

### ABBREVIATIONS LEGEND

AC	AIR CONDITIONING UNIT	EH	EXPANSION TANK	FW	PUMPED FEED WATER
ACC	AIR COOLED CONDENSER	EW	ELECTRIC UNIT HEATER	FW	PROFPLEM GLYCOOL-WATER SOLUTION
ACCU	AIR COOLER CONDENSING UNIT	EW	EMERGENCY WATER COOLER	PH	POWER OPERATED, OPPOSED BLADE DAMPER
ACRU	AIR COOLED RECIPROCATING CHILLER UNIT	EX	EXISTING	PH	POWER OPERATED, PARALLEL BLADE DAMPER
AD	ADSORPTION CHILLER UNIT	FC	FLEXIBLE CONNECTION	PRV	PRESSURE REDUCING VALVE
AD	ACCESS DOOR	FCU	FAN COIL UNIT	RCU	RETURN AIR RECIPROCATING CHILLER UNIT
AF	AFTER FILTER	FD	FORWARD CURVED FAN	RH	REHEAT COIL
AFV	AIR FLOW CONTROL VALVE	FDR	FIRE DAMPER	RV	RELATIVE HUMIDITY POWER TYPE ROOF VENTILATOR
AFW	AIR FLOW MEASURING DEVICE	FS	FACTORY FABRICATED FAN SECTION	SA	SOUND ATTENUATING UNIT
AG	AIR GRILLE	FT	FAN TUBE INSULATION	SC	SMOKE CONTROL DAMPER
AP	ACCESS PANEL	GH	GRAVITY HOOD	SCR	SILICON CONTROLLED RECTIFIER DAMPER
AP	BACKWARD INCLINED WHEEL	HE	HEATING COIL	SG	SPECIFIC GRAVITY
BB	BOTTOM REGISTER (WALL TYPE)	HE	HEAT EXCHANGER	SH	STEAM HAMMOCK
BR	BOTTOM REGISTER (WALL TYPE)	HE	HEAT EXCHANGER	SP	HEATING AND VENTILATING UNIT
C	CONVERTER	HF	HEPA FILTER	SP	STATIC PRESSURE SENSOR
CC	CEILING COOLER	HP	HORSEPOWER	ST	TOP REGISTER (WALL TYPE)
CCF	CENTRIFUGAL CEILING FAN	HPS	HIGH PRESSURE STEAM	TR	TRIP UNIT (WALL TYPE)
CCF	CENTRIFUGAL OR HELICAL ROTARY SCREW CHILLER UNIT	HPS	HIGH PRESSURE STEAM	TRU	TRIP UNIT (WALL TYPE)
CD	CEILING DIFFUSER	HSP	HYDROSTATIC CEILING PANEL	U	UNIT
CE	CEILING EXHAUST	HV	HEATING AND VENTILATING UNIT	UH	UNIT HEATER
CE	CEILING GRILLE	ICF	IN-LINE CONDENSING FAN	UV	ULTRAVIOLET POWER TYPE ROOF VENTILATOR
CE	CLEAN OUT	IEF	INDUSTRIAL EXHAUST FAN	V	VALVE
COMP	COMPRESSOR	IF	INTEGRAL FAN AND BYPASS	VAF	VANE AXIAL FAN
CONV.	CONVECTOR	IW	INDUCTION UNIT	VCC	VOLUME CONTROL CENTER
CP	CONDENSATE PUMP	L	LOCAL	VD	VOLUME DAMPER (MANUAL OPPOSED BLADE)
CR	CEILING REGISTER	L	LOCAL	VE	VOLUME EXTRACTOR
CU	CONDENSING UNIT	L	LOCAL	VFD	VARIABLE FREQUENCY DRIVE
CUH	CABINET UNIT HEATER	L	LOCAL	V1	VIBRATION ISOLATOR
D	DRY BULB TEMPERATURE	L	LOCAL	V2	VARIABLE FREQUENCY VALVES
DB	DECELS	L	LOCAL	V3	VARIABLE FREQUENCY VALVES
DB	DISCHARGE DAMPERS	L	LOCAL	V4	VARIABLE FREQUENCY VALVES
DE	DEWPOINT TEMPERATURE	L	LOCAL	V5	VARIABLE FREQUENCY VALVES
DE	DIRECT EXPANSION UNIT	L	LOCAL	V6	VARIABLE FREQUENCY VALVES
E/A	EXHAUST AIR	L	LOCAL	V7	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V8	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V9	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V10	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V11	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V12	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V13	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V14	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V15	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V16	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V17	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V18	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V19	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V20	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V21	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V22	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V23	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V24	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V25	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V26	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V27	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V28	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V29	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V30	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V31	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V32	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V33	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V34	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V35	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V36	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V37	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V38	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V39	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V40	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V41	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V42	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V43	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V44	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V45	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V46	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V47	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V48	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V49	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V50	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V51	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V52	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V53	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V54	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V55	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V56	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V57	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V58	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V59	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V60	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V61	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V62	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V63	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V64	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V65	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V66	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V67	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V68	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V69	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V70	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V71	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V72	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V73	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V74	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V75	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V76	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V77	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V78	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V79	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V80	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V81	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V82	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V83	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V84	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V85	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V86	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V87	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V88	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V89	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V90	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V91	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V92	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V93	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V94	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V95	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V96	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V97	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V98	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V99	VARIABLE FREQUENCY VALVES
E	ENGINEERING CONTROL CENTER	L	LOCAL	V100	VARIABLE FREQUENCY VALVES

