ANCHORAGE / BRACING NOTES

ALL MECHANICAL/PLUMBING AND PLUMBING COMPONENTS SHALL BE ANCHORED AND INSTALLED PER THE DETAILS ON THE APPROVED CONTRACT DOCUMENTS. WHERE NO DETAIL IS INDICATED, THE FOLLOWING COMPONENTS SHALL BE ANCHORED OR BRACED TO MEET THE FORCE AND DISPLACEMENT REQUIREMENTS PRESCRIBED IN THE 2019 CBC, SECTION 1616A.1.18 THROUGH 1616A.1.26 AND ASCE 7-10, CHAPTERS 13, 26, AND 30.

1. ALL PERMANENT EQUIPMENT AND COMPONENTS
2. TEMPORARY OR MOVABLE EQUIPMENT THAT IS PERMANENTLY ATTACHED (E.G. HARD WIRED) TO THE BUILDING UTILITY SERVICES SUCH AS ELECTRICITY, GAS, OR WATER.
3. MOVABLE EQUIPMENT WHICH IS STATIONED IN ONE PLACE FOR MORE THAN 8 HOURS AND HEAVIER THAN 400 POUNDS ARE REQUIRED TO BE ANCHORED WITH TEMPORARY ATTACHMENTS.

THE ATTACHMENT OF THE FOLLOWING MECHANICAL/PLUMBING COMPONENTS SHALL BE POSITIVELY ATTACHED TO THE STRUCTURE, BUT NEED NOT BE DETAILED ON THE PLANS. THESE COMPONENTS SHALL HAVE FLEXIBLE CONNECTIONS PROVIDED BETWEEN THE COMPONENT AND ASSOCIATED DUCTWORK, PIPING, AND CONDUIT.

A. COMPONENTS WEIGHING LESS THAN 400 POUNDS AND HAVE A CENTER OF MASS LOCATED 4 FEET OR LESS ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT.

B. COMPONENTS WEIGHING LESS THAN 20 POUNDS, OR IN THE CASE OF DISTRIBUTED SYSTEMS, LESS THAN 5 POUNDS PER FOOT, WHICH ARE SUSPENDED FROM A ROOF OR FLOOR OR HUNG FROM A WALL.

FOR THOSE ELEMENTS THAT DO NOT REQUIRE DETAILS ON THE APPROVED DRAWINGS, THE INSTALLATION SHALL BE SUBJECT TO THE APPROVAL OF THE STRUCTURAL ENGINEER OF RECORD. THE PROJECT INSPECTOR WILL VERIFY THAT ALL COMPONENTS AND EQUIPMENT HAVE BEEN ANCHORED IN ACCORDANCE WITH THE ABOVE REQUIREMENTS.

PIPING AND DUCTWORK SYSTEM BRACING NOTE:

PIPING AND DUCTWORK SHALL BE BRACED TO COMPLY THE FORCE AND DISPLACEMENTS PRESCRIBED IN ASCE 7-10 SECTION 13.3 AS DEFINED IN ASCE 7-10 SECTION 13.6.5.6, 13.6.7, 13.6.8. AND 2019 CBC, SECTIONS 1616A.1.24, 1616A.1.25, AND 1615A.1.26.

THE BRACING AND ATTACHMENT TO THE STRUCTURE SHALL BE DETAILED ON THE APPROVED DRAWINGS OR THEY SHALL COMPLY WITH ONE OF THE OSHPD PRE-APPROVALS (OPM #) AS MODIFIED TO SATISFY ANCHORAGE REQUIREMENTS OF ACI 318, APPENDIX D.

COPIES OF THE MANUAL SHALL BE AVAILABLE ON THE JOBSITE PRIOR TO THE START OF HANGING AND BRACING OF THE PIPE AND DUCTWORK SYSTEMS.

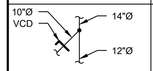
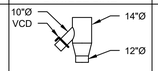
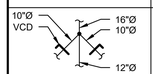
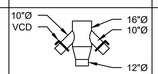
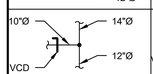
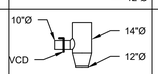
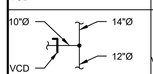
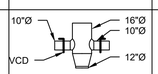
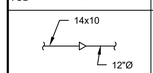
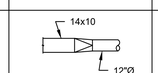
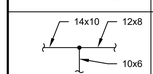
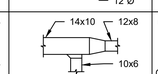
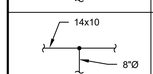
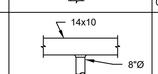
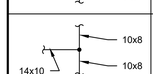
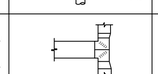
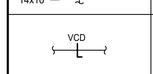
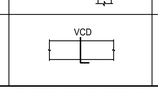
THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE STRUCTURE TO SUPPORT THE HANGER AND BRACE LOADS.

MECHANICAL NOTES

1. MECHANICAL AND PLUMBING DETAILS APPLY TO ALL BUILDINGS WHETHER REFERENCED OR NOT.
2. PROVIDE FIRE STOPPING ASSEMBLY PROTECTION FOR DUCT AND PIPE PENETRATIONS OF RATED ASSEMBLIES. FIRE STOP RATING SHALL MATCH RATED ASSEMBLY BEING PENETRATED.
3. CONTRACTOR TO OFFSET DUCTWORK AND PIPING AROUND SKYLIGHTS.
4. CONTRACTOR TO OFFSET DUCTWORK AND PIPING AROUND ROOF ACCESS LADDERS.
5. REFERENCE ARCHITECTURAL DRAWINGS FOR EXACT LOCATIONS OF DIFFUSERS/GRILLES.
6. DUCTWORK AND/OR PIPING SHALL NOT PENETRATE INTO, OVER, OR THROUGH IT CLOSETS OR ELECTRICAL ROOMS UNLESS IT SERVES THAT SPECIFIC ROOM.
7. DRAWINGS SHALL BE CONSIDERED DIAGRAMMATIC IN NATURE AND ARE NOT INTENDED TO SHOW EVERY OFFSET, FITTING, OR STRUCTURAL DIFFICULTY THAT MAY BE ENCOUNTERED DURING INSTALLATION OF WORK. THE CONTRACTORS SHALL COORDINATE LOCATION OF ALL DUCTWORK AND PIPING WITH ALL OTHER TRADES ON THIS PROJECT. LOCATION OF ALL ITEMS NOT DEFINITELY FIXED BY DIMENSIONS ARE APPROXIMATE ONLY. EXACT LOCATIONS NECESSARY TO SECURE BEST CONDITIONS AND RESULTS MUST BE DETERMINED AT THE JOB SITE AND SHALL HAVE THE APPROVAL OF THE ARCHITECT BEFORE BEING INSTALLED.
8. CEILING SUPPLY AIR DIFFUSERS TO HAVE 4-WAY BLOW PATTERN UNLESS SHOWN OTHERWISE.
9. ALL VALVES SHALL BE FULL LINE SIZES UNLESS NOTED OTHERWISE.
10. DUCTWORK AND PIPING (NOT REQUIRING SEISMIC RESTRAINTS) SHALL BE SUPPORTED IN ACCORDANCE TO SMACNA "GUIDELINES FOR SEISMIC RESTRAINTS OF MECHANICAL AND PLUMBING PIPING SYSTEMS".
11. ACCESS PANELS SHALL BE PROVIDED AS NECESSARY TO PROPERLY ACCESS THE VALVES, EQUIPMENT, ACTUATORS, AND DAMPERS.
12. REFERENCE ARCHITECTURAL DRAWINGS FOR BUILDING DIMENSIONS, EXACT LOCATIONS OF DIFFUSERS, GRILLES, AND MOUNTING HEIGHTS.
13. CONCEAL ALL PIPING AND DUCTWORK IN WALL FURRINGS, PARTITIONS, ABOVE CEILINGS, EXCEPT IN MECHANICAL ROOMS OR WHERE NOTED OTHERWISE.
14. THERMOSTATS TO BE INSTALLED AT 46" AFF (TOP OF THERMOSTAT). DO NOT INSTALL THERMOSTATS OVER CASEWORK OR SHELVING OVER 24" IN DEPTH AND 34" IN HEIGHT.
15. SAW DUST COLLECTION DUCTWORK IS SIZED IN COMPLIANCE WITH 2019 CMC CH. 5, TABLE 505.9 TO BE APPROXIMATELY 4,000 FPM.
16. SAWDUST COLLECTION DUCTWORK TO BE CLASS 2, 20 GAUGE STEEL PER CMC CHAPTER 5, TABLE 506.2. SEE SPECIFICATION 23-35-13 FOR ADDITIONAL INFORMATION.

DUCTWORK LEGEND

GENERAL DUCTWORK NOTES

SINGLE LINE	DOUBLE LINE	NOTES / DESCRIPTION
		45° BRANCH REDUCING LATERAL LOW LOSS
		45° REDUCING LATERAL CROSS LOW LOSS
		90° TEE LOW LOSS
		90° TEE CROSS LOW LOSS
		SQUARE TO ROUND
		CONVERGING OR DIVERGING TEE, 45° ENTRY, RECTANGULAR MAIN AND BRANCH. WHEN REDUCING MAIN, SIDE OF TAKEOFF OR ENTRY BRANCH TO BE FLAT, OTHER SIDES MAX. SLOPE OF 1:3
		ROUND DUCT TAKE OFF FROM RECTANGULAR VIA SMOOTH CONVERGING BELL MOUTH
		RECTANGULAR DUCT TEE THROAT SIZED FOR EQUAL PRESSURE DROP
		VOLUME CONTROL DAMPER

DUCTWORK SYMBOLS


FLEXIBLE DUCTWORK

DUCT (FIRST FIGURE SIDE SHOWN, SECOND FIGURE SIDE NOT SHOWN)

LINED DUCT (FIRST FIGURE SIDE SHOWN, SECOND FIGURE SIDE NOT SHOWN)


EXHAUST AIR DUCT SECTION


RETURN AIR DUCT SECTION


SUPPLY AIR DUCT SECTION

DROP IN DIRECTION OF ARROW

RISE IN DIRECTION OF ARROW


TURNING VANES

APPLICABLE CODES

ALL WORK PERFORMED UNDER THIS CONTRACT IS TO CONFIRM TO THE FOLLOWING CODES AND REGULATIONS:

1. CALIFORNIA CODE OF REGULATIONS - TITLE 24
2. CALIFORNIA BUILDING CODE, 2019
3. CALIFORNIA MECHANICAL CODE, 2019
4. CALIFORNIA PLUMBING CODE, 2019
5. CALIFORNIA FIRE CODE, 2019
6. CALIFORNIA ELECTRICAL CODE, 2019
7. CALIFORNIA BUILDING ENERGY EFFICIENCY STANDARDS, 2019

THE ABOVE CODES AND REGULATIONS REFER TO THE LATEST EDITION OR REVISION IF FORCE ON THE DATE OF THE CONTRACT, UNLESS OTHERWISE STATED. NOTHING ON THE DRAWINGS IS TO BE CONSTRUED AS REQUIRING OR PERMITTING WORK THAT IS CONTRARY TO THE LISTED CODES AND REGULATIONS, OR OTHER LOCAL, STATE OR FEDERAL CODES OR REGULATIONS WHICH MAY BE APPLICABLE.

SHEET INDEX

MECHANICAL LEGEND

ABBREVIATIONS

ABC	ABOVE FINISHED CEILING	FLR	FLOOR	OC	ON CENTER
AC	AIR CONDITIONING	FPM	FEET PER MINUTE	PC	PUMPED CONDENSATE
ACU	AIR CONDITIONING UNIT	FS	FLOW SWITCH	PD	PRESSURE DROP
AD	ACCESS DOOR	FSD	FIRE SMOKE DAMPER	PF	PRE FILTER
AFF	ABOVE FINISHED FLOOR	FT	FEET	PH	PHASE
AFC	ABOVE FINISHED CEILING	GA	GAUGE	PLBG	PLUMBING
AHU	AIR HANDLING UNIT	GC	GENERAL CONTRACTOR	POC	POINT OF CONNECTION
AP	ACCESS PANEL	GALV	GALVANIZED	POD	POINT OF DISCONNECTION
APD	AIR PRESSURE DROP	GSM	GALVANIZED SHEET METAL	PRV	PRESSURE REDUCING VALVE
AVV	AUTOMATIC AIR VENT	GPH	GALLONS PER HOUR	PS	PRESSURE SWITCH
ARCH	ARCHITECT	GPM	GALLONS PER MINUTE	PSI	POUNDS PER SQUARE INCH
BAS	BUILDING AUTOMATION SYSTEM	GV	GATE VALVE	PSIG	POUNDS PER SQUARE INCH GAUGE
BDD	BACK DRAFT DAMPER	HC	HEATING COIL	R	RISER
BF	BELOW FLOOR	HP	HORSEPOWER	RA	RETURN AIR
BHP	BRAKE HORSEPOWER	HPR	HIGH PRESSURE CONDENSATE RETURN	RAD	RETURN AIR DAMPER
BOD	BOTTOM OF DUCT	HPS	HIGH PRESSURE STEAM, ABOVE 60 PSIG	RD	REFRIGERANT DISCHARGE
BOP	BOTTOM OF PIPE	HR	HOUR	RF	RELIEF FAN
BTUH	BRITISH THERMAL UNIT PER HOUR	HRP	HEAT RECOVERY PUMP	RH	RELATIVE HUMIDITY
BV	BUTTERFLY VALVE	HRR	HEAT RECOVERY RETURN	RHC	REHEAT COIL
CA	COMPRESSED AIR	HRS	HEAT RECOVERY SUPPLY	RL	REFRIGERANT LIQUID
CAP	CAPACITY	HVAC	HEATING VENTILATING & AIR CONDITIONING	RLA	RUNNING LOAD AMPS
CAV	CONSTANT AIR VOLUME	HWP	HEATING WATER PUMP	RM	ROOM
CC	CENTER TO CENTER	HWR	HEATING WATER RETURN	RPM	REVOLUTIONS PER MINUTE
CD	CONDENSATE DRAIN	HWS	HEATING WATER SUPPLY	RS	REFRIGERANT SUCTION
CEF	CEILING EXHAUST FAN	HXR	HEAT EXCHANGER	RTS	REFER TO SPECIFICATIONS
CFM	CUBIC FEET PER MINUTE	ID	INSIDE DIAMETER	SA	SUPPLY AIR
CHWP	CHILLED WATER PUMP	IN WC	INCHES OF WATER COLUMN	SCD	SECONDARY CONDENSATE DRAIN
CHWR	CHILLED WATER RETURN	KW	KILOWATTS	SCH	SCHEDULE
CHWS	CHILLED WATER SUPPLY	KWH	KILOWATT HOUR	SCR	STEAM CONDENSATE RETURN
CO2	CARBON DIOXIDE	LAT	LEAVING AIR TEMPERATURE	SF	SUPPLY FAN
CU	CONDENSING UNIT	LBS	POUNDS	SHT	SHEET
CV	CONTROL VALVE	LDB	LEAVING DRY BULB	SHWP	SECONDARY HEATING WATER PUMP
CWP	CONDENSING WATER PUMP	LWB	LEAVING WET BULB	SM	SHEET METAL
CWR	CONDENSING WATER RETURN	LP	LOW PRESSURE	SMS	SHEET METAL SCREW
CWS	CONDENSING WATER SUPPLY	LPR	LOW PRESSURE CONDENSATE RETURN	SP	STATIC PRESSURE
D	DROP	LPS	LOW PRESSURE STEAM, 5-15 PSIG	SPD	STATIC PRESSURE DROP
DB	DRY BULB TEMPERATURE	LWT	LEAVING WATER TEMPERATURES	SQFT	SQUARE FEET
DET	DETAIL	LRA	LOCKED ROTOR AMPS	SQIN	SQUARE INCHES
DIA	DIAMETER	MAV	MANUAL AIR VENT	SS	STAINLESS STEEL
DIS	DEIONIZED (PURE) STEAM	MAX	MAXIMUM	TA	TO ABOVE
DN	DOWN	MBH	1,000 BRITISH THERMAL UNITS PER HOUR	TB	TO BELOW
DSD	DUCT SMOKE DETECTER	MC	MECHANICAL CONTRACTOR	TCV	TEMPERATURE CONTROL VALVE
DTR	DUCT THRU ROOF	MCC	MOTOR CONTROL CENTER	TG	TRANSFER GRILLE
DWG	DRAWING	MD	MANUEL DAMPER	TH	THERMOMETER
(E)	EXISTING	MFR	MANUFACTURER	TSP	TOTAL STATIC PRESSURE
(ER)	EXISTING RELOCATED	MIN	MINIMUM	TSTAT	THERMOSTAT
EA	EXHAUST AIR	MISC	MISCELLANEOUS	TYP	TYPICAL
EAD	EXHAUST AIR DAMPER	MPR	MEDIUM PRESSURE CONDENSATE RETURN	UON	UNLESS OTHERWISE NOTED
EAT	ENTERING AIR TEMPERATURE	(N)	NEW	UG	UNDER GROUND
EF	EXHAUST FAN	NC	NORMALLY CLOSED	UF	UNDER FLOOR
ELEC	ELECTRICAL	NFPA	NATIONAL FIRE PROTECTION ASSOCIATION	V	VOLTS
ESP	EXTERNAL STATIC PRESSURE	NIC	NOT IN CONTRACT	VAV	VARIABLE AIR VOLUME
ET	EXPANSION TANK	NO	NORMALLY OPEN	VD	VOLUME DAMPER
EWT	ENTERING WATER TEMPERATURE	NTS	NOT TO SCALE	VCD	VOLUME CONTROL DAMPER
°F	DEGREES FAHRENHEIT	NA	NOT APPLICABLE	VFD	VARIABLE FREQUENCY DRIVE
FA	FROM ABOVE	OA	OUTSIDE AIR	VLV	VALVE
FB	FROM BELOW	OAD	OUTSIDE AIR DAMPER	WB	WET BULB
FC	FLEXIBLE CONNECTION	OBD	OPPOSED BLADE DAMPER	WPD	WATER PRESSURE DROP
FCU	FAN COIL UNIT			WMS	WIRE MESH SCREEN
FD	FIRE DAMPER			W/	WITH
FF	FINAL FILTER			W/O	WITHOUT
FFU	FAN/FILTER UNIT			WT	WEIGHT
FLA	FULL LOAD AMPS			$	ON/OFF SWTCH/STARTER

SYMBOLS

CHWS	CHILLED WATER SUPPLY		BALL VALVE
CHWR	CHILLED WATER RETURN		BALANCE VALVE
CWS	CONDENSER WATER SUPPLY		BUTTERFLY VALVE
CWR	CONDENSER WATER RETURN		CHECK VALVE
HWS	HEATING HOT WATER SUPPLY		LEVER HANDLE GAS COCK
HWR	HEATING HOT WATER RETURN		PRESSURE REDUCING VALVE
RL	REFRIGERANT LIQUID LINE PIPING		SOLENOID VALVE W/ MOTOR ACTUATOR
RS	REFRIGERANT SUCTION LINE PIPING		STRAINER
	FLOW IN DIRECTION OF ARROW		PRESSURE GAUGE
	REDUCER		THERMOMETER
	OUTSIDE AIR INTO LOUVER		UNION
	RETURN OR EXHAUST AIR INTO REGISTER		VALVE BOX
	SUPPLY AIR FROM REGISTER		CAP (END OF PIPE)
	SUPPLY AIR GRILLE ID - SIZE / CFM		CIRCULATING PUMP
	RETURN AIR GRILLE ID - SIZE / CFM		ANGLE VALVE
	EXHAUST AIR GRILLE ID - SIZE / CFM		PRESSURE OR TEMP. RELIEF VALVE
		Ø	DIAMETER
		T	ROOM THERMOSTAT
	ITEM TO BE REMOVED / DEMOED		POINT OF CONNECTION
	ITEM TO BE ABANDONED IN PLACE		POINT OF DISCONNECTION
		ROOM NAME --	ROOM NAME AND NUMBER

CONSULTANT

SACRAMENTO CITY COLLEGE
EST. 1916

WESTON & ASSOCIATES
MECHANICAL ENGINEERS
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WESTON & ASSOCIATES #22-061

