

SECTION 23 36 00 – AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fan-powered air terminal units.
 - 2. Shutoff single-duct air terminal units.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data" include the following:
 - 1. Instructions for resetting minimum and maximum air volumes.
 - 2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.5 COORDINATION

- A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FAN-POWERED AIR TERMINAL UNITS

- A. **Available Manufacturers:**
 - 1. Anemostat; a Mestek Company.
 - 2. Carnes.
 - 3. Environmental Technologies, Inc.; Enviro-Air Div.
 - 4. Krueger.
 - 5. METALAIRE, Inc.; Metal Industries Inc.
 - 6. Nailor Industries of Texas Inc.
 - 7. Price Industries.
 - 8. Titus.
 - 9. Trane Co. (The); Worldwide Applied Systems Group.
 - 10. Tuttle & Bailey.
- B. Configuration: Volume-damper assembly and fan in series or in parallel arrangement inside unit casing with control components inside a protective metal shroud.

- C. Casing: **0.034-inch (0.85-mm) steel.**
1. Casing Lining: **1-inch- (25-mm-)** thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. **Cover liner with nonporous foil.**
 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 dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
- D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, **2 percent** of nominal airflow at **3-inch wg (750-Pa)** inlet static pressure.
 2. Damper Position: Normally **open**.
- E. Fan Section: Galvanized-steel plenum, with direct-drive, forward-curved fan with air filter and backdraft damper.
1. Lining: **1-inch- (25-mm-)** thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. **Cover liner with nonporous foil.**
 2. Motor: **Multispeed.** Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - a. Speed Control: Infinitely adjustable with pneumatic-electric and electronic controls.
 - b. Fan-Motor Assembly Isolation: Rubber isolators.
 3. Air Filter: **2-inch- (50-mm-)** thick, **fiberglass throwaway.**
- F. Attenuator Section: **0.034-inch (0.85-mm) steel** sheet metal.
1. Lining: **1-inch- (25-mm-)** thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. **Cover liner with nonporous foil.**
- G. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig (1380 kPa); and factory installed.
- H. Factory-Mounted and -Wired Controls: Electrical components shall be 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, and terminal lugs shall 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, fused type.
- I. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

- J. Electronic Controls: Bidirectional damper operator and microprocessor-based controller with integral airflow transducer and room sensor shall be compatible with temperature controls specified in Division 23 Section "Instrumentation and Control for HVAC" and shall have the following features:
1. Proportional, plus integral control of room temperature.
 2. Time-proportional reheat-coil control.
 3. Occupied and unoccupied operating mode.
 4. Remote reset of airflow or temperature set points.
 5. Adjusting and monitoring with portable terminal.
 6. Communication with temperature-control system specified in Division 23 Section "Instrumentation and Control for HVAC."
- K. Control Sequence:
1. With central system fan operating in occupied mode, sequence the controls as follows:
 - a. When primary duct is pressurized, modulate volume damper to maintain room temperature.
 - b. On reduced-cooling demand, close volume damper. At a field-adjustable point, air terminal fan is energized.
 - c. As cooling demand increases, increase air terminal fan speed.
 - d. If central duct system pressure varies, modulate volume damper to maintain constant primary airflow.
 - e. If no cooling or heating demand, control enters field-adjustable, no-load band.
 - f. On heating demand, energize heating coil.
 2. With central system fan operating in unoccupied mode, sequence the controls as follows:
 - a. On heating demand, energize air terminal unit fan and heating coil.
 - b. Maintain field-adjustable setback temperature.
 - c. Close volume damper.

2.3 SHUTOFF SINGLE-DUCT AIR TERMINAL UNITS

A. **Available Manufacturers:**

1. Anemostat; a Mestek Company.
2. Carnes.
3. Environmental Technologies, Inc.; Enviro-Air Div.
4. Krueger.
5. METALAIR, Inc.; Metal Industries Inc.
6. Nailor Industries of Texas Inc.
7. Phoenix Controls Corporation.
8. Price Industries.
9. Titus.
10. Trane Co. (The); Worldwide Applied Systems Group.
11. Trox USA, Inc.
12. Tuttle & Bailey.
13. Warren Technology.

- B. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.
- C. Casing: **0.034-inch (0.85-mm) steel**.
 - 1. Casing Lining: **1-inch- (25-mm-)** thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. **Cover liner with nonporous foil.**
 - 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 dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket.
- D. Regulator Assembly: Extruded-aluminum or galvanized-steel components; key damper blades onto shaft with nylon-fitted pivot points located inside unit casing.
 - 1. Automatic Flow-Control Assembly: Combined spring rates shall be matched for each volume-regulator size with machined dashpot for stable operation.
 - 2. Factory-calibrated and field-adjustable assembly with shaft extension for connection to externally mounted control actuator.
- E. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
 - 1. Maximum Damper Leakage: ARI 880 rated, **2 percent** of nominal airflow at **3-inch wg (750-Pa)** inlet static pressure.
 - 2. Damper Position: Normally **open**.
- F. Attenuator Section: **0.034-inch (0.85-mm) steel** sheet metal.
 - 1. Lining: **1-inch- (25-mm-)** thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. **Cover liner with nonporous foil.**
- G. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig (1380 kPa); and factory installed.
- H. DDC Controls: Bidirectional damper operators and microprocessor-based controller and room sensor 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. Terminal Unit Controller: Pressure-independent, variable-air-volume controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:
 - a. Proportional, plus integral control of room temperature.
 - b. Time-proportional reheat-coil control.
 - c. Occupied and unoccupied operating mode.
 - d. Remote reset of airflow or temperature set points.
 - e. Adjusting and monitoring with portable terminal.
 - f. Communication with temperature-control system specified in Division 23 Section "Instrumentation and Control for HVAC."

3. Room Sensor: Wall mounting, with temperature set-point adjustment and access for connection of portable operator terminal.
- I. Control Sequence:
 1. Suitable for operation with duct pressures between 0.25- and 3.0-inch wg (60- and 750-Pa) inlet static pressure.
 2. Factory-mounted and -piped, 5-micron filter; velocity-resetting, adjustable, high-limit control; and amplifying relay.
 3. System-powered, wall-mounting thermostat.

2.4 SOURCE QUALITY CONTROL

- A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.
- B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 - EXECUTION

3.1 INSTALLATION

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

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to air terminal units to allow service and maintenance.
- C. 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.
- D. Connect ducts to air terminal units according to Division 23 Section "**Metal Ducts**"
- E. Ground units with electric heating coils according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- G. 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.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, **test, and adjust** field-assembled components and equipment installation, including connections, **and to assist in field testing**. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 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. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - a. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
 - b. Verify that controls and control enclosure are accessible.
 - c. Verify that control connections are complete.
 - d. Verify that nameplate and identification tag are visible.
 - e. Verify that controls respond to inputs as specified.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION