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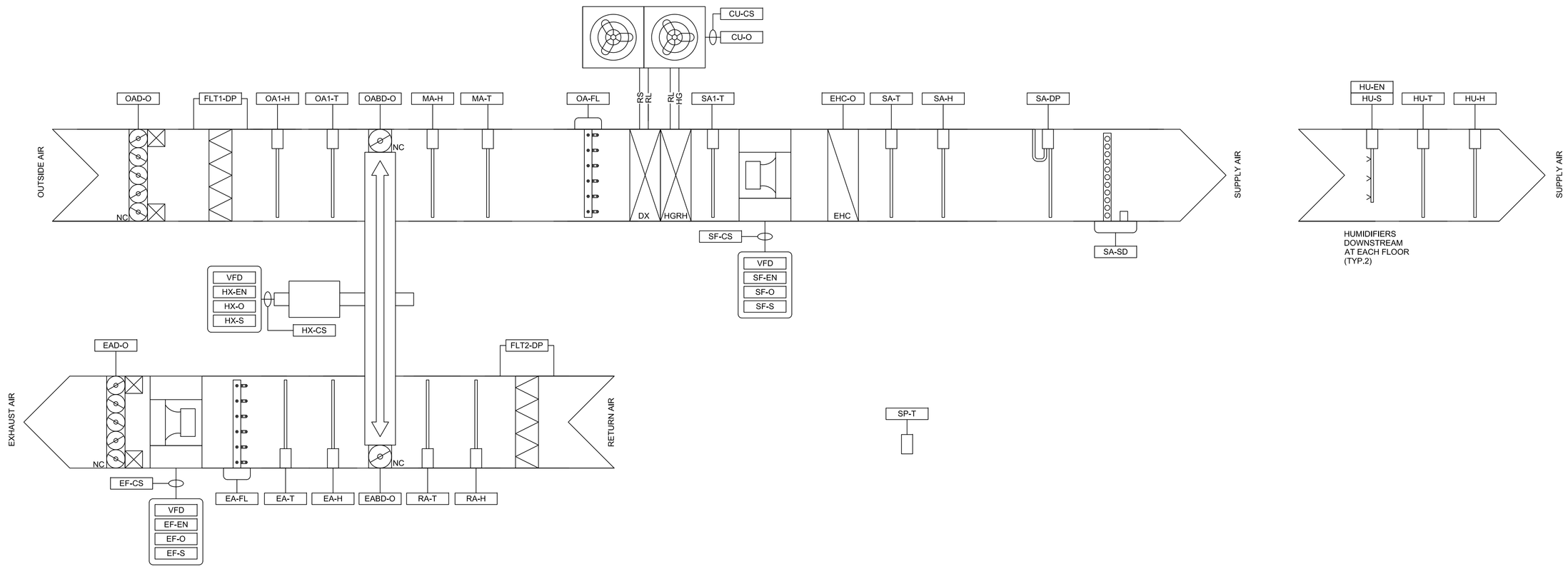
AIR HANDLING UNIT 513-DOAS CONTROL DIAGRAM



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AIR HANDLING UNIT 513-DOAS SEQUENCE OF OPERATIONS

GENERAL

1. THIS CONTROL SEQUENCE APPLIES TO THE FOLLOWING UNITS:
   513-DOAS
2. ALL CONTROLS DESCRIBED HEREIN SHALL BE PERFORMED BY THE UNIT MOUNTED CONTROLLER AND THE BUILDING CONTROL SYSTEM. PROVIDE WIRING, RELAYS, CONTROLS, PROGRAMMING AND STARTUP AS REQUIRED TO PROVIDED DESCRIBED INTERLOCKS TO OTHER MECHANICAL EQUIPMENT (FANS, COILS, ETC.)
3. WHEN THE UNIT IS OFF-LINE VIA THE START/STOP COMMAND OR VIA THE SERVICE DISCONNECT(S) OR ANY OF THE SAFETIES, COMPONENTS SHALL GO TO THEIR FAIL-SAFE POSITIONS. NAMELY, THE OUTSIDE AIR DAMPER AND EXHAUST AIR DAMPER SHALL BE CLOSED.
4. FILTER STATUS SHALL BE MONITORED BY FILTER DIFFERENTIAL PRESSURE SWITCH (FLT-DP) ACROSS THE FILTERS.
5. THE BCS SHALL MONITOR FAN AND CONDENSING UNIT STATUS VIA ELECTRONIC CURRENT SWITCHES (SF1-CS, EF1-CS, CU-CS).
6. ALL SETPOINTS SHALL BE ADJUSTABLE THROUGH THE BCS (EITHER AT THE UNIT CONTROLLER OR THROUGH THE NETWORK) WITHOUT SOFTWARE OR HARDWARE REVISIONS.

