# SECTION 23 80 00 - Terminal HVAC Equipment

## PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide Heating, Cooling, and Ventilating Equipment as specified herein and shown on the Drawings.

B. Equipment capacity and size shall be as indicated on the Drawings.

C. Related Work: The requirements of Section 23 05 00, Common HVAC Materials and Methods, also apply to this section.

1.2 QUALITY ASSURANCE

A. Air Handling Equipment: Rated in accordance with AMCA certified rating procedures and AMCA labeled.

B. Air Conditioning and Refrigeration Equipment Rating: Rated in accordance with ARI certified rating procedures and ARI labeled.

C. Gas-fired Equipment: Design certified by American Gas Association.

1.3 SUBMITTALS

A. Submit catalog data, construction details and performance characteristics for each HVAC unit.

B. Submit operating and maintenance data.

## PART 2 - PRODUCTS

2.1 terminal heating equipment

A. Wall mounted electric fan forced heaters: UL listed recessed heater with primary and secondary thermal safeties with secondary manual reset, nichrome heating element, recessed wall can, two stage centrifugal blower, and powder coat metal grille. Provide with remote 2-pole thermostat. Cadet C series, Qmark, Markel, King approved.

B. Wall mounted Cove Heaters: UL Listed radiant cove heater. King KCV, or equal.

2.2 ductless split system terminal HVAC equipment

A. Indoor Section: Compact fan coil unit designed for wall, ceiling, recessed ceiling, or low profile concealed ducted mounting. Quantity, style, and capacity as listed on the drawings. Multispeed direct drive fan with air filter. Provide with wired thermostat and condensate pump as indicated.

B. Outdoor Section: Capacity matched with indoor section(s), steel cabinet with hermetically sealed inverter driven compressor(s), accumulator, crankcase heater, high and low pressure switches, restart delay relay, condenser coil, and propeller fans. Low ambient operation to 20 degrees. Single or multiple circuit as indicated. Cooling only or heat pump as indicated on the Drawings. Provide preinsulated lineset for each indoor unit.

C. Acceptable Manufacturers: Mitsubishi, Daikin, or approved.

2.3 packaged terminal heat pump:

A. Through-the-wall, air-cooled, packaged terminal heat pump. Controls shall be factory wired and completely enclosed within the unit and be accessible. Fan control shall be a 3-position switch for high, medium, and low fan speeds for cooling and heating. Ventilation control shall be a 2-position control to introduce fresh air to the room or to close the vent. All vent air shall be 100% filtered. Electric heating element with outdoor thermostat lockout.

B. Hermetically sealed compressor shall be rubber shock mounted and internally spring mounted for quiet operation and vibration isolation. Unit shall operate in heat pump mode down to 28 degrees.

C. Evaporator and condenser coil shall have copper tubes and aluminum fins.

D. Evaporator and condenser fans shall be direct driven. Evaporator fan shall be centrifugal type and condenser fan shall be propeller type with a slinger ring for condensate removal.

E. Room panel shall be acoustically insulated and provide for top air discharge.

F. Wall sleeve shall be a one-piece sleeve, U-channel reinforced for added strength, for wall installation, fabricated from 18 gauge zinc clad steel and shall include outside architectural grille. Finish on sleeve shall be baked-on epoxy-resin enamel. Grille and sleeve shall be shipped with closure panel at both the front and rear of sleeve and with installation instructions on inside panel. Outside grille shall be mounted in sleeve from inside room. Finish on outside grille shall be either anodized aluminum or baked-on epoxy-resin enamel. Sleeve shall be no more than 42" wide, 18-1/4" high and 16-9/16" deep.

G. Unit chassis shall be slide-out and shall be shipped separate from sleeve.

H. Provide with remote 7 day programmable hard-wired thermostat, internal condensate drain kit.

 GE, Amana, LG, or approved.

2.4 Split System Heat Pump Fan coils:

A. The following specification is the basis of design, and is based around the Daikin SkyAir split system heat pump. Equivalent systems by Mitsubishi, Sanyo, LG, Carrier, Trane, and Samsung are considered equal and may bid on this project.