### MECHANICAL SYMBOLS & ABBREVIATIONS LEGEND

PIPING SYMBOLS		DRAWING SYMBOLS	
<p><b>HEATING</b></p> <p>--- HPS --- HIGH PRESSURE STEAM (60 PSIG &amp; ABOVE)</p> <p>--- HHR --- HIGH PRESSURE STEAM CONDENSATE RETURN</p> <p>--- LPS --- LOW PRESSURE STEAM (15 PSIG &amp; BELOW)</p> <p>--- LPR --- LOW PRESSURE STEAM CONDENSATE RETURN</p> <p>--- MPS --- MEDIUM PRESSURE STEAM (16 PSIG THRU 59 PSIG)</p> <p>--- MPR --- MEDIUM PRESSURE STEAM CONDENSATE RETURN</p> <p>--- CPD --- CONDENSATE PUMP DISCHARGE</p> <p>--- HWH --- HOT WATER HEATING SUPPLY</p> <p>--- HWHR --- HOT WATER HEATING RETURN</p> <p>--- DHS --- HOT GLYCOOL-WATER HEATING SUPPLY</p> <p>--- GHR --- HOT GLYCOOL-WATER HEATING RETURN</p> <p>--- V --- VENT LINE</p> <p><b>AIR CONDITIONING</b></p> <p>--- RL --- REFRIGERANT LIQUID</p> <p>--- RS --- REFRIGERANT SUCTON</p> <p>--- RHG --- REFRIGERANT HOT GAS</p> <p>--- CWIT --- CONDENSER WATER TO TOWER</p> <p>--- CH --- CHILLED WATER SUPPLY</p> <p>--- CHR --- CHILLED WATER RETURN</p> <p>--- GCS --- CHILLED GLYCOOL-WATER SUPPLY</p> <p>--- GCR --- CHILLED GLYCOOL-WATER RETURN</p> <p>--- GC --- MAKE-UP WATER</p> <p>--- D --- DRAIN LINE</p> <p><b>GENERAL</b></p> <p>--- DIRECTION OF PIPE PITCH (DOWN)</p> <p>--- DIRECTION OF FLOW</p> <p>--- ANCHOR</p> <p>--- REDUCER OR INCREASER</p> <p>--- ECCENTRIC REDUCER</p> <p>--- TOP CONNECTION, 45° OR 90°</p> <p>--- BOTTOM CONNECTION, 45° OR 90°</p> <p>--- SIDE CONNECTION</p> <p>--- CAPPED CONNECTION</p> <p>--- RISE OR DROP IN PIPE</p> <p>--- UNION</p> <p>--- POINT OF CONNECTION BETWEEN NEW AND EXISTING WORK</p> <p>--- INVERTED BUCKET TRAP SET INCLUDING PIPING ACCESSORIES (SEE STD. DETAIL)</p> <p>--- FLOAT &amp; THERMOSTATIC TRAP SET INCLUDING PIPING ACCESSORIES (SEE STD. DETAIL)</p> <p>--- STRAINER</p> <p>--- THERMOMETER</p> <p>--- PRESSURE GAUGE</p> <p>--- WATER FLOW MEASURING DEVICE</p> <p>--- WATER FLOW MEASURING DEVICE</p> <p>--- NATURAL GAS</p> <p>--- COMPRESSED AIR</p> <p><b>VALVES SYMBOLS</b></p> <p>--- GATE VALVE</p> <p>--- GLOBE VALVE</p> <p>--- GATE VALVE w/ 3/4" HOSE ADAPTOR</p> <p>--- CHECK VALVE</p> <p>--- ANGLE GLOBE VALVE</p> <p>--- BUTTERFLY VALVE</p> <p>--- BALL VALVE</p> <p>--- BALANCING COCK</p> <p>--- STRAIGHT-THRU MODULATING CONTROL VALVE</p> <p>--- THREE-WAY MODULATING CONTROL VALVE</p> <p>--- SAFETY OR PRESSURE RELIEF VALVE</p> <p>--- PRESSURE REDUCING VALVE</p> <p>--- MANUAL AIR VENT</p> <p>--- TEST PLUG (PRESSURE/TEMPERATURE)</p> <p><b>FIRE RATING LEGEND</b></p> <p>--- 1 HR FIRE RATED</p> <p>--- 2 HR FIRE RATED</p> <p>--- COMBINED 1 HR RATED &amp; SMOKE BARRIER</p> <p>--- COMBINED 2 HR RATED &amp; SMOKE BARRIER</p> <p>--- SMOKE BARRIER</p> <p><b>DOMESTIC WATER</b></p> <p>--- COLD WATER</p> <p>--- HOT WATER</p> <p>--- RECIRCULATING HOT WATER</p> <p>--- SANITARY VENT</p> <p>--- SANITARY WASTE PIPING</p> <p><b>MEDICAL GAS</b></p> <p>--- MEDICAL AIR MEDICAL GAS OUTLET</p> <p>--- OXYGEN MEDICAL GAS OUTLET</p> <p>--- VACUUM MEDICAL GAS OUTLET</p> <p>--- NITROGEN MEDICAL GAS OUTLET</p> <p>--- NITROUS OXIDE MEDICAL GAS OUTLET</p> <p>--- WAGD MEDICAL GAS OUTLET</p> <p>--- NATURAL GAS MEDICAL GAS OUTLET</p>	<p>--- BUILDING NO. WHERE EQUIPMENT IS LOCATED</p> <p>--- EQUIPMENT ABBREVIATION (SUPPLY FAN)</p> <p>--- SUPPLY FAN NO. 3 IN BUILDING NO. 28</p> <p>--- TYPICAL UNIT NO.</p> <p>--- ITEM (TERMINAL UNIT SHOWN)</p> <p>--- ITEM NUMBER (TERMINAL UNIT NO. 1)</p> <p>--- SERVED BY SUPPLY FAN NO.1</p> <p>--- DETAIL NUMBER</p> <p>--- DRAWING NUMBER WHERE SHOWN</p> <p>--- SECTION LETTER</p> <p>--- DRAWING NUMBER WHERE SHOWN</p> <p><b>DUCT SYMBOLS</b></p> <p>--- SUPPLY AIR DUCT (UP &amp; DOWN)</p> <p>--- RETURN AIR DUCT (UP &amp; DOWN)</p> <p>--- CEILING DIFFUSERS</p> <p>--- SUPPLY TOP REGISTER OR GRILLE (WALL TYPE)</p> <p>--- EXHAUST OR RETURN CEILING REGISTER OR GRILLE</p> <p>--- EXHAUST OR RETURN CEILING REGISTER OR GRILLE</p> <p>--- EXHAUST OR RETURN REGISTER OR TOP GRILLE (WALL TYPE)</p> <p>--- VANE ELBOW &amp; AIR SPLIT TYPE DUCT TAKEOFF</p> <p>--- CONNECT NEW DUCT TO EXISTING DUCT</p> <p>--- INCLINED RISE IN DIRECTION OF AIR FLOW</p> <p>--- INCLINED DROP IN DIRECTION OF AIR FLOW</p> <p>--- FLEXIBLE CONNECTION</p> <p>--- DUCT MOUNTED COIL (HOT WATER OR STEAM COIL)</p> <p>--- VANE ELBOW (PROVIDE ALL SQUARE OR RECTANGULAR ELBOWS WITH VANS EVEN IF SMOKE OR MISSING)</p> <p>--- VANE ELBOW (SHORT RADIUS)</p> <p>--- STANDARD RADIUS ELBOW</p> <p>--- NEW DUCT (WIDTH X DEPTH)</p> <p>--- EXISTING DUCT TO BE REMOVED</p> <p>--- LOUVER</p> <p>--- FLEXIBLE DUCTWORK (INSULATED)</p> <p>--- MANUAL VOLUME DAMPER</p> <p>--- FIRE DAMPER</p> <p><b>AIR TERMINAL SYMBOLS</b></p> <p>--- CONSTANT VOLUME TERMINAL UNIT WITH HEATING COIL LETTER INDICATES SIZE.</p> <p>--- VARIABLE VOLUME TERMINAL UNIT WITH HEATING COIL LETTER INDICATES SIZE.</p> <p>--- DOUBLE DUCT MAKING BOX LETTER INDICATES UNIT SIZE.</p> <p>--- FAN POWERED VARIABLE VOLUME TERMINAL UNIT WITH HEATING COIL LETTER INDICATES SIZE.</p> <p><b>CONTROLS</b></p> <p>--- ROOM CONTROL THERMOSTAT, HUMIDISTAT</p> <p>--- REMOTE BULB THERMOSTAT</p> <p>--- DUCT OR PIPE THERMOSTAT WITH AVERAGING ELEMENT (NOTE 1: PROVIDE 12" MIN. LENGTH IN DUCT WHEN SPACE PERMITS)</p> <p>--- DUCT THERMOSTAT WITH AVERAGING ELEMENT</p> <p>--- ROOM SENSOR: TEMPERATURE, HUMIDITY</p> <p>--- DUCT OR PIPE TEMPERATURE SENSOR (NOTE 1: PROVIDE 12" MIN. LENGTH IN DUCT WHEN SPACE PERMITS)</p> <p>--- DUCT HUMIDITY SENSOR</p> <p>--- DUCT STATIC PRESSURE SENSOR</p> <p>--- DUCT TEMPERATURE SENSOR WITH AVERAGING ELEMENT</p> <p>--- SMOKE DETECTOR (SEE ELECTRICAL SPEC.)</p>		

