SECTION 23 81 00
DECENTRALIZED UNITARY HVAC EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies split-systems air conditioners.

B. Definitions:

1. 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 (Btu hour/Watt).
2. Seasonal Energy Efficiency Ratio (EER): The ratio of the 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 (Btu hour/Watt).
3. Unitary: A Unitary Air Conditioner consists of one or more factory-made assemblies which normally include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function as well.
4. Where such equipment is provided in more than one assembly the separated assemblies are to be designed to be used together and the requirements of rating are based upon use of matched assemblies.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS: Requirements for pre-test of equipment: Seismic requirements for non-structural equipment.

B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.

C. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT: Requirements for different types of vibration isolators and noise ratings in the occupied areas.

D. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC: Requirements for testing and adjusting air balance.

E. Section 23 07 11, HVAC and BOILER PLANT INSULATION: Requirements for piping insulation.

F. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS: Requirements for commissioning, systems readiness checklists, and training.

G. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS: Requirements for air handling units using chilled water and hot water coils.

1.3 QUALITY ASSURANCE

A. Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Safety Standards: ASHRAE 15, Safety Standard for Refrigeration Systems.

1.4 SUBMITTALS

A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES

B. Manufacturer's literature and data:

1. Sufficient information, including capacities, pressure drops and piping connections clearly presented, shall be included to determine compliance with drawings and specifications for units noted below:
   a. Unitary air conditioners: Split systems
2. Unit Dimensions required clearances, operating weights accessories and start-up instructions.
3. Electrical requirements, wiring diagrams, interlocking and control wiring showing factory installed and portions to be field installed.

C. Certification: Submit proof of specified ARI Certification.

D. Performance Rating: Submit catalog selection data showing equipment ratings and compliance with required sensible-to-heat-ratio, energy efficiency ratio (EER), and coefficient of performance (COP).

E. Operating and Maintenance Manual: Submit three copies of Operating and Maintenance manual to COR three weeks prior to final inspection.

F. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):

210/240-2008.....Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment

270-2008.....Sound Rating of Outdoor Unitary Equipment

340/360-2007.....Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment

520-2004.....Performance Rating of Positive Displacement Condensing Units

C. Air Movement and Control Association International, Inc. (AMCA):
210-2007.....Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating
410-1996.....Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans

D. American National Standards Institute (ANSI):
S12.51-2012.....Acoustics - Determination of Sound Power Levels and Sound Energy Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Test Rooms (same as ISO 3741:2010)

E. American Society of Civil Engineers (ASCE):
7-2010.....Minimum Design Loads for Buildings and Other Structures

F. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
2012.....ASHRAE Handbook - HVAC Systems and Equipment
15-2013.....Safety Standard for Refrigeration Systems
52.1-92.....Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices used in General Ventilation for Removing Particulate Matter
52.2-2012.....Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
62.1-2013.....Ventilation for Acceptable Indoor Air Quality
90.1-2013.....Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

G. American Society of Testing and Materials (ASTM):
B117-2011.....Standard Practice for Operating Salt Spray (Fog) Apparatus

H. Federal Specifications (Fed. Spec.):
A-A-50502-1990..... Air Conditioner (Unitary Heat Pump) Air to Air (3000-300,000 Btu)

I. Military Specifications (Mil. Specs.):
MIL-PRF-26915D-2006.....Primer Coating, for Steel Surfaces

J. National Electrical Manufacturer's Association (NEMA):
MG 1-2011.....Motors and Generators
ICS 1-00 (R2005, R2008).Industrial Controls and Systems: General Requirements

K. National Fire Protection Association (NFPA) Publications:
70-2014.....National Electrical Code (NEC)

90A-2015.....Standard for the Installation of Air-Conditioning and Ventilating Systems
90B-2015.....Standard for the Installation of Warm Air Heating and Air-Conditioning Systems

PART 2 - PRODUCTS

2.1 UNITARY AIR CONDITIONERS - GENERAL

A. Applicable ARI Standards:
   1. Cooling Capacity 39.6 kW (135,000 Btu/h) and More: AHRI 340/ 360.
   2. Cooling Capacity Less Than 39.6 kW (135,000 Btu/h): AHRI 210/240. Units shall be listed in the ARI Directory of Certified Unitary Air-Conditioners.