OCCUPIED MODES OF OPERATION

1. COOLING MODE:
   1.1. BASIC OPERATIONS
   1.1.1. THE BCS SHALL MODULATE THE DX COOLING AT THE COMPRESSOR TO MAINTAIN THE SUPPLY AIR TEMPERATURE (SA-T) AT ADJUSTABLE SETPOINT OF 68°F SUMMER, 72°F WINTER.

2. HEATING MODE:
   2.1. BASIC OPERATIONS:
   2.1.1. THE BCS SHALL MODULATE THE HEAT PUMP HEATING AT THE COMPRESSOR TO MAINTAIN THE SUPPLY AIR TEMPERATURE (SA-T) AT ADJUSTABLE SETPOINT OF 68°F SUMMER, 72°F WINTER.
   2.1.2. IF THE HEAT PUMP FAILS TO HEAT THE SUPPLY AIR ADEQUATELY, THE ELECTRIC RESISTANCE HEATING COIL SHALL PROVIDE SUPPLEMENTAL HEATING TO PROVIDE 72°F SUPPLY AIR (EXTREME WINTER OPERATION ONLY).

3. FAN OPERATION:
   3.1. THE BCS SHALL COMMAND THE VFD TO MODULATE THE FANS SPEED TO MAINTAIN THE ADJUSTABLE 0.25 IN.W.C. DOWNSTREAM DUCT STATIC PRESSURE SETPOINT AT THE FURTHEST DAMPER.

4. HUMIDITY CONTROL:
   4.1. DEHUMIDIFICATION - IF DEWPOINT GREATER THAN 50°F
   4.1.1. DX COOLING COIL CONTROLLED TO MAINTAIN ADJUSTABLE LEAVING DEWPOINT TEMPERATURE OF AT ADJUSTABLE SETPOINT OF 50°F.
   4.1.2. HOT GAS REHEAT COIL: CONTROLLED TO REHEAT THE SUPPLY AIR TO THE ADJUSTABLE SETPOINT OF 68°F SUMMER, 72°F WINTER.
   4.2. HUMIDIFICATION - MIXED AIR DEWPOINT LESS THAN 40°F
   4.2.1. THE HUMIDIFIERS DOWNSTREAM OF THE DOAS SHALL INCREASE THE TEMPERED OUTSIDE AIR DEW POINT TO 25°F AT +0.5°F INCREMENTS EVERY 2 MINUTES, TO A MAXIMUM OF 37°F, UNTIL ALL SPACES HUMIDITY REACHES THE SET POINT OF 30% RELATIVE HUMIDITY.
   4.2.2. THE HUMIDIFIER SHALL NOT BE ACTIVE UNLESS AIRFLOW IS PROVEN.

HEAT RECOVERY WHEEL - VARIABLE SPEED:

