Contractor fails to update and submit Construction Schedule and reports as specified.

1.08 RECORD COPY

A. At completion of work items, submit Construction Schedule reflecting actual project critical paths.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 33 00 - SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division One apply to this section.

B. Section Includes:

1. Procedures for submitting, to the District, items such as schedules, shop drawings, product data, samples, material lists, manuals, warranties and certificates, required by this section and individual specification sections, finish hardware schedule and segregation of contract costs.

2. 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.

3. 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 District.

C. Related Sections:

1. Section 01 32 13: Construction Schedule.

2. Section 01 78 39: Project Record Documents.

3. Other sections requiring submittals, as indicated in specification sections.

1.02 DEFINITIONS

A. Shop Drawings: 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.

1.03 SUBMITTAL PROCEDURES

A. After award of contract, Contractor will receive the documentation checklist for project completion forms provided by the District. Forms will indicate documentation requested by the District, such as shop drawings, manufacturer's catalogs, samples, warranties, operating and instruction manuals.

B. Upon receipt of checklist, Contractor shall, during course of project, secure and submit the required documentation to the District for review and approval.

C. After the District has date-stamped, signed and reviewed submittals, with corrections noted, if any, the District will transmit submittals to Contractor. Final inspection shall not be held until documentation checklist has been completed.

D. Timing of Submittals:

1. Within 7 days after award of contract, Contractor shall submit to the District shop and diagram drawings, materials lists and other submittals required by the specifications, prior to the establishment of a job start date. (Exception - Finish Hardware Schedule and Segregation of Contract Costs). Contractor shall submit a single, complete submittal package – multiple submittal packages will not be accepted unless otherwise agreed upon by the District and Engineer. Should Contractor submit multiple submittal packages without the approval of the District and Engineer, Contractor may be subject to fee charges for additional review time spent by District and/or Engineer.

2. Provide a schedule of submittals in conformance with construction schedule. Refer to Section 01 32 13: Construction Schedule - CPM.

    a. Submit and review with the District, a schedule for shop drawing submittal dates and date of return required by Contractor in order to maintain construction schedule. Schedule of submittals shall indicate adequate time between submittals in order to allow adequate time for review without impact to construction schedule.

3. Schedule of submittals shall be related to work progress, and shall be organized to allow sufficient time for mailing, reviewing, corrections, resubmission and re-reviewing.

4. Coordinate submittal of related items.

5. Revise, update and submit schedule of submittals to the District, on first of each month, or as required.

6. Allow at least 5 days for the District's review following receipt of submittal. For Divisions 23 and 26 submittals, allow a minimum of 7 days following receipt of submittal.

E. Make submittals in accordance with the construction schedule, and shop drawing submission schedule, in sequence that avoids delaying work and progress of related work.

F. Each submittal shall be accompanied by a letter of transmittal containing an itemized and numbered list of submitted materials. Separate letters of transmittal shall accompany each submittal from different subcontractors.

G. Resubmission: If requested, resubmit submittals within 3 days. Resubmit as specified for initial submittal but identify as such. Indicate changes which have been made other than those requested by the District.

PART 2 - PRODUCTS

2.01 CONSTRUCTION SCHEDULE

A. Provide in accordance with Section 01 32 13 Construction Schedule – CPM.

2.02 SHOP DRAWINGS

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

B. Copies Required and Distribution: Unless otherwise indicated in individual specification sections, submit 7 sets of blueline prints of which four sets will be retained by the District, and 2 copies will be returned to Contractor.

C. Contractor MUST prepare shop drawings for all aspects of work, including but not limited to:

1. All work required for the replacement of the packaged rooftop unit and Split Dx unit. Drawings shall show plan (1/4” min) and elevation views (1/4” min) of the new unit dimensions, weight, service clearances, connection locations, and structural supports including curb modifications and anchorage. New ductworks drop and connect to the existing duct drop, including duct sizes, materials, transitions, routing. Gas and Condensate drain reconnection showing routing from the new unit to the existing drain including pipe size, slope, insulation, supports.

2. Provide roofing and penetration plans including curb locations, penetration sizes, required modifications, flashing, waterproofing, and coordination with roofing contractor for all interface details.

3. Controls wiring, schematics and sequences

D. All shop drawings must be approved by Engineer prior to the ordering, fabrication, and/or installation or equipment and/or contracted work.

E. See Section 23 30 00, paragraph 1.6 for additional requirements.

2.03 PRODUCT DATA

A. Manufacturer's Standard Schematic Drawings:

1. Delete information that 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 electronic format to District.

2.04 SEGREGATION OF CONTRACT COSTS

A. Provide a Segregation of Contract Costs as required by the general condition requirements of the District.

2.05 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: Electronic format to the District for review, approval and distribution.

2.06 CERTIFICATES

A. Submit in triplicate, in accordance with requirements of each specification section.

2.07 MATERIAL LIST SUBMITTALS

A. Provide material lists on following:

1. Electrical.
2. Heating, ventilating and air conditioning.
3. Plumbing.
4. Controls.

B. Copies Required: Electronic format copy will be returned to Contractor.

C. Provide supplementary submittals for materials omitted or not approved.

D. Substitutions proposed by Contractor shall be made in accordance with the General Conditions of the Contract.

PART 3 - EXECUTION

3.01 SUBMITTAL REVIEW BY CONTRACTOR

A. Review submittals prior to submission to the District. Review and stamp submittals prior to review by District.

B. Clearly identify deviations from the Contract drawings and specifications on submittals. Prior approval of deviations by the District or their representative is required. Contractor shall not use the submittal process for substitution requests.

C. Deliver submittals to the District. 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 deviations from contract documents.

3.02 SUBMITTAL REVIEW BY DISTRICT

A. District will not review submittals that have not been stamped and reviewed by Contractor. Such submittals will be returned, without review, to Contractor.

B. District will review submittals required, according to the submittal schedule, and make corrections, notes or modifications as appropriate. Submittals will be stamped, to indicate the action required, and returned to Contractor.

1. Submittals not required by the contract documents will be returned without review.
2. District's approval stamp is for design and quality only, and is not an approval for deviations or quantities.

END OF SECTION

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 40 00 - QUALITY CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Interpretation of requirements.

B. Quality assurance and control of installation.

C. Tolerances.

D. Field samples.

E. Mock-up.

F. Manufacturers' field services and reports.

1.02 INTERPRETATION OF REQUIREMENTS

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

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

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

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

1.03 QUALITY ASSURANCE/CONTROL OF INSTALLATION

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

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

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

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

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

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

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

before proceeding.

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

1.04 TOLERANCES

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

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

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

1.05 FIELD SAMPLES

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

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

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

1.06 MOCK-UP

A. Mock-up will be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items, with specified attachment and anchorage devices, flashings, seals and finishes.

C. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

D. Where mock-up is specified in individual Sections to be removed, clear area after mock-up has been reviewed by Architect.

1.07 MANUFACTURERS' FIELD SERVICES AND REPORTS

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

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

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

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

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

3.02 EXAMINATION

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

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

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

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

3.03 PREPARATION

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

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

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

END OF SECTION

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 42 13 - ABBREVIATIONS, SYMBOLS AND ACRONYMS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division One apply to this section.

B. Section Includes: List of abbreviations, symbols and acronyms used in these specifications:

1.02 ABBREVIATIONS

ac	Alternating current
amp	ampere
BTU	British thermal unit
cfh	Cubic feet per hour
cfm	Cubic feet per minute
cm	Centimeter
Co.	Company
COP	Coefficient of performance
Corp.	Corporation
d	Penny
db.	Decibel
DB	Dry bulb
dc	Direct current
EER	Energy efficiency ratio
F	Degrees Fahrenheit
fpm	Feet per minute
ft	Foot or feet
gph	Gallons per hour
gpm	Gallons per minute
HP	Horsepower
HVAC	Heating, ventilating and air conditioning
Hz	Hertz
Inc.	Incorporated
KHz	Kilohertz
Kip	thousand pounds
Ksf	Thousand pounds per square foot
Ksi	Thousand pounds per square inch
Kv	Kilovolt
KVA	Kilovolt amperes
KW	Kilowatt
KWH	Kilowatt hour
LF	Linear foot
lb	Pound
LED	Light emitting diode
MBH	1000 BTUs per hour
MHz	Mega hertz

mil	Thousandth of an inch
mm	Millimeter
mph	Miles per hour
oz.	Ounce
PCF	Pounds per cubic foot
pH	Acidity-alkalinity balance
psf	Pounds per square foot
psi	Pounds per square inch
psig	Pounds per square inch, gage
RF	Radio frequency
rpm	Revolutions per minute
SF	Square foot
SY	Square yard
V	Volt
WB	Wet bulb

1.03 SYMBOLS

#	Number or pound
'	Foot or feet
"	Inch(es)
%	Percent

1.03 ACRONYMS

AA	The Aluminum Association, Inc
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ABMA	American Boiler Manufacturers Association
ACI	American Concrete Institute
ADA	Americans for Disability Act
AGA	American Gas Association
AGCIH	American Conference of Governmental Industrial Hygienists
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
APA	APA – The Engineered Wood Association
ARI	Air-Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATBCB	Architectural & Transportation Barriers Compliance Board
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association

AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America
CCR	California Code of Regulations
CFR	Code of Federal Regulations
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CQC	California Quality Control (CMA Standards)
CRA	California Redwood Association
CRI	Carpet and Rug Institute
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards, U.S. Department of Commerce
CSFM	California State Fire Marshal
CSI	The Construction Specifications Institute
CTIOA	Ceramic Tile Institute of America
CTI	Cooling Tower Institute
DHI	Door and Hardware Institute
DSA	Division of the State Architect, Office of Regulation Services
EPA	Environmental Protection Agency
ETL	ETL Testing Laboratories
FCC	Federal Communication Commission
FM	Factory Mutual
FS	Federal Specifications
GA	Gypsum Association
GANA	Glass Association of North America
HMMA	Hollow Metal Manufacturer’s Association
HPVA	Hardwood Plywood & Veneer Association
IACS	International Annealed Copper Standards
IAMPO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
ICC	International Code Council
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical & Electronic Engineers, Inc.
IES	Illuminating Engineering Society
IMI	International Masonry Institute
IRI	Industrial Risk Insurers
ISO	International Organization for Standardization
MLSFA	Metal Lath/Steel Framing Association
MSS	Manufacturers Standardization Society of the Valve & Fittings Industry.

NAAMM	National Association of Architectural Metal Manufacturers
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NEMA	National Electrical Manufacturers Association
NEC	National Electrical Code
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NOFMA	National Oak Flooring Manufacturers Association
NPCA	National Paint and Coatings Association
NPDES	National Pollutant Discharge Elimination System
NRCA	National Roofing Contractors Association
NSF	National Sanitation Foundation
NTMA	National Terrazzo & Mosaic Association
NUSIG	National Uniform Seismic Installation Guidelines
NWMA	National Woodwork Manufacturers Association
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
PDI	Plumbing and Drainage Institute
PEI	Porcelain Enamel Institute
PS	Product Standard, U.S. Department of Commerce
RIS	Redwood Inspection Service
RFCI	Resilient Floor Covering Institute
SCAQMD	South Coast Air Quality Management District
SDEI	Steel Deck Institute
SDI	Steel Door Institute
SFM	State Fire Marshal
SFPA	Southern Forest Products Association
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Steel Structures Painting Council
SWI	Steel Window Institute
TCA	Tile Council of America
UBC	Uniform Building Code
UBPPA	Uni-Bell PVC Pipe Association
UCI	Uniform Construction Index
UFAS	Uniform Federal Accessibility Standards
UL	Underwriters' Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
WCLIB	West Coast Lumber Inspection Bureau

WDMA	Window and Door Manufacturers Association
WIC	Woodwork Institute of California
WWPA	Western Wood Products Association

END OF SECTION

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 51 00- CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division One apply to this section.

B. Section Includes Description of temporary utilities and protection of construction facilities that are to be provided and maintained by Contractor.

1.02 TEMPORARY UTILITIES

A. Water:

1. Water used on work will be furnished and paid for by the District. Contractor shall provide necessary temporary piping 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 wastewater from site to an approved disposal location.

B. Electricity:

1. The District will furnish and pay for electrical power necessary for construction purposes at site. 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 Los Angeles 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 feet 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 and piping necessary to perform his work, and shall remove same upon completion of work. Contractor shall pay for the gas used in work.

D. Heating and Ventilation:

1. Provide, maintain, and pay for heat 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 one cellular telephone or business telephone line at site for his use. Use of District telephones will not be permitted.

F. Temporary FAX: Make necessary arrangements and pay costs for installation and operation of telephone service to Contractor's office at site, suitable for sending and receiving FAX transmissions. Install a plain-paper FAX machine connected to this line and available 24 hours a day during construction operations.

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

H. 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.

1.03 TEMPORARY HEATING AND COOLING

A. Equipment:

1. Contractor shall provide heating and/or cooling equipment as required to provide heated and/or cooled conditioned air to occupied spaces for which construction has temporarily disabled air conditioning equipment serving that space. All equipment must be sized properly to meet cooling and/or heating load requirements.

2. All temporary equipment must be secured with provisions stated in Section 1.04 of this specification.

3. Contractor shall be responsible for furnishing and installing all equipment and/or items required to properly mount or secure temporary equipment.

4. Upon completion of this project, Contractor shall remove all temporary equipment and appurtenances from the site. All areas and material finishes must be restored to their original state.

1.04 CONTRACTOR'S FACILITIES

A. Storage Units:

1. Provide secure and waterproof storage units where required for the temporary storage of furniture, equipment and other items. Storage unit must be located within the confines of a safety barricade (see below) and shall remain inaccessible to facility occupants.

2. Storage Unit Construction: Walls, roof and doors minimum 16 gage steel; floors 1 inch tongue and groove hardwood or 3/4 inch minimum exterior type plywood, with undercarriage designed to accommodate forklift blades 42 inch to 60 inch long; doors at one end of storage unit, double wide swing out with waterproof gaskets and lockable steel bars.

3. Pay all delivery 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

B. Contractor's Safety Barricade:

1. Contractor shall erect safety barricade as required by the District Inspector for the protection and safety of staff and the public. New or pre-used material can be utilized.

2. Unless otherwise indicated or specified, barricade shall be constructed of 8 feet high chain link fencing and shall be properly secured to the ground and/or structure. Space posts not to exceed 10 feet on centers.

3. Chain link fencing shall be free from barbs, icicles or other projections resulting from galvanizing process. Fence 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. Fabric to be attached to frame at 12 inch 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.

6. The Inspector may allow the use of panelized chain link fence or properly supported orange plastic fence.

7. Edge Protection Guardrails for roof work per OSHA and District Requirements. Cones and caution tape is not acceptable.

C. Other Enclosures:

1. Provide lockable, temporary weather-tight enclosures at openings in exterior walls to facilitate temporary cooling or heating and security.

2. Provide protective barriers around trees, plants and other improvements designated to remain.

D. 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. District Inspector shall approve exact location, size and access of storage yards.

4. Remove storage yards and sheds as rapidly as progress of work will permit.

E. Contractor's Parking:

1. Location and number of spaces for Contractor's parking as directed by the District Inspector, temporarily stored and when directed by the District Inspector.

1.05 GENERAL ITEMS

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

B. Safety and Security Lighting: Provide 20-foot candles minimum inside building(s) and 5 foot candles outside.

C. Noise Control: Muffle all equipment. All noise levels shall comply with OSHA and CAL/OSHA requirements. Excessive noise tasks such as coring etc. shall be performed after hours or weekends.

D. Dust and Odor Control: Dust and odor barriers shall be in place dividing areas of work and remainder of building to provide a safe and clean environment for building occupants. Provide adequate ventilation if required. Comply with all OSHA and CAL/OSHA requirements.

E. Where temporary noise/duct partitions are required, Contractor shall build a dividing partition, which will extend from finished floor up tight to the underside of existing ceiling. (Upon removing partition, Contractor shall repair floor and/or ceiling as required to match existing conditions.) Contractor shall construct partition in accordance with local building codes. Under no circumstances shall temporary partition block any means of egress or impede the regular flow of occupant traffic. Contractor shall provide District with a scaled drawing indicating the exact location of the temporary partition relative to its' surroundings. Contractor must have approval from District prior to the erection of such partition.

1.06 TRENCHES

A. Open trenches for installation of utility lines (water, gas, electrical and similar utilities) and open pits outside barricaded working areas shall be cordoned at all times. Barricades, shall be as identified in another part of this section. Walk Plates shall be installed at all pedestrians and vehicle traffic cross-area (see below).

Trenches shall be backfilled and patch-paved within 72 hours after approval of installation by the District Inspector.

B. Open trenches deeper than 42 inches, and not located within a parking area or public street access, shall be enclosed within an 8-foot high chain-link fence.

C. Trenches or excavations which cannot be properly back-filled and patched prior to the end of each work day shall be bridged to permit an unobstructed flow of traffic. Trench walls and adjacent soils shall be sufficiently stabilized prior to the use of steel plates for bridging.

1. Bridging must be secured against displacement by using adjustable cleats, angles, bolts, or other devices to prevent movement by traffic.

2. The trench must be adequately shored to support the bridging and traffic.

3. Steel plates used for bridging must extend 1 foot beyond the edges of the trench. Temporary paving materials (premix) should be used to feather the edges of the plate to minimize wheel impact.

D. All excavations in public rights-of-way shall be in compliance with all current Occupational Safety and Health Act (CAL/O.S.H.A.) requirements. Any person in an excavation not in compliance with CAL/O.S.H.A. regulations will be ordered out of the excavation until it is brought into compliance.

E.

F. All excavations or trenches made in the parking area or sidewalk shall be backfilled and patched in accordance with the current CDOT and/or NCDOT specifications. District inspector shall be notified prior to making an excavation or cutting a trench in any pavement or sidewalk.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division One apply to this section.

B. Section Includes:

1. Quality assurance.

2. Delivery, storage and handling.

3. Installation requirements.

1.02 QUALITY ASSURANCE

A. Standard References: Material or procedure specified by reference to number, symbol, or title of a specific standard, such as a commercial standard, a Federal Specification, a trade association standard, or other similar standard document shall comply with requirements in latest version, revision, amendment or supplement of document in effect on date of executed contract, except as limited to type, class or grade, or modified in such reference.

1.03 DELIVERY, STORAGE AND HANDLING

A. All materials and products for the project shall be delivered in manufacturer's original, undamaged, factory sealed containers, with factory applied labels intact and legible.

B. The labels shall contain the following information as applicable: Manufacturer's name and address; brand name; product designation; type, class or grade; size or weight; batch number; testing lab certification and color.

1.04 EQUIPMENT FURNISHED BY THE DISTRICT

A. Delivery: Within 15 days after the Contract is awarded, Contractor shall notify the District, in writing, of date scheduled for installation of equipment. Upon delivery to site, Contractor shall store equipment inside rooms or protected spaces. The District Inspector will sign receipt, or bill of lading, as required.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Install equipment in location and orientation indicated on drawings, or in locations provided by District Inspector.

B. Equipment shall be installed plumb and level, by means of shims or spacers, in a manner that with all mounting bolts fully tightened, no distortion nor undue stresses will be set up within equipment. Furnish other accessories and components necessary to properly install equipment, such as bolts, washers, fittings or blocking.

C. Floor Mounted Equipment:

1. Equipment designed or specified to be attached to substrates such as concrete or steel shall be secured with anchor bolts and tampins, cinch anchors or fastite bolts and shells of size recommended by manufacturer of equipment, or as required for secure mounting.

2. Equipment designed or specified to be attached to wood construction shall be secured with machine bolts or lag screws, of size recommended by manufacturer of equipment, and as directed by the District Inspector.

D. Bench Mounted Equipment: Secure to bench or table by machine bolts.

E. Equipment shall be connected only to outlets with correct electrical characteristics. Contractor shall ascertain that the electrical characteristics of the equipment are for outlets indicated. Report discrepancies immediately to the District Inspector.

END OF SECTION

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division One apply to this section.

B. Section Includes:

1. Cutting, patching, and alteration procedures:

a. Removals, cutting, alterations and repairs to existing facilities as required to complete work.

b. Relocation and reinstallation of existing construction and finish.

c. Salvage, storage and protection of existing items to be reinstalled.

d. Salvage and delivery to the District of items so designated for removal and salvaged by Contractor.

2. Examination by Contractor.

3. Final inspection.

1.02 SUBMITTALS

A. Shop Drawings: Submit details of cutting and patching, including transition to existing items being patched. Provide details of all piping and ductwork routing, elevations and sizes. Also provide equipment locations and dimensions relative to equipment pads and all equipment support and pad locations.

B. Schedules: Contractor must submit proposed work schedules, including dates and hours proposed. Schedule must be approved by District prior to starting any work. Where special work conditions apply, Contractor must provide a detailed work schedule which must include all duties, work dates and times, completion dates, and an explanation stating means and methods for executing such work.

C. All work executed within the building shall be done on Monday through Friday during the hours of 7:00 a.m. to 6:30 p.m. Any deviations from the said days and/or times must be approved with the District prior to executing such work. Any work to be done before and/or after stated times (except on Saturday or Sunday) shall be scheduled as required and done without additional cost to the District.

1.03 WARRANTIES

A. Existing Warranties: Repair materials and systems that have been cut, modified or damaged as a result of cutting, patching or alteration procedures, using methods and materials that will not void existing warranties. It shall be the responsibility of the Contractor to contact the District and/or Contractor backing an existing warranty – coordinate and consult as required to ensure that all materials are restored to their original condition and warranties are not voided. Any damage to existing systems under warranty shall be repaired by Contractor at no additional cost to the District.

1.04 REMOVAL, ALTERATIONS AND REPAIRS

A. Restore and refinish new and existing construction and improvements that are cut into, damaged, relocated, or reinstalled. Workmanship and materials shall conform to applicable provisions of other sections.

B. Provide new fasteners, connectors, adhesives, and other accessory materials or components as required to complete the work.

C. Perform removals and alterations only to the extent required to complete the work. Carefully remove work to be salvaged or reinstalled. Protect and store for reuse.

1. Walls, Partitions, and Ceilings: Remove by accurately cutting and carefully removing.

2. Concrete: Saw with powered concrete saw, or chip where sawing is not feasible, to prevent spalling of concrete to remain. Cut off reinforcing bars, except where bonded into new concrete or masonry, and paint ends with bituminous paint before enclosing.

3. Woodwork: Cut or remove to a joint or panel line. Undamaged removed material may be reused.

4. Sheet Metal: Remove back to joint, lap, or connection. Secure loose or unfastened ends or edges and make watertight.

5. Glass: Remove broken or damaged glass and clean rebates and stops of setting materials.

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.

7. Gypsum Wallboard: Cut back on straight lines to undamaged surfaces, with at least two opposite cut edges centered on supports.

8. Acoustical Ceilings: Remove hanger wires where ceilings are not reinstalled.

9. Tile: Cut back to sound tile and backing on joint lines if portions are to remain.

10. Flooring: Completely remove flooring and clean backing of old cement or adhesive. Carefully remove wood flooring for patching and repairing of existing wood flooring to remain.

11. Miscellaneous Items: Grind items not mentioned but required to be removed in such manner as minimizes damage to Work to remain.

1.05 CUTTING AND PATCHING

A. Cutting, boring, saw cutting or drilling through new or existing structural elements to be done only when so detailed in drawings or accepted by the Structural Engineer, with approval from the District and DSA.

B. Batching, Repairing and Finishing:

1. Concrete: Keep the cut edges damp for 24 hours and scrub with a neat portland cement mortar just before new concrete is placed; epoxy adhesive may be used in lieu of cement mortar. Finish new concrete to match existing. Provide 3,000 psi concrete for repairs. At cut concrete edges to remain exposed, apply adhesive and restore with minimum 3/4" thick cement mortar finished to match adjoining surfaces.

2. Metal Items: Grind cut edges to remain exposed smooth and rounded.

3. Woodwork: Trim back to joint lines or splices, re-trim cut surfaces, and patch new matching or undamaged remove materials.

4. Sheet Metal: Restore removed or damaged sheet metal items as required or directed.

5. Glass: Install new matching glass and re-seal existing exterior windows, airtight.

6. Lath and Plaster:

a. Lath: Lath surfaces to be patched with matching lath as required, secured to supports at 6" centers. Lap new lath 6" over existing and wire-tie new and existing lath edges together at 6" intervals. Restore paper backings as required, shingled into existing.

b. Plaster: Apply a bonding agent on cut edges of existing plaster. Apply 3-coat plaster patching of type, thickness, finish, color, and texture to match existing plaster.

7. Gypsum Wallboard: Refasten cut edges of existing wallboard. Apply patches with at least two opposite edges centered on supports and secure at 6" centers. Tape and finish joints and fastener heads. Make patching non apparent when painted.

8. Acoustical Ceilings: Conform to requirements specified herein as necessary to match the existing conditions.

9. Resilient Flooring: Completely remove damaged flooring and clean off all old cement as specified. Install new flooring of color, pattern, and type as specified.

10. Painted Surfaces: Prepare patched areas and refinish as specified in Section 09 90 00: Painting.

1.06 PREPARATION OF EXISTING WORK

A. Holes: Drill holes through existing concrete or masonry for new conduit and/or piping, and do not jack-hammer.

B. Sandblasting: Work includes sandblasting of existing surfaces to receive materials secured by cementitious, adhesive, or chemical bond (such as concrete, toppings, elastomeric coatings, plaster, mortar, etc.), and the sandblasting of other surfaces as shown, specified, directed, or required for proper preparation of surfaces. Completely remove existing finishes, stains, oil, grease, bitumen, penetrated mastics and adhesives including primers, and substances deleterious to bond or connection of new materials, and expose clean sound surfaces. Employ wet sandblasting for interior surfaces, and for exterior surfaces where directed or necessary to prevent creation of a dust nuisance or required by Code.

C. Salvage: Existing removed items not indicated or specified to be reused or reinstalled the District intends to retain will be designated by District prior to start of removals in pertaining area. Carefully remove, salvage, box or bundle as approved, and deliver such items to storage at the site as the District Inspector directs.

D. Disposal: Conform to General Conditions. Dispose of removed material off the District's property except existing items to be salvaged or reinstalled. Promptly remove waste and debris and do not allow to accumulate within facilities or on site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. New Materials: Use materials identical in appearance and performance characteristics to existing materials, so that patch or alterations will visually match and blend seamlessly into adjacent existing surfaces.

B. New ceiling tile to replace the obsolete existing tile – Armstrong 741. See specification 09 51 23.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify compatibility and suitability of existing before starting the work. Perform a detailed survey of existing site and building conditions before starting work. Report unsatisfactory conditions to the District Inspector, such as discrepancies or conflicts between Drawings and actual conditions.

3.02 FINAL INSPECTION

A. A final examination shall be made when work is substantially complete, except for minor corrective items, in accordance with District regulations.

B. Before final examination, completed documentation checklist shall have been received and project record documents shall be completed.

END OF SECTION

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division One apply to this section.

B. Section Includes: Procedures and requirements for preparing project record documents for delivery to District upon completion of the work.

C. Related Sections:

1. General Conditions.

2. Section 01 33 00: Submittals.

3. Section 01 32 13: Construction Schedule-CPM.

1.02 PROCEDURES

A. Project Record Documents: Promptly following award of contract, Contractor shall secure from the District one complete set of Specifications and prints of contract drawings for use on the job site as project record drawings.

B. Timing of Entries: Make entries within 24 hours after receipt of information.

C. Contractor shall be responsible for maintaining and recording changes on project record documents set, by marking them on a daily basis to record the details of construction, including changes and substitutions.

D. Do not use project record documents set for any purpose except entry of new data, and for reference by the Engineer and District. Maintain separate sets for daily reference on job site.

E. Use all means necessary to protect project record documents set from deterioration, loss or damage.

F. Entries on Drawings: Using an erasable color pencil, other than blue, not ink or indelible pencil, clearly describe change by note and by graphic line as required. Date entries. Call attention to entry by a "cloud" around area or areas affected. In event of overlapping changes, different colors may be used for each change.

1. Changes due to approved change orders may be indicated by referencing change order number and scope of change in lieu of revising project record documents, but shall be indicated on the final as-built drawings.

2. Location and depth below finish grade or above ceilings and attic spaces of utilities shall be fully dimensioned and indicated on project record documents. Dimensions shall be taken to building lines or permanent landmarks.

G. District's periodic review of the progress being made on project record documents will be a prerequisite to District's approval of requests for progress or final payments.

1. Progress Approvals: Prior to submitting each request for progress payments, secure the District Inspector's approval of status of project record documents.

2. Prior to submitting request for final payment and final inspection, submit project record (as-built) documents set to the District Inspector, with transmittal letter, in duplicate, for approval and further processing.

3. The Contractor shall certify that the project record documents are complete and accurately reflect all changes or modifications to the original construction documents.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

DIVISION 02 – EXISTING CONDITIONS

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 DEFINITIONS

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

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

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

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

1.02 MATERIALS OWNERSHIP

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

B. Items of interest or value to Owner that may be uncovered during demolition remain the property of Owner. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.03 FIELD CONDITIONS

A. Owner may occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: If suspected hazardous materials are encountered, do not disturb; immediately notify Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities noted to remain in service and protect them against damage.

F. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 – PRODUCTS

2.01 PEFORMANCE REQUIREMENTS

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

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

PART 3 – EXECUTION

3.01 EXAMINATION

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

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

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

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

-END OF SECTION-

SECTION 05 50 00 MISCELLANEOUS METAL FABRICATIONS

PART 1 - GENERAL

1.1 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.

1.2 REFERENCE STANDARDS

A. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):

1. ASTM A36 – Standard Specification For Carbon Structural Steel.
2. ASTM A53 – Standard Specification For Pipe, Steel, Black And Hot-Dipped, Zinc-Coated, Welded And Seamless.
3. ASTM A108 – Standard Specification For Steel Bar, Carbon And Alloy, Cold-Finished.
4. ASTM A123 – Standard Specification For Zinc (Hot-Dipped Galvanized) Coatings On Iron And Steel Products.
5. ASTM A153 – Standard Specification For Zinc Coating (Hot-Dip) On Iron And Steel Hardware.
6. ASTM A307 – Standard Specification For Carbon Steel Bolts And Studs, 60000 Psi Tensile Strength.
7. ASTM A325 – Standard Specification For Structural Bolts, Steel, Heat Treated, 120/105 Ksi Minimum Tensile Strength.
8. ASTM A435 - Standard Specification For Straight-Beam Ultrasonic Examination Of Steel Plates.
9. ASTM A490 - Standard Specification For Structural Bolts, Steel, Heat Treated, 120/105 Ksi Minimum Tensile Strength.
10. ASTM A500 – Standard Specification For Cold-Formed Welded And Seamless Carbon Steel Structural Tubing In Round And Shapes.
11. ASTM A501 - Standard Specification For Hot-Formed Welded And Seamless Carbon Steel Structural Tubing.
12. ASTM A572 – Standard Specification For High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
13. ASTM A653 – Standard Specification For Steel Sheet, Zinc-Coated (Galvanized) Or Zinc-Iron Alloy-Coated (Galvannealed) By The Hot-Dip Process.
14. ASTM A673 - Standard Specification for Sampling Procedure for Impact Testing of Structural Steel,
15. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
16. ASTM A992 – Standard Specification for Structural Steel Shapes.
17. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).
18. ASTM E23 - Standard Test Methods for Notched Bar Impact Testing of Metallic Materials.
19. ASTM E112 - Standard Test Methods for Determining Average Grain Size.
20. ASTM F436 – Standard Specification for Hardened Steel Washers.
21. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
22. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-Ksi Yield Strength.
23. ASTM F1852 – Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tension Strength.

B. American Welding Society (AWS):

1. AWS D1.1 – Structural Welding Code - Steel.
2. AWS D1.8 – Structural Welding Code – Seismic Supplement.
3. AWS A2.4 – Standard Symbols for Welding, Brazing, and Nondestructive Examination.
4. AWS B2.1 – Specifications for Welding Procedures and Performance Qualification.

C. SSPC – Steel Structures Painting Council:
1. SP-2 - Hand Tool Cleaning.
2. PA-1 - Paint Application Specification No. 1.

D. Materials shall conform to California Building Code (CBC), Title 24, Part 2, Chapter 22A.

1.3 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.

1.4 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 1704A.3.
2. Welding inspection shall be in accordance with Title 24, Part 2, Section 1704A.3.
3. Shop Welding: Ensure that shop welding is performed in an approved, licensed shop. Continuous inspection shall be required as noted in Table 1704A.3.
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

2.1 MATERIALS

A. General: Structural steel shall comply with ASTM A6 and requirements of Title 24, Part 2, Chapter 22A.

B. Galvanized Carbon Steel Sheets: ASTM A653, with ASTM A525, G90 zinc coating.

C. Steel Wire Rope: ASTM A475, zinc coated steel wire strand, size and number of wires required, common grade with Class B zinc coating.

D. Shop Primer: Tnemec 10-99, or other approved.

E. Field Galvanizing: Provide ZRC Chemical, or other approved.

F. Common Bolts: ASTM A307 GR. A

G. Threaded Rods and Nuts: ASTM F1554 Gr. 36

2.2 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.

PART 3 - EXECUTION

3.1 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.

3.2 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.

3.3 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

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 07 01 50 - ROOF MAINTENANCE AND REPAIR

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Repairs to and maintenance of existing -roofing.

B. Repairs to roof flashing and trim, penetrations, rainwater drainage components and' other roof-related components.

1.02 RELATED SECTIONS

A. Section 07 62 00 - Sheet Metal Flashing and Trim.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Materials and 'installation shall meet or exceed applicable minimum requirements of California Building Code (CBC), Section 9 and Section.15

B. Industry Standards: 'Work specified in this Section shall comply to manufacturer’s product data and application instructions. Work shall also conform to recommended practices and details published in NRCA Roofing and Waterproofing Manual and the recommended practices and details of Western States Roofing Contractors Association (WSRCA); where such practices and details are more stringent

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery, Storage and Handling, General: Deliver, store and handle roofing sheet materials in a manner ensures that no significant quantity of moisture is absorbed.

B. Storage: Dry, well ventilated, weathertight locations. Unless protected from weather or other moisture sources, do not leave unused felts on roof overnight or when roofing Work is not in progress. Store rolls of felt and other sheet materials on end on pallets or other raised surfaces.

C. Temporary Placement on Structure: Distribute weight of packaged roofing materials over roof deck area to prevent substantial deflection of roof deck and overloading of the structure.

1.05 WARRANTY/MAINTENANCE AGREEMENT

A. Contractor Maintenance Agreement

1. For a one- (1) year period from the date of completion and owner acceptance, Contractor shall agree to inspect, maintain, and make necessary repairs to leaks in the roof and flashings. Emergency leaks will be attended to within twenty-four (24) hours from receipt of notice from the Owner. This Agreement shall be submitted to the Owner, in writing, before final payment is released for the Contract.

2. Contractor to provide (1) extra extended year warranty additional to the one- (1) year period from the date of completion and owner acceptance

3. If, Twenty four (24) hours after notification of roof leakage Contractor has not responded, Owner shall have the right, without invalidating his agreement, and at the expense of the Contractor, to make any emergency temporary repairs in order to protect the building and its contents from damage due to roof leakage.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Manufacturer: This specification is based upon Johns Manville roof materials and components to establish intended material, performance and quality standards. Requests for substitutions may be submitted for review and consideration in accordance with Division’s requirements and/or contract general conditions.

2.02 MATERIALS

A. Roofing Materials, General: Furnish roofing materials and systems to match existing roofing materials and preserve the existing Class 'B" minimum roof covering fire classification per CBC Chapter 15 requirements. All materials to be American made and asbestos free, and shall comply with the following standards.

B. Base Sheet

1. Material: Heavyweight' glass mat, bound together with a resinous binder and completely coated with weathering grade asphalt.

2. Manufacturer/Brand: Johns Manville GlasBase or GlasBase Plus

3. Manufacturing Standards: SS-R-620B, Type II; ASTM D4601; Type II.

4. Nominal Weight: 28 lbs. per 100 square feet.

C. Ply Sheet

1. Material: Heavy glass mat bound together with a resinous binder, and completely coated with asphalt. Surface with opaque, inert, non-combustible colored granules.

2. Manufacturer/Brand: Johns Manville Glasply IV.

3. Manufacturing Standards: ASTM D2178, Type IV.

4. Nominal Weight: .8 lbs. per 100 square feet.

D. Surfacing/Flashing Sheet

1. Material: Heavy glass mat bonded together with resinous binder and completely coated with asphalt. Surfaced with opaque, inert, non-combustible colored granules.

2. Manufacturer/Brand: Johns Manville GlaSKap

3. Manufacturing Standards: ASTM D3909;

4. Nominal Weight 75 lbs. per 100 square feet.

5. Color: White.

E. Bitumen:

1. Material: Air blown 'roofing grade asphalt.

2. Manufacturing Standards: ASTM D312 Type III.

F. Cold process Adhesive

1. Material: One part, elastomeric interply adhesive for use with SBS. or built-up roofing' base sheets.

2. Manufacturer/Brand: Johns Manville MBR .Cold: Application Adhesive

G. Fasteners for Base Sheet to Wood Deck:

1. Type: Annular or spiral thread ring shank, square head, one (1) piece nails. For other deck types, use NRCA recommended fastener appropriate for deck type.

2. Size: 12 gauge minimum with minimum 7/8" diameter head, of sufficient' length to penetrate at 3/4" into or through wood deck.

H. Roof/Flashing Cement

1. Material: Asphalt cutback flashing cement compound fortified with fibers, filler, and solvents, non-asbestos. Use Modified cement for modified bitumen Products'.

2. Manufacturing Standards: Federal Spec SS-C—153B, Type I ASTM D4586 Type II.

I. Asphalt primer:

1. Material: Black, medium consistency asphalt cutback primer compound of select asphalt and penetrating petroleum solvents.

2. Manufacturing Standards: ASTM.D41.

J. Elastomeric Sealant:

1. Material: One part moisture curing polyurethane sealant

2. Manufacturer/Brand: Tremor Vulkem 911.

3. Manufacturing Standards: Fed Spec TTS-00230C, Type 11,, Class A; ASTM C-920, Type S, Class 25.

K. Elastomeric Roof Coating:

1. Material: Two-part water-based white acrylic elastomeric roof coating system, comprised of a base coat component and a surface coat component

2. Manufacturer/Brand: Firestone Acrylitop PC-100.and Acrylic Base Coat.

L. Aluminum Coating:

1. Material: Asphalt emulsion based, non-asbestos, fiber reinforced reflective aluminum coating.

2. Manufacturer/Brand: Johns Manville Topgard Type A

M. Asphalt Emulsion:

1. Material: Clay stabilized; water based emulsified asphalt coating with non-asbestos reinforcing fibers.

2. Manufacturer/Brand: Johns Manville Topgard Type B

3. Manufacturing Standards: ASTM D1227, Type IV.

N. Protection Material/Walk Pad (obtain final approval from district):

1. Material: Asphalt and reinforced fibers compressed and molded under heat between inorganic fiberglass membranes, top and bottom. Surfaced with skid-resistant surfacing.

2. Manufacturing Standard: ASTM D517.

3. Size: 1/2" thick.

O. Fasteners for Base Flashing:

1. Type: Wood nails shall be minimum 11 gauge, barbed, galvanized with minimum 3/8 head. Masonry nails shall be case hardened. One (1) inch diameter tin caps or integral heads must be used for base flashing securement.

2. Size: Sufficient length to penetrate one-inch (1") minimum.

P. Cant Strips:

1. Material: Triangular wood fiber, perlite, or soft wood lumber.

2. Manufacturing Standard: ASTM C208 or ASTM C728.

3. Minimum size on Horizontal and Vertical Sides: Four (4") inches.

PART 3- EXECUTION

3.01 PREPARATION AND GENERAL REQUIREMENTS

A. Contractor shall be responsible not only to perform all applicable repairs as outlined, but also to inspect the roof(s) and perform any other - necessary repairs as needed to ensure a watertight condition for the duration of his maintenance agreement.

B. Contractor shall be responsible to verify the roof void prior to bidding. Due to several layers of existing roofing being applied over the years, depression will be created when the new roofing is applied. It is recommended that DensDeck roof board (or approved equal method) be applied to fill these voids. Contractor to include this scope of work in roof repair work.

C. Where roofs receiving repairs maintenance are covered' by manufacturer guarantee, ensure that repair methods/procedures and all other applicable requirements are complied with.

D. Where, applicable, comply with Section 07 62 00 - Sheet Metal Flashing and Trim, for sheet metal requirements.

E. Metal wall coping, counterflashing, etc. shall be removed or lifted, as needed to accommodate repairs.

F. Clean and prepare surfaces prior to sealant application, to ensure proper long-term adhesion.

G. Thoroughly dean and re-seal all exposed metal joints and, penetrations to result in a long-term watertight seal. .

H. All exposed metal fasteners shall be driven through, steel/neoprene washers or caulked with elastomeric sealant. Any loose or missing fasteners shall be replaced with new.

I. Clean and prime portions of existing membrane to receive new materials prior to application of repairs. Prime any sheet metal or masonry surfaces to which asphaltic materials are to be applied. Allow all primer to dry thoroughly.

J. At aggregate roof areas; remove all loose and embedded aggregate from repair area, 'prior to repair application.

K. Upon completion of repair, re-apply appropriate surfacing to match existing. Coat all exposed roof cement or. Modified bitumen with embedded gravel; granules or aluminum emulsion, as applicable.

L. Remove all debris from roofs, gutters, etc. and dispose of property.

M. Take precautions to keep materials dean, dry, and free of damage.

N. Use only materials and procedures that are proper and suitable for the slopes and for the underlying materials to which they are attached.

O. Provide approved and operable fire extinguishers on hand at all times on the roof and near any asphalt kettle. During all hot application work, including kettle loading, have all roofers wear protective clothing (i.e., long-sleeved shirts, gloves, and face shield for kettle operator). Follow all additional requirements of OSHA Safety Regulations.

P. Do not use any wet or damaged materials.

Q. Bitumen Heating Equipment must .be thermostatically controlled. Equipment must be dean and in sufficiently good operating condition to perform specified work.

R. Asphalt

1. Apply asphalt per EVT at the point of application. Discontinue operations if asphalt' temperatures at point of application cannot be maintained at the EVT.

2. Equip asphalt heating equipment with an accurate thermostat and thermometer.

3. Do not overheat. asphalt Kettle temperature generally may not exceed 5000F

4. Do not heat asphalt to the minimum flash point. The minimum finished blowing temperature may not be exceeded for more than a total of four (4) hours, for any asphalt batch or portion thereof. Remove from the projected any asphalt heated above these limits.

5. Cold weather application requires the use of insulated supply lines and equipment to minimize temperature drop from the kettle or tanker-to the point of application.

6. Do not apply materials when foaming; blistering; or bubbling of the hot bitumen occurs. Remove any materials emitted when such activity occurs.

S. Primer

1. Material may be applied by brush, spray, or roller.

2. Materials may not be diluted or adulterated.

3. Apply primer to any masonry or metal surfaces to receive bituminous products at the nominal rate-of one (1) gallon per 103 square feet Allow to dry thoroughly-prior to-application of roofing materials.

T. Roof Cement

1. Material may be applied either by trowel or by hand.

2. Material may not be diluted or adulterated.

3. Maintain materials at the working temperatures recommended by the Manufacturer.

3.02 GENERAL REPAIR METHODS/MATERIALS

A. The following options are acceptable for built-up or modified bitumen membrane repairs:

1. Base, plies and surfacing sheet set into continuous moppings of hot, steep asphalt.

2. Coated base sheets and/or cap Sheet set into continuous applications of gold process adhesive. Coated base sheet must first be mechanically fastened over any exposed deck surface.

B. The following options are acceptable for built-rip or modified bitumen base flashing and wall covering repairs/replacement

1. Base, plies and surfacing sheet set into continuous moppings of hot, steep asphalt.

2. Coated base sheets and/or cap sheet set into Continuous applications of flashing grade roof cement Base sheet must first be mechanically fastened for wall covering over exposed wood surfaces.

C. Repairs or replacement of various single-ply, shingle, tile, sprayed foam and metal roof types and components shall utilize like materials installed in accordance with manufacturer recommendations in conjunction with any requirements stated herein.

D. References to "elastomeric 3-course" application below refer to the following procedures:

1. Thoroughly clean surfaces to receive new materials. Apply appropriate primer if recommended by manufacturer of elastomeric sealant

2. Trowel-apply a thin layer of elastomeric sealant over surfaces to be treated. Embed a layer of woven polyester fabric into the sealant and work fabric into the sealant to ensure embedment. Except where stated otherwise, width of fabric shall be 4" minimum or as needed to accommodate condition; providing at least 2" Overlap of fabric onto adjacent surfaces.

3. Apply a second layer of elastomeric sealant over the first and work into the first to ensure adequate bond between layers. Ensure that the fabric is completely embedded within the two sealant layers.

E. References to "asphaltic 3-course" application below refer to the following procedures:

1. Thoroughly dean surfaces to receive new materials. Apply asphaltic primer and allow to dry thoroughly.

2. Trowel-apply a thin layer of roof cement over surfaces to be treated. Embed a layer of woven glass or polyester fabric into the roof cement and work fabric into the roof cement to ensure embedment. Width of fabric shall be 4" minimum or, as needed to accommodate condition, providing at least 2" overlap of fabric onto adjacent surfaces.

3. Apply a second layer of roof cement over the first and work into the first to ensure adequate bond between layers. Ensure that the fabric is completely embedded within the two layers of roof cement.

4. Cover exposed mastic with embedded granules or aluminum coating.

3.03 BUR/MODIFIED BITUMEN MEMBRANE REPAIRS:

A. General the following requirements apply to all BUR/Modified Bitumen membrane repairs:

1. Prior to application of new asphaltic components, apply primer to areas receiving repairs as described above. Allow to dry thoroughly.

2. It may be necessary "build up" repair areas using layers of embedded felt or other approved method in order to create a flush condition and eliminate indentations in the membrane prior to application of membrane repairs.

3. Membrane repairs shall be made with each subsequent ply extending at least six inches beyond the edge of the defect or the previous ply.

4. Membrane tie-in plies shall be installed as needed to extend cut portions of the membrane to the top of cant strips at the base of walls, supports, etc. prior to application of new base flashing materials. These tie-in plies shall be feathered onto the existing primed roof surface as described above.

B. Repair damaged, broken or split blisters or ridging conditions as follows:

1. No repairs are required unless blisters or ridging conditions are damaged, broken or split.

2. Remove all delaminated layers at broken areas.

3. Repair ply for ply using-hot or cold applied repair components including cap sheet surfacing,

C. Repair membrane splitting as follows:

1. Cut membrane at ends of splits perpendicular to splits.

2. Nail each side of split with cap nails at 5" o.c.

3. Repair over split using a 4" wide dry base sheet centered over the split and nailed at 6" o.c. Cover with 2 plies and cap sheet: set in asphalt, 2 base sheets and cap sheet Set in cold adhesive.

D. Repair holes, gouges, fastener back-out, exposed fasteners or similar small men-brat* damage or deterioration as follows:

1. Where necessary, remove object.

2. Repair ply for ply using hot or cold applied repair components including cap sheet surfacing with general requirements stated above.

E. Repair loose/open laps or fishmouths as follows:

1. Cut fishmouths.

2. Clean between open areas. If wet, cut open and dry completely.

3. If built-up roofing, seal between open areas with roof cement.

F. Repair significant membrane damage/deterioration due to ponding conditions or other significant membrane repair or-replacement needs, in accordance with the following:

1. Remove any damaged membrane.

2. Clean surrounding roof areas and, prime and slow to dry.

3. Install membrane ply for ply as removed within cut out area with hot asphalt or cold adhesive. Use all base sheets when using cold adhesive.

4. Over patch, install two additional layers of felt into hot or cold asphalt.

5. Install new cap sheet on cap sheet roofs. Spread new aggregate in asphalt, adhesive on aggregate roofs.

6. Feather the two plies and cap sheet 4" past underlying edge or layer.

7. If repair is adjacent to flashing condition(s), provide proper flashing tie=in based on condition.

G. Repair areas of bare asphalt, exposed felts or alligatoring as follows:

1. On aggregate roofs, apply cold: adhesive or emulsion at the equivalent rate of three (3) gallons/100 square feet Additional adhesive or emulsion may be needed on alligatored surfaces. Broadcast new, proper aggregate, completely covering exposed areas.

2. On cap sheet/granule roofs, install new cap sheet into hot asphalt-or cold asphalt adhesive, or embed loose granules into roof cement or cold adhesive over bare areas:

H. Perform replacement/repairs to roof coating on smooth surface 'roofs, and/or at areas where surfacing is peeling, flaking, separating or alligatoring, using appropriate compatible elastomeric coating in accordance with, the following:

1. Prepare surfaces in accordance with instructions of elastomeric coating manufacturer. Ensure that surfaces are .dean and free of dirt, debris, dust and contaminants. Use wire, brush or other method to ensure removal of any loose or flaking coating. Complete all required membrane repairs prior to re-coating.

2. If recommended or required, provide prime coat to ensure positive adhesion to underlying surfaces.

3. Apply new elastomeric coating components in accordance with manufacturer's instructions: Provide detail coats and/or reinforcing fabric at transitions, Junctures, etc. as required.

4. Install new coating at a minimum rate of one. (1) gallon per 100 square feet for base coat and one (1) gallon per 100 square feet' for surface coat, or as otherwise recommended by the coating manufacturer.

5. Precautions should- be exercised to minimize the amount of exposed asphalt at laps, etc. in order to limit the potential for displacement or “alligatoring” the surface coating when re-coating is required.

I. Remove debris and membrane contamination as follows:

1. Remove all debris from roof surfaces and dispose of properly. This Includes accumulation of leaves, granules, fasteners, scraps, trash, abandoned equipment, supplies, etc. Place any stored materials/supplies onto roof protection material.

2. Water wash, as needed, to thoroughly dean any contaminated roof, surfaces, including significant 'tobacco-juicing". Use mild detergent or other product or method, if needed, In compliance with manufacturer recommendations.

J. Treat low areas where -surface cracking/degradation is evident in granule-surfaced membranes' using the following methods:

1. Thoroughly dean and lightly prime membrane surfaces in affected area.

2. Surfaces to be coated shall be free from foreign material, oil, grease, dirt and other debris. Any surface defects shall be repaired as required prior to application of Coating. Surface May be damp. Power washing may be needed to clean some areas.

3. Coat the entire surface: with fibrated emulsion applied at a minimum rate of three (3) gallons per 100 square feet of roof area. Emulsion may be diluted 10% with cool, clear water when rolled or brushed on.

4. Material may be applied by spray or soft fibered brush or roller.

5. While emulsion is still, wet embed ceramic granules at a minimum rate of 50 lbs. per 100 square feet to roof area Granules shall be property broadcast to ensure a smooth, uniform appearance.

