

MECHANICAL ABBREVIATIONS

A/E	ARCHITECT / ENGINEER	DD-2	DESIGN DEVELOPMENT SUBMISSION 2	HSTAT	HUMIDISTAT	OA	OUTSIDE AIR	TP	TRAP
AAHX	AIR TO AIR HEAT EXCHANGER	DDC	DIRECT DIGITAL CONTROLS	HTM	HUMIDIFIER TERMINAL	OAG	OUTSIDE AIR GRILLE	TR	TOP REGISTER
AAV	AUTOMATIC AIR VENT	DEG	DEGREES	HUM	HUMIDIFIER UNIT MOUNTED	OAI	OUTSIDE AIR INTAKE	TSP	TOTAL STATIC PRESSURE
AB	AIR BLENDER	DF	DIFFUSER	HVD	HOISTWAY VENT DAMPER	OD	OUTER DIAMETER	TSTAT	THERMOSTAT
ACC	AIR COOLED CONDENSER	DI	DIGITAL INPUT	HVU	HEATING AND VENTILATING UNIT	OFM	OIL FLOWMETER	TU	TERMINAL UNIT
ACCH	AIR COOLED CHILLER	DIA	DIAMETER	HW	HOT WATER	OR	OPERATING ROOM	TWU	THRU-WALL UNIT
ACCU	AIR-COOLED CONDENSING UNIT	DIW	DEIONIZED WATER	HWC	HOT WATER COIL				
ACD	AUTOMATIC CONTROL DAMPER, MODULATING	DO	DIGITAL OUTPUT	HWHC	HOT WATER HEATING COIL	P	PUMP	UCT	UNDERCUT
ACD-TP	AUTOMATIC CONTROL DAMPER, TWO POSITION	DP	DEW POINT TEMPERATURE	HWP	HEATING WATER PUMP	PA	PASCAL	UC	UNIT COOLER
ACFM	ACTUAL CUBIC FEET PER MINUTE	DP	DIFFUSER PLATE	HWR	HEATING WATER RETURN	PC	PUMPED CONDENSATE	UH	UNIT HEATER
ACU	AIR CONDITIONING UNIT	DPA	DIFFERENTIAL PRESSURE ASSEMBLY	HWS	HEATING WATER SUPPLY	PCF	POUNDS PER CUBIC FOOT	UL	UNDERWRITER'S LABORATORY
AD	ACCESS DOOR	DPS	DIFFERENTIAL PRESSURE SENSOR	HWUH	HOT WATER UNIT HEATER	PD	PRESSURE DROP	URV	UPPLAST UNIT VENTILATOR
AF	AFTER FILTER	DX	DIRECT EXPANSION	HX	HEAT EXCHANGER	PEF	PROPELLER TYPE EXHAUST FAN		
AFCV	AIR FLOW CONTROL VALVE	DXCC	DIRECT EXPANSION COOLING COIL	HZ	HERTZ	PF	PRE-FILTER	V	VALVE
AFF	ABOVE FINISHED FLOOR					PG	PRESSURE GAUGE	VAF	VANE-AXIAL FAN
AFMD	AIR FLOW MEASURING DEVICE	EA	EXHAUST AIR	I/O	INPUT/OUTPUT	PGW	PROPYLENE GLYCOL-WATER SOLUTION	VAV	VARIABLE AIR VOLUME
AFW	AIR FOIL WHEEL (FAN)	EAT	ENTERING AIR TEMPERATURE	IAQ	INDOOR AIR QUALITY	PHC	PREHEAT COIL	VD	VOLUME DAMPER (MANUAL OPPOSED BLADE)
AHU	AIR HANDLING UNIT	EC	EVAPORATIVE COOLER	IBT	INVERTED BUCKET TRAP	PPM	PARTS PER MILLION	VFD	VARIABLE FREQUENCY DRIVE
AI	ANALOG INPUT	ECC	ENGINEERING CONTROL CENTER	ICF	IN-LINE CENTRIFUGAL FAN	PRS	PRESSURE REGULATING VALVE STATION	VHA	VETERANS HEALTH ADMINISTRATION
AMP	AMPERE	ECU	EVAPORATIVE CONDENSER UNIT	ICU	INTENSIVE CARE UNIT	PRV	PRESSURE REGULATING VALVE	VI	VIBRATION ISOLATOR
AO	ANALOG OUTPUT	EDH	ELECTRIC DUCT HEATER	ID	INSIDE DIAMETER	PSI	POUNDS PER SQUARE INCH	VIV	VARIABLE INLET VANES
AP	ACCESS PANEL	EER	ENERGY EFFICIENCY RATIO	IFB	INTEGRAL FACE AND BYPASS	PSIA	POUNDS PER SQUARE INCH, ABSOLUTE	VP	VACUUM PUMP
APD	AIR PRESSURE DROP	EF	EXHAUST FAN	IN	INCHES	PSIG	POUNDS PER SQUARE INCH, GAGE	VPS	VARIABLE PRIMARY SYSTEM
ARI	AIR CONDITIONING AND REFRIGERATION INSTITUTE	EG	EXHAUST GRILLE	IN HG	INCHES OF MERCURY	PSS	PRIMARY SECONDARY SYSTEM	VR	VACUUM (STEAM CONDENSATE) RETURN
AS	AIR SEPARATOR	EGS	EMERGENCY GAS SHUTOFF	IN WC	INCHES OF WATER COLUMN	PSV	PRESSURE SAFETY VALVE	VSD	VARIABLE SPEED DRIVE
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS	EGT	ENTERING GLYCOL TEMPERATURE	IN WG	INCHES OF WATER, GAUGE	PTAC	PACKAGED TERMINAL AIR CONDITIONER	VUH	VERTICAL UNIT HEATER
AV	ANALOG VARIABLE	EH	EXHAUST HOOD	IN-LB	INCH-POUND				
AW	AIR WASHER	EJ	EXPANSION JOINT	INLV	INTEGRATED PART LOAD VALUE				
AXF	AXIAL FLOW	EMD	END OF MAIN DRIP (STEAM)	IRH	INFRARED HEATER	R/E	RETURN OR EXHAUST	W	WASTE
		ENT	ENTERING	IS	INSECT SCREEN	RA	RETURN AIR	WAG	WASTE ANESTHESIA GAS
		ER	EXHAUST REGISTER	IU	INDUCTION UNIT	RAD	REFRIGERANT AIR DRYER	WB	WET BULB
B	BOILER	IV	INLET VANES			RAF	RADIO FREQUENCY	WC	WATER COOLED
BAS	BUILDING AUTOMATION SYSTEMS	KG	KILOGRAM			RAHX	ROTARY AIR HEAT EXCHANGER	WCCH	WATER COOLED CHILLER
BD	BUTTERFLY DAMPER	KG/H	KILOGRAMS PER HOUR			RAT	RETURN AIR TEMPERATURE	WCCU	WATER COOLED CONDENSING UNIT
BDD	BACKDRAFT DAMPER	KPA	KILOPASCAL			RCCH	REMOTE CONDENSER CHILLER	WCPU	WATER COOLED HEAT PUMPS
BDR	BASE BOARD RADIATOR	KW	KILOWATT			RCU	RECIPROCATING CHILLER UNIT	WEF	WATER COOLED PACKAGED UNIT
BFP	BACKFLOW PREVENTER	KWH	KILOWATT HOURS			RD	REFRIGERANT DISCHARGE	WF	WATER FILTER
BFT	BOILER PLANT FIRE TUBE					RDS	ROOM DATA SHEETS	WFCV	WATER FLOW CONTROL VALVE
BG	BOTTOM GRILLE					REA	RELIEF AIR	WFM	WATER FLOWMETER
BHP	BRAKE HORSEPOWER					RF	RETURN FAN	WFMD	WATER FLOW MEASURING DEVICE
BHW	HOT WATER HEATING BOILER					RG	RETURN GRILLE	WG	WATER GAGE
BHX	BOILER BLOWDOWN HEAT EXCHANGER					RH	RELATIVE HUMIDITY	WPD	WATER SIDE PRESSURE DROP
BIW	BACKWARD INCLINED WHEEN (FAN)	L	LITER			RHC	REHEAT COIL	YR	YEAR
BR	BONE REGISTER	L/H	LITERS PER HOUR			RHG	REFRIGERANT HOT GAS		
BSC	BIOLOGICAL SAFETY CABINETS	L/M	LITERS PER MINUTE			RL	REFRIGERANT LIQUID LINE		
BT	BLOWOFF TANK	L/S	LITERS PER SECOND			RLA	RUN LOAD AMPERE		
BTC	BLOWOFF TANK CONTROL VALVE	LAT	LEAVING AIR TEMPERATURE			RO	REVERSE OSMOSIS		
BTU	BRITISH THERMAL UNIT	LB/H	POUND PER HOUR			RPM	REVOLUTIONS PER MINUTE		
BTUH	BRITISH THERMAL UNIT PER HOUR	LF	LINEAR FOOT (FEET)			RR	RETURN REGISTER		
BV	BINARY VARIABLE	LGT	LEAVING GLYCOL TEMPERATURE			RS	REFRIGERANT SUCTION		
BWT	BOILER PLANT WATER TUBE	LH	LATENT HEAT			RTU	ROOFTOP UNIT		
		LLHX	LIQUID TO LIQUID HEAT EXCHANGER			RV	RELIEF VALVE		
		LPG	LIQUID PROPANE GAS						
		LPR	LOW PRESSURE RETURN (STEAM CONDENSATE)			SA	SUPPLY AIR		
		LPRC	LOW PRESSURE STEAM RETURN (CLEAN)			SAD	SOUND ATTENUATING DEVICE		
		LPS	LOW PRESSURE STEAM			SAT	SUPPLY AIR TEMPERATURE		
		LPGC	LOW PRESSURE STEAM (CLEAN)			SC	SHADING COEFFICIENT		
		LS	LINEAR SLOT DIFFUSER			SCFM	STANDARD CUBIC FEET PER MINUTE		
		LTC	LOCAL TEMPERATURE CONTROL PANEL			SCR	SILICON CONTROLLED RECTIFIER		
		LVD	LEAVING			SD	SMOKE DETECTOR		
		LVR	LOUVER			SD	SUPPLY AIR DIFFUSER		
		LWT	LEAVING WATER TEMPERATURE			SD-1	SCHEMATIC DESIGN SUBMISSION 1		
						SD-2	SCHEMATIC DESIGN SUBMISSION 2		
		M	METER			SDPR	SMOKE DAMPER		
		M/S	METERS PER SECOND			SDR	SMOKE DAMPER (RETURN)		
		MA	MIXED AIR			SDS	SMOKE DAMPER (SUPPLY)		
		MAT	MIXED AIR TEMPERATURE			SEN	SENSIBLE HEAT		
		MAU	MAKE-UP AIR UNIT			SF	SUPPLY FAN		
		MAV	MANUAL AIR VENT			SG	SUPPLY AIR GRILLE		
		MAX	MAXIMUM			SH	STEAM HUMIDIFIER		
		MB	MIXING BOX			SHC	STEAM HEATING COIL		
		MBH	1000 BTUH			SI	SQUARE INCHES		
		MCA	MINIMUM BRANCH CIRCUIT AMPACITY			SP	STATIC PRESSURE		
		MER	MECHANICAL EQUIPMENT ROOM			SP GR	SPECIFIC GRAVITY		
		MERV	MINIMUM EFFICIENCY REPORTING VALUE			SPD	SUPPLY PROCESS AND DISTRIBUTION		
		MH	MANHOLE			SPRV	STEAM PRESSURE REDUCING VALVE		
		MHP	MOTOR HORSEPOWER			SPS	STATIC PRESSURE SENSOR		
		MIN	MINIMUM			SQ FT	SQUARE FOOT		
		MM	MILLIMETER			SR	SUPPLY AIR REGISTER		
		MOV	MOTOR OPERATED VALVE			SS	STAINLESS STEEL		
		MPR	MEDIUM PRESSURE RETURN (STEAM CONDENSATE)			SSHX	STEAM TO STEAM HEAT EXCHANGER		
		MPS	MEDIUM PRESSURE STEAM			SSR	SOLID SEPARATOR		
		MRI	MAGNETIC RESONANCE IMAGING UNIT			ST	STEAM TRAP		
		MTD	MEAN TEMPERATURE DIFFERENCE			SUH	STEAM UNIT HEATER		
		MVD	MANUAL VOLUME DAMPER			SV	STEAM PRESSURE REDUCING VALVE		
		MZ	MULTI-ZONE			SVS	STEAM VENT SILENCER		
						SWHX	STEAM TO WATER HEAT EXCHANGER		
		NA	NOT APPLICABLE						
		NC	NOISE CRITERIA			T&PCV	TEMPERATURE AND PRESSURE CONTROL VALVE		
		NC	NORMALLY CLOSED			TAB	TESTING, ADJUSTING, AND BALANCING		
		NG	NATURAL GAS			TD	TEMPERATURE DIFFERENCE		
		NGFM	NATURAL GAS FLOW METER			TDH	TOTAL DYNAMIC HEAD		
		NO	NORMALLY OPEN			TDS	TOTAL DISSOLVED SOLIDS		
		NOAA	NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION			TG	TRANSFER GRILLE		
		NOM	NOMINAL						
		NPLV	NON-STANDARD PART LOAD VALUE						
		NPSH	NET POSITIVE SUCTION HEAD						
		NTS	NOT TO SCALE						

HVAC GENERAL NOTES

1. ALL PIPING AND DUCTS IN FINISHED ROOMS OR SPACES SHALL BE CONCEALED IN A FURRED CHASE OR ABOVE THE HARD SUSPENDED CEILING.
2. THE FIRST FIGURE OF DUCT SIZE INDICATES DIMENSION OF FACE SHOWN OR INDICATED. DUCT SIZES ARE NET INSIDE DIMENSIONS.
3. ACCESS PANELS IN HARD SUSPENDED CEILINGS ARE REQUIRED FOR ALL VALVES, TRAPS, DAMPERS, CLEANOUTS, CONTROLS, ETC. ACCESS PANELS SHALL BE FURNISHED AND INSTALLED UNDER THE ARCHITECTURAL SPECIFICATIONS.
4. TOTAL STATIC PRESSURE NOTED IN THE SCHEDULES INCLUDES DUCT SYSTEM, TERMINAL UNITS, FILTERS, COILS, ETC.
5. FOR TYPICAL STEAM AND WATER PIPING CONNECTIONS TO EQUIPMENT, SEE EQUIPMENT DETAILS.
6. DIFFUSER, REGISTER AND GRILLE SIZES SHOWN ON FLOOR PLANS ARE NECK SIZES.
7. WATER PIPE CONNECTIONS TO AIR HEATING AND COOLING COILS SHALL BE MADE TO PROVIDE COUNTER FLOW BETWEEN WATER AND AIR.
8. WALL TYPE EXHAUST REGISTERS NOTED AS "BR" ON DRAWINGS ARE TO BE INSTALLED WITH BOTTOM ELEVATION OF REGISTER AT 7" ABOVE FINISHED FLOOR.
9. ALL PRESSURES LISTED ARE GAGE PRESSURE UNLESS NOTED OTHERWISE
10. ALL CONTROL SYSTEM EQUIPMENT SHALL BE COMPATIBLE WITH EXISTING BUILDING MANAGEMENT SYSTEM CONTROLS. EXTEND EXISTING CONTROL SYSTEM TO INCLUDE ALL OF THE CONTROLS AND SEQUENCES SHOWN.
11. COORDINATE EXISTING FIRE SPRINKLER HEADS AND LIGHTS WITH NEW DUCTS AND DIFFUSERS.
12. PROVIDE ACOUSTICAL SEALANT PER SPECIFICATIONS SECTION 07 92 00 AT ALL DUCT AND PIPE PENETRATIONS THROUGH SOUND RATED PARTITIONS.
13. SUBMIT COMPLETE CONSOLIDATED AND COORDINATED SHOP DRAWINGS FOR ALL NEW SYSTEMS, AND FOR EXISTING SYSTEMS THAT ARE IN THE SAME AREAS. DO NOT INSTALL EQUIPMENT FOUNDATIONS, EQUIPMENT, OR PIPING UNTIL COORDINATION/SHOP DRAWINGS HAVE BEEN APPROVED.

GENERAL NOTES

1. CONTRACTOR SHALL PROVIDE AN INFECTION CONTROL RISK ASSESSMENT BARRIER AROUND THE PROJECT AREA CONSISTENT WITH THE CONTRACTOR'S PHASING PLAN AS APPROVED BY THE VHA COR.
2. CONTRACTOR SHALL PROVIDE ICRA BARRIER AROUND THE PROJECT AREA CONSISTENT WITH THE CONTRACTOR'S PHASING PLAN AS APPROVED BY THE VHA COR.

MECHANICAL/HVAC EQUIPMENT, PIPING AND DUCTWORK  
2015 IBC AND ASCE 7-10 NONSTRUCTURAL SEISMIC  
RESTRAINT, BRACING AND ANCHORAGE NOTES:

REFERENCE SPECIFICATION: SECTION 13 05 41  
SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

SEISMIC DESIGN DATA FOR ANALYSIS AND DESIGN:

H-18-8 SEISMICITY = MODERATE-HIGH  
SEISMIC RISK CATEGORY BASED UPON OCCUPANCY = III  
COMPONENT IMPORTANCE FACTORS:  
IP=1.0 FOR NON-ESSENTIAL COMPONENTS  
IP=1.5 FOR LIFE SAFETY AND DESIGNATED SEISMIC SYSTEMS (DSS) AND PERMANENT EQUIPMENT AND COMPONENTS REQUIRING SPECIAL SEISMIC CERTIFICATION PER H-18-8

MAPPED SPECTRAL RESPONSE ACCELERATION PARAMETERS:  
SS=0.533G S1=0.154G

SITE CLASS C (PER GEOTECHNICAL REPORT)

DESIGN SPECTRAL RESPONSE ACCELERATION PARAMETERS:  
SDS=0.421G SD1=0.169G  
SEISMIC DESIGN CATEGORY (SDC) = C

NOTE: NONSTRUCTURAL SEISMIC EXCEPTIONS AND EXEMPTIONS SHALL BE DETERMINED IN ACCORDANCE WITH H-18-8 AND CHAPTER 13 OF ASCE 7 FOR SDC = D. REFERENCE SPECIFICATION SECTION 13 05 14.






H-18-8 SPECIAL SEISMIC CERTIFICATION (SSC) REQUIREMENT:

IN STRUCTURES ASSIGNED TO SEISMIC DESIGN CATEGORY C, D, E, OR F, PERMANENT EQUIPMENT AND COMPONENTS ARE TO HAVE SPECIAL SEISMIC CERTIFICATION IN ACCORDANCE WITH REQUIREMENTS OF SECTION 13.2.2 OF ASCE 7 EXCEPT FOR EQUIPMENT AND COMPONENTS THAT ARE CONSIDERED RUGGED AS LISTED IN SECTION 2.2 OF OSHPD CODE APPLICATION NOTICE CAN NO. 2-1708A.5, AND SHALL COMPLY WITH SECTION 13.2.6 OF ASCE 7.

CLARIFICATION OF ASCE 7 "12 INCH RULE" SUSPENDED SEISMIC BRACING CODE EXCEPTION FOR PIPING AND HVAC DUCTWORK:

ALL PIPING OR DUCTWORK SUSPENDED BY INDIVIDUAL HANGER RODS 12" OR LESS AS MEASURED FROM THE TOP OF THE PIPING OR DUCTWORK TO THE BOTTOM OF THE SUPPORT WHERE THE HANGER IS ATTACHED, IF THE 12" LIMIT IS EXCEEDED BY ANY HANGER IN THE RUN, SEISMIC BRACING IS REQUIRED FOR THE RUN. NOTE: A SINGLE SUPPORT LOCATION THAT MEETS THE REQUIREMENT OF THIS EXCEPTION DOES NOT CONSTITUTE A SEISMIC SWAY BRACE LOCATION. IN ADDITION, TO MEET THE CODE REQUIREMENTS, ALL OF THE FOLLOWING CONDITIONS MUST ALSO BE SATISFIED:

1. LATERAL MOTION OF PIPING OR DUCTWORK WILL NOT CAUSE DAMAGING IMPACT WITH SURROUNDING SYSTEMS (E.G. OTHER CONDUIT, TRAY, PIPE, DUCT, EQUIPMENT, SPRINKLER HEADS ETC.) OR CAUSE LOSS OF SYSTEM VERTICAL SUPPORT.
2. PIPING OR DUCTWORK MUST BE MADE OF DUCTILE MATERIAL WITH DUCTILE CONNECTIONS.

		CONSULTANTS:	ARCHITECT/ENGINEERS:	STAMP:		Drawing Title MECHANICAL ABBREVIATIONS	Phase 100% CONSTRUCTION DOCUMENTS	Project Title OUTPATIENT MENTAL HEALTH / EDUCATION ADDITION	Project Number 436-114
		 1640 TOMAHAWK CREEK PARKWAY SUITE 400, LEANWOOD, KANSAS 66041	 750 W HAMPTON AVE SUITE #300 ENGLEWOOD CO 80110 (720) 550-6307 WWW.VALHALLAENGINEERING.COM			Approved: Project Director		Location 3687 VETERANS DRIVE, FORT HARRISON, MT 59636	Building Number 173 / 154
		 JIRSA HEDRICK Structural Engineers						Issue Date 08/05/2020	Checked DD
								Drawn DN	Drawing Number M-001
Issued:	Date:			VEG 4.11					



CONTROLS SYMBOLS

T	ROOM THERMOSTAT/TRANSMITTER - WALL MOUNT
M	ROOM HUMIDISTAT (MOISTURE)/TRANSMITTER - WALL MOUNT
TT	TEMPERATURE TRANSMITTER
TT	TEMPERATURE TRANSMITTER, AVERAGING ELEMENT
MT	MOISTURE (HUMIDITY) TRANSMITTER
PT	PRESSURE TRANSMITTER
SPS	STATIC PRESSURE SENSOR
FT	FLOW TRANSMITTER
IT	CURRENT TRANSMITTER
CT	CONDUCTIVITY TRANSMITTER
SD	SMOKE DETECTOR
PDT	PRESSURE DIFFERENTIAL TRANSMITTER
PDS	PRESSURE DIFFERENTIAL SWITCH
HS	HAND SWITCH (HAND-OFF-AUTO SWITCH)
ZC	VALVE OR DAMPER POSITION CONTROLLER
KR	LOCAL RECORDING TIME CLOCK (RUNTIME)
TSL	TEMPERATURE SWITCH, LOW (FREEZESTAT)
TSH	TEMPERATURE SWITCH, HIGH (FREEZESTAT)
LC	LEVEL CONTROLLER
LT	LEVEL TRANSMITTER
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
EPT	ELECTRONIC TO PNEUMATIC TRANSDUCER
AT <sub>CO2</sub>	CARBON DIOXIDE TRANSMITTER
AT <sub>CO</sub>	CARBON MONOXIDE TRANSMITTER
AT <sub>OC</sub>	OCCUPANCY SENSOR
LTCP	LOCAL TEMPERATURE CONTROL PANEL
HVAC	HVAC CONTROL PANEL
VSMC	VARIABLE SPEED MOTOR CONTROLLER
ECC	INTEGRATE CONTROL POINT ON REMOTE GRAPHICS WORKSTATION AT ENERGY CONTROL CENTER
TC	TEMPERATURE CONTROLLER. SEE SEQUENCE OF OPERATION
PC	PRESSURE CONTROLLER. SEE SEQUENCE OF OPERATION
SC	SPEED CONTROLLER. SEE SEQUENCE OF OPERATION
FC	FLOW CONTROLLER. SEE SEQUENCE OF OPERATION
FSH	FLOW SWITCH HIGH
FSL	FLOW SWITCH LOW
KC	TIME CLOCK CONTROLLING EQUIPMENT ON A SCHEDULE
	TEMPERATURE SENSING ELEMENT FOR TRANSMITTING TEMPERATURE TO EMCS (PROVIDE 12 INCHES MINIMUM LENGTH IN DUCT WHEN SPACE PERMITS.)
	SENSOR WITH AVERAGING ELEMENT TO TRANSMIT TEMPERATURE TO EMCS MOTOR STARTER
	ELECTRIC OPERATED CONTROL
M	DAMPER OR VALVE
BAS	BUILDING AUTOMATION SYSTEM

DUCTWORK SYMBOLS

UP	DN	SUPPLY DUCT (UP & DOWN)
UP	DN	EXHAUST DUCT (UP & DOWN)
UP	DN	RETURN DUCT (UP & DOWN)
		SQUARE 4-WAY CEILING DIFFUSERS
		SQUARE 3-WAY CEILING DIFFUSERS
		SQUARE 2-WAY CEILING DIFFUSERS
		SQUARE 1-WAY CEILING DIFFUSERS
		LINEAR SLOT DIFFUSER
		SUPPLY TOP REGISTER OR GRILLE (WALL TYPE)
		EXHAUST OR RETURN CEILING REGISTER OR GRILLE
		EXHAUST OR RETURN BOTTOM REGISTER OR GRILLE (WALL TYPE)
		EXHAUST OR RETURN REGISTER OR TOP GRILLE (WALL TYPE)
		VANED ELBOW & AIR SPLIT TYPE DUCT TAKE-OFF
		CONNECT NEW DUCT TO EXISTING DUCT
		INCLINED RISE, IN DIRECTION OF AIR FLOW
		INCLINED DROP, IN DIRECTION OF AIR FLOW
		LIMIT OF DEMOLITION
		FLEXIBLE CONNECTION, EQUIPMENT, VIBRATION, OR SEISMIC
		VANED ELBOW (PROVIDE ALL SQUARE OR RECTANGULAR ELBOWS WITH VANES EVEN IF SYMBOL IS MISSING)
		VANED ELBOW (SHORT RADIUS)
		STANDARD RADIUS ELBOW (LONG RADIUS)
10x8		NEW DUCT (INSIDE DIMENSIONS: WIDTH x DEPTH)
		EXISTING DUCT TO REMAIN

TERMINAL UNIT SYMBOLS

	CONVECTOR OR RADIATOR (RECESSED)
	CONVECTOR OR RADIATOR (WALL HUNG)
A	FLOOR MOUNTED VERTICAL RECESSED FAN COIL UNIT. LETTER INDICATES UNIT SIZE.
A	FLOOR MOUNTED VERTICAL CABINET FAN COIL UNIT. LETTER INDICATES UNIT SIZE.
A	THRU WALL AIR CONDITIONING UNIT. LETTER INDICATES UNIT SIZE.
A	WINDOW TYPE AIR CONDITIONING UNIT. LETTER INDICATES UNIT SIZE.
A	FLOOR MOUNTED HEAT PUMP. LETTER INDICATES UNIT SIZE.
	AIR CURTAIN
	UNIT HEATER (HORIZONTAL)
	UNIT HEATER (VERTICAL)
	2'x2' RADIANT CEILING PANEL
	2'x4' RADIANT CEILING PANEL

DRAWING SYMBOLS

2	DETAIL NUMBER
H4	DRAWING NUMBER WHERE DRAWN
A	SECTION LETTER
17	DRAWING NUMBER WHERE SHOWN
	BUILDING NO. WHERE EQUIPMENT IS LOCATED. EQUIPMENT ABBREVIATION (SUPPLY FAN)
26-SF 3	SUPPLY FAN NO. 3 IN BUILDING NO. 26
	TYPICAL UNIT NO.
	BUILDING NO. WHERE EQUIPMENT IS LOCATED
26-TU-4	ITEM (TERMINAL UNIT SHOWN)
	ITEM NUMBER (TERMINAL UNIT NO. 1)
	SERVED BY AIR HANDLER UNIT NO. 1

AIR TERMINAL SYMBOLS

	TERMINAL UNIT WITH REHEAT COIL
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HVAC PIPING SYMBOLS

HPS	HIGH PRESSURE STEAM (60 PSIG AND ABOVE)
HPR	HIGH PRESSURE STEAM CONDENSATE RETURN
MPS	MEDIUM PRESSURE STEAM (16 PSIG THRU 59 PSIG)
MPR	MEDIUM PRESSURE STEAM CONDENSATE RETURN
LPS	LOW PRESSURE STEAM (15 PSIG AND BELOW)
LPR	LOW PRESSURE STEAM CONDENSATE RETURN
PC	CONDENSATE PUMP DISCHARGE
HWS	HEATING WATER SUPPLY
HWR	HEATING WATER RETURN
GHS	GLYCOL-WATER HEATING SUPPLY
GHR	GLYCOL-WATER HEATING RETURN
SW	SOLAR WATER SUPPLY
SWR	SOLAR WATER RETURN
RL	REFRIGERANT LIQUID
RS	REFRIGERANT SUCTION
RHG	REFRIGERANT HOT GAS
CWS	CONDENSER WATER SUPPLY (FROM TOWER)
CWR	CONDENSER WATER RETURN (TO TOWER)
CHS	CHILLED WATER SUPPLY
CHR	CHILLED WATER RETURN
GCS	CHILLED GLYCOL-WATER SUPPLY
GCR	CHILLED GLYCOL-WATER RETURN
MW	MAKE-UP WATER
D	DRAIN LINE
V	VENT LINE
GRS	GLYCOL-WATER RUN AROUND SUPPLY
GRR	GLYCOL-WATER RUN AROUND RETURN
X	EXISTING PIPE TO BE REMOVED
FWPD	FEEDWATER PUMP DISCHARGE
FWPS	FEEDWATER PUMP SUCTION
CTPD	CONDENSATE TRANSFER PUMP DISCHARGE
CTPS	CONDENSATE TRANSFER PUMP SUCTION
VR	VACUUM CONDENSATE RETURN
TC	TUBE CLEANER WATER SUPPLY
BO	BOILER BLOWOFF
CBD	CONTINUOUS BLOWDOWN
BWS	BOILER WATER SAMPLE
FWS	FEEDWATER SAMPLE (FROM DEAERATOR)
CF	CHEMICAL FEED
OFL	OVERFLOW
A	COMPRESSED AIR
G	NATURAL GAS MAIN FUEL
GI	NATURAL GAS IGNITER FUEL
LPG(I)	LIQUEFIED PETROLEUM GAS IGNITER FUEL
FOS	FUEL OIL SUPPLY
FOR	FUEL OIL RETURN
CW	COLD WATER (CITY WATER)
SW	SOFTENED WATER
HW	HOT WATER
RH	ROLLER-TYPE HANGER
SH	VARIABLE SPRING-TYPE HANGER (TYPE 51)*
SCH	SPRING CUSHION-TYPE HANGER (TYPE 48 OR 49)*
	CLEVIS-TYPE HANGER
TH	TRAPEZE HANGER (PROVIDE U-BOLT PIPE ATTACHMENT TO TRAPEZE EXCEPT WHERE RH ARE INDICATED)
PS	FLOOR-SUPPORTED PIPE STAND
RC	RISER CLAMP (TYPE 42)*
WB	WALL BRACKET (TYPE 31, 32, 33)*
CSH	CONSTANT SUPPORT HANGER (TYPE 54, 55, 56)*
SS	SLIDING SUPPORTS (TYPE 35)*

