SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Fan-powered air terminal units.
2. Shutoff, single-duct air terminal units.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittal:
1. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1-2004, Section 5 - "Systems and Equipment."

C. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.

D. Field quality-control reports.

E. Operation and maintenance data.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

PART 2 - PRODUCTS

2.01 PARALLEL FAN-POWERED AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Anemostat Products; a Mestek Company.
2. Carnes.
3. Environmental Technologies, Inc.
4. Krueger.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Price Industries.

8. Titus.
9. Trane;
10. Tuttle & Bailey.

B. Configuration: Volume-damper assembly and fan in parallel arrangement inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch (0.85-mm) steel, single wall.
   a. Cover liner with nonporous foil.
   2. Casing Lining: Adhesive attached, 1-inch- (25-mm-) thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
   3. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
   4. Air Outlet: S-slip and drive connections.
   5. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
   6. Fan: Forward-curved centrifugal, located at plenum air inlet.
   7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

D. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.
   1. Maximum Damper Leakage: ARI 880 rated, 2 to 3 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
   2. Damper Position: Normally open.

E. Velocity Sensors: Multipoint array with velocity sensors in cold- and hot-deck air inlets and air outlets.

F. Motor:
   1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
   2. Type: Electronically commutated motor.
   3. Fan-Motor Assembly Isolation: Rubber isolators.
   4. Efficiency: Premium efficient.
   5. Motor Speed: Multispeed.
      a. Speed Control: Infinitely adjustable with electronic controls.

G. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
   1. Material: Pleated cotton-polyester media having 90 percent arrestance and 7 MERV.
   2. Thickness: 1 inch (25 mm).

H. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
   1. Location: Plenum air inlet.

2. Rows: 2

I. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
   1. Location: Plenum air inlet.
   2. Stage(s): Refer to schedule.
   3. Access door interlocked disconnect switch.
   4. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
   5. Nickel chrome 80/20 heating elements.
   6. Airflow switch for proof of airflow.
   7. Fan interlock contacts.
   8. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
   9. Magnetic contactor for each step of control (for three-phase coils).

J. Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.
   1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
   2. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.
   3. Disconnect Switch: Factory-mounted, fuse type.

K. Electric Controls: 24-V damper actuator with wall-mounted electric thermostat and appropriate mounting hardware.

2.02 SERIES FAN-POWERED AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Anemostat Products; a Mestek Company.
   2. Carnes.
   3. Environmental Technologies, Inc.
   4. Krueger.
   5. METALAIRE, Inc.
   6. Nailor Industries Inc.
   7. Price Industries.
   8. Titus.
   9. Trane; a business of American Standard Companies.
   10. Tuttle & Bailey.

B. Configuration: Volume-damper assembly and fan in series arrangement inside unit casing with control components inside a protective metal shroud for installation above a ceiling.

C. Casing: 0.034-inch (0.85-mm) steel single wall.

1. Casing Lining: Adhesive attached, 1-inch- (25-mm-) thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
5. Fan: Forward-curved centrifugal.
6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

D. Volume Damper: Galvanized steel with flow-sensing ring and peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
2. Damper Position: Normally open.

E. Velocity Sensors: Multipoint array with velocity sensors in cold- and hot-deck air inlets and air outlets.

F. Motor:
1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements.
2. Type: Electronically commutated motor.
3. Fan-Motor Assembly Isolation: Rubber isolators.
4. Efficiency: Premium efficient.
5. Motor Speed: Multispeed.
   a. Speed Control: Infinitely adjustable with electronic controls.

G. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Material: Pleated cotton-polyester media having 90 percent arrestance and 7 MERV.
2. Thickness: 1 inch (25 mm).

H. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
1. Row: 2.

I. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
1. Stage(s): Refer to drawings.
2. Access door interlocked disconnect switch.
3. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
4. Nickel chrome 80/20 heating elements.

5. Airflow switch for proof of airflow.
6. Fan interlock contacts.
7. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
8. Magnetic contactor for each step of control (for three-phase coils).

J. Factory-Mounted and -Wired Controls: Electrical components mounted in control box with removable cover. Incorporate single-point electrical connection to power source.
1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.
2. Wiring Terminations: Fan and controls to terminal strip. Terminal lugs to match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.
3. Disconnect Switch: Factory-mounted, fuse type.

K. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

L. Electric Controls: 24-V damper actuator with wall-mounted electric thermostat and appropriate mounting hardware.

2.03 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Anemostat Products; a Mestek Company.
2. Carnes.
3. Environmental Technologies, Inc.
4. Krueger.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Price Industries.
8. Titus.
9. Trane; a business of American Standard Companies.
10. Tuttle & Bailey.
11. Warren Technology.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch (0.85-mm) steel single wall.
1. Casing Lining: Adhesive attached, 1-inch- (25-mm-) thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

D. Regulator Assembly: System-air-powered bellows section incorporating polypropylene bellows for volume regulation and thermostatic control. Bellows shall operate at temperatures from 0 to 140 deg F (minus 18 to plus 60 deg C), shall be impervious to moisture and fungus, shall be suitable for 10-inch wg (2500-Pa) static pressure, and shall be factory tested for leaks.

E. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
2. Damper Position: Normally open.

F. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
1. Rows: 2.

G. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
1. Access door interlocked disconnect switch.
2. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
3. Nickel chrome 80/20 heating elements.
4. Airflow switch for proof of airflow.
5. Fan interlock contacts.
6. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
7. Magnetic contactor for each step of control (for three-phase coils).

H. Electronic Controls: Bidirectional damper operator and microprocessor-based thermostat with integral airflow transducer and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:
1. Damper Actuator: 24 V, powered closed, powered open.
2. Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg (1000 Pa); and shall have a multipoint velocity sensor at air inlet.
3. Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

3.02 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.03 SEISMIC-RESTRAINT-DEVICE INSTALLATION

3.04 CONNECTIONS

A. Install piping adjacent to air terminal unit to allow service and maintenance.

B. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

C. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."

D. Make connections to air terminal units with sheet metal ductwork. Inlet connection shall be a straight length of duct, equal to 12” or 3 times the inlet diameter of the terminal unit.

3.05 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Air terminal unit will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.07 STARTUP SERVICE

A. Perform startup service.
1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

3.08 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 23 36 00