MECHANICAL SPECIFICATIONS INDEX

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BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 OTHER REQUIREMENTS

A. The Bidding, General and Supplementary of this project manual and specific section as noted apply to the work specified in Mechanical Division 23 which encompasses Sections 23 00 00 through 23 82 19. This Section 23 00 00 applies to all sections of Mechanical Division 23.

1.2 SCOPE

A. It is the intent of these specifications and the accompanying drawings to describe complete mechanical systems installations for all building areas, new and renovation.

B. Furnish and install all material, labor and equipment in accordance with these documents.

C. Include all incidental items and work not specifically shown or specified but required by good practice in a complete system.

D. The drawings and specifications are complementary. What is called for in one shall be called for in both.

E. The drawings are diagrammatic but should be followed as closely as possible. Where required by jobsite conditions, relocate and provide fittings, etc., as required. Provide an allowance in the contract bid to furnish additional pipe and ductwork fittings required for coordination with structure and other construction trades.

F. Prepare and submit a utility coordination plan noting any disruptions of existing building services for approval by the school district, attaching any sketches, drawing excerpts, or step-by-step sequences / schedules required to fully-explain the proposed activities. Submit the coordination plan 2 weeks in advance of the planned activities.

G. Immediately notify the school district representative if existing mechanical elements are damaged or have been inadvertently damaged during the course of construction.

1.3 BID ALLOWANCES

A. Furnish in the bid – Allowances for additional heating water piping in addition to the base contract noted in the construction documents. See specification 23 20 00, paragraph 1.2.

1.4 DEFINITIONS

A. Project Manager: The individual(s) designated by Beaverton School District as their authorized representative(s) for the project coordination, construction and closeout phases.

B. Or approved equal: Requires approval prior to bid date.

C. Indicated:
   1. The term "indicated" is a cross reference to details, notes, or schedules on the drawings, other paragraphs or schedules in the specifications, and similar means of recording requirements in the Contract Documents.
   2. Where terms such as "shown," "noted," "scheduled," and "specified" are used instead of "indicated," it is for the purpose of helping the reader locate the cross reference, and no limitation of location is intended except as specifically noted.

D. Directed, Requested, Etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by the Engineer," "requested by the Engineer," etc. However, no such implied meaning will be interpreted to extend the Engineer's responsibility into the Contractor's area of construction supervision.

E. Site or Project Site: The space available to the Contractor for the performance of the work, either exclusively or in conjunction with others performing the work as part of the project. The extent of the project site is shown on the Mechanical drawings and is not identical with the description of the land upon which the project is to be built.

F. Approved:

1. Where used in conjunction with the Project Manager's response to submittals, requests, applications, inquiries, reports and claims by the Contractor, the meaning of the term "approved" will be held to the limitations of the Project Manager's responsibilities and duties as specified in the General and Supplementary Conditions.
2. In no case will "approval" by the Project Manager be interpreted as a release of the Contractor from responsibilities to fulfill requirements of the Contract Documents.

G. Provide: The term "provide" means to furnish and install, complete and ready for the intended use.

1.5 STANDARDS AND CODES

A. Provide all equipment and material and perform all work in accordance with all local, state and national codes and regulations.

B. For work on this project, comply with the latest edition of the appropriate standards published by the following:

1.	Air Diffusion Council	ADC
2.	American Gas Association	AGA
3.	Air Movement and Control Association	AMCA
4.	American National Standards Institute	ANSI
5.	Air-Conditioning and Refrigeration Institute	ARI
6.	Acoustical Society of America	ASA
7.	American Society of Heating, Refrigerating and Air-Conditioning	ASHRAE
8.	American Society of Mechanical Engineers	ASME
9.	American Society for Testing and Materials	ASTM
10.	Washington County, Oregon.	
11.	National Environmental Balancing Bureau	NEBB
12.	National Electrical Manufacturers Association	NEMA
13.	National Fire Protection Association	NFPA
14.	Sheet Metal and Air Conditioning Contractors' National Association	SMACNA
15.	Underwriters' Laboratories	UL
16.	Oregon Structural Specialty Code	OSSC
17.	Oregon Mechanical Specialty Code	OMSC
18.	Oregon Plumbing Specialty Code	OPSC
19.	Oregon Energy Efficiency Specialty Code	OEESC

1.6 APPROVAL OF EQUIPMENT AND MATERIALS

A. Manufacturer's trade names, catalog numbers and material specifications used in this specification are intended to establish the quality of equipment or materials expected. Materials and manufacturers not listed require approval prior to the bid date.

B. Approval of substitute equipment or materials will be based upon performance, quality and other factors deemed important by the Project Manager. The Contractor will be responsible for making all changes in this and other associated work required as a result of the substitution. Additional or modified structural calculations and roof penetrations required to accommodate the substitution will be the responsibility of the contractor.

1.7 SUBMITTALS

A. Submit a digital copy of the submittals to the Project Manager for review

B. Furnish performance data and technical information on all materials and equipment to be used on the project.

C. Include shop drawings with the submittals where necessary to determine clearance, where the Contractor proposes alternate equipment or material arrangements, and when requested by the Project Manager.

D. Review of submittals or shop drawings by the Project Manager does not relieve the Contractor from the requirements of the Contract Documents unless specific approval has been requested for a given deviation.

1.8 QUALITY ASSURANCE

A. Maintain the highest standards of workmanship throughout the project.

B. Use the latest editions of applicable and specifically referenced standards.

C. Inspect all material and equipment upon arrival at the site and return any which is not in new condition.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 COORDINATION

A. Cooperate with other trades to assure that construction proceeds in an orderly and timely manner. Contract cost increases due to improperly sequenced work with other trades will not be allowed.

B. Study the architectural, structural, electrical, shop and any specialty drawings as appropriate and specifications to determine required coordination.

C. Prepare detailed shop drawings where necessary to assure proper fit and necessary clearance.

D. Refer to electrical drawings to verify voltage and phase of mechanical equipment.

3.2 PERMITS, FEES AND INSPECTIONS

A. Obtain all required permits and pay for all fees and connection charges.

B. Schedule any required inspections.

3.3 MATERIALS AND WORKMANSHIP

A. Furnish all materials and equipment in new condition, free from defects and of size, make, type and quality specified. Installation shall be in a neat and workmanlike manner.

B. When two or more items of the same kind, type or class are required, use items of a single manufacturer.

3.4 MEASUREMENTS

A. Take all measurements from reference datums established by the mechanical contractor.

3.5 DELIVERY, HANDLING AND STORAGE

A. Receive all material and equipment at the jobsite or shop.

B. Use proper and sufficient equipment to handle all products employed in the project.

C. Where storage of material or equipment is necessary, it shall be a clean and weatherproof area. Seal any openings and cover the product to assure that there will be no corrosion or foreign matter introduced. Assure that it will be in new condition when placed in service.

3.6 EQUIPMENT INSTALLATION, BRACING AND SUPPORT

A. All serviceable equipment must be accessible without obstruction or removal of piping or accessories.

B. Install all equipment in strict accordance with the manufacturer's instructions unless otherwise indicated.

C. The drawings in general are based upon one of the specific manufacturers listed for a particular equipment item. The other specified manufacturers and additional approved manufacturers of equipment may require deviations from the drawings to properly install the particular equipment in accordance with the manufacturer's recommendations and to provide the system results required. Provide all work necessary in the base bid price to install this equipment.

D. Where the installation shown or specified is contrary to the manufacturer's instructions, advise the Project Manager in writing of the differences before proceeding with the installation.

E. Anchorage to Floors, Roofs, Etc., Sway Bracing and Seismic Restraints:
1. The contractor is responsible to determine the means and methods of equipment installation and support.
2. Provide supports for all apparatus as specified, detailed, as required by the manufacturers of specific equipment and the project governing code authorities. Anchor all roof and base/floor mounted equipment with size and spacing of anchor bolts or other attachment means as recommended by the respective equipment manufacturer.
3. Provide seismic restraints on all mechanical equipment in conformance with applicable OSSC sections. Costs for seismic calculations are to be included in the bid price.
4. Provide deferred submittals directly to the governing code jurisdiction for anchorage to floors, roofs, etc., sway bracing and seismic restraints. Submittals to show locations and sufficient support details as required by the governing code jurisdiction.
5. Provide supplementary drawings and calculations as required by governing code jurisdictions noting seismic support data/calculations as required for permit purposes.
6. Mechanical seismic criteria is as follows:
   a. Occupancy Classification III
   b. Seismic Design Category D
   c. Component Importance Factor (Ip)
      1) General building HVAC systems 1.0

F. Maintain a copy of the manufacturer's installation instructions at the jobsite for all equipment.

3.7 SLEEVES AND INSERTS

A. Provide sleeves at all locations where piping and ductwork passes through building construction.
1. Sleeves for interior walls and floors shall be 22 gauge galvanized or heavier as required.

2. Sleeves for exterior walls shall be cast iron, wall thickness as required.
3. Wall sleeves shall be installed in all exterior walls and all interior masonry or fire- rated walls in a manner that preserves the fire-rated or watertight integrity of the wall.
4. Interior wall sleeves for uninsulated pipe shall allow minimum 1/4-inch clearance all around pipe for pipe movement. Allow 1-inch clearance around pipe at building expansion joints.
5. Interior wall sleeves for insulated piping shall be selected to encompass the pipe and insulation and allow minimum 1/4-inch clearance around insulation for pipe movement. Allow 1-inch clearance around pipe and insulation at building expansion joints.
6. Floor sleeves shall extend 4-inches above the floor and shall be sealed watertight. Floor sleeves shall be oversized to allow 1/2-inch minimum space all around pipe or pipe and insulation where applicable. Seal space between pipe and sleeve with Dow Corning Fire Stop System, 3M brand CP25 or approved equal. Sealant must be between pipe and sleeve. Sealant between insulation and sleeve is not acceptable. Install firestop materials in complete accordance with the manufacturer's instructions and in compliance to applicable UL listings.

B. Seal space between pipe and sleeve with Dow Corning Fire Stop System, 3M Brand CP25 or approved equal where piping penetrates firewall or floors. Sealant must be between pipe and sleeve; sealant between insulation and sleeve is not acceptable. Install firestop materials in complete accordance with the manufacturer's instructions and in compliance to applicable UL listings.

C. Utilize Linkseals or similar closures on core-drilled penetrations through below grade walls. Repair existing below grade waterproofing systems as applicable.

3.8 FLOOR, WALL AND CEILING PLATES

A. Provide escutcheon plates where all exposed piping and ductwork passes through finished walls, floors and ceilings, including accessible cabinet spaces.

B. Floor plates: deep recessed, cast brass, chrome plated.

C. Wall and ceiling plates: spun aluminum, chrome plated.

D. Secure plates to pipe or structure. Plates shall not penetrate insulation vapor barriers. Size plates to sufficiently cover pipe sleeves and openings in finish materials.

3.9 ACCESS DOORS AND PANELS

A. Manufacturers: Cesco, Milcor, Elmdor. Cesco used as basis of selection.

B. Non-rated panels: Style W, SR-1, SR-2, P, PX as required for wall or ceiling construction, 12 inch x 12 inch or larger as required for ease of access.

C. Fire-rated panels: Style FB, U.L. listed for 1-1/2 hr for fire rated stud and masonry wall systems.

D. Provide access panels where shown on the drawings or as required for proper access to mechanical appurtenances. Coordinate the installation of access panels is with the specific building construction penetrated. Coordinate access panel installation with manufacturer's instructions.

E. Locate and size access doors to facilitate equipment service and optimize the safety of the maintenance personnel. Minimum access door size to be 18"x 18".

3.10 PROTECTION

A. Protect all work, material and equipment from loss or damage until the Owner accepts the project.

B. As the work progresses, keep all equipment covered and cap all ducts and piping that may temporarily be left unconnected.

C. Notify all other trades of any required precautions necessary to protect the work.

3.11 ACCESSIBILITY

A. Provide convenient access by location or access panel to all equipment requiring periodic service.

3.12 ELECTRICAL WORK

A. See Paragraph 3.21 for materials and work to be provided as a part of this Mechanical Division 23:

B. Wherever possible, provide all interconnect wiring within or on a piece of equipment with the equipment unless shown or specified otherwise. An electrician licensed to perform this type of work shall perform all field wiring.

3.13 RELATED WORK

A. The following work and materials are specified elsewhere:
1. Pipe chases, equipment pads and foundations, trenches, painting, air louvers, louvered penthouse and access panels except as otherwise specified in this division.
2. Framed openings, wood grounds and nailing strips, masonry, concrete and other architectural and structural elements.

3.14 CLEANING

A. Maintain premises and public properties free from accumulations of waste, debris and rubbish during construction.

B. Clean all mechanical equipment of dust, grease, iron cuttings, unnecessary stamps or shipping labels, etc.

C. Touch up factory-painted surfaces, as necessary, with paint of matching color.

3.15 RECORD DRAWINGS

A. Maintain one set of construction drawings at the jobsite for the sole purpose of recording work of the mechanical contract, as actually installed. Upon request, the Project Manager will make the original tracings available to the mechanical contractor for printing the drawings. The Contractor shall pay the reproduction costs.

B. Deliver record drawings to the Project Manager promptly upon completion of the project.

3.16 OPERATION AND MAINTENANCE MANUALS:

A. Submit a digital copy of the Operation and Maintenance Manuals to the Project Manager for approval before project completion. Include an index and tabs for major systems and equipment. Operation and Maintenance Manuals shall include the following:

B. Directories:
1. Supplier Directory: Alphabetical list of principal subcontractors and suppliers of equipment giving names, addresses and telephone numbers.
2. Equipment Directory: List of equipment installed such as fans, air supply units, pumps, heating and cooling equipment, plumbing fixtures, etc., giving drawing reference numbers, location, area served, manufacturer with model number and supplier.

C Manufacturer's Literature:

1. Show name, address and phone number of the nearest service facility authorized by the manufacturer.
2. Include illustrations, diagrams, and instructions for installation, startup, operation, inspections, maintenance, parts list, data sheets and other necessary materials.
3. Include complete electrical, schematic and connection diagrams for each equipment item.
4. Include the name, address and phone number of contractor(s) who furnished and who installed equipment and systems.
5. Where the literature covers more than one model, check off neatly in ink correct model number and data for the model number including all specified options.
6. In those instances where the equipment, its mode of control, or both, is job assembled for special functions, then provide written operating and maintenance instructions prepared by the assembler on 8-1/2" x 11" sheets.

D Maintenance Instructions:

1. Where instructions for maintenance are not included in the manufacturer's literature, provide supplemental data to enable proper maintenance of the equipment installed.
2. Include specific lubrication methods and recommended frequencies along with procedures and precautions for inspection and routine service.

E Copy of Written Guarantee.

F. Recommended Spare Parts Stock.

3.17 HVAC SYSTEMS TRAINING

A. Training must be on fully operational system, or the training must be repeated when the system is fully operational at no additional cost to the Owner. Training must be scheduled through the Beaverton School District representative at a time that is convenient to district personnel. The Beaverton School District representative must be notified of any changes, re-scheduling or modifications to the training schedule.

1. Provide a written agenda to the attendees outlining the general scope of the training session and the building equipment involved. Submit the written training outline to the district representative prior to the training date.
2. Maintain a start-up log notebook in the job trailer containing signed copies of the manufacturer's start-up sheets for all equipment.
3. Training walk-throughs to be performed by a contractor field project manager or technician who is fully knowledgeable with the project specifics and has had continuous involvement during the course of the project. The individual is to be knowledgeable in the specific installation details and maintenance of the project equipment.
4. All training to be video recorded and provided to Owner.

B. Maintenance Training: Maintenance training will take place within 30 days after substantial completion. This session to include a detailed review of the HVAC system record drawings and equipment installation instructions. The instructor shall then walk through the building identifying the location of the equipment installed and specific function(s) related to the overall mechanical systems. The training shall include answering maintenance personnel questions, troubleshooting and diagnostics procedures, repair instructions and preventive maintenance. This training will include all maintenance staff per the Beaverton School District.

3.18 CUTTING AND PATCHING

A. Cut work as required for installation and patch to match original conditions as directed and approved by Project Manager. Do not cut structural portion without Project Manager's approval.

B. When masonry construction must be penetrated, provide a steel pipe sleeve in opening and grout in place in a neat manner. Leave grout surface to match existing finish.

C. Prior to cutting any existing work, locate all concealed utilities to eliminate any possible service interruption or damage.

3.19 CHANGE ORDERS

A. All supplemental cost proposals by the Contractor shall be accompanied with a complete itemized breakdown of labor and materials cost without exception.

B. Contractor's estimating sheets for the supplemental cost proposals shall be made available to the Project Manager. Labor must be separated and allocated for each item of work.

3.20 VERIFICATION OF EXISTING CONDITIONS

A. Verify field conditions and measurements prior to the manufacture of shop fabricated materials and equipment.

B. Produce shop drawings with details as required verifying proper installation of materials & equipment in conformance with applicable codes and the manufacturer's requirements.

3.21 SYSTEMS WIRING AND RELATED DEVICES

	FURNISHED ITEM	BY	INSTALL BY	POWER WIRING	CONTROL WIRING
1.	Division 23 Equipment Motors	Div. 23	Div. 23	Div. 26	Div. 23
2.	Remote Motors Starters, Contactors and Overload Heaters – Integral	Div. 23	Div. 26	Div. 26	Div. 23
3.	Fused & Unfused Disconnect Switches	Div. 26	Div. 26	Div. 26	------
4.	Manual Operation Switches	Div. 26	Div. 26	Div. 26	Div. 26
5.	DDC Controls, Relays and Sensors	Div. 23	Div. 23	Div. 23	Div. 23

END OF SECTION

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Providing of all required hangers and supports for ductwork, piping and equipment.

1.2 SUBMITTALS

A. Provide submittals in accordance with Section 23 00 00.

B. Submittals shall include:
1. Manufacturer's technical literature for all products used indicating service for each type of hanger.
2. Include proposed pre-manufactured duct vibration isolation products.
3. Submit literature or describe duct-supporting method.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Caddy, Grinnell, Super Strut. Caddy used for selection.

2.2 DESCRIPTION

A. Pipe Hangers:
1. Insulated pipe: Figures 103 and 403.
2. Non-insulated copper pipe: Figure 101.
3. Riser clamp, copper pipe: Figure 520.

B. Structural Attachments: Provide all necessary structural attachments such as concrete anchors, beam clamps, hanger flanges and brackets. Hangers shall not be suspended from other piping, equipment, etc.

C. Miscellaneous items such as hanger rod, rod couplings, turnbuckles, etc. shall be standard figure numbers of the same manufacturer as the attachments.

D. All-thread rod used for pipe supports to be no less than 3/8-inch diameter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Powder-actuated tools or devices are not acceptable for use at any school site.

B. Provide hangers and supports in accordance with the instructions furnished by the manufacturers of these devices. Support ductwork as required by the OMSC and per SMACNA recommendations.

C. Provide additional structural members where required to support piping or ductwork.

D. Provide hangers and support devices in accordance with the equipment manufacturer's instructions for all equipment.

E. Anchorage to Floors, Roofs, Etc., Sway Bracing and Seismic Restraints:
1. The contractor is responsible to determine the means and methods of equipment installation and support.

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

2. Provide supports for all apparatus as specified, detailed, as required by the manufacturers of specific equipment and the project governing code authorities. Anchor all roof and base/floor mounted equipment with size and spacing of anchor bolts or other attachment means as recommended by the respective equipment manufacturer.
3. Provide seismic restraints on all mechanical equipment in conformance with applicable OSSC sections. Costs for seismic calculations are to be included in the bid price.
4. Provide deferred submittals directly to the governing code jurisdiction for anchorage to floors, roofs, etc., sway bracing and seismic restraints. Submittals to show locations and sufficient support details as required by the governing code jurisdiction.
5. Provide supplementary drawings and calculations as required by governing code jurisdictions noting seismic support data/calculations as required for permit purposes.

END OF SECTION

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Providing of all required identification systems for HVAC equipment and piping.

1.2 SUBMITTALS

A. Provide submittals in accordance with Section 23 00 00.

B. Submittals shall include:
1. List of proposed equipment tags.
2. Product information on piping markers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. W. H. Brady Co. or Seton.

2.2 DESCRIPTION

A. Equipment Identification: Equipment identification tags shall be three-ply, black face, white center, black back phenolic plastic plates with minimum 3/16" high letters.

B. Piping Markers:
1. All vinyl self-sticking labels.
2. Colors to conform school district standards.

C. The presence of above ceiling equipment items shall be marked using self-adhesive tape markers affixed to the ceiling grid. The markers shall indicate equipment category and equipment number.

D. Provide self-adhesive tape markers for space temperature sensors indicating corresponding HVAC system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide each piece of equipment with a manufacturer's standard nameplate indicating manufacturer's name, model number, capacities and characteristics.

B. In addition, provide each piece of equipment with a plastic tag indicating its designation on this project (such as FC-1, DC-1) and the area served. Mount this tag with screws, where possible, in a clearly visible location.

C. Affix piping markers to pipe or insulation in locations that make them clearly visible. Secure markers with two wraps of "Scotch Reinforced Tape" at each end.

D. Locate markers at intervals of no more than 25 feet allowing visual identification of a line from any point along that line and as follows: Within 5-feet of each valve, elbow, tee, where a pipe passes through a wall, direction of flow on each leg of a "T" and on lower quarters of the line on horizontal runs where view is not obstructed. Provide arrow markers to indicate direction of flow away from each pipe identification marker.

E. Attach ceiling markers to the ceiling grid noting access locations of equipment mounted above the ceiling.

END OF SECTION

TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A Work Included: Providing system balance work as specified.

1.2 OPERATION AND MAINTENANCE DATA

A. Provide O&M data in accordance with Section 23 00 00.

B. O&M data shall include copies of system balance data.

1.3 QUALITY ASSURANCE

A. Conduct the systems balance work in accordance with standard procedures and recognized practices outlined by ASH RAE and SMACNA. Record all actual equipment nameplate and operating data at the site. Test and balance to be performed by an independent air balance company certified by NEBB or AABC.

B. Contract with Pacific Coast Air Balancing, Neudorfer Engineers Inc., Accurate Balancing Agency Inc., Air Balancing Specialty Inc., Precision Test and Balance Inc., Northwest Engineering Service, Inc. or approved equal to perform the system balance work on this project.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 GENERAL

A. Install new air filters in the units before the start of testing and balancing.

B. Provide ladders, scaffolding, and access to each system for proper testing and balancing.

C. Confirm in writing that all wiring and controls for mechanical equipment have been installed, completed and tested.

D. Preparation: Prior to test run, Contractor shall have performed a rough balance and the following:
1. Verify correct rotation of all fans.
2. Check for excessive vibration and noise.
3. Verify filter installation in filter assembly.
4. Check proper calibration and settings of controls.
5. Confirm that ductwork has been sealed.

E. Air handling Unit / Duct Coils:
1. Assure that air filters are clean, if not new, prior to beginning air balance work.
2. Adjust the fan drive to obtain fan speed required for air volumes. Speed shall be set to the minimum to provide required air volume at furthest run without excessive static pressure.
3. Adjust minimum outside air volume to that shown on the plans.
4. Include the following in the logs:
    a. Supply, return and outside air volumes.
    b. Static pressure drops across the air handling unit.
    c. Total pressure drops for supply and return system.

d. Fan speed or RPM.
e. Actual motor voltage, amperage, RPM and overload heater sizes.

F. Air Distribution System:
1. Adjust air volumes at diffusers and grilles to within plus or minus 5% of the values shown on the plans.
2. Adjust diffusers and grilles for proper direction and throw.
3. Log all readings taken.
4. Mark final position of all balancing dampers.

G. Hydronic Systems (Duct Coils, Unit Ventilators, Fan Coils): Adjust circuit setters / balancing valves to obtain flows noted on drawings and note the flows and pressure drops in the balancing log.

H Controls and Sequence Commissioning
1. Cycle the air handling unit, duct coils, unit ventilators and fan coil units control systems through the entire range of functions and verify proper operation and sequencing of heating, cooling, thermostat operation, etc.
2. Coordinate with the DDC controls contractor for scheduling and system operation support.
3. Provide the following as a separate portion of the test and balance log:
a. Type and characteristics of the individual controls serving each unique system in the building.
b. Written verification that the equipment controls and sequencing appears to be correct and functioning properly at the time of performance of the system test and balance work.

END OF SECTION

HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A Work included:
1. Providing of all required insulation for ductwork and piping.
2. Notify the district representative prior to covering completed piping and duct systems - All piping and ductwork to be reviewed by the district representative, engineer or authorized representative prior to installation of insulation.

1.2 SUBMITTALS

A. Provide submittals in accordance with Section 23 00 00.

B. Submittals shall include:
1. Data to show compliance with flame and smoke rating.
2. Manufacturer's catalog or technical data showing performance, dimensions, materials of construction and recommended methods of installation.

1.3 QUALITY ASSURANCE

A. Insulation materials and accessories such as adhesives, cement, etc. shall have composite fire and smoke hazard ratings, as tested by procedures indicated in NFPA 255 and U.L. 723, not to exceed a flame spread index of 25 and a smoke developed index of 50. Products or their shipping cartons shall have identification of the flame spread and smoke developed index.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manville, Knauf, Owens-Corning, Certain-teed, or approved equal. Schuller used as basis of selection.

B. Elastomeric Insulation Products: Armacell, Rubatex, K-Flex or approved equal.

2.2 DESCRIPTION

A. External Duct Insulation: Manville Microlite EQ FSK formaldehyde free, fiberglass duct insulation with FSKL jacket, 0.75 lb./cu. ft. Minimum installed R-value = 2.8 / inch.

B. Duct Lining: Manville Linacoustic 1.5-3.0 lb./cu. ft. made of glass fibers bonded with a thermosetting resin with a “Permacote” coating proving added durability and microbial growth protection. Minimum installed R-value = 4.2 / inch. No fibrous material is to be exposed to the airstream.

C. Minimum installed R-value (external insulation and lining):
1. General Service (within Building Envelope) - R = Minimum 5.
2. Unconditioned Spaces - R = Minimum 8.
3. Outside Building / Vented Attic Space - R = Minimum 8.

D. Hot Water Pipe Insulation:
1. Manville Micro-Lok HP rigid pre-formed fiberglass.
2. Maximum conductivity (k) = 0.27 Btu per inch/hour * ft2 * degree-F.
3. Pipe fittings: Zeston 2000 premolded PVC covers with fiberglass blanket insulation.
4. Foam filled elbows are not acceptable.

HVAC INSULATION

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ductwork Insulation / Lining Application.
1. Rectangular supply and return air ductwork within 7 feet of a gas furnace – Internally lined.
2. Rectangular and round supply / return air ductwork except as noted above - Externally insulated or internally lined.
3. Outside air ductwork in mechanical rooms / mezzanines – Internally lined.

B. Ductwork Interior Lining Application.
1. General Requirements: Apply internal insulation in accordance with manufacturer's recommendations and SMACNA "Duct Liner Application Standard." Apply internal insulation to flat sheet metal with continuous coverage of adhesive.
2. Use adhesive on all butt edges. Install weld pins and clips on internal insulation 15" on center and no more than 2" maximum from any cut or exposed edge.
3. Coat all raw duct liner edges within the ductwork. No uncoated fiberglass is allowed within the ductwork.
4. Weld pins spaced maximum of 15 inch on center in both directions and within 2 inches of corners and joints. Weld pins flush with liner surface.
5. Complete duct surface coated with adhesive and insulation pressed tightly thereto.
6. Provide edges at terminal points with metal beading and heavily coated with adhesive.
7. Heavily coat joints and corners with adhesive.
8. Damaged areas replaced or heavily coated with adhesive.
9. Duct dimensions shown are net inside dimension.

C. Heating Hot Water Pipe Insulation.
1. 1-1/2 inch and smaller: Provide 1-1/2 inch pipe insulation on hot water supply and return piping.
2. Larger than 1-1/2 inch: Provide 2-inch pipe insulation on hot water supply and return piping.
3. Insulate fittings on piping utilizing preformed pipe covering.
4. Insulate all valve bodies, fittings, unions, flanges and equipment with insulation equal to the attached service piping.
5. Seal all insulation to maintain a vapor barrier.

END OF SECTION

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION

A. Furnishing and installing all control hardware and software necessary for a complete DDC control system revision as specified.

B. Furnish all modules, temperature sensors, flow sensors, control valves, control valve actuators, damper actuators and any other items necessary for a complete system and sequence of control

C. Final installation will allow all school control components to be monitored / controlled at a single point by district personnel through the existing district interface.
   1. Final graphics for the completed project must be consistent with the graphics for the areas of the school not in the project scope.
   2. Final user interface spaces tree for the completed project must be consistent with the areas of the school not in the project scope.
   3. Final control graphics and user interface spaces tree for the project areas and school areas not in scope should be identical in construction and appearance. Navigation of the control system throughout the entire school by school district personnel should be seamless with no distinction between the new project areas and the school areas outside the project scope.

D. Coordinate the installation of temperature sensors, dampers and actuators with the mechanical contractor to assure all work required for a complete system is included in the base bid.

E. Establish communication to the new equipment through BACnet IP protocol via the existing MSTP controllers in the classroom area as noted on the drawing. Do not establish communication through the existing N2 controller(s) in the boiler room. Bring the system DDC points into the district server and integrate the system graphics to match Beaverton School District (BSD) standards.

F. Commissioning Support.
   1. Furnish a time allowance for a controls technician familiar with the system operations to operate the DDC controls while the air balance contractor visually observes the system components are functioning / sequencing as appropriate.
   2. Coordinate scheduling with the air balance contractor to perform the controls commissioning.

1.2 QUALITY ASSURANCE

A. Provide control work by a single company with licensed journeymen specialists in the type of work required, so that only one supplier is responsible for all control work for the project.

B. Provide coordination with other contractors and subcontractors for work required by other trades for control work accomplishment.

1.3 SUBMITTALS

A. In diagrams, show complete piping or ductwork system schematics with DDC, electrical and pneumatic control devices, tubing and wiring superimposed.

B. Completely identify all control devices with manufacturer's type, number, and functional description.

C. Show all electric and hydronic connections of the control system to equipment furnished by others, complete to terminal points specifically identified with manufacturer's terminal designation.

D. Provide a bill of material and catalog data on all control device types, including control operation description, technical parameters and connection identifications. Describe the complete sequence of operation containing all information necessary for clarity and understanding of device function and system sequence of operation.

E. Furnish a list of connected data points, including connected control unit and input device.

F. Include a spreadsheet for the user interface showing relationships between spaces and equipment. This should document the final room numbers and names used in the building. Equipment names should match tags on units in the field as installed and be consistent with the remaining areas of the building.

1.4 OPERATING AND MAINTENANCE DATA:

A. O&M Manuals in PDF format.

B. Include a complete set of control Shop Drawings indicating as built and operating changes.

C. Include operating and maintenance data on all equipment requiring periodic or incidental services or adjustment. Include a summary schedule for all maintenance tasks. Describe troubleshooting procedures for anticipated problems.

D. Controls Systems Commissioning:
1. Submit a complete, dated, and initialed record of all system adjustment for components of the control system.
2. Indicate deviations from the specified temperatures, pressures, flows, setpoints, etc.
3. Include a copy of the completed commissioning worksheets in each copy of the Operating and Maintenance Data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND SYSTEMS

A. Johnson controls by the local factory branch, Northwest Controls Company (NCC), or Automated Controls (Kirkland / Redmond, Washington).