\* TYPE NUMBERS REFER TO MANUFACTURER'S STANDARDIZATION SOCIETY STANDARD PRACTICE SP-58

GENERAL PIPING SYMBOLS

	DIRECTION OF PIPE PITCH (DOWN)
	DIRECTION OF FLOW
	ANCHOR
	REDUCER OR INCREASER
	ECCENTRIC REDUCER
	TOP CONNECTION, 45° OR 90°
	BOTTOM CONNECTION, 45° OR 90°
	SIDE CONNECTION
	CAPPED OUTLET
	RISE OR DROP IN PIPE
	UNION
	PIPE UP
	PIPE DOWN
	INVERTED BUCKET TRAP SET INCLUDING PIPING ACCESSORIES SEE DETAIL
	FLOAT & THERMOSTATIC TRAP SET INCLUDING PIPING ACCESSORIES SEE DETAIL
	THERMOSTATIC TRAP SET INCLUDING PIPING ACCESSORIES SEE DETAIL
	THERMOMETER
	PRESSURE GAGE
	FLOW ELEMENT
	REFRIGERANT SIGHT GLASS
	TEST PLUG (PRESSURE/TEMPERATURE)
AV	AUTOMATIC AIR VENT
MV	MANUAL AIR VENT
C	QUICK-COUPLE HOSE CONNECTOR
	CONNECT TO EXISTING
	LIMIT OF DEMOLITION
	AIR SEPERATOR

VALVE SYMBOLS

	GATE VALVE - THREADED/FLANGED
	GLOBE VALVE - THREADED/FLANGED
	GATE VALVE WITH 3/4" HOSE ADAPTER
	CHECK VALVE
	WYE STRAINER (WITH BALL VALVE & HOSE CONNECTION)
	WYE STRAINER WITH VALVED DRAIN AND QUICK-COUPLE
	FLEXIBLE CONNECTION
	ANGLE GLOBE VALVE
	BUTTERFLY VALVE
	BALL VALVE
	MODULATING CONTROL VALVE
	MODULATING CONTROL BUTTERFLY VALVE
	TWO POSITION CONTROL VALVE
	THREE-WAY MODULATING CONTROL VALVE
	THREE-WAY TWO POSITION CONTROL VALVE
	PRESSURE REGULATING VALVE
	PRESSURE SAFETY VALVE
	AUTOMATIC BALANCING CONTROL VALVE
	WATER BALANCE DEVICE
	CIRCUIT SETTER VALVE
	GATE VALVE WITH GLOBE-VALVED BYPASS
	PLUG VALVE
	CONTROL VALVE (CV) - FLOAT-OPERATED
	PRESSURE REDUCING VALVE (PRV)
LC	WATER LEVEL CONTROLLER
M	FLOW METER

Issued:

1

Date:

2

CONSULTANTS:

HOEFER WYSOCKI

11600 TOMAHAWK CREEK PARKWAY SUITE 400 LEANWOOD, KANSAS 66041

LAND

3

Protection Engineering

CONSULTANTS

JIRSA

HEDRICK

Structural Engineers

ARCHITECT/ENGINEERS:

VALHALLA ENGINEERING GROUP, LLC

750 W HAMPDEN AVE SUITE #300 ENGLEWOOD CO 80110 (720) 550-6307 WWW.VALHALLAENGINEERING.COM

VEG 4.11

STAMP:

Professional Engineer

25791

2018

U.S. Department of Veterans Affairs

Drawing Title

MECHANICAL SYMBOLS

Approved: Project Director

Phase

100% CONSTRUCTION DOCUMENTS

Project Title

OUTPATIENT MENTAL HEALTH / EDUCATION ADDITION

Location

3687 VETERANS DRIVE, FORT HARRISON, MT 59636

Issue Date

08/05/2020

Checked

DD

Drawn

DN

Project Number

436-114

Building Number

173 / 154

Drawing Number

M-002

File Path

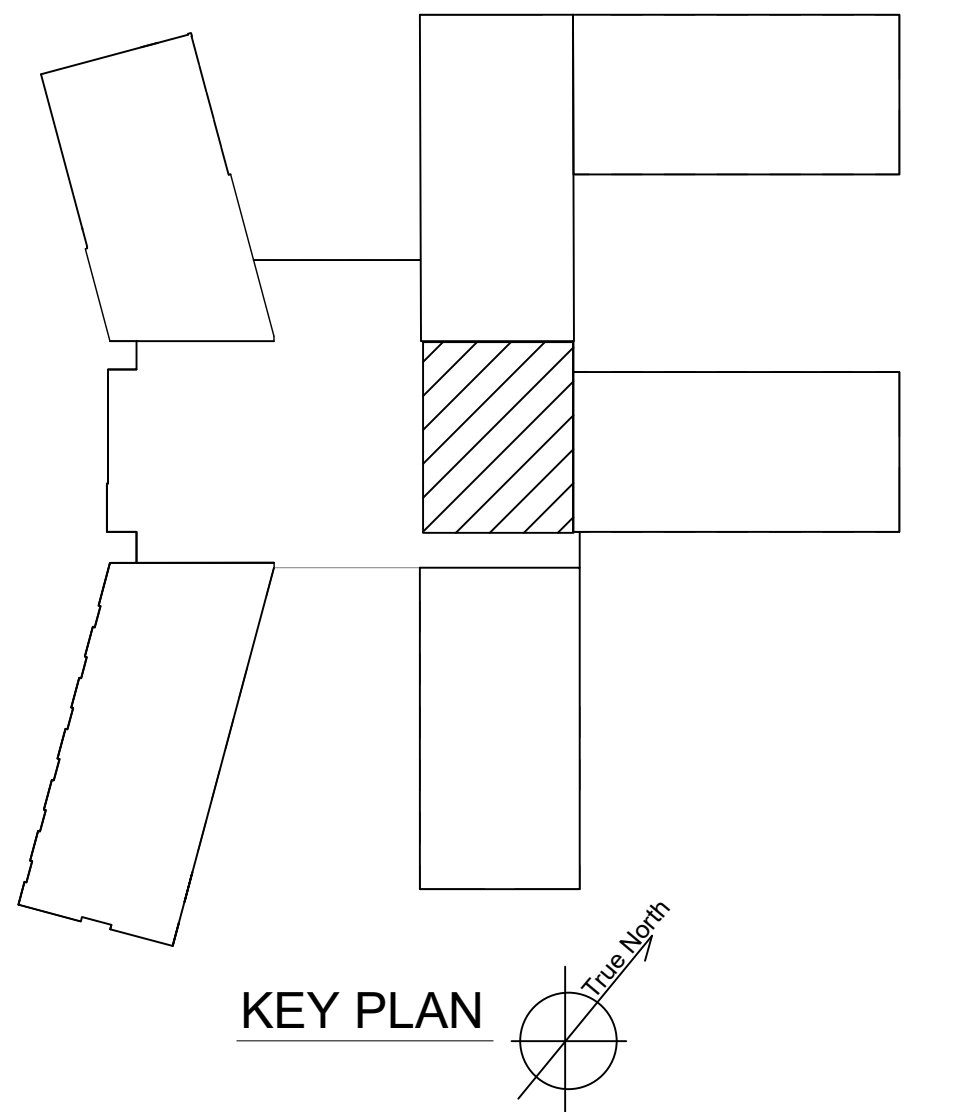
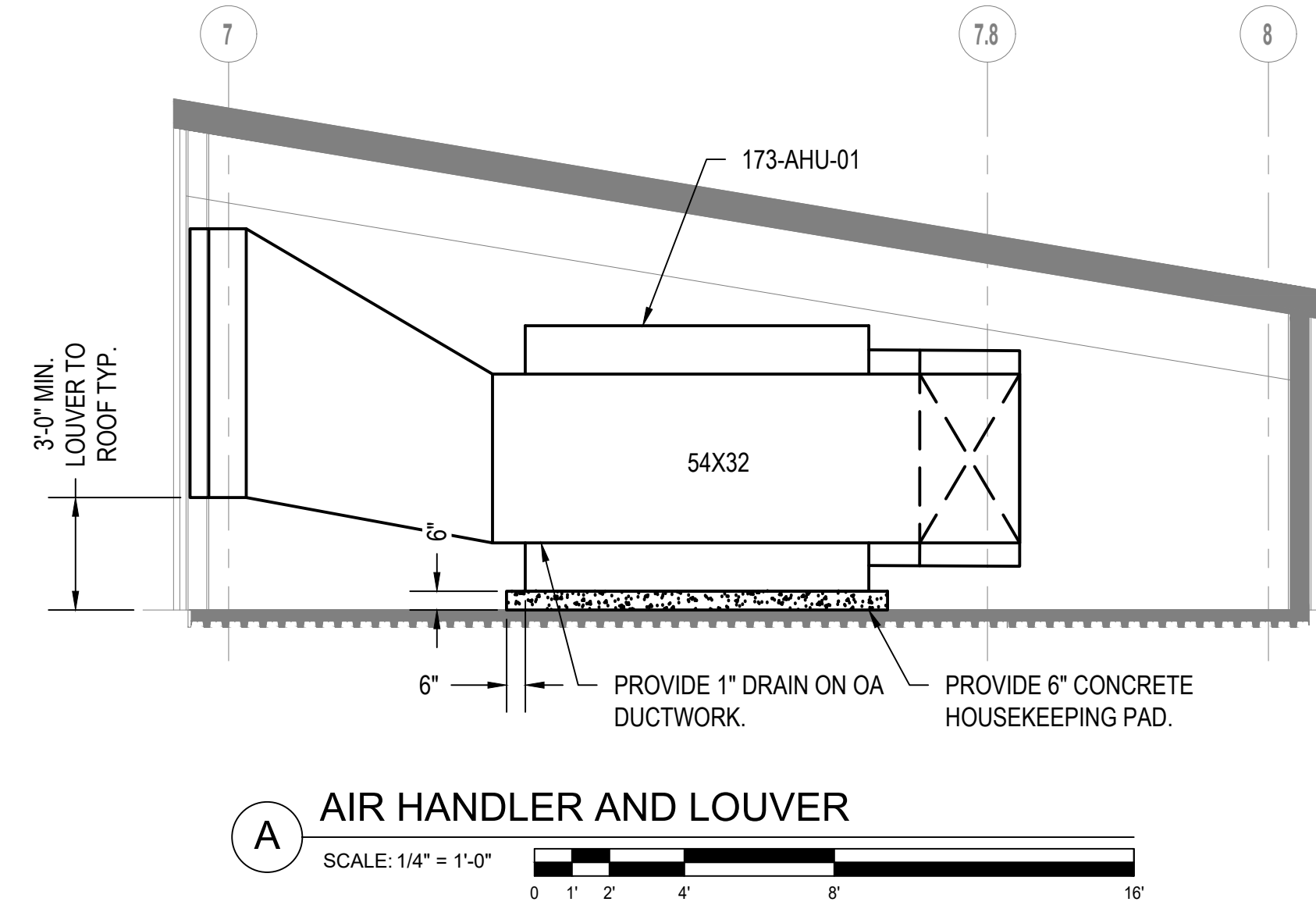
VA FORM 08 - 6231







1. REFER TO MECHANICAL DETAILS AND SPECIFICATIONS FOR INSTALLATION REQUIREMENTS.
2. PROVIDE SPRING ISOLATORS ON ALL DUCTWORK AND PIPING IN PENTHOUSE.
3. PROVIDE FLEX CONNECTORS TO ALL DUCT CONNECTIONS TO AIR HANDLER.
4. OUTSIDE AIR AND EXHAUST AIR DAMPERS SHALL COMPLY WITH ASHRAE 90.1-2013 TABLE 6.4.3.4.3 MAXIMUM DAMPER LEAKAGE.

[illegible]

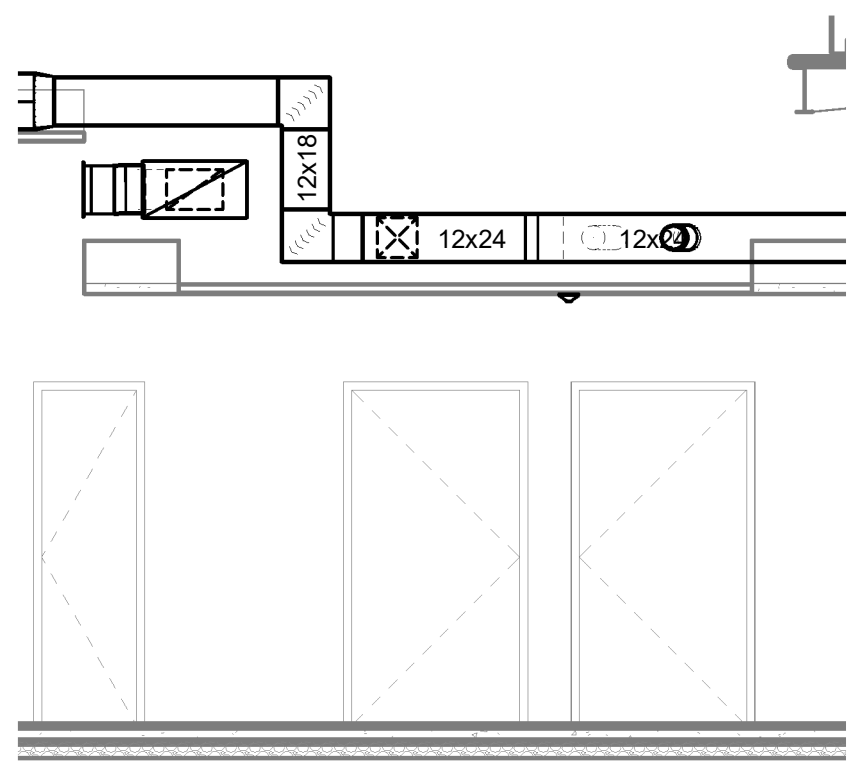




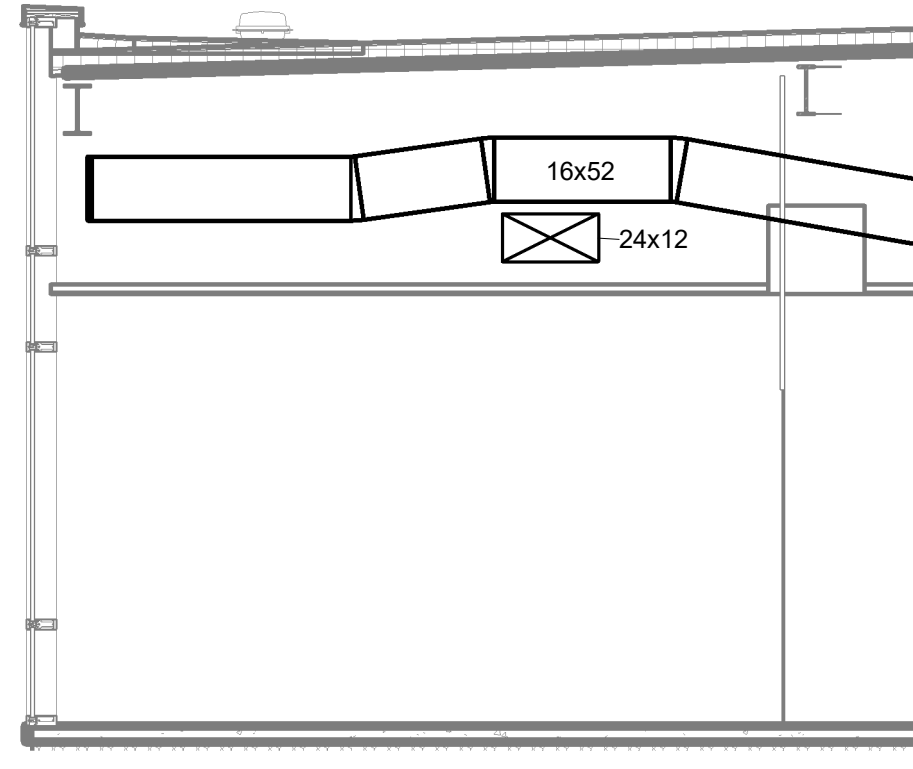


### KEY NOTES:

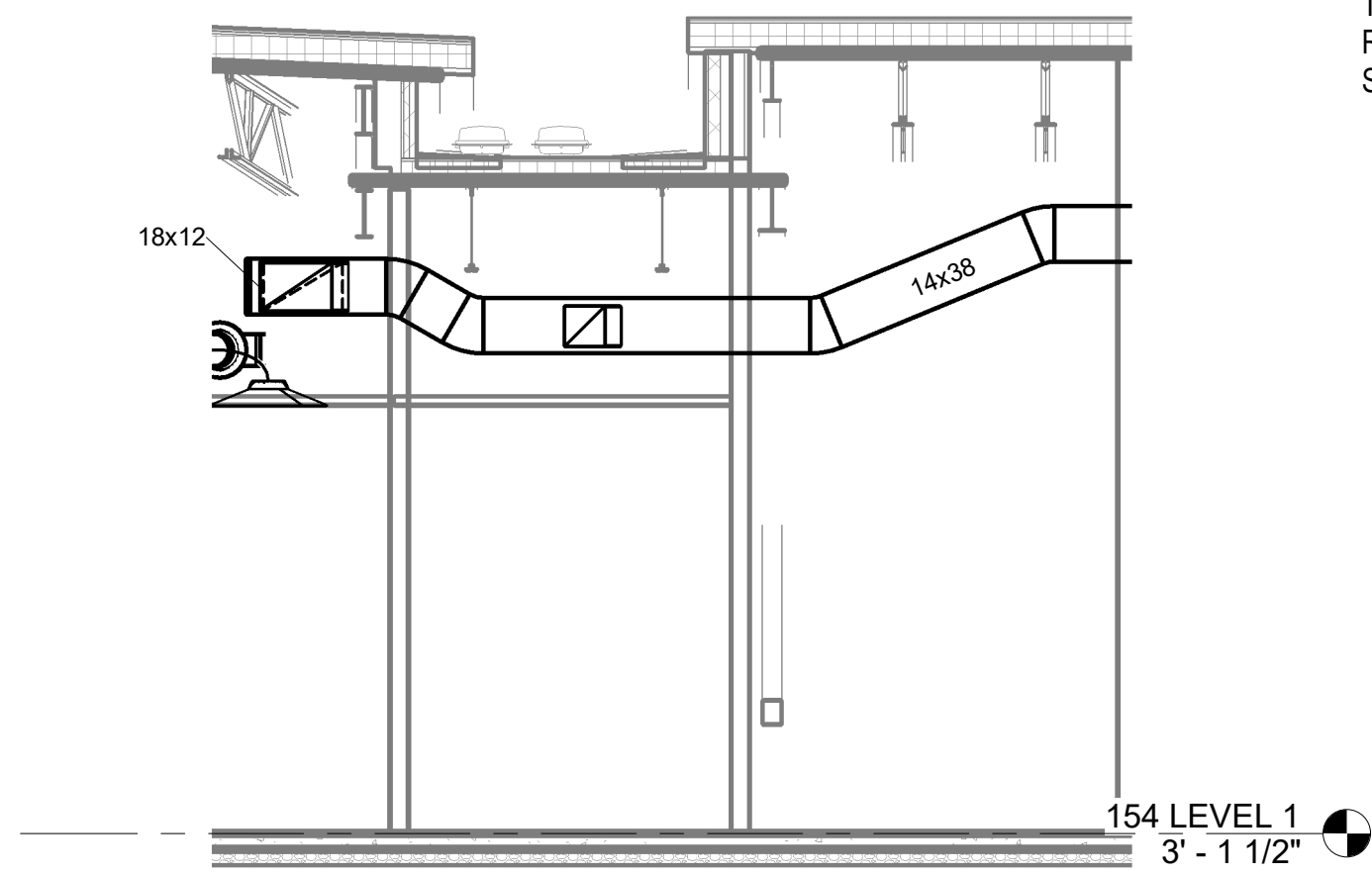
1 PROVIDE 2" THICK AP ARMAFLEX SA OR APPROVED  
EQUAL DUCT LINER. DUCT DIMENSION SHOWN IS TO  
THE INSIDE OF LINER. NO OUTSIDE INSULATION IS  
REQUIRED WHERE LINER IS PROVIDED. REFERENCE  
SPECIFICATION SECTION 23 07 11.



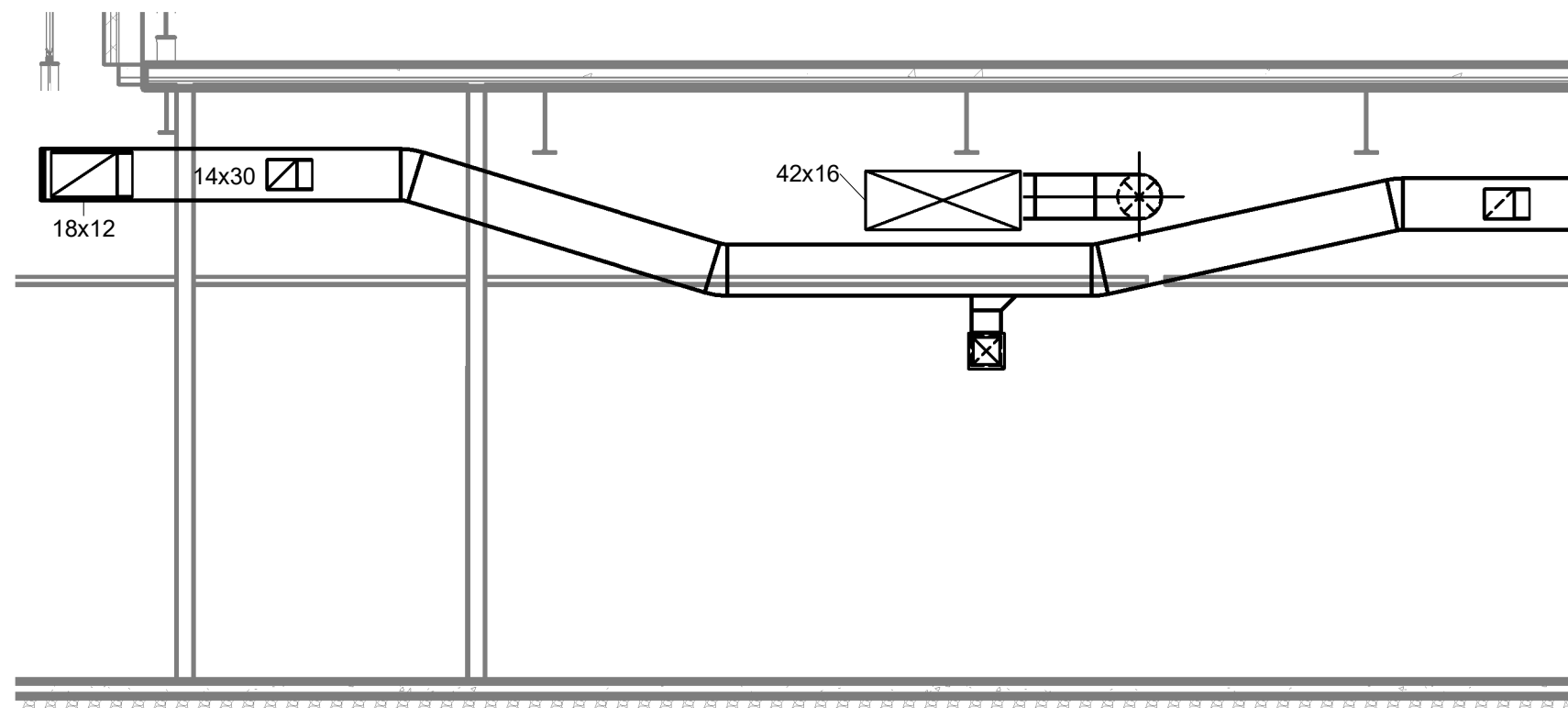
1 Section 1  
1/4" = 1'-0"



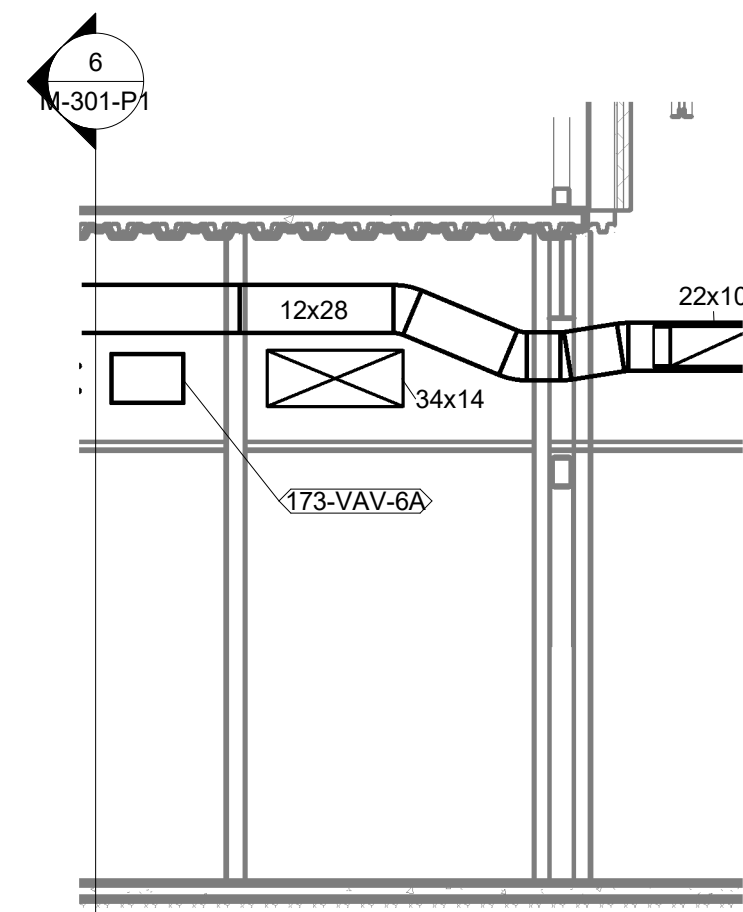
2 Section 2  
1/4" = 1'-0"



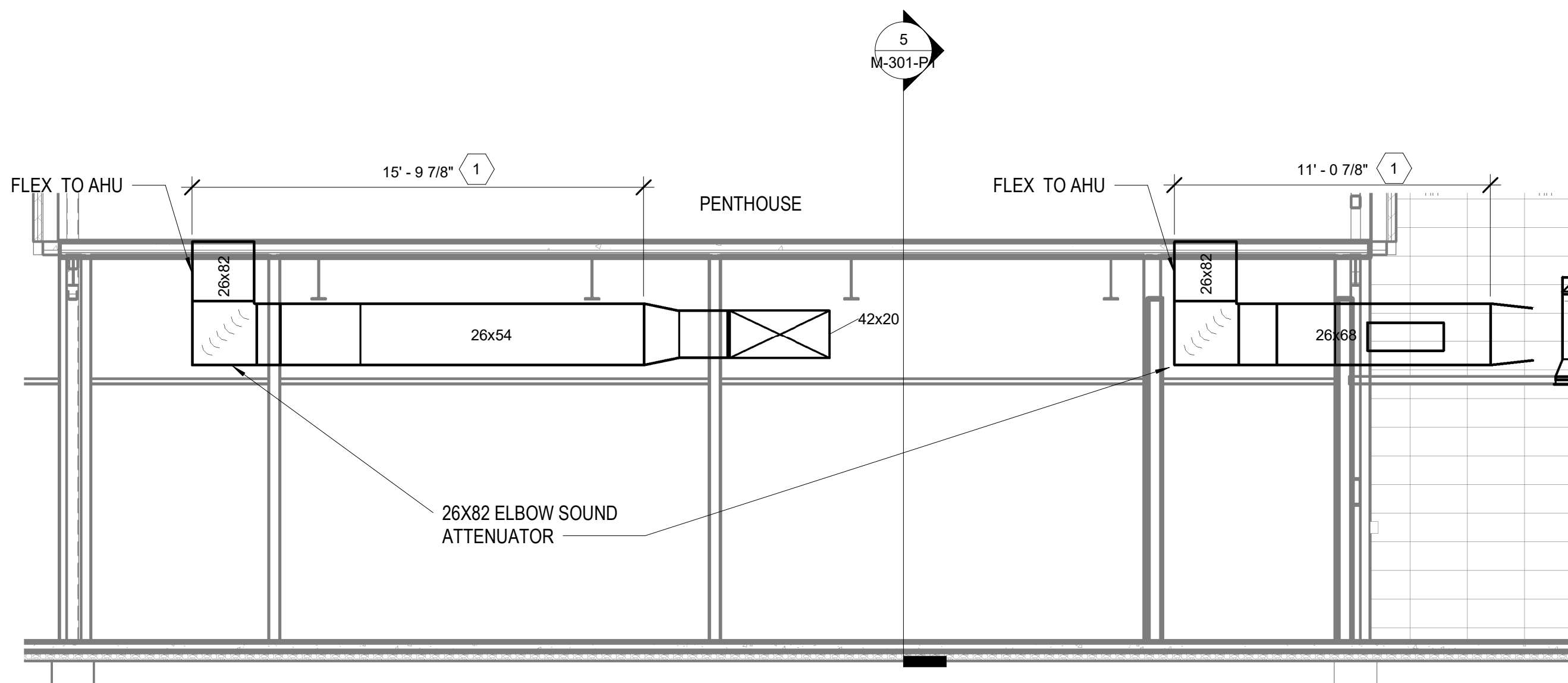
3 Section 3  
1/4" = 1'-0"



