

Project Title REPLACE OR UPGRADE HVAC SYSTEM COMPONENTS			Date SEPT. 14, 2016
			Scale: AS SHOWN
Designed By JP	Checked By JP	Drawn By JF	Drawing No. <b>H3.6</b>
Location FARGO VA HEALTH CARE SYSTEM FARGO, NORTH DAKOTA			
			Dwg. 41 of 66



EXPANSION SCHEDULE																	
UNIT NO.	SYSTEM	APPROX. VOLUME GAL.	SYSTEM TEMP.		INITIAL FILL PRESS. TANK (PSIG)	MAX. OPER. PRESS.	FILL PRESS. AT TANK		MIN. VOL. GAL.	MIN. ACFT VOL.	AIR SEPARATOR				SIZE TO TANK IN.	WATER FILL SIZE	
			MIN	MAX			RELIEF VALVE	AT TANK			UNIT NO.	SIZE IN	MAX F.D. FT	BUILD-UP STRAINER			
13-ET403	CWP-1	2/500.0	40	90	10.5	125	75	-	53	53	13-AS-1	4"	160	-	NO	3/4"	-

WATER COILS, COOLING																
COIL NO.	SYSTEM	GPM	MAX FY	MAX APO	EAT		LAT		FLUID	COIL SIZE		EWT	LWT	GPM	WPD	MIN. BTU/H
					DB	WB	DB	WB		HEIGHT	WIDTH					
13-CC-1	13-AHU-1	12500	595	1.4	82.2	67.0	53.4	53.1	35PG	54"	56"	42	56.3	77.4	15.0	522,248
13-CC-2	13-AHU-1	5000	498	1.0	82.2	67.0	53.7	53.5	35PG	42"	42"	42	56.0	30.9	12.0	204,190
NOTE: COOLING COIL 13-CC-1 SHALL BE SELECTED WITH BRASS TUBES/PIPIALS.																

WATER COILS, HEATING												
COIL NO.	SYSTEM	CFM	MAX FV	MAX APD	AIR TEMP		CIRCULATING FLUID					MIN. BTUH
					ENTERING	LEAVING	FLUID	LBS/HR	EWI	LWT	WPD	
13-HC-1	13-AHU-1	17500	731	0.62	20	112.8	STEAM	1889	-	-	-	1,754,200
NOTE: HC-22 SELECTION IS BASED ON 30 PSI STEAM.												

DEDICATED AIR CONDITIONING UNIT SCHEDULE																											
UNIT NO.	INDOOR UNIT FAN TYPE	TYPE	CFM	ESP	HP	COOLING			DRY COOLER PUMP					DRY COOLER ELECTRICAL				REHEAT		HUMIDIFIER		INDOOR UNIT ELECTRICAL				DISC BY	NOTES
						SETPOINT	TOTAL MBH	SENS MBH	GPM	HEAD (FT)	HP	FLA	MCA	MOP	VOLT	PH	TYPE	KW	TYPE	KW	MCA	MOP	VOLT	PH			
M-DAC-15	FORWARD CURVED	V/FM	1200	0.5	3/4	72/63	35.7	28.2	10.5	19.0	3/4	2.6	5.3	15.0	208	3	-	-	-	-	40	45	208	3	EC	1,2,3,4,5	
E	ELECTRIC	DISC	DISCONNECT		NOTES:																						
CM	CEILING MOUNTED	MC	MECHANICAL CONTRACTOR		1. INDOOR UNIT SHALL BE PROVIDED WITH UNIT MOUNTED DISCONNECT. OUTDOOR UNIT SHALL BE PROVIDED WITH DISCONNECT BY THE ELECTRICAL CONTRACTOR.																						
V	VERTICAL	EC	ELECTRICAL CONTRACTOR		2. PROVIDE 3-WAY WATER REGULATING VALVE FOR PRESSURE CONTROL.																						
WM	FLOOR MOUNTED	MOP	MAX OVERCURRENT PROTECTION		3. PROVIDE CONDENSATE PUMP CAPABLE OF 130 GPH AT 20 FEET OF HEAD.																						
MCA	MIN. CIRCUIT AMPACITY	FM	FLOOR MOUNTED UNIT		4. PROVIDE VIBRATION ISOLATION PADS TO BE INSTALLED BETWEEN THE INDOOR UNIT AND FLOOR AND COMPRESSOR SOUND JACKETS.																						
5. PROVIDE DUAL PUMPS FOR DRY COOLER PUMP PACKAGE.																											

FAN SCHEDULE																
UNIT NO.	LOCATION	AREA SERVED	CFM	E.S.P.	FAN TYPE	ARRANGEMENT, ROTATION, & DISCHARGE	WHEEL		MAX. RPM	DRIVE	MAX. BHP	MOTOR			SONES	VARIABLE CONTROL TYPE
							TYPE	MIN. DIA.				HP	VOLT	PH		
M-EF-15	BLDG. 46 ROOF	BLDG. 46 MECH. ROOMS	14000	1.0	BI	CENTRIFUGAL	ALUM	42.25	501	BELT	4.5	5	208	3	19.2	YES
M-EF-17	BLDG. 1 ROOF	FIRST FLOOR LAB	4000	1.5	BI	UTILITY FAN	ALUM	16.65	1864	BELT	2.50	3	208	3	19.6	YES
M-EF-36	BLDG. 46 ROOF	PENTHOUSE PUMP ROOM	11300	0.5	BI	CENTRIFUGAL	ALUM	36	554	BELT	2.75	3	208	3	18	YES
M-EF-39	BLDG. 46 ROOF	EAST PENTHOUSE AHUS	4700	0.5	BI	CENTRIFUGAL	ALUM	21.5	998	BELT	1.3	1.5	208	3	15.6	YES
M-EF-41	BLDG. 1 ROOF	CANTEEN GREASE HOOD	4500	1.5	BI	UPBLAST	ALUM	27	907	BELT	1.90	2	208	3	13.2	NO
M-EF-47	BLDG. 1 ROOF	2ND FLOOR KITCHEN HOOD	4500	1.8	BI	UPBLAST	ALUM	27	96	BELT	2.25	3	208	3	13.8	NO
M-EF-48	BLDG. 1 ROOF	2ND FLOOR KITCHEN HOOD	4500	1.8	BI	UPBLAST	ALUM	27	963	BELT	2.25	3	208	3	13.8	NO
M-EF-71	BLDG. 1 ROOF	2ND FLOOR TRAY ASSEMBLY	1600	1.9	BI	UPBLAST	ALUM	13.5	2298	BELT	1.30	1.5	208	3	17.4	NO
M-EF-73	BLDG. 9 ATTIC	BLDG. 9 WING A	5500	1.75	BI	UTILITY FAN	ALUM	22.25	1257	BELT	2.85	3	208	3	19.7	YES
M-EF-118	ROOM BA-65A	BA-65A PUMP ROOM	500	0.6	BI	SQUARE INLINE	ALUM	10.9	1744	DIRECT	0.15	1/8	120	1	9.2	YES
13-SF-1	BLDG. 13	BLDG. 13	17500	2.5	PL	PLENUM FAN	STEEL	36.5	1465	BELT	16.00	20	208	3	-	YES
13-EF-1	BLDG. 13	BLDG. 13	8500	2.5	MF	MIXED FLOW INLINE	STEEL	30	1655	BELT	5.75	7.5	208	3	-	YES
13-EF-2	BLDG. 13	BLDG. 13 MECH ROOM	3500	0.5	IL	CUBE INLINE	ALUM	17	1359	DIRECT	1.00	2	208	3	16	YES

NOTE: 1. SCHEDULED MAINSHIP BWP IS FOR SCHEDULED SP PLUS TEN PERCENT. FORWARD COLLAR/DRUM WHEEL MAY BE SUBSTITUTED IN LIEU OF AN SW FOR SP FOR HAND LANDING UNITS IF SCHEDULED MAINSHIP BWP IS MET. IF FINAL COLLAR PRESSURE DRUMS SUBMITTED ARE LESS THAN SCHEDULED, THE SP REQUIREMENT MAY BE REDUCED ACCORDINGLY. MAINSHIP BWP MAY BE BASED ON THE REVISED SP PLUS TEN PERCENT. SMALLER DIAMETER TANKS MAY BE SUBSTITUTED PROVIDED THAT THE WEIGHTS ARE THE SAME AND THE REVISED SOUND LEVELS ARE NOT EXCEEDED.