2.2 CONTROL WIRING / COORDINATION WITH LINE VOLTAGE CONTROL

A. Provide control wiring to all control modules, sensors and actuators required to provide the project sequences of operation.

B. Provide control interface air handling units, unit ventilators and accessory equipment as required.

C. All control wiring exposed in occupied areas to be in conduit. Coordinate exposed control wiring in normally occupied spaces with the school district project manager

D. Provide all control system related conduit within mechanical room or at equipment locations unless specifically shown to be in other divisions work.

E. Control wiring in non-accessible ceilings, walls or floors shall be in conduit.

F. All wiring not in conduit or control cabinets shall be rated for plenum installation.

G. Provide conduit where required between the zone temperature sensor locations and the zone equipment. Provide all wiring / conduit in the base bid necessary for a complete operating control system.

2.3 AUTOMATION SYSTEM / DDC CONTROL DEVICES

A. All control devices to be standard products of the specified control system and accessory devices utilized by the controls installer consistent with Beaverton School District standards.

B. Zone sensors:
1. Include set point adjustments subject to a programmable range.
2. Sensors to also include a timed local override to allow the occupant to override the schedule for an adjustable period of time (programmable from the global school control). At the expiration of the time , control of the unit will automatically return to the default schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Single source responsibility of supplier shall be the complete installation and proper operation of the building automation system and control system and shall include debugging and proper calibration of each component in the entire system.

B. Provide all controllers to accomplish the control sequences specified herein.

C. Provide / coordinate the installation of; sensors, pipe wells, relays and any other devices and materials required to accomplish the functions described herein.

D. Establish communication to the new equipment through BACnet IP protocol via the existing MSTP controllers in the classroom area as noted on the drawing. Do not establish communication through the existing N2 controller(s) in the boiler room. Bring the system DDC points into the district server and integrate the system graphics to match Beaverton School District (BSD) standards.

E. Furnish all software, device installation, programming, technical assistance to the school district and product licenses required for complete operating control systems throughout the entire facility.

F. All control identification points and HVAC systems graphics to conform to Beaverton School district naming standards – Verify with BSD project manager prior to initiation of programming and graphics development.

G. Provide all temperature sensors, flow sensors, humidity sensors, IAQ sensors, control valves, control valve actuators, dampers, damper actuators, programming and other items necessary for a complete system and sequence of control for new equipment as identified in the contract drawings.

H. All new equipment to have points as noted on Contract Drawing M1.00.

I. Program all control diagrams and sequences of operation into the system graphics to allow visual review of diagrams / sequence when viewing system programming.

J. Furnishing and installing all control hardware and software necessary for a complete DDC control system as specified.

K. Final installation will allow all school control components to be monitored / controlled at a single point by district personnel through a single user interface.

L. Coordinate the installation of automatic control valves, dry wells for fluid temperature sensors, dampers and actuators with the mechanical contractor to assure all work required for a complete system is included in the base bid.

M. The Controls Contractor shall be responsible for field verification of site conditions and for gathering all necessary field data for all items to be provided under this contract prior to submitting his or her bid.

N. Where work specified under other Sections of this Specification connects to equipment or systems that are listed and described in this Section, the Controls Contractor shall coordinate with other trades to provide proper connection(s) to such equipment.

O. Identification - Provide nameplates identifying all switches, lights and starters, and each control device where the control function is not readily apparent.

3.2 SEQUENCES OF OPERATION

A. Energy Management System Point Schedule: Provide monitoring and control functions as listed herein for each piece of equipment listed below. Provide a point list that includes each hard wired, calculated and/or resettable point.

B. Distributed Control – The control system shall observe the concept of distributed control. Modules shall be located at each operating equipment location such that individual systems or zones shall remain functional without communication to other systems on the network.

C. All general control points noted, software PID algorithms and setpoints to be per Beaverton School District standards. Sequences noted below should be generally followed – If conflicts arise between the sequences below and Beaverton School District standard operating sequences, notify the district project manager.

D. Setpoints and values noted below are to be capable of user adjustment within generally accepted industry value ranges.

E. Energy Compliance:
1. Provide 365 day, 24 hour occupancy scheduling.
2. When controlling both heating and cooling (mechanical), provide a 5-degree deadband in which the heating energy provided to the zone is reduced to a minimum.
3. Provide optimum start controls to enable a morning warm-up cycle capable of varying the unit start time to meet occupied setpoint at scheduled time of occupancy.
4. Close outside air dampers as appropriate to the equipment when the units are off and during the warm-up period.

F. Air Handling Unit / Duct Coils.
1. System to have independent schedule capability from global, group or local schedule.
2. Unoccupied Mode:
    a. Fans off, duct coil hydronic valves closed, outside air and return air dampers indexed to full recirculation.
    b. Relief damper closed.
    c. Unoccupied Low Limit: When the space temperature drops below the night low limit set point (district standard - adjustable), enable boiler / pump operation, start the air handling unit and open the duct coil valves to full heating. Heat to continue until the space is 5-degrees above night low limit set point.
    d. Subject to the boiler outside air lockout temperature (65). When the supply fan is operational in unoccupied low limit and there is a call for heating the boiler system will be enabled.
3. Warm-up Mode:
    a. At optimum warm up start period, start fan to run continuously. Index outside air and return air indexed to full recirculation. Relief damper remains closed. Open the duct coil valve to full heating.

b. Based on the space temperature, the optimum start/stop function starts the air handling system in warm-up mode so that the space temperature will reach set point at the scheduled occupancy time.
c. During warm-up the dampers will remain in full circulation and will cycle to appropriate ventilation mode control at occupancy time regardless of average zone temperature.

4. Occupied Mode:
   a. The occupied sequence of operations for the units shall consist of four separate control modes: heating, economizer cooling, chilled water cooling and ventilation.
   b. The Fan runs continuously.
   c. Heating Mode (Heating Hot Water):
      1) On a call for heat, mixed air shall modulate to the minimum position allowed by outside air setting and CO2 level.
      2) If heating water is available the duct coil valves shall modulate open until the heating setpoint is attained.
   d. Cooling Mode (Economizer cycle):
      1) Actuators shall operate outside air and return dampers in accordance with system operating status, supply air, zone air temperatures, and outside air temperatures.
      2) Modulate between minimum outside air position and 100% open to meet the cooling requirements.
      3) Duct coil valves are closed.
   e. Cooling Mode (Chilled Water):
      1) On a continued call for cooling, mixed air shall modulate to the minimum position allowed by outside air setting and CO2 level.
      2) If chilled water is available, the duct coil valves shall modulate open until the cooling setpoint is attained.
5. Demand Control Ventilation Mode: The mixed air control shall modulate to control the following in the priority listed:
   a. Mixed air low limit set point (45 deg F)
   b. CO2 high limit set point: Reset the outside air according to the following adjustable setpoints -
      1) 800-ppm CO2 and below - OSA at 5% maximum supply air volume.
      2) 1200-ppm CO2 maximum - OSA at 50% maximum supply air volume.
   c. The mixed air set point shall be reset from (55) deg F at (70) deg F outside air to (65) deg F at (50) deg F based on an outside air temperature reset. If the outside air temperature is above the return air temperature the mixed air should be at minimum position as allowed by the minimum outside air setting and CO2 level.
6. Night Purge Mode.
   a. Cooling setpoint 69-degrees F (adjustable).
   b. If a night purge mode is broadcast to the system and the following conditions are present-
      1) Zone is 5 hours (adjustable) prior to occupancy.
      2) Zone is 1-degree F over night purge setpoint.
      3) Outside air temperature is above 45 degrees F and more than 10 degrees F below the zone temperature.

      The fan will start and the outside air damper will index to full open / return air damper will close and the relief damper will open.
   c. Control valves will remain closed.
   d. Purge mode will end one hour prior to occupancy.

7. Alarms:
   a. Individual alarms generated will be setup for the following actions. Each alarm is unique and will have the following options per the district representative.
      1) Alarm popup at district DDC central station.
      2) Send email – Request list of emails from the district representative.
      3) Send text – Request list of telephone numbers from the district representative.
   b. Alarms are set with district standard messages – Custom messages may be sent without program change or memory download.
   c. System alarms.
      1) Air handling unit run status fault.
      2) High zone CO2 level – Library only.
      3) Smoke detector activation.
      4) High space temperature (2 zones).
      5) Low space temperature (2 zones).
      6) Mixed air low limit - Freeze.
         a) In addition to the alarms generated above – The air handling unit will stop and the outside air and return air dampers shall index to full recirculation.

G. Classroom Unit Ventilators.
   1. Unit ventilators to have independent schedule capability from global, group or local schedule.
   2. Unoccupied Mode:
      a. Fans off, coil hydronic valves closed, outside air and return air dampers indexed to full recirculation.
      b. Unoccupied Low Limit: When the space temperature drops below the night low limit set point (district standard - adjustable), enable boiler / pump operation, start the unit ventilator and open the coil valves to full heating. Heat to continue until the space is 5-degrees above night low limit set point.
      c. Subject to the boiler outside air lockout temperature (65). When the unit ventilator is operational in unoccupied low limit and there is a call for heating the boiler system will be enabled.
   3. Warm-up Mode:
      a. At optimum warm up start period, start fan to run continuously. Index outside air and return air indexed to full recirculation.
      b. Based on the space temperature, the optimum start/stop function starts the unit ventilator in warm-up mode so that the space temperature will reach set point at the scheduled occupancy time.
      c. During warm-up the dampers will remain in full circulation and will cycle to appropriate ventilation mode control at occupancy time regardless of average zone temperature.
   4. Occupied Mode:
      a. The occupied sequence of operations for the units shall consist of four separate control modes: heating, economizer cooling, chilled water cooling and ventilation.
      b. The Fan runs continuously.
      c. Heating Mode (Heating Hot Water):
         1) On a call for heat, mixed air shall modulate to the minimum position allowed by outside air setting and CO2 level.
         2) If heating water is available the coil valves shall modulate open until the heating setpoint is attained.

d. Cooling Mode (Economizer cycle):
   1) Actuators shall operate outside air and return dampers in accordance with system operating status, supply air, zone air temperatures, and outside air temperatures.
   2) Modulate between minimum outside air position and 100% open (adjustable) to meet the cooling requirements.
   3) Duct coil valves are closed.

e. Cooling Mode (Chilled Water):
   1) On a continued call for cooling, mixed air shall modulate to the minimum position allowed by outside air setting and CO2 level.
   2) If chilled water is available, the coil valves shall modulate open until the cooling setpoint is attained.

5. Demand Control Ventilation Mode: The mixed air control shall modulate to control the following in the priority listed:
   a. Mixed air low limit set point (45 deg F)
   b. CO2 high limit set point: Reset the outside air according to the following adjustable setpoints -
      1) 800-ppm CO2 and below - OSA at 5% maximum supply air volume.
      2) 1200-ppm CO2 maximum - OSA at 50% maximum supply air volume.
   c. The mixed air set point shall be reset from (55) deg F at (70) deg F outside air to (65) deg F at (50) deg F based on an outside air temperature reset. If the outside air temperature is above the return air temperature the mixed air should be at minimum position as allowed by the minimum outside air setting and CO2 level.
6. Night Purge Mode.
   a. Cooling setpoint 69-degrees F (adjustable).
   b. If a night purge mode is broadcast to the system and the following conditions are present-
      1) Zone is 5 hours (adjustable) prior to occupancy.
      2) Zone is 1-degree F over night purge setpoint.
      3) Outside air temperature is above 45 degrees F and more than 10 degrees F below the zone temperature.

      The fan will start and the outside air damper will index to full open / return air damper will close and the relief damper will open.
   c. Control valves will remain closed.
   d. Purge mode will end one hour prior to occupancy.
7. Alarms:
   a. Individual alarms generated will be setup for the following actions. Each alarm is unique and will have the following options per the district representative.
      1) Alarm popup at district DDC central station.
      2) Send email – Request list of emails from the district representative.
      3) Send text – Request list of telephone numbers from the district representative.
   b. Alarms are set with district standard messages – Custom messages may be sent without program change or memory download.
   c. System alarms.
      1) High space temperature.
      2) Low space temperature.
      3) High space CO2 level.
      4) Unit ventilator fan run status fault.
      5) Drain pan overflow switch activated.

6) Mixed air low limit - Freeze.
   a) In addition to the alarms generated above – The unit ventilator will stop and the outside air and return air dampers shall index to full recirculation.

H. Fan Coils.
1. Fan coil Units to have independent schedule capability from global, group or local schedule.
2. Unoccupied Mode:
   a. Fans off, coil hydronic valves closed, outside air damper closed.
   b. Unoccupied Low Limit: When the space temperature drops below the night low limit set point (district standard - adjustable), enable boiler / pump operation, start fan coil and open the coil valves to full heating. Heat to continue until the space is 5-degrees above night low limit set point.
   c. Subject to the boiler outside air lockout temperature (65). When the unit ventilator is operational in unoccupied low limit and there is a call for heating the boiler system will be enabled.
3. Warm-up Mode:
   a. At optimum warm up start period, start fan to run continuously. Outside air damper remains close.
   b. Based on the space temperature, the optimum start/stop function starts the fan coil in warm-up mode so that the space temperature will reach set point at the scheduled occupancy time.
   c. During warm-up the outside air damper will remain closed and will cycle to preset position at occupancy time regardless of average zone temperature.
4. Occupied Mode:
   a. The occupied sequence of operations for the units shall consist of two separate control modes: heating and chilled water cooling.
   b. The Fan runs continuously.
   c. Heating Mode (Heating Hot Water): On a call for heat, if heating water is available the coil valves shall modulate open until the heating setpoint is attained.
   d. Cooling Mode (Chilled Water): On a continued call for cooling, if chilled water is available, the coil valves shall modulate open until the cooling setpoint is attained.
5. Alarms:
   a. Individual alarms generated will be setup for the following actions. Each alarm is unique and will have the following options per the district representative.
      1) Alarm popup at district DDC central station.
      2) Send email – Request list of emails from the district representative.
      3) Send text – Request list of telephone numbers from the district representative.
   b. Alarms are set with district standard messages – Custom messages may be sent without program change or memory download.
   c. System alarms.
      1) High space temperature.
      2) Low space temperature.
      3) Unit ventilator fan run status fault.
      4) Drain pan overflow switch activated.
      5) Mixed air low limit - Freeze.
         a) In addition to the alarms generated above – The unit ventilator will stop and the outside air damper will close.

I. Split System Heat Pump.
1. Provide a space temperature sensor and calibrate to the split system thermostat setpoints.

2. Enable / disable the split system on a time schedule (adjustable) – The system will control space temperature with its package controls when in occupied and night setback modes.
3. Program remote setpoint adjustment capability from the district server.
4. Provide an alarm point from the drain pan overflow switch.
5. Alarms:
   a. Individual alarms generated will be setup for the following actions. Each alarm is unique and will have the following options per the district representative.
      1) Alarm popup at district DDC central station.
      2) Send email – Request list of emails from the district representative.
      3) Send text – Request list of telephone numbers from the district representative.
   b. Alarms are set with district standard messages – Custom messages may be sent without program change or memory download.

   c. System alarms.
      1) High space temperature.
      2) Low space temperature.
      3) Run status fault.
      4) Drain pan overflow switch activated.

3.3 FIELD QUALITY CONTROL

A. Startup: Implement a logical step-by-step startup and checkout of the control system. In addition, startup assistance and coordination shall be provided during startup of the mechanical equipment. Startup shall be considered complete after the entire system is operating properly.

B. Self-commission all hardware and software provided for the project.

C. Completed field commissioning sheets shall be included with the final “as-built” O&M manuals. These sheets shall include validation check fields for all physical and LAN inputs and outputs and graphics for each operating unit or system within the facility. Each system and point shall be listed, using logical names for future reference by the owner.

D. Commissioning shall include calibration and verification of operation of each I/O and graphic field. Functional commissioning of software programming to meet sequences of operation as submitted and approved shall be verified on the field commissioning sheets.

E. At the completion of the job, in the presence of an Owner's representative, thoroughly check out the entire control system by simulating each control function and determine that the system performs in accordance with the Contract Specifications.

3.4 INSTRUCTION OF OWNER PERSONNEL

A. Provide complete list of system generated messages for system operation, including alarm messages.

B. Modify error message wording as required by the Owner's personnel.

C. Locate all control components for Operating Engineer.

3.5 RECORD DRAWINGS

A. Provide complete and accurate record drawings noting all deviations from the information furnished in the original submittals.

3.6 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned.

B. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Include time allowance in the base bid to coordinate and participate in all commissioning activities with the designated commissioning contractor.

END OF SECTION

HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work included:
1. Providing of all hydronic systems piping, appurtenances and equipment for all systems specified or shown on the drawings.
2. Provide detailed piping and room layout drawings based on equipment and piping shown, specified and the piping diagram/schematics shown on drawing sheets M1.11. Coordinate the layouts with the existing equipment and piping to remain as required.
3. Pressure testing of piping.

1.2 UNIT COST ALLOWANCES

A. In the event Beaverton School District requests piping demolition / installation work in addition to the base contract scope, furnish in the bid lineal feet allowances for removal and replacement of the following piping:
1. 1/2-inch insulated black steel for heating water.
2. 3/4-inch insulated black steel for heating water.
3. 1-inch insulated black steel for heating water.
4. 1-1/4 inch insulated black steel for heating water.
5. 1-1/2 inch insulated black steel for heating water.
6. 2-inch insulated black steel for heating water.
7. 2-1/2-inch insulated black steel for heating water.
8. 3-inch insulated black steel for heating water.
9. 4-inch insulated black steel for heating water.

B. Include any minimum lengths, clarifications, etc. with the pricing.

1.3 SUBMITTALS

A. Provide submittals in accordance with Section 23 00 00.

B. Submittals shall include:
1. Manufacturer's technical literature for all products used.
2. List of selected flow control valves with pressure ranges and flow indicated.

1.4 OPERATION AND MAINTENANCE DATA

A. Provide O&M data in accordance with Section 23 00 00.

B. O&M data shall include:
1. Manufacturer's literature.
2. Maintenance instructions.

1.5 QUALITY ASSURANCE

A. Piping material, installation and testing to meet requirements of the local plumbing, fire and building codes and serving utility requirements. Perform required pipe tests in the presence of the authority having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Black Steel Pipe:
1. Pipe: Schedule 40 black steel pipe conforming to ASTM A120-82 or A53-93A.
2. Fittings: 150 psi screwed malleable iron for 2 1/2" and smaller, Schedule 40 weld fittings conforming to ASTM A234 for 3" and larger.
3. Standard product of manufacturer.

B. Balancing fitting: Bell & Gossett, Amtrol, Armstrong, Paco, Wheatley or approved equal.

C. Manual Air Vents: Dole or approved equal.

D. Pressure/Temperature Test Plug: Peterson Engineering, Inc., Universal Lancaster, and Sisco.

E. Chemical Pipe Cleaning and Treatment / Filter Feeder:

Watercare Industrial Services Inc.
Contact: Steve Carroll
360-835-7284
Cell 503-789-1692

F. Strainers: Wheatley, Watts or approved.

G. Unions: Standard product of manufacturer.

H. Coils: Daikin, Trane, Carrier or approved equal.

2.2 DESCRIPTION

A. Heating Water Piping:
1. Black steel – Provide screwed, welded or flanged fittings as required.
2. Flex Connectors (All Sizes): Stainless steel or copper, 2-foot maximum length.

B. Miscellaneous Condensate and Drain Piping:
1. Pipe: Hard drawn copper meeting ASTM B 88, type "L" hard drawn copper for plumbing service.
2. Fittings: Wrought copper solder type.
3. Solder / Brazing Alloy: 2-inch and smaller - Lead free 95-5, tin silver and flux. 2-1/2-inch and larger - Lead free brazing alloy and flux.

C. Balancing Fittings (Circuit Setters): Circuit setters shall be calibrated balance valves equipped with readout valves to facilitate the connecting of a differential readout meter. Each readout shall be fitted with an integral check or shutoff designed to minimize fluid loss during the monitoring process. The balancing valve shall have an indexing pointer and calibrated nameplate to indicate the degree of closure.

D. Manual Air Vents: Dole #9 coin valve or approved.

E. Pressure/Temperature Test Plug:
1. Acceptable Manufacturers: Peterson Engineering, Inc., Universal Lancaster, and Sisco.
2. General: 1/2 inch NPT fitting to receive either a temperature or pressure probe 1/8 inch outside diameter fitted with a color coded and marked cap with gasket.
3. Material: Solid brass with valve core of Nordel.

4. Rating: Minimum 300 psig at 275 F.
5. Provide Owner with two 0-30 psig gauges and two 0-220 degree F. pocket-testing thermometers. Gauges and thermometers to be equipped with appropriate adapters for test plugs.

F. Chemical Pipe Cleaning and Treatment Systems.
1. Filter Pot Feeder: Watercare Filter-Feeder #PF-DB-2HD chemical feed container with removable / replaceable filter. Provide a ball type drain valve and ball type isolation valves.
2. Cleaning Agents: Watercare #2500 Corrosion Inhibitor.

G. Strainers: Bronze or cast iron body, screwed pattern, 125 pound, 0.045 inch perforated type 304 stainless steel strainer. Equip strainers with 3/4" hose end drain valve.

H. Unions: 150 malleable iron, brass to iron seat, ground joint, black or galvanized to match pipe. 200-psi wog bronze, ground joint, solder type for copper tubing. Where dissimilar metals join, dielectric unions, couplings or flanges shall be installed.

I. Coils.
1. Cased coil with copper tubes secured to copper headers to form permanently tight joints.
2. Non-ferrous finned surface extending at right angles to tubes and mechanically secured at uniform pitch.
3. Completely drainable by gravity as installed.
4. 16 gauge galvanized steel casings, with required supply and return openings. For counterflow of air and water.
5. Situated in casing to permit piping connections with permanent metal seals to prevent air bypass.
6. Integral drain pan with 3/4-inch piping connection

PART 3 - EXECUTION

3.1 PREPARATION - MEASUREMENTS, LINES AND LEVELS

A. Check dimension at the building site and establish lines and levels for the work specified in this Division.

3.2 INSTALLATION

A. Hydronic Piping.
1. Grade mains and runouts to drain.
2. Provide miscellaneous valves and appurtenances as noted on the drawings.
3. Provide shutoff valves at equipment and coil connections.
4. Provide unions in piping at control valves, pressure reducing valves, pumps, coils, etc. if equipment is furnished without flanges for pipe connections.
5. Provide manual air vents at all high points and drain valves at all low points in the piping system.
6. Provide fittings and install automatic temperature control wells provided and located by the automatic temperature control contractor and where shown on the drawings.
7. Provide reducers as required for changes in pipe size, equipment connections and control valves.

B. Miscellaneous Condensate and Drain Systems:
1. Install condensate system sized in conformance with the drawings.
2. Slope lines in direction of flow.
3. Install indirect waste fittings as shown on the Drawings, providing access as required by code
4. Test piping system per this Section.

C. Pressure testing of piping:
   1. Piping: Test prior to concealment, insulation being applied, and connection to equipment, fixtures, or specialties. Conduct tests with all valves but those used to isolate the test section 10% closed.
   2. Leaks: Repair all leaks or replace defective pipe or fittings and retest until stipulated results are achieved.
   3. Notification: Advise the Project Manager 48 hours in advance of each test. Failure to so notify will require test to be rescheduled.
   4. Testing Equipment: Provide all necessary pumps, gauges, connections similar items required to perform the tests.

D. Maintain service clearances for all equipment, valves, etc. per the respective manufacturer's requirements and as required for adequate service.

E. Provide flexible pipe connections at all piping penetrations through building expansion joints.

F. Provide shutoff valves at equipment connections.

G. Install unions in all non-flanged piping connections to apparatus and adjacent to all screwed control valves, traps, and appurtenances requiring removal for servicing, so located that piping may be disconnected without disturbing the general system.

H. Coils:
   1. Install coils where noted on the drawings in accordance with the manufacturer's recommendations.
   2. Connect the ductwork when required to the coil casing providing transitions and fittings.
   3. Pipe 3/4-inch condensate lines to existing floor drains in the boiler room

I. Support all piping independently at apparatus so that the equipment shall not carry its weight.

J. Screwed Joints: Ream pipe ends. Apply dope or tape to male threads only. Brass joints shall be made with Teflon tape only. Make up fitting with not over two threads showing beyond the fitting end.

K. Provide reducers as required for changes in pipe size, equipment connections and valves

L. Cleaning and Chemical Treatment
   1. Replace the existing pot feeder with the specified filter feeder. Make piping connections and provide a ball type drain valve and ball type isolation valves.
   2. Fill, circulate, and flush system using the low point drain as an initial flush to remove all construction debris. Allow no delay in refilling, avoiding flash rust.
   3. Add Watercare #2500 Corrosion Inhibitor via the filter-feeder as required to maintain 1000-1400 ppm nitrite in the recirculating water.
   4. Clean / replace the filter feeder filtration media as recommended by the chemical cleaning and treatment supplier.

M. Strainers:
   1. Install per manufacturer’s instructions.
   2. Install with unions to allow isolation and replacement without destruction modification of the piping system.

HVAC PIPING AND EQUIPMENT

3.3 TESTING REQUIREMENTS

A. Piping - General: Test all piping as noted below, with no leaks or loss in pressure for the time indicated. Repair or replace defective piping until tests are completed successfully.

System	Test Pressure	Test Medium	Test Duration
Heating Hot Water	150 psig	Water	4-hours

3.4 FIRESTOPPING PENETRATIONS IN FIRE-RATED WALL/FLOOR ASSEMBLIES

A. Contractors shall provide proper sizing when providing sleeves or core-drilled holes to accommodate their through penetrating items. All voids between sleeve or core-drilled hole and pipe passing through, shall be firestopped with UL listed materials.

END OF SECTION

HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Providing of all required sheet metal ductwork specified or shown on the drawings.

1.2 SUBMITTALS

A. Submittals shall include Shop Drawings of any proposed revisions to the ductwork as shown on the drawings.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Provide G-60 galvanized sheet metal ductwork for supply and return air systems except as specified or shown on the drawings. Provide minimum gauge and reinforcing in accordance with Chapter Sixteen, "Duct Construction" of the Chapter 19 of the ASHRAE "Systems and Equipment" Handbook and the appropriate chapters of the latest edition of the Oregon State Mechanical Specialty Code

B. Round duct to be sheet metal spiral duct. Snap-lack furnace type pipe is not allowed.

C. Sheet metal duct only is to be used above hard ceiling areas.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General.
1. Construct and assemble all supply, return, outside air and general exhaust duct systems in accordance with latest edition of the "HVAC Duct Construction Standards" published by SMACNA, Chapter Sixteen, "Duct Construction" of the Chapter 19 of the ASHRAE "Systems and Equipment" Handbook and the appropriate chapters of the latest edition of the OMSC.
2. Cover ductwork openings during construction after delivery to the field prior to and after installation. Seal ends, protect from moisture and running water, adequately support to keep level and at least four inches off the ground.
3. Store in clean dry space or if stored outdoors cover and protect from the elements.
4. Ductwork pressure classifications to be appropriate for the scheduled external system pressures.

B. Seal all duct penetrations through walls at both sides of the partition. No air gaps are allowed around ductwork wall penetrations.

C. Cross brake and reinforce ductwork and plenums with structural steel members to prevent breathing or ballooning.

D. All joints in the air distribution system shall be sealed airtight with Hardcast CCWI-181 or similar LEED^{R} Compliant sealant.

END OF SECTION

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Providing of all required air duct accessories specified or shown on the drawings.

1.2 SUBMITTALS

A. Provide submittals in accordance with Section 23 00 00.

B. Submittals shall include: Manufacturer's catalog or technical data showing performance, dimensions, materials of construction and recommended methods of installation.

1.3 OPERATION AND MAINTENANCE DATA

A. Provide O&M data in accordance with Section 23 00 00.

B. O&M data shall include manufacturer's literature and maintenance instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Damper regulators and end bearings: Duro-Dyne, Ventlock or approved equal. DuroDyne used as basis of selection.

B. Turning vanes: Duro Dyne, Elgen All-Tight, General Sheet Metal or approved equal.

C. Flexible connections: Duro-Dyne or approved equal. Duro-Dyne used as basis of selection.

D. Control Dampers (Motorized): Greenheck, Ruskin, Cesco or approved equal with Belimo actuators.

2.2 DESCRIPTION

A. Volume Dampers:
1. Damper regulators and end bearings: 3/8-inch Figure SRH-288 for accessible ductwork and Figure SRC-380 for concealed ductwork.
2. Volume dampers shall be fabricated of 18 gage galvanized steel and have a continuous galvanized steel shaft.

B. Turning vanes: Airfoil double-blade turning vanes. Single-bladed, shop fabricated turning vanes are not acceptable except for supply diffuser plenums, see detail on drawings.

C. Flexible connections: Duro-Dyne "Insulflex" insulated flexible duct connector.

D. Control Dampers: Greenheck VCD-18 Low-Leakage Control Dampers.
1. 16-gauge galvanized hat channel with corner braces.
2. Galvanized steel, V-groove blade construction. Extruded vinyl blade seals.
3. Edge seals and flexible metal compressible jamb seals.
4. Synthetic bearings.
5. Square or hex plated steel axles.
6. Opposed blade operation.
7. Frame mounted actuator support.
8. Factory installed jackshaft for all multiple section dampers.

9. Maximum leakage rate of 4 CFM/sq. ft. at 1.0 inches w.g. when tested in accordance with AMCA Standard 500-1998.
10. Belimo actuators.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install volume dampers in all branch ducts to outlets and where shown on drawings. Provide regulators on all dampers. Assure that all dampers are aligned with their regulator pointers and left open for the air balance contractor. Permanently mark full open and full closed positions.

B. Install turning vanes in all mitered elbows.

C. Install flexible connections between air handling unit and connected ducts or plenums. Install with 2-inch space between the fan and connecting duct. Fabric should be snug, but not tight. Secure with flanged connections with accurate alignment between fan and duct.

D. Install control dampers with actuators in accordance with manufacturer's instructions where located on the drawings and as required to complete the specified control sequences.

END OF SECTION

SPLIT SYSTEM AIR CONDITIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Providing a split system air conditioning unit as specified and shown on the drawings.

1.2 SUBMITTALS

A. Provide submittals in accordance with Section 23 00 00.

B. Submittals shall include:
1. Manufacturer's catalog or technical data showing performance, dimensions, materials of construction and recommended methods of installation.
2. Control diagrams.

1.3 OPERATION AND MAINTENANCE DATA

A. Provide O&M data in accordance with Section 23 00 00.

B. O&M data shall include:
1. Manufacturer's literature.
2. Maintenance instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS: Daiken, Mitsubishi, Sanyo or approved equal.

2.2 PRODUCTS.

A. Heat Pump Units.
1. Heat pump unit to include compressor(s), condenser coils, condenser fans and motors, refrigerant reservoir, charging valve, all controls, refrigerant line sets, and a holding charge of R410A.
2. Galvanized steel cabinet coated with weather resistant powder paint.
3. Compressors: hermetic sealed scroll compressor with integral vibration isolation, overload and inherent winding thermostat protection to prevent burnout, crankcase heater. Horizontal condenser fan discharge. Reversing valve as required (heat pumps).
4. Refrigeration circuits: inverter driven, variable flow refrigerant unit shall include brass external liquid line solenoid valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on the compressor suction and discharge lines with Schrader type fittings with brass caps, accumulator, pressure relief, and full charge of refrigerant.
5. Condenser coil: Non-ferrous construction consisting of aluminum plate fins mechanically bonded to seamless copper tubes.
6. Condenser fans and motors: direct drive, resiliently mounted propeller fan arranged for horizontal discharge.
7. Accessories to include liquid solenoid valves and winter start control.
8. Internal refrigeration controls and safeties: provide time delay restart, automatic restart on power failure, safety lockout if unit safety is open, time delay control sequence, high and low pressure cutouts, internal overload protection on all motors.

