

SECTION 15900 - HVAC CONTROLS AND SEQUENCES OF OPERATION

I) GENERAL

- A) REFER TO SPECIFICATION SECTION 15500 - HVAC SPECIFICATIONS, ESPECIALLY GENERAL FOR WORK INCLUDED, QUALITY ASSURANCE AND RELATED DOCUMENTS.
- B) PROVIDE A COMPLETE ELECTRIC/ELECTRONIC CONTROL SYSTEM TO ACCOMPLISH ALL CONTROL SEQUENCES AS DESCRIBED BELOW.
- C) ALL LINE AND LOW VOLTAGE CONTROL WIRING, TRANSFORMERS, DISCONNECTS, ETC REQUIRED FOR THE CONTROL SYSTEMS THAT IS NOT SHOWN ON THE ELECTRICAL DRAWINGS SHALL BE PROVIDED BY THE CONTROLS CONTRACTOR (HENCEFORTH CALLED "THE CONTRACTOR").
 - 1) LINE VOLTAGE POWER FROM CIRCUIT BREAKERS IN ELECTRICAL PANELS TO CONTROL TRANSFORMERS OR CONTROL DEVICES SHALL BE INSTALLED BY THE CONTRACTOR.
 - 2) COMPLY WITH DIVISION 16 REQUIREMENTS.
 - 3) CONNECT VARIABLE FREQUENCY DRIVES (VFD) AND DUCT & AREA SMOKE DETECTORS (FURNISHED BY OTHERS) INTO CONTROL CIRCUITS TO ACCOMPLISH THE SEQUENCES OF OPERATION

II) PRODUCTS

- A) PROVIDE CONTROL PRODUCTS (IF NOT FACTORY PROVIDED BY HVAC EQUIPMENT MANUFACTURER) INCLUDING, BUT NOT LIMITED TO, CONTROL DAMPERS & VALVES, THERMOSTATS, TIMELOCKS, SENSORS, RELAYS, CONTROLLERS, AND OTHER COMPONENTS AS REQUIRED FOR A COMPLETE INSTALLATION.
- B) CONTROL DAMPERS SHALL BE LOW LEAKAGE DAMPERS WITH BLADE AND EDGE SEALS. CLASS 1A WITH LEAKAGE OF LESS THAN 3 CFM/SQFT AT 1.0" W.G.
- C) CONTROL VALVES SHALL BE SELECTED FOR FLUID TYPE, TEMPERATURE AND PRESSURE CLASS WHICH MATCH PIPING MATERIALS AND END CONNECTIONS. CONTROL VALVES MUST CLOSE OFF AGAINST MAXIMUM SYSTEM PRESSURE.
- D) DAMPER AND VALVE ACTUATORS SHALL BE ELECTRIC, SIZED TO SMOOTHLY OPERATE DAMPER OR VALVE WITH ADEQUATE TORQUE FOR TIGHT SHUTOFF AGAINST MAXIMUM SYSTEM PRESSURE.
 - 1) ACTUATION REQUIREMENTS SHALL BE PER THE SEQUENCES OF OPERATION.
- E) ROOM THERMOSTATS SHALL BE 7 DAY PROGRAMMABLE WITH A 5F DEADBAND BETWEEN HEATING & COOLING AND SETBACK CAPABILITY (55F HEATING & 85F COOLING).
 - 1) USER ADJUSTABLE SETPOINTS SHALL BE PROVIDED UNLESS NOTED OTHERWISE ON THE DRAWINGS.

