

SECTION 15732CPPR – PACKAGED AIR CONDITIONING UNITS

PART 1. GENERAL

- 1.1 This section includes rooftop, sideshot, indoor, and make-up air packaged units.
- 1.2 Related Sections¹:
 - A. Section 01351C - Brown University Standard for Narragansett Electric Company Rebate Program
 - B. Section 15002C – HVAC Design Criteria.
 - C. Section 15070 - Mechanical Sound, Vibration, and Seismic Control: Product requirements for vibration isolators for placement by this section.
 - D. Section 15080 - Mechanical Insulation: Product requirements for insulation for placement by this section.
 - E. Section 15120 - Piping Specialties: Product requirements for meters, gages and steam traps for placement by this section.
 - F. Section 15180 - Heating and Cooling Piping: Product requirements for piping connections to air handling units.
 - G. Section 15750 - Humidity Control Equipment: Product requirements for humidifiers and dehumidifiers for placement by this section.
 - H. Section 15820 - Duct Accessories: Product requirements for flexible duct connections for placement by this section.
 - I. Section 15900PPRS – HVAC/BAS
 - J. Section 15910 - Direct Digital Controls: Controls remote from unit.
 - K. Section 15920 - Pneumatic Controls: Product requirements for pneumatic controls to interface with air handling units.
 - L. Section 15940 - Sequence of Operation: Sequences of operation applying to units in this section.
 - M. Section 16150 - Wiring Connections: Execution requirements for electric connections specified by this section.

¹ Listing of related sections is for convenience and is not all-inclusive. Affected sections or drawings where specific design requirements are to be specified, or related sections where applicable Brown Guidelines may appear, are indicated.

- N. Section 16225 - Motors: Product requirements for electric motors for placement by this section.
 - O. Section 16265 - Variable Frequency Controllers: Variable frequency controllers.
- 1.3 Show Manufacturer's recommended service clearances and pull clearances as shaded areas on mechanical plans.

PART 2. PRODUCTS

2.1 Manufacturers

- A. Carrier
- B. Trane
- C. York
- D. No substitutions

2.2 Equipment must be capable of housing and moving air through minimum MERV 7 air filters. See Section 15002C – HVAC Design Criteria.

2.3 SUPPORT

- A. Mount on dunnage minimum 18 inches above roof to permit maintenance, or on waterproofed, insulated roof curb minimum 14 inches high.
- B. When vibration is critical, consider vibration type roof curb to be specified elsewhere.

2.4 CASING

- A. Designed for outdoor installation with weatherproof construction.
- B. Furnish removable access panels with handles or hinged access doors with handles and rubber gaskets at edges.
- C. Interior Surfaces: Sheet metal lined creating double wall construction on air handling section or portion unless not available from any of the three approved manufacturers.
- D. Insulation: Cabinets shall be insulated; where double wall construction is unavailable, use impervious or foil faced insulation.

- E. Condensate Drain Pans:
 - 1. Provide IAQ type condensate drain pan. Insulated stainless steel drain pan shall extend beyond cooling coil section as required to catch blow-by. Pan shall be minimum 20 gauge stainless steel continuously welded to form watertight basin, with insulation. Condensate drainpipe shall be either bottom connected or, if side connected, with bottom of nipple flush with bottom of pan.