REGISTERED PROFESSIONAL ENGINEER
ADAM C. DAVIS
M 34869
EXPIRES 06/30/24
MECHANICAL
STATE OF CALIFORNIA

LOS RIOS COMMUNITY COLLEGE DISTRICT
SACRAMENTO CITY COLLEGE MAKER SPACE
3835 FREEPORT BOULEVARD
SACRAMENTO, CA 95822

SHEET TITLE:
MECHANICAL LEGENDS AND NOTES

SCALE: AS SHOWN

REVISIONS

No.	Issue Description	Date

Drawn By: BZ

Checked By: AD

JOB NO. 22-061

DATE 02-01-2023

SHEET NUMBER M0.1 of

GRADE MOUNTED HEAT PUMP UNIT SCHEDULE

SYMBOL	MANUFACTURER & MODEL NUMBER	NOMINAL TONNAGE	SUPPLY AIR FAN					MIN. COOLING CAPACITY (MBH) @ ARI CONDITIONS)		HEATING CAPACITY		MINIMUM EER (SEER)	MINIMUM OUTSIDE AIR (CFM)	ELECTRICAL DATA				POWER EXHAUST MODEL #	POWER EXHAUST				DUCT SMOKE DETECTOR	MAXIMUM UNIT WEIGHT (LBS.)
			CFM	HP	bHP	TSP	ESP	GROSS TOTAL	NET SENSIBLE	INPUT (KW)	OUTPUT (MBH)		OCCUPIED CO2 ≤ 600 PPM	MCA / FLA / MOCP	VOLTS	PHASE	HERTZ		FLA	HP	MCA	MOCP		
HP 2	CARRIER MODEL: 50FCQM07A2A5	6	2,100	1.8	1.26	1.41	1.0	69.2	65.5	4.96	56.5	11.2	600	47 / 44 / 60	208	3	60	"MICROMETL" PECH-SRT12CB-D2DH-2L1	6.4	1.0	8.0	14.4	YES	825
HP 3	CARRIER MODEL: 50FCQM07A2A5	6	2,100	1.8	1.26	1.41	1.0	69.2	65.5	4.96	56.5	11.2	450	47 / 44 / 60	208	3	60	"MICROMETL" PECH-SRT12CB-D2DH-2L1	6.4	1.0	8.0	14.4	YES	825
HP 4	iAIRE MODEL: UPC-FC09MHT019M00B	8.5	2,300	2.4	2.0	1.41	1.0	95.9	94.9	25.1	39.2	11.2	350	91 / 53 / 100	208	3	60	"MICROMETL" PECH-SRT12CB-D2DH-2L1	6.4	1.0	8.0	14.4	YES	1,197

1. SCHEDULED COOLING CAPACITIES ARE LISTED AT - 105°F AMBIENT, 80°F DB / 67°F WB.
2. PROVIDE ALL UNITS WITH THE FOLLOWING MANUFACTURER'S FACTORY INSTALLED OPTIONS / ACCESSORIES:
   - HINGED ACCESS PANELS
   - STAINLESS STEEL HEAT EXCHANGERS
   - COIL GUARDS
   - 2" PLEATED PRE-FILTERS (MERV 13 FILTERS)
   - TXV VALVE
   - 0-100% FDD ECONOMIZER WITH BELIMO ACTUATOR.
   - VFDs ON SUPPLY AIR FAN AND EXHAUST AIR FAN.
3. UNITS GREATER THAN 2,000 CFM SUPPLY TO BE PROVIDED WITH A DUCT SMOKE DETECTOR IN THE SUPPLY AIR DUCT UNLESS NOTED OTHERWISE. WIRE UNIT TO SHUT DOWN UPON DETECTION OF SMOKE.
4. PROVIDE CURRENT SWITCH INTERLOCK BETWEEN SAWDUST COLLECTOR AND ECONOMIZER.

HEAT PUMP SCHEDULE (WITH DX COIL)

UNIT	"CARRIER" MODEL	SA TOTAL CFM	OA TOTAL CFM	ESP PER UNIT (in WG)	MOTOR PER UNIT			HEAT PUMP PER UNIT		HSPF	UNIT MCA	UNIT MOCP	CONDENSING UNIT	OPERATING WEIGHT PER UNIT (LBS)	MOUNTING DETAIL	CONTROL DIAGRAM	COMMENTS
					HP	FLA	VOLTS/PH	INPUT (MBH)	HEATSTRIP (KW)								
FC 1	FV4CNB006L00	2,000	450	0.5	0.75	6.8	208/1	49	3.8	8.2	31.2	35.0	HP 1	207	1 / M5.1	- / M5.1	1

SCHEDULE NOTES:
1. COOLING CAPACITIES BASED ON 101 DEG. F OUTSIDE AIR DRY BULB TEMPERATURE.
2. WEIGHTS LISTED INCLUDE COOLING COIL.
3. PROVIDE CRANKVASE HEATER KIT, QUICK START KIT.
4. PROVIDE "MICROMETL" MB-GP20CA-D2DH ECONOMIZER WITH ALL INDOOR UNITS.

COMMENTS NOTES:
1. PROVIDE UNITS WITH MERV 13 FILTERS

CONDENSING UNIT SCHEDULE

UNIT	"CARRIER" MODEL NO.	NOMINAL CAPACITY (TONS)	COOLING				ELECTRICAL DATA PER UNIT							SEER (EER)	OPERATING WEIGHT PER UNIT (LBS.)	MOUNTING DETAIL	COMMENTS
			TOTAL CAP. (MBH)	SENS. CAP. PER UNIT (MBH)	EDB (oF)	EWB (oF)	VOLTS/ PHASE	COMPRESSOR			COND. FAN		UNIT MCA	UNIT MOCP			
								QTY.	RLA	LRA	QTY.	FLA					
HP 1	25HCE460AP05	5	51.5	44.2	105	70	208/3	1	16.0	110.0	1	1.52	21.5	30	14 (11.5)	248	2 / M5.1	1

SCHEDULE NOTES:
1. CONDENSER ENTERING AIR TEMPERATURE = 101 F.
2. ALL LISTED VALUES ARE PER UNIT, UNLESS OTHERWISE NOTED.
3. SEE MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR REFRIGERANT PIPING DIAGRAM.

COMMENTS NOTES:
1. UNIT TO BE PROVIDED WITH R-410a REFRIGERANT.

DIFFUSER / GRILLE SCHEDULE

TAG	MANUFACTURER / MODEL #	DISCRIPTION
S1	TITUS MODEL S300FL	SPIRAL DIRECT DUCT MOUNT SUPPLY AIR DIFFUSER. DIFFUSER TO BE DOUBLE DEFLECTION GRILLE WITH LONG BLADES IN FRONT. EACH BLADE TO BE SPACED AT 3/4" AND BE INDIVIDUALLY ADJUSTABLE. PROVIDE WITH OPTIONAL MODEL ASD-AIR SCOOP DAMPER/EXTRACTOR.
R1 E1	TITUS MODEL 350ZRL	SIDEWALL LINEAR BAR RETURN/EXHAUST AIR GRILLE: GRILLE TO BE AS FOLLOWS: • STEEL LINEAR BAR GRILLE. • GRILL TO HAVE A 0° FIXED DEFLECTION ANGLE. • BLADES TO BE SPACED AT 3/4" • PROVIDE BORDER TYPE 1 FOR SURFACE MOUNT INSTALLATION

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REGISTERED PROFESSIONAL ENGINEER ADAM C. DAVIS M 34869 EXPIRES 06/30/24 MECHANICAL STATE OF CALIFORNIA

LOS RIOS COMMUNITY COLLEGE DISTRICT
SACRAMENTO CITY COLLEGE MAKER SPACE
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SHEET TITLE:
MECHANICAL EQUIPMENT SCHEDULES

SCALE: AS SHOWN

REVISIONS

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Drawn By: BZ
Checked By: AD

JOB NO. 22-061
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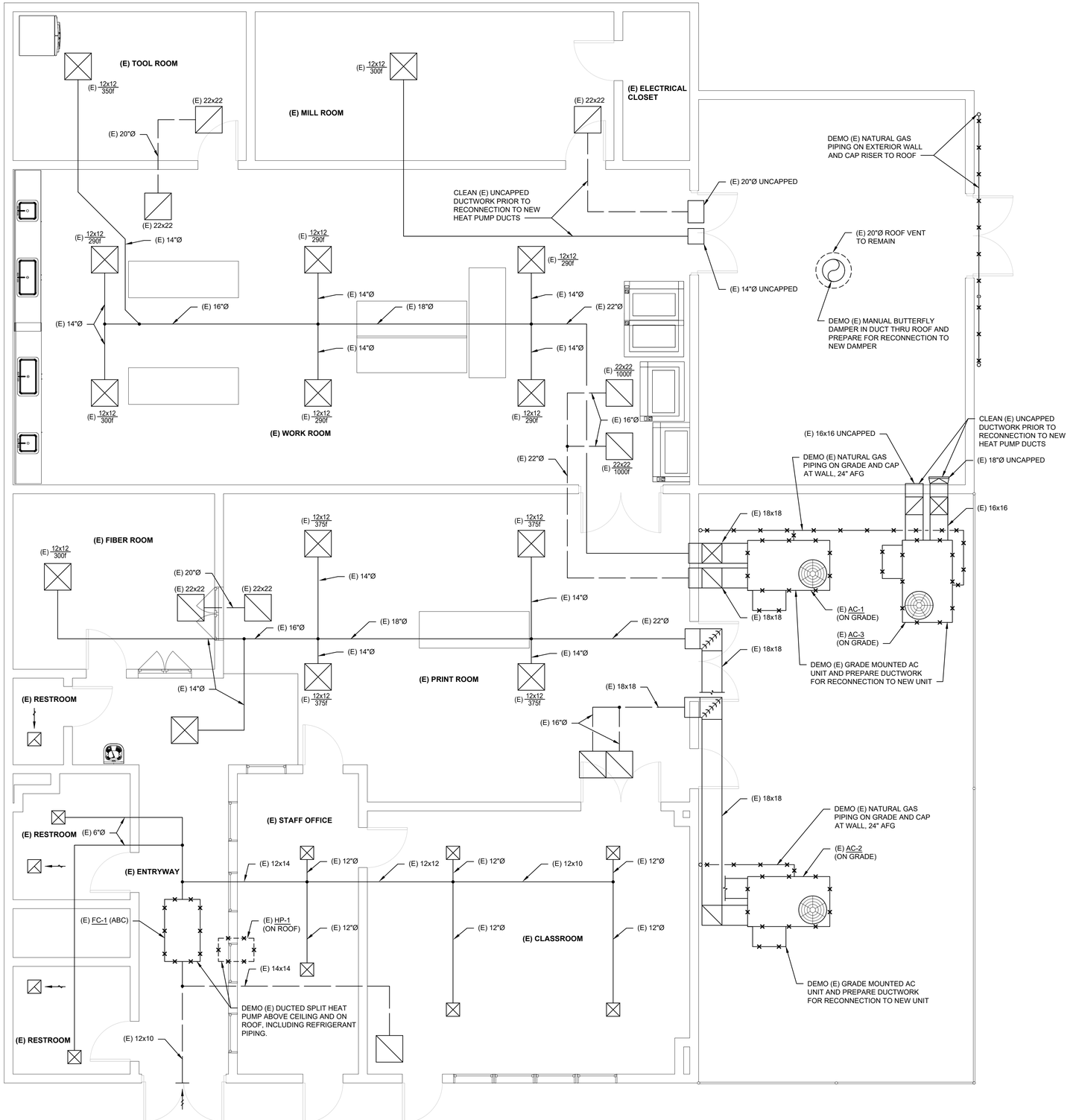
SHEET NUMBER M0.2 of



MECHANICAL DEMO FLOOR PLAN

SCALE: 1/4"=1'-0"

1 / M2.0

N

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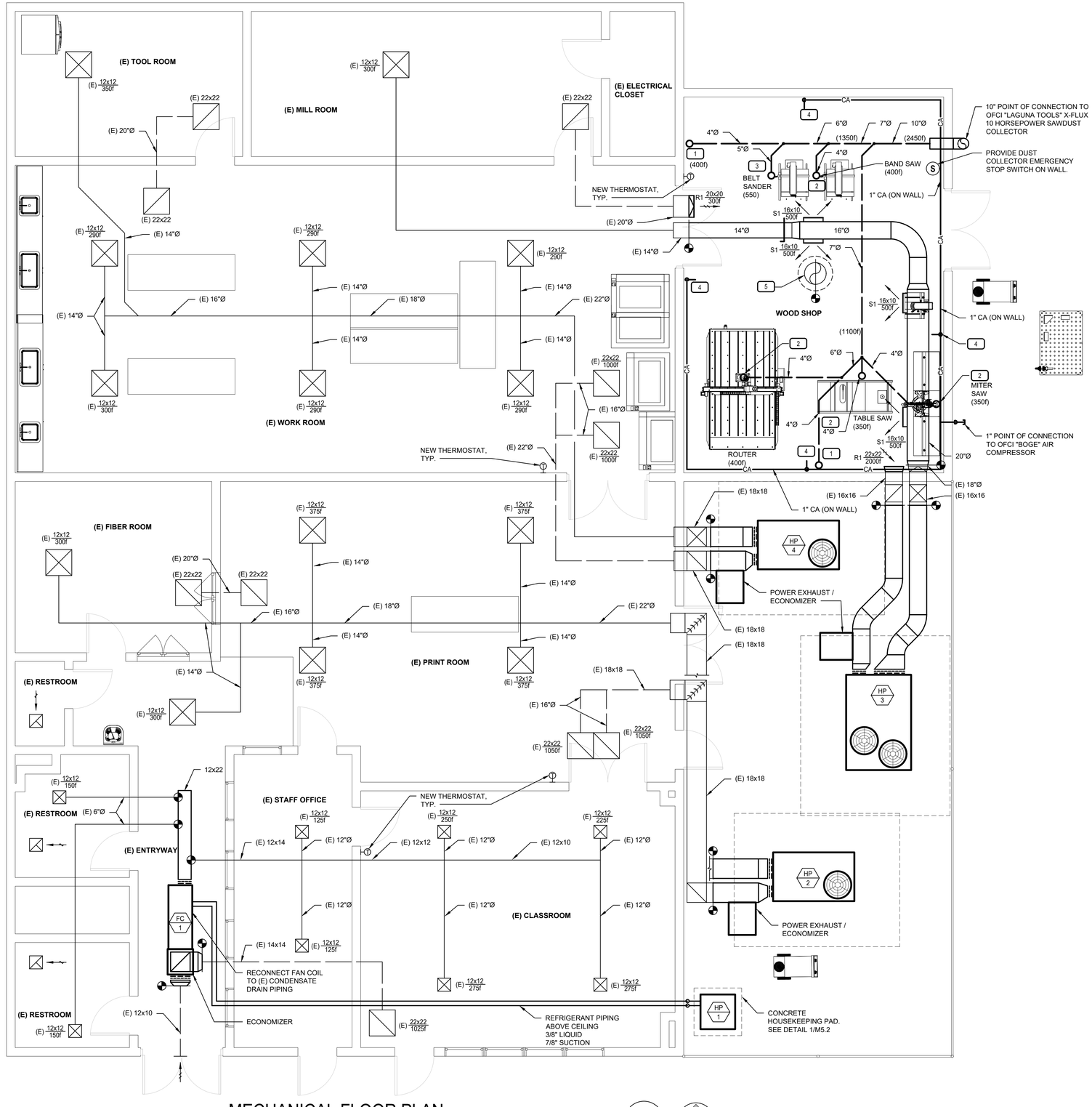
SHEET NOTES

1	4" EXHAUST TO FLOOR SWEEP. PROVIDE SIGNAGE AT FLOOR SWEEP TO READ, "FOR PROPER DUST EXTRACTION, FLOOR SWEEP BLAST GATES MUST REMAIN CLOSED UNLESS IMMEDIATELY IN USE."
2	ROUTE 4" EXHAUST DROP DOWN 18" ABOVE EQUIPMENT SURFACE. PROVIDE 4" FLEX HOSE TO EQUIPMENT CONNECTION.
3	ROUTE 5" EXHAUST DROP DOWN 18" ABOVE EQUIPMENT SURFACE. PROVIDE 5" FLEX HOSE TO EQUIPMENT CONNECTION.
4	ROUTE 1" CA DOWN WALL TO QUICK COUPLER OUTLET PER 5/M5.1
5	RECONNECT NEW 20"Ø INTAKE GRAVITY BACKDRAFT DAMPER TO (E) 20" DUCT THRU ROOF

KEYED NOTES ABOVE MAY NOT APPLY TO EACH SHEET. SEE SHEETS FOR KEYED NOTE REFERENCES. GENERAL NOTES BELOW APPLY TO EVERY SHEET.

GENERAL NOTES:

1. DUCTWORK SIZED FOR MINIMUM 4,000 FPM.



MECHANICAL FLOOR PLAN

SCALE: 1/4"=1'-0"

1 / M2.1

N

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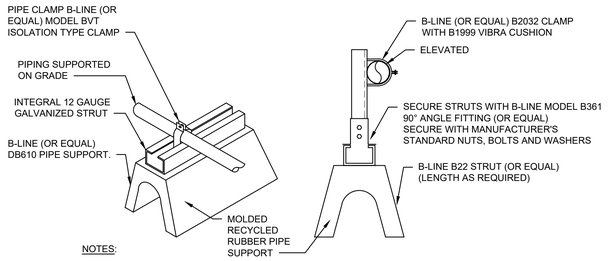
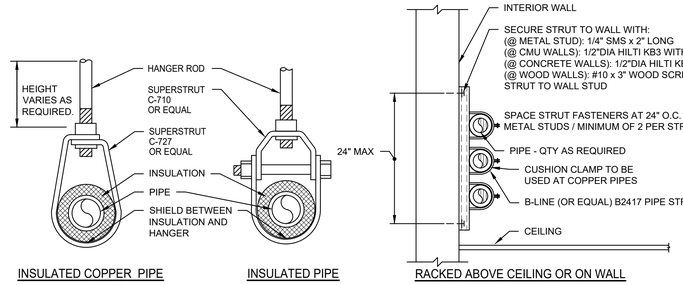


NOTES:

1. WHERE EXTENDED HEIGHT IS REQUIRED, PROVIDE WITH MODEL B408 SINGLE CHANNEL BRACKET. ATTACHED TO BASE STRUT WITH SPRING-NUTS AND BOLTS. ATTACH PIPE TO ELEVATED BRACKET.
2. MAXIMUM SPACING BETWEEN SUPPORTS NOT TO EXCEED 6'-0".
3. SUPPORT DETAIL TO BE USED FOR CONDENSATE PIPING.

PIPE SUPPORT ON GRADE DETAIL

NTS — 7 / M6.1



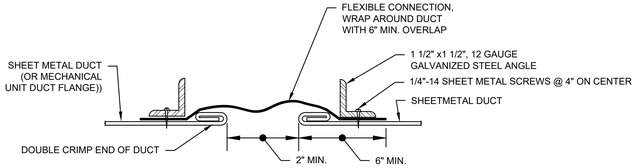
INSULATED COPPER PIPE — INSULATED PIPE — RACKED ABOVE CEILING OR ON WALL

NOTES:

1. MOUNTING DETAILS ABOVE ARE FOR PIPES THAT DO NOT REQUIRE SEISMIC BRACING. WHERE SEISMIC BRACING IS REQUIRED, SEE BRACING AND ANCHORAGE NOTES ON SHEET P0.0.1
2. WHERE MULTIPLE PIPING IS INSTALLED PARALLEL, PIPING SHALL BE INSTALLED ON A PIPE TRAPEZE PER MASON OPM-0052-13 SEISMIC RESTRAINT GUIDELINE.
3. MOUNTING DETAILS APPLY TO REFRIGERANT PIPING. FOR FIRE SPRINKLER PIPE MOUNTING, SEE FIRE SPRINKLER DRAWING DETAILS.
4. FOR HANGER ROD SUPPORT TO STRUCTURE, SEE 9/M601
5. MAX PIPE SIZE SHALL BE 1-1/8 DIA.

