SECTION 23 74 33

FACTORY FABRICATED PACKAGED HEATING AND COOLING MAKE-UP AIR UNITS SPECIFICATIONS

TAG: Modular Direct-Fired Heater

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes modular packaged heating and cooling units capable of supplying up to 100 percent outdoor air.

B. This section includes modular packaged heating and cooling units capable of supplying up to 80/20 recirculated outdoor air.

1.2 SUBMITTALS

A. The manufacturer assumes no liability for the use or results of use of this document. This specification is to be reviewed by the engineer to confirm requirements of the project and building codes are met.

B. As the manufacturer continues product development, it reserves the right to change design and specifications without notice.

1.3 QUALITY ASSURANCE

A. ETL-Listed to the American National Standard/CSA Standard for Gas Unit Heaters And Gas-Fired Duct Furnaces ANSI Z83.4, CSA 3.7.

B. ETL-Listed to the American National Standard/CSA Standard for Gas Unit Heaters And Gas-Fired Duct Furnaces ANSI Z83.4, CSA 3.7, and Z83.18. (Recirculating)

C. The Safety Control Board is ETL-Listed to standards UL 60730-2-9, UL 60730-1; CSA E60730-1, and CSA E60730-2-9.

1.4 WARRANTY

A. All units are provided with the following 2-year standard warranty.

B. This warranty shall not apply if:

1. The equipment is not installed by a qualified installer per the manufacturer's installation instructions shipped with the product.
2. The equipment is not installed in accordance with Federal, State, and Local codes and regulations.
3. The equipment is misused, neglected, or not maintained per the manufacturer's maintenance instructions.
4. The equipment is not operated within its published capacity.
5. The invoice is not paid within the terms of the sales agreement.

C. The manufacturer shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the 2-year warranty period, upon examination by the manufacturer, such part will be repaired or

replaced by the manufacturer at no charge. The buyer shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without manufacturer's prior authorization, and all returned equipment shall be shipped by the buyer, freight prepaid to a destination determined by the manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL ASSEMBLY

A. Unit(s) shall be factory assembled, tested and shipped as a complete packaged assembly, for indoor or outdoor mounting, consisting of the following specifications, deliver all capacities scheduled, and conform to design indicated herein. Alternate layouts or dimensional changes will not be accepted.

2.2 CABINET

A. Unit(s) shall be constructed of minimum 20-gauge G-90 galvanized steel riveted together via structural pop-rivets. All metal shall be CNC bent for precise assembly.

1. Base Construction: The base shall be constructed of galvanized steel for improved rigidity. Base shall be structurally reinforced to accommodate the blower assembly and burner.
2. Rigging Provisions: The unit shall have a structural base constructed of minimum 14-gauge G-90 galvanized steel, and include lifting points on all four sides.
3. Roof Construction: Roof shall be pitched to allow for proper drainage.
4. Exterior Wall Construction: All exterior walls shall consist of insulated galvanized steel construction.
5. Service Access Doors: All door jambs shall be gasketed around their perimeter. Doors may be mounted via spring actuated, stainless steel hinges with stainless steel rivets, and self-compressing stainless steel pad lockable latches or through removable sliding panels.
6. Each compartment shall have removable access panels to allow for ease of service and maintainability. Electrical cabinet doors shall be outfitted with manual pouches mounted on the door, along with wiring diagram attached to the indoor from the factory.

B. Entire interior and exterior casing shall be constructed of minimum 20-gauge G-90 galvanized steel with no painting, and shall have undergone a salt spray corrosion test as per ASTM B 117.

C. An observation port shall be located on the exterior of the unit for observation of the main flame and pilot flame. All controls, gas valves, modulating controls and electrical components shall be mounted within the burner vestibule. The burner vestibule shall be an integral part of the unit and not extend outside the exterior casing of the unit and not exposed to the main air stream.

D. When required, entire unit shall be Miami-Dade wind rated up to ±130psf per TAS 201, 202 & 203.

2.3 AIRFLOW CONFIGURATIONS

A. Unit shall be configurable for up (vertical) discharge through unit.

B. Unit shall be configurable for down (vertical) discharge through unit.

C. Unit shall be configurable for side (horizontal) discharge through the cabinet.

D. 100 percent outdoor air unit - The intake airflow configuration shall be through use of a fresh/outdoor Damper. 80/20 percent outdoor air unit - The intake airflow configuration shall be through use of a fresh/outdoor and return air damper.

