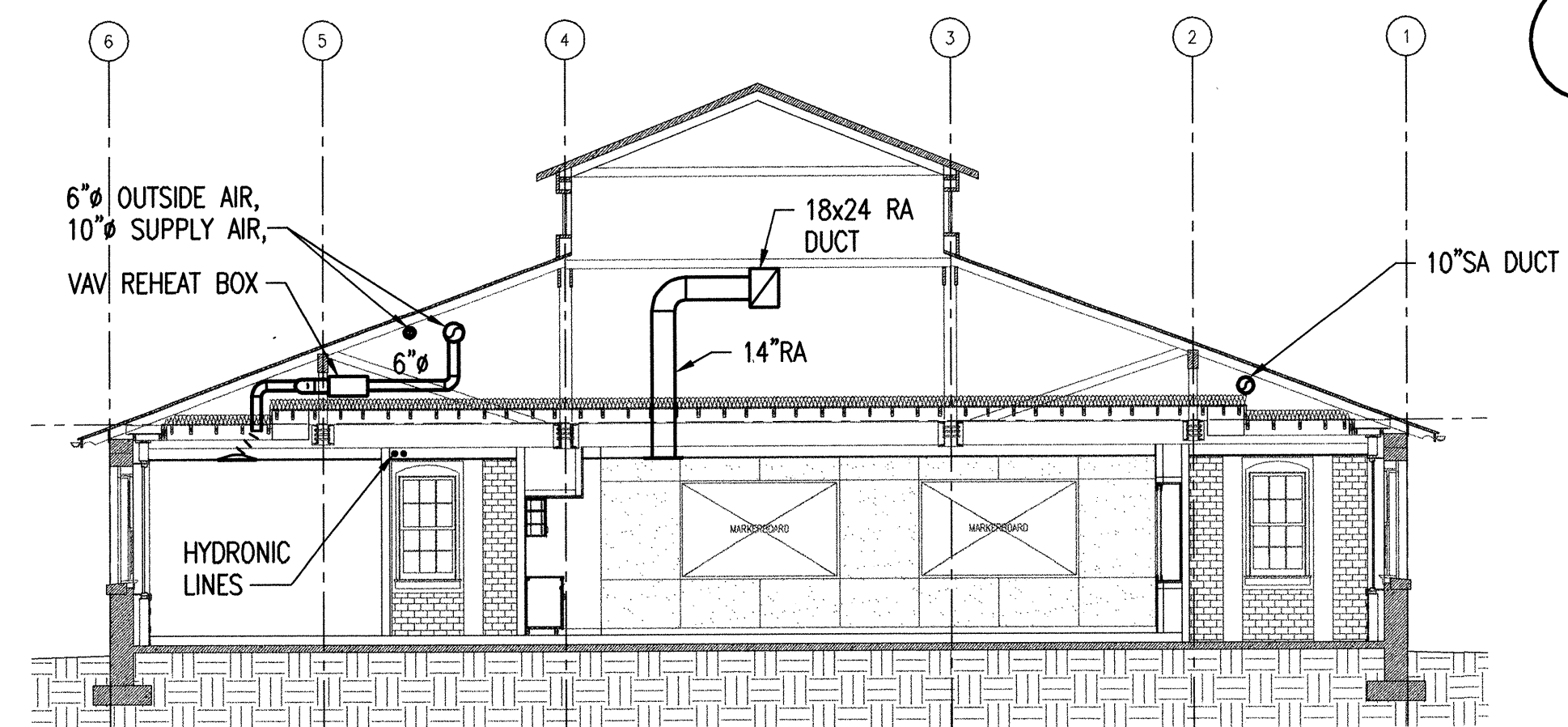
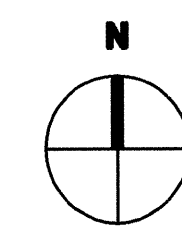


- PLAN NOTES:**
- ① RETURN AIR DUCT RISE INTO ATTIC SPACE AT SIZE INDICATED. REFER TO SHEET M103 FOR CONTINUATION.
 - ② 6"Ø RELIEF FROM CLOSET TO CLASSROOM CEILING SPACE. TYPICAL FOR CLOSETS.

MECHANICAL FLOOR PLAN

SCALE: 1/8"=1'-0"



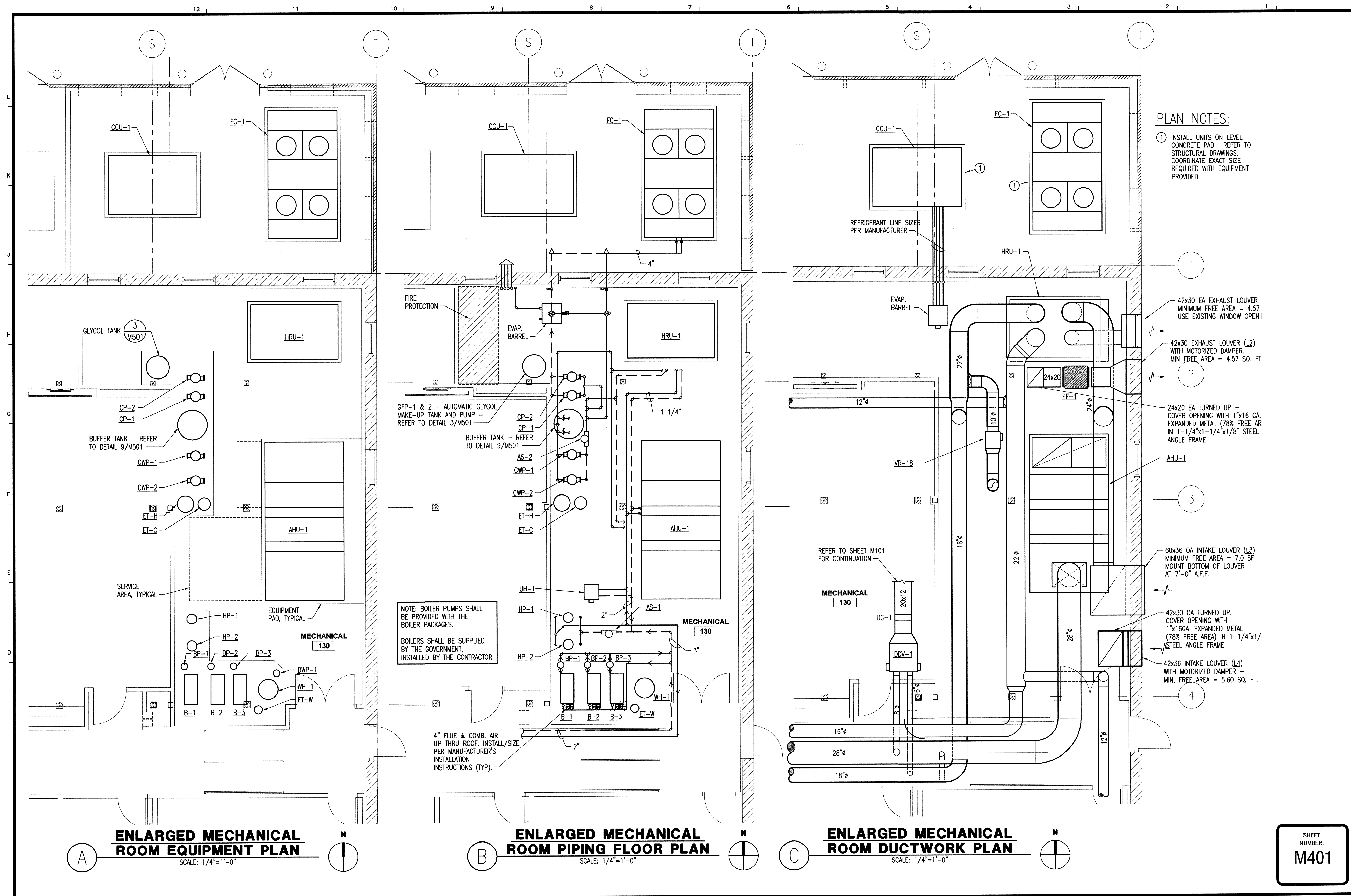
SECTION VIEW

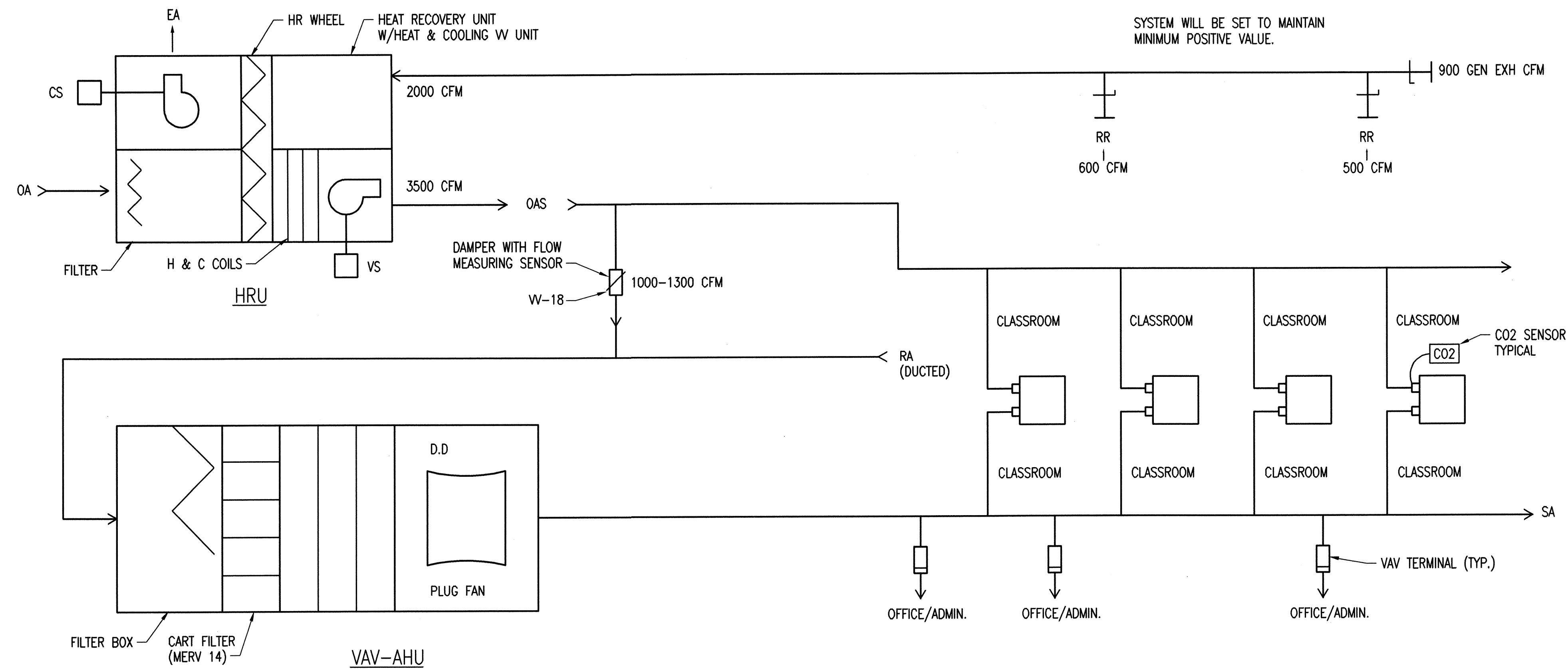
SCALE: 1/8"=1'-0"

SHEET
NUMBER:
M101





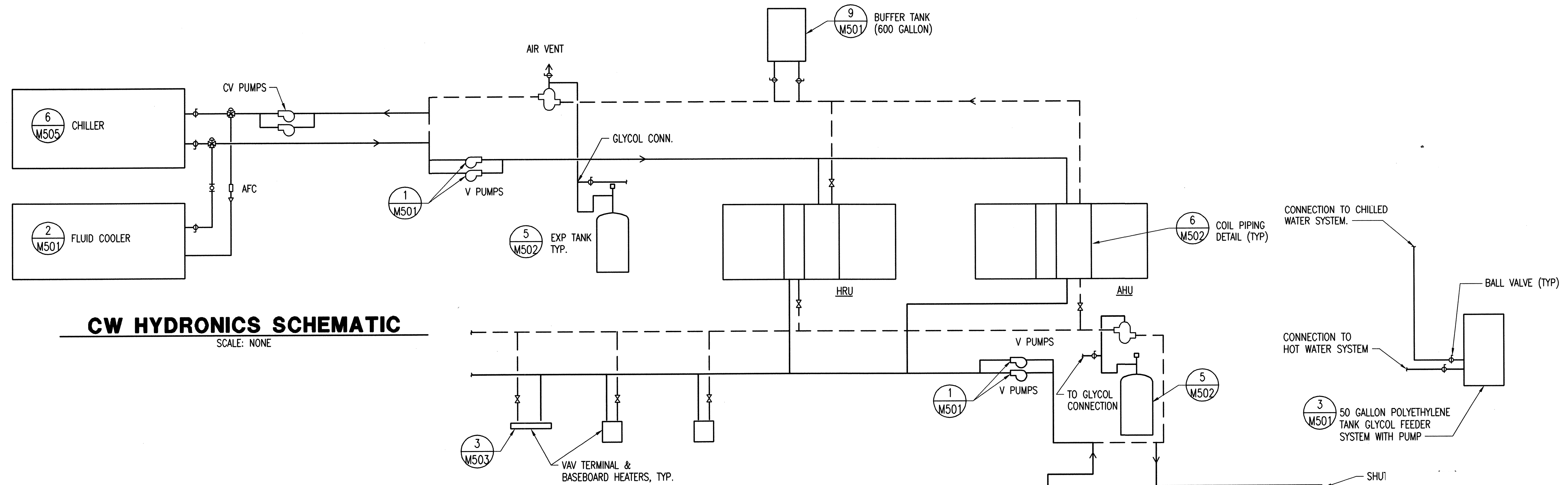




AIRSIDE SYSTEM SCHEMATIC

SCALE: NONE

TOTAL DDV MAX VENT = 3030
TOTAL DDV MIN VENT = 1300
TO MAINTAIN POSITIVE PRESSURE IN BLDG. VV-18 WILL OPEN AS DDV BOX VENT TOTAL DROPS BELOW 1600 CFM, VV-18 WILL OPEN TO MAINTAIN A MINIMUM OF 2400 CFM TO BLDG DURING OCCUPIED PERIODS.



