

Figure 10 displays 14 plots showing the evolution of the number of nodes in various sets over time  $t$  (from 0 to 14). The plots are arranged in two columns and seven rows. The left column shows the number of nodes in the set  $S_t$  (labeled  $S_t$  on the y-axis), and the right column shows the number of nodes in the set  $S_t^*$  (labeled  $S_t^*$  on the y-axis). The plots are labeled as follows:

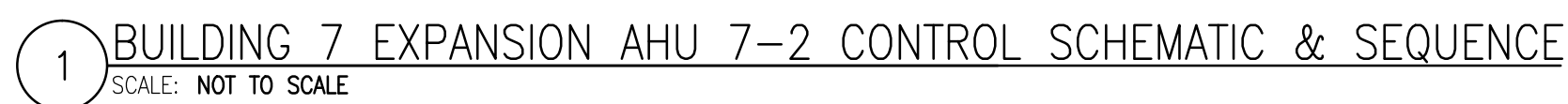
- Row 1:  $S_t$  and  $S_t^*$  (labeled  $S_t$  and  $S_t^*$  on the y-axis).
- Row 2:  $S_t$  and  $S_t^*$  (labeled  $S_t$  and  $S_t^*$  on the y-axis).
- Row 3:  $S_t$  and  $S_t^*$  (labeled  $S_t$  and  $S_t^*$  on the y-axis).
- Row 4:  $S_t$  and  $S_t^*$  (labeled  $S_t$  and  $S_t^*$  on the y-axis).
- Row 5:  $S_t$  and  $S_t^*$  (labeled  $S_t$  and  $S_t^*$  on the y-axis).
- Row 6:  $S_t$  and  $S_t^*$  (labeled  $S_t$  and  $S_t^*$  on the y-axis).
- Row 7:  $S_t$  and  $S_t^*$  (labeled  $S_t$  and  $S_t^*$  on the y-axis).

The plots show that the number of nodes in  $S_t$  and  $S_t^*$  generally increases over time, with some fluctuations. The plots are labeled with the number of nodes in  $S_t$  and  $S_t^*$  at each time step  $t$ .

1 BUILDING 7 EXPANSION AHU 7-2 CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

9. FREEZE PROTECTION
- 6.1. IF THE AIR TEMPERATURE AS SENSED BY PREHEATED MIXED AIR SENSOR (FREEZE/STAT) UPSTREAM OF COOLING COIL FALLS BELOW 45°F, AN ALARM SIGNAL SHALL INDICATE AT THE DIGITAL CONTROL PANEL AND ECC. IF THIS TEMPERATURE FALLS BELOW 40°F, AS SENSED BY THE LOW TEMPERATURE SWITCH, THE SUPPLY FAN SHALL SHUT DOWN AND A CRITICAL ALARM SHALL INDICATE AT THE DIGITAL CONTROL PANEL AND ECC. THE LOW TEMPERATURE SWITCH SHALL BE HARDWIRED TO THE SUPPLY FAN VFD, AND THE UNIT SHALL BE SHUTDOWN IN HAND, AUTO, OR BYPASS MODE WHENEVER THERE IS A LOW TEMPERATURE ALARM. THE LOW TEMPERATURE SWITCH SHALL REQUIRE MANUAL RESET AT THE DEVICE.
7. HIGH DUCT STATIC PROTECTION
- 7.1. A DUCT HIGH PRESSURE SENSOR LOCATED AT THE SUPPLY FAN DISCHARGE SHALL PREVENT THE SUPPLY FAN FROM DEVELOPING OVER 3" OF STATIC PRESSURE (FIELD ADJUSTABLE) IN THE SUPPLY DUCT. IF STATIC PRESSURE DOES EXCEED SET LIMIT, THE SUPPLY FAN SHALL STOP. DUCT HIGH PRESSURE SENSOR SHALL BE HARDWIRED TO THE SUPPLY FAN VFD AND THE UNIT SHALL BE SHUTDOWN IN HAND, AUTO OR BYPASS MODE WHENEVER THERE IS A HIGH DUCT PRESSURE ALARM. THE DUCT HIGH STATIC PRESSURE SENSOR SHALL REQUIRE MANUAL RESET AT DEVICE.
8. SMOKE PROTECTION AND AUTOMATIC SHUTDOWN/RESTART
- 8.1. A SUPPLY AIR SMOKE DETECTOR IN THE SUPPLY AIR DUCT SHALL STOP THE UNIT AND TRANSMIT A SIGNAL TO FIRE ALARM SYSTEM UPON DETECTION OF PRODUCTS OF COMBUSTION IN THE DUCT AND CLOSE THE UNIT ISOLATION SMOKE DAMPERS LOCATED IN SUPPLY AND RETURN DUCT MAINS ADJACENT TO THE UNIT. RE: ELECTRICAL FOR ADDITIONAL REQUIREMENTS. EXHAUST FANS SERVING THE AREA OF THE SUPPLY FAN SHALL CONTINUE TO RUN. THE SUPPLY FAN SHALL RESTART AND SMOKE DAMPERS SHALL OPEN WHEN FIRE ALARM IS RESET.
- 8.2. FIRESTATS SHALL BE PROVIDED FOR ANY FAN HANDLING 600CFM OR MORE. FIRESTATS SHALL STOP ASSOCIATED FAN ON A RISE IN AIR TEMPERATURE ABOVE 125°F.
9. EMERGENCY CONSTANT SPEED OPERATION
- 9.1. UPON FAILURE OF VFD, THE SUPPLY FAN SHALL BE STARTED/STOPPED MANUALLY AT THE DDC OR THE ECC THROUGH THE BYPASS STARTER. FANS SHALL THEN BE OPERATED AT CONSTANT SPEED.

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# VETERANS HEALTH CARE SYSTEM

Alexandria, Louisiana

[illegible]



MULTI-ZONE VAV AIR HANDLING UNIT		
LOCAL DDC CONTROLLER		
INPUTS		
ANALOG	AI1	OUTSIDE AIR FLOWMETER (F-1)
	AI2	RETURN AIR FLOWMETER (F-2)
	AI3	RETURN AIR TEMPERATURE SENSOR (T/H-1)
	AI4	RETURN AIR HUMIDITY SENSOR (T/H-1)
	AI5	RETURN AIR STATIC PRESSURE SENSOR (SPS-1)
	AI6	MIXED AIR TEMPERATURE SENSOR (T-2)
	AI7	HEATING COIL STEAM CONTROL VALVE (V-1)
	AI8	HEATING COIL DISCHARGE AIR TEMPERATURE SENSOR (T-4)
	AI9	COOLING COIL CHILLED WATER FLOWMETER
	AI10	CHILLED WATER CONTROL VALVE (V-2)
	AI11	COOLING COIL DISCHARGE AIR TEMPERATURE SENSOR (T-5)
	AI12	HUMIDIFIER STEAM CONTROL VALVE (V-4)
	AI13	SUPPLY FAN VFD STATUS
	AI14	SUPPLY DISCHARGE AIR STATIC PRESSURE SENSOR (SPS-2)
	AI15	SUPPLY DISCHARGE AIR TEMPERATURE SENSOR (T/H-2)
	AI16	SUPPLY DISCHARGE AIR HUMIDITY SENSOR (T/H-2)
	AI17	ZONE 2 SUPPLY AIR FLOWMETER (F-4)
	AI18	ZONE 1 SUPPLY AIR FLOWMETER (F-3)
DIGITAL	DI1	OUTSIDE AIR DAMPER (D-1) STATUS
	DI2	RETURN AIR DAMPER (D-2) STATUS
	DI3	AIR PRE-FILTER STATUS (DPS-1)
	DI4	RETURN AIR HIGH LIMIT TEMPERATURE SENSOR (T-1) STATUS
	DI5	AIR FILTER STATUS (DPS-2)
	DI6	RETURN AIR SMOKE DETECTOR (SD-1) STATUS
	DI7	HEATING COIL DISCHARGE AIR LOW LIMIT TEMPERATURE SENSOR (T-3) STATUS
	DI8	HUMIDIFIER ON/OFF STEAM CONTROL VALVE (V-3) STATUS
	DI9	SUPPLY FAN STATUS
	DI10	SUPPLY DISCHARGE AIR SMOKE DETECTOR (SD-2)
	DI11	SUPPLY DISCHARGE AIR HIGH LIMIT TEMPERATURE SENSOR (T-6) STATUS
	DI12	SUPPLY DISCHARGE AIR HIGH LIMIT STATIC PRESSURE SENSOR (SPS-3) STATUS
	DI13	ZONE 2 SUPPLY AIR HIGH LIMIT STATIC PRESSURE SENSOR (SPS-4) STATUS
OUTPUTS		
ANALOG	AO1	HEATING COIL STEAM CONTROL VALVE (V-1A)
	AO2	HEATING COIL STEAM CONTROL VALVE (V-1B)
	AO3	CHILLED WATER CONTROL VALVE (V-2)
	AO4	HUMIDIFIER STEAM CONTROL VALVE (V-4)
	AO5	SUPPLY FAN VFD SPEED
DIGITAL	DO1	OUTSIDE AIR DAMPER (D-1)
	DO2	RETURN AIR DAMPER (D-2) STATUS
	DO3	HUMIDIFIER ON/OFF STEAM CONTROL VALVE (V-3)
	DO4	SUPPLY FAN START/STOP

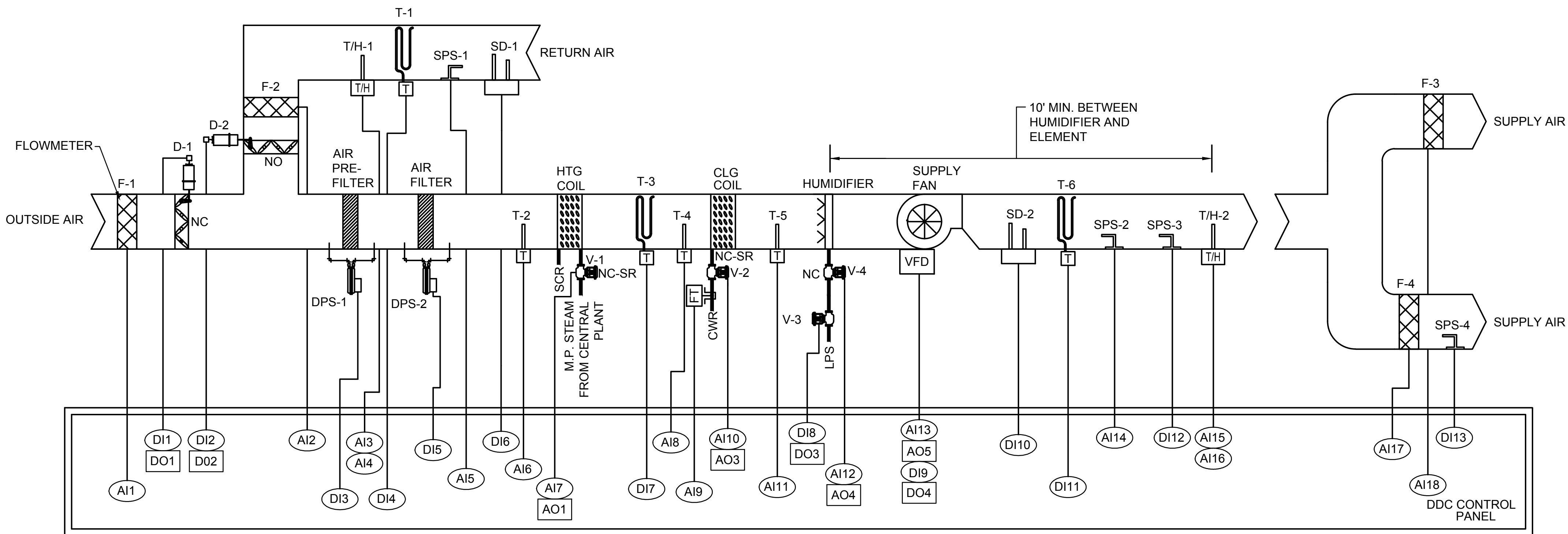
SEQUENCE OF OPERATION

1. START/STOP CONTROL
  - 1.1. 7E-AHU-7-3 IS NORMALLY STARTED AND STOPPED REMOTELY AT THE ECC. H-O-A SWITCH SHALL BE KEPT IN THE "AUTO" POSITION. "HAND" AND "OFF" POSITIONS SHALL BE USED ONLY FOR MAINTENANCE. WHEN FAN RUN STATUS IS PROVEN VIA A CURRENT SENSING RELAY, CONTROL LOOPS SHALL BE ENERGIZED. STOPPING THE UNIT SHALL DE-ENERGIZE THE CONTROL LOOPS AND ALL VALVES SHALL GO TO THE CLOSED POSITION. THE OUTSIDE AIR DAMPER SHALL CLOSE, AND THE RETURN AIR DAMPER SHALL OPEN. OUTSIDE AIR SHALL BE METERED TO MONITOR AND MAINTAIN CONSTANT MIN. O.A. AIRFLOW BY MODULATING THE RETURN AND OUTSIDE AIR CONTROL DAMPERS.
2. TEMPERATURE CONTROL
  - 2.1. A TEMPERATURE SENSOR IN THE UNIT SUPPLY AIR SHALL TRANSMIT TEMPERATURE CHANGES TO THE ASC. THE ASC SHALL MODULATE THE 2-WAY COOLING COIL VALVE TO MAINTAIN SUPPLY AIR SETPOINT AT 55°F (ADJUSTABLE). A TEMPERATURE SENSOR IN THE PREHEAT COIL DISCHARGE SHALL TRANSMIT TEMPERATURE CHANGES TO THE ASC. THE ASC SHALL MODULATE THE 2-WAY STEAM VALVE PREHEAT COIL VALVE TO MAINTAIN PREHEAT SETPOINT (ADJUSTABLE).
3. DEHUMIDIFICATION CONTROL
  - 3.1. HUMIDITY SENSOR, (1% ACCURACY), SHALL MEASURE RETURN AIR HUMIDITY AT THE AHU. THE BAS SHALL AVERAGE THE POSITION OF THE VAV BOX AIR VALVES AND SHALL ADJUST THE AIR TEMPERATURE UPWARD OR DOWNWARD TO MAXIMIZE THE SUPPLY AIR TEMPERATURE THAT SHALL ALLOW FOR THE MOST EFFICIENT (HIGHEST) SUPPLY AIR TEMPERATURE TO SATISFY VAV BOX OPERATION DURING THE OCCUPIED PERIOD OF OPERATION. IF THE RETURN AIR HUMIDITY RISES TO 60% (NOMINAL, ADJUSTABLE), THE SUPPLY AIR TEMPERATURE OF THE AHU SHALL BE LIMITED (LOWERED) SO AS TO KEEP THE RETURN AIR HUMIDITY AT OR BELOW 60% (ADJUSTABLE). ALSO, SYSTEM SHALL UTILIZE CALCULATED R.A. DEWPOINT TEMPERATURE TO COMPARE WITH A MAX. DEWPOINT SETPOINT OF 55°F (ADJUSTABLE). IN ADDITION TO HUMIDITY, TO OVERRIDE CHW VALVE FOR DEHUMIDIFICATION.
4. HUMIDIFICATION CONTROL
  - 4.1. RETURN AIR HUMIDITY SHALL BE MONITORED. HUMIDIFIER STEAM VALVE SHALL MODULATE TO SUPPLY STEAM TO AHU MOUNTED DIRECT-INJECTION STEAM MANIFOLD REQUIRED TO MAINTAIN THE RETURN AIR RELATIVE HUMIDITY SETPOINT OF 30% (ADJUSTABLE AT ECC) AS SENSED BY THE RETURN RELATIVE HUMIDITY SENSOR. PRIOR TO ACTIVATION OF MODULATING STEAM CONTROL VALVE, THE ON/OFF CONTROL VALVE SHALL BE ENABLED THROUGH ECC AND JACKET TEMPERATURE SENSED BY HIGH TEMPERATURE SENSOR SHALL BE WARM ENOUGH TO PREVENT CONDENSATION. THE HIGH LIMIT HUMIDITY SENSOR, LOCATED IN THE SUPPLY AIR DUCT 10' AWAY FROM THE HUMIDIFIER, SHALL DISBALE THE HUMIDIFIER AND GIVE AN ALARM SIGNAL TO THE ECC, IF THE SUPPLY AIR HUMIDITY EXCEEDS 85% RH (ADJUSTABLE). THE AIRFLOW SWITCH SHALL PROVE AIRFLOW BEFORE HUMIDITY CONTROLS ARE ACTIVATED. NORMALLY CLOSED HUMIDIFIER STEAM SUPPLY VALVES SHALL OPEN WHEN OUTSIDE AIR TEMPERATURE DROPS BELOW 60°F AND SHALL CLOSE ABOVE 62°F OUTSIDE AIR TEMPERATURE OR WHEN SUPPLY FAN IS OFF. TEMPERATURE SWITCH SHALL KEEP HUMIDIFIER VALVE CLOSED UNTIL CONDENSATE DRIP LEG REACHES OPERATING TEMPERATURE.
5. STATIC PRESSURE AND AIRFLOW CONTROL
  - 5.1. THE SUPPLY AIR FAN FLOW SHALL BE CONTROLLED BY THE DIGITAL CONTROL PANEL MODULATING FAN'S INDIVIDUAL ADJUSTABLE SPEED MOTOR CONTROLLER TO MAINTAIN 1.0" OF DUCT STATIC PRESSURE (FIELD ADJUSTABLE), AS SENSED BY THE DUCT STATIC PRESSURE SENSOR LOCATED AT ¾ DISTANCE DOWN LONGEST DUCT MAIN. RESET STATIC PRESSURE BASED ON ACTUAL BUILDING LOAD BY POLLING ALL VAV TERMINAL UNITS.
  - 5.2. FILTER STATUS SHALL BE MONITORED AT EACH PRE-FILTER AND AFTER-FILTER BANK.

