

MECHANICAL DUCT SYMBOLS	
DESCRIPTION	
	SQUARE DUCT SIZE TAG (WIDTH x HEIGHT)
	OVAL DUCT SIZE TAG (WIDTH / HEIGHT)
	ROUND DUCT SIZE TAG (DIAMETER)
	EXISTING DUCT TAG (GRAY ON DEMO PLANS, OTHERWISE SAME SYSTEM COLOR, ONLY HALFTONE)
	DUCT BEING DEMOLISHED
	DUCT BEING DEMOLISHED
	DUCT BEING DEMOLISHED
	SUPPLY AIR
	OUTDOOR AIR
	RETURN AIR
	EXHAUST AIR
	RELIEF AIR
	TRANSFER AIR
	SUPPLY AIR DIFFUSER (4-WAY)
	RETURN AIR GRILLE
	RETURN AIR GRILLE WITH SOUND BOOT
	EXHAUST AIR GRILLE
	PIPING BEING DEMOLISHED
	EXISTING PIPING
	NEW PIPING
	CHILLED WATER SUPPLY
	CHILLED WATER RETURN
	HOT WATER SUPPLY
	HOT WATER RETURN
	CONDENSATE DRAIN
	REFRIGERANT
	POINT OF EXISTING TO NEW CONNECTION
	POINT OF DISCONNECT TO EXISTING CONNECTION
M.C.	MECHANICAL CONTRACTOR
E.C.	ELECTRICAL CONTRACTOR
P.C.	PLUMBING CONTRACTOR
N.I.C.	NOT IN CONTRACT
(EX)	EXISTING
AF	ABOVE FINISHED FLOOR
DN	DOWN
UP	UP
	SECTION CUT
	REFERRING DETAIL NUMBER
	REFERRING SHEET NUMBER

MECHANICAL PIPING SYMBOLS	
SYMBOL	DESCRIPTION
	BUTTERFLY VALVE
	3-PIECE BALL VALVE
	CHECK VALVE
	STRAINER WITH BLOWDOWN VALVE WITH HOSE CONN.
	BALANCING VALVE
	B&G CIRCUIT SETTER
	UNION
	THERMOMETER
	PRESSURE GAGE & COCK
	GAGE COCK
	FLOW SWITCH
	ECCENTRIC REDUCER
	CONCENTRIC REDUCER
	STEAM TRAP, F&T
	STEAM TRAP, TB
	CONTROL VALVE
	GAS COCK
	PRESSURE REDUCING/REGULATING VALVE
	SOLENOID VALVE

