SECTION 23 73 16
BLOWER-COIL UNITS

PART 1 - GENERAL

1.1 STIPULATIONS

A. The specifications sections "General Conditions to the Construction Contract", "Special Conditions" and "Division 01 - General Requirements" form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 ADDITIONAL RELATED DOCUMENTS

A. Division 23 Section "Air Cooled Refrigerant Condensing Units" for refrigerant condensing units paired with DX cooling coils.

B. Division 23 Section "Refrigerant Piping" for interconnecting piping between the DX coils in blower coil units and outdoor, air cooled condensing units.

1.3 SUMMARY

A. This Section includes blower-coil units for indoor installations. This Section applies to both the AHUs and DOAS units.

1.4 ACTION SUBMITTALS

A. Product Data for each blower-coil unit specified, including the following:

1. Certified fan-performance curves with system operating conditions indicated.
2. Certified fan-sound power ratings.
3. Certified coil-performance ratings with system operating conditions indicated.
4. Motor ratings and electrical characteristics plus motor and fan accessories.
5. Material gages and finishes.
6. Filters with performance characteristics.
7. Dampers, including housings, linkages, and operators.

B. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Condensate Traps: Prepare a schedule detailing the necessary trap dimensions (trap seal depth and net 'fall') for each unit, based on the predicted maximum static pressure in the cabinet at the location of each trap, including the effect of loaded filters. The schedule shall detail unit tag, unit size, appropriate trap schematic with the recommended trap dimensions.

1. The Contractor shall be responsible for additional support rail height required for trapping beyond the factory supplied base rail height and the housekeeping pad / foundation height indicated. The Contractor shall also include in his bid the cost of core drilling the floor (or forming a pit in a slab on grade) in order to meet the required dimensions.

D. Wiring diagrams detailing wiring for power and control systems and differentiating between manufacturer-installed and field-installed wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings, including floor plans and sections drawn to scale. Submit with Shop Drawings. Show mechanical-room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

B. Rigging and Handling: Submit a description of the required rigging and handling procedures for each unit, with a description of all manufacturer's recommended temporary supports, braces, or other provisions to permit the safe passage of units / unit modules and sub-components to the location of final installation

C. Field test reports indicating and interpreting test results relative to compliance with specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data for blower-coil units to include in the operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. NFPA Compliance: Blower-coil units and components shall be designed, fabricated, and installed in compliance with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

B. Coil ratings shall be in accordance with AHRI-410.

C. UL and NEMA Compliance: Provide motors required as part of blower-coil units that are listed and labeled by UL and comply with applicable NEMA standards.

1. Electric heaters shall be listed in accordance with UL 1996.

D. Units with electric heat shall be ETL listed and labeled.

E. Comply with NFPA 70 for components and installation.

F. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

G. AHRI Certification:

1. Units shall be tested and certified in accordance with AHRI-430.
2. Coil ratings shall be in accordance with AHRI-410.

3. Report and rate sound power levels in accordance with AHRI-260 (ducted discharge, ducted inlet, free inlet sound).

H. Single Source Responsibility: For DX split systems, a single manufacturer shall be responsible for the integrated performance of the air conditioning unit / evaporator coil and associated air cooled condenser. The components shall be factory engineered and integrated as a single, functional system to meet the scheduled and specified performance. The field-pairing of system components provided by or through more than one manufacturer is not acceptable.

1.8 COORDINATION

A. Coordination: Coordinate layout and installation of blower-coil units with piping and ductwork and with other installations.

B. Coordinate motor starting and control requirements with Division 26 and the ATC system supplier / sub-contractor.

C. Coordinate the supply voltage and phase of motors and other electrical connections with Division 26.

D. Arrange the work to provide no less than 42" of service clearance in front of electric heat power and control panels, for the full width of the panel, or 30", whichever is larger, as per the requirements of the National Electric Code.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver blower-coil unit as a factory-assembled module with protective crating and covering.

B. Follow manufacturer’s recommendations for handling, unloading and storage.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Verify the entire travel path of the blower coil and sub-components into and through the building to the location of installation. If verification prior to bid is not made, the Contractor shall include in his bid the cost of a complete field assembly of the units from component parts. The Contractor shall also include the costs of any temporary or factory/permanent casing or component bracing or reinforcement, and additional rigging support points on the unit frame, required or recommended by the equipment manufacturer, that are required to transport the AHU or modules in the orientation required to pass through building openings and fit though available pathways without damage to the equipment.

1.10 SEQUENCING AND SCHEDULING

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete housekeeping bases. Cast anchor-bolt inserts into base.

1.11 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Filters: Furnish two (2) sets for each blower-coil unit. This is in addition to the filters installed at the time of turn over.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trane; a Div. of Ingersoll Rand
2. Daikin
3. International Environmental Corp. (IEC)
4. Or equal as approved by the Professional.