6. FREEZE PROTECTION
  - 6.1. IF THE AIR TEMPERATURE AS SENSED BY PREHEATED MIXED AIR SENSOR (FREEZESTAT) UPSTREAM OF COOLING COIL FALLS BELOW 45°F, AN ALARM SIGNAL SHALL INDICATE AT THE DIGITAL CONTROL PANEL AND ECC. IF THIS TEMPERATURE FALLS BELOW 40°F, AS SENSED BY THE LOW TEMPERATURE SWITCH, THE SUPPLY FAN SHALL SHUT DOWN AND A CRITICAL ALARM SHALL INDICATE AT THE DIGITAL CONTROL PANEL AND ECC. THE LOW TEMPERATURE SWITCH SHALL BE HARDWIRED TO THE SUPPLY FAN VFD, AND THE UNIT SHALL BE SHUTDOWN IN HAND, AUTO, OR BYPASS MODE WHENEVER THERE IS A LOW TEMPERATURE ALARM. THE LOW TEMPERATURE SWITCH SHALL REQUIRE MANUAL RESET AT THE DEVICE.
7. HIGH DUCT STATIC PROTECTION
  - 7.1. A DUCT HIGH PRESSURE SENSOR LOCATED AT THE SUPPLY FAN DISCHARGE SHALL PREVENT THE SUPPLY FAN FROM DEVELOPING OVER 3" OF STATIC PRESSURE (FIELD ADJUSTABLE) IN THE SUPPLY DUCT. IF STATIC PRESSURE DOES EXCEED SET LIMIT, THE SUPPLY FAN SHALL STOP. DUCT HIGH PRESSURE SENSOR SHALL BE HARDWIRED TO THE SUPPLY FAN VFD AND THE UNIT SHALL BE SHUTDOWN IN HAND, AUTO OR BYPASS MODE WHENEVER THERE IS A HIGH DUCT PRESSURE ALARM. THE DUCT HIGH STATIC PRESSURE SENSOR SHALL REQUIRE MANUAL RESET AT DEVICE.
8. SMOKE PROTECTION AND AUTOMATIC SHUTDOWN/RESTART
  - 8.1. A SUPPLY AIR SMOKE DETECTOR IN THE SUPPLY AIR DUCT SHALL STOP THE UNIT AND TRANSMIT A SIGNAL TO FIRE ALARM SYSTEM UPON DETECTION OF PRODUCTS OF COMBUSTION IN THE DUCT AND CLOSE THE UNIT ISOLATION SMOKE DAMPERS LOCATED IN SUPPLY AND RETURN DUCT MAINS ADJACENT TO THE UNIT. RE: ELECTRICAL FOR ADDITIONAL REQUIREMENTS. EXHAUST FANS SERVING THE AREA OF THE SUPPLY FAN SHALL CONTINUE TO RUN. THE SUPPLY FAN SHALL RESTART AND SMOKE DAMPERS SHALL OPEN WHEN FIRE ALARM IS RESET.
  - 8.2. FIRESTATS SHALL BE PROVIDED FOR ANY FAN HANDLING 600CFM OR MORE. FIRESTATS SHALL STOP ASSOCIATED FAN ON A RISE IN AIR TEMPERATURE ABOVE 125°F.
9. EMERGENCY CONSTANT SPEED OPERATION
  - 9.1. UPON FAILURE OF VFD, THE SUPPLY FAN SHALL BE STARTED/STOPPED MANUALLY AT THE DDC OR THE ECC THROUGH THE BYPASS STARTER. FANS SHALL THEN BE OPERATED AT CONSTANT SPEED.

NOTES:

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1 BUILDING 7 EXPANSION AHU 7-3 CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

Revisions		
No.	Date	Remarks

VETERANS HEALTH CARE  
SYSTEM  
Alexandria, Louisiana

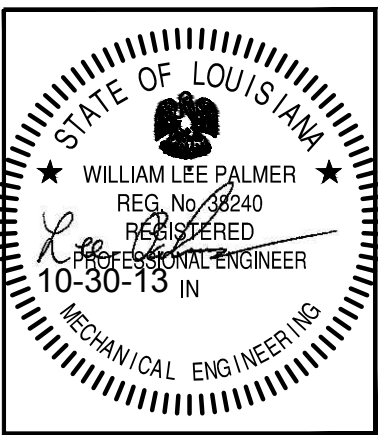
Hernandez Consulting  
ALBERT ARCHITECTURE  
Allen&Hoshall  
engineering since 1915

Approved:	
Title	Signature

Drawing Title	
AHU 7-3 CONTROL SCHEMATIC & SEQUENCE	
Approved: Service Engineer	
Approved: Service Director	

Project Title	
A&E Design - Upgrade Energy Management Control Systems	
Building Number	7 EXPANSION
Checked	WLP
Drawn	NMT
Location	Alexandria, LA

Date
October 30, 2013
Project No.
VA256-12-C-0253
Drawing No.
M7-401
Dwg. 1 OF 1





VAV AIR HANDLING UNIT WITH EXHAUST	
LOCAL DDC CONTROLLER	
INPUTS	
ANALOG	AI1 OUTSIDE AIR FLOWMETER (F-1)
	AI2 RETURN AIR DISCHARGE FLOWMETER (F-2)
	AI3 RETURN FAN VFD STATUS
	AI4 RETURN AIR TEMPERATURE SENSOR (T/H-1)
	AI5 RETURN AIR HUMIDITY SENSOR (T/H-1)
	AI6 RETURN AIR STATIC PRESSURE SENSOR (SPS-1)
	AI7 MIXED AIR TEMPERATURE SENSOR (T-2)
	AI8 HEATING COIL STEAM CONTROL VALVE (V-1A)
	AI9 HEATING COIL STEAM CONTROL VALVE (V-1B)
	AI10 RETURN AIR INTAKE FLOWMETER (F-3)
	AI11 HEATING COIL DISCHARGE AIR TEMPERATURE SENSOR (T-4)
	AI12 COOLING COIL CHILLED WATER FLOWMETER
	AI13 CHILLED WATER CONTROL VALVE (V-2)
	AI14 COOLING COIL DISCHARGE AIR TEMPERATURE SENSOR (T-5)
	AI15 HUMIDIFIER STEAM CONTROL VALVE (V-4)
	AI16 SUPPLY FAN VFD STATUS
	AI17 SUPPLY DISCHARGE AIR STATIC PRESSURE SENSOR (SPS-2)
	AI18 SUPPLY DISCHARGE AIR TEMPERATURE SENSOR (T/H-2)
	AI19 SUPPLY DISCHARGE AIR HUMIDITY SENSOR (T/H-2)
	AI20 SUPPLY DISCHARGE AIR FLOWMETER (F-4)
DIGITAL	DI1 EXHAUST AIR DAMPER (D-1) STATUS
	DI2 OUTSIDE AIR DAMPER (D-2) STATUS
	DI3 RETURN AIR DAMPER (D-3) STATUS
	DI4 AIR PRE-FILTER STATUS (DPS-1)
	DI5 RETURN FAN STATUS
	DI6 AIR FILTER STATUS (DPS-2)
	DI7 RETURN AIR HIGH LIMIT TEMPERATURE SENSOR (T-1) STATUS
	DI8 RETURN AIR SMOKE DETECTOR (SD-1) STATUS
	DI9 HEATING COIL DISCHARGE AIR LOW LIMIT TEMPERATURE SENSOR (T-3) STATUS
	DI10 HUMIDIFIER ON/OFF STEAM CONTROL VALVE (V-3) STATUS
	DI11 SUPPLY FAN STATUS
	DI12 SUPPLY DISCHARGE AIR SMOKE DETECTOR (SD-2)
	DI13 SUPPLY DISCHARGE AIR HIGH LIMIT TEMPERATURE SENSOR (T-6) STATUS
	DI14 SUPPLY DISCHARGE AIR HIGH LIMIT STATIC PRESSURE SENSOR (SPS-3) STATUS
	DI15 SUPPLY AIR HIGH LIMIT STATIC PRESSURE SENSOR (SPS-4) STATUS
OUTPUTS	
ANALOG	AO1 RETURN FAN VFD SPEED
	AO2 HEATING COIL STEAM CONTROL VALVE (V-1A)
	AO3 HEATING COIL STEAM CONTROL VALVE (V-1B)
	AO4 CHILLED WATER CONTROL VALVE (V-2)
	AO5 HUMIDIFIER STEAM CONTROL VALVE (V-4)
	AO6 SUPPLY FAN VFD SPEED
DIGITAL	DO1 EXHAUST AIR DAMPER (D-1)
	DO2 OUTSIDE AIR DAMPER (D-2)
	DO3 RETURN AIR DAMPER (D-3)
	DO4 RETURN FAN START/STOP
	DO5 HUMIDIFIER ON/OFF STEAM CONTROL VALVE (V-3)
	DO6 SUPPLY FAN START/STOP

SEQUENCE OF OPERATION

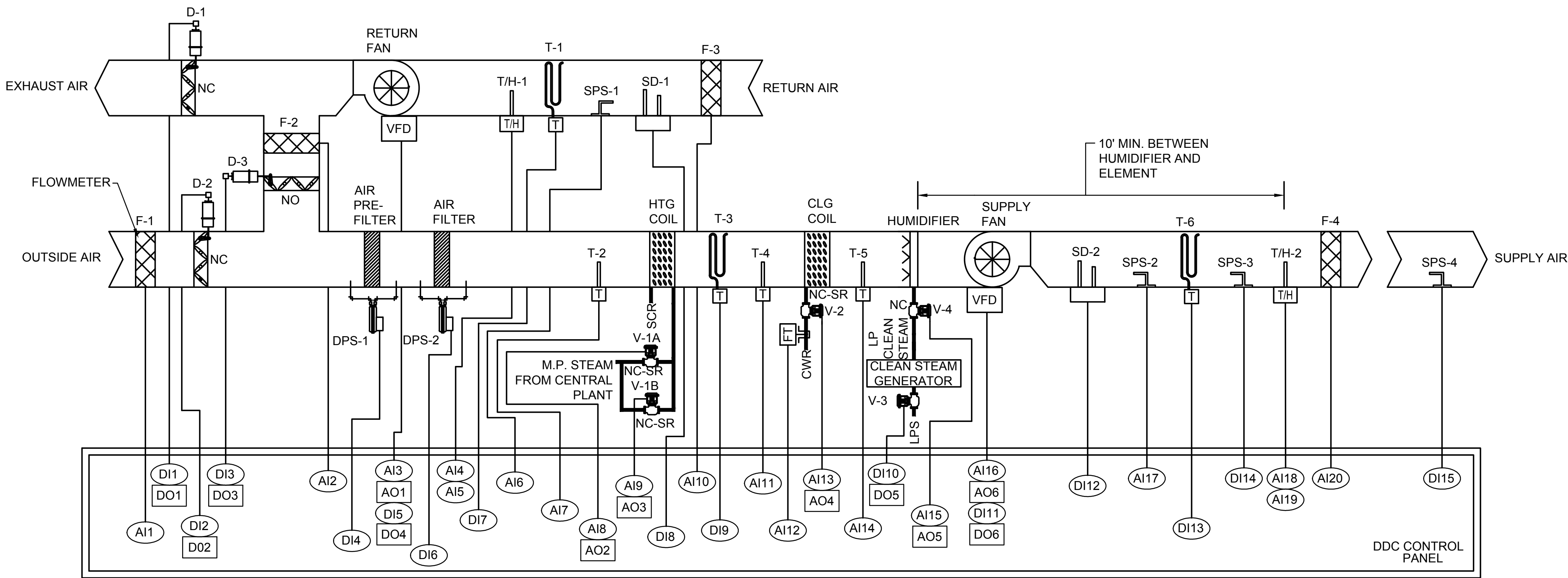
1. START/STOP CONTROL
  - 1.1. 7E-AHU-7-AC102 IS NORMALLY STARTED AND STOPPED REMOTELY AT THE ECC. H-O-A SWITCH SHALL BE KEPT IN THE "AUTO" POSITION. "HAND" AND "OFF" POSITIONS SHALL BE USED ONLY FOR MAINTENANCE. WHEN FAN RUN STATUS IS PROVEN VIA A CURRENT SENSING RELAY, CONTROL LOOPS SHALL BE ENERGIZED. STOPPING THE UNIT SHALL DE-ENERGIZE THE CONTROL LOOPS AND ALL VALVES SHALL GO TO THE CLOSED POSITION, THE OUTSIDE AIR DAMPER SHALL CLOSE, AND THE RETURN AIR DAMPER SHALL OPEN. OUTSIDE AIR SHALL BE METERED TO MONITOR AND MAINTAIN CONSTANT MIN. O.A. AIRFLOW BY MODULATING THE RETURN AND OUTSIDE AIR CONTROL DAMPERS.
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6. FREEZE PROTECTION

- 6.1. IF THE AIR TEMPERATURE AS SENSED BY PREHEATED MIXED AIR SENSOR (FREEZESTAT) UPSTREAM OF COOLING COIL FALLS BELOW 45°F, AN ALARM SIGNAL SHALL INDICATE AT THE DIGITAL CONTROL PANEL AND ECC. IF THIS TEMPERATURE FALLS BELOW 40°F, AS SENSED BY THE LOW TEMPERATURE SWITCH, THE SUPPLY FAN SHALL SHUT DOWN AND A CRITICAL ALARM SHALL INDICATE AT THE DIGITAL CONTROL PANEL AND ECC. THE LOW TEMPERATURE SWITCH SHALL BE HARDWIRED TO THE SUPPLY FAN VFD, AND THE UNIT SHALL BE SHUTDOWN IN HAND, AUTO, OR BYPASS MODE WHENEVER THERE IS A LOW TEMPERATURE ALARM. THE LOW TEMPERATURE SWITCH SHALL REQUIRE MANUAL RESET AT THE DEVICE.
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  - 8.2. FIRESTATS SHALL BE PROVIDED FOR ANY FAN HANDLING 600CFM OR MORE. FIRESTATS SHALL STOP ASSOCIATED FAN ON A RISE IN AIR TEMPERATURE ABOVE 125°F.
9. EMERGENCY CONSTANT SPEED OPERATION
  - 9.1. UPON FAILURE OF VFD, THE SUPPLY FAN SHALL BE STARTED/STOPPED MANUALLY AT THE DDC OR THE ECC THROUGH THE BYPASS STARTER. FANS SHALL THEN BE OPERATED AT CONSTANT SPEED.

