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.

B. Section(s) 23 09 13 – Instrumentation and Control Devices for HVAC (and companion sections)

C. Section 23 09 23 – Building Automation System (BAS) for HVAC

D. Section 23 34 00 – HVAC Fans

E. Section 23 31 00 – HVAC Ducts

F. Section 23 33 00 – Air Duct Accessories

G. Section 23 82 16 – Air Coils

1.2 SUMMARY

A. This section includes the following:
   1. Air terminal units, single duct

1.3 DEFINITIONS

A. Manufacturers: In Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Basis of Design: Products indicated by manufacturer and model within the contract documents are considered the Basis of Design. This includes plan drawings, drawing details, schedules, specifications, etc. Subject to compliance with requirements, provide the basis of design products unless the manufacturer provisions (below) or substitution provisions within the contract documents are complied with.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified. Non basis of design products which are listed by manufacturer name only may be considered for bid. By submitting a bid based on a non-basis of design product, the contractor acknowledges performance of a comprehensive review of the collateral impacts to themselves and to other trades. Contractor use of non-basis of design products shall not be the basis for additional time of costs to the Owner.
   3. Non-listed Products: Subject to compliance with requirements, Products not indicated within the Contract Documents shall not be used unless positively reviewed within a substitution request.

B. Abbreviations:
   1. AHRI: Air-conditioning, heating, and refrigeration institute.
   4. BAS: Building Automation System.
   5. CFM: Cubic feet per minute.
   6. DDC: Direct Digital Control
   7. Deg.: Degrees
8. Etc.: Et cetera “and other similar things”
10. FPM: Feet per minute.
11. HVAC: Heating, Ventilating, and Air-conditioning
12. IN or “”: Inches
14. Pcf: Pounds per cubic foot
15. TAB: Testing, adjusting, and balancing
16. UIUC or U of I: The University of Illinois at Urbana-Champaign
17. UL: Underwriter’s Laboratory
18. W.c.: Water column

1.2 REFERENCES
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. Materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   2. UL 181 - Factory-Made Air Ducts and Connectors.
   3. AHRI Standard 880 for Air Terminals.
   4. ANSI/ASHRAE Standard 130 – Methods of Testing for Rating Ducted Air Terminal Units.

1.3 QUALITY ASSURANCE
A. Air coils shall be AHRI certified, assuring validity of published performance ratings.
B. Products and execution shall be in compliance with applicable codes and standards including those referenced above in paragraph entitled REFERENCES.
C. Installation, start-up and operation shall be in compliance with Manufacturer’s recommendations and installation, operation, and maintenance manuals.

1.4 SUBMITTALS
A. Product Data:
   1. Shop Drawings of product data indicating configuration, general assembly, access space required for service, and materials used in fabrication.
   2. Electronic or Printed Catalog performance ratings that indicate nominal inlet size, CFM, applicable static pressure at the inlet or discharge of terminal unit, and noise criteria with sound octave band and sound decibel test in accordance with AHRI-880, for the insulation lining selected.
   3. Leakage curves indicating inlet static pressure and actual tested leakage rates shall be submitted for non-standard or custom-built terminal units.
PART 2 - PRODUCTS

2.1 GENERAL
A. Materials shall meet or exceed applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 MANUFACTURERS
A. The same manufacturer shall provide products supplied and/or installed under this Section.
B. Manufacturers:
   1. Daikin.
   2. Enviro-Tec.
   3. Metalaire
   5. Price.

2.3 GENERAL CONSTRUCTION
A. Casing:
   1. Unit casing: Terminal unit casing shall be constructed of minimum 22-gauge galvanized steel.
   2. Insulation: Insulation shall meet the requirements of UL181 and NFPA-90A and shall not support bacterial or fungal growth. Insulation shall be neatly installed with no rough edges to interrupt the smooth flow of air through the unit. Casing shall be insulated throughout its interior.
      a. For general use applications in supply and return air systems; Provide a minimum 1-inch thick, 1.5-pcf density, closed cell, fiber-free insulation liner.
      b. For wet, corrosive, or other applications such as outdoor air, exhaust air, mixed air, laboratories, natatoriums, showers, locker rooms, kitchens, etc.; Provide terminal unit casing of double-wall construction, internally insulated with a 1-inch thick, 1.9-pcf, glass fiber insulation to produce an R-value of 4.2 or greater. The interior liner shall be minimum 26-gauge metal of the type suitable for the application (galvanized steel, aluminum, stainless-steel, etc.).
   2. Casing Leakage: Assembled units shall be constructed such that casing leakage does not exceed 1.0-percent of terminal unit rated airflow at 4-in-w.c. of inlet static pressure.
B. Damper:
   1. Damper Leakage: Units shall be tested for inlet leakage with 4-in-w.c. static pressure imposed. The maximum percent leakage from tests shall be reported. The following table provides the maximum allowable damper leakage for the various size diameter inlets at 4 inches w.g. differential pressure.
2. Flow Measurement: Airflow through the unit shall be accomplished by the use of a metal multi-port velocity pressure cross sensor or multi-axis flow ring devices with a minimum of four (4) radially distributed pick-up points connected to a center averaging chamber.