1. Damper: Manufacturer shall provide and install on unit, when possible, a two-position, motor-operated damper with internal end switch to energize the blower-starter circuit, when damper is 80% open. Blades shall be a maximum of 6" wide 16-gauge G-90 galvanized steel and shall be made to guarantee the absence of noticeable vibration at design air velocities. Damper blades are to be mounted on friction-free synthetic bearings. Damper edges shall have PVC coated polyester fabric mechanically locked into blade edge. Jamb seals used are flexible metal, compression type. Dampers shall exceed AMCA Class 1A standard for low leakage.
2. Insulated Damper: Shall be thermally broken with an insulation R-value = 5.
3. Discharge Diffuser: Shall be constructed of G-90 galvanized steel with horizontal and vertical blades capable of four-way diffusion.
4. Actuator: A single direct drive damper actuator shall be used with spring return to ensure that the outdoor air section opens when not powered.

2.4 SUPPLY AIR BLOWER AND MOTOR

A. All supply fans shall be:

1. Direct Drive: Blower assembly shall consist of a centrifugal backward inclined, non-overloading wheel secured directly to a heavy-duty, ball bearing type motor via two set screws. The motor and wheel assembly shall be mounted to a heavy gauge galvanized steel frame. The motor shall be controlled by a variable frequency drive, allowing for variable airflow without the need of belts and pulleys.
2. Belt Drive: Blower(s) shall be forward-curved, centrifugal, Class I or II (depending on application requirements), double width, double inlet, constructed G-90 galvanized steel. Unit shall have a heavy-duty, solid-steel shaft. Belts shall be oil and heat resistant, non-static, grip-notch type. Drives shall be cast type, precision machined and keyed, and secured attached to the fan and motor shafts. Fan operating speed shall be factory set using adjustable pitch motor pulleys. All drives shall be a minimum of 2 grooves above 2 HP.

B. Blower Motor: Motor shall be a premium efficiency motor available as:

1. Open Drip Proof (ODP) motor driven by a Variable Frequency Drive.
2. Totally Enclosed Fan Cooled (TEFC) motor driven by a Variable Frequency Drive.
3. Electronically Commutated Motor (ECM).

C. Fans to be selected at or near efficiency peak. Check fan curves provided with job.

D. Blower and motor assembly shall be dynamically balanced. The entire blower and motor assembly shall be mounted on rubber vibration isolators. Wheels balanced as

per AMCA 204-96; Balance Quality and Vibration Levels for fans.

2.5 VARIABLE AIR VOLUME

A. VFD Manual - Blower will communicate with VFD. VFD will run at user defined static speed set through HMI.

B. VFD 0-10V - External 0-10V signal will be applied to MUA board for speed reference.

C. VFD Pressure - Differential pressure sensor located on MUA board. Blower will operate on differential set point option.

D. ECM Manual - PWM output signal for ECM. ECM speed set by user through HMI.

E. ECM 0-10V - External 0-10V signal will be applied to MUA board for speed reference.

F. ECM Pressure - Differential pressure sensor located on MUA board. Blower will operate on differential set point option.

2.6 SHAFTS AND BEARINGS

A. Shafts shall be precision ground and polished. Heavy duty, pre-lubricated bearings designed for, and individually tested, specifically for use in air handling applications.

2.7 COOLING SYSTEM

A. Cooling coil section shall be field bolted directly to discharge of blower section. Coil section to be designed to fit onto common curb with main unit.

B. Base of coil section to be constructed same as main unit with double pitch stainless steel drain pan for coil.

C. Casing and roof to be 20-gauge G-90 galvanized construction. Inside of section to be fully insulated with foil back insulation.