2.5 Fans:

- A. Fan: Backward inclined fans are preferred; where unavailable in smaller sizes forward curved centrifugal type is acceptable. All fans to be statically and dynamically balanced, resiliently mounted.
 - 1. Provide exhaust fan when available.
 - a. Where exhaust fan is not available, furnish barometric relief dampers.
 - b. Operation of non-modulating exhaust fans to be on or off based on economizer outdoor air damper position. (On-off setpoint selectable through remote potentiometer located in return air section.)
 - c. Operation of modulating exhaust fans to be based on field adjustable interior space pressure setpoint.
 - 2. Provide return fan when available.
 - a. Return Fan Modulation to be controlled in conjunction with supply fan.
- B. Fan Drive: Furnish solid shaft construction. Select adjustable pitch motor sheave to obtain required rpm with sheaves set at mid-position as recommended by manufacturer. On systems 10 tons and over, replace adjustable sheaves with fixed sheaves of size determined during TAB to provide design airflow rate.
 - 1. Drive Rating: Minimum 1.5 times nameplate rating of motor.
 - 2. Fan Sheave: Adjustable.
 - 3. Motor Sheave: Adjustable.
 - 4. Bearings: If permanently lubricated, rated 100,000 hours minimum. If open, to be compatible with standard grease used by Brown Maintenance Group for preventive maintenance.
- C. Fan motor: Three phase for motors 1/2 horsepower and larger, NEMA design B, continuously rated at 40 degrees C, high efficiency, open drip-proof with permanently lubricated bearings rated 100,000 hours minimum and integral overload protection.
- D. Fan Assembly Mounting
 - 1. Coordinate with project provisions for acoustic and vibration control.

2. Unit specifications and submittals shall include sufficient detail to demonstrate compliance with seismic restraint requirements.

E. Variable Frequency Drive:

1. Variable inlet vanes may not be used. Variable frequency drives shall be used where variable discharge is required.
2. Required for units serving VAV distribution systems over 4000 cfm.
3. Furnish for supply fan, and return fan where provided.
4. Controlled from duct static pressure by unit-mounted controller. Static pressure sensed by duct-mounted sensor(s). Engineer to determine and show sensor location on mechanical plan.
5. Furnish field adjustable duct high limit safety control to protect ductwork from excessive duct pressure.

2.6 Compressors:

A. Compressor Mounting

1. Coordinate with project provisions for acoustic and vibration control.
2. Unit specifications and submittals shall include sufficient detail to demonstrate compliance with seismic restraint requirements.
3. Provide factory-wired controls in separate enclosure. Safety devices shall consist of manual reset high pressure and oil pressure cutouts, low pressure switching, and compressor overload devices. Wiring shall incorporate positive acting timer to prevent short cycling of compressor if power is interrupted. Time shall prevent compressor from restarting for approximately 5 minutes after shutoff. Units shall have transformer control circuit.

2.7 Refrigeration circuit:

A. Furnish the following for each circuit:

1. Thermostatic expansion device.
2. Filter-drier.
3. Suction, discharge, and liquid line service valves with gauge ports.
4. Sight glass.
5. High and low pressure safety controls.

B. On VAV systems, furnish primary capacity control by cycling compressors with low load capacity control by variable speed or hot gas bypass.

C. For applications requiring winter operation, furnish low ambient control to 0°F.

1. DX air conditioning system be capable of starting and operating down to 0 degrees F ambient. Low ambient operation shall be

accomplished by varying the speed of condenser fan based on sensing of head pressure in refrigerant liquid line, by modulating damper in condenser fan discharge based on refrigerant head pressure sensing, or by flooding the condenser coil with liquid refrigerant to maintain the desired condenser pressure.

2. Low ambient systems that cycle fans or modulate dampers based on ambient temperature exclusively are prohibited.
3. Provide time delay relay for timed bypass of the low-pressure switch or other means to start condensing unit at 0 degrees F without nuisance safety trip.
4. If condensing unit does not come with hot gas bypass pre-piped, hot gas bypass system shall be installed in accordance with recommendations of condensing unit manufacturer and shop drawings shall be submitted. Shop drawings shall show refrigerant piping, hot gas piping layout including bypass pipe sizes and connection locations, hot gas bypass valve and solenoid valves manufacturers and model numbers, sensing capillary bulb locations, control wiring of solenoid and details of any other components.
5. Adjust hot gas bypass in field, as required, to maintain proper system operation.

2.8 Refrigerant Coils:

- A. Thermostatic expansion valves required.
- B. Headers: Seamless copper tubes with silver brazed joints.
- C. Liquid Distributors: Brass or copper venturi distributor with seamless copper distributor tubes.
- D. Configuration: Down feed with bottom suction.