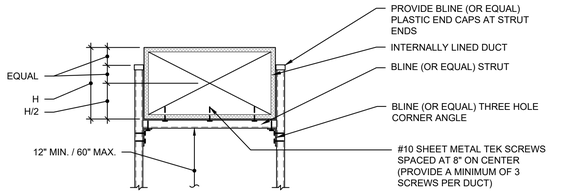
HANGER ROD / PIPE SUPPORT SUPPORT DETAILS FOR REFRIGERANT PIPING ONLY

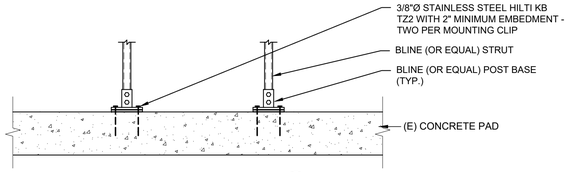
NTS — 5 / M5.1



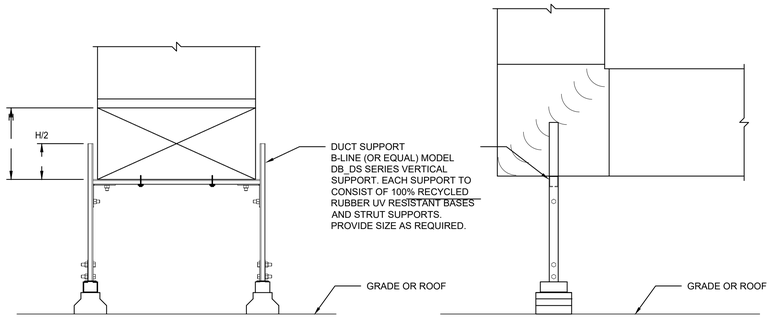
FLEXIBLE DUCT CONNECTION DETAIL

NTS — 2 / M5.1



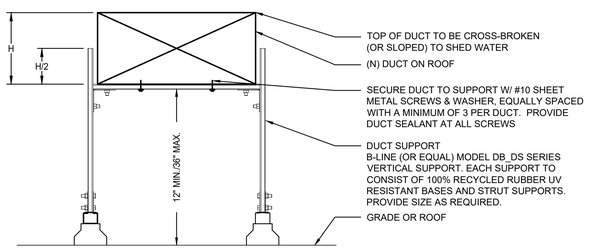


DUCT SUPPORT - STYLE (4)



END VIEW — END VIEW

DUCT SUPPORT - STYLE (3)



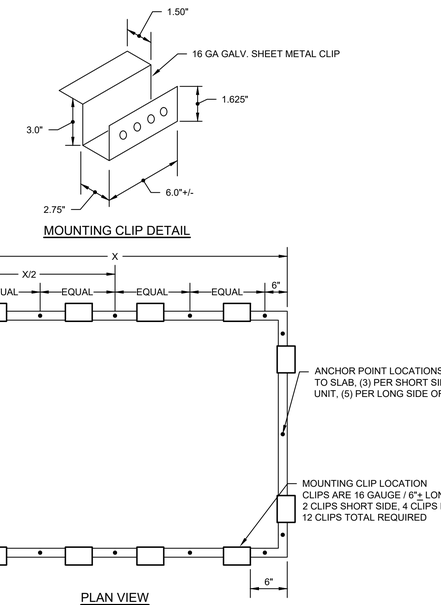
DUCT SUPPORT - STYLE (1)

NOTES:

1. CONNECT STRUT/FITTINGS TOGETHER WITH MANUFACTURERS HEX SCREWS AND STANDARD NUTS (WITHOUT SPRINGS). PROVIDE LOCK WASHER AT EACH CONNECTION.
2. MAXIMUM SPACING BETWEEN SUPPORTS TO BE 6'-0".

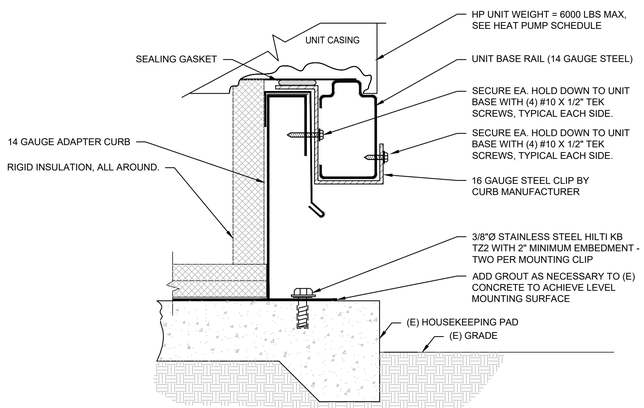
EXTERIOR DUCT SUPPORT DETAIL

NTS — 1 / M5.1



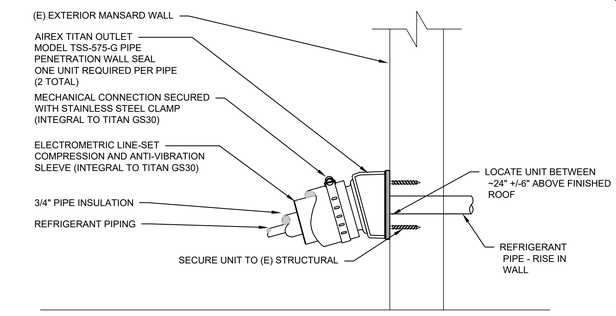
MOUNTING CLIP DETAIL

PLAN VIEW



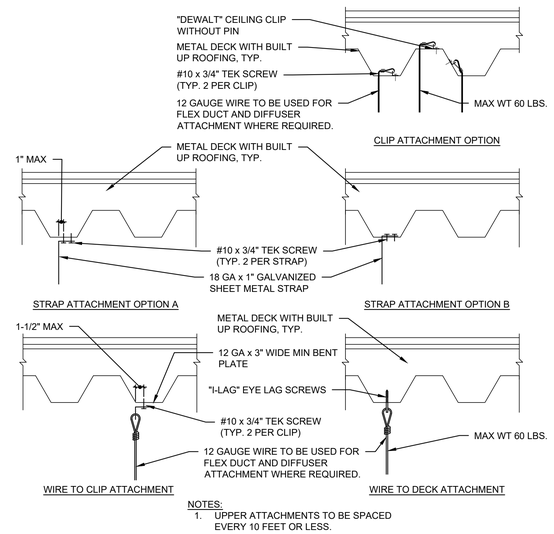
HP UNIT MOUNTING DETAIL

NTS — 6 / M6.1



REFRIGERANT PIPING SIDEWALL PENETRATION DETAIL

NTS — 4 / M5.1



NOTES:

1. UPPER ATTACHMENTS TO BE SPACED EVERY 10 FEET OR LESS.

UPPER ATTACHMENTS AT METAL DECK

NTS — 3 / M5.1

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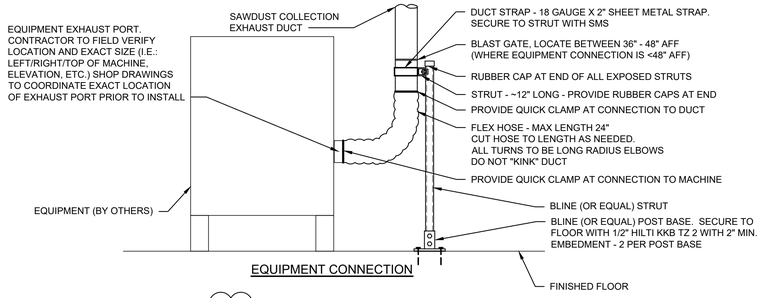
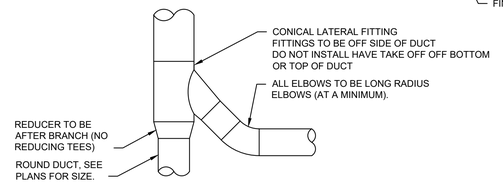


EQUIPMENT CONNECTION



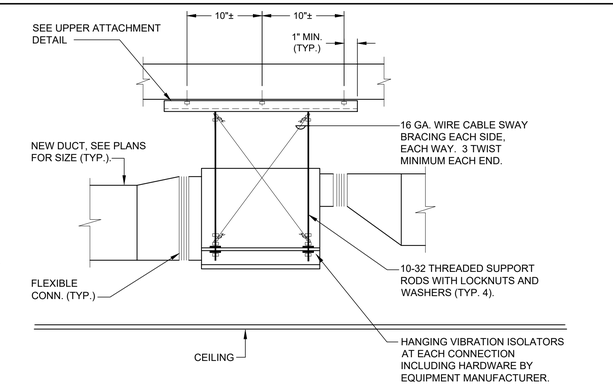
BRANCH TAKE OFF

NOTES:

1. DUCT SYSTEMS NOT INSTALLED IN ACCORDANCE WITH THIS DETAIL WILL BE REJECTED.
2. ALL FITTINGS TO BE LONG RADIUS FITTINGS AT A MINIMUM
3. DO NOT SECURE FITTINGS WITH SCREWS. SYSTEM TO BE FLANGED CONNECTIONS OR POP-RIVET - REFERENCE SPECIFICATIONS.
4. SEAL ALL CONNECTIONS. WITH DUCT SEALANT

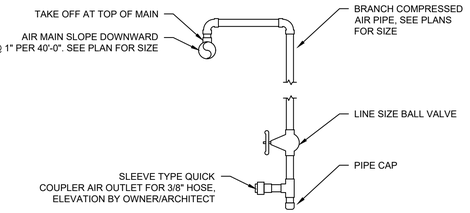
DUST COLLECTOR DUCT DETAIL

NTS — 7 / M5.2



INLINE DUCTED SPLIT SYSTEM MOUNTING

NTS — 4 / M5.2



AIR PIPING TAKE-OFF DETAIL

NTS — 3 / M5.2

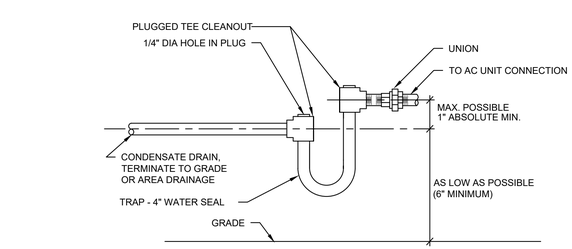
METAL DECK

NOTES:

1. REDUCE HANGER SPACING AS REQUIRED BASED ON MAX. ALLOWABLE HANGER LOAD SPECIFIED.
2. MAXIMUM ALLOWABLE HANGER LOAD TO BE 75 LBS PER FLUTE.
3. PIPE HANGER RODS TO BE 3/8" DIA

HANGER ROD SUPPORT DETAILS

NTS — 6 / M5.2

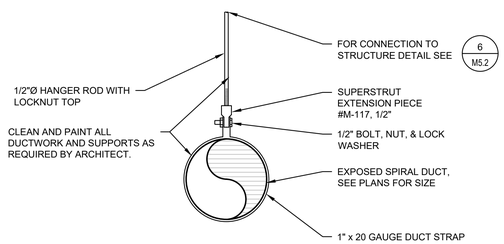


NOTES:

1. FOR CONDENSATE DRAIN PIPE SUPPORT, SEE DETAIL 7/M6.1

CONDENSATE TRAP DETAIL

NTS — 2 / M5.2

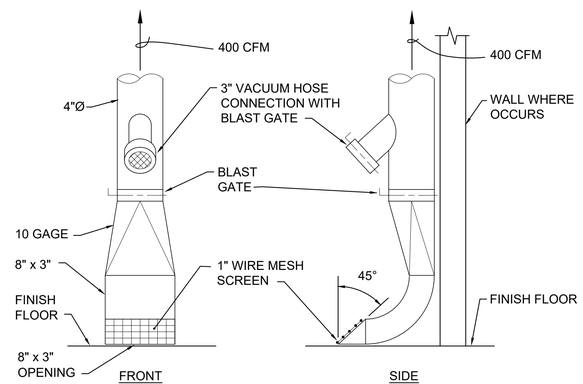


NOTES:

1. MAXIMUM SPACING OF SUPPORTS TO BE 10'-0".
2. DETAIL IS FOR EXPOSED DUCT THAT IS 6 SQUARE FEET OR LESS

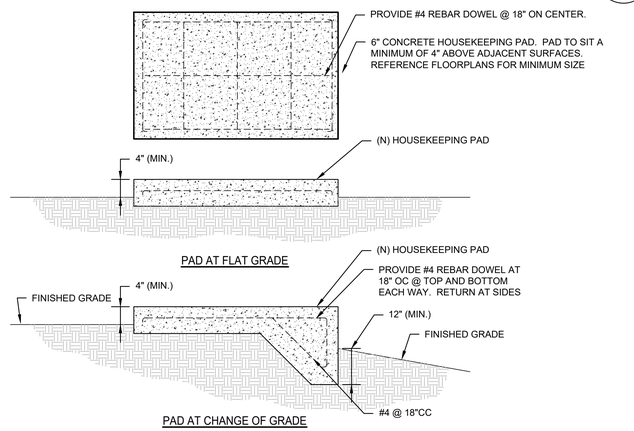
EXPOSED DUCT SUPPORT DETAIL

NTS — 3 / M6.2



FLOOR SWEEP DETAIL

NTS — 5 / M5.2



CONCRETE HOUSEKEEPING PAD DETAIL

NTS — 1 / M5.2

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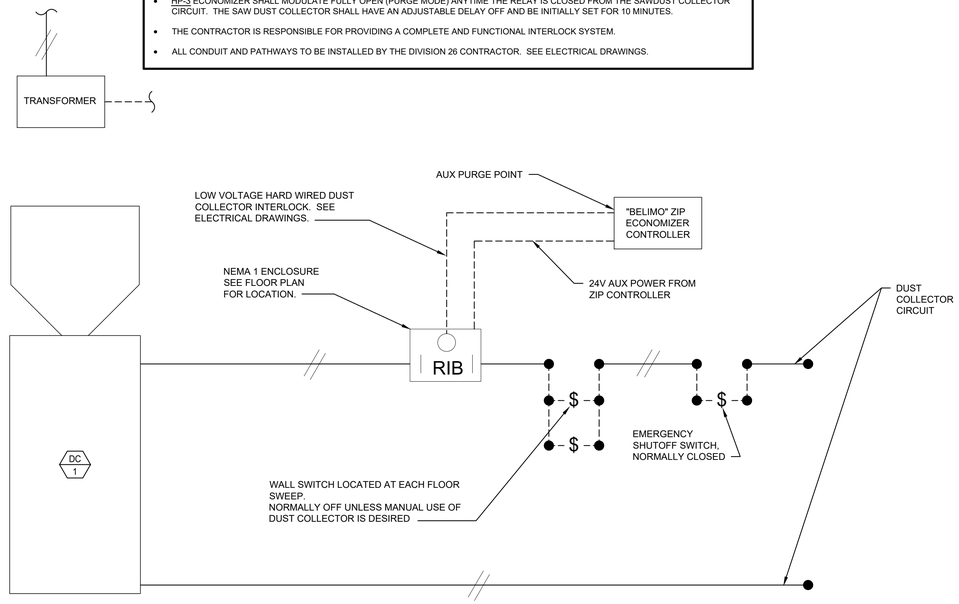
SEQUENCE OF OPERATION

- THE CONTRACTOR SHALL PROVIDE AN INTERLOCK BETWEEN SAWDUST COLLECTOR CIRCUITS AND HP-3 BELIMO ECONOMIZER CONTROLLER, REFERENCE ELECTRICAL DRAWINGS.
- HP-3 ECONOMIZER SHALL MODULATE FULLY OPEN (PURGE MODE) ANYTIME THE RELAY IS CLOSED FROM THE SAWDUST COLLECTOR CIRCUIT. THE SAW DUST COLLECTOR SHALL HAVE AN ADJUSTABLE DELAY OFF AND BE INITIALLY SET FOR 10 MINUTES.
- THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING A COMPLETE AND FUNCTIONAL INTERLOCK SYSTEM.
- ALL CONDUIT AND PATHWAYS TO BE INSTALLED BY THE DIVISION 26 CONTRACTOR. SEE ELECTRICAL DRAWINGS.



NOTES:

1. PROVIDE LOW VOLTAGE TRANSFORMER(S) AS REQUIRED FOR EQUIPMENT INTERLOCK.
2. REFERENCE ELECTRICAL DRAWINGS AND DIV 26 SPECIFICATIONS FOR ALL LINE VOLTAGE REQUIREMENTS. CONDUIT ROUTING AND MATERIALS SHOWN ABOVE SHALL ADHERE TO THE DIV 26 REQUIREMENTS.
3. THE MECHANICAL CONTRACTOR AND ELECTRICAL CONTRACTOR SHALL CLOSELY COORDINATE ALL DIVISION OF WORK ASSOCIATED WITH THE DUST COLLECTOR INTERLOCK BETWEEN TRADES.
4. ALL CONDUIT AND PATHWAYS TO BE INSTALLED BY THE DIVISION 26 CONTRACTOR. SEE ELECTRICAL DRAWINGS.

SAWDUST COLLECTOR CONTROL

NTS

3 M6.1

GENERAL NOTE:
1. ALL CONTROLS TO BE BACNET OPEN ARCHITECTURE, ALL BLT LISTED DEVICES.
2. ALL ACTUATORS SHALL BE BELIMO.

SEQUENCE OF OPERATION:

AIR CONDITIONING UNITS WITH POWER EXHAUST

SUPPLY FAN CONTROL:

THE VARIABLE SPEED SUPPLY FAN (SF-C) WILL BE STARTED BASED ON OCCUPANCY SCHEDULE (OCC-SCHEDULE). WHEN THE SUPPLY FAN STATUS (SF-S) INDICATES THE FAN STARTED, THE CONTROL SEQUENCE WILL BE ENABLED. THE SUPPLY FAN (SF-O) WILL MODULATE TO MAINTAIN THE DISCHARGE STATIC PRESSURE (DA-P) AT SETPOINT (DAP-SP). UPON A LOSS OF AIRFLOW (SF-S), THE SYSTEM WILL ATTEMPT TO AUTOMATICALLY RESTART UNTIL POSITIVE STATUS IS RECEIVED.

POWER EXHAUST FAN CONTROL:

THE POWER EXHAUST FAN, WILL MODULATE TO MAINTAIN THE BUILDING STATIC PRESSURE AT SETPOINT (BLDGP-SP).

ECONOMIZER CONTROL:

WHEN THE OUTDOOR AIR (OA-T) IS COOLER THAN THE ECONOMIZER SETPOINT, THE ECONOMIZER WILL ACT AS THE INITIAL STAGE OF COOLING, WORKING IN SEQUENCE WITH THE COOLING COIL.

HP-3 ECONOMIZER SHALL BE INTERLOCKED WITH SAWDUST COLLECTOR TO MODULATE FULL OPEN WHEN SAWDUST COLLECTOR IS ENABLED. HEAT PUMP CONTROL WILL SENSE DISCHARGE AIR TEMPERATURE (DA-T) AND MODULATE COMPRESSOR AS NECESSARY TO MAINTAIN SETPOINT.

TEMPERATURE CONTROL:

THE UNIT WILL CONTROL TO MAINTAIN THE LOCALLY ADJUSTABLE ZONE TEMPERATURE SETPOINT (ZNT-SP) AS SENSED BY THE ZONE TEMPERATURE SENSOR (ZN-T). THE UNIT WILL CONTROL TO MAINTAIN THE ZONE TEMPERATURE SETPOINT (ZNT-SP) AS SENSED BY THE ZONE TEMPERATURE SENSOR (ZN-T).

OCCUPIED MODE:

THE OCCUPANCY MODE WILL BE CONTROLLED VIA A NETWORK INPUT (OCC-SCHEDULE). THE OCCUPANCY MODE CAN ALSO BE OVERRIDDEN BY A NETWORK INPUT (OCC-OVERRIDE) OR A TEMPORARY OCCUPANCY SWITCH (ZN-TOCC) ON THE ZONE TEMPERATURE SENSOR (ZN-T).

UNOCCUPIED MODE:

THE UNIT WILL REMAIN OFF DURING UNOCCUPIED PERIODS.

DX/HP COIL:

THE HEAT PUMP CONTROL WILL SENSE THE DISCHARGE AIR TEMPERATURE (DA-T) AND MODULATE THE VARIABLE COMPRESSOR TO MAINTAIN DISCHARGE AIR TEMPERATURE SETPOINT (ADJ.) REVERSING VALVE SHALL ENABLE AS NECESSARY TO SWITCH BETWEEN HEATING AND COOLING TO MAINTAIN DISCHARGE AIR TEMPERATURE FROM THE COIL (CLG1-C).

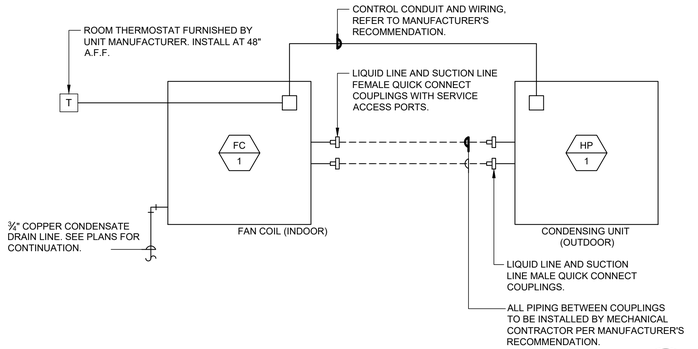
ALARMS:

THE DDC CONTROLLER WILL SEND AN ALARM TO THE OPERATOR WORKSTATION IF THE ZONE TEMPERATURE (ZN-T) RISES 5°F (ADJUSTABLE) ABOVE OR BELOW THE SETPOINT (ZNT-SP).