PROJECT ADD ALTERNATES LIST - MEP SCOPE	
#01	ENTRY VESTIBULE

OWNER PREFERRED ALTERNATE - MECHANICAL	
#M1	TRANE TECHNOLOGIES - BAS CONTROL SYSTEM

2018 NORTH CAROLINA ENERGY CONSERVATION CODE					
COMMERCIAL ENERGY EFFICIENCY - MECHANICAL SUMMARY					
C401 METHOD OF COMPLIANCE					
<input checked="" type="checkbox"/> 2018 NCECC CHAPTER 4	<input type="checkbox"/> COMCHECK PROVIDED (2018 NCECC)				
<input type="checkbox"/> ASHRAE 90.1-2013 PRESCRIPTIVE	<input type="checkbox"/> COMCHECK PROVIDED (90.1-2013)				
<input type="checkbox"/> ASHRAE 90.1-2013 PERFORMANCE	<input type="checkbox"/> ENERGY MODELING DATA PROVIDED				
<input type="checkbox"/> N/A (EXISTING LIGHTING, HVAC, AND DOM. WATER HEATING SYSTEMS TO REMAIN)					
C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS					
<input type="checkbox"/> C406.2 EFFICIENT MECH EQUIPMENT	<input type="checkbox"/> C406.5 ON-SITE RENEWABLE ENERGY				
<input checked="" type="checkbox"/> C406.3 REDUCED LTG DENSITY	<input type="checkbox"/> C406.6 DEDICATED OA SYSTEM				
<input type="checkbox"/> C406.4 ENHANCED LTG CONTROLS	<input type="checkbox"/> C406.7 SERVICE WATER HEATING				
C301 CLIMATE ZONE					
3A - MECKLENBURG COUNTY, NORTH CAROLINA					
DESIGN CONDITIONS					
EXTERIOR (ASHRAE 90.1-2013 TABLE D-1)					
winter dry bulb	18° F.				
summer dry bulb	91° F.				
summer wet bulb	74° F.				
INTERIOR (2018 NCECC SECTION C302.1)					
winter dry bulb	72° F.				
summer dry bulb	75° F.				
C403.2 HEATING & COOLING LOADS AND EQUIPMENT & SYSTEM SIZING					
BUILDING HEATING LOAD	SEE SCHEDULES				
BUILDING COOLING LOAD	SEE SCHEDULES				
INSTALLED HEATING CAPACITY	SEE SCHEDULES				
INSTALLED COOLING CAPACITY	SEE SCHEDULES				
C403.2.3 & C406.2 - REQUIRED & INCREASED HVAC EQUIPMENT PERFORMANCE					
SYSTEM DESCRIPTION - FAN POWERED TERMINAL BOXES W/ HOT WATER COILS; PACKAGED ERV DX VAV HEAT PUMP W/ ELECT. HEAT					
<input checked="" type="checkbox"/> MINIMUM HVAC EQUIP EFFICIENCY COMPLIANCE - TABLE C403.2.3					
<input type="checkbox"/> INCREASED HVAC EQUIP EFFICIENCY COMPLIANCE - 10% OVER TABLE C403.2.3					
EQUIP TYPE	SIZE CATEGORY (BTUH)	SUBCATEGORY	C403.2.3 MINIMUM EFFICIENCY (a)	10% INCREASED EFF. (a)	DESIGN EFFIC.
TABLE C403.2.3(1) - UNITARY AIR CONDITIONERS AND CONDENSING UNITS					
AIR COND. AIR COOLED	>= 240,000 & < 760,000	SPLIT SYSTEM & SINGLE PACKAGE	10.0 EER	11.0 EER	SEE SCHEDULE
11.0 EER					
12.0 EER					
C403.2.4 THRU C403.2.11					
HVAC SYSTEMS ARE FULLY COMPLIANT WITH THE REQUIREMENTS FOR HVAC SYSTEM CONTROL, VENTILATION, ENERGY RECOVERY, DUCT AND PLENUM INSULATION AND SEALING, PIPING INSULATION, AND SYSTEM COMPLETION.					
C403.2.12 - AIR SYSTEM DESIGN AND CONTROL					
<input checked="" type="checkbox"/> ALL FANS INSTALLED ON THE PROJECT ARE 5 HP OR LESS AND ARE EXEMPT FROM THESE REQUIREMENTS.					
<input type="checkbox"/> FANS ABOVE 5 HP MEET THE CFM LIMITATIONS SHOWN BELOW:					
OPTION 1 - FAN SYSTEM MOTOR NAMEPLATE HP - TABLE C403.2.12.(1)					
ALLOWABLE MOTOR HP	CONSTANT VOLUME MINIMUM CFM	VARIABLE VOLUME MINIMUM CFM	DESIGN CFM		
7.5	6,818 CFM	5,000 CFM	SEE SCHEDULE		
10	9,091 CFM	6,667 CFM	SEE SCHEDULE		
15	13,636 CFM	10,000 CFM	SEE SCHEDULE		
20	18,182 CFM	13,333 CFM	SEE SCHEDULE		
25	22,727 CFM	16,667 CFM	SEE SCHEDULE		
30	27,272 CFM	20,000 CFM	SEE SCHEDULE		
40	36,364 CFM	26,667 CFM	SEE SCHEDULE		
50	45,455 CFM	33,333 CFM	SEE SCHEDULE		
C405.8 - ELECTRICAL MOTORS (MANDATORY REQUIREMENTS).					
<input checked="" type="checkbox"/> ELECTRICAL MOTORS HAVE BEEN SPECIFIED TO MEET MINIMUM EFFICIENCY REQUIREMENTS PER C405.8, EXCEPT WHERE EXEMPT.					
<input type="checkbox"/> NOT APPLICABLE.					
C408 - SYSTEM COMMISSIONING					
<input type="checkbox"/> PROJECT AREA IS LESS THAN 10,000 SQUARE FEET AND IS EXEMPT FROM THE SYSTEM COMMISSIONING REQUIREMENTS OF SECTION C408.					
<input checked="" type="checkbox"/> PROJECT AREA IS GREATER THAN 10,000 SQUARE FEET AND REQUIRES SYSTEM COMMISSIONING PER SECTION C408.					