### AIR FILTER SCHEDULE

FILTER NO.	CFM	SYSTEM	VA GRADE	RATED EFF. %	MAX. S.P. INITIAL	MAX. S.P. FINAL	HOUSING TYPE	CARTRIDGES		
								NO.	SIZE	ARRANGE
5-AF-1	12000	M-AHU-5	A	30	0.3	1.0	AH CASING	NA	24" x 20" x 2"	NA
5-AF-2	12000	M-AHU-5	B	60	0.3	1.5	AH CASING	NA	20" x 20" x 4"	NA
5-AF-3	12000	M-AHU-5	D	90	0.4	2.0	AH CASING	NA	24" x 24" x 12"	NA

### WATER COILS, HEATING

COIL NO.	SYSTEM	CFM	MAX FV	MAX APD	AIR TEMP		CIRCULATING FLUID				MIN BTUH	
					ENTERING	LEAVING	FLUID	GPM	ENT	LWT	WPD	
HC-5	M-AHU-5	12000	514	0.10	45	66	PCG50	18.8	180	148	2.5	269,405

### TERMINAL COIL SCHEDULE

UNIT NO.	CFM	TYPE	MAX FV	MAX APD	EAT	LAT	SIZE	TOTAL MBH	INT. LWT	INT. WPD	NOTES	
TU-6-1	600	W	480	0.20	55	81.0	15 x 12	16.8	180	150	1.1 5.0	1

**NOTES:**

1. PROVIDE DUCT TRANSITION AT UNIT WHERE UNIT INLET SIZE AND DUCT RUNOUT SIZE ARE DIFFERENT.
- 2.

### AIR HANDLING UNIT SCHEDULE

UNIT NO.	LOCATION	AREA SERVED	SUPPLY FAN NO.	RETURN FAN NO.	SUPPLY CFM	EXTERNAL STATIC PRESSURE, 1	SPECIFIED INTERNAL LOSSES, 2	UNSPECIFIED INTERNAL LOSSES, 3	TYPE SYSTEM	NOTES	
										1	2
M-AHU-5	BLDG. 46	2ND FLOOR AND SIMULATION AREA	SF-5	RF-5	12000	3000	2.75	4.67	0.07	VAV	

**NOTES:**

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 ACCURACY.
2. TOTAL OF MAXIMUM PRESSURE DROPS OF COMPONENTS WHICH ARE SPECIFIED SEPARATELY, I.E. PREFILTERS, AFTERFILTERS, HEATING AND COOLING COILS.
3. INTERNAL LOSS ALLOWANCES SHALL INCLUDE LOSSES DUE TO ENTRANCE AND EXIT OF AHU, MAKING BOXES, DIFFUSER SECTION INCLUDING LOSSES DUE TO FAILURE TO PROPERLY CONVERT FAN DISCHARGE VELOCITY PRESSURE TO STATIC PRESSURE, FAN INLET CONDITIONS, CASINGS, HUMIDIFIERS, DAMPERS, ETC.

### SPLIT SYSTEM FAN COIL UNIT SCHEDULE

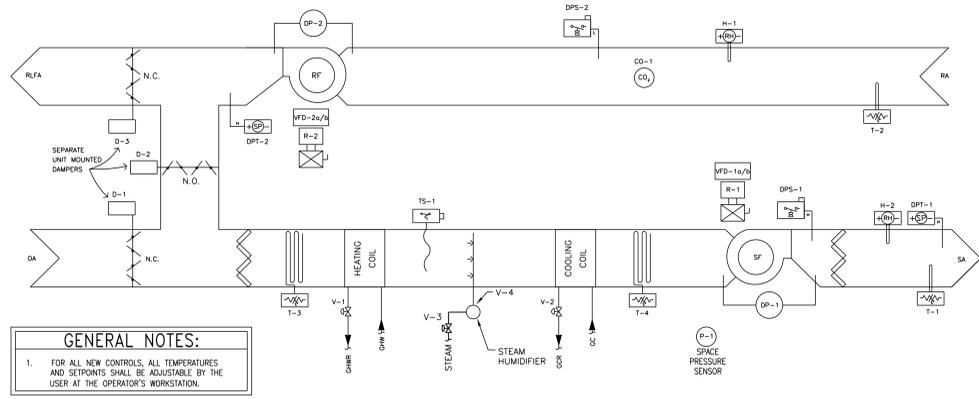
UNIT NO.	INDOOR UNIT TYPE	TYPE	CFM	ESP	COOLING		TOTAL	SENS	HEATING		ELECTRICAL		DISC BY	NOTES
					SETPOINT	MBH			SETPOINT	MBH	MCA	VOLT		
SS-1	WALL MOUNTED	H/W/M	260	0.4	75/63	7.5	6.4	--	--	0.4	208	1	EC	1,2

**NOTES:**

1. UNIT SHALL HAVE AN MOP OF 15A.
2. PROVIDE WITH UNIT MOUNTED CONDENSATE PUMP.

### AIR TERMINAL UNIT, SINGLE DUCT

UNIT NO.	CFM	MAX MIN	HEAT	INLET SIZE	MAX SP AT MAX CFM	SOUND MAX SP	NC	EAT	EWT	GPM	WPD	PIPE RUNOUT SIZE TO COIL	HEAT BTUH	MIN. BTUH	CONTROL TYPE
TU-5-2	380	190	380	6"	0.35	1.5	35	55.0	180	0.9	5.0	3/4"	380	13228	DDC
TU-5-3	625	400	510	8"	0.35	1.5	35	55.0	180	1.3	5.0	3/4"	510	19107	DDC
TU-5-4	130	70	110	4"	0.35	1.5	35	55.0	180	0.5	5.0	3/4"	110	7349	DDC
TU-5-5	115	65	110	4"	0.35	1.5	35	55.0	180	0.5	5.0	3/4"	110	7349	DDC
TU-5-6	110	60	110	4"	0.35	1.5	35	55.0	180	0.5	5.0	3/4"	110	7349	DDC
TU-5-7	1200	920	920	10"	0.35	1.5	35	55.0	180	1.9					



**GENERAL NOTES:**  
 1. FOR ALL NEW CONTROLS, ALL TEMPERATURES AND SETPOINTS SHALL BE ADJUSTABLE BY THE USER AT THE OPERATOR'S WORKSTATION.

CONTROL DEVICE	POINT NAME	POINT DESCRIPTION	POINT TYPE				ALARM	
			AI	BI	AO	BO	H	LN
T-1	DischAirTemp	DISCHARGE AIR TEMPERATURE	x					
T-2	RetAirTemp	RETURN AIR TEMPERATURE	x				x	x
T-3	MixAirTemp	MIXED AIR TEMPERATURE	x					x
T-4	LeavingCoolingCoilTemp	LEAVING COOLING COIL TEMPERATURE	x					x
DPT-1	SubDuctSP	SUPPLY DUCT STATIC PRESSURE	x				x	x
DPT-2	RetDuctSP	RETURN DUCT STATIC PRESSURE	x				x	x
DPS-1	HdPressure	HIGH DUCT PRESSURE SWITCH		x				x
DPS-2	LoPressure	LOW DUCT PRESSURE SWITCH		x				x
DPF-1	SupFanStatus	SUPPLY FAN STATUS		x				x
DPF-2	RetFanStatus	RETURN FAN STATUS		x				x
VFD-1 a	SupFanSpeed	SUPPLY FAN VFD SPEED		x	x	x		x
VFD-1 b	VFD1a	VFD POINTS	x	x	x		x	x
VFD-2 a	RetFanSpeed	RETURN FAN VFD SPEED		x	x		x	x
VFD-2 b	VFD2a	VFD POINTS	x	x	x		x	x
R-1	SupFanCtrl	SUPPLY FAN CONTROL				x		
R-2	RetFanCtrl	RETURN FAN CONTROL			x			
D-1	OutDamp	OUTDOOR AIR DAMPER			x	x		
D-2	RetDamp	RETURN AIR DAMPER			x			
D-3	RelDamp	RELIEF AIR DAMPER			x			
TS-1	FreezeStat	FREEZE STAT		x	x			x
V-1	HygValve	HEATING VALVE			x			
V-2	CoolingValve	COOLING VALVE			x			
V-3	OnOffHumValve	ON/OFF HUMIDIFIER VALVE			x	x		
V-4	ModHumValve	MODULATING HUMIDIFIER VALVE			x			
H-1	RetHumSens	RETURN AIR HUMIDITY SENSOR		x				
H-2	SupHumSens	SUPPLY AIR HUMIDITY SENSOR		x				
CO-1	CarbonDio	CARBON DIOXIDE SENSOR		x				
P-1	SpacePress	SPACE PRESSURE SENSOR		x			x	x

**SEQUENCE OF OPERATION:**

**OCCUPIED/UNOCCUPIED MODE:** A TIME SCHEDULE SHALL CONTROL THE AIR HANDLING UNIT MODE. THE TIME SCHEDULE (ADJUSTABLE) SHALL BE SET SO THAT THE AIR HANDLING UNIT IS IN THE OCCUPIED MODE FROM 6AM TO 6 PM ON NON-HOLIDAY WEEKDAYS. THE UNIT WILL HAVE THE CAPABILITY OF BEING STARTED AND STOPPED REMOTELY AT THE BAS. THE H-O-A SWITCH SHALL BE KEPT IN THE "AUTO POSITION." "HAND" AND "OFF" SHALL BE USED FOR MAINTENANCE ONLY. WHEN THE UNIT IS "OFF," THE OUTSIDE AIR DAMPER (D-1) AND RELIEF AIR DAMPER (D-3) SHALL BE FULLY CLOSED. WHEN THE UNIT IS "ON," D-1 AND D-3 SHALL MODULATE IN ACCORDANCE WITH THE SEQUENCE BELOW.

**FIRE ALARM SHUTDOWN:** IN THE FIRE-ALARM CONTROL MODE (WHEN SMOKE IS DETECTED BY DUCT SMOKE DETECTOR), THE SUPPLY AND RETURN FANS 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 AND RETURN FANS SHALL AUTOMATICALLY RESTART WHEN FIRE ALARM CIRCUIT IS RESET.