CW HYDRONICS SCHEMATIC

SCALE: NONE

HW HYDRONICS SCHEMATIC

SCALE: NONE

CONDENSING UNIT/REMOTE CHILLER SCHEDULE

MARK	CAP TONS	OA TEMP °F	COMPRESSOR				MIN AMB TEMP	COND	FANS	CHILLER EVAPORATOR ①				UNIT ELECTRICAL		REMARKS	ELECT. REF.
			REF TYPE	NO	RATED LOAD AMPS	CAP STEPS				PD FT.	ENT. WATER	LVG. WATER	VOLT 60 CYC	MIN CIRC AMPS			
CCU-1	60	100	410	4	57.8	4	0"	6	6.7	112	13.4	56	44	208/3Ø	290.6	① ② ③	

① REMOTE EVAP BARREL.
BASED ON TRANE RAUC-C60 CONDENSING UNIT WITH REMOTE CHILLER.
R 407 IS AN ACCEPTABLE REFRIGERANT.

BOILER SCHEDULE - GAS HOT WATER

MARK	LOC AT ROOM	TYPE	MINIMUM CAPACITY			WORK PRESS	NO. OF MODULES	INTAKE PIPE SIZE	EXHAUST PIPE SIZE	ELECTRICAL		REMARKS	ELEC REF
			MIN AFUE	MBH INPUT	MBH OUTPUT					AMPS PER MODULE	VOLTS		
B-1	MECH	①	93	285	263	30	1	4	4	2.5	120V	①	--
B-2	MECH	①	93	285	263	30	1	4	4	2.5	120V	①	--
B-3	MECH	①	93	285	263	30	1	4	4	2.5	120V	①	--

① BASED ON LOCHINVAR KBH285 BOILER WITH EWT 110°F AND LWT 140°F.
NOTE: BOILERS SHALL BE SUPPLIED BY THE GOVERNMENT, INSTALLED BY THE CONTRACTOR.

AIR HANDLING UNIT SCHEDULE

MARK	LOC. AT ROOM	TYPE	FAN								COIL		FILTER		MOTOR (BY M.C.)				REMARKS	ELECT. REF.	
			CFM	BHP	RPM	SP ² ESP	H ₂ O TSP	TYPE	MIN DIA.	MIN EFF.	1ST IN UNIT	2ND IN UNIT	MIN SQ. FT.	TYPE	HP	RPM	ELEC VOLT	STRT BY			
AHU-1			12000	14.2	1655	2.5	5.3	AF	27		HW-1	CC-1	24	CT	20	VFD	208/3		①		

① VFD, DIRECT DRIVE PLUG FAN.

PUMP SCHEDULE

MARK	LOC AT ROOM	TYPE	MIN CAPACITY			MIN SIZE CONN.		MOTOR (BY M.C.)						REMARKS	ELECT REF
			GPM	FEET HEAD	EFF	SUCTION	DISCH	HP	RPM	SPEED	ELECT	STARTER			
CP-1	MECH	VERT	120	30	67	2 1/2	2 1/2	2.0	1800	1	208/3Ø	EC	①③		
CP-2	MECH	VERT	120	30	67	2 1/2	2 1/2	2.0	1800	1	208/3Ø	EC	①③		
CWP-1	MECH	VERT	120	50	66	3	3	5.0	1800	VFD	208/3Ø	VFD	①③		
CWP-2	MECH	VERT	120	50	66	3	3	5.0	1800	VFD	208/3Ø	VFD	①③		
HP-1	MECH	VERT	100	50	67	3	3	3.0	1800	VFD	208/3Ø	VFD	①③		
HP-2	MECH	VERT	100	50	67	3	3	3.0	1800	VFD	208/3Ø	VFD	①③		
DHWP-1	MECH	INLINE	10	15	--	1	1	1/6	1750	1	120/1Ø	--	②		
BP-1	MECH	VERT	30	15	49	1 1/2	1 1/2	1/3	1200	1	115/1Ø	EC	④③		
BP-2	MECH	VERT	30	15	49	1 1/2	1 1/2	1/3	1200	1	115/1Ø	EC	④③		
BP-3	MECH	VERT	30	15	49	1 1/2	1 1/2	1/3	1200	1	115/1Ø	EC	④③		

① BASED ON ARMSTRONG SERIES 4032 VERTICAL INLINE PUMPS, SIZE 3x3x8.
② BASED ON ARMSTRONG CLOSE COUPLED INLINE CIRCULATOR H41 WITH ALL BRONZE CONSTRUCTION.
③ SELECTION BASED ON 30% PROPYLENE GLYCOL SOLUTION.
④ BASED ON ARMSTRONG 4380 1.5x1.5x8. PROVIDED BY THE GOVERNMENT WITH THE BOILERS.

VAV REHEAT BOX SCHEDULE

MARK	TYPE	UNIT SIZE	CFM		OPER SP	NC RAD	HOT WATER COIL														REMARKS	ELEC REF
			MAX	MIN			CFM	MBH	AIR			WATER				ROWS	S & R RUNOUT					
									ENT	LVG	APD	GPM	EWT	LWT	WPD							
VR-1	--	05	350	105	.15"	27	105	3.6	55	88	.09	0.5	140	126	0.2	1	3/4"	①②				
VR-2	--	05	250	75	.08"	22	75	3.0	55	93	.05	0.4	140	124	0.1	1	3/4"	①②				
VR-3	--	05	270	125	.09"	23	125	3.1	55	92	.06	0.4	140	124	0.1	1	3/4"	①②				
VR-4	--	05	250	75	.08"	22	75	3.0	55	93	.05	0.4	140	124	0.1	1	3/4"	①②				
VR-5	--	04	125	50	.04"	18	50	2.5	55	103	.01	0.4	140	127	0.1	1	3/4"	①②				
VR-6	--	07	600	180	.26"	24	180	6.5	55	90	0.14	3.4	140	136	7.2	1	3/4"	①②				
VR-7	--	04	160	80	.07"	23	80	2.5	55	103	.01	0.4	140	127	0.1	1	3/4"	①②				
VR-8	--	04	200	100	.11"	27	100	2.7	55	98	.03	0.4	140	126	0.1	1	3/4"	①②				
VR-9	--	06	400	200	.24"	23	200	4.4	55	90	.12	1.4	140	133	1.1	1	3/4"	①②				
VR-10	--	07	600	180	.26"	24	180	6.5	55	90	0.14	3.4	140	136	7.2	1	3/4"	①②				
VR-11	--	04	125	50	.04"	18	50	2.5	55	103	.01	0.4	140	127	0.1	1	3/4"	①②				
VR-12	--	05	250	75	.08"	22	75	3.0	55	93	.05	0.4	140	124	0.1	1	3/4"	①②				
VR-13	--	06	405	160	.35"	22	160	6.1	55	102	.23	0.8	140	124	0.2	2	3/4"	①②				
VR-14	--	04	225	90	.08"	22	90	3.0	55	93	.05	0.4	140	124	0.1	1	3/4"	①②				
VR-15	--	05	300	100	.11"	24	100	3.6	55	90	.07	0.6	140	128	0.3	1	3/4"	①②				
VR-16	--	04	225	90	.08"	22	90	3.0	55	93	.05	0.4	140	124	0.1	1	3/4"	①②				
VR-17	--	05	300	100	.11"	24	100	3.6	55	90	.07	0.6	140	128	0.3	1	3/4"	①②				
VR-18	--	10	1000	0	0.01"	24	--	--	--	--	--	--	--	--	--	--	--	②③				
VR-19	--	05	200	60	0.05	31	--	--	--	--	--	--	--	--	--	--	--	②③				
VR-20	--	05	200	60	0.05	31	--	--	--	--	--	--	--	--	--	--	--	②③				
VR-21	--	05	200	60	0.05	31	--	--	--	--	--	--	--	--	--	--	--	②③				
VR-22	--	05	200	60	0.05	31	--	--	--	--	--	--	--	--	--	--	--	②③				
VR-23	--	05	200	60	0.05	31	--	--	--	--	--	--	--	--	--	--	--	②③				

① BASED ON TRANE VCWF SINGLE DUCT TERMINAL UNIT WITH HOT WATER REHEAT.
② SELECTIONS BASED ON 30% PROPYLENE GLYCOL SOLUTION.
③ BASED ON TRANE VCCF SINGLE DUCT TERMINAL UNIT WITH NO HEAT.

HEAT RECOVERY UNIT SCHEDULE - ENERGY WHEEL

TAG	LOC.	MODE	CFM		SUPPLY MOTOR "S.P."	MOTOR 480/3 HP	EXHAUST MOTOR "S.P."	MOTOR 480/3 HP	OUTDOOR AIR		LVG WHEEL		SUPPLY AIR		CW COIL			HW COIL			ELECT		REMARKS
			EXH.	SUP.					DB	WB	DB	WB	DB	WB	GPM	EWT	LWT	GPM	EWT	LWT	VOLTS	MCA	
HRU-1		SUM WIN	2000	3500	3.6	5.0	1.3	2.0	96	77	85	70	55	54.9	38.0	44	56	12.0	140	108	208/3	--	①
									6	4	39	34	72	51									

① BASED ON GREENHECK ERCH-45H-15 INDOOR UNIT WITH CHILLED WATER AND HW COILS. VARIABLE SPEED SUPPLY FAN. COIL SELECTIONS BASED ON 30% PPG.

COIL SCHEDULE - HOT WATER

MARK	WITH AHU #	AIR				COIL								COIL DESCRIPTION				S & R RUNOUT SIZE	REMARKS
		CFM	MAX. APD	EAT	LAT	AREA (SF)	FV FPM	CAP MBH	WATER				COIL TYPE	ROWS	FIN TYPE	FINS /FT	TURB		
HW-1	1	12000	0.19	45	57	17.0	706	150	GPM	EWT	WTD	WPD	WA	1	PF	127	Y	1 1/4	①

① SELECTION BASED ON 30% PPG.

COIL SCHEDULE - CHILLED WATER

MARK	LOC. AT UNIT	AIR				COIL								TRANE COIL DESCRIPTION				S&R RUNOUT SIZE	REMARKS
		CFM	MAX. APD	E.A.T. db/wb	L.A.T. db/wb	GPM	EWT	WTR	WPD	CAP MBH	AREA (SF)	FV FPM	COIL TYPE	ROWS	FIN TYPE	FINS /FT	TURB		
CC-1	1	12000	1.18	77	51	88	44	12	17	489	23.38	513	W	8	PF	150	Y	3	①

① SELECTION BASED ON 30% PPG.

FLUID COOLER - AIR COOLED

MARK	CAP MBH	OAT °F	EWT °F	LWT °F	GPM	PD FT	ELECTRICAL				REMARKS	ELEC REF
							FANS NO	HP EA	VOLTAGE	STARTER		
FC-1	380	40	54	46	120	16	4	2.0	208/3Ø	MC		

① 30% PG SOLUTION REQUIRED.

EXPANSION TANK SCHEDULE

UNIT NO	SYSTEM	APPROX. SYSTEM VOL	SYSTEM TEMP RANGE °F		TANK CHARGE PSIG	FILL PRESS PSIG	MAX OPER PRESS PSIG	MIN VOLUME GAL	MIN ACCEPT VOLUME	AIR SEPARATOR			PIPE SIZE		REMARKS		
			MIN.	MAX.						SIZE	GPM	MAX. PD	STRAINER REQUIRED	TO TANK		CW FILL	
ET-H	HW	375	40	180	15		30	125	21.7	11.3	3"	140	1	3/4	3/4		
ET-C	CW	--	40	100	--		30	125	--	--	--	--	1	NO	3/4	3/4	

FAN SCHEDULE

MARK	LOC AT ROOM	TYPE	MIN. CAP		MAX. TIP SPEED (FPM)	DRIVE	MOTOR (BY M.C.)					REMARKS	CONTROLS	ELECT REF
			CFM	SP			HP (AMP)	RPM	SPEED	ELECT.	STARTER			
TF-1	118	CENT	300	0.4"	---	DIR	1.5	---	---	120V	---	①	ⓑ	
TF-2	120	CENT	200	0.4"	---	DIR	2.2	---	---	120V	---	②	ⓑ	
EF-1	130	INLINE	3000	0.5"	1279	BELT	1	1200	---	208/3	---	③	Ⓐ	

①

BASED ON COOK GEMINI SERIES, GC-520.

②

BASED ON COOK GEMINI SERIES, GC-420.

③

BASED ON COOK 165SQN-B.

Ⓐ

FAN SHALL RUN CONTINUOUSLY.

ⓑ

FAN SHALL RUN WHEN HRU-1 IS IN OPERATION.

DOUBLE DUCT VAV SCHEDULE

MARK	RADIATED N.C. @ 2" SP	VAV COOLING			VAV VENTILATION			HW COIL	REMARKS
		CFM MAX/MIN	INLET DIAMETER	INLET SP "W.C.	CFM MAX/MIN	INLET DIAMETER	INLET SP "W.C.		
DDV-1	22	850/0	8"ø	0.90"	350/150	6"ø	0.90"	DC-1	①
DDV-2	22	850/0	8"ø	0.90"	350/150	6"ø	0.90"	DC-2	①
DDV-3	22	850/0	8"ø	0.90"	350/150	6"ø	0.90"	DC-3	①
DDV-4	22	850/0	8"ø	0.90"	350/150	6"ø	0.90"	DC-4	①
DDV-5	22	850/0	8"ø	0.90"	350/150	6"ø	0.90"	DC-5	①
DDV-6	22	850/0	8"ø	0.90"	350/150	6"ø	0.90"	DC-6	①
DDV-7	22	850/0	8"ø	0.90"	350/150	6"ø	0.90"	DC-7	①
DDV-8	22	850/0	8"ø	0.90"	350/150	6"ø	0.90"	DC-8	①
DDV-9	16	300/0	6"ø	0.90"	150/0	4"ø	0.90"	DC-9	①
DDV-10	16	250/0	5"ø	0.90"	80/0	4"ø	0.90"	DC-10	①

①

BASED ON TRANE VDDF DUAL DUCT VAV BOX WITH DDC CONTROLS.