B. Wall Mounted Fans.
   1. Indoor fan coil unit with direct expansion refrigerant cooling coil, fan motor, piping connections, electrical controls and hanging brackets (wall mounted). Unit to have integral discharge blades and return air grille.
   2. Fan to be centrifugal type with adjustable discharge louvers.
   3. Non-ferrous construction consisting of a refrigerant coil with aluminum plate fins mechanically bonded to seamless copper tubes. Integral drip pan and drain connection.
   4. Electronic expansion valve.
   5. Integral condensate pump.
   6. Refrigerant metering piston and body.
   7. Filter.

C. Controls:
   1. Manufacturer's controller with remote thermostat capability. Provide all adaptor boards, relays and miscellaneous components for a complete system.
   2. Controller to have BACnet capability to communicate with the Beaverton School District control system installed in the school. Coordinate with the mechanical contractor for compatibility.
   3. Minimum capability of controller.
      a. Complete internal system troubleshooting capability.
      b. Accept remote time schedule from central school DDC system.
      c. Accept remote cooling and heating setpoints from central school DDC system.
      d. Send a fault alarm if system is not operational when commanded on by the central school DDC system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units per manufacturer's installation instructions. Install fan coil unit to allow access to interior components as recommended by the manufacturer.

B. Provide flexible pipe connectors at condensing unit connections.

C. Refrigerant Piping:
   1. Routing:
      a. Verify refrigerant pipe routing with the architect prior to installation – Piping within the building is to be routed in walls, above ceilings, in the attic, etc. – No exposed refrigeration piping is allowed within the building.
      b. Where building construction constraints or jobsite conditions requires exposed piping, verify routing with architect prior to installation. Failure to verify exposed pipe routing prior to installation will result in removal and reinstallation.
      c. Route within building construction where possible – Route vertical piping within exterior wall spaces where possible – Not attached to the building exterior.
   2. Provide packaged, insulated refrigerant line "sets" or specified piping and components as required for connection of indoor coil and outdoor condensing unit. Provide support devices and related data to the governing code authorities as required.
   3. Provide line set sizing as recommended by the manufacturer for the distance of run from refrigerant coil to the condensing unit.

4. Refrigeration system - Brazed joints
   a. Cleaning.
      1) Immediately before final assembly, visually inspect all pre-cleaned piping sealed from the manufacturer for internal contamination. Piping contaminated or damaged is to be rejected or cleaned to original specifications.
      2) On-site cleaning of the interior surfaces of fittings, tubing and other system components is limited to recleaning surfaces in the immediate vicinity of the joints that have become contaminated prior to brazing. These surfaces are to be cleaned by washing in a clean, hot water/alkaline solution such as sodium carbonate or trisodium phosphate (1 lb. to 3 gallons of potable water). Interior surfaces shall be thoroughly scrubbed and rinsed with clean, hot, potable water.
      3) Store acceptable piping in a clean, safe location.
      4) Quantities of piping cleaned or with seals removed shall not exceed the amount that can be installed within the same working day(s).
   b. Installation Requirements
      1) In applications where copper tube must be joined to brass or bronze system components brazing flux shall be applied sparingly to the exterior surface of the tube. Brazing flux shall not be applied to the interior surface of the fitting.
      2) During installation, care shall be taken to avoid contamination of interior "cleaned for refrigeration service" surfaces of the piping system components. Joints shall be brazed within one-hour of cleaning.
      3) During and after installation, openings in the piping system shall be kept capped, plugged or sealed to avoid unnecessary loss of purge gas while brazing and to prevent contamination of the system. During brazing, a discharge opening shall be provided on the opposite side of the joint from where the purge gas is being introduced. After brazing, this discharge opening shall be capped, plugged or sealed to prevent contamination of the system\m.
      4) Brazed joints shall be allowed to cool to the touch naturally shall not be shock cooled. After cooling, all joints shall be cleaned with water and a stainless steel wire brush to remove any residue and permit clear visual inspection of the joint. Where flux has been permitted, hot water shall be used.
      5) All refrigerant piping wall and slab penetrations shall be oversized for the full depth of the opening and sealed per architectural document requirements. No pipe contact with walls or slabs is allowed.
      6) Field fabricated, mechanically formed tees/outlets and coupling shall not be used.

D. Condensate.
   1. Provide condensate trap per manufacturer’s recommendations and drain line as noted on the drawings. Route condensate line as noted on the drawings. Provide condensate pumps as required.
   2. Provide an auxiliary condensate disposal system per Oregon Mechanical Specialty Code 3.07.2.3 – auxiliary drain pan, separate overflow line, water level detection device.

E. Mount heat pump unit on housekeeping pad. Provide seismic restraints as required in accordance with code requirements and manufacturer's instructions. Securely mount the condensing unit to the mounting surface.

F. Provide complete charge of refrigerant and oil required for operation. Provide any additional refrigerant or oil required during first year of operation.

G. Provide remote thermostat and control devices and wiring required for remote sensor installation to control space temperature.

H. Furnish startup, adjustment and initial service by factory representative.

END OF SECTION

AIR HANDLING UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide U.L. approved constant volume fan coil unit as specified and scheduled.

1.2 SUBMITTALS

A. Manufacturers' catalog or technical data substantiating performance required. Mark up literature to indicate operating points.

B. Show all dimensions and describe materials and methods of construction.

C. Show and describe recommended methods of installation.

1.3 OPERATION AND MAINTENANCE DATA

A. Furnish O&M data including manufacturer's literature and maintenance instructions.

B. Furnish complete operation and maintenance manuals noting service points and recommended service schedules. Note specific techniques and equipment recommended for this equipment service.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Daikin, Trane, Carrier, Modine or approved equal.

B. Note basis of design units have specific dimensional requirements for installation into the existing mechanical room.

C. Verify units submitted for approval have dimensional and electrical characteristics required for installation into the project mechanical rooms.

2.2 AIR HANDLING UNIT

A. Description: Constant volume, air-handling unit designed for vertical interior mounting. Bottom intake and top discharge as noted on the drawings, factory assembled, wired, piped, tested and shipped in one piece with U.L. listing, with single point electrical connection.

B. Casing:
1. 20-gauge galvanized steel casing lined with 1/2-inch thick fiber free thermal / acoustical insulation.
2. Supply duct connection flanges.
3. Removable front service panels.

C. Provide filter and mixing box section with low leakage dampers.
1. Dampers: **A**ll motorized inlet or discharge dampers shall be 14 gauge galvanized press formed steel with welded corners frame, 16 gauge galvanized steel with press formed damper blades, and nylon bearings/bushings.
2. The damper actuator shall be Belimo mounted directly to the shaft of the outside air (OA) damper. If return air (RA) dampers are provided, a damper linkage rod may be provided to set the positions of the opposite dampers.
3. Filters: Provide 2", 30% pleated disposable filters, accessible at the side access filter section.

D. Insulation: all interior surfaces will be lined with 1 inch thick, 1-1/2 pound density Thermafiber fiberglass insulation. The insulation shall comply with UL standard 181 for erosion and NFPA 90A for fire resistance and will be held in place with weld pins / adhesive.

E. ECM motor.

F. Filters: Merv-10, Two-inch thick throwaway type filters.

G. Warranty: One year on all parts.

H. Controls: Furnish the units ready for field installation of the project direct digital controls. Coordinate requirements with the control contractor prior to submittals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the air handling unit in accordance with the manufacturer's instructions. Do not start the unit until filters have been installed. Install a new set of filters upon job completion.

B. Provide seismic bracing and supports as required by the governing jurisdiction for all units. Provide seismic restraint details and calculations as required by the governing code jurisdiction. Cost for all seismic detail development and calculations are to be included in the base bid price.

C. Isolate ductwork from unit connections utilizing flexible connectors

D. Provide start-up service for each unit and verify proper operation per manufacturers' specifications.

END OF SECTION

UNIT VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide U.L. approved unit ventilators as specified herein.

1.2 SUBMITTALS

A. Provide submittals in accordance with Section 15010.

B. Submittals shall include: Manufacturer's catalog or technical data showing performance, dimensions, materials of construction and recommended methods of installation.

1.3 OPERATION AND MAINTENANCE DATA

A. Provide O&M data in accordance with Section 15010.

B. O&M data shall include manufacturer's literature and maintenance instructions.

PART 2 - PRODUCTS

2.1 UNIT VENTILATORS (UV-1, UV-2, UV-3, UV-4, UV-5)

A. Manufacturers: Daikin / Herman-Nelson Model AK, Johnson, Trane, Carrier, Modine or approved equal.

B. Description
1. Casing: 21-1/4 inch deep, 16-gauge furniture quality steel with all external edges rounded, with factory finish paint. Removable front panels allowing service access to all internal components, integral discharge grilles constructed of heavy steel bars. Filter access panels/grilles.
2. Provide 1-inch end caps to fully enclose the unit in the manufacturer's standard cabinet finish.
3. Removable outside end panels for field installation of valves and piping. Provide Leveling legs.
4. Dual blade type low-leak mixing dampers with continuous divider between fresh air and return air components.
5. Single rigid fan board assembly including fans, fan housings, bearings, shafts and motors. Motors to be single speed split capacitor with integral thermal overload protection.
6. Heating / cooling coils to be plate-fin type with coils easily exchangeable without revision of the basic unit.
7. Condensate drain pan with integral overflow switch
8. Insulated front panel.
9. Sub-base as required.
10. Color by Project Manager.

C. Controls.
1. Provide the unit ventilators DDC ready or without factory controls ready for field installation of DDC controls.
2. Onboard factory controls not “DDC ready” for field installation of DDC controls are not acceptable.

UNIT VENTILATORS

2.2 FAN COILS (FC-1, FC-2)

A. Manufacturers: Daikin, Johnson, Trane, Carrier or approved equal.

B. Description
1. Casing: flat top, top supply discharge, powder coated steel with all external edges rounded, with factory finish. Removable front panels allowing service access to all internal components, integral discharge grilles constructed of heavy steel bars. Filter access panels/grilles.
2. Cabinet extension as required for water piping installation.
3. Removable front panels.
4. Leveling legs.
5. Low leak outside air damper controlled through the return air opening with a motorized damper / actuator.
6. Single rigid fan assembly including fans, fan housings, bearings, shafts and motors. ECM motor.
7. Heating / cooling coils to be plate-fin type with seamless copper tubes expanded into fins.
8. ABS main drain condensate drain pan with integral overflow switch
9. Insulated front panel.
10. Sub-base as required.
11. Color by Project Manager.

C. Controls.
1. Provide the fan coils DDC ready or without factory controls ready for field installation of DDC controls.
2. Onboard factory controls not “DDC ready” for field installation of DDC controls are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the unit ventilators and fan coils as noted on the drawings in accordance with the manufacturer's instructions.
1. Provide all miscellaneous accessories to mount the new units and connect to the existing louver assembly through the building wall.
2. Provide an insulated sleeve with gasketing from the unit ventilator to the outside air louver. Seal the outside air opening to preclude air entry into the void area behind the unit intake.

B. Extend condensate drain through wall at existing location.

C. Connect the heating / cooling water piping complete and ready for service.

D. Install wall thermostat control and provide actuators, relays and related control devices for a fully functional system.

END OF SECTION

Mechanical Compliance Statement

Compliance Statement: The proposed mechanical alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 90.1 (2016) Standard requirements in COM*check* Version 4.1.2.1 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Kelly M Johnson, Sustainability Manager		05.07.2020
Name - Title	Signature	Date

Inspection Checklist

Energy Code: 90.1 (2016) Standard

Requirements: 92.0% were addressed directly in the COMcheck software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
4.2.2, 6.4.4.2.1, 6.7.2 [PR2][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical systems and equipment and document where exceptions to the standard are claimed. Load calculations per acceptable engineering standards and handbooks.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
4.2.2, 8.4.1.1, 8.4.1.2, 8.7 [PR6][2]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the electrical systems and equipment and document where exceptions are claimed. Feeder connectors sized in accordance with approved plans and branch circuits sized for maximum drop of 3%.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.7.2.4 [PR5][1]	Detailed instructions for HVAC systems commissioning included on the plans or specifications for projects >=50,000 ft2.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
6.4.3.7 [FO9][3]	Freeze protection and snow/ice melting system sensors for future connection to controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Specification 23 82 19

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.4.1.4, 6.4.1.5 [ME1][2]	HVAC equipment efficiency verified. Non-NAECA HVAC equipment labeled as meeting 90.1.	Efficiency:_____	Efficiency:_____	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Mechanical Systems list for values.*
6.4.1.5.2 [ME2][3]	PTAC and PTHP with sleeves 16 in. by 42 in. labeled for replacement only.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
6.4.3.4.1 [ME3][3]	Stair and elevator shaft vents have motorized dampers that automatically close.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.4.3.4.2, 6.4.3.4.3 [ME4][3]	Outdoor air and exhaust systems have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Check gravity dampers where allowed.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Specification 23 82 23, 23 82 19
6.4.3.4.5 [ME39][3]	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.4.3.4.4 [ME5][3]	Ventilation fans >0.75 hp have automatic controls to shut off fan when not required.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** HVAC systems intended to operate continuously.
6.4.3.8 [ME6][1]	Demand control ventilation provided for spaces >500 ft2 and >25 people/1000 ft2 occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow >3,000 cfm.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Specification 23 09 00
6.5.3.2.1 [ME40][2]	DX cooling systems >= 75 kBtu/h (>= 65 kBtu/h effective 1/2016) and chilled-water and evaporative cooling fan motor hp >= ¼ designed to vary supply fan airflow as a function of load and comply with operational requirements.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Minimum speed requirements of Standard 62.1 will be applied. **Location on plans/spec:** Specification 23 82 19 *See the Mechanical Systems list for values.*
6.4.4.1.1 [ME7][3]	Insulation exposed to weather protected from damage. Insulation outside of the conditioned space and associated with cooling systems is vapor retardant.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Specification 23 07 00
6.4.4.1.2 [ME8][2]	HVAC ducts and plenums insulated per Table 6.8.2. Where ducts or plenums are installed in or under a slab, verification may need to occur during Foundation Inspection.	R-_____	R-_____	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.4.4.1.3 [ME9][2]	HVAC piping insulation thickness. Where piping is installed in or under a slab, verification may need to occur during Foundation Inspection.	_____ in.	_____ in.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Specification 23 20 00
6.4.4.1.4 [ME41][3]	Thermally ineffective panel surfaces of sensible heating panels have insulation >= R-3.5.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Specification 23 07 00
6.4.4.2.1 [ME10][2]	Ducts and plenums having pressure class ratings are Seal Class A construction.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.8.1-14, 6.8.1-15 [ME110][2]	Electrically operated DX-DOAS units meet requirements per Tables 6.8.1-14 or 6.8.1-15.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.4.4.2.2 [ME11][3]	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Specification 23 20 00
6.4.4.2.2 [ME11][3]	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Specification 23 05 93
6.4.4.2.2 [ME11][3]	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.4.4.2.2 [ME11][3]	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.4.2.2 [ME11][3]	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.1.5 [ME16][1]	Economizer operation will not increase heating energy use during normal operation.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Specification 23 05 93
6.5.2.3 [ME19][3]	Dehumidification controls provided to prevent reheating, recooling, mixing of hot and cold airstreams or concurrent heating and cooling of the same airstream.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Cooling capacity 40 kBtu/h.
6.5.2.4.1 [ME68][3]	Humidifiers with airstream mounted preheating jackets have preheat auto-shutoff value set to activate when humidification is not required.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.5.2.4.2 [ME69][3]	Humidification system dispersion tube hot surfaces in the airstreams of ducts or air-handling units insulated >= R-0.5.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.2.5 [ME70][3]	Preheat coils controlled to stop heat output whenever mechanical cooling, including economizer operation, is active.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Specification 23 09 00
6.5.2.6 [ME106][3]	Units that provide ventilation air to multiple zones and operate in conjunction with zone heating and cooling systems are prevented from using heating or heat recovery to warm supply air above 60°F when representative building loads or outdoor air temperature indicate that most zones demand cooling.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.3.3 [ME42][3]	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.5.3.3 [ME42][3]	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.5.3.3 [ME42][3]	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.5.3.3 [ME42][3]	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Location on plans/spec:** Specification 23 05 93 *See the Mechanical Systems list for values.*
6.5.3.3 [ME42][3]	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.5.4.2 [ME25][3]	HVAC pumping systems with >= 3 control values designed for variable fluid flow (see section details).			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Variable flow not required for primary pumps in a primary/secondary system. **Location on plans/spec:** Specification 23 20 00
6.5.6.1 [ME56][1]	Exhaust air energy recovery on systems meeting Tables 6.5.6.1-1, and 6.5.6.1-2.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.7.2.1 [ME32][2]	Kitchen hoods >5,000 cfm have make up air >=50% of exhaust air volume.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.5.7.2.4 [ME49][3]	Approved field test used to evaluate design air flow rates and demonstrate proper capture and containment of kitchen exhaust systems.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.8.1 [ME34][2]	Unenclosed spaces that are heated use only radiant heat.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.9 [ME35][1]	Hot gas bypass limited to: <=240 kBtu/h – 15% >240 kBtu/h – 10%			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Location on plans/spec:** N/A
6.4.3.9 [ME63][2]	Heating for vestibules and air curtains with integral heating include automatic controls that shut off the heating system when outdoor air temperatures > 45F. Vestibule heating and cooling systems controlled by a thermostat in the vestibule with heating setpoint <= 60F and cooling setpoint >= 80F.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.10 [ME73][3]	Doors separating conditioned space from the outdoors have controls that disable/reset heating and cooling system when open.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Location on plans/spec:** N/A

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
8.4.2 [EL10][2]	At least 50% of all 125 volt 15- and 20-Amp receptacles are controlled by an automatic control device.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
8.4.3 [EL11][2]	New buildings have electrical energy use measurement devices installed. Where tenant spaces exist, each tenant is monitored separately. In buildings with a digital control system the energy use is transmitted to to control system and displayed graphically.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
10.4.1 [EL9][2]	Electric motors meet requirements where applicable.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
6.4.3.1.2 [FI3][3]	Thermostatic controls have a 5 °F deadband.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Thermostats requiring manual changeover between heating and cooling. **Location on plans/spec:** Specification 23 09 00
6.4.3.2 [FI20][3]	Temperature controls have setpoint overlap restrictions.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Specification 23 09 00
6.4.3.3.1 [FI21][3]	HVAC systems equipped with at least one automatic shutdown control.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Systems designed for continuous operation. **Location on plans/spec:** Specification 23 09 00
6.4.3.3.2 [FI22][3]	Setback controls allow automatic restart and temporary operation as required for maintenance.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Systems designed for continuous operation. **Location on plans/spec:** Specification 23 09 00
6.4.3.5 [FI5][3]	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** See cut sheet
6.4.3.6 [FI6][3]	When humidification and dehumidification are provided to a zone, simultaneous operation is prohibited. Humidity control prohibits the use of fossil fuel or electricity to produce RH > 30% in the warmest zone humidified and RH < 60% in the coldest zone dehumidified.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Location on plans/spec:** N/A
6.7.2.1 [FI7][3]	Furnished HVAC as-built drawings submitted within 90 days of system acceptance.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.7.2.2 [FI8][3]	Furnished O&M manuals for HVAC systems within 90 days of system acceptance.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.7.2.3 [FI9][1]	An air and/or hydronic system balancing report is provided for HVAC systems serving zones >5,000 ft2 of conditioned area.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.7.2.4 [FI10][1]	HVAC control systems have been tested to ensure proper operation, calibration and adjustment of controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met. **Location on plans/spec:** Specification 23 05 93
10.4.3 [FI24][2]	Elevators are designed with the proper lighting, ventilation power, and standby mode.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Blower Coil

Job Information	*Technical Data Sheet*
Job Name	SDC - Barnes ES
Date	5/7/2020
Submitted By	Robert Grace
Software Version	03.40
Unit Tag	AHU - 960 CFM

Unit Overview

Model Number	Voltage V/Hz/Phase	Airflow CFM	External Static Pressure inH_2O	Design Cooling Capacity Btu/hr
BCHD0121	208/60/1	960	1.25	32086

Unit

Model Number:	BCHD0121
Unit Arrangement:	Horizontal
Altitude:	0 ft

Physical

Dimensions and Weight

Length	Height	Width	Weight
46.0 in	18.0 in	37.0 in	394 lb

Construction

Insulation and Liners:	1" Injected Foam, R-6, Galvanized Steel Liner

Electrical

Field Connection	MCA	MROPD	SCCR
Disconnect and Fusing	9.6	15	5 kA

Mixing Box

Mixing Box Options

Outside Air Opening Location	Return Air Opening Location	Actuator Type
Top	Rear	0-10 VDC Modulating

Filter

Filter Access	Filter Depth	MERV Rating	(Quantity) Height x Width x Depth
Side	4 in	MERV 8	(2) 17.69 x 13.75

Primary DX Coil

Physical

Fins per Inch	Rows	Casing Material	Face Area ft²	Face Velocity ft/min
16	3	Galvanized Steel	2.4	395.0

Connection

Suction Size/Distributor Size	Type	Location
0.75/0.50 in	M-SWT	Right Hand

Drain Pan

Material		Connection
Primary Drain Pan	Secondary Drain Pan	
Stainless Steel	Stainless Steel	0.75 in

Performance

Capacity		Air Temperature			
		Entering		Leaving	
Total Btu/hr	Sensible Btu/hr	Dry Bulb °F	Wet Bulb °F	Dry Bulb °F	Wet Bulb °F
32086	27994	80.0	64.0	53.3	52.6

Secondary Hydronic Coil

Physical

Fins per Inch	Rows	Casing Material	Face Area ft²	Face Velocity ft/min
12	1	Galvanized Steel	2.4	395.0

Connection

Size	Type	Location
0.50	M-SWT	Right Hand

Performance

Total Btu/hr	Air Temperature	
	Dry Bulb °F	Dry Bulb °F
50756	50.0	98.3

Fluid

Type	Entering Temperature °F	Leaving Temperature °F	Flow Rate gpm	Pressure Drop ft H_2O
Water	190.0	155.4	3.0	2.60

Fan Section

Performance

Airflow	Total Static Pressure	Fan Speed	Controller Input Signal	Brake Horsepower	Altitude
960 CFM	1.83 inH_2O	1469 rpm	6.6 VDC	0.52 HP	0 ft

Motor

Type	Horsepower	Motor Control	FLA
Direct Current Brushless	1 Hp	0-10V Modulating	7.7 A

Unit Discharge Conditions

AirTemperature

Motor Heat Btu/hr	Unit Leaving Dry Bulb °F	Unit Leaving Wet Bulb °F	Unit Leaving Dewpoint °F
1505	54.8	53.1	51.8

Water Pressure Drop Calculation

	Primary Coil	Secondary Coil
Coil Pressure Drop:	0.00 ft H_2O	2.60 ft H_2O
Control Valve Pressure Drop:	0.00 ft H_2O	0.00 ft H_2O
Circuit Setter Pressure Drop:	0.11 ft H_2O	0.00 ft H_2O
Strainer Pressure Drop:	0.26 ft H_2O	0.00 ft H_2O
Total Pressure Drop:	0.00 ft H_2O	2.60 ft H_2O

Internal Pressure Drop Calculation

External Static Pressure:	1.25 inH_2O
Filter:	0.16 inH_2O
Chilled Water Coil:	0.34 inH_2O
Hot Water Heat:	0.08 inH_2O
Total Static Pressure:	1.83 inH_2O

Sound Power

	Sound Power (db)							
Frequency	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Inlet	76	77	67	62	63	54	50	40
Discharge	88	86	77	73	74	69	69	65
Radiated	65	64	53	47	50	46	31	24

Options

Controls	
Overflow Switch:	Factory mounted Overflow Switch
Freezestat:	Factory mounted Freezestat

Warranty

Parts:	Standard warranty

AHRI Certification

All equipment is rated and certified in accordance with AHRI 430.

Notes

Unitary Ventilators™

Job Information	*Technical Data Sheet*
Job Name	SDC - Barnes ES
Date	5/7/2020
Submitted By	Robert Grace
Software Version	07.10
Unit Tag	UV-1000 CFM

Unit Overview

Model Number	Model Type	Cooling Coil Type	Heating Coil Type
UAVS9H13	Face & Bypass	Chilled Water	Hot Water
Arrangement	**Control Type**	**Cooling Coil Hand**	**Heating Coil Hand**
Vertical, Floor Mounted, Type AN Adapter Back	Field Mounted Controls (By Others)	Left Hand Cooling	Right Hand Heating

Physical

Unit Length	Unit Depth	Unit Height	Weight
86.00 in	21.88 in	30.13 in	525 lb

Electrical

Voltage	Minimum Voltage	Maximum Voltage	Total Unit MCA	Maximum Fuse Size
208/60/1 V/Hz/Phase	197 V	228 V	3.8 A	15 A

Fan

Performance

Fan Motor	Speed	Air Volume CFM	External Static Pressure inH_2O	Motor Power HP	Fan Full Load Current A
ECM, 3-Speed	Medium	944	0.00	0.333	3.00

Chilled Water Coil

Performance

Capacity		Air Temperature			
		Entering		Leaving	
Total Btu/hr	Sensible Btu/hr	Dry Bulb °F	Wet Bulb °F	Dry Bulb °F	Wet Bulb °F
33442	25728	80.0	64.0	54.9	52.0

Number of Rows	Fluid				
	Temperature		Type	Flow Rate gpm	Pressure Drop ft H_2O
	Entering °F	Leaving °F			
3	45.0	51.7	Water	10.00	7.94

Fluid Connections

Supply	Return	Condensate
7/8 inch	7/8 inch	7/8 inch

Hot Water Coil

Performance

Total Capacity Btu/hr	Air Temperature Dry Bulb		Fluid Temperature	
	Entering °F	Leaving °F	Entering °F	Leaving °F
41157	70.0	110.2	190.0	148.8

Fluid

Type	Flow Rate gpm	Pressure Drop ft H_2O
Water	2.00	0.64

Physical

Number of Rows	Fluid Connections
1	7/8 inch

Warranty

Type

Extended:	None

Notes

DAIKIN

Catalog 722-6

ThinLine Vertical Fan Coils

Type FCVC, FCVH, FCVS Vertical Design

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ThinLine Vertical Fan Coils

Flat Top Vertical Fan Coil

Slope Top Vertical Fan Coil

Figure 1: Nomenclature

FC V S – 1 02 A

Unit Type
FC = Fan Coil
FH = Cabinet Unit Heater

Unit Configuration
V= Vertical
W = Wall Hung

Cabinet Type
C = Cabinet (Flat Top)
S = Slope Top
H = Hideaway

Voltage
A = 115/60/1
E = 208-230/60/1
J = 265-277/60/1

Unit Size
02 = 200 CFM
03 = 300 CFM
04 = 400 CFM
06 = 600 CFM
08 = 800 CFM
10 = 1000 CFM
12 = 1200 CFM

Design Series

AHRI Certification

AHRI CERTIFIED™ www.ahridirectory.org Room Fan-Coils AHRI Standard 440

Standard size units certified in accordance with the Room Fan-Coil Unit certification program, which is based on AHRI Standard 440.

Agency Listed

C ETL LISTED US Intertek

All standard units

All Canadian units

The ThinLine Advantage

New ThinLine vertical fan coils combine the features most desired in a fan coil by building owners, specifying engineers and contractors alike. The result is a new, third generation fan coil design that meets the needs of all three.

For building owners

ThinLine fan coils offer quiet operation. They fully comply with ASHRAE 62.1-2004 standards for high indoor air quality. And they offer a range of control options that can enhance occupant comfort and reduce operating costs. These units are also easy to maintain, with easy access to filters, fan motors and control systems. Heavier-gauge panels and locked control compartments for tamper-proof style cabinets are available. A total of five color options, both as standard and special requests are available for a variety of decor styles.

For specifying engineers

ThinLine fan coils provide great versatility. A variety of vertical models are available with multiple arrangements and configurations.

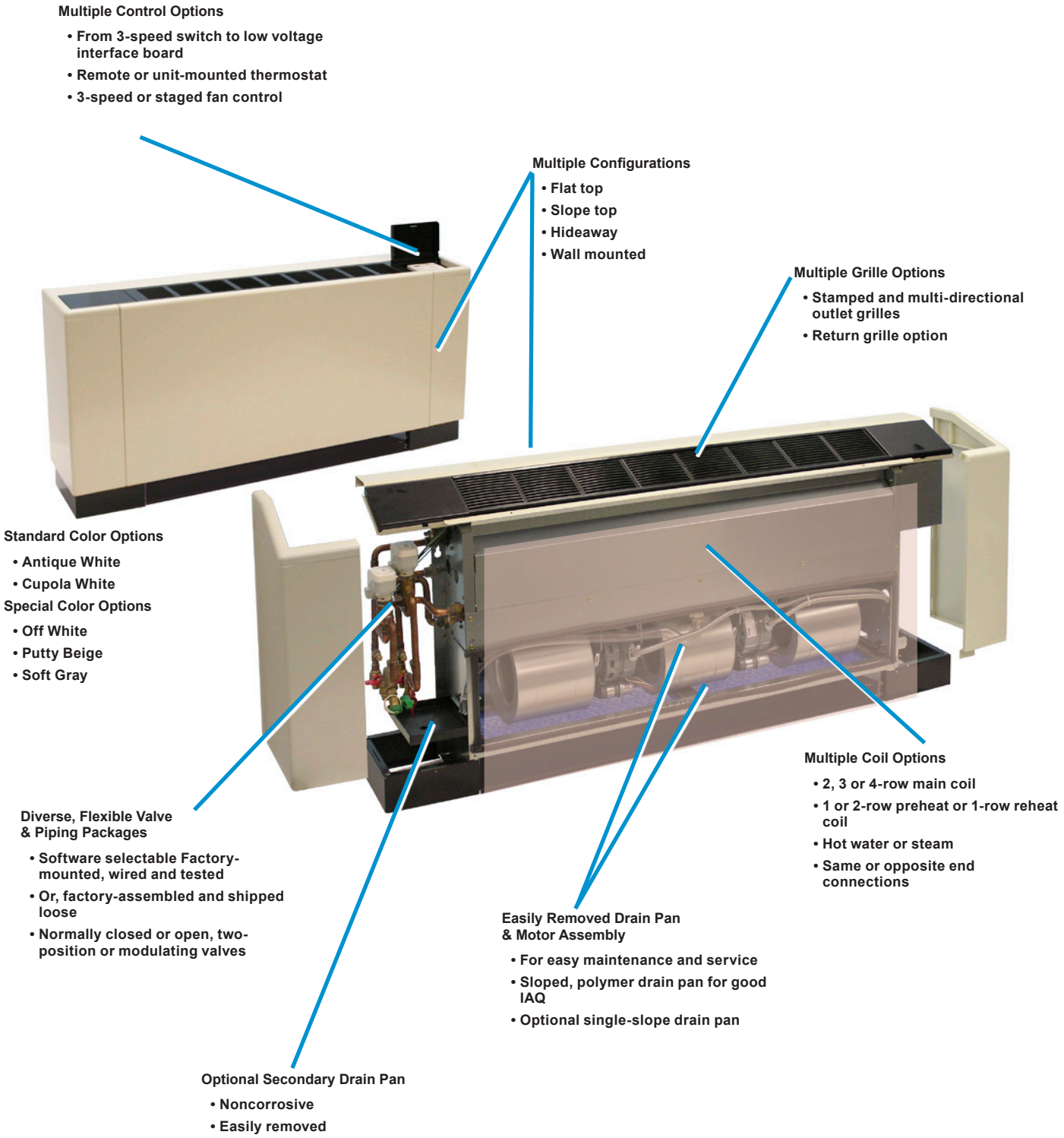
- Coil options include two, three, and four-row main coils to provide precise heating and cooling performance for any requirement. Separate, single-row reheat coils (hot water or steam) are available. Separate, one-row or two-row preheat coils are also available with same or opposite-end coil connections.
- Multiple control options range from a simple fan speed switch to a low voltage interface board that can tie into most building automation systems. Non-communicating or communicating control options for LonTalk® and BACnet® will be available soon. Contact your Daikin representative for details.
- Grille options include stamped inlet and outlet grilles and multidirectional grilles. Aluminum fresh air boxes are also available.
- Appearance options include cabinet units with a durable, powder paint finish and decorative wall plate panels for hideaway units in Cupola White or Antique Ivory. Other colors such as Off White, Putty Beige and Soft Gray are available as specials. Custom colors can be matched as a special item. Leveling feet are available, as are rear cabinet extensions in 4 and 8-inch depths. Tamper- proof units are a selectable option, with 16-gauge steel panels, a return grille and key-operated, locking access doors.