**DISCHARGE DUCT STATIC PRESSURE SETPOINT OPTIMIZATION:**

- THE BUILDING AUTOMATION SYSTEM (BAS) SHALL CONTINUOUSLY MONITOR THE DAMPER POSITION OF ALL VAV TERMINAL UNITS. THE DISCHARGE DUCT STATIC PRESSURE (DPT-1) SHALL BE SENSED DIRECTLY AT THE DISCHARGE OF EACH AIR HANDLER. THE SENSOR MUST BE MOUNTED IN A NON-TURBULENT LOCATION.
- WHEN ANY VAV DAMPER IS MORE THAN 75% (ADJ.) OPEN, THE SUPPLY FAN DISCHARGE DUCT STATIC PRESSURE SETPOINT SHALL BE RESET UPWARD BY 0.1 IN. W.C. (ADJ.), AT A FREQUENCY OF 15 MINUTES (ADJ.), UNTIL NO DAMPER IS MORE THAN 75% OPEN OR THE STATIC PRESSURE SETPOINT HAS RESET UPWARD TO THE SYSTEM MAXIMUM DUCT STATIC PRESSURE SETPOINT OR THE AHU VARIABLE-FREQUENCY DRIVE IS AT THE MAXIMUM SPEED SETTING.
- WHEN ALL VAV DAMPERS ARE LESS THAN 65% (ADJ.) OPEN, THE SUPPLY FAN DISCHARGE DUCT STATIC PRESSURE SETPOINT SHALL BE RESET DOWNWARD BY 0.1 IN. W.C. (ADJ.), AT A FREQUENCY OF 15 MINUTES (ADJ.), UNTIL AT LEAST ONE DAMPER IS MORE THAN 65% OPEN OR THE STATIC PRESSURE SETPOINT HAS RESET DOWNWARD TO THE SYSTEM MINIMUM DUCT STATIC PRESSURE SETPOINT OR THE AHU VARIABLE-FREQUENCY DRIVE IS AT THE MINIMUM SPEED SETTING.
- THE CONTROL BANDS, SETPOINT INCREMENT VALUES, SETPOINT DECREMENT VALUES AND ADJUSTMENT FREQUENCIES SHALL BE ADJUSTED TO MAINTAIN MAXIMUM STATIC PRESSURE OPTIMIZATION WITH STABLE SYSTEM CONTROL AND MAXIMUM COMFORT CONTROL.
- THE BAS SHALL HAVE THE CAPABILITY TO ALLOW THE OPERATOR TO EXCLUDE PROBLEM ZONES THAT SHOULD NOT BE CONSIDERED WHEN DETERMINING THE OPTIMIZED SETPOINT.
- THE BAS SHALL ALSO READ THE STATUS OF THE SUPPLY AIR STATIC PRESSURE SENSOR AND DISPLAY THE ACTIVE DUCT STATIC PRESSURE READING ON THE STATUS SCREEN.
- THE BAS SHALL HAVE THE ABILITY TO IDENTIFY, AND DISPLAY TO THE USER, THE VAV BOX THAT SERVES THE CRITICAL ZONE (THAT IS, THE ZONE WITH THE MOST WIDE-OPEN VAV DAMPER). THIS INFORMATION SHALL UPDATE DYNAMICALLY AS THE LOCATION OF THE CRITICAL ZONE CHANGES BASED ON BUILDING LOAD, AND DUCT STATIC PRESSURE SETPOINT OPTIMIZATION CONTROL.
- DURING THE COMMISSIONING/CHECK-OUT PROCESS, THE CONTROLS CONTRACTOR SHALL DEMONSTRATE THE PERFORMANCE OF FAN PRESSURE OPTIMIZATION.

**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 RETURN FAN SHALL BE MONITORED. WHENEVER A LOW STATIC PRESSURE CONDITION IS DETECTED (EXCEEDING 3-INCHES), THE RETURN FAN SHALL BE STOPPED AND "LOW STATIC PRESSURE" ALARM SHALL BE DISPLAYED ON THE OPERATOR WORKSTATION.

**TEMPERATURE CONTROL:** THE SUPPLY AIR TEMPERATURE, SENSED BY T-1, SHALL BE MAINTAINED AT SET POINT BY BAS MODULATING SUPPLY AIR FLOW (D-1) AND D-2 AND V-2 IN SEQUENCE. THE SUPPLY AIR TEMPERATURE SET POINT SHALL BE VARIED FROM 55 TO 60 DEGREES F (ADJUSTABLE) AS THE RETURN AIR TEMPERATURE VARIES FROM 78 TO 72 DEGREES F (ADJUSTABLE). D-3 SHALL BE POSITIONED OPPOSITE D-2 EITHER THROUGH A MECHANICAL LINKAGE OR THROUGH A SEPARATE ACTUATOR FROM THE SAME DOC OUTPUT. UPON LOSS OF AIR FLOW SENSOR BY DPS-1, V-1 SHALL MODULATE TO MAINTAIN 55 DEG. F (ADJUSTABLE) UNIT CASING TEMPERATURE MONITORED BY T-2.

- COOLING CONTROL: WHEN THE TEMPERATURE OF THE OUTSIDE AIR IS ABOVE 65 DEG. F, THE DCP SHALL PREVENT THE MODULATION OF D-1, D-2 AND D-3 AND SHALL ASSUME THE MINIMUM OUTSIDE AIR POSITION. THE DCP SHALL MODULATE THE COOLING VALVE (V-2) TO MAINTAIN THE SUPPLY AIR TEMPERATURE SETPOINT AS SENSED BY T-1.
- ECONOMIZER CONTROL: WHEN THE TEMPERATURE OF THE OUTSIDE AIR IS BETWEEN 65 DEG. F (ADJUSTABLE) AND THE SUPPLY AIR TEMPERATURE SETPOINT AS SENSED BY T-1, DAMPERS D-1, D-2, AND D-3 SHALL MODULATE TO MAINTAIN THE MIXED AIR TEMPERATURE AT 2 DEGREES LESS THAN THE SCHEDULED SUPPLY AIR TEMPERATURE. THE BAS SHALL MODULATE THE COOLING VALVE (V-2) TO MAINTAIN THE SUPPLY AIR TEMPERATURE SETPOINT AS SENSED BY T-1 AS REQUIRED.
- HEATING AND ECONOMIZER CONTROL: WHEN THE TEMPERATURE OF THE OUTSIDE AIR IS BELOW THE SUPPLY AIR TEMPERATURE SETPOINT AS SENSED BY T-1, DAMPERS D-1, D-2 AND D-3 SHALL MODULATE TO MAINTAIN THE MIXED AIR TEMPERATURE AT 2 DEGREES LESS THAN THE SCHEDULED SUPPLY AIR TEMPERATURE. D-1 SHALL BE POSITIONED OPPOSITE D-2 IF D-1 IS CLOSED TO MINIMUM OUTSIDE AIR, D-2 IS OPEN, AND D-3 IS CLOSED TO MINIMUM RELIEF AIR IN THIS MODE. THEN THE HEATING VALVE (V-1) SHALL BE MODULATED TO MAINTAIN THE SUPPLY AIR TEMPERATURE SETPOINT AS SENSED BY T-1.