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1 BUILDING 7 EXPANSION AHU 7-AC102 CONTROL SCHEMATIC & SEQUENCE  
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Revisions		
No.	Date	Remarks

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SYSTEM  
Alexandria, Louisiana

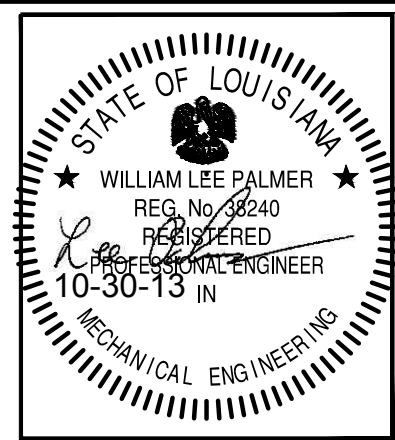
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ALBERT ARCHITECTURE  
Allen&Hoshall  
engineering since 1915

Approved:	
Title	Signature

Drawing Title	
AHU 7-AC102 CONTROL SCHEMATIC & SEQUENCE	
Approved: Service Engineer	
Approved: Service Director	

Project Title	
A&E Design - Upgrade Energy Management Control Systems	
Building Number	7 EXPANSION
Location	Alexandria, LA

Date	October 30, 2013
Project No.	VA256-12-C-0253
Drawing No.	M7-402
Dwg.	1 OF 1





4.1. RETURN AIR HUMIDITY SHALL BE MONITORED. HUMIDIFIER STEAM VALVE SHALL MODULATE TO SUPPLY STEAM TO A/H MOUNTED DIRECT-INJECTION STEAM MANIFOLD REQUIRED TO MAINTAIN THE RETURN AIR RELATIVE HUMIDITY SETPOINT OF 30% (ADJUSTABLE AT ECC) AS SENSED BY THE RELATIVE HUMIDITY SENSOR PRIOR TO ACTUATING THE HUMIDIFIER STEAM VALVE. ON/OFF CONTROL VALVE, THE ON/OFF CONTROL VALVE SHALL BE ENABLED THROUGH ECC AND JACKET TEMPERATURE SENSED BY HIGH TEMPERATURE SENSOR SHALL BE WARM ENOUGH TO PREVENT CONDENSATION. THE HIGH LIMIT HUMIDITY SENSOR, LOCATED IN THE SUPPLY AIR DUCT 10' AWAY FROM THE HUMIDIFIER, SHALL DISABE THE HUMIDIFIER AND GIVE AN ALARM SIGNAL TO THE ECC. IF THE SUPPLY AIR HUMIDITY EXCEEDS 85% RH (ADJUSTABLE), THE AIRFLOW SWITCH SHALL PROVE AIRFLOW BEFORE HUMIDIFIER CONTROLS ARE ACTIVATED. NORMALLY CLOSED HUMIDIFIER STEAM VALVE VALVES SHALL BE CLOSED WHEN OUTSIDE AIR TEMPERATURE DOPS BELOW 50°F AND SMALL CLOSURE ABOVE 62°F OUTSIDE AIR TEMPERATURE OR WHEN SUPPLY FAN IS OFF. TEMPERATURE SWITCH SHALL KEEP HUMIDIFIER VALVE CLOSED UNTIL CONDENSATE DRIP LEG REACHES OPERATING TEMPERATURE.

9.1. UPON FAILURE OF VFD, THE SUPPLY FAN SHALL BE STARTED/STOPPED MANUALLY AT THE DDC OR THE ECC THROUGH THE BYPASS STARTER. FANS SHALL THEN BE OPERATED AT CONSTANT SPEED.

[illegible]

1. THESE DRAWINGS ARE REPRESENTATIVE OF THE DESIGN DRAWINGS FOR THE BUILDING 7 EXPANSION CURRENTLY ON GOING AND ARE FOR REFERENCE ONLY.
2. ALL EQUIPMENT IN THIS PROJECT WILL BE CONTROLLED BY THE CAMPUS SIEMENS SYSTEM. MIGRATE ALL CONTROLS TO NEW SERVER.

STATE OF LOUISIANA  
WILLIAM LEE PALMER  
REG. NO. 38240  
REGISTERED  
MECHANICAL ENGINEER  
10-30-13  
MECHANICAL ENGINEERING



## 1. START/STOP CONTROL

- NOTES;

- 1

1 BUILDING 7 EXPANSION AHU 7-4 CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

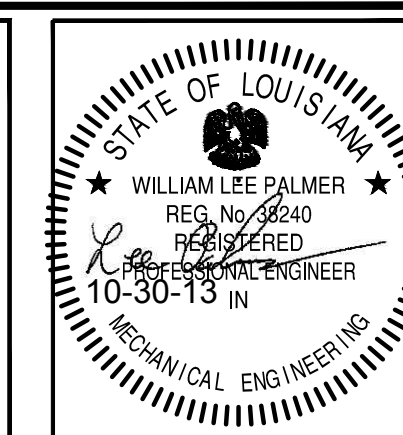
# VETERANS HEALTH CARE SYSTEM

Alexandria, Louisiana

**Hernandez Consulting**  
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Drawing Title	AHU 7-4 CONTROL SCHEMATIC & SEQUENCE
Approved: Service Engineer	
Approved: Service Director	

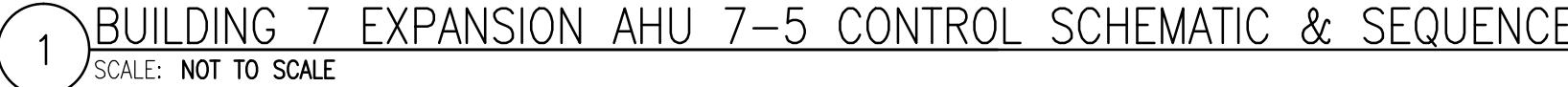




## 1. START/STOP CONTROL

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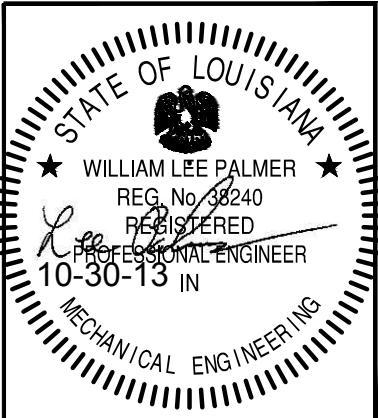


# VETERANS HEALTH CARE SYSTEM

Alexandria, Louisiana

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U.S. Department of  
Veterans Affairs







1. WATER METERING AND TOTALIZING

1.1. IN LINE ELECTROMAGNETIC FLOWMETER (NO MOVING PARTS, FLANGED 316 STAINLESS STEEL BODY) SHALL BE SUITABLE FOR MEASUREMENT OF ELECTRICALLY CONDUCTIVE LIQUIDS IN A WIDE VARIETY OF APPLICATIONS. THE FLOWMETER SHALL HAVE 0.4% FLOW METERING ACCURACY. COMPONENTS SHALL BE MOUNTED IN NEMA 4X ENCLOSURE. PROVIDE INHERENTLY BI-DIRECTIONAL, STANDARD TRANSMITTER THAT PROVIDES A SINLE ANALOG 4-20mA OUTPUT FOR FLOW RATE AND TWO PROGRAMMABLE PULSE OUTPUTS. OUTPUT OF METER SHALL BE SENT TO A WALL-MOUNTED REMOTE DISPLAY PANEL (COORDINATE LOCATION WITH VA AND ENGINEER) FOR TOTALIZATION AND BUILDING ENERGY MANAGEMENT SYSTEM VIA 4-20mA SIGNAL. PROVIDE ALL AC TO DC TRANSFORMERS AS REQUIRED TO POWER METER AND REMOTE DISPLAY PANEL. ALL METER AND REMOTE DISPLAY POWER AC POWER AC POWER REQUIREMENTS, AND INTERCONNECTING CABLING AND CONDUIT BETWEEN METER AND REMOTE DISPLAY PANEL TO BE SUPPLIED BY ELECTRICAL.

2. CHILLED WATER METERING AND TOTALIZING

TYPE	POINT	DESCRIPTION	UNITS	TREND	ALARM	TOTALIZE
AI-1	CHW-F	FLOWRATE	FT/SEC	X	X	X
AI-1	CHW-TS	SUPPLY TEMP	°F	X	X	X
AI-1	CHW-TR	RETURN TEMP	°F	X	X	X

3. PROGRAMS TO BE PROVIDED

3.1. NIGHT SETBACK / MORNING WARM-UP CONTROL

3.2. OPTIMUM START/STOP

3.3. EVENT SCHEDULING

3.4. ALARM REPORTING

3.5. CHILLED WATER PLANT OPERATION AND OPTIMIZATION

3.6. AUTOMATIC RESTART OF EQUIPMENT SEQUENCE AFTER POWER OUTAGE, & UPON RESUMPTION OF POWER SERVICE

3.7. POWER DEMAND LIMITING

3.8. PREVENTIVE MAINTENANCE INSTRUCTION

3.9. CALCULATING AIRFLOWS, WATERFLOWS, TONNAGE, BTU'S, W, KW, LB/HR, CFM, GPM, CCF, GPH, ETC.

3.10. UTILITY METERING AND TOTALIZATION

3.11. COMPUTER DIAGNOSTIC AND TESTING PROGRAMS

3.12. REMOTE COMMUNICATIONS

NOTES:

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GENERAL

- 1.1. THE EXISTING CONSTANT VOLUME PRIMARY CHILLED WATER SUPPLY FROM THE CENTRAL PLANT PROVIDES CHILLED WATER TO THE VARIABLE (CONTROLLED BY VFD) SECONDARY PUMPING SYSTEM LOCATED AT THE BUILDING. THERE ARE 2 SECONDARY CHILLED WATER PUMPS (EACH 100% REDUNDANT), ONLY 1 PUMP AT A TIME SHALL OPERATE TO COOL BUILDING.
- 1.2. ALL THE PUMP STARTERS ARE EQUIPPED WITH HOA SWITCHES. THE SWITCHES ARE KEPT IN THE "AUTO" POSITION. HAND AND OFF ARE USED ONLY FOR MAINTENANCE PURPOSES. ALL PUMPS SHALL BE STARTED/STOPPED BY THE FMS. ALL PUMPS SHALL PROPER INTERLOCKS TO RESPECTIVE EQUIPMENT AS PRE MANUFACTURER'S RECOMMENDATIONS.
- 1.3. UPON A CALL FOR COOLING FROM ANY AIR HANDLING UNIT, FAN COIL UNIT, OR BLOWER COIL UNIT, 1 LEAD CHILLED WATER PUMP SHALL ENERGIZE AND RESPECTIVE VARIABLE FREQUENCY DRIVE (VFD) SHALL MODULATE THE PUMP SPEED TO MAINTAIN PRESSURIZATION (ADJUSTABLE) AT THE DIFFERENTIAL PRESSURE SENSOR LOCATED  $\frac{3}{4}$  (MIN.) DOWN THE LONGEST PIPING RUN. THE DIFFERENTIAL PRESSURE SENSOR AND A FLOW SENSOR IN THE SECONDARY LINE SHALL BE USED TO CONTROL THE SPEED OF THE VFD-DRIVEN SECONDARY BUILDING CHILLED WATER PUMP. THE VFD SHALL RAMP UP OR DOWN AS REQUIRE TO MAINTAIN THIS SYSTEM PRESSURE SETPOINT. DIFFERENTIAL PRESSURE SETPOINT IS THE DIFFERENTIAL PRESSURE REQUIRED TO SATISFY THE BRANCH WITH THE HIGHEST PRESSURE DROP AT DESIGN FLOW. THE DIFFERENTIAL PRESSURE SENSOR MAINTAINS A CONSTANT DIFFERENTIAL BETWEEN THE SUPPLY LINE AND THE RETURN LINE TO COMPENSATE FOR SYSTEM LOAD CHANGES. ALSO, CHILLED WATER DIFFERENTIAL PRESSURE SETPOINT SHALL BE RESET BASED ON WEIGHTED AVERAGE OF THE CHW VALVE DEMAND FROM AHU'S.
- 1.4. 2-WAY CONTROL VALVE LOCATED AT HYDRONIC BRIDGE CIRCUIT DOWNSTREAM OF THE SECONDARY CHILLED WATER PUMPS WITH A FLOWMETER, TEMPERATURE SENSOR, AND MANUAL BALANCING VALVE SHALL BE UTILIZED TO BYPASS SECONDARY CHILLED WATER FLOW BACK TO THE PRIMARY LOOP AT MIN. VFD SETPOINT, WHILE COOLING COIL 2-WAY VALVES SHUT OFF AS COOLING LOAD DICTATES. MANUAL BALANCING VALVE SET AT PRESSURE DROP TO MATCH REMAINDER OF BUILDING PIPING CIRCUIT AT MIN. FLOW.
- 1.5. SECONDARY CHILLED WATER FLOWS SHALL BE MEASURED AND TOTALIZED AS MEASURED BY HIGH-ACCURACY FLOWMETERS AT EACH PUMP DISCHARGE, THE SECONDARY HYDRONIC BRIDGE BYPASS DOWNSTREAM OF PUMP DISCHARGE, AND THE COMMON SECONDARY CHILLED WATER SUPPLY DOWNSTREAM OF THE BRIDGE BYPASS.

2. LEAD/STANDBY PUMP CONTROL

- 2.1. IF THE LEAD BUILDING SECONDARY CHILLED WATER PUMP FAILS, THE STANDBY PUMP SHALL BE AUTOMATICALLY STARTED, AND THE SYSTEM SHALL RESUME NORMAL OPERATION. AN ALARM SHALL SOUND AND DISPLAY AT THE DDC CONTROL PANEL THAT A PUMP HAS FAILED.
- 2.2. THE LEAD/STANDBY NATURE OF THE PUMPS SHALL BE ROTATED EVERY WEEK TO ENSURE EVEN RUN TIME OF THE PUMPS.

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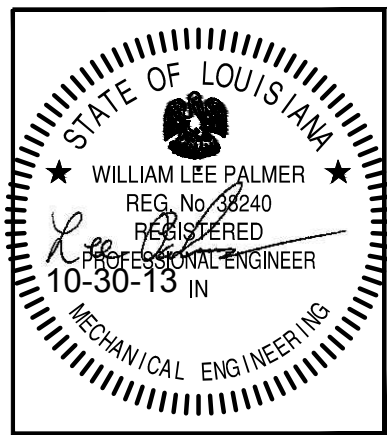
**Hernandez Consulting**  
ALBERT ARCHITECTURE

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engineering since 1915

Drawing Title	PRIMARY & SECONDARY CHILLED WATER SYSTEMS CONTROL SCHEMATICS & SEQUENCES
Approved: Service Engineer	
Approved: Service Director	



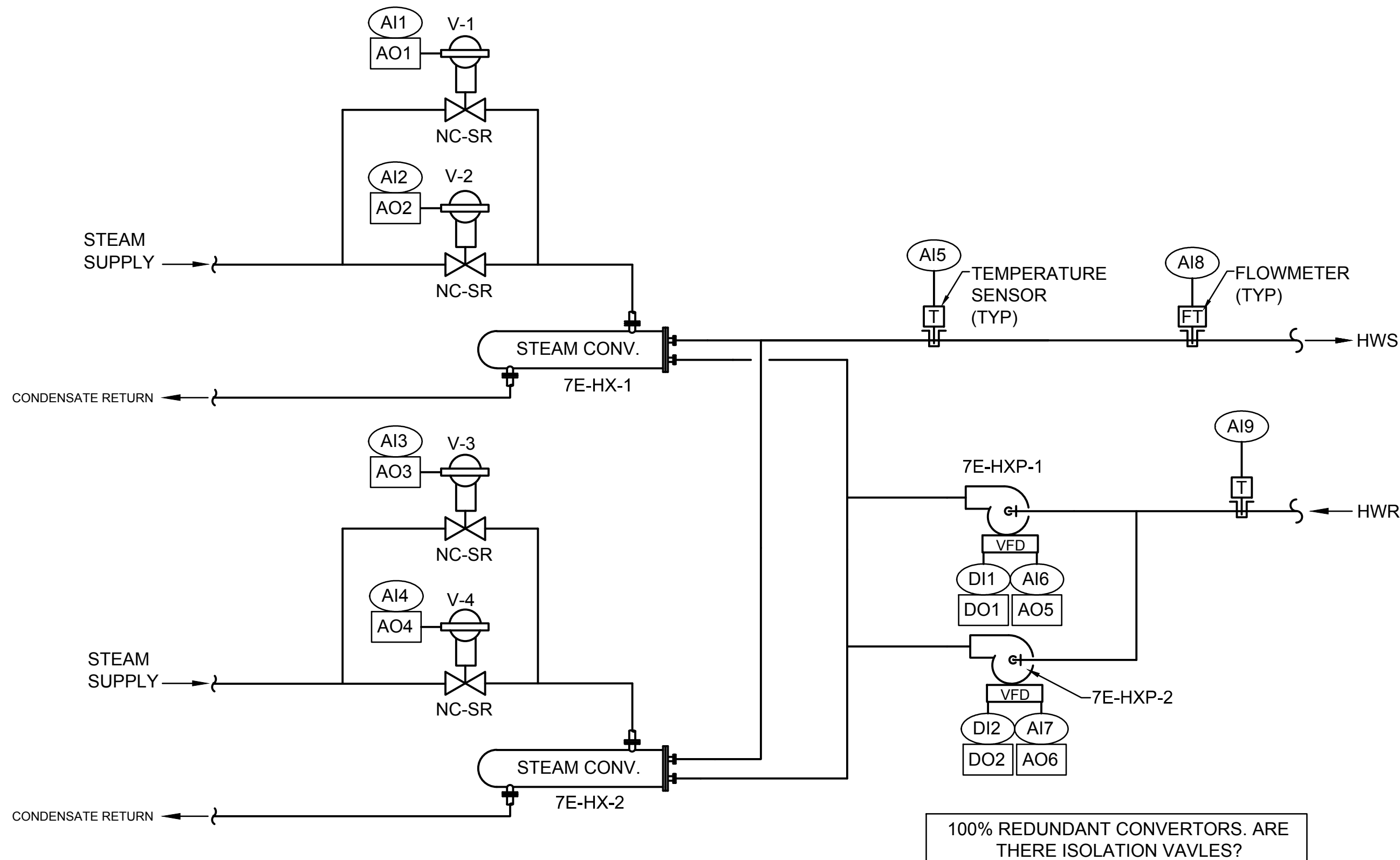
U.S. Department of  
Veterans Affairs





HOT WATER HEAT EXCHANGER	
LOCAL DDC CONTROLLER	
INPUTS	
ANALOG	AI1 STEAM CONVERTER (7E-HX-1) CONTROL VALVE (V-1)
	AI2 STEAM CONVERTER (7E-HX-1) CONTROL VALVE (V-2)
	AI3 STEAM CONVERTER (7E-HX-2) CONTROL VALVE (V-3)
	AI4 STEAM CONVERTER (7E-HX-2) CONTROL VALVE (V-4)
	AI5 HOT WATER SUPPLY TEMPERATURE SENSOR
	AI6 HOT WATER PUMP (7E-HXP-1) VFD STATUS
	AI7 HOT WATER PUMP (7E-HXP-2) VFD STATUS
	AI8 HOT WATER SUPPLY FLOWMETER
	AI9 HOT WATER RETURN TEMPERATURE SENSOR
DIGITAL	DI1 HOT WATER PUMP (7E-HXP-1) STATUS
	DI2 HOT WATER PUMP (7E-HXP-2) STATUS
OUTPUTS	
ANALOG	AO1 STEAM CONVERTER (7E-HX-1) CONTROL VALVE (V-1)
	AO2 STEAM CONVERTER (7E-HX-1) CONTROL VALVE (V-2)
	AO3 STEAM CONVERTER (7E-HX-2) CONTROL VALVE (V-3)
	AO4 STEAM CONVERTER (7E-HX-2) CONTROL VALVE (V-4)
	AO5 HOT WATER PUMP (7E-HXP-1) VFD SPEED
	AO6 HOT WATER PUMP (7E-HXP-2) VFD SPEED
DIGITAL	DO1 HOT WATER PUMP (7E-HXP-1) START/STOP
	DO2 HOT WATER PUMP (7E-HXP-2) START/STOP

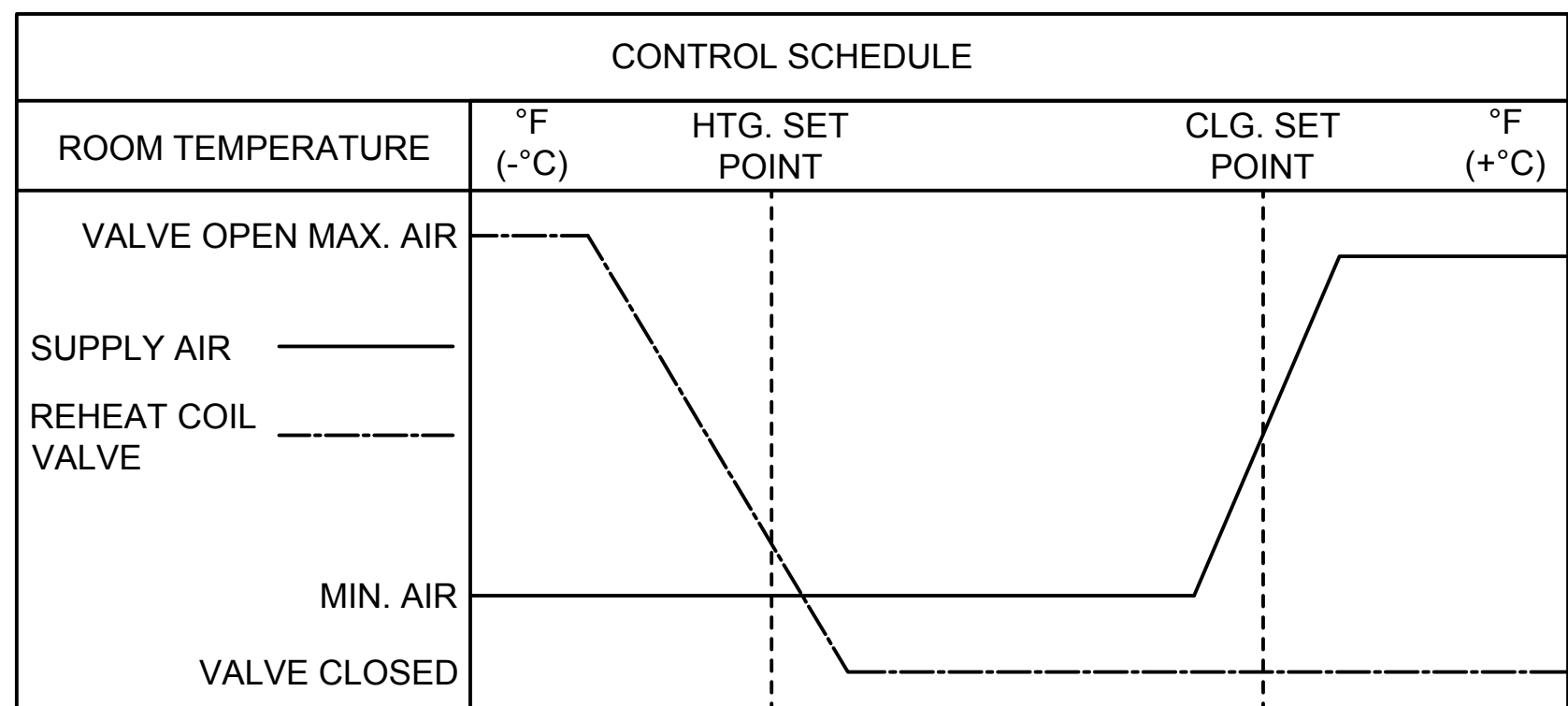
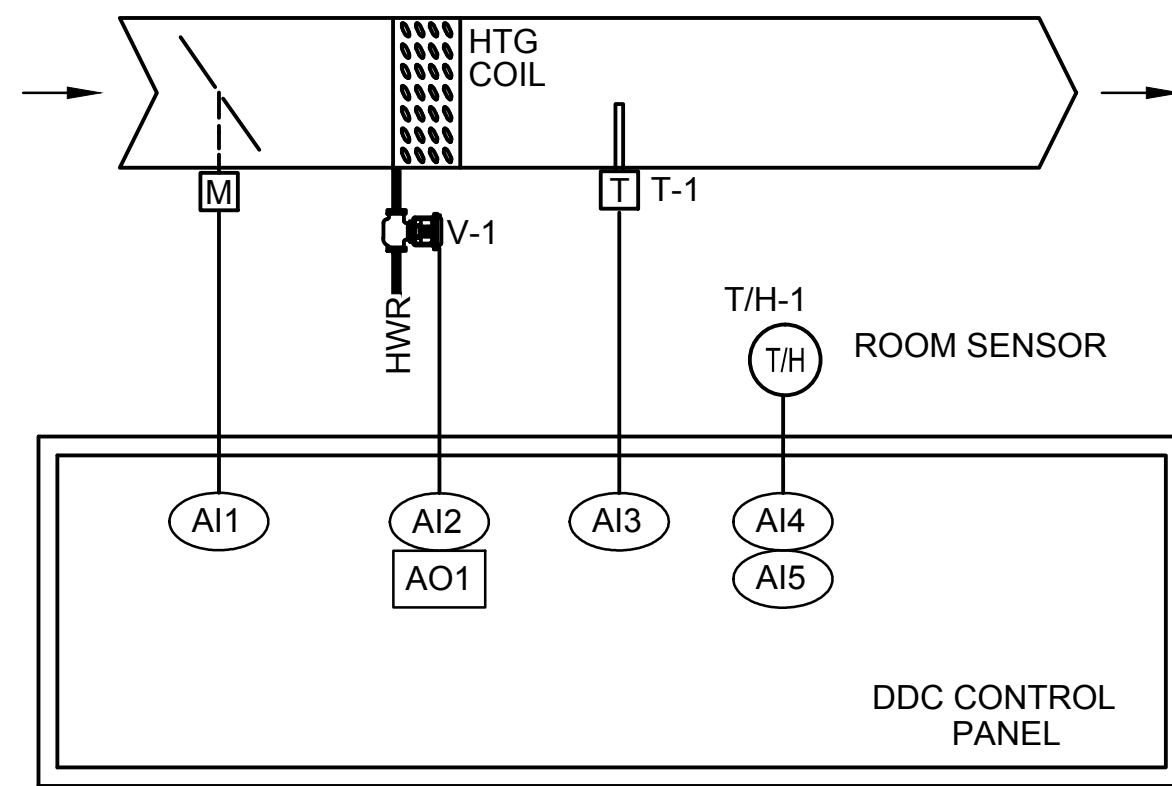
- SEQUENCE OF OPERATION
- OCCUPIED MODE
    - THE STEAM CONTROL VALVE SHALL MODULATE TO MAINTAIN THE LEAVING HOT WATER TEMPERATURE AT SETPOINT.
    - STEAM TO HOT WATER CONVERTERS 7E-HX-1 AND 7E-HX-2 ARE 100% REDUNDANT, REQUIRING ONLY ONE UNIT TO OPERATE AT FULL LOAD.
    - THE LEAVING HOT WATER TEMPERATURE SHALL BE RESET INVERSELY WITH THE OUTDOOR TEMPERATURE AS SCHEDULED (AT 30 °F O.A., HWS AT 180°F; AT 70°F O.A., HWS AT 140°F). ALSO, LWT SHALL BE RESET BASED ON HOT WATER RETURN SCHEDULE.
    - HOT WATER PUMPS SHALL BE STARTED/STOPPED BY THE FMS. ALL PUMPS SHALL HAVE PROPER INTERLOCKS TO RESPECTIVE EQUIPMENT AS PER EQUIPMENT MANUFACTURER'S RECOMMENDATION. EACH PUMP IS SIZED FOR 100% OF THE LOAD, I.E. 100% REDUNDANT, REQUIRING ONLY 1 PUMP FOR OPERATION. THE LEAD AND LAG HOT WATER PUMPS AND HEAT EXCHANGERS SHALL BE SEQUENCED BY THE OPERATOR CONTROLS AT THE PRE-DETERMINED INTERVAL (USUALLY 7 DAYS). IN THE EVENT LEAD PUMP FAILS TO START WITHIN 30 SECONDS, AN ALARM SHALL BE INITIATED AND THE LAG PUMP SHALL START AUTOMATICALLY.
  - VALVE SEQUENCE FOR LEAD HEAT EXCHANGER
    - THE ½ CAPACITY STEAM CONTROL VALVE MODULATES FULLY OPEN TO MAINTAIN SETPOINT.
    - THE ¾ CAPACITY STEAM CONTROL VALVE MODULATES FULLY OPEN TO MAINTAIN SETPOINT.
    - BOTH THE ½ CAPACITY & ¾ CAPACITY STEAM CONTROL VALVES MODULATE TOGETHER TO MAINTAIN SETPOINT.
  - UNOCCUPIED MODE
    - WHENEVER OUTSIDE AIR TEMPERATURE IS 40°F (ADJUSTABLE) OR BELOW, THE LOCAL DDC SHALL PLACE THE HOT WATER SYSTEM IN THE OCCUPIED MODE, START PUMPS, AND ACTUATE STEAM VALVES TO MAINTAIN SETPOINT.



1 BUILDING 7 EXPANSION HOT WATER CONVERTER CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

VARIABLE AIR TERMINAL	
LOCAL DDC CONTROLLER	
INPUTS	
ANALOG	AI1 INTAKE AIR DAMPER STATUS
	AI2 HEATING COIL CONTROL VALVE (V-1)
	AI3 DISCHARGE AIR TEMPERATURE SENSOR (T-1)
	AI4 ROOM AIR TEMPERATURE SENSOR (T/H-1)
	AI5 ROOM AIR HUMIDITY SENSOR (T/H-1)
OUTPUTS	
AN	AO1 HEATING COIL CONTROL VALVE (V-1)

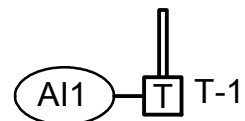
- SEQUENCE OF OPERATION
- OCCUPIED MODE
    - A SPACE SENSOR SHALL TRANSMIT ROOM TEMPERATURE AND HUMIDITY TO THE BOX CONTROLLER, WHICH SHALL VARY THE PRIMARY AIRFLOW AND VARY HEATING VALVE TO MAINTAIN SPACE TEMPERATURE SETPOINTS.
    - A RISE IN SPACE TEMPERATURE ABOVE SETPOINT MODULATE PRIMARY AIRFLOW TO MAX. CFM SETPOINT INTO THE SPACE. A DROP IN SPACE TEMPERATURE SHALL MODULATE THE PRIMARY AIRFLOW TO MIN. CFM SETPOINT. A FURTHER DROP IN SPACE TEMPERATURE SHALL MODULATE THE BOX REHEAT CONTROL VALVE OPEN TO HEAT THE SPACE TO MAINTAIN SETPOINT (+/- 0.5°F). THE ADJUSTABLE TOLERANCE OF (+/- 0.5°F) HAS BEEN SELECTED TO PREVENT VALVE HUNTING. VAV BOXES SHALL HAVE SEPARATE HEATING AND COOLING SPACE TEMPERATURE SETPOINTS FOR BOTH OCCUPIED AND UNOCCUPIED MODES.
  - UNOCCUPIED MODE
    - WHEN THE SYSTEM IS INDEXED TO UNOCCUPIED MODE, THE AIR HANDLING SHALL STOP, THE BOX DAMPER SHALL CLOSE, AND THE REHEAT VALVE SHALL CLOSE. IF THE SPACE TEMPERATURE FALLS BELOW THE NIGHT SETBACK POINT, THE AIR HANDLING UNIT SHALL START,



2 BUILDING 7 EXPANSION VAV TERMINAL CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

MORGUE COOLER	
LOCAL DDC CONTROLLER	
INPUTS	
AN	AI1 AIR TEMPERATURE SENSOR (T-1)

- SEQUENCE OF OPERATION
- OCCUPIED MODE
    - THE ANNUNCIATOR PANEL AT THE CAMPUS CENTRAL CONTROL CENTER SHALL ANNUNCIATE THE TROUBLE AND HIGH TEMPERATURE ALARMS FROM THE WALK-IN MORGUE REFRIGERATORS. TEMPERATURE ALARM SWITCHES AND ANALOG SENSORS SHALL MONITOR TEMPERATURE IN THE MORGUE COOLER (HIGH TEMPERATURE ALARM). THE ALARM SWITCHES AND ANALOG SENSOR SHALL BE INPUT TO THE DDC CONTROLS SYSTEM. A DOC "READ-ONLY" NETWORK DROP IN THE MAINTENANCE SUPERVISOR'S AND MORGUE DEPARTMENT OFFICES SHALL BE PROVIDED WITH ACCESS TO THE COOLER TEMPERATURE ALARMS. HOURLY HISTORICAL DATA (45 DAYS, MIN.). A CONSOLIDATED DAILY REPORT OF HOURLY TEMPERATURES SHALL BE AVAILABLE TO THE MAINTENANCE SUPERVISOR AND MORGUE DEPT. OFFICE VIA, DOC DROP. DOC SYSTEM SHALL SIGNAL TO OWNER-PROVIDED PHONE NUMBERS, PAGER NUMBERS, EMAIL AND TEXT MESSAGE AS REQUIRED BY OWNER REPRESENTATIVE FOR PROPER PERSONNEL COMMUNICATION.



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2 BUILDING 7 EXPANSION MORGUE COOLER CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

Revisions		
No.	Date	Remarks

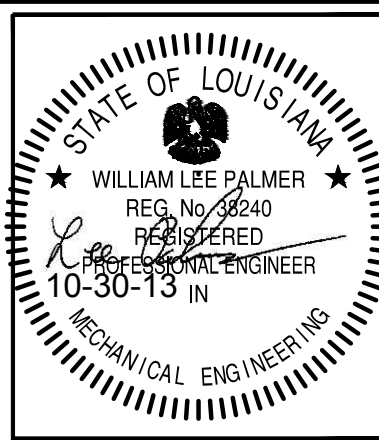
VETERANS HEALTH CARE  
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Alexandria, Louisiana

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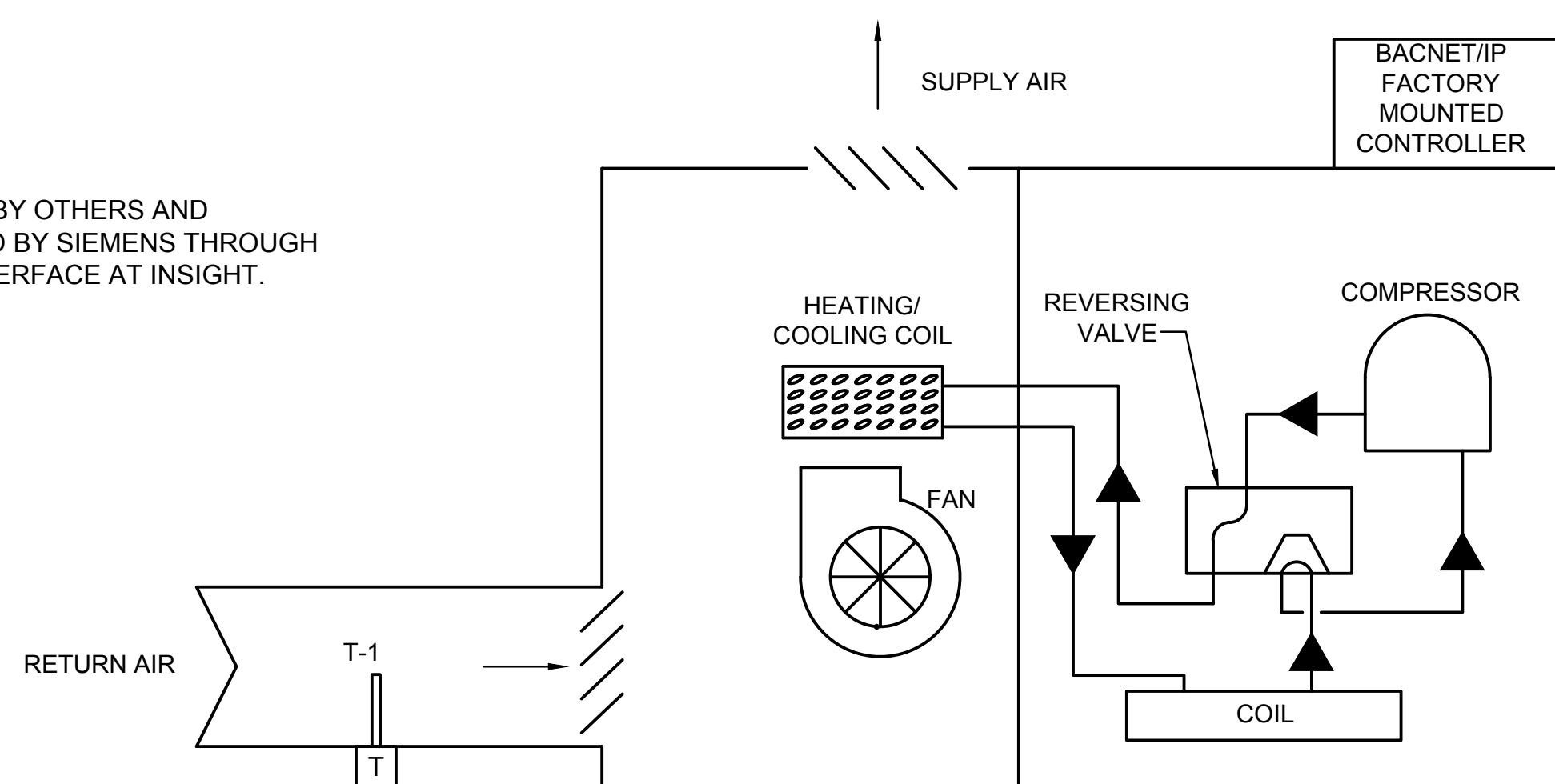
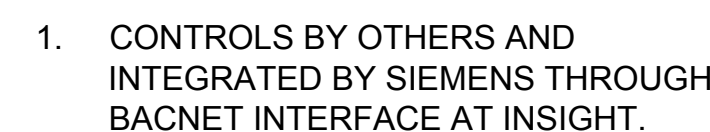
Approved:	
Title	Signature

Drawing Title	
HOT WATER CONVERTER, VAV TERMINAL, & MORGUE COOLER CONTROL SCHEMATICS & SEQUENCES	
Approved: Service Engineer	
Approved: Service Director	

Project Title	
A&E Design - Upgrade Energy Management Control Systems	
Building Number	7 EXPANSION
Checked	WLP
Drawn	NMT
Location	Alexandria, LA
Date	October 30, 2013
Project No.	VA256-12-C-0253
Dwg. No.	M7-407
Dwg. 1 OF 1	







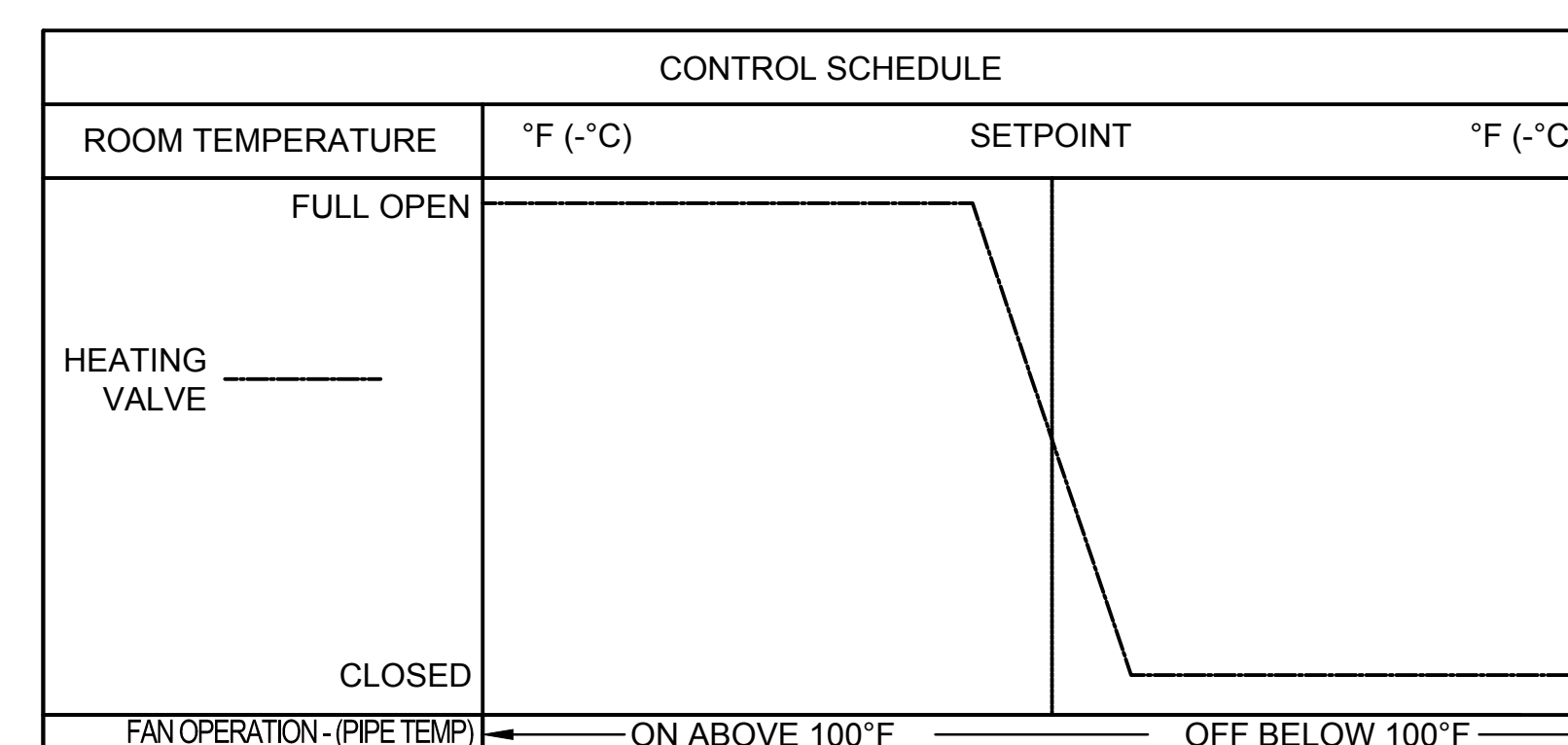
1 BUILDING 7 EXPANSION AC-7-1 CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

HEATING WATER UNIT HEATER		
LOCAL DDC CONTROLLER		
INPUTS		
ANALOG	AI1	HOT WATER CONTROL VALVE (V-1)
	AI2	ZONE AIR TEMPERATURE SENSOR (T-1)
DI	DI1	FAN STATUS
OUTPUTS		
AN	AO1	HOT WATER CONTROL VALVE (V-1)
DI	DO1	FAN START/STOP