DUCT HOT WATER COIL SCHEDULE

TAG DC	DWV TAG	CFM	MAX. APD IN WC	MAX. WPD FT	ROWS	GPM	EWT 'F	LWT 'F	EAT 'F	LAT 'F	SUPPLY & RETURN RUNOUTS	CONTROL VALVE TYPE	REMARKS
DC-1	DDV-1	350	0.05"	0.54	2	1.0	140	110	52	90	3/4"	---	①②
DC-2	DDV-2	350	0.05"	0.54	2	1.0	140	110	52	90	3/4"	---	①②
DC-3	DDV-3	350	0.05"	0.54	2	1.0	140	110	52	90	3/4"	---	①②
DC-4	DDV-4	350	0.05"	0.54	2	1.0	140	110	52	90	3/4"	---	①②
DC-5	DDV-5	350	0.05"	0.54	2	1.0	140	110	52	90	3/4"	---	①②
DC-6	DDV-6	350	0.05"	0.54	2	1.0	140	110	52	90	3/4"	---	①②
DC-7	DDV-7	350	0.05"	0.54	2	1.0	140	110	52	90	3/4"	---	①②
DC-8	DDV-8	350	0.05"	0.54	2	1.0	140	110	52	90	3/4"	---	①②
DC-9	DDV-9	150	0.09"	0.51	2	0.5	140	110	52	98	3/4"	---	①③
DC-10	DDV-10	100	0.09"	0.38	2	0.3	140	110	52	92	3/4"	---	①③

①

SELECTIONS BASED ON 30% PROPYLENE GLYCOL SOLUTION.

②

BASED ON TRANE HEATING COIL TYPE P2 WITH MAX FACE VELOCITY OF 700FPM, 16"x12" NOMINAL DIMENSIONS, PRIMA-FLO H FIN TYPE.

③

BASED ON TRANE HEATING COIL TYPE T WITH MAX FACE VELOCITY OF 700FPM, 9"x9" NOMINAL DIMENSIONS, PRIMA-FLO H FIN TYPE.

MINI SPLIT A/C SCHEDULE

MARK	SUPPLY FAN		HEATING		COOLING				OUTDOOR UNIT			REMARKS	INDOOR ELECT. REF.	OUTDOOR ELECT. REF.
	RLA	VOLTAGE	BTUH	AMPS	TOTAL (MBH)	EAT DB/WB	OAT 'F	MIN SEER	COMP RLA	MCA	VOLTAGE			
DAC-1	0.55	208/1	20,400	---	24	80/67	---	---	---	---	---	①②		
DCU-1	---	---	---	---	---	---	95	13.0	8.0	10.8	208/1	②		

①

LOAD MUST BE VERIFIED WITH COMM. ENGR.

②

BASED ON EMI, MODEL CAH24 DUCTLESS CASSETTE UNIT W/ S1HG4 HEAT PUMP. WITH R410A REFRIGERANT AND FACTORY CONDENSATE PUMP.

BASEBOARD RADIATION SCHEDULE

MARK	LOC. AT ROOM	TYPE	ELEMENT			WATER			RUNOUTS		REMARKS
			TOTAL BTUH	ACTIVE LENGTH	ROWS	GPM	MAX. P.D.	ENT.	LV.	SUPPLY RETURN	
BH-1	124	WALL	3168	56"	1	0.50	0.41	140	110	3/4" 3/4"	① 30% PPG
BH-2	124	WALL	3168	56"	1	0.50	0.41	140	110	3/4" 3/4"	① 30% PPG
BH-3	124	WALL	3168	56"	1	0.50	0.41	140	110	3/4" 3/4"	① 30% PPG
BH-4	124	WALL	3168	56"	1	0.50	0.41	140	110	3/4" 3/4"	① 30% PPG
BH-5	124	WALL	3168	56"	1	0.50	0.41	140	110	3/4" 3/4"	① 30% PPG
BH-6	100	WALL	3168	56"	1	0.50	0.41	140	110	3/4" 3/4"	① 30% PPG

①

BASED ON TRANE TYPE SW WALL-MOUNTED ARCHITECTURAL RADIATION CONVECTOR.

UNIT HEATER SCHEDULE - HOT WATER

MARK	LOC AT ROOM	CFM	GPM	MAX WPD	EWT	MBH	HP	ELECT	REMARKS	ELECT REF
UH-1	MECH	1200	3.2	2	140	40	1/8	120V	TRANE UHSB096	①
UH-2	STOR	800	2.4	2	140	30	1/20	120V	TRANE UHSB072	①
UH-3	ELEC	800	2.4	2	140	30	1/20	120V	TRANE UHSB072	①

①

SELECTION BASED ON 30% PPG.

GRILLE & REGISTER SCHEDULE

MARK	TYPE	MANUFACTURER BASED ON	MODEL	MATERIAL		FINISH						ACCESSORIES & REMARKS	O.B.D.
				ALUM	STEEL	WHITE	ALUM	BLACK	BRONZE	CLEAR	ANODZ.	OTHER	
A	SUPPLY DIFFUSER	TITUS	TDC-AA	X		X						24x24 LAY-IN	
B	SUPPLY DIFFUSER	TITUS	TDC-AA-1	X		X							X
C	RETURN GRILLE	TITUS	50F-3	X		X							
D	EXHAUST GRILLE	TITUS	4FL-1	X		X						SURFACE MOUNTED	X

DIRECTION OF AIR FLOW

GRILLE CALLOUT IN GRILLE AND REGISTER SCHEDULE

GRILLE SIZE IN INCHES

GRILLE SIZE IN mm

A-12x12 (305x305)

CUBIC FEET OF AIR PER MINUTE

600 (283 L/s)

GRILLE CALLOUT SYMBOL

LITERS OF AIR PER SECOND

LOUVER SCHEDULE

MARK	TYPE	MATERIAL	APPROX. SIZE	DEPTH	FINISH	USE	DESIGN CFM	MAX. APD	MIN. FREE AREA (SF)	TOP AT AFF	MAX. WATER PENETRATION OUNCES / SF AT 1000 FPM	REMARKS
L1	DRN	ALUM	42/30	6	②	EXH	2400	0.44	4.57	WINDOW	0.10	①
L2	DRN	ALUM	42/30	6	②	EXH	3000	0.44	4.57	10	0.10	①
L3	DRN	ALUM	60/36	6	②	INTK	3500	0.44	7.0	10	0.10	①
L4	DRN	ALUM	42/36	6	②	INTK	3000	0.44	5.60	10	0.10	①

①

BASED ON DOUBLE DRAINAGE EXTRUDED ALUMINUM LOUVER.

②

COLOR SELECTIONS BY ARCHITECT.

HVAC & PLUMBING SYMBOL SCHEDULE

TYPE	SYMBOL	DESCRIPTION	TYPE	SYMBOL	DESCRIPTION
①	----	DOMESTIC COLD WATER LINE (CW)	③		3-WAY CONTROL VALVE (PNEUMATIC)
①	----	EXISTING DOMESTIC COLD WATER LINE (CW)	③		PRESSURE REDUCING VALVE (PRV)
①	----	DOMESTIC HOT WATER LINE (HW)	③		CHECK VALVE
①	----	EXISTING DOMESTIC HOT WATER LINE (HW)	④		STRAINER
①	----	HOT WATER RECIRC LINE (HWC)	④		PLUG VALVE
①	----	EXISTING HOT WATER RECIRC LINE (HWC)	③		CALIBRATED BALANCE VALVE
①	—RO—	REVERSE OSMOSIS PURE WATER SUPPLY LINE (RO)	④		AUTOMATIC FLOW CONTROL VALVE
①	—ROR—	REVERSE OSMOSIS PURE WATER RETURN LINE (ROR)	④		CALIBRATED ORIFICE PLATE FLOW METER
①	—DI—	DIONIZED PURE WATER SUPPLY (DI)	④		THERMOMETER
①	—T—	DOMESTIC TEMPERED WATER LINE (TW)	④		PRESSURE GAUGE
①	—T—	EXIST. DOMESTIC TEMPERED WATER LINE (TW)	⑤		(UP) DUCT SECTION, POSITIVE PRESSURE (FIRST SIZE IS TOP DIMENSION)
①	—CA—	COMPRESSED AIR (CA)	⑤		(DOWN) DUCT SECTION, POSITIVE PRESSURE (FIRST SIZE IS TOP DIMENSION)
①	—CA—	EXISTING COMPRESSED AIR (CA)	⑤		(UP) DUCT SECTION, NEGATIVE PRESSURE (FIRST SIZE IS TOP DIMENSION)
①	----	ABOVE FLOOR WASTE LINE (W)	⑤		SUPPLY DUCT DROP
①	----	EXISTING ABOVE FLOOR WASTE LINE (W)	⑤		SUPPLY DUCT RISER
①	----	BELOW WASTE LINE (W)	⑤		RETURN DUCT DROP
①	----	EXISTING BELOW WASTE LINE (W)	⑤		RETURN DUCT RISER
①	-----	PLUMBING VENT LINE (V)	⑤		FLEXIBLE DUCT
①	-----	EXISTING PLUMBING VENT LINE (V)	⑤		TURNING VANES
①	—RL—	RAIN LEADER (RL)	⑤		SIDE WALL SUPPLY REGISTER
①	—RL—	EXISTING RAIN LEADER (RL)	⑤		(DOWN) DUCT SECTION, NEGATIVE PRESSURE (FIRST SIZE IS TOP DIMENSION)
①	—ORL—	OVERFLOW RAIN LEADER (ORL)	⑤		DUCT SIZE, FIRST FIGURE IS SIDE SHOWN (CLEAR INSIDE DIMENSIONS)
①	—ORL—	EXISTING OVERFLOW RAIN LEADER (ORL)	⑤		DUCT CHANGE OF ELEVATION RISE(R) DROP(D)
①	—SS—	STORM SEWER (SS)	⑤		FLEXIBLE CONNECTION
①	—SS—	EXISTING STORM SEWER (SS)	⑤		OPPOSED BLADE BALANCING DAMPER W/ MANUAL LOCKING QUADRANT (RECT DUCT)
①	—IW—	INDUSTRIAL WASTE	⑤		BUTTERFLY BALANCING DAMPER W/ MANUAL LOCKING QUADRANT (ROUND DUCT)
①	—G—	NATURAL GAS LINE (G)	⑤		OPPOSED BLADE BALANCING DAMPER W/ MOTORIZED LOCKING QUADRANT (RECT DUCT)
①	—VTR—	VENT THRU ROOF	⑤		BUTTERFLY BALANCING DAMPER W/ MOTORIZED LOCKING QUADRANT (ROUND DUCT)
①	—FD—	FLOOR DRAIN	⑤	BOD	BOTTOM OF DUCT ELEVATION ABOVE FLOOR
①	CO ●	CLEANOUT (FLOOR)	⑤	TOD	TOP OF DUCT ELEVATION ABOVE FLOOR
①	CO ●●	2-WAY CLEANOUT (FLOOR)	⑤	BOS	BOTTOM OF STEEL
①	WCO—	WALL CLEANOUT	⑥	VAV	VARIABLE AIR VOLUME
①	P—#	PLUMBING FIXTURE CALLOUT	⑥	OBD	OPPOSED BLADE DAMPER
①	WH—#	WATER HAMMER ARRESTOR — PDI SIZE	⑥	AHU	AIR HANDLING UNIT
①	----	FLOW LINE ELEVATION	⑥	EF	EXHAUST FAN
①	—DHWP—	DOMESTIC HOT WATER PUMP	⑥	FCU	FAN COIL UNIT
①	—RD—	ROOF DRAIN	⑥	RTU	ROOFTOP UNIT
①	—ORD—	OVERFLOW ROOF DRAIN	⑥	SF	SUPPLY AIR FAN
①	—WH—#	WATER HEATER CALLOUT	⑥	FTU	FAN POWERED TERMINAL UNIT
①	—FS—	FLOOR SINK	⑥	VAV	VARIABLE AIR VOLUME UNIT
① ②	—>—	CAP	⑥	SA	SUPPLY AIR
① ②	—o—	PIPE RISE	⑥	OA	OUTSIDE AIR
① ②	—v—	PIPE DROP	⑥	RA	RETURN AIR
① ②	— —	UNION OR FLANGE CONNECTION	⑥	EA	EXHAUST AIR
① ②	—>—	DIRECTION OF FLOW	⑥	FD +—+▲	FIRE DAMPER IN WALL (VERTICAL POSITION)
① ②	—X—	CONCENTRIC REDUCER OR INCREASER	⑥	FD +—+◆	FIRE DAMPER IN FLOOR (HORIZONTAL POSITION)
① ②	—E—	ECCENTRIC REDUCER	⑥	SD +—+△	SMOKE DAMPER
① ②	—>—	TOP CONNECTION, 45° OR 90°	⑥	FSD +—+△	COMBINATION FIRE/SMOKE DAMPER (VERTICAL POSITION)
① ②	—>—	BOTTOM CONNECTION, 45° OR 90°	⑥	FSD +—+◆	COMBINATION FIRE/SMOKE DAMPER (HORIZONTAL POSITION)
① ②	—A—	SIDE CONNECTION	⑥	Ⓢ	ELECTRIC OR DDC THERMOSTAT
① ②	—S—	CAPPED OUTLET	⑥	Ⓒ	CO2 SENSOR
① ②	BOP	BOTTOM OF PIPE ELEVATION ABOVE FLOOR	⑥	Ⓜ	ELECTRIC OR DDC HUMIDISTAT
① ②	TOP	TOP OF PIPE ELEVATION ABOVE FLOOR	⑥	M	MOTOR
②	—CWS—	CHILLED WATER SUPPLY LINE (CWS)	⑥	T	TEMPERATURE SENSOR
②	—CWS—	EXISTING CHILLED WATER SUPPLY LINE (CWS)	⑥	H	HUMIDITY SENSOR
②	—CWR—	CHILLED WATER RETURN LINE (CWR)	⑥	—#—	ELECTRIC WIRING (WITH 2 WIRES) — LOW VOLTAGE
②	—CWR—	EXISTING CHILLED WATER RETURN LINE (CWR)	⑥	120V —#—	120V POWER WIRING
②	—HWS—	HOT WATER SUPPLY LINE (HWS)	⑥	—#—	CONTROL COMMUNICATION WIRING
②	—HWS—	EXISTING HOT WATER SUPPLY LINE (HWS)	⑥	DP	DIFFERENTIAL PRESSURE
②	—HWR—	HOT WATER RETURN LINE (HWR)	⑥	T.C.C.	TEMPERATURE CONTROL CONTRACTOR
②	—HWR—	EXISTING HOT WATER RETURN LINE (HWR)	⑥	M.C.	MECHANICAL CONTRACTOR
②	—CHWS—	CHILLED HOT WATER SUPPLY	⑥	P.C.	PLUMBING CONTRACTOR
②	—CHWR—	CHILLED HOT WATER RETURN	⑥	E.C.	ELECTRICAL CONTRACTOR
②	—CHWS—	EXISTING CHILLED HOT WATER SUPPLY	⑥	G.C.	GENERAL CONTRACTOR
②	—CHWR—	EXISTING CHILLED HOT WATER RETURN	⑥	SR	SUPPLY REGISTER
②	—CD—	COOLING COIL CONDENSATE DRAIN LINE (CD)	⑥	RG	RETURN GRILLE
③		DOUBLE CHECK BACKFLOW ASSEMBLY	⑥	CH—#	CHILLER CALLOUT
③		REDUCED PRESSURE ZONE BACKFLOW ASSEMBLY	⑥	CWP	CHILLED WATER PUMP
③		GAS COCK	⑥	HWP	HOT WATER PUMP
③		VALVE IN DROP	⑥	CHWP	CHILLED/HOT WATER PUMP
③		VALVE IN RISER	⑥	CRAC	COMPUTER ROOM AIR CONDITIONING UNIT
③		GATE VALVE / SHUT OFF VALVE	① ② ⑤		ROOM CALLOUT
③		GLOBE VALVE	① ② ⑤	△	REVISION NUMBER
③		BALL VALVE	① ② ⑤	Ⓢ	CONNECT NEW TO EXISTING. VERIFY EXACT LOCATION.
③		BUTTERFLY VALVE	① ② ⑤	#	REFER TO PLAN NOTES
③		2-WAY CONTROL VALVE (PNEUMATIC)			