3.04 BUR/MODIFIED BITUMEN BASE, WALL AND EDGE FLASHING

A. Repair any significantly blistered or loose base/wall membrane flashings as follows:

1. Sagging, buckled, blistered or wrinkled flashings to be cut and mechanically secured with cap fasteners.

2. Install new base/wall flashings to match existing with hot asphalt applied.

3. Mechanically fasten top edges of flashings with cap fasteners at 6" o.c.

4. Conceal top of flashings with wall coping, wall flashing, or metal skirt.

5. All exposed fasteners at built-up flashings to be sealed with roof cement. Seal exposed fasteners on APP flashings with modified asphalt from heated materials. Coat all with aluminum emulsion or embedded granules.

B. Where required to remove and replace base/wall flashings, comply with the following:

1. Completely remove all affected base/wall flashings.

2. Install new base flashings consisting of two plies felt and cap sheet set into hot asphalt, depending on roof system.

3. Install new wall flashing consisting of base sheet, ply sheet, and cap sheet, all set into hot

4. Asphalt (over nailed base sheet at combustible surfaces). On walls over 24" high; install wall flashing separate from base flashing. Blind nail laps with 1" head cap nails.

5. Mechanically fasten top edges of flashings with cap nails at 6" on center. . .

6. Conceal top of wall flashings with wall coping or metal skirts:

7. All exposed fasteners at flashings to be sealed with roof cement and coated with aluminum emulsion.

C. Repair areas of improperly secured or mussing membrane wall flashings as follows:

1. Install new wall flashing components to tie into and match existing. Secure with appropriate cap fasteners at 6" o.c. along the top edge.

2. Any exposed fasteners to be sealed with roof cement (BUR) or modified asphalt from heated scrip material (APP).

3. Coat fastener repairs with aluminum emulsion.

D. Address all exposed fasteners at base/wall flashing as follows:

1. On built-up flashings, seal all exposed fasteners with roof cement:

2. On modified flashings, seal fasteners with asphalt from heated scrap flashing materials or compatible modified roof cement

3. Coat all with aluminum emulsion.

4. At HVAC, skylights, or other curbed units where base flashing fasteners are exposed, or where counter flashing width is less than 1.5", install 24-gauge metal skirt flashing with hemmed drips. Mechanically fasten with screws through steel/ neoprene washers.

E. Repair open base and/or wall flashing seams and comers, as well as scupper openings and other transitions, as follows:

1. Clean out any debris from open seam.

2. Fill void or opening with flashing cement (SSS/BUR) or heat between lap and reseal (APP).

3. Secure seam with appropriate fasteners as necessary.

4. Coat over finished repair with aluminum emulsion or embedded granules.

F. Repair small base flashing defects, such as gouges, holes, breaks, tears, etc. using asphaltic 3-course application applied in accordance with general requirements stated above.

G. At areas of "mud-cracking' or granule displacement at SBS flashings, resulting, in areas of exposed membrane, prepare and coat areas with embedded granules aluminum emulsion or elastomeric coating.

H. Repair splitting and other membrane damage at gravel-stop joints and edges as follows:

1. Remove loose materials at both sides of lap joints, or elsewhere as needed.

2. Double nail both sides of laps.

3. Clean and prime repair area and' metal and allow to dry.

4. Apply asphaltic 3-course application over defect area.

5. Check for poor adhesion of membrane to flange along edges and repair as needed by removing un-adhered material, re-securing and priming flange as needed, and providing new roof seal. If

delamination extends less than 4" in from the roof edge, asphaltic 3-course may be used. If greater theme, extend new tie-in membrane (hot, cold) onto the flange, solidly adhered.

3.05 ROOF PENETRATIONS AND FLANGED METAL FLASHING

A. Perform the following repairs, as needed, to address improper sheet metal penetration flashings:

1. Remove any foam insulation extending into flashing to at least one inch above top of flashing.

2. Remove and replace any damaged flashings with new. Solder all seams and laps of new components.

3. Clean and re-seal top of pipe flashings, as needed, with one part urethane sealant

4. Where contaminated with asphalt clean tops: of flashings and prime/allow to dry. Seal with asphaltic 3-course application: centered overtop edge of flashing sleeve.

5. A heat vent seams, seal with a high 'temperature sealant such as Red High Temperature Silicone Form-A-Gasket:

6. Cap any open unused penetrations, Replace any significantly rusted, damaged or missing vent caps.

7. Where applicable crimp lead flashing properly down into vent pipe.

B. Where metal flanges are not property integrated in to the roof membrane system, comply with the following:

1. Extend penetrations vertically as needed to accommodate proper flashing.

2. Clean membrane surface around flanges. Provide new flanged pipe flashing where none exist, with minimum 4" flange on all sides.

3. Prime exposed flanges and roof area and allow to dry: Set each flange into roof cement and secure flange at 4" o.c. with appropriate fasteners (securement not required for lead).

4. BUR Option - Install two layers ply. sheet set into asphalt or two layers base sheet set into cold asphalt adhesive. Feather each layer'4"beyond underlying layers. Install one layer cap sheet in cold asphalt adhesive on cap sheet roofs. '

5. For tile and shingle roofs, ensure that flanges are, properly sealed and-integrated (shingled) with tiles/shingles.

C. Where multiple penetrations occur without proper flashing (i.e. properly filled pitch pan or, better), perform one of.the-following:

1. Relocate existing pipes and. other roof projections as needed to provide at least twelve inches of clearance between projections, in order to accommodate: proper flashing application. Provide proper flashing as described above.

2. Fabricate and install new curbed pipe enclosure'assembly (i.e. "pelican head") to, provide a long-term, low maintenance, watertight condition.

3. At existing multi-pipe enclosures, fill with foam and seal opening with elastomeric.sealant.

D. Maintain any pitch pans as follows:

1. Remove any dirt, debris, and contaminants.

2. Top off all pitch pans with roof cement or elastomeric sealant, as applicable, 'sloping to Outside edges-to prevent standing water.

E. Ensure that any, abandoned penetrations are either.renioved and property pitched, or permanently tapped and. sealed against waterentry.

F. Any penetrations into or through walls, or penetrating components (ie: electrical boxes mounted on walls, wall vents etc.), shall be sealed with elastomeric sealant or asphaltic 3-course application; as applicable. Use backer rod/foam if needed.

G. Seal all conduit penetrations through fan unit base components.

H. Where cables penetrate roofing, ensure that penetration complies with code. Provide new weatherhead assembly or similar detail to ensure a long-term watertight seal at the penetration. Where existing antenna(e) are secured through root re-secure to nearby vent pipe, equipment screen, mechanical unit or other approved sedurement base/method.

I. Seal hese of penetrations and flanged components, as needed using materials appropriate for roof type (i.e. roof cement at BURISBS/APP systems).

3.06 DRAINAGE AND DRAINAGE COMPONENTS

A. Repair drainage components, including gutters/downspouts; scuppers and roof drains, as needed, in accordance with the following:

1. Seal outside edges of scuppers to walls and metal gutter joints with one part urethane sealant.

2. Remove any excess or loose roofing materials around scupper openings and drain bowls.

3. Prime and apply asphaltic three- (3) course application. On APP roofs, seal with heated bitumen from scrap pieces of APP.

4. Check all drain bolts and tighten as needed. Install additional washers as needed where bolt are too long.

5. Remove all debris in and around drains, gutters, downspouts and scuppers. All roof draing shall be inspected and tested to assure that no dogging of the drainage system is present. If necessary, use professional plumber or "rooter service to ensure that no blockage exists.

6. Replace significantly rusted or damaged gutter components with new to match existing.

7. Ensure adequate overlap of edge flashing overtop inside gutter flange, or provide necessary adjustment (i.e. reposition gUtter or provide flashing extension).

B. Where indicated, correct any ponding conditions which persist beyond 48 hours using one or both of the following methods, as needed to correct the condition:

1. Add new cast iron roof drains and.all related components, including all necessary flashing and tie-ins.

2. Lower existing roof drains/scuppers into recessed sumps.

C. All new and/or existing roof drains are to be cast iron with clamping rings and cast iron strainer dome. Remove and replace all plastic or stamped metal roof drains or drain components. Replace or repair any missing, broken or damaged drain components: to result in a functioning assembly.

D. Install new concrete splash blocks where none exist at the base of downspouts that drain onto roof surfaces secure all splash blocks overprotection material using an appropriate adhesive.

E. Where existing primary scuppers provide less than 24 square inch opening (i.e. less than about 4" high by 6" wide), enlarge scupper openings to"4" by 6" minimum. Provide new metat flashing and membrane tie-in as required:

3.07 COPING, COUNTERFLASHING AND MISCELIANEOUS SHEET METAL

A. Reseal or re-secure existing metal coping, counterflashing, cap flashing, etc., and replace any missing, significantly rusted or damaged components as follows:

1. Lift, clean lap areas with wire brush, and reset

2. Seal between overlapping components with one part urethane sealant

3. Secure vertical faces with metal screws through steel/neoprene washers at maximum 30" o.c.

4. Install new components to match, as needed to replace any significantly rusted, damaged or missing coping, counterflashing, cap flashing, etc.

5. Seal junctures/terminations of metal fleshings at wall junctures, corners, etc.

6. Check for seams or penetrations through metal fleshings. Seal as needed, with one part urethane Sealant. Any penetrations through top, horizontal' metal flashing Surface:ellen. sealed. Use 1/4" solid (non-grooved) neoprene gasket to seal any penetrations through horizontal surface of metal flashing at equipment support platforms, capped sleepers, wall copings, etc.

B. Where necessary to replace entire coping or add new coping, comply with the following:

1. Secure new taper strip over top of nallers to provide slope to inside.

2. Provide and install new pre-finished metal coping, cover plates and transition pieces in accordance with Section 07 62 00 - Sheet Metal Flashing and Trim. Secure the inside lace of new coping using appropriate strews placed at 30" o.c.. Secure the outside face using a continuous 22'gauge metal hook strip fastened to the wood 'nailer at 16" o.c..

C. Seal any existing counterflashing (including Surface-mounted counterflashing) as follows:

1. Remove (if practical), clean, and reset fleshings in one part urethane sealant.

2. Caulk sealant receiver or wall juncture with one part urethane sealant.

3. Re-secure counterfiashing using appropriate fasteners and secure lap joints.

D. Wherever coping, wall counterflashing, unit counterflashing or other existing counterflashing provides less than 1.5" overlap over underlying flashing components, where base flashing top fasteners are exposed, where otherwise requirements comply with the following:

1. Ensure that top surface of base/well flashing is adequately sealed and secured.

2. Install 4" skirts with hemmed drip edget at equipment Curbs, roof hatcties, etc., where counterflashing is non-existent or provides insufficient (i.e. less than 1.5") overlap over base flashing/wall covering.

3. Secure with minimum #10 size screws through steel/neoprene washers at 24" o.c.

4. Any exposed edges shall be fabricated with a flared sealant receiver (i.e. surface-mounted) and sealed with 1-part urethane sealant.

E. Repair/replace any rusted metal flashing components, including gutters, coping, cap flashing, vent caps, etc., as follows:

1. Wire brush all rusted flashing components or accessories.

2. Paint with rust inhibitor paint. Finish paint to match existing color.

3. Any sheet metal components with complete rust-through shall be replaced with new to match existing shape, gauge and finish.

F. Address any exposed or missing sheet metal fasteners, or holes through sheet metal flashing, etc., as follows:

1. Reset any displaced metal flashing back in place.

2. Replace any loose or missing fasteners with appropriate screws through steel/neoprene washers.

3. Any existing exposed fasteners without steel/neoprene or neoprene washers are to be sealed with one part urethane sealant

4. Replace any nails with appropriate screws through steel/neoprene washers.

5. Add any additional appropriate fasteners as needed. .

6. Seal any holes through sheet metal flashing with one-part urethane sealant.

G. Prepare, prime and paint metal flashing components exposed to view (i.e. coping, edge flashing, scupper exterior, gutters/downspouts, etc), in accordance with the following:

1. Flashing shall be cleaned, prepared and painted with a color to be determined. It is recommended that drip edge “undersides" be painted prior to re-installation.

2. Clean and remove any contaminants, including, asphalt residue. Use wire brush to remove any loose or flaking paint.

3. After dry, apply primer at a rate indicated to achieve a five (5) mil finish and allow to dry.

4. Apply paint in two (2) coats, allowing drying in accordance with manufacturer recommendations for method and finished coverage of ten (10) mils.

5. Painted surfaces shall be free of defects such as brush marks, heavy spots, peeling, curling, and cracking.

6. Where replaced with full new assembly, use pre-finished (such as Kynar) metal.

3.08 ELECTRICAL, MECHANICAL AND EQUIPMENT-SUPPORTS

A. Repair broken condensate lines, duct seals, etc. as follows:

1. Replace any broken condensate lines and connections.

2. Seal any exposed, open duct joints, punctures or holes using .Glencoat and fabric.

3. Any unit or duct repairs are to be performed by licensed mechanical contractor.

4. No repairs to equipment are to be made with roof cement.

B. Perform the following repairs to membrane and pipe supports, as applicable, and, install protection material as follows:

1. Separate adhered blocks from membrane: Remove any fasteners from supports secured through the roof membrane. Provide appropriate membrane repair at fastener holes, or any other membrane damage.

2. Replace any dry rotted or termite damaged pipe supports.

3. Provide additional pipe, supports if needed for 8 feet maximum spacing. Ensure that pipelines are clamped to blocks at that any stacked blocks are secured together.

4. Reposition pipe supports, if needed, at angles for better watertlow.

5. Install protection material under blocks, support legs, etc. set directly on roof. Adhere protection, material to blocks, not to roof.

6. Install new traffic pads in front of roof hatches, ladder access, and equipment and wall access panels, where none exist. Adhere over membrane per manufacturer's recommendations, according to type of membrane.

7. Install new traffic pads, as needed, under base supports, support, legs, etc. set directly on roof.

C. Where mechanical equipment is supported by unflashed sleepers; metal framed supports or other unlashed support placed directly onto the roof membrane, lift and .provide now roof protection material (i.e.: traffic pads) directly under sleeper support, extending at least four inches beyond the sleeper on all sides.

D. Where existingcurbs are less than 6" above the roof surface, extend curbs to 8" minimum height, including extension of flashing components.

E. Provide and install new flashed and capped curb or platform to elevate and support equipment or supports secured through the membrane (i.e. secured equipment support sleepers, guy wires, light support legs, tri-pod supports, etc.) in accordance with the following:

1. Use treated wood components necessary to provide adequate structural support for component being supported. Secure to underlying structure. Ensure-a minimum 8" flashing height above the finished roof surface.

2. Provide new cant strips on all sides, along with appropriate tie-in plies extending from the top of the cant strip, feathering out over the existing roof surface; prior to base flashing application.

3. Install new membrane and base fleshing to extend up and over support with complete encapsulation.

4. Provide and install new minimum 24 gauge metal flashing pan, fabricated with minimum 3" counterflashing on all sides, over the flashed support assembly.

5. Any metal seams to be "double flat lock' per SMACNA details.

6. Any brackets/supports on platforms/sleepers to be set over solid, flat (i.e. non-grooved) neoprene. Screws or lags to havezteel/neoprend washers.

F. Where existing conditions do not comply, with current code requirements modify condition to comply with applicable codes. This includes repair of disconnected conduit lines and open junction boxes.

G. Ensure that any abandoned supports are either removed, and properly patched, or permanently capped and sealed against water entry. Prior to removing, coordinate with Owner's Representative to confirm that supports are no longer required on the roof. Replace resultant holes or openings with new materials as required. Provide membrane repair in accordance withitem 1E above.

3.09 MISCELLANEOUS REPAIRS

A. Coat any exposed asphalt/mastic (existing or new) with aluminum emulsion' or embedded granules.

B. At areas of algae, moss, lichen or similar vegetation growth on membranes, consult with membrane manufacturer for compatible treatment to eliminate such growth.

C. Clean and seal joints, transitions, cracks, etc. (wail transitions, expansion joints, stucco: cracks, concrete cracks, etc.) using 1-part urethane sealant. Fill any significant open gaps or openings using expandable polyurethane foam.

D. Repair/replace missing/damaged/displaced components (i.e. broken roof hatch, missing vent caps, displaced condensate lines, etc.)

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 07 01 50.72 - REHABILITATION OF BUILT-UP ROOFING A1

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. New base and penetration flashings associated with HVAC installations.

1.2 MATERIALS OWNERSHIP

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

1.3 DEFINITIONS

A. Retain definitions and terms that remain after this Section has been edited.

B. Roofing Terminology: Refer to ASTM D1079 "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.

C. Existing Roofing System: Built-up asphalt roofing, and components and accessories between deck and roofing membrane.

D. Roofing Coating Preparation: Existing roofing that is to remain and be prepared to accept roof repairs.

E. 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.

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

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

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

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

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

K. 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. Review methods and procedures related to roofing system.

1. Meet with Owner; roofing 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 new flashings, including roofing system manufacturer's written instructions.

3. Review drawings and specifications.

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

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

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

7. 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. 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.

C. Contractor's Product Certificate: Submit certificate, 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.

1. Indicate that proposed system components are compatible.

D. Warranties: Unexecuted sample copies of special warranties.

E. Photographs: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, which might be misconstrued as having been damaged by coating operations. Submit before Work begins.

F. 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 24 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. Qualified by the manufacturer to install manufacturer's product and furnish warranty of type specified.

B. Manufacturer Qualifications: Primary product manufacturer 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.

2. An independent party certified as a Registered Roof Observer by the Roof Consultants Institute, retained by the Contractor or the Manufacturer and approved by 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 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.

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 CPG Incorporated. Provide specified products or pre-approved equivalent 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 G152, ASTM G154, or ASTM G155.

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.

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 RESTORATIVE COATINGS

A. Cold-Applied Rubberized Surfacer for Bituminous Roofing: Neoprene-modified water-based low VOC low odor asphalt emulsion surfacer formulated for use over new smooth surfaced bituminous roofing.

1. Tremco, Tremlastic S.

2. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 25 g/L.

3. Elongation, ASTM D412: 100 percent.

B. Cold-Applied Reflective Aluminum Roof Coating: Water-based aluminum coating approved by manufacturer.

2.5 FLASHING MATERIALS

A. Cold-applied bio-based low odor urethane roofing adhesive, two-part, USDA BioPreferred, formulated for compatibility and use with specified roofing membranes and flashings.

1. Tremco, Powerply Endure Bio Adhesive TF.

2. Volatile Organic Compounds (VOC), maximum, ASTM D3690: 0 g/L.

3. Low Temperature Flexibility, ASTM D2240: Pass at -30 deg F (-34 deg C).

4. Solids, by Volume, ASTM D2697: 100 percent.

5. Biobase Content, Minimum, ASTM D6866: 70 percent.

B. Base Sheet: ASTM D6164 Type I Grade S SBS/RET/Urethane-modified asphalt coated polyester reinforced high elongation sheet, smooth surfaced.

C. Reinforcing Fabric:

1. Reinforcing fabric, stitch-bonded polyester, 100 percent recycled content, infused with curing accelerant activated when installed in conjunction with specially formulated adhesive.
   a. Tremco, Rapid Set Fabric.

   b. Breaking Strength, minimum, ASTM D5034: Machine direction, 65 lbf/in (11 kN/m); Cross machine direction, 85 lbf/in (14 kN/m).

   c. Elongation, ASTM D5034: Machine direction, 24 percent; Cross machine direction, 95 percent.

   d. Weight, ASTM D3776: 2.5 lb/100 sq. ft. (120 g/m2).

   e. Thickness, minimum, ASTM D1777: 0.025 inch (0.63 mm).

   f. Recycled Content, post consumer: 83 percent.

2. Reinforcing fabric, stitch-bonded polyester, 100 percent recycled content, infused with curing accelerant activated when installed in conjunction with specially formulated adhesive.
   a. Tremco, Permafab.

   b. Breaking Strength, minimum, ASTM D 5034: Machine direction, 65 lbf/in (12.0 kN/m); Cross machine direction, 85 lbf/in (12.0 kN/m).

   c. Elongation: Machine direction, 24 percent; Cross machine direction, 95 percent.

   d. Weight, ASTM D 3776: 2.5 lb/100 sq. ft. (120 g/m2).

   e. Thickness, minimum, ASTM D 1777: 0.025 inch (0.63 mm).

   f. Recycled Content, post-consumer: 83 percent.

D. Bio-Based Polyurethane Roof Coating Base Coat: ASTM D7311, Two-part catalyzed low-odor polyurethane roof base coating formulated for direct application and for use with fiber reinforcement in conjunction with a compatible top coat.

E. Bio-Based Polyurethane Roof Coating Top Coat: ASTM D7311, Two-part catalyzed low-odor polyurethane roof top coating formulated for direct application over compatible reinforced base coat.

F. Polyurethane Metal Primer: Water-based, quick-drying, brush-grade one-part primer for use as an adhesion promoter for urethane sealants and coatings to non-porous surfaces.

G. Asphalt Primer, Water-Based: Water-based, polymer modified, asphalt primer.

1. Asbestos Content, EPA 600/R13/116: None.

2. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 2 g/L.

2.6 AUXILIARY MATERIALS

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

B. Joint Sealant: Elastomeric joint sealant recommended in writing by joint sealant manufacturer as compatible with applied coating and project substrates, 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. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 40 g/L.

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

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

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

   e. Color: Aluminum Stone.

C. Skirt Metal: 22-gauge galvanized metal with hemmed edge.

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

2.7 WALKWAYS

A. Walkway Pads:

1. Walkway pads, ceramic-granule-surfaced reinforced asphaltic composition slip-resisting pads, manufactured as a traffic pad for foot traffic, 1/2 inch (13 mm) thick minimum.
   a. Flexural Strength at max. load, minimum, ASTM C203: 218 psi (1.5 kPa).

   b. Granule adhesion (weight loss), maximum, ASTM D4977: 1.1 gram.

   c. Impact Resistance at 77 deg. F (25 deg. C), ASTM D3746: No Damage to Roof.

   d. Pad Size: 36 by 48 inch (914 by 1220 mm).

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect existing roofing system that is indicated not to be rehabilitated, and adjacent portions of building and building equipment.

1. Mask surfaces to be protected. Seal joints subject to infiltration by coating materials.

2. Limit traffic and material storage to areas of existing roofing membrane that have been protected.

3. Maintain temporary protection and leave in place until replacement roofing has been completed.

B. 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

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 PREPARATION

A. Membrane Surface Preparation:

1. Substrate Cleaning: Clean substrate of contaminants such as dirt, debris, oil, and grease that can affect adhesion of repair material.

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

3. Verify adhesion of new products.

B. Surface Priming: Prime surfaces to receive fluid-applied 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.

3.3 REPLACEMENT FLASHING AND STRIPPING INSTALLATION

A. Fill in where any roofing is removed with substrate board (and insulation if applicable) matching height of the existing roof system. Secure to decking per manufacturer’s written instructions.

1. Use low rise foam to adhere any insulation and coverboard.

B. Install cant strips at transitions to vertical edges.

C. Install modified ply sheet set in urethane adhesive over substrate board (if present), up sides of curbs, and onto the field of the roof 6”.

D. Install two polyester ply sheets set in rubberized emulsion over the completed ply sheet extending 12” and 24” past the edge of the ply sheet.

E. Install skirt metal counterflashing secured at 8” oc.

F. Install fully reinforced liquid applied flashing system over all new penetrations.

3.4 COATING APPLICATION

A. Existing aluminized roofs: Once ply system has adequately cured, apply aluminized coating in number of coats and thickness of application recommended in writing my manufacturer for application.

B. Existing acrylic coated roofs: Once ply system has adequately cured, apply acrylic coating in number of coats and thickness of application recommended in writing my manufacturer for application.

C. Existing polyurethane coated roofs: Once ply system has adequately cured, apply bio based coating system in number of coats and thickness of application recommended in writing my manufacturer for application.

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

3.5 WALKWAY INSTALLATION

A. Walkway Pads: Install walkway pads surrounding all new equipment.

1. Set walkway pads in cold-applied adhesive.

3.6 DISPOSAL

A. Collect demolished and waste 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.

3.7 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

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:
1. Sheet metal flashings in connection with roofing.
2. Reglet and counter flashing assemblies.
3. Miscellaneous metal flashing and counter flashing as required, except where provided under Division 23 or Division 26.
4. Coping caps.
5. Gravel stops and metal edging.
6. Gutters and downspouts.
7. Splash pans where downspouts empty onto roofing.
8. Conductor heads.
9. Drip flashings.
10. Sheet metal covering at outside storage units.
11. Sheet metal wall coverings.
12. Roof pipe flashings.
13. Roof expansion joint covers.
14. Other sheet metal items, not necessarily specified herein or in other sections, but required to prevent penetration of water into building.

C. Related Sections:
1. Division 23: Mechanical.
2. Division 26: Electrical.

1.02 SUBMITTALS

A. Shop Drawings: Submit for fabricated sheet metal indicating shapes, details, methods of joining, anchoring and fastening, thicknesses and gages of metals, concealed reinforcement, expansion joint details, sections, and profiles.

B. Samples: Submit Samples for materials or assemblies as requested.

C. Product Data: Submit brochures of manufactured items.

1.03 QUALITY ASSURANCE

A. Drawings and requirements specified govern. Provide the Work of this section in conformance with the Architectural Sheet Metal Manual published by SMACNA for conditions not indicated or specified and for general fabrication of sheet metal items.

B. Materials shall conform to following standards:
1. ASTM A 167 - Stainless and Heat-Resisting Crhomium-Nicket Steel Plate, Sheet and Strip.
2. ASTM A 653 - Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM B 370 - Copper Sheet and Strip for Building Construction.
4. ASTM B 749 - Lead and Lead Alloy Sheet, Strip and Plate Products.

C. Pre-installation Meetings: Refer to Division 7 roofing sections as appropriate. Attend the pre-installation and inspection meetings for roofing Work.

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not install bent and/or otherwise damaged materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Galvanized Sheet Steel: ASTM A 653, coating designation G90, hot-dip galvanized

B. Copper Plate, Sheet and Strip: ASTM B 370, cold-rolled, tempered. Copper sheet and strip shall be cold-rolled-temper.

C. Sheet Lead: ASTM B 749, Type L50049 or L51121, weighing not less than 4 pounds per square foot.

D. Stainless Steel: Plate, sheet and strip shall conform to ASTM A 167, Type 304 or Type 316, No. 4 finish on exposed surfaces and No. 2 finish on concealed surfaces unless otherwise specified or indicated. Furnish Type 304 for general applications and Type 316 where exposed to acidic or alkaline conditions.

E. Fastenings:
   1. Galvanized Steel: Nails, rivets, and other fastenings furnished in connection with galvanized sheet steel Work shall be sealed with rust resistive coating. Rivets shall be tinned. Nails and other fastenings shall be zinc-coated.
   2. Copper: Nails, rivets, and other fastenings furnished in connection with copper sheet metal Work, shall be manufactured from hard-temper copper or hard brass.
   3. Stainless Steel: Nails, rivets and other fastenings furnished in connection with stainless steel Work, shall be 300 series alloy to match alloy of stainless steel being fastened.

F. Soldering Flux: Raw muriatic acid for galvanized steel; rosin for tin, lead and tinned copper; non-corrosive soldering salts for uncoated copper and acid-type flux formulated for soldering stainless steel.

G. Solder: ASTM B 32, Grade 50A. Name of product manufacturer and grade designation shall be stamped or cast onto each bar.

2.02 FABRICATION

A. General:
   1. Accurately form sheet metal Work to dimensions and shapes indicated and required. Cope finish molded and brake metal shapes with true, straight, sharp lines and angles and, where intersecting each other, to a precise fit. Unless otherwise specified, all galvanized sheet steel shall be 22 gage. Exposed edges of sheet metal shall have a 1/2 inch minimum hemmed edge.
   2. Soldering of sheet steel or copper shall be performed with well-heated copper soldering iron or soldering torch, joints full flowing, neat and consistent. Thoroughly clean materials at joints before soldering, and tin coppers before soldering. Exposed soldering on finished surfaces shall be scraped smooth. Lock seam Work shall be fabricated flat and true to line and soldered along its entire length. Acid-fluxed Work shall be neutralized after fabrication.
   3. Form and install sheet metal Work to provide proper allowances for expansion and contraction, without causing undue stresses in any part of completed Work. Installation shall be water and weathertight.

B. Gutters and Downspouts:
   1. Gutters: Fabricate from 22 gage galvanized steel to match existing size and design unless otherwise indicated. Drain gutter towards nearest downspout and provide an expansion joint at mid-point between downspout outlets, but not to exceed 50 feet on center. Gutters shall not pond water. Rivet joints and ends with a minimum of 6 rivets per joint or maximum rivet spacing not to exceed 1-1/2 inch on center. Sweat solder from inside of gutter and in horizontal position where possible. Neatly fit downspouts to gutter using a slip joint. Provide expansion joints, consisting of 3 inch lap joints at not over 30 feet.

2. Form and install sheet metal Work to provide allowance for expansion and contraction without causing undue stresses in the completed Work.
3. Downspouts: Fabricate downspouts from 3 inch round, or 3 inch by 4 inch rectangular shapes, 16 gage steel tubing with butt joints and mitered elbows, sized as indicated. Downspouts exceeding 30 feet in length may be fabricated with a slip joint or leader head. Downspout shall be fabricated with elbows at bottom discharge or connected to drains as indicated. Joints, except expansion joints shall be sealed with a continuous weld. Galvanize downspouts after fabrication.
4. Outlets: Fabricate outlets of 22 gage galvanized sheet steel with a 1/4 inch rolled flanged soldered continuously to gutter. Outside diameter shall be 1/8 inch less than the diameter of the downspout and extend into downspout 3 inches. Install a 1/4 inch galvanized rod over center of outlet opening, lapping 1 inch over each side of outlet and soldered in place. Galvanize rod after fabrication, before installation.

C. Conductor Heads:
   1. Fabricate conductor heads and outlets from 22 gage galvanized sheet steel. Cover tops of the conductor heads with 22 gage galvanized 1/4 inch wire mesh soldered securely to separately fabricated frame and mechanically fastened to top conductor head with a minimum of 2 fasteners.

D. Gravel Stops: Provide 24 gage galvanized sheet steel gravel stops wherever roof area drops to a lower level; at the eaves and rake of roof, where roof comes to an abrupt edge, and where indicated. Stops shall be of height indicated and shall be fabricated with 2 flanges. Horizontal flange shall be not less than 4 inches wide, and vertical flange shall extend down over vertical surfaces of trim or gutter. Gravel stops shall lap 4 inches at ends and corners, and shall be fabricated by notching and interlocking vertical face flanges. Contact surfaces of lapped flanges, including raised areas, vertical face and corners shall be completely covered with flashing compound. Fabricate lap joints so that they will be in the direction of water flow. Where flanges are over 5 inches wide, provide 20 gage continuous cleats fastened at 24 inches on center.

E. Overflow Outlets: Provide galvanized sheet steel overflow outlets at locations and of sizes indicated. Outlets shall extend through full thickness of wall in one continuous piece and completely line the opening. On outside face of wall, top and sides of outlet shall finish 1/2 inch on surface of wall. Bottom of outlet shall project 1-1/2 inch beyond face of wall, and shall be bent down slightly. Outlets shall be sealed on the surface of the building. On inside face, side and bottom flanges shall extend not less than 8 inches beyond edge of opening, and not less than 6 inches at top. Outlets shall be installed at time roof is being installed.

F. Reglet Type Counterflashing: Where roof comes in contact with vertical surfaces, provide counterflashing. Set top of counterflashing 8 inches above roof deck unless otherwise indicated, and extend down at least 5 inches or to top of cant strip. Counterflashing and reglet shall be 22 gage galvanized sheet steel. Lap counterflashing and reglet 3 inches minimum at splices and miter at angles, or supply special metal corner fittings. Reglet and method of securing flashing shall be so constructed that flashing is firmly locked in place, but may be readily removed for replacement.

G. Splash Pans: Provide splash pans for all downspouts, which empty onto lower roofs. Pans shall be galvanized sheet steel 12 inches by 18 inches, unless otherwise indicated, and turned up 2 inches on at least 3 sides.

H. Roof Expansion Joint Covers: Fabricate of 22 gage galvanized sheet steel, as detailed. One side of joint shall be zee shaped, with 3 inch standing leg extended over the joint and turned down. The other side shall be box shaped, fabricated to extend over the joint, over the standing leg, and turn down to form a water barrier. Prefabricated bellows type joint covers are not permitted.

I. Louvers, Fixed: For sizes 2’ x 3’ maximum (Provide heavier gages as required for sizes indicated on Drawings).
   1. Gages: #22 gage for spans to 24”, #20 gage for spans to 36”.
   2. Type: Similar to SMACNA Plates #102, #103A-2 frame, #103D-1 louvers, folded U-frame Plate #108B
      a. Insect Screen: 8 mesh with #27 gage galvanized wire

J. Miscellaneous Flashing: Unless otherwise indicated, miscellaneous flashing shall be fabricated of galvanized steel. Exterior doors and windows, unless covered by overhangs shall be provided with 22 gage galvanized steel drip flashing as detailed. At wood construction, nail flashing to framing before paper backed lath is installed.

K. Sheet Metal Roofing at Outside Storage Units: Cover outside storage unit roof with #26 gage galvanized sheet steel as indicated. Turn metal under edge at top, hem 1/2 inch, and secure with countersunk, flathead wood screws, spaced at 12 inches on centers.

L. Sheet Metal Wall Covering: Wall surfaces, where indicated, shall be covered with sheet metal to height indicated. Metal covering shall be 24 gage galvanized sheet steel, with joints between sheets occurring only over studs. Joints locked together and rolled flat. Exposed edges of sheet metal shall be hemmed at least 1/2 inch. Nail sheets in field along studding at 12 inches on center, and at top and bottom edges and seams at 4 inches on center, using 3d galvanized nails.

M. Roof Pipe Flashings: Provide welded seam 4 pound non-toxic lead flashings. Field fabricated flashings shall also be welded.

PART 3 - EXECUTION

3.01 PREPARATION

A. Concrete and masonry materials in contact with sheet metal shall be painted with alkali resistant coating, such as heavy-bodied bituminous paint. Wood in contact with sheet metal shall be painted with 2 coats of aluminum paint or one coat of heavy-bodied bituminous paint

3.02 INSTALLATION

A. General: Coordinate with installation of underlayment.

B. Gutters and Downspouts:
   1. Anchor gutters to structure with 10 gage steel straps, galvanized after fabricating. Secure straps with galvanized fasteners at 3 feet on center. Drill pilot holes and use 12 x 2 inch pan head screws.
   2. Install 1/4 inch galvanized wire mesh continuous cover on gutter where indicated.
   3. Secure downspouts to walls with 1/8 inch x 2 inch galvanized steel straps. Straps shall be located at top, bottom, and at not over 10 feet on center. Block downspouts out 1/2 inch from the finish wall surfaces. Secure straps to wall framing with 1/4 inch by 2 inch long galvanized anchors. Expansion type anchors shall be provided when anchoring to concrete and masonry. Provide toggle bolts for attachment to masonry or plaster. At steel columns, provide fasteners as indicated. Plastic anchors are not permitted.
   4. Anchor conductor heads to walls with 1/4 inch x 2-1/2 inch galvanized lag screws or 1/4 inch expansion type anchors.

C. Reglets: Install reglets at constant height above cant or as indicated. Provide minimum 3 inch lap at end splices of reglets. Caulk laps solidly.

D. Counterflashing:
   1. Install at constant horizontal elevation across roof slope and slope at constant height above cant or as indicated.
   2. Provide minimum 3 inch lap at all end splices of counterflashing.

E. Galvanized sheet steel parapet coping and flashing shall be continuous over top of parapet to form a watertight cap, with waterproof seams at approximately 10 feet on center, or as indicated. Anchor coping to outside of wall with a continuous cleat face nailed at 24 inch centers. Coping shall be fastened on inside wall with hex head screws and bonded sealing washers through oversized holes in the back of the coping. Corners and angles shall be lapped and soldered; do not install joint sealant.

F. Prefabricated Louvers: Install plumb and level; securely anchor; seal watertight to adjoining construction. Install screens, cranks, and blackout plates where required.

3.03 TESTING

A. Perform field water testing to demonstrate installation is watertight. Continue testing with a continuous hose stream applied at base of installation for at least 30 minutes. If leaking is observed, discontinue test and repair installation, then test until satisfactory results are obtained.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

DIVISION 09 – FINISHES

SECTION 09 90 00 - PAINTING AND COATING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior and exterior painting.

B. Following items shall not be painted:

1. Brass valves, chromium or nickel-plated piping and fittings.

2. Refrigeration piping on top of aluminum jacket.

3. Fabric connections to fans.

4. Miscellaneous name plates, stamping, and instruction labels and manufacturer's data.

5. Mechanical and electrical utility lines, piping and heating and ventilation ductwork in tunnels, under-floor excavated areas or crawl spaces, attic spaces and enclosed utility spaces.

6. Flag, floodlight, parking light poles and loudspeaker poles, metal stairs, handrails and chain-link fence with a galvanized finish, unless otherwise noted.

7. Structural and miscellaneous steel, open web steel joists and metal floor decking, which will not be exposed in final construction, shall have no finish other than one coat of shop primer.

8. Hardboard covering on tops and backs of counters and benches.

9. Brass, bronze, aluminum, lead, stainless steel and chrome or nickel-plated surfaces.

10. Non-metallic walking surfaces unless specifically shown or specified to be painted.

C. Sheet metal paint.

1. Paint all exposed sheet metal ductwork and duct supports.

2. Paint all sheet metal roof curbs, cap flashing and sheet metal covers.

1.02 REGULATORY REQUIREMENTS

A. Paint materials shall comply with the Food and Drug Administration’s (F.D.A.) Lead Law and the current rules and regulations of local, state and federal agencies governing the use of paint materials.

1.03 SUBMITTALS

A. List of Materials: Before submittal of samples, submit a complete list of proposed paint materials, identifying each material by distributor's name, manufacturer's name, product name and number, including primers, thinners, and coloring agents, together with manufacturers' catalog data fully describing each material as to contents, recommended installation, and preparation methods. Identify surfaces to receive various paint materials.

B. Material Samples: Submit manufacturer's standard colors samples for each type of paint specified. Once colors have been selected, submit Samples of each color selected for each type of paint accordingly:

1. Samples of Paint and Enamel must be submitted on standard 8 ½" x 11" Leneta Opacity-Display Charts. Each display chart shall have the color in full coverage. The sample shall be prepared from the material to be installed on the Work. Identify the school on which the paint is to be installed, the batch number, the color number, the type of material, and the name of the manufacturer.

2. Elastomeric shall be submitted in duplicate samples of the texture coating. Samples will be not less than 2 ½ by 3 ½ in size and installed upon backing. Finished Work will match the reviewed Sample in texture.

3. Materials and color samples shall be reviewed and final approved by district before starting any painting.

1.04 QUALITY ASSURANCE

A. Certification of Materials: With every delivery of paint materials, the manufacturer shall provide written certification the materials comply with the requirements of this section.

B. Coats: The number of coats specified is the minimum number. If full coverage is not obtained with the specified number of coats, install additional coats as required to provide the required finish.

C. Install coats and undercoats for finishes in strict accordance with the recommendations of the paint manufacturer as reviewed by the Architect.

D. Paint materials shall comply with the following as a minimum requirement:

1. Materials shall be delivered to Project site in original unbroken containers bearing manufacturer's name, brand number and batch number.

2. Open and mix ingredients on premises in presence of the Project Inspector.

1.05 DELIVERY, STORAGE AND HANDLING

A. Storage and Mixing of Materials: Store materials and mix only in spaces suitable for such purposes. Maintain spaces clean and provide necessary precautions to prevent fire. Store paint containers so the manufacturer's labels are clearly displayed.

1.06 SITE CONDITIONS

A. Temperature: Do not install exterior paint in damp, rainy weather or until surface has thoroughly dried from effects of such weather. Do not install paint, interior, or exterior, when temperature is below 50 degrees F, or above 90 degrees F, or dust conditions are unfavorable for installation.

1.07 WARRANTY

A. Manufacturer shall provide a three year material warranty.

B. Installer shall provide a three year application warranty.

1.08 MAINTENANCE

A. Provide at least one gallon of each type, color and sheen of paint coating installed. Label containers with color designation indicated on Drawings.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS

A. Furnish the products of only one paint manufacturer unless otherwise specified or required. Primers, intermediate and finish coats of each painting system must all be the products of the same manufacturer, including thinners and coloring agents, except for materials furnished with shop prime coat by other trades.

B. Factory mix paint materials to correct color, gloss, and consistency for installation to the maximum extent feasible.

C. Paint materials to be minimum “Architectural Grade”.

D. Gloss degree standards shall be as follows:

HIGH GLOSS	70 and above	EGGSHELL	30 to 47
SEMI-GLOSS	48 to 69	SATIN	15 to 29

2.02 MANUFACTURERS

A. Acceptable manufacturers, unless otherwise noted:

1. Dunn-Edwards Corporation Paints
2. Frazee Paints and Wall coverings
3. Vista Paints
4. Sherwin Williams
5. ICI Paints
6. Equal.

PART 3 - EXECUTION

3.01 PREPARATION

B. Examine surfaces to receive paint finish. Surfaces which are not properly prepared and cleaned or which are not in condition to receive the finish specified shall be corrected before prime coat is installed.

C. New woodwork shall be thoroughly cleaned, hand sandpapered, and dusted off. Nail holes, cracks or defects in Work shall be filled. On stained woodwork, fill shall be colored to match stain. Filling shall be performed after the first coat of paint, shellac or varnish has been installed.

D. Plaster surfaces except veneer plaster shall be allowed to dry at least 3 weeks before painting. Veneer plaster shall be allowed to dry sufficiently to receive paint as determined by moisture meter tests.

E. Metal surfaces to be painted shall be thoroughly cleaned of rust, corrosion, oil, foreign materials, blisters, and loose paint.

F. Do not install painting materials to wet, damp, dusty, dirty, finger marked, rough, unfinished or defective surfaces.

G. Concrete surfaces shall be dry, cleaned of dirt and foreign materials and in proper condition to receive paint. Neutralize spots demonstrating effects of alkali.

H. Mask off areas where necessary.

3.02 APPLICATION

A. Backpainting: Immediately upon delivery to the Project site, finish lumber and millwork shall be backpainted on surfaces that will be concealed after installation. Items to be painted shall be backpainted with priming coat specified under "Priming".

B. Priming: New wood and metal surfaces specified to receive paint finish shall be primed. Surfaces of miscellaneous metal and steel not embedded in concrete, and surfaces of unprimed plain sheet metal Work shall be primed immediately upon delivery to the Project site. Galvanized metal Work and interior and exterior woodwork shall be primed immediately after installation. Priming of surfaces and priming coat shall be as follows:

1. Knots, Pitch and Sap Pockets: Shellac before priming.

2. Galvanized Metal Work: Clean oil, grease and other foreign materials from surfaces. Install vinyl wash pretreatment coating. Follow manufacturer's instructions for drying time, and then prime with one coat of metal primer.

3. Unprimed Iron, Steel, and Other Uncoated Metals: Where specified to be painted, prime with one coat of metal primer.

4. Shop Primed Metal Items: Touch up bare and abraded areas with metal primer before installation of second and third coats.

5. Coats shall be installed evenly and with full coverage. Finished surfaces shall be free of sags, runs and other imperfections.

C. Allow at least 24 hours between coats of paint.

D. Each coat of paint or enamel shall be a slightly different tint as required. Each coat of paint, enamel, stain, shellac, and varnish will be inspected by the IOR before next coat is applied. Notify the Project Inspector that such Work is ready for inspection.

1. Tinting Guideline: The first coat, primer/undercoat(s) to be untinted or tinted up to 50 percent lighter or darker (at the discretion of the installer) than the finish coat. The second coat (or third coat if a seal coat and undercoat have been specified) is to be factory tinted in the range of 10 percent to 15 percent lighter or darker (at the discretion of the installer) than the finish coat. The final coat is to be factory tinted to the required color selected. These tinting guidelines shall be provided on all surfaces receiving paint.

E. Do not "paint-out" UL labels, fusible links and identification stamps.

F. Paint Roller, brush and spray.

1. Only Paint rollers shall be used on interior plaster, drywall, masonry/plaster and plywood surfaces, nap shall not exceed one half inch in length.

2. First coat on wood overhang and ceilings shall have material applied by roller and then brushed out in a professional manner to leave surface free of imperfections. Finish coat may be sprayed.

3. Other surfaces shall have all coatings applied with brushes of proper size.

4. Spray work is permitted only on radiators, acoustic plaster, masonry and plaster.

G. Where ceilings are specified to be painted, beams, cornices, coves, ornamental features, plaster grilles, etc. shall be included.

H. Ceilings shall be white, including classrooms, storage rooms, offices, arcades, etc. Boiler room and fan room ceiling color shall match adjacent walls.

3.03 CLEANING

A. Remove rubbish, waste, and surplus material and clean woodwork, hardware, floors, and other adjacent Work.

B. Remove paint, varnish and brush marks from glazing material and, upon completion of painting Work, wash and polish glazing material both sides. Glazing material, which is damaged, shall be removed and replaced with new material.

C. Clean hardware and other unpainted metal surfaces with recommended cleaner. Do not furnish abrasives or edged tools.

3.04 SCHEDULE

A. Interior:

1. Plaster: 4 coats.

a. First Coats: Pigmented wall sealer.

b. Second coat: Enamel under coater.

c. Third and Fourth Coats – Interior enamel, semi-gloss or gloss as indicated.

2. Gypsum Board: 4 coats.

a. First Coat: Drywall sealer.

b. Second Coat: Enamel under coater.

c. Third and Fourth Coats: Interior enamel, semi-gloss or gloss as indicated.

3. Metal: Shall be cleaned, pre-treated and painted with 3 coats. Items to be painted include, but are not limited to: exposed structural and miscellaneous steel, metal doors and frames, ladders, table and bench legs.

a. First Coat: Metal primer.

b. Second and Third Coats: Interior gloss enamel, except metal doors and frames which shall be semi-gloss or gloss to match adjacent wall.

B. Exterior:

1. Metal: 3 coats. Shall be cleaned and pre-treated. Items to be painted include, but are not limited to: steel columns and miscellaneous steel items, gravel stops, metal doors and frames, hoods and flashings.

a. First Coat: As specified in this section under Priming.

b. Second and Third Coats: Exterior gloss enamel.

C. Mechanical and Electrical Work:

1. Except where interior mechanical and electrical Work to be painted is specified to receive another paint finish, Work occurring in finished rooms and spaces shall be cleaned, pre-treated, and painted with 3 coats. Items to be painted include, but are not limited to: steel and copper piping, pipes, vents, fittings, ducts, plenums, miscellaneous supports and hangers, electrical conduit, fittings, pull boxes, outlet boxes, unfinished surfaces of plumbing fixtures, miscellaneous metal cabinets, panels, and access doors and panels.

a. First Coat: As specified in this section under Priming.

b. Second and Third Coats: Interior enamel, semi-gloss or gloss to match adjacent wall or ceiling finish.

2. Insulation and Taping on Pipes and Ducts: 3 coats.

a. Finished Rooms:

1) First Coat: Interior waterborne primer.

2) Second and Third Coats: Interior semi-gloss or gloss enamel to match adjoining wall or ceiling finish.

b. Building Exterior:

1) First Coat: Exterior waterborne primer.

2) Second and Third Coats: Exterior gloss enamel.

3. Inside surfaces of ducts, vents, dampers and louvers as far back as visible from room in which they open shall be painted with 2 coats of flat black paint.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

DIVISION 22 – PLUMBING

SECTION 22 00 00 - PLUMBING

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.

1.2 QUALITY ASSURANCE

A. Code Requirements: All work covered by this Section shall conform to the latest requirements of the following regulations:
   1. C.C.R., Title 24, Part 5 (2025 CPC).
   2. 2025 California Plumbing Code.
   3. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
   4. National Fire Protection Association.
   5. California Division of the State Architect.
   6. California State Division of Industrial Safety.
   7. County Health Department.
   8. Any other legally constituted body-having jurisdiction thereof.

B. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's representative.

1.3 DRAWINGS

A. Because of the small-scale drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices which may be required to complete the installation.

B. The general arrangement indicated on the drawings shall be followed as closely as possible. Coordinate with the Architectural, Structural, Mechanical and Electrical Drawings and the work of other trades prior to installation of piping fixtures and equipment to verify adequate space available for installation of the work shown. In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed departures to the Architect for his approval. Only when Architect's approval is given, in writing, shall Contractor proceed with installation of the work.

C. Special Note: Should the Contractor make changes in the installation differing from what is indicated on the contract drawings and not necessitated due to field conditions as indicated hereinabove, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. Should it be impossible to re-install the work and the installation is in accordance with all governing authorities, the architect may permit the installation to remain. However, all costs incurred to revise the contract drawings by the engineer for resubmittal to the building department indicating the as-installed condition shall become the responsibility of the Contractor.

D. In case of a difference in the specifications or between the specifications and the drawings, the Contractor shall figure the most expensive alternate and after award of contract, shall secure direction from the Architect.

1.4 PERMITS, INSPECTIONS AND LICENSES

A. All permits, inspections and licenses required by the legally constituted authorities for installation of the work according to the plans and specifications shall be obtained and paid as a part of the work of this section.

1.5 EXAMINATION OF PREMISES

A. Before bidding on this work, Contractors shall make a careful examination of the premises and shall thoroughly familiarize themselves with the requirements of the contract. By the act of submitting a proposal for the work included in this contract, the Contractor shall be deemed to have made such study and examination, and that he is familiar with and accepts all conditions of the site.

1.6 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall make good all damage caused either directly or indirectly by his own workmen. Contractor shall also protect his own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all 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.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the Architect or Engineer that his work has been accepted.

1.7 LOCATIONS

A. The locations of apparatus, piping and equipment indicated on the drawings are approximate. Piping and equipment shall be installed in such a manner as to avoid all obstruction, preserve headroom, and keep openings and passages clear. The locations of and mounting heights of all fixtures shall be coordinated with the architectural plans and room elevations.

B. Clearances and Openings: Contractor shall cooperate and coordinate his work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The Contractor shall, in advance of the work, furnish instructions to the General Contractor as to his requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this Contractor.

C. Contractor shall verify and coordinate pipe routing with location of all electrical rooms, elevator equipment rooms, telecom/data rooms, and other rooms dedicated to the housing of switchgear, panels, or other electrical equipment. In no case shall piping be installed within or above the ceiling of such rooms.

1.8 SUBMITTAL DATA (Also see General Conditions)

A. Submittal Requirements:
   1. Furnish, all at one time, prior to any installation, within the time noted below, six (6) copies of valid submittal data on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to these specifications and to identification numbers on fixtures and equipment schedules.
   2. Manufacturers' submittal literature and shop drawings are required on all items to ensure the latest and most complete manufacturer's data is available for review. Requirements of the submittals and Engineer's submittal notes are a part of the work of this Division except that Engineer's notes may not be used as a means of increasing the scope of work of this Division.
   3. Submittals will be checked for general conformance with the design concept of the project but the review

does not guarantee quantities shown and does not supersede requirements of this Division to properly install work.