For contractors

For contractors, ThinLine fan coils feature Quick Ship options for fast delivery and a number of features that make installation fast and simple.

- Factory-mounted, wired and tested valve and piping packages for quick hookup to the building piping to reduce installation time. Packages can also be shipped loose with the unit for quick and easy field installation. Valve and piping packages are designed for entering-water-temperature sampling. This eliminates the need for inefficient bleed lines to sense automatic changeover on two-pipe units.
- Factory-mounted and tested controls minimize field setup. Depending on the option requested, controls can be wired with a 24 VAC transformer to provide a single-source power connection to the unit. Several options are available for unit or wall mounted thermostats and sensors. All wall-mounted thermostat and zone sensors require only low-voltage control wiring from the device to the unit control box.
- Easy, end-panel removal for hookup of electrical and piping connections minimizes field-labor time and cost.
- End compartment panels can be removed for installation and service without removing the front panel covering the fan blower section. This means that airflow through the filter and coil is not jeopardized for taking temperature and performance readings.
- Both the main drain pan and optional secondary drain pan are easily accessed for cleaning.
- The fan deck and motor assembly is easily removed when required for service.

Figure 2: Unit Features



Control Options

Manual 4-Position Fan Switch

Several styles of the four-position fan switch (OFF, High, Med, Low) are available for unit-mount, remote- or wall-mount. The remote-mount option operates on low-voltage or line-voltage power and can be provided with a factory-mounted, low-voltage interface board, which contains (3) 24-volt relays with line-voltage contactors and terminal connections. The transformer is factory-installed and wired. The unit-mounted option operates on line voltage.

Sequence of operation

- *OFF:* Fan is turned OFF. The two-position, motorized fresh-air damper, when supplied, is closed.
- *High, Medium, Low:* Fan runs continuously at the selected speed. The two-position, motorized fresh-air damper, when supplied, is opened.

Analog Electronic Thermostat with 3-Position Fan Switch, Unit-Mounted

This unit-mounted option combines the three-position fan switch with an analog thermostat (MT155). For two-pipe systems with a factory installed valve package, it will be provided with an automatic (MTB-155) to change from heating, or cooling. Or changeover can be made with a manual switch (MTA-155).

Sequence of operation

Fan Switch

- *OFF:* Fan is turned OFF. The two-position, motorized fresh-air damper, when supplied, is closed.
- *High, Medium, Low:* Fan runs continuously at the selected speed. The two-position, motorized fresh-air damper, when supplied, is opened.

Thermostat

- Cycles the valve(s) open or closed on demand based on occupant-desired level.

Changeover Switch:

- *Manual switch:* The user selects whether heating or cooling is desired. With automatic changeover, a pipe sensor works with the thermostat to operate the heating or cooling valve.
- *Heating:* Opens the valve when the temperature is below the setpoint.
- *Cool:* Opens the valve when the temperature is above the setpoint.

MT155 Thermostat, Wall-Mounted

The MT155 series thermostat provides ON-OFF control for low-voltage or line-voltage valves and fan motors. It is remote- mounted. Options include manual or automatic changeover and three-speed fan control for continuous or cycling fan operation. This thermostat can be field-mounted on any unit equipped with a low voltage interface board, refer to Daikin publication IM 1089.

Two standard control options are available:

- *Continuous fan and ON-OFF valve cycle operation:* The thermostat cycles the valves ON and OFF. The fan runs continuously at the manually selected fan speed.
- *ON-OFF fan and ON-OFF valve cycle operation:* The thermostat cycles the fan from the manually-selected fan speed to OFF and it cycles the valves ON and OFF.

When the system switch is in the OFF position, the fan coil system, including the fan, is shut OFF.

Digital Thermostats, Unit- and Wall-Mounted

Daikin offers a broad range of unit-mounted and remote, wall-mounted digital thermostats with the capability to control ON-OFF, 3-wire floating and proportional modulating actuator, and Normally-Closed or Normally-Open valves. See Table 1. For more information, refer to the Daikin publication ED 18513-1 and Installation Manuals for the specific thermostat (also see IM 980-1).

MT158 and MT168 Thermostat-Controllers with Digital Display

Series MT158 and MT168 microprocessor-based thermostat controllers combine a proportional integral (PI) control algorithm with adaptive logic. They can be unit-mounted or remote-wall mounted.

Heating and cooling outputs for the MT158 are individually configurable for three-wire floating control valves or ON/OFF valves in the Normally-Open (NO) or Normally-Closed (NC) modes.

Heating and cooling outputs for the MT168 provide 0-10 Vdc or 4-20 mA. An integrated, three-speed fan control switch is line-voltage capable to allow direct connection to the fan motors. A manual or automatic changeover is provided with remote setback capability from a time clock or facility management system. Features include a Fahrenheit or Celsius digital display and built-in purge cycling which assists the controller to determine if the system is supplying hot water or cooling.

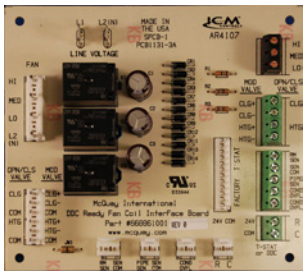
Two standard control options are available:

- *Continuous fan and modulating (or ON-OFF) valve operation.* The fan runs continuously at the manually selected fan speed (High, Medium or Low). The controller modulates the valves or, on the MT158, dip-switches can be set to cycle the valves ON and OFF. Mainly used for unit-mount thermostats.
- *ON-OFF fan cycle operation and modulating (or ON-OFF) valve operation.* The controller cycles the fan from the manually selected fan speed to OFF. The controller modulates the valves or, on the MT158, dip-switches can be set to cycle the valves ON and OFF. Used for remote-mount thermostats or with a remote room temperature sensor.

T180 Programmable Thermostat

Daikin offers two different 7-Day Programmable Digital Heating/ Cooling Thermostat with constant fan or Fan cycled, ON/OFF Valve Control depending on the fan speed control. The thermostat interface contains buttons for use in navigation to accompanying menus/screens and for performing specific operations. Detailed installation instructions and modes of operation can be found in IM 1152.

Low Voltage Interface Board



The Low-Voltage, Interface Board (LV board) is used with any remote (wall-mounted) Daikin thermostat. It can also be used with a BAS (Building Automation System) control where low voltage is needed to operate a fan coil.

The LV interface board includes:

- Three 24-volt relays with line voltage contactors to operate fan motor speeds
- A factory wired and installed transformer
- Terminal connections for interfacing to:
- An optional wall-mounted thermostat
- Low-voltage actuators for heating and cooling valves
- A return air sensor
- A pipe temperature sensor for changeover from heating to cooling on two-pipe systems
- An optional condensate overflow switch

Customer-Supplied Controls

Your Daikin representative can work with engineers and/or contractors to factory install and wire other manufacturers' DDC controllers in one of the end pockets of the fan coil. Contact your local Daikin representative for assistance with your specific project.

Table 1: Thermostat Summary Table

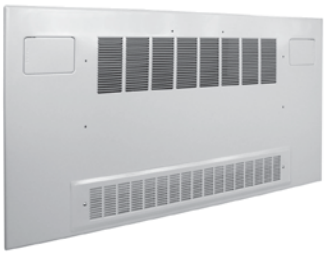
Thermostat Type	Model	Mounting	Software Tabs
On/Off Switch with 3-speed Fan Switch with Hi/Med/Lo Settings and Switched Auxiliary Connection	MTE-155	Unit or Remote*	Control Type or Accessories
2-Pole Dead-Band Auto-Changeover Thermostat with Manual ON-OFF System Switch and Manual 3-Speed Fan Switch, ON/OFF Valve Control	MTB-155	Unit or Remote*	Analog Control Type or Accessories
Thermostat with Manual Heat-OFF-Cool System Switch and Manual 3-speed Fan Switch, ON/OFF Valve Control	MTA-155	Unit or Remote*	Analog Control Type or Accessories
Digital Thermostat 24 vac/120-277 vac with 3-speed Fan Control (Continuous or Fan Cycle)	MTA-170	Remote	Accessories
Digital Thermostat with 7-Day Programmable, 24 vac/120-277 vac with 3-speed Fan Control (Continuous or Fan Cycle)	MTA-180	Remote	Accessories
Digital Thermostat 24 vac/120-277 vac with Staged Fan (Continuous or Fan Cycle)	MTB-170	Remote	Accessories
Digital Thermostat with 7-Day Programmable, 24 vac/120-277 vac with 3-speed Fan Control (Continuous or Fan Cycle)	MTB-180	Remote	Accessories
Digital Thermostat with Dead Band Auto-Changeover for Heating/Cooling. ON/OFF or 3-wire Floating Valve Control and 3-speed Fan Switch	MTB-158	Unit or Remote	Digital Control Type or Accessories
Digital Thermostat with Dead Band Auto-Changeover for Heating/Cooling, ON/OFF, and Manual 3-speed Fan Switch	MTA-158	Unit or Remote	Digital Control Type or Accessories
Digital Thermostat with Auto-Changeover, Dead-Band, 0-10 vDC Proportional Modulating Valve Control.	MTB-168	Unit or Remote	Digital Control Type or Accessories
Digital Thermostat with Auto-Changeover, Dead-Band, 0-10 vDC Proportional Modulating Valve Control, and Manual 3-speed Fan Switch	MTA-168	Unit or Remote	Digital Control Type or Accessories

*Can be field-mounted on units with Low Voltage Interface Boards, refer to IM 1089

NOTE: (†)To select a thermostat with a manual switch (MTA-155), simply click on the "Manual" option in the Changeover selection box in Daikin Tools software. If no factory valves are provided, the default choice for this thermostat type will be an Autoswitch (MTB-155).

Unit Accessories

Decorative Wall Plate Option



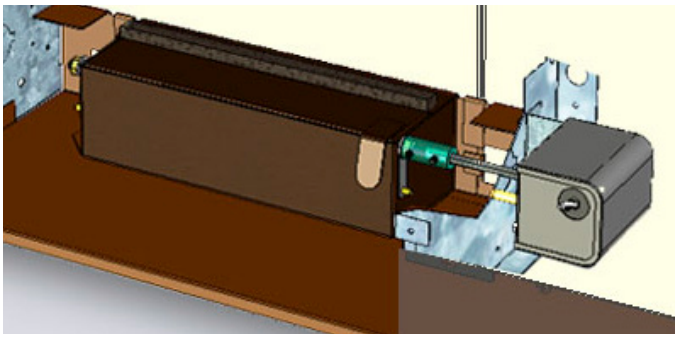
Decorative wall plates have rounded corners for an attractive appearance. Wall plate can be selected as an accessory in a variety of colors with front or top discharge. Custom colors may be available, Contact your Daikin Applications Group with inquiries. For Dimensions, see Figure 15 on page 26.

Cabinet Color Options

Exposed units are shipped in the standard color of Antique Ivory. Special colors include: Cupola White, Off White, Putty Beige and Soft Gray. For details of paint colors and finishes, refer to Daikin publication Form 2F-1188. Metal samples are available upon request.

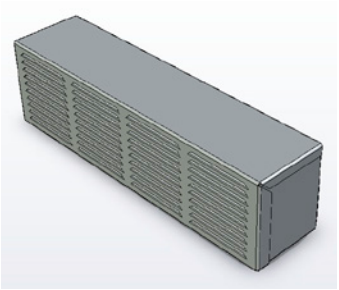
Fresh Air Damper Options (Manual and Motorized)

A fresh air intake damper that will provide up to 25% fresh air can be ordered either as factory-installed or as a field-installed kit. The kit consists of an intake with damper blade and insect screen. The damper may be manually controlled through the return air opening or with an optional factory- or field-installed 24 V damper motor. If freezing air temperatures are expected, the damper must be closed or outside air must be tempered before entering the unit. A low-temperature sensor is recommended.



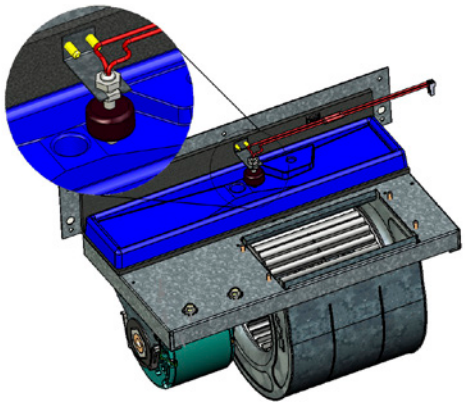
Fresh Air Intake Box Option

Fabricated of aluminum with weep holes, the Fresh Air Intake Box has a double set of louvers in series to prevent moisture draw-through. This is used with a fresh air damper and is mounted in an exterior wall. For Dimensions, see Figure 16 on page 26.



Condensate Overflow Switch Option

With proper mounting, the condensate overflow switch will detect water collecting in the primary drain pan before an overflow can occur. This is a N.C. low voltage switch that opens when water levels rise and closes when water is no longer present. The switch should be field-wired to a controller to facilitate the fan and/or control valve shut-down when condensate starts collecting in the drain pan.



Tamperproof Cabinet Option

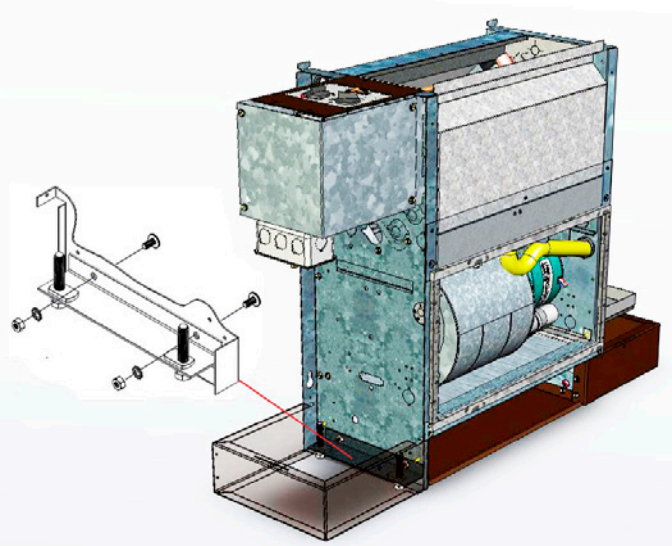
This option can be factory- or field-installed on cabinet units to prevent access to unit controls and unauthorized removal of cabinet panels. It includes a key lock access door to unit controls and torx head screws for cabinet panels. Stamped grille for return air is standard with tamper-proof models.

Return Air Grille

A stamped-steel return air grilles are available as factory- or field-installed options. This option is standard with tamper-proof models.

Leveling Legs Option

Field- or factory-installed kits are available with 0" to 1" adjustment for positive leveling of floor-mounted units.

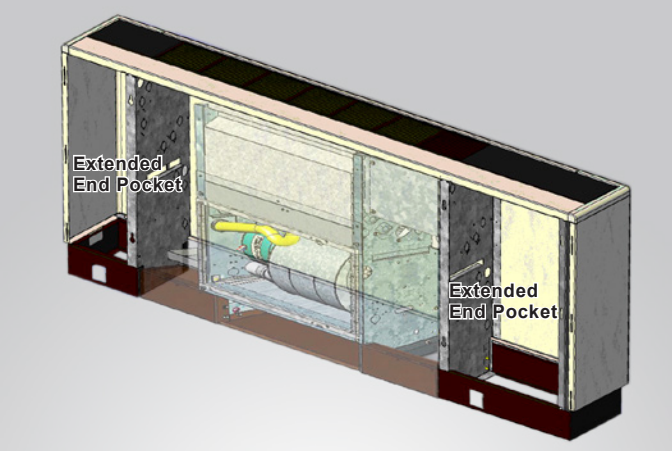


Extended End Pockets and Raised Sub-bases

Standard end pockets on Daikin units can accommodate most installation requirements. Therefore, extended pockets are seldom needed. However, units with 4" or 8" extensions on one or both sides of the unit are available. As a rule, a total extension of 8" is only possible. The extended end pockets are used for applications with field-installed valve piping packages or controls by others when extra space is needed. They can also be used for remodeling or replacement projects to hide floor covering terminations.

NOTE: When extended end pockets are used, a standard rear cabinet extension may not be usable. Call your Daikin Sales Representative for suggestions.

Raised sub-base options are also available. Contact your Daikin Sales representative for details.



Rear Cabinet Extension Option

This kit is available for applications where additional depth is needed. This kit is not designed to be an air duct or outside air plenum. 4" or 8" extension kits are standard. Other extension depths are available as a special request. Contact your Daikin representative for details.

Some common applications for the rear cabinet extension include:

- Additional depth for unit appearance
- Additional clearance for cross-over piping and connections
- Extend the discharge grille past drapery or wall hangings
- Hide floor covering terminations in remodeling projects
- Piping entry through the side panels of the unit

NOTE: When extended end pockets are used, a standard rear cabinet extension may not be usable. Call Daikin Applications Group for suggestions.

Factory Valve & Piping Packages

Factory valve and piping packages are available for both two-pipe and four-pipe systems with either right or left hand connections. Four-pipe systems can be configured with the heating and cooling connections on the same or opposite sides of the unit. Packages can be either factory-installed or factory-assembled and shipped loose with the unit. Units are also available without valve and piping packages in either a right-hand or left-hand configurations. All packages are fully leak tested.

Factory-installed packages are sweated to the coil and wired to the unit control box or LV Interface Board. Chilled and hot water pipes are the only field connections required. Piping is 1/2" nominal copper (5/8" OD).

Figure 3: Four-Pipe Deluxe Valve and Piping Package

Pre-determined field connection points are located for easy access. See Figure 10 on page 13 for connection locations. The installing contractor can pre-pipe the building water connections before the units arrive on the jobsite. A label clearly identifies chilled and hot water connection points on every unit.

All chilled water piping and components are located to allow condensate to drain into the secondary drain pan supplied with the valve package. Insulation of the factory piping package is not required.

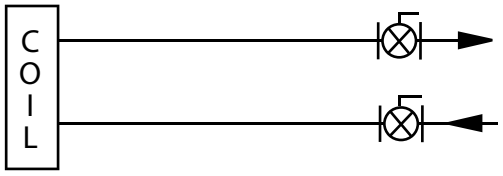
Available Packages

Numerous piping packages are available to match design configurations. Additional components can be added to meet exact requirements, including P/T ports, unions, and flexible stainless steel hoses.

Shut-Off Only Packages

Shut-Off Only piping packages provide interconnecting copper piping and shut-off ball valves for ease in connecting supply and return lines to the unit. Four-pipe packages include a venting valve for the preheat or reheat coil. Primary coils on all units have an integral venting valve.

Figure 4: Shut-Off Only Package

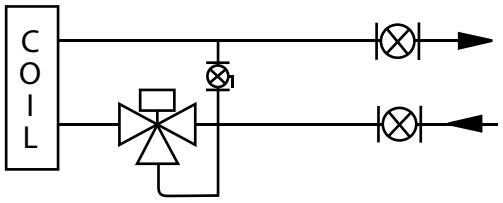


(See Figure 9 for components key)

Basic Packages

Basic valve and piping packages add control valves to the Shut-Off Only package. All Daikin control valves are factory-mounted in the supply water pipe. See Control Valve Options on page 12 for more information on the variety of control valves available.

Figure 5: Basic Package

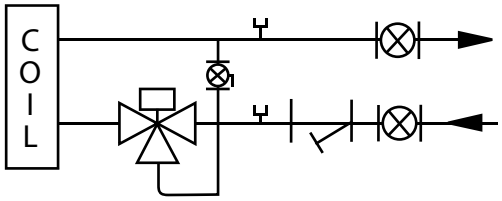


(See Figure 9 for components key)

Enhanced Packages

Enhanced valve and piping packages add a strainer to the Basic package supply water pipe. The strainer is attached to the supply water pipe at the coil connections. The strainer body is cast brass construction with a stainless steel mesh that is easy to remove for cleaning.

Figure 6: Enhanced Package



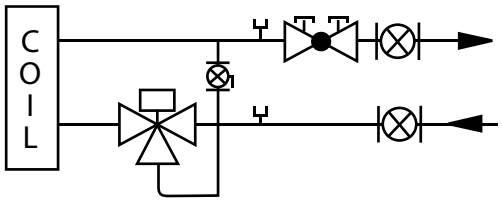
(See Figure 9 for components key)

Premium Packages

Premium valve and piping packages replace the Basic package a ball valve in the return line with a manual or automatic circuit setter. The manual circuit setter is also known as a manual flow control valve. The auto circuit setter acts as both a flow setting device and a shut-off valve. It allows water flow through the fan coil to be set quickly and accurately. The circuit setter includes a cartridge within the valve body that is sized to allow a specific flow rate through the coil without any action required by a system piping balancer.

P/T ports are included, which are used to measure the temperature or pressure drop across the valve. This pressure drop can be compared to factory supplied tables that relate the pressure drop to a specific flow rate. The manual circuit setter valve also has a memory stop so that the correct setting can be found quickly.

Figure 7: Premium Package

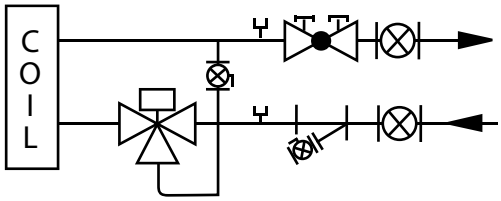


(See Figure 9 for components key)

Deluxe Packages

Deluxe valve and piping packages add a strainer to the Premium package. The strainer is available with or without an optional draining (blow-off) valve.

Figure 8: Deluxe Package



(See Figure 9 for components key)

Figure 9: Components Key for Schematics

		**Manual Shutoff Ball Valve:** Water shut-off. Handle rotates 90 degrees.
		**Manual Shutoff Ball Valve with Memory Stop:** Used on return line for limiting water flow.
		**2-Way, N.C., On/Off Valve, Spring Return:** Turn On or Off water flow to the coil in response to 24V or line voltage signal
		**3-Way, N.C., On/Off Valve, Spring Return:** Bypass water flow away from coil in response to 24V or line voltage signal. Includes fixed orifice for balancing.
		**2-Way Modulating Valve (3-wire or proportional):** Modulates water flow in response to 24V signal.
		**3-Way Modulating Valve (3-wire or proportional):** Modulates or bypass water flow in response to 24V signal. Includes fixed orifice for balancing.
		**PT Port:** For connecting a pressure or temperature gauge.
		**Y-Strainer:** Removable screen filters out small particles from supply line during normal system operation.
		**Manually Adjustable Circuit Setter with Shutoff:** Pressure-dependent, ball-type, manual flow control.
		**Cartridge-Type, Auto-Fixed Circuit Setter:** Pressure-compensated, automatic fixed-flow control.
		**Union:** For easy removal of piping from coil.
		**Bypass Balancing Valve:** Adjustable balancing of water flow through the bypass circuit on a 3-way control valve.

Note: Daikin 3-way valves are equipped with a fixed balance orifice in the bypass line, eliminating the need for a separate balancing valve

Control Valve Options

Except for Shut-off Only packages, all valve and piping packages include control valves for controlling water flow. All Daikin control valves are factory assembled and mounted in the supply water pipe downstream of the coil. Several options are available:

Two-Way/Two-Position Valves

These valves will be either Fully-Open or Fully-Closed in response to a line voltage (115, 208-230 or 265-277 VAC) or 24 VAC signal from the Daikin thermostat or controller. Some means of relieving pump head pressure should be applied when two-way valves are selected. Normally-Open or Normally-Closed valves are available, both spring-return type.

Three-Way Two-Position Valves

These valves either allow full water flow through the coil or divert the flow through a bypass line. The valves respond to a line voltage (115, 203-230 or 265-277 VAC) or to 24 VAC signal from the Daikin thermostat or controller. All standard three-way valves come with a fixed-balance orifice in a bypass line to compensate for flow balancing in the bypass position, eliminating the need for an additional balancing valve. Normally-Open or Normally-Closed valves are available.

Motor option

Horizontal ThinLine fan coil units are equipped with standard three-tap Permanently-Split Capacitor (PCS) motors for 115/1/60, 208-230/1/60 and 277/1/60 volt applications. Optional brush-less DC Electronically Commutated Motors (ECMs) are available for the above voltage ranges. These motors are also used for high-static applications. All motors are connected to a unit-mounted electric panel with Quick-Connect fitting for ease of maintenance

Two-Way Modulating Valves

These valves modulate the water flow through the coil in response to a signal from the Daikin thermostat or controller. Standard Daikin modulating valves are three-wire floating point equal percentage valves. Zero to 10 VDC proportional valves are also available. The modulating valves are factory mounted in the supply water pipe upstream of the coil.

Three-Way Modulating Valves

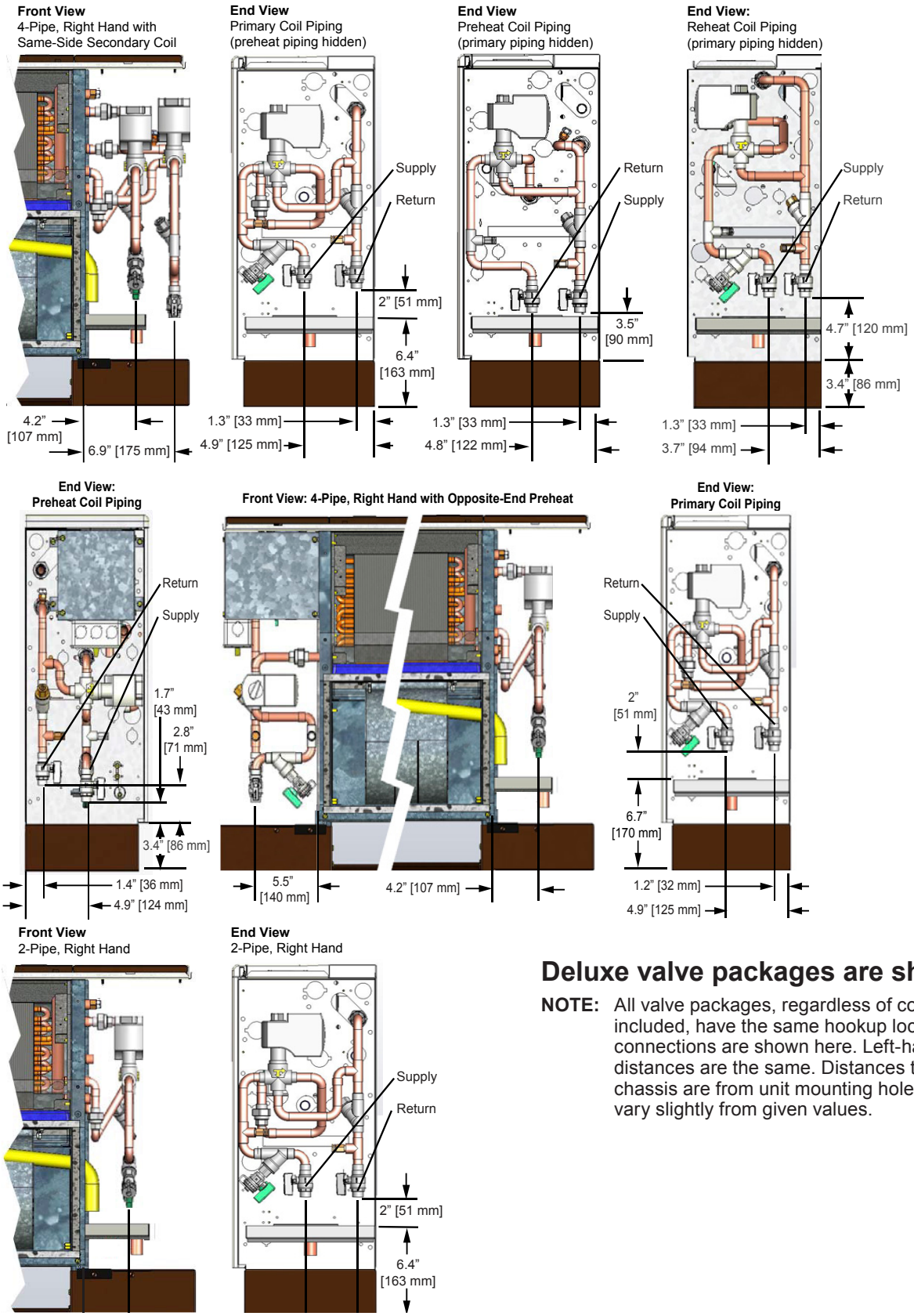
These valves modulate water flow through a coil in response to a signal from a Daikin thermostat or controller. Three-way valves allow water that is directed through the coil to mix with water that is directed through the bypass line. This mixture exits through the leaving water pipe. Modulating valves are three-wire, floating-point equal percentage valves or 0-10 VDC proportional. The modulating valves are factory mounted in the supply water pipe upstream of the coil.

Selecting Correct Size Modulating Valves

Daikin Tools™ software automatically selects the best modulating valve size for the unit and coil being considered. By combining the AHRI performance data, the coil flow rate and the DP across the water coil, the water coil Cv is calculated and the best matching modulating port size is selected. Valve and piping packages can easily be configured and automatically selected using Daikin Tools™.

Figure 10: Hook Up Locations: Factory-Installed Valve and Piping Packages

4-pipe arrangement wit Same end Connections



Deluxe valve packages are shown.

NOTE: All valve packages, regardless of components included, have the same hookup locations. RIght-hand connections are shown here. Left-hand connection distances are the same. Distances to connections from chassis are from unit mounting holes. Dimensions may vary slightly from given values.

To achieve an efficient fan coil system, accurate system design and proper equipment selection is necessary. Variations, limitations/control of fan coil systems, design conditions and design load calculations are not described in detail in this catalog. More detailed information may be found in the ASHRAE Guide. This catalog contains AHRI-certified ratings and application ratings for ThinLine fan coil units from which a design engineer can make initial unit selections to meet system requirements.