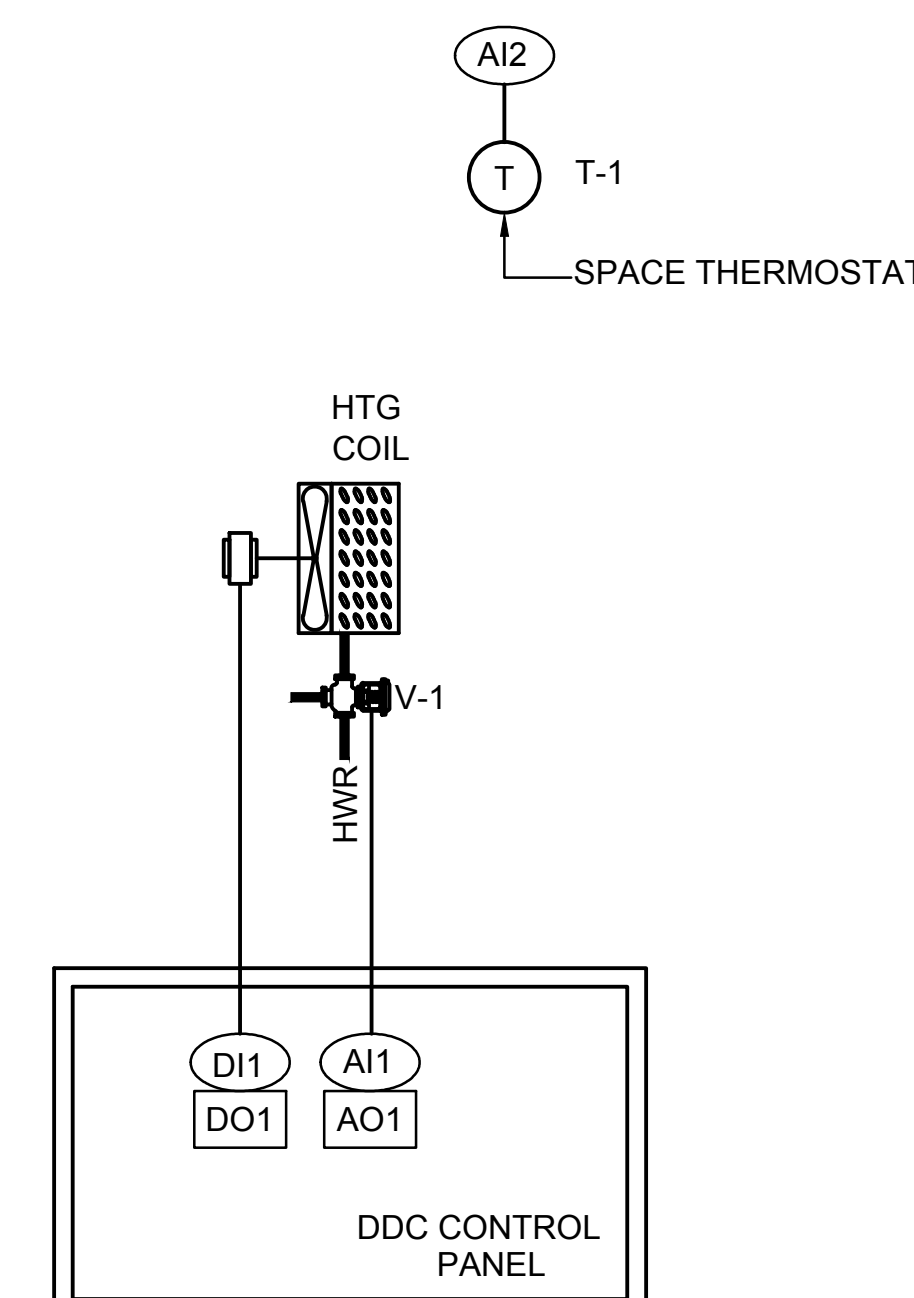
## 1. START/STOP CONTROL

- 1.1. UNIT IS NORMALLY STARTED AND STOPPED REMOTELY AT THE ECC.
- 1.2. H-O-A SWITCH SHALL BE KEPT IN THE "AUTO" POSITION. "HAND" AND "OFF" POSITIONS SHALL BE USED ONLY FOR MAINTENANCE. WHEN DAN IS COMMANDED TO RUN, THE CONTROL LOOPS SHALL BE ENERGIZED, OPENING COOLING COIL VALVE. STOPPING THE UNIT SHALL DE-ENERGIZE THE CONTROL LOOPS AND COOLING COIL VALVE SHALL GO TO CLOSED POSITION.
2. TEMPERATURE CONTROL
  - 2.1. SPACE THERMOSTAT LOCATED AS SHOWN ON THE PLANS SHALL TRANSMIT TEMPERATURE READINGS TO THE DDC. THE DDC SHALL MODULATE THE 3-WAY HOT WATER VALVE TO MAINTAIN TEMPERATURE SETPOINT.

1. TYPICAL FOR HWUH 7-1 (RM 1E-138) & HWUH 7-3 (1G-138).



NOTE: MUST HAVE SUBPOINT 05 COMMANDED TO HEAT MODE



2 BUILDING 7 EXPANSION HEATING HOT WATER UNIT HEATERS HWUH#7-1 & 7-3 CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

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VETERANS HEALTH CARE  
SYSTEM  
Alexandria, Louisiana

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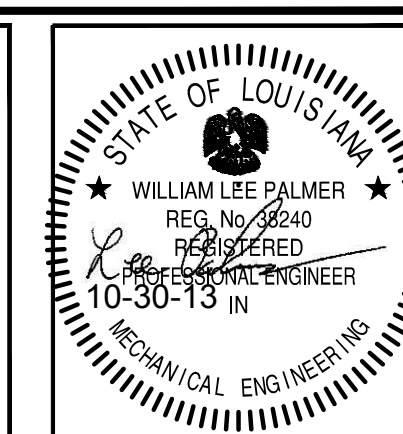
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[illegible]

	Drawing Title
	AC-7-1 & HEATING HOT WATER UNIT HEATER CONTROL SCHEMATICS & SEQUENCES
	Approved: Service Engineer
	Approved: Service Director

Project Title			
A&E Design - Upgrade Energy Management Control Systems			
Building Number	Checked	Drawn	
7 EXPANSION	WLP	NMT	
Location			
Alexandria, LA			

Date	October 30, 2013
Project No.	VA256-12-C-0253
DRAWING NO.	M7-408
	Dwg. 1 Of 1





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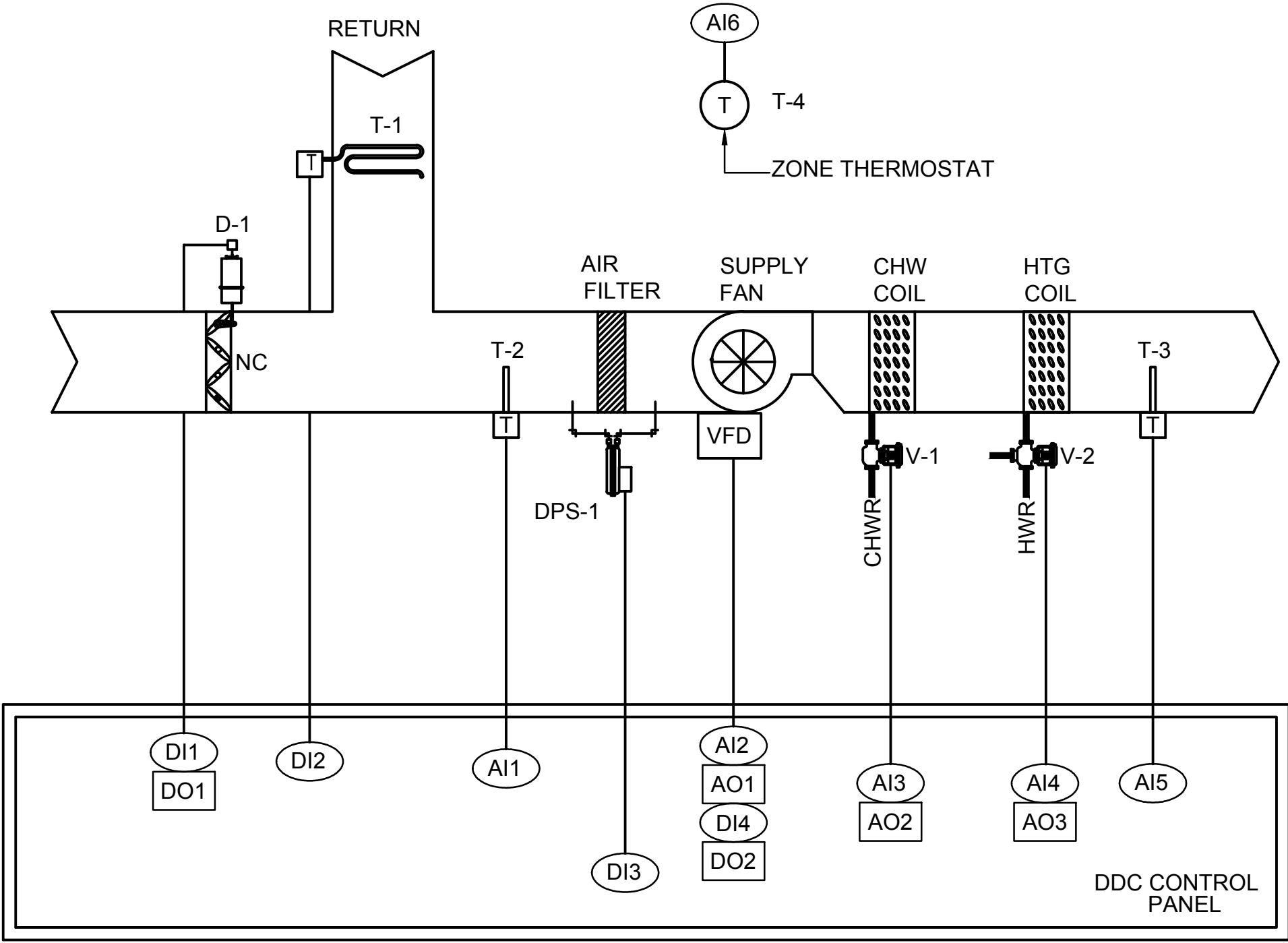
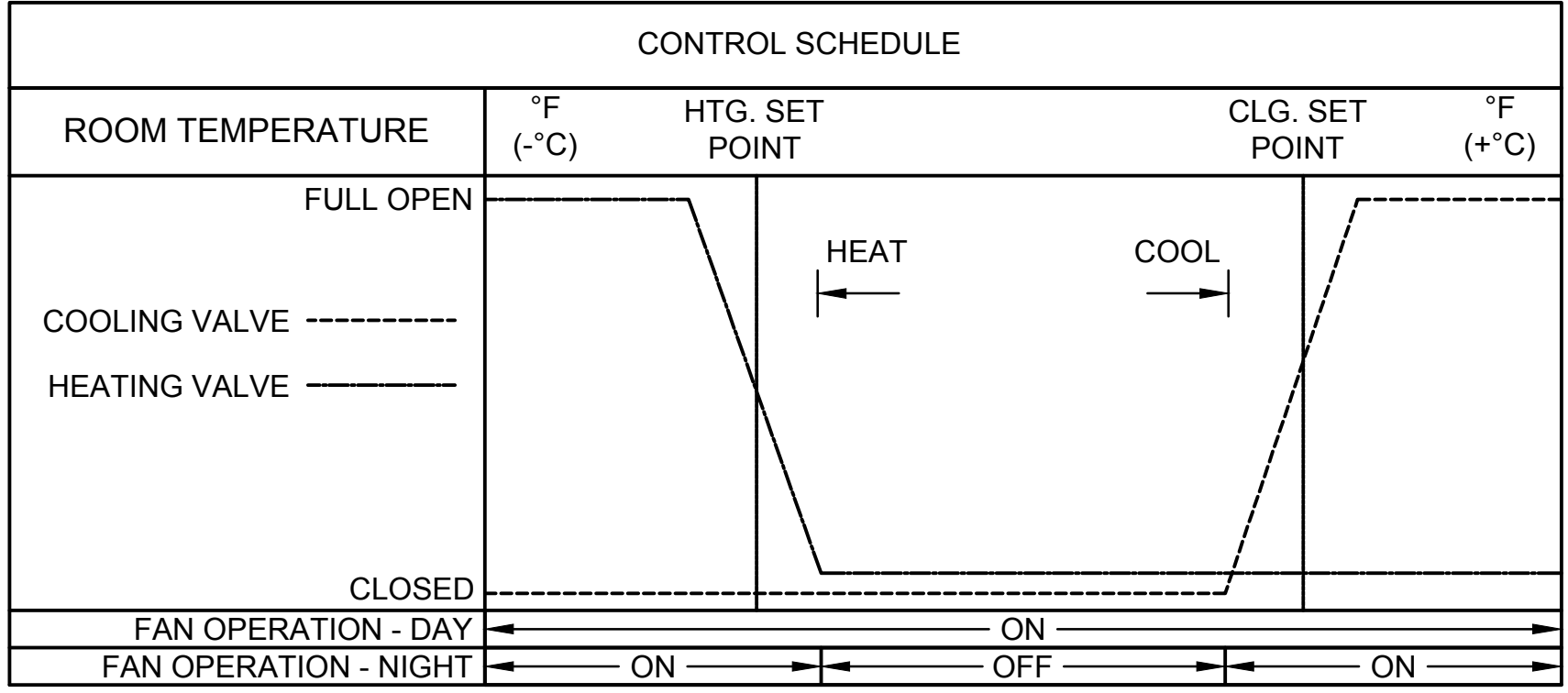
FAN COIL UNIT (FCU#7-4 & 7-5)	
LOCAL DDC CONTROLLER	
INPUTS	
ANALOG	AI1 SUPPLY FAN VFD STATUS
	AI2 CHILLED WATER CONTROL VALVE (V-1)
	AI3 ZONE AIR TEMPERATURE SENSOR (T-1)
DI	DI1 SUPPLY FAN STATUS
OUTPUTS	
ANALOG	AO1 SUPPLY FAN VFD SPEED
	AO2 CHILLED WATER CONTROL VALVE (V-1)
DI	DO1 SUPPLY FAN START/STOP

FAN COIL UNIT (FCU#7-1, 7-2 & 7-3)	
LOCAL DDC CONTROLLER	
INPUTS	
ANALOG	AI1 MIXED AIR TEMPERATURE SENSOR (T-2)
	AI2 SUPPLY FAN VFD STATUS
	AI3 CHILLED WATER CONTROL VALVE (V-1)
	AI4 HOT WATER CONTROL VALVE (V-2)
	AI5 SUPPLY AIR TEMPERATURE SENSOR (T-3)
	AI6 ZONE AIR TEMPERATURE SENSOR (T-4)
DIGITAL	DI1 OUTSIDE AIR DAMPER STATUS (D-1)
	DI2 RETURN AIR HIGH LIMIT TEMPERATURE SENSOR (T-1)
	DI3 AIR FILTER STATUS (DPS-1)
	DI4 SUPPLY FAN STATUS
OUTPUTS	
ANALOG	AO1 SUPPLY FAN VFD SPEED
	AO2 CHILLED WATER CONTROL VALVE (V-1)
	AO3 HOT WATER CONTROL VALVE (V-2)
DIGITAL	DO1 OUTSIDE AIR DAMPER (D-1)
	DO2 SUPPLY FAN START/STOP

