

**SECTION 23 09 93  
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS**

**PART 1 GENERAL**

**THE CONTRACTOR IS REFERRED TO THE “SPECIAL NOTICE TO CONTRACTORS SUMMARY FORM “THE “FORM OF PROPOSAL”; THE “FORM OF BID BOND”; “DIVISION 01 – GENERAL REQUIREMENTS” OF THE “CONTRACT SPECIFICATIONS”; THE “CONTRACT DRAWINGS” AND ALL AMENDMENTS AND ADDENDA THERETO; ALL OF WHICH GOVERN THE WORK OF THIS SECTION.**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.
- B. The HVAC system and equipment sequence of operation shall be based on controlled device, and required programming of related controller set point in compliance with manufacturer procedures and specified control and monitoring capability of this section.
- C. Temperature control contractor/installer, and the Mechanical contractor shall be a certified equipment installers. Contract shall provide new Control System, as required for control of Air Handling Unit level thermostats where shown on drawings. Contractor shall provide shop drawing submittals for Authority approval to reflect control ladder diagram, providing and installing complete and required Control Wiring, submittals shall include points of controller connection for required set points and applicable alarm indications. Shop drawing submittals shall be complete with all required sensors and controllers related to HVAC system equipment as scheduled on plans.
- D.

**1.03 AIR HANDLING SYSTEMS**

- A. Kitchen Hood Exhaust System:
  - 1. Auto Fan Control System shall override the fan switch any time hood sensor detects heat. Any temperature including room temperature over the preset mark of 80 Deg. F on the dial located on the control panel will activate the fan.
  - 2. The cooking appliance shall be interlocked with the exhaust hood system to prevent appliance operation when the exhaust hood system is not operating.
  - 3. In case of Fire Suppression System actuation, Exhaust Fan shall continue to operate and make-up air unit shall stop. Make-up air unit shall be reset manually.

**1.04 MAKE-UP AIR UNIT (WITH ELECTRIC HEATING)**

- A. EQUIPMENT: MAU-1

**1.05 DESCRIPTION:**

- A. Manual Operation (local):
  - 1. Supply Fan: The MAU unit's supply fan shall be started with the start button. Upon pressing the start button, the outside air DAMPER shall open. When outside air damper has fully opened as proven by the damper motor end switches, the supply fan will start. Pressing the stop push-button will cause the unit to stop immediately and close outside air damper. In the event of a power failure or malfunction, the unit shall be restarted manually.

- a. The following alarms, safeties and interlocks shall function in all modes. Functions apply as indicated.
  - 1) An emergency stop push-button (push-pull type) shall be provided that will stop the unit
    - (a) immediately.
    - (b) A low temperature switch (freezestat) shall be provided at the outlet of the heating section. This shall stop the unit and close the outside air dampers when the element senses a temperature below 40 degrees Fahrenheit. The switch shall be manually reset. The panel shall have an alarm indicating light.
    - (c) A high differential pressure switch shall be provided across the filter bank to sense increased differential pressure indicating a clogged filter. The unit shall be field set. The panel shall have an alarm indicating light. A jumper shall be provided in the panel to allow selection of unit shutdown or alarm only. If the unit shutdown function is enabled, a manual reset shall be required. The local stop button shall also serve as the reset for this condition when selected.
  - 2) Alarms: The following fault conditions shall be monitored and displayed as alarms for the unit and associated fans in all modes.
    - (a) Overload Tripped
    - (b) Dirty Filter
    - (c) Malfunction

Panel Mounted Controls for Make-up Air Unit.

1. Panel Controls and Indicators: The Contractor shall furnish and install the following panel mounted controls and indicators on the panel unless otherwise noted.
  - a. Unit Ready Status indicator
    - 1) Unit Running indicator
      - (a) Damper(s) Open (each) indicators
      - (b) E-Stop/Lockout
      - (c) Low Temperature indicator
      - (d) Dirty Filter indicator
      - (e) Malfunction indicator
      - (f) Start/stop push buttons
      - (g) Hand/Off/Auto
      - (h) Reset Pushbuttons
      - (i) Space/Discharge/OA Temp. indicators
    - 2) Temperature Control: The system shall provide filtered, tempered outside air to the area served. The system shall control supply air temperature at given level (default setting 60 degrees Fahrenheit based on the feedback from the sensor in the supply ductwork. Supply air temperature shall have an upper limit of 140 degrees Fahrenheit and a lower limit of 50 degrees Fahrenheit. An airflow switch shall prevent the heater from operating when the supply fan is not running. High temperature switches shall shut the heater down on a high temperature condition.
    - 3) Outside Air Temperature above 60 degrees Fahrenheit: The unit shall provide no supplemental heat when outdoor air temperature is above 60 degrees F.
      - (a) Outside Air Temperature below 60 degrees Fahrenheit: The unit shall control the amount of heat provided to the incoming air by staging the electric heating coil. The temperature controller (in the PLC) shall modulate the heating stages to maintain the supply air temperature at set point.

**1.06 PRODUCTS SHALL MEET DESCRIPTIVE CONTROL AND MONITING PERFORMANCE REQUIREMENTS SPECIFIED.**

**1.07 EXECUTION SHALL BE RELATED AND IN COMPLIANCE WITH REQUIREMENTS OF TAB AND COMMISSIONING SECTION.**

**END OF SECTION 23 09 93 23 09 93**