THE DDC CONTROLLER WILL SEND AN ALARM TO THE OPERATOR WORKSTATION AS FILTERS ARE LOADED. ALARM FOR PRE-FILTERS (PFILT-DP) TO BE SET TO 0.9" W.C. (ADJUSTABLE).

ADDITIONAL POINTS MONITORED BY THE FMS:

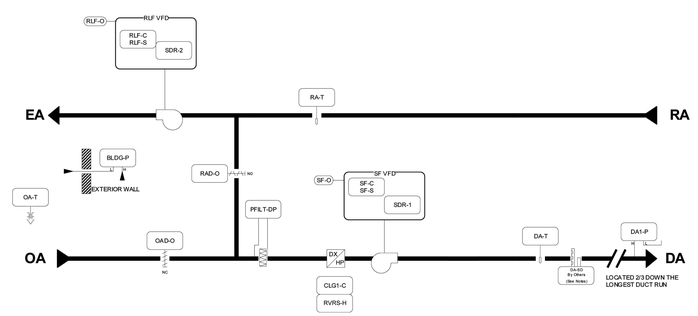
- DISCHARGE AIR TEMPERATURE (DA-T)
- RETURN AIR TEMPERATURE (RA-T)
- RELIEF FAN STATUS (RLF-S)
- DISCHARGE AIR SMOKE DETECTOR (DA-SD) - DISABLES THE FAN(S) VIA A HARD WIRED SHUTDOWN CIRCUIT



SPLIT SYSTEM HEAT PUMP CONTROLS

NTS

2 M6.1



Notes:
1) Locate control panel at AHU

"Belimo" Zip economizer controller with fast action damper motor

AC Unit with Powered Exhaust

HP UNIT CONTROL DIAGRAM

SCALE: NONE

1 M6.1

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REGISTERED PROFESSIONAL ENGINEER ADAM C. DAVIS M-34869 EXPIRES 06/30/24 MECHANICAL STATE OF CALIFORNIA

LOS RIOS COMMUNITY COLLEGE DISTRICT

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SHEET TITLE:
MECHANICAL CONTROLS

SCALE: AS SHOWN

REVISIONS

No.	Issue Description	Date

Drawn By: BZ

Checked By: AD

JOB NO. 22-061

DATE 02-01-2023

SHEET NUMBER M6.1 of

23-00-00 - MECHANICAL GENERAL CONDITIONS

PART 1 - GENERAL

1.01 GENERAL:

A. THIS SECTION SPECIFIES THE DIVISION 23 WORK COORDINATION REQUIREMENTS WITH GENERAL WORK PROVISIONS.

B. FOR CONVENIENCE AND REFERENCE THE DIVISION 23 SPECIFICATIONS ARE SEPARATED INTO DIVISIONS AND SECTIONS. SUCH SEPARATIONS SHALL NOT OPERATE TO MAKE THE ENGINEER AN ARBITRATOR TO ESTABLISH SUBCONTRACT LIMITS BETWEEN THE PRIME CONTRACTOR AND HIS SUBCONTRACTORS. IN ANY CASE, THE PRIME CONTRACTOR IS RESPONSIBLE TO THE OWNER FOR A COMPLETE JOB.

C. THIS SECTION CONSISTS OF GENERAL REQUIREMENTS AND STANDARD SPECIFICATIONS COVERING CERTAIN PARTS OF WORK UNDER DIVISION 23 AND IS SUPPLEMENTED BY OTHER DIVISION 23 SECTIONS COVERING ADDITIONAL WORK, REQUIREMENTS, AND MATERIALS SPECIFICALLY APPLICABLE TO THE WORK OF EACH SECTION.
1. REQUIREMENTS OF SUBSEQUENT SECTIONS OF THE SPECIFICATIONS, IF IN CONFLICT WITH THESE GENERAL REQUIREMENTS, SHALL GOVERN.

D. NO MATERIAL INSTALLED AS PART OF THIS WORK SHALL CONTAIN ASBESTOS IN ANY FORM.

1.02 CONDITIONS OF THE CONTRACT

A. THE CONDITIONS OF THE CONTRACT (GENERAL, SUPPLEMENTARY, AND OTHER CONDITIONS) AND THE GENERAL REQUIREMENTS (SECTIONS OF DIVISION 1) ARE HEREBY MADE A PART OF THIS SECTION.

B. THIS SECTION IS A DIVISION 23 BASIC MATERIALS AND METHODS SECTION AND IS A PART OF EACH DIVISION 23 SECTION.

1.03 DESCRIPTION OF REQUIREMENTS

A. PROVIDE FINISHED WORK, TESTED AND READY FOR OPERATION INCLUDING APPARATUS, APPLIANCES, MATERIALS, AND WORK. PROVIDE INCIDENTAL ACCESSORIES NECESSARY TO MAKE THE WORK COMPLETE AND READY FOR OPERATION WITHOUT ADDITIONAL EXPENSE TO THE OWNER.

B. BEFORE BEGINNING WORK OR ORDERING MATERIALS, CONSULT ARCHITECT FOR CLARIFICATION OF DISCREPANCIES BETWEEN, OR QUESTIONABLE INTENT, OF THE CONTRACT DOCUMENTS.

C. CONTRACTOR SHALL VISIT THE SITE AND FIELD SURVEY THE EXISTING SITE CONDITIONS PRIOR TO BID. ANY SITE CONDITIONS WHICH MAY CAUSE SIGNIFICANT DEVIATION FROM THE DESIGN DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE FOR CLARIFICATION PRIOR TO BID.

1.04 REQUIREMENTS OF REGULATORY AGENCIES:

A. PROVIDE WORK AND MATERIALS IN FULL ACCORDANCE WITH THE LATEST RULES AND REGULATIONS OF THE FOLLOWING:
1. CALIFORNIA CODE OF REGULATIONS - TITLE 24 - PARTS 2, 3, 4,5, AND 9
2. CALIFORNIA CODE OF REGULATIONS - TITLE 22 - CHAPTER 7
3. CALIFORNIA BUILDING CODE, 2019
4. CALIFORNIA MECHANICAL CODE, 2019
5. CALIFORNIA PLUMBING CODE, 2019
6. CALIFORNIA ELECTRIC CODE, 2019
7. CALIFORNIA FIRE CODE, 2019
8. CALIFORNIA BUILDING ENERGY EFFICIENCY STANDARDS 2019
9. CALIFORNIA GREEN BUILDING STANDARDS 2019
10. CALIFORNIA ENERGY CODE 2019
11. NATIONAL FIRE PROTECTION ASSOCIATION
12. CAL-OSHA
13. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
14. STATE FIRE MARSHAL, TITLE 19 CCR
15. OTHER APPLICABLE STATE LAWS

B. NOTHING IN DRAWINGS OR SPECIFICATIONS SHALL BE CONSTRUED TO PERMIT WORK NOT CONFORMING TO THESE CODES.

C. CONFORM TO STATE OF CALIFORNIA ENERGY CONSERVATION STANDARDS FOR ALL SYSTEMS, EQUIPMENT, AND CONSTRUCTION.

D. THE ABOVE CODES AND STANDARDS DEFINE MINIMUM REQUIREMENTS REQUIRED FOR THE PROJECT. WHERE CONTRACT DOCUMENTS DIFFER FROM GOVERNING CODES, FURNISH AND INSTALL HIGHER STANDARD.

1.05 FEES, PERMITS, AND UTILITY SERVICES:

A. ARRANGE FOR REQUIRED INSPECTIONS AND PERMITS REQUIRED IN INSTALLATION OF THE WORK.

B. THE OWNER WILL PAY CHARGES FOR PERMITS REQUIRED.

1.06 SITE EXAMINATION:

A. EXAMINE SITE, VERIFY DIMENSIONS AND LOCATIONS AGAINST DRAWINGS, AND INFORM SELF OF CONDITIONS UNDER WHICH WORK IS TO BE DONE BEFORE SUBMITTING PROPOSAL. NO ALLOWANCE WILL BE MADE FOR EXTRA EXPENSE ON ACCOUNT OF ERROR.

B. INFORMATION SHOWN RELATIVE TO EXISTING SERVICES IS BASED UPON AVAILABLE RECORDS AND DATA BUT IS APPROXIMATE ONLY. MAKE MINOR DEVIATIONS FOUND NECESSARY TO CONFORM WITH ACTUAL LOCATIONS AND CONDITIONS WITHOUT EXTRA COST. VERIFY LOCATION AND ELEVATION OF UTILITIES PRIOR TO COMMENCEMENT OF EXCAVATION FOR NEW PIPING OR ITS INSTALLATION.

C. EXERCISE CARE IN EXCAVATING NEAR EXISTING UTILITIES TO AVOID ANY DAMAGE THERETO. THIS CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE CAUSED BY HIS OPERATIONS.

1.07 MATERIAL LIST AND SUBSTITUTIONS:

A. PRIOR TO COMMENCEMENT OF WORK, AND WITHIN 35 DAYS AFTER AWARD OF CONTRACT, SUBMIT TO ARCHITECT FOR REVIEW ELECTRONIC COPIES OF A COMPLETE LIST OF EQUIPMENT AND MATERIALS TO BE FURNISHED, INCLUDING ALL SUBSTITUTIONS. ALL SUBMITTALS TO BE IN ELECTRONIC FORMAT AS FOLLOWS:
1. SUBMITTALS TO BE IN PDF FORMAT.
2. INDIVIDUAL PDF CUT SHEETS SHALL BE INSERTED INTO A SINGLE FILE FOR REVIEW.
3. ALL SHEETS TO BE "UNPROTECTED" AND WRITABLE.

B. PROVIDE SUBMITTAL INFORMATION FOR ALL MATERIALS PROPOSED FOR USE AS PART OF THIS PROJECT. PROVIDE STANDARD ITEMS ON SPECIFIED EQUIPMENT AT NO EXTRA COST TO THE CONTRACT REGARDLESS OF DISPOSITION OF SUBMITTAL DATA. OTHER MATERIAL OR METHODS SHALL NOT BE USED UNLESS APPROVED IN WRITING BY THE ARCHITECT. THE ARCHITECT'S REVIEW WILL BE REQUIRED EVEN THOUGH "OR EQUAL" OR SYNONYMOUS TERMS ARE USED.

C. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ASSUME ALL COSTS INCURRED BECAUSE OF ADDITIONAL WORK AND/OR CHANGES REQUIRED TO INCORPORATE THE PROPOSED SUBSTITUTE INTO THE PROJECT INCLUDING POSSIBLE EXTRA COMPENSATION DUE TO THE ARCHITECT. REFER TO DIVISION 1 FOR COMPLETE INSTRUCTIONS.

D. CONTRACTOR TO PROVIDE COMPLETE SUBMITTAL PACKAGES FOR EACH SYSTEM.

E. IDENTIFY EACH ITEM BY MANUFACTURER, BRAND, TRADE NAME, MODEL NUMBER, SIZE, RATING, OR WHATEVER OTHER DATA IS NECESSARY TO PROPERLY IDENTIFY AND REVIEW MATERIALS AND EQUIPMENT.
1. WHERE SUBMITTAL SHEETS INDICATE MORE THAN ONE PRODUCT, CONTRACTOR TO CLEARLY IDENTIFY PRODUCT BEING SUBMITTED. CONTRACTOR TO CROSS-OUT INFORMATION NOT BEING SUBMITTED FOR REVIEW.
2. MECHANICAL - WET SIDE PACKAGE INCLUDING: PIPING, VALVES, SOURCE EQUIPMENT, PUMPS, ACCESSORIES, ETC. WHEN REQUIRED BY SCHEDULE, A SEPARATE MECHANICAL UNDERGROUND SUBMITTAL PACKAGE WILL BE REVIEWED UPON REQUEST.
3. MECHANICAL - SOURCE EQUIPMENT (E.G.: PACKAGED AC UNITS, EXHAUST FANS, AIR HANDLING UNITS, ETC.)

F. IDENTITY EACH SUBMITTED ITEM BY REFERENCE TO SPECIFICATION SECTION NUMBER AND PARAGRAPH IN WHICH ITEM IS SPECIFIED. CROSS REFERENCE SUBMITTALS BY EQUIPMENT ID WHERE APPLICABLE.

G. QUANTITIES ARE THE CONTRACTOR'S RESPONSIBILITY AND WILL NOT BE REVIEWED.

1.08 SITE CONDITIONS

A. INFORMATION OF THE DRAWINGS RELATIVE TO EXISTING CONDITIONS IS APPROXIMATE ONLY. DEVIATIONS FOUND NECESSARY DURING PROGRESS OF CONSTRUCTION TO CONFORM TO ACTUAL CONDITIONS AS APPROVED BY THE ARCHITECT SHALL BE MADE WITHOUT ADDITIONAL COST TO THE OWNER. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY DAMAGE CAUSED TO EXISTING SERVICES. PROMPTLY NOTIFY THE ARCHITECT IF SERVICES ARE FOUND WHICH ARE NOT SHOWN ON THE DRAWINGS.

PART 2 - PRODUCTS

2.01 GENERAL:

A. MENTION HEREIN OR ON DRAWINGS REQUIRES THAT THIS CONTRACTOR PROVIDE EACH ITEM LISTED OF QUALITY NOTED OR EQUAL. REFER TO SUBSEQUENCE DIVISION 23 SPECIFICATION SECTIONS FOR SPECIFIC EQUIPMENT AND SYSTEM MATERIALS AND ACCESSORIES.

B. ALL MATERIAL SHALL BE NEW, FULL WEIGHT, STANDARD IN ALL RESPECTS, AND IN FIRST-CLASS CONDITION.

C. PROVIDE MATERIALS OF THE SAME BRAND OR MANUFACTURE THROUGHOUT FOR EACH CLASS OF MATERIAL OR EQUIPMENT WHEREVER POSSIBLE.

D. THE GRADE OR QUALITY OF MATERIALS DESIRED IS INDICATED BY THE TRADE NAMES OR CATALOG NUMBERS STATED HEREIN.

E. DIMENSIONS, SIZES, AND CAPACITIES SHOWN ARE A MINIMUM AND SHALL NOT BE CHANGED WITHOUT PERMISSION OF THE ARCHITECT.

2.02 MATERIALS FURNISHED:

A. IDENTIFY ALL MATERIALS AND EQUIPMENT BY MANUFACTURER'S NAME AND MODEL NUMBER. REMOVE UNIDENTIFIED MATERIALS AND EQUIPMENT FROM SITE.

B. EQUIPMENT OR MATERIAL DAMAGED DURING TRANSPORTATION, INSTALLATION, OR OPERATION IS CONSIDERED AS TOTALLY DAMAGED. REPLACE WITH NEW EQUIPMENT. VARIANCE FROM THIS PERMITTED ONLY WITH WRITTEN CONSENT OF THE ARCHITECT.

C. DELIVER, PROTECTION, AND CARE:
1. DELIVER MATERIALS OR EQUIPMENT TO THE PROJECT IN THE MANUFACTURER'S ORIGINAL, UNOPENED, LABELED CONTAINERS.
2. ADDED COSTS ASSOCIATED WITH REORDERING, EXPEDITING ORDERS, OR PROJECT DELAYS DUE TO REJECTED MATERIALS SHALL BE BORNE BY THE CONTRACTOR.
3. PROTECT FROM DAMAGE WHICH MAY BE CAUSED BY THEFT, WEATHER, AND BUILDING OPERATIONS. FAILURE TO PROTECT MATERIALS AND APPARATUS ADEQUATELY SHALL BE SUFFICIENT CAUSE FOR REJECTION OF ANY DAMAGED MATERIAL OR EQUIPMENT.
4. CLOSE PIPE AND EQUIPMENT OPENINGS TO PREVENT INTRUSION OF OBSTRUCTIONS AND DAMAGE.
5. OWNER OR ARCHITECT WILL REQUIRE REMOVAL AND REPLACEMENT OF SUCH MATERIAL OR WORK FROM THE PREMISES WHICH IS NOT IN ACCORDANCE WITH CONTRACT DOCUMENTS. REPLACE UNSATISFACTORY WORK WITHOUT DELAY, AT NO ADDITIONAL COST TO THE OWNER.
6. ALL MATERIAL AND EQUIPMENT SHALL BE PROTECTED AGAINST MOISTURE, DIRT AND DAMAGE. PROTECTIVE COVERINGS SHALL BE PROVIDED FOR BEARINGS, OPEN CONNECTIONS TO PUMPS AND TANKS, COILS, DUCTS, PIPES AND SIMILAR EQUIPMENT THAT IS VULNERABLE TO GRIT AND DIRT.
7. THE INTERIOR OF THE PIPES AND DUCTS SHALL BE KEPT CLEAN AT ALL TIMES.

PART 3 - EXECUTION

3.01 GENERAL:

A. GENERAL ARRANGEMENT AND LOCATION OF PIPING, DUCTWORK, EQUIPMENT, ETC. ARE SHOWN ON DRAWINGS OR HEREIN SPECIFIED. CAREFULLY EXAMINE OTHER WORK THAT MAY CONFLICT WITH THIS WORK. INSTALL THIS WORK IN HARMONY WITH OTHER CRAFTS AND AT PROPER TIME TO AVOID DELAY OF WORK. PROVIDE ALL OFFSETS AS REQUIRED TO AVOID OTHER TRADES AT NO ADDITIONAL COST TO THE OWNER.

B. IN ADVANCE OF CONSTRUCTION, WORK OUT MINOR CHANGES AND RELOCATIONS TO SUIT ACTUAL CONDITIONS AND WORK OF OTHER TRADES TO AVOID CONFLICT THEREWITH. THIS SHALL NOT BE CAUSE FOR ADDITIONAL COST.

C. EXECUTE ANY WORK OR APPARATUS SHOWN ON THE DRAWINGS AND NOT MENTIONED IN THE SPECIFICATIONS, OR VICE VERSA, THE SAME AS IF SPECIFICALLY MENTIONED BY BOTH. OMISSION FROM DRAWINGS OR SPECIFICATIONS OF ANY MINOR DETAILS OF CONSTRUCTION, INSTALLATION, MATERIALS, OR ESSENTIAL SPECIALTIES DOES NOT RELIEVE THIS CONTRACTOR FROM FURNISHING SAME IN PLACE COMPLETE.

D. FURNISH AND INSTALL ANY INCIDENTAL WORK NOT SHOWN OR SPECIFIED WHICH CAN REASONABLY BE INFERRED AS PART OF THE WORK AND NECESSARY TO PROVIDE A COMPLETE AND WORKABLE SYSTEM.
1. MINOR PIPING ASSOCIATED WITH INSTRUMENTATION AND CONTROL IS GENERALLY NOT SHOWN. INTERCONNECTION OF SENSORS, TRANSDUCERS, CONTROL DEVICES, INSTRUMENTATION PANELS, COMBUSTION CONTROL PANEL, BURNER CONTROL PANELS IS THE RESPONSIBILITY OF THE CONTRACTOR. SMALL PIPING ASSOCIATED WITH WATER COOLING, DRIPS, DRAINS AND OTHER MINOR PIPING MAY NOT BE SHOWN TO AVOID CONFUSION IN THE PLAN PRESENTATION BUT SHALL BE PROVIDED AS PART OF CONTRACT WORK. DRAINS SHALL BE PIPED TO THE NEAREST FLOOR DRAINS.

E. FURNISH MATERIALS AND WORK AT PROPER TIME TO AVOID DELAY OF THE WORK.

F. COORDINATE WITH TESTING AND BALANCING CONTRACTOR TO REVIEW DRAWINGS FOR PROPOSED ADDITIONAL BALANCING COMPONENTS REQUIRED FOR PROPER SYSTEM TESTING AND BALANCING.

3.02 ACCESS:

A. CONTINUOUSLY CHECK ARCHITECTURAL DRAWINGS FOR CLEARANCE AND ACCESSIBILITY OF EQUIPMENT SPECIFIED HEREIN TO BE PLACED. NO ALLOWANCE OF ANY KIND WILL BE MADE FOR NEGLIGENCE ON PART OF CONTRACTOR TO FORESEE MEANS OF INSTALLING HIS EQUIPMENT INTO PROPER POSITION.

3.03 CLOSING IN OF UNINSPECTED WORK:

A. DO NOT ALLOW OR CAUSE WORK INSTALLED TO BE COVERED UP OR ENCLOSED BEFORE IT HAS BEEN INSPECTED AND TESTED. SHOULD WORK BE ENCLOSED OR COVERED UP BEFORE IT HAS BEEN INSPECTED AND TESTED, UNCOVER WORK AT OWN EXPENSE. AFTER IT HAS BEEN INSPECTED AND TESTED, MAKE REPAIRS NECESSARY TO RESTORE WORK OF OTHER CONTRACTORS TO CONDITION IN WHICH IT WAS FOUND AT TIME OF CUTTING.