D. DX module to meet scheduled requirements.

E. Chilled water module to meet scheduled requirements.

2.8 HEATING SYSTEM

A. The gas burner shall be natural gas at an inlet-supply pressure to the unit of 7” w.c. minimum natural gas.

B. The gas burner shall be liquid-propane gas at an inlet-supply pressure to the unit of 11” w.c. minimum LP Gas.

C. Burner design shall be capable of using natural gas. Burner ignition shall be of the direct-spark design with remote flame sensing at the pilot assembly to detect the presence of flame in the burner.

D. Burner design shall be capable of using LP type gas. Burner ignition shall be of the direct-spark design with remote flame sensing at the pilot assembly to detect the presence of flame in the burner.

E. Direct-sparking sequence shall last through the complete duration of the trial for ignition period for guaranteed light-off. Each burner ignition module shall have LED indicators for troubleshooting and a set of exposed prongs for testing flame indication signal.

F. Unit should include self-adjusting burner profile plates, which ensure proper air velocity and pressure drop across the burner for clean combustion. Spring-loaded profile plates

should react to the momentum of the fresh air stream. No motors or actuators are needed to drive them, nor should they need to be manually set to a specific position. Units should be capable of variable air volume applications.

G. Each furnace shall have:

1. The burner shall have non-clogging, stainless steel combustion baffles attached to a ductile aluminum gas-supply section with no moving parts to wear out or fail. The burner shall be capable of 92% combustion efficiency with a maximum turndown ratio of up to 30 to 1.
2. Stainless steel Quick Seal Connection for gas connection.
3. Manifold and Input gas pressure gauges.
4. Inlet pressure gauge installed on the gas manifold (0-15#).
5. Inlet pressure gauge installed on the gas manifold (0-35” wc).
6. Inlet pressure gauge installed on the gas manifold (0-5#).
7. Inlet pressure gauge installed on the gas manifold (-5 to 15” wc).
8. High gas-pressure switches to disable heating if gas pressure is too high.
9. Low gas-pressure switch to disable heating if gas pressure is too low.
10. Proof-of-closure switch to energize the main-burner circuit only if the motorized gas valve is in a closed position.

2.9 FILTERS

A. Provide filters as part of unit. All filters shall be furnished and installed to meet the performance requirements set forth in the schedule and as specified under another section of this work.

B. The filters shall be 2" thick, aluminum mesh coated with super-filter adhesive, aluminum mesh with polyester foam or pleated throw away. Aluminum-mesh filters shall have aluminum frames with media to be layers of slit and expanded aluminum, varying in pattern to obtain maximum depth loading. Washable 2" filters shall be enclosed in two-piece, die-cut frame with diagonal supports. Frame shall be constructed of heavy-duty beverage board. Filter media is supported on the air leaving side by a metal grid.

C. All filters shall be installed on tracks for easy removal from the unit.

D. Shall be either insulated or non-insulated constructed of G-90 galvanized steel with filters supported by internal slides and with removable access panels.

E. Unit shall have an optional adjustable pressure differential sensor for the filter bank to alert in the event of a clogged filter.

2.10 ELECTRICAL

A. All controls shall be pre-wired and housed in an insulated electrical cabinet within the unit to protect against risk of condensation.

B. All direct fired and cooling only units shall be provided with single point electrical connection.

C. Unit shall be provided with a door safety switch that de-energizes the supply fan when the door is opened.

D. Units shall be provided with a factory mounted averaging intake air temperature sensor to allow for accurate intake temperature reading regardless of how the OA/RA dampers are positioned.

E. The electrical cabinet shall be outfitted with the following:

1. LED electrical cabinet service light with automatic activation upon door switch.
2. Color wiring schematics, laminated to the interior wall of the cabinet doors.
3. Factory mounted disconnect with unit bottom knockouts.
4. A LED backlit, LCD Human-Machine Interface (HMI) shall be mounted within the unit's control cabinet to allow for all set points configuration and refrigeration system monitoring at the unit.
5. Up to 4 additional space HMIs/wall mounted sensors are available. Verify wiring and/or CAT5/6 cables will be factory or field supplied.

- Optional space HMIs shall allow for full programming capabilities and are outfitted with integral temperature and humidity sensors. Additional HMIs shall be capable of being individually averaged for space temperature/humidity readings. All HMIs shall be wired using standard CAT5/6 cables.