2. EXHAUST FAN 13-1-1 SHALL BE SELECTED FOR A DISCHARGE SOUND RATING OF 71 dBA. PROVIDE SPRING SLOTTED HANGERS AND BOLTED ACCESS DOORS.

3. PROVIDE M-15-1, 16, 26, 36, 71, 135-1, 135-2, 135-3, 135-4, 135-2 with WDT and SHIRT GARDING KIT.

4. PROVIDE AIR INTAKE MOUNTED DISCONNECT FOR ALL EXHAUST FANS.

5. PROVIDE BACKFLOW DAMPERS FOR M-15-1, 16, 26, 36, 71, 135-1, 135-2, 135-3, 135-4.

6. M-15-1, 16, 26, 36, 71, 135-1, 135-2, 135-3, 135-4 SHALL BE INSTALLED ON EXISTING ROOF CURBS. PROVIDE A CURB EXTENSION TO MOUNT ON THE EXISTING CURBS.

7. PROVIDE WIND-RESISTANT HOODS FOR M-15-1, 16, 26, 36, 71, 135-1, 135-2, 135-3, 135-4. WIND-RESISTANT HOODS WITH PIVOTED EXHAUST FANS, LIFT SUPPORTS AND ROOF MOUNTED AND UPLIFT DISCHARGE. VERIFY ROOF PITCH PRIOR TO ORDERING ROOF SUPPORT RAILS. M-15-1 SHALL BE SELECTED FOR EXISTING DISCHARGE.

8. PROVIDE 18" CURB EXTENSION FOR M-15-1 & 46" FOR INSTALLATION ON EXISTING CURBS.

9. PROVIDE ADJUSTABLE SPEED CONTROLLED MOUNTED TO FAN M-15-1 & 118 and 135-1.

10. PROVIDE HANGED ACCESS DOOR, SPRING SLOTTED HANGERS, INSULATION CABINET FOR 135-1-2.

AIR FILTER SCHEDULE										
FILTER NO.	CFM	SYSTEM	VA GRADE	RATED EFF. %	MAX. S.P. DROP		HOUSING TYPE	CARTRIDGES		
					INITIAL	FINAL		NO.	SIZE	ARRANGE
13-AF-1	17500	13-AHU-1	A	30	0.3	1.0	AH CASING	NA	24"x 20" x 2"	NA
NOTE:										

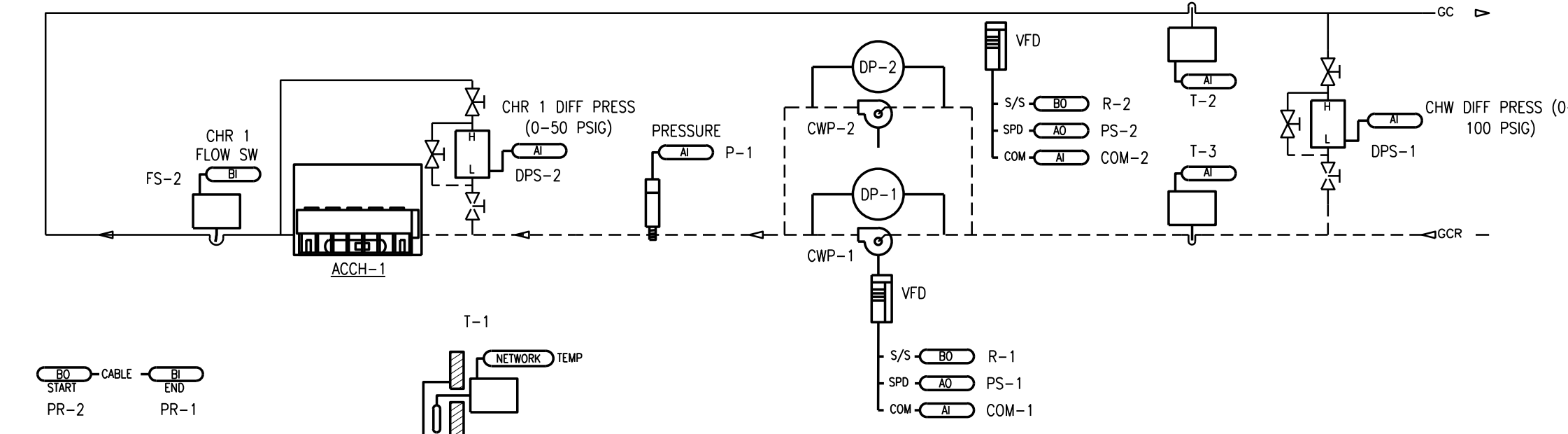
UNIT NO.	LOCATION	AREA SERVED	SUPPLY FAN NO.	RETURN FAN NO.	SUPPLY	CFM MIN. OA	EXTERNAL STATIC PRESSURE, 1.	SPECIFIED INTERNAL LOSSES, 2	UNSPECIFIED INTERNAL LOSSES, 3.	TYPE SYSTEM
13-AHU-1	BLDC. 13 MECH. ROOM	BUILDING 13	13-SF-1	N/A	17500	9000	2.5	1.27	0.06	VAV
<b>NOTES:</b> 1. EXTERNAL STATIC PRESSURE REQUIRED AT DUCT CONNECTIONS TO INLET AND OUTLET OF AHU. MEASUREMENTS SHALL BE TAKEN WITHIN 3 FT OF INLET AND OUTLET AT A POINT OF MAXIMUM ACQUET. 2. TOTAL OF MAXIMUM PRESSURE DROPS OF COMPONENTS WHICH ARE SPECIFIED SEPARATELY, I.E., PREFILTERS, AFTERFILTERS, HEATING AND COOLING COILS. 3. INTERNAL LOSS ALLOWANCE SHALL INCLUDE LOSSES DUE TO ENTRANCE AND EXIT OF AHU, MIXING BOXES, DIFFUSER SECTION INCLUDING LOSSES DUE TO FAILURE TO PROPERLY CONVERT FAN DISCHARGE VELOCITY PRESSURE TO STATIC PRESSURE, FAN INLET CONDITIONS, CHANGES, HANDPERS, DAMPERS, ETC. 4. MINIMUM WIDTH OF 13-AHU-1 SHALL BE 120-INCHES AND MAXIMUM WIDTH SHALL BE 124-INCHES.										

FAN COIL UNIT SCHEDULE																																
UNIT			COOLING														HEATING						ELECTRICAL				DISC		BY		NOTES	
			NO.	LOCATION	TYPE	CFM	ESP	APD	DB	EAT	WB	LAT	DB	WB	TOTAL	SENS	MBH	EWI	GPM	WPD	EWI	GPM	WPD	EAT	MBH	HP						
13-FC-1	BUILDING	13	H	1400	1.25	0.4	-78	-66	56.0	55.8	43.9	32.6	42.0	11.0	9.5	-	-	-	-	-	-	-	-	2	208	3	EC	1,2,3				
13-FC-2	BUILDING	13	H	4000	1.25	0.7	-80	-67	59.1	58.6	107.0	88.3	42.0	30.0	20.0	-	-	-	-	-	-	-	-	5	208	3	EC	1,2,3,4				
CON		CONSILE		DISC		DISCONNECT		<u>NOTES:</u>																								
H		HORIZONTAL		V		VERTICAL		ME		MECHANICAL CONTRACTOR		1. HORIZONTAL SUSPENDED UNIT. MAX DIMENSIONS 22 1/4" x 47 1/2" x 54 1/2". (FC-1) AND 28 1/2" x 56 1/2" x 87 1/2". (FC-2)																				
MCA		MINIMUM CIRCUIT AMPACITY		EC		ELECTRICAL CONTRACTOR		2. PROVIDE UNIT WITH FILTER SECTION FOR USE WITH 2-INCH 30% FILTERS.																								
												3. PROVIDE FORWARD CURVED FAN AND BOTTOM FAN AND FILTER HINGED ACCESS.																				
												4. PROVIDE MIXING BOX WITH DAMPERS, OUTSIDE AIR ON TOP AND RETURN ON END.																				