3.04 PROJECT MODIFICATIONS:

A. DURING THE PROGRESS OF CONSTRUCTION, IF SUCH CONDITIONS ARISE THAT REQUIRE REVISIONS, MODIFICATIONS, OR RELOCATIONS TO ANY MECHANICAL EQUIPMENT OR MATERIALS INCORPORATED IN THIS PROJECT, SUCH ALTERATIONS SHALL BE IMMEDIATELY CALLED TO THE ATTENTION OF THE ARCHITECT. CONTRACTOR SHALL THEN PREPARE NECESSARY DRAWINGS SHOWING PROPOSED CHANGES. SUBMIT PROPOSED CHANGES FOR REVIEW BY THE ARCHITECT PRIOR TO ACTUAL REVISION WORK IN THE FIELD.

B. TWO SETS OF DRAWINGS SHOWING ALL REVISIONS SHALL BE IMMEDIATELY PRESENTED TO ARCHITECT FOR HIS RECORDS. MAINTAIN ADDITIONAL COPIES ON THE PROJECT AS NECESSARY TO COMPLY WITH "RECORD DRAWINGS" REQUIREMENT OF THE GENERAL REQUIREMENTS.

C. INCORPORATE ALL REVISIONS INTO RECORD DRAWINGS.

3.05 FORMING, CUTTING AND PATCHING:

A. COORDINATE WITH OTHER CONTRACTORS AS NECESSARY TO PROVIDE ANY SPECIAL FORMING, RECESSES, CHASES, ETC., AND PROVIDE WOOD BLOCKING, BACKING, AND GROUNDS AS NECESSARY FOR PROPER INSTALLATION OF MECHANICAL WORK.

B. IF THIS CONTRACTOR FAILS TO COORDINATE WITH OTHER CONTRACTORS AT PROPER TIME OR FAILS TO LOCATE ITEMS PROPERLY, RESULTING IN EXTRA WORK, THEN THIS CONTRACTOR IS RESPONSIBLE.

C. THIS CONTRACTOR IS RESPONSIBLE FOR PROPER PLACEMENT OF PIPE SLEEVES, HANGERS, INSERTS, AND SUPPORTS FOR WORK.

D. CUTTING, PATCHING, AND REPAIRING OF EXISTING (OLD) CONSTRUCTION TO PERMIT INSTALLATION OF PIPING, ETC. IS RESPONSIBILITY OF THIS CONTRACTOR. REPAIR OR REPLACE DAMAGE TO EXISTING WORK WITH SKILLED MECHANICS FOR EACH TRADE INVOLVED IN FIRST_CLASS MANNER.

E. CORE OPENINGS THROUGH EXISTING CONSTRUCTION AS REQUIRED FOR THE PASSAGE OF NEW PIPING AND CONDUITS. CUT HOLES OF THE MINIMUM DIAMETER TO SUIT SIZE OF PIPE INSTALLED AND ASSOCIATED INSULATION.

3.06 DEMOLITION AND SALVAGE:

A. PROVIDE DEMOLITION OF MECHANICAL WORK UNDER THIS SECTION AS INDICATED ON DRAWINGS.

B. REMOVED MATERIALS WHICH WILL NOT BE RE-USED AND WHICH ARE NOT CLAIMED BY THE OWNER SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE PREMISES. CONSULT OWNER BEFORE REMOVING ANY MATERIAL FROM THE PREMISES. CAREFULLY REMOVE MATERIALS CLAIMED BY THE OWNER TO PREVENT DAMAGE. COORDINATED DELIVERY OF SUCH ITEMS TO OWNER.

3.07 WELDING FOR MECHANICAL WORK

A. ALL MECHANICAL WELDING AND INSPECTION REQUIREMENT SHALL BE IN ACCORDANCE WITH THE CALIFORNIA MECHANICAL CODE.

B. QUALIFY WELDING PROCEDURES, WELDERS AND OPERATORS SHALL BE IN ACCORDANCE WITH ASME BOILER AND PRESSURE VESSEL CODE, SECTION IX, WELDING AND BRAZING QUALIFICATIONS. WELDING PROCEDURES AND TESTING SHALL COMPLY WITH ANSI STANDARD B31.9 - STANDARD CODE FOR PRESSURE PIPING, AND THE AMERICAN WELDING SOCIETY (AWS) WELDING HANDBOOK.

C. SOLDERING AND BRAZING PROCEDURES SHALL CONFORM TO ANSI B9.1 STANDARD SAFETY CODE AND NFPA 99.

D. ALL WELDERS SHALL BE CERTIFIED BY A STATE APPROVED WELDING BUREAU. FABRICATOR SHALL HAVE CURRENT AND VALID CERTIFICATED REGISTRATION BY THE BUILDING OFFICIAL FOR THE TYPES OF WELDS REQUIRED BY THE PROJECT.. PRIOR TO START OF THE PROJECT, THE FABRICATOR SHALL SUBMIT A COPY OF CERTIFICATE OF REGISTRATION FOR APPROVAL. PRIOR TO PROJECT CLOSE OUT, THE FABRICATOR SHALL SUBMIT A CERTIFICATE OF COMPLIANCE THAT THE WORK WAS PERFORMED IN ACCORDANCE WITH THE APPROVED PLANS AND SPECIFICATIONS TO THE BUILDING OFFICIAL AND TO THE ENGINEER OR ARCHITECT OF RECORD.

3.08 EXISTING SERVICES:

A. PROVIDE AND INSTALL ALL REQUIRED CONNECTIONS TO EXISTING SYSTEMS AS REQUIRED BY THE DRAWINGS AND SPECIFICATIONS.

B. INTEGRATE EXISTING SYSTEMS WITH ALL NEW WORK TO PROVIDE A COMPLETE WORKING SYSTEM.

C. PROVIDE MINIMUM 72 HOUR NOTICE TO OWNER OF SERVICE INTERRUPTIONS. ALL SERVICE INTERRUPTIONS SHALL BE KEPT TO THE MINIMUM POSSIBLE TIME. WHEN REQUESTED BY OWNER SERVICE INTERRUPTIONS SHALL OCCUR OUTSIDE OF NORMAL WORKING HOURS AT NO ADDITIONAL COST TO OWNER.

3.09 ASBESTOS ABATEMENT:

A. EXISTING SYSTEMS WITHIN THE AREA OF THIS SCOPE OF WORK MAY HAVE ASBESTOS_BEARING MATERIALS. TESTING, ENCAPSULATION, REMOVAL, TREATMENT, OR CORRECTION OF EXISTING ASBESTOS_BEARING MATERIALS IS NOT A PART OF THIS SCOPE OF WORK AND IS NOT THE RESPONSIBILITY OF THE MECHANICAL CONTRACTORS.

3.10 STRUCTURAL DESIGN OF EQUIPMENT AND SEISMIC RESTRAINTS:

A. ALL MECHANICAL EQUIPMENT SUPPORTS SHALL BE DESIGNED BY A LICENSED STRUCTURAL ENGINEER AND SHALL COMPLY WITH THE 2016 CALIFORNIA BUILDING CODE, SECTION 1616A.1.18 THROUGH 1616A.1.26 AND ASCE 7-10. CHAPTERS 6 AND 30.

B. PROVIDE SEISMIC SWAY BRACING FOR ALL SUSPENDED PIPING AND DUCTWORK IN ACCORDANCE WITH THE OSHPD ANCHORAGE PRE-APPROVAL OPM-0043-13, THE "MASON INDUSTRIES SEISMIC RESTRAINT COMPONENTS FOR SUSPENDED UTILITIES".
1. OR EQUAL SYSTEMS BEARING CURRENT OPM NUMBERS SHALL ALSO BE ACCEPTABLE.

3.11 WARRANTY

A. BE RESPONSIBLE FOR WORK DONE AND MATERIAL INSTALLED UNDER THESE PLANS AND SPECIFICATIONS. REPAIR OR REPLACE, AS MAY BE NECESSARY, ANY DEFECTIVE WORK, MATERIAL, OR PART WHICH MAY SHOW DAMAGE TO ITSELF OR OTHER MATERIALS, FURNISHING, EQUIPMENT, OR PREMISES CAUSED BY SUCH DEFECTS DURING THIS PERIOD, IF IN THE OPINION OF THE ARCHITECT SAID DEFECT IS DUE TO IMPERFECTION OF MATERIAL OR WORKMANSHIP. PROVIDE ALL SUCH WORK AND MATERIALS AT NO COST TO OWNER.

B. BE RESPONSIBLE FOR DAMAGE TO ANY PART OF PREMISES DURING GUARANTEE PERIOD CAUSED BY LEAKS OR BREAKS IN WORK FURNISHED AND/OR INSTALLED UNDER THIS SECTION. REPLACE REFRIGERANT, LUBRICANTS, OR GASSES LOST AS RESULT OF DEFECTS, BREAKS, OR LEAKS IN WORK.

C. PROVIDE MANUFACTURER'S WRITTEN WARRANTIES COVERING DEFECTS IN MATERIAL AND WORKMANSHIP OF PRODUCTS AND EQUIPMENT UTILIZED FOR THE PROJECT.

D. WARRANTIES SHALL BE FOR A PERIOD OF 1 YEAR FROM THE DATE OF SUBSTANTIAL COMPLETION UNLESS MORE STRINGENTLY SPECIFIED WITHIN INDIVIDUAL SECTIONS OF THIS DIVISION.

3.12 MECHANICAL RECORD AS-BUILT DRAWINGS:

E. DURING THE COURSE OF PROJECT CONSTRUCTION, MECHANICAL CONTRACTOR SHALL MAINTAIN RECORDED "AS-BUILT" INFORMATION BY DISTINCTIVELY MARKING UP APPROVED SHOP DRAWINGS PRINTS TO DEPICT ALL ACTUAL WORK INSTALLED ON A DAILY BASIS FORM BUT NOT LIMITED TO FIELD CONDITIONS, ADDENDUMS, ARCHITECTURAL SUPPLEMENTAL INSTRUCTIONS (ASIS), INSTRUCTION BULLETINS (IBS), CHANGE ORDERS (COS), RESPONSES TO REQUEST FOR INFORMATION (RFIS), AND APPROVED PRODUCT SUBSTITUTIONS.

F. THE MARKED-UP SHOP DRAWINGS WILL BE MADE AVAILABLE AT THE CONSTRUCTION SITE TO THE ARCHITECT UPON REQUEST, AT ANY TIME.

G. THE MARKED UP SHOP DRAWINGS WITH THE RECORDED INFORMATION SHALL THEN BE PROVIDED TO THE ARCHITECT IN ORDER TO CREATE AS-BUILT RECORD DRAWINGS.

3.13 CLEANING UP:

H. REMOVE TOOLS, SCAFFOLDING, SURPLUS MATERIALS, BARRICADES, TEMPORARY WALKS, DEBRIS, AND RUBBISH FROM THE PROJECT PROMPTLY UPON COMPLETION OF THE WORK OF EACH SECTION. LEAVE THE AREA OF OPERATIONS COMPLETELY CLEAN AND FREE OF THESE ITEMS.

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SHEET TITLE:
MECHANICAL SPECIFICATIONS

SCALE: AS SHOWN

REVISIONS

No.	Issue Description	Date

Drawn By: BZ

Checked By: AD

JOB NO. 22-061

DATE 02-01-2023

SHEET NUMBER M7.1 of

SECTION 23.05.00 - COMMON WORK FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY
- A. THIS SECTION INCLUDES GENERAL MECHANICAL MATERIALS AND METHODS REQUIRED WITHIN THE PROJECT. ITEMS INCLUDED WITHIN THIS SPECIFICATION SECTION INCLUDE:
  1. DIELECTRIC UNIONS
  2. PIPE AND EQUIPMENT IDENTIFICATION
  3. FIREPROOFING
  4. ELECTRICAL WORK
  5. COMMISSIONING AND PRELIMINARY OPERATIONAL TESTS

1.02 QUALITY ASSURANCE
- A. MANUFACTURER'S QUALIFICATIONS: FIRMS REGULARLY ENGAGED IN MANUFACTURER OF PLUMBING PIPING SYSTEMS PRODUCTS, OF TYPES, MATERIALS, AND SIZES REQUIRED WHOSE PRODUCTS HAVE BEEN IN SATISFACTORY USE IN SIMILAR SERVICE FOR NOT LESS THAN 5 YEARS.
- B. CONTRACTOR'S QUALIFICATIONS: FIRM WITH AT LEAST 5 YEARS OF SUCCESSFUL INSTALLATION EXPERIENCE ON PROJECTS WITH PIPING SYSTEMS WORK SIMILAR TO THAT REQUIRED OF PROJECT.

1.03 SUBMITTALS:
- A. PRODUCT DATA: SUBMIT COMPLETE DATA OF MATERIALS PROPOSED INCLUDING:
  1. MANUFACTURER AND MODEL NUMBER
  2. CLEARLY INDICATE ALL OPTIONS, TRIM, AND ACCESSORIES.
  3. CROSS REFERENCE MANUFACTURER'S CUT SHEET TO SPECIFICATION SECTION ON SUBMITTAL SHEET.
- B. OPERATION AND MAINTENANCE DATA: WHERE APPLICABLE, SUBMIT COMPLETE O&M DATA INCLUDING:
  1. MAINTENANCE DATA AND PARTS LISTS FOR EACH COMPONENT.
  2. PROVIDE "TROUBLE_ SHOOTING" MAINTENANCE GUIDE
  3. INCLUDE THIS DATA WITHIN MAINTENANCE MANUAL

PART 2 - PRODUCTS

2.01 DIELECTRIC UNIONS:
- A. FURNISH AND INSTALL DIELECTRIC UNIONS AT ALL LOCATIONS DESCRIBED HEREIN, WHETHER SHOWN ON DRAWINGS OR NOT, AND EXCEPT AS NOTED HEREIN. CONSTRUCT COUPLINGS AND FLANGES SO THAT THE TWO PIPES BEING CONNECTED ARE COMPLETELY INSULATED FROM EACH OTHER WITH NO METAL_TO_METAL CONTACT. HEAVILY LINE THE COUPLINGS WITH A HARD, INSULATING, PHENOLIC PLASTIC THREADED IN STANDARD PIPE SIZES. MAKE UP THE FLANGES WITH INSULATING COMPONENTS CONSISTING OF A HARD, PHENOLIC GASKET, BOLT SLEEVES, AND BOLT WASHERS. SUPPLEMENT THE INSULATING GASKET WITH NEOPRENE FACES TO FORM A SEAL.
- B. ACCEPTABLE MANUFACTURERS: WATTS REGULATOR CO., ECLIPSE, INC., OR PERFECTION CORP.

2.02 PIPING AND EQUIPMENT IDENTIFICATION:
- A. PIPE IDENTIFICATION:
  1. EACH PIPING SYSTEM FURNISHED AND INSTALLED UNDER THIS WORK SHALL BE IDENTIFIED AND THE DIRECTION OF FLOW INDICATED BY A PREFABRICATED COILED PLASTIC COLORED LABEL.
  2. LABELS SHALL COMPLY WITH ASME A13.1 WITH REGARD TO COLOR, LETTER HEIGHT, AND MARKER SIZE. THE LABELS SHALL HAVE BLACK OR WHITE LETTERING AND FLOW ARROWS ON COLORED BACKGROUNDS AND SHALL NOT REQUIRE ADHESIVE. THE BACKGROUND COLORS SHALL CONFORM TO THE COLOR SCHEDULE SHOWN IN THIS ARTICLE.
  3. FOR USE INDOORS USE 20 MIL VINYL LABELS, MSI MODEL MS-970, OR EQUAL. FOR PIPING WITH AN OUTSIDE DIAMETER GREATER THAN 6 INCHES PROVIDE THE LABEL MANUFACTURERS NYLON STRAPS TO SECURE LABEL TO PIPING.
  4. FOR USE OUTDOORS USE POLYESTER/TEDLAR LAMINATED MATERIAL, MSI MODEL MS-977, OR EQUAL. FOR PIPING WITH OD GREATER THAN 6" PROVIDE THE LABEL MANUFACTURERS STAINLESS STEEL STRAPS TO SECURE LABEL TO PIPING.
  5. THE SIZE OF THE LETTERING AND LABEL SHALL BE SUCH THAT THE LETTERING CAN BE EASILY READ FROM THE FLOOR AND THE COLORS EASILY DISCERNIBLE.
  6. ACCEPTABLE MANUFACTURERS: MARKING SERVICES INCORPORATED (MSI), IDENTO METAL PRODUCTS CO., IDENTO BANDS, OR SETMARK
- B. EQUIPMENT IDENTIFICATION:
  1. PROVIDE WHITE LAMACOID PLATE FOR EACH AND EVERY PIECE OF EQUIPMENT INSTALLED IN THIS WORK.
     - a. LETTERING ON PLATE SHALL BE BLACK, WITH SIZE OF LETTERING TO SUIT EQUIPMENT.
     - b. LETTERING SHALL BE MINIMUM OF 3/8_INCH IN HEIGHT.
     - c. PLATES SHALL BE RIVETED OR BOLTED TO EQUIPMENT.
  2. EQUIPMENT TO INCLUDE, BUT NOT LIMITED TO:
     - a. VAV / CAV BOXES
     - b. ETC.
- C. ACCEPTABLE MANUFACTURERS: MARKING SERVICES INCORPORATED, (MSI), LEM PRODUCTS, SETON, OR CRAFTMARK.

2.03 FIREPROOFING
- A. FIREPROOFING TO BE INSTALLED AT ALL PIPE AND DUCT PENETRATIONS OF RATED ASSEMBLIES.
- B. FIREPROOFING TO BE UL RATED FIRE STOP MATERIAL.
- C. ACCEPTABLE MANUFACTURERS: HILTI, 3M PRO-SET, OR EQUAL

PART 3 - EXECUTION

3.01 DIELECTRIC UNIONS:
- A. INSTALL DIELECTRIC UNIONS IN THE FOLLOWING LOCATIONS:
  1. AT POINTS IN PIPING WHERE DISSIMILAR METAL PIPES ARE CONNECTED TOGETHER.
  2. ANY SPECIAL APPLICATIONS SHOWN ON THE DRAWINGS.

3.02 PIPE AND EQUIPMENT IDENTIFICATION:
- A. IDENTIFICATION SHALL BE APPLIED TO ALL PIPING, EXCEPT PIPING LOCATED IN FURRED SPACES WITHOUT ACCESS TO PERMIT ENTRANCE OF PERSONNEL, AND PIPING BURIED IN THE GROUND OR CONCRETE.
- B. UNDERGROUND PIPE IDENTIFICATION SHALL CONSIST OF A BURIED, CONTINUOUS, PREPRINTED, BRIGHT COLORED, PLASTIC RIBBON CABLE MARKER PROVIDED FOR EACH UNDERGROUND PIPE.
- C. THE LEGEND AND FLOW ARROW SHALL BE APPLIED AT THE FOLLOWING LOCATIONS:
  1. ALL VALVE LOCATIONS,
  2. ALL POINTS WHERE PIPING ENTERS OR LEAVES A WALL, PARTITION, CLUSTER OF PIPING, OR SIMILAR OBSTRUCTION
  3. ALL EXPOSED LOCATIONS
  4. AT APPROXIMATELY 20_FOOT INTERVALS ON PIPE RUNS.
- D. PRACTICAL VARIATIONS OR CHANGES IN LOCATIONS AND SPACING MAY BE MADE WITH THE SPECIFIC APPROVAL OF THE ARCHITECT TO MEET SPECIFIC CONDITIONS.
- E. WHEREVER TWO OR MORE PIPES RUN PARALLEL, THE PRINTED LEGEND AND OTHER MARKINGS SHALL BE APPLIED IN THE SAME RELATIVE LOCATION SO THAT ALL PIPING IS EASILY IDENTIFIED.
- F. THE MARKING SHALL BE LOCATED SO AS TO BE READILY CONSPICUOUS AT ALL TIMES FROM ANY REASONABLE POINT OF VANTAGE.
- G. WHERE DIFFERENT EQUIPMENT, SUCH AS FIRE SPRINKLERS, ARE SUPPLIED FROM A COMMON MAIN, SUCH AS DOMESTIC WATER, THE MAIN SHOULD BE IDENTIFIED AS "DOMESTIC WATER" AND EACH RESPECTIVE BRANCH TAKEOFF AS "FIRE WATER," ETC.
- H. LETTERING SIZE AND LABEL COLORS ARE TO BE PER ASME/ANSI A13.1 PIPE MARKING STANDARDS.

