

## **23 36 00 – AIR TERMINAL UNITS REVISION**

### **PART 1: GENERAL**

#### **1.1 PURPOSE:**

- A. This standard is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. The responsibility of the engineer is to apply the principles of this section such that the University may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be justified through LCC analysis and submitted to the University for approval.

#### **1.2 REFERENCES:**

- A. Base acoustic performance of terminal units upon units tested according to ARI 880 and ASHRAE Standard 130.
- B. Base occupied space sound level estimates on ARI 885.
- C. Terminal heating coils shall conform to ARI 410.

#### **1.3 REQUIREMENTS:**

- A. Base acoustic performance of terminal units upon units tested according to ARI 880 and ASHRAE Standard 130.
- B. Provide unit with factory-mounted 24 volt transformer for single point electrical connection.
- C. Electric actuators shall be sized appropriately with specified control type and manufactured by Belimo unless approved by Owner.

### **PART 2: PRODUCTS**

#### **2.1 SINGLE DUCT VARIABLE AIR VOLUME UNITS:**

- A. Units shall be capable of controlling air volume to within plus or minus 5% of air volume set-point, as determined by the zone temperature sensor demand with variations in inlet pressures from 0.10" to 6" w.g.
- B. Units shall have internal air resistance, including hydronic heating coil, not to exceed 0.4" w.g. at maximum flow.
- C. Provide external differential pressure taps separate from the control pressure taps for airflow measurement with a 0"-1" w.g. range.
- D. Select units at maximum 2,000 FPM and minimum 400 FPM inlet velocity with unit discharge and radiated sound power levels such that occupied space Noise Criteria does not exceed NC-30 per ARI 885.
- E. Units shall be constructed with minimum 22 gauge galvanized steel enclosures.
- F. Casing Leakage: Assembled units shall be so constructed and sealed to limit air leakage to the following listed quantities at 3" static pressure. If sealing is required to obtain the leakage performance, seal as for medium pressure ductwork Hardcast 1602 tape may be used to seal lap joints and flat seams only. Leakage curves or tables will be required as part of the submittal data. The following is the maximum allowable casing leakage including all components:

| <u>Diameter</u> | <u>Maximum Allowed CFM<br/>(Area x 2000fpm)</u> | <u>Maximum Allowable CFM<br/>Casing Leakage</u> |
|-----------------|---|---|
| 4"-5"-6"        | 393   | 8.0   |
| 7"-8"           | 698   | 14.0  |
| 9"-10"          | 1091  | 22.0  |
| 11"-12"         | 1571  | 30.0  |
| 13"-14"         | 2138  | 40.0  |

- G. The following is the maximum damper leakage allowable for the various size diameter inlets. The damper leakage shall not exceed the values listed in the table below at 6" w.g. differential pressure, following ARI 880 Testing Procedures.

| <u>Diameter</u> | <u>Maximum Allowed CFM<br/>(Area x 2000fpm)</u> | <u>Maximum Allowable<br/>CFM Casing Leakage</u> |
|-----------------|---|---|
| 4"-5"-6"        | 393   | 6.0   |
| 7"-8"           | 698   | 10.5  |
| 9"-10"          | 1091  | 16.5  |
| 11"-12"         | 1571  | 20.0  |
| 13"-14"         | 2138  | 30.0  |

- H. Provide minimum ¾" internal lining with all edges sealed against airflow erosion in accordance with NFPA 90A and UL 181.
- I. Unit air volume shall be set at factory and provided such that special tools are not required for field adjustment.

## 2.2 FAN POWERED VARIABLE AIR VOLUME UNITS:

- A. Units shall be capable of controlling air volume to within plus or minus 5% of air volume set-point, as determined by the zone thermostat demand with variations in inlet pressures from 0.10" to 6" w.g.
- B. Units shall be constructed with minimum 20 gauge galvanized steel enclosures.
- C. Damper (air valve) shall have a leakage rate of less than 2% of the box's maximum scheduled CFM at 2 times primary supply air duct static pressure or 3" w.g. (whichever is smaller).
- D. Provide minimum ¾" internal lining with all edges sealed against airflow erosion in accordance with NFPA 90A and UL 181.
- E. Fans in parallel terminal units shall be forward curved, centrifugal, direct-drive motor with SCR controller for airflow adjustments from 60%-100%. The SCR controller and fan motor shall be harmonically balanced to reduce electrical noise
- F. Fans in series terminal units shall be forward curved, centrifugal with direct-drive electronic commutated motors (ECM).
- G. Fan and motor assembly shall be internally suspended and isolated from the casing on rubber in shear isolators. Fan and motor assembly shall be easily accessible through access panels without disassembling the entire unit. Fan assembly shall include an anti-backward rotation device.

## 2.3 TERMINAL HEATING COILS:

- A. Shall be hot water fin and tube type constructed of seamless copper with aluminum fins mechanically bonded to the tubes and copper headers.
- B. Casing and tube supports shall be minimum 16 gauge galvanized steel.

- C. Coils shall be drainable, suitable for 250 psig working pressure, with circulated tubes factory tested at not less than 300 psig air pressure.

2.4 DUAL DUCT TERMINAL UNITS (MIXING LATERALS):

- A. Dual duct systems, either existing or justified through LCC, shall utilize UT standard mixing laterals for zone temperature control. Refer to UT System (OFPC) Standard Details (Section 6.01.03) and Section 23 31 00 for mixing lateral construction details.
- B. Damper casings shall be constructed of 18 gauge galvanized sheet metal, sized with female connections each end.
- C. The damper blades shall be 16 gauge cold rolled galvanized steel and shall be spot welded to shaft.
- D. The damper shafts shall be round and operate in rustproof self-lubricating bearings (not plastic). The end of the shaft at the operator end shall be scored in line with the damper blade to reference the damper blade position.
- E. Dampers shall be Arrow Model 70-UTA, or as approved by Owner.
- F. Electric actuators shall be furnished, mounted and adjusted by the BAS contractor. Terminal volume damper manufacturer shall provide mounting base on terminal unit for mounting of actuator. Actuator shall be sized for specific application with a minimum torque of 40”/lb. and shall utilize brushless motor. Housing shall be designed for reversing rotation. Actuator shall be proportional control, 0-10V, spring return with maximum run time of 150 seconds and spring return time of less than 60 seconds. Maximum power draw of actuator shall be 10VA. All actuators installed throughout project shall be of the same manufacturer and model.
- G. Electric actuators shall be sized appropriately with specified control type and manufactured by Belimo, unless approved by Owner.

**PART 3: EXECUTION**

3.1 INSTALLATION:

- A. Maintain NEC and manufacturer’s recommended clearances for control enclosures.
- B. Provide manufacturer’s minimum straight duct inlet requirements.

END OF SECTION 23 36 00