

AIR HANDLER SCHEDULE (EXTERIOR)

DRAWING CODE (DU/ODU)	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL	ALTERNATE APPROVED MANUFACTURERS	SYSTEM TYPE	SUPPLY FAN		RETURN FAN		COOLING COIL		CHILLED WATER		VELOCITY (FPM)		TOTAL CAP (MBH)		SENSIBLE CAP (MBH)	EAT (°F dbwb)	LAT (°F dbwb)	HEATING COIL (ELECTRIC, SSR STAGING)				ELECTRICAL				POWER SUPPLY (V/F/PH/Hz)	CIRCUIT 1 (FAN)	CIRCUIT 2 (FAN)	CIRCUIT 3 (HEAT)	WEIGHT (LBS)	NOTES	ACCESSORIES						
					AIRFLOW (CFM)	MAX OA (CFM)	VENT OA (CFM)	MIN OA (CFM)	BHP PER FAN (HP)	MOTOR (QTY)	ESP (IN.WG.)	AIRFLOW (CFM)	BHP PER FAN (HP)	MOTOR (QTY)	ESP (IN.WG.)	AIRFLOW (CFM)				AIRFLOW MIN (CFM)	VELOCITY (FPM)	TOTAL CAP (MBH)	APD (IN. H2O)	EWT (°F)	LWT (°F)	FLOW (GPM)	WFO (FT. H2O)								PIPE CONN. (IN)	FAN (A)	MOCP (A)	FAN (A)	MOCP (A)	MCA (A)
AH02	TRANE	CSAA006	YORK DAKIN	2-PIPE	2,810	2,810	570	-	2.73	1	2.00	2,810	1,405	460	95.0	64.8	73.6 / 63.7	52.7 / 52.1	6.0	42.0	52.0	18.9	3.2	1.5	2,810	594	17.7	55.0	75.0	460/360	4.2	-	2.9	-	28.1	-	30	3,940	1-4	A-1
AH03	TRANE	CSAA012	YORK DAKIN	2-PIPE	5,440	5,440	1,710	-	5.14	1	2.00	5,240	2,620	426	240.4	140.0	79.9 / 68.6	54.7 / 54.0	0.5	42.0	52.0	47.9	6.1	2	5,240	497	33.0	55.0	75.0	460/360	9.8	-	4.6	-	-	-	5,900	1-4	A-1	

NOTES:

1

REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.

2

COIL, DRAIN AND MOTOR SIDE ACCESS TO BE FIELD CONFIRMED PRIOR TO SUBMITTING FOR APPROVAL

3

MAXIMUM COIL FACE VELOCITY SHALL NOT EXCEED SCHEDULED VALUES

4

ALL CONTROLS SENSORS, ACTUATORS AND WIRING PROVIDED AND INSTALLED BY DDC CONTRACTOR

ACCESSORIES:

A

2" INSULATED DOUBLE WALL CONSTRUCTION WITH GALVANIZED STEEL EXTERIOR PANELS AND STAINLESS STEEL INTERIOR PANELS

B

COOLING COIL SECTIONS SHALL BE PROVIDED WITH AN INSULATED DOUBLE WALL, 201 STAINLESS STEEL DRAIN PAN WITH POSITIVE DRAINAGE MEETING INDOOR AIR QUALITY (IAQ) IN ACCORDANCE WITH ASHRAE 62.1.

C

FAN SHALL BE DIRECT DRIVE PLENUM FAN TYPE. SEE EQUIPMENT SCHEDULE FOR SIZES AND QUANTITIES

D

PROVIDE 2" MERV 8 PLATED MEDIA FILTERS, THREE SETS OF EACH TYPE. PROVIDE ONE SET IN UNIT. PROVIDE ONE SET FOR INSTALLATION AFTER SYSTEM IS BALANCED AND BUILDING IS CLEANED, AND ONE SET FOR TURN OVER TO OWNER.

E

UNIT PANELS SHALL BE MINIMUM 2" DOUBLE WALL FOAM R-13 CONSTRUCTION WITH ASHRAE 111 CLASS 9 CASING LEAKAGE.

F

PROVIDE WITH COASTAL ENVIRONMENT ALUMINUM LOW LEAK DAMPERS.

G

PROVIDE INLET AND EXHAUST HOODS.

H

PROVIDE FAN VIBES MOUNTED TO UNIT EXTERIOR

I

PROVIDE ACCESS / INSPECTION / TURNING SECTION

POWER VENTILATOR SCHEDULE

DRAWING CODE	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL	ALTERNATE APPROVED MANUFACTURERS	FAN TYPE	FAN WHEEL	SERVICE	DRIVE TYPE	DAMPER	MOTOR ENCLOSURE	CAPACITIES		ELECTRICAL				SONES	WEIGHT (LBS.)	NOTES	ACCESSORIES	
										AIRFLOW (CFM)	ESP (IN. WG.)	FAN RPM	MOTOR TYPE	MOTOR SIZE (HP)	V/PH/Hz					RLA
PV01	COOK	90C1TDH (V/F)	GREENHECK, PENNBARRY	CENTRIFUGAL VENTILATORS - ROOF DOWNBLAST	ALUMINUM HUB AND BLADES	EXHAUST	DIRECT	BACKDRAFT	OPEN DRIPPROOF	450	0.50	1,658	ECM	1/8	120/140	1.9	6.8	22	1.2	A,B,C,D,E,F
1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.																				
2 CONTROLLED VIA DDC																				
ACCESSORIES: A FACTORY MOUNTED DISCONNECT SWITCH (NEMA 3R)																				
B MOTORIZED BACKDRAFT DAMPER																				
C PERMATECTOR COASTAL DUTY COATING.																				
D STAINLESS STEEL FASTENERS																				
E BIRDSCREEN STAINLESS STEEL MESH																				
F ROOF CURB W/ SEAL																				

SINGLE DUCT TERMINAL UNIT SCHEDULE

DRAWING CODE	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL	ALTERNATE APPROVED MANUFACTURERS	PRIMARY AIRFLOW	COOLING MAX (CFM)	HEATING MIN (CFM)	INLET DIA. (IN)	COOLING INLET VELOCITY (FT/MIN)	AIR PRESSURE DROP (IN. H2O)	HEATING COIL CAPACITY (KW)	ELECTRIC HEATER STAGES	EAT (°F)	LAT (°F)	VOLTAGE (V/PHHZ)	FLA	MCA	MOCP	NOISE CRITERIA (NC)	OPERATING WEIGHT (LB)	UNIT SERVED FROM	NOTES	ACCESSORIES	
VAV01	TRANE	VCEF05	PRICE, TITUS	285	170	170	5	2,090	0.02	2.0	1	55.0	92.0	460/360	2.4	3.0	15	26	18	95	AH02	1,2	A,B,C,D,E,F,G
VAV02	TRANE	VCEF10	PRICE, TITUS	890	270	270	10	1,632	0.02	3.5	1	55.0	95.8	460/360	4.2	5.3	15	22	21	120	AH02	1,2	A,B,C,D,E,F,G
VAV03	TRANE	VCEF06	PRICE, TITUS	315	95	95	6	1,604	0.09	1.0	1	55.0	88.1	460/360	1.2	1.5	15	24	18	95	AH02	1,2	A,B,C,D,E,F,G
VAV04	TRANE	VCEF06	PRICE, TITUS	315	95	95	6	1,604	0.09	1.0	1	55.0	88.1	460/360	1.2	1.5	15	24	18	95	AH02	1,2	A,B,C,D,E,F,G
VAV05	TRANE	VCEF05	PRICE, TITUS	285	85	85	5	2,090	0.02	1.0	1	55.0	92.0	460/360	1.2	1.5	15	26	18	95	AH02	1,2	A,B,C,D,E,F,G
VAV06	TRANE	VCEF05	PRICE, TITUS	295	90	90	5	2,163	0.02	1.0	1	55.0	90.0	460/360	1.2	1.5	15	26	18	95	AH02	1,2	A,B,C,D,E,F,G
VAV07	TRANE	VCEF05	PRICE, TITUS	295	90	90	5	2,163	0.02	1.0	1	55.0	90.0	460/360	1.2	1.5	15	26	18	95	AH02	1,2	A,B,C,D,E,F,G
VAV08	TRANE	VCEF05	PRICE, TITUS	285	125	125	5	2,090	0.02	1.5	1	55.0	92.8	460/360	1.8	2.3	15	26	18	95	AH02	1,2	A,B,C,D,E,F,G
VAV09	TRANE	VCEF04	PRICE, TITUS	140	85	85	4	1,604	0.01	1.0	1	55.0	92.0	460/360	1.2	1.5	15	23	15	95	AH02	1,2	A,B,C,D,E,F,G
VAV10	TRANE	VCEF04	PRICE, TITUS	85	85	85	4	974	0.01	1.0	1	55.0	92.0	460/360	1.2	1.5	15	17	-	95	AH02	1,2	A,B,C,D,E,F,G
VAV11	TRANE	VCEF05	PRICE, TITUS	200	85	85	5	1,467	0.01	1.0	1	55.0	92.0	460/360	1.2	1.5	15	22	15	95	AH02	1,2	A,B,C,D,E,F,G
VAV12	TRANE	VCEF08	PRICE, TITUS	690	205	205	8	1,977	0.06	2.5	1	55.0	93.4	460/360	3.0	3.8	15	27	24	98	AH02	1,2	A,B,C,D,E,F,G
VAV13	TRANE	VCEF10	PRICE, TITUS	1,005	300	300	10	1,943	0.03	4.0	1	55.0	97.0	460/360	4.8	6.0	15	23	24	120	AH02	1,2	A,B,C,D,E,F,G
VAV14	TRANE	VCEF05	PRICE, TITUS	270	85	85	5	1,980	0.02	1.0	1	55.0	92.0	460/360	1.2	1.5	15	25	18	95	AH02	1,2	A,B,C,D,E,F,G

NOTES:

1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.

2 CONTROLS BY DDC CONTRACTOR. CONTROLS SUPPLIER

ACCESSORIES:

A FACTORY MOUNTED DISCONNECT

B ROUND AIR VALVE

C ELECTRIC COIL AS SCHEDULED

D 480/24 VOLT TRANSFORMER

E FOIL FACED INSULATION

F SCR MODULATED ELECTRIC HEAT

G AIRFLOW SWITCH

DIFFUSERS, REGISTERS AND GRILLES SCHEDULE

DRAWING CODE	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL	ALTERNATE APPROVED MANUFACTURERS	TYPE	SERVICE	NECK SIZE (IN.)	BRANCH CONN. SIZE (IN.)	MODULE SIZE (IN.)	MATERIAL	FINISH	MOUNTING	NOTES	ACCESSORIES
S1	PRICE	ASCD	GREENHECK, TITUS	SQUARE CEILING DIFFUSER	SUPPLY	60		24 X 24	ALUMINUM	WHITE	T-BAR	1-3	A,C
S2	PRICE	ASCD	GREENHECK, TITUS	SQUARE CEILING DIFFUSER	SUPPLY	80		24 X 24	ALUMINUM	WHITE	T-BAR	1-3	A,C
S3	PRICE	ASCD	GREENHECK, TITUS	SQUARE CEILING DIFFUSER	SUPPLY	100		24 X 24	ALUMINUM	WHITE	T-BAR	1-3	A,C
S4	PRICE	ASCD	GREENHECK, TITUS	SPIRAL DUCT GRILLE	SUPPLY	100		24 X 24	ALUMINUM	WHITE	DUCT SURFACE	1-3	A,C
R1	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	22 X 22		24 X 24	ALUMINUM	WHITE	T-BAR	1-2	A,C
R2	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	18 X 48		18 X 48	ALUMINUM	WHITE	DUCT SURFACE	1	B
E1	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	EXHAUST	22 X 22		24 X 24	ALUMINUM	WHITE	T-BAR	1	A,C

NOTES:

- REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.
- DUCT BRANCH CONNECTION SIZE TO BE EQUAL TO THE NECK SIZE OF DIFFUSER UNLESS NOTED OTHERWISE ON PLANS.
- PAIN ALL VISIBLE DUCTWORK THROUGH GRILLES AND REGISTERS FLAT BLACK.

ACCESSORIES:

- PATTERN CONTROLLERS
- INSULATED PLENUM BOX
- MANUAL VOLUME DAMPER

MECHANICAL LEGEND

	CEILING EXHAUST AIR GRILLE
	CEILING RETURN AIR / TRANSFER AIR GRILLE
	CEILING SUPPLY AIR DIFFUSER / GRILLE
	AIR TYPE DESIGNATOR
	AIRFLOW, CFM
	HUMIDISTAT / HUMIDITY SENSOR
	MANUAL VOLUME DAMPER
	MOTORIZED DAMPER
	RETURN, EXHAUST OR TRANSFER AIR FLOW
	SUPPLY AIR FLOW
	THERMOSTAT / TEMPERATURE SENSOR
	T-STAT / HUMIDISTAT OR TEMPHUMIDITY SENSOR

NOTE: ALL ITEMS LISTED MAY NOT BE USED IN THIS PROJECT.

MECHANICAL DUCTWORK LEGEND

	SUPPLY DUCT TURNING UP (ROUND OR RECTANGULAR)
	RETURN DUCT TURNING UP (ROUND OR RECTANGULAR)
	EXHAUST DUCT TURNING UP (ROUND OR RECTANGULAR)
	OUTSIDE AIR DUCT TURNING UP (ROUND OR RECTANGULAR)
	SUPPLY DUCT TURNING DOWN (ROUND OR RECTANGULAR)
	RETURN DUCT TURNING DOWN (ROUND OR RECTANGULAR)
	EXHAUST TURNING DOWN (ROUND OR RECTANGULAR)
	OUTSIDE AIR DUCT TURNING DOWN (ROUND OR RECTANGULAR)
	CONICAL TEE
	DUCT CROSSING
	MITERED ELBOW WITH TURNING VANES
	RADIUS ELBOW
	RECTANGULAR TO ROUND DUCT TRANSITION
	RECTANGULAR DUCT TURNING DOWN WITH CHANGE OF DIRECTION
	ROUND DUCT TURNING DOWN WITH CHANGE OF DIRECTION
	TAKEOFF WITH 45° THROAT
	TERMINATION OF DUCT WITH BRANCH CONNECTIONS

NOTE: ALL ITEMS LISTED MAY NOT BE USED IN THIS PROJECT.

MECHANICAL PIPE LEGEND

	BOILER FEED WATER PIPING
	BOILER FEED WATER PIPING - EXISTING
	BOTTOM BLOW DOWN PIPING
	BOTTOM BLOW DOWN PIPING - EXISTING
	CHEMICAL FEED RETURN PIPING
	CHEMICAL FEED RETURN PIPING - EXISTING
	CHEMICAL FEED SUPPLY PIPING
	CHEMICAL FEED SUPPLY PIPING - EXISTING
	CHILLED WATER RETURN PIPING
	CHILLED WATER RETURN PIPING - EXISTING
	CHILLED WATER SUPPLY PIPING
	CHILLED WATER SUPPLY PIPING - EXISTING
	CONDENSATE PIPING
	CONDENSATE PIPING - EXISTING
	CONDENSER WATER RETURN PIPING
	CONDENSER WATER RETURN PIPING - EXISTING
	CONDENSER WATER SUPPLY PIPING
	CONDENSER WATER SUPPLY PIPING - EXISTING
	CONTINUOUS BLOW DOWN PIPING
	CONTINUOUS BLOW DOWN PIPING - EXISTING
	DUAL TEMPERATURE SYSTEM RETURN PIPING
	DUAL TEMPERATURE SYSTEM RETURN PIPING - EXISTING
	DUAL TEMPERATURE SYSTEM SUPPLY PIPING
	DUAL TEMPERATURE SYSTEM SUPPLY PIPING - EXISTING
	GEO THERMAL HEAT PUMP SYSTEM RETURN PIPING
	GEO THERMAL HEAT PUMP SYSTEM RETURN PIPING - EXISTING
	GEO THERMAL HEAT PUMP SYSTEM SUPPLY PIPING
	GEO THERMAL HEAT PUMP SYSTEM SUPPLY PIPING - EXISTING
	HEAT RECOVERY RETURN PIPING
	HEAT RECOVERY RETURN PIPING - EXISTING
	HEAT RECOVERY SUPPLY PIPING
	HEAT RECOVERY SUPPLY PIPING - EXISTING
	HEATING HOT WATER RETURN PIPING
	HEATING HOT WATER RETURN PIPING - EXISTING
	HEATING HOT WATER SUPPLY PIPING
	HEATING HOT WATER SUPPLY PIPING - EXISTING
	HIGH PRESSURE CONDENSATE PIPING
	HIGH PRESSURE CONDENSATE PIPING - EXISTING
	HIGH PRESSURE STEAM PIPING
	HIGH PRESSURE STEAM PIPING - EXISTING
	LOW PRESSURE CONDENSATE PIPING
	LOW PRESSURE CONDENSATE PIPING - EXISTING
	MAKE-UP WATER PIPING
	MAKE-UP WATER PIPING - EXISTING
	NATURAL GAS PIPING
	NATURAL GAS PIPING - EXISTING
	REFRIGERANT LINE-SET PIPING
	REFRIGERANT LINE-SET PIPING - EXISTING

NOTE: ALL ITEMS LISTED MAY NOT BE USED IN THIS PROJECT.