3.03 FIREPROOFING:
- A. PACK THE ANNULAR SPACE BETWEEN THE PIPE SLEEVES AND THE PIPE AND BETWEEN DUCT OPENINGS AND DUCTS THROUGH ALL FLOORS AND WALLS WITH UL LISTED FIRE STOP.
- B. FIREPROOFING SYSTEM TO BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS AND DETAILS.

3.04 ELECTRICAL WORK:
- A. ADEQUATE WORKING SPACE SHALL BE PROVIDED AROUND ELECTRICAL EQUIPMENT IN COMPLIANCE WITH THE NATIONAL ELECTRIC CODE AND OTHER APPLICABLE CODES OR ORDINANCES. THE MECHANICAL WORK SHALL BE COORDINATED WITH THE ELECTRICAL WORK IN ORDER TO COMPLY WITH THESE REQUIREMENTS. ANY WORK WHICH DOES NOT CONFORM TO THESE REGULATIONS SHALL BE PROPERLY CORRECTED WITHOUT ADDITIONAL COST TO THE OWNER.
- B. FURNISH AND INSTALL ALL LINE VOLTAGE AND LOW_VOLTAGE TEMPERATURE CONTROL WIRING IN THE MECHANICAL WORK BY THE TEMPERATURE CONTROL SUB-CONTRACTOR, INCLUDING ALL INTERLOCK WIRING BETWEEN MOTOR STARTER COILS, INTERLOCK RELAYS, AND TEMPERATURE CONTROL EQUIPMENT. UNLESS NOTED OTHERWISE, THIS DOES NOT INCLUDE PRIMARY CONTROL WIRING BETWEEN STARTERS AND PUSH BUTTON OR OTHER MANUAL STARTER SWITCH OR BRANCH POWER CIRCUITS REQUIRED FOR TEMPERATURE CONTROL SYSTEMS.
- C. TEMPERATURE CONTROL EQUIPMENT, INCLUDING RELAYS SHOWN ON CONTROL DIAGRAM, SHALL BE FURNISHED AND INSTALLED BY THE TEMPERATURE CONTROL SUBCONTRACTOR.
- D. EQUIPMENT FURNISHED IN THIS WORK THAT IS FACTORY WIRED BUT REQUIRES MODIFICATION TO INTERNAL WIRING TO MEET SPECIFICATIONS OR DRAWING REQUIREMENTS SHALL HAVE SUCH INTERNAL MODIFICATIONS MADE AT FACTORY BEFORE SHIPMENT.
- E. ALL ELECTRICAL WORK AND EQUIPMENT, INCLUDING INTERNAL WIRING, MUST COMPLY WITH APPLICABLE CODES AND APPLICABLE PORTIONS OF ELECTRICAL SPECIFICATIONS. RUN LINE AND LOW_VOLTAGE CONTROL WIRING IN CONDUIT. CONDUIT FOR TEMPERATURE CONTROL WIRING SHALL BE RESPONSIBILITY OF MECHANICAL CONTRACTOR AND SHALL BE OF TYPE SPECIFIED IN ELECTRICAL SPECIFICATIONS.

3.05 DEMOLITION
- A. REFER TO DIVISION 1 SECTIONS FOR GENERAL DEMOLITION REQUIREMENTS AND PROCEDURES.
- B. DISCONNECT, DISMANTLE, AND REMOVE MECHANICAL SYSTEMS, EQUIPMENT, AND COMPONENTS INDICATED TO BE REMOVED. COORDINATE WITH ALL OTHER TRADES
  1. PIPING TO BE REMOVED: REMOVE PORTION OF PIPING INDICATED TO BE REMOVED. CAP OR PLUG REMAINING PIPING WITH SAME OR COMPATIBLE PIPING MATERIAL.
  2. PIPING TO BE ABANDONED IN PLACE: DRAIN PIPING AND CAP OR PLUG PIPING TO REMAIN WITH SAME OR COMPATIBLE PIPING MATERIAL. REFRIGERANT SYSTEM TO BE EVACUATED PER EPA REQUIREMENTS.
  3. DUCTS TO BE REMOVED: REMOVE PORTION OF DUCT INDICATED TO BE REMOVED. CAP REMAINING DUCTS WITH SAME OR COMPATIBLE DUCTWORK MATERIAL AND SEAL CAP AIR-TIGHT.
  4. DUCTS TO BE ABANDONED IN PLACE: CAP DUCTS WITH SAME OR COMPATIBLE DUCTWORK MATERIAL.
  5. EQUIPMENT TO BE REMOVED: DRAIN DOWN AND CAP REMAINING SERVICES AND REMOVE EQUIPMENT.
  6. EQUIPMENT TO BE REMOVED AND SALVAGED: DISCONNECT AND CAP SERVICES AND REMOVE EQUIPMENT AND DELIVER TO OWNER.
- C. IF PIPE, INSULATION, OR EQUIPMENT TO REMAIN IS DAMAGED IN APPEARANCE OR IS UNSERVICEABLE, REMOVED DAMAGED OR UNSERVICEABLE PORTIONS AND REPLACE WITH NEW PRODUCTS OF EQUAL CAPACITY AND QUALITY.
- D. NON-DESTRUCTIVE TESTING OF EXISTING CONCRETE SLABS:
  1. WHEN DRILLING OR SAW CUTTING EXISTING REINFORCED CONCRETE, USE CARE AND CAUTION TO AVOID CUTTING OR DAMAGING THE EXISTING REINFORCING BARS, CONDUIT, OR TENDONS. USE A NON_DESTRUCTIVE METHOD TO LOCATE METALS POURED INTO THE SLAB PRIOR TO DOING ANY WORK.

3.06 CARE AND CLEANING:
- A. REPAIR OR REPLACE BROKEN, DAMAGED, OR OTHERWISE DEFECTIVE PARTS, MATERIALS, AND WORK. LEAVE ENTIRE WORK IN CONDITION SATISFACTORY TO ARCHITECT. AT COMPLETION, CAREFULLY CLEAN AND ADJUST EQUIPMENT, FIXTURES, AND TRIM THAT ARE INSTALLED AS PART OF THIS WORK. LEAVE SYSTEMS AND EQUIPMENT IN SATISFACTORY OPERATING CONDITION.
- B. DRAIN AND FLUSH PIPING TO REMOVE GREASE AND FOREIGN MATTER. THOROUGHLY CLEAN OUT FLUSH VALVES, TRAPS, STRAINERS, AND PRESSURE_REDUCING VALVES.
- C. KEEP THE INTERIOR OF ALL DUCTWORK FREE OF DIRT, DUST, LOOSE INSULATION, AND OTHER FOREIGN MATERIALS AT ALL TIMES.
- D. CLEAN OUT AND REMOVE SURPLUS MATERIALS AND DEBRIS RESULTING FROM THE WORK, INCLUDING SURPLUS EXCAVATED MATERIAL.

3.07 OPERATION TEST:
- A. TEST EACH PIECE OF EQUIPMENT TO SHOW THAT IT WILL OPERATE IN ACCORDANCE WITH INDICATED REQUIREMENTS.

3.08 CLEANING UP:
- A. UPON COMPLETION OF WORK REMOVE MATERIALS, EQUIPMENT, APPARATUS, TOOLS, AND THE LIKE, AND LEAVE PREMISES CLEAN, NEAT, AND ORDERLY.

SECTION 23.07 - HVAC INSULATION

PART 1 - GENERAL

1.01 SUMMARY
- A. THIS SECTION INCLUDES INSULATION TYPES AND THICKNESS FOR MECHANICAL AND PLUMBING PIPING, DUCTWORK, AND EQUIPMENT.

1.02 REFERENCES
- A. CALIFORNIA CODE OF REGULATIONS - TITLE 24, PART 4.
- B. CALIFORNIA BUILDING CODE, CALIFORNIA ELECTRIC CODE, NFPA, AND UL
- C. ASTM
- D. ASHRAE
- E. MAIMA
- F. NFPA
- G. SMACNA - SHEET METAL AND AIR CONDITIONING CONTRACTOR'S NATIONAL ASSOCIATION, INC.
- H. UNDERWRITER'S LABORATORIES
- I. GREENGUARD

1.03 QUALITY ASSURANCE
- A. MANUFACTURER'S QUALIFICATIONS: FIRM SPECIALIZING IN MANUFACTURING OF MECHANICAL INSULATION PRODUCTS APPLICABLE TO PROJECT WHOSE PRODUCTS HAS BEEN IN SATISFACTORY USE IN SIMILAR SERVICES FOR A MINIMUM OF 3 YEARS.
- B. INSTALLER'S QUALIFICATIONS: COMPANY SPECIALIZING IN PIPING INSULATION APPLICATION WITH A MINIMUM OF 3 YEARS EXPERIENCE.
- C. FLAME/SMOKE RATINGS: INSULATION MATERIALS, INCLUDING BUT NOT LIMITED TO INSULATION, JACKETS, COVERINGS, SEALERS, ADHESIVES, ETC., TO HAVE FLAME-SPREAD RATING OF 25 OR LESS AND SMOKE-DEVELOPED INDEX OF 50 OR LESS WHEN TESTED IN ACCORDANCE WITH ASTM E84.
- D. INSULATING PRODUCTS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS AND IN ACCORDANCE WITH RECOGNIZED INDUSTRY PRACTICES.

1.04 SUBMITTALS
- A. SUBMIT COMPLETE DATA OF MATERIALS PROPOSED.
  1. INDICATE INDIVIDUAL SERVICES FOR EACH SYSTEM.
  2. INDICATE PROPOSED INSULATION THICKNESS FOR EACH SYSTEM
  3. INDICATE PROPOSED R-VALVES, DENSITIES, ETC. FOR EACH PRODUCT.
- B. PROVIDE MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR EACH PRODUCT.

PART 2 - PRODUCTS

2.01 GENERAL
- A. FOR PURPOSES OF THIS SPECIFICATION, FITTINGS, JOINTS, STRAINERS, FLEXIBLE PIPING, VALVES, ETC. SHALL BE CONSIDERED AS PIPING AND SHALL BE INSULATED WITH SAME MATERIAL AND THICKNESS AS ADJOINING PIPING UNLESS NOTED OTHERWISE.
- B. ACCEPTABLE MANUFACTURES: KNAUF, JOHNS MANVILLE, CERTAINTEED, OR OWENS-CORNING

2.02 MATERIALS
- A. FLEXIBLE CLOSED CELL INSULATION:
  1. FLEXIBLE ELASTOMERIC THERMAL CLOSED-CELL STRUCTURE INSULATION.
  2. MAXIMUM K-VALUE AT 75OF = 0.27 BTU-IN/HR-FT2-OF.
  3. JOINTS TO BE SEALED WITH ARMSTRONG 520 ADHESIVE
  4. INSULATION TO BE ARMSTRONG ARMAFLEX 22 OR EQUAL
- B. FIBERGLASS DUCTWORK INSULATION:
  1. DUCT WRAP TO BE BLANKET-TYPE THERMAL AND ACOUSTICAL INSULATION MADE FROM GLASS FIBERS, BONDED WITH WHITE FORMALDEHYDE-FREE RESIN.
  2. LABELED K-VALUE TO EQUAL 0.29 BTU-IN/HR-FT2-OF.
  3. COMPRESSED K-VALUE TO EQUAL 0.27 BTU-IN/HR-FT2-OF.
  4. INSULATION TO BE JOHNS MANVILLE MICROLITE XG OR EQUAL.

2.03 PIPING INSULATION:
- A. REFRIGERANT PIPING:
  1. INSULATE BOTH LIQUID AND SUCTION LINES WITH CLOSED-CELL PIPE INSULATION.
  2. INSULATION TO BE A MINIMUM OF 3/4" THICK.
  3. SEAL ALL JOINTS WITH ARMSTRONG 520 ADHESIVE.
  4. PIPING EXTERIOR TO THE BUILDING SHALL BE PROVIDED WITH FACTORY FABRICATED TYPE 3003 SHEET ALUMINUM COVERS. COVERS TO BE 0.024" MINIMUM THICKNESS.
     - a. PROVIDE STAINLESS STEEL METAL SCREWS SPACED AT 6" ON CENTER FOR FASTENING ALUMINUM JACKET AND FITTINGS. ALUMINUM BAN NOT ACCEPTABLE.

2.04 DUCTWORK INSULATION:
- A. WRAP ALL CONCEALED UNLINED SUPPLY AND RETURN DUCTWORK, WITH DUCT WRAP INSULATION AS FOLLOWS:
  1. WHERE INSTALLED OVER OR WITHIN CONDITIONED CONCEALED CEILINGS, WRAP DUCTWORK WITH TYPE 75, 2" THICK DUCT WRAP. MINIMUM INSTALLED R-VALUE TO EQUAL 5.6 (HR-FT2-OF)/BTU.
  2. DUCT WRAP TO HAVE FSK VAPOR BARRIER FACING.
  3. DUCT WRAP TO BE JOHNS MANVILLE MICROLITE XG OR EQUAL.

PART 3 - EXECUTION

3.01 GENERAL
- A. INSULATION TO BE STORED ON JOBSITE IN CLEAN / DRY LOCATION. ANY INSULATION EXPOSED TO WATER MUST BE DISCARDED IMMEDIATELY AND REMOVED FROM JOBSITE.

3.02 INSTALLATION OF PIPING INSULATION
- A. INSTALL PIPING INSULATION PRODUCTS IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS AND IN ACCORDANCE WITH RECOGNIZED INDUSTRY PRACTICES.
- B. INSTALLATION TO BE INSTALLED AFTER TESTING, ACCEPTANCE OF TESTING, AND CLEANING OF PIPE.
- C. INSULATE EACH CONTINUOUS RUN OF PIPING WITH FULL-LENGTH UNITS OF INSULATION. CUT PIECES TO SIZE AS REQUIRED. DO NOT USE MULTIPLE CUT PIECES AND/OR SCRAPS ABUTTING EACH OTHER.
- D. CLEAN AND DRY PIPING SURFACES PRIOR TO INSULATING. BUTT INSULATION JOINTS FIRMLY TOGETHER TO ENSURE COMPLETE AND TYPE FIT OVER SURFACE TO BE COVERED.
- E. INSTALL PIPING INSULATION WITHOUT INTERRUPTION THROUGH WALLS AND FLOORS EXCEPT WHERE OTHERWISE INDICATED.
- F. TAPER RAW ENDS OF INSULATION AND SEAL WITH CANVAS AND SEALANT AS NOTED FOR FITTINGS.
- G. INSTALL PIPE HANGERS ON THE OUTSIDE OF THE INSULATION.

3.03 INSTALLATION OF CONCEALED DUCTWORK INSULATION:
- A. INSTALL DUCTWORK INSULATION PRODUCTS IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS AND IN ACCORDANCE WITH RECOGNIZED INDUSTRY PRACTICES.
- B. PRIOR TO APPLYING DUCT WRAP, SHEET METAL DUCT SHALL BE CLEAN, DRY AND TIGHTLY SEALED AT ALL JOINTS AND SEAMS.
- C. WRAP INSULATION AROUND DUCT WITH FACING TO THE OUTSIDE SO THE 2" FLAP COMPLETELY OVERLAPS FACING AND INSULATION AT THE OTHER END OF STRETCH OUT. INSULATION SHALL BE SNUGLY BUTTED.
- D. SECURE SEAMS WITH OUTWARD CLINCHING STAPLES ON 6" CENTERS.
- E. NEATLY CUT INSULATION AT ALL VOLUME CONTROL DAMPERS.
- F. TAPE ALL SEAMS AND LOOSE EDGES WITH SCRIM BACKED FOIL TAPE.
- G. FOR DUCTS WHICH ARE GREATER THAN 24" WIDE, PROVIDE MECHANICAL FASTENERS AT BOTTOM OF DUCT SPACED AT A MAXIMUM OF 18" ON CENTER.
  - a. FASTENERS TO BE WELD PINS OR CLINCH PINS. ADHESIVE TYPE PINS SHALL NOT BE USED.

3.04 INSULATION REPAIR:
- A. REPAIR DAMAGED SECTIONS OF EXISTING AND/OR NEW MECHANICAL INSULATION WHERE DAMAGED OCCURRED DURING THIS CONSTRUCTION PERIOD. USE INSULATION OF SAME THICKNESS AS EXISTING INSULATION. INSTALL NEW JACKET LAPPING AND SEAL OVER EXISTING.

3.05 CARE AND CLEANING:
- A. REPAIR AND/OR REPLACE BROKEN, DAMAGED AND OR OTHER WISE DEFECTIVE INSULATION. WORK TO BE COMPLETED TO THE SATISFACTION OF THE ARCHITECT. AT COMPLETION OF WORK, CLEAN MATERIALS INSTALLED AS PART OF THIS WORK AND LEAVE SYSTEMS AND EQUIPMENT IN SATISFACTORY OPERATING CONDITION.
- B. UPON COMPLETION OF WORK REMOVE MATERIALS, EQUIPMENT, TOOLS FROM PREMISES. LEAVE PROJECT AREA NEAT, CLEAN AND ORDERLY.

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SHEET TITLE:
MECHANICAL SPECIFICATIONS

SCALE: AS SHOWN

REVISIONS

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SECTION 23.05.93 - AIR AND WATER SYSTEM BALANCING

PART 1 - GENERAL

1.01 SUMMARY
- A. THIS SECTION INCLUDES TOTAL SYSTEM BALANCE, AS DEFINED BY AABC, WHICH CONSTITUTES THE PROCESS OF TESTING, ADJUSTING, AND BALANCING EACH SYSTEM COMPONENT SO THAT THE ENTIRE SYSTEM PRODUCES THE RESULTS FOR WHICH IT WAS DESIGNED. TESTING RESULTS OF TOTAL SYSTEM BALANCE SHALL BE ACCEPTED BY THE MECHANICAL ENGINEER OF RECORD AND OWNER

1.02 QUALITY ASSURANCE
- A. OBTAIN THE SERVICE OF AN INDEPENDENT TEST AND BALANCE (TAB) AGENCY THAT SPECIALIZES IN, AND WHOSE BUSINESS IS LIMITED TO, TESTING, ANALYSIS, AND BALANCING OF AIR DISTRIBUTION AND HYDRONIC SYSTEMS.
- B. BALANCE AGENCY SHALL BE A MEMBER OF TAB
- C. WORK SHALL BE DONE BY QUALIFIED ENGINEERING TECHNICIANS AND TRAINED PERSONNEL, USING INSTRUMENTS CERTIFIED ACCURATE TO LIMITS USED IN STANDARD PRACTICE FOR TESTING AND BALANCING OF HYDRONIC AND AIR DISTRIBUTION FOR HEATING_COOLING SYSTEMS. AGENCY SHALL FIELD TEST AIR AND HYDRONIC FLOWS IN ACCORDANCE WITH METHODS SET UP BY ASSOCIATED AIR BALANCE COUNCIL, NATIONAL STANDARD VOLUME 1, LATEST EDITION.
- D. APPROVED BALANCING FIRMS: OBTAIN SERVICE FROM RS ANALYSIS.
- E. AABC COMPLIANCE: COMPLY WITH AABC'S "NATIONAL STANDARDS," VOLUME 1, AS APPLICABLE TO MECHANICAL AIR AND HYDRONIC DISTRIBUTION SYSTEMS AND ASSOCIATED EQUIPMENT AND APPARATUS.
- F. INDUSTRY STANDARDS: COMPLY WITH ASHRAE RECOMMENDATIONS PERTAINING TO MEASUREMENTS, INSTRUMENTS AND TESTING, ADJUSTING AND BALANCING, EXCEPT AS OTHERWISE INDICATED.
- G. REFERENCE STANDARDS: COMPLY WITH THE FOLLOWING STANDARDS:
  1. AABC _ ASSOCIATED AIR BALANCE COUNCIL _ A NATIONAL STANDARD VOLUME 1.
  2. ASHRAE _ AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR CONDITIONING ENGINEERS, INC.
  3. AMCA PUBLICATION 203, "A GUIDE TO THE MEASUREMENT OF FAN SYSTEM PERFORMANCE IN THE FIELD."
  4. ASHRAE HVAC APPLICATIONS HANDBOOK, CHAPTERS 34 AND 42 AS APPLICABLE.
  5. ADC TEST CODE NO. 1062, "EQUIPMENT TEST CODE."
  6. ANSI A1.4, SPECIFICATION FOR SOUND LEVEL METERS.
  7. ANSI S1.11, SPECIFICATION FOR OCTAVE, HALF_OCTAVE, AND THIRD-OCTAVE BAND FILTER SETS.