4 Section 4  
1/4" = 1'-0"



5 Section 5  
1/4" = 1'-0"



6 Section 6  
1/4" = 1'-0"

[illegible]



A

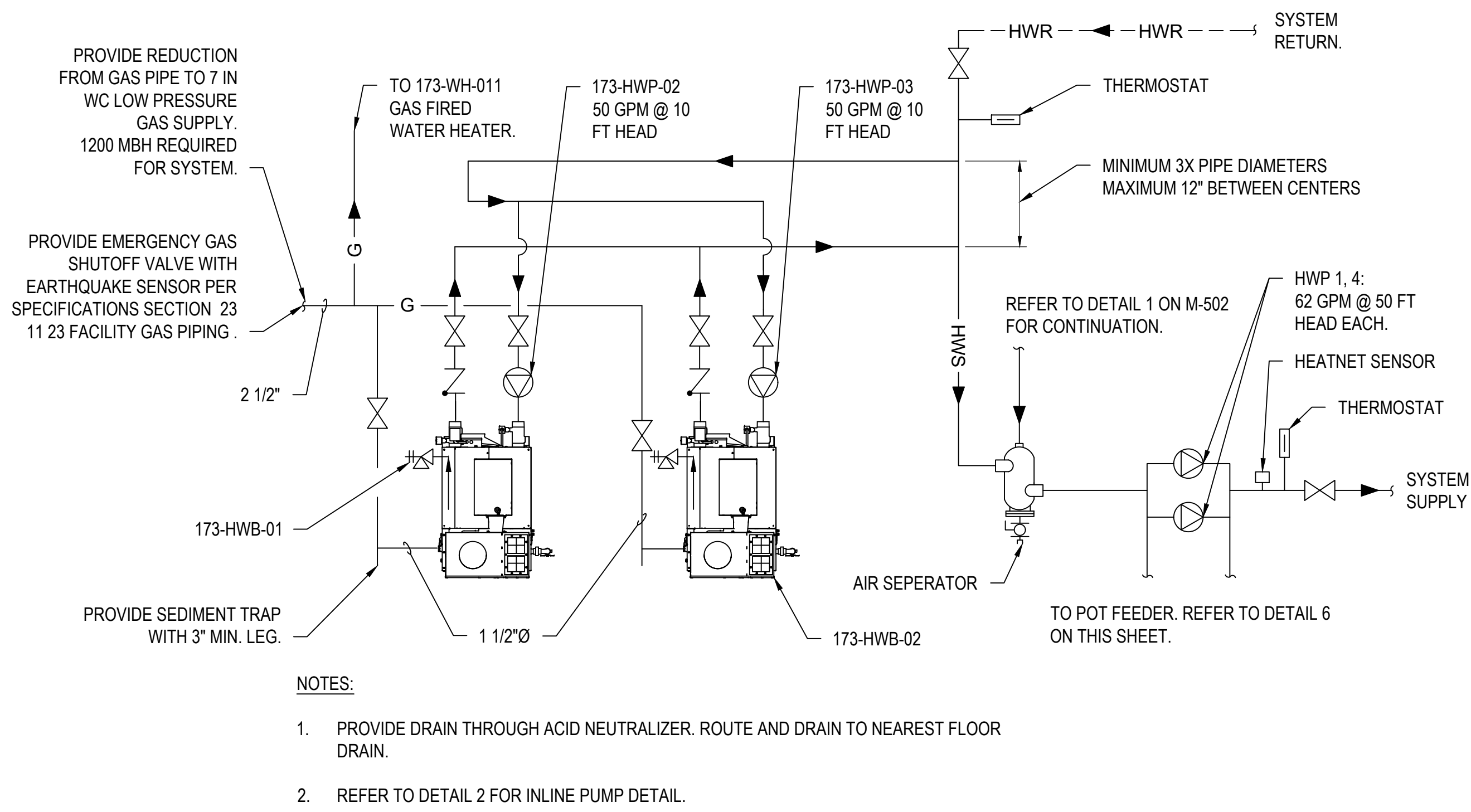
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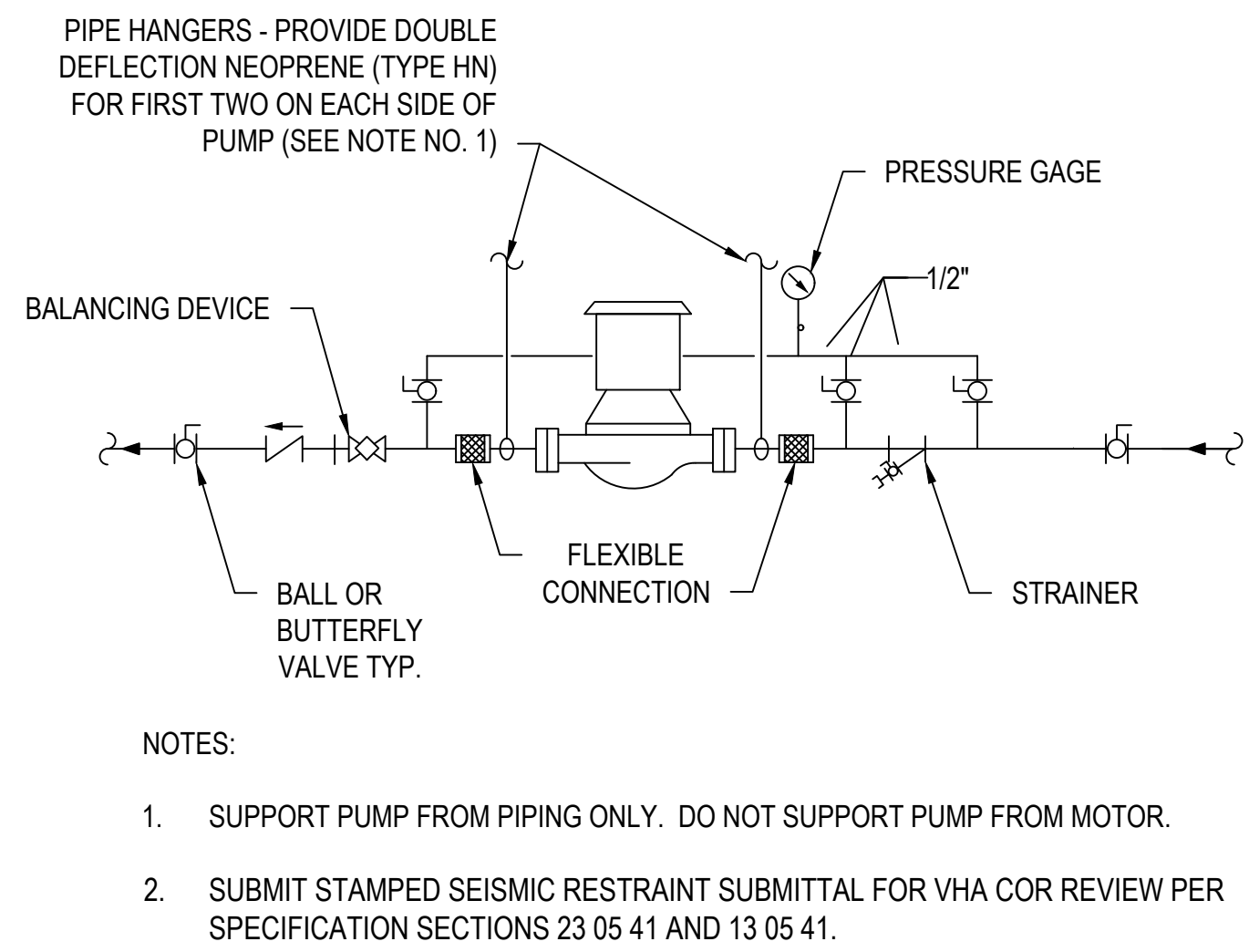
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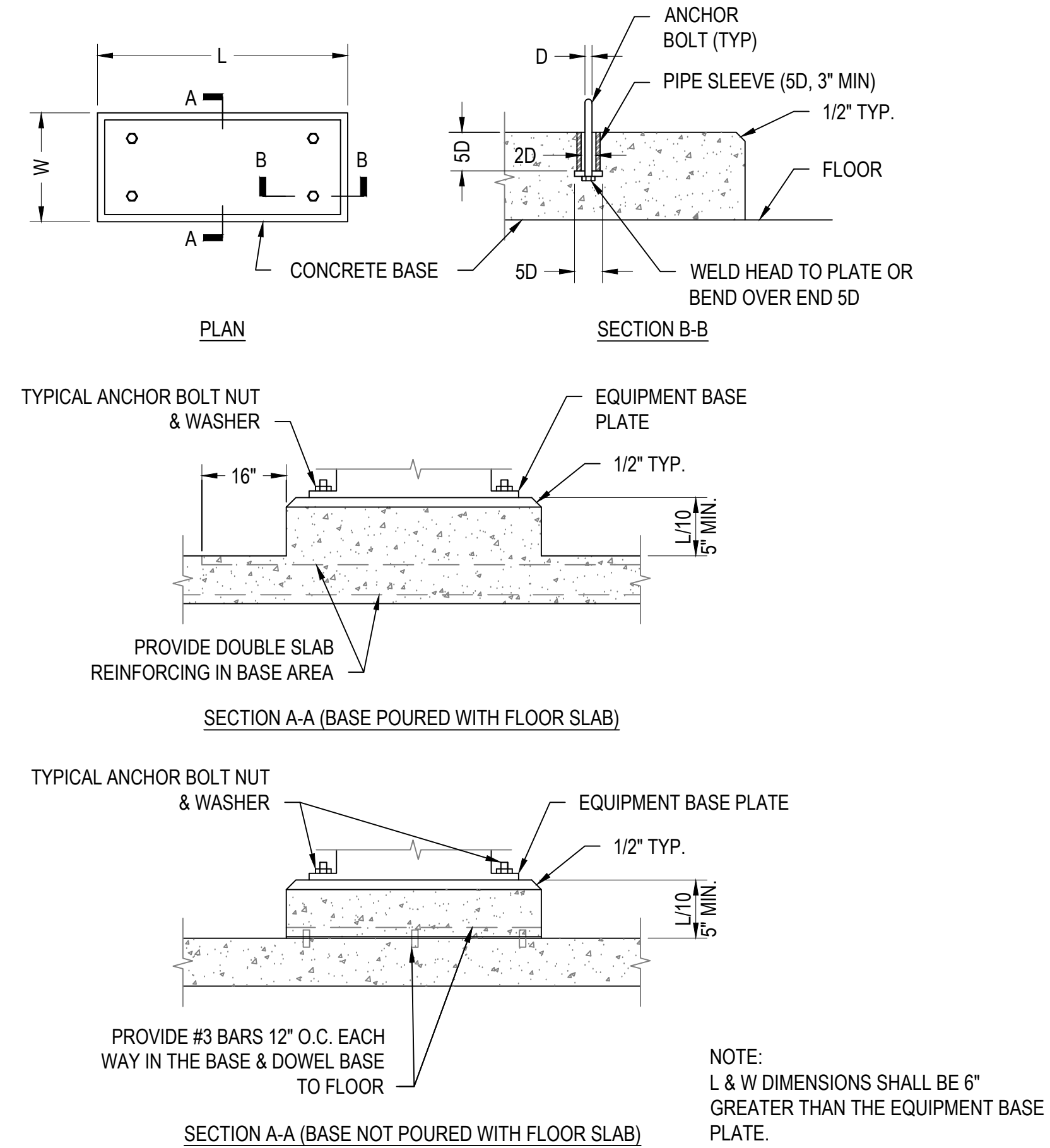
1 BOILER PIPING DIAGRAM

SCALE: NO SCALE



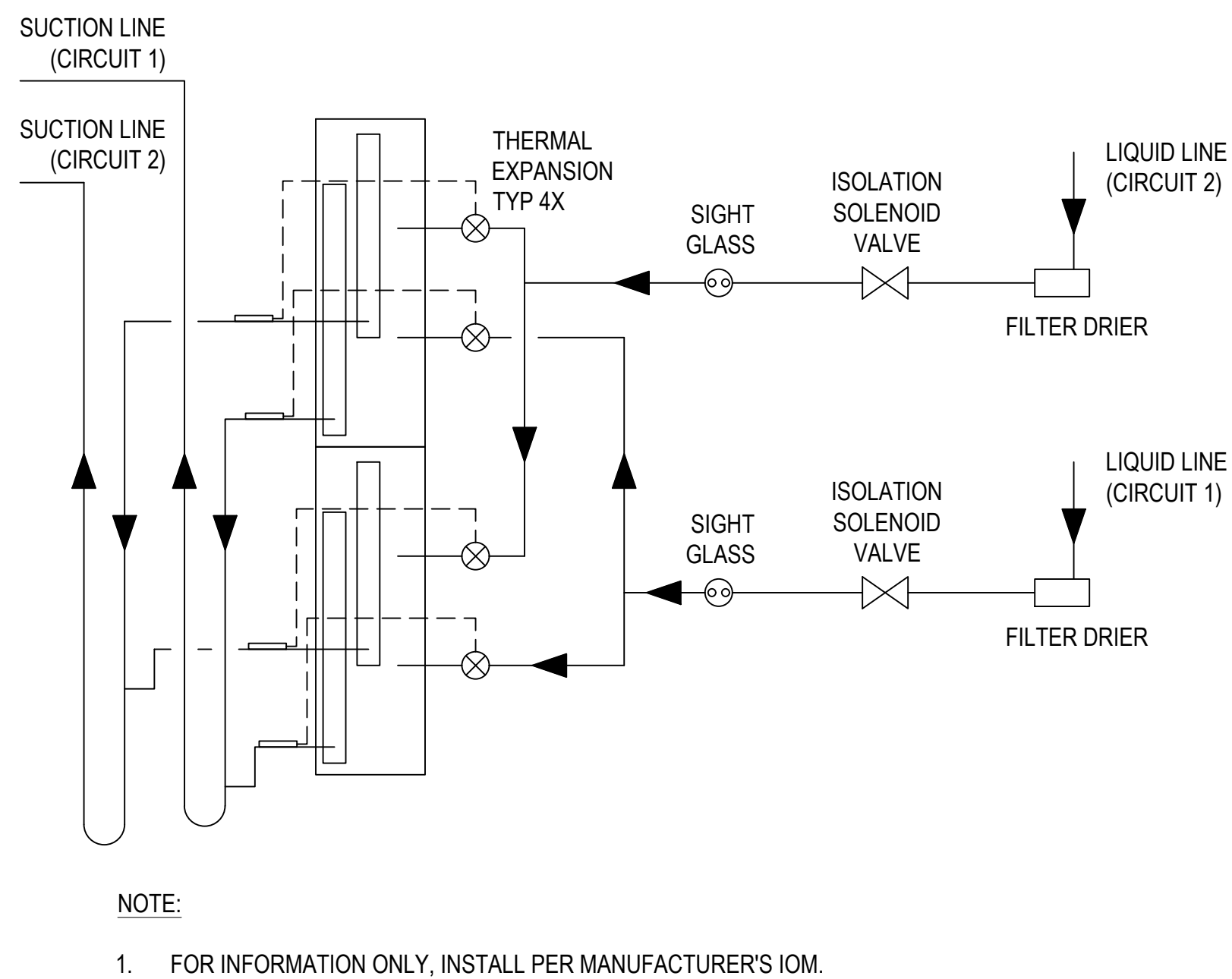
2 INLINE PUMPS

SCALE: NO SCALE



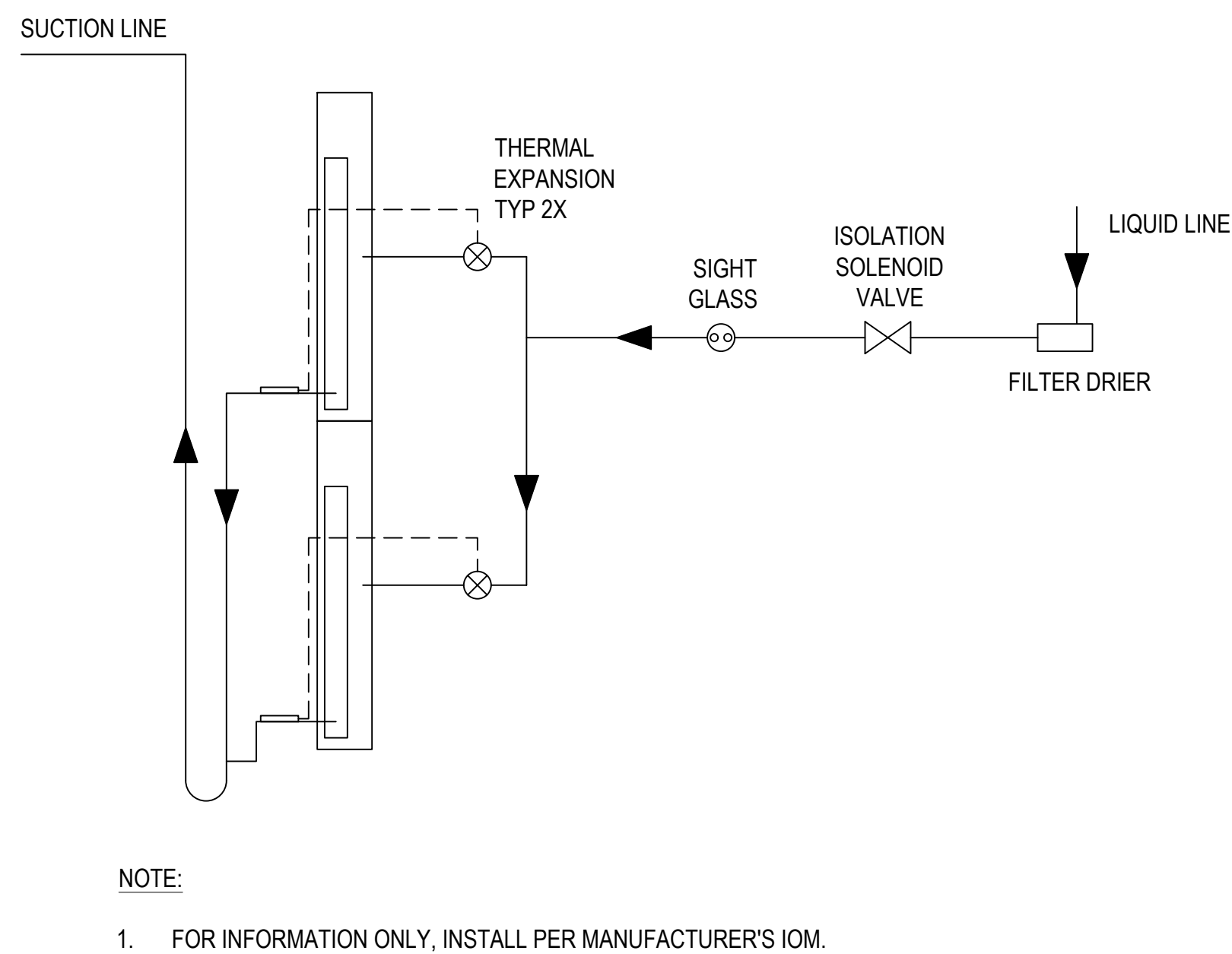
3 CONCRETE EQUIPMENT BASE

SCALE: NO SCALE



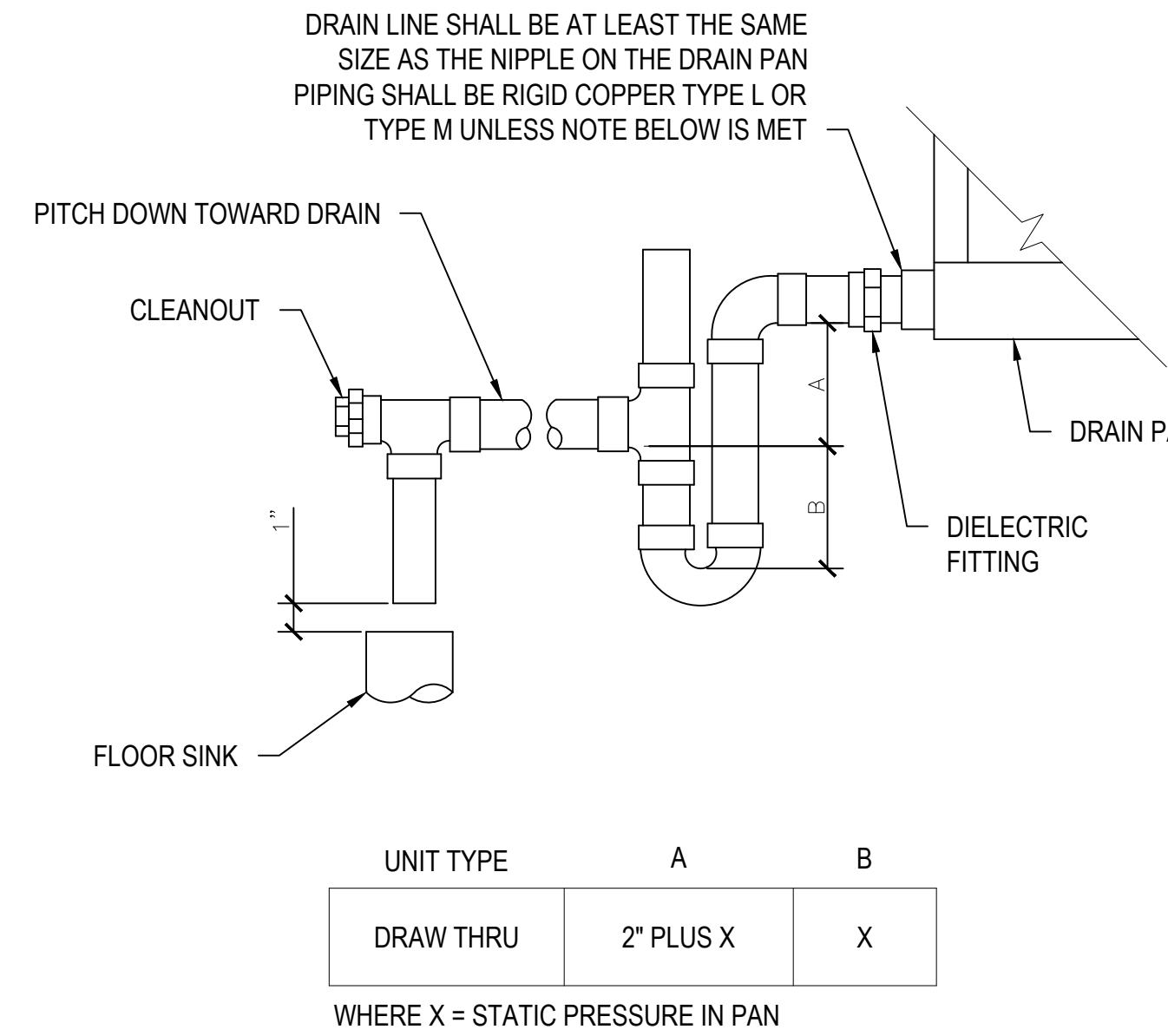
4 173-AHU-01 DX INTERTWINED EVAPORATOR PIPING DIAGRAM

SCALE: NO SCALE



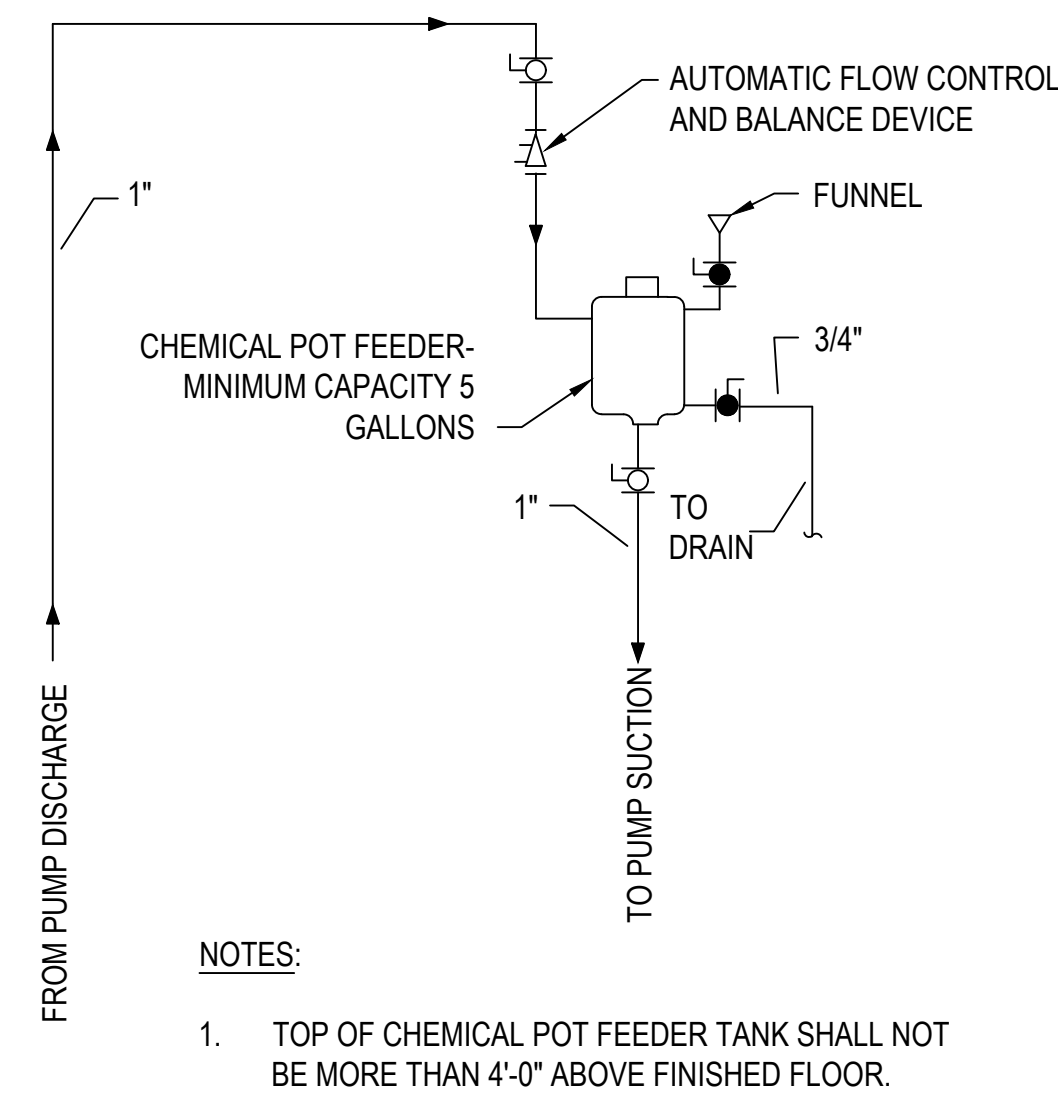
5 154-AHU-01-EDU DX EVAPORATOR PIPING DIAGRAM

SCALE: NO SCALE



6 AIR HANDLING UNIT DRAIN TRAP DETAIL

SCALE: NO SCALE



6 POT FEEDER DETAIL

SCALE: NO SCALE

File Path

VA FORM 08 - 6231

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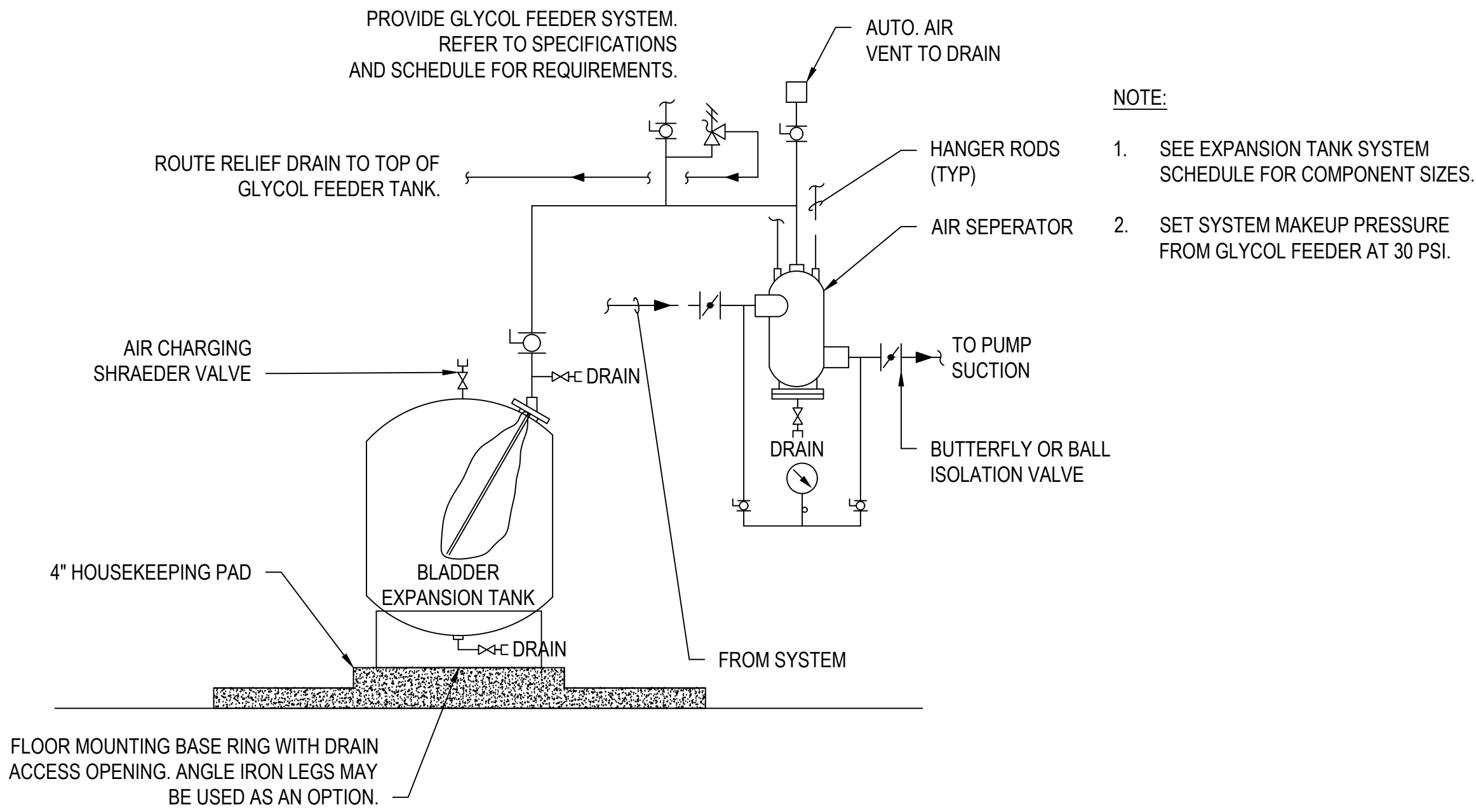
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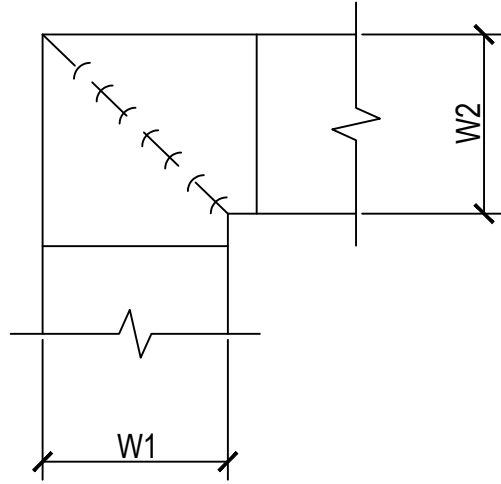


FLOOR MOUNTED EXPANSION TANK PIPING CONNECTIONS

1 SCALE: NO SCALE

NOTE:

1. SEE EXPANSION TANK SYSTEM SCHEDULE FOR COMPONENT SIZES.
2. SET SYSTEM MAKEUP PRESSURE FROM GLYCOL FEEDER AT 30 PSI.

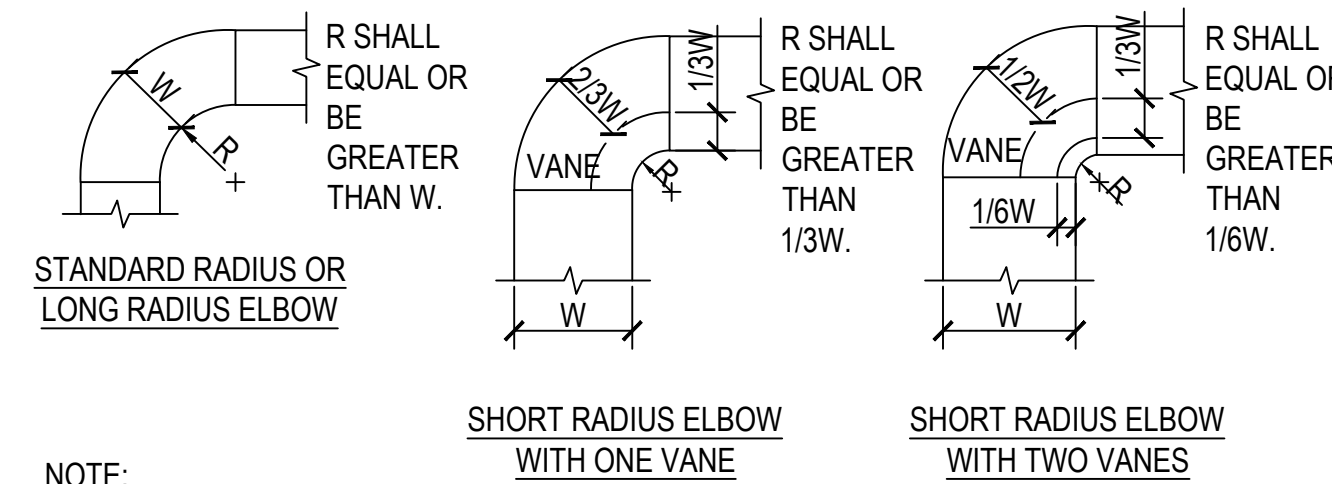


NOTES:

1. ALL VANE ELBOWS SHALL BE CONSTRUCTED AND INSTALLED AS DETAILED BY SMACNA.
2. WHEN W1 DOES NOT EQUAL W2, VANE SHALL BE SINGLE THICKNESS VANE TYPE REGARDLESS OF W DIMENSION.
3. ALL SINGLE THICKNESS VANES SHALL HAVE A 2" RADIUS, 1 1/2" MAXIMUM SPACE BETWEEN VANES AND A 3/4" TRAILING EDGE.
4. WHEN W1 EQUALS W2 AND W1 IS GREATER THAN 20", VANES SHALL BE DOUBLE VANE TYPE.