ABBREVIATIONS

TERM	ABBREVIATION	TERM	ABBREVIATION
ABOVE FINISHED FLOOR	AFF	INCH OF WATER GAUGE	INWG
ABOVE GROUND	AG	INDOOR UNIT	IDU
ABOVE SEA LEVEL	ASL	IRON PIPE SIZE	IPS
ACROSS THE LINE	ACL	KILOVOLT-AMP	KVA
AIR ADMITTANCE VALVE	AAV	KILOWATT	KW
AIR CONDITIONING, -ED)	AIR COND	KILOWATT HOUR	KWH
AIR-HANDLING UNIT	AHU OR AH	LEAVING AIR TEMPERATURE	LAT
AIR FLOW MEASURING STATION	AFMA	LEAVING WATER TEMPERATURE	LWT
AMBIENT	AMB	LENGTH	LG
AMPERE (AMP, AMPS)	AMP	LINEAR FEET	LF
ANALOG INPUT	AI	MAXIMUM	MAX
ANALOG OUTPUT	AO	MAXIMUM OVERCURRENT PROTECTION	MOCP
AND	&	MEDIUM-PRESSURE STEAM	MPS
APPARATUS DEW POINT	ADP	MILES PER HOUR	MPH
APPROXIMATE	APPROX	MINIMUM	MIN
ARCHITECT	ARCH	MINIMUM CIRCUIT AMPERES	MCA
ATMOSPHERE	ATM	MINUTE	MIN
AVERAGE	AVG	MANUFACTURER	MFR
BRAKE HORSEPOWER	BHP	MOTOR CONTROL CENTER	MCC
BROWN & SHARPE WIRE GAGE	B&S	NOISE CRITERIA	NC
BRITISH THERMAL UNIT	BTU	NON-STANDARD PART LOAD	NPLV
BRITISH THERMAL UNIT PER HOUR	BTU	NORMALLY OPEN	NO
100 BRITISH THERMAL UNIT	MBH	NORMALLY CLOSED	NC
BUILDING	BLDG	NOT APPLICABLE	N/A
BUILDING AUTOMATION SYSTEM	BAS	NOT IN CONTRACT	NI C
CELSIUS	°C	NOT TO SCALE	NTS
CHILLED WATER RETURN	CHWR	NUMBER	NO
CHILLED WATER SUPPLY	CHWS	ON CENTER	OC
COEFFICIENT VALVE FLOW	CV	OUNCE	OUN
COEFFICIENT OF PERFORMANCE FACTOR	COP	OUTDOOR UNIT	ODU
COMPRESSOR	COMP	OUTSIDE AIR	OA
CONCRETE	CONC	PACKAGE UNIT	PU
CONDENSER, -ING, -ATION)	COND	PACKAGE TERMINAL AIR CONDITIONER	PTAC
CONNECTION	CONN	PARTS PER MILLION	PPM
CONTINUATION	CONT	PERCENT	%
COOLING LOAD	CLG LOAD	PHASE	PH
CUBIC FEET	CU FT	POUNDS	LBS
CUBIC INCH	CU IN	POUNDS PER SQUARE FOOT	PSF
CUBIC FEET PER MINUTE	CFM	POWER VENTILATOR	PV
CFM, STANDARD CONDITIONS	SCFM	PRESSURE	PRESS
DECIBEL	DB	PRESSURE REDUCING VALVE	PRV
DEGREE	DEG OR °	PRESSURE SAFETY VALVE	PSV
DEDICATED OUTDOOR AIR SYSTEM	DOAS	PUMPED CONDENSATE	PC
DEGREES FAHRENHEIT	DEG. F	QUANTITY	QTY
DETAIL	DET	RATED LOAD AMPS	RLA
DEW-POINT TEMPERATURE	DEWPT	RECIRCULATE	RECIRC
DIAMETER	DIA	REDUCED PRESSURE BACKFLOW PREVENTER	RPZ
DIAMETER, INSIDE	ID	REFRIGERANT (12, 22, ETC.)	R22, R410
DIAMETER, OUTSIDE	OD	REFRIGERANT LIQUID	RL
DIFFERENCE OR DELTA	DIFF	REFRIGERANT SUCTION	RS
DIGITAL INPUT	DI	REQUIRED	REQD OR REQ'D
DIGITAL OUTPUT	DO	RELATIVE HUMIDITY	RH
DOMESTIC HOT WATER	DHW	RETURN AIR	RA
DOMESTIC HOT WATER RECIRCULATION	DHWR	REVOLUTIONS PER MINUTE	RPM
DRY-BULB TEMPERATURE	DBT	REVOLUTIONS PER SECOND	RPS
DUCTLESS SPLIT SYSTEM AIR HANDLER	DAH	ROOF VENTILATOR	RV
DUCTLESS SPLIT SYSTEM HEAT PUMP	DHP	ROOF TOP UNIT	RTU
ENERGY EFFICIENCY RATING	ERR	SAFETY FACTOR	SF
EFFICIENCY	EFF	SEASONAL ENERGY EFFICIENCY RATIO	SEER
ELECTRIC UNIT HEATER	EUH	SECOND	S
ELEVATION	EL	SHADING COEFFICIENT	SC
ENTERING	ENT	SPECIFICATION	SPEC
ENTERING WATER TEMPERATURE	EWT	SQUARE	SQ
ENTERING AIR TEMPERATURE	EAT	STANDARD	STD
EXISTING	(X)	STATIC PRESSURE	SP
EXTERNAL AMBIENT TEMPERATURE	EAT	SUPPLY	SPLY
EXTERNAL STATIC PRESSURE	ESP	SUPPLY AIR	SA
EXHAUST AIR	EA	TEMPERATURE	TEMP
EXHAUST FAN	EF	TEMPERATURE DIFFERENCE	TD
FACE VELOCITY	FVEL	THERMOSTAT	T
FAHRENHEIT	°F	TONS OF REFRIGERATION	TONS
FEET PER MINUTE	FPM	TO BE DETERMINED	TBD
FEET PER SECOND	FPS	TOTAL STYCLE	TOS
FLOOR	FLR	TOTAL DEYNAMIC HEAD	TDH
FOOT OR FEET	FOOT	TYPICAL	TYP
FULL LOAD AMPS	FLA	U-FACTOR	U
GAGE OR GAUGE	GA	UNDER GROUND	UG
GALLONS	GAL	UNLESS OTHERWISE NOTED	UN
GALLONS PER HOUR	GPH	UNIT HEATER, -ELECTRIC	UH
GALLONS PER MINUTE	GPM	VARIABLE AIR VOLUME	VAV
GALLONS PER DAY	GPD	VARIABLE FREQUENCY DRIVE	VFD
GAS UNIT HEATER	GUH	VELOCITY	VEL
GRAINS	GR	VENTILATION, VENT	VENT
HEAD	HD	VENT THRU ROOF	VTR
HEAT EXCHANGER	HEX	VERTICAL	VERT
HEATING AND VENTILATION UNIT	HV	VOLT	V
HEATING, VENTILATION AND AIR CONDITIONING	HVAC	VOLT AMPERE	VA
HEIGHT	HGT	VOLUME	VOL
HIGH DENSITY POLYPROPYLENE	HDPE	WATER PRESSURE DROP	WPD
HIGH-PRESSURE STEAM	HPS	WATER GAUGE	WG
HORSEPOWER, HEAT PUMP	HPP	WATT	W
HOT WATER COIL	HWC	WATT-HOUR	WH
(HOURS)	HR	WEIGHT	WT
HUMIDITY, RELATIVE	RH	WET BULB	WB
INTEGRATED PART LOAD VALVES	INCH	YARD	YD
INCH	IN	YEAR	YR