1.03 WORK INCLUDED
- A. TEST AND BALANCE OF EXISTING AND NEW AIR DISTRIBUTION SYSTEM, HYDRONIC SYSTEMS, AND ASSOCIATED EQUIPMENT.
- B. THE PROJECT CONSISTS OF A MULTIPLE PHASE PROJECT AND REQUIRES PRE-DEMOLITION READINGS AND FINAL BALANCE AT THE END OF EACH PHASE.
- C. SUBMITTING REPORTS, AND RECOMMENDING MODIFICATIONS TO WORK AS REQUIRED BY CONTRACT DOCUMENTS.
- D. COMPONENT TYPES OF TESTING, ADJUSTING, AND BALANCING SPECIFIED IN THIS SECTION INCLUDES THE FOLLOWING AS APPLIED TO MECHANICAL EQUIPMENT:
  1. FANS
  2. AC UNITS
  3. DUCTWORK SYSTEMS
  4. TERMINAL UNITS
- E. TAB AGENCY SHALL PERFORM THE FOLLOWING DURING INSTALLATION PHASE OF SYSTEMS:
  1. STUDY DESIGN SPECIFICATIONS AND ENGINEERING DRAWINGS AND PREPARE SCHEDULE TO PHYSICALLY INSPECT MECHANICAL EQUIPMENT FOR HYDRONIC AND AIR DISTRIBUTION SYSTEMS TO BE TESTED AND BALANCED.
     a. CONTRACTOR SHALL PROVIDE TAB AGENCY WITH ONE COPY OF CONTRACT DRAWINGS AND SPECIFICATIONS, MECHANICAL EQUIPMENT SUBMITTALS, AND CHANGE ORDERS NECESSARY FOR PROPER BALANCING OF AIR DISTRIBUTION SYSTEMS.
  2. TAB AGENCY SHALL MAKE PERIODIC FIELD INSPECTIONS PRIOR TO CLOSING IN PORTIONS OF SYSTEMS TO BE BALANCED. AGENCY SHALL VERIFY TO ITS SATISFACTION THAT ALL WORK, FITTINGS, DAMPERS, BALANCING DEVICES, ETC. ARE PROPERLY FABRICATED AND INSTALLED AS SHOWN OR SPECIFIED AND THAT AGENCY WILL BE ABLE TO PROPERLY BALANCE SYSTEM.
  3. PREPARE TEST AND BALANCING SCHEDULE, TEST RECORD FORMS, AND NECESSARY TECHNICAL INFORMATION ABOUT HYDRONIC AND AIR DISTRIBUTION SYSTEMS FOR INSTALLED HEATING_COOLING EQUIPMENT.
  4. RECOMMEND ADJUSTMENTS AND/OR CORRECTIONS TO MECHANICAL EQUIPMENT AND HYDRONIC AND AIR DISTRIBUTION SYSTEMS THAT ARE NECESSARY FOR PROPER BALANCING OF SYSTEMS.
     a. CORRECTIONS REQUIRED BASED ON TAB CONTRACTOR FIELD INSPECTIONS SHALL BE MADE AT NO ADDITIONAL COST TO THE OWNER.

1.04 SUBMITTALS:
- A. CONTRACTOR DATA:
  1. PROVIDE TAB CONTRACTOR COMPANY INFORMATION.
- B. FIELD INSPECTION REPORT:
  1. TAB CONTRACTOR TO PROVIDE WRITTEN VERIFICATION OF FIELD INSPECTIONS.
     a. INCLUDE DATE OF INSPECTION AND LIST OF ALL ITEMS TO BE CORRECTED PRIOR TO BALANCE.
- C. TAB CONTRACTOR TO PROVIDE TEST REPORTS AS FOLLOWS:
  1. SUBMIT DATA ON PRINTED REPORT FORMS PUBLISHED BY TABB.
  2. INCLUDE IDENTIFICATION AND TYPES OF INSTRUMENTS USED AND THEIR MOST RECENT CALIBRATION DATE WITH SUBMISSION OF FINAL TEST REPORT.
  3. REPORTS TO HAVE COMPUTER GENERATED DRAWINGS. DRAWINGS TO INCLUDE: GENERAL BUILDING LAYOUT, DUCTWORK AND PIPING LAYOUT, HVAC EQUIPMENT, AND AIR INLET/OUTLET LOCATIONS.
     a. HAND DRAWN/NUMBERED DRAWINGS SHALL NOT BE ACCEPTED.
  4. REPORTS TO BE STAMPED AND SIGNED LICENSED TAB CONTRACTOR.
  5. SUBMIT THREE COPIES OF COMPLETE TEST REPORT PRIOR TO FINAL ACCEPTANCE OF PROJECT.
- D. BALANCE AGENCY SHALL SUBMIT THE RESULTS OF TESTS IN THIS SECTION FOR REVIEW BY THE ARCHITECT.

PART 2 - PRODUCTS

2.01 PATCHING MATERIALS:
- A. EXCEPT AS OTHERWISE INDICATED, USE SAME PRODUCTS AS USED BY ORIGINAL INSTALLER FOR PATCHING HOLES IN INSULATION, DUCTWORK AND HOUSINGS WHICH HAVE BEEN CUT OR DRILLED FOR TEST PURPOSES, INCLUDING ACCESS FOR TEST INSTRUMENTS, ATTACHING JIGS, AND SIMILAR PURPOSES.
  1. AT TESTER'S OPTION, PLASTIC PLUGS WITH RETAINERS MAY BE USED TO PATCH DRILLED HOLES IN DUCTWORK AND HOUSINGS.

2.02 TEST INSTRUMENTS:
- A. UTILIZE TEST INSTRUMENTS AND EQUIPMENT FOR TEST AND BALANCE WORK REQUIRED, OF TYPE, PRECISION, AND CAPACITY AS RECOMMENDED IN THE FOLLOWING TEST AND BALANCE STANDARDS:
  1. COMPLY WITH AABC'S MANUAL "AABC NATIONAL STANDARDS," VOLUME 1.

PART 3 - EXECUTION

3.01 BALANCING OF EXISTING HYDRONIC AND AIR HANDLING SYSTEMS:
- A. PRIOR TO ANY OTHER WORK BEING STARTED ON THIS PROJECT, TEST ALL EXISTING AIR HANDLING SYSTEMS INDICATED ON THE DRAWINGS. PROVIDE REPORT INDICATING FAN RPM AND CFM, AIR VELOCITY AND AIR VOLUME FOR ALL AIR INLETS AND OUTLETS, AND ANY RECOMMENDED REPAIRS OR ALTERATIONS TO THE EXISTING SYSTEM.
- B. PRIOR TO COMPLETION OF THE WORK, REBALANCE ALL EXISTING AIR INLETS AND OUTLETS TO CONDITIONS AT START OF WORK.

3.02 BALANCING:
- A. UPON COMPLETION OF HYDRONIC AND AIR HANDLING SYSTEMS, BALANCE AGENCY SHALL COMPLETE TESTS, ANALYSIS, AND BALANCE OF HYDRONIC AND AIR HANDLING SYSTEMS FOR HEATING_COOLING EQUIPMENT.
- B. THIS REPORT SHALL INCLUDE AS MINIMUM, BUT NOT BE LIMITED TO, FOLLOWING DESIGN AND ACTUAL INFORMATION:
  1. AIR-MOVING EQUIPMENT DATA:
     a. FAN OR UNIT NUMBER.
     b. LOCATION, AREA SERVED
     c. MANUFACTURER, MODEL NUMBER AND SERIAL NUMBER.
  2. INDIVIDUAL OUTLET AND INLET DATA:
     a. IDENTIFY EACH OUTLET FOR LOCATION, AREA, AND FAN OR UNIT SYSTEM
     b. OUTLET OR INLET MANUFACTURER AND TYPE
     c. OUTLET OR INLET SIZE, EFFECTIVE AREA OR AK FACTOR
     d. DESIGN AND ACTUAL VELOCITY IN FEET PER MINUTE (FPM)
     e. DESIGN AND ACTUAL CFM
  3. TERMINAL HVAC UNITS:
     a. IDENTIFICATION AND LOCATION
     b. SERVICE
     c. MANUFACTURER
     d. MODEL NUMBER AND SERIAL NUMBER
     e. ACTUAL ENTERING AND LEAVING TEMPERATURES
     f. ACTUAL GPM
     g. OPERATING TEMPERATURES - ENTERING AND LEAVING
  4. OTHER INFORMATION REQUIRED TO ESTABLISH COMPLETELY BALANCED SYSTEMS.

3.03 BALANCE REQUIREMENTS:
- A. MAKE ALLOWANCE FOR AIR FILTER RESISTANCE AT TIME OF TESTS. BALANCE MAIN AIR SUPPLIES AT DESIGN AIR QUANTITIES AND AT AN AIR RESISTANCE ACROSS FILTER BANK MIDWAY BETWEEN DESIGN SPECIFICATIONS FOR CLEAN AND DIRTY FILTERS.
- B. BALANCE WORK WITHIN THE FOLLOWING TOLERANCES:
  1. SUPPLY, RETURN, EXHAUST INLETS/OUTLETS: BALANCE WITHIN -5% / +10% OF DESIGN CFM.
  2. OUTSIDE AIR INLETS: BALANCE WITHIN -0% / +10% OF DESIGN CFM.
  3. COILS: BALANCE WITHIN -5% / +10% OF DESIGN GPM.
- C. ROOMS WITH POSITIVE OR NEGATIVE PRESSURE REQUIREMENTS TO MAINTAIN A MINIMUM OF 15% DIFFERENTIAL PRESSURE REGARDLESS OF THE ABOVE TOLERANCES.
- D. PROVIDE A ROOM OR BUILDING PRESSURE TEST FOR EACH SYSTEM. MAXIMUM BUILDING PRESSURE SHALL NOT EXCEED 0.03" INCHES OF PRESSURE.
- E. HVAC SYSTEMS SHALL BE BALANCED AT NORMAL "MINIMUM OUTSIDE AIR" CONDITION. WHERE SUCH SYSTEMS ARE REQUIRED TO DELIVER 100-PERCENT RETURN AIR OR A VARIABLE AMOUNT OF OUTSIDE AIR, AS INDICATED IN SPECIFICATIONS FOR AUTOMATIC TEMPERATURE CONTROL SEQUENCES, TOTAL CFM TEST SHALL BE REPEATED FOR 100-PERCENT RETURN AIR AND MAXIMUM OUTSIDE AIR SHALL AGREE WITH CONDITIONS FOUND UNDER MAXIMUM OUTSIDE AIR OPERATION BEFORE SYSTEM IS CONSIDERED TO BE IN BALANCE. ADJUSTMENTS OF PROPER DAMPERS SHALL BE MADE TO ACHIEVE BALANCE AND MARKED SO THAT CONTROL SYSTEMS CONTRACTOR MAY SET DAMPER MOTORS ACCORDINGLY.
- F. AFTER FINAL AIR AND HYDRONIC BALANCE OF SYSTEMS, MAKE ADJUSTMENTS TO OBTAIN UNIFORM TEMPERATURES AS REQUIRED BY ACTUAL OCCUPANCY.
- G. TAKE STATIC PRESSURE READINGS WITH INCLINED MANOMETER. TAKE AIR VELOCITY READINGS WITH INSTRUMENTS OF RECENT CALIBRATION. TAKE FINAL VELOCITY READINGS WITH ALNOR VELOMETER, ANEMOTHERM OR VANE TYPE ANEMOMETER, CALIBRATED PRIOR TO TEST AND RECALIBRATED AT END OF TEST. INCLUDE CERTIFIED CORRECTION CURVES FOR EACH CALIBRATION AS PART OF RECORD. CERTIFY INSTRUMENTS ACCURATE TO STANDARDS CURRENTLY USED IN COMMON PRACTICE FOR SYSTEM BALANCE WORK. USE TEST CONES FOR DIFFUSERS.
- H. RUN TESTS WITH SUPPLY, RETURN, AND EXHAUST SYSTEMS OPERATING AND DOORS, WINDOWS, ETC. CLOSED OR UNDER REGULAR TRAFFIC. IF POSSIBLE, MAKE FINAL READINGS WITH COOLING COILS UNDER LOAD TO ENSURE THAT STATIC PRESSURES ARE AT MAXIMUM.
- I. ADJUST DEFLECTION OF SUPPLY OUTLETS TO ENSURE PROPER AND UNIFORM AIR DISTRIBUTION THROUGHOUT AREA SERVED BY SUCH OUTLETS.
- J. WORK WITH TEMPERATURE CONTROL SUBCONTRACTOR IN ADJUSTMENT OF AUTOMATIC DAMPERS, VALVES, THERMOSTATS, ETC. REQUIRED TO MAINTAIN PROPER TEMPERATURES IN ALL PORTIONS OF BUILDING.
- K. CONTRACTOR RESPONSIBLE FOR INSTALLING HEATING, COOLING, AND VENTILATING EQUIPMENT SHALL MAKE ANY CHANGES, ADDITIONS, OR MODIFICATIONS TO DAMPERS, FAN DRIVES AND MOTOR SHEAVES, PUMP IMPELLERS, MOTORS, AND OTHER EQUIPMENT NECESSARY FOR PROPER AIR AND HYDRONIC BALANCE.
- L. BALANCE OF SYSTEMS SHALL BE REVIEWED BY ARCHITECT AND DURING THIS REVIEW MECHANICAL CONTRACTOR SHALL FURNISH MEN, MATERIALS, LADDERS, ETC. TO ENABLE ARCHITECT TO TAKE ALL READINGS AS HE MAY DIRECT. IF ERRORS ARE FOUND, BALANCING AGENCY SHALL READJUST SYSTEM TO SATISFACTION OF ARCHITECT.

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SECTION 23.31.00 - HVAC DUCTWORK

PART 1 - GENERAL

1.01 SUMMARY
- A. THIS SECTION INCLUDES SHEET METAL MATERIALS, FASTENERS, SUPPORTS, AND DUCT CONSTRUCTION CLASSIFICATIONS FOR:
  1. SUPPLY, RETURN, AND EXHAUST SYSTEMS.

1.02 REFERENCES
- A. AABC - ASSOCIATED AIR BALANCE COUNCIL MANUAL: NATIONAL STANDARDS FOR TOTAL SYSTEM BALANCE
- B. ANSI - AMERICAN NATIONAL STANDARD INSTITUTE
- C. ASHRAE STANDARDS: COMPLY WITH AMERICAN SOCIETY OF AIR CONDITIONING, REFRIGERATION, AND AIR CONDITIONING ENGINEERS HANDBOOK.
- D. NFPA - COMPLIANCE. COMPLY WITH ANSI/NFPA 90A, STANDARD FOR THE INSTALLATION OF AIR CONDITIONING AND VENTILATING SYSTEMS, AND ANSI/NFPA 90B STANDARD FOR THE INSTALLATION OF WARM AIR HEATING AND AIR CONDITIONING SYSTEMS, LATEST ACCEPTED EDITION.
- E. CBC - CALIFORNIA BUILDING CODE
- F. CFC - CALIFORNIA FIRE CODE
- G. CMC - CALIFORNIA MECHANICAL CODE
- H. LOCAL CODES
- I. SMACNA - SHEET METAL AND AIR CONDITIONING CONTRACTOR'S NATIONAL ASSOCIATION, INC.
  1. DUCT CONSTRUCTION STANDARDS
  2. FIRE DAMPER AND HEAT STOP GUIDE.
  3. HVAC SYSTEMS TESTING ADJUSTING AND BALANCING.
  4. GUIDELINES FOR SEISMIC RESTRAINTS OF MECHANICAL SYSTEMS AND PLUMBING PIPE SYSTEMS.
- J. UL - UNDERWRITERS' LABORATORY STANDARDS FOR SAFETY: REFERRED TO AS UL 181, UL 555, ETC.

1.03 QUALITY ASSURANCE
- A. CONTRACTOR TO COMPLY WITH ALL THE ABOVE REFERENCED STANDARDS.
- B. THE ABOVE REFERENCED STANDARDS MAY BE SUPERSEDED BY NOTES AND DETAILS ON DRAWINGS AND IN SPECIFICATION.
- C. WHERE TWO OR MORE REFERENCES ARE IN CONFLICT, THE MOST STRINGENT, AS DETERMINED BY THE ARCHITECT, SHALL TAKE PRECEDENCE.
- D. FLAME_SMOKE RATINGS: ALL PRODUCTS USED IN DUCTWORK SYSTEM TO COMPLY WITH FLAME_SPREAD INDEX OF 25 OR LESS, FUEL_CONTRIBUTED INDEX OF 50 OR LESS, AND SMOKE_DEVELOPED INDEX OF 50 OR LESS.
- E. INSTALLER: A FIRM WITH AT LEAST THREE YEARS OF SUCCESSFUL INSTALLATION EXPERIENCE ON PROJECTS SIMILAR TO THAT REQUIRED FOR THIS WORK.
- F. FABRICATE ALL DUCTWORK WITH SHEET METAL. FIBERGLASS DUCTWORK WILL NOT BE ACCEPTED.
- G. DUCT LINER TO BE CERTIFIED BY GREENGUARD: GREENGUARD ENVIRONMENTAL INSTITUTE, INDEPENDENT TESTING OF PRODUCTS FOR EMISSIONS OF RESPIRABLE PARTICLES AND VOLATILE ORGANIC COMPOUNDS (VOCS), INCLUDING FORMALDEHYDE AND OTHER SPECIFIC PRODUCT-RELATED POLLUTANTS. PROVIDES INDEPENDENT, THIRD-PARTY CERTIFICATION OF IAQ PERFORMANCE. CERTIFICATION IS BASED UPON CRITERIA USED BY EPA, OSHA AND WHO

1.04 SUBMITTALS
- A. SUBMIT TYPICAL SHOP STANDARDS AND/OR SMACNA DETAILS FOR EACH CLASS OF DUCT SPECIFIED. INDICATE THE FOLLOWING FOR EACH STANDARD:
  1. GAUGE SIZES AND JOINT DETAILS
  2. PRESSURE CLASS
  3. SEAM CONSTRUCTION
  4. SYSTEM TYPE (E.G. SUPPLY AIR, RETURN, AIR, ETC.)
- B. SUBMIT SHOP DRAWINGS FOR DUCTWORK INCLUDING ELEVATIONS AND SHOWING ALL TERMINAL UNITS AND AIR DEVICES CONNECTIONS. DRAWINGS SHALL BE A MINIMUM SCALE OF ¼"=1'-0" AND BE COORDINATED WITH ALL OTHER TRADES.
- C. RECORD DRAWINGS: AT PROJECT CLOSET-OUT, SUBMIT RECORD DRAWINGS OF INSTALLED DUCTWORK, DUCT ACCESSORIES, AND INLETS / OUTLETS IN ACCORDANCE WITH THE REQUIREMENTS OF DIVISION 1.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
- A. MANUFACTURED ROUND AND OVAL DUCTWORK: UNITED MCGILL SHEET METAL, OMNI DUCT, OR EQUAL
- B. DUCT CONNECTION SYSTEMS: DUCTMATE INDUSTRIES, INC., TRAVERS DUCT CONNECTION (TDC), OR EQUAL
- C. FLEXIBLE DUCTWORK: FLEXMASTER, THERMAFLEX, OR EQUAL
- D. DUCT SEALANTS: UNITED MCGILL CORP., DUCTMATE PROSEAL, OR EQUAL
- E. DUCT LINER: JOHNS MANVILLE - LINACOUSTIC, OWENS CORNING FIBERGLAS CORPORATION - AEROFLEX PLUS, OR CERTAINTEED CORPORATION - TOUGHGARD
- F. DUCT ADHESIVES: FOSTERS ADHESIVE - 85-462, SWIFTS ADHESIVE - 7336, OR EQUAL

2.02 DUCT CONSTRUCTION CLASSIFICATIONS:
- A. GENERAL: CONSTRUCT AND SEAL DUCTWORK IN ACCORDANCE WITH SMACNA PRESSURE CLASSIFICATIONS AND SEAL CLASSES LISTED FOR DUCTWORK SYSTEMS INVOLVED.
  1. MINIMUM DUCT GAUGE FOR CONCEALED DUCTWORK TO BE 26 GAUGE.
  2. PROVIDE 20 GAUGE MINIMUM FOR DUCTWORK EXPOSED WITHIN OCCUPIED AREAS.
- B. RECTANGULAR DUCTWORK:
  1. +2" W.G. CLASS DUCTWORK:
     a. SUPPLY AIR DUCTWORK DOWNSTREAM OF TERMINAL BOXES.
     b. CONSTANT VOLUME SUPPLY AIR DUCTWORK IN SYSTEMS WITHOUT TERMINAL BOXES
  2. -2" W.G. CLASS DUCTWORK:
     a. GENERAL EXHAUST DUCTWORK.
     b. RETURN AIR DUCTWORK
  3. +4" W.G. CLASS DUCTWORK:
     a. SUPPLY AIR DUCTWORK BETWEEN SOURCE EQUIPMENT AND TERMINAL BOX
- C. ROUND OR OVAL DUCTWORK: SAME AS RECTANGULAR DUCTWORK