TYPE ① PLUMBING ⑤ DUCTWORK
② HVAC PIPING ⑥ EQUIPMENT
③ VALVE
④ PIPING ACCESSORIES

HVAC DESIGN CONDITIONS

SPACE OR AREA	OUTSIDE AIR		INDOOR HEATING °F	INDOOR COOLING °F	RELATIVE HUMIDITY %RH	MODE	NOTES
	SUMMER DB/WB	WINTER DB					
CLASSROOMS	93/75	3.5	70	76	50	OCCUP	
OFFICE	93/75	3.5	70	76	50	OCCUP	
MECH/ELEC	93/75	3.5	50	—	—	—	

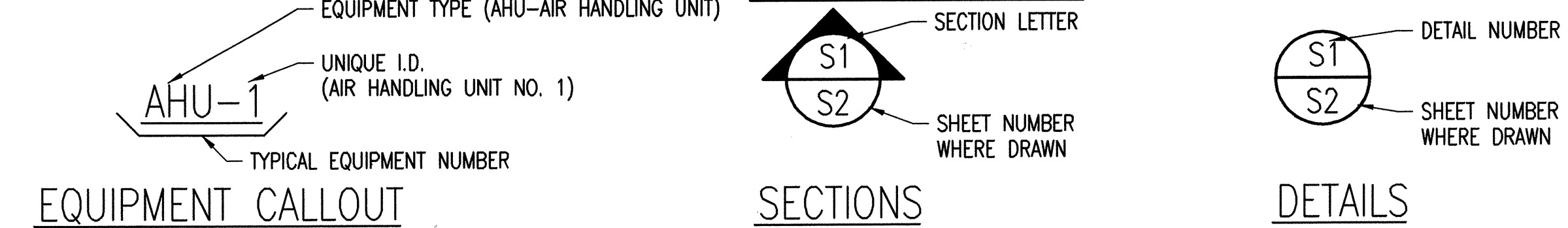
UNOCCUPIED CONDITIONS 55 HEATING, 85 COOLING

DUCT PRESSURE CLASSIFICATION

DUCT TYPE	PRESSURE CLASSIFICATION	SEAL CLASS	LEAKAGE CLASS	
			ROUND	RECT
MEDIUM VELOCITY SUPPLY (ROUND, OVAL OR RECT)	+4"WG	A	3	6
LOW VELOCITY SUPPLY (ROUND OR RECT)	+2"WG	A	6	12
EXHAUST (ROUND OR RECT)	-2"WG	A	3	6
RETURN (ROUND OR RECT)	-1"WG	C	12	24
RELIEF AIR	-1"WG	C	12	24
OUTSIDE AIR	-2"WG +3WG	A	6	12

OUTSIDE AIR DUCT UNDER POSITIVE PRESSURE SHALL BE +3"WC

DRAWING SYMBOLS



GENERAL NOTES:

- COORDINATE ALL WORK WITH OTHER TRADES PRIOR TO INSTALLATION.
- UNLESS OTHERWISE INDICATED, INSTALL ALL SPACE THERMOSTATS AND OTHER OCCUPANT ADJUSTABLE CONTROL DEVICES 48 INCHES ABOVE FINISHED FLOOR PER ADA REQUIREMENTS. COORDINATE EXACT LOCATION WITH CONSTRUCTION MANAGEMENT PRIOR TO INSTALLATION. COORDINATE LOCATIONS WITH FURNITURE/OFFICE PARTITIONS PRIOR TO INSTALLATION.
- DUCT SIZES SHOWN ARE ACTUAL INSIDE DIMENSIONS.
- MECHANICAL CONTRACTOR SHALL PROVIDE OPENING IN DUCT AND ACCESS PANEL FOR THE FIRE DAMPERS, FIRE/SMOKE DAMPERS, AND SMOKE DAMPERS.
- REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR COORDINATION OF ALL CEILING MOUNTED AIR DISTRIBUTION DEVICES.
- TEMPERATURE CONTROLS CONTRACTOR (TCC) SHALL PROVIDE AND INSTALL ALL LOW VOLTAGE WIRING AND TUBING REQUIRED FOR MECHANICAL CONTROL SYSTEM. ALL LINE VOLTAGE WIRING SHALL BE IN CONDUIT PROVIDED AND INSTALLED BY ELECTRICAL CONTRACTOR (EC). CONTROL SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH SPECIFICATIONS.
- COORDINATE ACCESS TO EQUIPMENT AND VALVES INSTALLED ABOVE 'HARD' CEILINGS AND IN MASONRY CHASES WITH GENERAL CONTRACTOR. PROVIDE LOCKING ACCESS DOORS FOR INSTALLATION BY CONTRACTOR AS REQUIRED TO SERVICE CONCEALED VALVES AND EQUIPMENT. CEILING ACCESS DOORS FOR FIRE DAMPERS, SMOKE DAMPERS AND FIRE SMOKE DAMPERS FURNISHED AND INSTALLED BY CONTRACTOR.
- WATER PIPE CONNECTIONS TO COILS SHALL BE MADE TO PROVIDE COUNTER FLOW BETWEEN WATER AND AIR.
- NO PIPING SHALL PENETRATE STRUCTURAL MEMBERS.
- A MAXIMUM LENGTH OF 6'-0" FLEX DUCT MAY BE USED AT EACH RUNOUT TO SUPPLY DIFFUSERS. FLEX DUCT SHALL NOT BE USED IN RETURN OR EXHAUST APPLICATIONS.
- COORDINATE ROUTING OF DUCTWORK AND PIPING WITH ELECTRICAL PANELS. DO NOT ROUTE OVER ELECTRICAL PANELS OR ELECTRICAL GEAR.
- ALL PENETRATIONS THROUGH FIRE RATED ASSEMBLIES SHALL BE FIRE STOPPED BY THE TRADE MAKING THE PENETRATION. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR REQUIREMENTS.
- INSTALL BALANCE DAMPER WITH LOCKING QUADRANT IN EACH RUNOUT TO SUPPLY DIFFUSER AND EXHAUST GRILLE.
- MAINTAIN MINIMUM 10'-0" CLEARANCE BETWEEN OUTSIDE AIR INTAKES AND EXHAUST/VENT TERMINATIONS.
- SEAL DUCTWORK AS CALLED OUT BELOW USING HARDCAST DT TAPE AND FTA-20 ADHESIVE SEAL TO SMACNA SEAL CLASS AS PER SPECIFICATIONS.
TYPE OF DUCT APPLY TO JOINTS
EXHAUST DUCT (ROUND OR RECT) TRANSVERSE AND LONGITUDINAL
LOW VELOCITY SUPPLY AND RETURN (RECT) TRANSVERSE AND LONGITUDINAL
LOW VELOCITY SUPPLY (ROUND) TRANSVERSE AND LONGITUDINAL
- EXISTING CONDITIONS INDICATED ARE FOR CONTRACTORS REFERENCE ONLY. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS PRIOR TO BEGINNING WORK. CONTRACTOR SHALL COORDINATE ALL WORK WITH OTHER TRADES PRIOR TO INSTALLATION.
- DUCT SIZES, HYDRONIC PIPING SIZES, AND ROUTING SHOWN ON PLANS ARE BASED ON EXISTING DRAWINGS. ACTUAL INSTALLED SIZES AND ROUTING HAVE NOT BEEN VERIFIED. CONTRACTOR SHALL FIELD VERIFY EXACT SIZES FOR CONNECTION TO EXISTING MATERIALS.
- THE DEMOLITION WORK IS INDICATED FOR THE CONTRACTOR'S REFERENCE ONLY. REMOVE ALL CONSTRUCTION, MATERIALS, FIXTURES, FINISHES, ETC. THAT ARE INDICATED WITH A DASHED LINE. THAT ARE NOTED TO BE REMOVED, THAT ARE REQUIRED TO BE REMOVED FOR NEW CONSTRUCTION, OR THAT ARE LOGICALLY REQUIRED TO BE REMOVED TO ACHIEVE THE INTENDED RESULTS. RELOCATE OR REUSE EXISTING MATERIALS OR FIXTURES, AS NOTED, INDICATED OR AS REQUIRED FOR NEW WORK. COORDINATE WITH G.C.
- MATERIALS, EQUIPMENT, FIXTURES, ETC. THAT ARE REMOVED OR DEMOLISHED DURING CONSTRUCTION, SHALL BE REMOVED OR DEMOLISHED BY THE RESPECTIVE CONTRACTOR WHO WOULD NORMALLY INSTALL THAT ITEM DURING NEW CONSTRUCTION, UNLESS OTHERWISE NOTED. BASE CIVIL ENGINEER SHALL RETAIN THE FIRST CHOICE OF ALL SO REMOVED/DEMOLISHED MATERIALS, EQUIPMENT, FIXTURES, ETC. ITEMS NOT RETAINED BY BASE CIVIL ENGINEER SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE SITE. COORDINATE ALL DEMOLITION REQUIREMENTS WITH G.C.
- BUILDING RUBBLE SHALL BE REMOVED FROM THE SITE EXPEDIENTLY AND DISPOSED OF LEGALLY AND PROPERLY. CONTRACTOR SHALL RECORD WEIGHT AND LOCATION OF DUMP AND TURN OVER REPORT TO COTR.
- PATCH AND REPAIR EXISTING MATERIALS AS REQUIRED WHERE NEW CONSTRUCTION ADJUTS EXISTING SURFACES AND AT EXISTING MATERIALS AND FINISHES ADJACENT TO DEMOLITION WORK. EXTEND NEW OR EXISTING FINISHES AS REQUIRED AT SURFACES EXPOSED BY DEMOLITION WORK.
- PROTECT EXISTING FINISHES, MATERIALS, EQUIPMENT, ETC. AS REQUIRED AND REPAIR OR REPLACE ANY THAT ARE DAMAGED AS DIRECTED BY AND TO THE SATISFACTION OF COTR AND ENG./ARCH.
- PROVIDE MISCELLANEOUS CUTTING, PATCHING AND REPAIRING OF FINISHES, ROOF, WALLS, ETC., AS REQUIRED TO ACCOMMODATE THE NEW WORK.
- ALL CONTROL DAMPERS SHALL BE PROVIDED AND INSTALLED BY THE MC. MOTOR OPERATORS SHALL BE PROVIDED AND INSTALLED BY THE TCC.
- EQUIPMENT, PIPE AND DUCT, HANGERS AND SUPPORTS SHALL BE IN CONFORMANCE WITH SPECIFICATIONS, ATTACHMENTS SHALL BE TO STRUCTURE ONLY. DO NOT ATTACH TO ROOF DECK. PROVIDE AUXILIARY STEEL AS REQUIRED.

SEQUENCE OF OPERATION: AIR HANDLER, AHU-1

OCCUPIED MODE:

Upon entering the occupied mode, VAV shutoff box VR-18 is open and the supply ramp to specified speed (see supply fan operation sequences). For a dead start the VFD ramp time is 30 seconds and is configured on the VFD.

