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AIR-COOLED OUTDOOR AIR UNITARY EQUIPMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section includes design, performance, refrigerants, controls, and installation requirements for air-cooled packaged HVAC units.

1.2 DEFINITIONS:

A. Coefficient of Performance (COP) - Cooling: The ratio of the rate of heat removed to the rate of energy input in consistent units, for a complete refrigerating system or some specific portion of that system under designated operating conditions.

B. Energy Efficiency Ratio (EER): The ratio of net cooling capacity is Btu/h to total rate of electricity input in watts under designated operating conditions.

C. Heating Seasonal Performance Factor (HSPF) - Total heating output of heat pump during its normal annual usage period for heating in Btu/h divided by total electric energy input in watts during the same period.

D. Seasonal Energy Efficiency Ratio (SEER) - Total cooling output of an air conditioner during its normal annual usage period for cooling in Btu/h divided by total electric energy input in watts during the same period.

E. Air-Source Unitary Heat Pump: One or more factory made assemblies that normally include an indoor conditioning coil, compressor(s) and an outdoor refrigerant-to-air coil. These units provide both heating and cooling functions.

1.3 QUALITY ASSURANCE:

A. Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.

B. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

C. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

D. Unit shall be certified in accordance with ANSI Z21.47b/CSA 2.3b and ANSI Z83.8/CSA 2.6, Safety Standard Gas-Fired Furnaces.

E. Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

F. Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.

G. Unit shall be approved for use in and outside High Velocity Hurricane Zones (HVHZ) by the Florida Building Code (FL# 15031), when using the required steel rooftop curb and attachment methods. Maximum allowable lateral wind pressure is +100psf/-100psf. Maximum allowable uplift is +50psf/-50psf. Positive and negative required design pressures calculated for use with this system shall be determined by others on a job specific basis, in accordance with the governing code. Site specific pressures shall be less than or equal to the listed positive or negative allowable lateral wind design pressure and allowable uplift values for the product.

H. Comply with specification requirements for seismic restraints if applicable.

I. Scheduled performance represents the minimum acceptable level of performance.

J. Manufacturer shall provide for design of all refrigerant piping systems to include line sizing and refrigerant pressure requirements. Manufacturer shall provide all components as required for reliable operation in long line length applications. It shall be the responsibility of the manufacturer to identify if the maximum distance, both vertical and total distance exceeds the listed limits of the equipment and to provide equipment and components and equipment as required for reliable operation given the length of the refrigerant line runs.

1.4 SUBMITTALS

A. Submit in accordance with specifications.

B. Manufacturer's Literature and Data:
   1. Air-Source Unitary Equipment:
      a. Packaged units

C. Certification: Submit, simultaneously with shop drawings, a proof of certification that this product has been certified by AHRI.

D. Performance Rating: Submit catalog selection data showing equipment ratings and compliance with required cooling and heating capacities EER and COP values as applicable.

E. Performance information indicated in the equipment schedules shall represent the minimum level of acceptable performance. All submitted equipment shall meet or exceed the stated performance.

F. Submit wind load pressure calculations for exterior components to demonstrate compliance with the prevailing codes at the time of permit. This shall include unit casing calculations, unit to curb attachment calculations and curb to roof calculations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be shipped with doors screwed shut and outdoor air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.

B. Follow Installation, Operation, and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation, and Maintenance manual.

1.6 WARRANTY

A. Manufacturer shall provide a limited “parts only” warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for Installation, Operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.

PART 2- PRODUCTS - UNITARY EQUIPMENT (PACKAGED SYSTEMS)

A. Products shall be provided by the following manufacturers:
   1. AAON

B. Substitute equipment may be considered for approval that includes at a minimum:
   1. UNIT OPERATING WEIGHT MUST BE UNDER 1,500 LBS.
   2. R-410A refrigerant
   3. Variable capacity compressor with 10-100% capacity control
   4. Direct drive supply fans
   5. Double wall cabinet construction
   6. Insulation with a minimum R-value of 13
   7. Stainless steel drain pans
   8. Hinged access doors with lockable handles
   9. All other provisions of the specifications must be satisfactorily addressed

C. General Description
   1. Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, reheat coil, gas heaters, and unit controls.
   2. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment’s literature pocket.
   3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
   4. Unit components shall be labeled, including refrigeration system components and electrical and controls components.
   5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
   6. Installation, Operation, and Maintenance manual shall be supplied within the unit.
   7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment’s hinged access door.
   8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment’s hinged access door.

D. Construction
   1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
   2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.
   3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture

accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.