2.03 GENERAL:
- A. ALL DUCT SIZES LISTED ON DRAWINGS ARE EXTERNAL SIZES.
- B. GALVANIZED SHEET STEEL TO BE LOCK-FORMING QUALITY, ASTM A924 AND ASTM. COATING TO BE DESIGNATION G90. PROVIDE MILL PHOSPHATIZED FINISH FOR EXPOSED SURFACES OF DUCTS EXPOSED TO VIEW.
  1. PROVIDE MILL CERTIFICATION FOR GALVANIZED MATERIAL AT REQUEST OF IOR.
- C. TAPERS TO BE AS FOLLOWS:
  1. LIMIT DIVERGING TAPERS TO A MAXIMUM OF 30 DEGREES.
  2. LIMIT EXPANDING TAPERS TO A MAXIMUM OF 20 DEGREES.
- D. RUN DUCTWORK PARALLEL TO ADJACENT WALLS UNLESS SHOWN OTHERWISE ON PLANS.
- E. JOINT SEALING:
  1. SEAL ALL CONCEALED DUCTWORK WITHIN THE BUILDING, ALL DUCTWORK WITHIN MECHANICAL ROOMS, AND ALL DUCTWORK EXPOSED TO WEATHER AIR TIGHT. SEAL ALL STANDING SEAMS, TRANSVERSE JOINTS, MANUFACTURED JOINTS AND SEAMS WITH DUCT SEALANT. DUCT SEALANT TO BE RATED FOR INDOOR AND OUTDOOR USE.
  2. SEAL PUNCHED HOLES, CORNER CRACKS, AND ALL SHEET METAL SCREWS.
  3. AFTER TESTING, RESEAL JOINTS FOUND TO BE LEAKING.
  4. AT DUCTMATE JOINTS, IN ADDITION TO DUCTMATE GASKETS, SEAL ALL BOLTED CORNERS TO ELIMINATE AIR LEAKAGE AT CORNERS.
  5. PRESSURE SENSITIVE TAPES SHALL NOT BE CONSIDERED.
- F. PROVIDE SHEET METAL ANGLE FRAME AT ALL DUCT PENETRATIONS TO WALL, FLOOR, ROOF, OR CEILING.
  1. DUCTS TO PENETRATE PERPENDICULAR TO WALLS, CEILINGS AND FLOORS.
- G. INTERNAL DUCT LINER:
  1. PROVIDE INTERNAL DUCT LINER AS FOLLOWS:
     b. EXHAUST DUCT WHERE INDICATED ON THE DRAWINGS.
  2. INTERNAL DUCT LINER WITHIN BUILDING INSTALLED OVER CONDITIONED SPACES TO BE AS FOLLOWS:
     a. 1" THICK, 1.5_POUND DENSITY (MINIMUM) WITH MATT FACING.
     b. THERMAL PERFORMANCE - C VALUE - 0.24 BTU / (H * FT2 * OF) - MINIMUM
     c. THERMAL PERFORMANCE - R VALUE - 4.2 (H * FT2 * OF) / BTU - MINIMUM
     d. LINER TO BE CERTAINTEED, TOUGHGARD R DUCT LINER, TYPE 150, OR EQUAL.
  3. CEMENT DUCT LINER IN PLACE WITH NONFLAMMABLE, NON-HARDENING DUCT ADHESIVE. SEAL UP ALL RAW EDGES OF INSULATION INSIDE DUCTWORK WITH ADHESIVE.
  4. PROVIDE SHEET METAL WELD PIN FASTENERS AND WASHERS ON ALL DUCT WORK ON 12_INCH INTERVALS WITH THE FIRST ROW WITHIN 3 INCHES OF THE LEADING EDGE OF EACH PIECE OF INSULATION AND 4 INCHES FROM CORNERS. NO SUBSTITUTIONS ON FASTENING METHOD WILL BE ALLOWED.
  5. DUCT LINER AND ADHESIVE SHALL NOT EXCEED FLAME_SPREAD RATING OF 25 AND SMOKE_DEVELOPED RATING OF 50, ALL IN CONFORMANCE WITH NFPA 90A.
  6. PROVIDE METAL NOSING AT ALL LOCATIONS WHERE LINER IS PRECEDED BY UNLINED METAL.
- H. DUCTWORK SUPPORT: PROVIDE HOT-DIPPED GALVANIZED STEEL FASTENERS, ANCHORS, RODS, STRAPS, TRIM, AND ANGLES FOR SUPPORT OF DUCTWORK, UNLESS NOTED OTHERWISE.
- I. MISCELLANEOUS DUCTWORK MATERIALS:
  1. DUCT JOINTS: INSTALL DUCT SEALERS, POP RIVETS, OR SHEET METAL SCREWS AT EACH FITTINGS AND JOINT. USE A MINIMUM OF #10 GALVANIZED SHEET METAL SCREWS.

2.04 ROUND DUCT CONSTRUCTION:
- A. SPIRAL LOCK SEAM PREFABRICATED FACTORY-BUILT ROUND AND OVAL DUCT AND FITTINGS SHALL BE USED WHEREVER POSSIBLE. SHOP FABRICATED DUCTS SHALL BE USED ONLY WHERE RECTANGULAR SHAPED DUCTS ARE SHOWN ON PLANS OR WHERE TRANSITIONS AND SPECIAL FITTINGS CANNOT BE PREFABRICATED BY FACTORY. PROVIDE COUPLINGS TO JOIN EACH LENGTH OF DUCT.
- B. FABRICATE DUCT FITTINGS TO MATCH ADJOINING DUCTS AND COMPLY WITH DUCT REQUIREMENTS AS APPLICABLE TO FITTINGS. EXCEPT AS NOTED OTHERWISE, FABRICATE ELBOWS AS FOLLOWS:
  1. CENTER-LINE RADIUS TO BE EQUAL TO 1.5 TIMES ASSOCIATED DUCT WIDTH.
  2. PROVIDE TWO-PIECE, DIE STAMPED, 45 DEGREE TO 90 DEGREE ELBOWS FOR SIZES UP TO 12 INCHES.
  3. PROVIDE 5 PIECE 90 DEGREE ELBOWS FOR SIZES 12" AND ABOVE, CONICAL TEES, AND CONICAL LATERALS.
  4. ALL REDUCERS TO BE LOCATED AFTER TAP. REDUCERS SHALL BE LONG-TAPER STYLE. REDUCING TEES SHALL NOT BE ALLOWED.
- C. ROUND DUCTWORK: CONSTRUCT OF GALVANIZED SHEET METAL COMPLYING WITH ANSI/ASTM A527 BY THE FOLLOWING METHODS AND IN MINIMUM GAUGES LISTED.
  1. DUCTS UP TO 14"Ø TO BE 26 GAUGE SPIRAL LOCKSEAM.
  2. DUCTS BETWEEN 15"Ø TO 23"Ø TO BE 24 GAUGE SPIRAL LOCKSEAM.
- D. FITTINGS AND COUPLINGS:
  1. CONSTRUCT OF SAME MINIMUM GAUGES LISTED FOR DUCTWORK.
  2. PROVIDE CONTINUOUS WELDS ALONG SEAMS.
  3. AT CONTRACTORS OPTION, PROVIDE SPOT WELDED FITTINGS SEALED INSIDE AND OUT.

2.05 FLEXIBLE DUCTWORK:
- A. FLEXIBLE DUCTS MAY BE USED IN CONCEALED AREAS WHERE DETAILED AND AS SPECIFIED.
- B. FLEXIBLE DUCTS FROM RIGID RUN-OUTS TO REGISTERS SHALL BE FLEXMASTER USA, INC., TYPE 1M ACOUSTICAL INSULATED FLEX DUCT, OR EQUAL.
- C. FLEXIBLE DUCTS SHALL BE AS FOLLOWS:
  1. MINIMUM OPERATING PRESSURE:
     a. POSITIVE = 10" W.G. FOR ALL SIZES
     b. NEGATIVE = 5" W.G. FOR SIZES THRU 16" AND 1" W.G. FOR SIZES 18 & 20"
  2. RATED VELOCITY = 5,500 FPM
  3. MINIMUM BURST PRESSURE = 2 1/2 TIMES WORKING PRESSURE
  4. MINIMUM R VALUE = 6.0 (H * FT2 * OF) / BTU
  5. DUCT TO BE ETL CLASS 1 AIR DUCT.
  6. FLAME SPREAD TO BE LESS THAN 25 AND SMOKE DEVELOPED LESS THAN 50.
  7. FLEX DUCT TO CONSIST OF AN EXTERIOR REINFORCED METALIZED VAPOR BARRIER, FIBERGLASS INSULATION, MECHANICAL LOCK WIRE HELIX, AND POLYETHYLENE INNER FILM. INNER LINER TO BE MECHANICALLY LOCKED WITHOUT ADHESIVES.
- D. MINIMUM LENGTH OF THREE FEET AND A MAXIMUM LENGTH OF FIVE FEET TO BE INSTALLED AT EACH AIR TERMINAL. FLEXIBLE DUCT SHALL HAVE NO BENDS GREATER THAN 45 DEGREES UNLESS SHOWN OTHERWISE. SPECIFICATIONS AND ANY APPLICABLE DRAWINGS OR DETAILS WILL BE STRICTLY ENFORCED. SUBMITTALS TO PROVIDE ACOUSTICAL CHARACTERISTICS OF FLEXIBLE DUCTWORK.
- E. MAKE CONNECTIONS TO RIGID DUCTWORK WITH PANDUIT STYLE DRAW BAND. PROVIDE ONE DRAW-BAND AT INNER LINER AND A SECOND DRAW BAND OVER THE OUTER VAPOR BARRIER MATERIAL.

2.06 DUST COLLECTOR EXHAUST DUCTWORK:
- A. PROVIDE DONALDSON TORIT EASY DUCT (OR EQUAL) EXHAUST DUCT SYSTEM. ALL DUCTWORK TO BE CLAMP-TOGETHER COMPONENTS.
- B. AT CONTRACTOR'S OPTION, PROVIDE SPIRAL LOCK SEAM PREFABRICATED FACTORY-BUILT ROUND DUCT AND FITTINGS SHALL BE USED. PROVIDE COUPLINGS TO JOIN EACH LENGTH OF DUCT.
  1. FABRICATE DUCT FITTINGS TO MATCH ADJOINING DUCTS AND COMPLY WITH DUCT REQUIREMENTS AS APPLICABLE TO FITTINGS. EXCEPT AS NOTED OTHERWISE, FABRICATE ELBOWS AS FOLLOWS:
     a. CENTER-LINE RADIUS TO BE EQUAL TO 2 TIMES ASSOCIATED DUCT WIDTH.
     b. PROVIDE CONTINUOUS WELDED SEEMS AT ALL FITTINGS.
     c. ALL REDUCERS TO BE LOCATED AFTER TAP. REDUCERS SHALL BE LONG-TAPER STYLE. REDUCING TEES SHALL NOT BE ALLOWED.
  2. ROUND DUCTWORK: CONSTRUCT OF GALVANIZED SHEET METAL COMPLYING WITH ANSI/ASTM A527 BY THE FOLLOWING METHODS AND IN MINIMUM GAUGES LISTED.
     a. DUCTS 4" - 24" DIAMETER TO BE 20-GAUGE MINIMUM SPIRAL LOCK-SEAM.
  3. FITTINGS AND COUPLINGS:
     a. CONSTRUCT OF SAME MINIMUM GAUGES LISTED FOR DUCTWORK.
     b. DUCTS TO BE JOINED BY POP-RIVETS IN LIEU OF SHEET METAL SCREWS. INTERIOR TO DUCTWORK TO BE SMOOTH FINISH FREE OF SCREWS.
     c. PROVIDE CONTINUOUS WELDS ALONG SEAMS.
- C. FLEX HOSES:
  1. FINAL CONNECTION TO SHOP EQUIPMENT SHALL BE MADE WITH FLEX HOSES. FLEX HOSES SHALL BE AS FOLLOWS:
     a. TONALDSON TORIT EASY DUCT RUBBER HOSE PT 3280.
     b. HOSES TO BE "CLEAR".
     c. PROVIDE WITH HOSE CLAMPS
     d. MAXIMUM LENGTH OF HOSE TO BE 24".
  2. PROVIDE OWNER WITH 4 SPARE HOSES IN EACH SIZE PROVIDED.
  3. PROVIDE OWNER WITH 4 SPARE HOSE CLAMPS IN EACH SIZE PROVIDED.

PART 3 - EXECUTION

3.01 INSTALLATION OF DUCTWORK:
- A. ASSEMBLE AND INSTALL DUCTWORK IN ACCORDANCE WITH RECOGNIZED INDUSTRY PRACTICES WHICH WILL ACHIEVE AIR TIGHT (LEAKAGE CLASS 12 FOR 2_INCH PRESSURE CLASS AND LEAKAGE CLASS 3 FOR 4_INCH PRESSURE CLASS) AND NOISELESS (NO OBJECTIONABLE NOISE) SYSTEMS CAPABLE OF PERFORMING EACH INDICATED SERVICE. INSTALL EACH RUN WITH MINIMUM OF JOINTS. ALIGN DUCTWORK ACCURATELY AT CONNECTIONS WITHIN 1/8_ INCH MISALIGNMENT TOLERANCE AND WITH INTERNAL SURFACES SMOOTH. SUPPORT DUCTS RIGIDLY WITH SUITABLE TIES, BRACES, HANGERS, AND ANCHORS OF TYPE WHICH WILL HOLD DUCTS TRUE TO SHAPE AND TO PREVENT BUCKLING.
- B. SEAL DUCTWORK AFTER INSTALLATION TO SEAL CLASS REQUIRED AND METHOD PRESCRIBED IN SMACNA "HVAC LEAKAGE TEST MANUAL," LATEST EDITION.
- C. PAINT INSIDE OF DUCT VISIBLE THROUGH GRILLE DULL BLACK.
- D. DUCT SUPPORTS:
  1. SUPPORT DUCTWORK IN MANNER COMPLYING WITH SMACNA "HVAC DUCT CONSTRUCTION STANDARDS," LATEST EDITION, HANGERS AND SUPPORTS SECTIONS. WHERE SPECIAL HANGING OF DUCTWORK IS DETAILED OR SHOWN ON DRAWINGS, DRAWINGS SHALL BE FOLLOWED.
     a. EXCEPT WHERE MODIFIED IN INDIVIDUAL PARAGRAPHS IN THIS SECTION OR DETAILED ON DRAWINGS, PROVIDE HANGER SUPPORT WITH MINIMUM 18 GAUGE STRAPS, 1 INCH WIDE. FOLD DUCT STRAP UNDER BOTTOM OF DUCT.
     b. INSTALL DUCT SUPPORTS TO RETANGULAR DUCTS WITH SHEET METAL SCREWS. PROVIDE ONE SCREW THROUGH STRAP AT TOP OF DUCT AND ONE SCREW THROUGH STRAP AT BOTTOM OF DUCT.
  2. UPPER CONNECTION OF SUPPORT TO WOOD STRUCTURE SHALL BE WITH WOOD SCREWS OR LAG SCREWS IN SHEAR FASTENED IN THE UPPER ONE HALF OF THE WOOD STRUCTURAL MEMBER. FASTENERS SHALL CONFORM TO THE FOLLOWING SCHEDULE:
     a. DUCTS WITH SIZES P/2 ≤ 30" TO BE FASTENED WITH #10 X 1 ½" WOOD SCREW.
     b. DUCTS WITH SIZES 31" ≤ P/2 ≤ 72" TO BE FASTENED WITH 1/4" X 1 ½" LAG SCREW.
     c. DUCTS WITH SIZES P/2 > 73" TO BE FASTENED WITH 3/8" X 1 ½" LAG SCREW.
- E. WHERE DUCTS PASS THROUGH INTERIOR PARTITIONS AND EXTERIOR WALLS, CONCEAL SPACE BETWEEN CONSTRUCTION OPENING AND DUCT OR DUCT_PLUS_ INSULATION WITH SHEET METAL FLANGES OF SAME GAUGE AS DUCT. OVERLAP OPENING ON FOUR SIDES BY AT LEAST 1_1/2 INCHES.
- F. WHERE DUCTWORK IS EXPOSED, CONTRACTOR TO PAINT DUCTWORK, SUPPORTS, AND AIR INLETS AND OUTLETS TO MATCH ADJACENT ARCHITECTURAL SURFACES, OR AS DIRECTED BY ARCHITECT.

3.02 INSTALLATION OF FLEXIBLE DUCTWORK
- A. PROVIDE FLEXIBLE DUCTS WITH SUPPORTS AT OR NEAR MID_LENGTH WITH 2_INCH WIDE, 26_GAUGE STEEL HANGER COLLAR ATTACHED TO THE STRUCTURE WITH AN APPROVED DUCT HANGER. INSTALLATION SHALL MINIMIZE SHARP RADIUS TURNS OR OFFSETS.
- B. MAKE CONNECTIONS TO RIGID DUCTWORK WITH PANDUIT STYLE DRAW BAND. PROVIDE ONE DRAW-BAND AT INNER LINER AND A SECOND DRAW BAND OVER THE OUTER VAPOR BARRIER MATERIAL.
- C. BENDS IN FLEXIBLE DUCTWORK SHALL BE KEPT TO A MINIMUM. WHEN REQUIRED, THE MINIMUM BEND RADIUS SHALL BE 1.5 TIMES THE DUCT DIAMETER. DUCT OFFSETS TO BE LIMITED TO 45 DEGREE TURNS.

3.03 CLEANING AND PROTECTION
- A. DUCTWORK BEING STORED ON SITE TO BE COVERED AND PROTECTED FROM ELEMENTS. INTERNALLY LINED DUCTWORK TO BE STORED ON JOBSITE IN CLEAN / DRY LOCATION. ANY INSULATION EXPOSED TO WATER MUST BE DISCARDED IMMEDIATELY AND REMOVED FROM JOBSITE.
- B. CLEAN DUCTWORK INTERNALLY, UNIT BY UNIT AS IT IS INSTALLED, OF DUST, DIRT, AND DEBRIS.
- C. CLEAN EXTERNAL SURFACES OF DIRT AND FOREIGN SUBSTANCES WHICH MIGHT CAUSE CORROSIVE DETERIORATION OF METAL OR WHERE DUCTWORK IS TO BE PAINTED.
- D. STRIP PROTECTIVE PAPER FROM STAINLESS DUCTWORK SURFACES, AND REPAIR FINISH WHEREVER IT HAS BEEN DAMAGED.
- E. TEMPORARY CLOSURE: AT ENDS OF DUCTS WHICH ARE NOT CONNECTED TO EQUIPMENT OR AIR DISTRIBUTION DEVICES AT TIME OF DUCTWORK INSTALLATION, PROVIDE TEMPORARY CLOSURE OF POLYETHYLENE FILM OR OTHER COVERING WHICH WILL PREVENT ENTRANCE OF DUST AND DEBRIS UNTIL TIME CONNECTIONS ARE TO BE COMPLETED.
- F. IF HVAC SYSTEM IS OPERATED PRIOR TO THE COMPLETION OF CONSTRUCTION, CONTRACTOR TO PROVIDE TEMPORARY FILTERS AT ALL RETURN AIR AND EXHAUST AIR GRILLES. FILTERS TO BE 2" THICK, MERV 8 FILTERS. CONTRACTOR TO SECURE FILTERS IN PLACE WITH TAPE OR WIRING. FILTERS TO COMPLETELY COVER GRILLE OPENING.

3.04 OPERATION TEST:
- A. TEST EACH PIECE OF EQUIPMENT TO SHOW THAT IT WILL OPERATE IN ACCORDANCE WITH INDICATED REQUIREMENTS.

3.05 CLEANING UP:
- A. UPON COMPLETION OF WORK REMOVE MATERIALS, EQUIPMENT, APPARATUS, AND TOOLS, AND LEAVE PREMISES CLEAN, NEAT, AND ORDERLY.

CONSULTANT

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SHEET TITLE:
MECHANICAL
SPECIFICATIONS

SCALE: AS SHOWN

REVISIONS

No.	Issue Description	Date

Drawn By: BZ

Checked By: AD

JOB NO. 22-061

DATE 02-01-2023

SHEET NUMBER
M7.4
of