UNOCCUPIED MODE:

VAV shutoff box VR-18 is closed. VAV terminal unit room temperature sensors reset to unoccupied setpoints of 55 degree heating and 85 degrees cooling. Upon request from any zone sensor, occupied setpoints for that zone is restored to control occupied heating and cooling setpoints. In the event that any VAV terminal override button is pressed, unit operation is restored for a predetermined 1 to 2 hours of occupied operation, ventilation from outside air is enabled.

SUPPLY FAN CONTROL:

Once enabled, supply fan VFD modulates to maintain duct static pressure setpoint. Default static pressure setpoint shall be 1.0" WC (adjustable). Coordinate duct static pressure setpoint with TAB contractor. Supply fan VFD minimum speed is 25 HZ (adjustable). Periodically (15 minutes) unit controller surveys VAV terminal damper positions associated with air handler. If survey indicates maximum damper position was found to be less than 90% position, then unit static pressure setpoint is decreased by 0.05" of static pressure. If survey indicates maximum damper position was found to be 100% position, then unit static pressure setpoint is increased by 0.05" of static pressure. If excessive pressure is detected at the unit, high limit pressure switch disables unit. This condition must be manually reset.

VENTILATION CONTROL:

During the occupied hours, ventilation shutoff box VR-18 modulates maintain scheduled minimum ventilation rate setpoint (adj.) as determined by integral air flow measuring device, regardless of supply fan speed. Any time AHU-1 is in the occupied mode and VR-18 operation is requested, a call for ERV-1 is sent. During unoccupied hours, ventilation shutoff box VR-18 is closed. During occupied mode when sum of DDV box vent total drops below minimum setting, VR-18 will modulate to maintain min positive bldg pressure, see M503.

DISCHARGE AIR TEMPERATURE CONTROL:

Heating and cooling control valves operate in sequence in order to control discharge air temperature setpoint 52°F (adjustable). When discharge temperature is far above setpoint, unit control valve is open and heating valve is closed. As discharge temperature falls to within the control range of the temperature sensor, the chilled water valve modulates to maintain discharge setpoint. When discharge temperature is below setpoint for a period of 15 minutes and heating water is available (secondary circulating pumps energized), then heating control valve is enabled to operate. Once enabled, heating water valve modulates to maintain discharge air temperature setpoint.

LOW TEMPERATURE CONDITION:

In the event that the discharge temperature falls below 38°F as seen by an averaging low limit serpentine type thermostat located on the discharge of the supply duct, an alarm will be sent to the DDC workstation.

WARM-UP CYCLE:

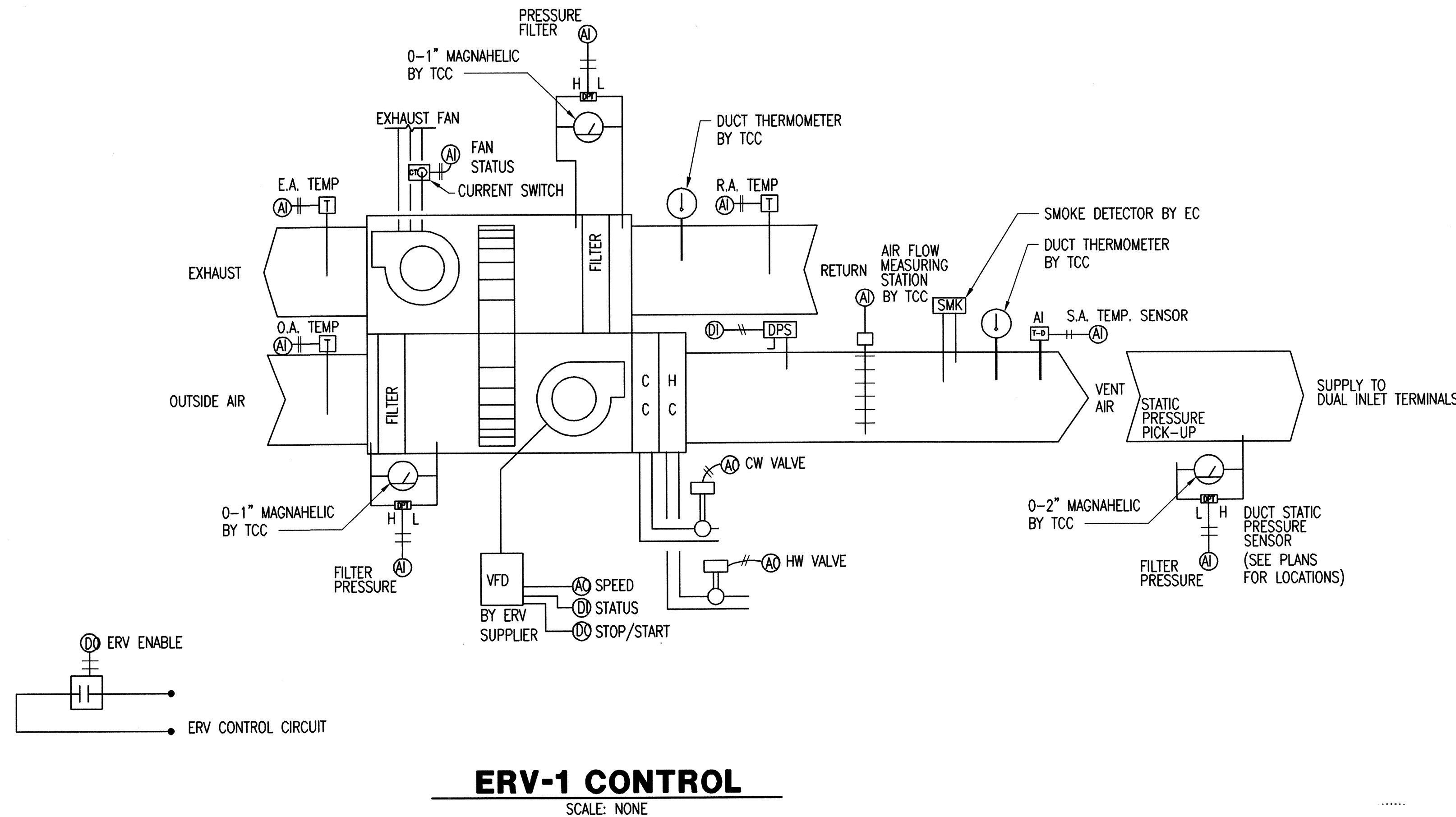
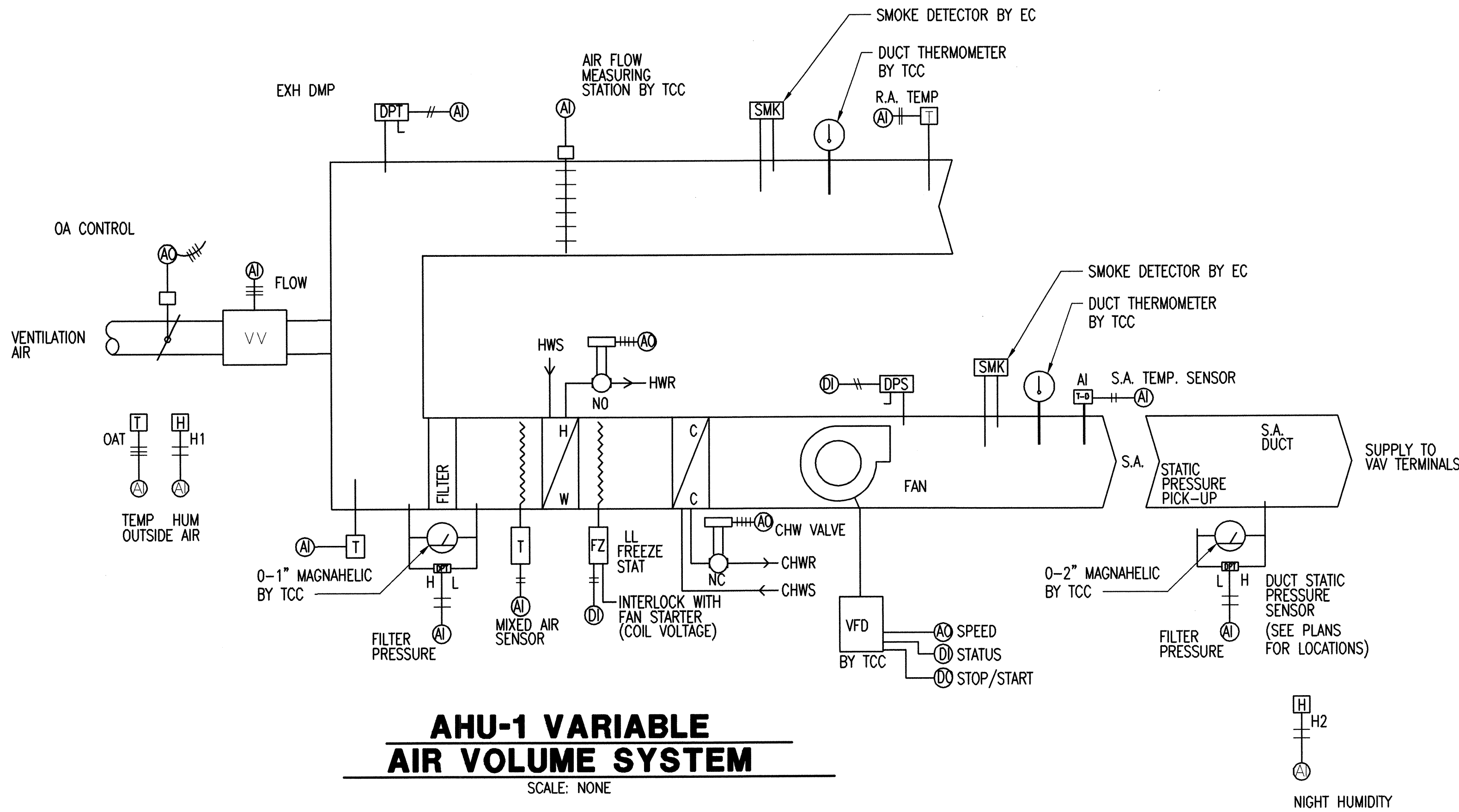
If upon entering the occupied mode, the return air temperature is below an operator definable limit (65°F), then a "warm-up cycle" shall initiate. The warm-up cycle shall heat normally with ventilation VAV shutoff box VR-18 closed. When return air temperature achieves the warmup setpoint of 70°F (adj.), the warmup cycle is terminated and normal occupied ventilation resumes. Once the warmup cycle occurs, it cannot occur again until the next occupied period.

FILTER PRESSURE MONITORING:

A differential pressure transmitter shall monitor the unit pre-filters. When there is excessive pressure drop, indicating filters need to be changed, an alarm is sent to the operator's workstation. Dirty pre-filter setpoint is 0.4" W.C. (adj.).

FAN MONITORING:

When fan is turned on, the fan status shall be determined by means of fan amp monitoring on supply fan. After an operator adjustable feedback time delay, if there is no proof of flow, an alarm shall be generated. Conversely, if proof of flow is detected while fan is turned off, a separate alarm shall be generated indicating hand operation of fans.



SEQUENCE OF OPERATION: HRU-1

OCCUPIED MODE:

During the occupied mode, as determined by time-of-day scheduling, the packaged energy recovery unit shall be enabled to operate continuously and supply and exhaust dampers are driven open through integral HRU controls. When enabled, unit supply and exhaust fan's are enabled to run continuously and heat recovery wheel is enabled to rotate through unit interlock.

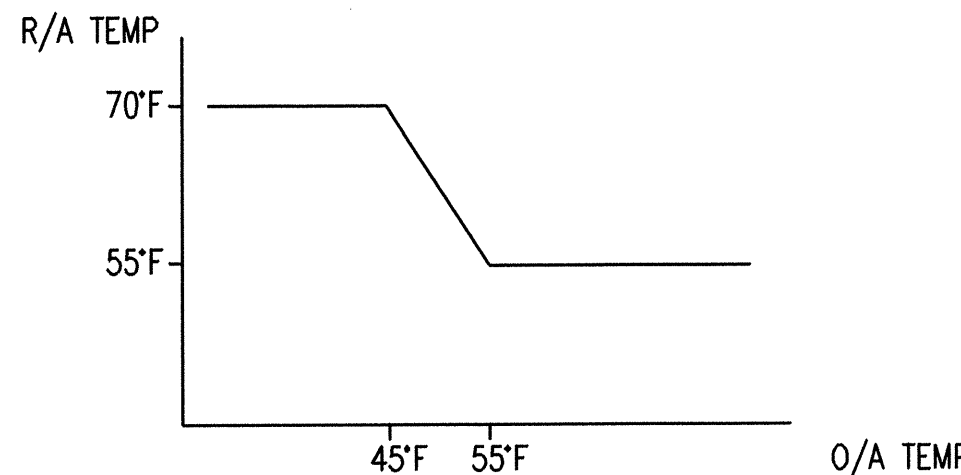
Above 30 degrees F outside temperature (adjustable), defrost capacities are locked out. Below 25 degrees outside air, defrost capacities are enabled. When differential pressure, as seen by packaged pressure sensor integral to the ERV pressure located across the wheel rises above differential setpoint value the wheel is stopped for a pre-determined amount of time.

SUPPLY FAN CAPACITY CONTROL:

Once enabled, supply fan VFD modulates to maintain duct static pressure setpoint. Default static pressure setpoint shall be 1.0" WC (adjustable). Coordinate duct static pressure setpoint with TAB contractor. Supply fan VFD minimum speed is 25 HZ (adjustable). Periodically (15 minutes) unit controller surveys VAV terminal damper positions associated with air handler. If survey indicates maximum damper position was found to be less than 90% position, then unit static pressure setpoint is decreased by 0.05" of static pressure. If survey indicates maximum damper position was found to be 100% position, then unit static pressure setpoint is increased by 0.05" of static pressure. If excessive pressure is detected at the unit, high limit pressure switch disables unit. This condition must be manually reset.