MECHANICAL SPECIFICATIONS									
<div>SECTION 230500 - COMMON WORK RESULTS FOR HVAC</div> <div><div><div><div>PART 1 - GENERAL</div><div>1.1 SUMMARY</div><div>A. SECTION INCLUDES:</div><div>1. THERMOMETERS, LIQUID IN GLASS.</div><div>2. THERMOWELLS.</div><div>3. PRESSURE GAUGES, DIAL TYPE.</div><div>4. GAUGE ATTACHMENTS.</div></div><div><div>1.2 ACTION SUBMITTALS</div><div>A. PRODUCT DATA.</div></div><div><div>1.3 CLOSEOUT SUBMITTALS</div><div>A. OPERATION AND MAINTENANCE DATA.</div></div><div><div>PART 2 - PRODUCTS</div><div>2.1 METERS AND GAUGES FOR HVAC PIPING</div><div>A. THERMOMETERS, LIQUID IN GLASS - METAL CASE, INDUSTRIAL STYLE:</div><div>1. STANDARD: ASME B40.200.</div><div>2. CASE: CAST ALUMINUM, 7-INCH NOMINAL SIZE UNLESS OTHERWISE INDICATED.</div><div>3. CASE FORM: ADJUSTABLE ANGLE UNLESS OTHERWISE INDICATED.</div><div>4. TUBE: GLASS WITH MAGNIFYING LENS AND BLUE OR RED ORGANIC LIQUID.</div><div>5. TUBE BACKGROUND: NONREFLECTIVE ALUMINUM WITH PERMANENTLY ETCHED SCALE MARKINGS GRADUATED IN DEG. F.</div><div>6. WINDOW: GLASS.</div><div>7. STEM: ALUMINUM AND OF LENGTH TO SUIT INSTALLATION.</div><div>8. DESIGN FOR THERMOWELL INSTALLATION, BARE STEM.</div><div>9. CONNECTOR: 1-1/4 INCHES, WITH ASME B1.1 SCREW THREADS.</div><div>9. ACCURACY: PLUS OR MINUS 1 PERCENT OF SCALE RANGE OR ONE SCALE DIVISION, TO A MAXIMUM OF 1.5 PERCENT OF SCALE RANGE.</div><div>B. THERMOWELLS:</div><div>1. STANDARD: ASME B40.200.</div><div>2. DESCRIPTION: PRESSURE-TIGHT, SOCKET-TYPE FITTING MADE FOR INSERTION IN PIPING TEE FITTING.</div><div>3. MATERIAL FOR USE WITH COPPER TUBING: CUNI.</div><div>4. MATERIAL FOR USE WITH STEEL PIPING: CRCS.</div><div>5. TYPE: STEPPED SHANK UNLESS STRAIGHT OR TAPERED SHANK IS INDICATED.</div><div>6. EXTERNAL THREADS: NPS 1/2, NPS 3/4, OR NPS 1, ASME B1.20.1 PIPE THREADS.</div><div>7. INTERNAL THREADS: 1/2, 3/4, AND 1 INCH, WITH ASME B1.1 SCREW THREADS.</div><div>8. BORE: DIAMETER REQUIRED TO MATCH THERMOMETER BULB OR STEM.</div><div>9. INSERTION LENGTH: LENGTH REQUIRED TO MATCH THERMOMETER BULB OR STEM.</div><div>10. LAGGING EXTENSION: INCLUDE ON THERMOWELLS FOR INSULATED PIPING AND TUBING.</div><div>11. BUSHINGS: FOR CONVERTING SIZE OF THERMOWELLS' INTERNAL SCREW THREAD TO SIZE OF THERMOMETER CONNECTION.</div><div>12. HEAT-TRANSFER MEDIUM: MIXTURE OF GRAPHITE AND GLYCERIN.</div><div>C. PRESSURE GAUGES, DIAL TYPE - DIRECT MOUNTED, METAL CASE:</div><div>1. STANDARD: ASME B40.100.</div><div>2. CASE: LIQUID-FILLED TYPE(S); CAST ALUMINUM OR DRAWN STEEL; [4-1/2-INCH] NOMINAL DIAMETER.</div><div>3. PRESSURE-ELEMENT ASSEMBLY: BOURDON TUBE.</div><div>4. PRESSURE CONNECTION: BRASS, WITH NPS 1/4 OR NPS 1/2, ASME B1.20.1 PIPE THREADS AND BOTTOM-OUTLET TYPE UNLESS BACK-OUTLET TYPE IS INDICATED.</div><div>5. MOVEMENT: MECHANICAL, WITH LINK TO PRESSURE ELEMENT AND CONNECTION TO POINTER.</div><div>6. DIAL: NONREFLECTIVE ALUMINUM WITH PERMANENT SCALE MARKINGS GRADUATED IN PSI.</div><div>7. POINTER: DARK-COLORED METAL.</div><div>8. WINDOW: SAFETY GLASS.</div><div>9. RING: STAINLESS STEEL.</div><div>10. ACCURACY: GRADE B, PLUS OR MINUS 2 PERCENT OF MIDDLE HALF OF SPAN.</div><div>D. GAUGE ATTACHMENTS:</div><div>1. VALVES: BRASS BALL, WITH NPS 1/4 OR NPS 1/2, ASME B1.20.1 PIPE THREADS.</div></div><div><div>PART 3 - EXECUTION</div><div>3.1 INSTALLATION OF METERS AND GAUGES</div><div>A. INSTALL THERMOWELLS WITH SOCKET EXTENDING ONE-THIRD OF PIPE DIAMETER AND IN VERTICAL POSITION IN PIPING TEES.</div><div>B. INSTALL THERMOWELLS OF SIZES REQUIRED TO MATCH THERMOMETER CONNECTORS, INCLUDE BUSHINGS IF REQUIRED TO MATCH SIZES.</div><div>C. INSTALL THERMOWELLS WITH EXTENSION ON INSULATED PIPING.</div><div>D. FILL THERMOWELLS WITH HEAT-TRANSFER MEDIUM.</div><div>E. INSTALL DIRECT-MOUNTED THERMOMETERS IN THERMOWELLS AND ADJUST VERTICAL AND TILTED POSITIONS.</div><div>F. INSTALL DIRECT-MOUNTED PRESSURE GAUGES IN PIPING TEES WITH PRESSURE GAUGE LOCATED ON PIPE AT THE MOST READABLE POSITION.</div><div>G. INSTALL VALVE IN PIPING FOR EACH PRESSURE GAUGE FOR FLUIDS.</div><div>H. INSTALL CONNECTION FITTINGS IN ACCESSIBLE LOCATIONS FOR ATTACHMENT TO PORTABLE INDICATORS.</div><div>I. INSTALL THERMOMETERS IN THE FOLLOWING LOCATIONS:</div><div>1. INLET AND OUTLET OF EACH HYDRONIC COIL IN AIR-HANDLING UNITS.</div><div>J. INSTALL PRESSURE GAUGES IN THE FOLLOWING LOCATIONS:</div><div>1. INLET AND OUTLET OF EACH HYDRONIC COIL IN AIR-HANDLING UNITS.</div></div><div><div>3.2 CONNECTIONS</div><div>A. INSTALL METERS AND GAUGES ADJACENT TO MACHINES AND EQUIPMENT TO ALLOW SPACE FOR SERVICE AND MAINTENANCE OF METERS, GAUGES, MACHINES, AND EQUIPMENT.</div></div><div><div>3.3 ADJUSTING</div><div>A. AFTER INSTALLATION, CALIBRATE METERS ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS.</div><div>B. ADJUST FACES OF METERS AND GAUGES TO PROPER ANGLE FOR BEST VISIBILITY.</div></div><div><div>3.4 THERMOMETER APPLICATION</div><div>A. THERMOMETER STEMS ARE TO BE OF LENGTH TO MATCH THERMOWELL INSERTION LENGTH.</div></div><div><div>3.5 THERMOMETER SCALE-RANGE APPLICATION</div><div>A. SCALE RANGE FOR CHILLED-WATER PIPING:</div><div>1. 0 TO 150 DEG. F.</div></div><div><div>3.6 PRESSURE-GAUGE APPLICATION</div><div>A. PRESSURE GAUGES AT INLET AND OUTLET OF EACH CHILLER CHILLED-WATER CONNECTION.</div></div><div><div>3.7 PRESSURE-GAUGE SCALE-RANGE APPLICATION</div><div>A. SCALE RANGE FOR CHILLED-WATER PIPING:</div><div>1. 0 TO 160 PSI.</div></div></div><div><div>SECTION 230520 - GENERAL-DUTY VALVES FOR HVAC PIPING</div><div><div><div><div>PART 1 - GENERAL</div><div>1.1 SUMMARY</div><div>A. SECTION INCLUDES:</div><div>1. BALL VALVES.</div><div>2. BUTTERFLY VALVES.</div><div>3. CHECK VALVES.</div></div><div><div>1.2 ACTION SUBMITTALS</div><div>A. PRODUCT DATA.</div></div><div><div>PART 2 - PRODUCTS</div><div>2.1 PERFORMANCE REQUIREMENTS</div><div>A. ASME COMPLIANCE:</div><div>1. ASME B1.20.1 FOR THREADS FOR THREADED-END VALVES.</div><div>2. ASME B16.5 FOR FLANGES ON STEEL VALVES.</div><div>3. ASME B16.34 FOR FLANGED- AND THREADED-END CONNECTIONS.</div><div>4. ASME B31.9 FOR BUILDING SERVICES PIPING VALVES.</div><div>B. VALVE PRESSURE-TEMPERATURE RATINGS, NOT LESS THAN INDICATED AND AS REQUIRED FOR SYSTEM PRESSURES AND TEMPERATURES.</div></div><div><div>C. VALVE SIZES: SAME AS UPSTREAM PIPING UNLESS OTHERWISE INDICATED.</div><div>D. VALVE ACTUATOR TYPE:</div><div>1. HAND LEVER: FOR QUARTER-TURN BALL VALVES SMALLER THAN NPS 4.</div><div>E. VALVES IN INSULATED PIPING:</div><div>1. PROVIDE 2-INCH EXTENDED NECK STEMS.</div><div>2. PROVIDE EXTENDED OPERATING HANDLES WITH NONTHERMAL-CONDUCTIVE COVERING MATERIAL AND PROTECTIVE SLEEVES THAT ALLOW OPERATION OF VALVES WITHOUT BREAKING VAPOR SEALS OR DISTURBING INSULATION.</div><div>3. PROVIDE MEMORY STOPS THAT ARE FULLY ADJUSTABLE AFTER INSULATION IS APPLIED.</div></div><div><div>2.2 BALL VALVES</div><div>A. BALL VALVES, FLANGED ENDS - STEEL, WITH FULL PORT AND STAINLESS-STEEL TRIM, CLASS 300:</div><div>1. STANDARD: MSS SP-72.</div><div>2. CWP RATING: 720 PSIG.</div><div>3. BODY DESIGN: SPLIT BODY.</div><div>4. BODY MATERIAL: CARBON STEEL, ASTM A216/A216M, TYPE WCB.</div><div>5. ENDS: FLANGED.</div><div>6. SEATS: PTFE.</div><div>7. STEM: STAINLESS STEEL.</div><div>8. BALL: STAINLESS STEEL, VENTED.</div><div>9. PORT: FULL.</div></div><div><div>2.3 BUTTERFLY VALVES</div><div>A. BUTTERFLY VALVES, SINGLE FLANGE (LUG TYPE), IRON, WITH STAINLESS STEEL DISC:</div><div>1. STANDARD: MSS SP-67, TYPE I.</div><div>2. CWP RATING: 150 PSIG OR 200 PSIG. SEE PART 3 BUTTERFLY VALVE SCHEDULE ARTICLES.</div><div>3. BODY DESIGN: SINGLE FLANGE (LUG TYPE), SUITABLE FOR BIDIRECTIONAL DEAD-END SERVICE AT RATED PRESSURE WITHOUT USE OF DOWNSTREAM FLANGE.</div><div>4. BODY MATERIAL: ASTM A126, CAST IRON OR ASTM A538, DUCTILE IRON.</div><div>5. SEAT: EPDM OR NBR, SEE PART 3 BUTTERFLY VALVE SCHEDULE ARTICLES.</div><div>6. STEM: ONE- OR TWO-PIECE STAINLESS STEEL.</div><div>7. DISC: STAINLESS STEEL.</div></div><div><div>2.4 CHECK VALVES</div><div>A. CHECK VALVES, SWING TYPE, FLANGED ENDS - IRON, WITH LEVER- AND SPRING-CLOSURE CONTROL, CLASS 125:</div><div>1. STANDARD: MSS SP-71, TYPE I.</div><div>2. CWP RATING: NPS 2-1/2 TO NPS 12 (DN 65 TO DN 300), 200 PSIG.</div><div>3. CWP RATING, NPS 14 TO NPS 24 (DN 350 TO DN 600), 150 PSIG.</div><div>4. BODY DESIGN: CLEAR OR FULL WATERWAY.</div><div>5. BODY MATERIAL: ASTM A126, GRAY IRON WITH BOLTED BONNET.</div><div>6. ENDS: FLANGED.</div><div>7. TRIM: BRONZE.</div><div>8. GASKET: ASBESTOS FREE.</div><div>9. CLOSURE CONTROL: FACTORY-INSTALLED, EXTERIOR LEVER AND SPRING.</div></div></div><div><div>SECTION 230520 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT</div><div><div><div><div>PART 1 - GENERAL</div><div>1.1 SUMMARY</div><div>A. SECTION INCLUDES:</div><div>1. PIPE HANGERS AND SUPPORTS - METAL.</div><div>2. PIPE HANGERS - METAL, TRAPEZE TYPE.</div><div>3. STRUT SUPPORT SYSTEMS - ROOFTOP MOUNTED.</div><div>4. THERMAL-HANGER SHIELD INSERTS.</div><div>5. EQUIPMENT SUPPORTS.</div></div><div><div>PART 2 - PRODUCTS</div><div>2.1 PERFORMANCE REQUIREMENTS</div><div>A. STRUCTURAL PERFORMANCE: HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT ARE TO WITHSTAND THE EFFECTS OF GRAVITY LOADS AND STRESSES WITHIN LIMITS AND UNDER CONDITIONS INDICATED IN ACCORDANCE WITH ASCE/SEI 7.</div><div>1. DESIGN SUPPORTS FOR MULTIPLE PIPES, INCLUDING PIPE STANDS, CAPABLE OF SUPPORTING COMBINED WEIGHT OF SUPPORTED SYSTEMS, SYSTEM CONTENTS, AND TEST WATER.</div><div>2. DESIGN EQUIPMENT SUPPORTS CAPABLE OF SUPPORTING COMBINED OPERATING WEIGHT OF SUPPORTED EQUIPMENT AND CONNECTED SYSTEMS AND COMPONENTS.</div></div><div><div>2.2 PIPE HANGERS AND SUPPORTS - METAL</div><div>A. PIPE HANGERS AND SUPPORTS - CARBON STEEL:</div><div>1. DESCRIPTION: MSS SP-58, TYPES 1 THROUGH 58, FACTORY-FABRICATED COMPONENTS.</div><div>2. GALVANIZED METALLIC COATINGS: PREGALVANIZED, HOT-DIP GALVANIZED, OR ELECTRO-GALVANIZED.</div><div>3. NONMETALLIC COATINGS: PLASTIC COATED, OR EPOXY POWDER COATED.</div><div>4. PADDED HANGERS: HANGER WITH FIBERGLASS OR OTHER PIPE INSULATION PAD OR CUSHION TO SUPPORT BEARING SURFACE OF PIPING.</div><div>5. HANGER RODS: CONTINUOUS-THREAD ROD, NUTS, AND WASHERS MADE OF CARBON STEEL.</div></div><div><div>2.3 PIPE HANGERS - METAL, TRAPEZE TYPE</div><div>A. DESCRIPTION: MSS SP-58, TYPE 59, SHOP- OR FIELD-FABRICATED PIPE-SUPPORT ASSEMBLY, MADE FROM STRUCTURAL CARBON-STEEL SHAPES WITH MSS SP-58 CARBON-STEEL HANGER RODS, NUTS, SADDLES, AND U-BOLTS.</div></div><div><div>2.4 STRUT SUPPORT SYSTEMS - ROOFTOP MOUNTED</div><div>A. GENERAL REQUIREMENTS: SHOP-FABRICATED ASSEMBLIES MADE OF MANUFACTURED CORROSION-RESISTANT COMPONENTS TO SUPPORT ROOF-MOUNTED PIPING.</div><div>B. PIPE STAND - COMPACT:</div><div>1. DESCRIPTION: SINGLE BASE UNIT WITH INTEGRAL-ROD ROLLER, PIPE CLAMPS, OR V-SHAPED CRADLE TO SUPPORT PIPE, FOR ROOF INSTALLATION WITHOUT MEMBRANE PENETRATION.</div><div>2. BASE: SINGLE, VULCANIZED RUBBER, MOLDED POLYPROPYLENE, OR POLYCARBONATE.</div><div>3. HARDWARE: GALVANIZED STEEL OR POLYCARBONATE.</div><div>4. ACCESSORIES: PROTECTION PADS.</div><div>C. PIPE STAND - SINGLE BASE, SINGLE PIPE, LOW PROFILE:</div><div>1. DESCRIPTION: SINGLE BASE WITH VERTICAL AND HORIZONTAL MEMBERS, AND PIPE SUPPORT, FOR ROOF INSTALLATION WITHOUT MEMBRANE PENETRATION.</div></div></div><div><div>2. BASE: SINGLE, VULCANIZED RUBBER, MOLDED POLYPROPYLENE, OR POLYCARBONATE.</div><div>3. VERTICAL MEMBERS: TWO, GALVANIZED-STEEL, CONTINUOUS-THREAD 1/2-INCH RODS.</div><div>4. HORIZONTAL MEMBER: ADJUSTABLE HEIGHT, GALVANIZED-STEEL PIPE SUPPORT CHANNELS.</div><div>5. PIPE SUPPORTS: CLEVIS HANGER.</div><div>6. HARDWARE: GALVANIZED STEEL.</div><div>7. ACCESSORIES: PROTECTION PADS, 1/2-INCH CONTINUOUS-THREAD GALVANIZED-STEEL ROD.</div><div>8. HEIGHT: 12 INCHES ABOVE ROOF.</div><div>D. PIPE STAND - SINGLE BASE, SINGLE PIPE, HIGH PROFILE:</div><div>1. DESCRIPTION: SINGLE BASE, VERTICAL, AND HORIZONTAL MEMBERS, AND PIPE SUPPORT, FOR ROOF INSTALLATION WITHOUT MEMBRANE PENETRATION.</div><div>2. BASE: SINGLE VULCANIZED RUBBER OR MOLDED POLYPROPYLENE.</div><div>3. VERTICAL MEMBERS: TWO, GALVANIZED-STEEL, CONTINUOUS-THREAD 1/2-INCH RODS.</div><div>4. HORIZONTAL MEMBER: ONE, ADJUSTABLE HEIGHT, GALVANIZED-STEEL OR STAINLESS STEEL PIPE SUPPORT SLOTTED CHANNEL OR PLATE.</div><div>5. PIPE SUPPORTS: CLEVIS HANGER.</div><div>6. HARDWARE: GALVANIZED STEEL.</div><div>7. ACCESSORIES: PROTECTION PADS, 1/2-INCH CONTINUOUS-THREAD GALVANIZED-STEEL ROD.</div><div>8. HEIGHT: 36 INCHES ABOVE ROOF.</div><div>E. PIPE STAND - MULTIPLE PIPE, HIGH PROFILE:</div><div>1. DESCRIPTION: ASSEMBLY OF BASES, VERTICAL, AND HORIZONTAL MEMBERS, AND PIPE SUPPORTS, FOR ROOF INSTALLATION WITHOUT MEMBRANE PENETRATION.</div><div>2. BASES: TWO OR MORE, VULCANIZED RUBBER.</div><div>3. VERTICAL MEMBERS: TWO OR MORE, GALVANIZED-STEEL CHANNELS.</div><div>4. HORIZONTAL MEMBERS: ONE OR MORE, ADJUSTABLE HEIGHT, GALVANIZED-STEEL PIPE SUPPORT.</div><div>5. PIPE SUPPORTS: CLEVIS HANGER.</div><div>6. HARDWARE: GALVANIZED STEEL.</div><div>7. ACCESSORIES: PROTECTION PADS, 1/2-INCH CONTINUOUS-THREAD ROD.</div><div>8. HEIGHT: 36 INCHES ABOVE ROOF.</div><div>F. PIPE STAND - CURB-MOUNTED-TYPE: SHOP- OR FIELD-FABRICATED PIPE SUPPORTS MADE FROM STRUCTURAL-STEEL SHAPES, CONTINUOUS-THREAD RODS, AND ROLLERS, FOR MOUNTING ON PERMANENT STATIONARY ROOF CURB.</div></div><div><div>2.5 THERMAL-HANGER SHIELD INSERTS</div><div>A. INSULATION-INSERT MATERIAL FOR COLD PIPING: ASTM C591, TYPE VI, GRADE 1 POLYISOCYANURATE WITH 125 PSI MINIMUM COMPRESSIVE STRENGTH AND VAPOR BARRIER.</div><div>B. FOR TRAPEZE OR CLAMPED SYSTEMS: INSERT AND SHIELD ARE TO COVER ENTIRE CIRCUMFERENCE OF PIPE.</div><div>C. FOR CLEVIS OR BAND HANGERS: INSERT AND SHIELD ARE TO COVER BOTTOM 180 DEGREES OF PIPE.</div><div>D. INSERT LENGTH: EXTEND 2 INCHES BEYOND SHEET METAL SHIELD FOR PIPING OPERATING BELOW AMBIENT AIR TEMPERATURE.</div></div><div><div>2.6 EQUIPMENT SUPPORTS</div><div>A. DESCRIPTION: WELDED, SHOP- OR FIELD-FABRICATED EQUIPMENT SUPPORT MADE FROM STRUCTURAL CARBON-STEEL SHAPES.</div></div><div><div>2.7 MATERIALS</div><div>A. CARBON STEEL: ASTM A1011/A1011M.</div><div>B. STRUCTURAL STEEL: ASTM A36/A36M, CARBON-STEEL PLATES, SHAPES, AND BARS: GALVANIZED.</div><div>C. THREADED RODS: CONTINUOUSLY THREADED, ZINC-PLATED OR GALVANIZED STEEL FOR INDOOR APPLICATIONS AND STAINLESS STEEL FOR OUTDOOR APPLICATIONS. MATING NUTS AND WASHERS OF SIMILAR MATERIALS AS RODS.</div></div></div><div><div>SECTION 230520 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT</div><div><div><div><div>PART 1 - GENERAL</div><div>1.1 SUMMARY</div><div>A. SECTION INCLUDES:</div><div>1. EQUIPMENT LABELS.</div><div>2. PIPE LABELS.</div></div><div><div>1.2 ACTION SUBMITTALS</div><div>A. PRODUCT DATA: FOR EACH TYPE OF PRODUCT.</div></div><div><div>PART 2 - PRODUCTS</div><div>2.1 EQUIPMENT LABELS</div><div>A. HANGER ADJUSTMENTS: ADJUST HANGERS TO DISTRIBUTE LOADS EQUALLY ON ATTACHMENTS AND TO ACHIEVE INDICATED SLOPE OF PIPE.</div><div>B. PLASTIC LABELS FOR EQUIPMENT:</div><div>1. MATERIAL AND THICKNESS: MULTILAYER, MULTICOLOR, PLASTIC LABELS FOR MECHANICAL ENGRAVING, 1/16 INCH THICK, WITH PREDRILLED HOLES FOR ATTACHMENT HARDWARE.</div><div>2. LETTER AND BACKGROUND COLOR: AS INDICATED FOR SPECIFIC APPLICATION UNDER PART 3.</div><div>3. MAXIMUM TEMPERATURE: ABLE TO WITHSTAND TEMPERATURES OF UP TO 160 DEG. F.</div><div>4. MINIMUM LABEL SIZE: LENGTH AND WIDTH VARY FOR REQUIRED LABEL CONTENT, BUT NOT LESS THAN 2-1/2 BY 3/4 INCH.</div><div>5. MINIMUM LETTER SIZE: 1/4 INCH FOR NAME OF UNITS IF VIEWING DISTANCE IS LESS THAN 24 INCHES, 1/2 INCH FOR VIEWING DISTANCES OF UP TO 72 INCHES, AND PROPORTIONATELY LARGER LETTERING FOR GREATER VIEWING DISTANCES. INCLUDE SECONDARY LETTERING TWO-THIRDS TO THREE-FOURTHS THE SIZE OF PRINCIPAL LETTERING.</div><div>6. FASTENERS: STAINLESS STEEL RIVETS OR SELF-TAPPING SCREWS.</div><div>7. ADHESIVE: CONTACT-TYPE PERMANENT ADHESIVE, COMPATIBLE WITH LABEL AND WITH SUBSTRATE.</div><div>B. LABEL CONTENT: INCLUDE EQUIPMENTS DRAWING DESIGNATION OR UNIQUE EQUIPMENT NUMBER, DRAWING NUMBERS WHERE EQUIPMENT IS INDICATED (PLANS, DETAILS, AND SCHEDULES), AND THE SPECIFICATION SECTION NUMBER AND TITLE WHERE EQUIPMENT IS SPECIFIED.</div></div><div><div>2.2 PIPE LABELS</div><div>A. GENERAL REQUIREMENTS FOR MANUFACTURED PIPE LABELS: PREPRINTED, COLOR CODED, WITH LETTERING INDICATING SERVICE AND SHOWING FLOW DIRECTION IN ACCORDANCE WITH ASME A13.1.</div><div>B. LETTER AND BACKGROUND COLOR: AS INDICATED FOR SPECIFIC APPLICATION UNDER PART 3.</div><div>C. SELF-ADHESIVE PIPE LABELS: PRINTED PLASTIC WITH CONTACT-TYPE PERMANENT-ADHESIVE BACKING.</div><div>D. PIPE LABEL CONTENTS: INCLUDE IDENTIFICATION OF PIPING SERVICE USING SAME DESIGNATIONS OR ABBREVIATIONS AS USED ON DRAWINGS. ALSO INCLUDE:</div><div>1. PIPE SIZE.</div><div>2. FLOW-DIRECTION ARROWS: INCLUDE FLOW-DIRECTION ARROWS ON MAIN DISTRIBUTION PIPINGS. ARROWS MAY BE EITHER INTEGRAL WITH LABEL OR APPLIED SEPARATELY.</div><div>3. LETTERING SIZE: SIZE LETTERS IN ACCORDANCE WITH ASME A13.1 FOR PIPING.</div></div><div><div>PART 3 - EXECUTION</div><div>3.1 PREPARATION</div><div>A. CLEAN PIPING AND EQUIPMENT SURFACES OF INCOMPATIBLE PRIMER, PAINTS, AND ENCAPSULANTS, AS WELL AS DIRT, OIL, GREASE, RELEASE AGENTS, AND OTHER SUBSTANCES THAT COULD IMPAIR BOND OF IDENTIFICATION DEVICES.</div></div><div><div>3.2 INSTALLATION, GENERAL REQUIREMENTS</div><div>A. COORDINATE INSTALLATION OF IDENTIFYING DEVICES WITH COMPLETION OF COVERING AND PAINTING OF SURFACES WHERE DEVICES ARE TO BE APPLIED.</div><div>B. COORDINATE INSTALLATION OF IDENTIFYING DEVICES WITH LOCATIONS OF ACCESS PANELS AND DOORS.</div></div></div><div><div>END OF SECTION 230530</div><div>SECTION 230530 - HEAT TRACING FOR HVAC PIPING</div><div><div><div><div>PART 1 - GENERAL</div><div>1.1 SUMMARY</div><div>A. SECTION INCLUDES HEAT TRACING FOR FREEZE PROTECTION OF HVAC PIPING WITH SELF-REGULATING, PARALLEL-RESISTANCE, ELECTRIC HEATING CABLES.</div></div><div><div>1.2 ACTION SUBMITTALS</div><div>A. PRODUCT DATA: FOR EACH TYPE OF PRODUCT.</div><div>B. SHOP DRAWINGS: FOR ELECTRIC HEATING CABLE.</div></div><div><div>1.3 WARRANTY</div><div>A. SPECIAL WARRANTY: MANUFACTURER AGREES TO REPAIR OR REPLACE ELECTRIC HEATING CABLE THAT FAILS IN MATERIALS OR WORKMANSHIP WITHIN SPECIFIED WARRANTY PERIOD.</div><div>1. WARRANTY PERIOD: THREE YEARS FROM DATE OF SUBSTANTIAL COMPLETION.</div></div><div><div>PART 2 - PRODUCTS</div><div>2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES</div><div>A. STANDARD: IEEE 515.1.</div><div>B. HEATING ELEMENT: PAIR OF PARALLEL NO. 16 AWG, TINNED, STRANDED COPPER BARS WIRES EMBEDDED IN CROSSLINKED CONDUCTIVE POLYMER CORE, WHICH VARIES HEAT OUTPUT IN RESPONSE TO TEMPERATURE ALONG ITS LENGTH.</div><div>C. ELECTRICAL INSULATING JACKET: FLAME-RETARDANT POLYOLEFIN.</div><div>D. GROUNDING COVER: TINNED-COPPER BRAID.</div><div>E. CABLE COVER: TINNED-COPPER BRAID.</div><div>F. TERMINATE WITH WATERPROOF, FACTORY-ASSEMBLED, NONHEATING LEADS WITH CONNECTORS AT ONE END, AND SEAL THE OPPOSITE END WATERTIGHT. CABLE IS TO BE CAPABLE OF CROSSING OVER ITSELF ONCE WITHOUT OVERHEATING.</div><div>G. MAXIMUM OPERATING TEMPERATURE (POWER ON): 150 DEG. F.</div><div>H. MAXIMUM EXPOSURE TEMPERATURE (POWER OFF): 185 DEG. F.</div><div>I. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: LISTED AND LABELED AS DEFINED IN NFPA 70, BY A QUALIFIED TESTING AGENCY, AND MARKED FOR INTENDED LOCATION AND APPLICATION.</div><div>J. CAPACITIES AND CHARACTERISTICS:</div><div>1. MAXIMUM HEAT OUTPUT: 8 W/FT.</div><div>2. ELECTRICAL CHARACTERISTICS FOR SINGLE-CIRCUIT CONNECTION:</div></div></div><div><div>2.2 PIPE LABELS</div><div>A. GENERAL REQUIREMENTS FOR MANUFACTURED PIPE LABELS: PREPRINTED, COLOR CODED, WITH LETTERING INDICATING SERVICE AND SHOWING FLOW DIRECTION IN ACCORDANCE WITH ASME A13.1.</div><div>B. LETTER AND BACKGROUND COLOR: AS INDICATED FOR SPECIFIC APPLICATION UNDER PART 3.</div><div>C. SELF-ADHESIVE PIPE LABELS: PRINTED PLASTIC WITH CONTACT-TYPE PERMANENT-ADHESIVE BACKING.</div><div>D. PIPE LABEL CONTENTS: INCLUDE IDENTIFICATION OF PIPING SERVICE USING SAME DESIGNATIONS OR ABBREVIATIONS AS USED ON DRAWINGS. ALSO INCLUDE:</div><div>1. PIPE SIZE.</div><div>2. FLOW-DIRECTION ARROWS: INCLUDE FLOW-DIRECTION ARROWS ON MAIN DISTRIBUTION PIPINGS. ARROWS MAY BE EITHER INTEGRAL WITH LABEL OR APPLIED SEPARATELY.</div><div>3. LETTERING SIZE: SIZE LETTERS IN ACCORDANCE WITH ASME A13.1 FOR PIPING.</div></div><div><div>PART 3 - EXECUTION</div><div>3.1 PREPARATION</div><div>A. CLEAN PIPING AND EQUIPMENT SURFACES OF INCOMPATIBLE PRIMER, PAINTS, AND ENCAPSULANTS, AS WELL AS DIRT, OIL, GREASE, RELEASE AGENTS, AND OTHER SUBSTANCES THAT COULD IMPAIR BOND OF IDENTIFICATION DEVICES.</div></div><div><div>3.2 INSTALLATION, GENERAL REQUIREMENTS</div><div>A. COORDINATE INSTALLATION OF IDENTIFYING DEVICES WITH COMPLETION OF COVERING AND PAINTING OF SURFACES WHERE DEVICES ARE TO BE APPLIED.</div><div>B. COORDINATE INSTALLATION OF IDENTIFYING DEVICES WITH LOCATIONS OF ACCESS PANELS AND DOORS.</div></div></div><div><div>END OF SECTION 230530</div><div>SECTION 230530 - MODULATING SINGLE-DUCT AIR TERMINAL UNITS (ABBREVIATED)</div><div><div><div><div>PART 1 - GENERAL</div><div>1.1 SUMMARY</div><div>A. SECTION INCLUDES: MODULATING SINGLE-DUCT AIR TERMINAL UNITS WITH ELECTRIC ACTUATORS.</div><div>B. SUBMITTALS: PRODUCT DATA AND SHOP DRAWINGS.</div></div><div><div>PART 2 - PRODUCTS</div><div>2.1 UNITS: FACTORY-FABRICATED GALVANIZED STEEL CASING WITH REMOVABLE ACCESS PANELS AND GASKETS.</div><div>2.2 DAMPER: GALVANIZED STEEL WITH GASKETED EDGES, SELF-LUBRICATING BEARINGS.</div></div></div><div><div>END OF SECTION 230530</div><div>SECTION 230530 - MODULATING SINGLE-DUCT AIR TERMINAL UNITS (ABBREVIATED)</div><div><div><div><div>PART 1 - GENERAL</div><div>1.1 SUMMARY</div><div>A. SECTION INCLUDES: MODULATING SINGLE-DUCT AIR TERMINAL UNITS WITH ELECTRIC ACTUATORS.</div><div>B. 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PART 3 - EXECUTION