1. COOLING RECOVERY MODE:
   1.1. THE CONTROLLER SHALL MEASURE THE HEAT WHEEL DISCHARGE AIR TEMPERATURE AND MODULATE THE HEAT WHEEL SPEED TO MAINTAIN A SETPOINT 2°F (ADJ.) LESS THAN THE UNIT SUPPLY AIR TEMPERATURE SETPOINT. THE HEAT WHEEL SHALL RUN FOR COOL RECOVERY WHENEVER:
   1.1.1. UNIT RETURN AIR TEMPERATURE IS 5°F (ADJ.) OR MORE BELOW THE OUTSIDE AIR TEMPERATURE.
   1.1.1.1. AND THE UNIT IS IN A COOLING MODE.
   1.1.1.2. AND THE SUPPLY FAN IS ON.
2. HEATING RECOVERY MODE:
   2.1. THE CONTROLLER SHALL MEASURE THE HEAT WHEEL DISCHARGE AIR TEMPERATURE AND MODULATE THE HEAT WHEEL SPEED TO MAINTAIN A SETPOINT 2°F (ADJ.) GREATER THAN THE UNIT SUPPLY AIR TEMPERATURE SETPOINT. THE HEAT WHEEL SHALL RUN FOR HEAT RECOVERY WHENEVER:
   2.1.1. UNIT RETURN AIR TEMPERATURE IS 5°F (ADJ.) OR MORE ABOVE THE OUTSIDE AIR TEMPERATURE.
   2.1.1.1. AND THE UNIT IS IN A HEATING MODE.
   2.1.1.2. AND THE SUPPLY FAN IS ON.
3. PERIODIC SELF-CLEANING:
   3.1. THE HEAT WHEEL SHALL RUN AT 5% SPEED (ADJ.) FOR 10SEC (ADJ.) EVERY 4HRS (ADJ.) THE UNIT RUNS.
4. FROST PROTECTION:
   4.1. THE HEAT WHEEL SHALL RUN AT 5% SPEED (ADJ.) WHENEVER:
   4.1.1. OUTSIDE AIR TEMPERATURE DROPS BELOW 15°F (ADJ.)
   4.1.2. OR WHENEVER EXHAUST AIR TEMPERATURE DROPS BELOW 20°F (ADJ.).
   4.1.3. THE BYPASS DAMPERS WILL OPEN WHENEVER THE HEAT WHEEL IS DISABLED.
5. ALARMS SHALL BE PROVIDED AS FOLLOWS:
   5.1. HEAT WHEEL ROTATION FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
   5.2. HEAT WHEEL IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
   5.3. HEAT WHEEL RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.).
   5.4. HEAT WHEEL VFD IN FAULT

SAFETIES AND ALARMS

1. THE FOLLOWING SAFETIES, EACH WITH ITS OWN MANUAL RESET BUTTON, SHALL SHUT DOWN ITS RESPECTIVE UNIT, AND INITIATE A SPECIFIC ALARM, AFTER APPROPRIATE TIME DELAYS WHERE SPECIFIED:
   - SMOKE DETECTOR INDICATES SMOKE - DELAY: NONE. DRY CONTACTS ON THE SMOKE DETECTOR INITIATES THE SHUTDOWN OF THE AHU VIA THE VFD SAFETY CIRCUIT(S). SECOND (DRY) CONTACT NOTIFIES THE BUILDING FIRE ALARM SYSTEM WHICH SHALL INITIATE AN APPROPRIATE RESPONSE (BY THE FIRE ALARM CONTRACTOR.)
   - HIGH LIMIT SENSOR (SA-T) INDICATES A TEMPERATURE OF 140°F OR HIGHER - DELAY: NONE.
   - HIGH LIMIT SENSOR (HU-H) INDICATES A RELEATIVE HUMIDITY OF 90% OR HIGHER - DELAY: NONE. HUMIDIFIER SHALL SHUT OFF.
   - SUPPLY AIR PRESSURE SENSOR (SA-SP) INDICATES A PRESSURE OF 2.0-IN W.C. OR HIGHER IN THE DISCHARGE AIR STREAM - DELAY: NONE.
2. THE CONTROL SYSTEM SHALL INITIATE AN ALARM FOR IF ANY OF THE FOLLOWING CONDITIONS ARE MET:
   - FAN OR COMPNENT IS COMMANDED TO START AND ANYTIME AFTER A 15 SECOND DELAY THE BCS SENSES NO STATUS (SF1-CS, EF1-CS) OR THE INTERNAL DIAGNOSTICS ON THE VFD INDICATE THERE IS A FAULT.
   - TEMPERATURE SENSOR (SA-T) INDICATES A DISCHARGE TEMPERATURE MORE THAN 10°F ABOVE OR BELOW SETPOINT FOR 5 CONSECUTIVE MINUTES WHEN AHU STATUS IS ON.
   - TEMPERATURE SENSOR (SP-T) INDICATES A SPACE TEMPERATURE MORE THAN 5°F ABOVE OR BELOW SETPOINT FOR 5 CONSECUTIVE MINUTES WHEN AHU STATUS IS ON.