DISCHARGE AIR TEMPERATURE CONTROL:

Heating and cooling control valves operate in sequence in order to control discharge air temperature setpoint. When discharge temperature is far above setpoint, unit control valve is open and heating valve is closed. As discharge temperature falls to within the control range of the temperature sensor, the chilled water valve modulates to maintain discharge setpoint. When discharge temperature is below setpoint for a period of 15 minutes and heating water is available (secondary circulating pumps energized), then heating control valve is enabled to operate. Once enabled, heating water valve modulates to maintain discharge air temperature setpoint. Discharge air temperature is reset per the following schedule.



UNOCCUPIED, WARMUP AND COOLDOWN MODES:

During the occupied mode, as determined by time-of-day scheduling, the packaged energy recovery unit shall be disabled and both supply and exhaust dampers are driven closed. Electric heat is de-energized anytime unit is disabled.

Alarm Modes:

LOW TEMPERATURE CONDITION:

In the event that the discharge temperature falls below 38°F as seen by a low limit serpentine type thermostat located on the discharge of the heating and cooling water coils, the unit supply fan and exhaust fans are both is disabled, and heating and chilled water control valves are positioned for full flow through the coil. The condition will cause a message to be sent to the operators workstation and a request to the chiller plant asking for a secondary pump to be enabled for water circulation. This condition shall be manually reset at the unit location. This condition shall be manually reset at unit location.

FILTER PRESSURE MONITORING:

A differential pressure transmitter shall monitor the unit pre-filters. When there is excessive pressure drop, indicating filters need to be changed, an alarm is sent to the operator's workstation. Dirty pre-filter setpoint is 0.4" W.C. (adj.).

FAN MONITORING:

When supply and exhaust fans are turned on, the fan status shall be determined by means of fan amp monitoring on both fans. After an operator adjustable feedback time delay, if there is no proof of flow, an alarm shall be generated. Conversely, if proof of flow is detected while fan is turned off, a separate alarm shall be generated indicating hand operation of fans.

In the event that fan HRU has been enabled for a period of 60 seconds, and either supply or exhaust fan fails to prove operation via current operated switch, the unit is disabled, both supply and exhaust dampers are closed and an alarm message is sent to the operators workstation. This condition may only be reset from the graphic display.

In the event that the HRU has been enabled for a period of 60 seconds, and either supply or exhaust dampers fail to prove operation via damper end switch. The unit is disabled, both dampers are closed and an alarm message is sent to the operators workstation. This condition may only be manually reset from the graphic display.

In the event that supply air temperature falls below 45 degrees F (adjustable), an alarm message "low ERV temp" shall be sent to the operators workstation. Upon further drop in supply air temperature below 38 degrees F, the unit shall be de-energized and an alarm message "low HRU temp shutdown" shall be sent to the operators workstation. This condition may only be manually reset from the graphic display.

Unit supply and return fans accumulated run-time in hours shall be summed and alarmed when manufacturer's recommended maintenance period has elapsed. An alarm indicating "routine ERV maintenance" shall be sent to the operator's workstation. Alarm shall report only once and shall be reset manually at the operator's workstation.

SHEET
NUMBER:

MI601

SEQUENCE OF OPERATION: - Dual Inlet VAV Box

OCCUPIED MODE:

In the occupied mode, as determined time-of-day scheduling, Unit fan runs continuously and ventilation air damper modulates to maintain ventilation airflow setpoint. Upon entering the occupied mode, both the ventilation air damper and primary air dampers are driven closed for the auto zero duration time to ensure that the dampers are closed. The dampers are then calibrated to indicate it is in the closed position.

VENTILATION RATE RESET:

Minimum ventilation rate setpoint is reset based on CO2 concentration setpoint. CO2 concentration setpoint shall be 800 PPM for office space (ie: return air CO2 concentration) and 1100 PPM for conference room CO2 concentration. At CO2 concentration setpoint or higher, minimum ventilation rate setpoint shall equal scheduled value. At 400 PPM or lower (O/A concentration), minimum vent setpoint may be reset to 66% of scheduled value. Between 400 PPM and CO2 setpoint (800 or 1100 PPM), unit minimum vent shall be reset from 66% to 100% of scheduled value. Anytime supply fan loses proof of flow for more than 30 seconds (adj.) minimum outside air, outside air, return and relief dampers return to their normal positions. In the event that minimum ventilation airflow rate falls 15% below or rises 15% (adj) above the desired airflow rate, an alarm is sent to the operator's workstation. In the event that CO2 concentration rises 10% above the desired setpoint in any location, the an alarm is sent to the operator's workstation.

COOL MODE:

When room temperature is above the control range of the room sensor, the primary airflow setpoint is at scheduled maximum cooling CFM. As room temperature falls to within the control range of the room sensor, the primary airflow setpoint varies between scheduled maximum cooling primary airflow and zero airflow in order to maintain room temperature setpoint. In order to avoid instability, airflow control loop will position damper closed as flow setpoint approaches zero airflow. In the cool mode, the heating valve is closed.

HEAT MODE:

When room temperature is below the control range of the room sensor, the primary airflow setpoint is at scheduled heating CFM and heating valve is open to flow through the reheat coil. As room temperature rises to within the control range of the room sensor, the heating valve modulates in order to maintain room temperature setpoint.

HEAT/COOL SWITCHOVER:

While in the heating mode, if room temperature rises above the room control setpoint by 2 degrees for a period of 10 minutes (adjustable), the unit switches from heating to cooling. While in the cooling mode, if room temperature falls below the room control setpoint by 2 degrees for a period of 10 minutes (adjustable), the unit switches from cooling to heating.

SETPOINT DIAL LIMITS:

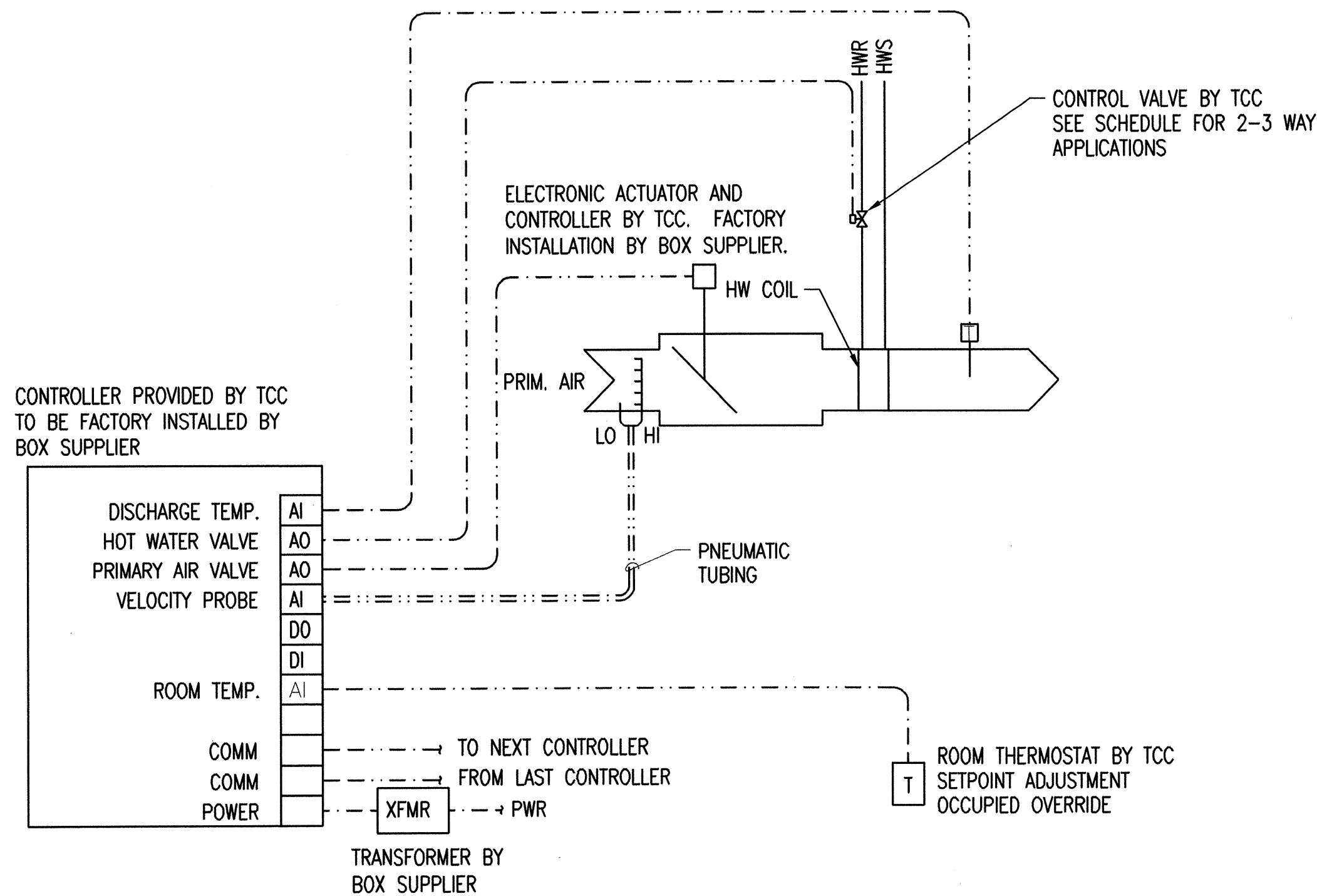
In the cool mode, local room setpoint control shall be limited to a range of 76°F to 80°F (adjustable). In the heating mode, local room setpoint control shall be limited to a range of 65°F to 70°F (adjustable).

UNOCCUPIED MODE HEATING:

Primary air valve is closed. Unit heating valve attempts to modulates to maintain unoccupied heating setpoint. As heating valve opens, unit fan cycles on. Once energized, minimum run time is 5 minutes (adjustable). Occupied mode may be restored for a predetermined amount of time be pressing the "on" button on the local room sensor.

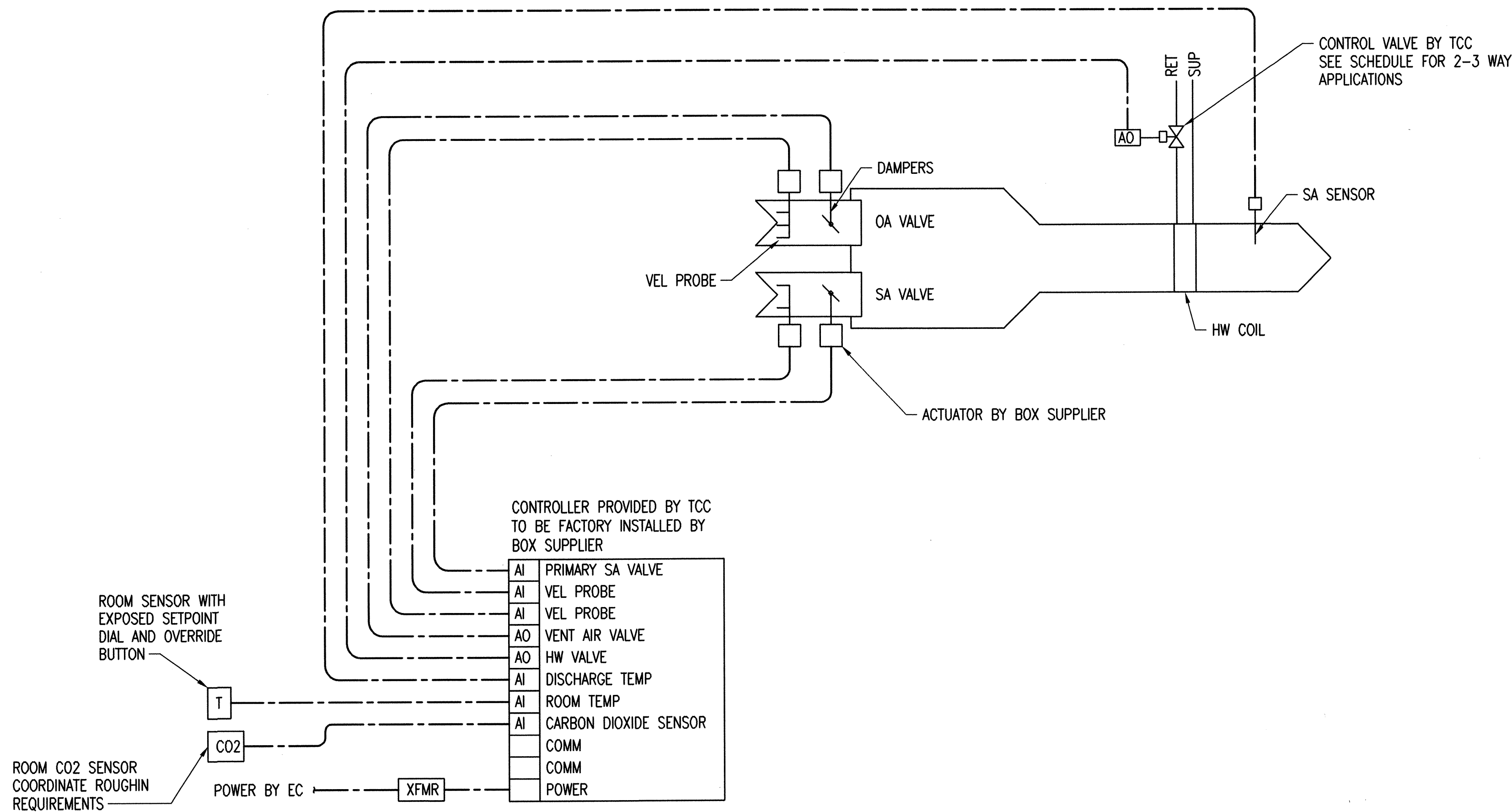
UNOCCUPIED MODE COOLING:

Heating valve is closed. On a call for cooling, unit fan is energized and primary air damper opens as necessary to deliver minimum cooling air flow setpoint. A request for supply air is sent to the air handling unit. Unit fan minimum run time is 5 minutes (adjustable). Occupied mode may be restored for a predetermined amount of time be pressing the "on" button on the local room sensor.