3.1 APPLICATION

A. STRENGTH OF SUPPORT ASSEMBLIES: WHERE NOT INDICATED, SELECT SIZES OF COMPONENTS SO STRENGTH WILL BE ADEQUATE TO CARRY STATIC LOADS WITHIN SPECIFIED LOADING LIMITS. MINIMUM STATIC DESIGN LOAD USED FOR STRENGTH DETERMINATION IS TO INCLUDE WEIGHT OF SUPPORTED COMPONENTS PLUS 200 LB.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. INSTALL HANGERS AND SUPPORTS TO ALLOW CONTROLLED THERMAL MOVEMENT OF PIPING SYSTEMS, TO PERMIT FREEDOM OF MOVEMENT BETWEEN PIPE ANCHORS, AND TO FACILITATE ACTION OF EXPANSION JOINTS, EXPANSION LOOPS, EXPANSION BENDS, AND SIMILAR UNITS.

B. PIPE STAND INSTALLATION:

1. PIPE STAND TYPES EXCEPT CURB-MOUNTED TYPE: ASSEMBLE COMPONENTS AND MOUNT ON SMOOTH ROOF SURFACE; DO NOT PENETRATE ROOF MEMBRANE.

2. CURB-MOUNTED-TYPE PIPE STANDS: ASSEMBLE COMPONENTS OR FABRICATE PIPE STAND AND MOUNT ON PERMANENT, STATIONARY ROOF CURB. SEE SECTION 07200 "ROOF ACCESSORIES" FOR CURBS.

C. INSTALL HANGERS AND SUPPORTS COMPLETE WITH NECESSARY ATTACHMENTS, INSERTS, BOLTS, RODS, NUTS, WASHERS, AND OTHER ACCESSORIES.

D. EQUIPMENT SUPPORT INSTALLATION:

1. FABRICATE FROM WELDED-STRUCTURAL-STEEL SHAPES.

2. FABRICATE STRUCTURAL-STEEL STANDS TO SUSPEND EQUIPMENT FROM STRUCTURE OVERHEAD OR TO SUPPORT EQUIPMENT ABOVE FLOOR.

3. GROUTING: PLACE GROUT UNDER SUPPORTS FOR FLOOR-MOUNTED EQUIPMENT, AND MAKE BEARING SURFACE SMOOTH.

4. PROVIDE LATERAL BRACING, TO PREVENT SWAYING.

3.3 METAL FABRICATIONS

A. CUT, DRILL, AND FIT MISCELLANEOUS METAL FABRICATIONS FOR TRAPEZE PIPE HANGERS AND EQUIPMENT SUPPORTS.

3.4 ADJUSTING

A. HANGER ADJUSTMENTS: ADJUST HANGERS TO DISTRIBUTE LOADS EQUALLY ON ATTACHMENTS AND TO ACHIEVE INDICATED SLOPE OF PIPE.

3.5 HANGER AND SUPPORT SCHEDULE

A. COMPLY WITH MSS SP-58 FOR PIPE-HANGER SELECTIONS AND APPLICATIONS THAT ARE NOT SPECIFIED IN PIPING SYSTEM SECTIONS.

END OF SECTION 230520

SECTION 230530 - HEAT TRACING FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. SECTION INCLUDES HEAT TRACING FOR FREEZE PREVENTION OF HVAC PIPING WITH SELF-REGULATING, PARALLEL-RESISTANCE, ELECTRIC HEATING CABLES.

1.2 ACTION SUBMITTALS

A. PRODUCT DATA, FOR EACH TYPE OF PRODUCT.

B. SHOP DRAWINGS: FOR ELECTRIC HEATING CABLE.

1.3 WARRANTY

A. SPECIAL WARRANTY: MANUFACTURER AGREES TO REPAIR OR REPLACE ELECTRIC HEATING CABLE THAT FAILS IN MATERIALS OR WORKMANSHIP WITHIN SPECIFIED WARRANTY PERIOD.

1. WARRANTY PERIOD: THREE YEARS FROM DATE OF SUBSTANTIAL COMPLETION.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. STANDARD: IEEE 515.1.

B. HEATING ELEMENT: PAIR OF PARALLEL NO. 16 AWG, TINNED, STRANDED COPPER BUS WIRES EMBEDDED IN CROSSLINKED CONDUCTIVE POLYMER CORE, WHICH VARIES HEAT OUTPUT IN RESPONSE TO TEMPERATURE ALONG ITS LENGTH.

C. ELECTRICAL INSULATING JACKET: FLAME-RETARDANT POLYOLEFIN.

D. GROUNDING COVER: TINNED-COPPER BRAID.

E. CABLE COVER: TINNED-COPPER BRAID.

F. TERMINATE WITH WATERPROOF, FACTORY-ASSEMBLED, NONHEATING LEADS WITH CONNECTORS AT ONE END, AND SEAL THE OPPOSITE END. WATERIGHT CABLE IS TO BE CAPABLE OF CROSSING OVER ITSELF ONCE WITHOUT OVERHEATING.

G. MAXIMUM OPERATING TEMPERATURE (POWER ON): 150 DEG. F.

H. MAXIMUM EXPOSURE TEMPERATURE (POWER OFF): 185 DEG. F.

I. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: LISTED AND LABELED AS DEFINED IN NFPA 70, BY A QUALIFIED TESTING AGENCY, AND MARKED FOR INTENDED LOCATION AND APPLICATION.

J. CAPACITIES AND CHARACTERISTICS:

1. MAXIMUM HEAT OUTPUT: 8 W/FT.

2. ELECTRICAL CHARACTERISTICS FOR SINGLE-CIRCUIT CONNECTION:

a. VOLTS: 120 V.

b. PHASE: 1.

c. HERTZ: 60 HZ.

d. FULL-LOAD AMPERES: 30 A.

e. MINIMUM CIRCUIT AMPACITY: 25 A.

f. MAXIMUM OVERCURRENT PROTECTION: 30 A.

2.2 CONTROLS

A. PIPE-MOUNTED THERMOSTATS FOR FREEZE PROTECTION:

1. REMOTE BULB TEMPERATURE-CONTROL UNIT WITH ADJUSTABLE RANGE FROM 30 TO 50 DEG. F.

2. SNAP ACTION, OPEN-ON-RISE, SINGLE-POLE SWITCH WITH MINIMUM CURRENT RATING ADEQUATE FOR CONNECTED CABLE.

3. REMOTE TEMPERATURE-SENSING BULB ON CAPILLARY, RESISTANCE TEMPERATURE DEVICE, OR THERMISTOR FOR DIRECTLY SENSING AMBIENT AIR OR PIPE-WALL TEMPERATURE.

4. CORROSION-RESISTANT, WATERPROOF CONTROL ENCLOSURE.

2.3 ACCESSORIES

A. CABLE INSTALLATION ACCESSORIES: FIBERGLASS TAPE, HEAT-CONDUCTIVE PUTTY, CABLE TIES, SILICONE END SEALS AND SPLICER KITS, AND INSTALLATION CLIPS ALL FURNISHED BY MANUFACTURER, OR AS RECOMMENDED IN WRITING BY MANUFACTURER.

B. WARNING TAPE: CONTINUOUSLY PRINTED "ELECTRICAL TRACING" VINYL, AT LEAST 3 MILS THICK, AND WITH PRESSURE-SENSITIVE, PERMANENT, WATERPROOF, SELF-ADHESIVE BACK.

1. WIDTH FOR MARKERS ON PIPES WITH OD, INCLUDING INSULATION, LESS THAN 6 INCHES: 3/4 INCH MINIMUM.

PART 3 - EXECUTION

3.1 INSTALLATION

A. INSTALL ELECTRIC HEATING CABLE AT LOCATIONS INDICATED AND IN ACCORDANCE WITH NFPA 70.

B. INSTALL ELECTRIC HEATING CABLE ACROSS EXPANSION, CONTRACTION, AND CONTROL JOINTS IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS. USE CABLE-PROTECTION CONDUIT AND SLACK CABLE TO ALLOW MOVEMENT WITHOUT DAMAGE TO CABLE.

C. INSTALL ELECTRIC HEATING CABLES AFTER PIPING HAS BEEN TESTED AND BEFORE INSULATION IS INSTALLED.

D. INSTALL ELECTRIC HEATING CABLES IN ACCORDANCE WITH IEEE 515.1.

E. INSTALL INSULATION OVER PIPING WITH ELECTRIC CABLES IN ACCORDANCE WITH SECTION 230710 "HVAC PIPING INSULATION."

F. INSTALL WARNING TAPE ON PIPING INSULATION WHERE PIPING IS EQUIPPED WITH ELECTRIC HEATING CABLES.

G. SET FIELD-ADJUSTABLE SWITCHES AND CIRCUIT-BREAKER TRIP RANGES.

H. INSTALL TEMPERATURE-CONTROL UNITS IN AN ACCESSIBLE LOCATION AND IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS. LOCATE SENSING BULBS TO SENSE OUTSIDE AIR TEMPERATURE IN A LOCATION WHERE IT WILL NOT BE AFFECTED BY DIRECT SUNLIGHT OR OTHER HEAT SOURCES.

I. INSTALL OUTSIDE AIR AND PIPE TEMPERATURE SENSORS.

3.2 ELECTRICAL CONNECTIONS

A. GROUND EQUIPMENT IN ACCORDANCE WITH SECTION 260526 "GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS."

B. CONNECT WIRING IN ACCORDANCE WITH SECTION 260519 "LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES."

C. CONNECT TEMPERATURE-CONTROL UNIT TO INTERRUPT POWER SUPPLY TO ELECTRIC HEATING CABLE WHEN OUTSIDE AIR IS ABOVE SET POINT.

3.3 FIELD QUALITY CONTROL

A. PERFORM THE FOLLOWING TESTS AND INSPECTIONS:

1. PERFORM TESTS AFTER CABLE INSTALLATION BUT BEFORE APPLICATION OF COVERINGS, SUCH AS INSULATION, WALL OR CEILING CONSTRUCTION, OR CONCRETE.

2. TEST CABLES FOR ELECTRICAL CONTINUITY AND INSULATION INTEGRITY BEFORE ENERGIZING.

3. TEST CABLES TO VERIFY RATING AND POWER INPUT, ENERGIZE AND MEASURE VOLTAGE AND CURRENT SIMULTANEOUSLY.

B. REPEAT TESTS FOR CONTINUITY, INSULATION RESISTANCE, AND INPUT POWER AFTER APPLYING THERMAL INSULATION ON PIPE-MOUNTED CABLES.

C. CABLES WILL BE CONSIDERED DEFECTIVE IF THEY DO NOT PASS TESTS AND INSPECTIONS.

D. PREPARE TEST AND INSPECTION REPORTS.

3.4 PROTECTION

A. PROTECT INSTALLED HEATING CABLES, INCLUDING NONHEATING LEADS, FROM DAMAGE.

B. REMOVE AND REPLACE DAMAGED HEAT-TRACING CABLES.

END OF SECTION 230530

SECTION 230600 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. SECTION INCLUDES:

1. EQUIPMENT LABELS.

2. PIPE LABELS.

1.2 ACTION SUBMITTALS

A. PRODUCT DATA: FOR EACH TYPE OF PRODUCT.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. PLASTIC LABELS FOR EQUIPMENT:

1. MATERIAL AND THICKNESS: MULTILAYER, MULTICOLOR, PLASTIC LABELS FOR MECHANICAL ENGRAVING, 1/16 INCH THICK, WITH PREDRILLED HOLES FOR ATTACHMENT HARDWARE.

2. LETTER AND BACKGROUND COLOR: AS INDICATED FOR SPECIFIC APPLICATION UNDER PART 3.

3. MAXIMUM TEMPERATURE: ABLE TO WITHSTAND TEMPERATURES OF UP TO 160 DEG. F.

4. MINIMUM LABEL SIZE: LENGTH AND WIDTH VARY FOR REQUIRED LABEL CONTENT, BUT NOT LESS THAN 2-1/2 BY 3/4 INCH.

5. MINIMUM LETTER SIZE: 1/4 INCH FOR NAME OF UNITS IF VIEWING DISTANCE IS LESS THAN 24 INCHES, 1/2 INCH FOR VIEWING DISTANCES OF UP TO 72 INCHES, AND PROPORTIONATELY LARGER LETTERING FOR GREATER VIEWING DISTANCES INCLUDE SECONDARY LETTERING TWO-THIRDS TO THREE-FOURTHS THE SIZE OF PRINCIPAL LETTERING.

