

SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

Air terminal units, air flow control valves.

1.2 RELATED WORK

- A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic restraints for 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: Noise requirements.
- D. Section 23 31 00, HVAC DUCTS AND CASINGS: Ducts and flexible connectors.
- E. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Valve operators.
- F. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC: Flow rates adjusting and balancing.
- G. Section 23 82 16, AIR COILS: Heating and Cooling Coils pressure ratings.
- H. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS: Requirements for commissioning, systems readiness checklists, and training.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Place adhesive colored dots on the ceiling grid to show location of equipment located above the ceiling requiring maintenance such as VAV boxes, filters, Fire Alarm Dampers, combination fire/smoke dampers, venture valves and similar items.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
 - 1. Air Terminal Units: Submit test data.

2. Air flow control valves.

C. Samples: Provide one typical air terminal unit for approval by the Resident Engineer. This unit will be returned to the Contractor after all similar units have been shipped and deemed acceptable at the job site.

D. Certificates:

1. Compliance with paragraph, QUALITY ASSURANCE.

2. Compliance with specified standards.

E. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.

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 and Refrigeration Institute (AHRI)/(ARI):

880-08.....Air Terminals Addendum to ARI 888-98

incorporated into standard posted 15th December
2002

C. National Fire Protection Association (NFPA):

90A-09.....Standard for the Installation of Air
Conditioning and Ventilating Systems

D. Underwriters Laboratories, Inc. (UL):

181-08.....Standard for Factory-Made Air Ducts and Air
Connectors

E. American Society for Testing and Materials (ASTM):

C 665-06.....Standard Specification for Mineral-Fiber
Blanket Thermal Insulation for Light Frame
Construction and Manufactured Housing

1.6 GUARANTY

In accordance with Section 00 72 00, GENERAL CONDITIONS.

PART 2 - PRODUCTS

2.1 GENERAL

A. Coils:

1. Water Heating Coils:

a. ARI certified, continuous plate or spiral fin type, leak
tested at 2070 kPa (300 PSI).

- b. Capacity: As indicated, based on scheduled entering water temperature.
 - c. Headers: Copper or Brass.
 - d. Fins: Aluminum, maximum 315 fins per meter (8 fins per inch).
 - e. Tubes: Copper, arrange for counter-flow of heating water.
 - f. Water Flow Rate: Minimum 0.032 Liters/second (0.5 GPM).
 - g. Provide vent and drain connection at high and low point, respectively of each coil.
 - h. Coils shall be guaranteed to drain.
- B. Labeling: Control box shall be clearly marked with an identification label that lists such information as nominal CFM, maximum and minimum factory-set airflow limits, coil type and coil connection orientation, where applicable.
- C. Factory calibrate air terminal units to air flow rate indicated. All settings including maximum and minimum air flow shall be field adjustable.
- D. Dampers with internal air volume control: See section 23 31 00 HVAC DUCTS and CASINGS.
- E. Terminal Sound Attenuators: See Section 23 31 00 (HVAC DUCTS AND CASINGS).

2.2 AIR TERMINAL UNITS (BOXES)

- A. General: Factory built, pressure independent units, factory set-field adjustable air flow rate, double-wall construction, suitable for single duct applications, as indicated. Clearly show on each unit the unit number and factory set air volumes corresponding to the contract drawings. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC work assume factory set air volumes. Coordinate flow controller sequence and damper operation details with the drawings and Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. All air terminal units shall be brand new products of the same manufacturer.
- B. Capacity and Performance: The Maximum Capacity of a single terminal unit shall not exceed 566 Liters/second (1,200 CFM)
- C. Sound Power Levels:
Acoustic performance of the air terminal units shall be based on the design noise levels for the spaces stipulated in Section 23 05 41 (Noise and Vibration Control for HVAC Piping and Equipment). Equipment schedules shall show the sound power levels in all octave bands.

Terminal sound attenuators shall be provided, as required, to meet the intent of the design.

- D. Casing: Unit casing shall be constructed of galvanized steel **double-wall** construction, not lighter than 0.85 mm (22 gauge) or aluminum sheet not lighter than 1 mm (0.040 IN). Provide hanger brackets for attachment of supports.

1. Insulating material: Suitable to provide required acoustic performance, thermal insulation and prevent sweating. Meet the requirements of NFPA 90A and comply with UL 181 for erosion. Insulation shall consist of 25mm (1-INCH) thick non-porous foil faced rigid fiberglass insulation of 4-lb/cu.ft, secured by full length galvanized steel z-strips which enclose and seal all edges. Tape and adhesives shall not be used. Materials shall be non-friable and with surfaces, including all edges, fully encapsulated and faced with perforated metal or coated so that the air stream will not detach material. No internal lining material is permitted in the boxes serving Laboratories, Tissue Culture Rooms, or Animal Procedure Rooms.
2. Access panels (or doors): Provide double-wall panels large enough for inspection, adjustment and maintenance without disconnecting ducts, and for cleaning heating coils attached to unit, even if there are no moving parts. Panels shall be insulated to same standards as the rest of the casing and shall be secured and gasketed airtight. It shall require no tool other than a screwdriver to remove.
3. Total leakage from casing: Not to exceed 2 percent of the nominal capacity of the unit when subjected to a static pressure of 747 pa (3 IN WG), with all outlets sealed shut and inlets fully open.