A mechanical system designer must select the unit types best suited to the overall system before the actual unit sizes can be determined. The factors that generally influence this decision are: intended building usage, building layout, architectural and aesthetic values, economics, geographical location, and type of maintenance service available. The general results may be a mixture of unit types within a given system. Daikin manufactures fan coil units to meet many needs including ThinLine, HiLine™ and Large Capacity models. For Daikin product information, please go to www.DaikinApplied.com.

Basic design data

Prior to selecting individual unit sizes, a design engineer must fix or determine the following factors:

- Inside and outside wet and dry bulb design temperatures
- Total and sensible heat gains and losses of the area to be served
- Ventilation air
- Properties of the heating and cooling medium
- Available electric power service
- Any special design requirements of the building or system

Unit Size

The capacity ratings presented in this catalog are provided for initial unit selection only. Water cooling and heating capacities, unit air flow, static pressure and glycol solutions are all incorporated into the program to provide the best possible selection. Consult your Daikin representative for a selection tailored to specific applications.

Unit sizes for the ideal system should be selected by calculating peak load requirements due to unusually high occupancy or severe climatic conditions and with fans operating at high speed. Ordinary day-to-day cooling and heating requirements are then achieved at low and medium speeds.

The initial unit selection should be checked for air volume in the design system and the cooling capacities checked against actual operating conditions. While units selected on the basis of sensible load will generally meet the total cooling load, total load should be checked in all cases.

The unit size is generally selected on the basis of matching the sensible cooling capacity of the unit with the calculated requirements when operating at high speed.

Coil Types

Standard coils are designed to meet both cooling and heating requirements in a typical system. Two additional levels of enhanced primary coils are available to meet the total and sensible requirements of any application.

Heating requirements for two-pipe systems are generally met by employing the same water flow rate as cooling and adjusting the entering hot water temperature to obtain a matching unit heat output at low fan speed.

Four-pipe systems are generally designed by specifying the flow rate through the separate heating coil to meet the required heat load with the fan operating at the desired fan speed. Daikin offers two coil options for preheat and one option for reheat.

Two-Pipe Systems - Hot Water Heat

All performance measured on high speed tap, 115 V, zero ESP, with a throwaway filter. Cooling performance is based on 80/67°F (27/19°C) entering air temperature, 45°F (7°C) entering chilled water temperature with a 10°F (5.5°C) ΔT.

Heating performance is based on 70°F (21°C) entering air temperature, 180°F (82°C) entering hot water temperature with a 30°F (17°C) DT.

Table 2: Cooling and Heating Performance – Two-Pipe Systems

Unit Size	Main Coil Rows	SCFM	Cooling Performance*				Heating Performance*			
			Total MBh (kW)	Sensible MBh (kW)	G(L/s)	WPD Ft H_2O (kPa)	MBh	Q/ITD	G(L/s)	WPD Ft H_2O (kPa)
02	2 Row	218	4.2 (1.2)	3.8 (1.1)	0.9 (0.06)	0.3 (0.9)	14.1 (4.1)	0.128 (0.067)	0.9 (0.06)	0.3 (0.9)
	3 Row	209	5.7 (1.7)	4.6 (1.3)	1.2 (0.08)	0.5 (1.5)	17.2 (5.0)	0.156 (0.082)	1.2 (0.08)	0.5 (1.5)
	4 Row	200	5.9 (1.7)	4.7 (1.4)	1.2 (0.08)	0.6 (1.8)	19.2 (5.6)	0.175 (0.092)	1.2 (0.08)	0.6 (1.8)
03	2 Row	299	5.0 (1.5)	4.8 (1.4)	1.1 (0.07)	0.4 (1.2)	19.8 (5.8)	0.180 (0.095)	1.1 (0.07)	0.4 (1.2)
	3 Row	291	6.9 (2.0)	6.0 (1.8)	1.5 (0.09)	0.5 (1.5)	24.4 (7.2)	0.222 (0.118)	1.5 (0.09)	0.5 (1.5)
	4 Row	265	9.4 (2.8)	6.9 (2.0)	1.9 (0.12)	1.5 (4.5)	27.2 (8.0)	0.247 (0.131)	1.9 (0.12)	1.5 (4.5)
04	2 Row	398	8.0 (2.3)	7.2 (2.1)	1.7 (0.11)	1.0 (3.0)	28.3 (8.3)	0.257 (0.136)	1.7 (0.11)	1.0 (3.0)
	3 Row	385	10.7 (3.1)	8.7 (2.5)	2.2 (0.14)	1.3 (3.9)	34.0 (10.0)	0.309 (0.164)	2.2 (0.14)	1.3 (3.9)
	4 Row	374	14.3 (4.2)	10.2 (3.0)	2.9 (0.18)	3.4 (10.2)	38.9 (11.4)	0.354 (0.187)	2.9 (0.18)	3.4 (10.2)
06	2 Row	602	14.0 (4.1)	11.5 (3.4)	2.9 (0.18)	4.4 (13.1)	41.0 (12.0)	0.373 (0.196)	2.9 (0.18)	4.4 (13.1)
	3 Row	565	17.7 (5.2)	13.3 (3.9)	3.7 (0.23)	5.2 (15.5)	47.1 (13.8)	0.428 (0.226)	3.7 (0.23)	5.2 (15.5)
	4 Row	554	22.4 (6.6)	15.2 (4.5)	4.6 (0.29)	9.0 (26.9)	52.6 (15.4)	0.478 (0.252)	4.6 (0.29)	9.0 (26.9)
08	2 Row	675	17.0 (5.0)	13.4 (3.9)	3.6 (0.23)	7.7 (23.0)	50.3 (14.7)	0.457 (0.241)	3.6 (0.23)	7.7 (23.0)
	3 Row	656	21.7 (6.4)	15.9 (4.7)	4.5 (0.28)	8.0 (23.9)	58.7 (17.2)	0.534 (0.281)	4.5 (0.28)	8.0 (23.9)
	4 Row	634	26.4 (7.7)	17.8 (5.2)	5.5 (0.35)	14.8 (44.2)	64.3 (18.8)	0.585 (0.308)	5.5 (0.35)	14.8 (44.2)
10	2 Row	831	20.9 (6.1)	16.7 (4.9)	4.4 (0.28)	6.8 (20.3)	62.4 (18.3)	0.567 (0.299)	4.4 (0.28)	6.8 (20.3)
	3 Row	808	27.4 (8.0)	19.9 (5.8)	5.7 (0.36)	8.7 (26.0)	73.2 (21.5)	0.665 (0.352)	5.7 (0.36)	8.7 (26.0)
	4 Row	795	32.4 (9.5)	21.9 (6.4)	6.7 (0.42)	11.1 (33.2)	80.8 (23.7)	0.735 (0.388)	6.7 (0.42)	11.1 (33.2)
12	2 Row	1118	27.1 (7.9)	21.2 (6.2)	5.6 (0.35)	12.5 (37.4)	78.3 (22.9)	0.712 (0.375)	5.6 (0.35)	12.5 (37.4)
	3 Row	1059	34.5 (10.1)	24.9 (7.3)	7.1 (0.45)	15.5 (46.3)	95.4 (28.0)	0.867 (0.458)	7.1 (0.45)	15.5 (46.3)
	4 Row	1022	40.2 (11.8)	27.0 (7.9)	8.3 (0.52)	18.3 (54.7)	103.8 (30.4)	0.944 (0.497)	8.3 (0.52)	18.3 (54.7)

* Performance at medium or low fan speed settings is approximately 88% and 68%, respectively, of that shown in the table above. 115/1/60 PSC motor at high speed setting.

Four-Pipe Systems - Hot Water Preheat (1 or 2 row) or Reheat (1 row)

All performance measured on high speed tap, 115 V, zero ESP, with a throwaway filter. Cooling performance is based on 80/67°F (27/19°C) entering air temperature, 45°F (7°C) entering chilled water temperature with a 10°F (5.5°C) ΔT.

Heating performance is based on 70°F (21°C) entering air temperature, 180°F (82°C) entering hot water temperature with a 30°F (17°C) DT.

Table 3: Cooling and Heating Performance – Four-Pipe Systems, Hot Water Heat

Unit Size	Main Coil Rows	Heating Coil Rows	SCFM	Cooling Performance				Heating Performance			
				Total MBh (kW)	Sensible MBh (kW)	G(L/s)	WPD Ft H_2O (kPa)	MBh (kW)	Q/ITD	G(L/s)	WPD Ft H_2O (kPa)
02	2 Row	1 Row	201	4.0 (1.2)	3.6 (1.1)	0.8 (0.05)	0.3 (0.9)	8.4 (2.5)	0.076 (0.041)	0.9 (0.1)	1.4 (4)
		2 Row*	192	3.9 (1.1)	3.5 (1.0)	0.8 (0.05)	0.3 (0.9)	11.6 (3.4)	0.105 (0.056)	0.8 (0.1)	0.6 (1.8)
	3 Row	1 Row	192	5.3 (1.6)	4.3 (1.3)	1.1 (0.07)	0.4 (1.2)	8.2 (2.4)	0.075 (0.039)	0.9 (0.1)	1.3 (4)
		2 Row*	184	5.1 (1.5)	4.2 (1.2)	1.1 (0.07)	0.4 (1.2)	11.3 (3.3)	0.102 (0.054)	0.8 (0.1)	0.6 (1.8)
	4 Row	1 Row	184	5.7 (1.7)	4.5 (1.3)	1.2 (0.08)	0.6 (1.8)	8.1 (2.4)	0.073 (0.039)	0.9 (0.1)	1.3 (4)
		2 Row*	176	6.4 (1.9)	4.7 (1.4)	1.3 (0.08)	0.7 (2.1)	11.0 (3.2)	0.100 (0.052)	0.8 (0.1)	0.5 (1.5)
03	2Row	1 Row	275	4.7 (1.4)	4.5 (1.3)	1.0 (0.06)	0.4 (1.2)	12.4 (3.6)	0.113 (0.059)	1.3 (0.1)	3.5 (10)
		2 Row*	263	4.6 (1.3)	4.4 (1.3)	1.0 (0.06)	0.4 (1.2)	17.3 (5.1)	0.157 (0.083)	1.2 (0.1)	1.5 (4.5)
	3 Row	1 Row	268	6.5 (1.9)	5.6 (1.6)	1.4 (0.09)	0.4 (1.2)	12.3 (3.6)	0.112 (0.059)	1.3 (0.1)	3.4 (10)
		2 Row*	256	6.3 (1.8)	5.4 (1.6)	1.3 (0.08)	0.4 (1.2)	17.0 (5.0)	0.154 (0.082)	1.2 (0.1)	1.4 (4.2)
	4 Row	1 Row	244	8.8 (2.6)	6.4 (1.9)	1.8 (0.11)	1.3 (3.9)	11.7 (3.4)	0.107 (0.056)	1.2 (0.1)	3.2 (10)
		2 Row*	233	8.4 (2.5)	6.1 (1.8)	1.8 (0.11)	1.2 (3.6)	16.0 (4.7)	0.145 (0.077)	1.1 (0.1)	1.3 (3.9)
04	2 Row	1 Row	366	7.5 (2.2)	6.8 (2.0)	1.6 (0.10)	0.9 (2.7)	16.9 (5.0)	0.153 (0.082)	1.8 (0.1)	7.1 (21)
		2 Row*	350	7.3 (2.1)	6.5 (1.9)	1.5 (0.09)	0.8 (2.4)	23.7 (6.9)	0.215 (0.113)	1.7 (0.1)	2.9 (8.7)
	3 Row	1 Row	354	10.1 (3.0)	8.1 (2.4)	2.1 (0.13)	1.2 (3.6)	16.6 (4.9)	0.151 (0.080)	1.8 (0.1)	6.9 (21)
		2 Row*	339	9.7 (2.8)	7.8 (2.3)	2.0 (0.13)	1.1 (3.3)	23.2 (6.8)	0.211 (0.111)	1.7 (0.1)	2.8 (8.4)
	4 Row	1 Row	344	13.4 (3.9)	9.4 (2.8)	2.8 (0.18)	3.0 (9.0)	16.4 (4.8)	0.149 (0.079)	1.7 (0.1)	6.7 (20)
		2 Row*	329	12.9 (3.8)	9.1 (2.7)	2.7 (0.17)	2.8 (8.4)	22.7 (6.7)	0.207 (0.110)	1.6 (0.1)	2.7 (8.1)
06	2 Row	1 Row	554	13.3 (3.9)	10.8 (3.2)	2.8 (0.18)	4.0 (12.0)	23.2 (6.8)	0.211 (0.111)	2.8 (0.2)	19.6 (59)
		2 Row*	530	12.9 (3.8)	10.4 (3.0)	2.7 (0.17)	3.8 (11.4)	32.9 (9.6)	0.299 (0.157)	2.6 (0.2)	7.7 (23.0)
	3 Row	1 Row	520	16.7 (4.9)	12.4 (3.6)	3.4 (0.21)	4.6 (13.7)	22.5 (6.6)	0.205 (0.108)	2.7 (0.2)	18.5 (55)
		2 Row*	497	16.1 (4.7)	12.0 (3.5)	3.3 (0.21)	4.3 (12.9)	31.6 (9.3)	0.287 (0.152)	2.5 (0.2)	7.2 (21.5)
	4 Row	1 Row	510	21.0 (6.2)	14.2 (4.2)	4.3 (0.27)	8.0 (23.9)	22.3 (6.5)	0.203 (0.106)	2.6 (0.2)	18.2 (54)
		2 Row*	488	20.2 (5.9)	13.6 (4.0)	4.2 (0.26)	7.5 (22.4)	31.2 (9.1)	0.284 (0.149)	2.5 (0.2)	7.0 (20.9)
08	2 Row	1 Row	621	16.1 (4.7)	12.6 (3.7)	3.4 (0.21)	7.0 (20.9)	28.3 (8.3)	0.257 (0.136)	3.2 (0.2)	28.0 (84)
		2 Row*	594	15.6 (4.6)	12.2 (3.6)	3.3 (0.21)	6.6 (19.7)	40.0 (11.7)	0.364 (0.191)	3.0 (0.2)	10.7 (32.0)
	3 Row	1 Row	604	20.4 (6.0)	14.9 (4.4)	4.2 (0.26)	7.2 (21.5)	27.9 (8.2)	0.254 (0.134)	3.1 (0.2)	27.3 (82)
		2 Row*	577	19.7 (5.8)	14.3 (4.2)	4.1 (0.26)	6.8 (20.3)	39.2 (11.5)	0.357 (0.188)	2.9 (0.2)	10.4 (31.1)
	4 Row	1 Row	583	24.8 (7.3)	16.6 (4.9)	5.1 (0.32)	13.2 (39.4)	27.4 (8.0)	0.249 (0.131)	3.1 (0.2)	26.4 (79)
		2 Row*	558	23.9 (7.0)	16.0 (4.7)	5.0 (0.32)	12.4 (37.1)	38.4 (11.3)	0.349 (0.185)	2.9 (0.2)	9.9 (29.6)
10	2Row	1 Row	765	19.8 (5.8)	15.7 (4.6)	4.1 (0.26)	6.2 (18.5)	35.9 (10.5)	0.326 (0.172)	4.0 (0.3)	51.1 (153)
		2 Row*	731	19.2 (5.6)	15.2 (4.5)	4.0 (0.25)	5.8 (17.3)	50.6 (14.8)	0.460 (0.242)	3.8 (0.2)	18.8 (56.2)
	3 Row	1 Row	743	25.7 (7.5)	18.6 (5.5)	5.3 (0.33)	7.8 (23.3)	35.3 (10.3)	0.321 (0.169)	4.0 (0.3)	49.7 (149)
		2 Row*	711	24.9 (7.3)	18.0 (5.3)	5.1 (0.32)	7.3 (21.8)	49.6 (14.5)	0.451 (0.237)	3.7 (0.2)	18.2 (54.4)
	4 Row	1 Row	731	30.2 (8.9)	20.4 (6.0)	6.2 (0.39)	9.8 (29.3)	35.1 (10.3)	0.319 (0.169)	3.9 (0.2)	49.0 (146)
		2 Row*	700	29.1 (8.5)	19.6 (5.7)	6.0 (0.38)	9.2 (27.5)	49.1 (14.4)	0.447 (0.236)	3.7 (0.2)	17.8 (53.2)
12	2 Row	1 Row	1029	25.9 (7.6)	20.1 (5.9)	5.4 (0.34)	11.5 (34.4)	43.8 (12.8)	0.398 (0.209)	5.2 (0.3)	93.6 (280)
		2 Row*	984	25.2 (7.4)	19.4 (5.7)	5.2 (0.33)	11.0 (32.9)	62.7 (18.4)	0.570 (0.301)	5.0 (0.3)	34.6 (103.4)
	3 Row	1 Row	974	32.7 (9.6)	23.3 (6.8)	6.7 (0.42)	14.0 (41.8)	45.1 (13.2)	0.410 (0.216)	5.1 (0.3)	89.0 (266)
		2 Row*	932	31.7 (9.3)	22.6 (6.6)	6.6 (0.42)	13.3 (39.7)	64.1 (18.8)	0.583 (0.308)	4.8 (0.3)	32.4 (96.8)
	4 Row	1 Row	940	37.8 (11.1)	25.2 (7.4)	7.8 (0.49)	16.2 (48.4)	44.3 (13.0)	0.403 (0.213)	5.0 (0.3)	86.2 (258)
		2 Row*	899	36.5 (10.7)	24.3 (7.1)	7.6 (0.48)	15.2 (45.4)	62.6 (18.3)	0.569 (0.299)	4.7 (0.3)	31.0 (92.6)

NOTE: *2-Row hot water coils are only available in the preheat position

Four-Pipe Systems - Steam Preheat or Reheat

All performance measured on high speed tap, 115 V, zero ESP, with a throwaway filter. Medium and low-speed capacities are approximately 88% and 68% respectively of the high-speed capacity.

$$Q/ITD = \frac{MBh\ (kW)}{Saturated\ steam\ temp - Entering\ air\ temp}$$

To determine heating capacities at different entering steam pressure or entering air temperature, compute the new Inlet Temperature Differential (ITD) and multiply it by the Q/ITD shown. See Table 5 to determine the saturated steam temperatures at various entering steam pressures. For more accurate values, use Daikin Tools™ selection program available from your Daikin representative.

Table 4: Steam Coil Performance with Free-Discharge Motor

Unit Size	Steam Coil Rows	2 psig (14 kPa) Total MBH (KW)	5 psig (103 kPa) Total MBH (KW)	Q/ITD MBH/ºF (KW/ºC)
02	Pre/ReHeat 1 Row	10.2 (3.0)	11.3 (3.3)	0.069 (0.036)
03	Pre/ReHeat 1 Row	14.4 (4.2)	16.0 (4.7)	0.098 (0.052)
04	Pre/ReHeat 1 Row	19.1 (5.6)	21.1 (6.2)	0.130 (0.069)
06	Pre/ReHeat 1 Row	28.7 (8.4)	31.7 (9.3)	0.195 (0.103)
08	Pre/ReHeat 1 Row	32.7 (9.6)	36.2 (10.6)	0.222 (0.117)
10	Pre/ReHeat 1 Row	40.9 (12.0)	45.4 (13.3)	0.279 (0.147)
12	Pre/ReHeat 1 Row	52.7 (15.4)	58.1 (17.0)	0.358 (0.189)

NOTE: *2-Row coils only available in preheat position.

Table 5: Steam Properties

Steam Pressure PSIG (kPa)	2 (13)	3 (20)	4 (27)	5 (34)
Sat. Steam Temp. ºF (ºC)	219 (104)	222 (106)	224 (107)	227 (108)
Latent Heat Btu/Lb (kJ/kg)	966 (2245)	964 (2242)	962 (2239)	961 (2233)

Air Volume Capacity Data

Air volumes shown in the table are measured at the motor speeds indicated with 115v/60/1 electrical power, with a 1" throwaway filter installed, and with a stamped discharge grille on a vertical cabinet unit or a discharge duct collar on a hideaway unit at approximately 0.10 inch of pressure drop.

Table 6: Air Volume at Various Fan Speeds, scfm, PSC Motors

Unit Size	Main Coil Rows	Heating Coil Rows	SCFM		
			Motor on High Speed	Motor on Medium Speed	Motor on Low Speed
02	2 Row	None	214	197	167
		1 Row	197	181	154
		2 Row*	188	173	147
	3 Row	None	204	190	161
		1 Row	188	175	148
		2 Row*	180	168	142
	4 Row	None	197	183	159
		1 Row	181	169	146
		2 Row*	173	161	140
03	2 Row	None	296	264	211
		1 Row	272	243	194
		2 Row*	260	232	186
	3 Row	None	292	256	205
		1 Row	268	236	188
		2 Row*	257	225	180
	4 Row	None	283	253	206
		1 Row	260	233	189
		2 Row*	249	223	181
04	2 Row	None	380	330	261
		1 Row	349	304	241
		2 Row*	334	291	230
	3 Row	None	365	325	250
		1 Row	336	299	230
		2 Row*	321	286	220
	4 Row	None	368	319	249
		1 Row	338	294	229
		2 Row*	323	281	219
06	2 Row	None	600	524	421
		1 Row	552	482	387
		2 Row*	528	461	371
	3 Row	None	559	483	373
		1 Row	514	445	343
		2 Row*	492	425	329
	4 Row	None	554	486	409
		1 Row	510	447	376
		2 Row*	488	427	360
08	2 Row	None	668	585	465
		1 Row	614	538	428
		2 Row*	588	515	409
	3 Row	None	654	576	456
		1 Row	601	530	419
		2 Row*	575	507	401
	4 Row	None	632	562	450
		1 Row	581	517	414
		2 Row*	556	495	396
10	2 Row	None	831	712	548
		1 Row	764	655	504
		2 Row*	731	626	482
	3 Row	None	807	696	536
		1 Row	742	640	493
		2 Row*	710	612	472
	4 Row	None	789	680	523
		1 Row	726	625	481
		2 Row*	695	598	460
12	2 Row	None	1110	995	840
		1 Row	1021	916	773
		2 Row*	977	876	740
	3 Row	None	1059	960	822
		1 Row	974	883	756
		2 Row*	932	845	723
	4 Row	None	1025	930	803
		1 Row	943	856	739
		2 Row*	902	818	707

NOTE: *2-row HW coils are only available in the preheat position

Table 7: Approximate Air Volume for Units with ECM Motors for 3-Row Coils and External Static Pressure up to 0.2"

Size	Vertical		
	High	Medium	Low
02	214	195	172
03	309	262	209
04	395	308	240
06	621	502	417
08	834	554	462
10	1011	692	539
12	1244	1003	836

MCA (Minimum Circuit Ampacity), MOP (Maximum Overcurrent Protection) or MFS (Maximum Fuze Size) Calculations

The minimum circuit ampacity (MCA) is the minimum wire size required for a field-wired product. The maximum overcurrent protection (MOP), or maximum fuse size (MFS) is the maximum fuse or circuit breaker size required to properly protect the equipment.

Select a standard fuse size or HACR type circuit breaker equal to the MOP. Standard Fuse Sizes are: 15, 20, 25, 30, 35, 40, 45, 50, 60 amps. Use the next larger standard size if the MOP does not equal a standard size. See Table 8 through Table 10 for motor FLAs.

HACR (Heating, Air-Conditioning and Refrigeration) type circuit breakers are required in the branch circuit wiring for all fan coils with electric heat.

NOTE: MCA and MOP ratings are based on the unit and electric heat power supply having the same voltage. If the electric heat power supply is different, a separate circuit breaker may be required. Follow local codes.

$$\text{Heater Amps} = \frac{(\text{Heater kW} \times 1000)}{\text{Heater Voltage}}$$

NOTE: Use 120V heater voltage for 115V units. Use 240V heater voltage for 230V units.

MCA = 1.25 × (heater amps + all motor FLAs)

MOP or MFS = (2.25 x Largest Motor FLA) + Second Motor FLA + Heater Amps [If Applicable]

Electric Heaters

Table 8: Electric Heat kW*

Unit Size	Unit Voltage	kW								
02	115	0.5	1.0	1.5						
	230	0.5	1.0							
	277	0.5	1.0	1.5						
	208	0.5	0.9							
03	115		1.0	1.5	2.0					
	230		1.0							
	277		1.0	1.5						
	208		0.9							
04	115		1.0	1.5	2.0					
	230		1.0	1.5	2.0					
	277		1.0	1.5	2.0					
	208		0.9	1.4	1.8					
06	115			1.5	2.0					
	230			1.5	2.0	2.5	3.0			
	277			1.5	2.0	2.5	3.0	4.0		
	208			1.4	1.8	2.3	2.7			
08	115				2.0					
	230				2.0	2.5	3.0	4.0		
	277				2.0	2.5	3.0	4.0		
	208				1.8	2.3	2.7	3.6		
10	115									
	230					2.5	3.0	4.0		
	277					2.5	3.0	4.0		
	208					2.3	2.7	3.6		
12	115									
	230						3.0	4.0	5.0	6.0
	277						3.0	4.0	5.0	6.0
	208						2.7	3.6	4.5	5.4

Note: *Electric heat MBh = (Heater kW) x(3.413)

Motor Electrical Data

Table 9: Electrical Data - Standard (Free Discharge) Motor – 2-Row Coil

	Motor Speed	Size 02			Size 03			Size 04			Size 06			Size 08			Size 10			Size 12		
		Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM
115 V	High	0.49	53	1059	0.56	63	993	0.68	72	991	1.32	123	1122	1.20	129	1015	1.37	148	987	2.52	237	1123
	Med	0.42	44	984	0.48	53	886	0.57	59	876	0.99	95	987	1.01	108	910	1.16	124	866	1.81	175	1013
	Low	0.35	36	856	0.39	42	726	0.45	45	705	0.90	81	815	0.83	84	741	0.92	95	681	1.64	153	864
208 V	High	0.27	53	955	0.30	62	837	0.38	75	928	0.61	122	1102	0.77	154	1070	0.72	147	860	1.15	236	1113
	Med	0.23	48	766	0.24	52	639	0.30	59	764	0.44	87	910	0.58	48	709	0.58	120	681	0.83	166	960
	Low	0.19	39	561	0.19	42	485	0.25	49	611	0.36	65	691	0.50	39	504	0.45	93	533	0.70	127	708
230 V	High	0.27	57	1026	0.30	67	949	0.37	75	998	0.63	133	1124	0.80	180	1093	0.73	163	954	1.19	261	1131
	Med	0.23	52	914	0.25	60	791	0.31	64	880	0.41	89	1011	0.57	131	1006	0.61	139	797	0.81	178	1021
	Low	0.20	45	742	0.21	50	607	0.26	6	737	0.36	78	844	0.50	111	870	0.50	113	616	0.71	149	831
265 V	High	0.28	55	1026	0.29	61	931	0.34	77	917	0.47	117	1118	0.79	172	1097	0.65	149	906	0.95	246	1104
	Med	0.20	49	915	0.21	44	778	0.27	64	771	0.34	85	986	0.56	133	1007	0.50	126	737	0.74	188	933
	Low	0.16	41	758	0.16	43	597	0.20	46	609	0.30	69	836	0.47	114	882	0.38	99	594	0.63	152	737
277 V	High	0.29	57	1049	0.29	66	948	0.35	75	955	0.49	132	1125	0.81	183	1110	0.71	159	948	0.97	265	1115
	Med	0.22	51	953	0.22	58	788	0.27	65	820	0.34	86	1018	0.57	139	1030	0.51	135	791	0.72	196	968
	Low	0.16	44	827	0.17	47	625	0.21	56	682	0.30	72	890	0.47	120	924	0.39	108	638	0.64	159	793

Table 10: Electrical Data - Standard (Free Discharge) Motor – 3-Row Coil

	Motor Speed	Size 02			Size 03			Size 04			Size 06			Size 08			Size 10			Size 12		
		Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM
115 V	High	0.48	52	1067	0.55	62	1005	0.68	72	994	1.29	121	1120	1.20	129	1018	1.37	149	992	2.48	231	1127
	Med	0.41	43	1007	0.48	53	899	0.57	59	876	1.01	96	976	1.01	108	915	1.15	124	871	1.76	169	1029
	Low	0.34	35	889	0.39	42	722	0.45	45	700	0.89	80	783	0.83	84	749	0.91	95	689	1.60	149	895
208 V	High	0.26	52	962	0.29	62	847	0.38	75	931	0.60	120	1100	0.77	154	1073	0.72	148	865	1.13	230	1117
	Med	0.22	46	784	0.24	52	648	0.30	59	764	0.45	88	900	0.58	48	713	0.57	119	685	0.81	160	975
	Low	0.18	38	583	0.19	42	482	0.25	49	607	0.36	64	664	0.50	39	509	0.45	93	539	0.68	124	733
230 V	High	0.26	55	1034	0.29	66	960	0.37	75	1001	0.62	131	1122	0.80	179	1096	0.72	163	959	1.17	254	1135
	Med	0.22	50	935	0.25	59	803	0.31	64	880	0.42	90	1000	0.57	130	1011	0.60	138	802	0.79	172	1037
	Low	0.19	44	771	0.21	50	604	0.26	6	732	0.36	77	811	0.50	111	879	0.49	113	624	0.69	145	861
265 V	High	0.27	54	1034	0.28	61	942	0.34	77	920	0.46	115	1116	0.79	172	1100	0.65	150	911	0.93	240	1108
	Med	0.20	47	936	0.21	44	789	0.27	64	771	0.35	86	975	0.56	133	1012	0.49	126	742	0.72	182	948
	Low	0.16	41	787	0.17	44	594	0.20	46	605	0.30	68	803	0.47	114	891	0.38	99	601	0.61	148	763
277 V	High	0.28	56	1057	0.29	65	959	0.35	75	958	0.48	130	1123	0.81	183	1113	0.70	159	953	0.95	258	1119
	Med	0.21	49	975	0.22	58	800	0.27	65	820	0.35	87	1007	0.57	139	1035	0.51	134	796	0.70	189	983
	Low	0.16	43	859	0.17	48	622	0.21	56	677	0.30	71	855	0.47	120	933	0.39	108	646	0.62	155	821

Table 11: Electrical Data - Standard (Free Discharge) Motor – 4-Row Coil

	Motor Speed	Size 02			Size 03			Size 04			Size 06			Size 08			Size 10			Size 12		
		Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM	Amps	Watts	RPM
115 V	High	0.48	52	1069	0.54	61	1019	0.68	71	1002	1.28	118	1127	1.17	126	1027	1.36	152	993	2.46	228	1131
	Med	0.41	43	1007	0.47	52	923	0.57	59	890	0.93	88	1017	0.98	105	935	1.15	123	863	1.73	166	1036
	Low	0.34	35	888	0.38	41	779	0.45	45	712	0.86	77	873	0.81	83	769	0.91	94	684	1.57	147	909
208 V	High	0.26	52	964	0.29	60	859	0.38	74	938	0.60	117	1107	0.75	150	1083	0.71	151	865	1.12	227	1121
	Med	0.22	46	784	0.23	50	665	0.30	59	776	0.41	81	938	0.56	47	729	0.57	118	678	0.80	157	982
	Low	0.18	38	582	0.19	41	520	0.25	49	617	0.35	62	740	0.48	39	523	0.45	92	535	0.67	122	744
230 V	High	0.26	55	1036	0.29	64	973	0.37	74	1009	0.62	128	1129	0.78	175	1106	0.72	166	959	1.16	251	1139
	Med	0.22	50	935	0.24	58	824	0.31	64	894	0.39	83	1042	0.55	127	1034	0.60	137	795	0.78	169	1044
	Low	0.19	44	770	0.20	49	652	0.26	6	745	0.35	74	904	0.49	110	903	0.49	112	619	0.68	143	874
265 V	High	0.27	54	1036	0.28	59	955	0.34	76	927	0.46	112	1123	0.77	167	1110	0.65	153	911	0.92	237	1112
	Med	0.20	47	936	0.21	42	810	0.27	64	783	0.32	79	1016	0.55	130	1034	0.49	125	735	0.71	179	954
	Low	0.16	40	786	0.16	43	641	0.20	46	615	0.29	65	895	0.45	113	915	0.37	98	597	0.60	146	775
277 V	High	0.28	56	1059	0.28	63	972	0.35	74	966	0.48	127	1130	0.79	178	1123	0.70	162	953	0.94	255	1123
	Med	0.21	49	975	0.21	56	821	0.27	65	833	0.32	80	1049	0.55	136	1058	0.51	133	789	0.69	186	990
	Low	0.16	42	858	0.17	46	671	0.21	56	689	0.29	68	953	0.46	119	959	0.39	106	641	0.61	153	834

Unit Data

Table 12: Physical Data: Coils, Fans, Motors and Filters

	02	03	04	06	08	10	12
Primary Coil Data							
Face Area, ft² (cm²)	0.74 (685)	1.08 (1004)	1.43 (1323)	2.11 (1962)	2.46 (2281)	3.14 (2917)	3.83 (3559)
Fins/inch (cm)	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]
Connection Size	1/2" Nominal Copper (5/8" OD)						
Coil Dimensions							
2-Row L × D × H, in (cm)	11.8 × 1.7 × 9 (30.0×4.4×22.9)	17.3 × 1.7 × 9 (43.9×4.4×22.9)	22.8 × 1.7 × 9 (57.9×4.4×22.9)	33.8 × 1.7 × 9 (85.9×4.4×22.9)	39.3× 1.7 × 9 (99.8×4.4×22.9)	50.2 × 1.7 × 9 (127.6×4.4×22.9)	61.3 × 1.7 × 9 (155.7×4.4×22.9)
3-Row L × D × H, in (cm)	11.8 × 2.6 × 9 (30×6.6×22.9)	17.3 × 2.6 × 9 (43.9×6.6×22.9)	22.8 × 2.6 × 9 (57.9×6.6×22.9)	33.8 × 2.6 × 9 (85.9×6.6×22.9)	39.3 × 2.6 × 9 (99.8×6.6×22.9)	50.2 × 2.6 × 9 (127.6×6.6×22.9)	61.3 × 2.6 × 9 (155.7×6.6×22.9)
4-Row L × D × H, in (cm)	11.8 × 3.5 × 9 (30.0×8.8×22.9)	17.3 × 3.5 × 9 (43.9×8.8×22.9)	22.8 × 3.5 × 9 (57.9×8.8×22.9)	33.8 × 3.5 × 9 (85.9×8.8×22.9)	39.3 × 3.5 × 9 (99.8×8.8×22.9)	50.2 × 3.5 × 9 (127.6×8.8×22.9)	61.3 × 3.5 × 9 (155.7×8.8×22.9)
Coil Volume, Gal (Liters)							
2-Row	0.15 (0.6)	0.19 (0.7)	0.24 (0.9)	0.32 (1.2)	0.37 (1.4)	0.46 (1.7)	0.55 (2.1)
3-Row	0.20 (0.7)	0.26 (1.0)	0.32 (1.2)	0.45 (1.7)	0.52 (2.0)	0.64 (2.4)	0.77 (2.9)
4-Row	0.26 (1.0)	0.34 (1.3)	0.43 (1.6)	0.61 (2.3)	0.70 (2.6)	0.87 (3.3)	1.05 (4.0)
Reheat Coil Data: 1-Row, Hot Water or Steam							
Face Area, ft² (cm²)	0.49 (456)	0.72 (669)	0.95 (882)	1.41 (1308)	1.64 (1521)	2.09 (1944)	2.55 (2372)
Fins/inch (cm)	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]
L × D × H, in (cm)	11.8 × 0.9 × 6 (30.0×2.2×15.2)	17.3 × 0.9 × 6 (43.9×2.2×15.2)	22.8 × 0.9 × 6 (57.9×2.2×15.2)	33.8 × 0.9 × 6 (85.9×2.2×15.2)	39.3 × 0.9 × 6 (99.8×2.2×15.2)	50.2 × 0.9 × 6 (127.6×2.2×15.2)	61.3 × 0.9 × 6 (155.7×2.2×15.2)
Connection Size	1/2" Nominal Copper (5/8" OD)						
Volume, Gal (Liters)	0.04 (0.1)	0.05 (0.2)	0.07 (0.3)	0.10 (0.4)	0.11 (0.4)	0.14 (0.5)	0.17 (0.7)
Preheat Coil Data, 2-Row, Hot Water or Steam							
Hot Water or Steam							
Face Area, ft² (cm²)	0.49 (456)	0.72 (669)	0.95 (882)	1.41 (1308)	1.64 (1521)	2.09 (1944)	2.55 (2372)
Fins/inch (cm)	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]	12 [4.7]
L × D × H, in. (cm)	11.8 × 1.7 × 6 (30.0×4.4×15.2)	17.3 ×1.7 × 6 (43.9×4.4×15.2)	22.8 × 1.7 × 6 (57.9×4.4×15.2)	33.8 × 1.7 × 6 (85.9×4.4×15.2)	39.3 × 1.7 × 6 (99.8×4.4×15.2)	50.2 × 1.7 × 6 (127.6×4.4×15.2)	61.3 × 1.7 × 6 (155.7×4.4×15.2)
Connection Size	1/2" Nominal Copper (5/8" OD)						
Volume, Gal (Liters)	0.08 (0.3)	0.10 (0.4)	0.13 (0.5)	0.19 (0.7)	0.22 (0.8)	0.29 (1.1)	0.35 (1.3)
Fan/Motor Data							
Fan Quantity	1	1	2	2	3	4	4
Size, Dia" × W" (cm)	6.26 × 6.3 (15.9 × 16)	7.95 × 6.3 (20 × 16)	6.26 × 6.3 (15.9 × 16)	7.95 × 6.3 (20 × 16)	6.26 × 6.3 (15.9 × 16)	6.26 × 6.3 (15.9 × 16)	7.95 × 6.3 (20 × 16)
Motor Quantity	1	1	1	1	2	2	2
Filter Data							
Part Number	668332901	668332902	668332903	668332907	668332905	668332906	668332904
1" (25.4 cm) Media	TA only	TA only	TA only	TA only	TA only	TA only	TA only
Quantity	1	1	1	1	2	2	2
L × D × H, in. (cm)	16 × 8.75 × 1 (40.6 × 22 × 2.5)	21.5 × 8.75 × 1 (54.6 × 22 × 2.5)	27 × 8.75 × 1 (68.5 × 22 × 2.5)	38 × 8.75 × 1 (96.5 × 22 × 2.5)	21.7 × 8.75 × 1 (56.1 × 22 × 2.5)	27.2 × 8.75 × 1 (69.0 × 22 × 2.5)	32.7 × 8.75 × 1 (83.1 × 22 × 2.5)

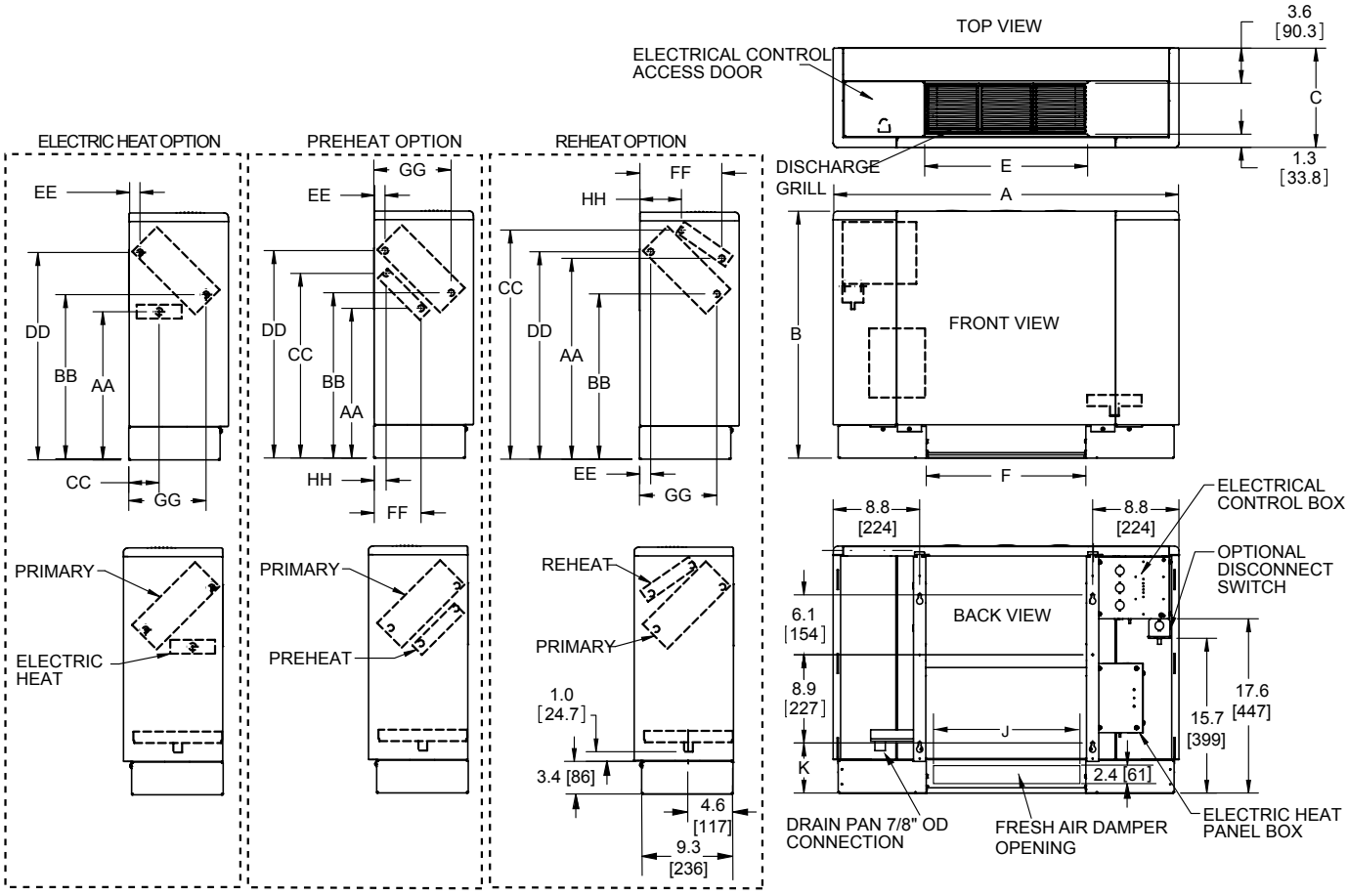
Table 13: Approximate Shipping Weights - lbs (kg)*

Unit Type	Unit Size						
	S02	S03	S04	S06	S08	S10	S12
FCVC, FCVS	84 (38)	95 (43)	108 (49)	131 (60)	152 (69)	177 (80)	202 (92)
FCVH	55 (25)	63 (29)	74 (34)	91 (41)	110 (50)	129 (59)	149 (68)

Note: *Approximate shipping weights do not include valve packages, hot water coils, electric heaters or other options.

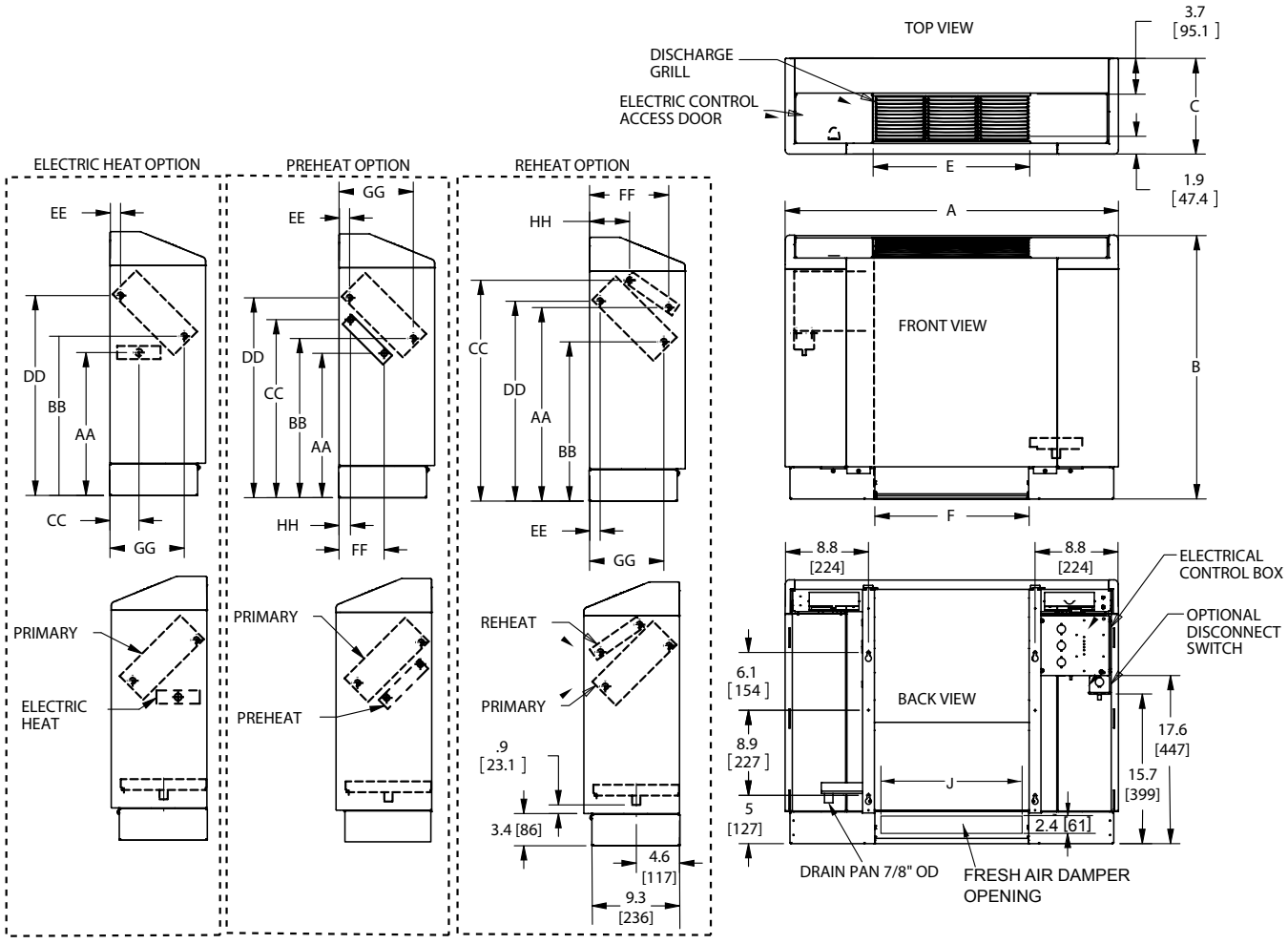
Unit Dimensions

Figure 11: Dimensions: Flat Top Fan Coils



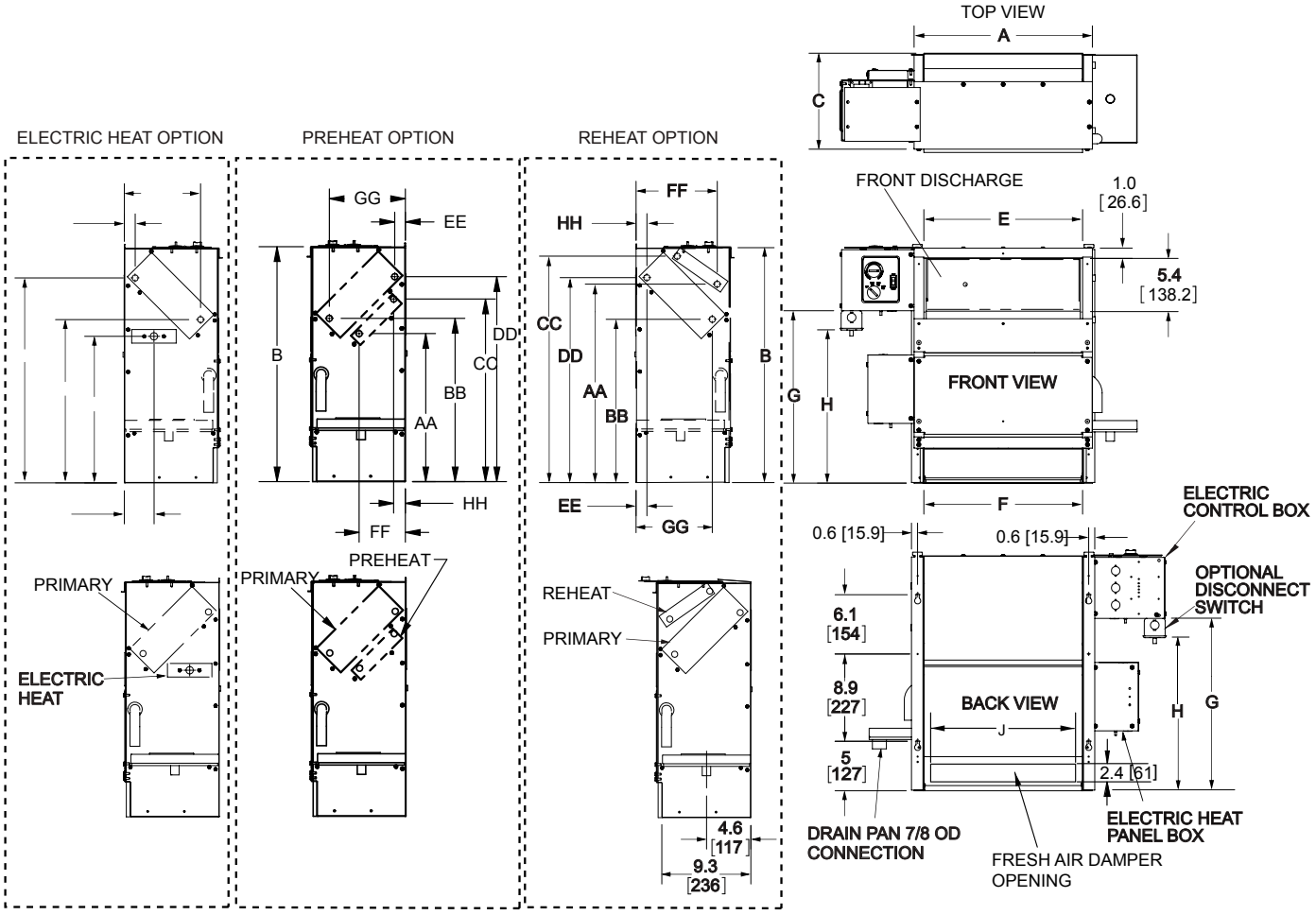
Dimension		S02		S03		S04		S06		S08		S10		S12	
		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
Unit Width	A	35.0	889	40.5	1029	46.0	1168	57.0	1448	62.5	1588	73.5	1867	84.5	2146
Unit Height	B	25.0	635	25.0	635	25.0	635	25.0	635	25.0	635	25.0	635	25.0	635
Unit Depth	C	10.0	254	10.0	254	10.0	254	10.0	254	10.0	254	10.0	254	10.0	254
Discharge Grille - Width	E	16.3	414	21.8	554	27.3	693	38.3	973	43.8	1113	54.8	1392	65.8	1671
Return Air Opening - Width	F	16.2	411	21.7	551	27.2	691	38.2	970	43.7	1110	54.7	1389	65.7	1669
Electric Heat Connection	AA	15.1	384	15.1	384	15.1	384	15.1	384	15.1	384	15.1	384	15.1	384
	CC	3.0	76	3.0	76	3.0	76	3.0	76	3.0	76	3.0	76	3.0	76
Primary Coil - Water Return	DD	21	533	21	533	21	533	21	533	21	533	21	533	21	533
	EE	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28
Primary Coil - Water Supply	BB	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424
	GG	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198
Preheat Coil - Water Return	CC	18.7	475	18.7	475	18.7	475	18.7	475	18.7	475	18.7	475	18.7	475
	HH	1.2	30	1.2	30	1.2	30	1.2	30	1.2	30	1.2	30	1.2	30
Preheat Coil - Water Supply	AA	15	381	15	381	15	381	15	381	15	381	15	381	15	381
	FF	4.7	119	4.7	119	4.7	119	4.7	119	4.7	119	4.7	119	4.7	119
Reheat Coil - Water Return	CC	23.2	589	23.2	589	23.2	589	23.2	589	23.2	589	23.2	589	23.2	589
	HH	4.2	107	4.2	107	4.2	107	4.2	107	4.2	107	4.2	107	4.2	107
Reheat Coil - Water Supply	AA	20.3	516	20.3	516	20.3	516	20.3	516	20.3	516	20.3	516	20.3	516
	FF	8.3	211	8.3	211	8.3	211	8.3	211	8.3	211	8.3	211	8.3	211
Fresh Air Damper Width	J	10	254	10	254	16	406	16	406	32	813	32	813	32	813

Figure 12: Dimensions: Slope Top Fan Coils



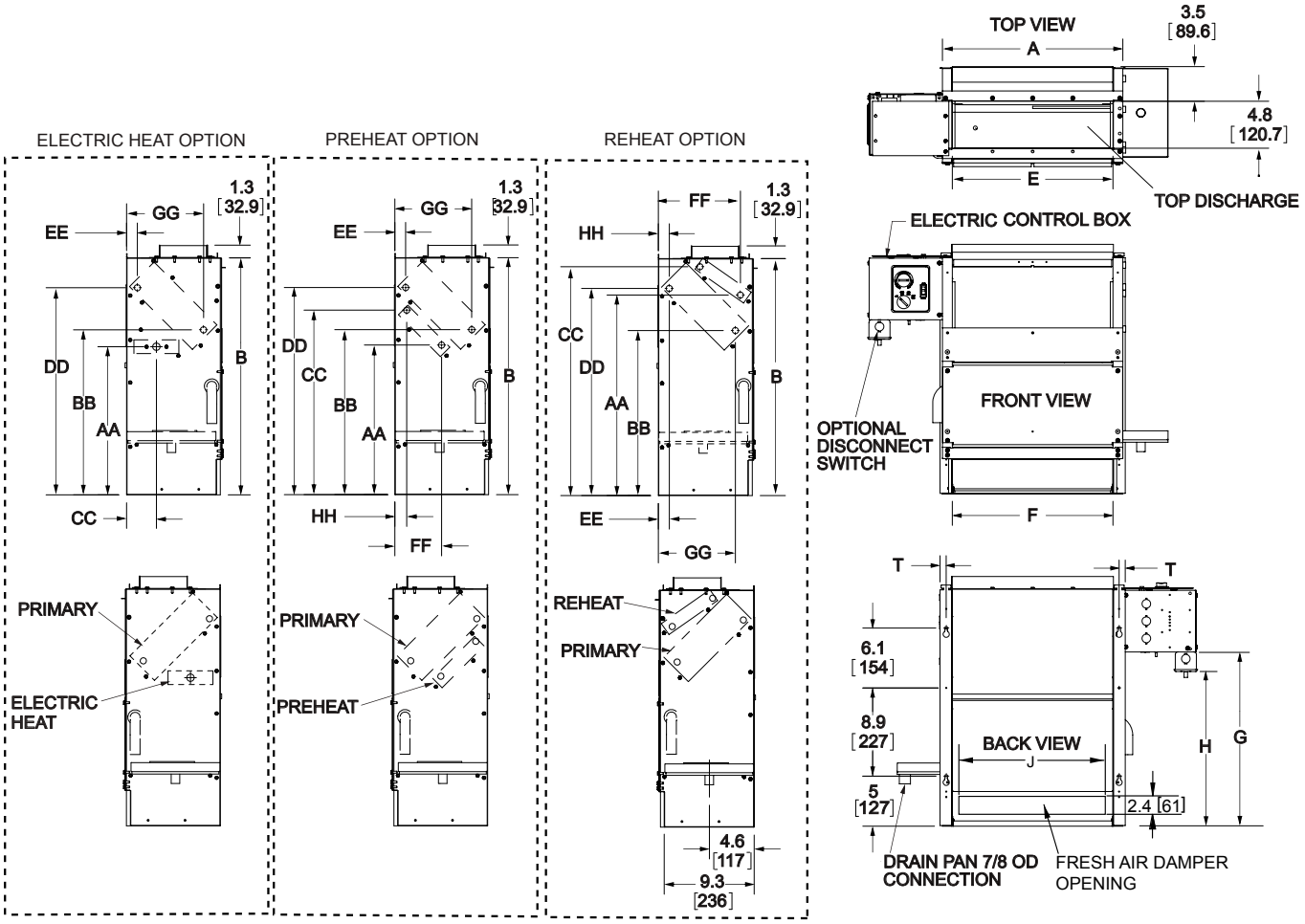
Dimension		S02		S03		S04		S06		S08		S10		S12	
		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
Unit Width	A	35.0	889	40.5	1029	46.0	1168	57.0	1448	62.5	1588	73.5	1867	84.5	2146
Unit Height	B	27.6	701	27.6	701	27.6	701	27.6	701	27.6	701	27.6	701	27.6	701
Unit Depth	C	10.0	254	10.0	254	10.0	254	10.0	254	10.0	254	10.0	254	10.0	254
Discharge Grille - Width	E	16.3	414	21.8	554	27.3	693	38.3	973	43.8	1113	54.8	1392	65.8	1671
Return Air Opening - Width	F	16.2	411	21.7	551	27.2	691	38.2	970	43.7	1110	54.7	1389	65.7	1669
Electric Heat Connection	AA	15.1	384	15.1	384	15.1	384	15.1	384	15.1	384	15.1	384	15.1	384
	CC	3.0	76	3.0	76	3.0	76	3.0	76	3.0	76	3.0	76	3.0	76
Primary Coil - Water Return	DD	21	533	21	533	21	533	21	533	21	533	21	533	21	533
	EE	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28
Primary Coil - Water Supply	BB	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424
	GG	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198
Preheat Coil - Water Return	CC	18.7	475	18.7	475	18.7	475	18.7	475	18.7	475	18.7	475	18.7	475
	HH	1.2	30	1.2	30	1.2	30	1.2	30	1.2	30	1.2	30	1.2	30
Preheat Coil - Water Supply	AA	15	381	15	381	15	381	15	381	15	381	15	381	15	381
	FF	4.7	119	4.7	119	4.7	119	4.7	119	4.7	119	4.7	119	4.7	119
Reheat Coil - Water Return	CC	23.2	589	23.2	589	23.2	589	23.2	589	23.2	589	23.2	589	23.2	589
	HH	4.2	107	4.2	107	4.2	107	4.2	107	4.2	107	4.2	107	4.2	107
Reheat Coil - Water Supply	AA	20.3	516	20.3	516	20.3	516	20.3	516	20.3	516	20.3	516	20.3	516
	FF	8.3	211	8.3	211	8.3	211	8.3	211	8.3	211	8.3	211	8.3	211
Fresh Air Damper Width	J	10	254	10	254	16	406	16	406	32	813	32	813	32	813

Figure 13: Dimensions: Hideaway, Front-Discharge Fan Coils



Dimension		S02		S03		S04		S06		S08		S10		S12	
		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
Unit Width	A	18.8	475	24.3	617	29.8	757	40.8	1036	46.3	1176	57.3	1455	68.3	1735
Unit Height	B	24.0	610	24.0	610	24.0	610	24.0	610	24.0	610	24.0	610	24.0	610
Unit Depth	C	9.6	243	9.6	243	9.6	243	9.6	243	9.6	243	9.6	243	9.6	243
Discharge Grille - Width	E	16.3	414	21.8	554	27.3	693	38.3	973	43.8	1113	54.8	1392	65.8	1671
Return Air Opening - Width	F	16.2	411	21.7	551	27.2	691	38.2	970	43.7	1110	54.7	1389	65.7	1669
Control Box to Floor	G	17.6	447	17.6	447	17.6	447	17.6	447	17.6	447	17.6	447	17.6	447
Disconnect Switch to Floor	H	15.7	399	15.7	399	15.7	399	15.7	399	15.7	399	15.7	399	15.7	399
Electric Heat Connection	AA	15.1	384	15.1	384	15.1	384	15.1	384	15.1	384	15.1	384	15.1	384
	CC	3.0	76	3.0	76	3.0	76	3.0	76	3.0	76	3.0	76	3.0	76
Primary Coil - Water Return	DD	21	533	21	533	21	533	21	533	21	533	21	533	21	533
	EE	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28
Primary Coil - Water Supply	BB	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424
	GG	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198
Preheat Coil - Water Return	CC	18.7	475	18.7	475	18.7	475	18.7	475	18.7	475	18.7	475	18.7	475
	HH	1.2	30	1.2	30	1.2	30	1.2	30	1.2	30	1.2	30	1.2	30
Preheat Coil - Water Supply	AA	15	381	15	381	15	381	15	381	15	381	15	381	15	381
	FF	4.7	119	4.7	119	4.7	119	4.7	119	4.7	119	4.7	119	4.7	119
Reheat Coil - Water Return	CC	23.2	589	23.2	589	23.2	589	23.2	589	23.2	589	23.2	589	23.2	589
	HH	4.2	107	4.2	107	4.2	107	4.2	107	4.2	107	4.2	107	4.2	107
Reheat Coil - Water Supply	AA	20.3	516	20.3	516	20.3	516	20.3	516	20.3	516	20.3	516	20.3	516
	FF	8.3	211	8.3	211	8.3	211	8.3	211	8.3	211	8.3	211	8.3	211
Fresh Air Damper Width	J	10	254	10	254	16	406	16	406	32	813	32	813	32	813

Figure 14: Dimensions: Hideaway, Top-Discharge Fan Coils

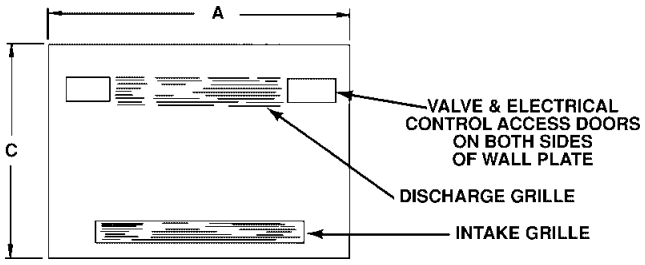


Dimension		S02		S03		S04		S06		S08		S10		S12	
		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
Unit Width	A	18.8	475	24.3	617	29.8	757	40.8	1036	46.3	1176	57.3	1455	68.3	1735
Unit Height	B	24.0	610	24.0	610	24.0	610	24.0	610	24.0	610	24.0	610	24.0	610
Unit Depth	C	9.6	243	9.6	243	9.6	243	9.6	243	9.6	243	9.6	243	9.6	243
Discharge Grille - Width	E	16.3	414	21.8	554	27.3	693	38.3	973	43.8	1113	54.8	1392	65.8	1671
Return Air Opening - Width	F	16.2	411	21.7	551	27.2	691	38.2	970	43.7	1110	54.7	1389	65.7	1669
Control Box to Floor	G	17.6	447	17.6	447	17.6	447	17.6	447	17.6	447	17.6	447	17.6	447
Disconnect Switch to Floor	H	15.7	399	15.7	399	15.7	399	15.7	399	15.7	399	15.7	399	15.7	399
Electric Heat Connection	AA	15.1	384	15.1	384	15.1	384	15.1	384	15.1	384	15.1	384	15.1	384
	CC	3.0	76	3.0	76	3.0	76	3.0	76	3.0	76	3.0	76	3.0	76
Primary Coil - Water Return	DD	21	533	21	533	21	533	21	533	21	533	21	533	21	533
	EE	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28	1.1	28
Primary Coil - Water Supply	BB	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424	16.7	424
	GG	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198	7.8	198
Preheat Coil - Water Return	CC	18.7	475	18.7	475	18.7	475	18.7	475	18.7	475	18.7	475	18.7	475
	HH	1.2	30	1.2	30	1.2	30	1.2	30	1.2	30	1.2	30	1.2	30
Preheat Coil - Water Supply	AA	15	381	15	381	15	381	15	381	15	381	15	381	15	381
	FF	4.7	119	4.7	119	4.7	119	4.7	119	4.7	119	4.7	119	4.7	119
Reheat Coil - Water Return	CC	23.2	589	23.2	589	23.2	589	23.2	589	23.2	589	23.2	589	23.2	589
	HH	4.2	107	4.2	107	4.2	107	4.2	107	4.2	107	4.2	107	4.2	107
Reheat Coil - Water Supply	AA	20.3	516	20.3	516	20.3	516	20.3	516	20.3	516	20.3	516	20.3	516
	FF	8.3	211	8.3	211	8.3	211	8.3	211	8.3	211	8.3	211	8.3	211
Fresh Air Damper Width	J	10	254	10	254	16	406	16	406	32	813	32	813	32	813

Decorative Wall Plate Dimensions

Figure 15: Wall Plate Dimensions and Kit Part Numbers

Unit Size	Inches (mm)		Kit Part Number	
	Wall Plate	Recommended Wall Opening	Front Discharge	Top Discharge
02	37.25 × 28.81 (946 × 732)	34 × 26 (864 × 660)	668114901	668114908
03	42.75 × 28.81 (1086 × 732)	40 × 26 (1016 × 660)	668114902	668114909
04	48.25 × 28.81 (1226 × 732)	45 × 26 (1143 × 660)	668114903	668114910
06	59.25 × 28.81 (1505 × 732)	56 × 26 (1422 × 660)	668114904	668114911
08	64.75 × 28.81 (1645 × 732)	62 × 26 (1575 × 660)	668114905	668114912
10	75.75 × 28.81 (1924 × 732)	72 × 26 (1828 × 660)	668114906	668114913
12	86.75 × 28.81 (2203 × 732)	84 × 26 (2134 × 660)	668114907	668114914



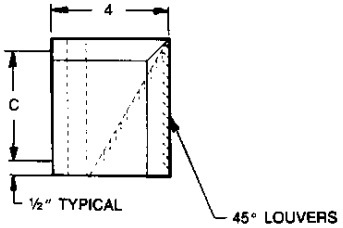
Wall Mounted (Four Side Overlap)

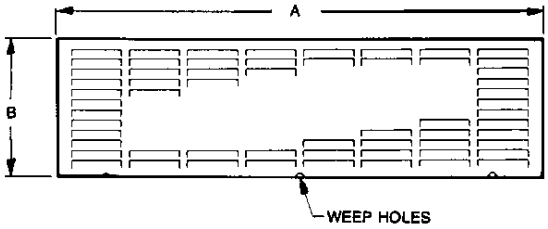
END VIEW

NOTE: Wall plate is designed for use with ThinLine vertical hideaway units mounted a minimum of 1.5 inches (38 mm) above the floor. Wall plates for Size 08, 10 and 12 units are in two sections. For installation instructions, see Daikin IM 1022

Fresh Air Intake Box Dimensions

Figure 16: Fresh Air Intake Box Dimensions





Style	Dimensions (Inches)		
	A	B	C
2 Brick × 2 Brick	16 ¾	4 ¾	3 ¾
4 Brick × 4 Brick	33 ½	4 ¾	3 ¾

.