6. FASTENERS: STAINLESS STEEL RIVETS OR SELF-TAPPING SCREWS.

7. ADHESIVE: CONTACT-TYPE PERMANENT ADHESIVE, COMPATIBLE WITH LABEL AND WITH SUBSTRATE.

B. LABEL CONTENT: INCLUDE EQUIPMENT'S DRAWING DESIGNATION OR UNIQUE EQUIPMENT NUMBER, DRAWING NUMBERS WHERE EQUIPMENT IS INDICATED (PLANS, DETAILS, AND SCHEDULES), AND THE SPECIFICATION SECTION NUMBER AND TITLE WHERE EQUIPMENT IS SPECIFIED.

2.2 PIPE LABELS

A. GENERAL REQUIREMENTS FOR MANUFACTURED PIPE LABELS: PREPRINTED, COLOR CODED, WITH LETTERING INDICATING SERVICE AND SHOWING FLOW DIRECTION IN ACCORDANCE WITH ASME A13.1.

B. LETTER AND BACKGROUND COLOR: AS INDICATED FOR SPECIFIC APPLICATION UNDER PART 3.

C. SELF-ADHESIVE PIPE LABELS: PRINTED PLASTIC WITH CONTACT-TYPE, PERMANENT-ADHESIVE BACKING.

D. PIPE LABEL CONTENTS INCLUDE IDENTIFICATION OF PIPING SERVICE USING SAME DESIGNATIONS OR ABBREVIATIONS AS USED ON DRAWINGS, ALSO INCLUDE:

1. PIPE SIZE.

2. FLOW-DIRECTION ARROWS: INCLUDE FLOW-DIRECTION ARROWS ON MAIN DISTRIBUTION PIPING. ARROWS MAY BE EITHER INTEGRAL WITH LABEL OR APPLIED SEPARATELY.

3. LETTERING SIZE: SIZE LETTERS IN ACCORDANCE WITH ASME A13.1 FOR PIPING.

PART 3 - EXECUTION

3.1 PREPARATION

A. CLEAN PIPING AND EQUIPMENT SURFACES OF INCOMPATIBLE PRIMERS, PAINTS, AND ENCAUSULANTS, AS WELL AS DIRT, OIL, GREASE, RELEASE AGENTS, AND OTHER SUBSTANCES THAT COULD IMPAIR BOND OF IDENTIFICATION DEVICES.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. COORDINATE INSTALLATION OF IDENTIFYING DEVICES WITH COMPLETION OF COVERING AND PAINTING OF SURFACES WHERE DEVICES ARE TO BE APPLIED.

B. COORDINATE INSTALLATION OF IDENTIFYING DEVICES WITH LOCATIONS OF ACCESS PANELS AND DOORS.

C. LOCATE IDENTIFYING DEVICES SO THAT THEY ARE READILY VISIBLE FROM THE POINT OF NORMAL APPROACH.

3.3 INSTALLATION OF EQUIPMENT LABELS

A. PERMANENTLY FASTEN LABELS ON EACH ITEM OF MECHANICAL EQUIPMENT.

B. SIGN AND LABEL COLORS:

1. WHITE LETTERS ON AN ANSI Z353.1 SAFETY-BLUE BACKGROUND.

C. LOCATE EQUIPMENT LABELS WHERE ACCESSIBLE AND VISIBLE.

3.4 INSTALLATION OF PIPE LABELS

A. INSTALL PIPE LABELS SHOWING SERVICE AND FLOW DIRECTION WITH PERMANENT ADHESIVE ON PIPES.

B. PIPE-LABEL LOCATIONS: LOCATE PIPE LABELS WHERE PIPING IS EXTERIOR EXPOSED LOCATIONS AS FOLLOWS:

1. WITHIN 3 FT. OF EACH VALVE AND CONTROL DEVICE.

2. WITHIN 3 FT. OF EQUIPMENT ITEMS AND OTHER POINTS OF ORIENTATION AND TERMINATION.

3. SPACED AT MAXIMUM INTERVALS OF 25 FT. ALONG EACH RUN, REDUCE INTERVALS TO 10 FT. IN AREAS OF CONGESTED PIPING, DUCTWORK, AND EQUIPMENT.

C. DO NOT APPLY PLASTIC PIPE LABELS OR PLASTIC TAPES DIRECTLY TO BARE PIPES CONVEYING FLUIDS AT TEMPERATURES OF 125 DEG. F. OR HIGHER, WHERE THESE PIPES ARE TO REMAIN UNINSULATED. USE A SHORT SECTION OF INSULATION OR USE STENOLED LABELS.

D. FLOW-DIRECTION ARROWS: USE ARROWS TO INDICATE DIRECTION OF FLOW IN PIPES, INCLUDING PIPES WHERE FLOW IS ALLOWED IN BOTH DIRECTIONS.

E. PIPE-LABEL COLOR SCHEDULE:

1. CHILLED-WATER PIPING: WHITE LETTERS ON AN ANSI Z353.1 SAFETY-GREEN BACKGROUND.

MAXIMUM LEAKAGE 2% AT 3 IN. WG.

2.3 VELOCITY SENSOR: MULTIPPOINT ARRAY, FACTORY CALIBRATED.

2.4 ATTENUATOR: INTEGRAL ATTENUATOR SECTION MATCHING CASING.

2.5 CONTROLS: PROVIDE DDC OR ELECTRIC ACTUATORS AS SCHEDULED, FACTORY-ADJUSTED.

2.6 ELECTRIC RESISTANCE HEAT: INTEGRAL DUCT HEATER WITH NICKEL-CHROMIUM ELEMENTS, GALVANIZED STEEL CASING, PRIMARY AUTOMATIC HIGH-LIMIT CUTOUT, SECONDARY MANUAL-RESET CUTOUT, AND AIRFLOW PROVING SWITCH.

PART 3 - EXECUTION

3.1 INSTALLATION: INSTALL LEVEL, PLUMB, PER NFPA 90A, PROVIDE FLEXIBLE DUCT CONNECTORS AT CONNECTIONS.

3.2 ELECTRICAL: PROVIDE FIELD POWER WIRING AND GROUNDING PER NEC, COORDINATE WITH DIVISION 26.

3.3 IDENTIFICATION: LABEL EACH UNIT WITH SCHEDULE DESIGNATION AND AIRFLOW.

3.4 STARTUP: VERIFY PROPER OPERATION, HEATER SAFETIES, AND CONTROL RESPONSE.

3.5 ADJUSTING: BALANCE AIRFLOWS IN ACCORDANCE WITH SECTION 230603.

END OF SECTION 233600

SECTION 230690 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. SECTION INCLUDES:

1. TESTING, ADJUSTING, AND BALANCING OF AIR SYSTEMS:

a. CONSTANT-VOLUME AIR SYSTEMS.

2. TESTING, ADJUSTING, AND BALANCING OF HYDRONIC PIPING SYSTEMS:

a. CONSTANT-FLOW HYDRONIC SYSTEMS.

3. TESTING, ADJUSTING, AND BALANCING OF EQUIPMENT.

4. DUCT LEAKAGE TESTS VERIFICATION.

5. PIPE LEAKAGE TESTS VERIFICATION.

6. HVAC-CONTROL SYSTEM VERIFICATION.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. PERFORM TESTING AND BALANCING PROCEDURES ON EACH SYSTEM IN ACCORDANCE WITH THE PROCEDURES CONTAINED IN AIA/CES' NATIONAL STANDARDS FOR TOTAL SYSTEM BALANCE AND IN THIS SECTION.

3.2 DUCT LEAKAGE TESTS

A. WITNESS THE DUCT LEAKAGE TESTING PERFORMED BY INSTALLER.

B. VERIFY THAT PROPER TEST METHODS ARE USED AND THAT LEAKAGE RATES ARE WITHIN SPECIFIED LIMITS.

C. REPORT DEFICIENCIES OBSERVED.

3.3 PIPE LEAKAGE TESTS

A. WITNESS THE PIPE PRESSURE TESTING PERFORMED BY INSTALLER.

B. VERIFY THAT PROPER TEST METHODS ARE USED AND THAT LEAKAGE RATES ARE WITHIN SPECIFIED LIMITS.

C. REPORT DEFICIENCIES OBSERVED.

3.4 HVAC CONTROLS VERIFICATION

A. IN CONJUNCTION WITH SYSTEM BALANCING, PERFORM THE FOLLOWING:

1. VERIFY HVAC CONTROL SYSTEM IS OPERATING WITHIN THE DESIGN LIMITATIONS.

2. CONFIRM THAT THE SEQUENCES OF OPERATION ARE IN COMPLIANCE WITH CONTRACT DOCUMENTS.

3. VERIFY THAT CONTROLLERS ARE CALIBRATED AND FUNCTION AS INTENDED.

4. VERIFY THAT CONTROLLER SET POINTS ARE AS INDICATED.

5. VERIFY THE OPERATION OF LOCKOUT OR INTERLOCK SYSTEMS.

6. VERIFY THE OPERATION OF VALVE AND DAMPER ACTUATORS.

7. VERIFY THAT CONTROLLED DEVICES ARE PROPERLY INSTALLED AND CONNECTED TO CORRECT CONTROLLER.

8. VERIFY THAT CONTROLLED DEVICES TRAVEL FREELY AND ARE IN POSITION INDICATED BY CONTROLLER: OPEN, CLOSED, OR MODULATING.

9. VERIFY LOCATION AND INSTALLATION OF SENSORS TO ENSURE THAT THEY SENSE ONLY INTENDED TEMPERATURE, HUMIDITY, OR PRESSURE.

B. REPORTING: INCLUDE A SUMMARY OF VERIFICATIONS PERFORMED, REMAINING DEFICIENCIES, AND VARIATIONS FROM INDICATED CONDITIONS.

3.5 TOLERANCES

A. SET HVAC SYSTEMS AIRFLOW RATES AND WATER FLOW RATES WITHIN THE FOLLOWING TOLERANCES:

1. SUPPLY, RETURN, AND EXHAUST FANS AND EQUIPMENT WITH FANS: PLUS 10 PERCENT OR MINUS 5 PERCENT, IF DESIGN VALUE IS LESS THAN 100 CFM, WITHIN 10 CFM.

2. AIR OUTLETS AND INLETS: PLUS 10 PERCENT OR MINUS 5 PERCENT, IF DESIGN VALUE IS LESS THAN 100 CFM, WITHIN 10 CFM.

3. CHILLED-WATER FLOW RATE: PLUS OR MINUS 5 PERCENT, IF DESIGN VALUE IS LESS THAN 10 GPM, WITHIN 10 PERCENT.

B. MAINTAINING PRESSURE RELATIONSHIPS AS DESIGNED SHALL HAVE PRIORITY OVER THE TOLERANCES SPECIFIED ABOVE.

3.6 VERIFICATION OF TAB REPORT

A. THE TAB SPECIALISTS' TEST AND BALANCE ENGINEER SHALL CONDUCT THE INSPECTION IN THE PRESENCE OF THE CONSTRUCTION MANAGER.

B. THE CONSTRUCTION MANAGER SHALL RANDOMLY SELECT MEASUREMENTS, DOCUMENTED IN THE FINAL REPORT, TO BE RECHECKED. RECHECKING SHALL BE LIMITED TO THE LESSEST OF EITHER 10 PERCENT OF THE TOTAL MEASUREMENTS RECORDED OR THE EXTENT OF MEASUREMENTS THAT CAN BE ACCOMPLISHED IN A NORMAL 8-HOUR BUSINESS DAY.

C. IF RECHECKS YIELD MEASUREMENTS THAT DIFFER FROM THE MEASUREMENTS DOCUMENTED IN THE FINAL REPORT BY MORE THAN THE TOLERANCES ALLOWED, THE MEASUREMENTS SHALL BE NOTED AS "FAILED."

D. IF THE NUMBER OF "FAILED" MEASUREMENTS IS GREATER THAN 10 PERCENT OF THE TOTAL MEASUREMENTS CHECKED DURING THE FINAL INSPECTION, THE TAB SHALL BE CONSIDERED INCOMPLETE AND SHALL BE REJECTED.

E. IF RECHECK MEASUREMENTS FIND THE NUMBER OF FAILED MEASUREMENTS NONCOMPLIANT WITH REQUIREMENTS INDICATED, PROCEED AS FOLLOWS:

1. TAB SPECIALISTS SHALL RECHECK ALL MEASUREMENTS AND MAKE ADJUSTMENTS, REVISE THE FINAL REPORT AND BALANCING DEVICE SETTINGS TO INCLUDE ALL CHANGES, RESUBMIT THE FINAL REPORT AND REQUEST A SECOND FINAL INSPECTION. ALL CHANGES SHALL BE TRACKED TO SHOW CHANGES MADE TO PREVIOUS REPORT.

2. IF THE SECOND FINAL INSPECTION ALSO FAILS, OWNER MAY PURSUE OTHERS CONTRACT OPTIONS TO COMPLETE TAB WORK.

F. PREPARE TEST AND INSPECTION REPORTS.

3.7 ADDITIONAL TESTS

A. WITHIN 90 DAYS OF COMPLETING TAB, PERFORM ADDITIONAL TAB TO VERIFY THAT BALANCED CONDITIONS ARE BEING MAINTAINED THROUGHOUT AND TO CORRECT UNUSUAL CONDITIONS.

B. SEASONAL PERIODS: IF INITIAL TAB PROCEDURES WERE NOT PERFORMED DURING NEAR-PEAK SUMMER AND WINTER CONDITIONS, PERFORM ADDITIONAL TAB DURING NEAR-PEAK SUMMER AND WINTER CONDITIONS.

END OF SECTION 230690

SECTION 233600 - MODULATING SINGLE-DUCT AIR TERMINAL UNITS (ABBREVIATED)

PART 1 - GENERAL

1.1 SUMMARY

A. SECTION INCLUDES: MODULATING SINGLE-DUCT AIR TERMINAL UNITS WITH ELECTRIC RESISTANCE HEAT.

B. SUBMITTALS: PRODUCT DATA AND SHOP DRAWINGS.

PART 2 - PRODUCTS

2.1 UNITS: FACTORY-FABRICATED GALVANIZED STEEL CASING WITH REMOVABLE ACCESS PANELS AND GASKETS.

2.2 DAMPER: GALVANIZED STEEL WITH GASKETED EDGES, SELF-LUBRICATING BEARINGS.

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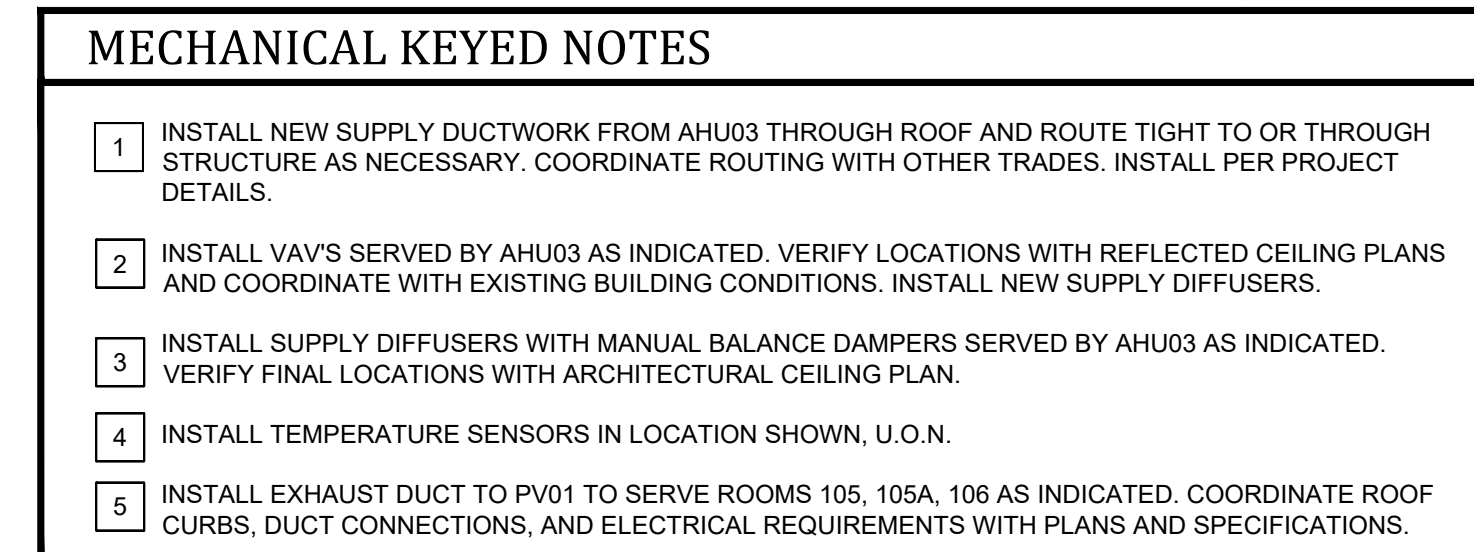
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REFERENCE DRAWINGS

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213.