3. THE GAS CONTROLLER SHALL MONITOR THE CHILLED WATER SYSTEM DIFFERENTIAL PRESSURE SENSOR. WHEN THE CHILLED WATER FLOW FREQUENCY IS EXCEEDED, THE GAS CONTROLLER SHALL CONTINUE TO MAINTAIN A MINIMUM SPEED SIGNAL. NOISE IS SENT TO THE PUMP VARIABLE FREQUENCY DRIVE TO MAINTAIN A MINIMUM SPEED DIFFERENTIAL PRESSURE SETPOINT OF 5.0 PSIG (AQU) AND A MINIMUM SPEED IN ORDER TO MAINTAIN MINIMUM CHILLED WATER FLOW FOR THE CHILLER (COORDINATE WITH CHILLER MANUFACTURER).
4. THE BUILDING AUTOMATION SYSTEM SHALL CONTINUOUSLY MONITOR THE CHILLED WATER CONTROL VALVE POSITION OF ALL AIR HANDLING UNITS.
5. AT SYSTEM STARTUP, THE CHILLED WATER PUMP PRESSURE SETPOINT SHALL BE 90% OF THE MAXIMUM PRESSURE SETPOINT.
6. WHEN ANY CHILLED WATER FLOW IS MORE THAN 85% OPEN, THE CHILLED WATER PUMP PRESSURE SETPOINT SHALL BE ADJUSTED TO 90% OF THE CURRENT CHILLED WATER PUMP PRESSURE SETPOINT AT A FREQUENCY OF EVERY 2 MINUTES UNTIL NO FLOW IS MORE THAN 90% OPEN OR THE CHILLED WATER PUMP PRESSURE SETPOINT REVERTS TO THE MAXIMUM SETTING OR THE PUMP VARIABLE FREQUENCY DRIVES ARE AT THEIR MAXIMUM SETTING.
7. WHEN ALL CHILLED WATER FLOWS ARE LESS THAN 85% OPEN, THE CHILLED WATER PUMP PRESSURE SETPOINT SHALL BE RESET DOWN BY 3% OF THE CURRENT CHILLED WATER PUMP PRESSURE SETPOINT AT A FREQUENCY OF EVERY 2 MINUTES UNTIL AT LEAST ONE FLOW IS MORE THAN 85% OPEN OR THE PUMP'S FLOW RATE IS EQUAL TO THE CHILLER(S) MINIMUM FLOW RATE OR THE PUMP VARIABLE FREQUENCY DRIVES ARE AT THEIR MINIMUM SETTING.
8. THE CONTROL BANDS, SETPOINT INCREMENTS, SETPOINT DECREMENTS, AND ADJUSTMENT FREQUENCIES SHALL BE ADJUSTED TO MAINTAIN MAXIMUM PUMP PRESSURE OPTIMIZATION WITH STABLE SYSTEM CONTROL.

CHILLER CONTROL:  
ON A CALL FOR COOLING, THE CHILLER SHALL BE ENABLED. PROOF OF FLOW SHALL BE SENT TO THE CHILLER PRIOR TO STARTING. ONCE STARTED, THE CHILLER SHALL MODULATE TO MAINTAIN CHILLED WATER SETPOINT.

FILL PRESSURE:  
THE SYSTEM FILL PRESSURE SHALL BE MONITORED. IF IT DROPS BELOW 15 PSI (ADJ.) IT SHALL ALARM AT THE WORKSTATION AND SHUT DOWN THE PUMPS.

[illegible]

1 CHILLED WATER PLANT CONTROL  
H37 NO SCALE

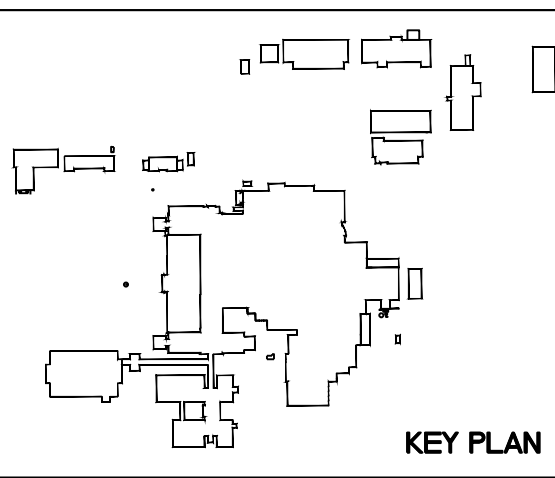
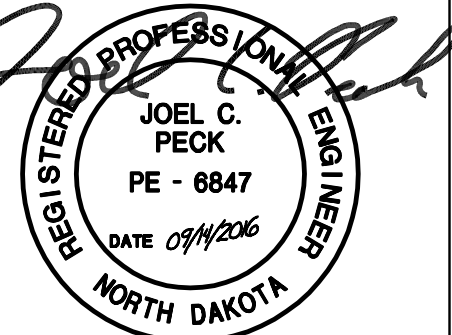
CIRCULATING PUMP (HVAC) SCHEDULE												
UNIT NO.	LOCATION	CIRCULATING FLUID						% EFF.	TYPE	MOTOR		
		SYSTEM	FLUID	GPM	HEAD (FT.)	TEMP	SP. GR.			HP	VOLT	PH
13-CWP-1	BLDG. 13 MECH RM	CHILLED	PC30	160	55	50	1.04	74.2	HES	5	208	3
13-CWP-2	BLDG. 13 MECH RM	CHILLED	PC30	160	55	50	1.04	74.2	HES	5	208	3
NOTES:												
1. PUMPS SHALL BE VFD OUT AND PROVIDED WITH VFD.												
2. ALL PUMPS SHALL BE SELECTED AT 1750 RPM.												

STORAGE TANK SCHEDULE							
UNIT NO.	LOCATION	NOMINAL GALLONS	ACTUAL GALLONS	DIA	LENGTH	ORIENTATION	NOTES
ST-1	BLDG. 13 MECH. RM	175	175.0	32"	67"	VERTICAL	
NOTES:							
1.							