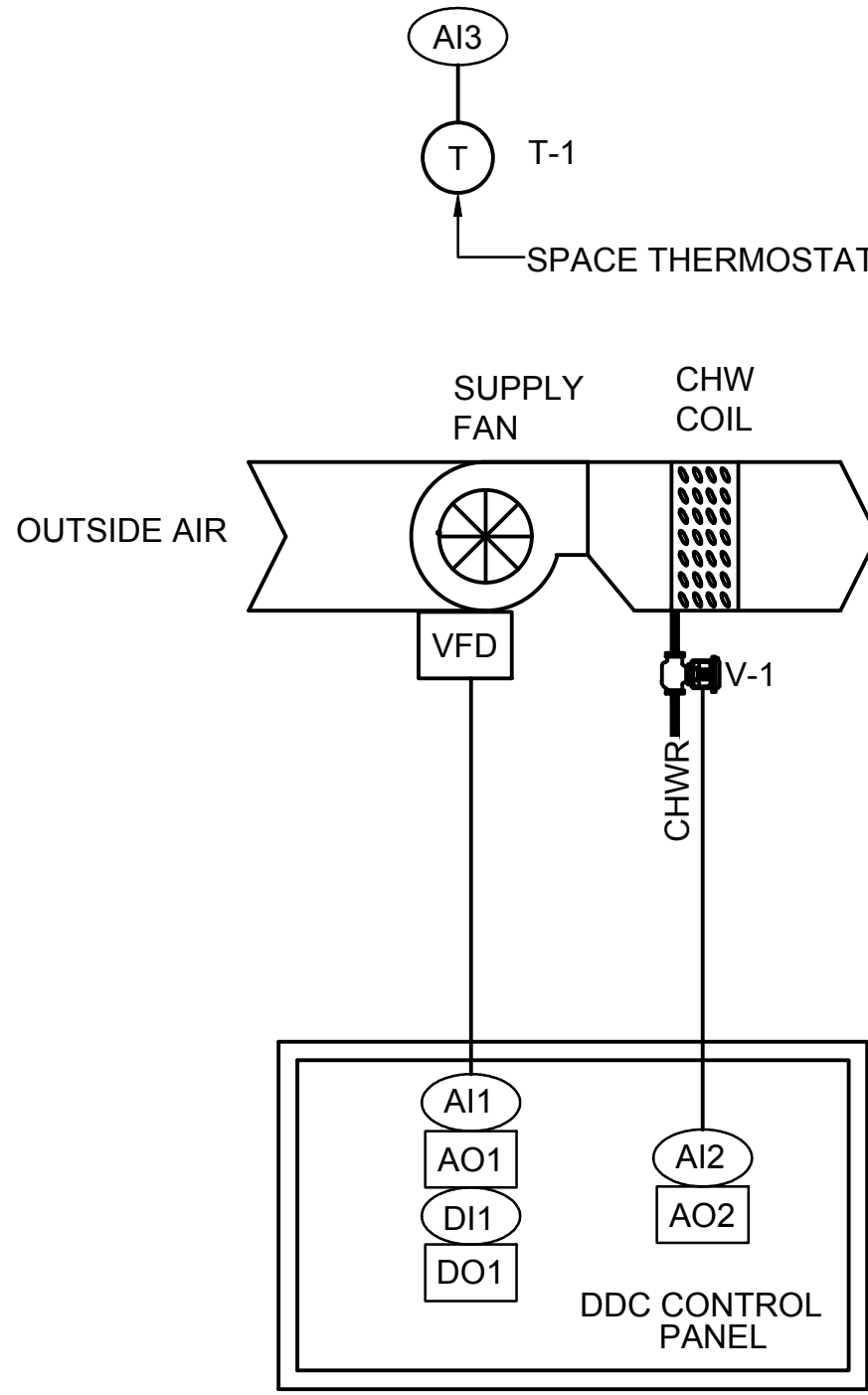
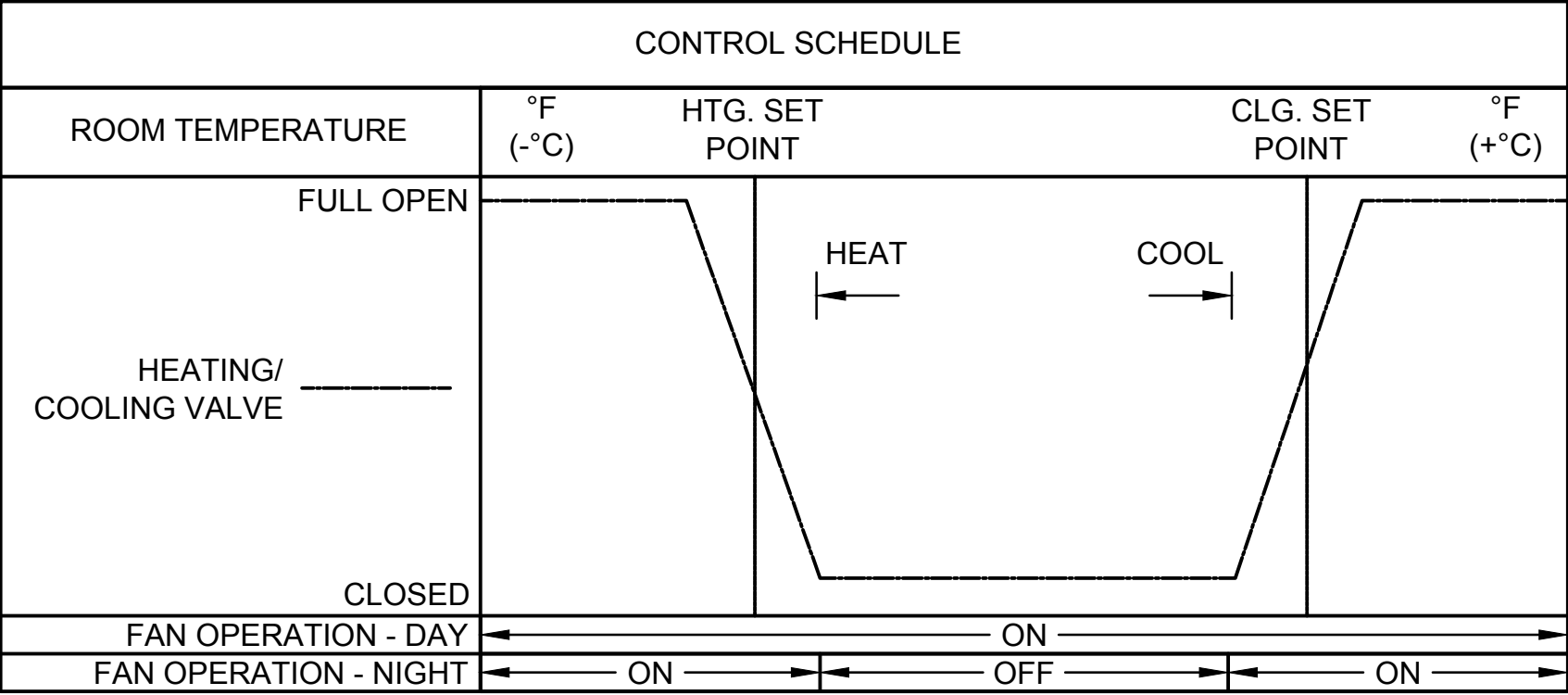
- SEQUENCE OF OPERATION: FCU#7-1, 7-2, & 7-3
- START/STOP CONTROL:
    - UNIT IS NORMALLY STARTED AND STOPPED REMOTELY AT THE ECC. H-O-A SWITCH SHALL BE KEPT IN THE "AUTO" POSITION. "HAND" AND "OFF" POSITIONS SHALL BE USED ONLY FOR MAINTENANCE. WHEN FAN RUN STATUS IS PROVEN VIA A CURRENT SENSING RELAY, THE CONTROL LOOPS SHALL BE ENERGIZED, OPENING ALL VALVES AND OUTSIDE AIR DAMPER. STOPPING THE UNIT SHALL DE-ENERGIZE THE CONTROL LOOPS AND ALL VALVES SHALL GO TO THE CLOSED POSITION AND THE OUTSIDE AIR DAMPER SHALL CLOSE.
  - SAFETIES:
    - AN INTELLIGENT DUCT SMOKE DETECTOR IN THE PURE SUPPLY AIR (RE: ELECTRICAL) SHALL STOP THE UNIT UPON DETECTION OF PRODUCTS OF COMBUSTION. ELECTRIC LOW LIMIT THERMOSTAT IN THE MIXED AIR SHALL STOP THE UNIT UPON DETECTION OF TEMPERATURE BELOW ITS SETPOINT. FIRESTATS SHALL BE PROVIDED FOR ANY FAN HANDLING 600 CFM OR MORE. FIRESTATS SHALL STOP ASSOCIATED FAN ON A RISE IN AIR TEMPERATURE ABOVE 125°F.
  - TEMPERATURE CONTROL:
    - SPACE TEMPERATURE SENSOR LOCATED AS SHOWN ON THE PLANS SHALL TRANSMIT TEMPERATURE CHANGES TO THE DCP. THE DCP SHALL MODULATE THE 2-WAY CHILLED WATER AND 3-WAY HOT WATER PREHEAT VALVE IN SEQUENCE TO MAINTAIN SPACE TEMPERATURE SETPOINT.
  - FILTER STATUS:
    - FILTER STATUS SHALL BE MONITORED AT EACH FILTER BANK.

- SEQUENCE OF OPERATION: FCU#7-4 & 7-5
- START/STOP CONTROL
    - UNIT IS NORMALLY STARTED AND STOPPED REMOTELY AT THE ECC.
    - H-O-A SWITCH SHALL BE KEPT IN THE "AUTO" POSITION. "HAND" AND "OFF" POSITIONS SHALL BE USED ONLY FOR MAINTENANCE. WHEN DAN IS COMMANDED TO RUN, THE CONTROL LOOPS SHALL BE ENERGIZED, OPENING COOLING COIL VALVE. STOPPING THE UNIT SHALL DE-ENERGIZE THE CONTROL LOOPS AND COOLING COIL VALVE SHALL GO TO CLOSED POSITION.
  - TEMPERATURE CONTROL
    - SPACE THERMOSTAT LOCATED AS SHOWN ON THE PLANS SHALL TRANSMIT TEMPERATURE CHANGES TO THE DCP. THE DCP SHALL MODULATE THE 2-WAY CHILLED WATER VALVE TO MAINTAIN TEMPERATURE SETPOINT.

- NOTES:
- TYPICAL OF 3 FCUS: 7E-1, 7E-2, & 7E-3.



- NOTES:
- TYPICAL OF 3 FCUS: 7E-4 & 7E-5.



1 BUILDING 7 EXPANSION FAN COIL UNITS FCU#7-1, 7-2, & 7-3 CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

2 BUILDING 7 EXPANSION FAN COIL UNITS FCU#7-4 & 7-5 CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

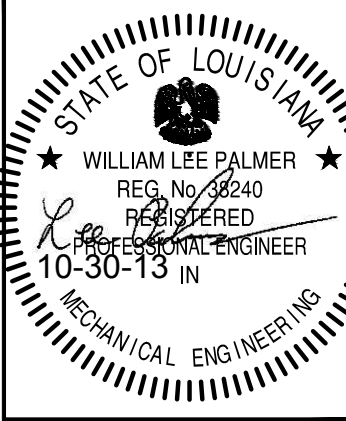
Revisions		
No.	Date	Remarks

VETERANS HEALTH CARE  
SYSTEM  
Alexandria, Louisiana

Hernandez Consulting  
ALBERT ARCHITECTURE  
Allen&Hoshall  
engineering since 1915

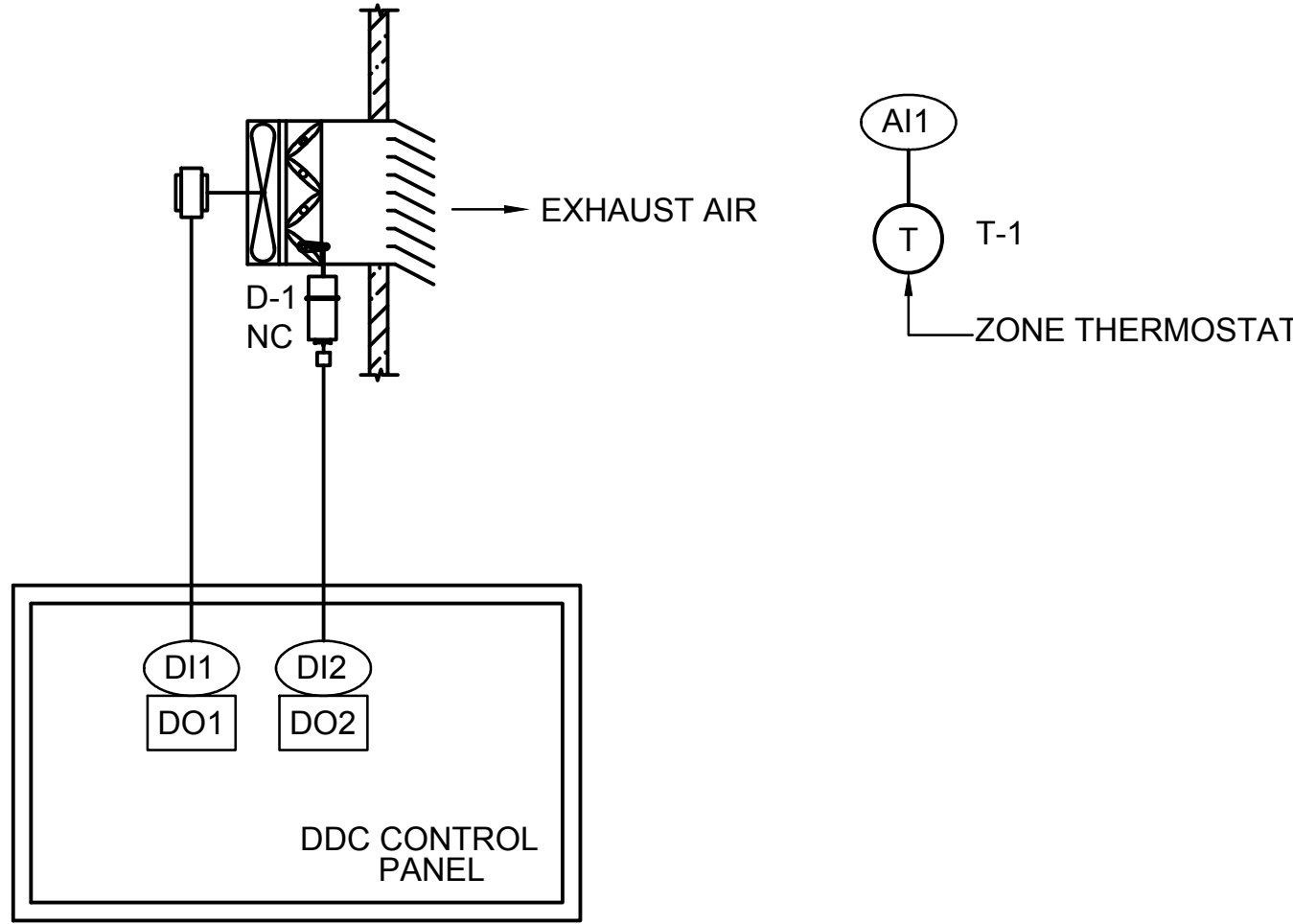
Approved:	
Title	Signature

Drawing Title		Project Title		Date	
FAN COIL UNITS FCU #7-1, 7-2, 7-3, 7-4, & 7-5 CONTROL SCHEMATIC & SEQUENCE		A&E Design - Upgrade Energy Management Control Systems		October 30, 2013	
Approved: Service Engineer		Building Number		Project No. VA256-12-C-0253	
7 EXPANSION		Checked WLP		Drawing No. M7-409	
Approved: Service Director		Location		Dwg. 1 OF 1	
Alexandria, LA					