4. To be valid, all submittals must:

   (a) Be delivered to the Architect's office within thirty-five (35) days of award of the contract. Contractor shall make time allowance for Engineer's review, return of comments, if any, and resubmittal if required. Corrections or changes in submittals returned as inadequate or incomplete shall be accomplished within this time limit.

   (b) Clearly indicate and label as such any items proposed as substitution for that specified or shown on plans.

   (c) Include all pertinent construction, installation, performance and technical data.

   (d) Have all product data sheets clearly labeled to indicate the individual items being submitted. In addition, all required options and accessories shall be clearly marked.

      (1) Product data sheets corresponding to items indicated on plans shall be clearly labeled with the corresponding fixture or equipment tag number.

      (2) Product data sheets corresponding to items indicated in specifications shall be clearly labeled with the specification section, page and item numbers.

   (e) Include, for every item which differs in size, configuration, connections, service, accessibility or any other significant way, a drawing to the same (or larger) scale as to the pertinent portions of the contract drawings. In this drawing show a complete layout of the system except that which is identical to the contract drawings, unless the unchanged portions must be shown to indicate such things as clearances. This drawing, together with the contract design drawings must show the complete system as revised to accommodate the proposed alternate.

B. Substitution Requirements:

1. Any items included in submittals and proposed by the Contractor as substitution for that specified or shown on plans shall be submitted within thirty five (35) days of award of the contract. After such time, proposed substitutions shall not be accepted for review, and the Contractor shall submit all items as specified or shown on plans.

   (a) For each item proposed as substitution for that specified or shown on plans, copies of product data sheets for the specified item shall be placed side by side with product data sheets for the proposed substitution item within the submittal.

      (1) In addition to the Submittal Requirements for labeling listed above, product data sheets for the specified item shall be clearly labeled "SPECIFIED ITEM, NOT SUBMITTED". Product data sheets for the corresponding proposed substitution item shall be clearly labeled "PROPOSED SUBSTITUTION".

   (b) Provide calculations and other detailed data justifying how any items proposed as substitution were selected for proposal. Data must be complete enough to permit detailed comparison of every significant characteristic for which the specified item was analyzed during design.

2. It shall be the Contractor's responsibility to provide sufficient information to allow the Engineer to analyze any proposed alternate. If inadequate information is provided, the proposal will not be approved and resubmittal will not be allowed.

3. The Contractor shall provide or perform tests required by Engineer for purpose of judging acceptability of proposed substitutions.

4. The Contractor assumes full responsibility that alternate items and procedures will meet the job requirements and is responsible for cost of redesign and of modifications to this and other parts of work caused by alternate items furnished under work in this Section. In view of these responsibilities, it is the purpose of these specifications to establish procedures to ensure that the Contractor has considered all the ramifications of proposed alternates before submitting them for review. Submittals which do not comply with the requirements of these specifications or which indicate proposed alternates that were selected without proper regard to the requirements of the job will not be approved. No more than one proposed alternate will be considered for each item.

5. Alternate items installed without Engineer's approval will be replaced with specified items at Contractor's expense.

6. The Architect or his authorized representative shall be the sole judge as to the quality and suitability of proposed alternate equipment, fixtures or materials. Decisions of the Architect or that of his representative shall be final and conclusive.

1.9 UNINSPECTED WORK

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.

1.10 RECORD DRAWINGS (Also see General Conditions)

A. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this Section of the specifications. This set shall include locations, dimensions, depth of buried piping, cleanouts, shut-off valves, sewer invert locations, plugged wyes, tees, etc. where applicable. On completion of the work, the Contractor shall incorporate all as-built information on a set of reproducible tracings provided by the Architect and this set of reproducibles shall be delivered to the Architect.

1.11 GUARANTEES (Also see General Conditions)

A. Contractor shall guarantee the entire plumbing and piping systems unconditionally for a period of one (1) year after final acceptance. If, during this period, any materials, equipment, or any part of the systems fail to function properly, the Contractor shall make good the defects promptly and without any expense to the Owner.

B. Contractor shall be responsible for all damage to any part of the premises caused by leaks in pipelines or equipment furnished and installed under this Section for a period of one (1) year after date of acceptance of his work.

C. All equipment and fixtures shall carry manufacturer's warranty against defective parts or poor workmanship for not less than one (1) year. See specific equipment specifications for extended warranty requirements.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT (See Schedules on Drawings)

A. General: All materials, as specified or required in the work, shall be new, free from defects and imperfections. All manufactured shall comply with California Assembly Bill 1953.

B. Pipe and Fittings:
1. Soil and Waste Piping:

(a) Soil and waste piping within the building itself and outside within five feet (5') of the foundation, shall be no-hub cast iron pipe and fittings, asphaltum coated, free from defects, and shall comply with CISPI. Standard 301, ASTM A-888 or ASTM A-74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. Fittings shall be made up with "Husky" SD 4000 series or “Clamp All” HI-TORQ 125 series stainless steel type 304 couplings and shall conform to ASTM C1540 & ASTM C564 except all above ground vent pipe fittings may be made with "Anaco" or "Tyler" stainless steel two band couplings conforming to CISPI Standard 310.

2. Vent Piping:

(b) Concealed or underground vent piping shall be cast iron pipe and fittings as specified for soil and waste piping.

(c) Exposed vent piping shall be Schedule 40 galvanized steel pipe, ASTM A53, with black cast iron recessed drainage fittings.

(d) Vent piping within and passing through fire rated partions shall be no-hub cast iron service weight pipe and fittings, asphaltum coated, free from defects, and shall comply with C.I.S.P.I. Standard 301-00 or ASTM A-888-98. Fittings shall be made up with "Anaco" or "Tyler" stainless steel two band couplings and shall comply with ASTM C564.

(1) All vents through roof shall terminate with vandal proof caps (Refer to “Roof Flashing” herein).

3. Domestic Water Piping:

(e) Piping within the building and above grade shall be Type "L" ASTM B88, hard drawn copper tubing with wrought copper sweat fittings ANSI B16.18 and B16.22.

(f) Outdoor underground piping in sizes 2-1/2" and 3" shall be Type "L" ASTM B88, hard drawn copper as specified for water piping within the building. Piping 2" and smaller shall be Type "K" ASTM B88, hard drawn copper with wrought copper sweat fittings ANSI B16.18 and B16.22. Piping below the building floor shall be Type "K" soft annealed copper tubing with no fittings below the slab.

4. Air Conditioning Condensate Drain Piping.

(a) Shall be Type "M" copper below roof and indoor.

(b) Shall be Schedule 80 CPVC on roof.

5. All exposed piping at plumbing fixtures shall be chrome plated yellow brass except exposed pipes in shop or utility areas.

6. Aluminum Jacketing.

(c) All 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.

(d) 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.

7. Unions or flanges shall be furnished and installed at each threaded connection to all equipment or valves. The unions or flanges shall be located so that the piping can be easily disconnected for removal of the equipment, tank, or valve, and shall be of the type specified in the following schedule.

(e) Unions:

(1) Copper or Brass Tubing: 150 pound cast bronze or copper, ground joint, nonferrous seat with ends, by Walseal, Nibco or Mueller.

(f) Flanges: Tube Turn or approved equal, raised face 150 pound class forged steel, weld, neck or slip-on type conforming to ASA B16.5 and ASTM A181. For copper piping systems, provide flanges conforming to ANSI B16.24. The faces of the flanges being connected to be alike in all cases. Locate flanges so that the piping can be easily disconnected for removal of the equipment or valve. Gasket material shall be of material suiting the service of the opening system in which installed and which conforms to its respective ANSI Standard (A21.11. B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

8. All piping on roof shall be supported by pipe supports as manufactured by MAPA Products or Eaton B-Line Dura Blok. Products by Miro Industries and Erico shall be accepted for submittal review.

(g) Gravity System Piping 2” and Less: MS-1 single post, adjustable height pipe support.

9. All underground non-metallic piping shall have 14 gauge copper "Tracer Wire" continuous for entire length.

C. Traps, Strainers and Tailpieces: Every sanitary fixture, unless otherwise specified, shall be provided with a seventeen (17) gauge chromium tailpiece, a Los Angeles pattern chrome plated cast-brass trap and galvanized nipple trap arm and wall flanges. Trap arm shall be provided with chromium plated brass casing between the

trap and wall flanges at each fixture. All sanitary waste system floor drains and floor sinks shall have cast iron "P" traps.

D. Cleanouts: Shall be Jay R. Smith and Zurn.
   1. General: Provide cast-iron ferrule and countersunk brass clean-out plug with round cast iron access frame and heavy duty secured top cover.
   2. Wall Cleanouts: Jay R. Smith No. 4472 for steel pipe and Jay R. Smith No. 4532 for cast iron pipe.
   3. Floor Cleanouts: Jay R. Smith No. 4023 or 4028, bronze plug and non-skid nickel bronze top.
   4. Cleanouts to Grade: Jay R. Smith No. 4258 or Jay R. Smith No. 4253 with X-H bronze plug and X-X-H non-skid cover with lifting device set flush with surface for concrete areas. Asphalt or nonsurfaced areas shall be installed with ring of concrete poured around the bottom flange six inches (6") below surface. Use cast iron soil pipe on cleanout risers. For cleanouts in non-traffic areas, terminate cleanout plug in concrete yard box.

E. Access Panels: Wall access panels shall be minimum 12" x 12" for concealed valves and other equipment unless otherwise specified or indicated. Ceiling access panels shall be 18" x 18" minimum. Access panels shall be located and positioned for ready access and service of equipment housed within. Where access panels are specified with keyed cylinder locks, all such locks shall be identically keyed.
   1. Wall, Non-Fire Rated: Elmdor/Stoneman DW-SS-CL, drywall, stainless steel finish, cylinder lock.
   2. Ceiling, Non-fire Rated: Elmdor/Stoneman DW, drywall, prime coated finish, screwdriver latch.
   3. Wall, Fire Rated: Elmdor/Stoneman FR-SS-CL, fire rated, stainless steel finish, cylinder lock.
   4. Ceiling, Fire rated: Elmdor/Stoneman FRC, Fire rated, prime coated finish, return latch.

F. Yard Boxes & Vaults: For service shut-off valves on gas and domestic water; for pressure regulator assemblies and for cleanouts, shall be Brooks Products or Fraser Cement Products Co., rectangular concrete type with vandal-proof cast iron cover and name of service clearly marked on cover. Box shall be of size to permit full range of valve operation and to permit easy removal of valve assembly. Vaults shall be sectional type.

G. Roof Flashing:
   1. Sanitary vents thru roof and grease vents thru roof: Stoneman No. 1100-5, one (1) piece, seamless, four (4) pound, series with reinforcing steel boot counterflashed with cast iron flashing sleeve and equipped with vandal-proof hood for all vent piping. Seal joint between flashing and pipe with waterproofing compound per flashing manufacturer’s recommendations.
   2. Water, gas, condensate drainage and other metallic piping thru roof: Stoneman No. 1100-4, one (1) piece, seamless, four (4) pound, series with reinforcing steel boot counterflashed with cast iron flashing sleeve. Seal joint between flashing and pipe with waterproofing compound per flashing manufacturer’s recommendations

H. Escutcheons: Shall be chrome plated cast brass with setscrew locking device.

I. Dielectric Union Isolators: Connection between incompatible materials above grade and inside building shall be made with two (2) dielectric unions separated by a twelve inch (12") section of red brass pipe. Dielectric union isolator for connection piping or non-compatible materials shall be of standard commercial design with threaded connections.

J. Pipe Supports: Unless otherwise indicated on the drawings, shall be as follows:
   1. The Contractor shall furnish and install all miscellaneous iron work including angles, channels, etc., required to appropriately support the various piping systems. Hanger spacing and location shall conform to 2025 California Plumbing Code Table 313.1.
   2. All horizontal runs of piping within the building to be supported from the structural framing with steel rods and split ring hangers, B-Line, Grinnell Company, Tolco, or approved equal. Steel rods shall be secured to overhead framing with side beam connectors. Where necessary, install angle iron between framing to accommodate hanger rods. Where several pipes are running together, Unistrut, B-Line or Powerstrut channels with clamps may be used in lieu of individual pipe hangers, and supported from structure as herein specified. Submit test data for type of hanger supports to be provided. For support conditions other than specified herein, the Contractor shall submit method of support for approval prior to any

installation.

3. Horizontal Piping Hangers and Supports:

   (a) General: Provide factory fabricated horizontal hangers and supports complying with one of the following MSS types listed to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.

      (1) Adjustable Steel Clevis Hangers: (MSS Type 1.) B-Line B 3100

      (2) Adjustable Swivel Pipe Rings: (MSS Type 5) B-Line B3690

4. Vertical-Piping Clamps:

   (a) General: Provide factory fabricated vertical-piping clamps complying with the following types listed, to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

   (b) Two-Bolt Riser Clamps: (MSS Type 8) B-Line B3373

5. Hanger-Rod Attachments:

   (a) General: Provide factory fabricated hanger-rod attachments B-Line, Tolco or approved equal, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-58 and manufacturer's published product information. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

   (b) Side beam eye socket, Tolco Fig. #57 for rod sizes 3/8" dia. and Tolco Fig. #25-30-251 for rod sizes 1/2" dia.

6. Building Attachments:

   (a) General: Provide factory fabricated building attachments, selected by Installer to suit building structural framing conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

7. Hanger Rods and Spacing shall conform to the following table:

Pipe Sizes	Spacing	Rods
2 Inch and Smaller	6 Feet	3/8 Inch

8. Hangers and Supports shall be adequate to maintain alignment and prevent sagging and shall be placed within 18 inches of joint. Support shall be provided at each horizontal branch connection.

9. Bracing all piping laterally to structural framing to prevent swaying or lateral movement per bracing detail on plans per seismic note on plumbing sheet P-0.1.

10. Miscellaneous Supports, Wall Brackets, Etc.: Provide where required in accordance with the best standard practices of the trade. Submit shop drawings for all fabricated supports.

11. Isolators. All piping which is not isolated from contact with the building by its insulation shall be installed with a manufactured type isolator. Isolators shall be B-Line vibra clamp and cushion, Super Strut, Stoneman "Trisolator", or approved equal. Piping shall be installed and supported in a manner to provide for expansion without strains. Guides shall be properly installed to ensure this requirement.

12. Shields:

   (a) General: Provide shields at piping hangers and supports, factory-fabricated, for all insulated piping as manufactured by Pipe shields Incorporated or approved equal. Size shields for exact fit to mate with pipe insulation.

   (b) Protection Shields: MSS Type 40; provide high density insert of same thickness of insulation or equal 100-psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

K. Insulation:
1. All condensate drain piping building shall be insulated.

(a) Owens Corning fiberglass SSL 11 with ASJ Max with wrap or equal, composite surface burning characteristics: flame spread 25, smoke developed 50. All condensate drain piping on roof shall have aluminum jacketing.

PART 3 – EXECUTION

3.1 INSTALLATION - GENERAL

A. Locations and Accessibility: Install equipment for ease of maintenance and repair. If changes in the indicated locations or arrangements are made by the Contractor, they shall be made without additional charges.

B. Openings: Furnish information to the other trades on size and location of openings which are required in walls, slabs, roof, for piping and equipment at the proper times.

C. Closing-In of Uninspected Work: Do not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and approved by the Architect. Any work enclosed or covered prior to such inspection and test shall be uncovered and, after it has been inspected, tested, and approved, make all repairs with such materials as may be necessary to restore all work, including that of other trades, to its original and proper condition.

D. Before laying of any pipe or digging of any trenches, Contractor shall determine by actual excavation and measurement exact locations and depth of existing utility and service lines to which he is going to connect. In event depth of existing sewer main or storm drain is not sufficient to permit installation of piping as detailed on drawings or to make connection in manner indicated, Contractor shall confer with the Architect, Owner's representative and Engineer for Direction.

E. Excavation, Trenching and Backfill: Perform all necessary trench excavation, shoring, backfilling and compaction required for the proper laying of the pipe lines.
1. The Contractor shall coordinate the layout of all below grade piping and components with the General Contractor prior to bid to determine the extent of required sawcutting, excavation, alterations, and subsequent repair/restoration of all affected hardscape and softscape surfaces. All such items shall be included in bid.
2. Backfill shall be clean soil free from rocks and debris. Compact to ninety percent (90%) of surrounding soil. All piping shall be installed in a minimum 6" sand bed and covered with 6" of sand prior to backfill. Continue backfill with materials free of rocks and debris, properly moistened and mechanically tapered and compacted to 90% of surrounding soil.
3. Water, soil and waste piping shall have twenty-four (24") of cover minimum, except all PVC pipe material and all gas piping shall have eighteen (18") of cover minimum. All other pipe shall have not less than eighteen inches (18") of cover, unless otherwise noted on the drawings. Offset gas and water piping as required to permit crossover of underground piping systems, and electrical conduit systems.
4. Bottoms of Trenches: Cut to grade and excavate bell holes to ensure the pipes bearing for their entire length upon the outside periphery of the lower third of the pipe.
5. Water piping shall not be run in the same trench with sewer or drainage piping unless separated as required by the CPC.
6. All horizontal soil and waste piping 3” and smaller shall be installed to a uniform grade of not less than one-fourth inch (1/4") per foot. All horizontal soil and waste piping 4” and larger shall be installed to a uniform grade of not less than one-eighth inch (1/8") per foot, unless otherwise indicated or directed.

F. Piping Installation:
1. All piping shall be concealed in finished portion of the building except where otherwise indicated or directed at the time the work is done. All piping shall be installed to clear all framing members and beams, even if drawings do not indicate same. Contractor shall constantly check the work of other trades so as to prevent any interference with the installation of this work.
2. All piping into stem walls and footings shall be double half lap wrapped with 1/8" thick "Armaflex" insulation. The Contractor shall also provide blocked out areas in stem wall and footing as required for

the installation of the piping. All piping shall avoid the lower 9" of the footing and the Contractor shall coordinate and provide dropped footings as required for the installation of the underground piping.

3. Unions shall be installed on one side of all screwed shut-off valves, at both sides of screwed automatic valves and on all by-passes, at all equipment connections and elsewhere as indicated or required for ease of installation and dismantling.
4. Connections between copper tubing and equipment shall be with Mueller Brass Company, or approved equal, brass stream line copper to P.P.S. ground joint unions.
5. Cleanouts shall be installed on all condensate drain piping at each aggregate horizontal and vertical change in direction exceeding 135 degrees.
6. All condensate drain piping shall be installed with a minimum slope of 1/8”/FT.
7. All condensate piping on roof shall be painted with UV protection paint.
8. Corrosion Protection:

(a) General.

(1) Corrosion protection shall be provided for all below grade cast iron and copper piping and associated valves and fittings. Such piping shall be protected from corrosion by encasement in a polyethylene protective wrapping, referred to hereafter as polywrap. Although not intended to be a completely air and water tight enclosure, the polywrap shall provide a continuous barrier between the pipe and surrounding bedding and backfill.

(b) Materials.

(1) Cast iron piping encasement.

i. The polywrap shall be minimum 8 mil. in thickness, group 2, linear low density, flat tube, natural (clear) virgin polyethylene film formed into tubes or sheets as required. Material shall meet or exceed the requirements of AWWA C105, ANSI A21.5 and ASTM A674.

ii. The polywrap shall be as manufactured by Northtown Company or approved equal.

(2) Copper piping encasement.

i. The polywrap shall be minimum 6 mil. in thickness, group 2, linear low density, flat tube, natural (clear) virgin polyethylene film formed into tubes or sheets as required. Material shall conform to the requirements of ASTM D1248.

ii. The polywrap shall be as manufactured by Northtown Company or approved equal.

(3) The minimum Polywrap flat tube width for each pipe diameter shall be as follows:

Pipe Size / Type	Polywrap Flat Tube Width
½” to ¾” copper	2”
1” to 1-½ copper	3”
4” cast iron	16”

(4) The polywrap shall be secured as specified with 2 inch wide pressure sensitive plastic tape not less than 10 mils thick.

i. Tape shall be Scotchwrap No. 50, Polyken No. 900, Tapecoat CT, Johns-Manville No. V-10 Trantex or approved equal.

ii. Piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts.

(c) Installation.

(1) The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. Slip the tube around the pipe, centering it to provide a 1-ft overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. . A shallow bell hole must be made at each joint to facilitate installation of the polywrap. The bunched-up polywrap shall be pulled from the

preceding length of pipe, slipped over the end of the new length of pipe, and secured in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. The end of the polywrap shall be slipped from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe and tape it in place. The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.

(2) Rips, punctures or other damage to the tube shall be repaired with the adhesive tape or pieces of tube material secured with tape. Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.

(3) Valves, tees, crosses and outlets shall be wrapped with flat sheets of the same material. The sheets shall be passed under valves and brought up around the body to the stem. Edges shall be brought together, folded twice and secured with the adhesive tape.

G. Sleeves: Shall be plastic or galvanized steel where pipes pass through concrete walls or floor slabs.
1. Isolate pipes through ground floor slabs with Kraft paper, plastic tape or similar materials unless conduit is specified or indicated.
2. Sleeves for pipes through exterior walls shall be non-metallic with minimum 2” weep ring as manufactured by Link Seal. Pipe shall be sealed with Link Seal modular seal with EPDM seal elements.
3. Below-grade piping through exterior walls shall be sealed using Link Seal modular seal with nitrile seal elements and stainless steel bolts and sleeves as manufactured by Century Line.

H. Contraction and Expansion: Install all work in such a manner that its contraction and expansion will not do any damage to the pipes, the connected equipment, or the building. Install offsets, swing joints, expansion joints, seismic joints, anchors, etc., as required to prevent excessive strains in the pipe work. All supports shall be installed to permit the materials to contract and expand freely without putting any strain or stress on any part of the system. Provide anchors as necessary.

I. Pipe Joints and Connections:
1. Copper Tubing and Brass Pipe with Threadless Fittings:
(a) Solder joints for copper shall be made with 95/5 lead free solder in accordance with manufacturer's recommendations for the service intended.
(b) Use threaded adapters on copper tubing where threaded connections are required.

J. All closet bends shall be adequately blocked and secured. Trap arms and similar connections installed below the floor level or under concrete slabs shall be adequately supported and anchored to prevent motion in any direction. All piping installed above grade within buildings shall be secured to structural framing with Unistrut or pipe clamps to provide a rigid installation. Piping utilizing gaskets as a seal shall be given prime consideration to providing adequate stability through proper supports and anchors because of its flexible nature.

K. Each pipe penetration of the roof shall be separated from other piping and any roof equipment by a minimum of 18" to insure a proper pipe flashing installation.

L. Floor, Wall and Ceiling Plates: Where pipes pierce finished surfaces, C.P. brass split flanges with setscrew lock shall be provided.

M. Completion of Installation:
1. Cleaning and Flushing: Clean all equipment and materials thoroughly. Leave surface to be painted smooth and clean, ready for painting.
2. Flush each unit of water supply and distribution system thoroughly with clean water at the highest velocities attainable.
3. Clean all piping, valves, traps, water heaters, fixtures and other devices thoroughly and flush or blow out until free of scale, oil silt, sand, sediment, pipe dope and foreign matter of any kind.

3.2 OPERATION INSTRUCTION

A. Prior to occupancy or prior to the date of final inspection, whichever may occur first, the Contractor shall prepare two (2) sets of typewritten instructions for the operation of all equipment, valves, etc., specified and furnished as a part of the work under this section, and shall assign a competent person, thoroughly familiar with the job, to demonstrate and instruct a representative of the Owner in the operation of the equipment. The time of said demonstration and instructions shall be arranged with the Owner's representative approximately one (1) week in advance. Verbal instructions shall include shut-off location of gas and water. The Contractor shall assemble all operation and maintenance data supplied by the manufacturers of the various pieces of equipment, all keys and special wrenches required to operate and service the equipment (including keys for yard boxes, gas stops and fixture stops), and all equipment warranties and deliver same to the representative of the Owner on date of said instructions.

3.3 PIPE AND EQUIPMENT IDENTIFICATION

A. Each operating and service line shut-off valve shall be identified by a 19 ga. brass tag with stamped, engraved type of service identified and area served, complete 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.

B. All piping systems shall be readily identifiable by appropriate labeling with the name of the piping contained. Such labeling shall be by means of metal tags, stenciling, stamping, or with adhesive markers, in a manner that is not readily removable. Labeling shall appear on the piping at intervals of not more than 20 ft and at least once in each room and each story traversed by the piping system.

C. Provide on exterior wall of each building opposite the building's main gas service a sign reading "Gas Shut Off". Sign shall be metal with minimum 1-1/2" high-embossed letters.

D. All equipment shall be provided with name plate indicating all pertinent information on it.

END OF SECTION

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

A. 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.

1. Fire Damper Red

2. Manual Volume Dampers Blue

   a. Supply Air Full Dot

   b. Return Air Half Dot.

3.	Fan coil unit	Green
4.	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

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Balancing Air Systems:
    1) Constant-volume air systems.
    2) Multizone systems.
    3) Induction-unit systems.
2. Duct leakage tests.

1.03 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.04 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:
    1) The Contract Documents examination report.
    2) The TAB plan.
    3) Needs for coordination and cooperation of trades and subcontractors.
    4) Proposed procedures for documentation and communication flow.

1.05 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. Retain first paragraph below for verification purposes unless standard report forms from AABC, NEBB, or TABB are acceptable.

H. Sample report forms.

I. 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.

1.06 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."

1.07 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. See "Design Data" Article in the Evaluations.

E. 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.

F. 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.

G. 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.

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

I. Examine test reports specified in individual system and equipment Sections.

J. 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.

K. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

M. Examine operating safety interlocks and controls on HVAC equipment.

N. 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.
         1) Volume, smoke, and fire dampers are open and functional.
         2) Clean filters are installed.
         3) Fans are operating, free of vibration, and rotating in correct direction.
         4) Variable-frequency controllers' startup is complete and safeties are verified.
         5) Automatic temperature-control systems are operational.
         6) Ceilings are installed.

7) Windows and doors are installed.
8) 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.

1) Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
2) Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
3) 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. First two subparagraphs below may require changes to installed systems or equipment; these changes may require a Contract Modification.
4. 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.
5. 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.
6. 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 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each refrigerant coil:
1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

3.9 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.

3.10 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.

3.11 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.

3.12 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.

3.13 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.

3.14 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.

3.15 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 07 19 - DIRECT EXPANSION PIPING SYSTEM INSULATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes insulating the following HVAC piping systems.

1. Refrigerant suction (low pressure gas) piping and hot gas (discharge or high-pressure gas) piping.

2. Refrigerant liquid piping, for VRF/VRV and Heat Pump systems.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include thermal conductivity, water vapor permeance, thickness, and jackets (both factory and field applied if any).

B. Shop Drawing: Include plans, elevation, section, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, flanges, valves and specialties for each type of insulation.
3. Detail application of field applied jackets.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Tubular Preformed Pipe Insulation Materials: 12 inches long by 7/8” pipe size.
2. Jacket Materials for Pipe: 12 inches long by 7/8” pipe size coordinated with insulation wall thickness.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05QUALITY ASSURANCE

A. Installer Qualification: Only trained installers that are familiar with the products should be used.

B. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training. Preference will be given to those who have successfully completed a manufacturer's installation training program, such as the 'Armacell Qualified Installer Program' (AQIP) or similar.

C. Inspection: A certified mechanical insulation shall be performed by inspectors who maintain current certification, by the National Insulation Association or other certified mechanical association, throughout the project to inspect and verify the materials and the total insulation system has been installed correctly in accordance with the specifications and material manufacturer’s instructions.

D. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having

jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

E. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by engineer/owner. Use materials indicated for the completed Work.

1. Piping Mockups:
    a) One 10-foot section of straight pipe.
    b) One each of a 90-degree welded elbow and one each of a welded tee fitting.
    c) One smaller valve, and one larger valve.
    d) Four support hangers including hanger shield and insert.
    e) One welded reducer and one mechanical coupling.
2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify engineer/owner two(2) days in advance of dates & times when mockups will be constructed.
4. Obtain engineer/owner 's approval of mockups before starting insulation application.
5. Retain first subparagraph below if mockups are not only for establishing appearance factors.
6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless engineer/owner specifically approves such deviations in writing.
7. Maintain mockups in an undisturbed condition as a standard for judging the completed Work.
8. Demolish and remove mockups when directed.

1.06 DELIVERY STORAGE AND HANDLING

A. Material to be delivered in new condition, free of defects and stored in a clean, dry space that provides protection against damage and contamination.

1.07 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.08 SCHEDULING

A. Schedule insulation application after pressure testing and leak testing of systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Flexible Elastomeric Foam: EPDM - Closed cell expanded rubber. Comply with ASTM C 534, Type I for tubular materials for refrigeration pipe sizes 1/4" and greater.

1. Outdoor Use, Basis of Design Product: Provide Armacell, LLC, ArmaFlex Shield
2. Provide Reftekk EPS (EPDM pre-split with lap seal and field applied Aeroflex Aerocoat) or comparable product by one of the following.
    a) Aeroflex, EPDM SSPT with field applied Aerocel Aerocoat

b) Armacell, LLC, ArmaFlex Shield EPDM ArmaFlex UT or ArmaFlex UT Pre-split with lap seal and with field applied Black PVC jacket.

3. Indoor Use, Basis of Design Product: Armacell, LLC, ArmaFlex Shield EPDM ArmaFlex UT (EPDM pre-split with lap seal) or comparable product by one of the following.
4. Reftekk EPS (EPDM pre-split with lap seal) or comparable product by one of the following.
   a) Aeroflex, EPDM SSPT
   b) Armacell, LLC, ArmaFlex UT EPDM, Pre-split with lap seal
5. Applied to Annealed Straight Tubing, Basis of Design Product: EPDM continuous tube.

B. Elastomeric insulation shall not use CFC's or HFC's in the manufacturing process.

C. Elastomeric insulation shall have a flame spread-index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E84 for all products through 2" thickness.

D. Elastomeric insulation and elastomeric joining system shall be suitable of use from -70°F to 257°F continuous service temperature, per ASTM C 411.

E. Elastomeric insulation shall have a maximum thermal conductivity of 0.245 Btu-in/h-ft2-°F at a mean temperature of 75°F when tested in accordance with ASTM C 177 or ASTM C 518.

F. Elastomeric insulation shall have a maximum water vapor transmission of ≤0.03 perm-inch when tested in accordance with ASTM E 96, Procedure A, latest revision.

G. Elastomeric insulation must exhibit long-term UV resistance in outdoor installation per ASTM G 7 and ASTM G 90.

H. Elastomeric insulation must not contribute to external stress corrosion cracking when tested per ASTM C 692.

2.02 ADHESIVES, AND TAPES

A. Flexible Elastomeric and Polyolefin Adhesive: Comply with SCAQMD Rule 1168.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Armacell LLC; [**ArmaFlex 520 Black Low VOC Adhesive**] or a comparable product by one of the following:
      a) Aeroflex USA, Inc.
      b) Foster Brand; H. B. Fuller Construction Products.
      c) K-Flex USA.
   2. Adhesives shall have a VOC content of **50** g/L or less.
   3. Adhesive shall comply with the testing and product requirements of the MAS Certified Green Program.

B. Flexible Elastomeric and Polyolefin Adhesive: High Temperature.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Armacell LLC; [**HT 625 Insulation Adhesive**] or a comparable product by one of the following:
      a) Aeroflex USA, Inc.
      b) Foster Brand; H. B. Fuller Construction Products.
      c) K-Flex USA.

C. Flexible Elastomeric Adhesive for Indoor and Outdoor Application:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Armacell LLC; [**ArmaFlex 520 Adhesive**] or a comparable product by one of the following:
      a) Aeroflex USA, Inc.
      b) Foster Brand; H. B. Fuller Construction Products.
      c) K-Flex USA.

D.
   1. Basis of Design Product: Provide Aeroflex AeroSeal contact adhesive or comparable product by one of the following.
      a) Armacell, LLC HT 625 contact adhesive

E. Flexible Elastomeric for LEED low VOC Application:
   1. Basis of Design Product: provide Armacell LLC; [**ArmaFlex 520 Black Low VOC Adhesive**] or a comparable product by one of the following:

a) Provide Aeroflex AeroSeal LVOCAeroflex USA, Inc.
b) Foster Brand; H. B. Fuller Construction Products.
c) K-Flex USA.

2. Adhesives shall have a VOC content of 50 g/L or less.
3. Adhesive shall comply with the testing and product requirements of the MAS Certified Green Program.

F. Seaming tape to be 15-mil EPDM rubber with acrylic adhesive.

2.03 INSULATING PIPE HANGER SUPPORTS

A. Support the piping system using high density rigid foam insulating pipe hanger supports with an inner lining of EPDM rubber insulating tape and 15-mil exterior EPDM rubber jacket. Insulation density to be a minimum of 10 lb. / cu. ft. with a compressive strength of 284 PSI or greater, and a k-value of 0.312 or lower. Continuous use temperature range to be -70°F to 257°F with water absorption of 5% or less.

1. Basis of Design Product: Provide Reftekk “Cush-A-Therm”, model CAT insulated pipe support complete with steel channel insulation OD clamp or comparable product by one of the following.
   a) Aeroflex USA, Aerofix-U with matching steel channel insulation OD clamp.
   b) Armaflex LLC, Armafix IPH with matching steel channel insulation OD clamp.

B. Continuous insulation passing through pipe hangers, supports and sleeves or other openings, except underground sleeves.

2.04 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket:

1. Product:
   a) SChilders Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
   b) ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
   c) RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
   a) Finish and thickness are indicated in field-applied jacket schedules.
   b) Factory-Fabricated Fitting Covers:
      1) Same material, finish, and thickness as jacket.
      2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      3) Tee covers.
      4) Flange and union covers.
      5) End caps.
      6) Beveled collars.
      7) Valve covers.

3. Field fabricate fitting covers only if factory-fabricated fitting covers are not available

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and free of leaks and defects
2. Verify that surfaces to be insulated are clean, dry and free of dirt, dust, grease, frost, and moisture.
3. Work shall be performed at the installation temperatures recommended by the product manufacturer.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. B. Tape seams and lap seam tape overlaps shall be clean dry, fan free of dirt, dust, grease, frost and moisture.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. All piping, valves and fittings scheduled to be insulated to have all insulation applied in strict accordance with the insulation manufacturers installation instructions and practices described in the National Commercial and Industrial Insulation Standards Manual. In case of conflict, the manufacturers installation guidelines and instruction will be used.

B. Install insulation materials, accessories and finishes with smooth, straight, and even surfaces; free of voids, throughout the length of the piping including supports, fittings, valves and specialties.

C. Install insulation materials, vapor barriers, vapor dams, jackets, and thicknesses required for each item of the pipe system as required.

D. Install insulation with longitudinal seams oriented per the insulation manufacturers installation instructions for all horizontal runs.

E. Keep insulation dry and clean during application and finishing. Do not apply insulation to operating systems.

F. Install insulation with the least number of joints practical.

G. Piping to be insulated with tubular preformed pipe insulation.

H. Install insulation continuously through roof penetrations, wall penetrations and floor penetrations.

I. Install insulation continuously through fire rated wall and fire rated floor penetrations complying with Penetration Fire-stopping details.

J. Insulating Pipe Hanger Supports are to be installed at all pipe support and clamp locations. Insulating Pipe Hanger Supports are to be installed at the time of piping installation such that the pipe insulation system is installed in a continuous manner through the pipe support system.

K. All insulation terminations, butt joints, longitudinal joints, and access points to be properly glued or sealed with the insulation manufacturers sealant system.

L. Vapor dams to be installed every 12’ to 18’ per insulation manufacturers installation instructions, high point of piping run and at all insulation terminations (supports, valves, flanges and end of pipe runs)

M. Provide sufficient clearance between insulated pipes to allow air circulation.

N. Provide mitered insulation fittings at elbows to prevent compression of the insulation at the throat of the elbow and stretching on the outside of the bend.

O. Do not compress the insulation at penetrations or structural members, such as joists or studs. Do not allow the insulation to be compressed by ceiling hanger wires.

P. Do not allow attachment of anything to the insulated piping that will reduce the effective thickness of the insulation, such as control wiring, cabling, telephone wiring, etc. When using insulation manufacturers recommended tape on joints, do not compress the insulation.

Q. Insulation should be installed such that butt joints are in slight compression. This prevents separation of the insulation joints over time or due to changes in temperature. Do NOT apply the insulation in a stretched condition.

R. Insulation thickness: Provide minimum Insulation Thickness required (in inches) based on pipe sizes per table 120.3-A on 2025 California Energy code Split & VRF DX Piping. Refer

3.04 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed: None.

D. Piping, Exposed:

1. Aluminum, [Smooth] or [Stucco Embossed]: [0.016 inch thick]
2. Painted Aluminum, [Smooth] or [Stucco Embossed]: [0.016 inch]

3.05 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

1. Aluminum, [Smooth] or [Stucco Embossed] with Z-Shaped Locking Seam: [0.016 inch]

3.06 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

-END OF SECTION-

DIVISION 23 – HEATING, VENTILATING & AIR CONDITIONING

SECTION 23 23 01 - DX REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for split heat pump system and VRV/VRF air-conditioning applications.

B. Related Requirements:
1. Section 23 07 19: Mechanical DX Piping Insulation
2. Section 23 30 00: Heating, Ventilation, and Air Conditioning

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:
1. Suction (low pressure gas) Lines: 550 psig, or per equipment manufacturers recommendation.
2. Hot-Gas (high pressure gas) and Liquid Lines: 550 psig, or per equipment manufacturers recommendation.

1.3 REFERENCES

A. ASTM International:
1. ASTM B32 - Standard Specification for Solder Metal.
2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

B. American National Standard Institute (ANSI) and The American Society for Mechanical Engineers (ASME):
1. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

1.4 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, valve arrangements and locations, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

C. Installer Qualification: Only trained installers skilled in refrigeration pipe installation and brazing of copper tubing should be used.

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube:

1. Straight Lengths: ASTM B 75, UNS C12200, H55 Temper (Light Drawn), ACR Bending Quality; Cleaned, Eddy Current Tested, and Plugged per ASTM B 280.

a. Reftekk “HHC”
b. Approved Equal.

2. No Coiled Temper (Soft Annealed), ACR, shall be used in this project.

B. Brazing Filler Metals: AWS A5.8.

1. Reftekk “BRG”
2. Approved Equal.

C. Field Swaged Brazing Cups: MSS-SP-73, ASME B 16.50

D. Field Bends (all angles): ASME B31.5

2.2 VALVES AND SPECIALTIES

A. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Socket ends.
5. Working Pressure Rating: 700 psig.
6. Maximum Operating Temperature 250 deg. F
7. Valves must be specifically rated for R-410A.

B. REFRIGERANTS

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

D. ASHRAE 34, R-410A: R-32/R-125 (50.0/50.0)

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Suction (low pressure gas), Hot Gas (high pressure gas) and Liquid Lines OD 5/8” and Smaller for Conventional Air-Conditioning, Heat Pump, and Heat Recovery Applications: Straight Lengths, Copper, Type ACR Type L, H55 (light drawn)-temper tubing and field bent fittings with brazed joints.

B. Suction (low pressure gas), Hot Gas (high pressure gas), and Liquid Lines OD 2-1/8” and smaller for Conventional Air-Conditioning, Heat Pump, and Heat Recovery Applications: Straight Lengths, Copper, Type ACR Type L, H55 (light drawn)-temper tubing and field bent fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install service valves as shown on plans or as required to isolate system components.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Field Bend changes in direction.

I. Select system components with pressure rating equal to or greater than maximum allowable working pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install insulated refrigerant piping in water-tight protective conduit where installed belowground.

M. Provide Jacketed insulation in locations where exposed to mechanical injury.

N. When brazing, remove solenoid-valve coils and sight glasses; also, remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

P. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

R. Retain first paragraph below for piping that penetrates an exterior concrete wall or concrete slab.

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

U. Provide proper compensation for pipe/tube expansion and contraction per equipment manufacturers recommendations.

3.4 PIPE JOINT CONSTRUCTION

A. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP-5 (15% Ag, 80% Cu, 5% P), copper-phosphorus alloy pre-formed brazing rings for joining copper swage fittings and copper socket fittings with copper pipe. Do NOT use flux.
2. Use Type Bag-5 (45% Ag), cadmium-free silver alloy for joining copper with bronze or steel. Use manufacturers recommended flux.

B. Field Swaged Brazing Cups: Fabricate brazing cup on one tubing end for each coupling. Only H55 (light drawn) may be swaged. Do NOT swage H58 (drawn general purpose). Use swaging tool designed to provide a minimum of 0.0015” brazing gap and a maximum of 0.005” brazing gap. Brazing cup depth for each tube size shall be as follows.

1/4"	3/8”	1/2"	5/8”	3/4"	7/8”	1-1/8”	1-3/8”	1-5/8”	2-1/8”
0.250”	0.280”	0.310”	0.390”	0.420”	0.460”	0.510”	0.560”	0.600”	0.700”

C. Field Bends: Fabricate field bends with a center-line bend radius greater than or equal to 4 times the nominal OD of the pipe or tube. Tube shall be bent with a tubing bender sized for ACR OD tube sizes and shall not cause cracks or wrinkles in the tube or pipe. Do NOT use a conduit bender for bending ACR copper. The difference between maximum and minimum diameters for pipe bends should not exceed 8% of the nominal outside diameter of the pipe. Only H55 light drawn-temper shall be field bent. Do NOT field bend H58 drawn general purpose-temper copper tube.

D. BRAZING AND JOINING PROCEDURE

1. Tube ends shall be cut with a clean sharp tubing cutter.
2. Deburr the I.D. of the cut tube end with a clean deburring tool.
3. Visually inspect the interior of each tube for obstructions and debris before assembly. Protect the joint from contamination before brazing.
4. Method of pre-cleaning: Non-shedding abrasive pads (Scotch Bright) to remove all oxides in the brazing area followed by wiping with a clean lint-free white cloth. Do not groove the surfaces while cleaning.
5. Purge all tubing with oil free nitrogen while brazing and until cool to the touch. Use an oxygen analyzer to verify the absence of oxygen prior to brazing. The oxygen content shall be less than 1% before start of brazing.
6. Use a neutral to slightly reducing flame using oxy/acetylene or oxy/propane.
7. Use the proper torch tip based on tube size as recommended by the torch manufacturer. Use of Turbo-Torch or Rosebud is permitted.
8. Post Brazing Cleaning: Exterior of all completed joints shall be washed with water soaked rag or sponge, followed by brushing with a stainless-steel hand wire brush to remove any residue for inspection.

3.5 HANGERS AND SUPPORTS

A. Piping hangers and supports must accommodate expansion and contraction, vibration, dead load of piping and its contents, and seismic-bracing requirements.

B. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs.
2. Rigid high compressive strength foam insulating pipe support at all support points. Comply with Section 230719 “DX Piping System Insulation”.
3. Do NOT attach hangers directly to pipe or tube.

D. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. Up to 3/4" OD: Maximum span, 60 inches; minimum rod size, 3/8 inch.
2. Greater than 3/4" thru 1” OD: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. Greater than 1” thru 2-1/8” OD: Maximum span, 96 inches; minimum rod size, 3/8 inch.

E. Support multi-floor vertical runs every 10 feet and at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test as recommended by equipment manufacturer’s instructions.
3. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
   a. Fill system with 95/5 nitrogen/hydrogen to the required test pressure.
   b. System shall maintain test pressure at the manifold gage throughout duration of test.
   c. Test all joints and fittings with hydrogen leak detector, at test pressure.
   d. Remake leaking joints using new materials and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures and per equipment manufacturers instructions.

1. Evacuate (triple evacuation procedure) entire refrigerant system with a vacuum pump to obtain a steady state vacuum of less than 500 micrometers. If vacuum holds for 12 hours, system is ready for charging. Do NOT evacuate the system through a charging manifold. Use only suction rated hoses and core removal tools.
2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
3. Charge system as recommended by equipment manufacturer.

- 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 Gas/Electric Units

B. Split Heat Pump System

C. Ductwork and Accessories

D. Grilles, Registers and Diffusers

E. Duct Cleaning

F. Test and Balance

G. Submittals and Shop Drawings

H. Record Drawings

I. Operation and Maintenance Manuals

J. 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 Certified Aerodynamic Performance Rating

C. AMCA 300 - Reverberant Room Method for Sound Testing of Fans

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 - a. Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings ASTM A120 - Black and Galvanized Steel Pipe

H. ASTM B88 - Seamless Copper Water Tube

I. ASTM C518 - Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

J. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

K. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation

L. ASTM E84 - Surface Burning Characteristics of Building Materials

M. ASTM E96/E96M - Gravimetric Determination of Water Vapor Transmission Rate of Materials

N. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems

O. SMACNA - HVAC Duct Construction Standards - Metal and Flexible

P. UL 181 - Factory Made Air Ducts and Connectors

Q. UL 723 - Surface Burning Characteristics of Building Materials

R. California Mechanical Code - 2025 Edition

S. California Building Code - 2025 Edition

T. 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. Package Roof Top Gas/Electric Units (OFCI). Obtain submittals from district/owner prior to construction.
2. Split Heat Pump System(OFCI). Obtain submittals from district/owner prior to construction.
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.

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 and local rules and 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.

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. Package Roof Top Gas/Electric Units: The HVAC Packaged units are Owner-Furnished and Contractor-Installed (OFCI) and are currently stored at two locations: 2850 EAST DEL AMO BOULEVARD, CARSON,CALIFORNIA 90221. The contractor shall be fully responsible for all handling, loading, transportation, delivery, unloading, staging, and installation of the equipment at the project site. Obtain submittals from district/owner prior to construction.

B. Split Heat Pump Units: The HVAC Split units are Owner-Furnished and Contractor-Installed (OFCI) and are currently stored at two locations: 2850 EAST DEL AMO BOULEVARD, CARSON,CALIFORNIA 90221. The contractor shall be fully responsible for all handling, loading, transportation, delivery, unloading, staging, and installation of the equipment at the project site. Obtain submittals from district/owner prior to construction.

2.3 Air Distribution

A. GENERAL

1. Data Sheet: Indicate materials of construction, finish and mounting details and performance data including throw vertical and horizontal, static pressure, sound ratings.
2. Source quality-control reports.
3. The air inlet/outlets shall be tested in accordance with ANSI/ASHRAE Standard 70 – 2006
4. All air inlets/outlets shall be of the sizes and mounting types shown on the plans and outlet schedule.

B. INSTALLATION

1. Install all air inlet/outlets level and plumb
2. Verify air patterns are as indicated on drawings during installation
3. Install air inlet/outlet with airtight connections to ducts and to allow service and maintenance of dampers, air extractors and fire dampers.

C. ARCHITECTURAL PLAQUE DIFFUSERS

1. Face Plate: shall be 22-gauge steel face panel, removable by means of four hanger brackets, exposed surface shall be smooth, flat, and free of visible fasteners, panel shall project no more than ¼ inch below

the outside border of the diffuser back pan, the face panel plaque shall have an aerodynamically shaped, rolled edge to ensure a tight horizontal discharge pattern. A plaque without a rolled edge on the face panel will not be accepted. Ceiling diffusers with a 24 x 24-inch full face shall have no less than an 18 x 18-inch face panel size.

2. Back pan: shall be one piece precision die-stamped and shall include an integrally drawn inlet (welded-in inlets and corner joints are not acceptable). The diffuser back pan shall be constructed of 22-gauge steel.
3. Neck: shall have a minimum of 1¼-inch depth available for duct connection.
4. Finish: Standard finish shall be #26 white. Optional finishes including special powder coat and wood grain patterns shall be available.
5. The standard finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes.
6. The pencil hardness must be HB to H.
7. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film.
8. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

D. HIGH-CAPACITY LOUVERED FACE

1. Face Plate: shall be 22-gauge steel face panel, removable by means of four hanger brackets, exposed surface shall be smooth, flat, and free of visible fasteners, panel shall project no more than ¼ inch below the outside border of the diffuser back pan, the face panel plaque shall have an aerodynamically shaped, rolled edge to ensure a tight horizontal discharge pattern. A plaque without a rolled edge on the face panel will not be accepted. Ceiling diffusers with a 24 x 24-inch full face shall have no less than an 18 x 18-inch face panel size.
2. Back pan: shall be one piece precision die-stamped and shall include an integrally drawn inlet (welded-in inlets and corner joints are not acceptable). The diffuser back pan shall be constructed of 22-gauge steel.
3. Neck: shall have a minimum of 1¼-inch depth available for duct connection.
4. Finish: Standard finish shall be #26 white. Optional finishes including special powder coat and wood grain patterns shall be available.
5. The standard finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes.
6. The pencil hardness must be HB to H.
7. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film.
8. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

E. SPIRAL DUCT MOUNTED GRILLE

1. The deflection blades shall be available parallel to the long or short dimension of the grille. All supply grilles shall be constructed with radius end caps and foam gaskets for a tight seal to the duct diameter. All supply grilles shall be constructed with a 1 3/8-inch wide border.
2. Blades shall be constructed of heavy duty extruded aluminum and shall be spaced ¾-inch apart. Blades shall extend completely through the side frame on each side to ensure stability throughout the complete cfm operating range of the grille. Blades shall be individually adjustable without loosening or rattling and shall be securely held in place with tension wire.
3. Optional air scoop damper/extractor (option ASD) shall be constructed of heavy duty aluminum. The ASD must be operable from the face with a screwdriver.
4. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

F. ALUMINUM RETURN GRILLE

1. The fixed deflection blades shall be available parallel to the long or short dimension of the grille. Construction shall be of extruded aluminum with a 1¼-inch wide border on all sides. Minimum border thickness shall be 0.040-0.050 inch. Sizes 24 x 24 inches and smaller shall be constructed using a roll-formed frame.

2. Corners shall be welded with full penetration resistance welds. Sizes larger than 24 x 24 inches shall be constructed by using heavy aluminum extrusions and shall be interlocked at the four corners and mechanically staked to form a rigid frame. Screw holes shall be counter-sunk for a
3. neat appearance.
4. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed in place by crimping or welding. Blade deflection angle shall be available at 35°.
5. Optional opposed blade volume damper shall be constructed of heavy gauge steel or aluminum. Damper must be operable from the face of the grille.
6. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315° F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

G. EGGCRATE RETURN GRILLE

1. Return grilles must provide a free area of at least 90%. Outer borders shall be constructed of heavy extruded aluminum with a thickness of 0.040-0.050 inch and shall have countersunk screw holes for a neat appearance. Border width shall be
2. 1¼ inches on all sides and shall be interlocked at the four corners and mechanically staked to form a rigid frame. Choice of three sizes of aluminum grid: ½ x ½ x ½ inch, ½ x ½ x 1 inch, or 1 x 1 x 1 inch shall
3. be available.
4. Optional opposed-blade volume damper shall be constructed of heavy gauge steel or aluminum. Damper must be operable from the face of the grille.
5. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
6. See equipment schedule for more details.