2 DUCTWORK SQUARE VANE ELBOWS

SCALE: NO SCALE

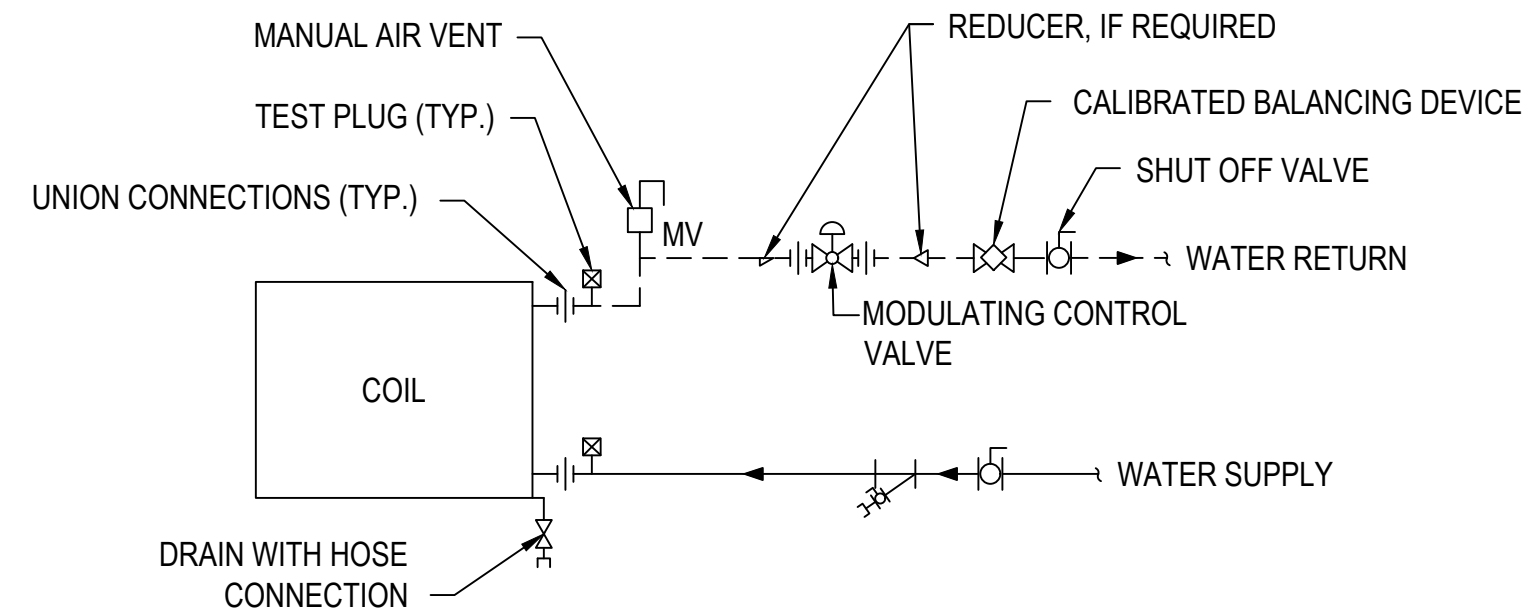


NOTE:

1. THE INTERIOR SURFACE OF ALL RADIUS ELBOWS SHALL BE MADE ROUND.
2. ALL STANDARD RADIUS ELBOWS CAN BE SUBSTITUTED WITH SHORT RADIUS ELBOWS. ALL SHORT RADIUS ELBOWS SHALL HAVE VANES. VANES SHALL BE CONSTRUCTED, SUPPORTED AND FASTENED AS RECOMMENDED BY SMACNA.

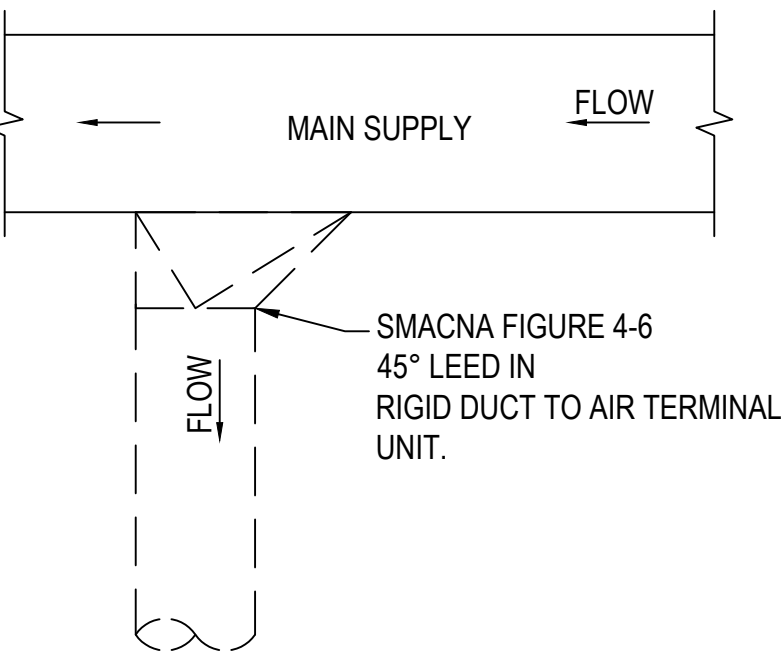
3 DUCTWORK ROUND RADIUS ELBOWS

SCALE: NO SCALE



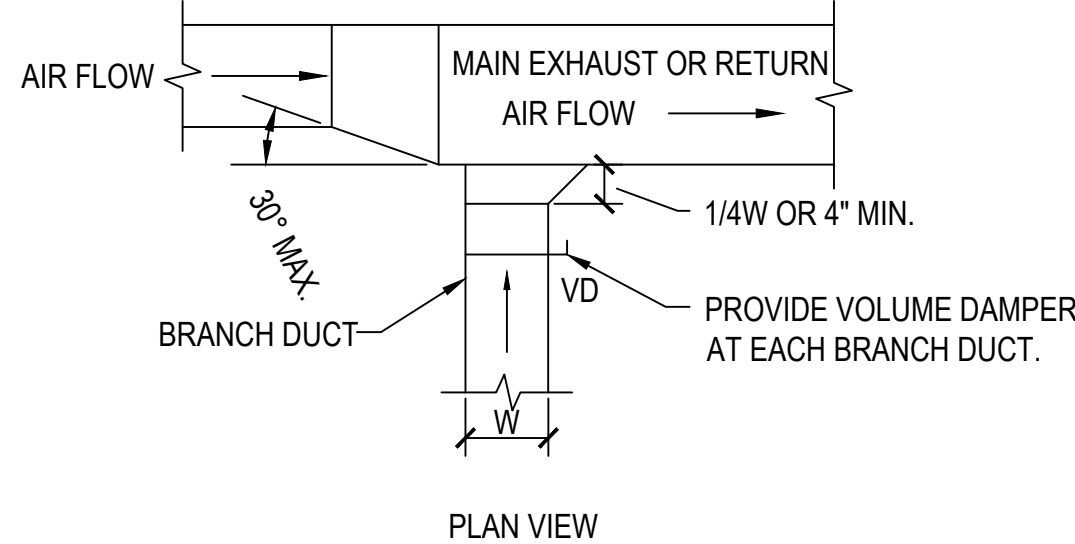
4 TERMINAL UNIT WATER COILS AND CABINET HEATER PIPING CONNECTIONS

SCALE: NO SCALE



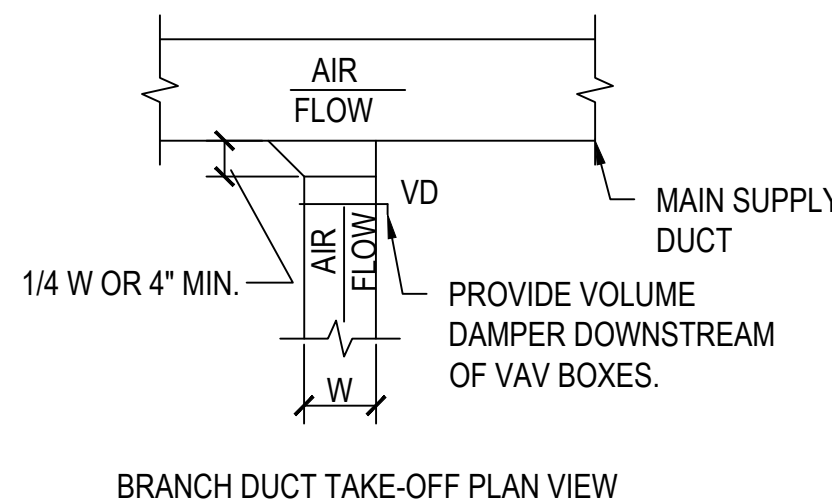
5 SUPPLY DUCT TAKEOFF AIR TERMINAL UNIT

SCALE: NO SCALE



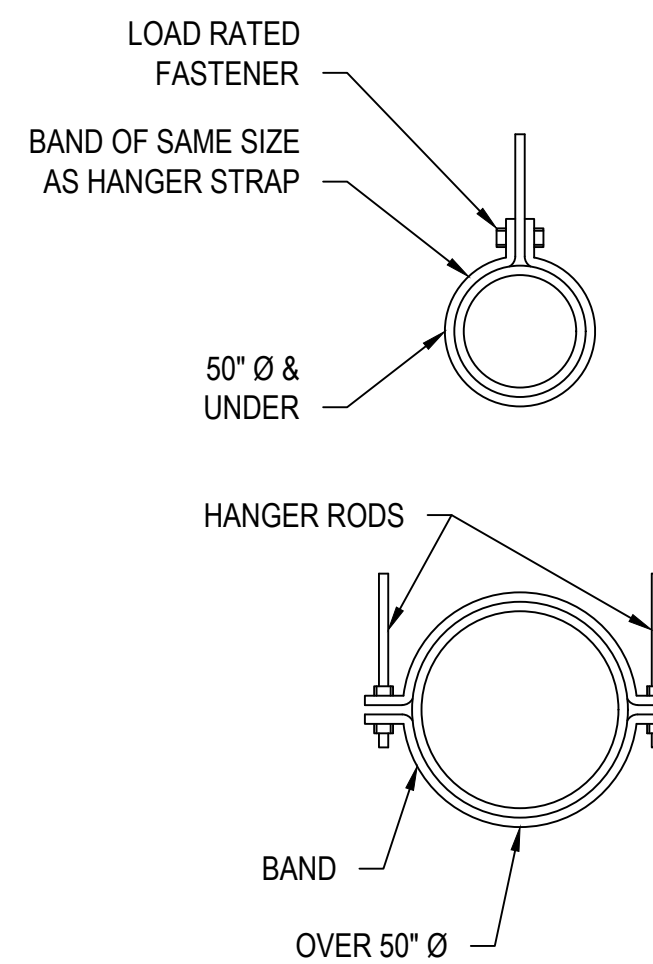
6 EXHAUST OR RETURN BRANCH DUCTWORK

SCALE: NO SCALE



7 SUPPLY DUCTWORK TAKE-OFFS

SCALE: NO SCALE



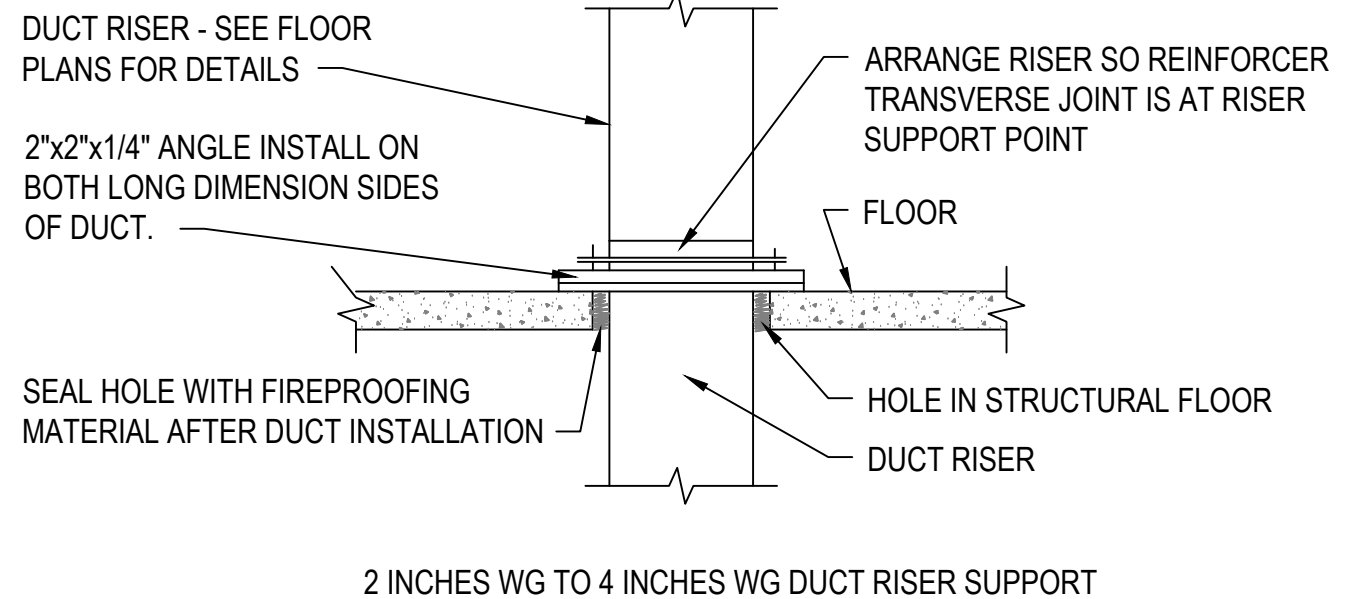
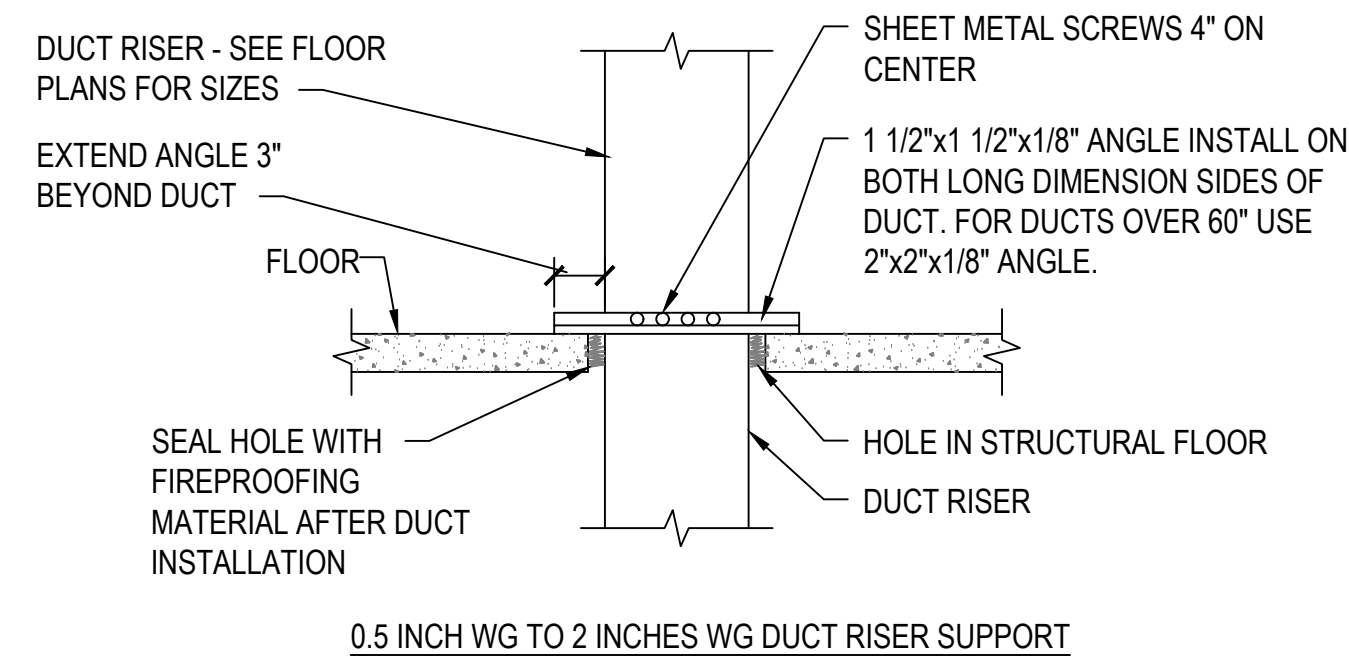
HANGER STRAPS OR RODS			
MAX. DUCT Ø (IN.)	QUANTITY/SIZE (IN.)	MAX. LOAD (LBS.)	MAX. SPACING (IN.)
26	ONE 1 X 22 GA STRAP	260	144
36	ONE 1 X 18 GA STRAP	420	144
50	ONE 1 X 16 GA STRAP	700	144
60	TWO 3/8 Ø RODS	1320	144
84	TWO 1/2 Ø RODS	2500	144

NOTE:

TABULATED DATA FROM SMACNA ALLOWS FOR DUCT REINFORCING AND INSULATION, BUT NO EXTERNAL LOAD.

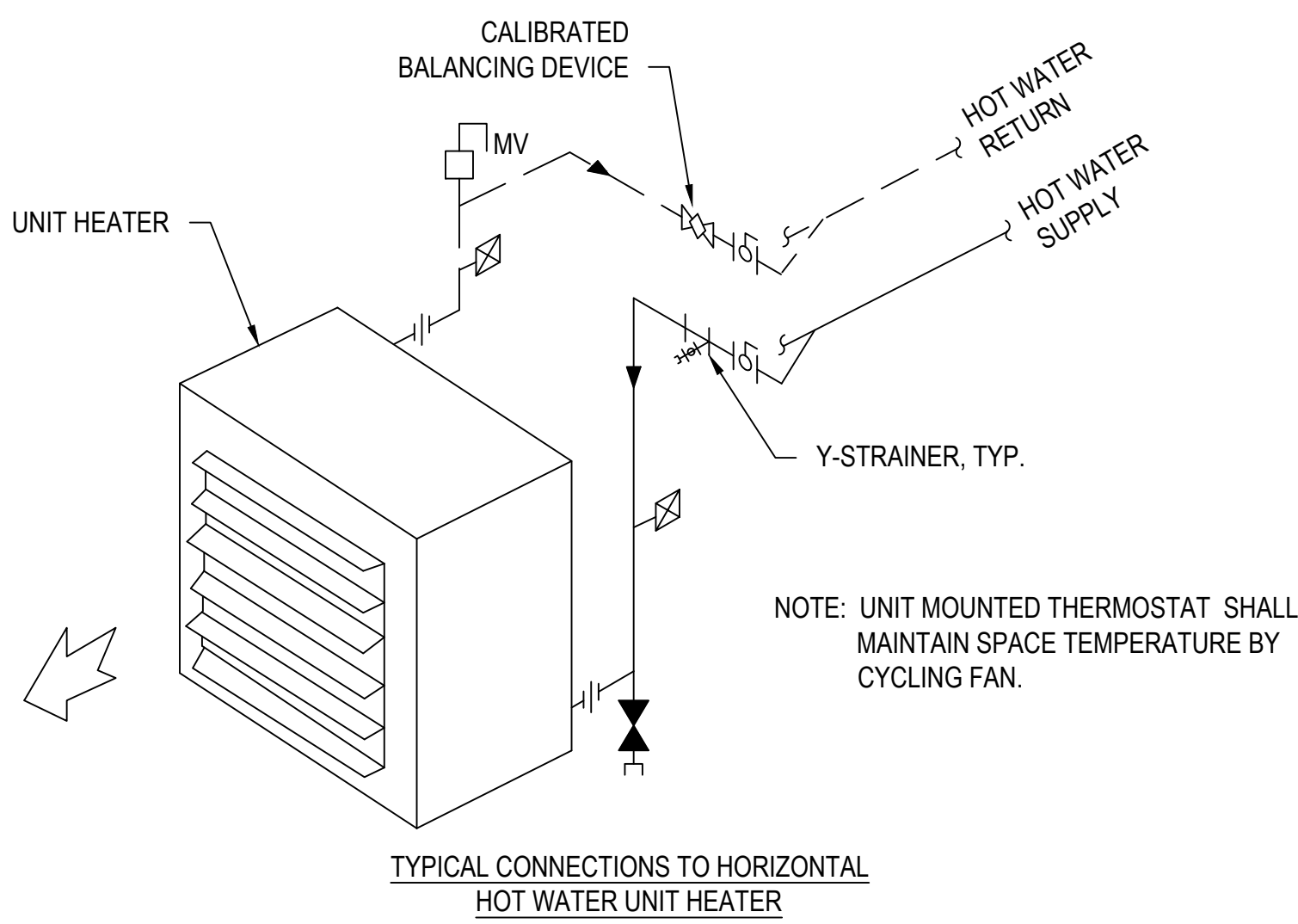
8 ROUND DUCT HANGERS

SCALE: NO SCALE



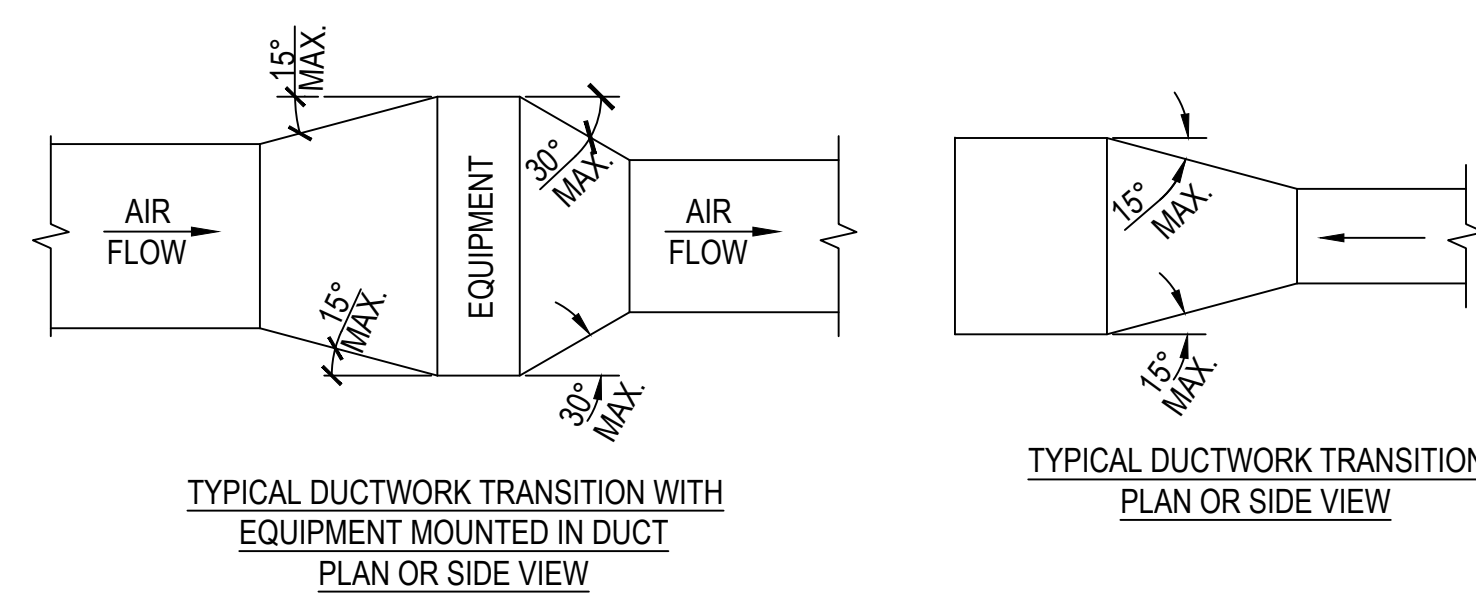
10 SUPPLY DUCT TAKEOFF POWER ROOF VENTILATOR

SCALE: NO SCALE



11 HOT WATER UNIT HEATER DETAIL

SCALE: NO SCALE

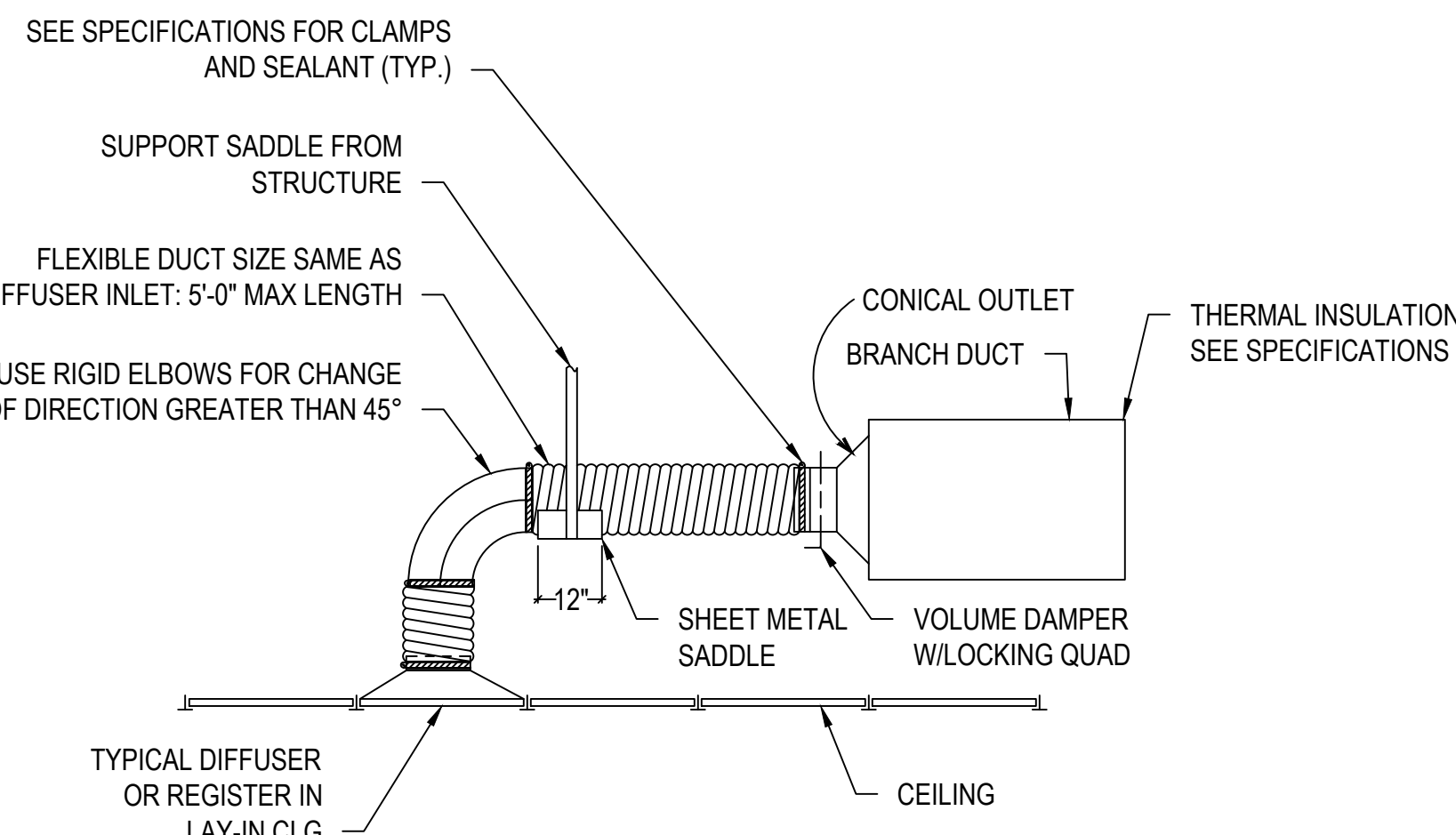


NOTE:

1. UNLESS OTHERWISE INDICATED ON PLANS, MAXIMUM ANGLES SHOWN SHALL APPLY.

12 DUCTWORK TRANSITIONS (WITH EQUIPMENT MOUNTED IN DUCT)

SCALE: NO SCALE



13 FLEXIBLE AIR DUCT CONNECTOR

SCALE: NO SCALE

CONSULTANTS:	ARCHITECT/ENGINEERS:	STAMP:	Drawing Title	Phase	Project Title	Project Number
HOEFER WYSOCKI 11640 TONAWANDA CREEK PARKWAY SUITE 400, LEANWOOD, KANSAS 66041	VALHALLA ENGINEERING GROUP, LLC 750 W HAMPTON AVE SUITE #300 ENGLEWOOD CO 80110 (720) 550-6307 WWW.VALHALLAENGINEERING.COM		MECHANICAL DETAILS	100% CONSTRUCTION DOCUMENTS	OUTPATIENT MENTAL HEALTH / EDUCATION ADDITION	436-114
Protection Engineering	JIRSA HEDRICK Structural Engineers	VEG 4.11	Approved: Project Director		Location 3687 VETERANS DRIVE, FORT HARRISON, MT 59636	Building Number 173 / 154
Issue Date 08/05/2020	Checked DD	Drawn DN				Drawing Number M-502



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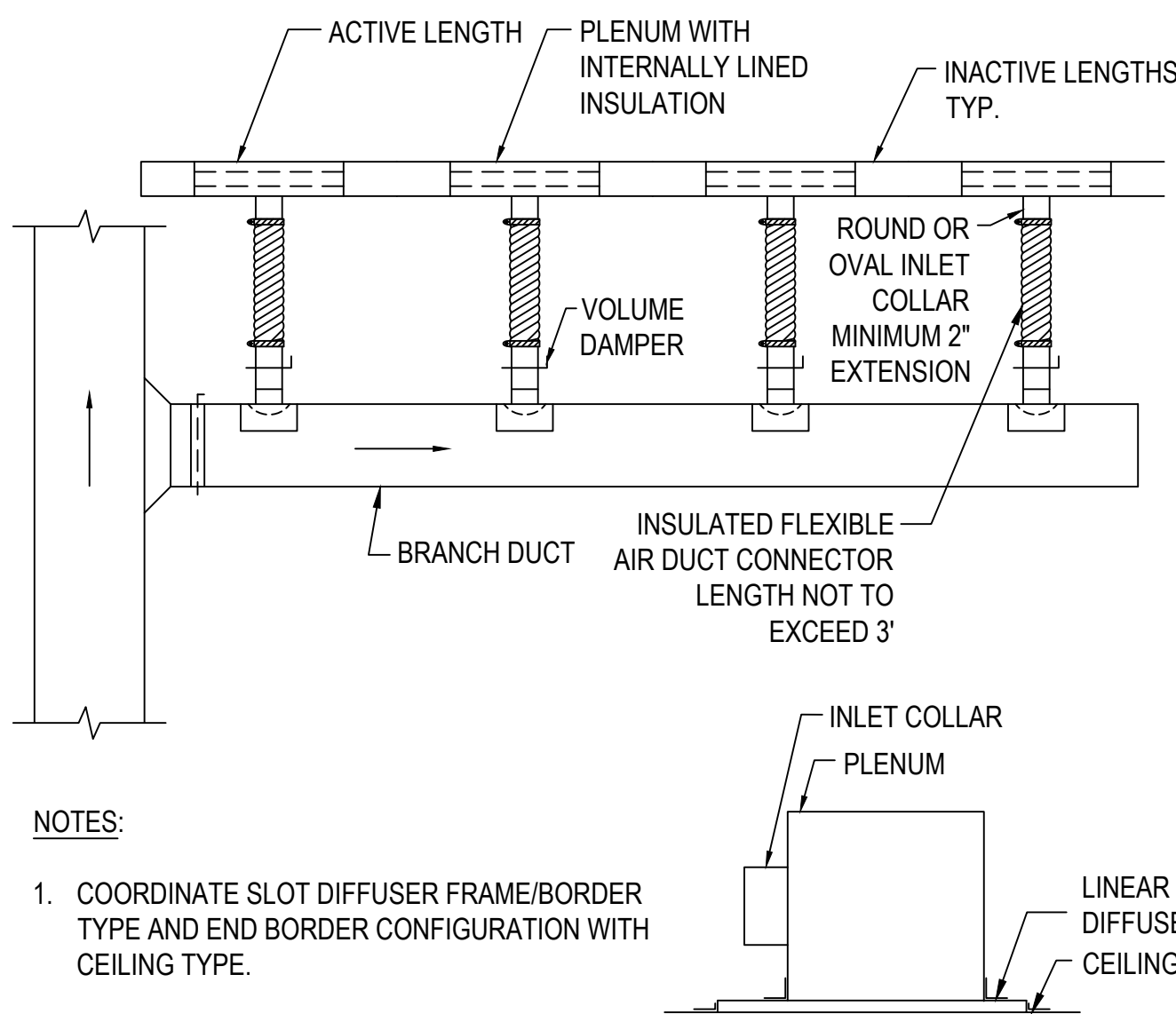
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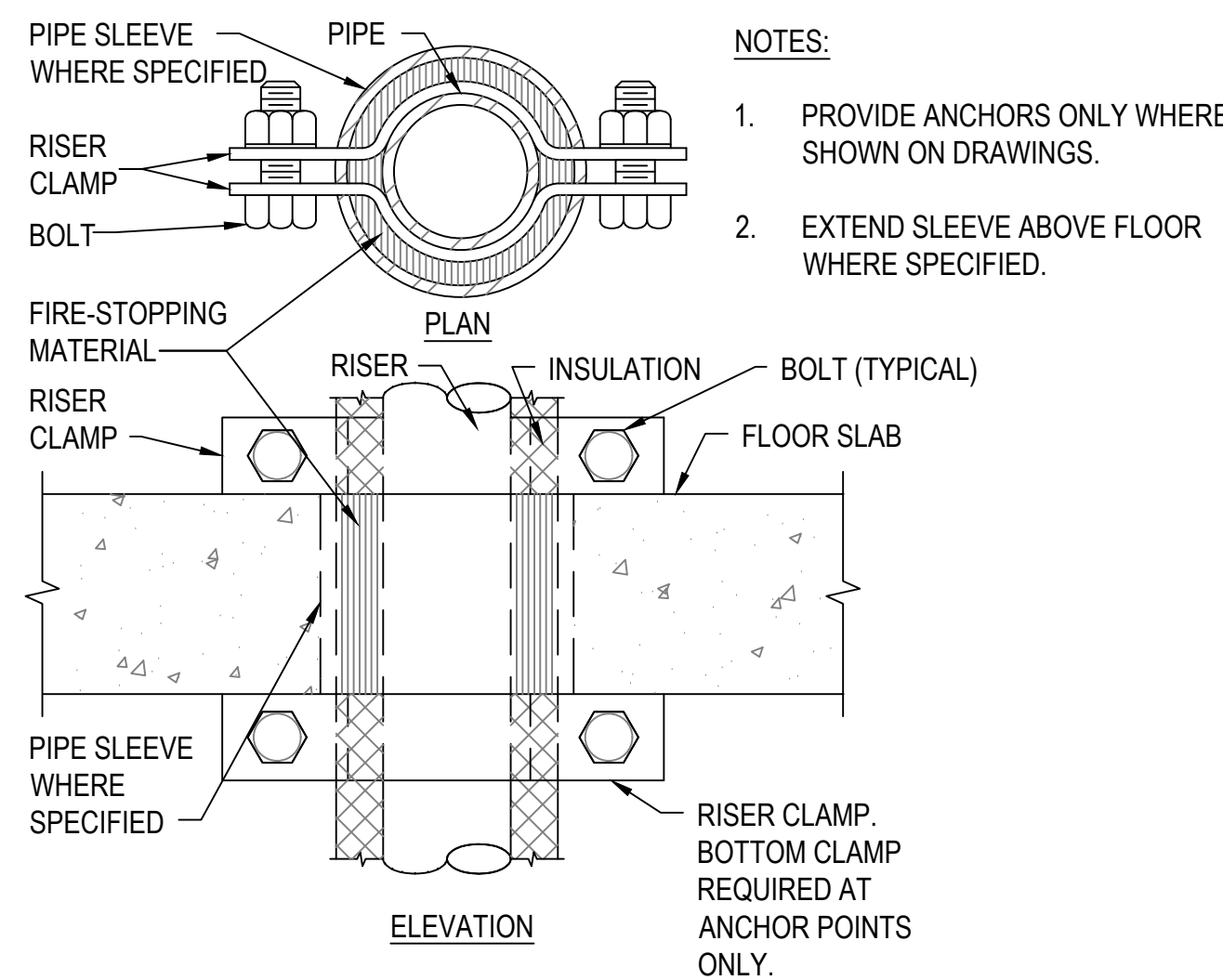
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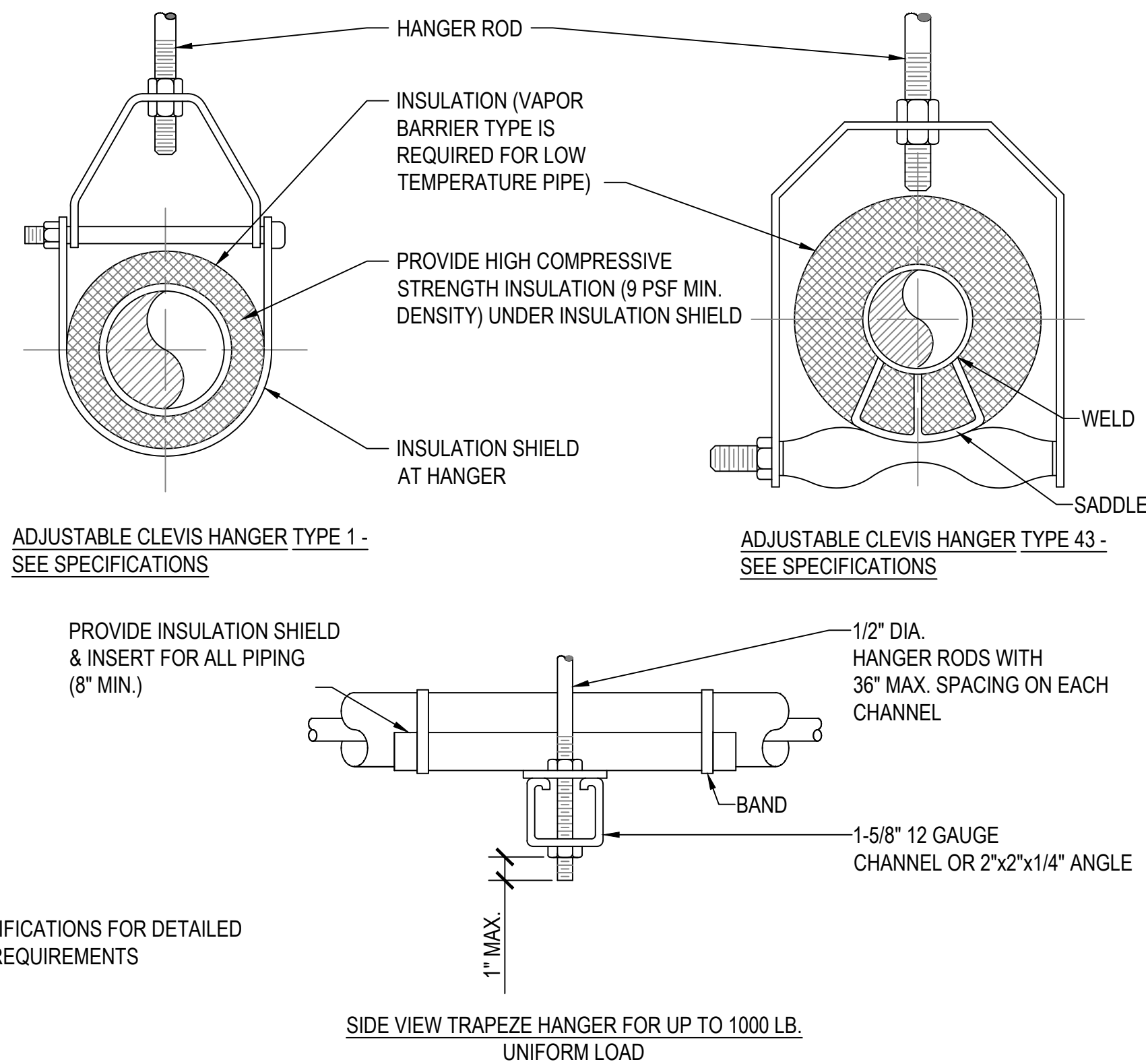
### 1 LINEAR SLOT DIFFUSERS

SCALE: NO SCALE



### 2 SUPPORT/ANCHOR FOR PIPE RISERS

SCALE: NO SCALE

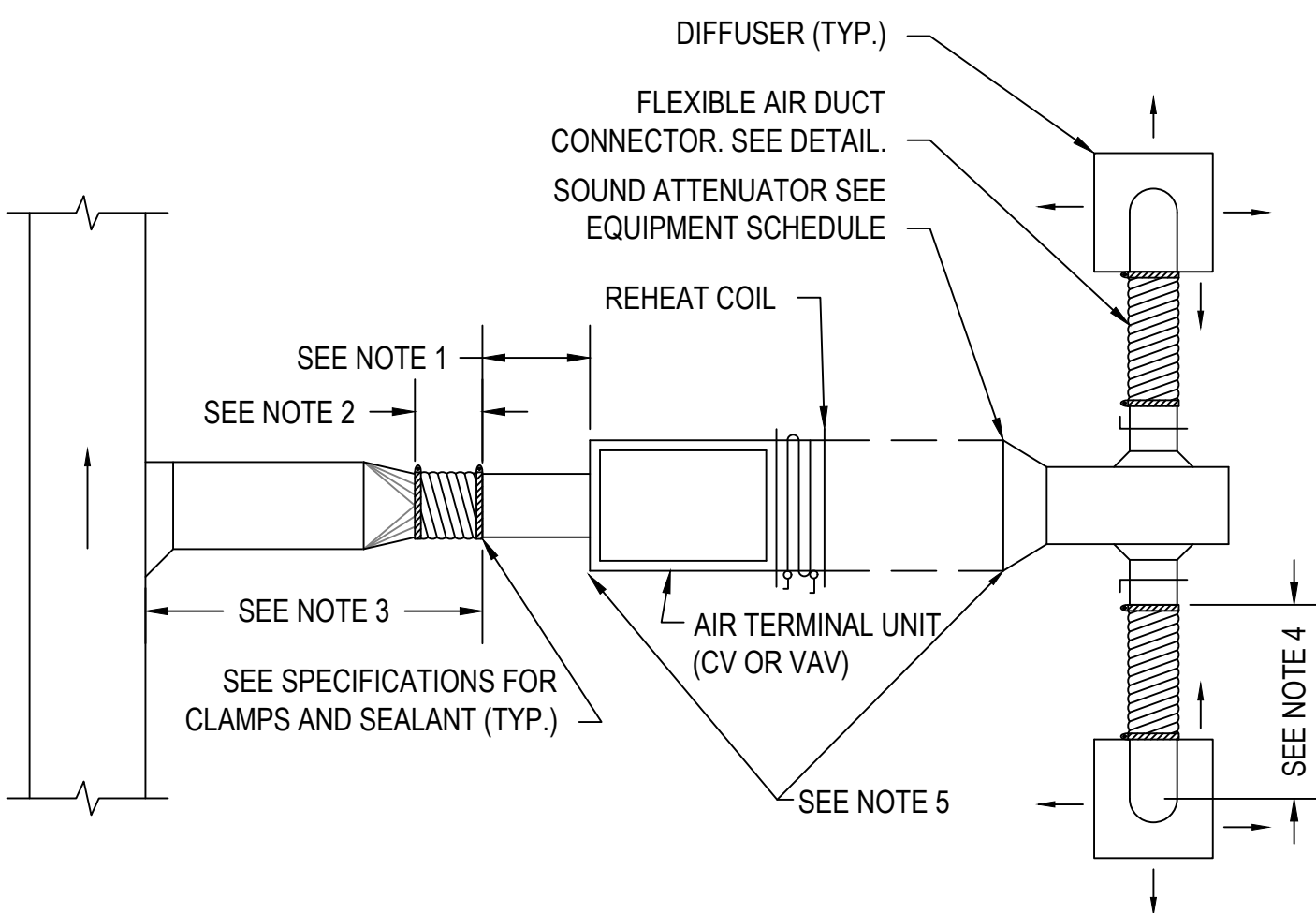


MAXIMUM PIPE/TUBING SUPPORT SPACING																			
NOM. SIZE	IN.	THRU 3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12	14	16	18	20	24
PIPE	FT.	7	7	7	9	10	11	12	14	16	17	19	22	23	25	27	28	30	32
TUBING	FT.	5 FT	6	7	8	8	9	10	12	13	14	16	-	-	-	-	-	-	-
NOTE: FOR TRAPEZE HANGER TAKE SPACING OF SMALLEST SIZE ON TRAPEZE.																			

NOTE: FOR TRAPEZE HANGER TAKE SPACING OF SMALLEST SIZE ON TRAPEZE.

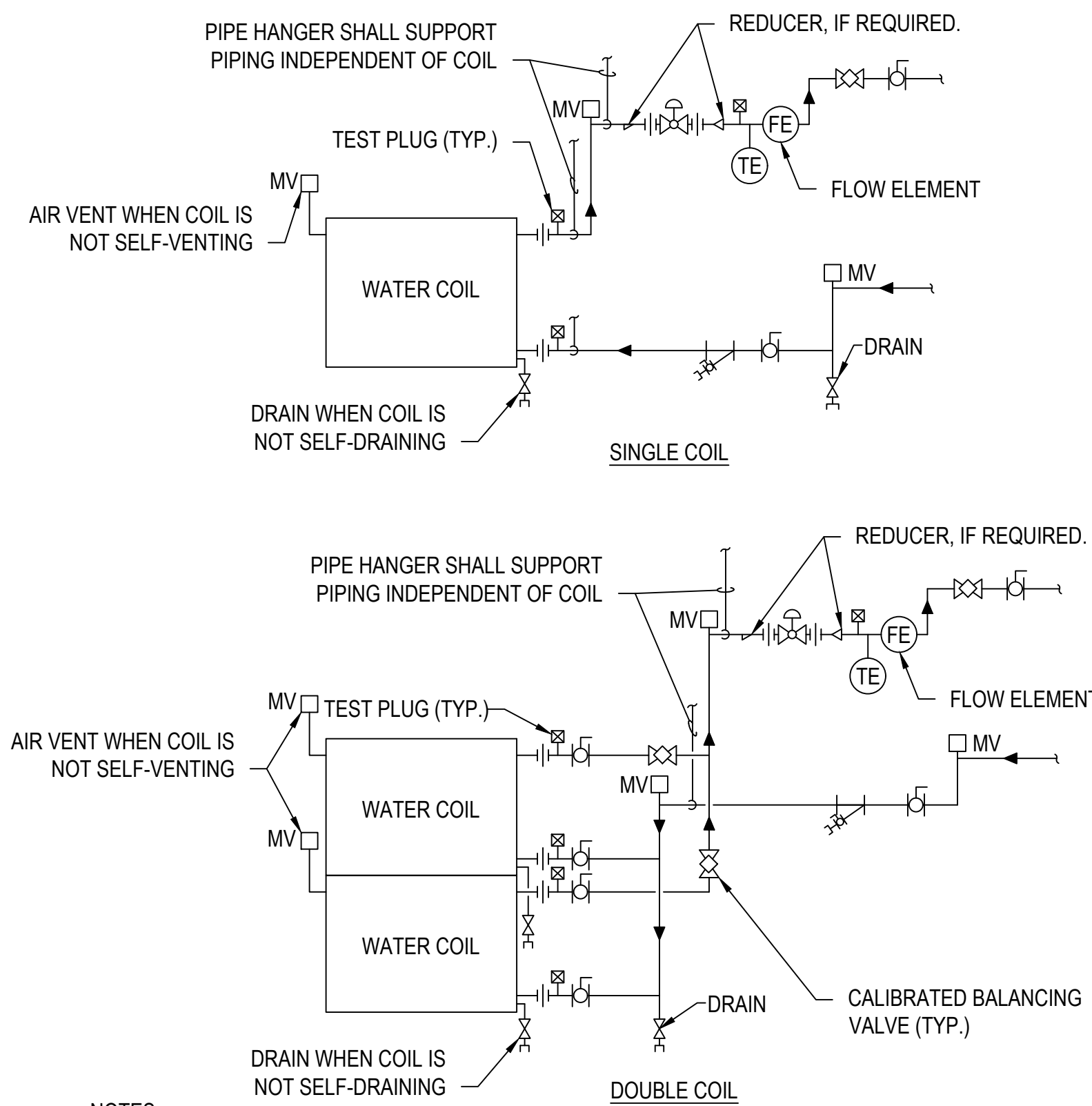
### 3 PIPE HANGERS

SCALE: NO SCALE



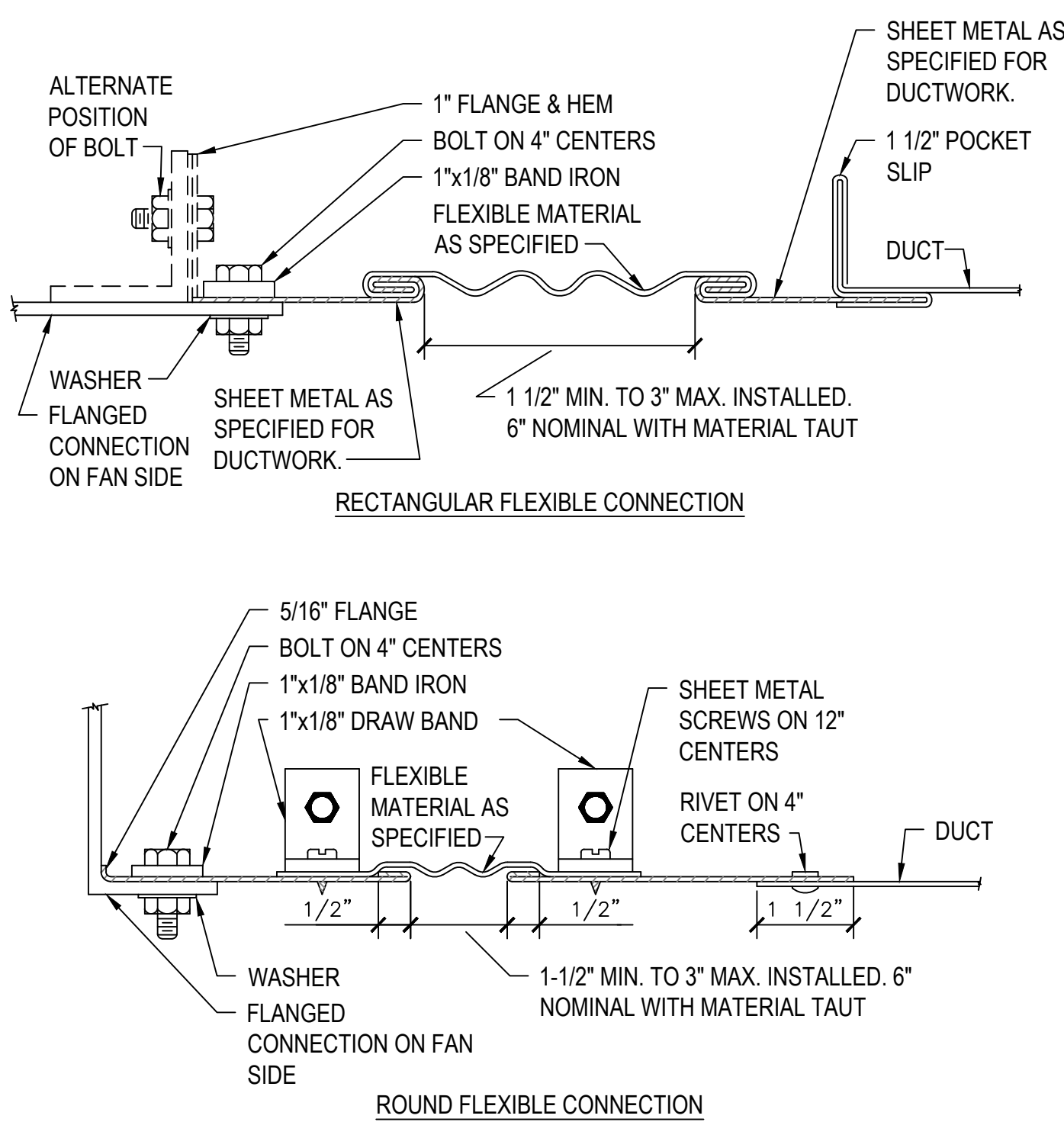
### 4 DUCT CONNECTIONS - AIR TERMINAL UNITS

SCALE: NO SCALE



### 5 WATER COILS - PIPING CONNECTIONS

SCALE: NO SCALE



### 6 FLEXIBLE DUCT CONNECTIONS

SCALE: NO SCALE

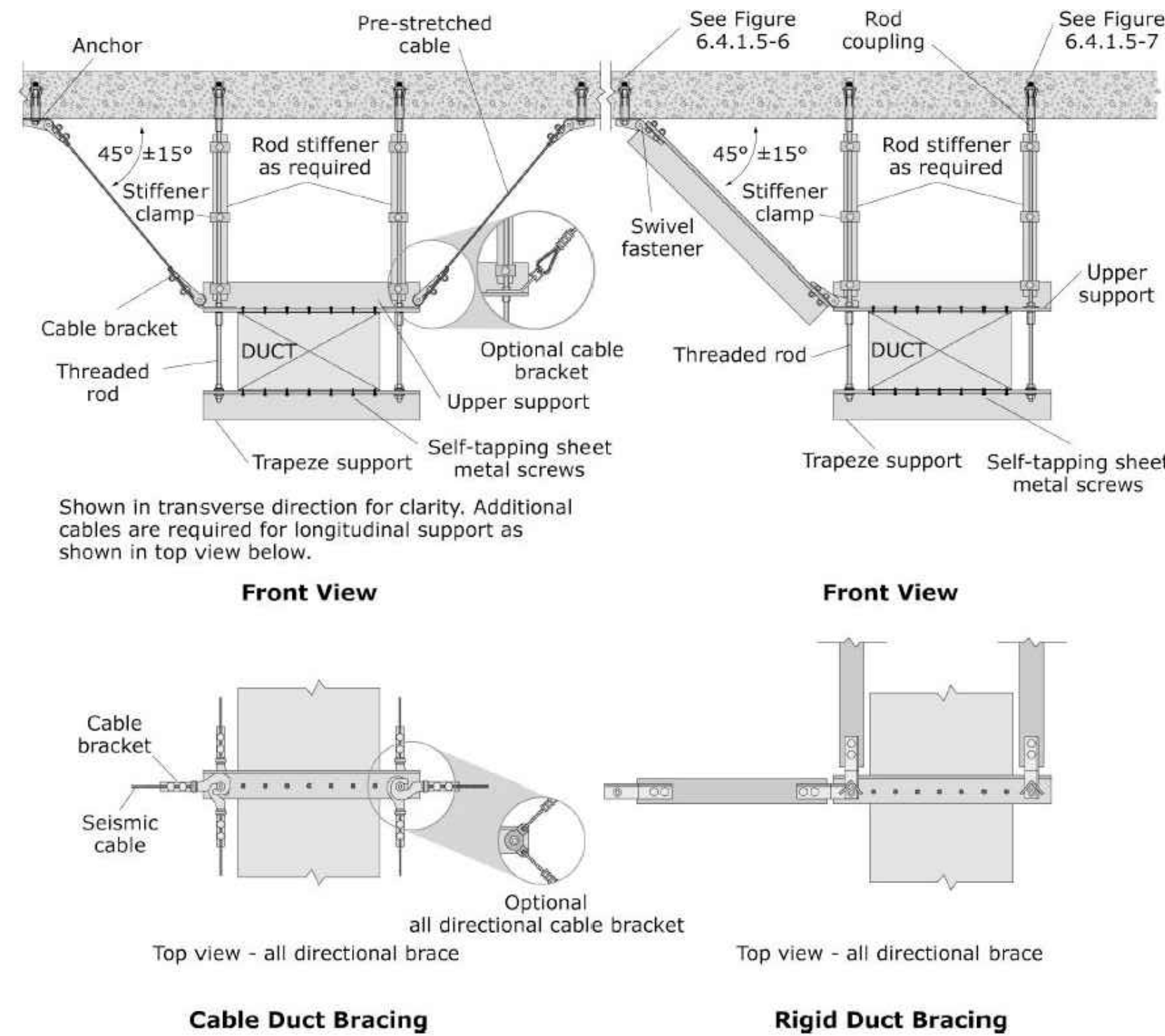


FIGURE 6.4.6.1-8  
SUSPENDED DUCTWORK

#### NOTES:

- SEE SHEET M-001 FOR SEISMIC RESTRAINT NOTES AND FACILITY-SPECIFIC SEISMIC DESIGN BASIS PARAMETERS.
- SEE M-504 FOR CONTINUATION OF SEISMIC BRACING FIGURES.
- FIGURES ARE FROM FEMA E-74 REDUCING THE RISKS OF NONSTRUCTURAL EARTHQUAKE DAMAGE - A PRACTICAL GUIDE, DECEMBER 2012.