PACKAGED AIR COOLED RECIPROCATING CHILLER UNIT							
UNIT NO.	EQUIP.	LOCATION	PERFORMANCE MINIMUM CAPACITY		MOTOR		REMARKS
					MCA/ MAX FUSE SIZE	PHASE VOLT	
13-ACCH-1	COMPRESSOR	EAST OF BLDG. 1	77 TONS		181/200	480V 3-PHASE	COMPRESSOR SHALL BE CAPABLE OF CAPACITY REDUCTION TO 25%
	CHILLER		145 GPM                      56 F WATER IN 42 F WATER OUT				6.0 FT. MAX. WATER P.D.
	AIR COOLED CONDENSER		AIR COOLED CONDENSER SHALL PROVIDE ABOVE PERFORMANCE WITH 95 F AMBIENT TEMP.				CHILLER PERFORMANCE OF 10.1 EER AND 16.9 IPLV
<div>1. PACKAGED AIR COOLED SCROLL CHILLER UNIT SHALL BE PROVIDED WITH STAGED CONTROL BY MANUFACTURER TO PROVIDE SATISFACTORY OPERATION DOWN TO 25% CAPACITY WITH A 55 F AMBIENT TEMPERATURE. STATERS REQUIRED SHALL BE FURNISHED BY MANUFACTURER OF EQUIPMENT. MULTIPLE COMPRESSORS SHALL BE FURNISHED FOR THE CHILLER. CHILLER PERFORMANCE BASED ON 35% PROPYLENE GLYCOL/WATER SOLUTION.</div> <div>2. CHILLER SHALL HAVE A W/TON RATING OF 1.18. CHILLER SHALL HAVE A MAXIMUM SOUND RATING OF 86 LWA AT FULL LOAD. PROVIDE ACOUSTIC SOUND BLANKET AND ULTRA QUIET FANS WITH VARIABLE SPEED CONTROLS. ALSO PROVIDE UNIT MOUNTED FUSED DISCONNECT.</div>							

[illegible]

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Drawing Title <b>MECHANICAL SCHEDULES &amp; CONTROL DIAGRAM</b>		Project Title <b>REPLACE OR UPGRADE HVAC SYSTEM COMPONENTS</b>			Date <b>SEPT. 14, 2016</b>
Project Phase <b>PHASE 3</b>		Scale: <b>AS SHOWN</b>			
VA Project No. <b>437-13-111</b>	Contract No. <b>VA263-P-128</b> <b>VA263-C-</b>	Designed By <b>JP</b>	Checked By <b>JP</b>	Drawn By <b>JF</b>	Drawing No. <b>H3.7</b> Dwg. 42 of 66
Building No. <b>VAMC CAMPUS</b>	AutoCAD File Name <b>3002275-PH437DWG</b>	Location <b>FARGO VA HEALTH CARE SYSTEM FARGO, NORTH DAKOTA</b>			



## SEQUENCE OF OPERATION:

**SUPPLY FAN CONTROL:** UPON THE CALL FOR COOLING, THE SUPPLY FAN SHALL RAMP UP TO FULL SPEED. THE CAPACITY OF THE SUPPLY FAN SHALL BE CONTROLLED BY A VARIABLE FREQUENCY DRIVE (VFD-1). THE STATUS OF THE SUPPLY FAN SHALL BE MONITORED VIA DIFFERENTIAL PRESSURE SENSOR. WHENEVER THE SUPPLY FAN IS COMMANDED TO RUN AND THE STATUS CANNOT BE PROVEN, A "SUPPLY FAN FAILURE" ALARM SHALL BE DISPLAYED ON THE OPERATOR WORKSTATION.

**EXHAUST FAN CONTROL:** UPON THE CALL FOR FAN COIL OPERATION THE EXHAUST FAN SHALL MODULATE TO MAINTAIN THE SPACE PRESSURE (P-1) AT 0.02" (ADJUSTABLE). PROVIDE ALARM IF THE SPACE PRESSURE RISES ABOVE 0.1" OR BELOW -0.02" INCHES (ADJUSTABLE) FOR AT LEAST 5 MINUTES. THE CAPACITY OF THE EXHAUST FAN SHALL BE CONTROLLED BY A VARIABLE FREQUENCY DRIVE (VFD-1). THE STATUS OF THE EXHAUST FAN SHALL BE MONITORED VIA DIFFERENTIAL PRESSURE SENSOR. WHENEVER THE EXHAUST FAN IS COMMANDED TO RUN AND THE STATUS CANNOT BE PROVEN, AN "EXHAUST FAN FAILURE" ALARM SHALL BE DISPLAYED ON THE OPERATOR WORKSTATION.

**LOW TEMPERATURE DETECTION:** THE STATUS OF A MANUAL LOW TEMPERATURE DETECTION SWITCH (TS-1) INSTALLED ON THE LEAVING SIDE OF THE COOLING COIL SHALL BE MONITORED. IF THE AIR TEMPERATURE AS SENSED BY TS-1 FALLS BELOW 45 DEGREES (ADJUSTABLE), A "LOW AIR TEMPERATURE" ALARM SHALL BE GENERATED AT THE OPERATOR'S WORKSTATION. IF THE TEMPERATURE DROPS BELOW 40 DEGREES (ADJUSTABLE), THE SUPPLY AND RETURN FANS SHALL BE STOPPED AND A CRITICAL "LOW AIR TEMPERATURE" ALARM SHALL BE DISPLAYED ON THE OPERATOR WORKSTATION. THE OPERATOR SHALL HAVE THE ABILITY TO MANUALLY RESTART THE SUPPLY FAN AT THE UNIT.

**TEMPERATURE SETPOINT CONTROL:** THE ACTIVE TEMPERATURE SETPOINTS SHALL BE OBTAINED FROM THE SPACE TEMPERATURE SETPOINT DIAL (T-4). THE OPERATOR SHALL HAVE THE ABILITY TO LIMIT THE RANGE OF THE SETPOINT DIAL AND ALSO TO DISABLE THE SETPOINT DIAL ENTIRELY. IF THE SETPOINT DIAL IS DISABLED, THE ACTIVE TEMPERATURE SETPOINTS SHALL BE ADJUSTABLE BY THE OPERATOR.

**COOLING COIL CONTROL:** THE COOLING VALVE (V-1) SHALL MODULATE IN SERIES TO MAINTAIN THE SPACE TEMPERATURE AT THE ACTIVE SETPOINT. IF THE CHILLED WATER PUMP SERVING THIS AIR HANDLING UNIT IS PROVEN RUNNING, THE CHILLED WATER CONTROL VALVE SHALL BE UNDER CONTROL. IF THE CHILLED WATER PUMP IS NOT PROVEN RUNNING, THE COOLING VALVE SHALL BE CLOSED TO PREVENT FLOW THROUGH THE COIL. THE DISCHARGE AIR TEMPERATURE (T-1) SHALL BE MONITORED.

**TEMPERATURE MONITORING:** MONITOR THE SUPPLY AIR TEMPERATURE (T-1) AND LEAVING CHILLED WATER COIL AIR TEMPERATURE (T-3).

POINT SCHEDULE										
CONTROL DEVICE	POINT NAME	POINT DESCRIPTION	POINT TYPE				ALARM			
			AI	BI	AO	BO	H	LOW	BN	
T-1	DischSupAirTemp	DISCHARGE SUPPLY AIR TEMPERATURE								
T-2	RetAirTemp	MIXED AIR TEMPERATURE						X		
T-3	LeavingCoilTemp	LEAVING COOLING COIL AIR TEMPERATURE								
T-4	SpaceTempSetPt	SPACE TEMPERATURE SETPOINT								
T-4	SpaceTemp	SPACE TEMPERATURE								
V-1	COilValve	COOLING VALVE								
D-1	OA/RdDampers	OUTSIDE AIR AND RETURN AIR DAMPERS								
TS-1	FreezeStat	FREEZESTAT								
VFD-1 a	SupFanSpeed	SUPPLY FAN VFD SPEED								
VFD-1 b	VFDpts	VFD POINTS (SEE VFD SPEC)								
R-1	SupFanCtrl	SUPPLY FAN CONTROL								
DP-1	RelFanStatus	SUPPLY FAN STATUS (DIFFERENTIAL PRESSURE SENSOR)								
VFD-2 a	ExhFanSpeed	EXHAUST FAN VFD SPEED								
VFD-2 b	VFDpts	VFD POINTS (SEE VFD SPEC)								
R-2	ExhFanCtrl	EXHAUST FAN CONTROL								
DP-2	ExhFanStatus	EXHAUST FAN STATUS (DIFFERENTIAL PRESSURE SENSOR)								
P-1	SpacePress	SPACE PRESSURE								

