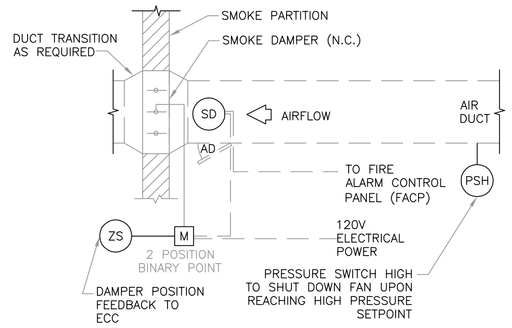


NOTE:
UPON DETECTION OF SMOKE BY THE SMOKE DETECTOR, THE SMOKE DAMPER SHALL CLOSE & SEND AN ALARM TO THE ECC.

2 SMOKE DAMPER CONTROL DIAGRAM

NTS

CONTROL LEGEND

DM	DAMPER WITH OPERATOR
CT	CURRENT TRANSFORMER
EN	ENTHALPY SENSOR
TS	TEMPERATURE SENSOR
TS	DUCT-MOUNTED TEMPERATURE SENSOR (AVERAGING)
FZ	FREEZE STAT
	AIR FILTER (PRE/FINAL AS INDICATED)
H	HUMIDITY SENSOR
	HYDRONIC HEATING COIL
	HYDRONIC COOLING COIL
AO	ANALOG OUTPUT
AI	ANALOG INPUT
DO	DIGITAL OUTPUT
DI	DIGITAL INPUT
DM	DAMPER MOTOR
DPS	DIFFERENTIAL PRESSURE SWITCH
HPS	HIGH PRESSURE LIMIT SWITCH
LPS	LOW PRESSURE LIMIT SWITCH
M	MODULATING VALVE (2-WAY CONTROL)
M	MODULATING VALVE (3-WAY CONTROL)
	TWO POSITION VALVE
	SOLENOID AIR VALVE
	SOLENOID VALVE
VFD	VARIABLE FREQUENCY DRIVE
FT	FLOW ELEMENT/ FLOW TRANSMITTER AIR
	SMOKE DETECTOR (FURNISHED AND WIRED BY ELECTRICAL CONTRACTOR, MOUNTED BY MECHANICAL CONTRACTOR)
	PLENUM (PLUG) FAN

CONTROL POINTS SCHEDULE (AHU-17 & 18)

POINT	DESCRIPTION	NOTES
1	MIXED AIR TEMPERATURE	
2A	OUTDOOR AIR DAMPER	
2B	MINIMUM OUTDOOR AIR DAMPER	
3	RETURN DAMPER	
4	FREEZE STAT (LOW TEMPERATURE LIMIT SENSOR)	
5	RELIEF AIR FLOW QUANTITY	
6	RELIEF DAMPER	
7	COOLING COIL CONTROL VALVE	
8A, B & C	SUPPLY AIR FLOW QUANTITY	
9	HEATING COIL CONTROL VALVE	
10	SUPPLY FAN STATUS	
11	SUPPLY FAN SPEED CONTROL	
12	RETURN DUCT STATIC PRESSURE (STATUS)	
13	HI LIMIT HUMIDITY SENSOR	
14	SUPPLY DUCT STATIC PRESSURE	
15A & B	ENTHALPY CONTROLLER, OUTSIDE AIR & RETURN AIR	
16	RETURN AIR TEMPERATURE	
17	RETURN DUCT HUMIDITY SENSOR	
18	RETURN AIR SMOKE DETECTOR	
19	RETURN FAN STATUS	
20	RETURN FAN SPEED CONTROL	
21	SUPPLY SMOKE DETECTOR	
22	DISCHARGE TEMPERATURE	
23	HUMIDIFIER VALVE CONTROL	
24	HUMIDIFIER POSITIVE SHUTOFF ON/OFF	
25	SUPPLY DUCT STATIC PRESSURE SENSOR	
26	RETURN DUCT STATIC PRESSURE SENSOR	

GENERAL NOTE: CONTRACTOR AND CONTRACTOR'S SUB IS RESPONSIBLE FOR RECOMMENDING PROPER DEVICES, PICKING DEVICE LOCATION AND INSTALLING THEM ACCORDING TO MANUFACTURER SPECIFICATIONS AND INSTRUCTIONS TO ENSURE A COMPLETE, PROPERLY WORKING SYSTEM.