**SUPPLY FAN CONTROL:** THE CAPACITY OF THE SUPPLY FAN SHALL BE CONTROLLED BY A VARIABLE FREQUENCY DRIVE. IN THE OCCUPIED MODE, THE SUPPLY FAN SHALL START (R-1) AND THE SPEED OF THE SUPPLY FAN (VFD-1A) SHALL MODULATE TO MAINTAIN THE SUPPLY DUCT STATIC PRESSURE (DPT-1) AT 1.0" W.C. (ADJUSTABLE) OR AT A VALUE AS COORDINATED WITH THE TAB CONTRACTOR IN THE "OFF" MODE, THE SUPPLY FAN SHALL BE OFF AND THE SPEED SHALL BE SET TO 0 HZ. THE STATUS OF THE SUPPLY FAN (DPF-1) SHALL BE MONITORED. 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.

**RETURN FAN CONTROL:** THE CAPACITY OF THE RETURN FAN SHALL BE CONTROLLED BY A VARIABLE FREQUENCY DRIVE. THE RETURN FAN SHALL START (R-2) WHENEVER THE SUPPLY FAN IS PROVEN RUNNING. THE RETURN AIR VFD SHALL BE SET TO MAINTAIN A CONSTANT SPEED DIFFERENCE (VFD-2A) BETWEEN THE SPEED OF THE SUPPLY FAN AND THE SPEED OF THE RETURN FAN. THE RETURN STATIC PRESSURE (DPT-2) SHALL BE MONITORED. THE VARIABLE FREQUENCY DRIVE SHALL BE OFF AND THE SPEED SHALL BE SET TO 0 HZ IF THE SUPPLY FAN IS NOT RUNNING. WHENEVER THE RETURN FAN IS COMMANDED TO RUN AND THE STATUS (DPF-2) CANNOT BE PROVEN, A "RETURN FAN FAILURE" ALARM SHALL BE DISPLAYED ON THE OPERATOR WORKSTATION.

**OUTSIDE AIR DAMPER CONTROL:** INITIALLY, THE OUTSIDE AIR DAMPER (D-1) SHALL BE SET TO THE MINIMUM AMOUNT AS INDICATED ON THE AIR HANDLER SCHEDULE AND COORDINATED WITH THE TESTING & BALANCING CONTRACTOR. THE CARBON DIOXIDE SENSOR (CO-1) IN THE RETURN AIR DUCTWORK SHALL MONITOR THE CARBON DIOXIDE LEVELS AND DECREASE THE AMOUNT OF OUTSIDE AIR BASED ON MAINTAINING BELOW A 700 PPM OFFSET BETWEEN INDOOR CONDITIONS AND 400 PPM. THE OUTSIDE AIR DAMPER SHALL MODULATE OPEN AS REQUIRED BY THE ECONOMIZER CYCLE DESCRIBED ABOVE.

**BUILDING PRESSURIZATION CONTROL:** THE BUILDING PRESSURE (P-1) SHALL BE MONITORED. IF THE BUILDING PRESSURE DROPS BELOW 0.0" W.C., OUTSIDE AIR DAMPER SHALL OVERRIDE THE CO2 SENSOR TO MAINTAIN BUILDING PRESSURE AT A MINIMUM OF 0.02" W.C. THE PRESSURE SENSOR SHALL BE INSTALLED NEAR THE CENTER OF THE 2 INTERSECTING CORRIDORS.

**HUMIDITY CONTROL:** WHEN THE SYSTEM IS NOT CALLING FOR HUMIDITY, SENSED BY H-1, "ON-OFF" TWO WAY CONTROL VALVE V-3 SHALL REMAIN CLOSED. WHEN THE SYSTEM IS CALLING FOR HUMIDITY V-3 SHALL REMAIN OPEN. THE RETURN AIR HUMIDITY, SENSED BY H-1, SHALL BE MAINTAINED AT SET POINT BY THE SYSTEM MODULATING HUMIDITY CONTROL VALVE V-4 TO MAINTAIN THE DESIRED RELATIVE HUMIDITY. THE CONTROLS SYSTEM SHALL OVERRIDE THE CONTROL TO MAINTAIN MAXIMUM HUMIDITY OF 80% (ADJUSTABLE) AS SENSED BY H-2. THE CONTROLS SYSTEM SHALL CLOSE VALVE V-3 WHENEVER THE SUPPLY FAN IS OFF. VALVE V-4 SHALL BE INTERLOCKED WITH A TEMPERATURE SWITCH TO KEEP THE HUMIDIFIER OFF UNTIL CONDENSATE TEMPERATURE APPROACHES STEAM TEMPERATURE.

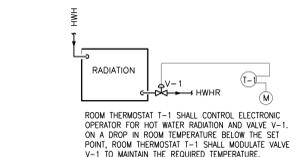
**TEMPERATURE MONITORING:** MONITOR THE SUPPLY AIR TEMPERATURE (T-1), RETURN AIR TEMPERATURE (T-2), LEAVING COOLING COIL TEMPERATURE (T-4), MIXED AIR TEMPERATURE (T-3), AND RETURN AIR CARBON DIOXIDE LEVELS (CO-1).

**EMERGENCY CONSTANT SPEED OPERATION:** ON ALL VARIABLE SPEED FANS IN VAV SYSTEMS UPON FAILURE OF THE VFD, THE FANS SHALL BE STARTED/STOPPED MANUALLY AT THE UNIT OR THE ECC THROUGH THE BY-PASS STARTER. FANS SHALL THEN BE OPERATED AT CONSTANT SPEED.

**POWER OUTAGE OPERATION:** ON THE EVENT OF A POWER OUTAGE AIR HANDLING UNIT SHALL AUTOMATICALLY RESTART WHEN POWER HAS BEEN RE-ESTABLISHED. AFTER 3 ATTEMPTS TO RE-START, THE UNIT SHALL GO INTO ALARM. ALARM SHALL INDICATE ONLY ONCE UNTIL CLEARED BY USER.