- Optional wall mounted sensors are capable of measuring temperature, relative humidity, CO2, TVOCs (total volatile organic compounds), and absolute pressure. Powered by a MODBUS/ethernet cable (24 VDC).

2.11 CONTROLS

A. Unit shall be outfitted with a control board to allow for full control of the entire unit.

B. Provide onboard air flow switch located on MUA control board to sense air flow.

C. All unit controls shall be compatible with BACnet and LonWorks based building management systems.

D. All units shall be outfitted with CASLink cloud based monitoring, which monitors every point of operation. Provides configurable automated fault alert e-mails, and remote control capabilities.

E. Integrated cellular module to provide remote connection to monitoring services to view both real time and historical unit operation. Data shall be stored a minimum of 3 years on the cloud. Data sample rate shall be a maximum of 60 seconds.

F. Temperature Control System:

1. **Discharge Temp Control (Heating)** - Unit modulates the burner flame to accurately maintain the desired discharge temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using heating PID controls.
2. **Intake Temp Control (Cooling)** - Unit controls the cooling stage(s) based on intake temperature set point(s) and compensates for fluctuations in entering air temperature, air volume and % of OA.
3. **Space Temp Control (Heating)** - Unit modulates the burner flame (current supply in the case of electric heating) to accurately maintain the desired space temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using heating PID controls. Minimum and maximum discharge set points can be set to limit the temperature entering the space. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.
4. **Space Temp Control (Cooling)** - Unit controls the cooling stage(s) based on space temperature set point(s) and compensates for fluctuations in space air temperature, air volume and % of OA. An optional additional HMI or room thermostat can be used to determine the space temperature. In the case that no temperature sensor is available in the space, the unit will use an internal return temperature sensor.

G. Activation Controls:

1. **Activate Based on Intake (Heating)** - Unit will activate heating when the intake temperature drops below the desired set point.
2. **Activate Based on Intake (Cooling)** - Unit will activate Cooling when the intake temperature rises above the desired set point.
3. **Activate Based on Space (Heating)** - Unit will activate heating when the space temperature drops below the desired set point.
4. **Activate Based on Space (Cooling)** - Unit will activate cooling when the space temperature rises above the desired set point.
5. **Activate Based on Both (Heating)** - Unit will activate heating when the space AND intake temperature drop below the desired set point.
6. **Activate Based on Both (Cooling)** - Unit will activate cooling when the space AND intake temperature rise above the desired set point.
7. **Activate Based on Either (Heating)** - Unit will activate heating when the space OR intake temperature drops below the desired set point.
8. **Activate Based on Either (Cooling)** - Unit will activate cooling when the space OR intake temperature rises above the desired set point.
9. **Activate Based on Stat (Heating)** - Unit will activate heating when the space thermostat sends a 24V signal to W and G on the main control board. Unit will modulate to maintain a constant discharge heat set point.
10. **Activate Based on Stat (Cooling)** - Unit will activate cooling when the space thermostat sends a 24V signal to Y and G on the main control board. Unit will modulate to maintain a constant discharge cool set point.

2.12 CURBS

A. Curb shall be factory assembled and constructed of 20-gauge minimum, galvanized or aluminized steel.

B. Insulation options are 1” (R4.3) and 2” (R13).

C. Rivet together or fully welded, depending on curb size and length.

D. Plenum curb (option).

E. Factory take-offs are available with plenum curb options.

F. Miami Dade Certified (option).

G. Seismic Certified (option).

2.13 VARIABLE FREQUENCY DRIVES

A. Provide Variable Frequency Drive for speed control on all non-ECM direct drive supply fans.

B. All VFDs shall provide the following inherent protections:

1. Phase protection
2. Brownout protection
3. Overload/Overheat protection
4. Soft starts to protect bearings/hardware
5. Low & High voltage & over-torque protections

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine all areas and conditions under which packaged units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION

A. Install units in accordance with manufacturer's instructions, drawings, written specifications, manufacturer’s installation manual and all applicable building codes.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties. Install piping to allow service and maintenance.

B. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts.

C. Electrical connections conform to applicable requirements in Division 26 Sections.

3.4 SYSTEM START-UP

A. System start-up is performed by a factory-trained Service Technician.