2.4 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:
   a.

RECTANGULAR DUCT		ROUND DUCT	
Dimension of Largest Side (L) in Inches	Gage	Diameter (D) in Inches	Ga.
L≤12	26	D<9	26
12≤L≤30	24	9≤D<14	24
30<L≤54	22	14≤D<23	22
54<L≤84	20	23≤D<37	20
84<L	18	37≤D<51	18
		51≤D<61	16
		61≤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. 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.

2.5 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.
   3. Split System Insulation
      a. Insulation Specification

1) Manufacturer: (i.) Reftekk (ii.) aerocell-sspt or Approved Equal.
2) Material: Low-density EPDM closed cell elastomeric foam, CFC and HCFC gas free with over-lap seal
3) Thermal Conductivity: 0.235 (BTU * in/h *ft2 * °F) at 75°F.
4) Water Vapor Permeability: <0.03 perm (4.38 x 10-11g/Pa*s*m) per ASTM E96.
5) Water Absorption: <0.2% by volume per ASTM C 209.
6) Working Temperature: -70 °F to 257 °F (-57 °C to 125 °C) continuous per ASTM C 411.
7) Surface Burning Characteristics: Meets 25/50 Flame-Spread/ Smoke-Generated per UL 723 and ASTM E84. Additionally meets UL-94 5 V-A, V-0 and is self-extinguishing per ASTM D 635.
8) UV Resistant: EPDM provides UV Resistance in accordance with ASTM G7/G90.
9) Ozone Resistant: Meets ASTM D 1171

b. Title 24 Insulation Wall Thickness Specification
   1) Liquid pipes:
      a) 1” wall thickness (R-7.7 with insulation conductivity 0.22-0.28 in Btu•in/h•ft2 • °F at 100 F mean operating temperature) for less than 1” pipe nominal pipe diameter
      b) 1.5” wall thickness (R-12.5 with insulation conductivity 0.22-0.28 in Btu•in/h•ft2 •°F at 100 F mean operating temperature) for pipe greater and equal to 1” and less than 1.5” nominal pipe diameter
   2) Suction Gas pipes
      a) 1.5”” wall thickness (R-11.5 with insulation conductivity 0.25-0.29 in Btu•in/h•ft2 •°F at 125 F mean operating temperature) for less than 1.5” nominal pipe diameter

4. Contractor shall provide continuous insulation R-value and thickness at all supports and hangers.

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. 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 provide lead free flashing and counter flashing.

C. 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.

D. 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.

E. 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".

F. 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.

G. 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 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 2 (DN 50) and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, straight annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, straight annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, straight annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

D. No Coiled Temper (Soft Annealed), ACR, shall be used in this project.

3.3 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install a full-size, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by 2017 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor as required by manufacturer.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.4 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in plans if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

1. Shot blast the interior of piping.
2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.
7. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

F. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and to restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 HANGERS AND SUPPORTS

A. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

B. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod, 1/4 inch (6.4 mm).
2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod, 1/4 inch (6.4 mm).
3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod, 1/4 inch (6.4 mm).
4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod, 3/8 inch (9.5 mm).
5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod, 3/8 inch (9.5 mm).
6. NPS 2 (DN 50): Maximum span, 96 inches (2400 mm); minimum rod, 3/8 inch (9.5 mm).

3.7 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.

3.8 SYSTEM CHARGING

A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
4. Charge system with a new filter-dryer core in charging line.

3.9 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

3.10 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.

3.11 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. 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.

E. 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.

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. Distribution and 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.

j. Transformers.

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 and be mechanically fastened to equipment.

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.

1.10 SUBSTITUTIONS

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. 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.

7. PVC coated rigid steel conduit for exposed aboveground locations.

C. 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.

8. PVC coated rigid steel conduit fitting for aboveground installations.

9. PVC conduit fittings shall match the conduit system (i.e. Schedule 80 fittings used on Schedule 80 conduit).

D. 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:

   k. Power 480/277V, 3PH, 4W:
      (1) Phase A = Brown
      (2) Phase B = Orange
      (3) Phase C = Yellow
      (4) Neutral = White

   l. Power 208/120V, 3PH, 4W:
      (1) Phase A = Black
      (2) Phase B = Red
      (3) Phase C = Blue
      (4) Neutral = White

   m. 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.

E. 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.

3. PVC coated metal junction/pull boxes for use with PVC coated conduits in aboveground installations.

F. 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.

3. PVC coated metal outlet boxes for use with PVC coated conduits in aboveground installations.

G. 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.

H. 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.

I. 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.

J. Seismic Design and Anchoring of Electrical Equipment:

1. Seismic anchorage of electrical equipment shall conform to C.C.R. Title 24, 2025 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. All boxes installed outdoors shall be PVC coated, gasketed, screw cover.

21. 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.

22. All conduit entries to outdoor mounted panels, cabinets, boxes, etc., shall be made using Myers "SCRU-TITE" hubs Series ST.

23. 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.

24. All rotating electrical equipment shall be supplied with flexible, liquid-tight conduit with appropriate slack and shall not exceed thirty-six (36) inches.

25. 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.

26. 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

2) Carrier Equipment Purchased Submittal

10- Will Rogers Elementary

Carrier
turn to the experts

Sigler

COMMERCIAL HVAC DIVISION

S U B M I T T A L

Contractor: Lynwood USD

Job Name: Will Rogers Elementary

Engineer:

Date: 02/01/2024

Mark For	Qty	Model Number	Description
All Units Include Sigler Pass Services			
Bldg H			
HP-CU-1-10	*10*	*25SCA524A003*	***Nominal 2 Ton Split Heat Pump Condenser, 208-230/1/60***
HP-FC-10	*10*	*FJ4DNXB24L00*	***Nominal 2 Ton Fan Coil, 208-230/1/60***
H-5	*1*	*48FCDM07A2M6-3A0A0*	***Nominal 6 Ton G/E RTU, 460/3/60*** • *Low gas heat* • *Single circuit, two stage cooling.* • *Standard Packaging* • *Direct drive, EcoBlue, medium static fan* • *Al/Cu cond. coil - Al/Cu evap coil hail guard* • *SystemVu Controller* • ***Direct Fit – No Curb Adapter Required***
	1	*PECD-SRT12CB-D0DB-4L1-4*	*Vertical Economizer+Power Exhaust Combo, 1 HP* ****Field Installed***
H-6	*1*	*48FCGA04A2M6-3A0A0*	***Nominal 3 Ton G/E RTU, 460/3/60*** • *Ultra-low NOx low gas heat* • *One stage cooling* • *Standard Packaging* • *Direct drive, EcoBlue, medium static fan* • *Al/Cu cond. coil - Al/Cu evap coil hail guard* • *SystemVu Controller* • ***Direct Fit – No Curb Adapter Required***

H-11-14; 19-22	*8*	*48FCGA05A2M6-3A0A0*	***Nominal 4 Ton G/E RTU, 460/3/60*** • *Ultra low NOx low gas heat* • *One stage cooling* • *Standard Packaging* • *Direct drive, EcoBlue, medium static fan* • *Al/Cu cond. coil - Al/Cu evap coil hail guard* • *SystemVu Controller* • ***Direct Fit – No Curb Adapter Required***
	9	*PECD-SRT12CB-D0DB-4LH-4*	*Vertical Economizer+Power Exhaust Combo, 1/2 HP* ****Field Installed***
H-1-4, H-7-10; H-15-18; H-23,24	*14*	*48FCGA06A2M6-3A0A0*	***Nominal 5 Ton G/E RTU, 460/3/60*** • *Ultra-low NOx low gas heat* • *One stage cooling* • *Standard Packaging* • *Direct drive, EcoBlue, medium static fan* • *Al/Cu cond. coil - Al/Cu evap coil hail guard* • *SystemVu Controller* • ***Direct Fit – No Curb Adapter Required***
H-3,4	*2*	*PECD-SRT12CB-D0DB-4L1-4*	*Vertical Economizer+Power Exhaust Combo, 1 HP* ****Field Installed***
	12	*ECD-SRT12CB-D0DB-4*	*Vertical Economizer* ****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.
- **BLDG H SPLIT SYTEMS WERE UPSIZED FROM 1.5 TON TO 2 TON UNITS. VOLTAGE FOR BLDG F-F-1 NEEDS TO BE VERIFIED AS THE MODEL NUMBER IS NOT SUFFICIENT AND THERE IS NO SERIAL #. 3.5 TON UNITS WERE ALSO UPSIZED TO 4 TONS.**

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.

"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."

REVISION: ORIGINAL

SUBMITTED BY: DAVID ROSS/TRAVON CHADWICK

PREPARED BY: BRANDON HERNANDEZ

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SECTION V. DUCTLESS SPLIT SYSTEM ACCESSORIES

SECTION I. ROOFTOP UNITS



SUBMITTAL

Project

Lynwood USD Will Rogers Elementary

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Prepared By: 01:40PM

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Bldg D D-1,2

Tag Cover Sheet
Unit Report
Certified Drawing
Performance Report

Unit Report For Bldg D D-1,2

Project: Lynwood USD Will Rogers Elementary 02/01/2024
Prepared By: 01:40PM

Unit Parameters

Unit Model: **50VT-K48---3**
Unit Size: **48 (4 Tons)**
Volts-Phase-Hertz: **208-1-60**
Heating Type: **Heat Pump**
Duct Cfg: **Vertical Supply / Vertical Return**

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **4' 0.25"**
Unit Width: **3' 8.1875"**
Unit Height: **3' 8.75"**

*** Weights and Dimensions are approximate. Weight does not include roof curbs, unit packaging, field installed accessories or factory installed options. Approximate dimensions are provided primarily for shipping purposes. For exact dimensions and weights, refer to appropriate product data catalog.

Base Unit Weight (Does not include any accessories):
426 lb

Warranty Information

1 year warranty on parts
5 yearwarranty on compressor

No optional warranties were selected.

NOTE: Please see Warranty Catalog 500-089 for explanation of policies and ordering methods.

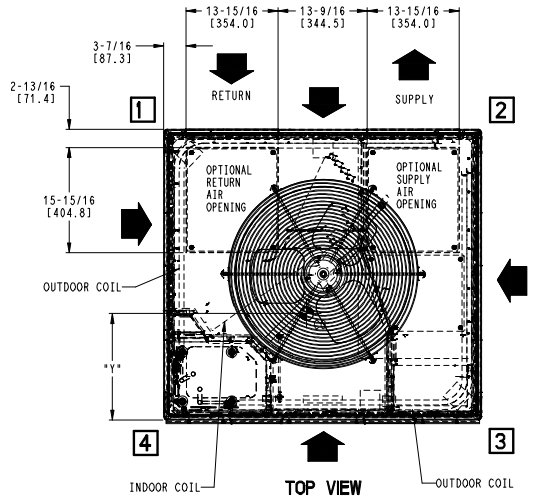
Ordering Information

Part Number	Description	Quantity
50VT-K48---3	Rooftop Unit	2

CARRIER / BRYANT HP (LARGE CHASSIS)

COOLING CAPACITY	UNIT WT.		UNIT HEIGHT IN/MM		CENTER OF GRAVITY IN/MM					
	LB	KG	"A"		X		Y		Z	
36	406	184.2	54-3/4	1391	20-1/2	521	17-1/2	445	17-3/8	441
42	426	193.3	54-3/4	1391	20-1/2	521	17-1/2	445	17-3/8	448
48	426	193.3	44-3/4	1137	20-1/2	521	17-1/2	445	17-3/8	448
60	496	225.0	48-3/4	1238	20-1/2	521	17-1/2	445	18	457

UNIT	CORNER WEIGHT LB/KG							
	"1"		"2"		"3"		"4"	
36	88.6	40.2	78.4	35.6	78.4	51.1	112.6	57.4
42	92.9	42.2	82.4	37.4	82.4	53.7	118.3	60.0
48	92.6	42.0	82.5	37.4	82.5	53.5	117.9	60.4
60	107.5	48.8	95.5	43.3	95.5	62.5	137.8	70.4



TOP VIEW

REQUIRED CLEARANCES TO COMBUSTIBLE MATL.

	INCHES [MM]
TOP OF UNIT	14 [355.6]
DUCT SIDE OF UNIT	2 [50.8]
SIDE OPPOSITE DUCTS	14 [355.6]
BOTTOM OF UNIT	0 [0.0]
ELECTRICAL PANEL	36 [914.4]

NEC. REQUIRED CLEARANCES.

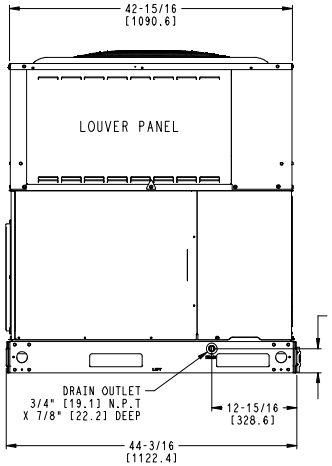
	INCHES [MM]
BETWEEN UNITS, POWER ENTRY SIDE	42 [1066.8]
UNIT AND UNGROUNDED SURFACES, POWER ENTRY SIDE	36 [914.0]
UNIT AND BLOCK OR CONCRETE WALLS AND OTHER GROUNDED SURFACES, POWER ENTRY SIDE	42 [1066.8]

REQUIRED CLEARANCE FOR OPERATION AND SERVICING

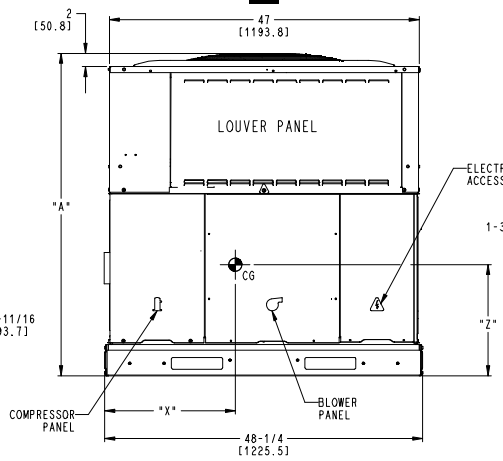
	INCHES [MM]
EVAP. COIL ACCESS SIDE	36 [914.0]
POWER ENTRY SIDE	42 [1066.8]
(EXCEPT FOR NEC REQUIREMENTS)	
UNIT TOP	48 [1219.2]
SIDE OPPOSITE DUCTS	36 [914.0]
DUCT PANEL	12 [304.8]*

*MINIMUM DISTANCES:IF UNIT IS PLACED LESS THAN 12 [304.8] FROM WALL SYSTEM,THEN SYSTEM PERFORMANCE MAYBE COMPROMISED.

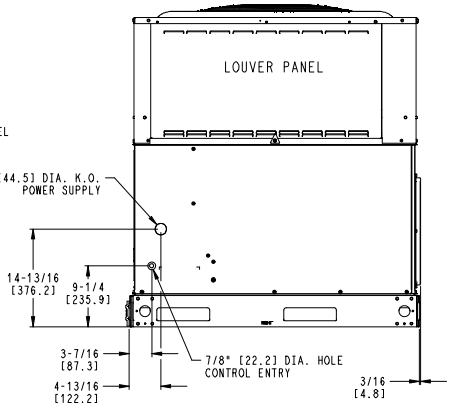
DIMENSIONS IN [] ARE IN MILLIMETERS



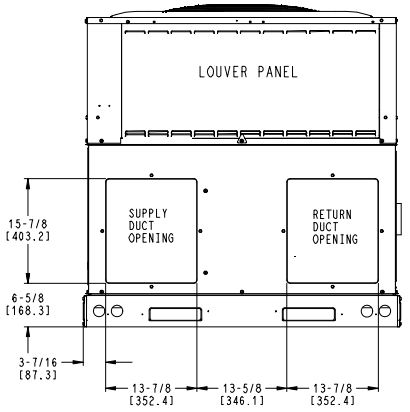
LEFT SIDE VIEW



FRONT VIEW



RIGHT SIDE VIEW



REAR VIEW

10/19/22	UPDATED TABLE DIMS.	SINGLE ZONE ELECTRIC COOLING & HEAT(LG)	SD5770-4	A

Part Number:50VT-K48---3

ARI SEER2:	**13.40**	

Base Unit Dimensions

Unit Length:	**48.3**	in
Unit Width:	**44.2**	in
Unit Height:	**44.8**	in
Base Unit Weight (Does not include any accessories):	**426**	lb

Unit

Unit Voltage-Phase-Hertz:	**208-1-60**	
Air Discharge:	**Vertical**	
Fan Drive Type:	**Direct**	
Actual Airflow:	**1590**	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:	**58.8**	F
Evaporator Leaving Air WB:	**57.8**	F
Evaporator Leaving Air Enthalpy:	**24.87**	BTU/lb
Net Cooling Capacity:	**46.97**	MBH
Net Sensible Capacity:	**36.33**	MBH
Total Unit Power Input:	**4.09**	kW
Coil Bypass Factor:	**0.000**	

Heating Performance

Outdoor Ambient Temperature:	**47.0**	F
Entering Air Indoor Coil DB:	**70.0**	F
Leaving Air Indoor Coil DB:	**96.7**	F
Total Heating Capacity:	**45.86**	MBH
Integrated Heating Capacity:	**45.86**	MBH
Heating Power Input:	**3.64**	kW
High Temperature COP:	**3.70**	
Low Temperature COP:	**2.30**	
HSPF2:	**6.7**	

Supply Fan

External Static Pressure:	**0.50**	in wg
Options / Accessories Static Pressure		
Wet Coil:	**0.11**	in wg
Application External Static (ESP + Unit Opts/Acc.):	**0.61**	in wg
Fan Power:	**0.57**	BHP
Fan Motor Size, hp:	**1**	
NOTE:	**Medium Motor Speed, Vert**	

Selection includes construction throwaway filter into the base fan curve. This filter is not MERV Rated.

Electrical Data

Minimum Voltage:	**197**
Maximum Voltage:	**253**
Compressor RLA:	**19.7**
Compressor LRA:	**130**
Outdoor Fan FLA (ea):	**1.2**
Indoor Fan Motor FLA (Total):	**6.9**
Power Supply MCA:	**32.7**

Power Supply MOCP (Fuse or HACR): **50**

Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

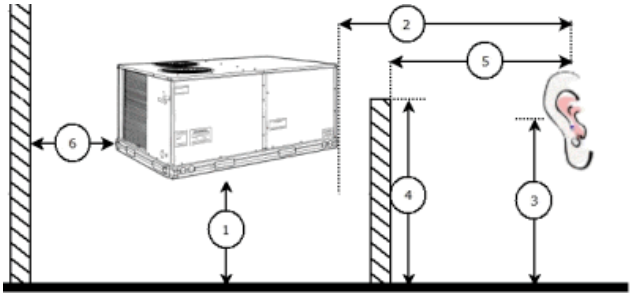
Acoustics

Sound Rating: **74.0** db

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	NA	NA	NA
125 Hz	NA	NA	56.9
250 Hz	NA	NA	59.3
500 Hz	NA	NA	63.9
1000 Hz	NA	NA	64.5
2000 Hz	NA	NA	61.7
4000 Hz	NA	NA	55.4
8000 Hz	NA	NA	47.4

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	0.0	56.9	59.3	63.9	64.5	61.7	55.4	47.4	69.3 Lw
B	-26.2	40.8	50.7	60.7	64.5	62.9	56.4	46.3	68.2 LwA
C	0.0	24.5	26.9	31.5	32.1	29.3	23.0	15.0	36.9 Lp
D	-26.2	8.4	18.3	28.3	32.1	30.5	24.0	13.9	35.8 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.

Bldg E E-1,2

Tag Cover Sheet
Unit Report
Certified Drawing
Performance Report

Unit Report For Bldg E E-1,2

Project: Lynwood USD Will Rogers Elementary 02/01/2024
Prepared By: 01:40PM

Unit Parameters

Unit Model: **50VT-K48---3**
Unit Size: **48 (4 Tons)**
Volts-Phase-Hertz: **208-1-60**
Heating Type: **Heat Pump**
Duct Cfg: **Horizontal Supply / Horizontal Return**

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **4' 0.25"**
Unit Width: **3' 8.1875"**
Unit Height: **3' 8.75"**

*** Weights and Dimensions are approximate. Weight does not include roof curbs, unit packaging, field installed accessories or factory installed options. Approximate dimensions are provided primarily for shipping purposes. For exact dimensions and weights, refer to appropriate product data catalog.

Base Unit Weight (Does not include any accessories):
426 lb

Warranty Information

1 year warranty on parts
5 yearwarranty on compressor

No optional warranties were selected.

NOTE: Please see Warranty Catalog 500-089 for explanation of policies and ordering methods.

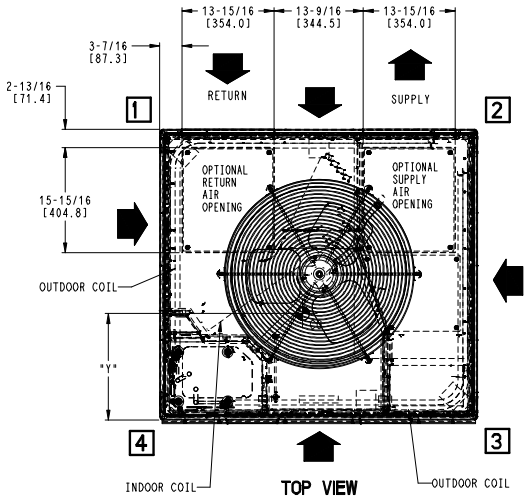
Ordering Information

Part Number	Description	Quantity
50VT-K48---3	Rooftop Unit	2

CARRIER / BRYANT HP (LARGE CHASSIS)

COOLING CAPACITY	UNIT WT.		UNIT HEIGHT IN/MM		CENTER OF GRAVITY IN/MM					
	LB	KG	"A"		X		Y		Z	
36	406	184.2	54-3/4	1391	20-1/2	521	17-1/2	445	17-3/8	441
42	426	193.3	54-3/4	1391	20-1/2	521	17-1/2	445	17-3/8	448
48	426	193.3	44-3/4	1137	20-1/2	521	17-1/2	445	17-3/8	448
60	496	225.0	48-3/4	1238	20-1/2	521	17-1/2	445	18	457

UNIT	CORNER WEIGHT LB/KG							
	"1"		"2"		"3"		"4"	
36	88.6	40.2	78.4	35.6	78.4	51.1	112.6	57.4
42	92.9	42.2	82.4	37.4	82.4	53.7	118.3	60.0
48	92.6	42.0	82.5	37.4	82.5	53.5	117.9	60.4
60	107.5	48.8	95.5	43.3	95.5	62.5	137.8	70.4



TOP VIEW

REQUIRED CLEARANCES TO COMBUSTIBLE MATL.

	INCHES [MM]
TOP OF UNIT	14 [355.6]
DUCT SIDE OF UNIT	2 [50.8]
SIDE OPPOSITE DUCTS	14 [355.6]
BOTTOM OF UNIT	0 [0.0]
ELECTRICAL PANEL	36 [914.4]

NEC. REQUIRED CLEARANCES.

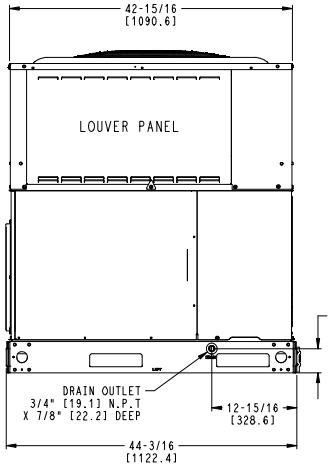
	INCHES [MM]
BETWEEN UNITS, POWER ENTRY SIDE	42 [1066.8]
UNIT AND UNGROUNDED SURFACES, POWER ENTRY SIDE	36 [914.0]
UNIT AND BLOCK OR CONCRETE WALLS AND OTHER GROUNDED SURFACES, POWER ENTRY SIDE	42 [1066.8]

REQUIRED CLEARANCE FOR OPERATION AND SERVICING

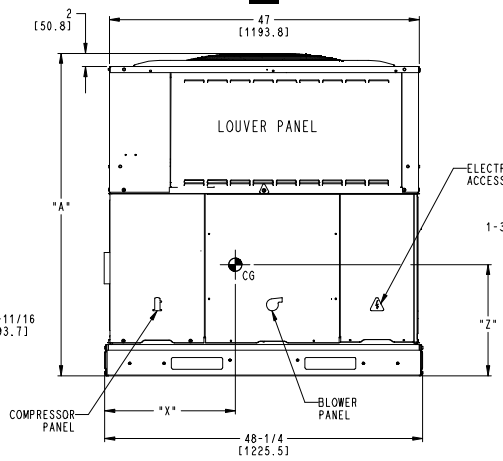
	INCHES [MM]
EVAP. COIL ACCESS SIDE	36 [914.0]
POWER ENTRY SIDE	42 [1066.8]
(EXCEPT FOR NEC REQUIREMENTS)	
UNIT TOP	48 [1219.2]
SIDE OPPOSITE DUCTS	36 [914.0]
DUCT PANEL	12 [304.8]*

*MINIMUM DISTANCES:IF UNIT IS PLACED LESS THAN 12 [304.8] FROM WALL SYSTEM,THEN SYSTEM PERFORMANCE MAYBE COMPROMISED.

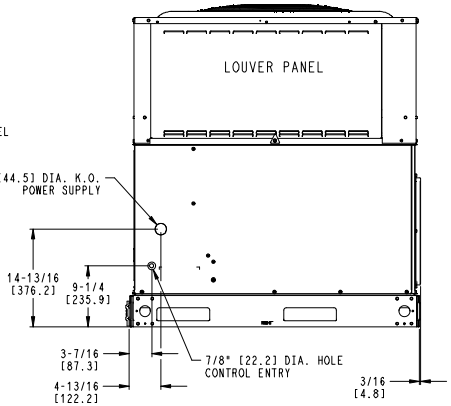
DIMENSIONS IN [] ARE IN MILLIMETERS



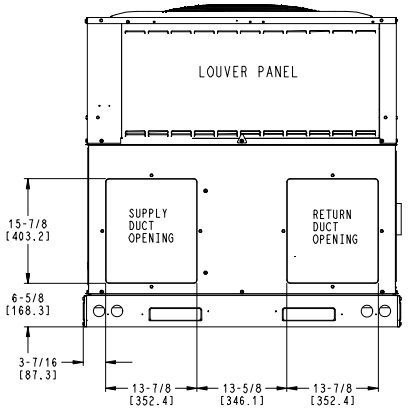
LEFT SIDE VIEW



FRONT VIEW



RIGHT SIDE VIEW



REAR VIEW

10/19/22	UPDATED TABLE DIMS.	SINGLE ZONE ELECTRIC COOLING & HEAT(LG)	SD5770-4	A

Part Number:50VT-K48---3

ARI SEER2:	**13.40**	

Base Unit Dimensions

Unit Length:	**48.3**	in
Unit Width:	**44.2**	in
Unit Height:	**44.8**	in
Base Unit Weight (Does not include any accessories):	**426**	lb

Unit

Unit Voltage-Phase-Hertz:	**208-1-60**	
Air Discharge:	**Horizontal**	
Fan Drive Type:	**Direct**	
Actual Airflow:	**1590**	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:	**58.8**	F
Evaporator Leaving Air WB:	**57.8**	F
Evaporator Leaving Air Enthalpy:	**24.87**	BTU/lb
Net Cooling Capacity:	**46.97**	MBH
Net Sensible Capacity:	**36.33**	MBH
Total Unit Power Input:	**4.09**	kW
Coil Bypass Factor:	**0.000**	

Heating Performance

Outdoor Ambient Temperature:	**47.0**	F
Entering Air Indoor Coil DB:	**70.0**	F
Leaving Air Indoor Coil DB:	**96.7**	F
Total Heating Capacity:	**45.86**	MBH
Integrated Heating Capacity:	**45.86**	MBH
Heating Power Input:	**3.64**	kW
High Temperature COP:	**3.70**	
Low Temperature COP:	**2.30**	
HSPF2:	**6.7**	

Supply Fan

External Static Pressure:	**0.50**	in wg
Options / Accessories Static Pressure		
Wet Coil:	**0.11**	in wg
Application External Static (ESP + Unit Opts/Acc.):	**0.61**	in wg
Fan Power:	**0.57**	BHP
Fan Motor Size, hp:	**1**	
NOTE:	**Medium Motor Speed, Horz**	

Selection includes construction throwaway filter into the base fan curve. This filter is not MERV Rated.

Electrical Data

Minimum Voltage:	**197**
Maximum Voltage:	**253**
Compressor RLA:	**19.7**
Compressor LRA:	**130**
Outdoor Fan FLA (ea):	**1.2**
Indoor Fan Motor FLA (Total):	**6.9**
Power Supply MCA:	**32.7**

Power Supply MOCP (Fuse or HACR): **50**

Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

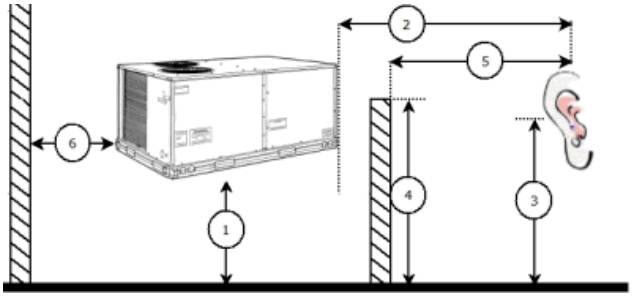
Acoustics

Sound Rating: **74.0** db

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	NA	NA	NA
125 Hz	NA	NA	56.9
250 Hz	NA	NA	59.3
500 Hz	NA	NA	63.9
1000 Hz	NA	NA	64.5
2000 Hz	NA	NA	61.7
4000 Hz	NA	NA	55.4
8000 Hz	NA	NA	47.4

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	0.0	56.9	59.3	63.9	64.5	61.7	55.4	47.4	69.3 Lw
B	-26.2	40.8	50.7	60.7	64.5	62.9	56.4	46.3	68.2 LwA
C	0.0	24.5	26.9	31.5	32.1	29.3	23.0	15.0	36.9 Lp
D	-26.2	8.4	18.3	28.3	32.1	30.5	24.0	13.9	35.8 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.

Bldg F F-1

Tag Cover Sheet
Unit Report
Certified Drawing
Performance Report

Unit Parameters

Unit Model: **50VT-K48---3**
Unit Size: **48 (4 Tons)**
Volts-Phase-Hertz: **208-1-60**
Heating Type: **Heat Pump**
Duct Cfg: **Horizontal Supply / Horizontal Return**

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **4' 0.25"**
Unit Width: **3' 8.1875"**
Unit Height: **3' 8.75"**

***** Weights and Dimensions are approximate. Weight does not include roof curbs, unit packaging, field installed accessories or factory installed options. Approximate dimensions are provided primarily for shipping purposes. For exact dimensions and weights, refer to appropriate product data catalog.

Base Unit Weight (Does not include any accessories):
426 lb

Warranty Information

1 year warranty on parts
5 yearwarranty on compressor

No optional warranties were selected.

NOTE: Please see Warranty Catalog 500-089 for explanation of policies and ordering methods.

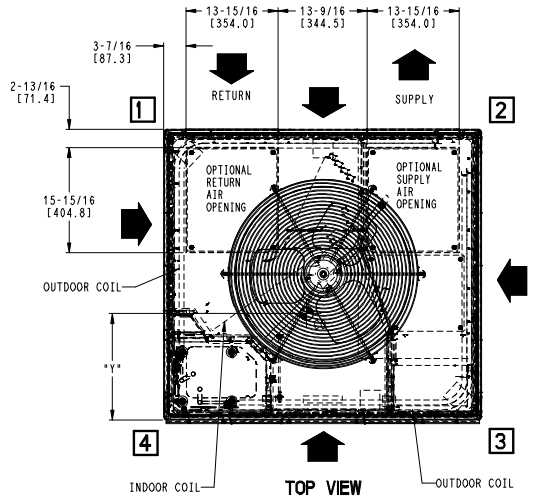
Ordering Information

Part Number	Description	Quantity
50VT-K48---3	Rooftop Unit	1

CARRIER / BRYANT HP (LARGE CHASSIS)

COOLING CAPACITY	UNIT WT.		UNIT HEIGHT IN/MM		CENTER OF GRAVITY IN/MM					
	LB	KG	"A"		X		Y		Z	
36	406	184.2	54-3/4	1391	20-1/2	521	17-1/2	445	17-3/8	441
42	426	193.3	54-3/4	1391	20-1/2	521	17-1/2	445	17-3/8	448
48	426	193.3	44-3/4	1137	20-1/2	521	17-1/2	445	17-3/8	448
60	496	225.0	48-3/4	1238	20-1/2	521	17-1/2	445	18	457

UNIT	CORNER WEIGHT LB/KG							
	"1"		"2"		"3"		"4"	
36	88.6	40.2	78.4	35.6	78.4	51.1	112.6	57.4
42	92.9	42.2	82.4	37.4	82.4	53.7	118.3	60.0
48	92.6	42.0	82.5	37.4	82.5	53.5	117.9	60.4
60	107.5	48.8	95.5	43.3	95.5	62.5	137.8	70.4



TOP VIEW

REQUIRED CLEARANCES TO COMBUSTIBLE MATL.

	INCHES [MM]
TOP OF UNIT	14 [355.6]
DUCT SIDE OF UNIT	2 [50.8]
SIDE OPPOSITE DUCTS	14 [355.6]
BOTTOM OF UNIT	0 [0.0]
ELECTRICAL PANEL	36 [914.4]

NEC. REQUIRED CLEARANCES.

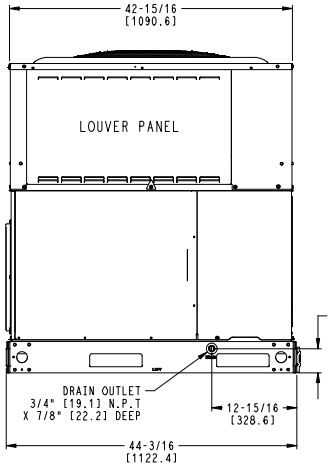
	INCHES [MM]
BETWEEN UNITS, POWER ENTRY SIDE	42 [1066.8]
UNIT AND UNGROUNDED SURFACES, POWER ENTRY SIDE	36 [914.0]
UNIT AND BLOCK OR CONCRETE WALLS AND OTHER GROUNDED SURFACES, POWER ENTRY SIDE	42 [1066.8]

REQUIRED CLEARANCE FOR OPERATION AND SERVICING

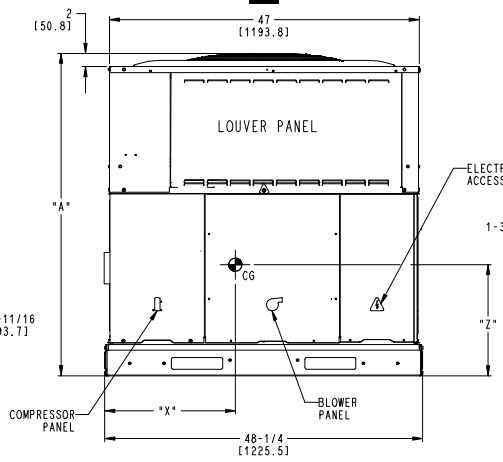
	INCHES [MM]
EVAP. COIL ACCESS SIDE	36 [914.0]
POWER ENTRY SIDE	42 [1066.8]
(EXCEPT FOR NEC REQUIREMENTS)	
UNIT TOP	48 [1219.2]
SIDE OPPOSITE DUCTS	36 [914.0]
DUCT PANEL	12 [304.8]*

*MINIMUM DISTANCES:IF UNIT IS PLACED LESS THAN 12 [304.8] FROM WALL SYSTEM,THEN SYSTEM PERFORMANCE MAYBE COMPROMISED.

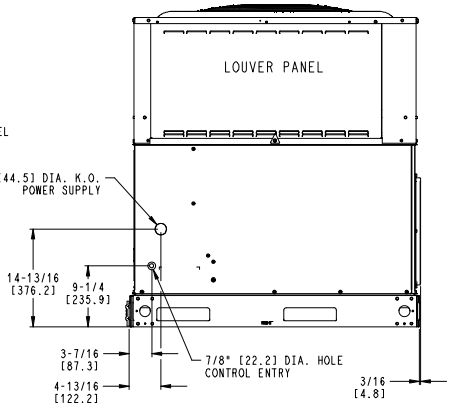
DIMENSIONS IN [] ARE IN MILLIMETERS



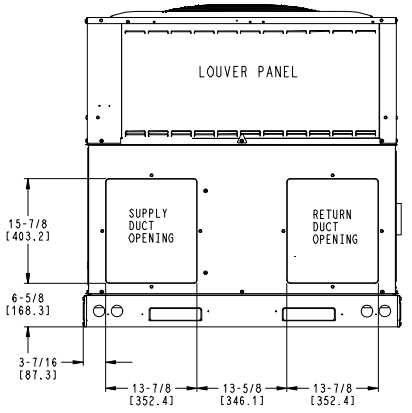
LEFT SIDE VIEW



FRONT VIEW



RIGHT SIDE VIEW



REAR VIEW

10/19/22	UPDATED TABLE DIMS.	SINGLE ZONE ELECTRIC COOLING & HEAT(LG)	SD5770-4	A

Part Number:50VT-K48---3

ARI SEER2:	**13.40**	

Base Unit Dimensions

Unit Length:	**48.3**	in
Unit Width:	**44.2**	in
Unit Height:	**44.8**	in
Base Unit Weight (Does not include any accessories):	**426**	lb

Unit

Unit Voltage-Phase-Hertz:	**208-1-60**	
Air Discharge:	**Vertical**	
Fan Drive Type:	**Direct**	
Actual Airflow:	**1590**	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:	**58.8**	F
Evaporator Leaving Air WB:	**57.8**	F
Evaporator Leaving Air Enthalpy:	**24.87**	BTU/lb
Net Cooling Capacity:	**46.97**	MBH
Net Sensible Capacity:	**36.33**	MBH
Total Unit Power Input:	**4.09**	kW
Coil Bypass Factor:	**0.000**	

Heating Performance

Outdoor Ambient Temperature:	**47.0**	F
Entering Air Indoor Coil DB:	**70.0**	F
Leaving Air Indoor Coil DB:	**96.7**	F
Total Heating Capacity:	**45.86**	MBH
Integrated Heating Capacity:	**45.86**	MBH
Heating Power Input:	**3.64**	kW
High Temperature COP:	**3.70**	
Low Temperature COP:	**2.30**	
HSPF2:	**6.7**	

Supply Fan

External Static Pressure:	**0.50**	in wg
Options / Accessories Static Pressure		
Wet Coil:	**0.11**	in wg
Application External Static (ESP + Unit Opts/Acc.):	**0.61**	in wg
Fan Power:	**0.57**	BHP
Fan Motor Size, hp:	**1**	
NOTE:	**Medium Motor Speed, Horz**	

Selection includes construction throwaway filter into the base fan curve. This filter is not MERV Rated.

Electrical Data

Minimum Voltage:	**197**
Maximum Voltage:	**253**
Compressor RLA:	**19.7**
Compressor LRA:	**130**
Outdoor Fan FLA (ea):	**1.2**
Indoor Fan Motor FLA (Total):	**6.9**
Power Supply MCA:	**32.7**

Power Supply MOCP (Fuse or HACR): **50**

Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

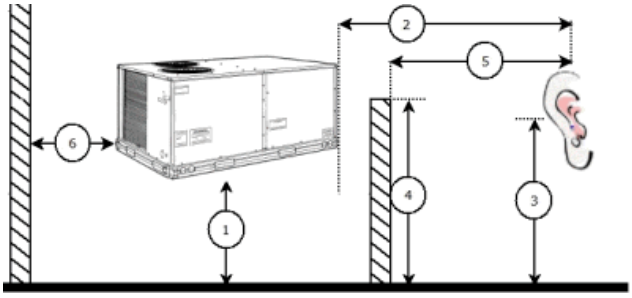
Acoustics

Sound Rating: **74.0** db

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	NA	NA	NA
125 Hz	NA	NA	56.9
250 Hz	NA	NA	59.3
500 Hz	NA	NA	63.9
1000 Hz	NA	NA	64.5
2000 Hz	NA	NA	61.7
4000 Hz	NA	NA	55.4
8000 Hz	NA	NA	47.4

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	0.0	56.9	59.3	63.9	64.5	61.7	55.4	47.4	69.3 Lw
B	-26.2	40.8	50.7	60.7	64.5	62.9	56.4	46.3	68.2 LwA
C	0.0	24.5	26.9	31.5	32.1	29.3	23.0	15.0	36.9 Lp
D	-26.2	8.4	18.3	28.3	32.1	30.5	24.0	13.9	35.8 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.

Bldg F F-2

Tag Cover Sheet
Unit Report
Certified Drawing
Performance Report

Unit Parameters

Unit Model: **50VT-K48---3**
Unit Size: **48 (4 Tons)**
Volts-Phase-Hertz: **208-1-60**
Heating Type: **Heat Pump**
Duct Cfg: **Vertical Supply / Vertical Return**

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **4' 0.25"**
Unit Width: **3' 8.1875"**
Unit Height: **3' 8.75"**

*** Weights and Dimensions are approximate. Weight does not include roof curbs, unit packaging, field installed accessories or factory installed options. Approximate dimensions are provided primarily for shipping purposes. For exact dimensions and weights, refer to appropriate product data catalog.

Base Unit Weight (Does not include any accessories):
426 lb

Warranty Information

1 year warranty on parts
5 yearwarranty on compressor

No optional warranties were selected.

NOTE: Please see Warranty Catalog 500-089 for explanation of policies and ordering methods.

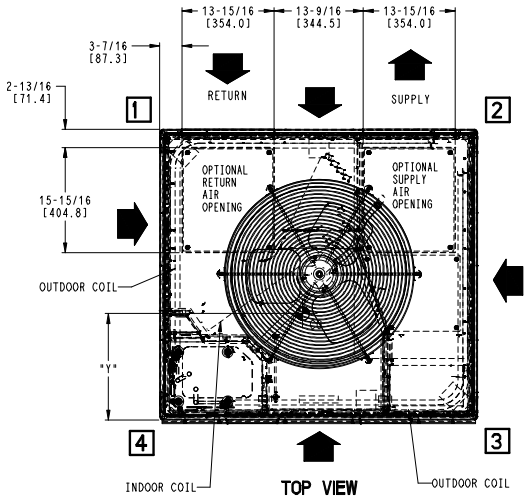
Ordering Information

Part Number	Description	Quantity
50VT-K48---3	Rooftop Unit	1

CARRIER / BRYANT HP (LARGE CHASSIS)

COOLING CAPACITY	UNIT WT.		UNIT HEIGHT IN/MM		CENTER OF GRAVITY IN/MM					
	LB	KG	"A"		X		Y		Z	
36	406	184.2	54-3/4	1391	20-1/2	521	17-1/2	445	17-3/8	441
42	426	193.3	54-3/4	1391	20-1/2	521	17-1/2	445	17-3/8	448
48	426	193.3	44-3/4	1137	20-1/2	521	17-1/2	445	17-3/8	448
60	496	225.0	48-3/4	1238	20-1/2	521	17-1/2	445	18	457

UNIT	CORNER WEIGHT LB/KG							
	"1"		"2"		"3"		"4"	
36	88.6	40.2	78.4	35.6	78.4	51.1	112.6	57.4
42	92.9	42.2	82.4	37.4	82.4	53.7	118.3	60.0
48	92.6	42.0	82.5	37.4	82.5	53.5	117.9	60.4
60	107.5	48.8	95.5	43.3	95.5	62.5	137.8	70.4



TOP VIEW

REQUIRED CLEARANCES TO COMBUSTIBLE MATL.

	INCHES [MM]
TOP OF UNIT	14 [355.6]
DUCT SIDE OF UNIT	2 [50.8]
SIDE OPPOSITE DUCTS	14 [355.6]
BOTTOM OF UNIT	0 [0.0]
ELECTRICAL PANEL	36 [914.4]

NEC. REQUIRED CLEARANCES.

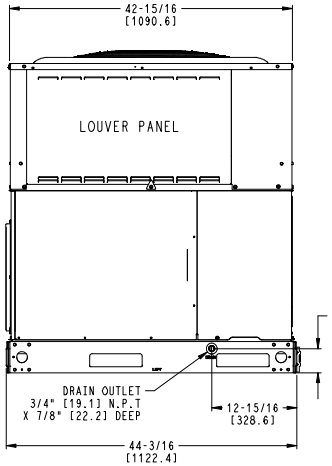
	INCHES [MM]
BETWEEN UNITS, POWER ENTRY SIDE	42 [1066.8]
UNIT AND UNGROUNDED SURFACES, POWER ENTRY SIDE	36 [914.0]
UNIT AND BLOCK OR CONCRETE WALLS AND OTHER GROUNDED SURFACES, POWER ENTRY SIDE	42 [1066.8]

REQUIRED CLEARANCE FOR OPERATION AND SERVICING

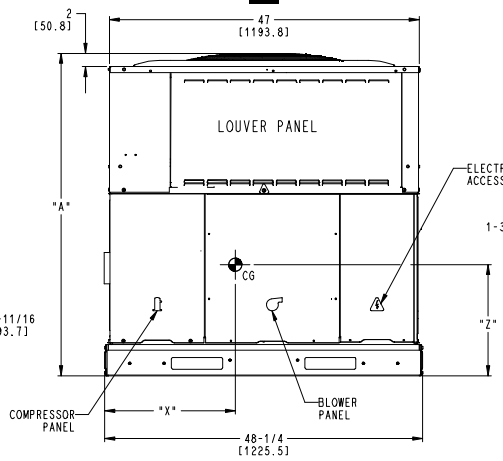
	INCHES [MM]
EVAP. COIL ACCESS SIDE	36 [914.0]
POWER ENTRY SIDE	42 [1066.8]
(EXCEPT FOR NEC REQUIREMENTS)	
UNIT TOP	48 [1219.2]
SIDE OPPOSITE DUCTS	36 [914.0]
DUCT PANEL	12 [304.8]*

*MINIMUM DISTANCES:IF UNIT IS PLACED LESS THAN 12 [304.8] FROM WALL SYSTEM,THEN SYSTEM PERFORMANCE MAYBE COMPROMISED.

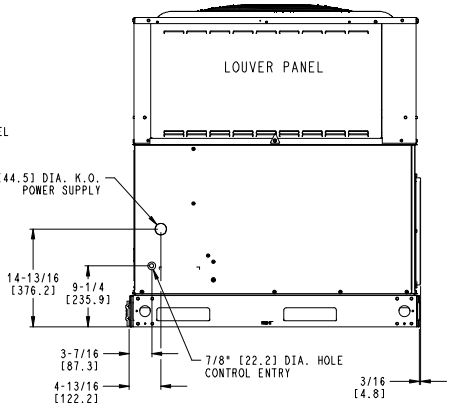
DIMENSIONS IN [] ARE IN MILLIMETERS



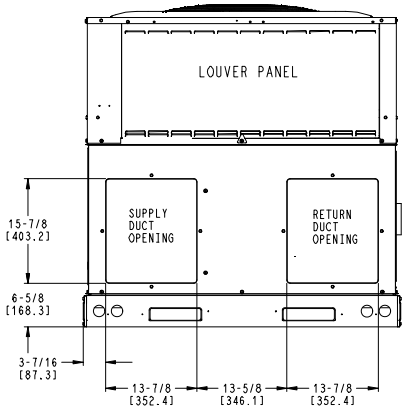
LEFT SIDE VIEW



FRONT VIEW



RIGHT SIDE VIEW



REAR VIEW

10/19/22	UPDATED TABLE DIMS.	SINGLE ZONE ELECTRIC COOLING & HEAT(LG)	SD5770-4	A

Part Number:50VT-K48---3

ARI SEER2:	**13.40**	

Base Unit Dimensions

Unit Length:	**48.3**	in
Unit Width:	**44.2**	in
Unit Height:	**44.8**	in
Base Unit Weight (Does not include any accessories):	**426**	lb

Unit

Unit Voltage-Phase-Hertz:	**208-1-60**	
Air Discharge:	**Vertical**	
Fan Drive Type:	**Direct**	
Actual Airflow:	**1590**	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:	**58.8**	F
Evaporator Leaving Air WB:	**57.8**	F
Evaporator Leaving Air Enthalpy:	**24.87**	BTU/lb
Net Cooling Capacity:	**46.97**	MBH
Net Sensible Capacity:	**36.33**	MBH
Total Unit Power Input:	**4.09**	kW
Coil Bypass Factor:	**0.000**	

Heating Performance

Outdoor Ambient Temperature:	**47.0**	F
Entering Air Indoor Coil DB:	**70.0**	F
Leaving Air Indoor Coil DB:	**96.7**	F
Total Heating Capacity:	**45.86**	MBH
Integrated Heating Capacity:	**45.86**	MBH
Heating Power Input:	**3.64**	kW
High Temperature COP:	**3.70**	
Low Temperature COP:	**2.30**	
HSPF2:	**6.7**	

Supply Fan

External Static Pressure:	**0.50**	in wg
Options / Accessories Static Pressure		
Wet Coil:	**0.11**	in wg
Application External Static (ESP + Unit Opts/Acc.):	**0.61**	in wg
Fan Power:	**0.57**	BHP
Fan Motor Size, hp:	**1**	
NOTE:	**Medium Motor Speed, Vert**	

Selection includes construction throwaway filter into the base fan curve. This filter is not MERV Rated.

Electrical Data

Minimum Voltage:	**197**
Maximum Voltage:	**253**
Compressor RLA:	**19.7**
Compressor LRA:	**130**
Outdoor Fan FLA (ea):	**1.2**
Indoor Fan Motor FLA (Total):	**6.9**
Power Supply MCA:	**32.7**

Power Supply MOCP (Fuse or HACR): **50**

Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

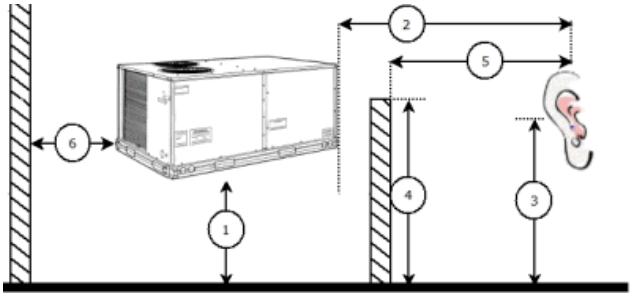
Acoustics

Sound Rating: **74.0** db

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	NA	NA	NA
125 Hz	NA	NA	56.9
250 Hz	NA	NA	59.3
500 Hz	NA	NA	63.9
1000 Hz	NA	NA	64.5
2000 Hz	NA	NA	61.7
4000 Hz	NA	NA	55.4
8000 Hz	NA	NA	47.4

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	0.0	56.9	59.3	63.9	64.5	61.7	55.4	47.4	69.3 Lw
B	-26.2	40.8	50.7	60.7	64.5	62.9	56.4	46.3	68.2 LwA
C	0.0	24.5	26.9	31.5	32.1	29.3	23.0	15.0	36.9 Lp
D	-26.2	8.4	18.3	28.3	32.1	30.5	24.0	13.9	35.8 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.