B. System Description: The variable capacity, heat pump air conditioning system shall be a Daikin inverter driven SkyAir series (heat/cool model) split system. The system shall consist of a built-in ceiling concealed indoor evaporator model exclusively matched to the outdoor condensing unit model as follows:

|  |  |
| --- | --- |
| **Outdoor Model** | **Indoor Model** |
| RZQ18PVJU9 | FBQ18PVJU |
| RZQ24PVJU9 | FBQ24PVJU |
| RZQ30PVJU | FBQ30PVJU |

B. The RZQ outdoor condensing unit models shall be a direct expansion (DX), air-cooled heat pump air-conditioning system, with a variable speed inverter driven compressor & fan motor using R-410A refrigerant. The outdoor unit is a horizontal discharge, variable speed, single fan unit using a single phase power supply.

C. Quality Assurance

1. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.

 2. All wiring shall be in accordance with the National Electric Code (NEC). The system shall be rated in accordance with Air Conditioning Refrigeration Institute’s (ARI) Standard 210/240 and bear the ARI label.

3. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

4. Mechanical equipment for wind-born debris regions shall be designed in accordance with ASCE 7-2002 and installed to resist the wind pressures on the equipment and the supports.

5. The outdoor unit will be factory charged with R-410A.

6. A holding charge of dry nitrogen shall be provided in the evaporator.

7. System efficiency shall meet or exceed 16.0 SEER and 9.2 HSPF.

D. Limited Warranty

1. Daikin AC (Americas), Inc. (“Daikin AC”) warrants to the customer who is the original owner and user of the Daikin AC products specified above (“Customer”) that under normal use and maintenance for comfort cooling and conditioning applications such products (the “Products”) will be free from defects in material or workmanship. This warranty applies to parts only and is limited in duration to one (1) year from the earlier to occur of (a) the date of original installation, whether or not actual use begins on that date, or (b) eighteen (18) months from the date of shipment by Daikin AC. Customer must present proof of the original date of receipt and of installation of the Product in order to establish the effective date of this warranty. Otherwise the effective date will be deemed to be the date of manufacture plus sixty (60) days. Repaired or replacement parts are warranted for the balance of the warranty period applicable to the original part following the date on which the repaired or replacement part is provided to the Customer.

E Extended Warranty

1. For its compressors only, Daikin AC provides the above warranty (which is applicable to parts only) for a six (6) year period. This extended warranty for compressors is limited in duration to six (6) years from the earlier to occur of (a) the date of original installation, whether or not actual use begins on that date, or (b) eighteen (18) months from the date of shipment by Daikin AC, and applies to the compressor and compressor parts only. The effective date of this extended warranty shall be established as above.

F Installation Requirements: The system must be installed by a Daikin factory trained contractor/dealer.

GPerformance:The system performance shall be in accordance with ARI 210/240 test conditions as shown in the performance table below:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **System Model** | **Cooling Capacity** | **Heating Capacity** | **Cooling Power (Watts)** | **Heating Power (Watts)** | **SEER** | **EER** | **HSPF** |
| RZQ18PVJU9\_FBQ18PVJU | 18,000 | 20,000 | 1,280 | 1,540 | 17.5 | 14.1 | 10.6 |
| RZQ24PVJU9\_FBQ24PVJU | 24,000 | 27,000 | 2,000 | 2,330 | 16.5 | 12.0 | 10.5 |
| RZQ30PVJU\_FBQ30PVJU | 30,000 | 34,000 | 2,860 | 3,020 | 16.0 | 10.5 | 9.2 |

The cooling performance is based on 80°F DB / 67°F WB for the indoor unit and 95°F DB / 75°F WB for the outdoor unit with 25ft of interconnecting pipe-work & 0ft level difference.

The heating performance is based on 70°F DB / 60°F WB for the indoor unit and 47°F DB / 43°F WB for the outdoor unit with 25ft of interconnecting pipe-work & 0ft level difference.

HCooling Operating Range:The operating range in cooling will be 23°F DB ~ 115°F DB and 0°F DB ~ 115°F DB when used with an optional wind baffle.

I Heating Operating Range: The operating range in heating will be 0°F DB – 77°F DB / 0°F WB – 60°F WB.