KITCHEN HOOD INTERLOCK

1. WHEN ONE OR BOTH KITCHEN EXHAUST HOODS ARE OPERATING, MODULATE SUPPLY AND EXHAUST FAN SPEEDS TO MAINTIAN THE FOLLOWING FLOWS:
   - NORMAL OPERATION - 8,000 CFM SUPPLY, 6,000 CFM EXHAUST
   - ONE HOOD OPERATING - 8,500 CFM SUPPLY, 5,365 CFM EXHAUST
   - TWO HOODS OPERATING - 9,000 CFM SUPPLY, 4,730 CFM EXHAUST

ENERGY MONITORING

1. THE BCS SHALL CALCULATE ENERGY CONSUMPTION BASED ON AMP DRAW FROM FANS AS WELL AS CONDENSING UNIT.

513-DOAS POINT SCHEDULE

POINT	DESCRIPTION	TYPE
FLT1-DP	OUTSIDE AIR FILTER DIFF. PRESSURE	ANALOG INPUT
OA1-T	OUTSIDE AIR TEMPERATURE	ANALOG INPUT
OA1-H	OUTSIDE AIR HUMIDITY	ANALOG INPUT
OABD-O	OUTSIDE AIR BYPASS DAMPER	DIGITAL OUTPUT
OA-FL	OUTSIDE AIR FLOWRATE	ANALOG INPUT
EA-FL	RETURN AIR FLOWRATE	ANALOG INPUT
EABD-O	EXHAUST AIR BYPASS DAMPER	DIGITAL OUTPUT
EF-EN	EXHAUST FAN ENABLE	DIGITAL OUTPUT
EF-S	EXHAUST FAN SPEED FEEDBACK	ANALOG INPUT
EF-CS	EXHAUST FAN CURRENT SWITCH	DIGITAL INPUT
EF-O	EXHAUST FAN SPEED	ANALOG OUTPUT
SA-SD	SUPPLY AIR SMOKE DETECTOR	WIRED TO SAFETY CIRCUIT(S)
MA-T	RETURN AIR TEMPERATURE	ANALOG INPUT
RA-H	RETURN AIR HUMIDITY	ANALOG INPUT
HX-EN	ENTHALPY WHEEL ENABLE	DIGITAL OUTPUT
HX-S	ENTHALPY WHEEL SPEED FEEDBACK	ANALOG INPUT
HX-CS	ENTHALPY WHEEL CURRENT SWITCH	DIGITAL INPUT
HX-O	ENTHALPY WHEEL SPEED	ANALOG OUTPUT
SF-EN	SUPPLY FAN ENABLE	DIGITAL OUTPUT
SF-S	SUPPLY FAN SPEED FEEDBACK	ANALOG INPUT
SF-CS	SUPPLY FAN CURRENT TRANSMITTER	ANALOG INPUT
SF-O	SUPPLY FAN SPEED	ANALOG OUTPUT
FLT2-DP	FILTER DIFFERENTIAL PRESSURE	ANALOG INPUT
CU-O	CONDENSING UNIT CONTROL	BY INTERNAL UNIT CONTROLS
EHC-O	ELECTRIC RESISTANCE HEATING COIL	ANALOG OUTPUT
SA-T	SUPPLY AIR TEMPERATURE	ANALOG INPUT
SA-H	SUPPLY AIR HUMIDITY	ANALOG INPUT
EA-T	EXHAUST AIR TEMPERATURE	ANALOG INPUT
EA-H	EXHAUST AIR HUMIDITY	ANALOG INPUT
MA-T	MIXED AIR TEMPERATURE	ANALOG INPUT
MA-H	MIXED AIR HUMIDITY	ANALOG INPUT
SA-DP	SUPPLY AIR STATIC PRESSURE	DIGITAL INPUT
HU-EN	HUMIDIFIER ENABLE	DIGITAL OUTPUT
HU-S	HUMIDIFIER STATUS	DIGITAL INPUT
HU-T	HUMIDIFIER DISCHARGE TEMPERATURE	ANALOG INPUT
HU-H	HUMIDIFIER DISCHARGE HUMIDITY	ANALOG INPUT
OAD-O	OUTSIDE AIR DAMPER POSITION	DIGITAL OUTPUT
EAD-O	EXHAUST AIR DAMPER POSITION	DIGITAL OUTPUT
FLT	UNIT FAULT	BY BACNET INTERFACE

BID DOCUMENTS

FULLY SPRINKLERED

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