Bldg H-1,2,3,4,7,8,9,10,15-18,23,24

Tag Cover Sheet
Unit Report
Certified Drawing
Performance Report

Unit Parameters

Unit Model: **48FCGA06A2M6-3A0A0**
Unit Size: **06 (5 Tons)**
Volts-Phase-Hertz: **460-3-60**
Heating Type: **Gas**
Heat Control: **Ultra Low NOx, Low Heat**
Duct Cfg: **Vertical Supply / Vertical Return**
DX Options: **Standard One Stage Cooling Models**

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **6' 2.375"**
Unit Width: **3' 10.625"**
Unit Height: **2' 9.375"**
Total Operating Weight: 601 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: **1/2**
Condensate Drain Line Size: **3/4**
Return Air Filter Type: **Throwaway**
Return Air Filter Quantity: **2**
Return Air Filter Size: **16 x 25 x 2**

Selection includes construction throwaway filter into the base fan curve.

Unit Configuration

Direct Drive - EcoBlue - Medium Static
Al/Cu - Al/Cu - Louvered Hail Guards
SystemVu Controls
Standard Packaging

Warranty Information

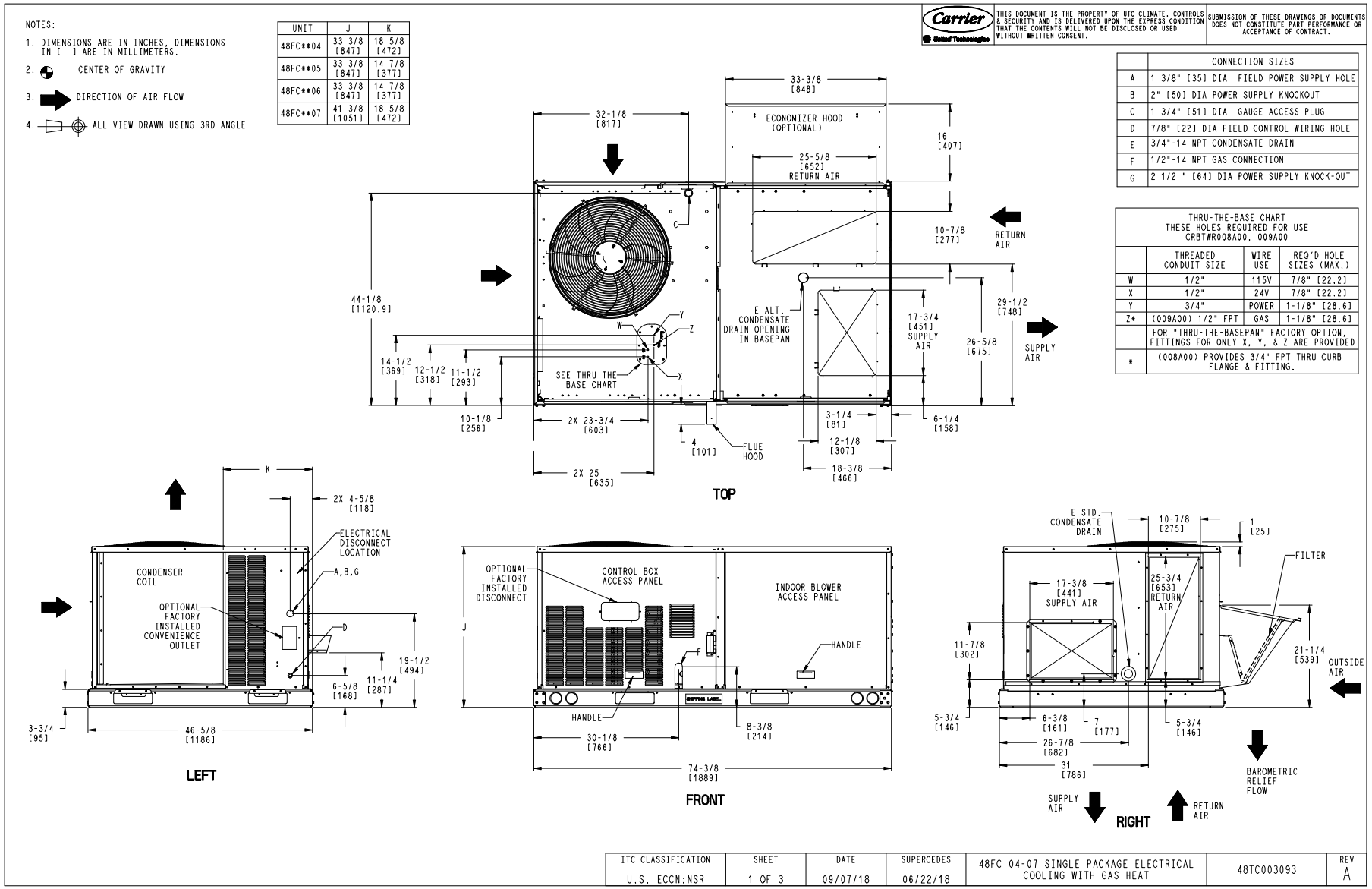
1-Year parts(std.)
5-Year compressor parts(std.)
3-Year SystemVu

No optional warranties were selected.

NOTE: Please see Warranty Catalog 500-089 for explanation of policies and ordering methods.

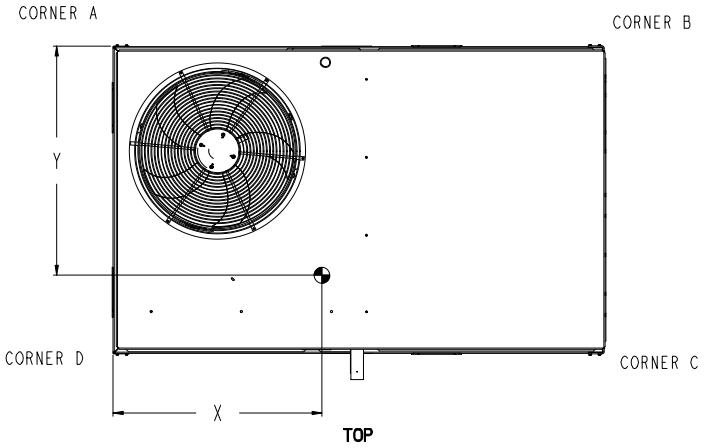
Ordering Information

Part Number	Description	Quantity
48FCGA06A2M6-3A0A0	Rooftop Unit	14

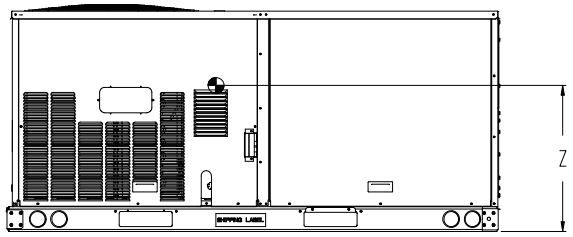

NOTES:
1. DIMENSIONS ARE IN INCHES. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY
3. DIRECTION OF AIR FLOW
4. ALL VIEW DRAWN USING 3RD ANGLE
UNIT J K
48FC**04 33 3/8 [847] 18 5/8 [472]
48FC**05 33 3/8 [847] 14 7/8 [377]
48FC**06 33 3/8 [847] 14 7/8 [377]
48FC**07 41 3/8 [1051] 18 5/8 [472]
Carrier
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SUBMISSION OF THESE DRAWINGS OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.
CONNECTION SIZES
A 1 3/8" [35] DIA FIELD POWER SUPPLY HOLE
B 2" [50] 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
G 2 1/2 " [64] DIA POWER SUPPLY KNOCK-OUT
THRU-THE-BASE CHART
THESE HOLES REQUIRED FOR USE CRBTWR008A00, 009A00
THREADED CONDUIT SIZE
WIRE USE
REQ'D HOLE SIZES (MAX.)
W 1/2" 115V 7/8" [22.2]
X 1/2" 24V 7/8" [22.2]
Y 3/4" POWER 1-1/8" [28.6]
Z* (009A00) 1/2" FPT GAS 1-1/8" [28.6]
FOR *THRU-THE-BASEPAN* FACTORY OPTION, FITTINGS FOR ONLY X, Y, & Z ARE PROVIDED
* (008A00) PROVIDES 3/4" FPT THRU CURB FLANGE & FITTING.
33-3/8 [848]
32-1/8 [817]
ECONOMIZER HOOD (OPTIONAL)
25-5/8 [652] RETURN AIR
16 [407]
10-7/8 [277]
RETURN AIR
44-1/8 [1120.9]
E ALT. CONDENSATE DRAIN OPENING IN BASEPAN
17-3/4 [451] SUPPLY AIR
29-1/2 [748]
26-5/8 [675]
SUPPLY AIR
14-1/2 [369]
12-1/2 [318]
11-1/2 [293]
SEE THRU THE BASE CHART
10-1/8 [256]
2X 23-3/4 [603]
2X 25 [635]
4 [101]
FLUE HOOD
3-1/4 [81]
12-1/8 [307]
18-3/8 [466]
6-1/4 [158]
TOP
K
2X 4-5/8 [118]
ELECTRICAL DISCONNECT LOCATION
A,B,G
CONDENSER COIL
OPTIONAL FACTORY INSTALLED CONVENIENCE OUTLET
D
19-1/2 [494]
11-1/4 [287]
6-5/8 [168]
3-3/4 [95]
46-5/8 [1186]
LEFT
OPTIONAL FACTORY INSTALLED DISCONNECT
CONTROL BOX ACCESS PANEL
INDOOR BLOWER ACCESS PANEL
J
F
HANDLE
HANDLE
30-1/8 [766]
8-3/8 [214]
74-3/8 [1889]
FRONT
E STD. CONDENSATE DRAIN
10-7/8 [275]
1 [25]
FILTER
17-3/8 [441] SUPPLY AIR
25-3/4 [653] RETURN AIR
11-7/8 [302]
21-1/4 [539]
OUTSIDE AIR
5-3/4 [146]
6-3/8 [161]
7 [177]
5-3/4 [146]
26-7/8 [682]
31 [786]
BAROMETRIC RELIEF FLOW
SUPPLY AIR
RETURN AIR
RIGHT
ITC CLASSIFICATION U.S. ECCN:NSR
SHEET 1 OF 3
DATE 09/07/18
SUPERCEDES 06/22/18
48FC 04-07 SINGLE PACKAGE ELECTRICAL COOLING WITH GAS HEAT
48TC003093
REV A

UNIT	STD. UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		HEIGHT
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48FC**04	482	219	113	51	116	53	128	58	125	57	37 5/8 [956]	24 9/16 [624]	18 1/4 [464]
48FC**05	543	246	138	63	133	60	133	60	138	63	36 1/2 [927]	23 3/8 [594]	18 [457]
48FC**06	556	252	142	64	136	62	136	62	142	64	36 1/2 [927]	23 3/8 [594]	18 [457]
48FC**07	607	275	162	73	152	69	141	64	151	68	36 [914]	22 1/2 [572]	19 3/8 [492]

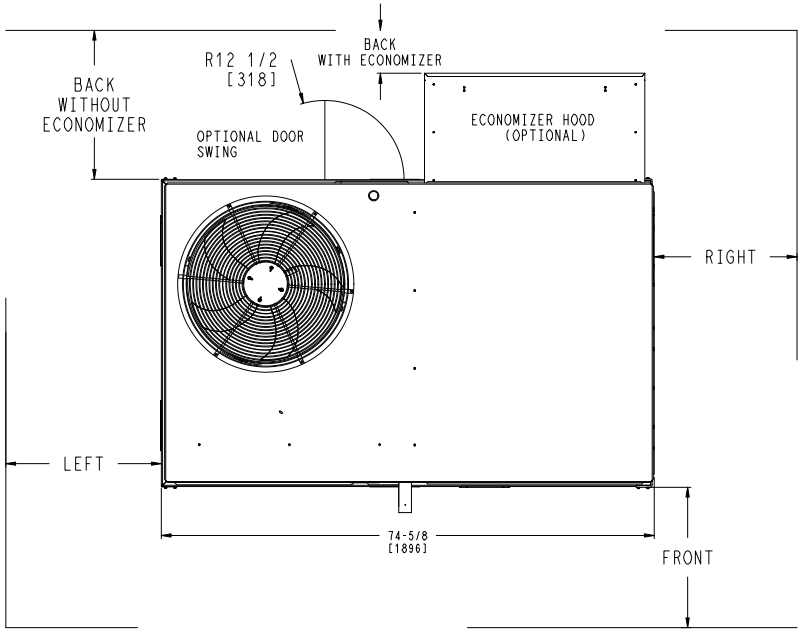
* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



TOP



FRONT



NOTES:

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	48 [1219mm]	42 [1067mm]	18 [457mm]
BACK W/HOOD	36 [914mm]	36 [914mm]	18 [457mm]
RIGHT	36 [914mm]	36 [914mm]	18 [457mm]
TOP	72 [1829mm]	72 [1829mm]	72 [1829mm]

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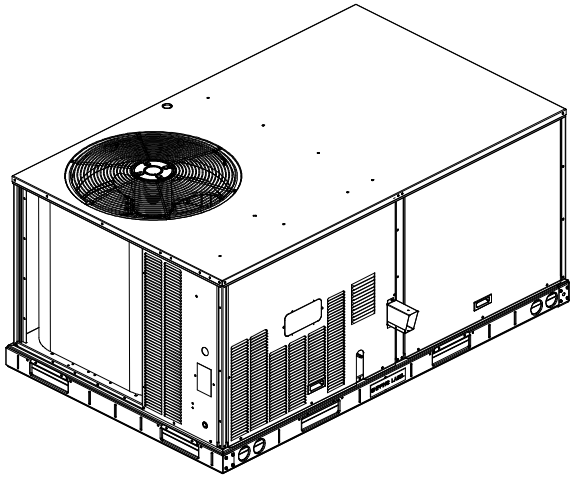
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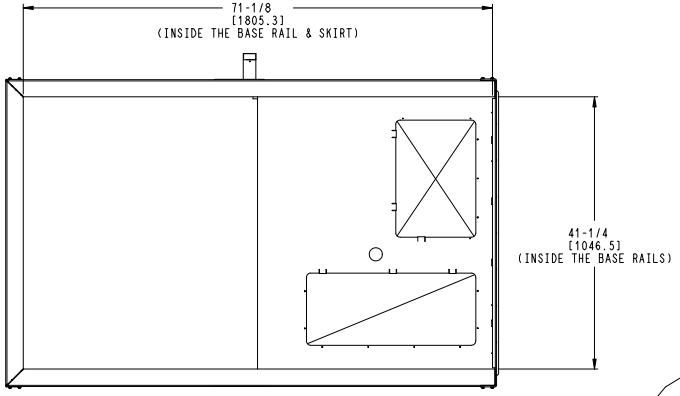
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	2 OF 3	09/07/18	06/22/18	48FC 04-07 SINGLE PACKAGE ELECTRICAL COOLING WITH GAS HEAT	48TC003093	A

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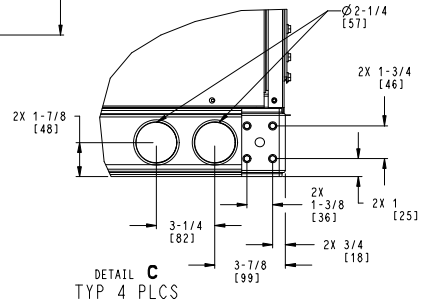
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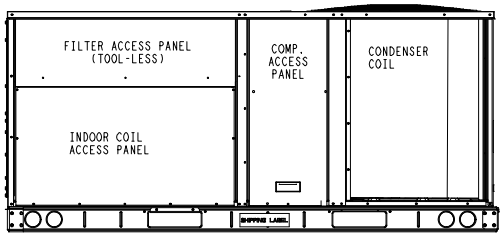


INSIDE BASERAIL DIMENSIONS

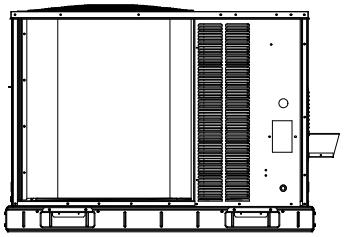
BOTTOM



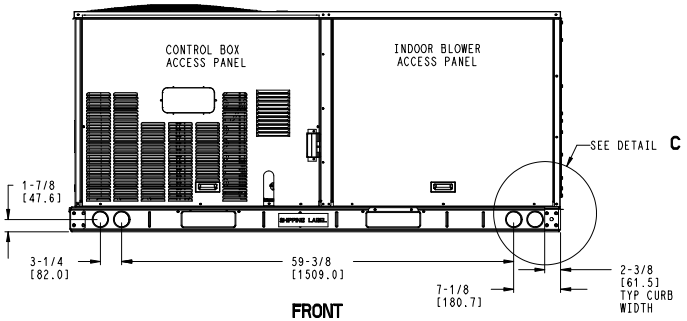
DETAIL **C**
TYP 4 PLCS



BACK



LEFT



FRONT

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	3 OF 3	09/07/18	06/22/18	48FC 04-07 SINGLE PACKAGE ELECTRICAL COOLING WITH GAS HEAT	48TC003093	A

Part Number:48FCGA06A2M6-3A0A0

ARI SEER:	**14.00**	
ARI SEER2:	**13.40**	

Base Unit Dimensions

Unit Length:	**74.4**	in
Unit Width:	**46.6**	in
Unit Height:	**33.4**	in

Operating Weight

Base Unit Weight:	**586**	lb
Al/Cu - Al/Cu - Louvered Hail Guards:	**13**	lb
SystemVu Controls:	**2**	lb
Total Operating Weight:	**601**	lb

Unit

Unit Voltage-Phase-Hertz:	**460-3-60**	
Air Discharge:	**Vertical**	
Fan Drive Type:	**Vane Axial**	
Actual Airflow:	**2000**	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:	**59.3**	F
Evaporator Leaving Air WB:	**57.7**	F
Evaporator Leaving Air Enthalpy:	**24.85**	BTU/lb
Gross Cooling Capacity:	**59.31**	MBH
Gross Sensible Capacity:	**44.73**	MBH
Compressor Power Input:	**4.14**	kW
Coil Bypass Factor:	**0.163**	

Heating Performance

Heating Airflow:	**2000**	CFM
Entering Air Temp:	**70.0**	F
Leaving Air Temp:	**92.7**	F
Gas Heating Input Capacity:	**60.0**	MBH
Gas Heating Output Capacity:	**49.0**	MBH
Temperature Rise:	**22.7**	F
Thermal Efficiency (%):	**81.0**	

Supply Fan

External Static Pressure:	**1.00**	in wg
Fan RPM:	**2363**	
Fan Power:	**1.42**	BHP
NOTE:	**Selected IFM RPM Range: 1478 - 2390**	

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:	**7.8**
Compressor #1 LRA:	**52**
Indoor Fan Motor Type:	**MED**
Indoor Fan Motor FLA (Total):	**2.1**
Combustion Fan Motor FLA (ea):	**0.25**

Power Supply MCA: **13**
Power Supply MOCP (Fuse or HACR): **20**
Disconnect Size FLA: **12**
Disconnect Size LRA: **57**
Electrical Convenience Outlet: **None**
Outdoor Fan [Qty / FLA (ea)]: **1 / 0.8**

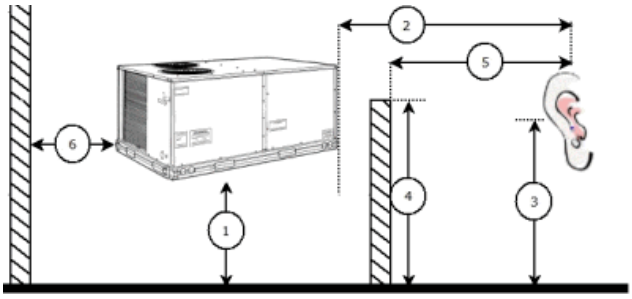
Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

Acoustics

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	96.7	94.7	85.6
125 Hz	88.5	84.6	84.7
250 Hz	82.7	75.5	80.5
500 Hz	77.7	71.8	76.0
1000 Hz	75.3	72.6	72.4
2000 Hz	72.1	63.5	68.0
4000 Hz	67.9	57.6	62.8
8000 Hz	62.9	50.2	59.3
A-Weighted	81.7	76.8	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

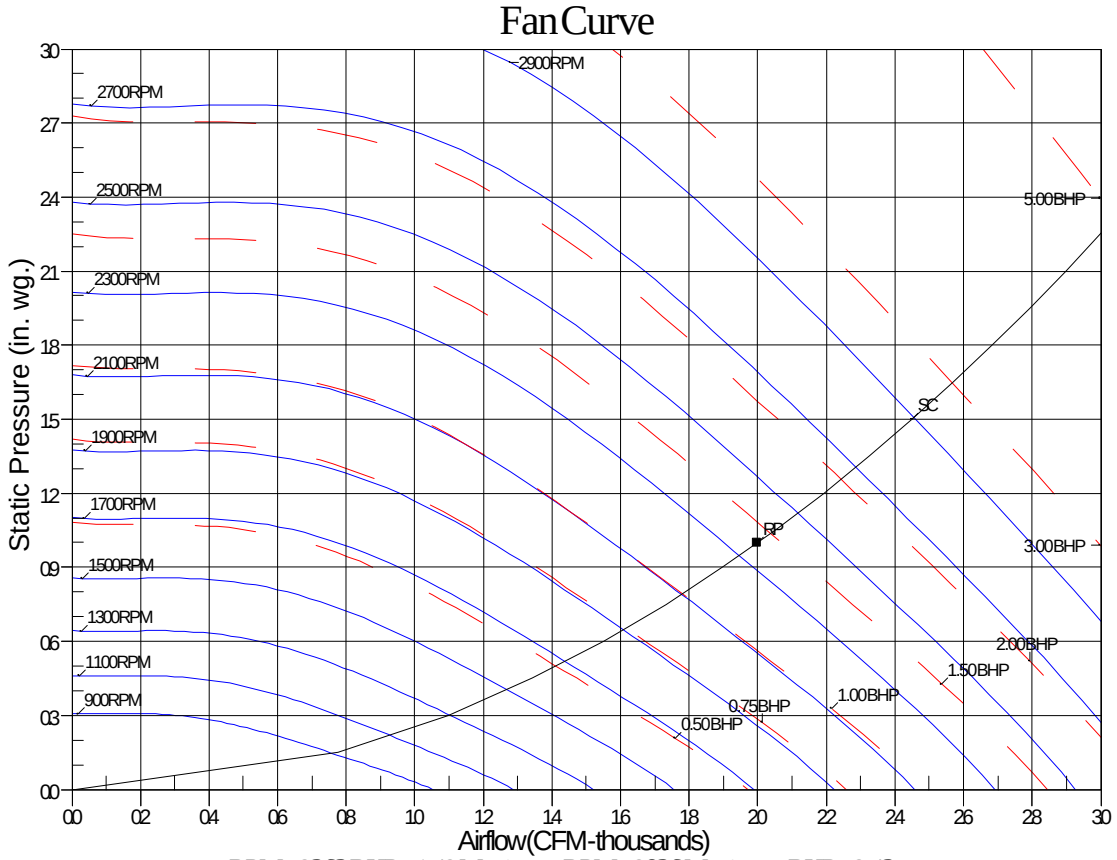
Detailed Acoustics Information

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

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=2363 BHP=1.42 Maximum RPM=2836 Maximum BHP=2.43
SC-System Curve RP-Rated Point

Bldg H-11-14,19-22

Tag Cover Sheet
Unit Report
Certified Drawing
Performance Report

Unit Parameters

Unit Model: **48FCGA05A2M6-3A0A0**
Unit Size: **05 (4 Tons)**
Volts-Phase-Hertz: **460-3-60**
Heating Type: **Gas**
Heat Control: **Ultra Low NOx, Low Heat**
Duct Cfg: **Vertical Supply / Vertical Return**
DX Options: **Standard One Stage Cooling Models**

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **6' 2.375"**
Unit Width: **3' 10.625"**
Unit Height: **2' 9.375"**
Total Operating Weight: **588** 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: **1/2**
Condensate Drain Line Size: **3/4**
Return Air Filter Type: **Throwaway**
Return Air Filter Quantity: **2**
Return Air Filter Size: **16 x 25 x 2**

Selection includes construction throwaway filter into the base fan curve.

Unit Configuration

Direct Drive - EcoBlue - Medium Static
Al/Cu - Al/Cu - Louvered Hail Guards
SystemVu Controls
Standard Packaging

Warranty Information

1-Year parts(std.)
5-Year compressor parts(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
48FCGA05A2M6-3A0A0	Rooftop Unit	8

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	J	K
48FC**04	33 3/8 [847]	18 5/8 [472]
48FC**05	33 3/8 [847]	14 7/8 [377]
48FC**06	33 3/8 [847]	14 7/8 [377]
48FC**07	41 3/8 [1051]	18 5/8 [472]

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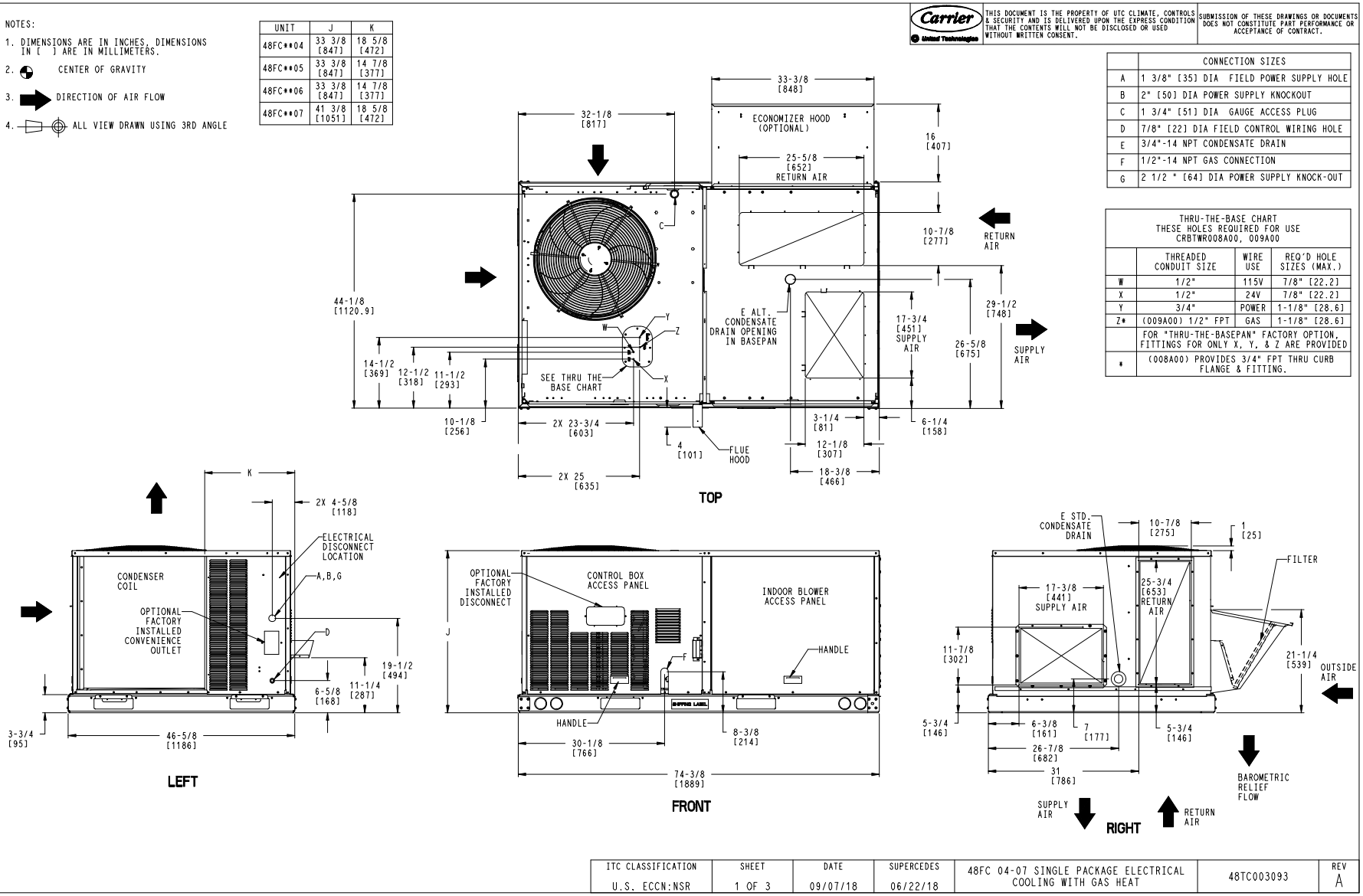
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	CONNECTION SIZES
A	1 3/8" [35] DIA FIELD POWER SUPPLY HOLE
B	2" [50] DIA POWER SUPPLY KNOCKOUT
C	1 3/4" [51] DIA GAUGE ACCESS PLUG
D	7/8" [22] DIA FIELD CONTROL WIRING HOLE
E	3/4"-14 NPT CONDENSATE DRAIN
F	1/2"-14 NPT GAS CONNECTION
G	2 1/2 " [64] DIA POWER SUPPLY KNOCK-OUT

THRU-THE-BASE CHART
THESE HOLES REQUIRED FOR USE CRBTWR008A00, 009A00

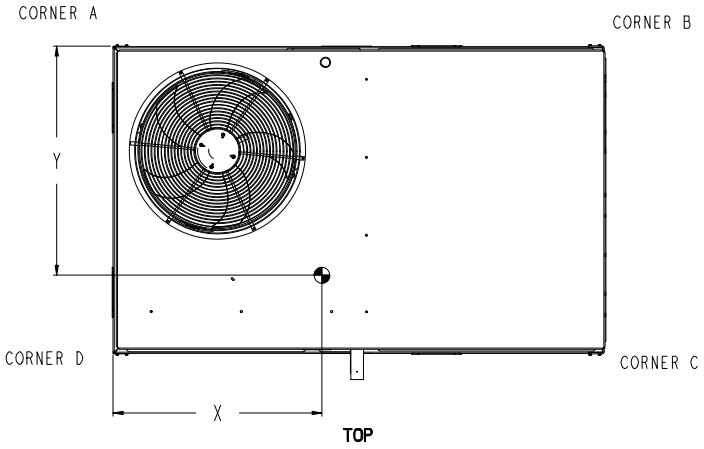
	THREADED CONDUIT SIZE	WIRE USE	REQ'D HOLE SIZES (MAX.)
W	1/2"	115V	7/8" [22.2]
X	1/2"	24V	7/8" [22.2]
Y	3/4"	POWER	1-1/8" [28.6]
Z*	(009A00) 1/2" FPT	GAS	1-1/8" [28.6]
	FOR "THRU-THE-BASEPAN" FACTORY OPTION, FITTINGS FOR ONLY X, Y, & Z ARE PROVIDED		
*	(008A00) PROVIDES 3/4" FPT THRU CURB FLANGE & FITTING.		



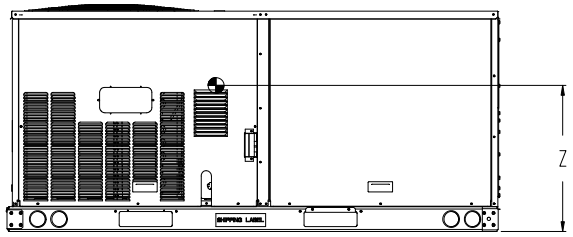
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	1 OF 3	09/07/18	06/22/18	48FC 04-07 SINGLE PACKAGE ELECTRICAL COOLING WITH GAS HEAT	48TC003093	A

UNIT	STD. UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		HEIGHT
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48FC**04	482	219	113	51	116	53	128	58	125	57	37 5/8 [956]	24 9/16 [624]	18 1/4 [464]
48FC**05	543	246	138	63	133	60	133	60	138	63	36 1/2 [927]	23 3/8 [594]	18 [457]
48FC**06	556	252	142	64	136	62	136	62	142	64	36 1/2 [927]	23 3/8 [594]	18 [457]
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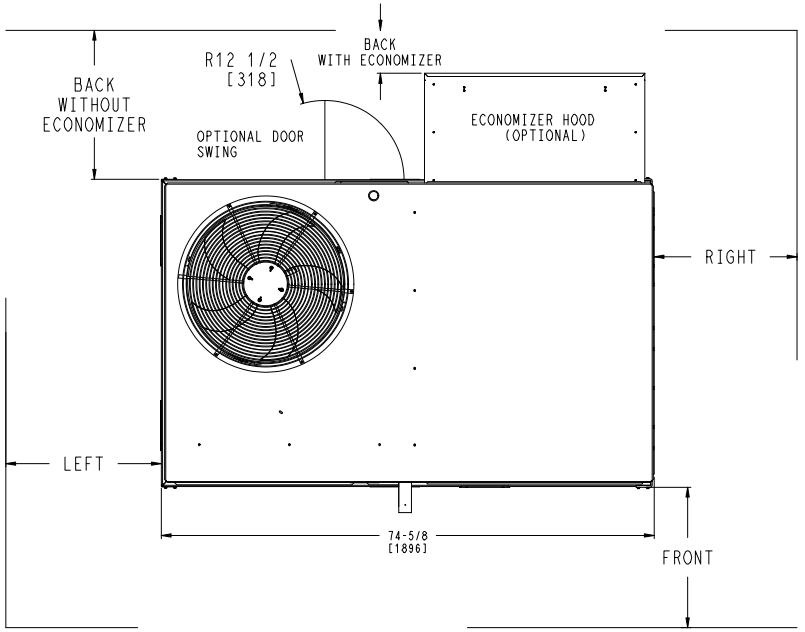
* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



TOP



FRONT



NOTES:

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	48 [1219mm]	42 [1067mm]	18 [457mm]
BACK W/HOOD	36 [914mm]	36 [914mm]	18 [457mm]
RIGHT	36 [914mm]	36 [914mm]	18 [457mm]
TOP	72 [1829mm]	72 [1829mm]	72 [1829mm]

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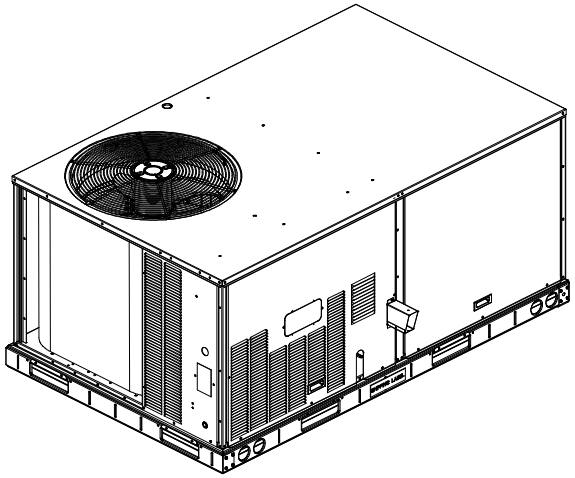
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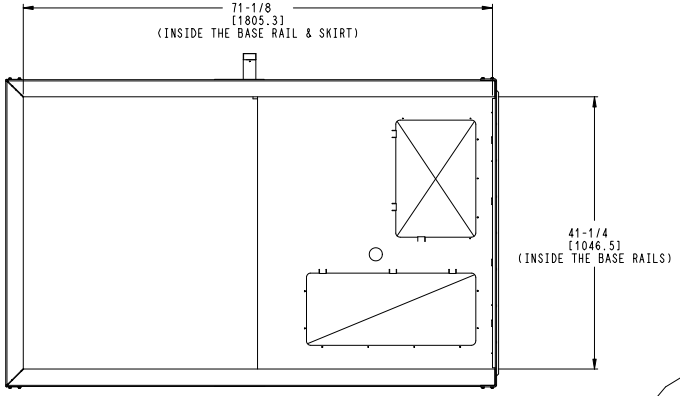
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	2 OF 3	09/07/18	06/22/18	48FC 04-07 SINGLE PACKAGE ELECTRICAL COOLING WITH GAS HEAT	48TC003093	A

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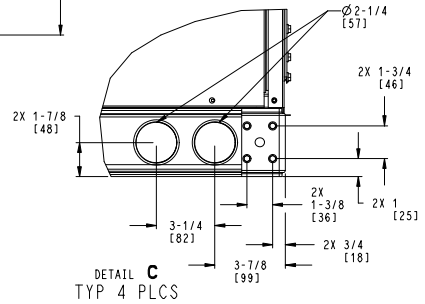
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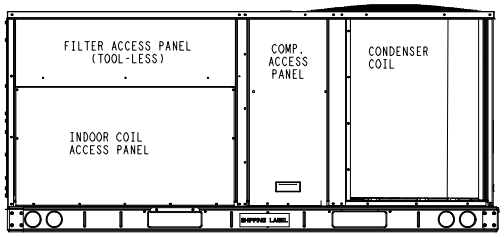


INSIDE BASERAIL DIMENSIONS

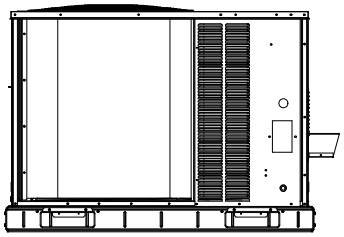
BOTTOM



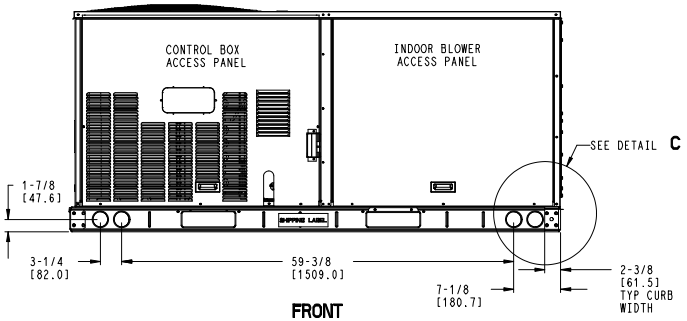
DETAIL **C**
TYP 4 PLCS



BACK



LEFT



FRONT

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	3 OF 3	09/07/18	06/22/18	48FC 04-07 SINGLE PACKAGE ELECTRICAL COOLING WITH GAS HEAT	48TC003093	A

Part Number:48FCGA05A2M6-3A0A0

ARI SEER:	**14.00**	
ARI SEER2:	**13.40**	

Base Unit Dimensions

Unit Length:	**74.4**	in
Unit Width:	**46.6**	in
Unit Height:	**33.4**	in

Operating Weight

Base Unit Weight:	**573**	lb
Al/Cu - Al/Cu - Louvered Hail Guards:	**13**	lb
SystemVu Controls:	**2**	lb
Total Operating Weight:	**588**	lb

Unit

Unit Voltage-Phase-Hertz:	**460-3-60**	
Air Discharge:	**Vertical**	
Fan Drive Type:	**Vane Axial**	
Actual Airflow:	**1600**	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:	**60.1**	F
Evaporator Leaving Air WB:	**57.5**	F
Evaporator Leaving Air Enthalpy:	**24.71**	BTU/lb
Gross Cooling Capacity:	**48.41**	MBH
Gross Sensible Capacity:	**34.31**	MBH
Compressor Power Input:	**3.44**	kW
Coil Bypass Factor:	**0.129**	

Heating Performance

Heating Airflow:	**1600**	CFM
Entering Air Temp:	**70.0**	F
Leaving Air Temp:	**98.4**	F
Gas Heating Input Capacity:	**60.0**	MBH
Gas Heating Output Capacity:	**49.0**	MBH
Temperature Rise:	**28.4**	F
Thermal Efficiency (%):	**81.0**	

Supply Fan

External Static Pressure:	**1.00**	in wg
Fan RPM:	**2114**	
Fan Power:	**1.02**	BHP
NOTE:	**Selected IFM RPM Range: 1262 - 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:	**6.2**
Compressor #1 LRA:	**41**
Indoor Fan Motor Type:	**MED**
Indoor Fan Motor FLA (Total):	**1.7**
Combustion Fan Motor FLA (ea):	**0.25**

Power Supply MCA: **11**
Power Supply MOCP (Fuse or HACR): **15**
Disconnect Size FLA: **10**
Disconnect Size LRA: **45**
Electrical Convenience Outlet: **None**
Outdoor Fan [Qty / FLA (ea)]: **1 / 0.8**

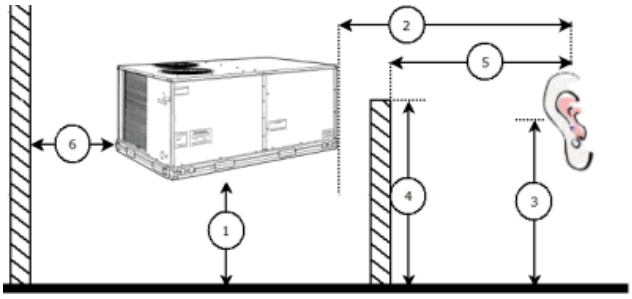
Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

Acoustics

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	95.9	92.9	85.6
125 Hz	87.3	82.3	84.7
250 Hz	81.1	74.5	80.5
500 Hz	74.9	68.8	76.0
1000 Hz	72.1	70.0	72.4
2000 Hz	68.8	61.0	68.0
4000 Hz	65.4	55.2	62.8
8000 Hz	61.4	48.0	59.3
A-Weighted	79.4	74.5	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

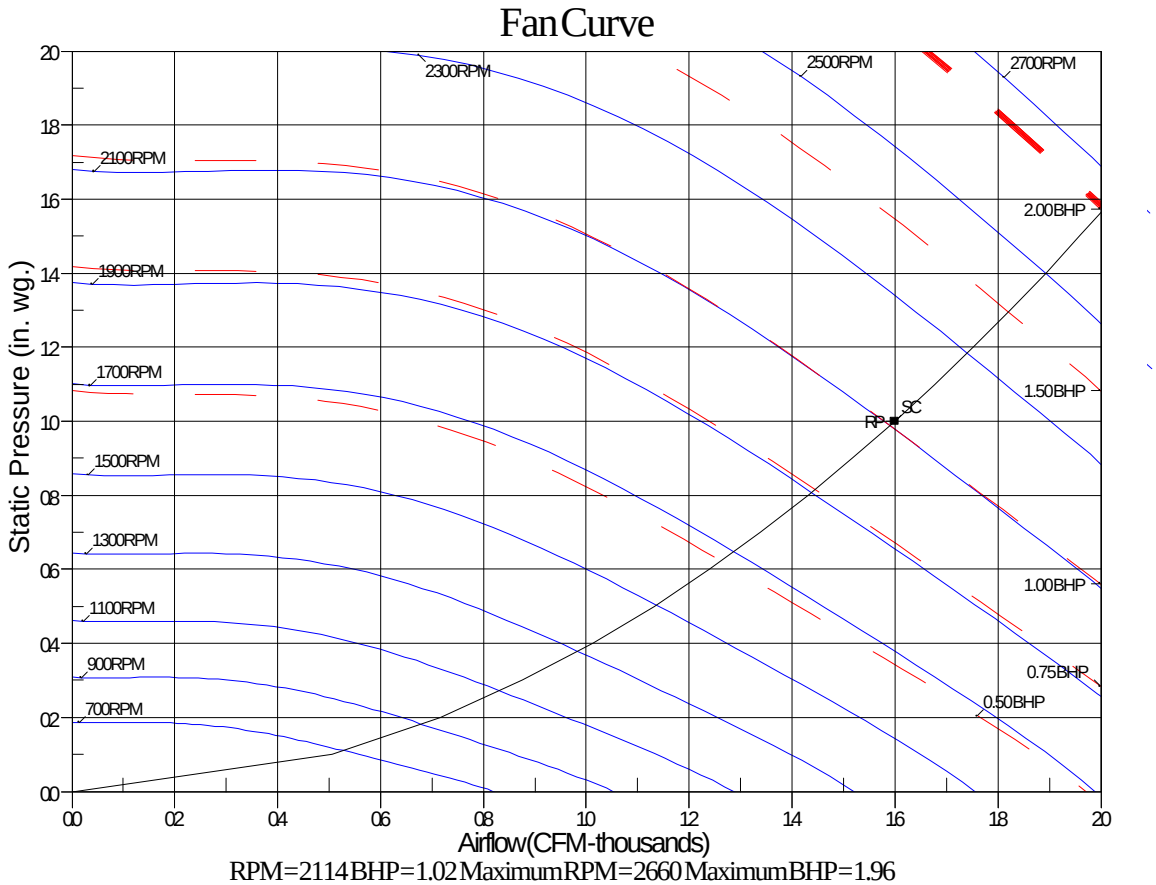
Detailed Acoustics Information

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

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.



Bldg H-6

Tag Cover Sheet
Unit Report
Certified Drawing
Performance Report

Unit Report For Bldg H-6

Project: Lynwood USD Will Rogers Elementary 02/01/2024
Prepared By: 01:40PM

Unit Parameters

Unit Model: **48FCGA04A2M6-3A0A0**
Unit Size: **04 (3 Tons)**
Volts-Phase-Hertz: **460-3-60**
Heating Type: **Gas**
Heat Control: **Ultra Low NOx, Low Heat**
Duct Cfg: **Vertical Supply / Vertical Return**
DX Options: **Standard One Stage Cooling Models**

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **6' 2.375"**
Unit Width: **3' 10.625"**
Unit Height: **2' 9.375"**
Total Operating Weight: **527** 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: **1/2**
Condensate Drain Line Size: **3/4**
Return Air Filter Type: **Throwaway**
Return Air Filter Quantity: **2**
Return Air Filter Size: **16 x 25 x 2**

Selection includes construction throwaway filter into the base fan curve.

Unit Configuration

Direct Drive - EcoBlue - Medium Static
Al/Cu - Al/Cu - Louvered Hail Guards
SystemVu Controls
Standard Packaging

Warranty Information

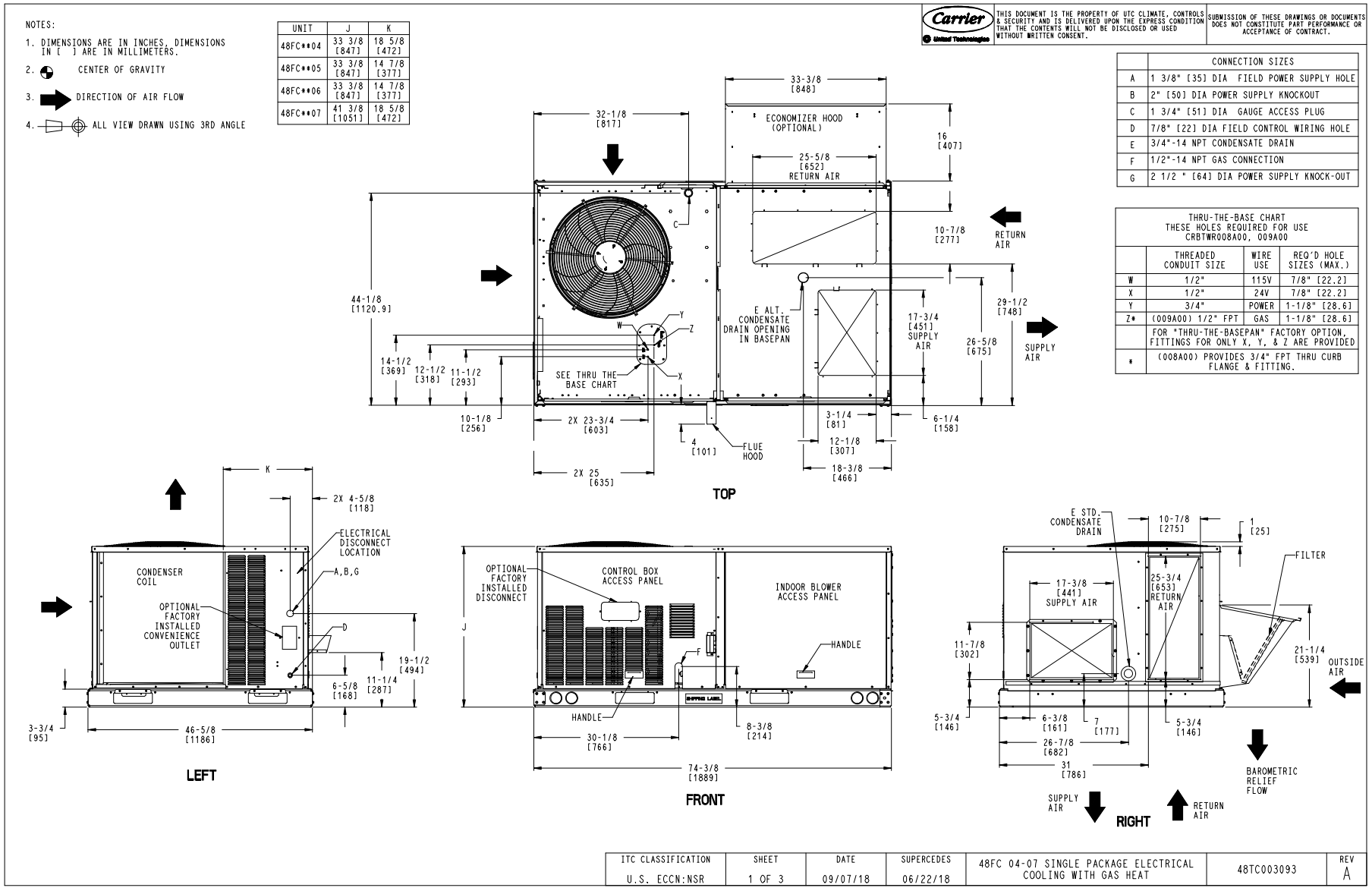
1-Year parts(std.)
5-Year compressor parts(std.)
3-Year SystemVu

No optional warranties were selected.

NOTE: Please see Warranty Catalog 500-089 for explanation of policies and ordering methods.