**VAV BOX-CONTROL
W/HOT WATER REHEAT**

SCALE: NONE



DUAL INLET VAV BOX

SCALE: NONE

SEQUENCE OF OPERATION: - VAV Reheat Box

OCCUPIED MODE:

In the occupied mode, as determined time-of-day scheduling, Unit fan runs continuously and primary air damper modulates to maintain primary airflow setpoint. Upon entering the occupied mode, the primary air damper is driven closed for the auto zero duration time to ensure that the damper is closed. The damper is then calibrated to indicate it is in the closed position.

COOL MODE:

When room temperature is above the control range of the room sensor, the primary airflow setpoint is at scheduled maximum cooling CFM. As room temperature falls to within the control range of the room sensor, the primary airflow setpoint varies between scheduled maximum cooling primary airflow and minimum cooling primary airflow in order to maintain room temperature setpoint. In the cool mode, the heating valve is closed.

HEAT MODE:

When room temperature is below the control range of the room sensor, the primary airflow setpoint is at scheduled heating CFM and heating valve is open to flow through the reheat coil. As room temperature rises to within the control range of the room sensor, the heating valve modulates in order to maintain room temperature setpoint. If the heating valve is open and additional heating is required, primary airflow setpoint increases to the heating flow maximum setpoint.

HEAT/COOL SWITCHOVER:

While in the heating mode, if room temperature rises above the room control setpoint by 2 degrees for a period of 10 minutes (adjustable), the unit switches from heating to cooling. While in the cooling mode, if room temperature falls below the room control setpoint by 2 degrees for a period of 10 minutes (adjustable), the unit switches from cooling to heating.

SETPOINT DIAL LIMITS:

In the cool mode, local room setpoint control shall be limited to a range of 76°F to 80°F (adjustable). In the heating mode, local room setpoint control shall be limited to a range of 65°F to 70°F (adjustable).

UNOCCUPIED MODE HEATING:

Primary air valve is closed and heating valve is closed. Occupied mode may be restored for a predetermined amount of time be pressing the "on" button on the local room sensor.

UNOCCUPIED MODE COOLING:

Heating valve is closed. On a call for cooling, primary air damper opens as necessary to deliver minimum cooling air flow setpoint. A request for supply air is sent to the air handling unit. Occupied mode may be restored for a predetermined amount of time be pressing the "on" button on the local room sensor.

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SEQUENCE OF OPERATION: Hydronic Heating Hot Water System

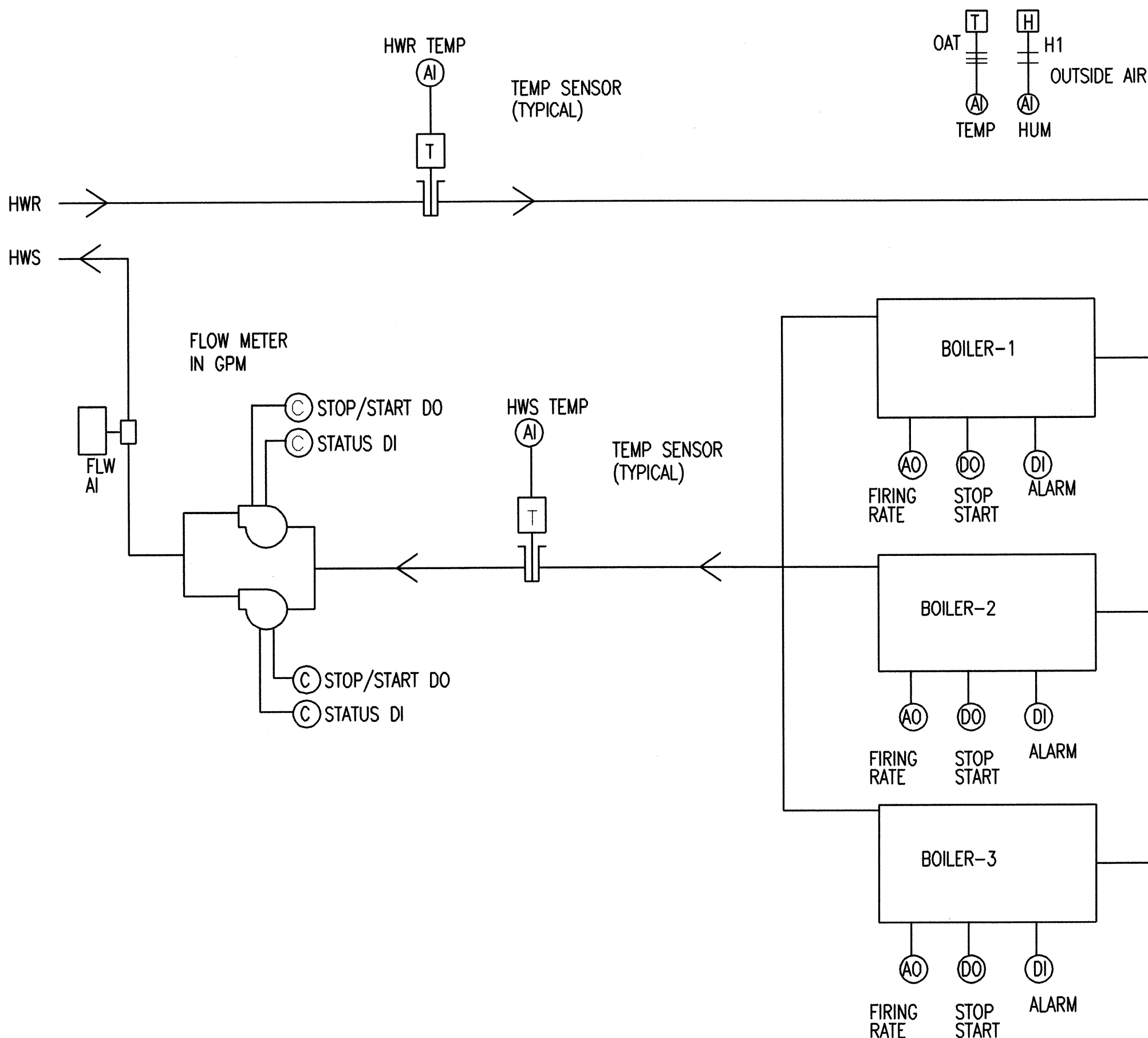
System Enable and loop enable:
(1) This system shall monitor the enabled status of all systems served by this system. If one or more systems served by this system are enabled, this system shall be enabled. If all systems served by this system are not enabled, this system shall not be enabled. When this system is enabled and the hot water pump operation is proofed on, the boiler control and hot water temperature control loops shall be enabled.

Boiler Staging:
When this loop is active lead boiler is enabled and associated pump is energized. DDC hardware modulates firing rate output to maintain heating water supply temp (HWS-T) at setpoint (HWS-T-SP). When heating water supply temperature falls 10 °F below supply setpoint for a period of ten minutes (adj.) 1st lag boiler and associated pump is enabled. Firing rate for lead boiler and first lag boiler operate in parallel to control heating water supply setpoint. When both lead boiler and 1st lag boiler are at 100% firing rate and additional heat is required, 2nd lag boiler and additional pump is enabled. Once enabled, all three boilers operate in modulated together (in parallel) to maintain heating water supply temperature.

When heating water return temperature (HWR-T) rises to within 10 degrees of heating water supply temperature (HWS-T) for a period of 20 minutes (adj.), then lag boiler and associated pump may be disabled.

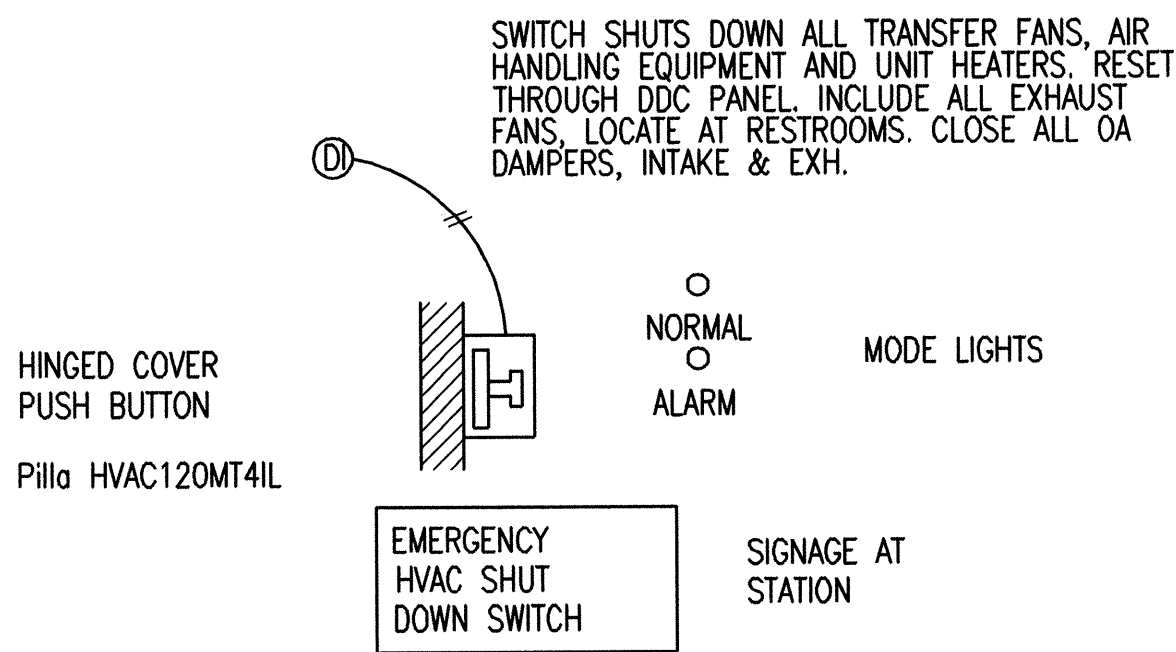
Hot Water Temperature Control:
When this loop is enabled the DDC Hardware shall modulate the firing rate to maintain hot water supply temperature (HWS-T) at setpoint (HWS-T-SP). The Hot Water Supply Temperature Setpoint (HWS-T-SP) shall be [determined from a linear reset schedule as shown. When this loop is disabled, the output shall be zero.

Pump Staging:
Lead psecondary pump runs when loop is active. In the event that the lead pump fails to prove operation via status indication then lag pump is energized. Lead pump is periodically rotated based on time scheduling.



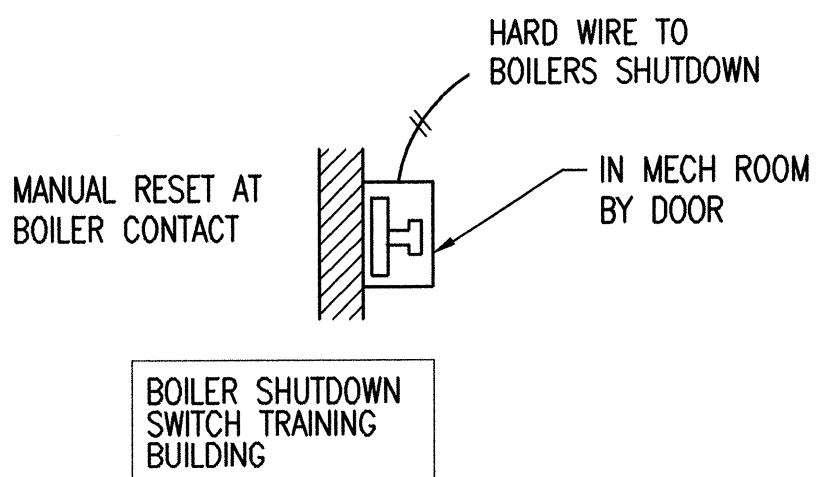
HOT WATER SYSTEM

SCALE: NONE



HVAC SHUTDOWN SWITCH

SCALE: NONE



BOILER SHUTDOWN SWITCH

SCALE: NONE

SEQUENCE OF OPERATION: Chilled Water Hydronic

Occupied Mode:

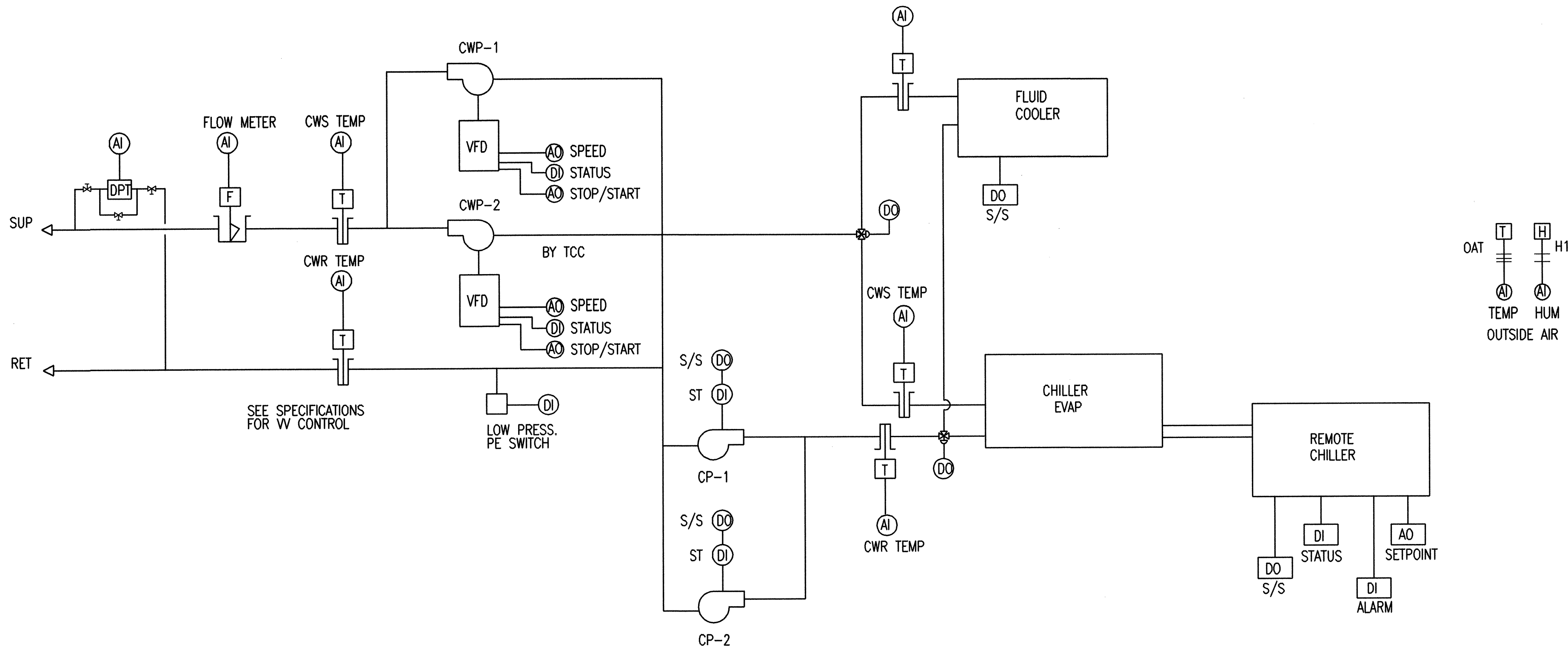
Above 50°F outside air temperature, primary chilled water pumps, CP-1 and CP-2 are enabled to operate in a primary / standby fashion. Secondary chilled water pumps, CWP-1 and CWP-2, are also enabled to operate in a primary / standby fashion. Upon proof of flow, as determined by current operated switch, chiller is enabled for operation. After integral chiller flow switch is made, chiller operates to maintain chilled water setpoint via packaged unit controls. DDC modulates pump speed through variable frequency (VFD) drive to maintain system differential pressure setpoint. differential pressure setpoint is 22 psi (adj.). Differential pressure setpoint must be coordinated with TAB contractor. VFD shall incorporate a 30 second ramp time.