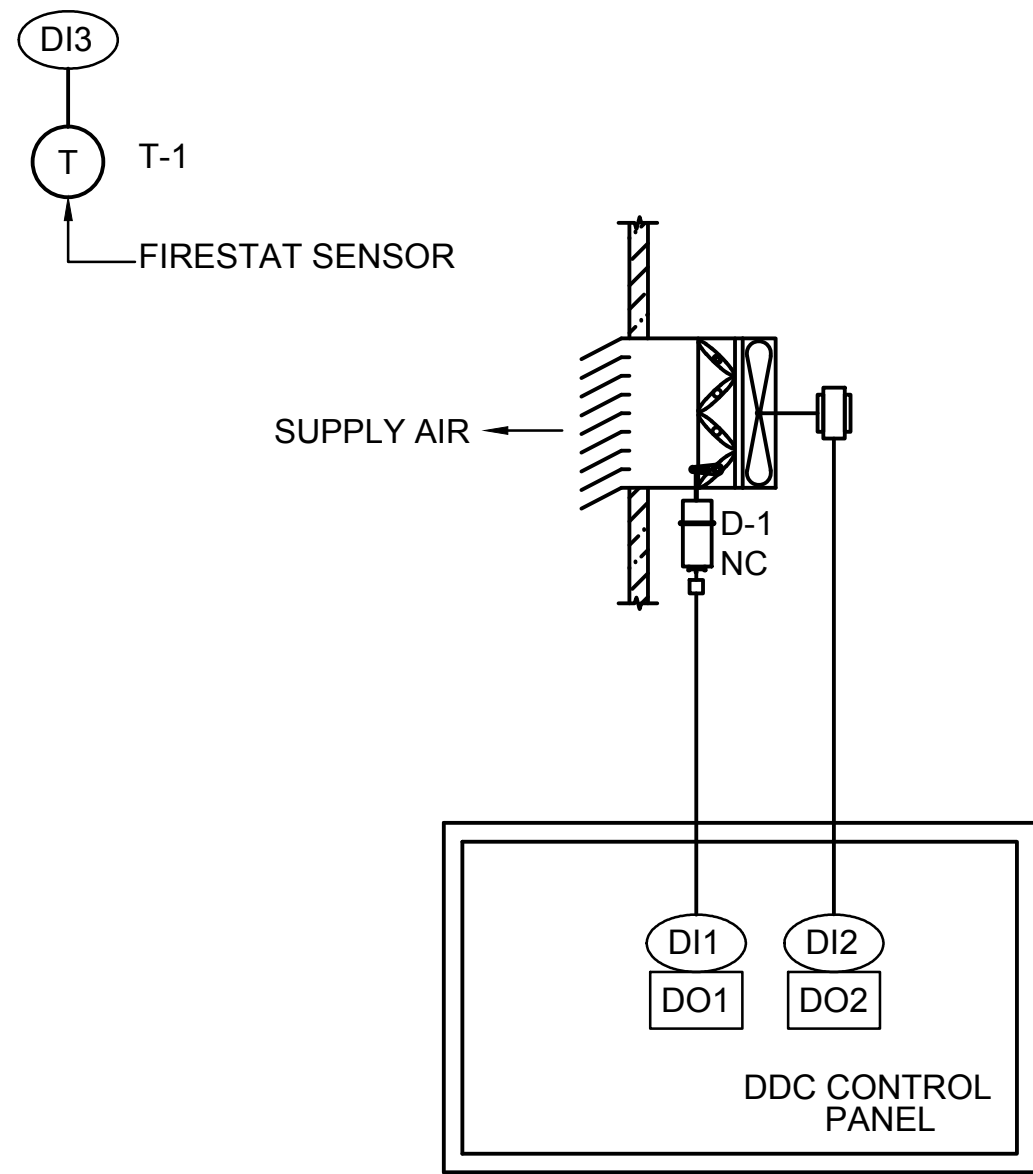
EXHAUST FAN 7-EF-127		
LOCAL DDC CONTROLLER		
INPUTS		
DIGITAL IN:	AI1	ZONE AIR TEMPERATURE SENSOR (T-1)
	DI1	UNIT FAN STATUS
DIGITAL IN:	DI2	AIR DAMPER (D-1) STATUS
OUTPUTS		
DIGITAL	DO1	UNIT FAN START/STOP
	DO2	AIR DAMPER (D-1)



1 BUILDING 7 EXPANSION EXHAUST FAN 7-EF-127 CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

NOTES:

1. THESE DRAWINGS ARE REPRESENTATIVE OF THE DESIGN DRAWINGS FOR THE BUILDING 7 EXPANSION CURRENTLY ON GOING AND ARE FOR REFERENCE ONLY.
2. ALL EQUIPMENT IN THIS PROJECT WILL BE CONTROLLED BY THE CAMPUS SIEMENS SYSTEM. MIGRATE ALL CONTROLS TO NEW SERVER.



SUPPLY FAN 7-SF-115		
LOCAL DDC CONTROLLER		
INPUTS		
DIGITAL	DI1	AIR DAMPER (D-1) STATUS
	DI2	UNIT FAN STATUS
DIGITAL	DI3	FIRESTAT SENSOR (T-1) STATUS
OUTPUTS		
DIGITAL	DO1	AIR DAMPER (D-1)
	DO2	UNIT FAN START/STOP

2 BUILDING 7 EXPANSION SUPPLY FAN 7-SF-115 CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

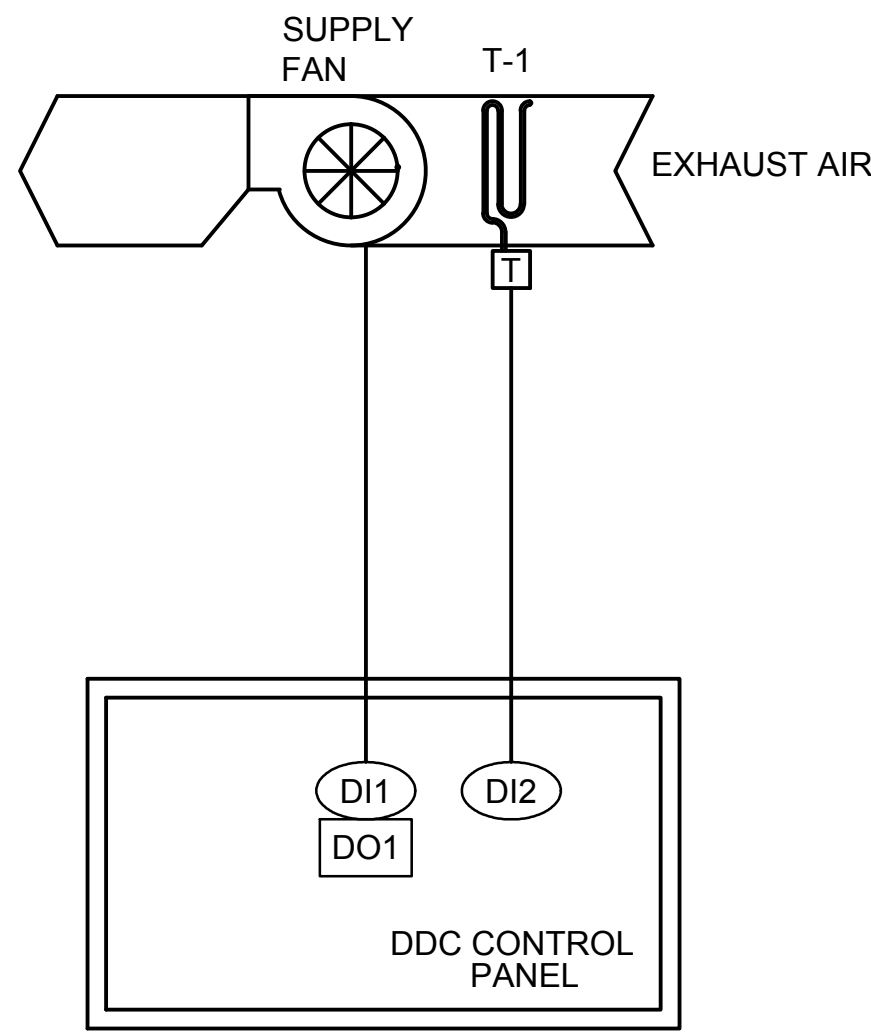
SEQUENCE OF OPERATION

1. START/STOP CONTROL
  - 1.1. ALL FANS SHALL BE START/STOPPED ON A TIME OF DAY SCHEDULE BY THE DDC SYSTEM AND LOCAL OPERATING DEVICE (SWITCH, ETC). WHERE APPROPRIATE, A ROOM THERMOSTAT SHALL CYCLE THE FAN TO MAINTAIN ROOM TEMPERATURE SETPOINT.
2. TEMPERATURE CONTROL
  - 2.1. ALARM IF SPACE TEMPERATURE RISES OUT OF RANGES.
3. FIRESTATS
  - 3.1. FIRESTATS SHALL BE PROVIDED FOR ANY FAN HANDLING 600 CFM OR MORE. FIRESTATS SHALL STOP ASSOCIATED FAN ON A RISE IN AIR TEMPERATURE ABOVE 125°F.

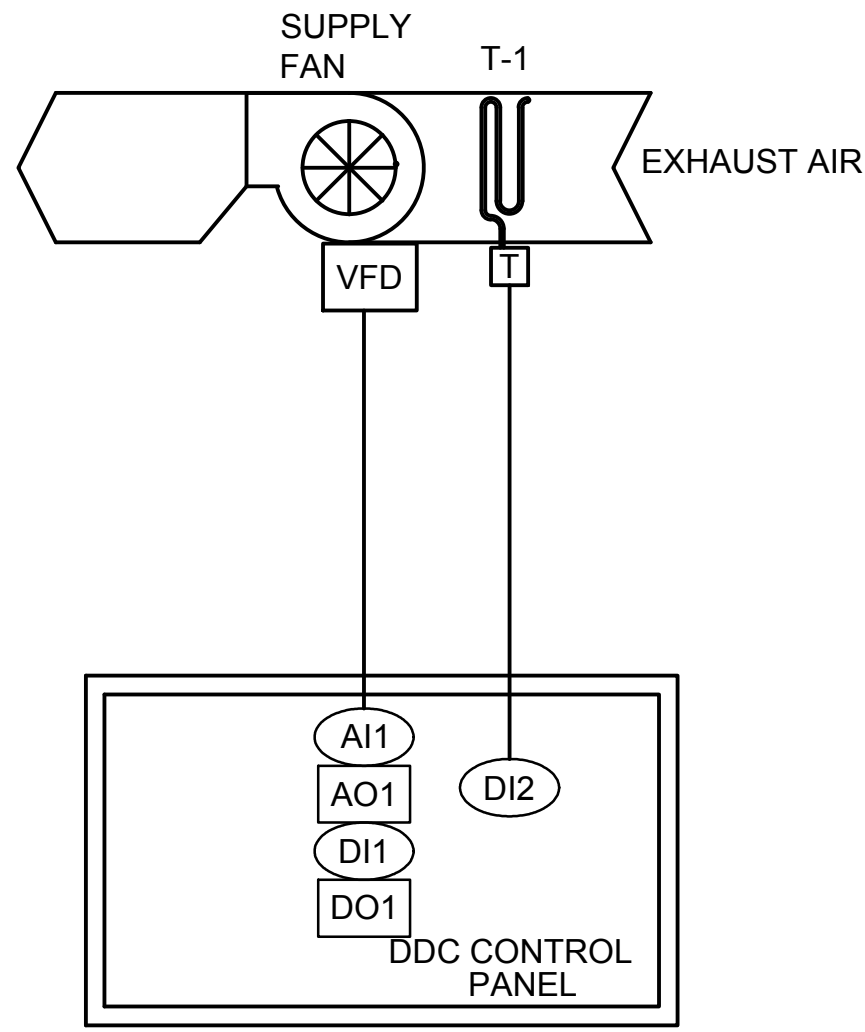
EXHAUST FANS: EF#7-5 & EF#7-7		
LOCAL DDC CONTROLLER		
INPUTS		
DIGITAL	DI1	SUPPLY FAN STATUS
	DI2	INTAKE AIR HIGH LIMIT TEMPERATURE SENSOR (T-1)
OUTPUTS		
DI	DO1	SUPPLY FAN START/STOP

NOTES:

1. TYPICAL OF EF#7-5 & 7-7.



3 BUILDING 7 EXPANSION EXHAUST FAN EF#7-5 & 7-6 CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE



EXHAUST FANS EF#7-6		
LOCAL DDC CONTROLLER		
INPUTS		
DIGITAL IN:	AI1	SUPPLY FAN VFD STATUS
	DI1	SUPPLY FAN STATUS
DIGITAL IN:	DI2	INTAKE AIR HIGH LIMIT TEMPERATURE SENSOR (T-1)
OUTPUTS		
DIGITAL	AO1	SUPPLY FAN VFD SPEED
	DO1	SUPPLY FAN START/STOP

4 BUILDING 7 EXPANSION EXHAUST FAN EF#7-6 CONTROL SCHEMATIC & SEQUENCE  
SCALE: NOT TO SCALE

Revisions		
No.	Date	Remarks

VETERANS HEALTH CARE  
SYSTEM  
Alexandria, Louisiana

Hernandez Consulting  
ALBERT ARCHITECTURE  
Allen&Hoshall  
engineering since 1915

Approved:	
Title	Signature

Drawing Title		Project Title		Date	
SUPPLY FAN 7-SF-115 & EXHAUST FANS 7-EF-127, EF#7-5, 7-6, & 7-7 CONTROL SCHEMATICS & SEQUENCE		A&E Design - Upgrade Energy Management Control Systems		October 30, 2013	
Approved: Service Engineer		Building Number		Project No.	
		7 EXPANSION		VA256-12-C-0253	
Approved: Service Director		Checked		Drawing No.	
		WLP		M7-410	
		Drawn		Dwg. 1 OF 1	
		Location			
		Alexandria, LA			

