

SEQUENCE OF CONTROLS

- ALARMS: THE CONTROL SYSTEM SHALL ALARM THE USER INTERFACE AND TAKE THE INDICATED ACTIONS WHENEVER ANY OF THE FOLLOWING CONDITIONS OCCURS:
1. MIXED AIR TEMPERATURE NOT AT SETPOINT FOR 5 MINUTES OR LONGER WHEN UNIT IS IN ECONOMIZER MODE.
 2. COOLING COIL LEAVING AIR TEMPERATURE NOT AT SETPOINT FOR FIVE MINUTES OR LONGER.
 3. RETURN AIR RELATIVE HUMIDITY NOT AT SETPOINT FOR 15 MINUTES OR LONGER.
 4. SUPPLY DUCT STATIC PRESSURE NOT AT SETPOINT FOR 5 MINUTES OR LONGER.
 5. SPACE PRESSURE NOT AT SETPOINT FOR FIVE MINUTES OR LONGER (WHEN ON ECONOMIZER MODE)
 6. WHEN THE SUPPLY FAN IS OPERATING IN MANUAL OVERRIDE AS DETERMINED BY FAN OPERATION OUTSIDE THE CONTROL OF THE CONTROL SYSTEM.
 7. TURN OFF ALL FANS WHEN SUPPLY STATIC PRESSURE AS MEASURED BY DISCHARGE STATIC PRESSURE SENSOR EXCEEDS 3.5" WG.
- IX. REHEAT VAV TERMINALS SEQUENCE OF CONTROL FOR TERMINALS ON AH-1-4SRF-2/-3
- A. ALL VAV TERMINALS SHALL OPERATE THE PRIMARY AIR DAMPER AND HEATING CONTROL VALVE IN SEQUENCE TO MAINTAIN SPACE TEMPERATURE AT SETPOINT. THE SEQUENCE SHALL BE AS FOLLOWS:
1. ON A CALL FOR COOLING THE PI OR PID LOOP SHALL INCREASE PRIMARY AIR FLOW FROM SCHEDULED MINIMUM TO SCHEDULED MAXIMUM.
 2. ON A CALL FOR HEATING THE PI OR PID LOOP SHALL DECREASE PRIMARY AIR FLOW FROM SCHEDULED MAXIMUM TO SCHEDULED MINIMUM.
 3. ON A FURTHER CALL FOR HEATING THE CONTROL SYSTEM SHALL OPEN THE HEATING WATER FLOW AND INCREASE AIR FLOW FROM SCHEDULED MINIMUM TO SCHEDULED MAXIMUM TO MAINTAIN HEATING SUPPLY AIR AT SCHEDULED MAXIMUM AND SATISFY THE SPACE HEATING LOAD.
 4. THERE SHALL BE A 2 DEGREE F DEAD BAND BETWEEN THE COOLING AND HEATING MODES WHERE PRIMARY AIR FLOW SHALL BE AT THE SCHEDULED MINIMUM CFM.
- B. SPACE OCCUPANTS SHALL HAVE A 4" RANGE OF SETPOINT ADJUSTMENT AT EACH SENSOR EXCEPT THAT ALL TERMINALS ON AHU-05 SHALL NOT HAVE USER CONTROLS AND THE SETPOINT SHALL BE SET TO THE SAME VALUE YEAR ROUND BASED ON THE CT OR MRI EQUIPMENT REQUIREMENTS. COORDINATE WITH MEDICAL EQUIPMENT MANUFACTURERS.
- X. SEQUENCE OF CONTROL FOR ISOLATION ROOM EXHAUST FAN EF-1-4SRF-1
- A. EXHAUST FAN OPERATING AND SAFETY CONTROLS SHALL INCLUDE
1. WALL MOUNTED DISCONNECT
 2. HAND-OFF-AUTO SELECT SWITCH
 3. MOTOR CURRENT TRANSDUCER
- B. THE EXHAUST FAN SHALL BE TURNED ON AND OFF AS NEEDED BY A WALL MOUNTED SWITCH IN THE ISOLATION ROOM.
- C. ALARMS: THE CONTROL SYSTEM SHALL ALARM THE USER INTERFACE AND TAKE INDICATED ACTION WHENEVER ANY OF THE FOLLOWING CONDITIONS OCCURS:
1. MOTOR CURRENT PLUS OR MINUS 10% OF FULL LOAD AMPS FOR 10 SECONDS OR LONGER. FULL LOAD CURRENT SHALL BE AS DETERMINED DURING TEST AND BALANCE. STOP FAN.