J Refrigerant Piping: The system shall be capable of refrigerant piping up to 164 total feet with a 98 feet maximum vertical difference, without any oil traps or additional components.

K. Outdoor Unit: The outdoor condensing unit is designed specifically for use with matched capacity (e.g. RZQ24PVJU9/FBQ24PVJU) SkyAir series indoor evaporator units.

1. The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a Daikin swing compressor, motors, fan, condenser coil, electronic expansion valves, solenoid valves, 4 way valve, distribution headers, capillaries, filters, shut off valves, service ports and suction accumulator.

2. Both liquid and suction lines must be individually insulated between the outdoor and indoor units.

3. The outdoor unit can be wired and piped with outdoor unit access from the left, right, front or rear.

4. The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit.

5. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for re-programming.

6. The outdoor unit shall be modular in design and should allow for side-by-side installation with minimum spacing.

7. The following safety devices shall be included on the condensing unit; high pressure switch, control circuit fuses, fusible plug, high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.

8. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.

9. The outdoor unit shall be capable of cooling & heating operation at 0°F dry bulb ambient temperature without additional low ambient controls.

L. Unit Cabinet:

1. The outdoor unit model RZQ\_\_PVJU9 shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

M. Fan:

1. The condensing unit shall consist of one propeller type, direct-drive 70 W fan motor that has multiple speed operation via a DC (digitally commutating) inverter.

|  |  |
| --- | --- |
| **Model Number** | **Fan Motor Output (W) & Quantity** |
| RZQ18PVJU9 | 70 x 1 |
| RZQ24PVJU9 | 70 x 1 |
| RZQ30PVJU | 70 x 1 |

2. The fan shall be a horizontal discharge configuration with a nominal airflow maximum of 1,835 cfm.

3. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.

4. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

5. The outdoor unit shall be capable of operating at further reduced sound levels during night time.

N. Condenser Coil:

1. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.

2. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure highly efficient performance.

3. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.

4. The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1.

5. The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.

O. Compressor:

1. The Daikin swing compressor shall be variable speed (PAM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity shall be controlled to eliminate deviation from target value.

2. The inverter driven compressor shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed swing “F-type” type.

3. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.

4. The capacity control range shall be as shown below:

|  |  |
| --- | --- |
| **Model Number** | **Capacity Control Range** |
|  RZQ18PVJU9 | 35-100% |
|  RZQ24PVJU9 | 30-100% |
|  RZQ30PVJU | 25-100% |

5. The compressor shall be equipped with a crankcase heater, high pressure safety switch and internal thermal overload protector.

6. The compressor shall be mounted to avoid the transmission of vibration.

P. Electrical:

1. The power supply to the outdoor unit shall be 208-230 volts, 1 phase, 60 hertz +/- 10%.

|  |  |
| --- | --- |
| **Power Supply Voltage** | **Voltage Range** |
| 208-230V/1/60 | 187V-253V |

|  |  |  |
| --- | --- | --- |
| **Model** | **MCA** | **MOP** |
| RZQ18PVJU9 | 16.5 | 20 |
| RZQ24PVJU9 | 16.5 | 20 |
| RZQ30PVJU | 16.5 | 20 |

2. The control voltage between the indoor and outdoor unit shall be 16VDC non-shielded, stranded 2 conductor cable.

3. The control wiring shall be a two-wire multiplex transmission system, thus simplifying the wiring operation.

4. The control wiring lengths shall be as shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Outdoor to Indoor Unit** | **Outdoor to Central Controller** | **Indoor Unit to Remote Control** |
| Control Wiring Length | 6,665 | 3,330 | 1,665 |
| Wire Type | 18 AWG, 2 wire, non-polarity, non-shielded, stranded |

QFBQ Indoor Unit – Ceiling Concealed Ducted Unit (Med. Static)

1. General: Daikin indoor unit model FBQ shall be a wall mounted fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation onto a wall within a conditioned space. It shall be available in capacities from 18,000 Btu/h to 30,000 Btu/h. Model numbers are FBQ18PVJU, FBQ24PVJU, and FBQ30PVJU to be connected to the corresponding SkyAir series outdoor condensing unit model RZQ18PVJU9, RZQ24PVJU9, and RZQ30PVJU. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while inhibiting changes in room temperature when used with Daikin BRC1E71 programmable controller, BRC2A71 simplified controller or optional wireless controller. Included as standard equipment, a condensate drain pan and drain pump kit that pumps to 18-3/8” from the drain pipe opening. The indoor units sound pressure shall range from 37 dB(A) to 43 dB(A) at low speed measured 5 feet below the ducted unit.