AHU-1 AND 2 CONTROL SEQUENCE

GENERAL OPERATING MODES:
UNIT IS NORMALLY STARTED AND STOPPED REMOTELY AT THE E.C.C. OR MANUALLY AT THE VFD. H-O-A SWITCH SHALL BE KEPT IN THE "AUTO" POSITION & AHU SYSTEM (FANS, VALVES, DAMPERS, ETC.) WILL BE CONTROLLED BY DDC SYSTEM. "HAND" AND "OFF" POSITIONS SHALL BE USED ONLY FOR MAINTENANCE.

ECONOMIZER MODE:
OUTSIDE AIR, RETURN AIR & RELIEF AIR DAMPERS SHALL MODULATE AS NECESSARY TO MAINTAIN THE REQUIRED COOLING SUPPLY AIR TEMPERATURE WHEN THE OUTSIDE AIR ENTHALPY LEVEL IS SUITABLE FOR THE FREE COOLING MODE OF OPERATION.

DELAY FOR DAMPERS TO POSITION:
UNIT OPERATION SHALL ALWAYS DELAY FOR A 15 SECOND (ADJUSTABLE) PERIOD TO ALLOW SMOKE DAMPERS TO FULLY OPEN AND OTHER DAMPERS TO MODULATE TO THEIR REQUIRED POSITIONS.

ENTHALPY CONTROL:
MODULATE DAMPERS AS REQUIRED TO PROVIDE PROPER ENTHALPY CONTROL UNDER ALL OPERATING CONDITIONS.

HIGH PRESSURE LIMIT:
HIGH PRESSURE SENSOR LOCATED AT THE SUPPLY FAN DISCHARGE SHALL PREVENT THE SUPPLY FAN FROM DEVELOPING OVER A STATIC PRESSURE SETPOINT (ADJUSTABLE 0" TO "" W.G.). IF STATIC PRESSURE AT THE SENSOR EXCEEDS THE SETPOINT, THE SUPPLY FAN SHALL SHUT "OFF".

HUMIDITY CONTROL:
MODULATE THE HUMIDIFIER OUTPUT TO MAINTAIN RETURN AIR HUMIDITY AT SETPOINT (ADJUSTABLE). THE HIGH LIMIT HUMIDITY SENSOR SHALL KEEP THE SUPPLY DUCT HUMIDITY BELOW 80% RH (ADJUSTABLE). WHEN THE TEMPERATURE OF THE OUTSIDE AIR IS ABOVE 60 DEGREES F (ADJUSTABLE), THE DCP SHALL CLOSE ON-OFF TWO-WAY CONTROL VALVE. WHEN THE TEEMPERATURE IS BELOW 60 DEGREES (ADJUSTABLE), THE DCP SHALL OPEN TWO-WAY CONTROL VALVE.

FREEZE PROTECTION:
IN THE MIXED AIR TEMPERATURE FALLS BELOW 45 DEGREES F (ADJUSTABLE), AN ALARM SIGNAL SHALL BE INDICATED AT THE DCP AND E.C.C. IF THIS MIXED AIR TEMPERATURE FALLS BELOW 40 DEGREES F (ADJUSTABLE), THE UNIT SUPPLY AND RETURN FANS SHALL SHUT "OFF" AND CRITICAL ALARM SHALL BE INDICATED AT THE DCP AND E.C.C.

EMERGENCY CONSTANT SPEED OPERATION:
ON ALL VFD FANS IN VAV SYSTEMS, UPON FAILURE OF THE VFD THE FANS SHALL BE STARTED/STOPPED MANUALLY AT THE VFD THROUGH THE INTEGRAL BYPASS. FANS SHALL THEN BE OPERATED AT CONSTANT DESIGN SPEED.