Ordering Information

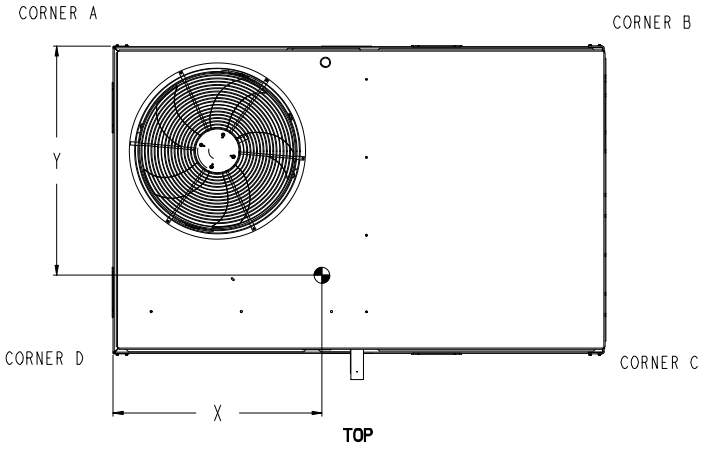
Part Number	Description	Quantity
48FCGA04A2M6-3A0A0	Rooftop Unit	1



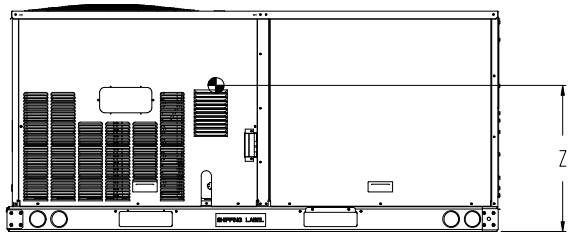
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	1 OF 3	09/07/18	06/22/18	48FC 04-07 SINGLE PACKAGE ELECTRICAL COOLING WITH GAS HEAT	48TC003093	A

UNIT	STD. UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		HEIGHT
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48FC**04	482	219	113	51	116	53	128	58	125	57	37 5/8 [956]	24 9/16 [624]	18 1/4 [464]
48FC**05	543	246	138	63	133	60	133	60	138	63	36 1/2 [927]	23 3/8 [594]	18 [457]
48FC**06	556	252	142	64	136	62	136	62	142	64	36 1/2 [927]	23 3/8 [594]	18 [457]
48FC**07	607	275	162	73	152	69	141	64	151	68	36 [914]	22 1/2 [572]	19 3/8 [492]

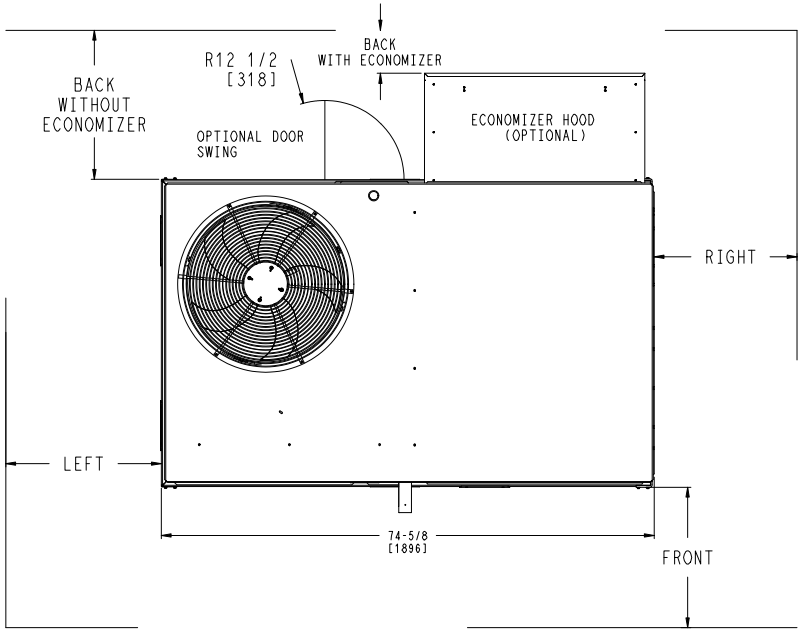
* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



TOP



FRONT



NOTES:

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	48 [1219mm]	42 [1067mm]	18 [457mm]
BACK W/HOOD	36 [914mm]	36 [914mm]	18 [457mm]
RIGHT	36 [914mm]	36 [914mm]	18 [457mm]
TOP	72 [1829mm]	72 [1829mm]	72 [1829mm]

Carrier
United Technologies

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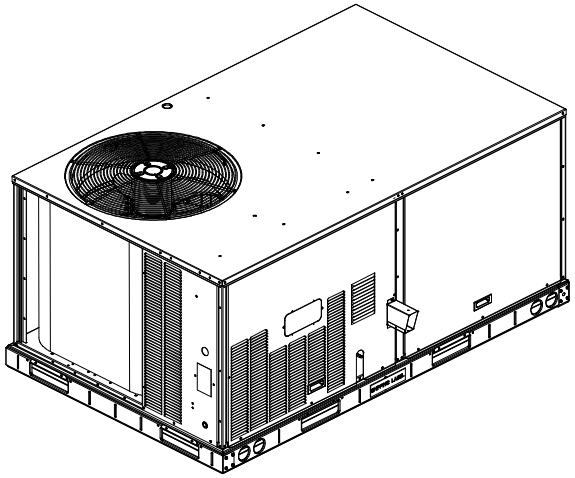
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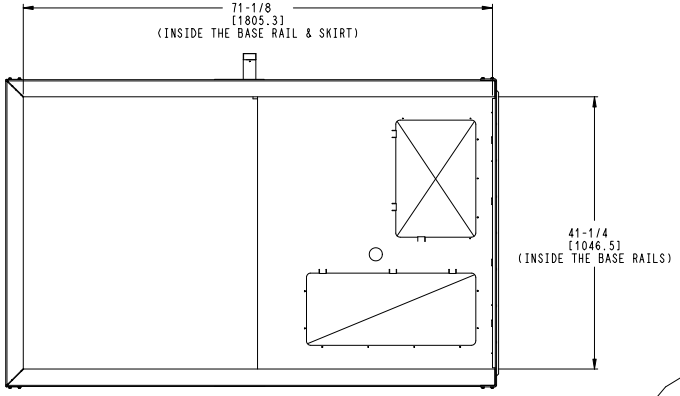
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	2 OF 3	09/07/18	06/22/18	48FC 04-07 SINGLE PACKAGE ELECTRICAL COOLING WITH GAS HEAT	48TC003093	A

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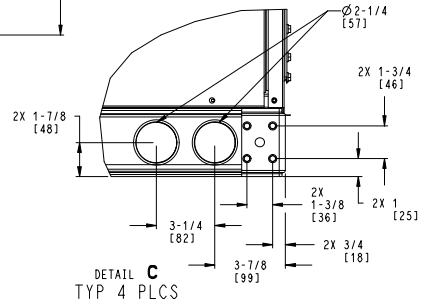
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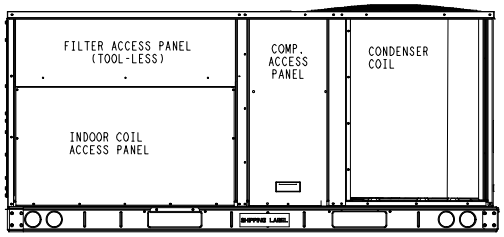


INSIDE BASERAIL DIMENSIONS

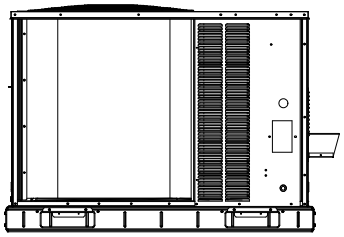
BOTTOM



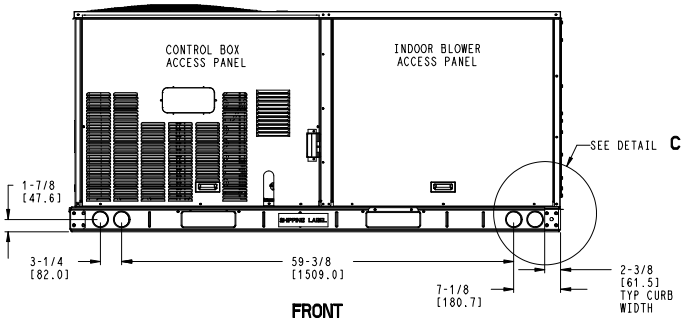
DETAIL **C**
TYP 4 PLCS



BACK



LEFT



FRONT

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	3 OF 3	09/07/18	06/22/18	48FC 04-07 SINGLE PACKAGE ELECTRICAL COOLING WITH GAS HEAT	48TC003093	A

Part Number:48FCGA04A2M6-3A0A0

ARI SEER:	**14.00**	
ARI SEER2:	**13.40**	

Base Unit Dimensions

Unit Length:	**74.4**	in
Unit Width:	**46.6**	in
Unit Height:	**33.4**	in

Operating Weight

Base Unit Weight:	**512**	lb
Al/Cu - Al/Cu - Louvered Hail Guards:	**13**	lb
SystemVu Controls:	**2**	lb
Total Operating Weight:	**527**	lb

Unit

Unit Voltage-Phase-Hertz:	**460-3-60**	
Air Discharge:	**Vertical**	
Fan Drive Type:	**Vane Axial**	
Actual Airflow:	**1200**	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:	**60.4**	F
Evaporator Leaving Air WB:	**57.9**	F
Evaporator Leaving Air Enthalpy:	**24.93**	BTU/lb
Gross Cooling Capacity:	**35.13**	MBH
Gross Sensible Capacity:	**25.39**	MBH
Compressor Power Input:	**2.50**	kW
Coil Bypass Factor:	**0.180**	

Heating Performance

Heating Airflow:	**1200**	CFM
Entering Air Temp:	**70.0**	F
Leaving Air Temp:	**107.8**	F
Gas Heating Input Capacity:	**60.0**	MBH
Gas Heating Output Capacity:	**49.0**	MBH
Temperature Rise:	**37.8**	F
Thermal Efficiency (%):	**81.0**	

Supply Fan

External Static Pressure:	**1.00**	in wg
Fan RPM:	**1954**	
Fan Power:	**0.55**	BHP
NOTE:	**Selected IFM RPM Range: 1112 - 2190**	

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:	**5.8**
Compressor #1 LRA:	**38**
Indoor Fan Motor Type:	**MED**
Indoor Fan Motor FLA (Total):	**1.2**
Combustion Fan Motor FLA (ea):	**0.25**

Power Supply MCA: **10**
Power Supply MOCP (Fuse or HACR): **15**
Disconnect Size FLA: **9**
Disconnect Size LRA: **42**
Electrical Convenience Outlet: **None**
Outdoor Fan [Qty / FLA (ea)]: **1 / 0.8**

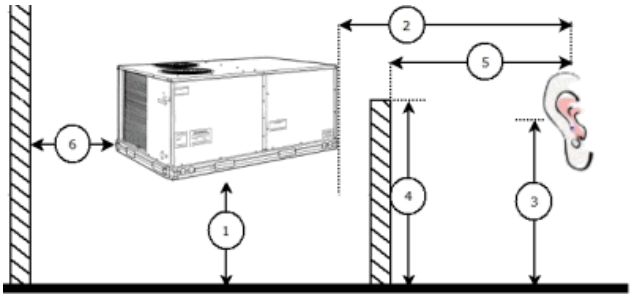
Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

Acoustics

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	92.5	86.2	85.6
125 Hz	83.7	79.3	84.7
250 Hz	76.6	70.1	80.5
500 Hz	69.2	62.9	76.0
1000 Hz	66.6	64.2	72.4
2000 Hz	63.6	56.0	68.0
4000 Hz	59.6	50.1	62.8
8000 Hz	57.1	43.3	59.3
A-Weighted	74.7	69.4	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

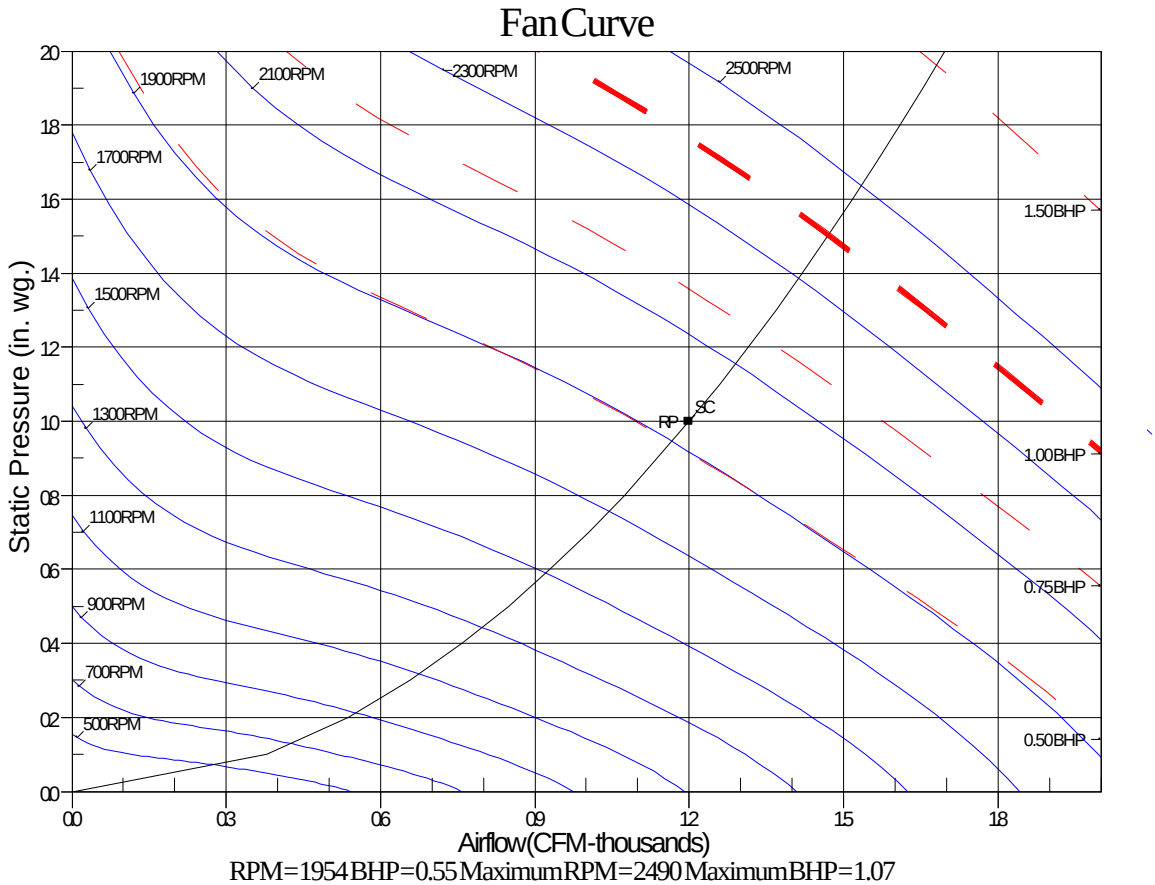
Detailed Acoustics Information

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

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=1954 BHP=0.55 Maximum RPM=2490 Maximum BHP=1.07
SC-System Curve RP-Rated Point

Bldg H-5

Tag Cover Sheet
Unit Report
Certified Drawing
Performance Report

Unit Report For Bldg H-5

Project: Lynwood USD Will Rogers Elementary 02/01/2024
Prepared By: 01:40PM

Unit Parameters

Unit Model: **48FCDM07A2M6-3A0A0**
Unit Size: **07 (6 Tons)**
Volts-Phase-Hertz: **460-3-60**
Heating Type: **Gas**
Heat Control: **Low Heat**
Duct Cfg: **Vertical Supply / Vertical Return**
DX Options: **Single Circuit, Two Stage Cooling (07 only)**

Dimensions (ft. in.) & Weight (lb.) ***

Unit Length: **6' 2.375"**
Unit Width: **3' 10.625"**
Unit Height: **3' 5.375"**
Total Operating Weight: **626** 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: **1/2**
Condensate Drain Line Size: **3/4**
Return Air Filter Type: **Throwaway**
Return Air Filter Quantity: **4**
Return Air Filter Size: **16 x 16 x 2**

Selection includes construction throwaway filter into the base fan curve.

Unit Configuration

Direct Drive - EcoBlue - Medium Static
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
48FCDM07A2M6-3A0A0	Rooftop Unit	1

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	J	K
48FC**04	33 3/8 [847]	18 5/8 [472]
48FC**05	33 3/8 [847]	14 7/8 [377]
48FC**06	33 3/8 [847]	14 7/8 [377]
48FC**07	41 3/8 [1051]	18 5/8 [472]

Carrier United Technologies

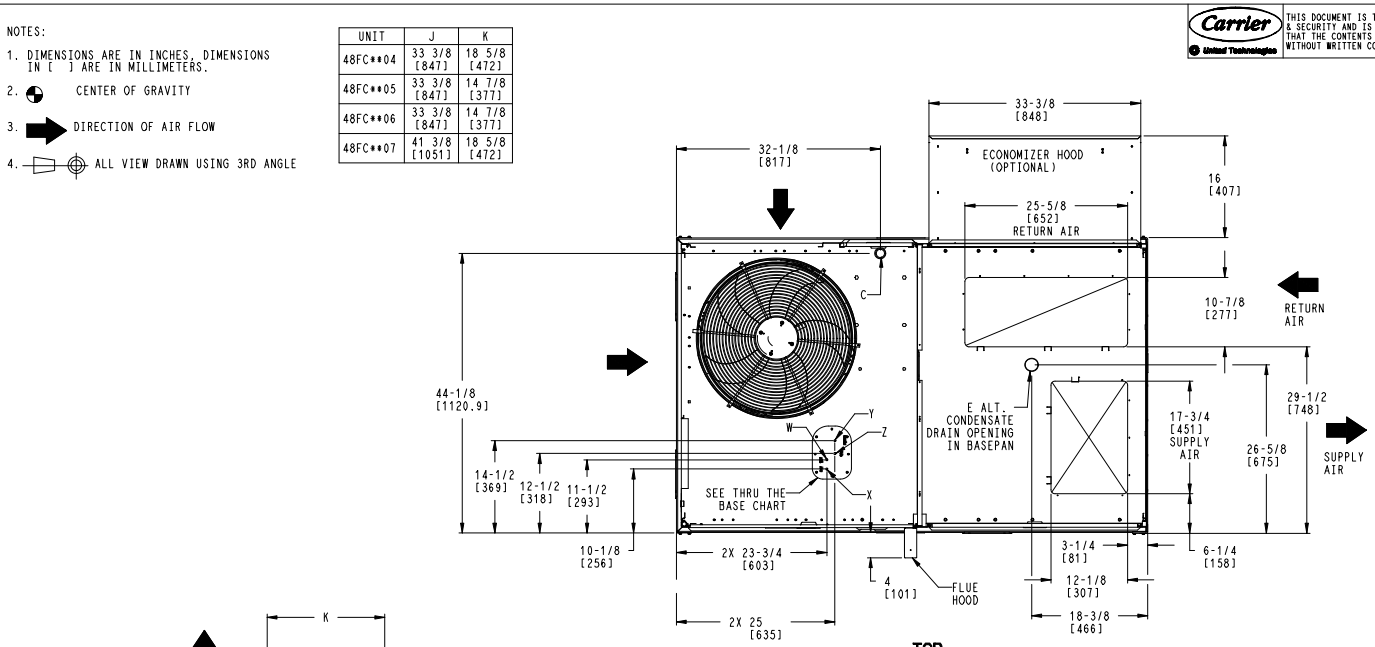
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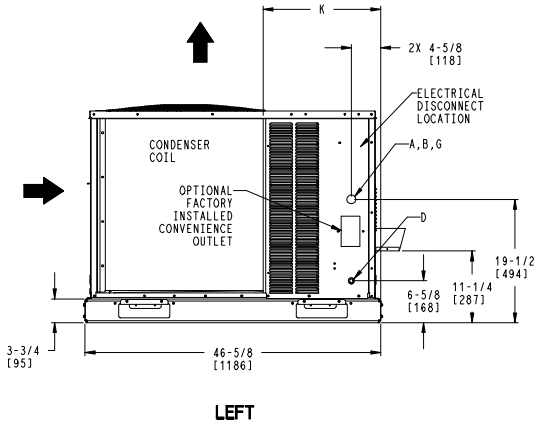
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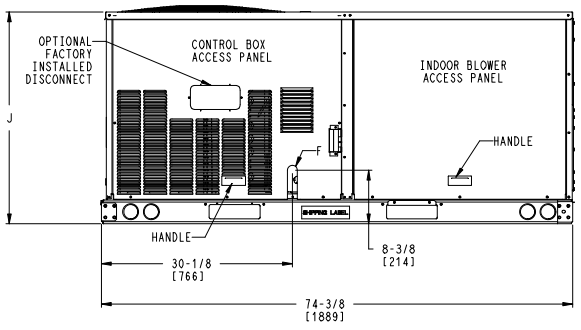
	CONNECTION SIZES
A	1 3/8" [35] DIA FIELD POWER SUPPLY HOLE
B	2" [50] DIA POWER SUPPLY KNOCKOUT
C	1 3/4" [51] DIA GAUGE ACCESS PLUG
D	7/8" [22] DIA FIELD CONTROL WIRING HOLE
E	3/4"-14 NPT CONDENSATE DRAIN
F	1/2"-14 NPT GAS CONNECTION
G	2 1/2 " [64] DIA POWER SUPPLY KNOCK-OUT

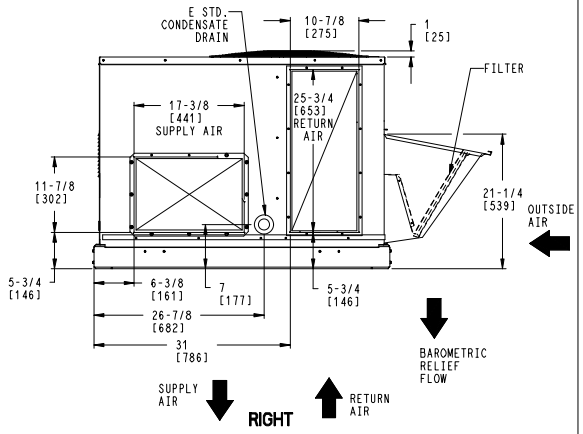
THRU-THE-BASE CHART
THESE HOLES REQUIRED FOR USE CRBTWR008A00, 009A00

	THREADED CONDUIT SIZE	WIRE USE	REQ'D HOLE SIZES (MAX.)
W	1/2"	115V	7/8" [22.2]
X	1/2"	24V	7/8" [22.2]
Y	3/4"	POWER	1-1/8" [28.6]
Z*	(009A00) 1/2" FPT	GAS	1-1/8" [28.6]
	FOR "THRU-THE-BASEPAN" FACTORY OPTION, FITTINGS FOR ONLY X, Y, & Z ARE PROVIDED		
*	(008A00) PROVIDES 3/4" FPT THRU CURB FLANGE & FITTING.		





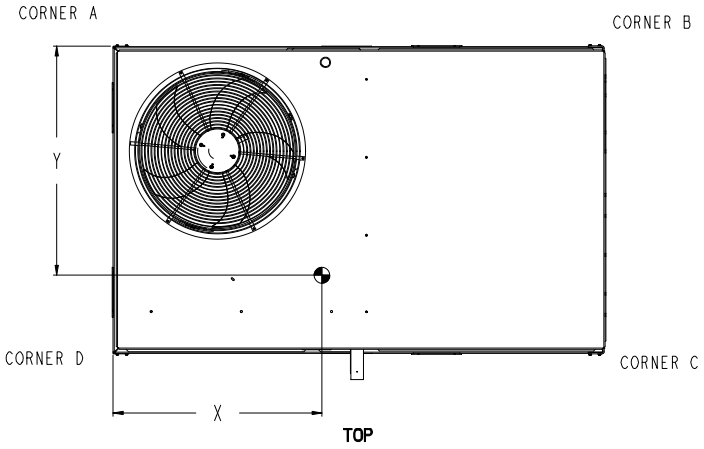




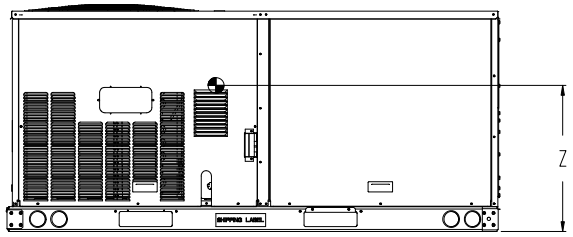
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	1 OF 3	09/07/18	06/22/18	48FC 04-07 SINGLE PACKAGE ELECTRICAL COOLING WITH GAS HEAT	48TC003093	A

UNIT	STD. UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		HEIGHT
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
48FC**04	482	219	113	51	116	53	128	58	125	57	37 5/8 [956]	24 9/16 [624]	18 1/4 [464]
48FC**05	543	246	138	63	133	60	133	60	138	63	36 1/2 [927]	23 3/8 [594]	18 [457]
48FC**06	556	252	142	64	136	62	136	62	142	64	36 1/2 [927]	23 3/8 [594]	18 [457]
48FC**07	607	275	162	73	152	69	141	64	151	68	36 [914]	22 1/2 [572]	19 3/8 [492]

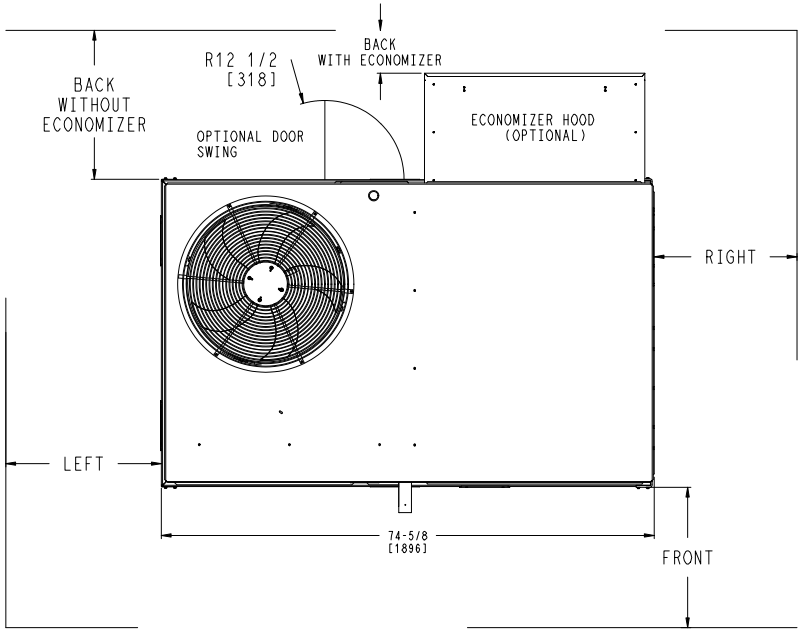
* STANDARD UNIT WEIGHT IS WITH LOW GAS HEAT AND WITHOUT PACKAGING.
FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



TOP



FRONT



NOTES:

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	48 [1219mm]	42 [1067mm]	18 [457mm]
BACK W/HOOD	36 [914mm]	36 [914mm]	18 [457mm]
RIGHT	36 [914mm]	36 [914mm]	18 [457mm]
TOP	72 [1829mm]	72 [1829mm]	72 [1829mm]

Carrier
United Technologies

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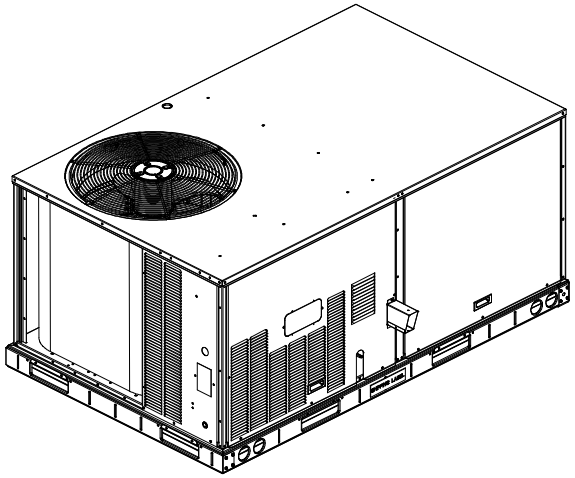
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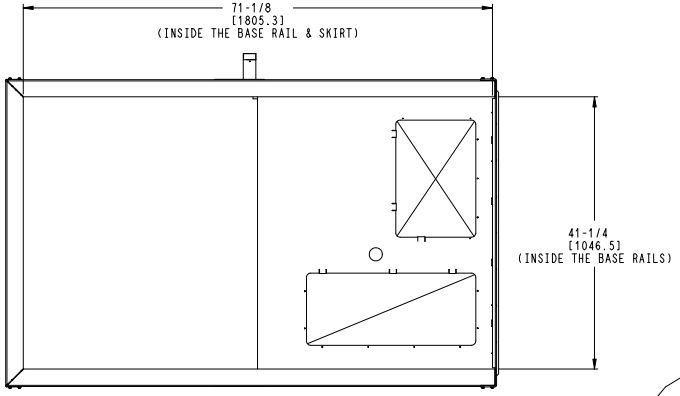
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	2 OF 3	09/07/18	06/22/18	48FC 04-07 SINGLE PACKAGE ELECTRICAL COOLING WITH GAS HEAT	48TC003093	A

Carrier
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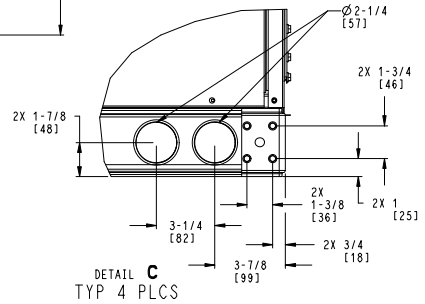
SUBMISSION OF THESE DRAWINGS OR DOCUMENTS DOES NOT CONSTITUTE PART PERFORMANCE OR ACCEPTANCE OF CONTRACT.



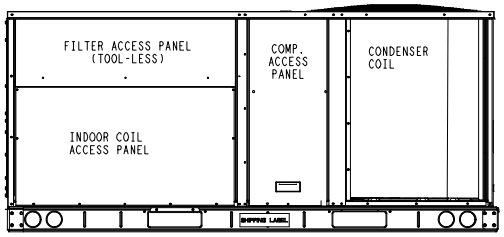


INSIDE BASERAIL DIMENSIONS

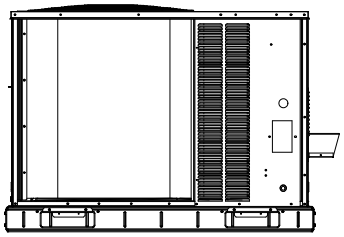
BOTTOM



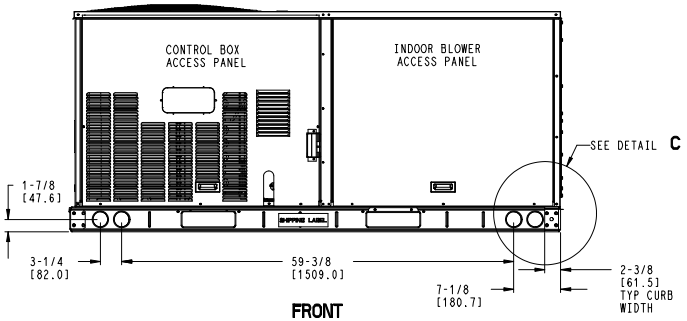
DETAIL **C**
TYP 4 PLCS



BACK



LEFT



FRONT

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	3 OF 3	09/07/18	06/22/18	48FC 04-07 SINGLE PACKAGE ELECTRICAL COOLING WITH GAS HEAT	48TC003093	A

Part Number:48FCDM07A2M6-3A0A0

ARI EER:	**11.00**	
IEER:	**15.0**	

Base Unit Dimensions

Unit Length:	**74.4**	in
Unit Width:	**46.6**	in
Unit Height:	**41.4**	in

Operating Weight

Base Unit Weight:	**607**	lb
Al/Cu - Al/Cu - Louvered Hail Guards:	**17**	lb
SystemVu Controls:	**2**	lb
Total Operating Weight:	**626**	lb

Unit

Unit Voltage-Phase-Hertz:	**460-3-60**	
Air Discharge:	**Vertical**	
Fan Drive Type:	**Vane Axial**	
Actual Airflow:	**2100**	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:	**57.1**	F
Evaporator Leaving Air WB:	**56.2**	F
Evaporator Leaving Air Enthalpy:	**23.91**	BTU/lb
Gross Cooling Capacity:	**71.15**	MBH
Gross Sensible Capacity:	**52.00**	MBH
Compressor Power Input:	**5.27**	kW
Coil Bypass Factor:	**0.083**	

Heating Performance

Heating Airflow:	**2100**	CFM
Entering Air Temp:	**70.0**	F
Leaving Air Temp:	**93.8**	F
Gas Heating Input Capacity:	**67.0**	MBH
Gas Heating Output Capacity:	**54.0**	MBH
Temperature Rise:	**23.8**	F
Thermal Efficiency (%):	**81.0**	

Supply Fan

External Static Pressure:	**1.00**	in wg
Fan RPM:	**2310**	
Fan Power:	**1.32**	BHP
NOTE:	**Selected IFM RPM Range: 1596 - 2530**	

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:	**8.4**
Compressor #1 LRA:	**66**
Indoor Fan Motor Type:	**MED**
Indoor Fan Motor FLA (Total):	**2.6**
Combustion Fan Motor FLA (ea):	**0.25**

Power Supply MCA: **14**
Power Supply MOCP (Fuse or HACR): **20**
Disconnect Size FLA: **14**
Disconnect Size LRA: **72**
Electrical Convenience Outlet: **None**
Outdoor Fan [Qty / FLA (ea)]: **1 / 0.8**

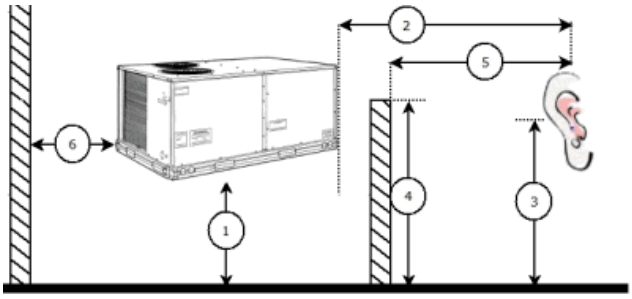
Control Panel SCCR: 5kA RMS at Rated Symmetrical Voltage

Acoustics

Sound Power Levels, db re 10E-12 Watts

	Discharge	Inlet	Outdoor
63 Hz	95.5	93.8	85.6
125 Hz	87.2	83.5	84.7
250 Hz	81.4	74.8	80.5
500 Hz	77.1	70.8	76.0
1000 Hz	74.5	71.9	72.4
2000 Hz	71.4	62.7	68.0
4000 Hz	67.3	56.7	62.8
8000 Hz	62.5	49.6	59.3
A-Weighted	80.8	76.0	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

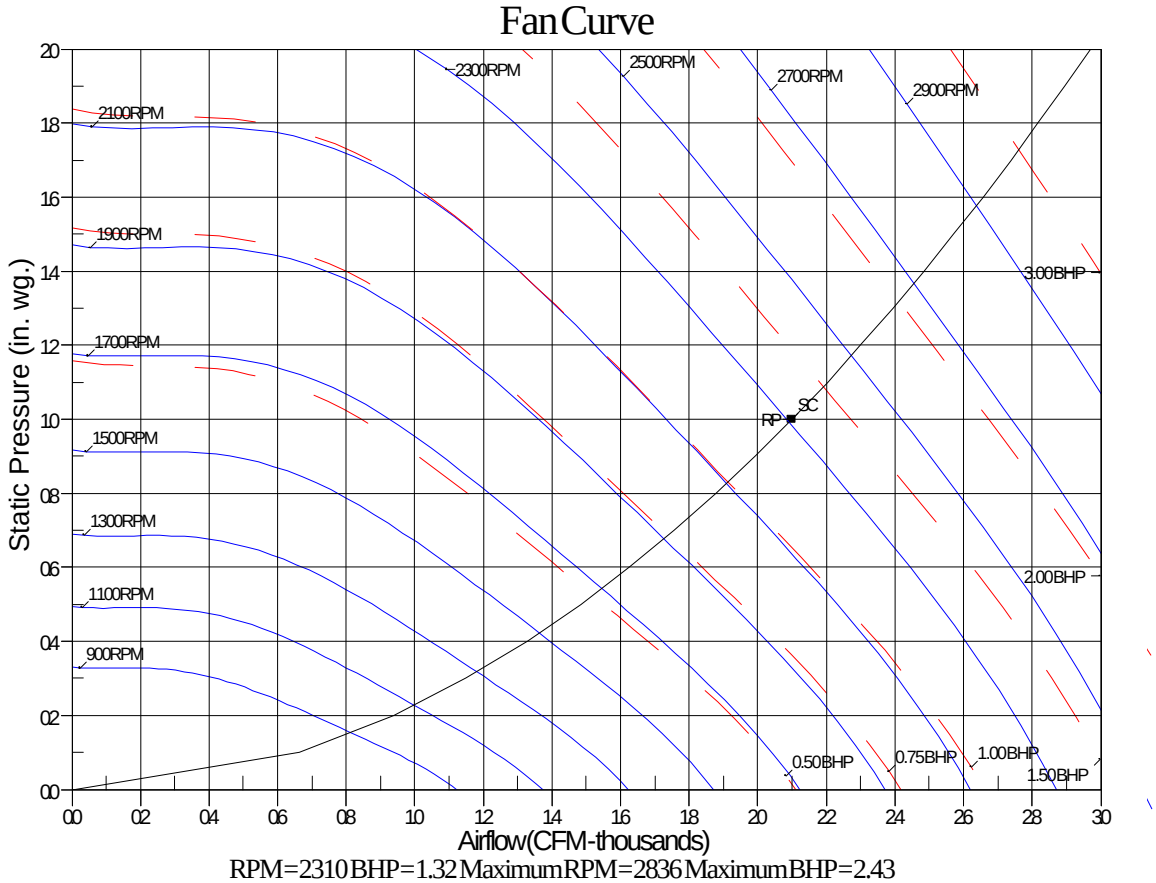
Detailed Acoustics Information

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

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=2310 BHP=1.32 Maximum RPM=2836 Maximum BHP=2.43
SC-System Curve RP-Rated Point

SECTION II. ROOFTOP UNIT ACCESSORIES

MicroMetl	DATE: 03/2020	WEIGHT (LBS): 17	DESCRIPTION: ADAPTER KIT FOR 0571 SERIES	PART NUMBER: **ADPT-0571-SD-W (Rev A)**
SUBMITTED TO:	**COMPANY:**		**JOB NAME:**	**APPROVED BY:** **DATE:**
EXISTING UNIT:			**NEW UNIT:**	

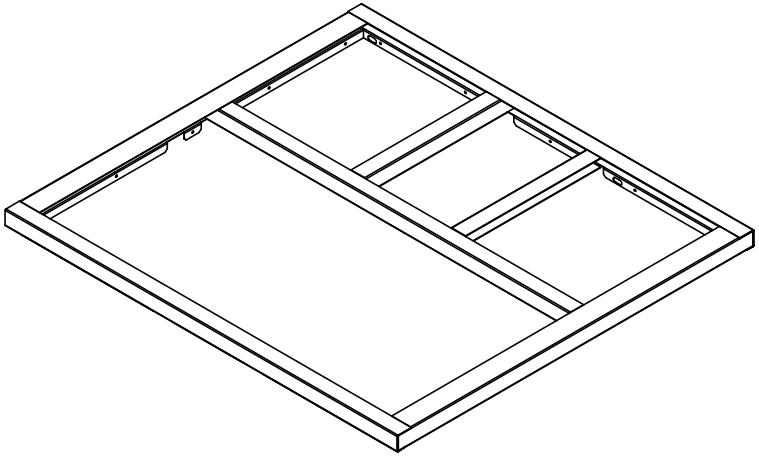
CURB ADAPTER INFORMATION:

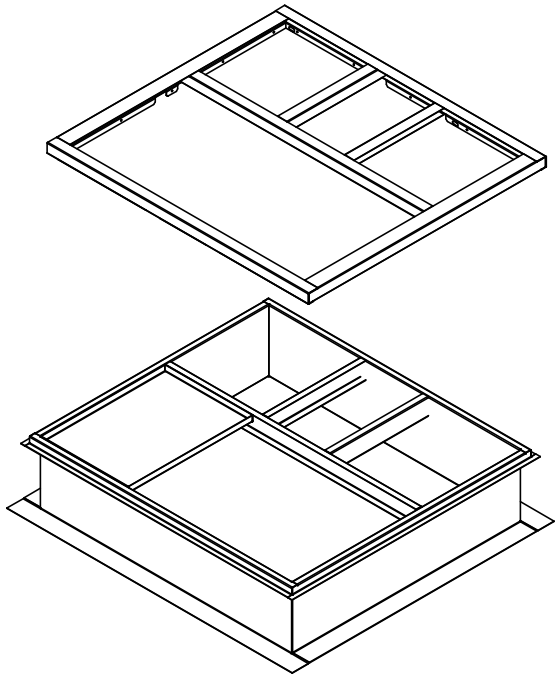
1. BEFORE ORDERING CURB ADAPTER, CONTRACTOR MUST CONFIRM THE DIMENSIONS OF THE EXISTING CURB ON THIS DRAWING

2. BEFORE NEW HVAC UNIT IS SET IN PLACE, INSPECT STRUCTURAL STABILITY OF EXISTING CURB AND BUILDING'S ROOF LOAD CAPABILITY. REINFORCE IF REQUIRED.

3. ALL CURB ADAPTERS WILL INCREASE THE SYSTEM'S EXTERNAL STATIC PRESSURE AND MUST BE INCLUDED WHEN CALCULATING UNIT REQUIREMENTS

Bldg-D-1,2; Bldg F-F-2

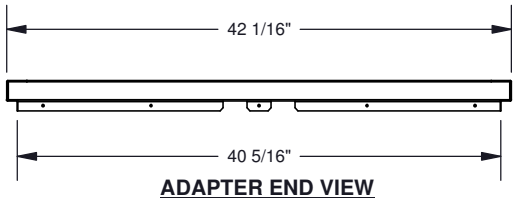




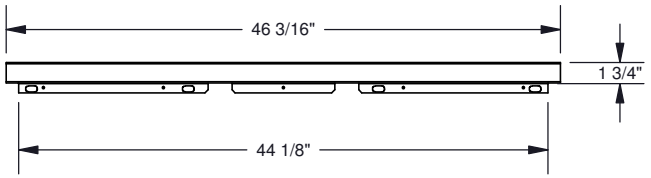
FEATURES:
- FULLY WELDED HEAVY GAUGE CONSTRUCTION
- TRANSITIONS INCLUDED
- FULL INTERNAL INSULATION
- GASKET PACKAGE INCLUDED

ADPT-0571-SD-W

MicroMetl 0571 series curb
or CPRFCURB008A00
or CPRFCURB009A00



ADAPTER END VIEW



ADAPTER SIDE VIEW

NOTES:

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CANNON FABRICATION INC
182 GRANITE STREET, SUITE 101, CORONA, CA 92879
PHONE: (951)278-1830 FAX: (951)278-8444 www.canfab.com canfab@canfab.com

CARRIER 3 - 5 TON
48/50 ES, EZ, 48/50VL-A 42-60, 48/50 VT-A, VG, 48/50VR, XL, XT-A 36-60

PART NO: SEE BELOW

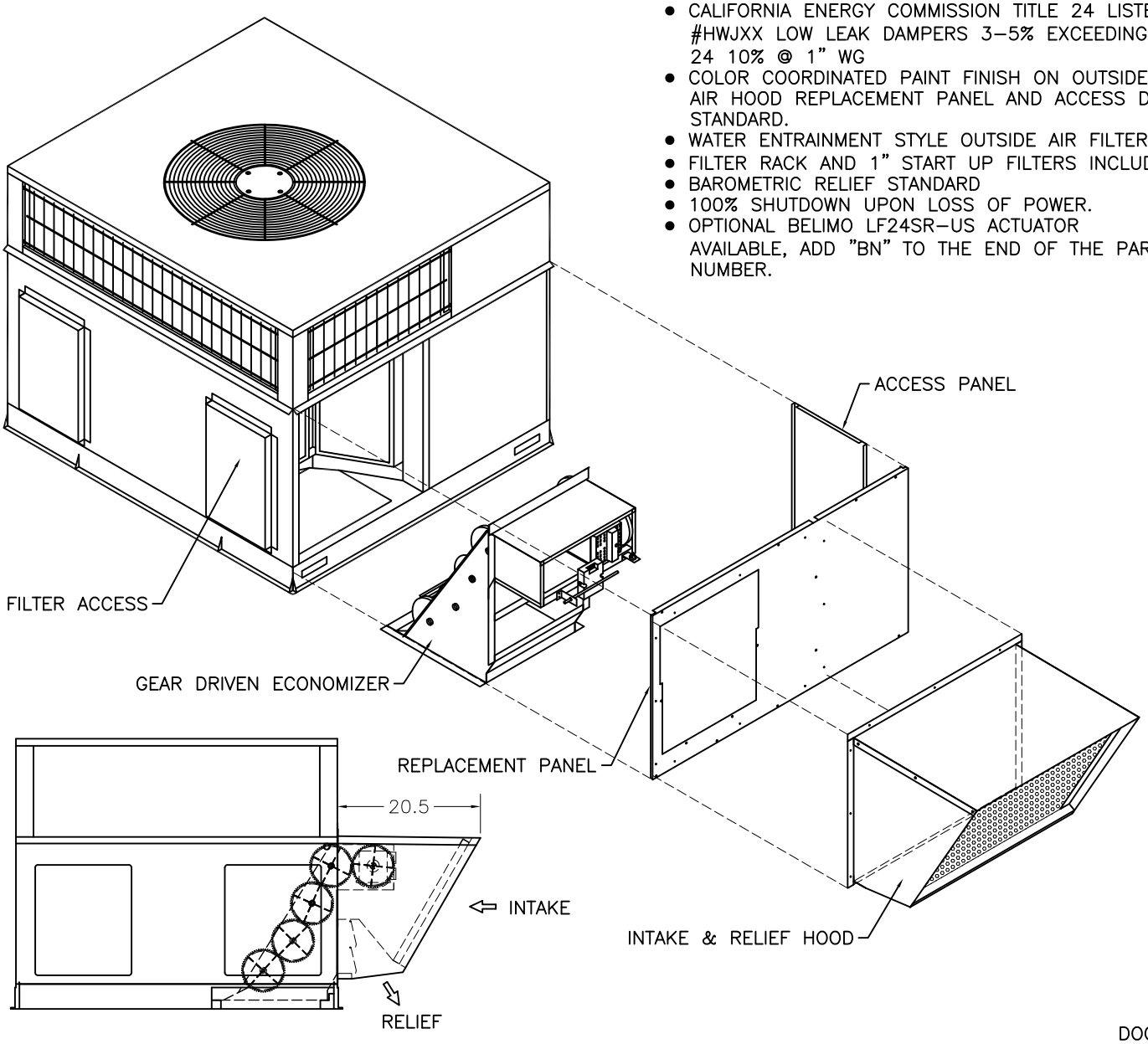
DEDICATED DOWN DISCHARGE ECONOMIZER

REPLACES 1103-EC ECONOMIZER

Bldg-D-1,2; Bldg F-F-2

PART NUMBER	SHIPPING WEIGHT
1161-EC	84 LBS.

- GEAR DRIVEN HONEYWELL JADE FDD MODULATING DRYBULB CONTROL SYSTEM. OPTIONS: ENTHALPY " HE"; COMPARATIVE ENTHALPY "-HC"
- CALIFORNIA ENERGY COMMISSION TITLE 24 LISTED #HWJXX LOW LEAK DAMPERS 3-5% EXCEEDING TITLE 24 10% @ 1" WG
- COLOR COORDINATED PAINT FINISH ON OUTSIDE AIR HOOD REPLACEMENT PANEL AND ACCESS DOOR STANDARD.
- WATER ENTRAINMENT STYLE OUTSIDE AIR FILTER.
- FILTER RACK AND 1" START UP FILTERS INCLUDED.
- BAROMETRIC RELIEF STANDARD
- 100% SHUTDOWN UPON LOSS OF POWER.
- OPTIONAL BELIMO LF24SR-US ACTUATOR AVAILABLE, ADD "BN" TO THE END OF THE PART NUMBER.



DOC: 01-01

PROJECT: DATE:

ENGINEER: DISTRIBUTOR:

DRAWING NUMBER:

CanFab
CANNON FABRICATION INC
182 GRANITE STREET, SUITE 101, CORONA, CA 92879
PHONE: (951)278-1830 FAX: (951)278-8444 www.canfab.com canfab@canfab.com

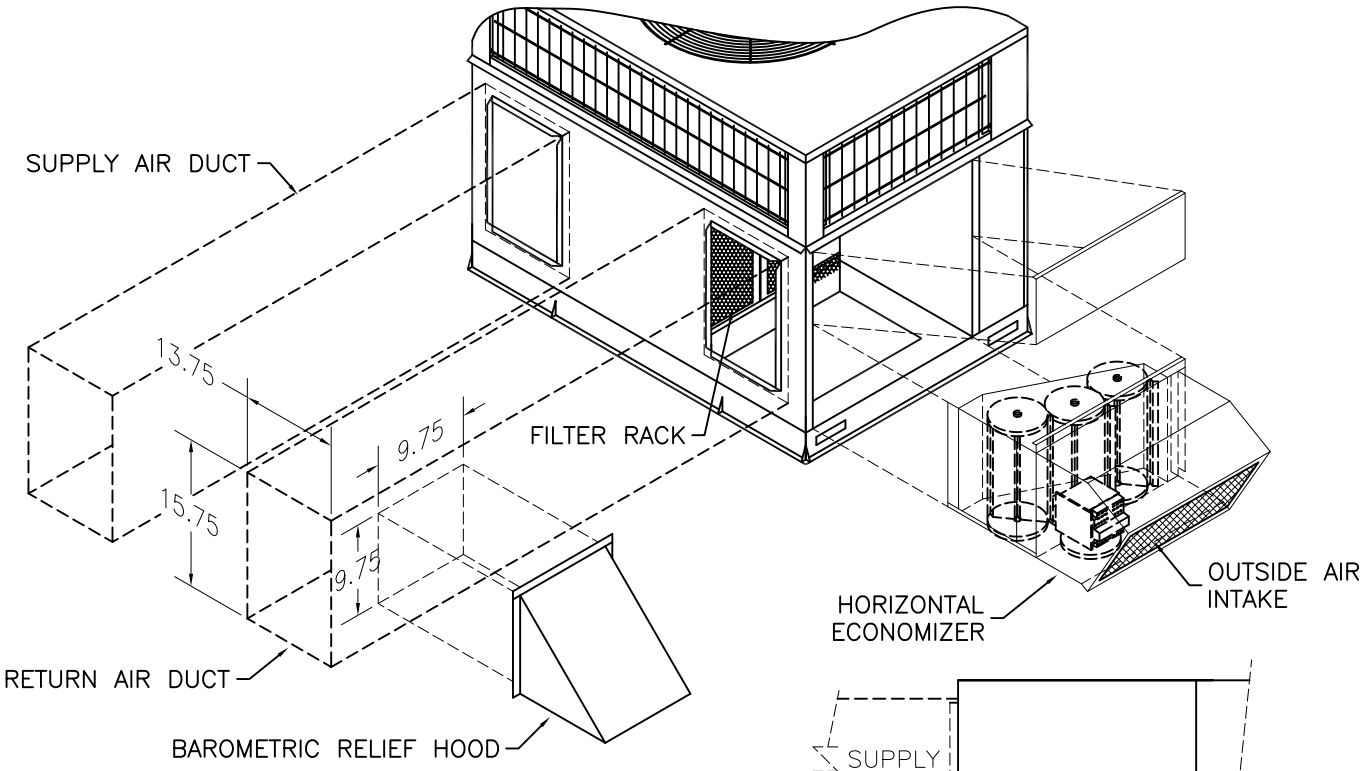
CARRIER 3 - 5 TON
48/50 ES, EZ, 48/50VL-A 42-60, 48/50 VT-A, VG, 48/50VR, XL, XT-A 36-60

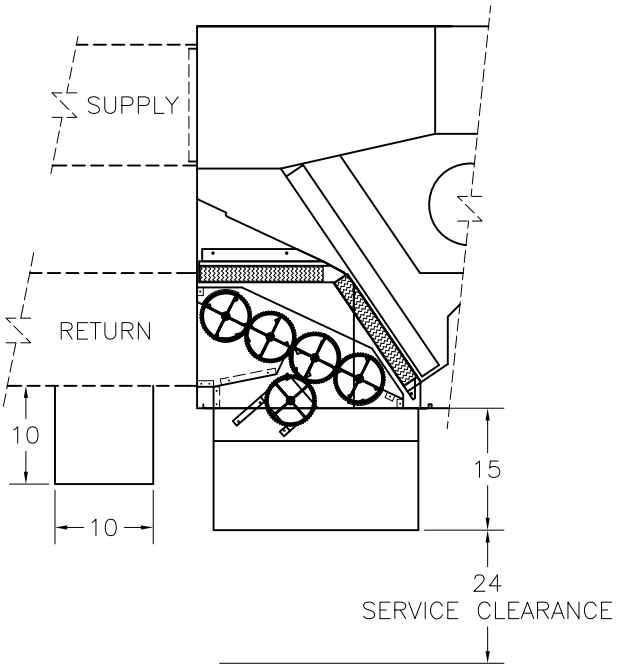
PART NO: SEE BELOW

DEDICATED HORIZONTAL ECONOMIZER

Bldg-E-1,2; Bldg F-F-1

PART NUMBER	SHIPPING WEIGHT
1161-HEC	142 LBS.