2.9 Water Coils:

- A. Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.
- B. Tubes: Minimum 1/2-inch OD seamless copper expanded into fins, brazed joints.
- C. Fins: Aluminum.
- D. Casing: Die formed channel frame of galvanized steel.
- E. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.

- F. Configuration: Drainable, with threaded plugs for drain and vent.

2.10 Steam Heating Coil:

- A. Use only where medium temperature hot water is not available.
- B. Headers: Cast iron with tubes expanded into header, seamless copper tube with silver brazed joints, or prime coated steel pipe with brazed joints.
- C. Configuration: Drainable, with threaded plugs for drain and vent, threaded plugs in return bends and in headers opposite each tube, sloped within frame to condensate connection.

2.11 Gas-Fired Heating Section:

- A. Heat Exchanger: Stainless steel where available, or aluminized steel, of welded construction.
 - 1) Make-up air units shall contain a heat exchanger of 409 stainless, die-formed burner of 409 stainless steel, 409 stainless steel drip pan.
- B. Gas Burner: Indirect fired type induced draft burner only. Direct fired not permitted.
- C. All units shall be equipped with intermittent spark pilot shall shut off pilot gas flow between heat cycles.
- D. Gas control shall be fully modulating from 0 to 100% unless unavailable in unit size from approved manufacturers.

2.12 Outdoor Air Section:

- A. Dampers: Furnish with leakage rate not to exceed 1 percent of nominal airflow based on 1 inch water column static pressure.
- B. Economizer: Furnish fully integrated factory installed fully modulating from 0 to 100 percent outside air economizer. Economizer operation through microprocessor based primary temperature controls automatically modulating dampers to maintain space temperature conditions.
 - 1. Furnish economizer with dry bulb control.
 - 2. Furnish adjustable minimum position control.
 - 3. Furnish spring return motor for outside air damper closure during unit shutdown or power interruption.

2.13 Exhaust and Return Section:

- A. Barometric relief gravity type dampers to operate in conjunction with economizer. Furnish barometric relief damper capable of closing by gravity. Furnish rain hood with screen.

2.14 Controls:

- A. For stand alone control, furnish 7 day programmable electronic space thermostat with 4 time periods per day, 1 or 2 stage heating, 1 or 2 stage cooling, automatic changeover, heating setback, cooling setup, override capability, liquid crystal display, memory storage without batteries, security levels feature, and setpoint limiting. Furnish system selector switch off-heat-auto-cool.
- B. For microprocessor based controls integrated with building and/or campus BAS, provide factory control package with the following features:
 - 1. Constant Volume Controls: To operate rooftop from space temperature sensor, including economizer control. Furnish space temperature sensor with setpoint adjustment, or supply air sensor for supply air temperature control where required, for control of unit equipped with override button for timed override. Furnish space temperature control with reprogrammable space temperature offset of plus or minus 5 degrees F.
 - 2. Variable Air Volume Controls: To operate VAV rooftop from supply air temperature including supply air sensor, and variable frequency drive. Microprocessor coordinates economizer control and stages of cooling with supply air temperature reset capability based upon outdoor air temperature. Furnish with reprogrammable space temperature offset of plus or minus 5 degrees F.
- C. Control Functions: Furnish the following:
 - 1. Unit scheduling.
 - 2. Occupied-unoccupied mode.
 - 3. Start-up and coast-down modes.
 - 4. Nighttime free-cool purge mode.
 - 5. Demand limiting.
 - 6. Night setback.
 - 7. Timed override.
 - 8. Alarm shutdown.
 - 9. Discharge air set point adjustment.
 - 10. Static pressure setpoint adjustment.
- D. Furnish the following options or accessories:
 - 1. Crankcase heaters.
 - 2. Manual reset high pressure and oil pressure switches.

2.15 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Disconnect Switch: Factory mounted, non-fused type, interlocked with access door, accessible from outside unit, with power lockout capability.
- B. Convenience Outlet: Factory installed, 115 volt, 15 amp, GFI type.

END OF SECTION