#### CONSULTANTS:



#### ARCHITECT/ENGINEERS:



#### STAMP:



#### Drawing Title

### MECHANICAL DETAILS

Approved: Project Director

Phase  
100% CONSTRUCTION  
DOCUMENTS

Project Title  
OUTPATIENT MENTAL HEALTH /  
EDUCATION ADDITION

Project Number  
436-114

Building Number  
173 / 154

Location  
3687 VETERANS DRIVE, FORT HARRISON, MT 59636

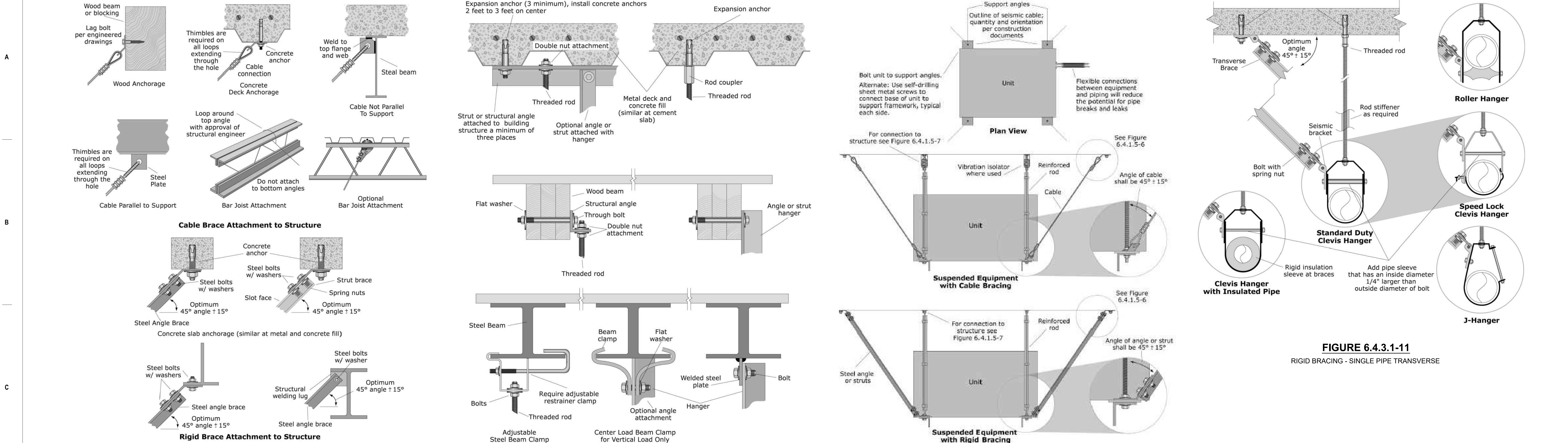
Issue Date  
08/05/2020

Checked  
DD

Drawn  
DN

Drawing Number  
M-503





**FIGURE 6.4.1.5-6**  
CABLE AND RIGID BRACE ATTACHMENTS TO STRUCTURE

**FIGURE 6.4.1.5-7**  
HANGER ATTACHMENT DETAILS

**FIGURE 6.4.1.6-2**  
SUSPENDED EQUIPMENT

**FIGURE 6.4.3.1-11**  
RIGID BRACING - SINGLE PIPE TRANSVERSE

**FIGURE 6.4.3.1-13**  
RIGID BRACING - SINGLE PIPE ALTERNATE TRANSVERSE

**FIGURE 6.4.3.1-14**  
RIGID BRACING - SINGLE PIPE LONGITUDINAL

**FIGURE 6.4.3.1-15**  
RIGID BRACING - TRAPEZE SUPPORTED PIPING

**FIGURE 6.4.3.1-16**  
CABLE BRACING - TRAPEZE SUPPORTED PIPING

**NOTES:**

- SEE SHEET M-001 FOR SEISMIC RESTRAINT NOTES AND FACILITY-SPECIFIC SEISMIC DESIGN BASIS PARAMETERS.
- FIGURES ARE FROM FEMA E-74 REDUCING THE RISKS OF NONSTRUCTURAL EARTHQUAKE DAMAGE - A PRACTICAL GUIDE, DECEMBER 2012.

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AIR HANDLING UNIT SCHEDULE																															
MARK	MIN OA (CFM)	MAX LENGTH (IN.)	MAX. HEIGHT (IN.)	MAX. WIDTH (IN.)	SUPPLY FAN												DX COOLING COIL										PREFILTER			MANUFACTURER AND MODEL	
					AIRFLOW (CFM)	T.S.P. (IN. W.G.)	E.S.P. (IN. W.G.)	WHEEL (TYPE)	DRIVE	VFD	FAN RPM	FAN QTY	MOTOR HP EACH	PH	Hz	V	MOTOR FLA EACH	MAX. F.V. (FT/MIN)	MAX. A.P.D. (IN.W.G.)	EAT-DB (°F)	EAT-WB (°F)	LAT-DB (°F)	LAT-WB (°F)	SMBH	TMBH	REF	SUCTION TEMP(°F)	MERV	THICKNESS (IN)		FINAL A.P.D. (IN. W.G.)
173-AHU-01	5100	452	85	110	19600	7.31	2.5	HPF-A100	DIRECT	Y	3,862	6	7	3	60	208	17	417	0.39	80	64	55	55	456	491	R-410A	45	8	2	0.7	HUNTAIR CSU-20K HW/DX OR APPROVED EQUAL
					RETURN FAN												HEATING COIL										PREFILTER #2			REMARKS	
					AIRFLOW (CFM)	T.S.P. (IN. W.G.)	E.S.P. (IN. W.G.)	WHEEL (TYPE)	DRIVE	VFD	FAN RPM	FAN QTY	MOTOR HP EACH	PH	Hz	V	MOTOR FLA EACH	HEATING AIRFLOW (CFM)	MAX. F.V. (FT/MIN)	MAX. A.P.D. (IN.W.G.)	EAT-DB (°F)	LAT-DB (°F)	MBH	PROPYLENE GLYCOL CONTENT	EWT (°F)	LWT (°F)	FLOW RATE (GPM)	MERV	THICKNESS (IN)		FINAL A.P.D. (IN. W.G.)
					18800	1.98	1.7	HPF-A100	DIRECT	Y	3,862	6	2	3	60	208	5.7	16650	353	0.03	45	69	378	40%	160	130	28	11	6		0.7

HEATING WATER BOILER SCHEDULE																			
MARK	SYSTEM AND/OR SERVICE	TYPE	FLUID				BOILER				% EFF	NATURAL GAS SUPPLY PRESSURE	FUEL	RELIEF VALVE SETTING	ELECTRICAL			MANUFACTURER AND MODEL	REMARKS
			FLOW	EWT	LWT	WPD	POWER	OUTPUT GENERATED	MAX HEAT INPUT	VOLT					PHASE	FLA			
			GPM	°F	°F	FT	HP	MBH	MBH										
173-HWB-01	HEATING HOT WATER	CONDENSING CAST IRON	50	130	160	1.85	16.3	552	600	92	7	NG	50	120	1	13.1	ADVANCED THERMAL HYDRONICS KN-6 OR APPROVED EQUAL	1,2,3	
173-HWB-02	HEATING HOT WATER	CONDENSING CAST IRON	50	130	160	1.85	16.3	552	600	92	7	NG	50	120	1	13.1	ADVANCED THERMAL HYDRONICS KN-6 OR APPROVED EQUAL	1,2,3	
NOTE: 1. UNIT SHALL BE RATED FOR SEISMIC DESIGN CATEGORY C (SEE SEISMIC NOTE AND DSS EQUIPMENT TABULATION). 2. PROVIDE ACID NEUTRALIZATION KIT FOR DRAIN. 3. PROVIDE DISCONNECT FOR UNIT. REFER TO E-601 AND E-602 FOR REQUIREMENTS.																			

EXPANSION TANK SCHEDULE															
MARK	SYSTEM AND/OR SERVICE	TYPE	APPROX SYSTEM VOLUME	SYSTEM TEMPERATURE RANGE		INITIAL PRESSURE IN TANK	MAX OPERATING PRESSURE	FILL PRESSURE AT TANK		MIN VOLUME TANK	MIN ACCEPTANCE VOLUME	PIPE SIZE TO TANK	MAKE-UP WATER FILL SIZE	MANUFACTURER AND MODEL	REMARKS
				MIN	MAX			RELIEF VALVE	AT TANK						
				GAL	°F	°F	PSIG	PSIG	PSIG	GAL	GAL	IN	IN		
173-ET-01	HEATING WATER	VERTICAL DIAPHRAGM	349	40	160	30	45	50	30	57	27	1"	1"	TACO CX-215 OR APPROVED EQUAL	

HOT WATER UNIT HEATER SCHEDULE															
MARK	AREA AND/OR BLDG SERVED	TYPE UNIT	AIR FLOW CFM	MIN CAPACITY BTUH	TEMPERATURES		FLUID TYPE	FLOW GPM	WPD FT	MOTOR			MANUFACTURER AND MODEL	REMARKS	
					EAT °F	EWT °F				POWER HP	PHASE	VOLT			RPM
173-UH-01	VESTIBULE	FLOOR MOUNTED	169	10000	55	160	40% PROPYLENE GLYCOL	1.08	6.43	0.13	1	208	831	TRANE FFB8020 OR APPROVED EQUAL	1,2
173-HWHU-01	PENTHOUSE	HORIZONTAL	730	14200	70	160	40% PROPYLENE GLYCOL	0.9	0.1	0.07	1	115	-	ZEHNDER RH-47 OR APPROVED EQUAL	1,2
NOTES: 1. PERFORMANCE AT 4000 FT ELEVATION. 2. PROVIDE DISCONNECT FOR UNIT. REFER TO E-601 AND E-602 FOR REQUIREMENTS.															

ELECTRIC STEAM HUMIDIFIER GENERATOR SCHEDULE															
MARK	SYSTEM AND/OR SERVICE	HUMIDIFIER TYPE	AIR FLOW CFM	EAT		LAT		HUMIDIFICATION LOAD (LBS/HR)	SOURCE	ELECTRICAL DATA				MANUFACTURER AND MODEL	REMARKS
				DB °F	°F	DB °F	DEWPOINT °F			VOLTS	PHASE	HZ	FLA		
173-SH-01	173-AHU-01	ELECTRIC	16650	55	-20	55	34	100	DOMESTIC WATER	208	3	60	89	DRISTEEM VAPORSTREAM 32-2 OR APPROVED EQUAL	1,2,3
NOTE: 1. UNIT SHALL BE RATED FOR SEISMIC DESIGN CATEGORY C (SEE SEISMIC NOTE AND DSS EQUIPMENT TABULATION). 2. HUMIDIFICATION DESIGN CONDITION: MIN OUTSIDE AIR AT -11 F DB, -12.1 F WB. SPACE DESIGN: 72 F AT 25% RH. 3. PROVIDE DISCONNECT FOR UNIT. REFER TO E-601 AND E-602 FOR REQUIREMENTS.															


AIR COOLED CONDENSING UNIT SCHEDULE												
MARK	SYSTEM AND/OR SERVICE	TYPE	MIN REFRIGERATION	REFRIGERANT	MAX SUCTION TEMP @ COMP	OA TEMP	MIN EER	ELECTRICAL DATA			MANUFACTURER AND MODEL	REMARKS
			MBH		°F	°F		VOLT	PHASE	MOP		
173-QUAC-AHU01	173-AHU-01	SCROLL	484	R410A	43	95	11.4	208	3	300	DAIKIN RCS045D OR APPROVED EQUAL	1, 2, 3, 4
NOTE: 1) PERFORMANCE SHALL BE RATED FOR 4000 FT ALTITUDE. 2) UNIT SHALL BE RATED FOR SEISMIC DESIGN CATEGORY C (SEE SEISMIC NOTE AND DSS EQUIPMENT TABULATION). 3) UNIT SHALL INCLUDE DIGITAL COMPRESSOR. 4) PROVIDE DISCONNECT FOR UNIT. REFER TO E-601 AND E-602 FOR REQUIREMENTS.												


SPLIT SYSTEM AIR CONDITIONER SCHEDULE																
MARK	LOCATION	AREA AND/OR BLDG SERVED	TYPE	MAX INDOOR AIR FLOW	COOLING CAPACITY						ELECTRICAL INPUT				MANUFACTURER AND MODEL	REMARKS
					MIN TOTAL CAPACITY	MIN SENS CAPACITY	MIN SEER	Db	Wb	OSA DESIGN TEMP	CONTROL	MCA	PHASE	VOLT		
173-ACU-01	GROUND	ELEC A112	PACKAGED	890	30.4	21	17.5	80	67	95	THERMOSTAT	17	1	208	DAIKIN FTX30N/JU / RK30NMV/JU OR APPROVED EQUAL	1, 2, 3
173-ACU-02	GROUND	TELECOM A113	PACKAGED	890	30.4	21	17.5	80	67	95	THERMOSTAT	17	1	208	DAIKIN FTX30N/JU / RK30NMV/JU OR APPROVED EQUAL	1, 2, 3
NOTES: 1. UNIT SHALL BE RATED FOR SEISMIC DESIGN CATEGORY C (SEE SEISMIC NOTE AND DSS EQUIPMENT TABULATION). 2. CONTRACTOR SHALL FABRICATE A 2 FT. STAND TO ELEVATE THE OUTDOOR CONDENSING UNIT FOR SNOW CLEARANCE. 3. UNIT SHALL INCLUDE FIELD SETTINGS AND WIND BAFFLE FOR OPERATION DOWN TO -22 F AMBIENT TEMPERATURE. 4. PROVIDE DISCONNECT FOR UNIT. REFER TO E-601 AND E-602 FOR REQUIREMENTS.																

File Path:

Issued:	Date:

CONSULTANTS:	
	<b>HOEFER WYSOCKI</b> 11640 TOMAHAWK CREEK PARKWAY SUITE 400, LEANWOOD, KANSAS 66041
	<b>LANDMARK ENGINEERING</b>
	<b>Protection Engineering</b> CONSULTANTS
	<b>JIRSA HEDRICK</b> Structural Engineers

ARCHITECT/ENGINEERS:	
	<b>VALHALLA ENGINEERING GROUP, LLC</b> 750 W HAMPTDEN AVE SUITE #300 ENGLEWOOD CO 80110 (720) 550-6307 WWW.VALHALLAENGINEERING.COM
VEG 4.11	

STAMP:	
	

 U.S. Department of Veterans Affairs	
--	--

Drawing Title	PHASE 1 MECHANICAL SCHEDULES
Approved: Project Director	

Phase	100% CONSTRUCTION DOCUMENTS

Project Title	OUTPATIENT MENTAL HEALTH / EDUCATION ADDITION
Location	3687 VETERANS DRIVE, FORT HARRISON, MT 59636
Issue Date	08/05/2020
Checked	DD
Drawn	DN

Project Number	436-114
Building Number	173
Drawing Number	M-601



AIR DEVICE SCHEDULE BLDG 173							
MARK	TYPE	MOUNTING	PANEL/FRAME SIZE	NECK SIZE	FINISH	MANUFACTURER AND MODEL	REMARKS
			IN x IN	IN			
CD-1	LOUVERED FACE DIFFUSER	LAY-IN CEILING	24 x 24	6	WHITE	PRICE SMD OR APPROVED EQUAL	1,2,3
CD-2	LOUVERED FACE DIFFUSER	LAY-IN CEILING	24 x 24	8	WHITE	PRICE SMD OR APPROVED EQUAL	1,2,3
CD-3	SQUARE CONE DIFFUSER	LAY-IN CEILING	24 x 24	10	WHITE	PRICE SCD OR APPROVED EQUAL	1,2,3
CD-4	LOUVERED FACE DIFFUSER	EXPOSED	24 x 24	6	WHITE	PRICE SMD OR APPROVED EQUAL	1,2
CD-5	LINEAR SLOT PLENUM DIFFUSER	HARD CEILING	48", 2 SLOTS	6	WHITE	PRICE SDB100 OR APPROVED EQUAL	4
CD-6	LINEAR SLOT PLENUM DIFFUSER	HARD CEILING	48", 3 SLOTS	8	WHITE	PRICE SDB100 OR APPROVED EQUAL	4
CD-7	SQUARE CONE DIFFUSER	LAY-IN CEILING	24 x 24	6	WHITE	PRICE SCD OR APPROVED EQUAL	1,2,3
EG-1	PERFORATED EXHAUST DIFFUSER	HARD CEILING	12 x 12	6 x 6	WHITE	PRICE PDDE OR APPROVED EQUAL	2
RG-1	PERFORATED RETURN DIFFUSER	LAY-IN CEILING	24 x 24	6 x 6	WHITE	PRICE PDDR OR APPROVED EQUAL	2,3
RG-2	PERFORATED RETURN DIFFUSER	LAY-IN CEILING	24 x 24	8 x 8	WHITE	PRICE PDDR OR APPROVED EQUAL	2,3
RG-3	PERFORATED RETURN DIFFUSER	LAY-IN CEILING	24 x 24	10 x 10	WHITE	PRICE PDDR OR APPROVED EQUAL	2,3
RG-4	PERFORATED RETURN DIFFUSER	LAY-IN CEILING	24 x 24	12 x 12	WHITE	PRICE PDDR OR APPROVED EQUAL	2,3
RG-5	PERFORATED RETURN DIFFUSER	EXPOSED	24 x 24	6 x 6	WHITE	PRICE PDDR OR APPROVED EQUAL	---
RG-6	PERFORATED RETURN DIFFUSER	EXPOSED	24 x 24	10 x 10	WHITE	PRICE PDDR OR APPROVED EQUAL	---
RG-7	RETURN GRILLE	SIDE WALL	32 x 12	32 x 12	WHITE	PRICE 500 APPROVED EQUAL	5
RG-8	RETURN GRILLE	SIDE WALL	24 x 12	24 x 12	WHITE	PRICE 500 APPROVED EQUAL	5
RG-9	RETURN GRILLE	SIDE WALL	17 x 12	17 x 12	WHITE	PRICE 500 APPROVED EQUAL	6
RG-10	RETURN GRILLE	SIDE WALL	8 x 8	17 x 12	WHITE	PRICE 500 APPROVED EQUAL	6
SG-1	SUPPLY GRILLE	SIDE WALL	7 x 4	7 x 4	WHITE	PRICE 500 APPROVED EQUAL	5
SG-2	SUPPLY GRILLE	SIDE WALL	12 x 6	12 x 6	WHITE	PRICE 500 APPROVED EQUAL	5
SG-3	SUPPLY GRILLE	SIDE WALL	8 x 6	8 x 6	WHITE	PRICE 500 APPROVED EQUAL	6
NOTES: 1. SEE PLANS FOR THROW DIRECTIONS. DIFFUSERS SHOWN WITH NO ARROWS ARE 4-WAY THROW. 2. WHERE DAMPERS ARE NOT SHOWN ON DRAWINGS, DAMPER SHALL BE FURNISHED WITH AIR DEVICE AND ACCESSIBLE FROM THE ROOM. 3. FRAME STYLE SHALL BE FOR TEGULAR T-BAR CEILING GRID. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING SYSTEM. 4. SLOT WIDTH SHALL BE 1 INCH. 5. BLADE DEFLECTION ANGLE SHALL BE 0 DEGREES. BLADE SPACING SHALL BE 3/4". 6. BLADE DEFLECTION ANGLE SHALL BE 45 DEGREES. BLADE SPACING SHALL BE 3/4".							

PUMP SCHEDULE													
MARK	SYSTEM AND/OR SERVICE	TYPE	CIRCULATING FLUID				ELECTRICAL MOTOR				MANUFACTURER AND MODEL	REMARKS	
			FLUID	FLOW	HEAD	TEMPERATURE	HP	PHASE	VOLT	MAX RPM			SPEED CONTROL
				GPM	FT	°F							
173-HWP-01	HEATING WATER SECONDARY	INLINE CIRCULATOR	40% PROPYLENE GLYCOL	62	50	160	2.00	3	208	1760	VFD	TACO 1919 W/ 7.6" IMPELLER OR APPROVED EQUAL	1
173-HWP-02	HEATING WATER PRIMARY	INLINE CIRCULATOR	40% PROPYLENE GLYCOL	50	10	160	0.50	1	115	1750	ECM	TACO VR15-3 OR APPROVED EQUAL	2,3
173-HWP-03	HEATING WATER PRIMARY	INLINE CIRCULATOR	40% PROPYLENE GLYCOL	50	10	160	0.50	1	115	1750	ECM	TACO VR15-3 OR APPROVED EQUAL	2,3
173-HWP-04	HEATING WATER SECONDARY	INLINE CIRCULATOR	40% PROPYLENE GLYCOL	62	50	160	2.00	3	208	1760	VFD	TACO 1919 W/ 7.6" IMPELLER OR APPROVED EQUAL	1
NOTES: 1. PROVIDE UNIT WITH VFD. 2. 0-10V INPUT FOR SPEED CONTROL INTERFACE WITH CONDENSING BOILER. 3. PROVIDE DISCONNECT FOR UNIT. REFER TO E-601 AND E-602 FOR REQUIREMENTS.													

FAN SCHEDULE														
MARK	SYSTEM AND/OR SERVICE	AIR FLOW CFM	ESP IN W.C.	FAN				MOTOR ELECTRICAL				MANUFACTURER AND MODEL	REMARKS	
				TYPE	DRIVE	FAN MAX RPM	CURB	HP	VOLT	PHASE	RPM			SPEED CONTROL
173-EF-01	RESTROOMS AND HAC EXHAUST	300	0.5	ROOF MOUNTED DOWNBLAST	DIRECT	1550	YES	1/8	115	1	1550	VARIABLE	COOK 100R15DH OR APPROVED EQUAL	1,2,3,5,6
173-EF-02	RESTROOMS EXHAUST	500	0.5	ROOF MOUNTED DOWNBLAST	DIRECT	1075	YES	1/6	115	1	1075	VARIABLE	COOK 150RH10D OR APPROVED EQUAL	1,2,3,5,6
173-EF-03	PENTHOUSE VENTILATOR	1000	0.125	WALL MOUNTED PROPELLER	DIRECT	1550	NO	1/8	208	1	1550	WALL MOUNTED CONTROL WITH THERMOSTAT	COOK 2XP40D15 OR APPROVED EQUAL	1,2,4,6
173-EF-04	UTILIDOR VENTILATION	300	0.5	INLINE	DIRECT	1313	NO	0.12	115	1	1313	VARIABLE	COOK GN-622 OR APPROVED EQUAL	1,2,5,6
NOTES: 1. MUST BE SEISMICALLY CERTIFIED FOR SEISMIC DESIGN CATEGORY C. (SEE SEISMIC NOTE AND DSS EQUIPMENT TABULATION) 2. PERFORMANCE AT 4000 FT ELEVATION. 3. PROVIDE ROOF CURB AND BACKDRAFT DAMPER 4. PROVIDE GRAVITY DISCHARGE SHUTTER AND WEATHER HOOD. 5. PROVIDE FAN SPEED CONTROLLER 6. PROVIDE DISCONNECT FOR UNIT. REFER TO E-601 AND E-602 FOR REQUIREMENTS.														

GLYCOL FEEDER SCHEDULE												
MARK	SERVICE	GLYCOL TYPE	GLYCOL PERCENTAGE	TANK VOLUME (GAL)	PUMP CAPACITY	ELECTRICAL DATA					MANUFACTURER AND MODEL	REMARKS
						POWER	VOLT	PHASE	RPM	HZ		
173-GF-01	HEATING WATER	PROPYLENE	40%	50	1.5 GPM AT 100 PSI	1/3	115	1	1750	60	NEPTUNE G-50-1A OR APPROVED EQUAL	INCLUDE LOW LEVEL LIGHT AND AUDIBLE ALARM.

LOUVER SCHEDULE											
MARK	SYSTEM AND/OR SERVICE	TYPE	WIDTH	HEIGHT	AIR FLOW	FREE AREA	FREE AREA VELOCITY	APD	MANUFACTURER AND MODEL	REMARKS	
			IN	IN	CFM	SQ FT	FPM	W.G.			
173-LVR-01	OUTSIDE AIR INTAKE	STATIONARY	74	86	19600	24.27	808	0.07	RUSKIN L375D OR APPROVED EQUAL		
173-LVR-02	RELIEF AIR	STATIONARY	74	86	18800	24.27	754	0.06	RUSKIN L375D OR APPROVED EQUAL		

ACTIVE/ENERGIZED DESIGNATED SEISMIC SYSTEMS (DSS) EQUIPMENT










REQUIRES ASCE 7 CH 13.2.2 SPECIAL SEISMIC CERTIFICATION (SSC) TO BE QUALIFIED EITHER BY ICC-ESS-AC156 SHAKE TABLE TESTING OR BY EXPERIENCE TO WITHSTAND AND CONTINUE TO BE FULLY FUNCTIONAL AFTER BEING SUBJECTED TO SITE SPECIFIC DESIGN- MAGNITUDE EARTHQUAKE GROUND MOTIONS. A "CERTIFICATE OF COMPLIANCE" MUST BE SUBMITTED PRIOR TO INSTALLATION.