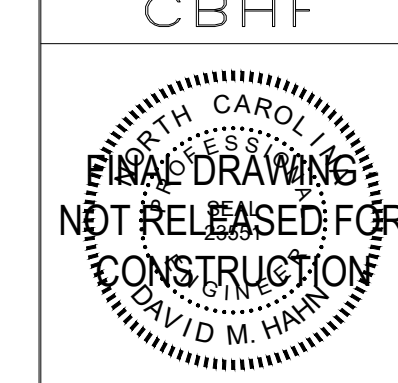


- | MECHANICAL GENERAL NOTES | |
|--------------------------|---|
| 1. | MECHANICAL CONTRACTOR TO COORDINATE WITH OTHER TRADES PRIOR TO BEGINNING WORK . |
| 2. | COORDINATE DUCT ELEVATION AND GENERAL PLACEMENT WITH STRUCTURE AND OTHER TRADES, TYP. |
| 3. | COORDINATE AIR HANDLING EQUIPMENT LOCATIONS TO MAXIMIZE SPACE WHILE MAINTAINING ALL OF THE MANUFACTURER'S CLEARANCE REQUIREMENTS. |

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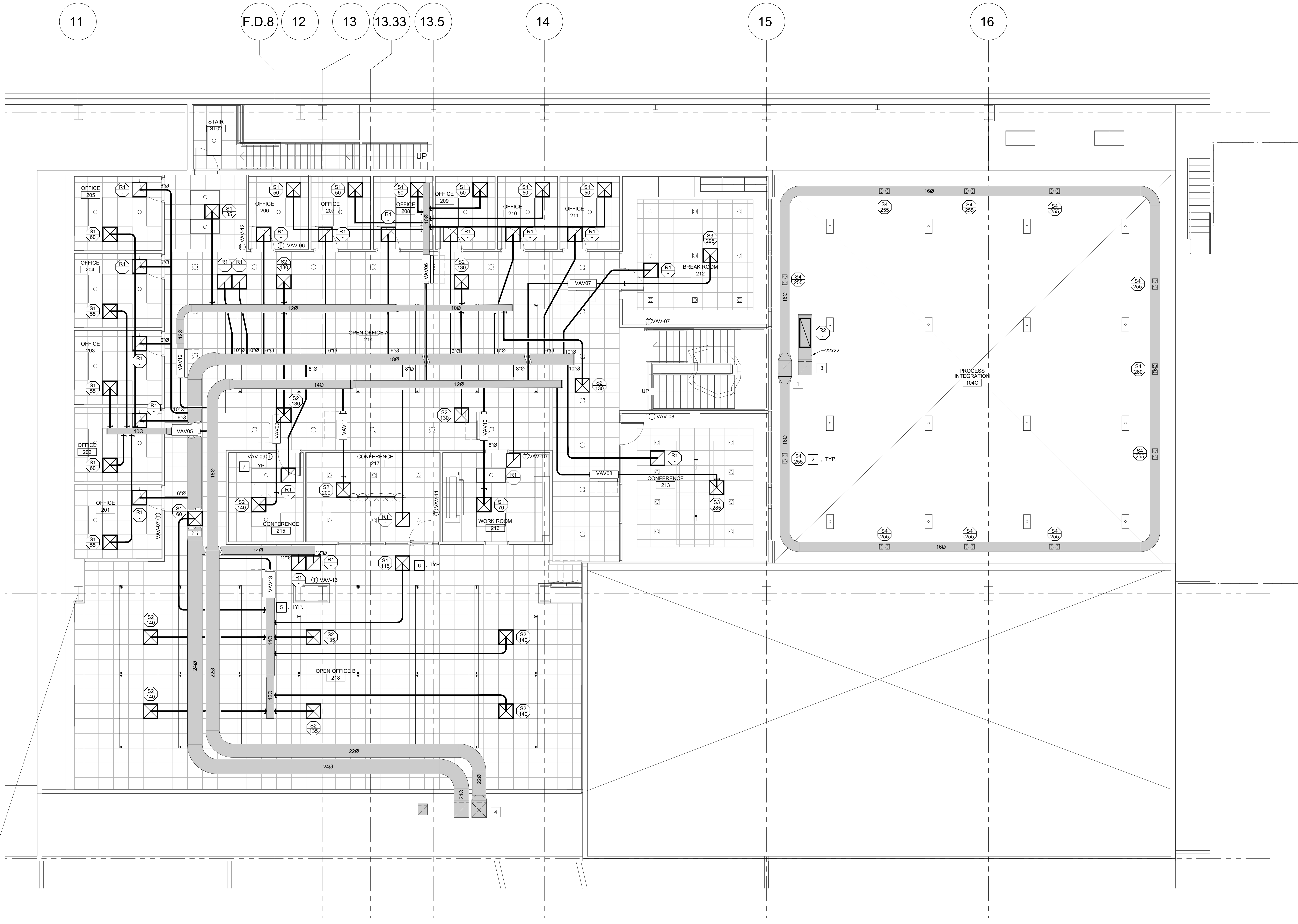
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TRUE NORTH PROJECT NORTH



- MECHANICAL KEYED NOTES**
1. INSTALL NEW SUPPLY DUCTWORK FROM AHU02 THROUGH ROOF AND ROUTE TIGHT TO STRUCTURE. COORDINATE ROUTING WITH OTHER TRADES. INSTALL PER PROJECT DETAILS.
 2. INSTALL SUPPLY DIFFUSERS SERVED BY AHU02 TO THE UNDERSIDE OF DUCT.
 3. INSTALL NEW RETURN DUCTWORK TO AHU02 THROUGH ROOF. INSTALL NEW RETURN GRILLE ON TOP OF DUCT AS INDICATED BY PLANS.
 4. INSTALL NEW SUPPLY DUCTWORK FROM AHU03 THROUGH ROOF AND ROUTE TIGHT TO STRUCTURE. COORDINATE ROUTING WITH OTHER TRADES. INSTALL PER PROJECT DETAILS.
 5. INSTALL VAVS SERVED BY AHU03 AS INDICATED. VERIFY LOCATIONS WITH REFLECTED CEILING PLANS AND COORDINATE WITH EXISTING BUILDING CONDITIONS. INSTALL NEW SUPPLY DIFFUSERS.
 6. INSTALL SUPPLY DIFFUSERS WITH MANUAL BALANCE DAMPERS SERVED BY AHU03 AS INDICATED. VERIFY FINAL LOCATIONS WITH ARCHITECTURAL CEILING PLAN.
 7. INSTALL THERMOSTATS IN LOCATION SHOWN. U.O.N.

- MECHANICAL GENERAL NOTES**
1. MECHANICAL CONTRACTOR TO COORDINATE WITH OTHER TRADES PRIOR TO BEGINNING WORK.
 2. COORDINATE DUCT ELEVATION AND GENERAL PLACEMENT WITH STRUCTURE AND OTHER TRADES. TYP.
 3. COORDINATE AIR HANDLING EQUIPMENT LOCATIONS TO MAXIMIZE SPACE WHILE MAINTAINING ALL OF THE MANUFACTURER'S CLEARANCE REQUIREMENTS.

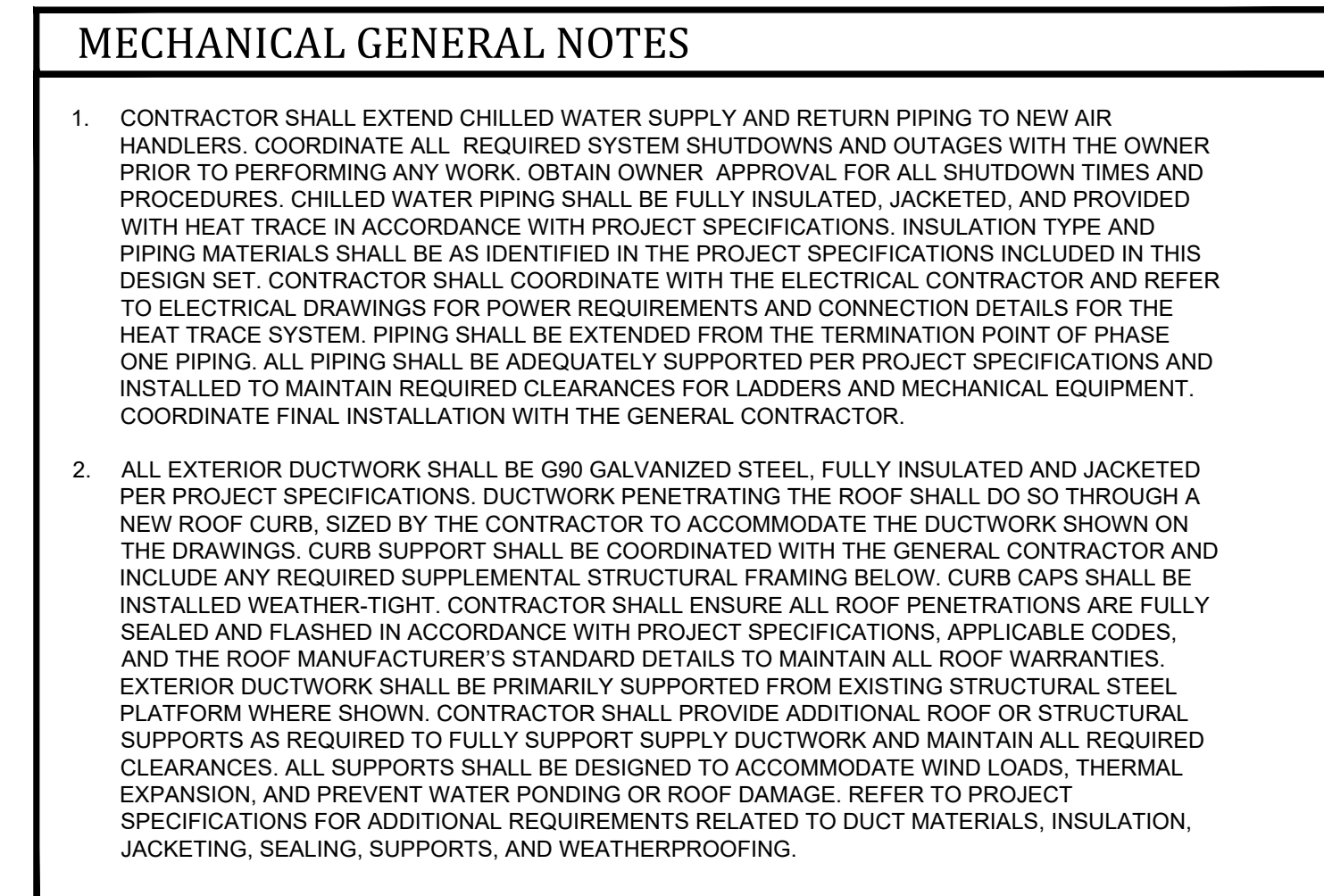
B8 HVAC SECOND FLOOR PLAN
3/16" = 1'-0"
PLAN NORTH


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| REFERENCE DRAWINGS | | REVISIONS | | SIGNATURES | | DATE | | TYPE OF DRAWING | |
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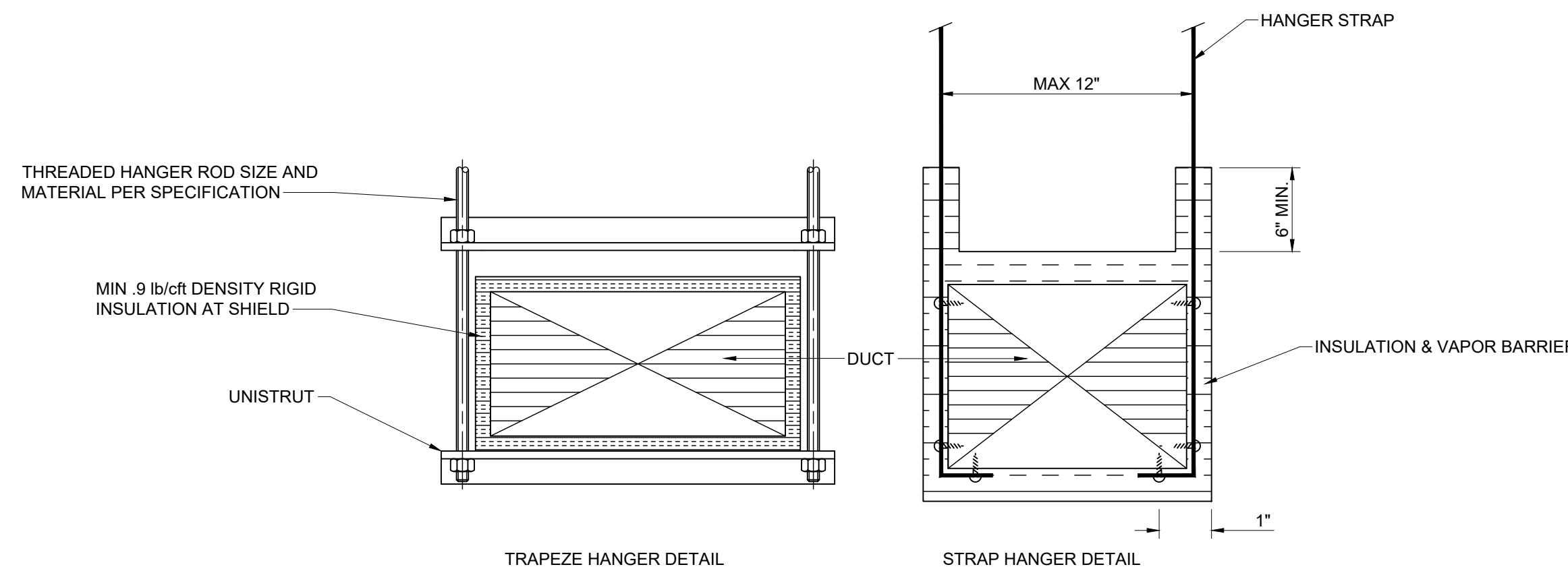
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SEE SPECIFICATIONS FOR
ADDITIONAL
REQUIREMENTS

**HEAVY DUTY
CLEVIS HANGE
(FOR 1/2" UP TO
INCL. 2" PIPE)**

H8 PIPE HANGER SUPPORT DETAIL
NOT TO SCALE

NOT TO SCALE

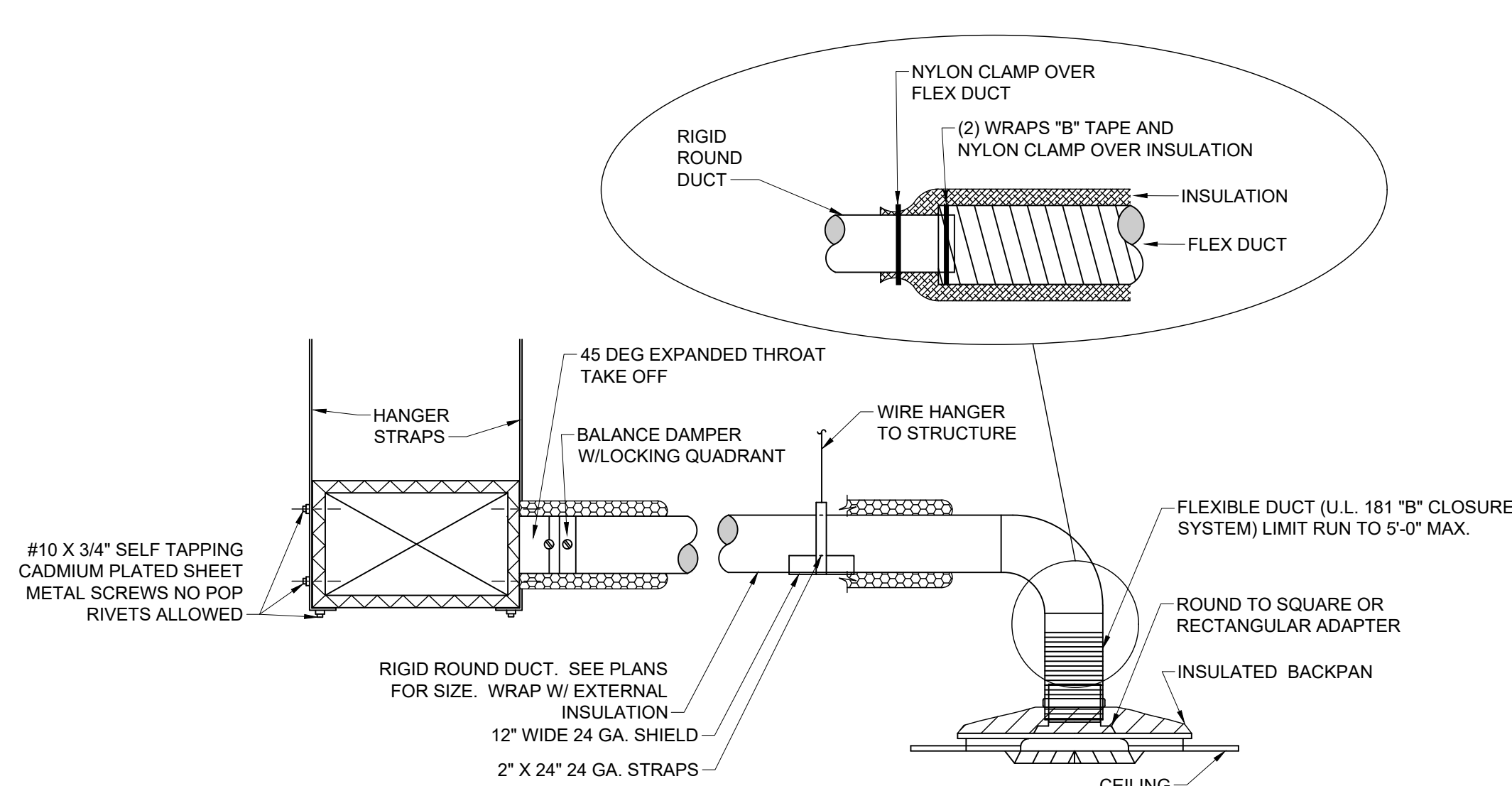


NOTES

1. TRAPEZE HANGERS SHALL BE PROVIDED FOR ALL DUCT WORK. TRAPEZE HANGERS CANNOT BE USED FOR BRANCH DUCT WORK 12" IN WIDTH AND SHORTER REFER TO STRAP HANGER DETAIL.
2. SUPPORTS SHALL BE SPACED AND SIZED AS PER SPECIFICATIONS.
3. RIGID INSULATION SHALL EXTEND MINIMUM OF 3" BEYOND STRUT ON BOTH SIDES. MAINTAIN VAPOR BARRIER ACROSS STRUT.