- XI. SEQUENCE OF CONTROL FOR GENERAL EXHAUST FANS EF-1-4SRF-2/-4/-5
- A. EXHAUST FAN OPERATING AND SAFETY CONTROLS SHALL INCLUDE
1. WALL MOUNTED DISCONNECT
 2. HAND-OFF-AUTO SELECT SWITCH
 3. MOTOR CURRENT TRANSDUCER
- B. THE CONTROL SYSTEM SHALL TURN THE FANS ON DURING OCCUPIED HOURS AND TURN THEM OFF DURING UN-OCCUPIED HOURS.
- C. ALARMS: THE CONTROL SYSTEM SHALL ALARM THE USER INTERFACE AND TAKE INDICATED ACTION WHENEVER ANY OF THE FOLLOWING CONDITIONS OCCURS:
1. MOTOR CURRENT PLUS OR MINUS 10% OF FULL LOAD AMPS FOR 10 SECONDS OR LONGER. FULL LOAD CURRENT SHALL BE AS DETERMINED DURING TEST AND BALANCE. STOP FAN.
 2. ALARM USER INTERFACE ANYTIME THE FAN IS OPERATING IN HAND OR MANUAL CONTROL AS DETERMINED BY THE FAN OPERATING WHEN THE CONTROL SYSTEM IS NOT COMMANDING THE FAN TO ON.
- XII. SEQUENCE OF CONTROL FOR CRYOGENIC EXHAUST FANS EF-1-4SRF-6/-7
- A. EXHAUST FAN OPERATING AND SAFETY CONTROLS SHALL INCLUDE
1. FAN MOUNTED DISCONNECT
 2. HAND-OFF-AUTO SELECT SWITCH
 3. MOTOR CURRENT TRANSDUCER
 4. MANUAL REMOTE START / STOP SWITCH IN OPERATOR ROOM
- B. THE MANUAL START / STOP SWITCH IN EACH MRI CONTROL ROOM SHALL START AND STOP THE RESPECTIVE FAN.
- C. ALARMS: THE CONTROL SYSTEM SHALL ALARM THE USER INTERFACE AND TAKE INDICATED ACTION WHENEVER ANY OF THE FOLLOWING CONDITIONS OCCURS:
1. MOTOR CURRENT PLUS OR MINUS 10% OF FULL LOAD AMPS FOR 10 SECONDS OR LONGER. FULL LOAD CURRENT SHALL BE AS DETERMINED DURING TEST AND BALANCE. STOP FAN.
 2. ALARM USER INTERFACE ANYTIME THE FAN IS OPERATING IN HAND OR MANUAL CONTROL AS DETERMINED BY THE FAN OPERATING WHEN THE CONTROL SYSTEM IS NOT COMMANDING THE FAN TO ON.
- XIII. STEAM TO HEATING WATER HEAT EXCHANGER SEQUENCE OF CONTROL
- A. HEATING WATER PUMP OPERATING, AND SAFETY CONTROLS SHALL INCLUDE:
1. WALL MOUNTED DISCONNECT
 2. HAND-OFF-AUTO SELECT SWITCH
 3. VARIABLE FREQUENCY MOTOR SPEED CONTROL DRIVE (VFD)
 4. HEAT EXCHANGER DIFFERENTIAL PRESSURE SWITCH.
- B. THE CONTROL SYSTEM SHALL OPERATE HWP-03 AND HWP-04 ON A WEEKLY LEAD / LAG SCHEDULE TO MAINTAIN PUMP RUN TIMES EQUAL. SEE PARAGRAPH I-F.
- C. UPON FAILURE OF THE LEAD PUMP THE CONTROL SYSTEM SHALL TURN OFF THE LEAD PUMP.
- D. THE INITIAL SYSTEM WATER PRESSURE SETPOINT SHALL BE DETERMINED BY THE TAB CONTRACTOR DURING TAB WORK. THE CONTROL SYSTEM SHALL RESET THE SYSTEM WATER PRESSURE SETPOINT BASED ON THE POSITION OF THE CHILLED WATER VALVES. IF ANY VALVE IS FULLY OPEN THE CONTROL SYSTEM SHALL INDEX THE SETPOINT UP BY 5% (ADJUSTABLE). IF NONE OF THE VALVES ARE FULLY OPEN THE CONTROL SYSTEM SHALL INDEX THE SETPOINT DOWN BY 5% (ADJUSTABLE). RESET SHALL TAKE PLACE EVERY 15 MINUTES (ADJUSTABLE).
- E. UPON FAILURE OF THE LEAD CHILLER THE CONTROL SYSTEM SHALL TURN OFF THE LEAD CHILLER AND TURN ON THE LAG CHILLER.
- F. WHEN ONE CHILLER IS ON THE CONTROL SYSTEM SHALL MODULATE THE LEAD PUMP SPEED TO MAINTAIN THE SYSTEM DIFFERENTIAL WATER PRESSURE AT SETPOINT. WHEN TWO CHILLERS ARE ON THE CONTROL SYSTEM SHALL SIMULTANEOUSLY MODULATE THE SPEED OF BOTH PUMPS TO MAINTAIN SYSTEM DIFFERENTIAL PRESSURE AT SETPOINT.