DISCIPLINE	EQUIPMENT TAG	EQUIPMENT DESCRIPTION	LOCATION (Z/H=0)"	MOUNTING METHOD	ESTIMATED WEIGHT (LB)
MECHANICAL	173-AHU-01	AIR HANDLER	1	FLOOR	20,259
MECHANICAL	173-SH-01	ELECTRIC STEAM HUMIDIFIER GENERATOR	1	FLOOR	185
MECHANICAL	173-HWB-01	HOT WATER HEATING BOILER	0	FLOOR	1150
MECHANICAL	173-HWB-02	HOT WATER HEATING BOILER	0	FLOOR	1150
MECHANICAL	173-CHAC-AHU01	AIR COOLED CONDENSING UNIT	0	GROUND	2470
MECHANICAL	173-GF-01	GLYCOL FEEDER	0	FLOOR	606
MECHANICAL	173-CUH-01	CABINET UNIT HEATER	0	FLOOR	97
MECHANICAL	173-HWH-01	HOT WATER UNIT HEATER	1	CEILING	60
MECHANICAL	173-ACU-01	SPLIT SYSTEM CONDENSER	0	GROUND	133
MECHANICAL	173-ACU-01	SPLIT SYSTEM EVAPORATOR	1	CEILING	38
MECHANICAL	173-ACU-02	SPLIT SYSTEM CONDENSER	0	GROUND	133
MECHANICAL	173-ACU-02	SPLIT SYSTEM EVAPORATOR	1	CEILING	38
MECHANICAL	173-EF-01	ROOF MOUNTED DOWNBLAST FAN	1	ROOF	60
MECHANICAL	173-EF-02	ROOF MOUNTED DOWNBLAST FAN	1	ROOF	105
MECHANICAL	173-EF-03	WALL MOUNTED PROPELLER FAN	1	WALL	72
MECHANICAL	173-VAV-5	VAV BOX	1	CEILING	98
MECHANICAL	173-VAV-22	VAV BOX	1	CEILING	98
MECHANICAL	173-VAV-36	VAV BOX	1	CEILING	116
PLUMBING	173-WH-01	GAS FIRED WATER HEATER	0	FLOOR	961

\*NOTE: FOR DETERMINATION OF SEISMIC DESIGN FORCE FP PER ASCE 7 CHAPTER 13  
Z = INSTALLED HEIGHT ABOVE GROUND FLOOR  
H = MEAN ROOF HEIGHT OF BUILDING

SEISMIC NOTE:

FOR SEISMIC DESIGN PARAMETERS SEE: SEISMIC RESTRAINT & ANCHORAGE NOTES ON SHEET M-001 AND REFERENCE SPEC SECTION 13 05 41 - SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

Issued:	Date:	CONSULTANTS:		ARCHITECT/ENGINEERS:		STAMP:		Drawing Title PHASE 1 MECHANICAL SCHEDULES	Phase 100% CONSTRUCTION DOCUMENTS	Project Title OUTPATIENT MENTAL HEALTH / EDUCATION ADDITION			Project Number 436-114	
										Building Number 173				
										Drawing Number M-602				
														
														
Approved: Project Director		Location 3687 VETERANS DRIVE , FORT HARRISON, MT 59636		Issue Date 08/05/2020		Checked DD		Drawn DN						



**B**

**C**

**A**

**B**

**C**

**F**

**F**

**F**

**C**

E

D



I/O POINTS LIST BUILDING 173											
	QUANTITY	GRAPHICS REQUIRED	DO	AO	DI	AI	READ	WRITE	TREND	BACnet OBJECT	
AIR HANDLING UNIT 173-AHU-01											
SUPPLY FAN START/STOP	1	X		X						X	HARDWIRED
SUPPLY FAN SPEED CONTROL	1	X		X						X	HARDWIRED
SUPPLY FAN STATUS	1	X				X				X	HARDWIRED
SUPPLY FAN VFD OUTPUT FREQUENCY	1	X					X			X	AV
SUPPLY FAN VFD OUTPUT CURRENT	1	X					X			X	AV
SUPPLY FAN VFD OUTPUT VOLTAGE	1	X					X			X	AV
SUPPLY FAN VFD ALARM	1	X					X			X	BV
SUPPLY AIR STATIC PRESSURE	2	X				X				X	HARDWIRED
SUPPLY AIR PRESSURE HIGH LIMIT	1	X				X				X	HARDWIRED
SUPPLY AIRFLOW	1	X					X			X	HARDWIRED
SUPPLY AIR TEMPERATURE	1	X					X			X	HARDWIRED
FILTER AIR PRESSURE HIGH LIMIT	2	X				X				X	HARDWIRED
HEATING COIL VALVE CONTROL	1	X			X					X	HARDWIRED
SMOKE DETECTOR ALARM	1	X				X				X	HARDWIRED
FREEZE STAT	1	X				X				X	HARDWIRED
MIXED AIR TEMPERATURE	1	X					X			X	HARDWIRED
MIXED & EXHAUST AIR DAMPER CONTROL	1	X			X					X	HARDWIRED
RETURN FAN START/STOP	1	X		X						X	HARDWIRED
RETURN FAN SPEED CONTROL	1	X		X						X	HARDWIRED
RETURN FAN VFD OUTPUT FREQUENCY	1	X					X			X	AV
RETURN FAN VFD OUTPUT CURRENT	1	X					X			X	AV
RETURN FAN VFD OUTPUT VOLTAGE	1	X					X			X	AV
RETURN FAN VFD ALARM	1	X					X			X	BV
RETURN FAN STATUS	1	X				X				X	HARDWIRED
RETURN AIRFLOW	1	X					X			X	HARDWIRED
RETURN AIR TEMPERATURE	1	X					X			X	HARDWIRED
OUTSIDE AIRFLOW	1	X					X			X	HARDWIRED
OUTSIDE AIR TEMPERATURE	1	X					X			X	HARDWIRED
OUTSIDE AIR HUMIDITY	1	X					X			X	HARDWIRED
RETURN AIR HUMIDITY	1	X					X			X	HARDWIRED
SUPPLY AIR HUMIDITY HIGH LIMIT	1	X				X				X	HARDWIRED
HUMIDIFIER CONTROL VALVE	1	X			X					X	HARDWIRED
SMOKE DETECTOR ALARM	1	X				X				X	HARDWIRED
CONDENSING UNIT 173-CUAC-01											
SCROLL COMPRESSOR ENABLE	3	X		X						X	HARDWIRED
DIGITAL COMPRESSOR CONTROL	1	X				X				X	HARDWIRED
CIRCUIT FAIL ALARM	2	X					X			X	HARDWIRED
AIRFLOW PROVING	2	X		X						X	HARDWIRED
VAV BOX											
VAV BOX DAMPER POSITION	45	X		X						X	HARDWIRED
VAV BOX INLET PRESSURE TRANSDUCER (FLOW)	45	X					X			X	HARDWIRED
VAV BOX HEATING WATER CONTROL VALVE	45	X				X				X	HARDWIRED
VAV BOX TEMPERATURE SET POINT	45	X				X				X	HARDWIRED
VAV BOX SUPPLY AIR TEMPERATURE SENSOR	45	X					X			X	HARDWIRED
SPACE TEMPERATURE SENSOR	45	X					X			X	HARDWIRED
EXHAUST FAN 173-EF-01/173-EF-02											
EXHAUST FAN START/STOP	2	X		X						X	HARDWIRED
EXHAUST FAN SPEED CONTROL	2	X				X				X	HARDWIRED
EXHAUST FAN STATUS	2	X					X			X	HARDWIRED
EXHAUST FAN 173-EF-03											
EXHAUST FAN START/STOP	1	X		X						X	HARDWIRED
EXHAUST FAN STATUS	1	X				X				X	HARDWIRED
SPLIT AIR CONDITIONER 173-ACU-01/173-ACU-02											
ON/OFF COMMAND	2	X						X			BO
STATUS	2	X						X		X	BI
ALARM	2	X						X			BI

173-AHU-01/173-CUAC-01 CONTROL SEQUENCE BLDG 173:

SUPPLY FAN START/STOP CONTROL: THE SUPPLY FAN SHALL HAVE A HAND-OFF-AUTO SWITCH IN THE VARIABLE FREQUENCY DRIVE. WHEN IN THE "HAND" POSITION THE FAN SHALL OPERATE. WHEN IN THE "OFF" POSITION THE FAN SHALL NOT OPERATE. WHEN IN THE "AUTO" POSITION, THE FAN SHALL BE CONTROLLED BY THE BAS AND VFD. SUPPLY FAN PRESSURE TRANSMITTER SHALL MODULATE THE FAN AND VARIABLE FREQUENCY DRIVE TO MAINTAIN PROPER DUCT STATIC SET POINT. AN AUXILIARY CONTACT ON THE VFD SHALL SEND A SIGNAL TO THE BAS FOR FAN STATUS. PROGRAM BAS TO SIGNAL AN ALARM CONDITION IF THE FAN FAILS TO PROVE STATUS. PROVIDE HARDWIRED INTERLOCKS TO SHUTDOWN FAN IF THE MOTOR OVERLOADS, SUPPLY AIR PRESSURE HIGH LIMIT IS REACHED, SMOKE DETECTOR CONTACTS OPEN, OR FREEZE STAT CONTACTS OPEN. PROGRAM BAS TO OPERATE THE SUPPLY FAN CONTINUOUSLY IN OCCUPIED MODE.

SUPPLY AIR PRESSURE HIGH LIMIT: WHEN THE SUPPLY SIDE OF THE AIR HANDLER REACHES SET DUCT STATIC PRESSURE (ADJ.), MANUAL RESET HIGH PRESSURE SWITCH SHALL SHUT DOWN THE AIR HANDLER.

HEATING WATER COIL CONTROL: THE HEATING COIL SHALL MODULATE TO MAINTAIN SUPPLY AIR SETPOINT TEMPERATURE.

COOLING CONTROL: A TEMPERATURE SENSOR LOCATED IN THE SUPPLY AIR DUCT SHALL, THROUGH THE DDC CONTROLLER, STAGE COMPRESSORS, AS REQUIRED, TO MAINTAIN LEAVING AIR SETPOINT (ADJ.). TO MINIMIZE COMPRESSOR CYCLING, THERE SHALL BE A 5 MINUTE MINIMUM OFF TIME AND 5 MINUTE MINIMUM ON TIME FOR COMPRESSORS UNLESS AN ALARM OCCURS.

SUPPLY AIR TEMPERATURE RESET SCHEDULE: THE BAS SHALL RESET THE SUPPLY AIR TEMPERATURE BASED ON THE VAV BOX REQUIRING THE MOST AIRFLOW (CRITICAL VAV). THE SUPPLY AIR RESET TEMPERATURE SHALL BE BETWEEN 55°F AND 65°F AS THE CRITICAL VAV DAMPER MODULATES FROM 95% TO 65% WITH A STRAIGHT LINE RELATIONSHIP BETWEEN. DISCHARGE TEMPERATURE SHALL BE RESETTABLE IN THE SOFTWARE.

RETURN FAN START/STOP CONTROL: THE RETURN FAN SHALL HAVE A HAND-OFF-AUTO SWITCH IN THE VARIABLE FREQUENCY DRIVE. WHEN IN THE "HAND" POSITION THE FAN SHALL OPERATE. WHEN IN THE "OFF" POSITION, THE FAN SHALL NOT OPERATE. WHEN IN THE "AUTO" POSITION, THE FAN SHALL BE CONTROLLED BY THE BAS AND VFD. AN AUXILIARY CONTACT ON THE VFD SHALL SEND A SIGNAL TO THE BAS FOR FAN STATUS. PROGRAM BAS TO SIGNAL AN ALARM CONDITION IF THE FAN FAILS TO PROVE STATUS. PROVIDE HARDWIRE INTERLOCKS TO SHUTDOWN FAN IF THE MOTOR OVERLOADS, SMOKE DETECTOR, OR FREEZE STAT CONTACTS OPEN. PROGRAM BAS TO START RETURN FAN AFTER PROOF OF SUPPLY FAN STATUS.

RETURN FAN SPEED CONTROL: RETURN FAN SHALL BE MODULATED TO MAINTAIN A FIXED CFM DIFFERENTIAL BETWEEN SUPPLY AIRFLOW AND RETURN AIRFLOW. THE CFM DIFFERENTIAL WILL BE DETERMINED BY THE TAB CONTRACTOR TO MAINTAIN POSITIVE BUILDING PRESSURE.

MINIMUM OUTSIDE AIR: THE OUTSIDE AIR DAMPER SHALL MODULATE TO MAINTAIN THE SCHEDULED MINIMUM OUTSIDE AIR FLOW SETPOINT WITH A MIXED AIR TEMPERATURE OF 55°F (ADJ.). SIGNAL AN ALARM CONDITION IF MIXED AIR TEMPERATURE IS LESS THAN 40°F. RAD, EAD, AND OAD POSITIONS SHALL ALWAYS SUM TO 100 AND THE BUILDING SHALL REMAIN POSITIVELY PRESSURIZED.

ECONOMIZER CONTROL: OUTSIDE AIR AND RETURN AIR SECTIONS OF THE AIR HANDLING UNITS SHALL HAVE ENTHALPY SENSORS, VAISALA HMX8XH OR ENGINEERED APPROVED EQUIVALENT.

WHEN OUTSIDE AIR ENTHALPY IS ABOVE RETURN AIR ENTHALPY, ECONOMIZER IS DISABLED AND MIXING DAMPERS ARE AT MINIMUM POSITION. WHEN OUTSIDE AIR ENTHALPY IS BELOW RETURN AIR ENTHALPY, ECONOMIZER IS ENABLED AND OUTSIDE AIR TEMPERATURE IS 55°F OR ABOVE, MIXING DAMPERS ARE 100% OPEN TO OUTSIDE AIR. WHEN OUTSIDE AIR ENTHALPY IS BELOW RETURN AIR ENTHALPY AND OUTSIDE AIR TEMPERATURE IS BELOW 55°F, ECONOMIZER IS ENABLED AND MIXING DAMPERS MODULATE TO MAINTAIN MIXED AIR TEMPERATURE AT SETPOINT. MIXED AIR TEMPERATURE SETPOINT IS EQUAL TO SUPPLY AIR TEMPERATURE SETPOINT MINUS 2°F TO COMPENSATE FOR FAN HEAT.

THE ECONOMIZER SHALL CLOSE WHENEVER ONE (1) OF THE FOLLOWING CONDITIONS ARE MET:

- SUPPLY FAN OR RETURN FAN IS OFF.
- MIXED AIR TEMPERATURE IS LESS THAN 40° F.
- OA DEWPOINT IS BELOW 35 F (ADJ).
- LOSS OF FAN STATUS.
- SUPPLY AIR TEMPERATURE SENSOR HAS FAILED.

UNOCCUPIED MODE: THE AHU SET TO UNOCCUPIED MODE ON A USER DEFINABLE SCHEDULE VIA THE BAS WITH MANUAL OVERRIDE, AS REQUIRED, FROM THE VA ACCESSIBLE FRONT END. THE BAS SHALL ENABLE THE ASSOCIATED VAV BOXES TO OPERATE IN THEIR UNOCCUPIED MODE SETPOINTS. DURING UNOCCUPIED MODE, THE MINIMUM OUTSIDE AIR DAMPER SHALL BE ALLOWED TO CLOSE COMPLETELY IF ECONOMIZER CONDITIONS AREN'T MET. THE SUPPLY FAN IS OFF WHENEVER SPACE TEMPERATURE IS BETWEEN THE UNOCCUPIED HEATING AND COOLING SETPOINTS.

MORNING WARMUP/COOLDOWN MODE: THE AHU IS SCHEDULED TO ENTER WARMUP/COOLDOWN MODE 1 HOUR (ADJ) PRIOR TO OCCUPIED MODE AS SET ON A USER DEFINABLE SCHEDULE VIA THE BAS WITH MANUAL OVERRIDE, AS REQUIRED, FROM THE VA ACCESSIBLE FRONT END. THE BAS SHALL KEEP OUTDOOR DAMPERS CLOSED IF ECONOMIZER CONDITIONS AREN'T MET. THE BAS SHALL ENABLE THE ASSOCIATED VAV BOXES TO OPERATE IN THEIR OCCUPIED MODE SETPOINTS. AS THE SPACE TEMPERATURE APPROACHES WITHIN 2 F OF SPACE SETPOINT TEMPERATURE, OUTSIDE AIR DAMPER SHALL MODULATE TO THE SCHEDULED MINIMUM OUTSIDE AIR.

THE ALARMS SHALL BE PROVIDED AS FOLLOWS:

- HIGH MIXED AIR TEMPERATURE: 5° F HIGHER THAN SETPOINT.
- LOW MIXED AIR TEMPERATURE: 5° F LOWER THAN SETPOINT.
- HIGH OR LOW SUPPLY AIR TEMPERATURE.

EXHAUST FAN CONTROL SEQUENCES BLDG 173:

173-EF-01 AND 173-EF-02

- EXHAUST FAN SHALL BE INTERLOCKED WITH AHU. THE FAN SPEED IS ADJUSTED DURING TAB THROUGH THE BAS. WHEN STATUS IS LOST, AN ALARM SHALL BE SENT TO THE BAS.

173-EF-03

- EXHAUST FAN SHALL BE CONTROLLED BY A LOCAL THERMOSTAT. FAN SHALL ENABLE WHEN TEMPERATURE IS ABOVE 80 F (ADJ.). STATUS SHALL BE MONITORED BY THE BAS.

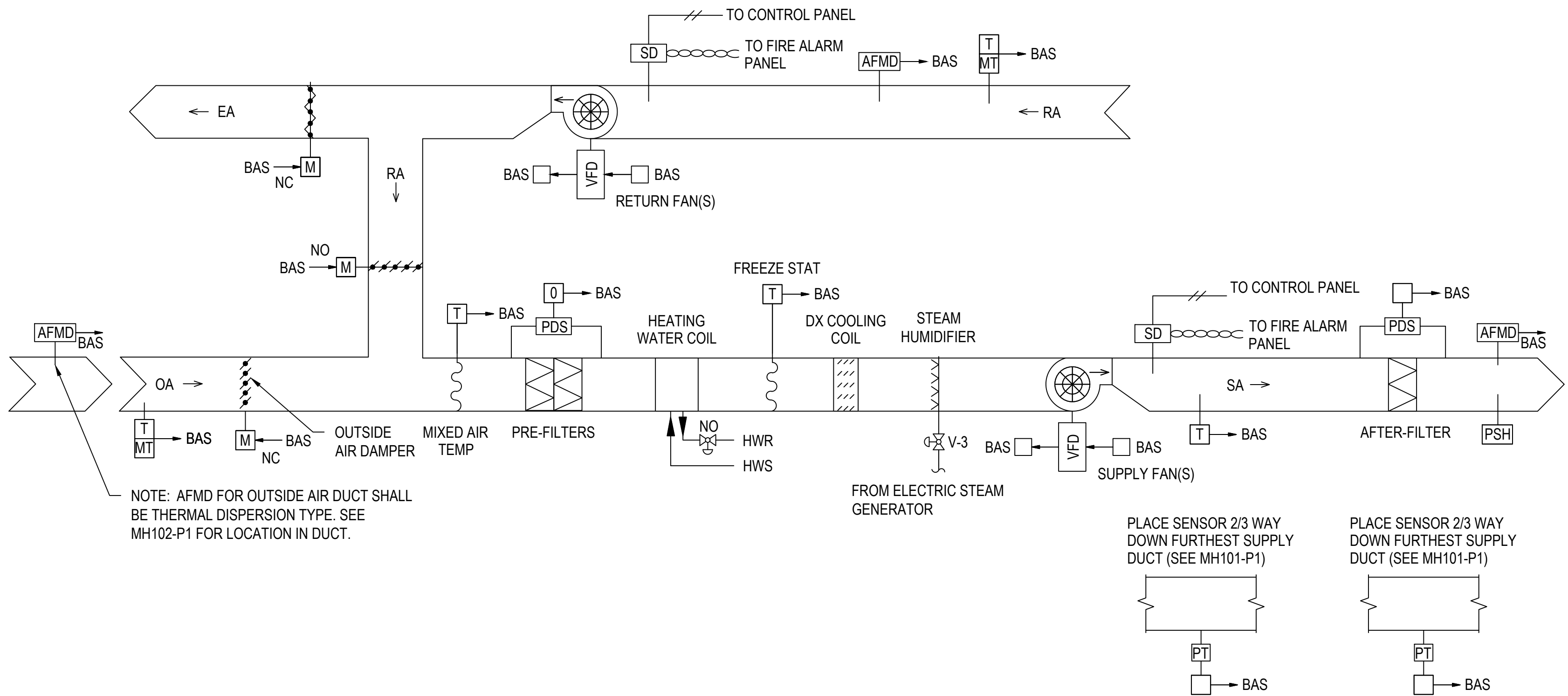
SPLIT AIR CONDITIONER SEQUENCES BLDG 173:

173-ACU-01 AND 173-ACU-02

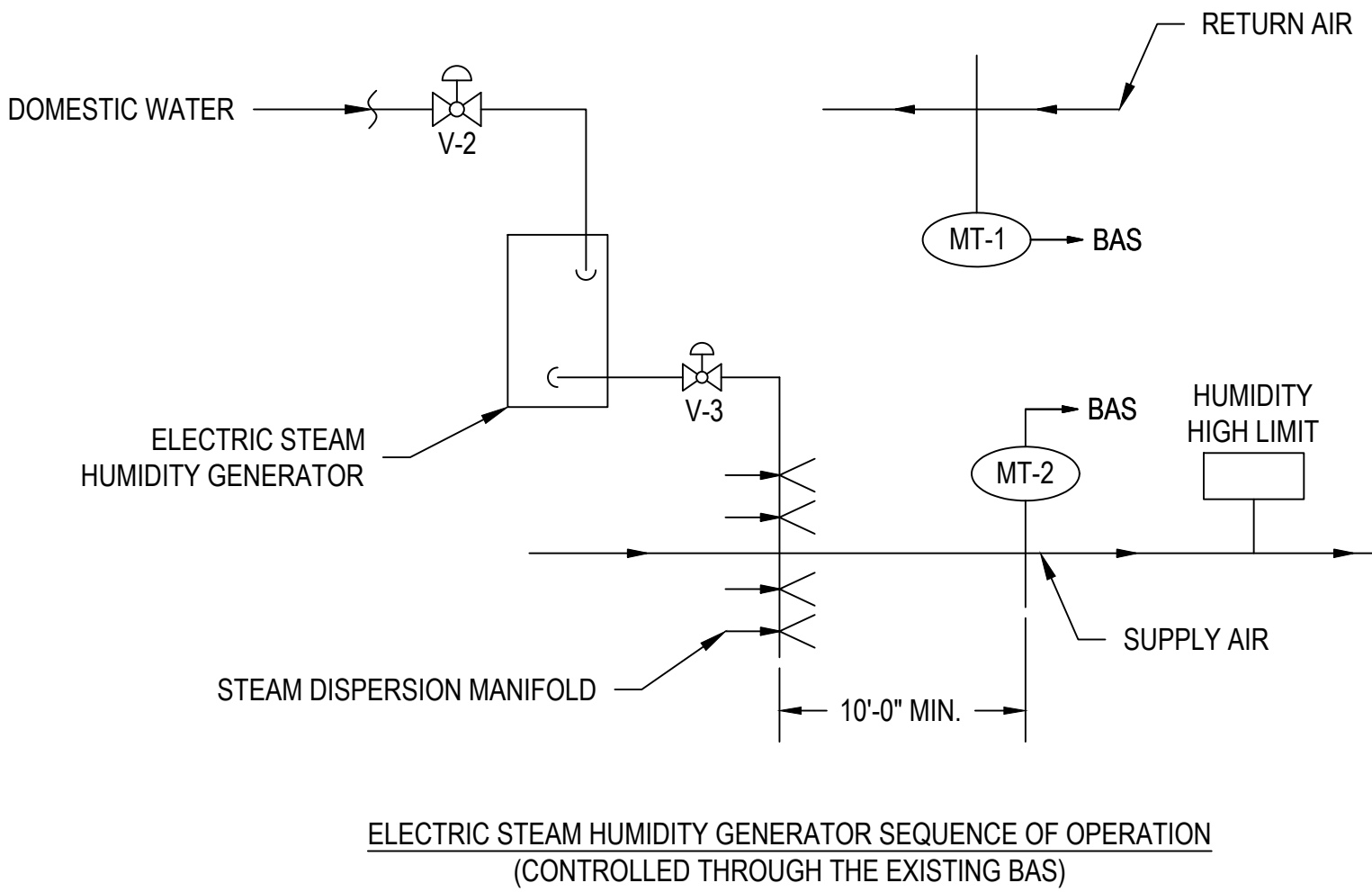
- UNITS SHALL OPERATE CONTINUOUSLY VIA INTERNAL CONTROLS TO MAINTAIN ROOM SETPOINT TEMPERATURE OF 80 F (ADJ.). WHEN STATUS IS LOST OR UNIT SIGNALS AN ALARM, AN ALARM SHALL BE SENT TO THE BAS.

GENERAL NOTES:

- DDC SYSTEM SHALL COMMUNICATE WITH EXISTING CENTRAL BAS VIA ETHERNET. EXISTING BAS IS A SMART STRUCTURE CONTROL SYSTEM BY SCHNEIDER ELECTRIC.
- ALL EQUIPMENT CONTROLLED AND MONITORED BY THE BAS.

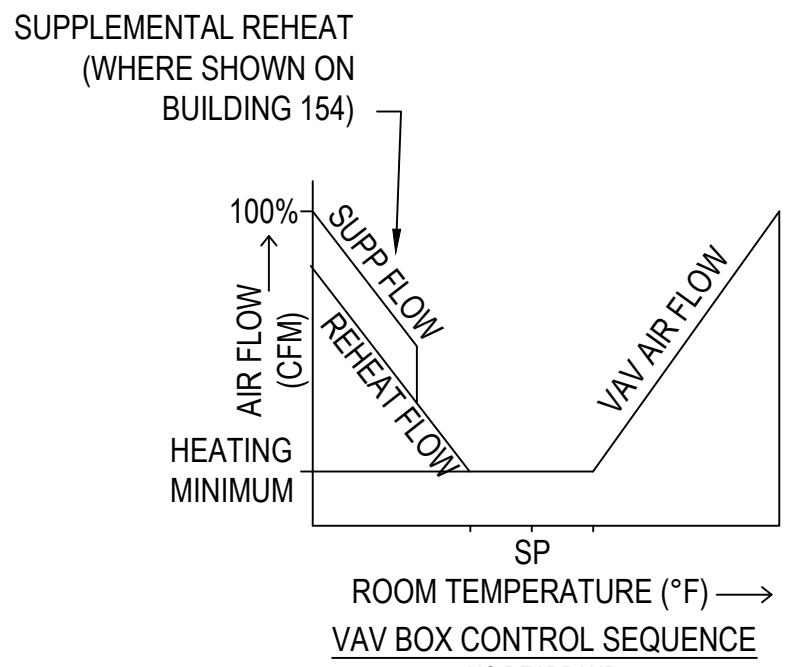


1 173-AHU-01 VARIABLE AIR VOLUME AIR HANDLING UNIT WITH MINIMUM OUTSIDE AIR CONTROLS DIAGRAM BLDG 173  
SCALE: NO SCALE



- WHEN HUMIDIFIER IS FIRST ACTIVATED, FILL VALVE V-2 OPENS AND THE EVAPORATING CHAMBER FILLS WITH WATER TO OPERATING LEVEL. V-2 SHALL OPEN AS REQUIRED TO MAINTAIN WATER LEVEL UNDER THE HUMIDIFIER'S OWN CONTROLS.
- DUCT HUMIDISTAT, MT-1, SHALL ENABLE HUMIDIFIER WHEN AIR HUMIDITY IS BELOW ITS SETPOINT. V-3 SHALL MODULATE, AS REQUIRED, TO MAINTAIN MT-1 SETPOINT. HIGH LIMIT HUMIDISTAT SHALL DISABLE HUMIDIFIER IF SUPPLY DUCT HUMIDITY EXCEEDS 80% ADJUSTABLE. VALVE V-3 SHALL REMAIN CLOSED UNTIL STEAM IS AVAILABLE FROM HUMIDIFIER.
- HUMIDIFIER IS DISABLED WHEN AIR HANDLER IS INOPERATIVE.
- PROVIDE ALARM TO BAS IF HUMIDIFIER FAILS TO OPERATE.

2 ELECTRIC STEAM HUMIDIFIER CONTROLS DIAGRAM BLDG 173  
SCALE: NO SCALE



TEMPERATURE SET POINTS SHALL BE SET AS FOLLOWS:

OCCUPIED COOLING 75°F (ADJ) UNOCCUPIED COOLING 80°F (ADJ)  
OCCUPIED HEATING 70°F (ADJ) UNOCCUPIED HEATING 60°F (ADJ)

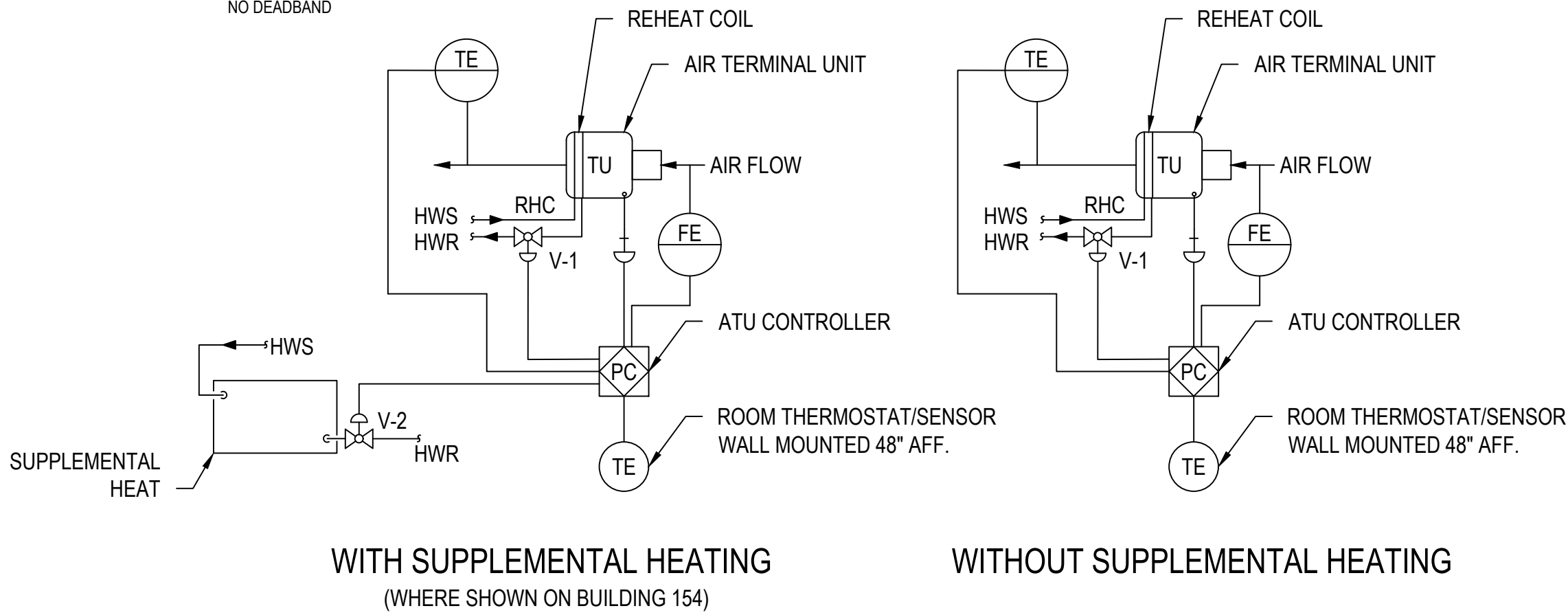
DEAD BAND OF 5° F BETWEEN HEATING AND COOLING SET POINTS WILL BE MAINTAINED. UPON FALL IN SPACE TEMPERATURE THE VAV DAMPER WILL MODULATE TO MINIMUM POSITION. VAV SHALL BE PRESSURE INDEPENDENT.

UPON FURTHER DROP IN SPACE TEMPERATURE, VALVE V-1 WILL MODULATE TO MAINTAIN SET POINT  $\pm$  5° F. THE ADJUSTABLE TOLERANCE OF  $\pm$  5° F HAS BEEN SELECTED TO PREVENT VALVE HUNTING.

FOR SUPPLEMENTAL REHEAT (WHERE SHOWN ON BUILDING 154): VALVE V-2 SHALL BE ENABLED WHEN OUTSIDE AIR FALLS BELOW 40° F (ADJ) AND VALVE V-1 HAS BEEN MODULATED OPEN ABOVE 30% (ADJ). VALVE V-2 SHALL MAINTAIN SET POINT  $\pm$  5° F. THE ADJUSTABLE TOLERANCE OF  $\pm$  5° F HAS BEEN SELECTED TO PREVENT VALVE HUNTING.

THE REVERSE SHALL OCCUR ON THE RISE IN SPACE TEMPERATURE.

V-1 SHALL BE A THREE-WAY VALVE AT THE VAV WITH THE LONGEST HOT WATER PIPE RUN (173-VAV-37 FOR BLDG 173, VAV-2-18 FOR BLDG 154).



3 VARIABLE AIR VOLUME TERMINAL UNIT CONTROLS DIAGRAM  
SCALE: NO SCALE

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GENERAL NOTES:

1. DDC SYSTEM SHALL COMMUNICATE WITH EXISTING CENTRAL BAS VIA ETHERNET. EXISTING BAS IS A SMART STRUCTURE CONTROL SYSTEM BY SCHNEIDER ELECTRIC.
2. ALL EQUIPMENT CONTROLLED AND MONITORED BY THE BAS.