## 6 H3.8 NO SCALE

## SEQUENCE OF OPERATION: (M-EF-15, 36, &amp; 39)

**SCHEDULED CONTROL:** A LINE VOLTAGE RELAY (R-1) FOR EXHAUST FANS SHALL BE CONTROLLED BY A TIME SCHEDULE. THE TIME SCHEDULE SHALL BE INITIALLY SET TO 24/7 (FULLY ADJUSTABLE THROUGH THE BUILDING AUTOMATION/ENERGY MANAGEMENT SYSTEM). THE STATUS OF THE EXHAUST FANS SHALL BE MONITORED BY A CURRENT SENSING SWITCH (CS-1). IF THE EXHAUST FAN CANNOT BE PROVEN RUNNING, AN "EXHAUST FAN FAILURE" ALARM SHALL BE GENERATED. THE STATUS OF THE OUTSIDE AIR DAMPERS SHALL BE MONITORED WITH BLADE END CONTACTS. IF THE DAMPER IS CALLED TO CLOSE AND IS NOT VERIFIED, AN "OUTSIDE AIR DAMPER MALFUNCTION" ALARM SHALL BE GENERATED. IF THE TEMPERATURE OF THE MECHANICAL ROOM RISES ABOVE 90 DEGREES (ADJUSTABLE), AN "OVERHEATING MECHANICAL ROOM" ALARM SHALL BE GENERATED. FOR EF-15, ANY THERMOSTAT IN ANY OF THE MECHANICAL ROOMS SERVED BY THE FAN SHALL OPERATE THE FAN. IF ALL THERMOSTATS ARE SATISFIED, THE FAN SHALL BE TURNED OFF.

POINT SCHEDULE										
CONTROL DEVICE	POINT NAME	POINT DESCRIPTION	POINT TYPE				ALARM			
			AI	BI	AO	BO	H	LOW	BN	
R-1	ExhFanCtrl	EXHAUST FAN CONTROL RELAY								
CS-1	ExhFanStatus	EXHAUST FAN STATUS								
T-1	SpaceTemp	SPACE TEMPERATURE								
D-1	OA/RdTemp	OUTSIDE AIR DAMPER								

## 5 H3.8 NO SCALE

## SEQUENCE OF OPERATION:

**SCHEDULED CONTROL:** (M-EF-73) A LINE VOLTAGE RELAY (R-1) FOR EXHAUST FANS SHALL BE CONTROLLED BY A TIME SCHEDULE. THE TIME SCHEDULE SHALL BE INITIALLY SET TO 24/7 (FULLY ADJUSTABLE THROUGH THE BUILDING AUTOMATION/ENERGY MANAGEMENT SYSTEM). THE STATUS OF THE EXHAUST FANS SHALL BE MONITORED BY A CURRENT SENSING SWITCH (CS-1). IF THE EXHAUST FAN CANNOT BE PROVEN RUNNING, AN "EXHAUST FAN FAILURE" ALARM SHALL BE GENERATED.

**M-EF-17 CONTROL:** CONNECT NEW EXHAUST FAN INTO EXISTING SIEMENS CONTROL SEQUENCE FOR M-AHU-22. M-EF-17 RUNS CONTINUOUSLY IF M-AHU-22 IS OPERATING. PROVIDE NEW CURRENT SENSOR FOR EXHAUST FAN AND CONNECT TO EXISTING CONTROLS AS REQUIRED.

POINT SCHEDULE										
CONTROL DEVICE	POINT NAME	POINT DESCRIPTION	POINT TYPE				ALARM			
			AI	BI	AO	BO	H	LOW	BN	
R-1	ExhFanCtrl	EXHAUST FAN CONTROL RELAY								
CS-1	ExhFanStatus	EXHAUST FAN STATUS								

## 4 H3.8 NO SCALE

## SEQUENCE OF OPERATION:

**OCCUPIED/UNOCCUPIED MODE:** REFER TO AND MAINTAIN EXISTING SEQUENCE.

**FIRE ALARM SHUTDOWN:** IN THE FIRE-ALARM CONTROL MODE (WHEN SMOKE IS DETECTED BY DUCT SMOKE DETECTOR), THE SUPPLY FAN VARIABLE FREQUENCY DRIVES SHALL BE SET TO OFF AND THE FREQUENCY SIGNALS SHALL BE SET TO ZERO AND AN ALARM SIGNAL SHALL BE TRANSMITTED TO THE FIRE ALARM SYSTEM. EXHAUST FANS SERVING SPACE OF THE SUPPLY FAN SHALL CONTINUE TO RUN. SUPPLY FAN SHALL RESTART WHEN FIRE ALARM CIRCUIT IS RESET.

**UNOCCUPIED CASING-TEMPERATURE CONTROL:** WHEN THE UNIT IS OFF, THE HEATING COIL VALVE SHALL MODULATE WHEN THE TEMPERATURE DROPS BELOW 45 DEGREES (ADJUSTABLE) TO MAINTAIN 60 DEGREES (ADJUSTABLE) IN THE AIR HANDLER CASING MEASURED BY T-3.

**LOW TEMPERATURE DETECTION CONTROL:** THE STATUS OF A MANUAL LOW TEMPERATURE DETECTION SWITCH (TS-1) INSTALLED ON THE LEAVING SIDE OF THE HEATING COIL SHALL BE MONITORED. IF THE AIR TEMPERATURE AS SENSED BY TS-1 FALLS BELOW 45 DEGREES (ADJUSTABLE), A "LOW AIR TEMPERATURE" ALARM SHALL BE GENERATED AT THE OPERATOR'S WORKSTATION. IF THE TEMPERATURE DROPS BELOW 40 DEGREES (ADJUSTABLE), THE SUPPLY AND RETURN FANS SHALL BE STOPPED AND A CRITICAL "LOW AIR TEMPERATURE" ALARM SHALL BE DISPLAYED ON THE OPERATOR WORKSTATION. THE OPERATOR SHALL HAVE THE ABILITY TO MANUALLY RESTART THE SUPPLY FAN AT THE UNIT.

**HIGH STATIC PRESSURE CONTROL:** THE STATUS OF A HIGH STATIC PRESSURE SWITCH (DPS-1) INSTALLED ON THE DISCHARGE SIDE OF THE SUPPLY FAN SHALL BE MONITORED. WHENEVER A HIGH STATIC PRESSURE CONDITION IS DETECTED (EXCEEDING 3-INCHES), THE SUPPLY FAN SHALL BE STOPPED AND "HIGH STATIC PRESSURE" ALARM SHALL BE DISPLAYED ON THE OPERATOR WORKSTATION.

**LOW STATIC PRESSURE CONTROL:** THE STATUS OF A LOW STATIC PRESSURE SWITCH (DPS-2) INSTALLED ON THE INLET SIDE OF THE EXHAUST FAN SHALL BE MONITORED. WHENEVER A LOW STATIC PRESSURE CONDITION IS DETECTED (EXCEEDING 3-INCHES), THE EXHAUST FAN SHALL BE STOPPED AND "LOW STATIC PRESSURE" ALARM SHALL BE DISPLAYED ON THE OPERATOR WORKSTATION.

**TEMPERATURE CONTROL:** REFER TO AND MAINTAIN EXISTING SEQUENCE. MONITOR THE DISCHARGE TEMPERATURE OF EACH COOLING COIL (T-7 & T-8) AND PROVIDE ALARM IF TEMPERATURE EXCEEDS 65 DEGREES (ADJUSTABLE) WHEN THE CHILLER IS OPERATIONAL. THERMOSTATS IN EACH SPACE (T-5 & T-6) SHALL CONTROL ITS RESPECTIVE COOLING. THE COOLING COIL CONTROL VALVE (V-1) SHALL MODULATE AS REQUIRED TO MAINTAIN SPACE TEMPERATURE.