- G. THE INITIAL SYSTEM WATER PRESSURE SETPOINT SHALL BE DETERMINED BY THE TAB CONTRACTOR DURING TAB WORK. THE CONTROL SYSTEM SHALL RESET THE SYSTEM WATER PRESSURE SETPOINT BASED ON THE POSITION OF THE CHILLED WATER VALVES. IF ANY VALVE IS FULLY OPEN THE CONTROL SYSTEM SHALL INDEX THE SETPOINT UP BY 5% (ADJUSTABLE). IF NONE OF THE VALVES ARE FULLY OPEN THE CONTROL SYSTEM SHALL INDEX THE SETPOINT DOWN BY 5% (ADJUSTABLE). RESET SHALL TAKE PLACE EVERY 15 MINUTES (ADJUSTABLE).
- H. SEQUENCE TO ENERGIZE CHILLER (SAME FOR LEAD OR LAG CHILLER): THE DDC CONTROL SYSTEM SHALL SEND SIGNAL TO CHILLER TO ENABLE UNIT OPERATION. CHILLER SHALL BEGIN START OPERATION AND SEND SIGNAL TO CHILLER MOTORIZED ISOLATION VALVE TO OPEN. WHEN THE MOTORIZED VALVE IS COMPLETELY OPEN, THE END PROVING SWITCH ON THE MOTORIZED ISOLATION VALVE SHALL SEND A SIGNAL TO THE ASSOCIATED CHILLER PUMP VFD TO START.
- I. THE CONTROL SYSTEM SHALL RESET THE SYSTEM WATER PRESSURE SETPOINT BASED ON THE POSITION OF THE CHILLED WATER VALVES. IF ANY VALVE IS FULLY OPEN THE CONTROL SYSTEM SHALL INDEX THE SETPOINT UP BY 5% (ADJUSTABLE). IF NONE OF THE VALVES ARE FULLY OPEN THE CONTROL SYSTEM SHALL INDEX THE SETPOINT DOWN BY 5% (ADJUSTABLE). RESET SHALL TAKE PLACE EVERY 15 MINUTES (ADJUSTABLE).
- J. SEQUENCE TO ENERGIZE LAG CHILLER: WHEN LEAD CHILLER REACHES 80% OF CAPACITY (SET POINT SHALL BE ADJUSTABLE), THE DDC CONTROL SYSTEM SHALL ENABLE LAG CHILLER. DDC CONTROL SYSTEM SHALL LIMIT CAPACITY OF LEAD CHILLER TO 40% (SET POINT SHALL BE ADJUSTABLE) UNTIL LAG CHILLER IS COMPLETE WITH START-UP. BOTH CHILLERS SHALL OPERATE TO MAINTAIN SAME DISCHARGE WATER TEMPERATURE.
- K. SEQUENCE TO TURN OFF CHILLER: WHEN BOTH CHILLERS ARE OPERATING AND THE INDIVIDUAL CHILLER CAPACITY DROPS TO 25% (SET POINT TO BE ADJUSTABLE), THE DDC CONTROL SYSTEM SHALL SEND SIGNAL TO LAG CHILLER TO STOP. LAG CHILLER SHALL BEGIN SEQUENCE TO STOP OPERATION AND SEND SIGNAL TO CHILLER MOTORIZED VALVE TO CLOSE. WHEN MOTORIZED VALVE BEGINS TO CLOSE, VALVE PROVING END SWITCH SHALL SEND SIGNAL TO ASSOCIATED CHILLER PUMP VFD TO STOP. LEAD CHILLER SHALL CONTINUE TO OPERATE TO MAINTAIN DISCHARGE WATER TEMPERATURE.
- L. THE CONTROL SYSTEM SHALL ALARM THE USER INTERFACE WHENEVER ANY OF THE FOLLOWING CONDITIONS OCCURS:
1. PUMP FAILURE.
 2. CHILLER FAILURE.
 3. CHILLED WATER SUPPLY TEMPERATURE NOT AT SETPOINT FOR 5 MINUTES (ADJUSTABLE) OR LONGER.
 4. LOW SWITCH NOT MADE ON AN OPERATING CHILLER.
- XV. ELEVATOR MACHINE ROOM ROOF-OP UNIT
- A. THE ELEVATOR MACHINE ROOF-TOP UNIT SHALL BE OPERATED BY ITS OWN COOL ONLY THERMOSTAT. THE SETPOINT SHALL BE SET TO 70 F (ADJUSTABLE) AND THE FAN SHALL BE SET TO AUTOMATIC SO THAT THE FAN CYCLES OFF WHEN SPACE TEMPERATURE IS MAINTAINED.