PART 1: GENERAL

1.01 SECTION INCLUDES

A. Vertical Fan Coil

1.02 REFERENCES

A. Load Ratings and Fatigue Life for Ball Bearings.
B. Standards Handbook.
C. Laboratory Methods of Testing Fans for Rating Purposes.
D. Test Code for Sound Rating Air Moving Devices.
E. Test Methods for Louver, Dampers, and Shutters.
F. Room Fan Coil Unit.
G. Standard Practice for Operating Salt Spray Apparatus.
H. Motors and Generators.
I. National Electrical Code.
J. HVAC Duct Construction Standards - Metal and Flexible
K. Test for Surface Burning Characteristics of Building Materials.
L. Test Performance of Air Filter Units.
M. Standard for Heating and Cooling Equipment.
N. Test for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.03 SUBMITTALS

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
B. Product Data
   1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, and electrical characteristics and connection requirements.

1.04 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include instructions for lubrication and filter replacement.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Air Handler products specified in this section must show a minimum five years documented experience and complete catalog data on total product.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.
B. Accept products on site wrapped in protective cardboard wrap. Inspect for damage.
C. Store in a clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage.

1.07 ENVIORMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The following manufacturers are approved for use. No substitutions.
   1. Daikin Applied - 'ThinLine 3G' Fan Coil is the basis of design, including standard product features and all special features required per plans and specifications.
   2. ETI
   3. Greenheck

2.02 FAN COIL TYPE AND ARRANGEMENT

A. The fan coil shall be furnished as a draw-through cooling coil with a heating coil in preheat/reheat position.

2.03 CABINET

A. Unit shall be supplied with powder coat painted cabinet. Finish must meet ASTM B117 specifications (salt spray test).
B. Unit shall be supplied with a decorative wall plate with powder coat paint. Finish must meet ASTM B117 specifications (salt spray test).

2.04 GENERAL CONSTRUCTION

A. Hideaway

2.05 SUPPLY FAN

A. Supply fans shall be a DWDI forward-curved type. Fan assemblies including fan, motor and sheaves shall be dynamically balanced by the manufacturer on all three planes at all bearing supports. Manufacturer must ensure maximum fan RPM is below the first critical speed.
B. The complete fan assembly, including motor and main drain pan shall be easily removable.

C. Units shall be certified in accordance with the Room Fan Coil Unit certification program that is based on ARI Standard 440.

D. An ECM blower motor shall be provided on all units. Factory motor wiring shall be set for optimum fan performance. The unit shall be shipped at one fixed setting. The ECM motor shall utilize a permanent magnet rotor, which is connected to the shaft through resilient rings to absorb high frequency torque ripple. ECM motor shall be programmed for constant CFM or constant torque.

E. ECM blower motor shall be 3 speeds, single phase with means for proportional field adjustment of each speed.

2.06 ELECTRICAL

A. Supply fans shall be driven by permanent split-capacitor motors that are run-tested in the assembled unit and permanently lubricated. All motors shall have integral thermal overload protection with a maximum ambient operating temperature of 104°F. Motors shall be capable of starting at 78 percent of rated voltage and operating at 90 percent of rated voltage on all speed settings. Motors can operate up to 10 percent overvoltage.

B. Motor wires shall include a quick-disconnect motor plug.

2.07 COOLING AND HEATING

A. Cooling Coils

1. Cooling performance shall be as specified on the unit schedule.
2. Water coil fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Seamless copper tubes shall be mechanically expanded into the fins to provide a continuous primary-to-secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins. Coil casing shall be constructed of galvanized steel.
3. Water coils shall be provided with headers of seamless copper tubing with intruded tube holes to permit expansion and contraction without creating undue stress or strain. Coil connections shall be copper sweat connections with connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain connections shall be furnished on the coil connection, external to the cabinet. Vent connections provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point.
4. All steel parts exposed to moisture shall be galvanized.
5. Unit shall include a noncorrosive, ABS main drain pan, positively sloped in every plane and insulated with closed-cell insulation. The drain pan shall be designed to ensure no pooling of condensate water per ASHRAE 62.2.

B. Water/Steam Heating Coil

1. Heating performance shall be as specified on the unit schedule.
2. Coil fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Seamless copper tubes shall be mechanically expanded into the fins to provide a continuous primary-to-secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.
3. Coils shall be provided with headers of seamless copper tubing with intruded tube holes to permit expansion and contraction without creating undue stress or strain. Coil connections shall be copper sweat connections with connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain connections shall be furnished on the coil connection, external to the cabinet. Vent connections shall be provided at the highest point to ensure proper venting. Drain connections shall be provided at the lowest point.

2.08 VALVE PACKAGES

A. Fan coil units shall be provided with factory-installed valve / piping package(s)available for the primary and secondary coils. All piping packages shall be factory assembled and tested at 400 psig (2760 kPa) and re-tested for leak when factory soldered to the coil(s) at 300 psig (2069 kPa) Maximum Working Pressure of the piping package shall be 300 psig (2069 kPa).

B. The valve package shall be designed so that any condensation is directed into the secondary drain pan. With the secondary drain pan provided, insulation of the piping package is not required.

C. The valve package shall be provided with:

1. Interconnecting copper piping and shut-off ball valves.
2. Connecting supply and return lines to the unit. Four-pipe packages shall include a venting valve for the preheat or reheat coil.
3. A manual circuit setter in the supply water pipe. The circuit setter acts as both a flow-setting device and a shut-off valve. It allows water flow through the fan coil to be set quickly and accurately. The valve shall have a memory stop so that the correct setting can be found quickly.
4. An automatic circuit setter. The circuit setter includes a cartridge within the valve body that is sized to allow a specific flow rate through the coil. This valve sets flow through the coil without any action required by a system piping balancer.
5. P/T ports to measure the temperature or pressure drop across the valve. This pressure drop can be compared to factory-supplied curves that relate the pressure drop to a specific flow rate.

6. Unions at the coil connections.
7. A 20 mesh strainer on the supply side that is easily removed for cleaning, with a blow-off valve. The strainer shall have a pressure rating of up to 400 psig (2,758 kPa).
8. Isolating ball valve on the supply side.
9. Balancing flow valve (auto-fixed or manual) with isolating ball valve on the return.
10. Control valves in the supply water pipe.
11. Two-Way/Two-Position Valves that are fully open or fully closed in response to a line voltage (115 or 265-277 VAC) or a 24 VAC signal from the Daikin Applied thermostat or controller. Some means of relieving pump head pressure should be accounted for when two-way valves are selected. Normally open or normally closed valves are available. Both are spring-return.
12. Three-Way, Two-Position Valves that either allow full water flow through the coil or divert the flow through a bypass line. The valves respond to a line voltage (115 or 265-277 VAC) or to a 24 VAC signal from the Daikin Applied thermostat or controller. All standard three-way valves come with a fixed-balance orifice in the bypass line to compensate for flow balancing in the bypass position, eliminating the need for an additional balancing valve. Normally open or normally closed valves are available.
13. Two-Way Modulating Valves that modulate the water flow through the coil in response to a signal from the Daikin Applied thermostat or controller. All standard Daikin Applied modulating valves are three-wire floating point equal percentage valves. The modulating valves are factory mounted in the supply water pipe upstream of the coil.
14. Three-Way Modulating Valves that modulate the water flow through the coil in response to a signal from the Daikin Applied thermostat or controller. Three-way valves allow water that is directed through the coil to mix with water that is directed through the bypass line. This mixture exits through the leaving water pipe. All modulating valves are three-wire, floating-point equal percentage valves.

2.09 FILTERS

A. Filters shall be 1” (25 mm) throwaway. They shall be concealed from sight and easily removable.

2.010 MICROTECH CONTROLS

A. The unit control board shall be the main component of the system and shall contain the required inputs/outputs to operate a fan coil unit.

B. Unit controller inputs/outputs: The MicroTech controller will be microprocessor-based and have capabilities, performance, and memory sufficient to execute the various functions detailed in this specification. This document will not specify a type, a manufacturer, or a family of microcontrollers to be considered for use. However, at a minimum, the following features are deemed essential:

1. Analog Inputs: Room or Return Temperature & Timed Override Switch, Condensate Overflow, Set point Adjust, Fan Speed Switch, Heat/Cool/Auto Switch, Entering Water Temperature, Discharge Air Temperature.
2. Condensate Overflow. The presence of excessive condensate in the condensate drain pan is detected by a condensate sensor, which consists of a metal terminal ring mounted just below the top of the condensate pan. The analog input dedicated to condensate sensing must be capable of detecting the conductivity of water between the ring terminal and chassis ground. The conductivity trip point is 2.5 micro-ohms.
3. Set point Adjust. The Set point Adjust range will be interpreted by the base controller as an offset to the current temperature setpoint -5 to +5 degrees F or a range of 55 to 95 degrees F (software jumper selectable and scaled accordingly in software).
4. Heat/Cool/Auto - The Room Sensor shall incorporate a voltage signal that present different values to a single analog input which correspond to the unit operating mode functions detailed below. The room sensor is designed with specific voltage values to coincide with the software in unit control module.

   0.0v = Cool, 1.0v = Auto, 2.5v = Heat, 5.0v = Switch not present.
5. Fan Speed Switch - The Room Sensor shall incorporate a voltage signal that present different voltage values to a single analog input which correspond to the fan speed mode functions detailed below. The room sensor is designed with specific voltage values to coincide with the software in unit control module.

   0.0v = Auto, 1.0v = High, 2.0v = Medium, 3.0v = Low, 4.0v = OFF, 5.0v = Switch is not present.

6. Temperature Input. Sensing element in the MicroTech room temperature sensor is equivalent to NTC Thermistor – 10K ohms @ 25°C, 0.2°C interchangeability. Advanced Thermal Products – Curve Z. **NOTE:** The Timed (Tenant) Override switch will short out the Room sensor thermistor. Sensing range shall be 0 to 158°F with a resolution of 1°F and an accuracy of +/- 1.5°F Maximum Total Error.
7. Binary Inputs. 2 total (Freeze Fault Detection, Occupancy Sensor)

   The Freeze Fault Detection switch shall be sourced with 24VAC or DC, +/-20%. The binary input detection circuit shall be designhned such that a minimum of 7mA current flows through the external contacts. Unoccupied Mode: this binary input will detect the presence of an earth-grounded signal, which is supplied by an external, remote set of contacts.

C. Binary Outputs: 9 total (Fan Low Speed, Fan Medium Speed, Fan High Speed, Valve Output #1, Valve Output #2, Valve Output #3, or Electric Heat Stage 1, Valve Output #4 or Electric Heat Stage 2, 2 Position Damper, Room Sensor Status LED).
   1. Fan Speed Outputs -There are three fan speed outputs on baseboard. If all three outputs are de-energized, the fan motor is off. Only a single type (low, medium, high) of speed output shall be turned on when fan operation is required.

      Low Speed: this binary output is used to operate the fan at low speed. If this output is energized, the fan operates at low speed.

      Medium Speed: this binary output is used to operate the fan at medium speed. If this output is energized, the fan operates at medium speed.

      High Speed: this binary output is used to operate the fan at high speed. If this output is energized, the fan operates at high speed.
   2. Two-Position Damper Output: Binary output may be used to open a fresh air ventilation damper. If the output is de-energized, the damper is closed. If the output is energized, the damper is open.
   3. Room Sensor Status Output: Binary output may be used to energize and de-energize an indicator located on the room sensor. See Room Sensor Status Output Annunciation Table.

D. Automatic Fan speed selection.
   1. When the fan mode/speed switch is in the “Auto” position and capacity is required, the fan speed is determined automatically based on the amount of error from the respective heating or cooling on setpoint. If the room temperature error exceeds 4°F (2.22°C), the fan will be “forced on” in the highest available fan speed. Once the room temperature error falls below 3°F (1.67°C), the fan will no longer be “forced on” in the highest available fan speed. If the “Highest Speed Force On” is not active the fan will start at low speed, and fan speed changes are determined by whether the room temperature is above or below the effective controlling on setpoint.

E. Valve and Electric Heat Control
   1. The controller will be factory configurable for the following valve and electric heat control configurations.

Pipe Cooling Only Valve	2-Pipe Hydronic Cooling with 2-Position Valve
	2-Pipe Hydronic Cooling with Modulating Valve
	2-Pipe Hydronic Cooling with 2-Position Valve with Electric Heat
2-Pipe Heating Only Valve	2-Pipe Hydronic Heating with 2-Position Valve
	2-Pipe Hydronic Heating with Modulating Valve
	2-Pipe Hydronic Heating with 2-Position Valve with Electric Heat
	2-Pipe Hydronic Heating with Modulating Valve with Electric Heat
2-Pipe Changeover Valve	2-Pipe Hydronic Heating or Cooling Changeover with 2-Position Valve
	2-Pipe Hydronic Heating or Cooling Changeover with Modulating Valve
	2-Pipe Hydronic Heating or Cooling Changeover with 2-Position Valve with Electric Heat
	2-Pipe Hydronic Heating or Cooling Changeover with Modulating Valve with Electric Heat
4-Pipe, 2-Valves	4-Pipe Hydronic Heating and Cooling with 2-Position Valve
	4-Pipe Hydronic Heating and Cooling with Modulating Valve
Electric Heat Only	Electric Heat Only

F. Software Jumpers

1. Software Jumpers will be designed into the MicroTech Fan Coil controller and used to modify controller configuration to match equipment configuration. The values of the jumper's (zero or one) shall set valve operation, fan operation, etc. Software Jumper definitions are below.

Function	Bit/Binary Setting	Model/Feature
Service Test Mode	Byte 1:b0	0 = Normal Operation 1 = Service Test Mode
Continuous/Cycling Fan	Byte 1: b1	0 = Continuous Fan 1 = Cycling Fan
Setpoint Adjust – Temperature Range	Byte 1: b2	0 = Short Range (-5 – +5°F) 1 = Long Range (55 to 95°F)
IO Expansion Board Selection	Byte1: b3	0 = No IO Expansion Board Present 1 = Enable IO Expansion Board
Economizer Selection	Byte 1: b4	0 = No Economizer Present 1 = Enable Economizer Use
N.O./N.C. 2-Position Heating Valve	Byte 1: b5	0 = Normally Open Heating Valve 1 = Normally Closed Heating Valve
N.O./N.C. 2-Position Cooling Valve	Byte 1: b6	0 = Normally Open Cooling Valve 1 = Normally Closed Cooling Valve
2-Position/Modulating Valves	Byte 1: b7	0 = 2-position Hydronic Valves 1 = Modulating Hydronic Valves
Heating Selection	Byte 2: b1=0,b0=0 Byte 2: b1=0,b0=1 Byte 2: b1=1,b0=0	00 = No Electric Heating 01 = 1-Stage Electric Heat 10 = 2-Stage Electric Heat (Future) 11 = Not Valid
Hydronic Valves Selection	Byte 2: b4=0,b3=0,b2=0 Byte 2: b4=0,b3=0,b2=1 Byte 2: b4=0,b3=1,b2=0 Byte 2: b4=0,b3=1,b2=1 Byte 2: b4=1,b3=0,b2=0	000 = No Hydronic Valves 001 = 2-Pipe Heating Only 010 = 2-Pipe Cooling Only 011 = 2-Pipe Heat & Cool Changeover 100 = 4-Pipe Hydronic Heat & Cool
Fan Speed Selection	Byte 2: b6=0,b5=0 Byte 2: b6=0,b5=1 Byte 2: b6=1,b5=0	00 = 1-Speed (Uses: High) 01 = 2-Speed (Uses: Low, High) 10 = 3-Speed (Uses: Low, Medium, High)
Freeze Fault Detect Binary Input Selection	Byte 2: b7	0 = Disable Binary Input 1 = Enable Binary Input
Emergency Shutdown Binary Input Selection	Byte 3: b0	0 = Disable Binary Input 1 = Enable Binary Input
Dirty Air Filter Binary Input Selection	Byte 3: b1	0 = Disable Binary Input 1 = Enable Binary Input

G. Intelligent Reset: (Condensate Overflow Alarm). The "Fault Retry" feature helps to minimize nuisance trips of automatic lockouts caused by low-pressure or low temperature faults. This feature automatically clears these faults the first two times they occur within a 24-hour period and triggers an automatic lockout on the 3rd fault. The retry count is reset to zero every 24 hours. The fault retry feature does not apply to a high pressure fault – which causes an immediate lockout and requires a manual reset, or condensate overflow or brownout faults – which are self-clearing.

H. MicroTech Unit Controller Status LED: Remote LED boards will provide visual feedback.

1. Room Sensor Status LED: A 5VDC signal and shall operate as follows:

Condition	LED ON Time (sec)	LED OFF Time (sec)
Alarm Active: specific alarm determines number of flashes	0.3	0.3 (1.3 between cycles)
Calibration or Network Wink Activity	3.0	3.0
Service Test Mode	0.0	Continually
Unoccupied Mode	0.5	5.5
Standby Mode	5.5	0.5
Occupied, Bypass Mode	Continually	0.0

I. Warranty - The contractor shall provide one full year warranty for furnishing parts on site which becomes defective in normal operation, from the date of start-up by the manufacturer's representative, or first beneficial use of the unit.

1. Manufacturer's warranty time periods may or may not coincide with the contractor's time period of obligation, but where the manufacturer's warranty contains an expiration date based upon the equipment shipping date, the contractor shall not be relieved of responsibility for covering the full time periods listed above.
2. The contractor shall be responsible for all shipping expenses not included by the manufacturer, both to procure the replacement part, and to return any defective parts to the manufacturer, as they may require.
3. The contractor's replacement warranty obligation after the first year shall be limited to furnishing of replacement parts only, and shall not include repair labor costs or materials such as refrigerant, oils, dehydration, refrigerant- moisture dryers, air filters, or drive belts.
4. The owner shall be responsible for providing replacement filters beyond the spares provided in the original contract, and for filter installation labor.

PART 3: EXECUTION

3.01 INSTALLATION

A. The Thinline Fan Coil unit shall be installed per manufacturer's Installation & Maintenance Bulletin.

1. Selected field mounted kits shall be specified on the unit schedule and installed per manufacturer's instruction.

Daikin Applied Training and Development

Now that you have made an investment in modern, efficient Daikin equipment, its care should be a high priority. For training information on all Daikin HVAC products, please visit us at www.DaikinApplied.com and click on Training, or call 540-248-9646 and ask for the Training Department.

Warranty

All Daikin equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin Applied representative for warranty details. To find your local Daikin Applied representative, go to www.DaikinApplied.com.

Aftermarket Services

To find your local parts office, visit www.DaikinApplied.com or call 800-37PARTS (800-377-2787). To find your local service office, visit www.DaikinApplied.com or call 800-432-1342.

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to www.DaikinApplied.com.

Products manufactured in an ISO Certified Facility.

Job Name:	
Tag#	

Submittal Data Sheet

FTX09NMVJU / RX09NMVJU

0.75-Ton Wall Mounted Heat Pump System

Complete warranty details available from your local dealer or at www.daikincomfort.com. To receive the 12-Year Parts Limited Warranty, online registration must be completed within 60 days of installation. Online registration is not required in California or Quebec. *If product is installed in a commercial application, limited warranty period is 5 years.*

Indoor Specifications

	Cooling		Heating	
Airflow Rate (cfm)	**H**	**M**	**H**	**M**
	417	297	403	328
	L	**SL**	**L**	**SL**
	244	141	251	215
Sound (dBA) H / M / L / SL	43 / 36 / 30 / 19		43 / 36 / 29 / 25	
Dimensions (H × W × D) (in)	11-1/4 × 30-5/16 × 8-3/4			
Weight (Lbs)	18			

Outdoor Specifications

Compressor	Hermetically Sealed Swing Type			
Refrigerant	R-410A			
Factory Charge (Lbs)	1.54			
Refrigerant Oil	PVE (FVC50K)			
Airflow Rate (cfm)	Cooling		Heating	
	H	1,102	**H**	1,006
	SL	1,035	**SL**	918
Sound Pressure Level (dBA)	46 / 48			
Dimensions (H × W × D) (in)	21-5/8 × 26-9/16 × 11-3/16			
Weight (Lbs)	55			

Efficiency

Cooling		Heating	
SEER	19	**HSPF**	9.0
EER	12.5	**COP**	4.06

Performance

Cooling (Btu/hr)	
Rated (Min/Max)	9,000 (4,400 / 10,200)
Sensible @ AHRI	8,170
Moisture Removal gal/h	.32
Standard Operating Range	50°F – 115°F
Extended Operating Range*	-4°F - 115°F

Rated Cooling Conditions: Indoor: 80°F DB/67°F WB
Outdoor: 95°F DB/75°F WB

***With field settings and wind baffle**

Heating (Btu/hr)	
1:@ 47° Rated (Min/Max)	10,000 (4,400 / 13,000)
2: @ 17° Rated	6,000
3: @ 5°	4,470
Operating Range	5°F – 65°F

1: Rated Heating Conditions: Indoor: 70°F DB/60°F WB
Outdoor: 47°F DB/43°F WB

2: Rated Heating Conditions: Indoor: 70°F DB/60°F WB
Outdoor: 17°F DB/15°F WB

3: Heating Conditions: Indoor: 70°F DB/60°F WB
Outdoor: 5°F DB/5°F WB

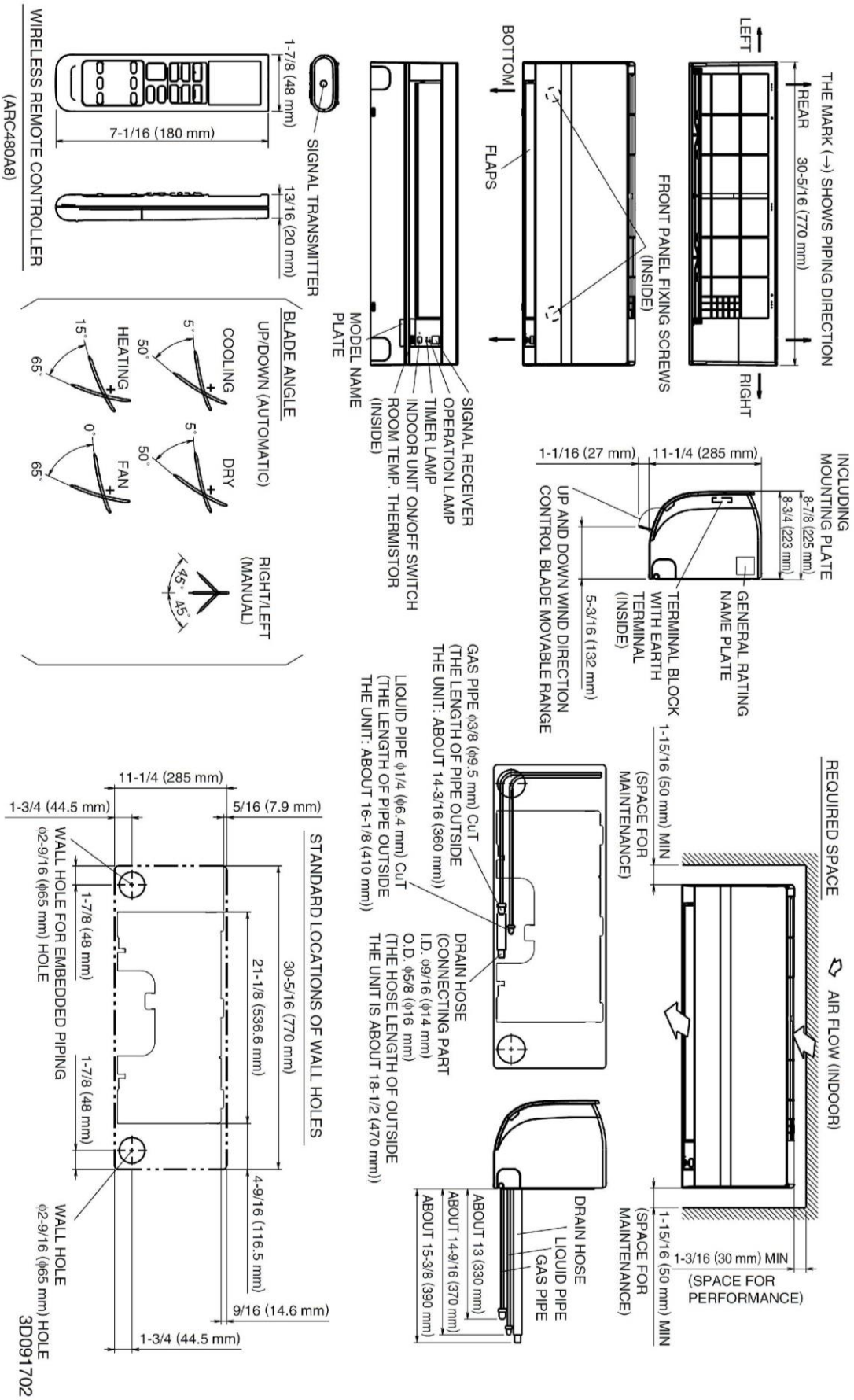
Electrical

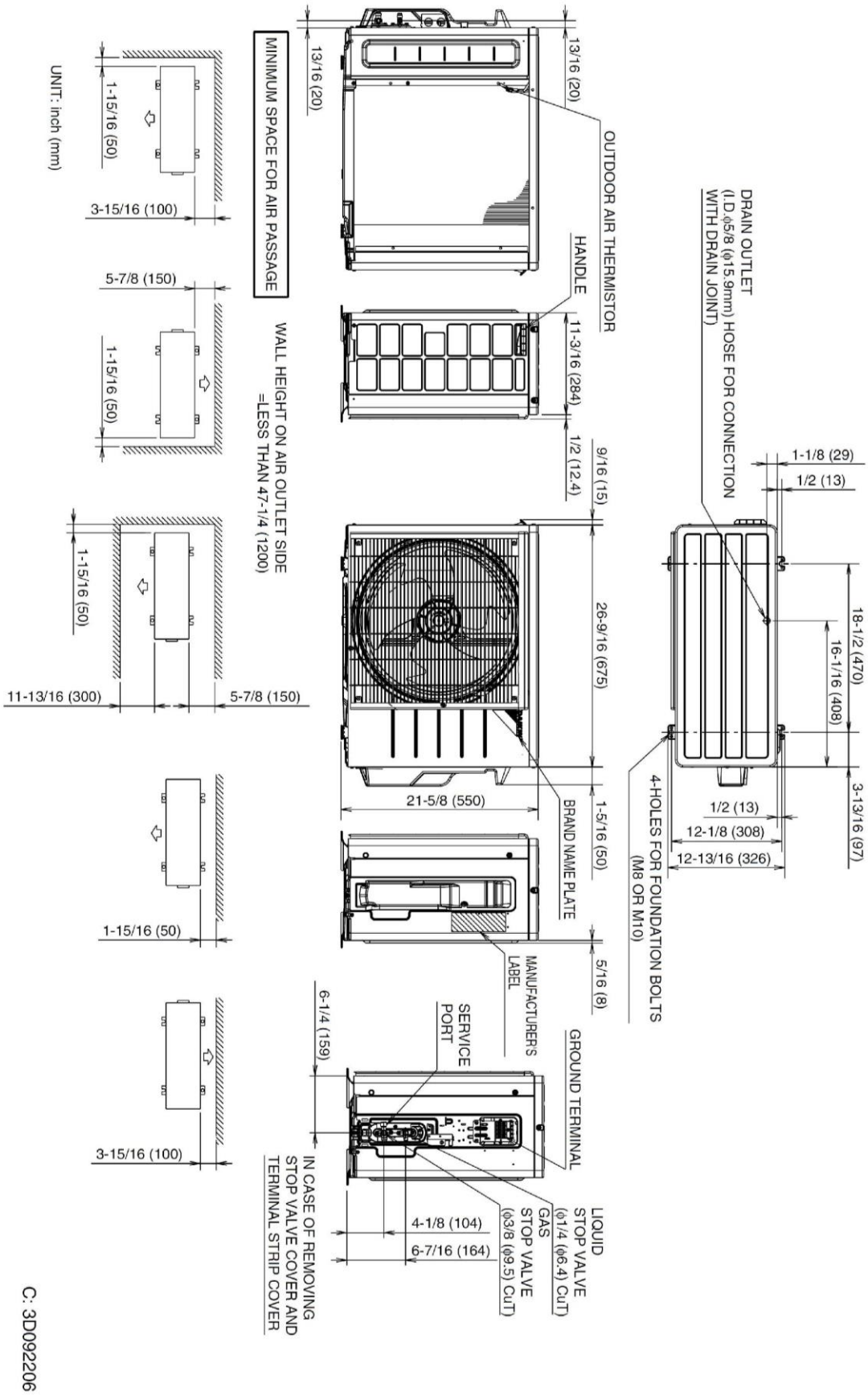
	208/60/1	230/60/1
System MCA	12.1	12.1
System MFA	15	15
Compressor RLA	8.5	8.5
Outdoor fan motor FLA	.13	.13
Outdoor fan motor W	14	14
Indoor fan motor FLA	.20	.20
Indoor fan motor W	21	21