R. Performance: Each units performance is based on nominal operating conditions:

|  |  |  |
| --- | --- | --- |
| **Model Number** | **Cooling** (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length) | **Heating** (Indoor 47°F DB / 43°F WB,Outdoor 70°F DB, 25 ft pipe length) |
| FBQ18PVJU | 18,000 | 20,000 |
| FBQ24PVJU | 24,000 | 27,000 |
| FBQ30PVJU | 30,000 | 34,000 |

S. Indoor Unit:

1. The Daikin indoor unit FBQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.

2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.

3. Both refrigerant lines shall be individually insulated from the outdoor unit.

4. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 18-3/8” of lift from the center of the drain outlet.

5. The indoor units shall be equipped with a return air thermistor.

6. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.

7. The voltage range will be 253 volts maximum and 187 volts minimum.

T. Unit Cabinet:

1. The cabinet shall be located into the ceiling and ducted to the supply and return air openings.

2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

U. Fan:

1. The fan shall be direct-drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.

2. The unit shall be equipment with an automatically adjusting external static pressure logic selectable during commissioning.

3. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range of 0.47 HP.

4. The airflow rate shall be available in three settings.

5. The fan motor shall be thermally protected.

6. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.

7. Fan motor external static pressure range for nominal airflow:

|  |  |
| --- | --- |
| **Model Number** | **Fan ESP (in. WG)** |
| FBQ18PVJU | 0.80 – 0.20 |
| FBQ24PVJU | 0.80 – 0.20 |
| FBQ30PVJU | 0.80 – 0.20 |

V. Coil:

1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.

3. The coil shall be a 3 row cross fin copper evaporator coil with 15 fpi design completely factory tested.

4. The refrigerant connections shall be flare connections and the condensate will be 1-1/4” outside diameter PVC.

5. A condensate pan shall be located under the coil.

6. A condensate pump with a 18-3/8” lift shall be located below the coil in the condensate pan with a built in safety alarm.

7. A thermistor will be located on the liquid and gas line.

W. Electrical:

1. A separate power supply will be required of 208-230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.

2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).

3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

X. Control:

1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.

2. A full array of fault diagnostics shall be accessible via the wired remote controller.

3. The unit shall be compatible with interfacing with connection to BACnet and LonWorks networks or interfacing with connection to BMS system. Consult with Daikin prior to applying controls.

Y. Required Accessories Available:

1. Remote “in-room” sensor kit KRCS01-4B (recommended).

a. The Daikin wall mounted, hard wired remote sensor kit is recommended for applications where there could be a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

2. Navigation Remote Controller (BRC1E71)

3. Condensate pumps where required for drainage.

## PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and arrange equipment as shown on the Drawings and as recommended by the equipment manufacturer.

3.2 AIR HANDLING INSTALLATION

A. Installation and Arrangement: Air handling equipment shall be instal­led and arranged as shown on the Drawings. Comply with the manufacturer's recommendations for installation connection and start-up.

B. Lubrication: All moving and rotating parts shall be lubricated in accordance with the manufacturer's recommendations prior to start-up.

3.3 Condensate drainage

A. Provide complete condensate drainage system for cooling and heat pump equipment. Route condensate to approved interior receptor. Discharging condensate to the exterior is not permitted. See Division 22 for piping materials and methods.

3.4 CONTROLS

A. Wiring: All wiring shall be in accordance with the National Electrical Code and local electrical codes. All thermostat wire shall be minimum 18 gauge, 6 conductor.

B. Mounting: All controls intended to be operable by the occupant shall be mounted with the operating portion no more than 46” above the floor or as otherwise required by applicable codes.

END OF SECTION 23 80 00