

PART 1 GENERAL**1.01 SUMMARY**

- A. This section describes the sequence of operations for HVAC control systems specified elsewhere in these specifications.
- B. Related Work: The requirements of Section 23 0500, Common HVAC Materials and Methods, also apply to this section.

PART 2 PRODUCTS – NOT USED**PART 3 EXECUTION****3.01 SEQUENCE OF OPERATIONS**

- A. Provide a complete and operational temperature control and building automation system based on the following points and sequence of operation, complete as to sequences and standard control practices. The determined point list is the minimum amount of points that are to be provided. Provide any additional points required to meet the sequence of operation.
- B. Object List:
 - 1. The following points as defined for each piece of equipment are designated as follows:
 - a. Binary Out (BO) - Defined as any two-state output (start/stop) (enable/disable), etc.
 - b. Binary In (BI) - Defined as any two-state input (alarm, status), etc.
 - c. Analog In (AI) - Defined as any variable input (temperature) (position), etc.
 - d. Analog Out (AO) - Defined as any electrical variable output. 0–20mA, 4–20mA and 0–10VDC are the only acceptable analog outputs. The driver for analog outputs must come from both hardware and software resident in the controllers. Transducers will not be acceptable under any circumstance.
- C. Occupancy and Performance Time Periods:
 - 1. Occupied Period is signaled automatically by adjustable settings at DDC server, Building Controller, Application Controller and also, at each zone when zone bypass timer is activated.
 - 2. Warm-up period occurs one hour before occupied start time or as calculated by Building Controller based on system performance history and outside air temperature.
 - 3. Unoccupied period occurs whenever Occupied, Warm-up, or Cool-down are not in effect.
- D. Typical Space Setpoints:
 - 1. Heating-Occupied Period:
 - a. Exam/Treatment, Conferences and Offices: 70 °F with adjustment range of 65 to 70°F.
 - b. Storage Rooms: 65 °F with adjustment range of 60 to 70 °F.
 - 2. Heating-Unoccupied Period: 55 °F
 - 3. Cooling-Occupied Period:
 - a. Exam/Treatment, Conference and Offices: 75 °F with adjustment range of 74 to 78 °F.
 - b. Storage Rooms: 72 °F.
 - 4. Cooling-Unoccupied: 85 °F
 - 5. Deadband: Systems with mechanical cooling shall maintain a minimum deadband of 5 °F.
- E. Main Heating Water Pumps: Existing Controls to remain.

- F. Operating Sequence - Domestic Hot Water Pumps: Operate pump during the occupied cycle.

4.03 VRF HEAT PUMP SYSTEM

- A. Room thermostats to modulate heating and cooling to maintain set-point.
- B. Fan coils have supplemental auxiliary electric duct heaters. The electric duct coils are equipped with SCR controllers. During heating operation, the control sequence shall include the following:
 - 1. The auxiliary heater shall provide supplemental heat with the VRV heat pump heating.
 - 2. The auxiliary heater shall provide emergency heat when the VRV Heat pump heating is locked out.
- C. Fan coils are interlocked with operation of the existing HRU-1.

4.04 EXHAUST FANS

- A. Exhaust Fan EF-200(gas room):
 - 1. Relays or starters provided under Division 26.
 - 2. Exhaust fan(s) operation shall be continuous and be supervised.
 - 3. On fan command on, fan starts.
 - 4. Input/Output Point Monitoring Summary:
 - a. As a minimum, the following points and features are to be monitored and alarmed. Control Contractor shall add additional points necessary to accomplish sequence of operation and interface with other control equipment.
 - b. Inputs:
 - 1) Fan run status (BI)
 - c. Outputs:
 - 1) Fan start/stop (BO)
 - d. General Alarms (any unscheduled fan shut-down)
 - 1) Fan failure (annunciated)

4.05 DOMESTIC WATER SYSTEMS

- A. Enable circulation pumps with BAS time signal. Operation shall be based on aqua stat.

4.06 ALARMS

- A. Any device that monitors status and fails to show status after 10 minutes will generate an alarm.
- B. Any device that monitors status and shows status when the device is commanded off for 10 minutes will generate an alarm.
- C. Any zone temperature sensor that is 4° F (adj) below occupied set point during an occupied period for 10 minutes (adj) will generate a low sensor out of range alarm.
- D. Any zone temperature sensor that is 4° F (adj) above occupied set point during an occupied period for 30 minutes (adj) and the associated unit has mechanical cooling will generate a high sensor out of range alarm.
- E. Sensor failure will generate a non-critical alarm.
- F. High priority alarms are any alarms related to the electrical room exhaust fan, freeze protection, or smoke detection.
- G. Medium priority alarms are any alarms related to supply or return fans and condenser units.

- H. Low priority alarms are any alarms related to DHWR pumps, general exhaust fans, or any other alarms not specifically identified with a priority status.
- I. Alarm Categories:
 - 1. Maintenance
 - a. Filters
 - b. Sensor out of Range
 - 2. General
 - a. DHWP CMD/STS
 - b. EF CMD/STS
 - 3. Important
 - a. Software Freeze protection
 - b. Failed Sensor/All
 - c. Fan CMD/STS
 - d. Building COM
 - 4. Critical
 - a. Hard Freeze Protection
 - b. Duct Smoke detectors
 - 5. Default
 - a. Should not be utilized.

END OF SECTION