- E. Construct dampers and other internal devices of corrosion resisting materials which do not require lubrication or other periodic maintenance.

1. Damper Leakage: Not greater than 2 percent of maximum rated capacity, when closed against inlet static pressure of 1 kPa (4-inch WG).

- F. Provide multi-point velocity pressure sensors with external pressure taps.

1. Provide direct reading air flow rate table pasted to box.

- G. Provide static pressure tubes.
- H. Factory calibrate air terminal units to air flow rate indicated. All settings including maximum and minimum air flow shall be field adjustable.
- H. Provide sound attenuators where scheduled. Attenuators to be as specified in Section 23 31 00, HVAC DUCTS AND CASINGS.
- I. Externally powered DDC variable air volume controller and damper actuator to be furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC for factory mounting on air terminal units. The DDC controller shall be electrically actuated.
- J. Heating coils for air terminal units: ARI certified, continuous plate or spiral fin type, leak tested at 2070 kPa (300 PSI).
 - 1. Capacity: As indicated, based on scheduled entering water temperature.
 - 2. Headers: Copper or Brass.
 - 3. Fins: Aluminum, maximum 315 fins per meter (8 fins per IN).
 - 4. Tubes: Copper, arrange for counter-flow of heating water.
 - 5. Water velocity: 2.4 m/s (8 FPS) maximum with head loss not greater than indicated.
 - 6. Provide vent and drain connection at high and low point, respectively of each coil.
 - 7. Coils shall be guaranteed to drain.

2.3 AIR FLOW CONTROL VALVE (AFCV)

- A. Airflow control device shall be a venturi valve type air flow control valve.
- B. Pressure independent over a 150 Pa-750 Pa 0.6 IN WG - 3.0 IN WG drop across valve.
- C. Volume control accurate to plus or minus 5% of airflow over an airflow turndown range of 16 to 1. No minimum entrance or exit duct diameters shall be required to ensure accuracy or pressure independence.
- D. Response time to change in command signal and duct static pressure within three seconds.
- E. Supply and General Exhaust Applications: 16 gauge spun aluminum valve body and control device with continuous welded seam and 316 stainless steel shaft and shaft support brackets. Pressure independent springs shall be stainless steel. Shaft bearing surfaces shall be Teflon or polyester.

F. Fumehood and BioSafety Cabinet Exhaust Applications: 316 stainless steel continuous welded seam valve body, control device, shaft, shaft support bracket, pivot arm and internal mounting link. The control device shall have a baked on corrosion resistant phenolic coating. The shaft shall have a Teflon coating and all shaft bearing surfaces shall be made of Teflon. The pressure independent springs shall be made of stainless steel.

G. The airflow device shall have no exposed aluminum or stainless steel components. The shaft support brackets, pivot arm, internal mounting link, and pressure independent springs shall have a baked-on corrosion resistant phenolic coating. Internal nuts, bolts, and rivets shall be titanium or phenolic coated stainless steel.

H. Constant volume units:

1. Internal spring compresses to maintain constant volume of air.
2. As static pressure decreases internal spring expands to increase annular area to maintain constant volume of air.
3. Shaft positioned using direct potentiometer measurement to produce a linear factory calibrated feedback.

I. Variable volume units:

1. Actuator to be factory mounted to the valve.
2. Closed loop control of airflow by way of flow feedback signal with less than 1 second response time.
3. Shaft positioned using direct potentiometer measurement to produce a linearized factory calibrated feedback.
4. The maximum and minimum airflows shall be as scheduled.

J. Certification:

1. Control device: factory calibrated to airflows detailed on plans using NIST traceable air stations and instrumentation having a combined accuracy of plus or minus 1% of signal over the entire range of measurement.
2. Electronic airflow control devices: further calibrated and their accuracy verified to plus or minus 5% of signal at a minimum of eight different airflows across the full operating range of the device.
3. All airflow control devices: individually marked with device specific, factory calibration data to include: tag number, serial

number, model number, eight point characterization information (for electronic devices), and quality control inspection numbers.

2.06 BENCHTOP MECHANICAL SNORKEL

- A. Where indicated on the drawings, furnish and install Nederman FX ESD Safe Extractor Arm 3"- ESD Fume Extractor or approved substitute.
- B. Base: Constructed of PolyPropylene (PP) Conductive. Base shall have 360 degree swivel capability.
- B. Hose: White, 3-inch tube with minimum 6-foot working radius.
- D. Provide a stainless steel extension at exhaust connection to the snorkel such that overhead duct connection to the snorkel is not visible below the ceiling.
- C. Adjustable from 60 to 150 cfm.
- D. Suitable for benchtop venting of dust, fumes, vapors and solvents.
- E. Adjustable arm joints shall be fully external for unobstructed airflow.
- F. Unit shall be suitable for wall or ceiling mounting.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.
- B. Handle and install units in accordance with manufacturer's written instructions.
- C. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.
- D. Locate air terminal units to provide a straight section of inlet duct for proper functioning of volume controls.
- E. Place adhesive colored dots on the ceiling grid to show location of equipment located above the ceiling requiring maintenance such as VAV boxes, filters, Fire Alarm Dampers, combination fire/smoke dampers, venturi valves, control valves, controllers and similar items.

3.2 OPERATIONAL TEST

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

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