Unoccupied Mode:

Chiller, fluid cooler and associated pumps are disabled.

Economizer Operation:

Below 40°F outside air temperature, chillers are disabled. Primary chilled water pump(s) continue to run for a period of 15 minutes after chiller is off. After time delay, pumps are disabled while valves are positioned for flow through fluid cooler. Fluid cooler is then enabled to operate on integral thermostat control.

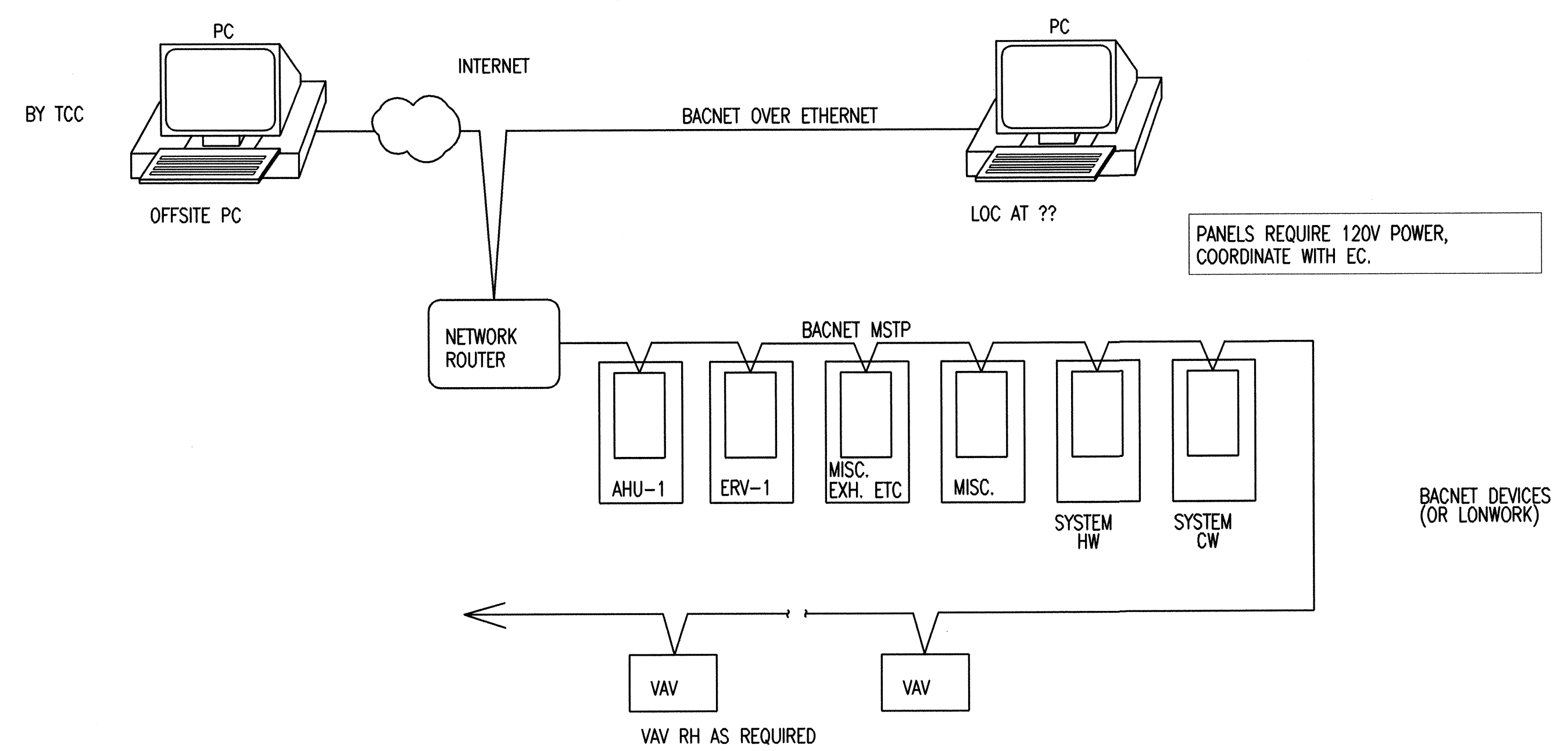


CHILLED WATER SYSTEM

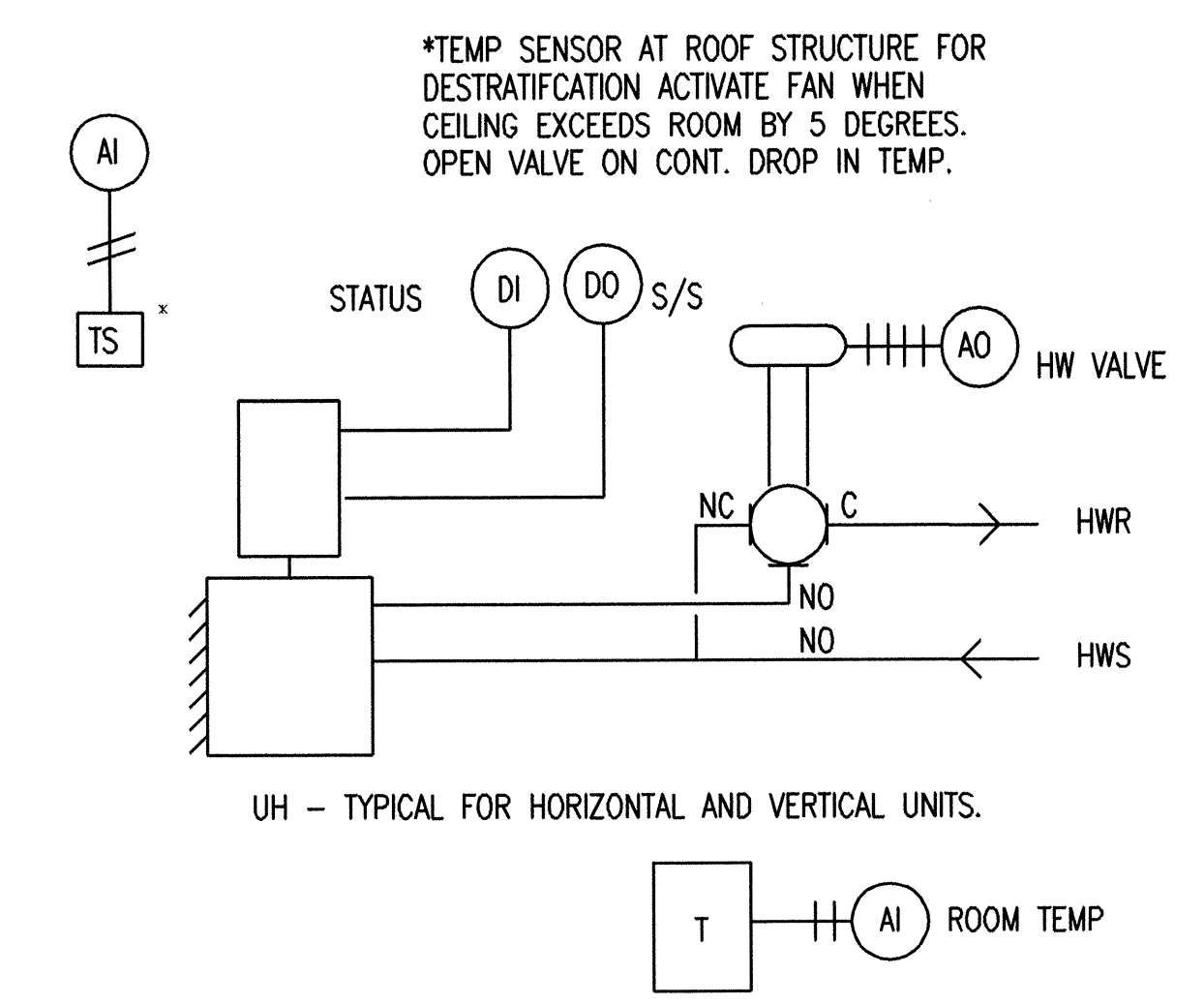
SCALE: NONE

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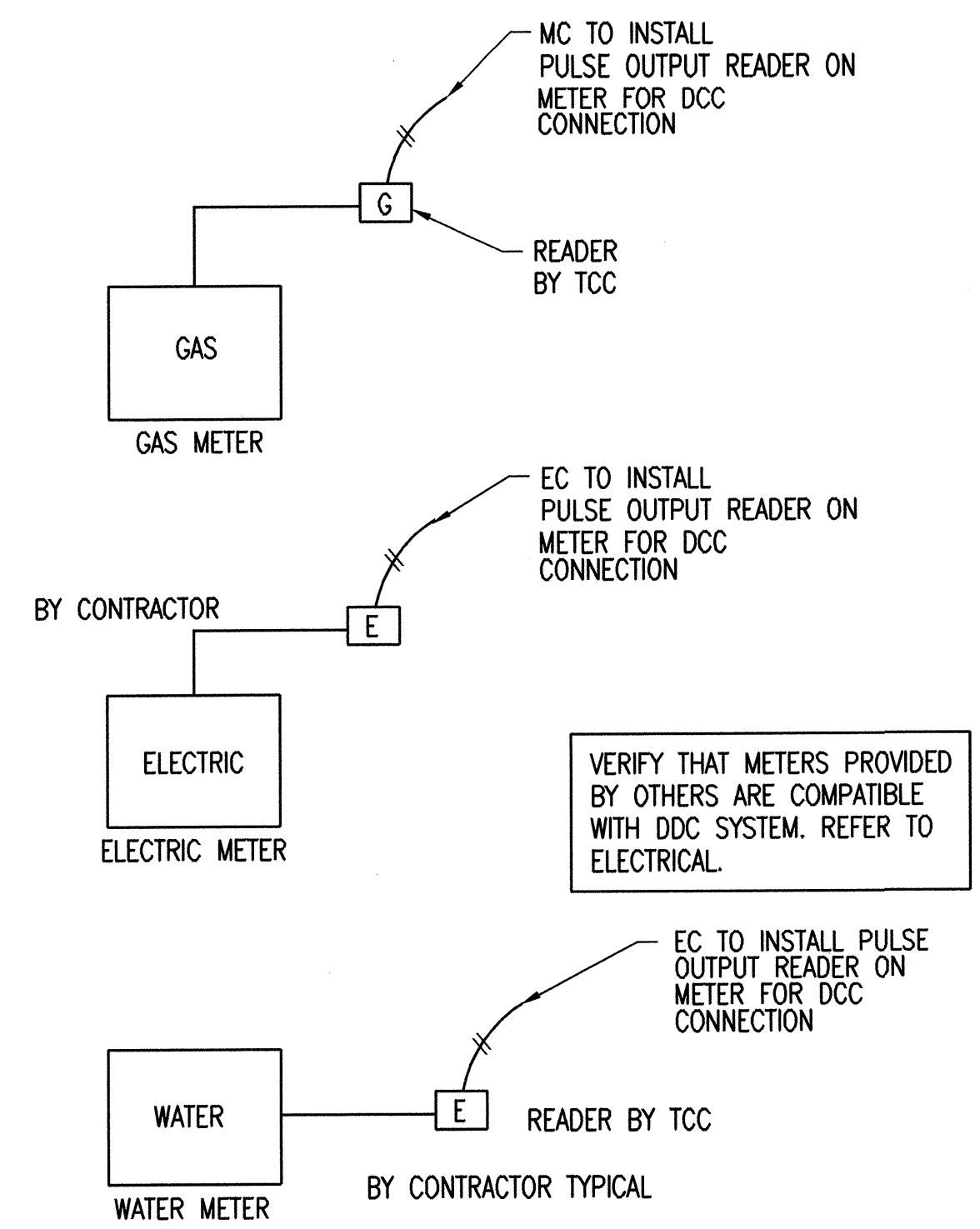
12 11 10 9 8 7 6 5 4 3 2 1



LOCAL AREA NETWORK DETAIL
SCALE: NONE



UNIT HEATER CONTROL
SCALE: NONE



UTILITY MONITORING
SCALE: NONE