

SECTION 23 75 10 - PACKAGED OUTDOOR DX AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes packaged outdoor units and accessories.

1.3 SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. (ERU-2 only) Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 210/240 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.
- B. (All other units) 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.
- C. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
- D. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
- E. Unit Seasonal Energy Efficiency Ratio (SEER) 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 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.

PACKAGED OUTDOOR DX AIR-HANDLING UNITS

- G. Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.
- H. Source Limitations: Obtain all Packaged Outdoor Units from a single manufacturer, regularly engaged in production of the required components.

1.5 WARRANTY

- A. Provide a written warranty in which the contractor agrees to repair or replace any unit component that fails for a period of one year from the date of Substantial Completion.
- B. In addition to the above, the unit manufacturer shall provide the following warranties:
 - 1. A 5-year warranty for the unit compressors. The warranty period will begin at the date of shipment and will not include labor.
 - 2. A 5-year warranty for gas furnace heat exchangers: The warranty period will begin at the date of shipment and will include materials and labor.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: Two sets of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide units manufactured by Aeon, Inc. Subject to review, equipment meeting the full requirements of the specifications and project installation limitations (i.e., physical size and weight) and manufactured by one of the following will be considered by alternate bid:
 - 1. Trane.
- B. Manufactures other the basis of design manufacturer shall carefully review the contract drawings, prior to bidding to verify the equipment will meet all requirements, including installation clearances, electrical power, and structural support. Any change in cost required for alternate bid manufacturers shall be included in the alternate bid price.

2.2 DESCRIPTION

- A. Packaged units shall include DX compressors & evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, hot-gas reheat coil, exhaust fans, energy recovery wheels, and unit controls. All units shall contain heating with either hot water hydronic coils of natural gas furnaces. Refer to the following specifications and the contract drawings for all options and accessories required for all units.

- B. Unit shall be factory assembled and tested including leak testing of the 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 controls compartment's literature pocket.

2.3 CONSTRUCTION

- A. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
- B. 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.
- C. 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, reduces heat transfer through the panel, and prevents exterior condensation on the panel.
- D. 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.
- E. 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 210/240. 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.
- F. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
- G. Access to filters, dampers, cooling coils, reheat coil, energy recovery wheels, 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.
- H. 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.
- I. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
- J. 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.
- K. Unit shall include lifting lugs on the top of the unit.
- L. Unit base pan shall be provided with 1/2-inch-thick foam insulation.

PACKAGED OUTDOOR DX AIR-HANDLING UNITS

- M. (RTU-1 only) Unit base shall be fabricated of 1-inch-thick double wall, impact resistant, rigid polyurethane foam panels.

2.4 FANS

A. Supply Fans:

1. Unit shall include direct drive, unhooded, 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.

B. Exhaust Fans (where indicated on drawings schedules):

1. Exhaust dampers shall be sized for 100% relief.
2. Fans and motors shall be dynamically balanced.
3. Unit shall include barometric relief dampers.
4. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
5. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn lockable handles.
6. Unit shall include belt driven, unhooded, backward curved, plenum exhaust fans.
7. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

2.5 COOLING COMPONENTS

A. Evaporator Coils:

1. 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.
2. Coil shall be standard capacity.
3. Coils shall be 6 row high capacity.
4. Coils shall be hydrogen or helium leak tested.
5. Coils shall be furnished with factory installed expansion valves.

- B. (RTU-2, ERU-2, and ERU-4) Unit shall include a variable capacity scroll compressor on the refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.

- C. (RTU-3, ERU-1, 3, 5, 6, 7, 8, 9, 10, 11, and 12) Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity, and unit shall include a two-stage compressor on the lag refrigeration circuit that shall modulate between two capacity settings, 67% and 100%.

- D. Unit shall include factory provided and installed compressor sound jackets on all compressors.

- E. Refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allows the unit to have a dehumidification

PACKAGED OUTDOOR DX AIR-HANDLING UNITS

mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

- F. Reheat coil shall be multi-pass and fabricated from aluminum microchannel tubes. The reheat coil shall be piped in parallel with the condensing unit.
- G. Each capacity stage shall be equipped with a 5 minute off delay timer to prevent compressor short cycling.
- H. Each additional capacity stage shall be equipped with an adjustable, 20 second delay timer to prevent multiple capacity stages from starting all at once.
- I. Unit shall be provided with an adjustable compressor lockout.
 - 1. Coils shall be designed for use with R-410A refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes.

2.6 HYDRONIC HEATING COIL

- A. Coils shall be certified in accordance with AHRI Standard 410 and be hydrogen or helium leak tested.
- B. Coils shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
- C. Coils shall be located in the reheat position downstream of the cooling coil.

2.7 GAS HEATING

- A. Where indicated provide units with natural gas heating.
- B. High Turndown Modulating 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. Gas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet. Heat trace shall be included on the condensate drain.

2.8 REFRIGERATION SYSTEM

- A. Unit shall be factory charged with R-410A refrigerant. Compressors shall be scroll type with thermal overload protection and independently circuited. 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 insulated panels to prevent the transmission of noise outside the cabinet. 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. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control. 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 factory installed liquid line filter driers. Unit shall include 2 stages of capacity control.