- GEAR DRIVEN HONEYWELL JADE FDD MODULATING DRYBULB CONTROL SYSTEM. OPTIONS: ENTHALPY " HE"; COMPARATIVE ENTHALPY "-HC"
- CALIFORNIA ENERGY COMMISSION TITLE 24 LISTED #HWJXX LOW LEAK DAMPERS 3-5% EXCEEDING TITLE 24 10% @ 1" WG
- COLOR COORDINATED PAINT FINISH ON OUTSIDE AIR HOOD REPLACEMENT PANEL AND ACCESS DOOR STANDARD.
- WATER ENTRAINMENT STYLE OUTSIDE AIR FILTER.
- FILTER RACK AND 1" START UP FILTERS INCLUDED.
- BAROMETRIC RELIEF STANDARD
- 100% SHUTDOWN UPON LOSS OF POWER.
- OPTIONAL BELIMO LF24SR-US ACTUATOR AVAILABLE, ADD "BN" TO THE END OF THE PART NUMBER.

DOC: 01-01

PROJECT: DATE:

ENGINEER: DISTRIBUTOR:

DRAWING NUMBER:

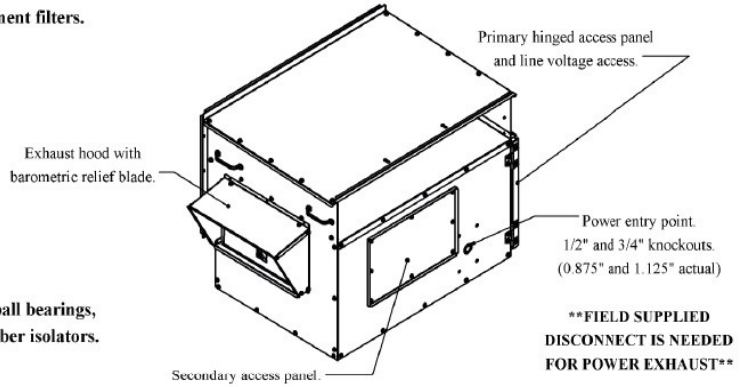
MicroMetl	Date: 1/24/2024	Weights: 191lbs/86.64kg	Units: Bldg H-H-5; H-3,4	Part Number: PECD-SRT12CB-D0DB-4L1-4

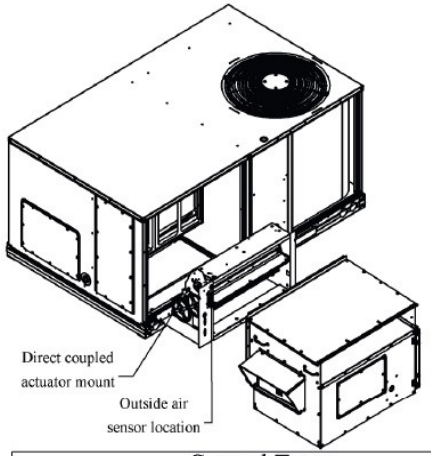
Submitted To: brhernandez@siglers.com	Job:	Notes:

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Vertical with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 2675 CFM @ 1/2" - 1 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..

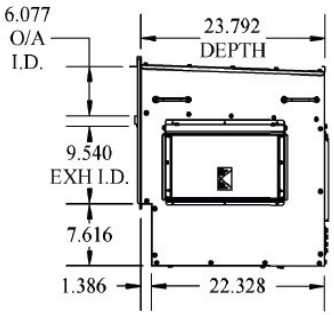
FEATURES:

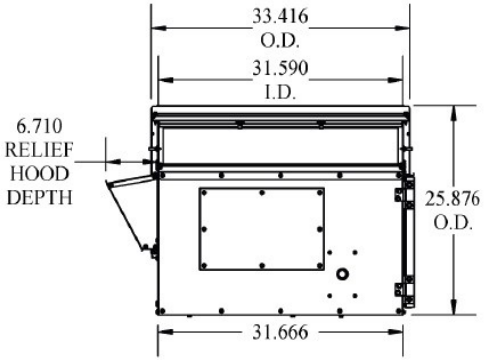
- **Includes ECD-SRT12CB series economizer.**
- **External gear driven dampers with roll formed blades.**
- **Designed for vertical applications only.**
- **Factory assembled rain hood, with aluminum water entrainment filters.**
- **Filter access door supplied with RTU.**
- **Hinged filter access door is ordered separately.**
  - **MMC P/# for Chassis 1 - ECD-SRT1CA-HDOOR**
  - **MMC P/# for Chassis 2 - ECD-SRT2CA-HDOOR**
- **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**
- **See page 2 for PE performance and electrical data.**











-Control Types	
-D2DH	W7220 controller, actuator w/feedback, adjustable drybulb controls
-D2EH	W7220 controller, actuator w/feedback, enthalpy controls
-D2XH	W7220 controller, actuator w/feedback, dual adjustable drybulb controls
-D2ZH	W7220 controller, actuator w/feedback, dual enthalpy controls
-D0DB-4	RTU Open - Premier Link - System VU, No controller, Adjustable dry bulb, Belimo actuator
-D0DB-X	Comfortlink - No controller, Adjustable dry bulb, Belimo MFT actuator with 500 ohm resistor
-D00H-H	Communicating Honeywell actuator only
-D00H	Non-communicating Honeywell actuator only
-D00B	Belimo actuator with feedback and end switch
-D00S	Siemens actuator with feedback
-PE Options	
-2VH or -2V1	208/230V 1PH or 3PH, Constant Volume, 1/2HP or 1HP
-2LH or -2L1	208/230V 1PH or 3PH, Modulating, BACNet ready, 1/2HP or 1HP
-2TH or -2T1	20/230V 1PH or 3PH, 3rd Party Controls, BACNet ready, 1/2HP or 1HP
-4VH or -4V1	460V 1PH or 3PH, Constant Volume, 1/2HP or 1HP
-4LH or -4L1	460V 1PH or 3PH, Modulating, BACNet ready, 1/2HP or 1HP
-4TH or -4T1	460V 1PH or 3PH, 3rd Party Controls, BACNet ready, 1/2HP or 1HP

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.

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MicroMetl	Date: 1/24/2024	Weights: 191lbs/86.64kg	Units: 48FC M07	Part Number: PECD-SRT12CB-D0DB-4L1-4
Submitted To: brhernandez@siglers.com	Job:	Notes:		

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Vertical with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 2675 CFM @ 1/2" - 1 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 **ECD-SRT12CA** Series Economizer. See economizer submittal for economizer details.
- Designed specifically for vertical discharge applications. Easy to install. Easy to service.
- Includes assembled rainhood with aluminum water entrainment filters in the outside air section.
- Rainhood is sloped for water run-off.
- Built-in barometric relief damper provided.
- All harnesses and plugs needed are provided.
- Uses standard filter access door shipped with HVAC unit.
- If factory hinged access door option is installed on unit, an additional kit is required to seal hinged door properly.
  - OEM part no. CRPECONV003A00 or MicroMetl part number 0640-0100-HDANGL

Notes:

1. Control systems include DDC actuator, 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: 1/24/2024	Weights: 191lbs/86.64kg	Units: 48FC M07	Part Number: PECD-SRT12CB-D0DB-4L1-4

Submitted To: brhernandez@siglers.com	Job:	Notes:

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Vertical with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 2675 CFM @ 1/2" - 1 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: 1/24/2024	Weights: 191lbs/86.64kg	Units: 48FC M07	Part Number: PECD-SRT12CB-D0DB-4L1-4
Submitted To: brhernandez@siglers.com	Job:	Notes:		

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Vertical with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 2675 CFM @ 1/2" - 1 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 Low Static Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
1VH	208-230	1	Constant Volume	0.5	4.1-4.3	5.1-5.4	9.2-9.7	N/A
2VH	208-230	3	Constant Volume	0.5	2.3-2.2	2.9-2.8	5.2-5.0	N/A
1LH or 1TH	230	1	Modulating	0.5	5.7*	7.1	12.8	10 Amp
2LH or 2TH	230	3	Modulating	0.5	3.9*	4.9	8.8	10 Amp
4VH	460	3	Constant Volume	0.5	1.1	1.4	2.5	N/A
4LH or 4LH	460	3	Modulating	0.5	1.5*	1.9	3.4	10 Amp

- Series High 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
1L1	208-230	1	Modulating	1.0	10.0*	12.5	22.5	20 Amp
2L1 or 2T1	230	3	Modulating	1.0	6.4*	8.0	14.4	12 Amp
4V1	460	3	Constant Volume	1.0	1.9	2.4	4.3	N/A
4L1 or 4T1	460	3	Modulating	1.0	2.8*	3.5	6.3	10 Amp

*VFD Input Current

"1/2 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.
2200	0.1	712	dBA	76	74	71	69	68	65	61	58	62
2075	.25	760		78	76	74	71	70	68	64	61	64
2025	.3	781		78	76	75	72	71	69	64	61	65
1950	.4	821		81	78	76	73	71	69	65	62	66
1850	.5	864		83	80	77	74	72	69	66	63	67
1775	.6	908		84	82	79	76	74	72	68	65	68
1650	.75	974		86	83	82	78	76	76	70	67	71

"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.
2900	0.1	840	dBA	82	79	76	73	71	68	65	62	66
2825	.25	875		83	80	78	74	73	70	67	64	67
2800	.3	886		83	81	78	75	73	71	67	64	68
2725	.4	909		84	81	79	76	74	73	68	65	69
2675	.5	935		85	82	80	77	75	74	69	66	70
2625	.6	967		86	83	82	78	76	75	70	67	71
2525	.75	1011		87	85	83	79	77	76	71	68	72

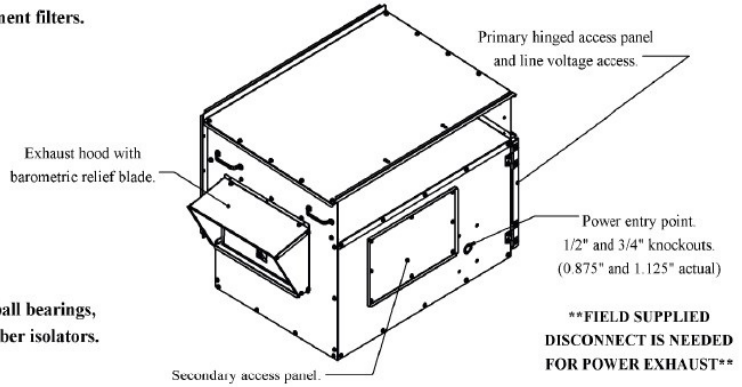
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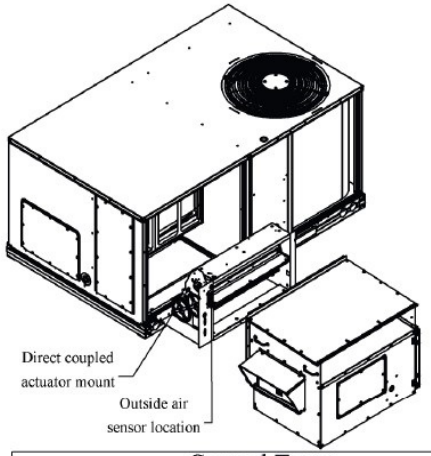
MicroMetl	Date: 1/25/2024	Weights: 191lbs/86.64kg	Units: Bldg H-H-11-14;19-22	Part Number: PECD-SRT12CB-D0DB-4LH-4
Submitted To: brhernandez@siglers.com	Job:	Notes:		

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Vertical with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 1850 CFM @ 1/2" - 1/2 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..

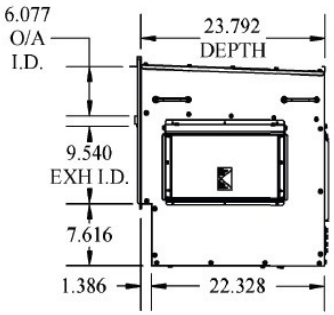
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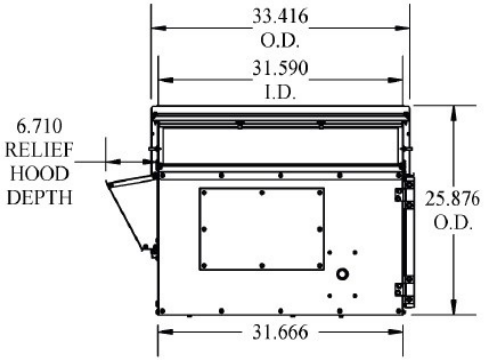
- **Includes ECD-SRT12CB series economizer.**
- **External gear driven dampers with roll formed blades.**
- **Designed for vertical applications only.**
- **Factory assembled rain hood, with aluminum water entrainment filters.**
- **Filter access door supplied with RTU.**
- **Hinged filter access door is ordered separately.**
  - **MMC P/# for Chassis 1 - ECD-SRT1CA-HDOOR**
  - **MMC P/# for Chassis 2 - ECD-SRT2CA-HDOOR**
- **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**
- **See page 2 for PE performance and electrical data.**











-Control Types	
-D2DH	W7220 controller, actuator w/feedback, adjustable drybulb controls
-D2EH	W7220 controller, actuator w/feedback, enthalpy controls
-D2XH	W7220 controller, actuator w/feedback, dual adjustable drybulb controls
-D2ZH	W7220 controller, actuator w/feedback, dual enthalpy controls
-D0DB-4	RTU Open - Premier Link - System VU, No controller, Adjustable dry bulb, Belimo actuator
-D0DB-X	Comfortlink - No controller, Adjustable dry bulb, Belimo MFT actuator with 500 ohm resistor
-D00H-H	Communicating Honeywell actuator only
-D00H	Non-communicating Honeywell actuator only
-D00B	Belimo actuator with feedback and end switch
-D00S	Siemens actuator with feedback
-PE Options	
-2VH or -2V1	208/230V 1PH or 3PH, Constant Volume, 1/2HP or 1HP
-2LH or -2L1	208/230V 1PH or 3PH, Modulating, BACNet ready, 1/2HP or 1HP
-2TH or -2T1	20/230V 1PH or 3PH, 3rd Party Controls, BACNet ready, 1/2HP or 1HP
-4VH or -4V1	460V 1PH or 3PH, Constant Volume, 1/2HP or 1HP
-4LH or -4L1	460V 1PH or 3PH, Modulating, BACNet ready, 1/2HP or 1HP
-4TH or -4T1	460V 1PH or 3PH, 3rd Party Controls, BACNet ready, 1/2HP or 1HP

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.

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MicroMetl	Date: 1/25/2024	Weights: 191lbs/86.64kg	Units:	Part Number: PECD-SRT12CB-D0DB-4LH-4
Submitted To: brhernandez@siglers.com	Job:	Notes:		

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Vertical with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 1850 CFM @ 1/2" - 1/2 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 **ECD-SRT12CA** Series Economizer. See economizer submittal for economizer details.
- Designed specifically for vertical discharge applications. Easy to install. Easy to service.
- Includes assembled rainhood with aluminum water entrainment filters in the outside air section.
- Rainhood is sloped for water run-off.
- Built-in barometric relief damper provided.
- All harnesses and plugs needed are provided.
- Uses standard filter access door shipped with HVAC unit.
- If factory hinged access door option is installed on unit, an additional kit is required to seal hinged door properly.
  - OEM part no. CRPECONV003A00 or MicroMetl part number 0640-0100-HDANGL

Notes:

1. Control systems include DDC actuator, 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: 1/25/2024	Weights: 191lbs/86.64kg	Units:	Part Number: PECD-SRT12CB-D0DB-4LH-4
Submitted To: brhernandez@siglers.com	Job:	Notes:		

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Vertical with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 1850 CFM @ 1/2" - 1/2 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: 1/25/2024	Weights: 191lbs/86.64kg	Units:	Part Number: PECD-SRT12CB-D0DB-4LH-4
Submitted To: brhernandez@siglers.com	Job:	Notes:		

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Vertical with RTU Open - Premier Link - System VU - No Controller, Belimo Actuator, Adjustable Dry Bulb Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 1850 CFM @ 1/2" - 1/2 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 Low Static Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
1VH	208-230	1	Constant Volume	0.5	4.1-4.3	5.1-5.4	9.2-9.7	N/A
2VH	208-230	3	Constant Volume	0.5	2.3-2.2	2.9-2.8	5.2-5.0	N/A
1LH or 1TH	230	1	Modulating	0.5	5.7*	7.1	12.8	10 Amp
2LH or 2TH	230	3	Modulating	0.5	3.9*	4.9	8.8	10 Amp
4VH	460	3	Constant Volume	0.5	1.1	1.4	2.5	N/A
4LH or 4LH	460	3	Modulating	0.5	1.5*	1.9	3.4	10 Amp

- Series High 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
1L1	208-230	1	Modulating	1.0	10.0*	12.5	22.5	20 Amp
2L1 or 2T1	230	3	Modulating	1.0	6.4*	8.0	14.4	12 Amp
4V1	460	3	Constant Volume	1.0	1.9	2.4	4.3	N/A
4L1 or 4T1	460	3	Modulating	1.0	2.8*	3.5	6.3	10 Amp

*VFD Input Current

"1/2 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.
2200	0.1	712	dBA	76	74	71	69	68	65	61	58	62
2075	.25	760		78	76	74	71	70	68	64	61	64
2025	.3	781		78	76	75	72	71	69	64	61	65
1950	.4	821		81	78	76	73	71	69	65	62	66
1850	.5	864		83	80	77	74	72	69	66	63	67
1775	.6	908		84	82	79	76	74	72	68	65	68
1650	.75	974		86	83	82	78	76	76	70	67	71

"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.
2900	0.1	840	dBA	82	79	76	73	71	68	65	62	66
2825	.25	875		83	80	78	74	73	70	67	64	67
2800	.3	886		83	81	78	75	73	71	67	64	68
2725	.4	909		84	81	79	76	74	73	68	65	69
2675	.5	935		85	82	80	77	75	74	69	66	70
2625	.6	967		86	83	82	78	76	75	70	67	71
2525	.75	1011		87	85	83	79	77	76	71	68	72

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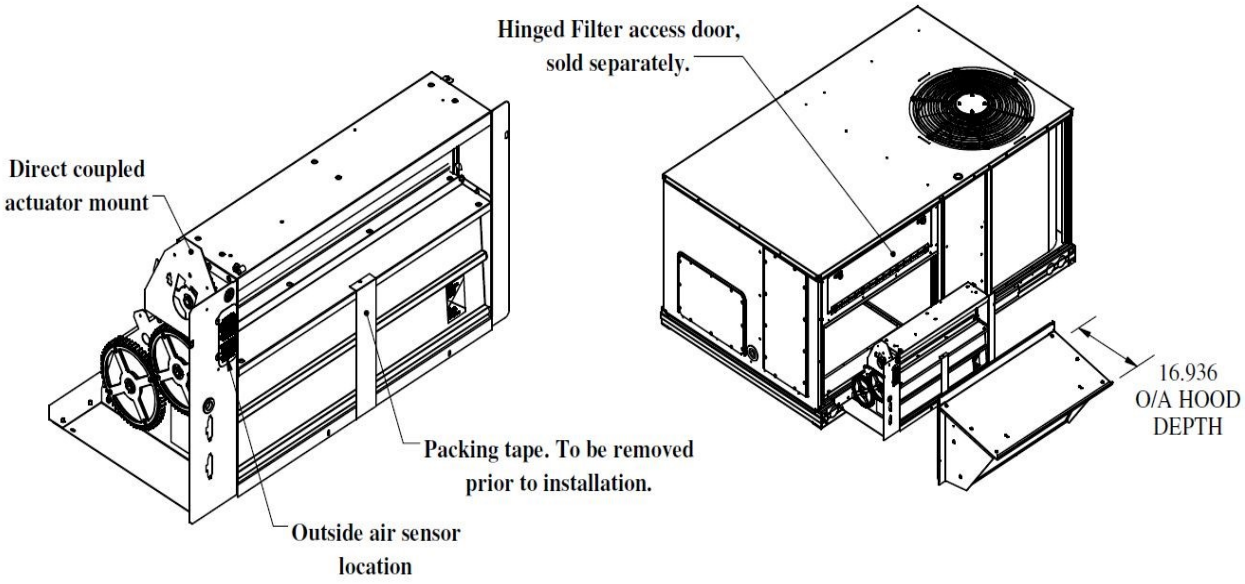
MicroMetl	Date:	Weight: 45lbs (US) 20.41kg (Metric)	Part Number: ECD-SRT12CB-D0DB-4
	RTU:		
Submitted to:		Approved by:	Notes:

Economizer - Economizer - Genesis Ultra Low Leak Economizer, Vertical Orientation, RTU Open - Premier Link - System VU - No Controller, Adjustable Dry Bulb Sensor, Belimo Actuator. Painted Rain Hood With Aluminum Filter, Barometric Relief, All Necessary Panels And Hardware Included.

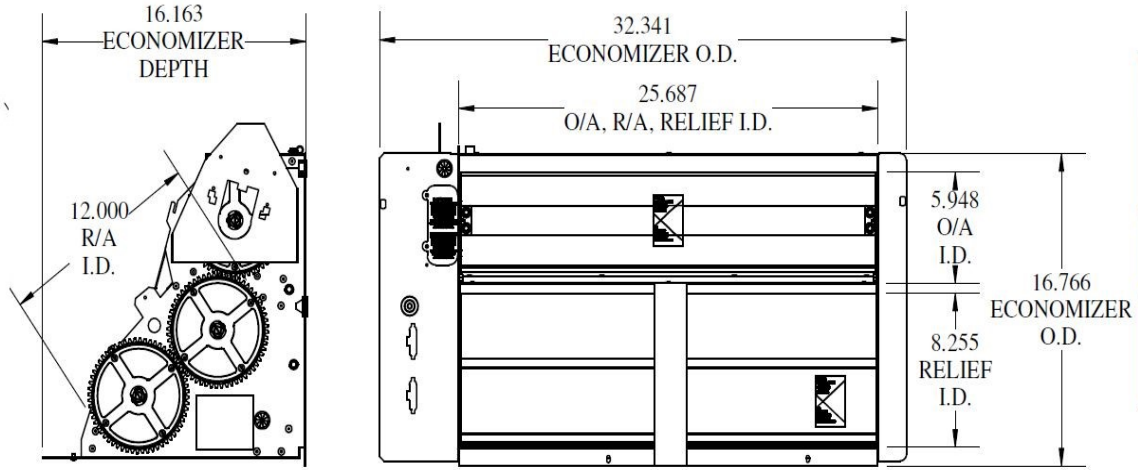
Bldg H-1-4;7-10;15-18;23,24

FEATURES:

- External gear driven dampers with roll formed blades.
- Designed for vertical applications only.
- Factory assembled rain hood, with aluminum water entrainment filters.
- Filter access door supplied with RTU.
- Hinged filter access door is ordered separately.
  - MMC P/# for Chassis 1 - ECD-SRT1CA-HDOOR
  - MMC P/# for Chassis 2 - ECD-SRT2CA-HDOOR
- Rain hood is sloped for water run off.
- All harnesses and plugs needed are supplied.
- Economizer is class 1A & AMCA rated.
- Relief blades are AMCA rated.
- Uses filter rack with unit.
- Motorized relief available, add -M to end of part number
  - Ex: ECD-SRT12CB-D00H-M
- Economizer with smoke detector available, add -S to end of part number
  - Ex: ECD-SRT12CB-D00H-S



-Control Types	
-D0DB-4	RTU Open - Premier Link - System VU, No controller, Adjustable dry bulb, Belimo actuator
-D0DB-X	Comfortlink - No controller, Adjustable dry bulb, Belimo MFT actuator with 500 ohm resistor
-D00H-H	Communicating Honeywell actuator only
-D00H	Non-communicating Honeywell actuator only
-D00B	Belimo actuator with feedback and end switch
-D00S	Siemens actuator with feedback



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Master Revision 0001A

Page Revision 0001A

MicroMetl	Date:	Weight: 45lbs (US) 20.41kg (Metric)	Part Number: ECD-SRT12CB-D0DB-4
	RTU:		
Submitted to:		Approved by:	Notes:

Economizer - Economizer - Genesis Ultra Low Leak Economizer, Vertical Orientation, RTU Open - Premier Link - System VU - No Controller, Adjustable Dry Bulb Sensor, Belimo Actuator. Painted Rain Hood With Aluminum Filter, Barometric Relief, All Necessary Panels And Hardware Included.

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:

- For single or 2 speed indoor fan units. Other control options available.
- Gear driven design for trouble-free operation, eliminating slippage and binding associated with standard linkage.
- Includes assembled rainhood with aluminum water entrainment filters in the outside air section.
- Rainhood is sloped for water run-off.
- Built-in barometric relief damper provided. Power exhaust options available.
- All harnesses and plugs needed are provided.
- Uses standard factory filter access door shipped with HVAC unit.
- If factory hinged access door option is installed on unit, an additional kit is required to seal hinged door properly.
  - OEM part no. CRPECONV003A00 or MicroMetl part number 0640-0100-HDANGL

Notes:

1. Control systems include DDC actuator, 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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Master Revision 0001A

Page Revision 0001A

SECTION III. RESIDENTIAL SPLIT SYSTEM



SUBMITTAL

Project

Lynwood USD Will Rogers Elementary

Table Of Contents

Project: Lynwood USD Will Rogers Elementary 02/01/2024
Prepared By:

Bldg H-HP-1-10 ..... **3**
Unit Report 4
Performance Summary 5
System Parameters 5
Electrical Data 5
Acoustic Summary 6
Certified Drawing 7

Bldg H-HP-1-10

Submittal Cover Sheet
Unit Report
Performance Summary Report
Acoustic Summary
Certified Drawings

Unit Report For Bldg H-HP-1-10

Project: Lynwood USD Will Rogers Elementary 02/01/2024
Prepared By:





Outdoor Unit Parameters

Unit Model:	**25SCA**	
Unit Size:	**2 Tons (Size 24)**	
Voltage:	**208/230-1-60**	V-Ph-Hz

Indoor Coil Parameters

Unit Model:	**FJ4D**	
Unit Size:	**24,000 Btuh (Size 24)**	
Cabinet Width:	**TXV/ 17 Inches Cabinet**	
Voltage:	**208-1-60**	V-Ph-Hz
Heating Size:	**No Heat**	

Outdoor Unit Dimensions and Weight

Unit Length:	**31.1875**	in
Unit Width:	**31.1875**	in
Unit Height:	**32.0625**	in
Unit Shipping Weight:	**190.**	lb

Indoor Coil Dimensions and Weight

Unit Length:	**22.0625**	in
Unit Width:	**17.625**	in
Unit Height:	**49.625**	in
Unit Shipping Weight:	**131.**	lb

RESIDENTIAL APPLICATIONS

This warranty is to the original purchasing owner and subsequent owners only to the extent and as stated in the Warranty Conditions and below. The limited warranty period in years, depending on the part and the claimant, is as shown in the table below.

Limited Warranty (Years)		
Item	**Original Owner**	**Subsequent Owner**
Parts	10* (or 5)	5
Compressor	10* (or 5)	5

***If properly registered within 90 days of original installation, otherwise 5 years (except in California and Quebec and other jurisdictions that prohibit warranty benefits conditioned on registration). See Warranty Conditions below.**

OTHER APPLICATIONS

The warranty period is five (5) years on the compressor, and one (1) year on all other parts. The warranty is the original owner only and is not available for subsequent owners.

Ordering Information

Part Number	Description	Quantity
Outdoor Unit		
25SCA524A003	25SCA Comfort Single Stage Heat Pump with Puron Refrigerant 2 Tons Cooling	10
	15 SEER @ ARI Conditions	
Indoor Coil		
FJ4DNXB24L00	FJ4D Base Series Fan Coil with Puron 24000 BTU Cooling 208/230-1-60	10
	TXV/ 17 Inches Cabinet	
	Aluminum	

The Product and Ratings Data in this program is subject to change at any time and without notice. Please refer to the latest product literature and the AHRI directory at www.ahridirectory.org for the most up-to-date information.

Performance Summary For Bldg H-HP-1-10

Project: Lynwood USD Will Rogers Elementary 02/01/2024
Prepared By:

System Performance

System:	**25SCA/FJ4D**	
System Quantity:	**10**	
Altitude:	**0.0**	ft
Linear Pipe Length:	**0.0**	ft
COP @ 47 F:	**3.98**	
COP @ 17 F:	**2.60**	
SEER2 @ ARI Conditions:	**15.2**	
EER2 @ ARI Conditions:	**12.5**	
HSPF2 @ ARI Conditions:	**7.5**	

Actual Clg Airflow:	**800.0**	CFM
Standard Clg Airflow:	**800.0**	CFM
Total Net Clg Capacity:	**23.86**	MBH
Net Sensible Clg Capacity:	**18.03**	MBH
Htg HP Capacity:	**23.64**	MBH
Htg HP Integrated Capacity:	**23.64**	MBH
Total System Power:	**1.83**	kW

System Parameters

Outdoor Unit Parameters

Unit Model:	**25SCA524A003**	
Unit Size (Nominal):	**2 Tons (Size 24)**	
Voltage:	**208/230-1-60**	V-Ph-Hz
Clg Ent Air DB Ambient:	**95.0**	°F
Htg Ent Air DB Ambient:	**47.0**	°F

Indoor Coil Parameters

Unit Model:	**FJ4DNXB24L00**	
Unit Size (Nominal):	**24,000 Btuh (Size 24)**	
Voltage:	**208-1-60**	V-Ph-Hz
Ent Air DB:	**80.00**	°F
Ent Air WB:	**67.00**	°F
Ent Enthalpy:	**31.44**	BTU/lb
Lvg Air DB:	**59.14**	°F
Lvg Air WB:	**57.65**	°F
Lvg Enthalpy:	**24.81**	BTU/lb
Htg Ent Air DB:	**70.0**	°F
Htg Lvg Air DB:	**97.4**	°F
Heating Size (Nominal):	**No Heat**	
Total External Static Pressure:	**0.50**	in wg

Electrical Data

Outdoor Electrical Data

Unit Voltage:	**208/230-1-60**	V-Ph-Hz
Fan Motor FLA:	**0.60**	Amps
MCA:	**14.5**	Amps
Max Fuse:	**25**	Amps
Operating Range Min:	**197**	V
Operating Range Max:	**253**	V
Compressor RLA:	**11.1**	Amps
Compressor LRA:	**59.5**	Amps

Indoor Electrical Data:

(For units with no factory installed electric heaters)

Unit Voltage:	**208-1-60**	V-Ph-Hz
Unit FLA:	**2.9**	Amps
Unit MCA:	**3.6**	Amps
Unit MOCP:	**15.0**	Amps
Unit Min Wire Size:	**14.0**	
Unit Fuse/Ckt Bkr Amps:	**15.0**	Amps
Motor HP:	**1/3**	HP

Notice: Indoor Elect. data is for 208-1-60 voltage

The Product and Ratings Data in this program is subject to change at any time and without notice. Please refer to the latest product literature and the AHRI directory at www.ahridirectory.org for the most up-to-date information.

Acoustic Summary For Bldg H-HP-1-10

Project: Lynwood USD Will Rogers Elementary 02/01/2024
Prepared By:

Outdoor Unit Parameters:

Unit Model: **25SCA**
Unit Size: **2 Tons (Size 24)**
Variations: **Standard**

Octave Band Center Frequency, Hz	125	250	500	1k	2k	4k	8k	dBA
Sound Power,dB	66.3	68.4	69.4	67.7	64.4	61.4	55.9	
A-Weighted Sound Power, dBA								76.0

Indoor Coil Parameters:

Unit Model: **FJ4D**
Unit Size: **24,000 Btuh (Size 24)**
Cabinet Width: **TXV/ 17 Inches Cabinet**

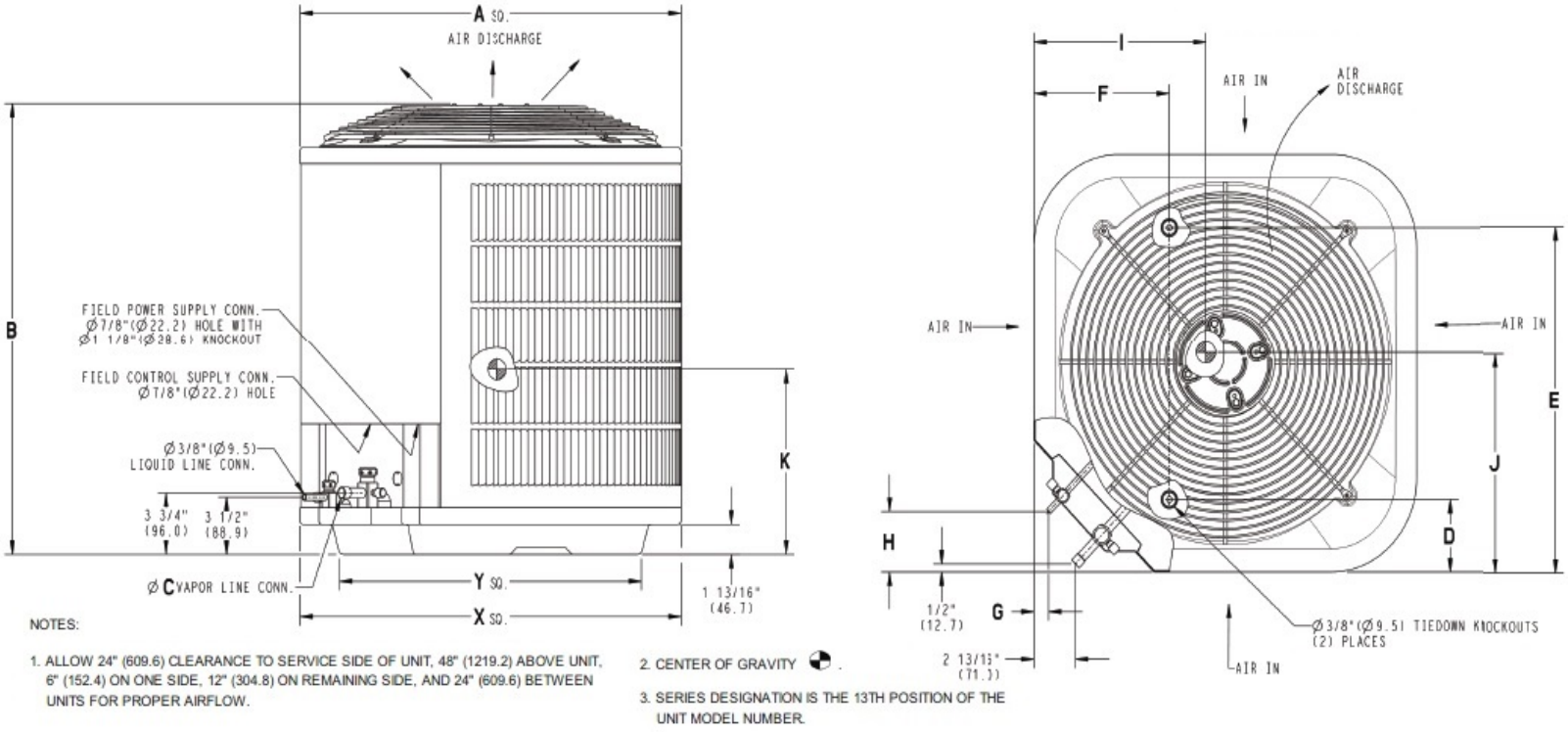
Octave Band Center Frequency, Hz	63	125	250	500	1k	2k	4k
Sound Power,dB	72.0	68.0	64.0	61.0	59.0	57.0	53.0

The Product and Ratings Data in this program is subject to change at any time and without notice. Please refer to the latest product literature and the AHRI directory at www.ahridirectory.org for the most up-to-date information.

Certified Drawing For Bldg H-HP-1-10

Project: Lynwood USD Will Rogers Elementary
Prepared By:

02/01/2024



Outdoor Model

Unit Model:	**25SCA**	
Unit Size:	**2 Tons (Size 24)**	
Voltage:	**208/230-1-60**	V-Ph-Hz
SEER:	**15**	
PartNumber:	**25SCA524A003**	

Shipping Dimensions and Weights	Outdoor Unit
Height	37.31 in
Width	34.25 in
Length	34.25 in
Operating Weight	159. lb
Shipping Weight	190. lb

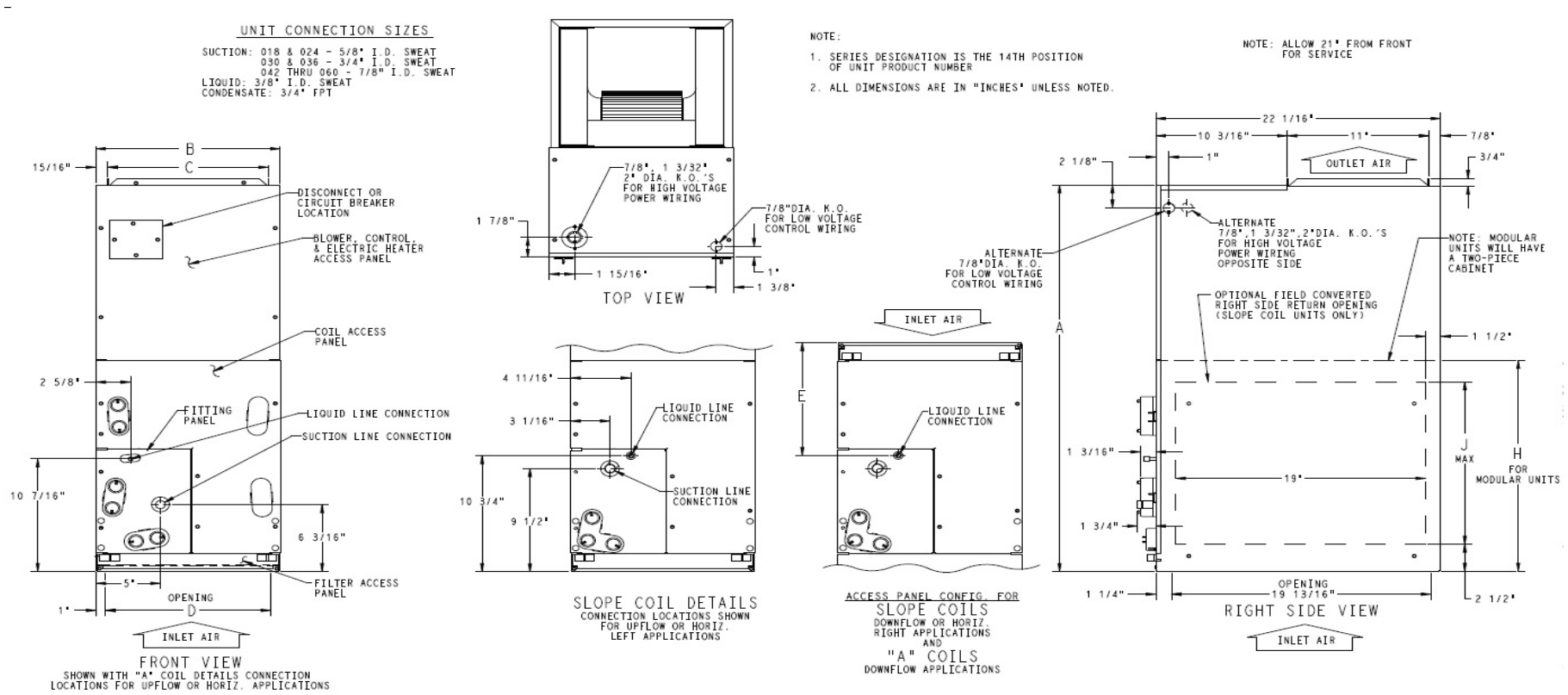
Dimensions										
A	B	C	D	E	F	G	H	I	J	K
31.19 in	32.06 in	0.63 in	6.56 in	24.70 in	9.13 in	1.10 in	3.81 in	13.75 in	14.00 in	14.50 in

The Product and Ratings Data in this program is subject to change at any time and without notice. Please refer to the latest product literature and the AHRI directory at www.ahridirectory.org for the most up-to-date information.

Certified Drawing For Bldg H-HP-1-10

Project: Lynwood USD Will Rogers Elementary
Prepared By:

02/01/2024



Indoor Coil

Unit Model:	**FJ4D**	
Unit Size:	**24,000 Btuh (Size 24)**	
Voltage:	**208-1-60**	V-Ph-Hz
Cabinet Insulation:	**TXV/ 17 Inches Cabinet**	
PartNumber:	**FJ4DNXB24L00**	

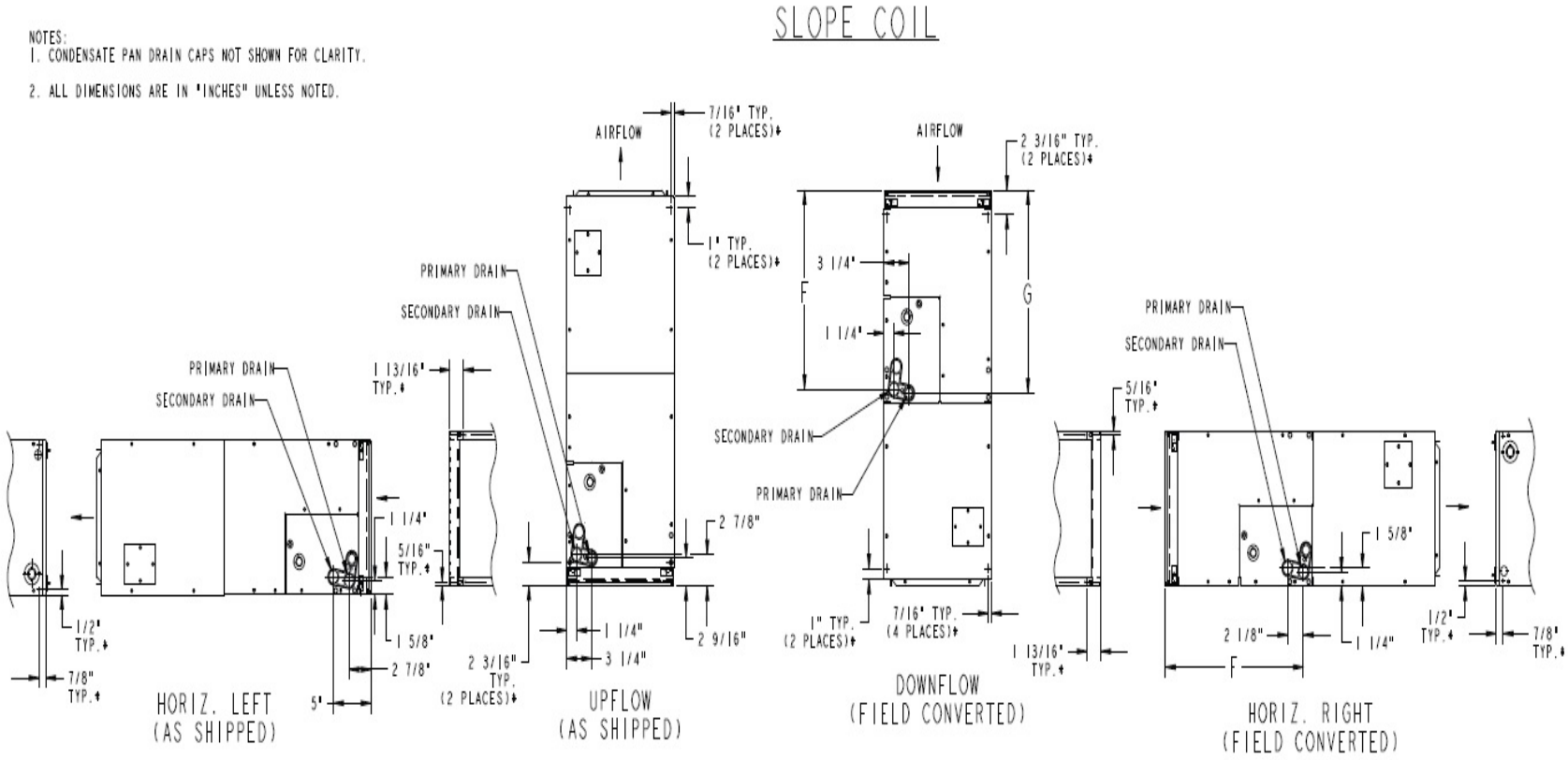
Dimensions and Weights	Indoor Coil
Height	50.00 in
Width	17.63 in
Length	22.06 in
Shipping Weight	131. lb

Dimensions								
A	B	C	D	E	F	G	H	J
49.63 in	17.63 in	15.75 in	15.63 in	15.40 in	23.10 in	24.00 in	--	17.00 in

The Product and Ratings Data in this program is subject to change at any time and without notice. Please refer to the latest product literature and the AHRI directory at www.ahridirectory.org for the most up-to-date information.

Certified Drawing For Bldg H-HP-1-10

Project: Lynwood USD Will Rogers Elementary 02/01/2024
Prepared By:



Indoor Coil

Unit Model:	**FJ4D**	
Unit Size:	**24,000 Btuh (Size 24)**	
Voltage:	**208-1-60**	V-Ph-Hz
PartNumber:	**FJ4DNXB24L00**	

The Product and Ratings Data in this program is subject to change at any time and without notice. Please refer to the latest product literature and the AHRI directory at www.ahridirectory.org for the most up-to-date information.