**SUPPLY FAN CONTROL:** REFER TO AND MAINTAIN EXISTING SEQUENCE.

**EXHAUST FAN CONTROL:** REFER TO AND MAINTAIN EXISTING SEQUENCE.

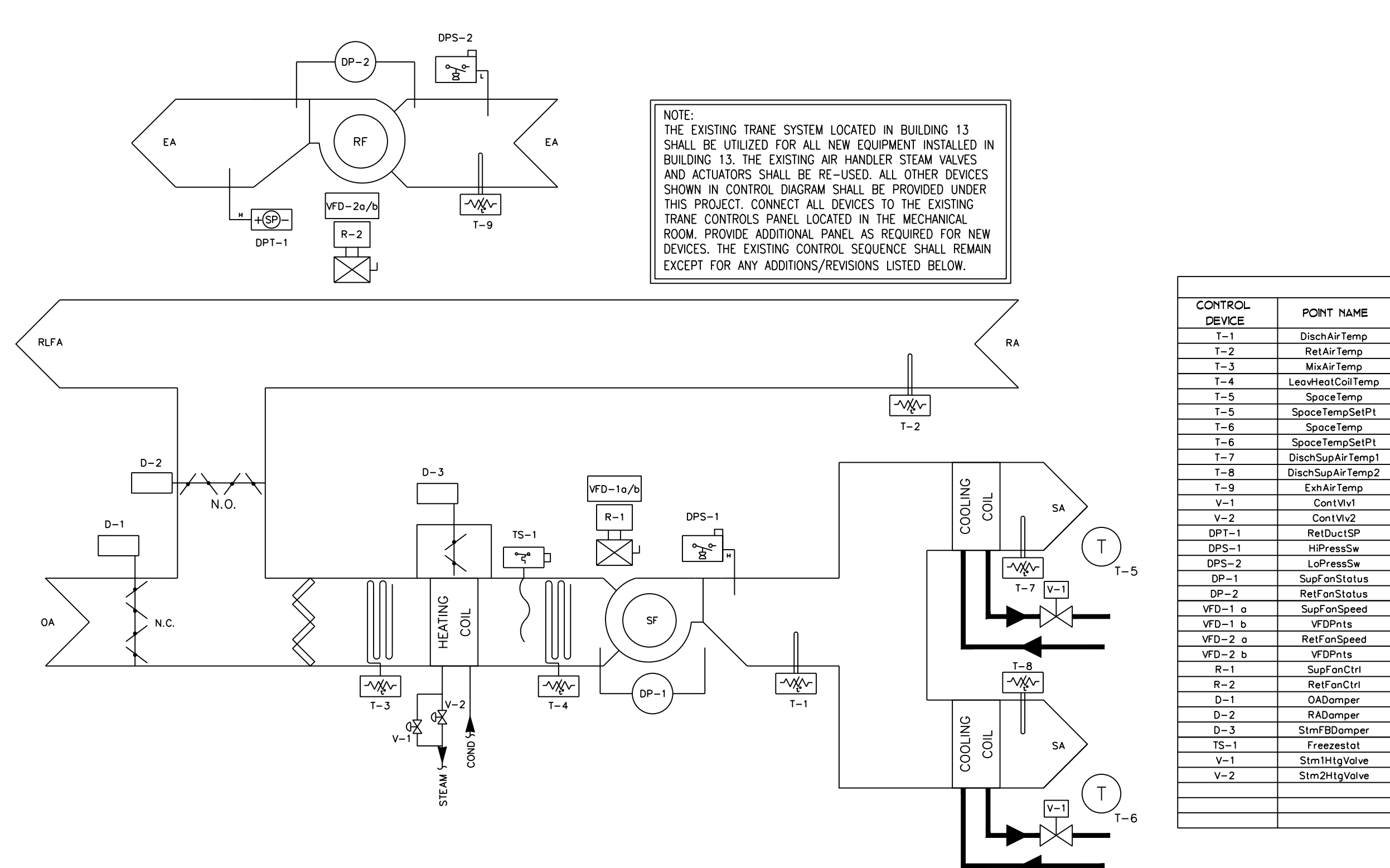
**OUTSIDE AIR DAMPER CONTROL:** REFER TO AND MAINTAIN EXISTING SEQUENCE.

**TEMPERATURE MONITORING:** MONITOR THE SUPPLY AIR TEMPERATURE (T-1), RETURN AIR TEMPERATURE (T-2), LEAVING HEATING COIL TEMPERATURE (T-4), MIXED AIR TEMPERATURE (T-3), AND EXHAUST AIR TEMPERATURE (T-9).

**EMERGENCY CONSTANT SPEED OPERATION:** REFER TO AND MAINTAIN EXISTING SEQUENCE.

**POWER OUTAGE OPERATION:** ON THE EVENT OF A POWER OUTAGE AIR HANDLING UNIT SHALL AUTOMATICALLY RESTART WHEN POWER HAS BEEN RE-ESTABLISHED.

**UNIT START-UP:** ON UNIT START-UP, ENABLE SUPPLY AND RETURN FANS FOR A MINIMUM OF 5 MINUTES (ADJUSTABLE) BEFORE STARTING PROGRAM IN ORDER TO EQUALIZE ALL UNIT SENSORS.



## 2 H3.8 NO SCALE

## SEQUENCE OF OPERATION:

**CONTROL MODE:** REFER TO AND MAINTAIN EXISTING SEQUENCE.

**FIRE ALARM SHUTDOWN:** IN THE FIRE-ALARM CONTROL MODE, THE SUPPLY FAN SHALL BE OFF.

**OPTIMAL START MODE:** THE BAS SHALL INITIATE THE OPTIMAL START MODE SUCH THAT THE FAN COIL UNIT IS STARTED, TO ALLOW THE ZONE TEMPERATURE TO REACH THE PENDING OCCUPIED HEATING OR COOLING SETPOINT. THE SYSTEM SHALL WAIT AS LONG AS POSSIBLE BEFORE STARTING, SO THAT THE TEMPERATURE IN EACH ZONE REACHES THE OCCUPIED SETPOINT JUST IN TIME FOR SCHEDULED OCCUPANCY.

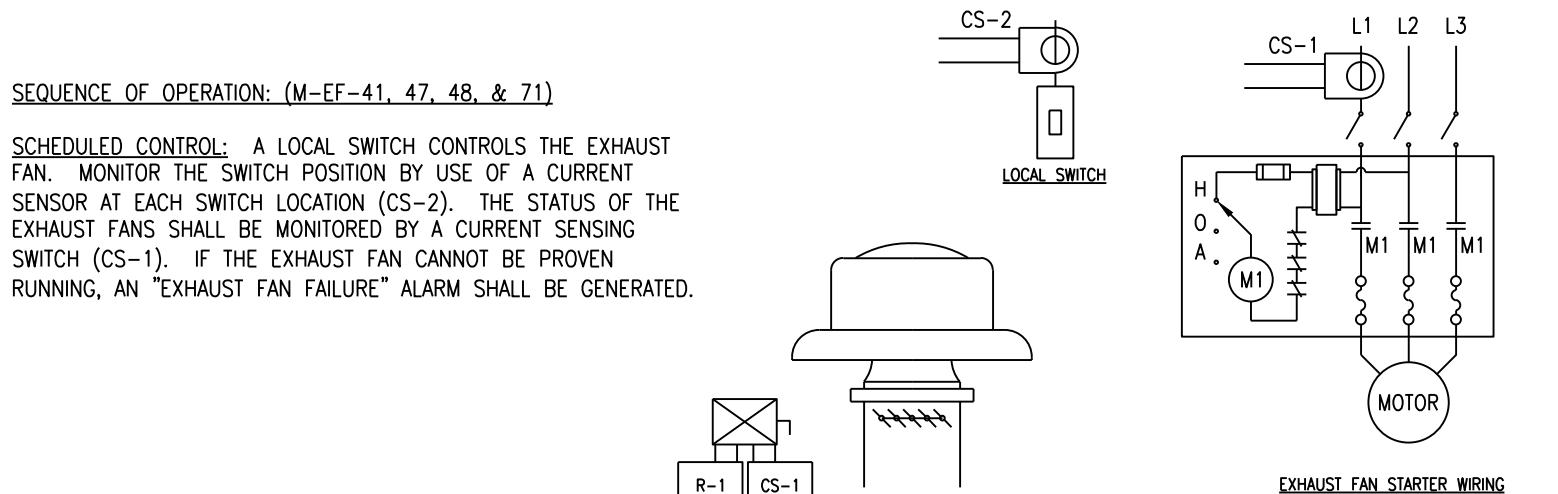
**NIGHT CYCLE:** IN THE UNOCCUPIED MODE, IF A SPACE TEMPERATURE FALLS BELOW THE UNOCCUPIED HEATING TEMPERATURE SETPOINT, THE AIR HANDLING UNIT SHALL ACTIVATE THE NIGHT CYCLE. THE NIGHT CYCLE SHALL REMAIN ACTIVE UNTIL THE SPACE TEMPERATURE IS SATISFIED OR THE TIME SCHEDULE CHANGES THE UNIT TO THE OCCUPIED MODE.