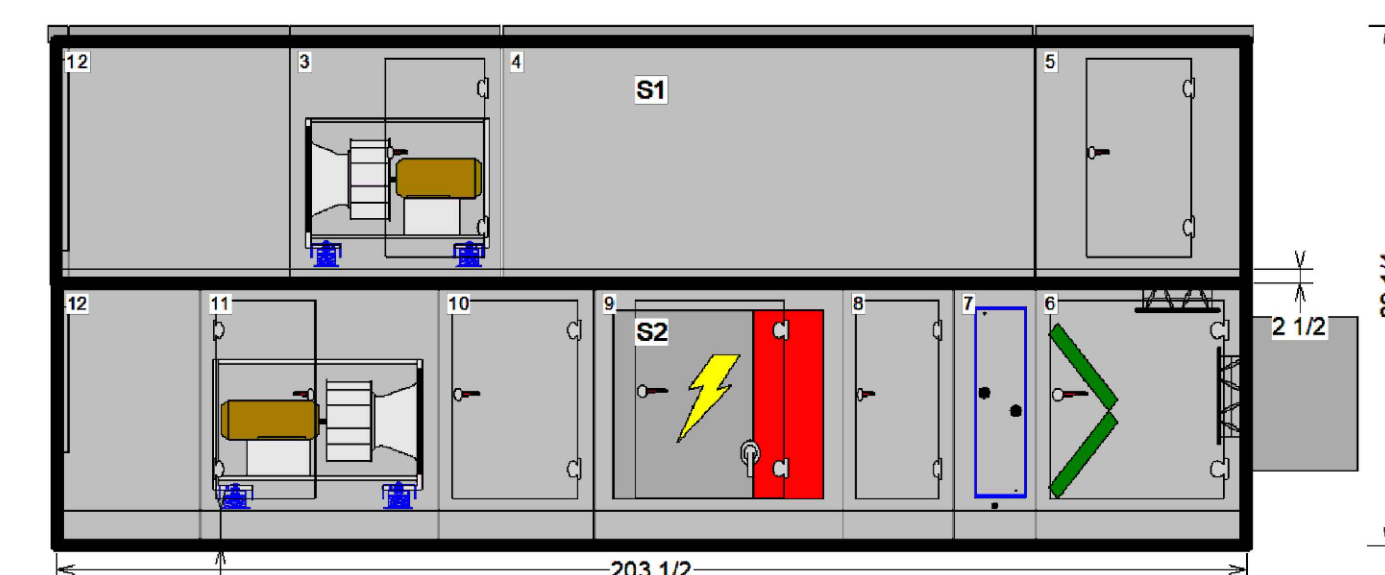
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NOT TO SCALE

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U4 TYPICAL DIFFUSER CONNECTION DETAIL

NOT TO SCALE

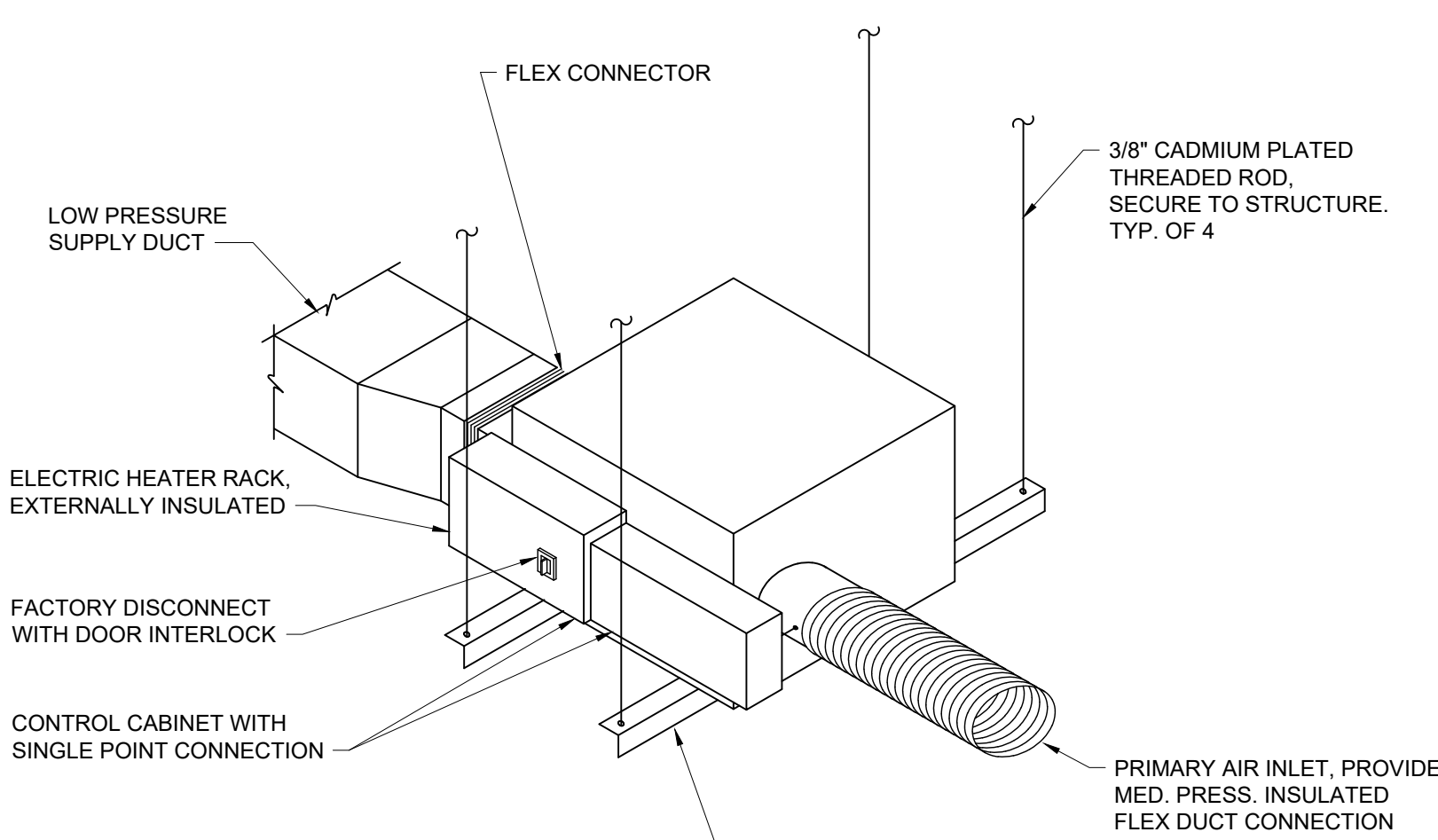


| Pos # | Module | Length | Weight |
|-------|-----------------------|--------|--------|
| 1 | Access section | 2 | 112.53 |
| 2 | Custom length section | 37 7/8 | 288.06 |
| 3 | Fan section | 36 1/4 | 857.67 |
| 4 | Custom length section | 91 3/8 | 688.78 |
| 5 | Air mixing section | 36 1/8 | 361.39 |
| 6 | Air mixing section | 36 | 406.64 |
| 7 | Coil section | 14 | 332.84 |
| 8 | Access section | 19 | 129.00 |
| 9 | Coil section | 42 5/8 | 920.60 |
| 10 | Access section | 26 5/8 | 177.88 |
| 11 | Fan section | 40 3/4 | 800.56 |
| 12 | Discharge Plenum | 24 1/2 | 216.34 |

Installed Unit Weight 5292.19 lbs

U2 AH03 SIDE ELEVATION

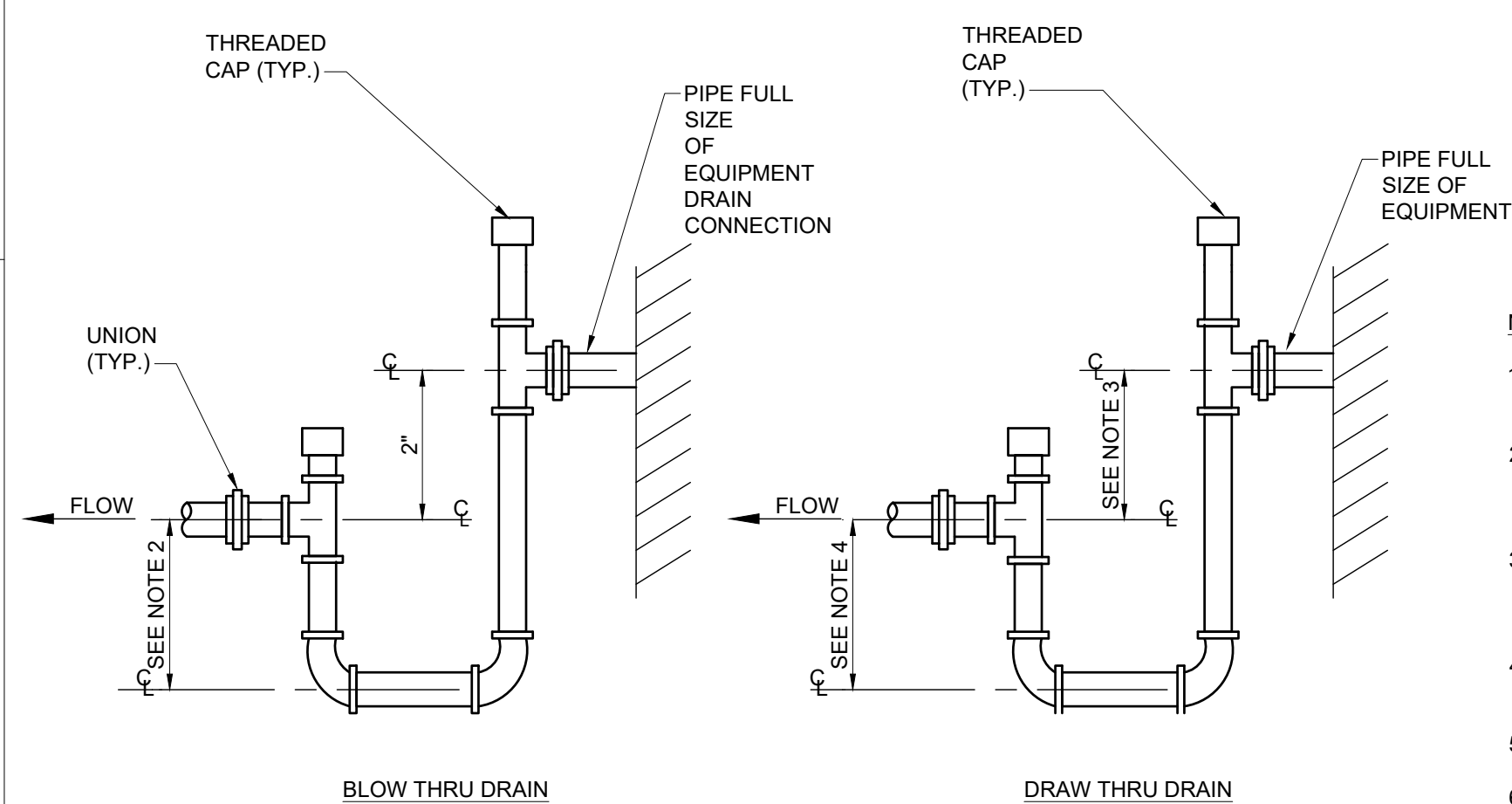
NOT TO SCALE



NOTE:
MAINTAIN MANUFACTURERS RECOMMENDED CLEARANCE AND
VERIFY INSTALLATION INSTRUCTIONS FOR HANGING SO THAT
ALL NECESSARY ACCESS PANELS ARE NOT OBSTRUCTED.

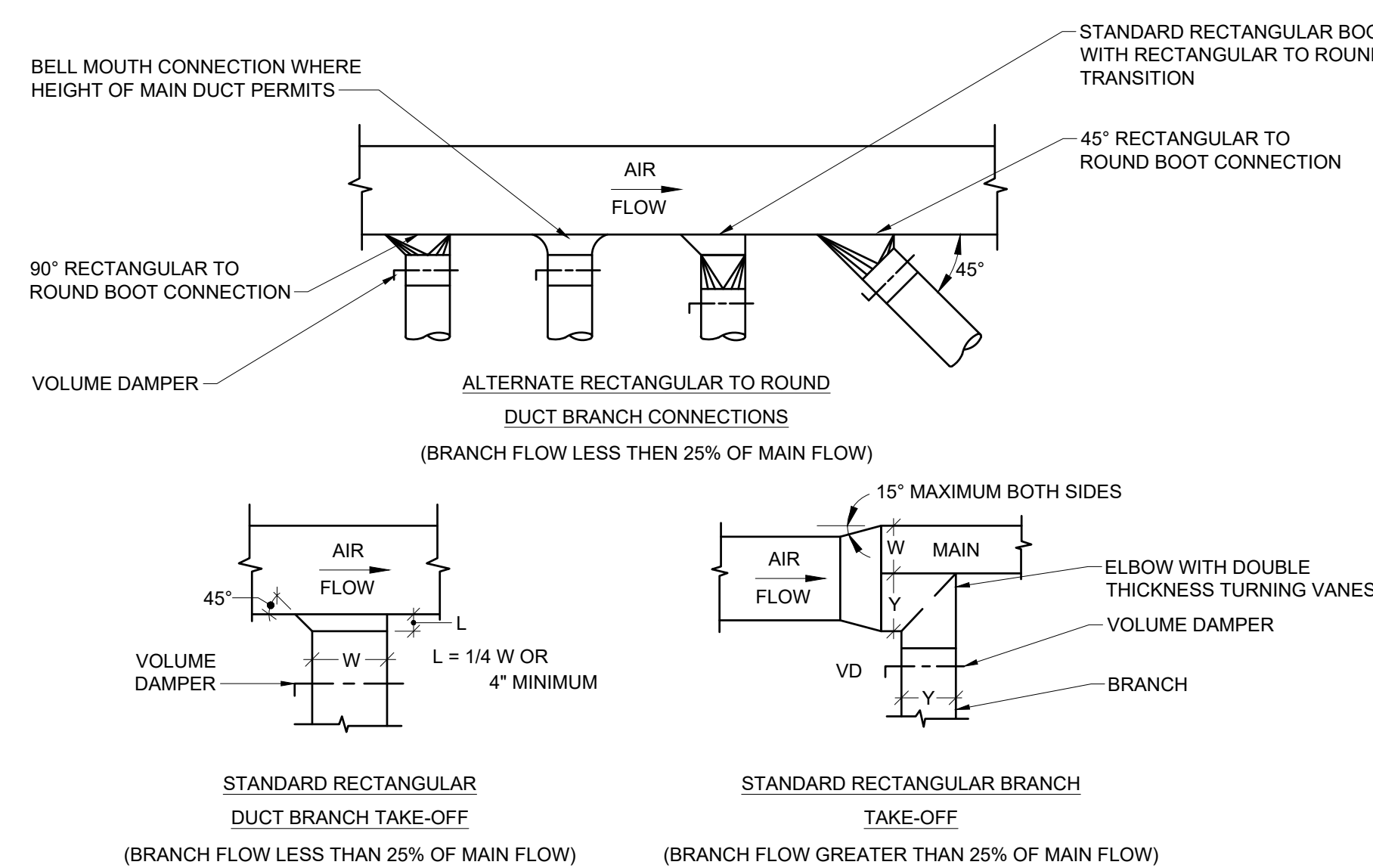
53 TYPICAL SINGLE DUCT TERMINAL w/ELECTRIC HEAT DETAIL

NOT TO SCALE



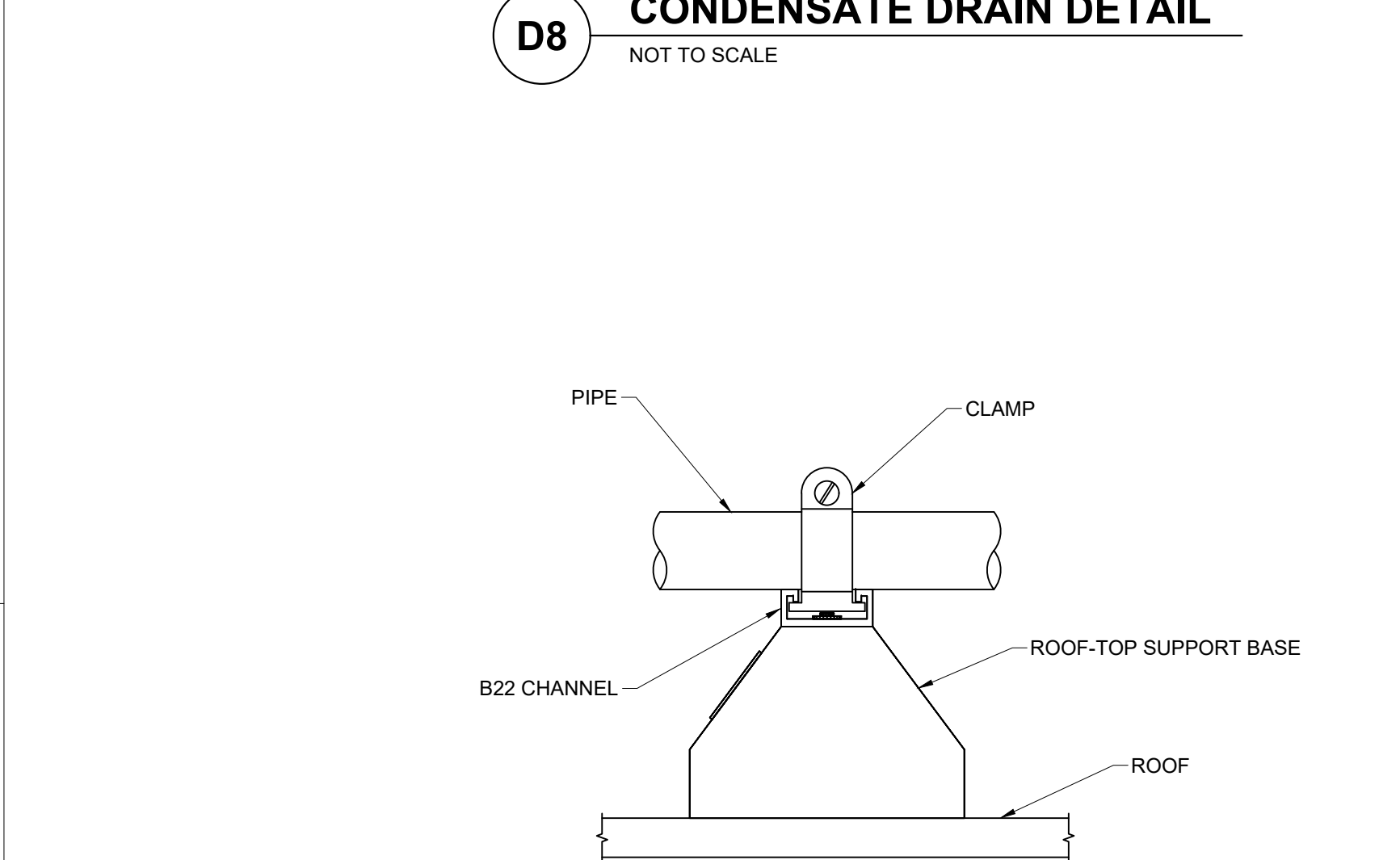
NOTES

1. LOCATE TRAPS SO AS TO BE ACCESSIBLE FOR CLEANING.
2. HEIGHT MUST BE EQUAL TO UNIT MAXIMUM TOTAL STATIC PRESSURE PLUS 1/2".
3. HEIGHT MUST BE EQUAL TO UNIT MAXIMUM NEGATIVE STATIC PRESSURE PLUS 1".
4. HEIGHT MUST BE 1/2 OF HEIGHT INSTALLED IN NOTE 3.
5. PIPE TO NEAREST DRAIN.
6. TRAP MUST NOT BLOCK ACCESS TO EQUIPMENT
7. PROVIDE UNIONS AT INLET AND OUTLET OF TRAP.



