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1. **Design Criteria:**

- a. The intent of this section is to outline the basic requirements for Terminal Air units and associated components.

2. **Reference Standards:**

- a. NFPA 90A - Installation of Air Conditioning and Ventilation Systems
- b. UL 181 - Factory-Made Air Ducts and Connectors
- c. NFPA 70 - Electric Duct Heaters
- d. UL 1995, Heating and Cooling Equipment
- e. CUL C22.2 No. 236, Heating and Cooling Equipment
- f. ARI 880 - Air-Conditioning and Refrigeration Institute Standard Rating Conditions for Air Terminals.

3. **Submittals to be reviewed by University:**

- a. Submit shop drawings and product data sheets indicating configuration, general assembly, and materials used in fabrication.
- b. Submit product performance data indicating design air flow, minimum static pressure drop, fan operating condition.
- c. Submit sound power and noise criteria (NC) values for radiated and discharge paths.
- d. Submit installation, operation and maintenance documentation

4. **Products, Materials & Equipment:**

- a. Acceptable manufacturers contingent on compliance with the specifications:
 - i. Enviro-Tec
 - ii. Price
 - iii. Nailor
 - iv. Trane
 - v. Titus
- b. Provide Terminal unit assemblies with:
 - i. Operating characteristics and other requirements so as to comply with schedules and details on the drawings and as hereinafter specified
 - ii. The physical sizes of units shall not be larger than the scheduled units.
 - iii. Terminal units shall be UL listed as an entire assembly.
 - iv. Terminal units shall be UL Labeled as an entire assembly.
 - v. Shall be lined with thermal and acoustic insulation meeting "Hospital

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- Grade".
- vi. Access doors securely attached to the box upstream of the heating coil.
- vii. Access doors securely attached to the box downstream of the heating coil.
- viii. Identification label
 - 1. Box Identification number matching the drawings
 - 2. Air flow.
 - 3. Maximum factory-set air flow.
 - 4. Minimum factory-set air flow.
 - 5. Coil type
- ix. Direction of Air flow.
- c. Primary Air Valve:
 - i. Minimum 22 gauge cylindrical body
 - ii. Damp Blade
 - 1. Connected to a solid shaft by means of an integral molded sleeve which does not require screw or bolt fasteners.
 - 2. Minimum of 20 gauge
 - iii. The shaft shall include a damper position indicator visible from the exterior of the unit
 - iv. The damper shall pivot in self-lubricating bearings
 - v. The damper actuator shall be mounted on the exterior of the terminal for ease of service
 - vi. The valve assembly shall include internal mechanical stops for both full open and closed positions
 - vii. The damper blade seal shall be secured without use of adhesives
 - viii. The air valve leakage shall not exceed 1% of maximum inlet rated airflow at 3" w.g. inlet pressure
 - ix. Damper shall pivot in nylon self-lubricating bearings
 - x. Damper shall remain unaffected by temperature and humidity
- d. Primary Air Sensor:
 - i. The primary air valve shall include a differential pressure type sensor upstream of the damper blade
 - ii. The sensor shall traverse the inlet collar (for total pressure) along (2) axis. A minimum of (12) sensing points shall be utilized
 - iii. The sensor shall be accessible and removable for easy cleaning.
 - iv. Each sensing point shall be located for accuracy.
 - v. The sensor shall be designed to average the pressure signals.
 - vi. The average signal of these pressures shall pass to the control device signal through a single port
 - vii. Brass balancing taps and airflow calibration charts shall be provided for

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- field measurements.
- viii. The sensor shall be designed to provide an amplified differential pressure signal.
- ix. Signal shall provide accurate control of the air flow to or below the minimum flows scheduled and to one half the minimum for variable volume units.
- x. Documentation shall be submitted which substantiates this requirement.
- e. The manufacturer shall display the ARI Symbol on all units:
 - i. Insulation:
 - 1. Min. thickness of 1.0"; min. R-Value 4.6.
 - 2. Complies with:
 - a. NFPA-90A.
 - b. UL 181
 - c. UL 723
 - d. ASTM 84
 - e. Bacteriological Standard ASTM C665
 - f. Hospital Grade
 - g. All insulation to be metal encased
 - h. Adhesives shall comply with NFPA 90A
 - i. Secured to the terminal casing using mechanical fasteners in addition to adhesives.
 - 3. Closed cell foam:
 - a. Min. density of 2.5lb/cu.ft
 - b. Min. R-value of 1.4
 - f. Heating coils:
 - i. All supply terminals scheduled with a heating coils shall be equipped hot water heating.
 - 1. Coils shall be enclosed in a sheet metal casing.
 - 2. Coils casing shall be insulated with min. R6.0 insulation.
 - 3. The maximum coil air velocity shall be as scheduled.
 - 4. The minimum coil performance shall be as scheduled.
 - 5. The maximum pressure drop scheduled shall not be exceeded at the box maximum CFM.
 - 6. Coils shall be removable.
 - 7. Coils shall have access doors upstream and downstream of coil.
 - 8. Coils shall have left- or right-hand connections to suit job conditions
 - 9. Two (2) rows to meet heating requirements
 - 10. Coils shall have aluminum plate fins maximum of 6 fins per inch.
 - 11. Tested with 400 psig hydrostatic pressure (underwater).
 - 12. The minimum fin thickness shall be 0.095 inches

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13. All coils shall be performance certified in accordance with ARI 410 (latest Edition)

- g. Sound Attenuators
 - i. Min. sheet metal gauge: 20 gauge
 - ii. Hospital grade lining
- h. Unit controls:
 - i. DDC controls with:
 - 1. Terminal Air Units
 - 2. Furnished and shipped to the box manufacturer by the ATC Contractor.
 - 3. The ATC Contractor shall be responsible for all costs associated with shipping the controls to the terminal box manufacturing facility.
 - 4. Box damper actuators, transformers, and controller shall be installed by the box manufacturer. Box actuator and damper shall be separate components, not permanently fixed together.
 - 5. The box manufacturer shall factory mount and wire the controller and actuator in accordance with ATC Contractor's instructions.
 - 6. Controller installation costs shall be borne by the airflow terminal box manufacturer.
 - 7. Box manufacturer shall provide velocity inlet probe and NEMA control cover
 - i. Single Duct Terminal Units:
 - i. Terminal casings shall be:
 - 1. Minimum 22 gauge sheet metal casing and insulation
 - 2. Primary valve: See Products - General
 - 3. Primary Air Pressure Sensor: See Products - General
 - 4. Terminal shall be assembled and sealed for an airtight casing:
 - a. Meet SMACNA leakage class 3 at 3" w.g

5. Installation, Fabrication, and Construction:

- a. Terminal boxes shall be installed with adequate service space to access the controller side of the unit and the reheat coil control valve.
- b. Provide an access door in ductwork downstream of heating coil in addition to access door on unit upstream of coil. Label all access doors in accordance with UVM labeling requirements.

6. Warranties:

- a. Provide manufacturer's parts warranty for one (1) year from unit start-up.