**SUPPLY FAN CONTROL:** IN ALL CONTROL MODES EXCEPT THE FIRE-ALARM CONTROL MODE, THE SUPPLY FAN SHALL BE ON (R-1). THE STATUS OF THE SUPPLY FAN SHALL BE MONITORED (DP-1). WHENEVER THE SUPPLY FAN IS COMMANDED TO RUN AND THE STATUS OF THE SUPPLY FAN CANNOT BE PROVEN, A "SUPPLY FAN FAILURE" ALARM SHALL BE GENERATED AT THE OPERATOR WORKSTATION.

**TEMPERATURE SETPOINT CONTROL:** IN THE OPTIMAL START OR OCCUPIED CONTROL MODE, THE ACTIVE TEMPERATURE SETPOINTS SHALL BE OBTAINED FROM THE AVERAGE OF THE SPACE TEMPERATURE SETPOINT DIAL (T-3) LOCATED IN THE OFFICE AND THE EXISTING SENSOR LOCATED IN THE ADJACENT BREAKROOM. THE OPERATOR SHALL HAVE THE ABILITY TO LIMIT THE RANGE OF THE SETPOINT DIAL AND ALSO TO DISABLE THE SETPOINT DIAL ENTIRELY. IF THE SETPOINT DIAL IS DISABLED, THE ACTIVE TEMPERATURE SETPOINTS SHALL BE ADJUSTABLE BY THE OPERATOR. IN THE UNOCCUPIED CONTROL MODE, THE ACTIVE TEMPERATURE SETPOINTS SHALL BE SEPARATE NIGHT-SETBACK/SETUP TEMPERATURE SETPOINTS THAT ARE ADJUSTABLE BY THE OPERATOR.

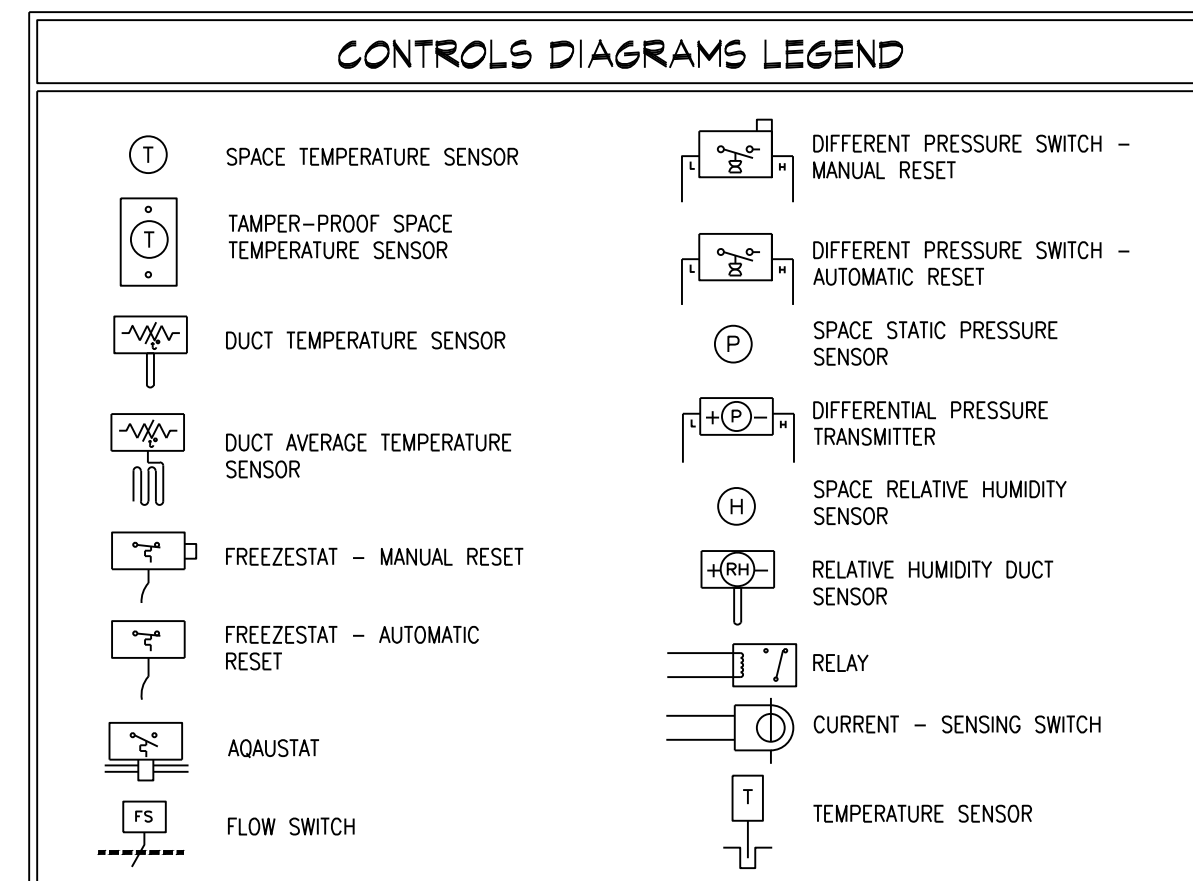
**MAIN COOLING COIL CONTROL:** THE COOLING COIL CONTROL VALVE (V-2) SHALL MODULATE TO MAINTAIN THE SPACE TEMPERATURE SETPOINT (T-3).

**AUXILIARY HEAT:** FOR ROOMS WITH AUXILIARY FAN-TUB RADIATION, THE CONTROL VALVE (V-1) SHALL MODULATE AS REQUIRED TO MAINTAIN ROOM TEMPERATURE WHEN THE ROOM TEMPERATURE FALLS BELOW THE ROOM SETPOINT. HEATING SHALL ONLY BE ALLOWED WHEN THE OUTSIDE AIR TEMPERATURE IS BELOW 55 DEGREES.