2.2 BLOWER COIL UNITS

A. Provide blower/coil units consisting of horizontal air handling units installed in accordance with the manufacturer's recommendations.

1. Unit assembly shall consist of fans, motor, DX cooling coil, hot water heating coil, electric heating (for DOAS units), and a filter section with filters. Units shall be completely factory wired and piped requiring only connecting wiring and piping to building systems.
2. The cabinets shall be of bolted sectional construction that may be dismantled for repair or replacement. Gasketed access doors shall be provided for access to and removal of coils, motor, fans, filters, etc. The Contractor's attention is directed to the limited space available and the units shall be arranged for access and removal of components.
3. Cabinet Construction and Insulation: Units shall be double wall construction with minimum 1" thick fiberglass, flexible elastomeric, or injected foam insulation and a galvanized steel liner throughout. Single wall units will exposed insulation to the airstream are not acceptable. Cabinets shall be constructed of minimum 18 gauge sheet, except that foam injected cabinets shall use minimum 24 gauge galvanized steel.
4. Supply Fan: Units shall be equipped with direct drive fans with EC motors with a double-width, double-inlet forward-curved centrifugal fan wheel. Belt-drive units are not acceptable.

    a. Motors: The motors shall be 3-tap electrically commutated (ECM) type with permanently lubricated bearings, built-in thermal overload protection, and three discreet speeds selected through a manual speed switch. AC induction and PSC type motors are not acceptable.

5. Hydronic Heating Coils (AHUs Only): The hot water coils shall be constructed with plate type aluminum fins, seamless copper tubes and copper headers. Coils shall have galvanized steel casings. Coil shall be tested at 300 psig while under water. Coils shall be suitable for at least 200 psig water-working pressure at 200 deg. F.

    a. Hot water coils shall be located in the re-heat position.

6. DX Cooling Coils: Multi-row type fabricated from seamless copper tubing mechanically bonded to rippled and corrugated aluminum fins. Casings shall be stainless steel. All evaporator coil circuits shall be interlaced. Coils shall be factory leak tested under water.

The evaporator coil circuiting shall be fed with an adjustable thermal expansion valve with an external equalizer.

7. Drain Pan: Cooling coil sections shall be provided with a factory installed double-sloped, stainless steel or plastic insulated drain pan extending through entire coil section. Drain pan shall be equipped with a primary condensate drain opening located near the bottom of the pan.

    a. AC Condensate Overflow Protection: Provide a water level sensor complying with UL508 to provide protection against drain pan overflow by sensing a high condensate level in the drain pan, in conformance with the 2018 International Mechanical Code. The sensor shall fully de-activate the unit's cooling mode upon detection of a high water level. The sensor shall be approved for use in plenums per UL 2043. The sensor shall be a Rectorseal Model 'SS2AP' or approved equal.

8. Electric Heat (DOAS Units Only): Electric heating elements shall be constructed of high-grade open-coil resistance wire of 80 percent nickel and 20 percent chromium supported by ceramic insulators on plated steel brackets. The heating elements shall be suspended in front of the unit outlet, after the blower and coil. An auto and manual thermal limit switch shall protect the heating elements in the event of an air failure. Electric coils shall be located in the re-heat position (downstream of the cooling coil).

    a. Control Panel: Unit mounted with disconnecting means and both line and control terminal blocks and magnetic contactors. Disconnect switch shall be of the door-interlock type. The electric heat shall be powered from the unit's single-point electrical connection. Include the following additional controls:

        1) Solid-state stepless SCR/SSR controller receiving 0-10 VDC pilot signals from the DDC system.
        2) Airflow proving switch.
        3) Pilot light.
        4) Over-temperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box without removing heater from duct or unit.
        5) Secondary Protection: Load-carrying, manually resettable thermal cutouts; factory wired.

9. DOAS Filters: None required. Outdoor air will be filtered with the filter and side service filter housing located upstream of the DOAS and IFB coil that is specified in Division 23 Section "Particulate Air Filtration". The IFB coil is specified in Division 23 Section "Air Coils".
10. AHU Filters: Provide two filter banks - MERV 8 and MERV 13. Both filters shall be minimum 2" thickness, pleated throwaway type, arranged and located so that air shall pass through the filters before it contacts either the coil or fans. Filters shall be in a flat arrangement sized for a velocity of no greater than 500 fpm at nominal airflow. Filters shall be furnished in short sections and shall be removable from the unit as required by conditions at the site. The unit shall be complete with two sets of filters. One set of replaceable type filters shall be installed in the unit during the construction period. After final cleanup and the area is ready for occupancy, the second set of replaceable filters shall be installed by the Contractor.
11. Filter Pressure Drop Gauges: Each individual particulate filter bank shall be provided with a dedicated, 4" diameter Dwyer Series 2000 Magnahelic dial-type differential pressure gauge piped to both sides of the filter with aluminum or polyethylene tubing to indicate status. Provide a pair of Dwyer A-301 or A-302 series static pressure tips for each gauge. Gauge shall maintain a +/- 4 percent accuracy within operating temperature limits of -20°F to 140°F.