4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers, cooling coils, reheat coil, heaters, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
10. Unit shall include lifting lugs on the top of the unit.

E. Electrical
1. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
2. Unit shall be provided with a factory installed and factory wired 115V, 13 amp GFI outlet disconnect switch in the unit control panel.
3. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.
4. Unit shall be provided with remote stop/start terminals which require contact closure for unit operation. When these contacts are open the low voltage circuit is broken and the unit will not operate.

D. Supply Fans
1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

E. Cooling Coils
1. Evaporator Coils
   a. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.

b. Coils shall be 6 row high capacity.
c. Coils shall be hydrogen or helium leak tested.
d. Coils shall be furnished with factory installed expansion valves.

F. Refrigeration System
1. Unit shall be factory charged with R-410A refrigerant.
2. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.
4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
5. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.
6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter driers.
7. Unit shall include a variable capacity scroll compressor on the refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.
8. Refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

G. Condensers
1. Air-Cooled Condenser
a. Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
b. Coils shall be designed for use with R-410A refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes.
c. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
d. Coils shall be hydrogen or helium leak tested.

H. Gas Heating
1. Stainless steel heat exchanger furnace shall carry a 25 year non-prorated warranty, from the date of original equipment shipment from the factory.
2. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.
3. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
4. Unit shall include a single gas connection and have gas supply piping entrances in the unit base for through-the-curb gas piping and in the outside cabinet wall for across the roof gas piping.

5. Natural gas furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment. 90 MBH, 150 MBH, 195 MBH, 210 MBH, 270 MBH, 292.5 MBH, 390 MBH, 540 MBH and 800MBH gas heating assemblies shall be capable of operating at any firing rate between 100% and 30% of their rated capacity. 405 MBH and 810 MBH gas heating assemblies shall be capable of operating at any firing rate between 100% and 20% of their rated capacity. 1080 MBH and 1600 MBH gas heating assembly shall be capable of operating at any firing rate between 100% and 15% of its rated capacity. 2400 MBH gas heating assembly shall be capable of operating at any firing rate between 100% and 10% of its rated capacity.

I. Filters
   1. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the cooling coil.
   2. Unit shall include 1 inch aluminum mesh pre filters upstream of the outdoor air opening.

J. Outdoor Air/Economizer
   1. Unit shall include 100% motor operated outdoor air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge and end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring return, 2 position actuator. Unit shall include outdoor air opening bird screen and outdoor air hood.

K. Controls
   1. Factory Installed and Factory Provided Controller
      a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of stand alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
      b. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
      c. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
      d. Makeup Air Controller
         1. Unit shall modulate cooling with constant airflow to meet ventilation outdoor air loads. Cooling capacity shall modulate based on supply air temperature.
         2. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet outdoor air humidity loads and prevent supply air temperature swings and overcooling of the space.
         3. Unit shall modulate heating with constant airflow to meet ventilation outdoor air loads. Heating capacity shall modulate based on supply air temperature.
            e. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with

connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network.

L. Accessories
   1. Unit shall be provided with a smoke detector sensing the supply air of the unit, wired to shut off the unit's control circuit.
   2. Unit shall be provided with a safety shutdown terminal block for field installation of a smoke detector which shuts off the unit's control circuit.

M. Curbs
   1. Provide a 24" tall spring isolated, acoustically lined curb equal to TECO Stealth Curb.

2.1 OPERATING CONTROLS

A. Low voltage, adjustable duct thermostat to control heating and cooling in sequence with delay between stages, compressor and supply fan to maintain temperature setting. Include space-mounted controller with system selector switch (off-heat-auto-cool) and fan control switch (auto-on). Thermostats shall be equal to the Honeywell VisionPRO IAQ series with integral 7 day programming and humidistat. System shall be capable of operating in dehumidification mode regardless of space temperature when humidity levels exceed setpoints.

PART 3- EXECUTION

3.1 INSTALLATION

A. Install electrical and control devices furnished by the manufacturer but not specified to be factory mounted. All electrical work shall comply with the electrical specifications

B. Perform startup checks according to manufacturer's written instructions.

C. Provide factory start-up for all units. Provide Project Engineer and Commissioning Agent with copies of the factory start-up sheets.

D. Test controls and demonstrate its compliance with project requirements. Replace damaged or malfunctioning controls and equipment and retest the equipment to the satisfaction of the Project Engineer and Commissioning Agent.

E. Provide services of manufacturer's technical representative for four hours to instruct owner personnel in operation and maintenance of units.

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