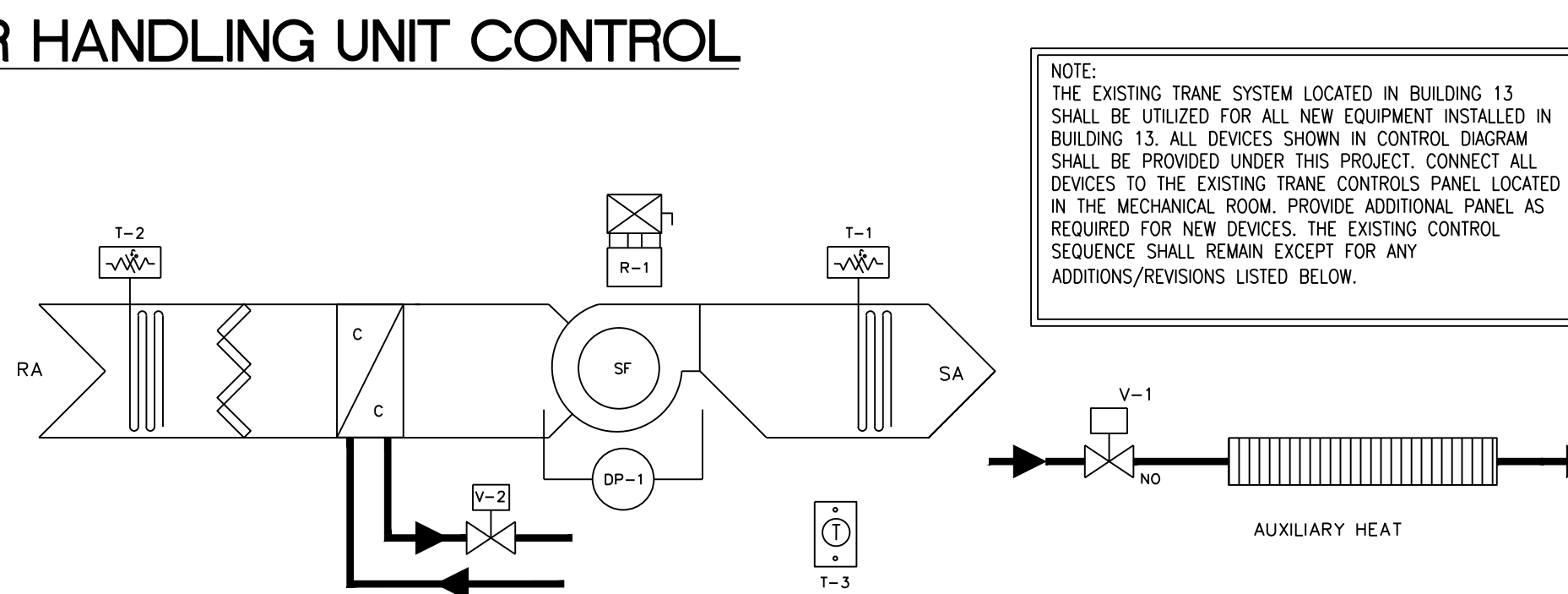


POINT SCHEDULE										
CONTROL DEVICE	POINT NAME	POINT DESCRIPTION	POINT TYPE				ALARM			
			AI	BI	AO	BO	H	LOW	BN	
CS-1	ExhFanStatus	EXHAUST FAN STATUS								
CS-2	ExhFanStatus	EXHAUST FAN STATUS								

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POINT SCHEDULE										
CONTROL DEVICE	POINT NAME	POINT DESCRIPTION	POINT TYPE				ALARM			
			AI	BI	AO	BO	H	LOW	BN	
T-2	DischAirTemp	DISCHARGE AIR TEMPERATURE								
T-2	RetAirTemp	RETURN AIR TEMPERATURE						X		
T-3	MixAirTemp	MIXED AIR TEMPERATURE							X	
T-4	LeavingCoilTemp	LEAVING HEATING COIL TEMPERATURE								
T-5	SpaceTemp	SPACE TEMPERATURE							X	X
T-5	SpaceTempSetPt	SPACE TEMPERATURE SETPOINT								
T-6	SpaceTemp	SPACE TEMPERATURE								
T-6	SpaceTempSetPt	SPACE TEMPERATURE SETPOINT								
T-7	DischSupAirTemp	DISCHARGE SUPPLY AIR TEMPERATURE 1								
T-8	DischSupAirTemp	DISCHARGE SUPPLY AIR TEMPERATURE 2								
T-9	ExhAirTemp	EXHAUST AIR TEMPERATURE								
V-1	COilValve	COOLING COIL CONTROL VALVE 1								
V-2	COilValve	COOLING COIL CONTROL VALVE 2								
DPS-1	HiPressSw	HIGH DUCT PRESSURE SWITCH								
DPS-2	LoPressSw	LOW DUCT PRESSURE SWITCH								
DP-1	SupFanStatus	SUPPLY FAN STATUS								
DP-2	RelFanStatus	RETURN FAN STATUS								
VFD-1 a	SupFanSpeed	SUPPLY FAN VFD SPEED								
VFD-1 b	VFDpts	VFD POINTS								
VFD-2 a	RelFanSpeed	EXHAUST FAN VFD SPEED								
VFD-2 b	VFDpts	VFD POINTS								
R-1	SupFanCtrl	SUPPLY FAN CONTROL								
R-2	RelFanCtrl	EXHAUST FAN CONTROL								
D-1	OA/RdDmp	OUTSIDE AIR DAMPER								
D-2	RA/RdDmp	RETURN AIR DAMPER								
D-3	StmBypass	STEAM COIL FACE & BYPASS DAMPER								
TS-1	FreezeStat	FREEZESTAT								
V-1	StmHtgValve	STEAM 1/3 HEATING VALVE								
V-2	StmHtgValve	STEAM 2/3 HEATING VALVE								



POINT SCHEDULE										
CONTROL DEVICE	POINT NAME	POINT DESCRIPTION	POINT TYPE				ALARM			
			AI	BI	AO	BO	H	LOW	BN	TOTAL
T-1	DischSupAirTemp	DISCHARGE SUPPLY AIR TEMPERATURE								
T-2	RetAirTemp	RETURN AIR TEMPERATURE								
T-3	SpaceTempSetPt	SPACE TEMPERATURE SETPOINT								
T-3	SpaceTemp	SPACE TEMPERATURE								
R-1	SupFanCtrl	SUPPLY FAN CONTROL								
DP-1	SupFanStatus	SUPPLY FAN STATUS								
V-1	HydValve	AUXILIARY HEATING VALVE								
V-2	COilValve	COOLING COIL VALVE								

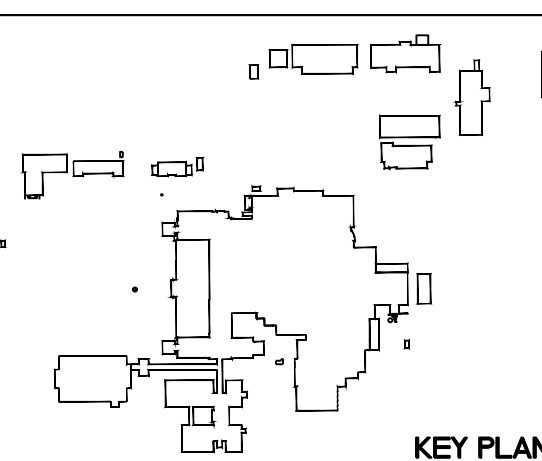
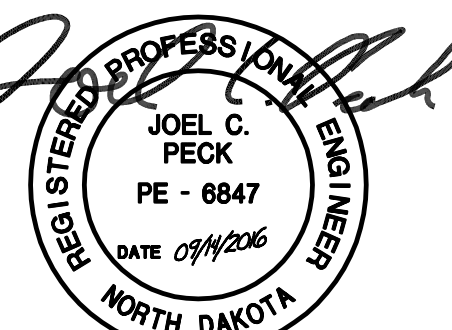
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Drawing Title <b>MECHANICAL CONTROL DIAGRAMS</b>	Project Phase <b>PHASE 3</b>	VA Project No. <b>437-13-111</b>	Contract No. <b>VA263-P-1218</b>	AutoCAD File Name <b>202272-PR04.DWG</b>
Building No. <b>VAMC CAMPUS</b>	Location <b>FARGO VA HEALTH CARE SYSTEM FARGO, NORTH DAKOTA</b>	Designed By <b>JP</b>	Checked By <b>JP</b>	Drawn By <b>JF</b>

Project Title <b>REPLACE OR UPGRADE HVAC SYSTEM COMPONENTS</b>	Date <b>SEPT. 14, 2016</b>
Scale <b>AS SHOWN</b>	Drawing No. <b>H3.8</b>
Dwg. 43 of 66	