12. Electrical:

    a. Each unit shall be wired and tested at the factory before shipment. Wiring shall comply with NEC requirements and shall conform to all applicable UL standards. All electrical components shall be labeled according to the electrical diagram and shall be UL recognized where applicable. Each unit shall have a 115-volt circuit transformer, 24-volt control circuit transformer, and control circuit fuses.
    b. The unit shall be wired for a single point electrical connection.
    c. The main control panel shall be provided with a terminal block for the main power connection and a terminal board shall be provided for the low voltage control wiring.
    d. A main unit non-fused disconnect switch in a NEMA 1 enclosure shall be provided. The disconnect handle shall be through the main control panel door.

13. Unit Control System: All controls shall be provided by the DDC System Supplier as specified in Division 23 Section "Instrumentation and Controls for HVAC ".

2.3 MOTORS

A. Refer to Division 23 Section "Common Motor Requirements for HVAC Equipment" for general requirements for factory-installed motors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions to receive equipment, for compliance with installation tolerances and other conditions affecting performance of blower-coil units.

B. Examine roughing-in of refrigerant, hydronic, condensate drainage piping, and electrical to verify actual locations of connections before installation.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install blower-coil units level and plumb, according to manufacturer's written instructions.

1. Suspended Units: Support on hanger rods with vibration isolators suspended from building structural system.
2. Floor Mounted Units: Set on a 4" high concrete housekeeping pad, and support on spring vibration isolators.
3. Vibration isolators are specified in Division 23 Section "Vibration Controls for HVAC".

B. Arrange installation of units to provide access space around blower-coil units for service and maintenance.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters at the time of turnover. Provide an additional set(s) of filters as described herein under "Extra Materials".

D. For units with DX cooling, add additional refrigerant and oil as required for the as-installed system.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. The Drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install piping adjacent to machine to allow service and maintenance.
2. Connection piping to blower-coil units with flexible connectors or flexible hoses.
3. Connect piping to condensate drain pans and extend to nearest equipment or floor drain or condensate pump where indicated on the Drawings. Construct deep seal p-trap at connection to drain pan and install cleanouts at changes in direction.
4. Refrigerant Piping: Provide refrigerant piping in accordance with Division 23 Section "Refrigerant Piping."
5. Hot Water Piping: Conform to applicable requirements of Division 23 Section "Hydronic Piping." Connect to supply and return coil tappings with shutoff and balancing valve and union or flange at each connection.

B. Duct installation and connection requirements are specified in other Division 23 Sections. The Drawings indicate the general arrangement of ducts and duct accessories. Make final duct connections with flexible connections. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

C. Electrical: Conform to applicable requirements of Division 26 Sections.

1. Temperature control wiring and interlock wiring is specified in Division 23 Section "Instrumentation and Controls for HVAC."
2. Set field-adjustable switches and circuit-breaker trip ranges.
3. Ground equipment.
4. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 CLEANING

A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

B. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

C. Flush drain pans and traps clear of debris and dirt.

D. Prior to startup, provide final cleaning of units to remove road debris from interior and exterior of unit. The interior airstream surfaces of the unit shall be oil and grease free and wiped clean with 50-50 mix of denatured alcohol and water.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Inspection: Engage a factory-authorized service representative to perform the following:

1. Inspect field assembly of components and installation of blower coil units including piping, ductwork, dampers, and electrical connections.
2. Assist Contractor in starting up the units.
3. Prepare a written report on findings and recommended corrective actions.

B. Final Checks Before Startup: Perform the following before startup:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify that proper thermal overload protection is installed in motors, starters, and disconnects.
3. Perform cleaning and adjusting specified in this Section.
4. Verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearings operations.
5. Lubricate bearings and other moving parts with factory-recommended lubricants.
6. Comb coil fins for parallel orientation.
7. Install clean filters.

C. Starting procedures for blower coil units shall include the following:

1. Energize motor; verify proper operation of motor and fan wheel. Adjust fan to indicated rpm.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.
4. Operate electric heating elements through each stage to verify proper operation and electrical connections. Measure the electric current of the heaters.
5. Test and adjust controls and safeties.

D. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

E. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing.

3.6 DEMONSTRATION

A. Engage the services of a factory-authorized service representative to train Client Agency's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

1. Review data in the operation and maintenance manuals.
2. Schedule training with Client Agency, through Architect, with at least 7 days' advance notice.

END OF SECTION