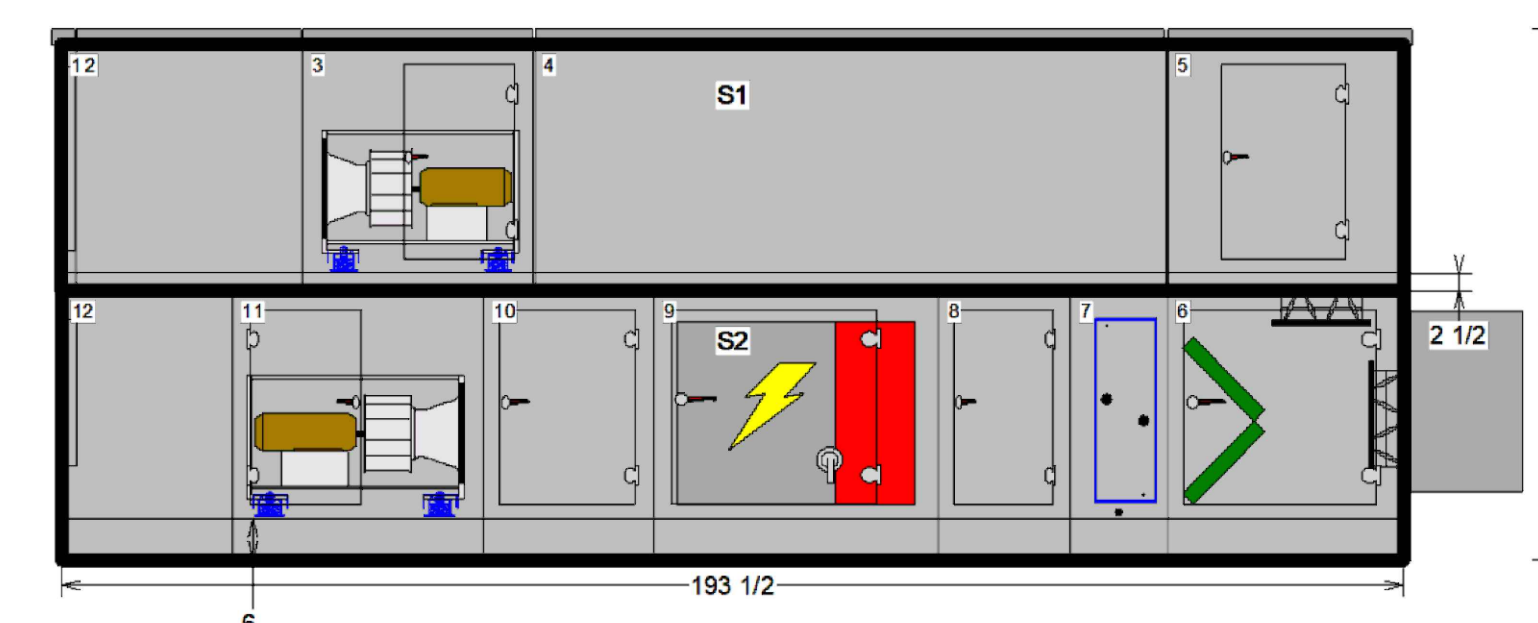
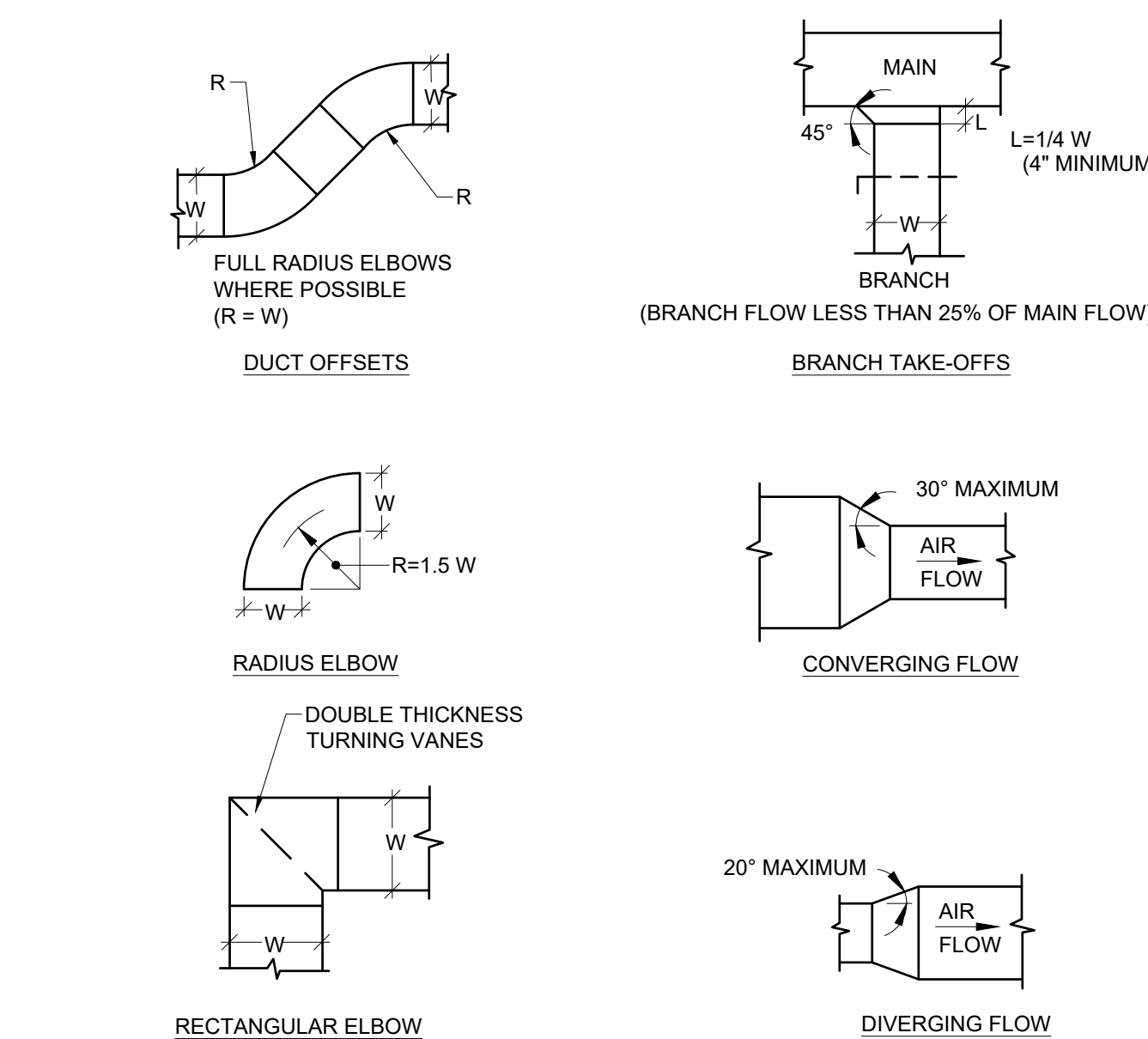
CONDENSATE DRAIN DETAIL

NOT TO SCALE



C8 CONDENSATE TYPICAL ROOF SUPPORT DETAIL

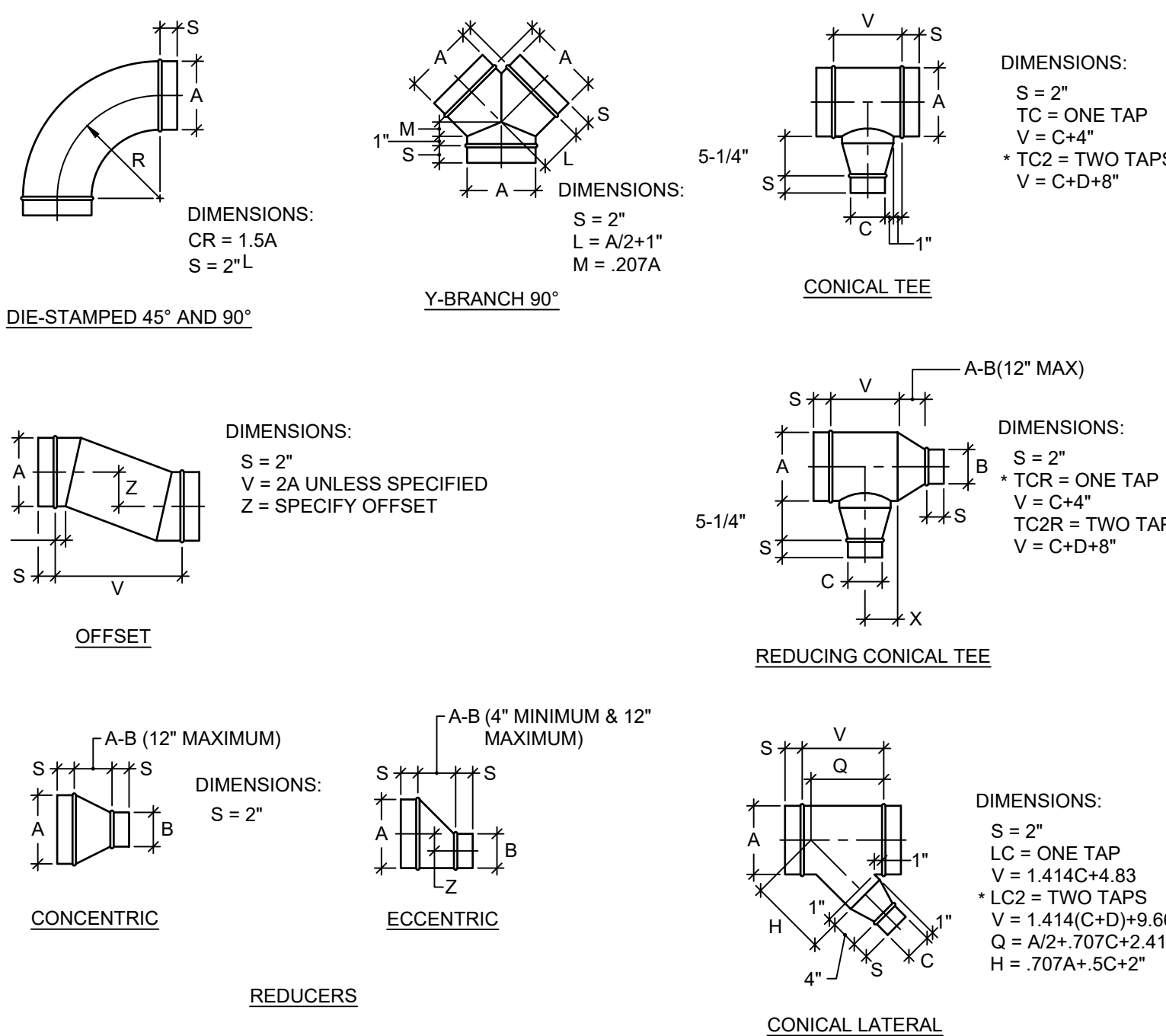
NOT TO SCALE



| Pos # | Module | Length | Weight |
|-----------------------|-----------------------|---------|--------|
| 1 | Access section | 2 | 72.95 |
| 2 | Custom length section | 32 3/4 | 190.03 |
| 3 | Fan section | 33 3/8 | 555.66 |
| 4 | Custom length section | 91 3/8 | 525.00 |
| 5 | Air mixing section | 34 | 246.82 |
| 6 | Air mixing section | 34 | 274.12 |
| 7 | Col section | 14 | 203.48 |
| 8 | Access section | 19 | 100.00 |
| 9 | Col section | 41 1/8 | 636.95 |
| 10 | Access section | 24 5/8 | 128.69 |
| 11 | Fan section | 36 1/4 | 551.90 |
| 12 | Discharge Plenum | 24 1/2 | 153.61 |
| Installed Unit Weight | | 3639.24 | lb |

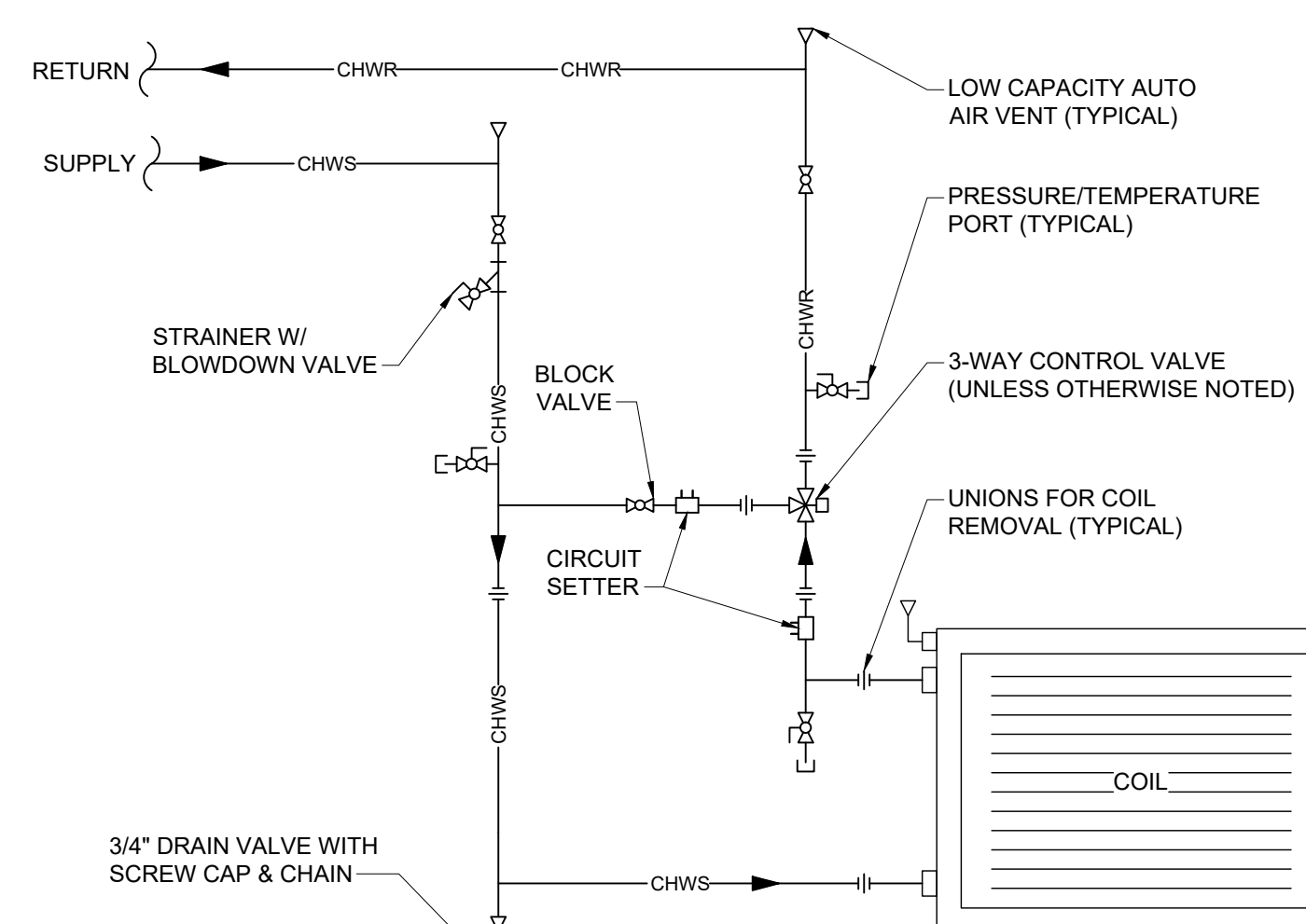
C4 AH02 SIDE ELEVATION

NOT TO SCALE



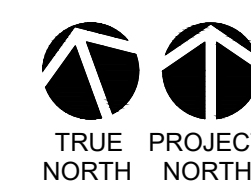
12 TYPICAL DUCT FITTING DETAILS

NOT TO SCALE



CHILLED WATER COIL PIPING 3-WAY DETAIL

NOT TO SCALE



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| REFERENCE DRAWINGS | |
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