SUPPLY FAN SPEED CONTROL:
THE DDC SYSTEM SHALL MODULATE THE VFD OUTPUT TO MAINTAIN SUPPLY DUCT STATIC PRESSURE AT SETPOINT, SUCH THAT THE PRESSURE AT THE SENSOR (IN MAIN BRANCH NEAR END-OF-LINE) IS MAINTAINED AT THE SETPOINT (ADJUSTABLE)

RETURN FAN CONTROL:
THE RETURN FAN SPEED CONTROL SHALL MODULATE THE FAN SPEED SO THAT THE RETURN FAN FLOW IS EQUAL TO THE SUPPLY FAN FLOW LESS 20% (ADJUSTABLE).

RETURN FAN DIRECT INTERLOCK W/SUPPLY:
THE RETURN FAN SHALL BE HARDWIRED SO ITS DIRECTLY INTERLOCKED WITH THE SUPPLY FAN VFD SUCH THAT THE RETURN FAN OPERATES ONLY WHEN THE SUPPLY FAN IS OPERATING. DIRECT INTERLOCKS SHALL DROP POWER TO FANS DIRECTLY; NOT THRU THE DDC/DCP.

SUPPLY FAN AND CONTROLS INTERLOCK:
WHENEVER THE SUPPLY FAN IS OFF (FOR ANY REASON) ALL CONTROL ACUTATORS SHALL BE PLACED IN THEIR NORMAL POSITION AND FANS SHALL SHUTDOWN.

SMOKE DETECTION AT FANS:
SMOKE DETECTORS AT AHU SUPPLY OR RETURN FANS (OTHER BLDG FIRE ALARMS WILL NOT AFFECT UNIT) SHALL BE HARD WIRED (DIRECTLY INTERLOCKED) TO FAN VFD AND SHALL SEND A SIGNAL FROM AN AUXILIARY CONTACT TO DDC CONTROL SYSTEM TO SHUTDOWN THE AHU SYSTEM (FANS, DAMPERS, VALVES, ETC.). IN ADDITION, SMOKE DETECTORS SHALL SEND A SIGNAL TO THE BUILDING FIRE ALARM SYSTEMS. DIRECT INTERLOCKS SHALL DROP POWER TO FANS DIRECTLY; NOT THRU THE DDC/DCP

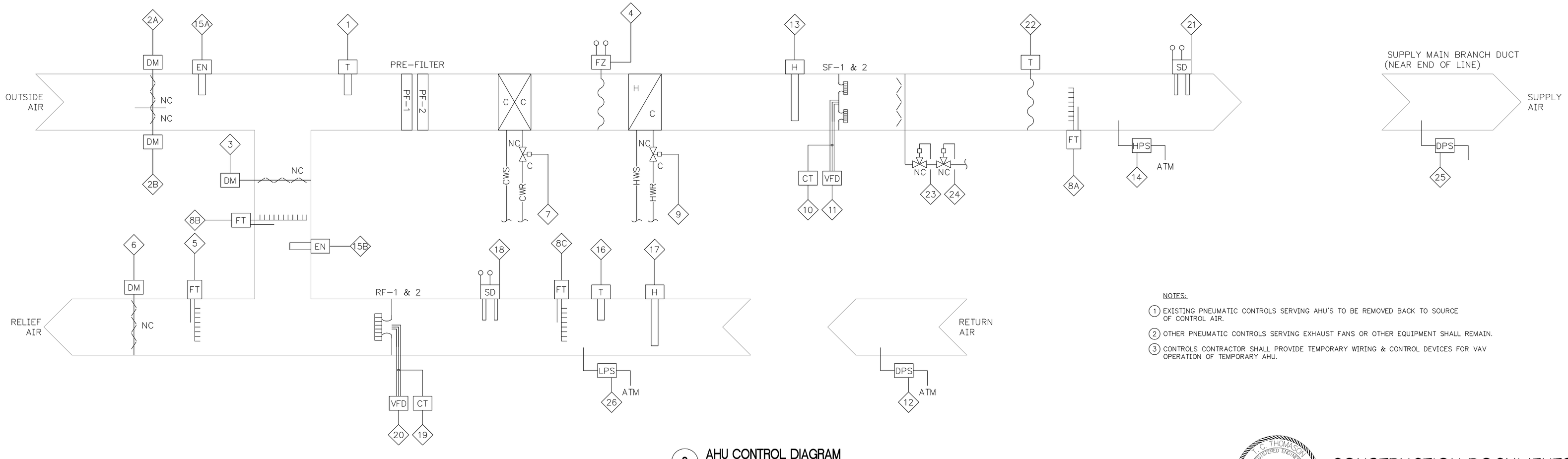
MIXED AIR SECTION:
THE CONTROL SYSTEM SHALL MODULATE THE OUTSIDE AIR RETURN AIR & RELIEF AIR DAMPERS INTO THEIR PROPER OPERATING POSITIONS WHENEVER THE SUPPLY FAN IS OPERATING, THE OPERATING POSITIONS SHALL BE CALIBRATED FOR THE SCHEDULED MINIMUM OUTSIDE AIR FLOW.