PACKAGED OUTDOOR DX AIR-HANDLING UNITS

- B. All units shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity. Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a dehumidification 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. Where the unit(s) is to be furnished with a single compressor the compressor shall be a variable capacity scroll compressor.

2.9 AIR-COOLED CONDENSER

- A. The Condenser fans shall be vertical discharge, axial flow, direct drive fans. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum (copper) fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled. Coils shall be designed for a minimum of 10-degree F of refrigerant sub-cooling. Coils shall be helium leak tested.

2.10 FILTERS

- A. Unit shall include 4-inch thick, pleated panel filters with an ASHRAE MERV rating of 13, upstream of the cooling coil. Unit shall also include 2-inch thick, pleated panel pre filters with an ASHRAE MERV rating of 8, upstream of the 4-inch standard filters.
- B. Unit shall include 1 inch aluminum mesh pre filters upstream of the outside air opening.
- C. Unit shall include a clogged filter switch.

2.11 OUTDOOR AIR / ECONOMIZER

- A. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum 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 DDC actuator. Unit shall include outside air opening bird screen and outside air hood. Unit, except for horizontal series, shall also include barometric relief dampers.
- B. Outdoor Airflow Monitoring
 - 1. Provide an outside airflow measuring station on RTU-1, 2, and 3.
 - 2. Provide an outside airflow measuring station and airflow signal processor that communicates directly with the factory provided control systems or can also be used with customer provided controls with a 0-10 VDC output signal. LonTalk and BACnet may also be available for some applications. Monitoring size is dependent on the cfm.

2.12 ENERGY RECOVERY

- A. Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.
- B. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.

PACKAGED OUTDOOR DX AIR-HANDLING UNITS

- C. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.
- D. Hinged service access doors shall allow access to the wheel.
- E. Aluminum Energy Recovery Wheels
 - 1. Unit shall contain a factory mounted and tested monolithic aluminum energy recovery wheel with an inverter duty motor and a durable segmented link drive belt composite. Wheel frame shall be constructed with prime G90 hot-dip galvanized steel tested for corrosion resistance of 400 hours of salt spray.
 - 2. Total energy recovery wheels shall be made of corrugated aluminum with a 3A molecular sieve desiccant coating. Coated segments shall be cleanable with hot water or compressed air without degrading the latent recovery.

2.13 ELECTRICAL POWER CONNECTION

- A. Unit shall have a 5k AIC SCCR.
- B. Unit shall be provided with a factory installed and factory wired 115V, 12-amp GFI outlet disconnect switch in the unit control panel.
- C. Unit shall be provided with power block for connecting power to the unit.
- D. 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.

2.14 CONTROLS

- A. Unit shall be provided with a low voltage terminal strip for field supplied DDC controls By Others.
- B. Isolation relays shall be factory installed.

2.15 ROOF CURBS

- A. Refer to drawings for the type of curb required for the specified roofing system and the required curb height. Furnish curbs with an integral metal cant, stepped integral metal cant raised the thickness of roof insulation or as required to suit the details.
- B. Curbs shall to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit.
- C. Solid bottom curb shall be factory assembled and fully lined with curb rated 1-inch fiberglass insulation and include a wood nailer strip. Curbs shall be provided with a factory assembled and mounted 1" deflection spring vibration isolation rail assembly.

PART 3 - EXECUTION

3.1 SHIPPING

- A. Protect equipment during shipment and delivery, all units shall be completely stretch or shrink wrapped. Wrap shall be a minimum of 7 mil plastic. Pipe ends and pipe connection holes in the casing shall be capped or plugged prior to shipment.

3.2 ON-SITE STORAGE

- A. If equipment is to be stored for a period of time prior to installation, the installing contractor shall remove all stretch or shrink wrap from units upon receipt to prevent unit corrosion and shall either place the units in a controlled indoor environment or shall cover the units with canvas tarps and place them in an area not subject to rain and/or snow.

3.3 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSTALLATION

- A. Roof curb: provide a roof curb for all roof mounted units. Install the roof mounted air handling unit(s) on the roof curb immediately after the curb is installed. If immediate installation is not performed provide temporary watertight covering, for all curb openings, consisting of minimum $\frac{3}{4}$ " exterior grade plywood and watertight rubber or plastic cover.
- B. When spring isolation roof curbs are specified, the installing contractor is required to verify factory installed tie-down bolts, located at the fan / motor isolation base(s), remain in a locked down condition.
- C. At the direction of the Owner's Representative the contractor shall remove and dispose of filters from the respective units and install a new filter obtained from the Extra Materials required in Part 1 of this specification. If additional filter installation is not required, forward filters to the owner as extra stock, at the completion of the project.

3.5 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- B. Install piping adjacent to RTUs to allow service and maintenance. Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

PACKAGED OUTDOOR DX AIR-HANDLING UNITS

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

3.6 FIELD QUALITY CONTROL

- A. Engage a factory service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections and to provide start-up service. Unit or components will be considered defective if unit or components do not pass tests and inspections. Prepare test and inspection reports.

3.7 CLEANING

- A. After completing system installation, testing, adjusting, and balancing and after completing startup service, clean rooftop units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.8 DEMONSTRATION AND STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service and to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 23 75 10