**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.

**5 VARIABLE VOLUME AIR HANDLING UNIT CONTROL**  
 H7 NO SCALE



**4 RADIATION CONTROL DIAGRAM**  
 H7 NO SCALE

**SEQUENCE OF OPERATION:**

**CONTROL MODE:** THE CONTROL MODE OF THE BRONCHOSCOPY ROOM SHALL BE BASED ON THE STATUS OF THE ROOM CONTROLLER (NORMAL (BRONCHOSCOPY) OR POSITIVE MODE). DURING THE NORMAL OCCUPIED MODE, THE EXHAUST AIR TO THE SPACE SHALL MAINTAIN A MINIMUM AIRFLOW OF 12 AIR CHANGES PER HOUR (LISTED AS THE MINIMUM AIRFLOW ON THE SCHEDULE). THE SUPPLY AIRFLOW SHALL BE SET TO A CONSTANT VOLUME DURING NORMAL MODE (LISTED AS THE MINIMUM AIRFLOW ON THE SCHEDULE). IF THE ROOM IS SWITCHED TO POSITIVE MODE, THE SUPPLY AIR TO THE SPACE SHALL MAINTAIN THE MAXIMUM SCHEDULED AIRFLOW.

**RETURN AIR CONTROL:** DURING POSITIVE MODE, THE RETURN AIR VAV SHALL TRACK THE SUPPLY AIR AND LAG IN AIRFLOW TO MAINTAIN POSITIVE SPACE PRESSURE. DURING NORMAL MODE, THE RETURN AIR VALVE SHALL BE CLOSED.

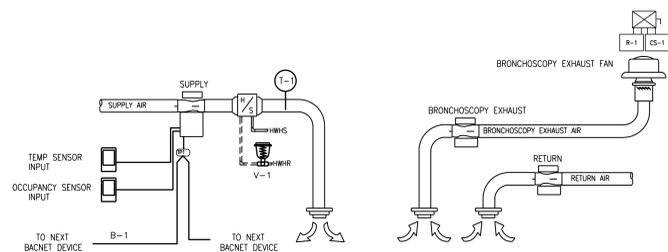
**EXHAUST AIR VALVE:** THE EXHAUST AIR VALVE SHALL BE CLOSED DURING POSITIVE ROOM MODE. DURING NORMAL MODE, THE VALVE SHALL BE OPEN TO THE MAXIMUM SCHEDULED AIRFLOW.

**BRONCHOSCOPY EXHAUST FAN CONTROL:** WHEN THE BRONCHOSCOPY (NORMAL) MODE IS ACTIVATED, THE EXHAUST FAN SHALL BE TURNED (R-1) ON AFTER THE ISOLATION EXHAUST AIR VALVE HAS BEEN OPENED. WHEN ROOM IS CHANGED TO POSITIVE MODE, THE FAN SHALL BE DISABLED. WHEN THE EXHAUST FAN IS CALLED TO RUN BUT IS NOT PROVEN RUNNING (CS-1), AN "EXHAUST FAN FAILURE" ALARM SHALL BE REPORTED AT THE OPERATOR'S WORKSTATION. EXHAUST FAN RELAYS AND CURRENT SENSORS SHALL BE PROVIDED WITH THE AIRFLOW VALVE PACKAGE.

**HEATING COIL CONTROL:** THE HOT WATER CONTROL VALVE (V-1) SHALL MODULATE TO MAINTAIN SPACE TEMPERATURE AT SET POINT WHETHER IN NORMAL MODE OR POSITIVE MODE. THE DISCHARGE AIR TEMPERATURE (T-1) SHALL BE MONITORED AND AN ALARM SHALL BE GENERATED IF IT DROPS BELOW 50 DEGREES IN THE HEATING MODE.

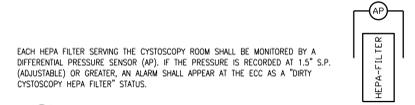
**BAS/EC:** THE ROOM AIRFLOW VALVES WILL BE PROVIDED WITH BACNET CONTROLS. PROVIDE ALL PROGRAMMING AND INTEGRATION INTO THE BUILDING AUTOMATION SYSTEM. THE BAS SHALL MONITOR THE ROOM PRESSURE (B-1) TRANSMITTED FROM THE PRESSURE MONITOR PANEL. IF THE PRESSURE IS REPORTED AT 0.0" FOR A MINIMUM OF 5 MINUTES (ADJUSTABLE), A "BRONCHOSCOPY ROOM PRESSURE ALARM" SHALL BE REPORTED TO THE OPERATOR'S WORKSTATION. MONITOR THE DOOR ALARM TO INDICATE WHETHER THE DOOR IS OPEN OR CLOSED.

**CONTROL WIRING:** ALL WIRING ASSOCIATED WITH THE BRONCHOSCOPY ROOM AIRFLOW CONTROL, VALVES, REHEAT VALVES, ROOM PRESSURE CONTROL PANEL POWER/COMMUNICATIONS, ETC. SHALL BE PROVIDED AND INSTALLED BY THE TEMPERATURE CONTROLS CONTRACTOR.



CONTROL DEVICE	POINT NAME	POINT DESCRIPTION	POINT TYPE				ALARM	
			AI	BI	AO	BO	H	LN
CS-1	ExhaustStatus	EXHAUST FAN CONTROL RELAY						x
V-1	HygValve	HEATING VALVE		x	x			
T-1	DischTemp	DISCHARGE TEMPERATURE	x					x
B-1	BACNET	BACNET PRESSURE ALARM		x				x

**3 BRONCHOSCOPY ROOM AIRFLOW VALVE UNIT CONTROL**  
 H7 NO SCALE



**2 HEPA FILTER CONTROL DIAGRAM**  
 H7 NO SCALE

**SEQUENCE OF OPERATION:**

**OCCUPIED/UNOCCUPIED MODE:** A TIME SCHEDULE SHALL CONTROL THE TERMINAL UNIT MODE. THE TIME SCHEDULE (ADJUSTABLE) SHALL INITIALLY BE SET SO THAT THE SPACE IS IN THE OCCUPIED MODE 6AM TO 6PM ON NON-HOLIDAY WEEKDAYS. INITIALLY, ALL TERMINAL UNITS SHALL USE THE SAME TIME SCHEDULE. THE SPACE THERMOSTAT OVERRIDE SWITCH SHALL BE MONITORED. THE SPACE SHALL RETURN TO THE OCCUPIED MODE FOR 2 HOURS (ADJUSTABLE) IF THE OVERRIDE SWITCH, IF ENABLED, IS PRESSED.