HYDRONIC HEATING COILS:
THE CONTROL SYSTEM SHALL MODULATE THE HEATING COIL CONTROL VALVE TO MAINTAIN COIL LEAVING AIR TEMPERATURE AT 55 DEGREES F. (ADJUSTABLE) SETPOINT.

HYDRONIC COOLING COILS
THE CONTROL SYSTEM SHALL MODULATE THE COOLING COIL VALVE TO MAINTAIN SUPPLY AIR TEMPERATURE AT 55 DEGREES F. (ADJUSTABLE) SETPOINT.

ALARMS:
THE CONTROL SYSTEM SHALL TURN OFF THE AIR HANDLING UNIT SUPPLY FAN AND ALARM THE USER INTERFACE WHENEVER ANY OF THE FOLLOWING CONDITIONS OCCURS:
1. NO AIR FLOW FOR 2 MINUTES (ADJUSTABLE) OR LONGER.
2. SMOKE DETECTED AT AHU (@ RF OR SUPPLY FAN) RESTART AUTOMATICALLY UPON DETECTOR RESET.
3. FREEZE STAT INDICATING TEMPERATURES BELOW 40º F.
4. SUPPLY DUCT PRESSURE EXCEEDS HI LIMIT SETPOINT (DETERMINED DURING TEST AND BALANCE).
5. COOLING COIL LEAVING AIR TEMPERATURE NOT AT SETPOINT FOR FIVE MINUTES (ADJUSTABLE) OR LONGER.
6. SUPPLY DUCT STATIC PRESSURE NOT AT SETPOINT FOR 5 MINUTES (ADJUSTABLE) OR LONGER.

SUPPLY FAN OPERATING AND SAFETY CONTRLS SHALL INCLUDE:
1. HAND-OFF-AUTO SELECT SWITCH
2. VARIABLE FREQUENCY MOTOR SPEED CONTROL DRIVE (VFD)
3. MOTOR CURRENT TRANSFORMER
4. RETURN AIR SMOKE DETECTOR
5. SUPPLY AIR SMOKE DETECTOR
6. FREEZE PROTECTION THERMOSTAT
7. SUPPLY DUCT OVER PRESSURE SWITCH



3 AHU CONTROL DIAGRAM

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NOTES:
1. EXISTING PNEUMATIC CONTROLS SERVING AHU'S TO BE REMOVED BACK TO SOURCE OF CONTROL AIR.
2. OTHER PNEUMATIC CONTROLS SERVING EXHAUST FANS OR OTHER EQUIPMENT SHALL REMAIN.
3. CONTROLS CONTRACTOR SHALL PROVIDE TEMPORARY WIRING & CONTROL DEVICES FOR VAV OPERATION OF TEMPORARY AHU.

CONSTRUCTION DOCUMENTS

Revisions	Date

TVHS NASHVILLE CAMPUS

Tennessee Valley Healthcare System

TVHS MURFREESBORO CAMPUS

TENNESSEE VALLEY HEALTHCARE SYSTEM MURFREESBORO CAMPUS	Drawing Title: HVAC CONTROLS	Project Title: REPLACE ATTIC AHU'S BUILDING 6	Date: 01/20/2012
			Project No.: 626A4-11-204
Approved: --	Approved: Facility Manager	Building Number: 6 / Checked: TCT / Drawn: SVP	DRAWING NO.: 6 - M 15
Approved: --	Approved: Director	Location: TVHS - YORK CAMPUS	FILE NAME: 11027D02

Veterans Administration