C. Access Plenum:

3. Single duct units with hot water coils shall be provided with one access section or plenum between the single duct terminal and the coil, and another access downstream of the coil, for coil inspection. Plenum construction shall be equal to the quality of materials and workmanship of the terminal unit.

4. Access plenum may also be used as a transition. Construct with a transition angle not to exceed 15-degrees.

5. Access plenum shall contain a minimum of a 12-in diameter or 12-in x 12-in (or full unit width if less than 12-in) access door as specified in Section 23 33 00.

6. Door frame may be bolted, screwed, or flanged and sealed to the casing. Door shall be gasketed and shall be double wall construction or insulated similar to main casing. Door shall be held in place with latches or other captive retainer devices.

D. Hot Water Heating Coil:

1. Heating coils shall be installed on terminal units without exception and regardless of area served. The heating coil shall be provided with modulating temperature controls. Reference Section 23 82 16 for specifications on coils.

   a. Note: At the Contractor’s option, coils may be provided by the equipment manufacturer listed in separate sections. Coils provided by the equipment manufacturer shall meet the full requirements of this section.

E. Unit Controls:

1. General Performance: Flow stations, control transformers, disconnect switch, and controls enclosure shall be furnished, mounted and adjusted by the terminal unit manufacturer to assure their proper placement within the units. If DDC controls of another manufacturer (not the terminal unit manufacturer) are provided for the Project, the terminal unit manufacturer shall be responsible only for construction of the terminal unit and installation of internal control components installed at the manufacturer’s factory and shall not be responsible for installation of controls not installed at the terminal unit manufacturer’s factory, nor shall the manufacturer be responsible for the performance of the DDC controls. The performance of DDC controls in connection with terminal units shall be the responsibility of the BAS Provider.
2. Control Performance: Assemblies shall be able to be reset to airflow values between zero and the maximum CFM shown on Drawings. To allow for maximum future flexibility, it shall be necessary to make only simple screwdriver or keyboard adjustments to arrange each unit for specified maximum airflow within the ranges for each inlet size as scheduled on the Drawings. The control devices shall be designed to maintain the desired flow regardless of inlet flow deflection.

3. Control Sequences: Terminal units shall be shipped from the manufacturer with necessary control devices to accomplish each sequence, except as may be prohibited by the BAS Provider.

F. DDC Controls Protocol/Description:

1. BAS Provider shall be responsible for providing damper actuators, linkages, flow transducers, controllers, room temperature sensors, and other devices required for unit control, except as specified below.

2. BAS Provider shall be responsible for calibrating the actuator and its controller through TAB work for scheduled airflow rates. Units shall be capable of field calibration and readjustment with external gauge taps.

3. Unit manufacturer shall provide unit inlet flow sensor and pneumatic tubing for BAS Provider's use.

4. Unit manufacturer shall factory install devices furnished by BAS Provider to result in a complete functioning unit. Unit manufacturer shall be responsible for reviewing compatibility of devices furnished by BAS Provider to units provided.

2.4 SINGLE DUCT VARIABLE OR CONSTANT VOLUME TERMINAL UNIT

A. Pressure independent, single duct variable or constant air volume control assemblies with integral attenuator, of the sizes, capacities and configurations as scheduled on the Drawings.

B. Unit pressure drop across the assembly with an equivalent 2,000-fpm inlet velocity through the inlet shall not exceed 0.15-in water gauge.

C. Air terminal units shall be selected with set air and water flow rates, set entering air and water temperatures. Discharge air shall be allowed to be between 90-deg-F and 110-deg-F. Return water temperature shall be at the system design return water temperature and allowed to be higher only if required to meet 0.5-gpm flow minimum. Variations from this require written approval of the Owner.

D. Sound Ratings: Sound power levels shall be obtained from testing in accordance with AHRI Standard 880.

E. Fan powered terminal units are prohibited.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall meet or exceed applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. Installation shall be in accordance with manufacturer’s published recommendations.

C. Provide clearance for inspection, repair, replacement, and service. Ensure accessibility to terminal unit electrical control panel doors, controllers and operators are located a minimum of 42-inches from all obstructions (walls, pipe, etc.).
D. Wiring and controller compartments, electronic motors and damper motors shall have a minimum 42-inch clear wide and deep working space readily accessible from lift out ceiling tiles or access panels.

E. Provide ceiling access doors or locate units above easily removable ceiling components.

F. Install terminal units with a minimum of four (4) diameters of straight duct directly prior to the entry into each terminal unit connection.

G. Support units individually from structure. Terminal units shall be supported using units hanger brackets and threaded rods. Do not support from adjacent ductwork. Refer to other Division 23 Section(s) for vibration isolation requirements.

H. Connect to ductwork in accordance with Section 23 31 00.

I. Install heating coils in accordance with Section 23 82 16.

END OF SECTION 23 36 00

This section of the U of I Facilities Standards establishes minimum requirements only. It should not be used as a complete specification.