- B. THE DDC CONTROL SYSTEM SHALL MONITOR THE ELEVATOR MACHINE ROOM TEMPERATURE AND THE ELEVATOR MACHINE ROOM ROOF-TOP UNIT DISCHARGE AIR TEMPERATURE.
- C. THE DDC CONTROL SYSTEM SHALL ISSUE THE FOLLOWING ALARMS:
1. ELEVATOR MACHINE ROOM SPACE TEMPERATURE 76 F (ADJUSTABLE) OR HIGHER.
 2. ELEVATOR MACHINE ROOM UNIT SUPPLY AIR TEMPERATURE 60 F (ADJUSTABLE) OR HIGHER WHEN THE UNIT IS OPERATING AS DETERMINED BY SPACE TEMPERATURE ABOVE 70 F SETPOINT (ADJUSTABLE)
- XVI. FAN COIL UNITS IN ELEVATOR LOBBY
- A. THE FAN COIL UNITS SHALL BE OPERATED BY A UNIT SPECIFIC CONTROLLER.
- B. THE FAN COIL UNITS IN THE ELEVATOR LOBBY SHALL OPERATE CONTINUOUSLY AND SHALL OPERATE THE COOLING AND HEATING COIL VALVES IN SEQUENCE TO MAINTAIN SPACE TEMPERATURE AT SETPOINT.
- C. SETPOINT SHALL BE SOFTWARE ADJUSTABLE ONLY FROM THE USER INTERFACE AND SHALL BE 74 F COOLING AND 70 F HEATING.
- D. THE DDC CONTROL SYSTEM SHALL MONITOR THE ELEVATOR LOBBY SPACE TEMPERATURE AND THE FAN COIL UNIT DISCHARGE AIR TEMPERATURE AND SHALL ALARM THE DDC SYSTEM USER INTERFACE ANYTIME THE SPACE TEMPERATURE IS 5 F HIGHER THAN COOLING SETPOINT OR 5 F LOWER THAN HEATING TEMPERATURE.
- E. THE DDC CONTROL SYSTEM GRAPHICS SHALL DISPLAY THE FAN COIL UNIT DISCHARGE AIR TEMPERATURE.
- XVII. FAN COIL UNITS IN AIR HANDLING UNITS
- A. THE FAN COIL UNITS SHALL BE OPERATED BY A UNIT SPECIFIC CONTROLLER.
- B. THE FAN SHALL BE SET TO AUTOMATIC SO THAT THE FAN ONLY OPERATES ON A CALL FOR HEATING OR FOR COOLING.
- C. SETPOINT SHALL BE SOFTWARE ADJUSTABLE ONLY FROM THE USER INTERFACE AND SHALL BE 78 F COOLING AND 65 F HEATING.
- D. THE DDC CONTROL SYSTEM SHALL MONITOR THE SPACE TEMPERATURE AND THE FAN COIL UNIT DISCHARGE AIR TEMPERATURE AND SHALL ALARM THE DDC SYSTEM USER INTERFACE ANYTIME THE SPACE TEMPERATURE IS 5 F HIGHER THAN COOLING SETPOINT OR 5 F LOWER THAN HEATING TEMPERATURE.
- E. THE DDC CONTROL SYSTEM GRAPHICS SHALL DISPLAY THE FAN COIL UNIT DISCHARGE AIR TEMPERATURE.
- XVIII. FAN COIL UNIT IN SPS EQUIPMENT WASH SPACE
- A. THE FAN COIL UNITS SHALL BE OPERATED BY A UNIT SPECIFIC CONTROLLER.
- B. THE FAN SHALL BE SET TO AUTOMATIC SO THAT THE FAN ONLY OPERATES ON A CALL FOR COOLING.
- C. SETPOINT SHALL BE SOFTWARE ADJUSTABLE ONLY FROM THE USER INTERFACE AND SHALL BE 70 F.
- D. ON A CALL FOR COOLING THE UNIT CONTROLLER SHALL TURN ON THE SUPPLY FAN AND SHALL OPEN THE CHILLED WATER VALVE TO 100%. THE UNIT SHALL RUN FOR 30 MINUTES (ADJUSTABLE) AFTER THE SPACE TEMPERATURE REACHES SETPOINT.
- E. THE DDC CONTROL SYSTEM SHALL MONITOR THE SPACE TEMPERATURE AND THE FAN COIL UNIT DISCHARGE AIR TEMPERATURE AND SHALL ALARM THE DDC SYSTEM USER INTERFACE ANYTIME THE SPACE TEMPERATURE IS 10 F (ADJUSTABLE) HIGHER THAN SETPOINT FOR 30 MINUTES (ADJUSTABLE) OR LONGER.
- F. THE DDC CONTROL SYSTEM GRAPHICS SHALL DISPLAY THE FAN COIL UNIT DISCHARGE AIR TEMPERATURE.