**NIGHT CYCLE:** IN THE UNOCCUPIED MODE, IF THE SPACE TEMPERATURE (T-1) FALLS BELOW THE UNOCCUPIED HEATING TEMPERATURE SETPOINT, THE TERMINAL UNIT SHALL ACTIVATE THE NIGHT CYCLE TO SIGNAL THE AIR HANDLING UNIT TO START. THE NIGHT CYCLE SHALL REMAIN ACTIVE UNTIL THE SPACE TEMPERATURE IS SATISFIED OR THE TIME SCHEDULE CHANGES THE UNIT TO THE OCCUPIED MODE.

**HEATING/COOLING MODE:** THE TERMINAL UNIT SHALL START IN THE DEAD BAND MODE. IF THE SPACE TEMPERATURE (T-1) IS ABOVE THE COOLING SETPOINT, THE UNIT SHALL BE IN THE COOLING MODE. IF THE SPACE TEMPERATURE IS BELOW THE HEATING SETPOINT, THE UNIT SHALL BE IN THE HEATING MODE.

**DAMPER CONTROL:** IN THE COOLING MODE, THE INLET DAMPER (D-1) SHALL MODULATE THE SUPPLY AIRFLOW BETWEEN THE MINIMUM AIRFLOW SETPOINT AND THE MAXIMUM AIRFLOW SETPOINT TO MAINTAIN THE SPACE TEMPERATURE (T-1) AT THE COOLING SETPOINT. IN THE HEATING MODE, THE SUPPLY AIRFLOW SHALL BE HELD AT THE HEATING AIRFLOW SETPOINT.

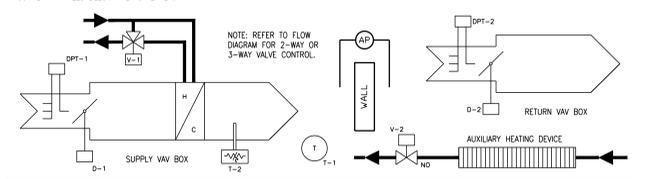
**HEATING COIL VALVE CONTROL:** THE CONTROL VALVE (V-1) ON THE HOT WATER RETURN LINE TO THE TERMINAL UNIT HEATING COIL SHALL MODULATE TO MAINTAIN SPACE TEMPERATURE AT THE HEATING SETPOINT.

**AIRFLOW AND TEMPERATURE MONITORING:** MONITOR SUPPLY AIRFLOW (DPT-1) AND SUPPLY AIR TEMPERATURE (T-2).

**AUXILIARY HEAT CONTROL:** FOR SPACES WITH AUXILIARY HEATING DEVICES, THE CONTROL VALVE FOR THE PERIMETER RADIATION SHALL MODULATE IN PARALLEL WITH THE HEATING VALVE FOR THE VAV BOX.

**ROOM PRESSURE MONITORING:** THE CYSTOSCOPY ROOM PRESSURE SHALL BE MONITORED AND A "NEGATIVE CYSTOSCOPY ROOM PRESSURE" ALARM SHALL BE INDICATED AT THE OPERATOR'S WORKSTATION IF THE ROOM PRESSURE FALLS BELOW 0" FOR MORE THAN 15 CONSECUTIVE MINUTES. PROVIDE DOOR INDICATORS TO SUPPRESS THE ALARM IF ANY ROOM DOORS ARE LEFT OPEN. THE VAV BOX SHALL TAKE CORRECTIVE MEASURES BY OPENING 5% EVERY 3 MINUTES (UNTIL OPEN 100%) IF THE ROOM PRESSURE IS NEGATIVE BEFORE AN ALARM IS INITIATED.

**CYSTOSCOPY ROOM AIRFLOW CONTROL:** THE CYSTOSCOPY ROOM INCLUDES A SUPPLY VAV BOX AND 1 RETURN VAV BOXES (D-2). CYSTOSCOPY ROOM SUPPLY AIR AND RETURN AIR TERMINAL UNITS SHALL OPERATE AT CONSTANT VOLUME AT MAXIMUM VOLUME WHEN IN OCCUPIED MODE. TERMINAL UNITS SHALL OPERATE AT MINIMUM VOLUME WHEN IN UNOCCUPIED MODE (SEE VAV SCHEDULE FOR AIRFLOWS). THE OPERATOR SHALL BE ABLE TO MANUALLY RETURN THE SYSTEM TO THE OCCUPIED MODE FROM THE OPERATOR'S WORKSTATION. THE SYSTEM SHALL REMAIN IN THE OCCUPIED MODE UNTIL THE NEXT SCHEDULED CYCLE OR UNTIL MANUALLY RETURNED TO THE UNOCCUPIED MODE. THE SUPPLY (DPT-1) AND RETURN (DPT-2) AIRFLOWS SHALL BE MONITORED AT THE OPERATOR'S WORKSTATION. AN ALARM SHALL APPEAR IF THE SUPPLY AIR FALLS BELOW THE TOTAL RETURN AIR.



CONTROL DEVICE	POINT NAME	POINT DESCRIPTION	POINT TYPE				ALARM	
			AI	BI	AO	BO	H	LN
T-1	SpaceTempSpot	SPACE TEMPERATURE SETPOINT	x					
T-1	SpaceTemp	SPACE TEMPERATURE					x	x
DPT-1	SupAirFlow	SUPPLY AIRFLOW				x		x
DPT-2	RetAirFlow	RETURN AIRFLOW				x		x
T-2	DischAirTemp	DISCHARGE AIR TEMPERATURE	x					x
D-1	SupDamp	SUPPLY DAMPER CONTROL				x		x
D-2	RetDamp	RETURN DAMPER CONTROL				x		x
V-1	HygValve	HEATING CONTROL VALVE				x		
V-2	AuxHygValve	AUXILIARY HEATING CONTROL VALVE				x		
AP	RoomPressureMon	ROOM PRESSURE MONITOR					x	x

**1 AIR TERMINAL UNIT CONTROL DIAGRAM VAV REHEAT**  
 H7 NO SCALE

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**KEY PLAN**

**Drawing Title**  
**MECHANICAL CONTROLS DIAGRAMS**

**Project Title**  
 RENOVATE 2ND FLOOR,  
 BLDG 46 FOR MEDICAL SPECIALTIES

**Date**  
 JULY 29, 2016

**Scale**  
 AS NOTED

**Designed By**  
 JCP

**Checked By**  
 JCP

**Drawn By**  
 MCW

**Drawing No.**  
 H7

**Dwg. 28 of 36**

**Department of Veterans Affairs**