III) EXECUTION

- A) INSTALL SYSTEMS AND MATERIALS IN ACCORDANCE WITH MANUFACTURER INSTRUCTIONS AND ROUGHING-IN DRAWINGS AND DETAILS ON THE DRAWINGS. INSTALL ELECTRICAL COMPONENTS AND USE ELECTRICAL PRODUCTS COMPLYING WITH REQUIREMENTS OF APPLICABLE DIVISION 16 SECTIONS. COORDINATE THE INSTALLATION IN ACCORDANCE WITH FINAL SHOP DRAWINGS, FIELD MEASUREMENTS, MANUFACTURER'S DATA AND AS SPECIFIED HEREIN.
- B) MOUNT CONTROLLERS AT CONVENIENT LOCATIONS AND HEIGHTS. COORDINATE WITH ARCHITECT AND OTHER TRADES.
- C) PROVIDE REMOTE CONTROL OF MANUAL RESET CONTROLLERS AS REQUIRED FOR USER ACCESSIBILITY. COORDINATE WITH OWNER.
- D) THE TERM "CONTROL WIRING" IS DEFINED TO INCLUDE PROVIDING OF WIRE, CONDUIT AND MISCELLANEOUS MATERIALS AS REQUIRED FOR MOUNTING AND CONNECTING ELECTRIC CONTROL DEVICES.
- E) INSTALL COMPLETE CONTROL WIRING SYSTEM FOR CONTROL SYSTEMS. CONCEAL WIRING, EXCEPT IN MECHANICAL ROOMS AND AREAS WHERE OTHER CONDUIT AND PIPING ARE EXPOSED. PROVIDE MULTI-CONDUCTOR INSTRUMENT HARNESS (BUNDLE) IN PLACE OF SINGLE CONDUCTORS WHERE A NUMBER OF CONDUCTORS CAN BE RUN ALONG A COMMON PATH. FASTEN FLEXIBLE CONDUCTORS BRIDGING CABINETS AND DOORS NEATLY ALONG HINGE SIDE AND PROTECT AGAINST ABRASION. TIE AND SUPPORT CONDUCTORS NEATLY.
- F) INSTALL CIRCUITS OVER 25-VOLT WITH COLOR-CODED THWN/THHN WIRE IN EMT OR MC CABLE AS WHIPS TO EQUIPMENT CONNECTIONS. USE LIQUID-TITE CONDUIT IN EXTERIOR OR HAZARDOUS LOCATIONS.
- G) INSTALL CIRCUITS UNDER 25-VOLT WITH COLOR-CODED NO. 18 WIRE WITH INSULATION ON EACH CONDUCTOR AND PLASTIC SHEATH OVER ALL. PROVIDE PLENUM RATED CABLE IN PLENUM CEILINGS.
- H) INSTALL LOW VOLTAGE CIRCUITS WHICH ARE LOCATED IN CONCRETE SLABS OR IN MASONRY WALLS IN CONDUIT.
- I) WHERE CONTROL WIRING MUST BE SURFACE MOUNTED IN OCCUPIED ROOMS AND IT IS NOT POSSIBLE TO CONCEAL WIRING, RUN WIRING IN WIREMOLD RACEWAY (COLOR BY ARCHITECT).
- J) NUMBER-CODE OR COLOR-CODE CONDUCTORS APPROPRIATELY FOR IDENTIFICATION AND SERVICING OF THE CONTROL SYSTEM.
- K) DEMONSTRATE CONTROL SYSTEM TO AND TRAIN OWNER'S PERSONNEL IN OPERATION AND MAINTENANCE OF CONTROL SYSTEM.

IV) SEQUENCES OF OPERATION

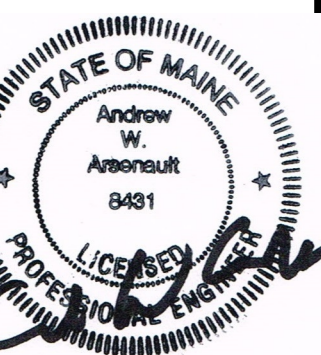
- A) ROOF TOP UNITS (RTU)
 - 1) THE RTU FAN SHALL OPERATE CONTINUOUSLY DURING OCCUPIED TIMES.
 - (a) DURING UNOCCUPIED TIMES, THE FAN SHALL ONLY RUN ON A CALL FOR HEATING OR COOLING.
 - 2) DURING OCCUPIED TIMES, THE OA DAMPER SHALL OPEN TO ROOM PORTION MIN OA POSITION WHEN THE RTU FAN IS OPERATING.
 - (a) FOR RTUS WITH CO2 CONTROL, AS THE CO2 LEVEL RISES FROM 500 TO 1,000 PPM, THE OA DAMPER SHALL MODULATE OPEN FROM ROOM PORTION MIN OA TO MAX OCCUPANCY MIN OA.
 - 3) THE ASSOCIATED 7-DAY PROGRAMMABLE THERMOSTAT SHALL INCLUDE OCCUPIED AND UNOCCUPIED HEATING AND COOLING SETPOINTS WITH A DEADBAND OF 5F.
 - (a) OCCUPIED SETPOINTS SHALL BE 70F HEATING AND 75F COOLING.
 - (b) UNOCCUPIED SETPOINTS SHALL BE 65F HEATING AND 85F COOLING.
 - 4) RTUS SHALL INCLUDE A COMPARATIVE ENTHALPY ECONOMIZER. WHEN OA ENTHALPY IS LESS THAN RA ENTHALPY AND COOLING IS CALLED FOR, MODULATE THE OA DAMPER OPEN AND THE RA DAMPER CLOSED TO SATISFY THE CALL FOR COOLING BEFORE MECHANICAL COOLING IS ENGAGED.
- B) FANS (FAN)
 - 1) FAN-1 SHALL OPERATE DURING OCCUPIED TIMES AND SHALL BE OFF DURING UNOCCUPIED TIMES.
- C) DUCTLESS SPLIT SYSTEMS (DAC)
 - 1) COOLING SHALL OPERATE AS NEEDED TO MAINTAIN ROOM TEMPERATURE.
- D) ELECTRIC DUCT HEATER (EDH)
 - 1) HEATING SHALL BE MODULATED TO MAINTAIN ROOM TEMPERATURE OF 70F.
- E) ELECTRIC WALL & CEILING HEATERS (EWH & ECH)
 - 1) FAN AND HEATING ELEMENT SHALL BE ON/OFF TO MAINTAIN ROOM TEMPERATURE OF 70F.

END OF SECTION 15900

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THE PROJECT MANAGER FOR THIS PROJECT IS NOTED BELOW. PLEASE REFER ALL QUESTIONS, SUBMITTALS AND REQUESTS TO THE PROJECT MANAGER.
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HVAC Sequences of Control & Details

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