

SECTION 230900 – SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

- A. Provide certificates to show that all products meet the following requirements.
 - 1. American Iron and Steel (AIS)
 - 2. Build America, Buy America Act
- B. See Supplementary Conditions for details.

1.02 SUMMARY

- A. Section includes HVAC instrumentation and sequence of operation for:
 - 1. Exhaust Fan.
 - 2. Ventilation Fan.
 - 3. Dampers for Generator Air Exhaust and Supply.
 - 4. Unit Heaters.
 - 5. Convection Heaters.

1.03 REFERENCES

- A. National Electrical Manufacturers Association
 - 1. NEMA DC 3 - Residential Controls - Electrical Wall Mounted Room Thermostats.
- B. National Fire Protection Association
 - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.04 SUBMITTALS

- A. Section 013300 – “Submittal Procedures”: Submittal procedures.
- B. Shop Drawings: Indicate mechanical system controlled and control system components.
 - 1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.
 - 2. Submit flow diagrams for each control system, graphically depicting control logic.
 - 3. Submit draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
 - 4. Coordinate submittals with information requested in mechanical specifications.

PART 2 - PRODUCTS

2.01 THERMOSTATS

- A. Manufacturers: Honeywell, Johnson Controls, or equal.
- B. Electric Room Thermostats:
 - 1. Type: NEMA DC 3, 24 volts.
 - 2. Service: Heating.
 - 3. Covers: Locking with set point adjustment and thermometer.
- C. Line Voltage Thermostats:
 - 1. Integral manual On/Off/Auto selector switch, single or two-pole.
 - 2. Dead band: Maximum 2 degrees F.
 - 3. Cover: Locking with set point adjustment and thermometer.
 - 4. Load capacity rating.

2.02 GAS DETECTORS

- A. Manufacturer: Hydro Instruments GA-180 or approved equal.
- B. Provide:
 - 1. Electrochemical Chlorine (Cl) gas sensor, with adjustable setpoint with a range of 0 to 10 ppm and 25-foot 22 AWG shielded cable and isolated 4-20mA outputs for sensors.
 - 2. Digital alarm control panel shall be menu driven, containing push button interface and two line alpha numeric back list LCD display. Controller shall be housed in NEMA4X enclosure with visual and audible alarms. Communication shall be Modbus, RS485, with MicroSDHC internal data logging.
 - 3. Alarm outputs shall activate external devices.
 - 4. Alarm Horn: 90dB horn shall be located at the panel with additional horn located within the Chlorine Treatment Room.
 - 5. Audible alarm capability.
 - 6. Battery backup with 12 hours 2.0Ahr, 12VDC gel cell.

2.03 ELECTRIC DAMPER ACTUATORS

- A. Operation: Two-position.
- B. Mounting: Direct mount.
- C. Stroke: 90 seconds end to end full stroke, 15 seconds return to normal for spring return.
- D. Protection: Electronic stall protection.
- E. Control Input: 0-10 VDC or 0-20 mADC.
- F. Torque: Size for minimum 150 percent of required duty.
- G. Duty cycle: rated for 65,000 cycles.

2.04 OCCUPANCY SENSOR

- A. For EF-01 control, space shall be considered occupied when space lights are ON or when occupancy sensor senses motion. Refer to electrical plan and specifications for motion sensor and timing relay.

PART 3 - EXECUTION

3.01 EXHAUST FAN (EF-01):

- A. The water treatment room exhaust fan (EF-01) shall be provided with a positive shut-off control damper. The unit shall be controlled using electric actuation. EF-01 positive shut-off damper shall open, and EF-01 shall operate:
 - 1. When the room lights are turned on by an external light switch to activate the exhaust fan before entering the room, the fan shall operate for a minimum of 20 minutes (adjustable). A timer relay shall reset fan run time when room motion sensor detects motion in the room.
 - 2. When the Chlorine Gas (Cl₂) Detection monitor exceeds setpoints (adjustable) of 1 ppm for Cl₂.
- B. The minimum run time upon EF-01 activation is 20 minutes (adjustable).
- C. EF-01 shall be off with a Cl₂ level detection below 0.5 ppm (adjustable), when space is unoccupied, and after the minimum run time has elapsed.
- D. Make-up air will be provided by a wall opening control damper, which will open whenever EF-01 is on.
- E. Safety:
 - 1. Whenever the Cl₂ concentration is above the set point (adjustable) for more than five minutes, an integral alarm shall sound from the detector, an alarm signal shall be sent to the Control System, and a horn alarm shall sound from the pumproom.

3.02 VENTILATION FAN (VF-01):

- A. The pump room ventilation fan (VF-01) shall be provided with a positive shut-off control damper. The unit shall be controlled using electric actuation. VF-01 positive shut-off damper shall open and VF-01 shall operate:
 - 1. Whenever room temperature exceeds 75 degrees F (adjustable) and shall turn off when the space temperature reaches 65 degrees F (adjustable).
- B. Relief air will be provided by a wall opening with control damper, which will open whenever VF-01 is on.

3.03 GENERATOR ROOM SUPPLY, EXHAUST & RETURN DAMPERS:

- A. When Generator is not in operation:
 - 1. Outside Air Supply dampers shall be closed.

2. Return Air Damper shall be closed.
3. Exhaust Damper shall be closed.

B. When generator is operating:

1. Outside Air Supply dampers shall be fully open.
2. Exhaust Damper and Return Air dampers shall modulate to maintain a space temperature of 65 deg F (adjustable).
 - a. Exhaust air dampers shall fail closed and return dampers shall fail open.
 - b. If the room temperature rises above 80 degrees (adjustable) or below 50 degrees (adjustable) for 5 minutes, an alarm shall be generated.
 - c. If the room temperature rises above 90 degrees (adjustable) or below 40 degrees (adjustable) for 5 minutes, a critical alarm shall be generated.

3.04 UNIT HEATERS (UH-01, UH-02):

- A. Unit shall operate per the manufacturer controller and remote sensor based upon room temperature setpoint of 55 deg F (adjustable).
1. Room temperature below setpoint minus a deadband.
 - a. Unit heater fan and electric coil shall energize
 2. Room temperature rising above setpoint plus a deadband.
 - a. Unit heater electric coil is de-energized
 - b. Unit heater fan is de-energized.
 3. The unit shall run a minimum of 5 minutes to prevent short cycling.

3.05 CONVECTION HEATERS (CH-01, CH-02, CH-03):

- A. Unit shall operate per the packaged manufacturer controller and integral thermostat based upon setpoint of 55 deg F (adjustable).

3.06 FUEL SYSTEM, TANK (FT-01) ACCESSORIES:

- A. Fuel tank controls are performed by manufacturer's packaged controls for fuel system monitoring and alarm sequences. Fuel system monitoring and alarm sequences shall be performed by the package Tank Monitoring System supplied with the fuel storage tank. Reference Section 231323 "Facility Fuel-Storage Tanks".

END OF SECTION