MFA: Max. fuse amps **MCA**: Min. circuit amps (A) **FLA**: Full load amps (A)
RLA: Rated load amps (A) **W**: Fan motor rated output (W)

Piping

Liquid (in)	1/4
Gas (in)	3/8
Drain (in)	5/8
Max. Interunit Piping Length (ft)	65.625
Max. Interunit Height Difference (ft)	49.25
Chargeless (ft)	32.8
Additional Charge of Refrigerant (oz/ft)	.21


LEFT
RIGHT
REAR
THE MARK (→) SHOWS PIPING DIRECTION
30-5/16 (770 mm)
FRONT PANEL FIXING SCREWS
(INSIDE)
BOTTOM
FLAPS
INCLUDING MOUNTING PLATE
8-7/8 (225 mm)
8-3/4 (223 mm)
1-1/16 (27 mm)
11-1/4 (285 mm)
UP AND DOWN WIND DIRECTION CONTROL BLADE MOVABLE RANGE
5-3/16 (132 mm)
TERMINAL BLOCK WITH EARTH TERMINAL (INSIDE)
GENERAL RATING NAME PLATE
SIGNAL RECEIVER
OPERATION LAMP
TIMER LAMP
INDOOR UNIT ON/OFF SWITCH
ROOM TEMP. THERMISTOR (INSIDE)
MODEL NAME PLATE
SIGNAL TRANSMITTER
1-7/8 (48 mm)
7-1/16 (180 mm)
13/16 (20 mm)
WIRELESS REMOTE CONTROLLER
(ARC480A8)
BLADE ANGLE
UP/DOWN (AUTOMATIC)
COOLING
HEATING
DRY
FAN
RIGHT/LEFT (MANUAL)
45°
GAS PIPE ϕ3/8 (ϕ9.5 mm) CuT
(THE LENGTH OF PIPE OUTSIDE THE UNIT: ABOUT 14-3/16 (360 mm))
LIQUID PIPE ϕ1/4 (ϕ6.4 mm) CuT
(THE LENGTH OF PIPE OUTSIDE THE UNIT: ABOUT 16-1/8 (410 mm))
DRAIN HOSE (CONNECTING PART I.D. ϕ9/16 (ϕ14 mm) O.D. ϕ5/8 (ϕ16 mm) (THE HOSE LENGTH OF OUTSIDE THE UNIT IS ABOUT 18-1/2 (470 mm))
1-15/16 (50 mm) MIN
(SPACE FOR MAINTENANCE)
REQUIRED SPACE
AIR FLOW (INDOOR)
1-3/16 (30 mm) MIN
(SPACE FOR PERFORMANCE)
DRAIN HOSE
LIQUID PIPE
GAS PIPE
ABOUT 13 (330 mm)
ABOUT 14-9/16 (370 mm)
ABOUT 15-3/8 (390 mm)
STANDARD LOCATIONS OF WALL HOLES
11-1/4 (285 mm)
1-3/4 (44.5 mm)
5/16 (7.9 mm)
WALL HOLE FOR EMBEDDED PIPING
ϕ2-9/16 (ϕ65 mm) HOLE
1-7/8 (48 mm)
30-5/16 (770 mm)
21-1/8 (536.6 mm)
4-9/16 (116.5 mm)
9/16 (14.6 mm)
WALL HOLE
ϕ2-9/16 (ϕ65 mm) HOLE
3D091702


UNIT: inch (mm)
MINIMUM SPACE FOR AIR PASSAGE
WALL HEIGHT ON AIR OUTLET SIDE
=LESS THAN 47-1/4 (1200)
1-15/16 (50)
3-15/16 (100)
5-7/8 (150)
11-13/16 (300)
13/16 (20)
OUTDOOR AIR THERMISTOR
HANDLE
11-3/16 (284)
1/2 (12.4)
9/16 (15)
26-9/16 (675)
21-5/8 (550)
1-5/16 (50)
BRAND NAME PLATE
5/16 (8)
MANUFACTURER'S LABEL
SERVICE PORT
GROUND TERMINAL
6-1/4 (159)
4-1/8 (104)
6-7/16 (164)
LIQUID STOP VALVE (φ1/4 (φ6.4) CuT)
GAS STOP VALVE (φ3/8 (φ9.5) CuT)
IN CASE OF REMOVING STOP VALVE COVER AND TERMINAL STRIP COVER
DRAIN OUTLET (I.D.φ5/8 (φ15.9mm) HOSE FOR CONNECTION WITH DRAIN JOINT)
1-1/8 (29)
1/2 (13)
18-1/2 (470)
16-1/16 (408)
3-13/16 (97)
1/2 (13)
12-1/8 (308)
12-13/16 (326)
4-HOLES FOR FOUNDATION BOLTS (M8 OR M10)
C: 3D092206

Indoor Unit		
Included	**Part Number**	**Description**
	BRP072A43	Wireless Interface Adapter (S21 Adapter Included)
	BRC944B2-A08	Wired Remote Controller kit (Adaptor Required)
	BRCW901A08	Wired Remote Controller Cable – 25ft (Included in above kit)
	BRCW901A03	Wired Remote Controller Cable – 10ft
	KRP067A41	Adaptor for wired remote controller (09 & 12)
	KAF970A45	Titanium apatite photocatalytic air-purifying filter WITH frame
	KAF970A46	Titanium apatite photocatalytic air-purifying filter WITHOUT frame
	DACA-CP1-1	Inline Condensate Pump (Fits inside all Daikin wall & floor mount units)
	DACA-CP4-1	External Condensate Pump
	KRP928BB2S + KRP067A41	Interface Adaptor for DIII-NET

Outdoor Unit		
Included	**Part Number**	**Description**
	DACA-WB-1	Powder-Coated Wall-Mounted Bracket
	KPW937F4	Air direction adjustment grille (09 & 12)
	KEH067A41E	Daikin BMS Drain Pan Heater Small RX09,12 & RXN09,12
	KKG067A41	Back protection wire net (09 & 12)
	KKP937A4	Drain Plug for OD Unit

Rating Sheet

Air Reps

15860 SW Upper Boones Ferry Rd / Lake Oswego, OR 97035
Phone # - 503-517-9128 / Fax # - Fax Number
Rob Grace

Customer: Sell To Customer Company Name **Job: Barnes ES**
Quote #: 1000023 **Item #: 1**

12W23.75X30-10-5-W-Z-R

HC-1 cooling

No. Coils:	1	Coil Type:	Water - Cooling
Fin Height (In.):	23.75	Fin Mat./Thickness/Type:	Aluminum/ 0.008/ Waffle
Fin Length (In.):	30	Tube Mat./Wall/OD:	Copper/ 0.025/ 1/2 Inch
Air Flow/Coil (ACFM/SCFM)	2445 / 2400 (S)	Tube Spacing:	1.25 x 1.0825
ACFM/SCFM Velocity (fpm):	494.2 / 485.1	Tube Surface:	Smooth
EDB/EWB (°F):	80 / 64	Casing Material:	Galv
EWT (°F):	42	Fluid Type:	Water
GPM (Fluid Flow/Coil):	12	FF Inside*:	0
Rows/FPI:	5/10	FF Outside*:	0
Circuiting:	7/12/11/SE		

	Per Coil	Total All Coils
LDB/LWB (°F):	54.9 / 53.2	
Total Heat (BTUH):	75,405	75,405
Sensible. Heat (BTUH):	65,409	65,409
LWT (°F):	54.5	
Fluid Flow (GPM):	12.0	12.0
Fluid Press. Drop (Feet):	8.01	
Tube Velocity (fps):	3.16	
Reynolds number:	8,561.81	
Air Pressure Drop (in W.G.):	0.53	
Connection Size (In.):	1	
Approximate Fluid Volume (Gal) :	2.3	2.3

Uncrated, Dry Coil Weight: 93.4

Warning - Dropped Tubes (11) exceeds 5% of Total Tubes (95).
AHRI Limit - Dropped Tubes (11) exceeds 5% of Total Tubes (95).

Printed on 4/30/2020 using Total Package II; program version 7.22.2019.8 - DLL/Data 1.0.5.84/20190712.1

* (Hr*ft^2*°F/Btu) Fouling Factor Units

Rating Sheet

Air Reps

15860 SW Upper Boones Ferry Rd / Lake Oswego, OR 97035
Phone # - 503-517-9128 / Fax # - Fax Number
Rob Grace

Customer: Sell To Customer Company Name **Job: Barnes ES**
Quote #: 1000023 **Item #: 2**

12W23.75X30-10-5-W-Z-R

HC-1 heating

No. Coils:	1	Coil Type:	Water - Heating
Fin Height (In.):	23.75	Fin Mat./Thickness/Type:	Aluminum/ 0.008/ Waffle
Fin Length (In.):	30	Tube Mat./Wall/OD:	Copper/ 0.025/ 1/2 Inch
Air Flow/Coil (ACFM/SCFM)	2332 / 2400 (S)	Tube Spacing:	1.25 x 1.0825
ACFM/SCFM Velocity (fpm):	471.3 / 485.1	Tube Surface:	Smooth
EDB (°F):	55	Casing Material:	Galv
EWT (°F):	180	Fluid Type:	Water
GPM (Fluid Flow/Coil):	2	FF Inside*:	0
Rows/FPI:	5/10	FF Outside*:	0
Circuiting:	7/12/11/SE		

	Per Coil	Total All Coils
LDB (°F):	95.3	
Total Heat (BTUH):	104,440	104,440
Sensible. Heat (BTUH):	104,440	104,440
LWT (°F):	74.1	
Fluid Flow (GPM):	2.0	2.0
Fluid Press. Drop (Feet):	0.26	
Tube Velocity (fps):	0.53	
Reynolds number:	3,626.36	
Air Pressure Drop (in W.G.):	0.31	
Connection Size (In.):	1	
Approximate Fluid Volume (Gal) :	2.3	2.3

Uncrated, Dry Coil Weight: 93.4

Warning - Dropped Tubes (11) exceeds 5% of Total Tubes (95).
AHRI Limit - Dropped Tubes (11) exceeds 5% of Total Tubes (95).

Printed on 4/30/2020 using Total Package II; program version 7.22.2019.8 - DLL/Data 1.0.5.84/20190712.1

* (Hr*ft^2*°F/Btu) Fouling Factor Units

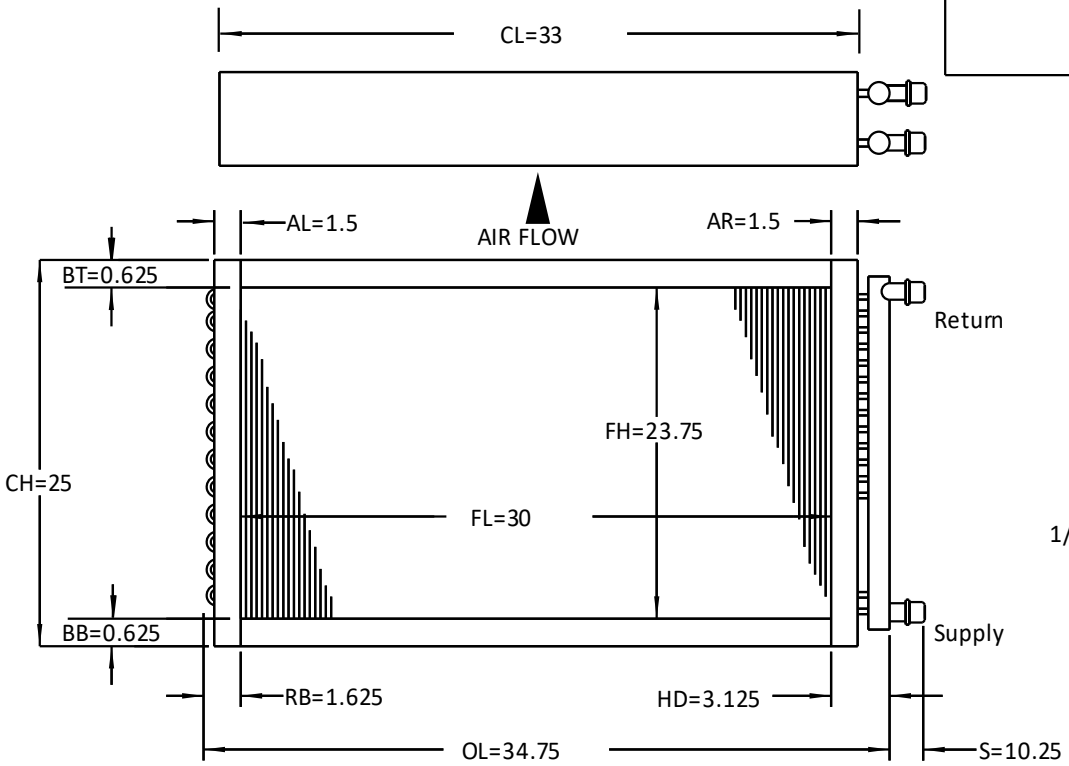
Sell To Customer Company Name

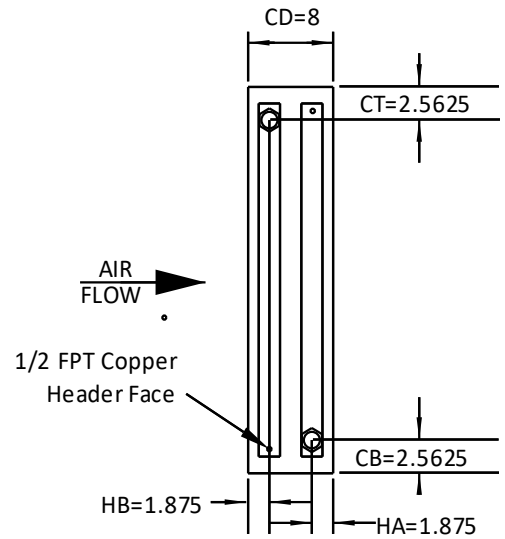
12W23.75X30-10-5-W-Z-R

Project: Barnes ES

Tag: HC-1 cooling

TP2 Number: 1000023 - 1 Qty(1)





Fin Type:	**Waffle**
Fin Material:	**Aluminum**
Fin Thickness:	**0.008**
Rows/FPI:	**5/10**
Circuiting:	**7/12/11/SE**
Tube Type:	**1/2 Inch / Copper / Smooth**
Tube Thickness:	**0.025**
Casing: Galv Gages: TS=18/ SP=18	

Connection Material:	**Copper**
Supply Connection Size:	**1**
Supply Header Dia.:	**1.125**
Return Connection Size:	**1**
Return Header Dia.:	**1.125**
Connection Type:	**MPT**
App. weight (Uncrated each) :	**93.4**

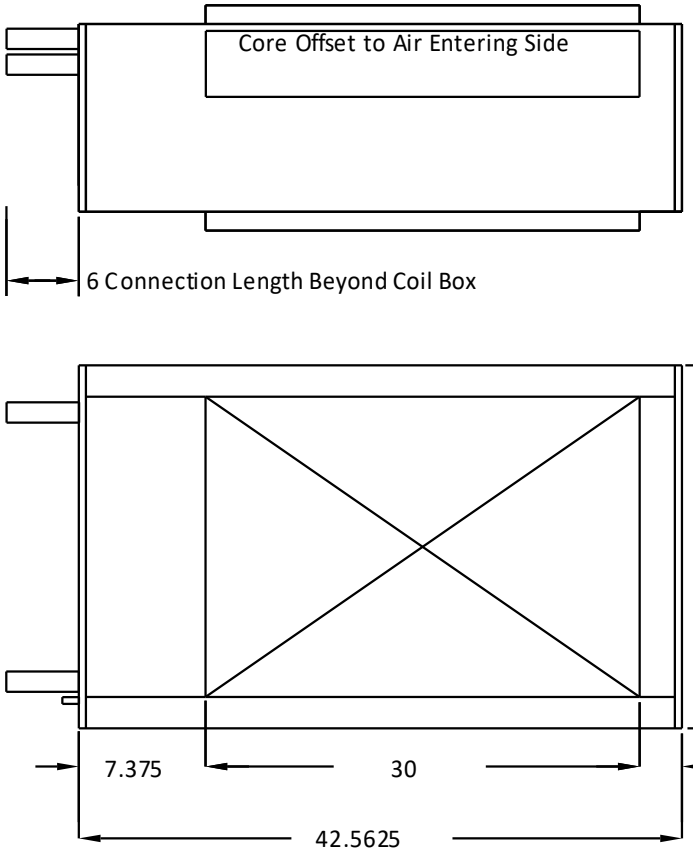
Approximate Fluid Volume (Gal) : 2.5
Tube Sheet Flange Standard
Side Plate Flange: Stacking

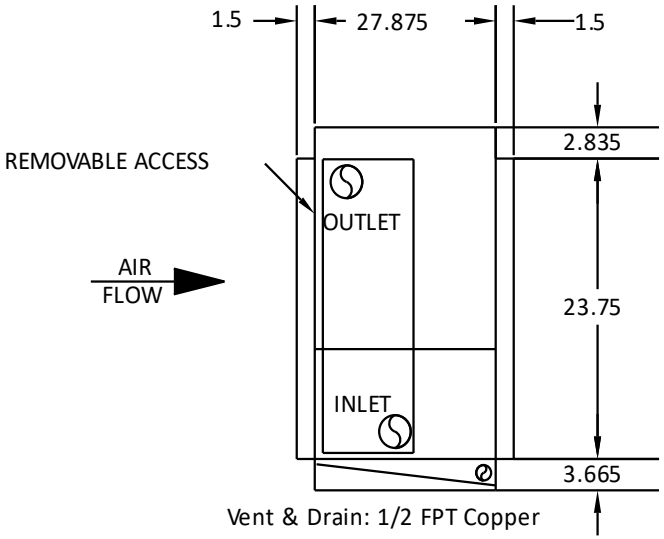
Date: 4/30/2020 12:57:07 PM **Program Version: 7.22.2019.8** **Sales Person: Rob Grace**

RAE Corporation
4492 Hunt St Pryor, OK 74361 Phone 918.825.7222 Fax 1.800.264.5329

CB-12W23.75X30-10-5-W-Z-R

Project: Barnes ES





Stainless Steel Drain Pan
Double Wall Construction
2" Insulation
Drain Pan Depth = 2.4775
App Weight = 334.2 lbs.

Rating Sheet

Air Reps

15860 SW Upper Boones Ferry Rd / Lake Oswego, OR 97035
Phone # - 503-517-9128 / Fax # - Fax Number
Rob Grace

Customer: Sell To Customer Company Name **Job: Barnes ES**
Quote #: 1000023 **Item #: 3**

12W15X15-10-5-W-J-R

HC-2 cooling

No. Coils:	1	Coil Type:	Water - Cooling
Fin Height (In.):	15	Fin Mat./Thickness/Type:	Aluminum/ 0.008/ Waffle
Fin Length (In.):	15	Tube Mat./Wall/OD:	Copper/ 0.025/ 1/2 Inch
Air Flow/Coil (ACFM/SCFM)	611 / 600 (S)	Tube Spacing:	1.25 x 1.0825
ACFM/SCFM Velocity (fpm):	391.2 / 384	Tube Surface:	Smooth
EDB/EWB (°F):	80 / 64	Casing Material:	Galv
EWT (°F):	42	Fluid Type:	Water
GPM (Fluid Flow/Coil):	4.5	FF Inside*:	0
Rows/FPI:	5/10	FF Outside*:	0
Circuiting:	2/30/0/SE/Two Tube Feed No Headers		

	Per Coil	Total All Coils
LDB/LWB (°F):	51.6 / 50.5	
Total Heat (BTUH):	23,065	23,065
Sensible. Heat (BTUH):	18,516	18,516
LWT (°F):	52.2	
Fluid Flow (GPM):	4.5	4.5
Fluid Press. Drop (Feet):	17.10	
Tube Velocity (fps):	4.14	
Reynolds number:	11,026.86	
Air Pressure Drop (in W.G.):	0.43	
Connection Size (In.):	0.75	
Approximate Fluid Volume (Gal) :	0.9	0.9

Uncrated, Dry Coil Weight: 37.4

Coil is NOT certified by AHRI.
Use of the Specified Fin Surface is NOT AHRI Certified.

Printed on 4/30/2020 using Total Package II; program version 7.22.2019.8 - DLL/Data 1.0.5.84/20190712.1

* (Hr*ft^2*°F/Btu) Fouling Factor Units

Rating Sheet

Air Reps

15860 SW Upper Boones Ferry Rd / Lake Oswego, OR 97035
Phone # - 503-517-9128 / Fax # - Fax Number
Rob Grace

Customer: Sell To Customer Company Name **Job: Barnes ES**
Quote #: 1000023 **Item #: 4**

12W15X15-10-5-W-J-R

HC-2 heating

No. Coils:	1	Coil Type:	Water - Heating
Fin Height (In.):	15	Fin Mat./Thickness/Type:	Aluminum/ 0.008/ Waffle
Fin Length (In.):	15	Tube Mat./Wall/OD:	Copper/ 0.025/ 1/2 Inch
Air Flow/Coil (ACFM/SCFM)	583 / 600 (S)	Tube Spacing:	1.25 x 1.0825
ACFM/SCFM Velocity (fpm):	373.1 / 384	Tube Surface:	Smooth
EDB (°F):	55	Casing Material:	Galv
EWT (°F):	180	Fluid Type:	Water
GPM (Fluid Flow/Coil):	0.5	FF Inside*:	0
Rows/FPI:	5/10	FF Outside*:	0
Circuiting:	2/30/0/SE/Two Tube Feed No Headers		

	Per Coil	Total All Coils
LDB (°F):	97.7	
Total Heat (BTUH):	27,695	27,695
Sensible. Heat (BTUH):	27,695	27,695
LWT (°F):	67.8	
Fluid Flow (GPM):	0.5	0.5
Fluid Press. Drop (Feet):	0.28	
Tube Velocity (fps):	0.46	
Reynolds number:	3,084.91	
Air Pressure Drop (in W.G.):	0.21	
Connection Size (In.):	0.75	
Approximate Fluid Volume (Gal) :	0.9	0.9

Uncrated, Dry Coil Weight: 37.4

AHRI Limit - Water velocity - Reynolds Number (3085) is less than 3100.
AHRI Limit - Number of Rows Specified (5) is outside of the range of 1 thru 4.

Printed on 4/30/2020 using Total Package II; program version 7.22.2019.8 - DLL/Data 1.0.5.84/20190712.1

* (Hr*ft^2*°F/Btu) Fouling Factor Units

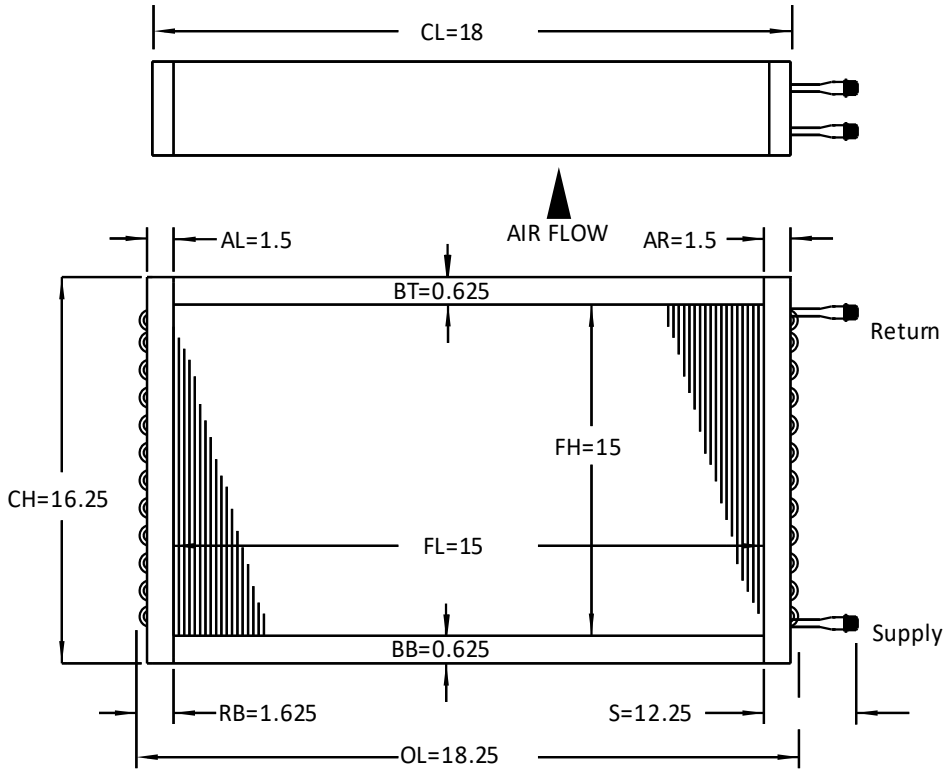
Sell To Customer Company Name

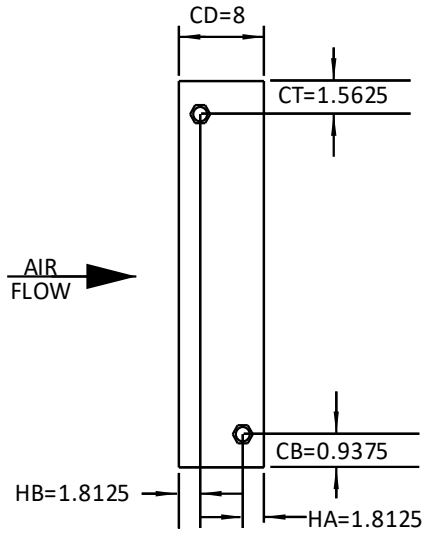
12W15X15-10-5-W-J-R

Project: Barnes ES

Tag: HC-2 cooling

TP2 Number: 1000023 - 3 Qty(1)





Fin Type:	**Waffle**
Fin Material:	**Aluminum**
Fin Thickness:	**0.008**
Rows/FPI:	**5/10**
Circuiting:	**2/30/0/SE/Two Tube Feed No Headers**
Tube Type:	**1/2 Inch / Copper / Smooth**
Tube Thickness:	**0.025**
Casing: Galv Gages: TS=18/ SP=18	

Connection Material:	**Copper**
Supply Connection Size:	**0.75**
Return Connection Size:	**0.75**
Connection Type:	**MPT**
App. weight (Uncrated each) :	**37.4**

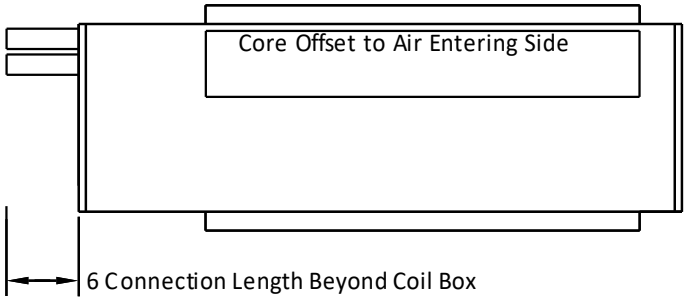
Approximate Fluid Volume (Gal) : 0.9
Tube Sheet Flange Standard
Side Plate Flange: Stacking

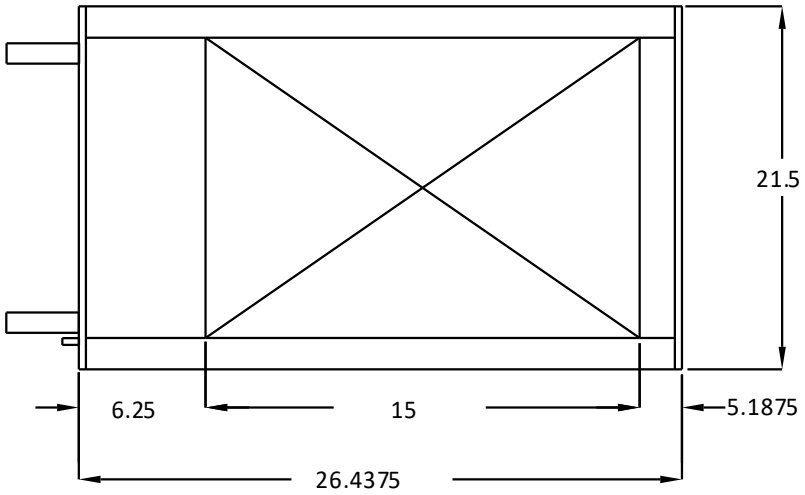
Date: 4/30/2020 12:58:03 PM **Program Version: 7.22.2019.8** **Sales Person: Rob Grace**

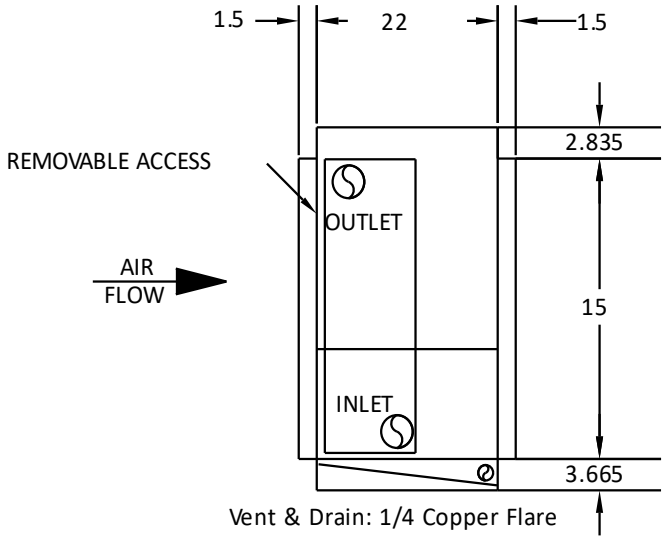
RAE Corporation
4492 Hunt St Pryor, OK 74361 Phone 918.825.7222 Fax 1.800.264.5329

CB-12W15X15-10-5-W-J-R

Project: Barnes ES







Stainless Steel Drain Pan
Double Wall Construction
2" Insulation
Drain Pan Depth = 2.4775
App Weight = 191 lbs.