SECTION IV. DUCTLESS SPLIT SYSTEMS

Residential & Light Commercial Heat Pump System

Indoor Model: RAV-SM362UTP-UL
Outdoor Model: RAV-SP362AT2P-UL

TOSHIBA
Carrier

Submittal Data

Job Name _____ Location _____

Tag _____

L2-CU



A221038

OUTDOOR UNIT STANDARD FEATURES

- Digital inverter compressor technology
- System can operate in cooling only mode with heating locked out
- Line lengths up to 246 ft
- Low-ambient cooling down to 5°F
- System diagnostics

OUTDOOR UNIT MODEL		RAV-SP362AT2P-UL
SYSTEM PERFORMANCE		
Nominal Cooling Capacity†	Btu/h	36,000
SEER2		25.70
EER2		14.50
Nominal Heating Capacity†	Btu/h	40,000
HSPF2		11.10
COP2		3.80
REFRIGERANT LINES		
Total Piping Length	ft	246
Vertical Lift	ft	98
Suction Line Size	in	5/8
Liquid Line Size	in	3/8
AMBIENT OPERATING RANGE		
Cooling DB Min ~ Max*	F	-13~115
Heating DB Min ~ Max	F	-13~59
REFRIGERANT		R410A
FACTORY CHARGE	lbs	6.80

AIRFLOW		
Cooling	CFM	3570
Heating	CFM	3100
SOUND PRESSURE LEVEL		
Cooling	db(A)	54
Heating	db(A)	54
ELECTRICAL		
Power Supply	V/Ph/Hz	208-230/1/60
Minimum Circuit Amps (MCA)	A	30
Recommended Fuse Size	A	40
Maximum Over Current Protection (MOCP)	A	40
PHYSICAL DATA		
Unit Width	in	35-3/8
Unit Height	in	52-3/4
Unit Length	in	12-5/8
Unit Weight - Net / Gross	lbs	218 / 232

Legend
db — Dry Bulb
SEER — Seasonal Energy Efficiency Ratio
HSFP — Heating Seasonal Performance Factor
wb — Wet Bulb

†Rated per AHRI (Air-Conditioning, Heating and Refrigeration Institute) 210/240 Standard.
Cooling: Indoor 80°F (27°C) db/67°F (20°C) wb; Outdoor 95°F (35°C) db
Heating: Indoor 70°F (21°C) db; Outdoor 47°F (8°C) db/43°F (6°C) wb

* Requires wind baffle to operate in cooling mode down to -13°F

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Edition Date: 11/22
Printed in U.S.A.
Form No: RAV-SM362UTP-UL-02
Replaces: RAV-SM362UTP-UL-01

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L2-Cassette



A220922

RAV-SM362UTP-UL 4-WAY CASSETTE FEATURES

- R-410A refrigerant
- Six sizes from 18,000 to 48,000 Btu/h
- Optional fresh air intake
- Quiet operation (as low as 35 dBA)
- Standard condensate pump with 26 in. lift capacity
- Independent louver control (fixed or swing)
- Optional wired or wireless controls
- Auto or manually set three fan speeds
- Easy to remove cleanable filter

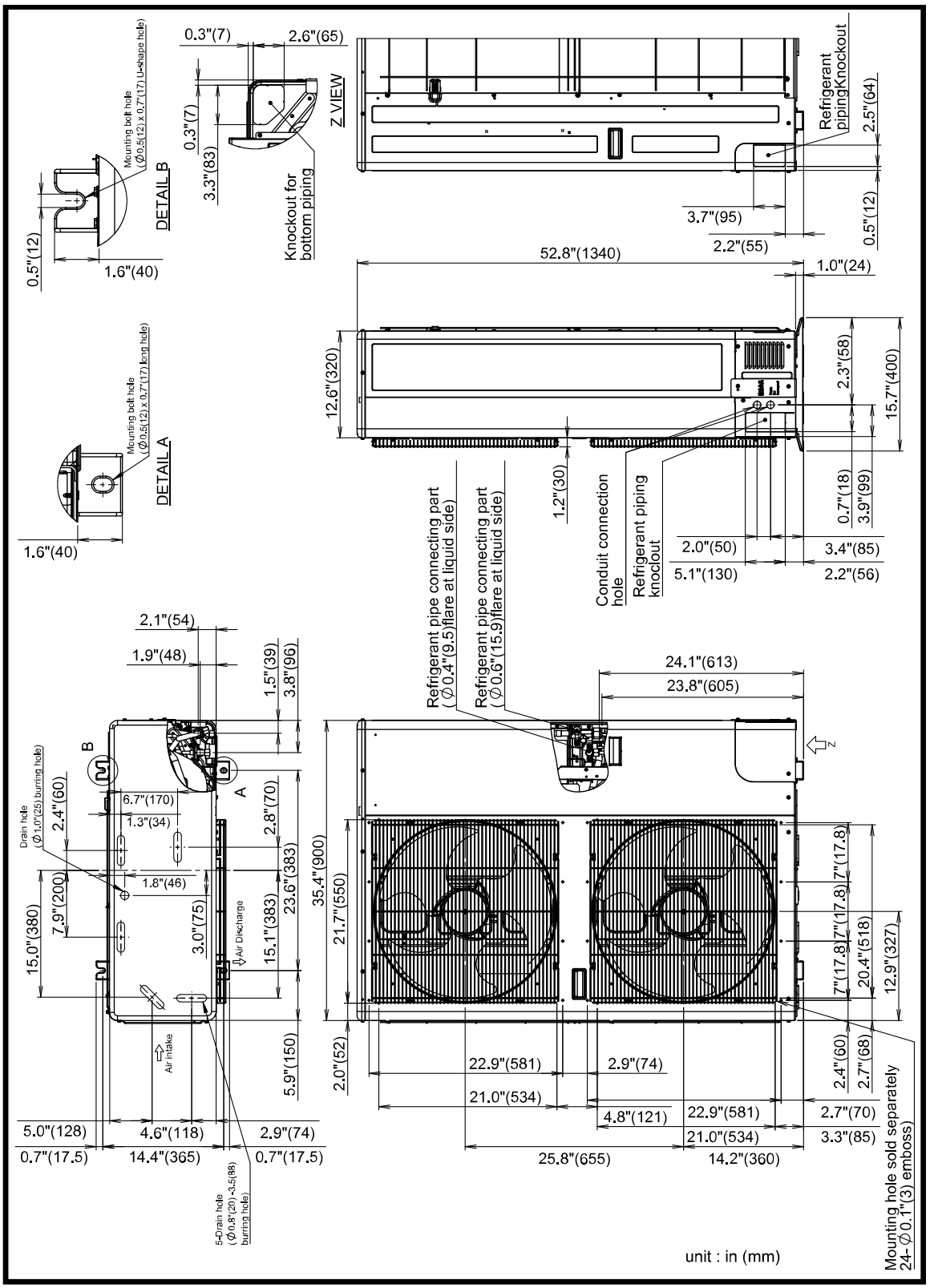
INDOOR UNIT MODEL		RAV-SM362UTP-UL
PERFORMANCE		
Cooling Rated Capacity	Btu/h	36,000
Heating Rated Capacity	Btu/h	40,000
Fan Type (Qty)		Turbo (1)
Airflow (H/M/L)	CFM	1200/850/650
Sound Pressure (H/M/L)	dBA	45/39/35
ELECTRICAL		
Power Supply	V/Ph/Hz	From ODU
FILTER		
Type		Washable
Quantity		1
MERV Corresponding Value		5
Dimensions (W x L x D)	in.	21-3/8 x 21-7/8 x 3/4

PHYSICAL DATA		
Pipe Connection Size - Liquid (High Pressure)	in	3/8 (Flare)
Pipe Connection Size - Gas (Low Pressure)	in	5/8 (Flare)
Condensate Drain Connection	in	1-1/4
Refrigerant		R-410A
External Finish		Zinc Hot Dipping Steel Plate
Unit Width	in	33-1/8
Unit Height	in	12-5/8
Unit Depth	in	33-1/8
Unit Net Weight	lb	55
Panel Width	in	37-3/8
Panel Height	in	1-1/4
Panel Depth	in	37-3/8
Panel Weight	lb	10.0
MOTOR		
Motor Type		DC
Motor Watts	W	130

ACCESSORIES (Optional)

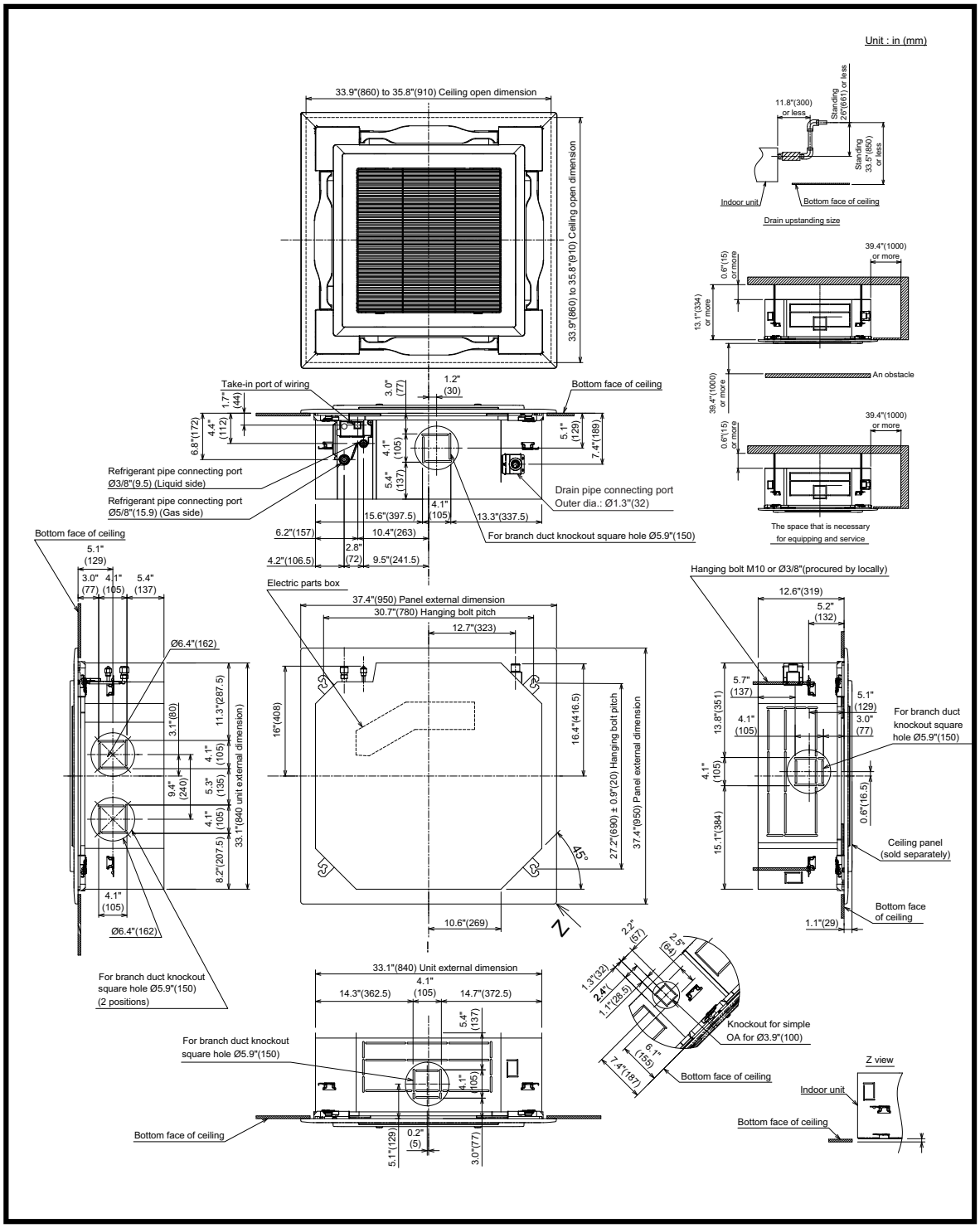
- ☐ Wired Remote Controller (7-Day Programmable) RBC-AMS54E-UL
- ☐ Simple Wired Remote Controller RBC-AS41UL
- ☐ Integral Receiver with Wireless Remote RBC-AX32U(W)-UL
- ☐ Stand Alone Receiver with Wireless Remote TCB-AX32-UL
- ☐ Remote Sensor TCB-TC41LUL
- ☐ Wired Remote Controller RBC-AMT32UL
- ☐ Grille Panel RBC-U32PGP-UL
- ☐ Spacer for Height Adjustment TCB-SP1602UUL
- ☐ Air Discharge Direction Kit TCB-BC1602UUL
- ☐ Fresh Air Chamber TCB-GFC1602UUL
- ☐ Fresh Air Inlet Box TCB-GB1602UUL
- ☐ Auxiliary Fresh Air Flange TCB-FF101URUL

DIMENSIONAL DRAWING
OUTDOOR UNIT RAV-SP362AT2P-UL



A221039

DIMENSIONAL DRAWING
INDOOR UNIT 4-WAY CASSETTE RAV-SP362UTP-UL



A221040

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Edition Date: 11/22
Printed in U.S.A.
Form No: RAV-SM362UTP-UL-02
Replaces: RAV-SM362UTP-UL-01

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Residential & Light Commercial Heat Pump System

Indoor Model: RAV-SM482UTP-UL
Outdoor Model: RAV-SP482AT2P-UL

TOSHIBA
Carrier

Submittal Data

Job Name _____ Location _____

Tag _____

L1-CU



A221038

OUTDOOR UNIT STANDARD FEATURES

- Digital inverter compressor technology
- System can operate in cooling only mode with heating locked out
- Line lengths up to 246 ft
- Low-ambient cooling down to 5°F
- System diagnostics

OUTDOOR UNIT MODEL		RAV-SP482AT2P-UL
SYSTEM PERFORMANCE		
Nominal Cooling Capacity†	Btu/h	48,000
SEER2		22.40
EER2		10.60
Nominal Heating Capacity†	Btu/h	54,000
HSPF2		9.80
COP2		3.20
REFRIGERANT LINES		
Total Piping Length	ft	246
Vertical Lift	ft	98
Suction Line Size	in	5/8
Liquid Line Size	in	3/8
AMBIENT OPERATING RANGE		
Cooling DB Min ~ Max*	F	-13~115
Heating DB Min ~ Max	F	-13~59
REFRIGERANT		R410A
FACTORY CHARGE	lbs	7.3

AIRFLOW		
Cooling	CFM	4540
Heating	CFM	4060
SOUND PRESSURE LEVEL		
Cooling	db(A)	60
Heating	db(A)	60
ELECTRICAL		
Power Supply	V/Ph/Hz	208-230/1/60
Minimum Circuit Amps (MCA)	A	32
Recommended Fuse Size	A	40
Maximum Over Current Protection (MOCP)	A	40
PHYSICAL DATA		
Unit Width	in	35-3/8
Unit Height	in	52-3/4
Unit Length	in	12-5/8
Unit Weight - Net / Gross	lbs	234 / 247

Legend

db — Dry Bulb
SEER — Seasonal Energy Efficiency Ratio
HSFP — Heating Seasonal Performance Factor
wb — Wet Bulb

†Rated per AHRI (Air-Conditioning, Heating and Refrigeration Institute) 210/240 Standard.
Cooling: Indoor 80°F (27°C) db/67°F (20°C) wb; Outdoor 95°F (35°C) db
Heating: Indoor 70°F (21°C) db; Outdoor 47°F (8°C) db/43°F (6°C) wb

* Requires wind baffle to operate in cooling mode down to -13°F

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Edition Date: 11/22
Printed in U.S.A.
Form No: RAV-SM482UTP-UL-02
Replaces: RAV-SM482UTP-UL-01

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A220922

RAV-SM482UTP-UL 4-WAY CASSETTE FEATURES

- R-410A refrigerant
- Six sizes from 18,000 to 48,000 Btu/h
- Optional fresh air intake
- Quiet operation (as low as 42 dBA)
- Standard condensate pump with 26 in. lift capacity
- Independent louver control (fixed or swing)
- Optional wired or wireless controls
- Auto or manually set three fan speeds
- Easy to remove cleanable filter

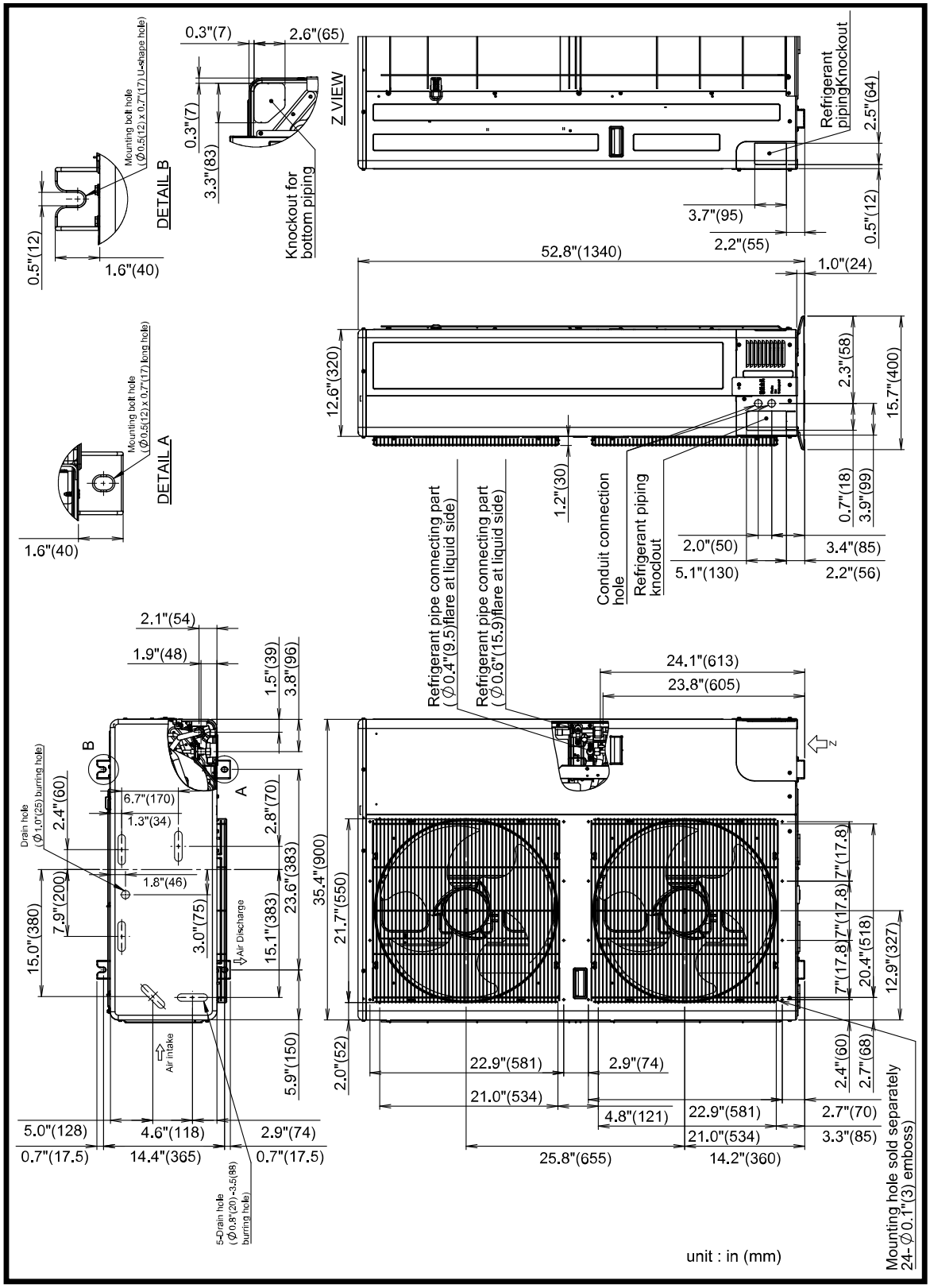
INDOOR UNIT MODEL		RAV-SM482UTP-UL
PERFORMANCE		
Cooling Rated Capacity	Btu/h	48,000
Heating Rated Capacity	Btu/h	54,000
Fan Type (Qty)		Turbo (1)
Airflow (H/M/L)	CFM	1300/1080/880
Sound Pressure (H/M/L)	dBA	48/44/42
ELECTRICAL		
Power Supply	V/Ph/Hz	From ODU
FILTER		
Type		Washable
Quantity		1
MERV Corresponding Value		5
Dimensions (W x L x D)	in.	21-3/8 x 21-7/8 x 3/4

PHYSICAL DATA		
Pipe Connection Size - Liquid (High Pressure)	in	3/8 (Flare)
Pipe Connection Size - Gas (Low Pressure)	in	5/8 (Flare)
Condensate Drain Connection	in	1-1/4
Refrigerant		R-410A
External Finish		Zinc Hot Dipping Steel Plate
Unit Width	in	33-1/8
Unit Height	in	12-5/8
Unit Depth	in	33-1/8
Unit Net Weight	lb	55
Panel Width	in	37-3/8
Panel Height	in	1-1/4
Panel Depth	in	37-3/8
Panel Weight	lb	10.0
MOTOR		
Motor Type		DC
Motor Watts	W	130

ACCESSORIES (Optional)

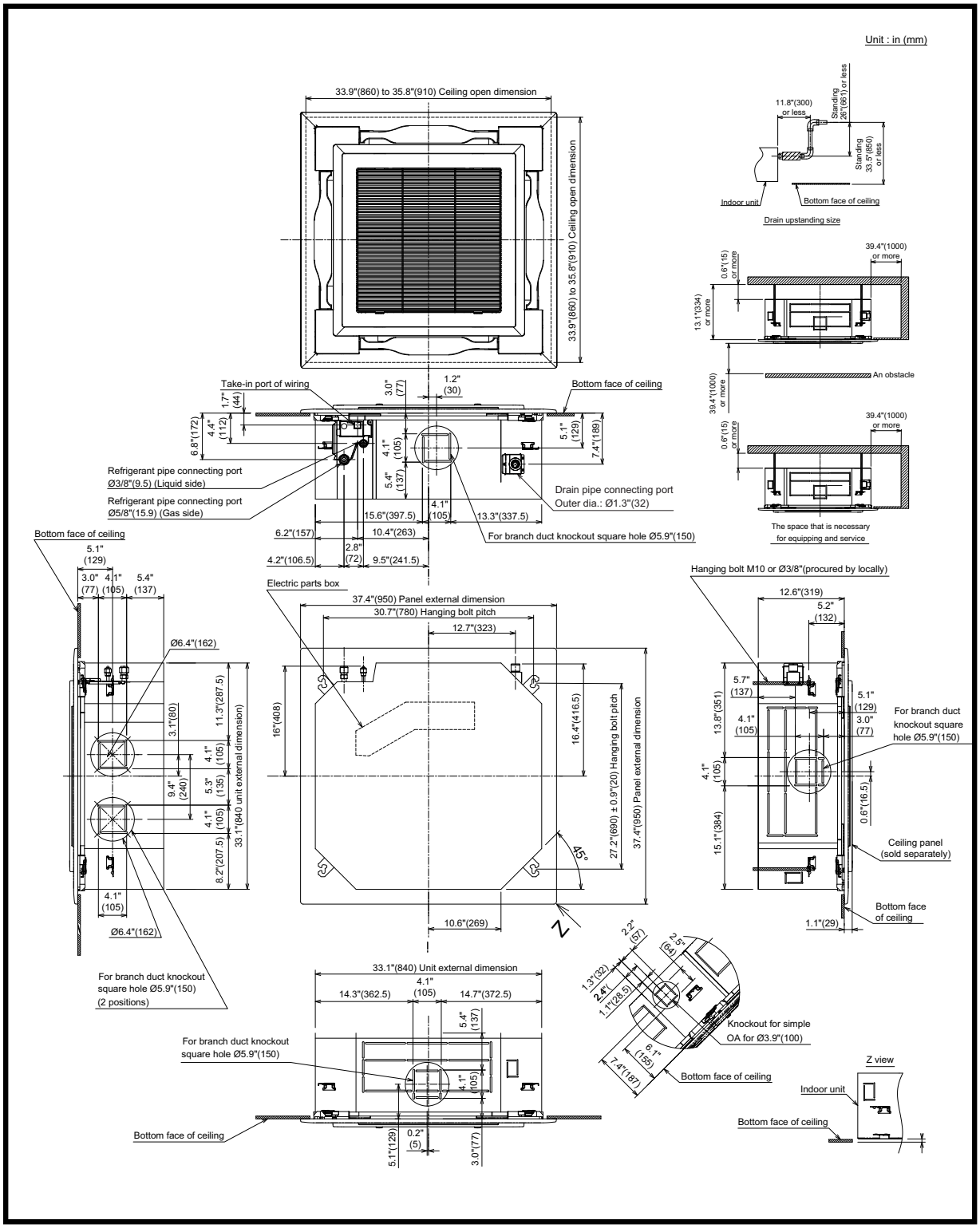
- ☐ Wired Remote Controller (7-Day Programmable) RBC-AMS54E-UL
- ☐ Simple Wired Remote Controller RBC-AS41UL
- ☐ Integral Receiver with Wireless Remote RBC-AX32U(W)-UL
- ☐ Stand Alone Receiver with Wireless Remote TCB-AX32-UL
- ☐ Remote Sensor TCB-TC41LUL
- ☐ Wired Remote Controller RBC-AMT32UL
- ☐ Grille Panel RBC-U32PGP-UL
- ☐ Spacer for Height Adjustment TCB-SP1602UUL
- ☐ Air Discharge Direction Kit TCB-BC1602UUL
- ☐ Fresh Air Chamber TCB-GFC1602UUL
- ☐ Fresh Air Inlet Box TCB-GB1602UUL
- ☐ Auxiliary Fresh Air Flange TCB-FF101URUL

DIMENSIONAL DRAWING
OUTDOOR UNIT RAV-SP482AT2P-UL



A221039

DIMENSIONAL DRAWING
INDOOR UNIT 4-WAY CASSETTE RAV-SP482UTP-UL



A221040

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Edition Date: 11/22

Printed in U.S.A.

Form No: RAV-SM482UTP-UL-02

Replaces: RAV-SM482UTP-UL-01

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SECTION V. DUCTLESS SPLIT SYSTEM ACCESSORIES

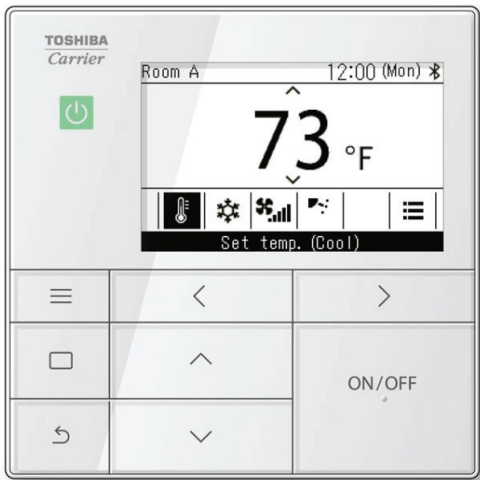
SMMSu / SHRMu VRF Controls and Accessories
RBC-AWSU52-UL - Wired Remote Controller

TOSHIBA Carrier

Submittal Data

Job Name _____ Location _____

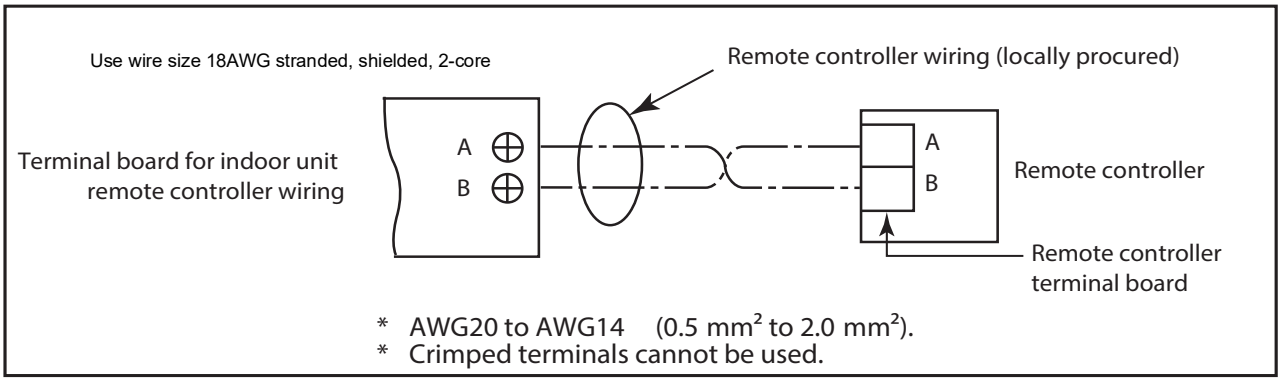
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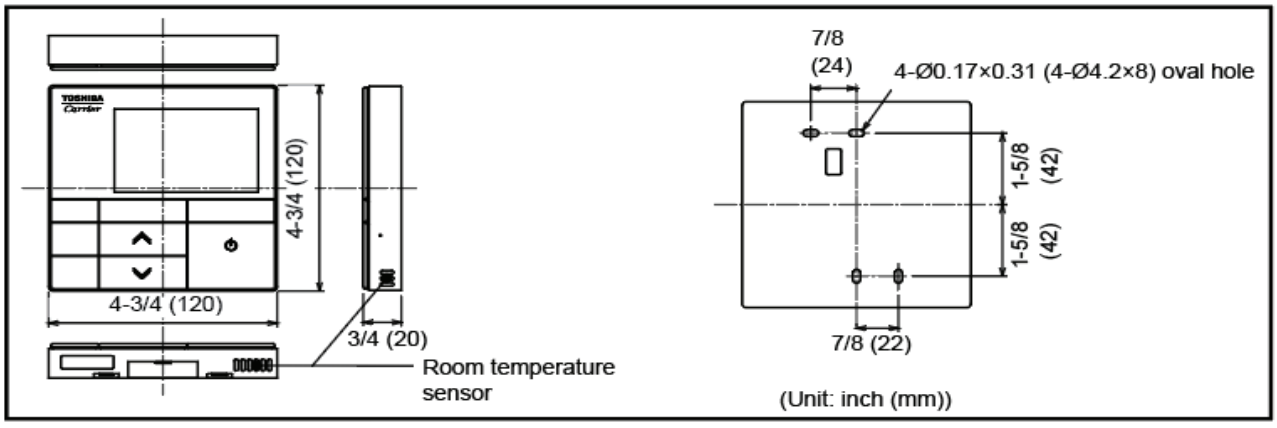
RBC-AWSU52-UL - Wired Remote Controller Features

- Back lit easy to read
- ON/OFF
- Unit addressing capability
- Mode setting: cool, heat, dry, fan, and auto
- Room temperature display
- Fan speed setting
- Louver swing operation
- Temperature display in 1°F
- Indoor temperature range limiting (62°F to 88°F)
- Dual set-point control
- Error display
- Group Control (Max 16 IDU)
- Touch Buttons
- Three configurable input ports
- Two output ports
- Backwards compatible

WIRING DIAGRAM



DIMENSIONAL DRAWING



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Edition Date: 07/23
Form No: RBC-AWSU52-UL_01
A Carrier Company
Printed in U.S.A.
Replaces: New

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REFERENCE

Building	Mark For	Manufacture	Exisiting unit Model	Orentation	Tonnage	Voltage	Replacement
Bldg F	F-1	Unknown	SPP P48A1	sideshot	4	208-3-60	50VT-K48---3
Bldg F	F-2	Bryant	604APX042	Downshot	3.5	208-3-60	50VT-K48---5
Bldg E	E-1	Bryant	655ANX042000	sideshot	3.5	208-1-60	50VT-K48---3
Bldg E	E-2	Carrier	50ZH-042---301	Sideshot	3.5	208-1-60	50VT-K48---3
Bldg D	D-1	Carrier	50SZ-042---301	Downshot	3.5	208-1-60	50VT-K48---3
Bldg D	D-2	Carrier	50SZ-042---301	Downshot	3.5	208-1-60	50VT-K48---3
Bldg H	H-1	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-2	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-3	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-4	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-5	Carrier	48HJD007---651	Downshot	6	460-3-60	48FCDM07A2M6-3A0A0
Bldg H	H-6	Carrier	48HJM004---641	Downshot	3	460-3-60	48FCGA04A2M6-3A0A0
Bldg H	H-7	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-8	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-9	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-10	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-11	Carrier	48HJL005---651	Downshot	4	460-3-60	48FCGA05A2M6-3A0A0
Bldg H	H-12	Carrier	48HJL005---651	Downshot	4	460-3-60	48FCGA05A2M6-3A0A0
Bldg H	H-13	Carrier	48HJL005---651	Downshot	4	460-3-60	48FCGA05A2M6-3A0A0
Bldg H	H-14	Carrier	48HJL005---651	Downshot	4	460-3-60	48FCGA05A2M6-3A0A0
Bldg H	H-15	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-16	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-17	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-18	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-19	Carrier	48HJL005---651	Downshot	4	460-3-60	48FCGA05A2M6-3A0A0
Bldg H	H-20	Carrier	48HJL005---651	Downshot	4	460-3-60	48FCGA05A2M6-3A0A0
Bldg H	H-21	Carrier	48HJL005---651	Downshot	4	460-3-60	48FCGA05A2M6-3A0A0
Bldg H	H-22	Carrier	48HJL005---651	Downshot	4	460-3-60	48FCGA05A2M6-3A0A0
Bldg H	H-23	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	H-24	Carrier	48HJL006---641	Downshot	5	460-3-60	48FCGA06A2M6-3A0A0
Bldg H	HP-1	Carrier	38YRA018341	Split	1.5	208-1-60	25SCA524A003
Bldg H	HP-2	Carrier	38YRA018341	Split	1.5	208-1-60	25SCA524A003
Bldg H	HP-3	Carrier	38YRA018341	Split	1.5	208-1-60	25SCA524A003
Bldg H	HP-4	Carrier	38YRA018341	Split	1.5	208-1-60	25SCA524A003
Bldg H	HP-5	Carrier	38YRA018341	Split	1.5	208-1-60	25SCA524A003
Bldg H	HP-6	Carrier	38YRA018341	Split	1.5	208-1-60	25SCA524A003
Bldg H	HP-7	Carrier	38YRA018341	Split	1.5	208-1-60	25SCA524A003
Bldg H	HP-8	Carrier	38YRA018341	Split	1.5	208-1-60	25SCA524A003
Bldg H	HP-9	Carrier	38YRA018341	Split	1.5	208-1-60	25SCA524A003
Bldg H	HP-10	Carrier	38YRA018341	Split	1.5	208-1-60	25SCA524A003
Bldg L	L-1	Bryant	655AEX04200 * VRF,RTU OR WAI	Sideshot	3.5	460-3-60	50VT-K48---6
Bldg L	L-2	Bryant	655AEX03600AABF * VRF,RTU OF	Sideshot	3	460-3-60	50VT-K36---6

3) Thermostat Cutsheets

Introducing the **NEW!**

ColorTouch®

A high resolution digital thermostat with a full color touch screen display

NEW Wi-Fi On Board*



VENSTAR smart SM

VENSTAR®

ColorTouch®

Now with **Wi-Fi Onboard*** and a **4x faster** processor

RESIDENTIAL MODELS

features for model **T7800**

- Up to 4 Heat & 2 Cool Stages
- Gas Electric or Heat Pump Control
- Dual Fuel Capable
- Simple as you want Operation
- Switchable Programmable or Non-Programmable
- Adjustable Timers & Deadbands
- Set Point Limiting
- Programmable Fan
- Accepts Remote Sensor or Outdoor Sensor
- Can Control to a Remote Sensor
- Choice of English, Spanish or French
- Customizable Screensaver & Wallpaper
- API for 3rd Party Monitor & Control



model **T7850***

All of the T7800 features plus:

- **Wi-Fi Built In** — Free mobile apps available
- Drop down current weather and forecast screen
- Title 24 Compliant

model **T7900***

All of the T7800 features plus:

- **Wi-Fi Built In** — Free mobile apps available
- Controls humidification & dehumidification
- Drop down current weather and forecast screen
- Title 24 Compliant

COMMERCIAL MODELS

features for model **T8800**

- Up to 4 Heat & 2 Cool Stages
- Gas Electric or Heat Pump Control
- Switchable Programmable or Non-Programmable
- Adjustable Timers & Deadbands
- Set Point Limiting
- Preoccupancy Fan Purge
- Up to 4 Hour Override
- Accepts Remote Sensor or Outdoor Sensor
- Can Control to a Remote Sensor
- Choice of English, Spanish or French
- Customizable Screensaver & Wallpaper
- API for 3rd Party Monitor & Control

model **T8850***

All of the T8800 features plus:

- **Wi-Fi Built In** — Free mobile apps available
- Drop down current weather and forecast screen
- 365 Day Calendar for Holiday programming
- Title 24 Compliant

model **T8900***

All of the T8800 features plus:

- **Wi-Fi Built In** — Free mobile apps available
- Controls humidification & dehumidification
- Drop down current weather and forecast screen
- 365 Day Calendar for Holiday programming
- Title 24 Compliant

Monitor & Control

your thermostat from anywhere using your iPhone®, iPad®, Android® Amazon® (Kindle Fire,® Kindle Fire Phone®) or Blackberry® device.

Skyport™ CLOUD SERVICES

Wi Fi®



features


Digital picture frame screensaver


Time period programming


Simple stat


Runtime graphs


Themes


Test outputs


Security


Drop down weather

accessories


ACC-FP1SL
ACC-FP1BL
ACC-FP1WH
ACC-FP1BW


ACC-TSENWB
Indoor remote sensor with Override button


ACC-TSEN
Indoor/Outdoor remote sensor



ACC-TSENWIFI
Indoor/Outdoor WiFi wireless sensor

c UL us LISTED 4295


ACC-WPLWH
Wallplate for all ColorTouch thermostats


ACC-DSEN
Indoor/Outdoor duct sensor

Thermostat FC Tested to Comply with FCC Standards FOR HOME OR OFFICE USE

Industry Canada / Industrie Canada

Patents Pending and Patents Issued

Skyport™ CLOUD SERVICES

FREE Services



With our FREE app, access all these features remotely from your mobile device

- **Monitor & Control thermostat information**
  - Name & Location of the Thermostat
  - Current Weather & Forecast
  - Change Heat & Cool Setpoints
  - Change Thermostat Modes
  - View Equipment Status: Heating, Cooling, Off – Including Lockouts
- **Set "Occupied" or "Unoccupied" at the touch of a button**
- **Enable or disable the time period schedule**
- **View thermostat alerts**
  - Supply Air Temperature
  - Time for Service
  - Air Filter Replacement
  - Humidity Pad Replacement
  - UV light bulb Replacement
- **Send text messages to the thermostat**
- **View current system temperatures with high and low values for the day**
  - Indoor Temperature
  - Indoor Humidity
  - Outdoor Temperature
  - Remote Temperature
  - Supply Air Temperature
  - Return Air Temperature
- **View heating & cooling runtimes for the day, current week, and last week**

FREE Additional Features available from the Skyport website:

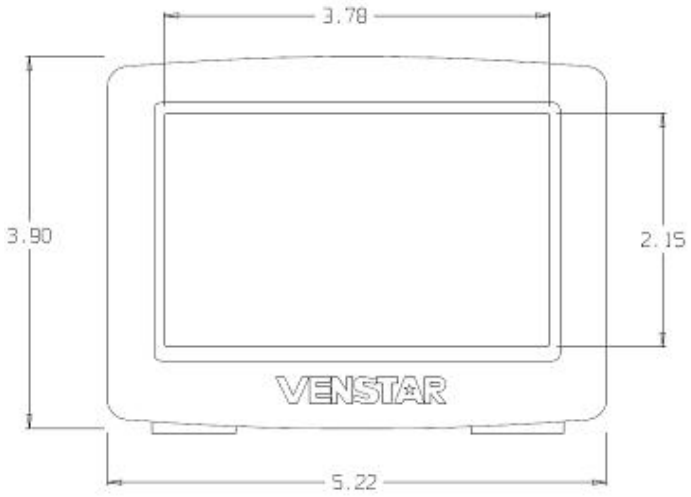
- **View daily, weekly, and monthly runtime graphs**
- **Advanced confirguation**
  - Stage Deadbands
  - Stages of Cooling & Heating
  - Hum/Dehum Setpoints
  - Thermostat Language
  - Readout in Degrees F or C
  - Display Brightness
  - Night Dimmer
  - Screen Savers and more
- **Program time period schedules**
- **Security Settings**
  - Change the Passcode
  - Set View Only Access
  - Disable Mode Changes
  - Disable/Enable Override
  - Enable Setpoint Limits
- **Enable popular holidays at the touch of a button**
- **Program custom holidays up to 5 years in advance**

VENSTAR®

www.venstar.com

©Venstar Inc.
88-1100

Commercial WiFi Thermostat
T8850



STANDARD FEATURES:

- For use with gas/electric, heat pump and electric units up to 4-stages of heat, 2-stage cool
- Built-in 2.4Ghz wireless B/G/N WiFi antenna, WEP and WPA/WPA2 compatible
- 365-day programmable, 7, 5/2, 1-day or non-programmable
- Up to 3 occupied time periods per day
- California Title-24 approved
- Full color touchscreen with customizable wallpaper and screen savers
- Customizable service alerts that can display dealers' name, full color logo and phone number
- High resolution touchscreen display with 4.3" diagonally viewing area
- 3 advanced security levels with customizable 4-digit passcode for full screen lock
- Automatic daylight savings operation
- 72-hour super-cap for keeping internal time current during power loss
- Energy Watch keeps track of energy use by tracking heating, cooling and auxiliary heat hours
- Override button adjustable in 30 min. increment (up to 4 hours)
- Preoccupancy purge feature, allows the fan to be turned on in 15-minute increments (up to 3 hours)
- Heating and cooling setpoint limiting with adjustable dead bands and timers
- Smart Fan (keeps the fan from running during unoccupied periods)
- Optional auxiliary heat lockout based on outdoor temperature
- All programming and setpoints stored in non-volatile memory and are never lost in power failure
- Emergency Heat switch when set in heat pump mode
- Display supports English, Spanish and French languages
- Service filter and service UV lamp indicators
- Accepts standard SD card (not included) to upload photos, settings and dealer logo
- Accepts optional remote temperature sensors, part numbers ACC-TSEN or ACC-DSEN
- Accepts optional wall plate part number ACC-WPLWH
- Optional colored face plates part ACCFP1(_ _) available in black (BL), silver (SL) or burl wood (BW)

MODEL:	T8850	QUANTITY:		DATE:	
JOB NAME:					
LOCATION:					
BUYER:			BUYER P.O.#:		
ENGINEER:					

TotalSense™ Series
Indoor Environmental and Air Quality Sensor Matrix

NEW



Industry's first IAQ sensor with PIR motion detection
Eight environmental sensors: PIR, PMx, VOC, CO_2, RH, T, ambient light, barometric pressure
BACnet/Modbus or analog outputs with set-point relay

DESCRIPTION

The TotalSense™ Series provides more data for more advanced ventilation control while drastically reducing installation cost and time on a project. It includes a comprehensive selection of IAQ sensing with carbon dioxide (CO2), relative humidity (RH), and temperature plus options for occupancy detection (PIR), total volatile organic compounds (TVOC), particulate matter (PM) and ambient light. More than an IAQ sensor, it's the first fully configurable Indoor Environmental Quality (IEQ) sensor matrix.

Motion detection (PIR) can initiate ventilation upon occupancy, providing air exchanges the instant people are present (in addition to monitored elevated CO2 levels). This technology provides a much faster trigger for ventilation allowing for cleaner and safer indoor spaces while still saving energy. PIR and ambient light sensors can also be utilized for light harvesting for additional energy savings and code compliance.

APPLICATIONS

- Verify effectiveness of IAQ strategies in post covid environment
- Energy management/building control
- Facilitates compliance with ASHRAE 62.1 standard for air quality
- Contributes toward satisfying Feature A08 and T06 under the WELL Building Standard®



Made in USA

Modbus BACnet

FEATURES

- Reduce installation costs with multiple sensors in a standard size enclosure
- Specify the exact product with over 25,000 unique combinations
- Color display and Air Quality Ring for tenant assurance (programmable)
- Initiate ventilation immediately upon occupancy detection for healthier buildings and energy savings
- Sense unhealthy or offensive air with TVOC. Compensated for temperature and barometric pressure for total accuracy
- Detect a variety of PM sizes to indicate airborne respiratory droplets, allergens, and other dangers
- Industry-leading temperature and barometric pressure compensated CO_2 sensing with non-dispersive infrared sensing element (NDIR), 15+ year life expectancy on CO_2 sensing element; ±30ppm, ±3% of reading
- Capacitive touch buttons make setup and use simple
- Slim and sleek surface-mount enclosure is tamper-proof and easy to install
- Field-replaceable PM, RH, Temp, and CO_2 sensors ease maintenance
- Set-point sliders and pushbuttons are also available to meet the requirements for any job
- 7-year limited warranty / 3 years on CO_2 sensor - 2 years on all others



Versatile display (optional)



Slim surface-mount enclosure

OPTIONS



Versatile Display

- Fully customizable
- Good/Fair/Poor settings and color icons available



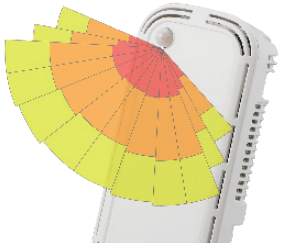
Non-Display for more discreet sensing

- Display + cover option also available for ease of setup



Air Quality Ring

- Provides occupants assurance without confusing metrics
- Green/yellow/red

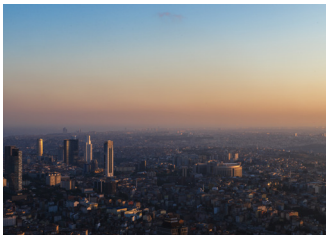


PIR Motion Sensing

- Trigger ventilation or lighting based on occupant movement

Analog outputs or BACnet MSTP / Modbus RTU

- Compreshensive data
- Intregrated set-point relay (programmable)



TVOC and PM Sensors

- Detect unhealthy airborne particulates or VOC's for a comprehensive understanding of indoor air quality.

EIGHT TECHNOLOGIES FOR OPTIMUM INDOOR AIR QUALITY



PIR (Passive Infrared) Motion detector typically used for lighting control that can also be used to immediately indicate occupancy and deliver fresh air

CO_2 (Carbon Dioxide) Detect levels of CO_2 indicating occupancy to trigger ventilation (field replaceable)

PMx (Particulate Matter) Detect the presence of airborne bacteria, dust, pollen, and other airborne particulates. Can be used to determine the effectiveness of filtration (field replaceable)

Ambient Light Adjust lighting levels based on natural light for energy savings

TVOC (Total Volatile Organic Compounds) Monitor for toxins from chemical by-products of manufacturing, paints, cleaning products, solvents, and more

Temperature Maintain comfort levels (field replaceable)

RH (Relative Humidity) Monitor humidity - regulating humidity levels ensures occupant comfort and may minimize risk of spreading pathogens (field replaceable)

Barometric Pressure Used to compensate TVOC and CO2 readings

SPECIFICATIONS

Power Supply	Non-Display	16-30VDC/24VAC[1], 3.5W nominal, 4W max.
	Display or LED Ring	24-30VDC/24VAC[1], 4.3W nominal, 5W max.
Interface	OLED (optional)	1.5" Organic LED Display, 128x128, color
	Air Quality Ring	Color changing (red/yellow/green) LED Air Quality Ring
Analog Outputs (Analog version only)	Quantity	Up to 3 outputs
	Source	CO2, RH%, Temp, Temp slider, TVOC (selectable)
	Scale	0-5V, 0-10V, 4-20mA (switch selectable, programmable per output)
Protocol Output (Comms version only)	Protocol	BACnet MS/TP or Modbus RTU
	Connection	3-wire RS-485, with isolated ground
	Data Rate	9600, 19200, 38400, 57600, 76800, 115200 (switch selectable)
	Address Range	0-127
Relay (Standard except for PM models)	Type	Solid-state output, 1A @ 30VAC/DC, N.O.
	Polarity	NO/NC (selectable)
	Source	CO_2 setpoint, RH setpoint, Temp setpoint, TVOC setpoint, PIR motion detection, Air Quality, off (selectable)
CO_2 (Optional)	Type	Non-dispersive Infrared (NDIR)
	Accuracy	±(30ppm + 3% of reading) (400-2,000ppm), -10-50°C, 0-85%RH ±(50ppm+ 5% of reading) (2,000-5,000ppm), -10-50°C, 0-85%RH >5,000ppm consult factory
	Resolution	1 ppm
	Range	0-2,000 PPM (Default) (Programmable up to 10,000ppm)
	Response time	90 seconds to 90% reading
	Sample rate	1s
	Temp and Pressure Compensation	Yes, barometric pressure readable over comms
Relative Humidity (Optional)	Type	Digital CMOS
	Accuracy[2]	2% models, +/-2% over 0 to 80%RH range
	Resolution	0.05%RH
	Response time [3]	30s
	Sample rate	3s
	Operating range	0 to 100%RH (non-condensing)
	Operating conditions [4]	-4 to 140°F (-20 to 60° C) @ RH>90%; -4 to 176°F @ RH=50%

Temperature Transmitter (Optional)	With RH option	Without RH option
Type	Silicon Band-gap	NTC Thermistor
Nominal Accuracy	±0.3° C (operating range)	±0.5° C (operating range)
Maximum Accuracy [2]	±0.5° C (at 25° C), ±1.0° C	±1.0° C (at 25° C), ±2.0° C
Resolution	0.1° C	0.05° C
Response time	30s	30s
Sample rate	3s	100 milliseconds

TVOC (Optional)	Type	MOS
	Gas	Total VOC
	Range	0-10,000 µg/m³ (Display may be programmed to show PPB)
	Response Time	<10s
	Temp and Pressure Compensation	Yes
	Output	0-2,000 µg/m³ (default) programmable up to 10,000 µg/m³

1. *One side of transformer, secondary is connected to signal common. Dedicated transformer is recommended.*
2. *Models with PM sensor included achieve* ±5% accuracy over 0 to 80%RH range and an additional temperature shift of up to +0.5°C
3. *Time for reaching 63% of reading at 25° C and 1 m/s airflow*
4. *Long term exposures to conditions outside normal range at high humidity may temporarily offset the RH reading (+3%RH after 60 hours.)*

SPECIFICATIONS

PMx (Optional) CLASS 1 LASER PRODUCT	Type	Optical
	Size Range	PM1.0, PM2.5, PM4.0, PM10.0
	Scale	0-1,000 µg/m^3
	Lower detection limit	0.3 µm
	Precision	±10 µg/m^3 (0-100µg/m^3); ±10% (100-1,000 µg/m^3)
	Long-Term Drift	±1.25 µg/m^3 / year
PIR (Optional)	Type	Passive Infrared
	Axis X field of view	140º, 15 ft (4.5m)
	Axis Y field of view	76º, 15 ft (4.5m)
Ambient Light	Type	Phototransistor
	Scale	0-100 fc (lm/ft^2), readable over comms
Operating Environment	Temperature	32 to 122ºF (0 to 50ºC)
	Humidity	0-95% non-condensing
Enclosure	Material	ABS Plastic
	Dimensions	5.67"h x 3.00"w x 1.07"d (With concealing ring: 6.35"h x 3.69"w x 1.25"d)
Compliance	Agency	CE, RoHS

BACnet® is a registered trademark of ASHRAE

ORDERING

AQ2 ☐ - ☐

Package
W = Surface

Output Type
A = Analog
B = BACnet/ Modbus

CO2
A = None
C = CO2
D = Dual Channel CO2

Relative Humidity
A = None
2 = 2% RH

VOC
A = None
V = VOC

Particulate Matter*
A = None
P = PM 1.0, 2.5, 4.0, 10.0

Temperature Output
A = None
B = Transmitter
C = 100Pt RTD
D = 1000Pt RTD
E = 10K Type 2
F = 10K Type 3
G = 10k w/11k
H = 3k
I = 2k2
J = 1k8
K = 20k

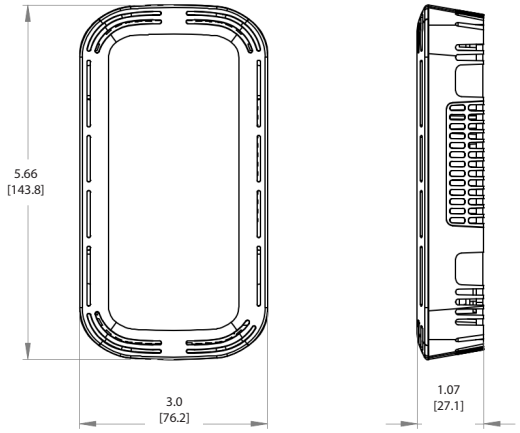
Display
X = None
D = OLED Display
S = OLED display with solid cover
R = Air Quality Ring

PIR Sensor
P = PIR Sensing

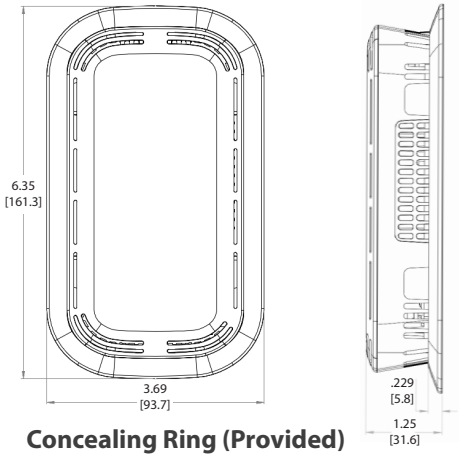
Accessories**
C = 1k Ω SP Slider
F = 10k Ω SP Slider
E = 910 Ω offset resistor
S= Slider override PB
O = Thermistor Override PB
U = User PB

*PM Available on AQ2W-B Surface mount + BACnet/Modbus versions only
**Additional SP sliders and offset resistors available upon request
**Slider and pushbutton options not available with PM sensor. Call for additional slider and override options.

DIMENSIONS



Standard Surface Mount



Concealing Ring (Provided)

- Conceal oversized drywall cutouts or European junction boxes

4) DSA-103-25

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: **Will Rogers Elementary School** Application No.: **03-125978** Increment:
School District: **Lynwood Unified School District** File No.: **19-66**

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: **Will Rogers Elementary School** Application No.: **03-125978** Increment:
School District: **Lynwood Unified School District** File No.: **19-66**

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: **Will Rogers Elementary School** Application No.: **03-125978** Increment:
School District: **Lynwood Unified School District** File No.: **19-66**

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

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

Name of Structural Engineer of Record (when applicable):

Signature of Architect or Structural Engineer: **Date:**

3/12/2026

DSA STAMP

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-125978 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☐
DATE: 05/26/2026

Project Name: **Will Rogers Elementary School**
School District: **Lynwood Unified School District**

Application No.: **03-125978** Increment:
File No.: **19-66**

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.

Appendix: LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

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.