B. Performance Rating: Cooling capacity of units shall meet the sensible heat and total heat requirements shown in the contract documents. In selecting unit size, make true allowance for "sensible to total heat ratio" to satisfy required sensible cooling capacity.

C. Machinery Guards: Provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated casings.

D. Corrosion Prevention: Unless specified otherwise, equipment fabricated from ferrous metals that do not have a zinc coating or a duplex coating of zinc and paint shall be treated for prevention of rust with a factory coating or paint system that will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall be tested for 500 hours. The salt-spray fog test shall be in accordance with ASTM B117 using a 20 percent sodium chloride solution. Immediately after completion of the test, the coating shall show no signs of blistering, wrinkling or cracking, no loss of adhesion, and the specimen shall show no signs of rust beyond 3 mm (1/8-inch) on both sides from the scratch mark.

2.2 SPLIT-SYSTEM AIR CONDITIONERS

A. Description: Factory assembled and tested, floor-mounted unit, with an air-cooled remote condensing unit, and field-installed refrigeration piping. Unit shall include an electric-resistance heating coil.

B. Concealed Evaporator Components:
   1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
   2. Insulation: Factory-applied duct liner.

3. Drain Pans: Galvanized steel, with connection for drain; insulated and complying with ASHRAE 62.1.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
5. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with AHRI 210/240, and with thermal-expansion valve.
6. Electric-Resistance Heating Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection. Provide SCR control of electric heating coils as indicated.
7. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
8. Fan Motors: Comply with requirements in Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT for multi-tapped, multi-speed motors with internal thermal protection and permanent lubrication.
9. Disposable Filters: 25 mm (1 inch) thick, in fiberboard frames with MERV rating of 7 or higher according to ASHRAE 52.2.
10. Wiring Terminations: Connect motor to chassis wiring with plug connection.

C. Air-Cooled, Compressor-Condenser Components:
1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Service valves, fittings, and gage ports shall be brass and located outside of the casing.
2. Compressor: Hermetically sealed scroll with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
3. Compressor motor with manual-reset, high-pressure switch and automatic-reset, low-pressure switch.
4. Refrigerant: R-410A unless otherwise indicated.
5. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with AHRI 210/240, and with liquid subcooler.
6. Fan: Aluminum, propeller type, directly connected to motor.
7. Motor: Permanently lubricated, with integral thermal-overload protection.

8. Low Ambient Kit: Permit operation down to minus 18 deg C (0 deg F).
9. Mounting Base: Polyethylene.
10. Minimum Energy Efficiency: Comply with ASHRAE 90.1.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install wind and seismic restraints according to manufacturer's written instructions.
B. Install units level and plumb maintaining manufacturer’s recommended clearances and tolerances.
C. Install ground-mounting, compressor-condenser components on 100 mm (4-inch) thick, reinforced concrete base; 100 mm (4 inches) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Section 03 30 00, CAST-IN-PLACE CONCRETE. Coordinate anchor installation with concrete base.
D. Install ground-mounting, compressor-condenser components on polyethylene mounting base.
E. Install seismic restraints.
F. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 25 mm (1 inch) unless otherwise indicated. Refer to Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
G. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.
H. Install wall sleeves in finished wall assembly and weatherproof. Install and anchor wall sleeves to withstand, without damage seismic forces as required by code.

3.2 CONNECTIONS

A. Verify condensate drainage requirements.
B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest area drain.
C. Install piping adjacent to units to allow service and maintenance.
D. Connect supply ducts to units with flexible duct connectors specified in Section 23 31 00, HVAC DUCTS and CASINGS.
E. Ground equipment and install power wiring, switches, and controls for split systems.
F. Connect refrigerant piping to coils with shutoff valves on the suction and liquid lines at the coil and a union or flange at each connection at the coil and condenser.
G. Install ducts to the units with flexible duct connections.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections: After installing units and after electrical circuitry has been energized, test units for compliance with requirements. Inspect for and remove shipping bolts, blocks, and tie-down straps. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Remove and replace malfunctioning units and retest as specified above.

3.4 INSTRUCTIONS

A. Provide services of manufacturer’s technical representative for four hours to instruct VA personnel in operation and maintenance of units.

3.5 STARTUP AND TESTING

A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.6 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.7 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for four hours to instruct VA personnel in operation and maintenance of units.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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