154-AHU-01-EDU/154-EF-01 CONTROL SEQUENCE BLDG 154:

SUPPLY FAN START/STOP CONTROL: THE SUPPLY FAN SHALL HAVE A HAND-OFF-AUTO SWITCH IN THE VARIABLE FREQUENCY DRIVE. WHEN IN THE "HAND" POSITION, THE FAN SHALL OPERATE. WHEN IN THE "OFF" POSITION, THE FAN SHALL NOT OPERATE. WHEN IN THE "AUTO" POSITION, THE FAN SHALL BE CONTROLLED BY THE BAS AND VFD. SUPPLY FAN PRESSURE TRANSMITTER SHALL MODULATE THE FAN AND VARIABLE FREQUENCY DRIVE TO MAINTAIN PROPER DUCT STATIC SET POINT. AN AUXILIARY CONTACT ON THE VFD SHALL SEND A SIGNAL TO THE BAS FOR FAN STATUS. PROGRAM BAS TO SIGNAL AN ALARM CONDITION IF THE FAN FAILS TO PROVE STATUS. PROVIDE HARDWIRED INTERLOCKS TO SHUTDOWN FAN IF THE MOTOR OVERLOADS. SUPPLY AIR PRESSURE HIGH LIMIT IS REACHED, SMOKE DETECTOR CONTACTS OPEN, OR FREEZE STAT CONTACTS OPEN. PROGRAM BAS TO OPERATE THE SUPPLY FAN CONTINUOUSLY IN OCCUPIED MODE.

SUPPLY AIR PRESSURE HIGH LIMIT: WHEN THE SUPPLY SIDE OF THE AIR HANDLER REACHES SET DUCT STATIC PRESSURE (ADJ.), MANUAL RESET HIGH PRESSURE SWITCH SHALL SHUT DOWN THE AIR HANDLER.

HEATING WATER COIL CONTROL: THE HEATING COIL SHALL MODULATE TO MAINTAIN SUPPLY AIR SETPOINT TEMPERATURE.

COOLING CONTROL: A TEMPERATURE SENSOR LOCATED IN THE SUPPLY AIR DUCT SHALL, THROUGH THE DDC CONTROLLER, STAGE COMPRESSORS, AS REQUIRED, TO MAINTAIN LEAVING AIR SETPOINT (ADJ.), TO MINIMIZE COMPRESSOR CYCLING, THERE SHALL BE A 5 MINUTE MINIMUM OFF TIME AND 5 MINUTE MINIMUM ON TIME FOR COMPRESSORS UNLESS AN ALARM OCCURS.

SUPPLY AIR TEMPERATURE RESET SCHEDULE: THE BAS SHALL RESET THE SUPPLY AIR TEMPERATURE BASED ON THE VAV BOX REQUIRING THE MOST AIRFLOW (CRITICAL VAV). THE SUPPLY AIR RESET TEMPERATURE SHALL BE BETWEEN 55°F AND 65°F AS THE CRITICAL VAV DAMPER MODULATES FROM 95% TO 65% WITH A STRAIGHT LINE RELATIONSHIP BETWEEN. DISCHARGE TEMPERATURE SHALL BE RESETTABLE IN THE SOFTWARE.

RETURN FAN START/STOP CONTROL: THE RETURN FAN SHALL HAVE A HAND-OFF-AUTO SWITCH IN THE VARIABLE FREQUENCY DRIVE. WHEN IN THE "HAND" POSITION, THE FAN SHALL OPERATE. WHEN IN THE "OFF" POSITION, THE FAN SHALL NOT OPERATE. WHEN IN THE "AUTO" POSITION, THE FAN SHALL BE CONTROLLED BY THE BAS AND VFD. AN AUXILIARY CONTACT ON THE VFD SHALL SEND A SIGNAL TO THE BAS FOR FAN STATUS. PROGRAM BAS TO SIGNAL AN ALARM CONDITION IF THE FAN FAILS TO PROVE STATUS. PROVIDE HARDWARE INTERLOCKS TO SHUTDOWN FAN IF THE MOTOR OVERLOADS, SMOKE DETECTOR, OR FREEZE STAT CONTACTS OPEN. PROGRAM BAS TO START RETURN FAN AFTER PROOF OF SUPPLY FAN STATUS.

RETURN FAN SPEED CONTROL: RETURN FAN SHALL BE MODULATED TO MAINTAIN A FIXED CFM DIFFERENTIAL BETWEEN SUPPLY AIRFLOW AND RETURN AIRFLOW. THE CFM DIFFERENTIAL WILL BE DETERMINED BY THE TAB CONTRACTOR TO MAINTAIN POSITIVE BUILDING PRESSURE.

MINIMUM OUTSIDE AIR: THE OUTSIDE AIR DAMPER SHALL MODULATE TO MAINTAIN THE SCHEDULED MINIMUM OUTSIDE AIR FLOW SETPOINT WITH A MIXED AIR TEMPERATURE OF 55°F (ADJ.). THE MINIMUM OUTSIDE AIR CAN BE RESET BY THE CO2 CONTROL. SIGNAL AN ALARM CONDITION IF MIXED AIR TEMPERATURE IS LESS THAN 40°F. RAD, EAD, AND OAD POSITIONS SHALL ALWAYS SUM TO 100 AND THE BUILDING SHALL REMAIN POSITIVELY PRESSURIZED.

CO2 CONTROL: THE BAS SHALL RESET THE MINIMUM OUTSIDE AIR FROM THE MINIMUM SCHEDULED 850 CFM TO 1400 CFM AS THE CO2 SENSOR REPORTS FROM 1000 PPM TO 1400 PPM WITH A STRAIGHT LINE RELATIONSHIP BETWEEN.

ECONOMIZER CONTROL: OUTSIDE AIR AND RETURN AIR SECTIONS OF THE AIR HANDLING UNITS SHALL HAVE ENTHALPY SENSORS, VAISALA HMx8XH OR ENGINEERED APPROVED EQUIVALENT.

WHEN OUTSIDE AIR ENTHALPY IS ABOVE RETURN AIR ENTHALPY, ECONOMIZER IS DISABLED AND MIXING DAMPERS ARE AT MINIMUM POSITION. WHEN OUTSIDE AIR ENTHALPY IS BELOW RETURN AIR ENTHALPY, ECONOMIZER IS ENABLED AND OUTSIDE AIR TEMPERATURE IS 55°F OR ABOVE, MIXING DAMPERS ARE 100% OPEN TO OUTSIDE AIR. WHEN OUTSIDE AIR ENTHALPY IS BELOW RETURN AIR ENTHALPY AND OUTSIDE AIR TEMPERATURE IS BELOW 55°F, ECONOMIZER IS ENABLED AND MIXING DAMPERS MODULATE TO MAINTAIN MIXED AIR TEMPERATURE AT SETPOINT. MIXED AIR TEMPERATURE SETPOINT IS EQUAL TO SUPPLY AIR TEMPERATURE SETPOINT MINUS 2°F TO COMPENSATE FOR FAN HEAT.

THE ECONOMIZER SHALL CLOSE WHENEVER ONE (1) OF THE FOLLOWING CONDITIONS ARE MET:

- SUPPLY FAN OR RETURN FAN IS OFF.
- MIXED AIR TEMPERATURE IS LESS THAN 40° F.
- OA DEWPOINT IS BELOW 35 F (ADJ.).
- LOSS OF FAN STATUS.
- SUPPLY AIR TEMPERATURE SENSOR HAS FAILED.

THE ALARMS SHALL BE PROVIDED AS FOLLOWS:

- HIGH MIXED AIR TEMPERATURE: 5° F HIGHER THAN SETPOINT.
- LOW MIXED AIR TEMPERATURE: 5° F LOWER THAN SETPOINT.
- HIGH OR LOW SUPPLY AIR TEMPERATURE.

UNOCCUPIED MODE: THE AHU SET TO UNOCCUPIED MODE ON A USER DEFINABLE SCHEDULE VIA THE BAS WITH MANUAL OVERRIDE, AS REQUIRED. FROM THE VA ACCESSIBLE FRONT END. THE BAS SHALL ENABLE THE ASSOCIATED VAV BOXES TO OPERATE IN THEIR UNOCCUPIED MODE SETPOINTS. DURING UNOCCUPIED MODE, THE MINIMUM OUTSIDE AIR DAMPER SHALL BE ALLOWED TO CLOSE COMPLETELY IF ECONOMIZER CONDITIONS ARENT MET. THE SUPPLY FAN IS OFF WHENEVER SPACE TEMPERATURE IS BETWEEN THE UNOCCUPIED HEATING AND COOLING SETPOINTS.

MORNING WARMUP/COOLDOWN MODE: THE AHU IS SCHEDULED TO ENTER WARMUP/COOLDOWN MODE 1 HOUR (ADJ) PRIOR TO OCCUPIED MODE AS SET ON A USER DEFINABLE SCHEDULE VIA THE BAS WITH MANUAL OVERRIDE, AS REQUIRED. FROM THE VA ACCESSIBLE FRONT END. THE BAS SHALL KEEP OUTDOOR DAMPERS CLOSED IF ECONOMIZER CONDITIONS ARENT MET. THE BAS SHALL ENABLE THE ASSOCIATED VAV BOXES TO OPERATE IN THEIR OCCUPIED MODE SETPOINTS. AS THE SPACE TEMPERATURE APPROACHES WITHIN 2 F OF SPACE SETPOINT TEMPERATURE, OUTSIDE AIR DAMPER SHALL MODULATE TO THE SCHEDULED MINIMUM OUTSIDE AIR.

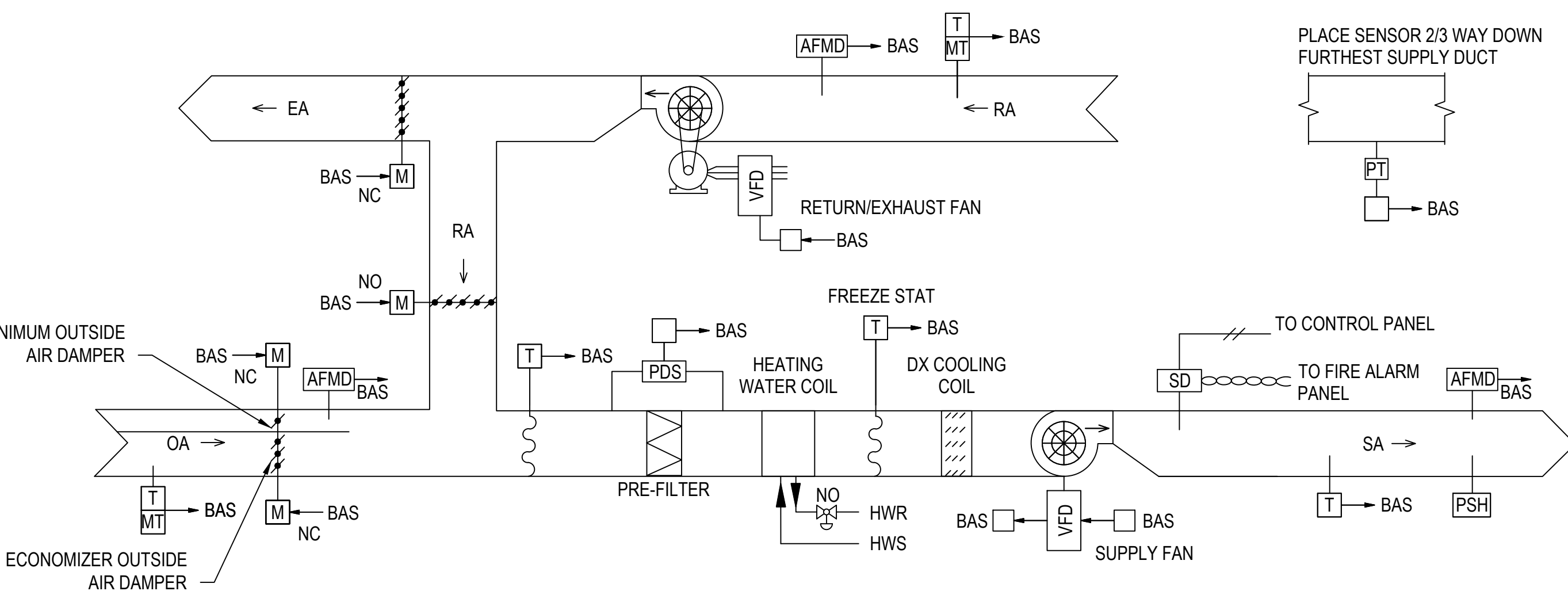
EXHAUST FAN CONTROL SEQUENCE BLDG 154:

EF-2-1 (EXISTING)

- EXHAUST FAN SHALL RUN CONTINUOUSLY WITH MANUAL ON/OFF CONTROL THROUGH THE BAS. WHEN STATUS IS LOST, AN ALARM SHALL BE SENT TO THE BAS.

SPLIT AIR CONDITIONER SEQUENCES BLDG 154:

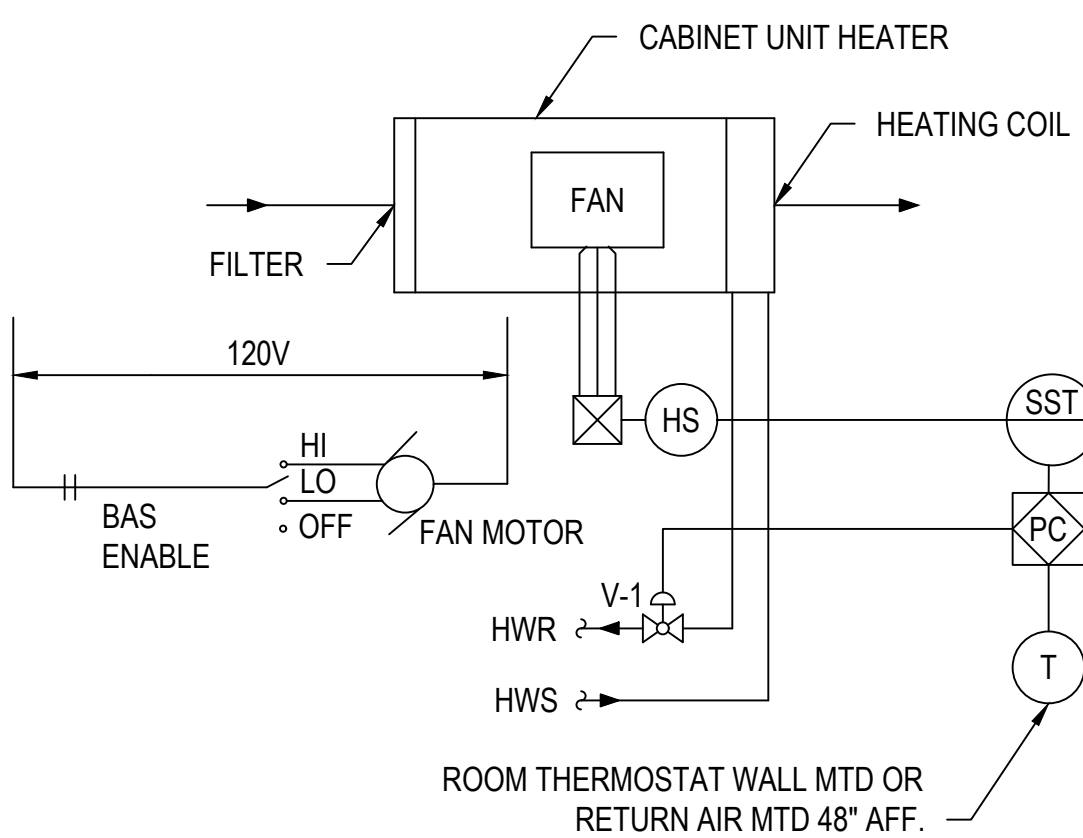
- 154-ACU-01 SHALL OPERATE CONTINUOUSLY VIA INTERNAL CONTROLS TO MAINTAIN ROOM SETPOINT TEMPERATURE OF 80 F (ADJ.). WHEN STATUS IS LOST OR UNIT SIGNALS AN ALARM, AN ALARM SHALL BE SENT TO THE BAS.



154-AHU-01-EDU AND 154-EF-01 CONTROLS DIAGRAM BLDG 154

SCALE: NO SCALE

I/O POINTS LIST BUILDING 154											
	QUANTITY	GRAPHICS REQUIRED	DO	AO	DI	AI	READ	WRITE	TREND	BACnet	OBJECT
<b>AIR HANDLER 154-AHU-01-EDU</b>											
SUPPLY FAN START/STOP	1	X		X							HARDWIRED
SUPPLY FAN SPEED CONTROL	1	X		X						X	HARDWIRED
SUPPLY FAN STATUS	1	X			X					X	HARDWIRED
SUPPLY FAN VFD OUTPUT FREQUENCY	1	X					X		X		AV
SUPPLY FAN VFD OUTPUT CURRENT	1	X						X			AV
SUPPLY FAN VFD OUTPUT VOLTAGE	1	X						X			AV
SUPPLY FAN VFD ALARM	1	X						X			BV
SUPPLY AIR STATIC PRESSURE	1	X				X				X	HARDWIRED
SUPPLY AIR PRESSURE HIGH LIMIT	1	X			X						HARDWIRED
SUPPLY AIRFLOW	1	X				X			X		HARDWIRED
SUPPLY AIR TEMPERATURE	1	X				X			X		HARDWIRED
FILTER AIR PRESSURE HIGH LIMIT	1	X				X					HARDWIRED
SMOKE DETECTOR ALARM	1	X				X					HARDWIRED
FREEZE STAT	1	X				X					HARDWIRED
MIXED AIR TEMPERATURE	1	X					X			X	HARDWIRED
MIXED & EXHAUST AIR DAMPER CONTROL	1	X			X						HARDWIRED
OUTSIDE AIR TEMPERATURE	1	X					X			X	HARDWIRED
<b>CONDENSING UNIT 154-CUAC-01-EDU</b>											
SCROLL COMPRESSOR ENABLE	3	X		X							HARDWIRED
DIGITAL COMPRESSOR CONTROL	1	X			X						HARDWIRED
CIRCUIT FAIL ALARM	2	X				X					HARDWIRED
AIRFLOW PROVING	2	X		X							HARDWIRED
<b>RETURN/EXHAUST FAN 154-EF-01</b>											
RETURN FAN START/STOP	1	X		X							HARDWIRED
RETURN FAN SPEED CONTROL	1	X		X						X	HARDWIRED
RETURN FAN STATUS	1	X			X					X	HARDWIRED
RETURN FAN VFD OUTPUT FREQUENCY	1	X					X				AV
RETURN FAN VFD OUTPUT CURRENT	1	X						X			AV
RETURN FAN VFD OUTPUT VOLTAGE	1	X						X			AV
RETURN FAN VFD ALARM	1	X						X			BV
RETURN AIRFLOW	1	X				X				X	HARDWIRED
RETURN AIR TEMPERATURE	1	X				X				X	HARDWIRED
<b>VAV BOX</b>											
VAV BOX DAMPER POSITION	21	X		X						X	HARDWIRED
VAV BOX INLET PRESSURE TRANSDUCER (FLOW)	21	X				X				X	HARDWIRED
VAV BOX HEATING WATER CONTROL VALVE	21	X			X					X	HARDWIRED
VAV BOX TEMPERATURE SET POINT	21	X			X					X	HARDWIRED
VAV BOX SUPPLY AIR TEMPERATURE SENSOR	21	X				X				X	HARDWIRED
SPACE TEMPERATURE SENSOR	21	X				X				X	HARDWIRED
<b>SPLIT AIR CONDITIONER 154-ACU-01</b>											
ON/OFF COMMAND	1	X					X				BO
STATUS	1	X						X		X	BI
ALARM	1	X						X			BI



SEQUENCE OF OPERATION:

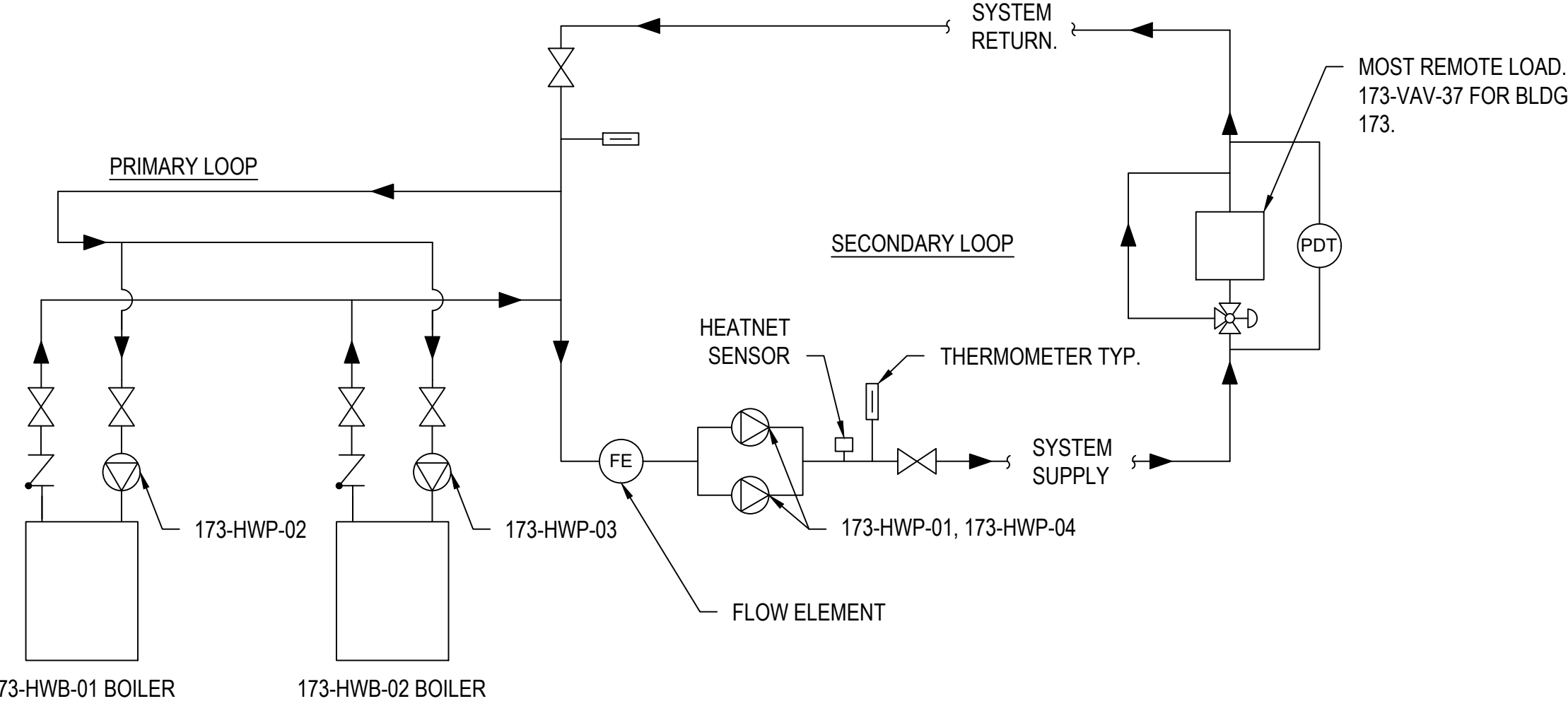
CABINET HEATER SHALL OPERATE ON A SCHEDULE AS SET BY THE BAS. FAN STATUS SHALL BE MONITORED AND AN ALARM MESSAGE GENERATED IN THE EVENT THE FAN FAILS TO RUN. THE ROOM TEMP SETPOINT WILL BE 50° (ADJ.). THE HEATING WATER VALVE AND FAN SHALL BE ENABLED, AS REQUIRED, TO MAINTAIN SPACE TEMP SETPOINT.

HOT WATER CABINET HEATER CONTROLS DIAGRAM BLDG 173

SCALE: NO SCALE

I/O POINTS LIST BUILDING 173

	QUANTITY	GRAPHICS REQUIRED	DO	AO	DI	AI	READ	WRITE	TREND	BACnet	OBJECT
<b>HEATING WATER BOILERS 173-HWB-01 (MASTER), 173-HWB-02 (SLAVE)</b>											
HEAT DEMAND	1	X				X	X	X			BV
BOILER SETPOINT TEMPERATURE	1	X				X	X				BV
OUTSIDE AIR RESET ENABLE	1	X				X	X				AV
OUTSIDE AIR RESET SETPOINT	1	X				X	X				AV
OUTSIDE AIR RESET HIGH WATER TEMPERATURE	1	X				X	X				AV
OUTSIDE AIR RESET HIGH AIR TEMPERATURE	1	X				X	X				AV
OUTSIDE AIR RESET LOW WATER TEMPERATURE	1	X				X	X				AV
OUTSIDE AIR RESET LOW AIR TEMPERATURE	1	X				X	X				AV
OUTSIDE AIR TEMPERATURE	1	X				X		X			AI
SYSTEM SUPPLY WATER TEMPERATURE	1	X				X		X			AI
BOILER RUN STATUS	2	X				X		X			BV
BOILER SUPPLY WATER TEMPERATURE	2	X				X		X			AI
BOILER RETURN WATER TEMPERATURE	2	X				X		X			AI
BOILER ALARM	2	X				X					BV
BOILER MODULATION RATE	2	X				X		X			AI
BOILER RUNTIME	2	X				X					AI
BOILER CYCLES	2	X				X					AI
BOILER FAILED	2	X				X					BV
<b>SECONDARY LOOP HEATING WATER PUMPS 173-HWP-01, 173-HWP-04</b>											
PUMP STATUS	2	X			X					X	HARDWIRED
PUMP START/STOP	2	X		X							HARDWIRED
PUMP SPEED CONTROL	2	X		X						X	HARDWIRED
SUPPLY WATER TEMPERATURE	1	X				X		X			HARDWIRED
RETURN WATER TEMPERATURE	1	X				X		X			HARDWIRED
WATER DIFFERENTIAL PRESSURE	1	X				X		X			HARDWIRED
WATER FLOW	1	X				X		X			HARDWIRED
PUMP VFD OUTPUT FREQUENCY	2	X					X		X		AV
PUMP VFD OUTPUT CURRENT	2	X					X				AV
PUMP VFD OUTPUT VOLTAGE	2	X					X				AV
PUMP VFD ALARM	2	X					X				BV
<b>173-CUH-01</b>											
ON/OFF COMMAND	1	X		X			X				HARDWIRED
STATUS	1	X				X		X		X	HARDWIRED
ALARM	1	X				X		X			HARDWIRED
<b>STORMWATER HEAT TRACING</b>											
STATUS	1	X				X		X			HARDWIRED
<b>DOMESTIC CIRCULATION PUMP 173-PP-01</b>											
PUMP STATUS	1	X			X					X	HARDWIRED
PUMP START/STOP	1	X		X							HARDWIRED



SEQUENCE OF OPERATION:

BOILER/BOILER PUMP CONTROL (173-HWP-02, 173-HWP-03, 173-HWB-01, AND 173-HWB-02): BOILERS SHALL BE CONNECTED WITH 173-HWB-01 BEING MASTER AND 173-HWB-02 AS THE SLAVE BOILER. BOILERS AND BOILER PRIMARY PUMPS (173-HWP-02, 173-HWP-03) OPERATION SHALL BE CONTROLLED BY THE BOILER MANAGEMENT SYSTEM (BMS) VIA INPUT FROM THE BAS. BOILERS (AND ASSOCIATED PUMPS) SHALL OPERATE IN A LEAD/LAG CONFIGURATION. LEAD/LAG STATUS SHALL ROTATE MONTHLY BY BAS.

HEATING WATER SYSTEM TEMPERATURE CONTROL:

WHEN HEATING WATER SYSTEM PUMP (SECONDARY: 172-HWP-01 AND 173-HWP-04) IS OPERATING, BAS SHALL CONTROL BOILERS TO MAINTAIN SYSTEM HEATING WATER TEMPERATURE SETPOINT. TEMPERATURE SETPOINT SHALL BE AS FOLLOWS:






- 130°F WHEN OUTSIDE AIR TEMPERATURE IS ABOVE 55°F.
- 160°F WHEN OUTSIDE AIR TEMPERATURE IS BELOW 0° F.
- TEMPERATURE SETPOINT SHALL BE PROPORTIONAL BETWEEN 130°F AND 160°F WHEN OUTSIDE AIR IS BETWEEN 55°F AND 0°F.

WHEN OPERATING, BOILER PUMP SPEED SHALL BE CONTROLLED BY BMS TO MAINTAIN DIFFERENTIAL TEMPERATURE SETPOINT ACROSS BOILER OF 30° F (ADJ.). BOILER AND PUMP STATUS SHALL BE REPORTED TO BAS. BMS SHALL CONTROL BOILER STARTING AND FIRING TO MAINTAIN SETPOINT.

SECONDARY LOOP PUMP CONTROL (173-HWP-01 AND 173-HWP-04): PUMP OPERATION SHALL BE CONTROLLED VIA INPUT FROM THE BAS. PUMPS SHALL OPERATE IN A LEAD/STANDBY CONFIGURATION. LEAD/STANDBY STATUS SHALL BE ROTATED WEEKLY BY BAS. PUMP SPEED SHALL BE CONTROLLED VIA A PRESSURE DIFFERENTIAL SENSOR AT THE MOST REMOTE LOAD. A 3-WAY BYPASS VALVE SHALL ENSURE MINIMUM PUMP FLOW IS MET TO PREVENT PUMP DEADHEADING.

BOILER CONTROLS DIAGRAM BLDG 173

SCALE: NO SCALE

		<div>CONSULTANTS:</div> <div><div><div><div>HOEFER WYSOCKI</div><div>11660 TOMAHAWK CREEK PARKWAY SUITE 400, LEAWOOD, KANSAS 66011</div></div></div><div></div></div>			<div>ARCHITECT/ENGINEERS:</div> <div><div><div><div>VALHALLA ENGINEERING GROUP, LLC</div><div>750 W HAMPDEN AVE SUITE #300 ENGLEWOOD CO 80110 (720) 550-6307 WWW.VALHALLAENGINEERING.COM</div></div></div><div>VEG 4.11</div></div>			<div>STAMP:</div> <div></div>	<div><div>U.S. Department of Veterans Affairs</div></div>	<div>Drawing Title</div> <div>MECHANICAL CONTROLS</div> <div>Approved: Project Director</div>	<div>Phase</div> <div>100% CONSTRUCTION DOCUMENTS</div>	<div>Project Title</div> <div>OUTPATIENT MENTAL HEALTH / EDUCATION ADDITION</div> <div>Location 3687 VETERANS DRIVE, FORT HARRISON, MT 59636</div> <div>Issue Date 08/05/2020</div> <div>Checked DD</div> <div>Drawn DN</div>	<div>Project Number</div> <div>436-114</div> <div>Building Number</div> <div>173 / 154</div> <div>Drawing Number</div> <div>M-702</div>
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