TESTING, ADJUSTING, AND BALANCING	
1.	MECHANICAL CONTRACTOR SHALL PROVIDE A PRE-DEMOLITION TEST AND BALANCE REPORT AND CONTROLS DIAGNOSTICS REPORT ON THE EXISTING SYSTEMS INDICATED TO REMAIN: VAV TERMINAL UNITS, EX-AHU-1A, 1B, 2B, ETC. REPORT SHALL INCLUDE AIR AND WATER FLOWS; ENTERING AND LEAVING AIR CONDITIONS; EXTERNAL AND TOTAL STATIC PRESSURES; AND ALL PERFORMANCE AND CONTROLS DEFICIENCIES DISCOVERED. ANY EQUIPMENT OR COMPONENT FOUND TO BE INOPERABLE OR SHORT OF DESIGN CAPACITIES SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER. SUMMATION OF GRILLES IS AN ACCEPTABLE ALTERNATIVE TO DUCT TRAVERSE READINGS. PRE-DEMOLITION TEST AND BALANCE REPORT TO BE COMPLETED BY AN INDEPENDENT, CERTIFIED TEST AND BALANCE CONTRACTOR. CONTROLS DIAGNOSTICS REPORT SHALL BE COMPLETED BY THE CONTROLS CONTRACTOR. REPORTS SHALL BE SUBMITTED FOR REVIEW DURING SHOP SUBMITTAL PROCESS.
2.	THE MECHANICAL CONTRACTOR SHALL BALANCE ALL MECHANICAL SYSTEMS TO THE PERFORMANCE SPECIFICATIONS INDICATED ON PLANS AND PROVIDE THE ENGINEER WITH THREE COPIES OF A COMPLETE TEST AND BALANCE REPORT. THE REPORT IS TO BE ISSUED A MINIMUM OF TWO WEEKS PRIOR TO PROJECT COMPLETION. THE TEST AND BALANCE REPORT WILL BE SUBJECT TO REVIEW AND APPROVAL BY THE ENGINEER. ANY ADDITIONAL TESTING, ADJUSTING AND BALANCING REQUIRED (AT ENGINEER'S REQUEST) AFTER REVIEW OF THE INITIAL REPORT SHALL BE PROVIDED AT NO ADDITIONAL COST. TEST AND BALANCE REPORT TO BE COMPLETED BY AN INDEPENDENT, CERTIFIED TEST AND BALANCE CONTRACTOR.
3.	CONDUCT TESTING AND BALANCING IN ACCORDANCE WITH TECHNICAL PORTIONS OF THE ASHRAE "NATIONAL STANDARDS FOR TESTING AND BALANCING HVAC SYSTEMS", LATEST EDITION.
4.	INSTRUMENTS USED FOR BALANCING MUST HAVE BEEN CALIBRATED WITHIN A PERIOD OF SIX (6) MONTHS PRIOR TO BALANCING. SUBMIT SERIAL NUMBERS, AND DATES OF CALIBRATION OF ALL INSTRUMENTS TO BE USED PRIOR TO THE START OF WORK.
5.	SET HVAC SYSTEM AIRFLOW AND WATER FLOW RATES WITHIN THE FOLLOWING TOLERANCES:
A.	SUPPLY, RETURN, AND EXHAUST FANS AND EQUIPMENT WITH FANS: MINUS 5 TO PLUS 10 PERCENT.
B.	AIR OUTLETS AND INLETS: 0 TO MINUS 10 PERCENT.
C.	HEATING-WATER FLOW RATE: 0 TO MINUS 10 PERCENT.
D.	COOLING-WATER FLOW RATE: 0 TO MINUS 5 PERCENT.
6.	REFER TO SPECIFICATION SECTION 230593 AND CONTRACT DRAWINGS IN THEIR ENTIRETY FOR ADDITIONAL REQUIREMENTS.

MECHANICAL GENERAL NOTES	
SEE SPECIFICATIONS FOR ADDITIONAL PROJECT REQUIREMENTS. THESE GENERAL NOTES ARE INTENDED TO SUPPLEMENT THE SPECIFICATIONS. IN THE EVENT THAT THE VERBAGE IS IN CONFLICT OR CONTRADICTS THE REQUIREMENTS LISTED HERE, THE QUESTION SHALL BE ASKED PRIOR TO BIDDING OR THE MORE STRINGENT SHALL APPLY AT THE ENGINEER'S DISCRETION.	
1.	DO NOT SCALE DRAWINGS. SEE ARCHITECTURAL DRAWINGS AND REFLECTED CEILING PLANS FOR EXACT LOCATION OF DOORS, WINDOWS, CEILING DIFFUSERS, ETC.
2.	ALL EQUIPMENT LISTED IN PROJECT SCHEDULES IS TO BE CONSIDERED DESIGN BASIS EQUIPMENT. ALL COST ASSOCIATED WITH SUBSTITUTED/NON-DESIGN BASIS EQUIPMENT TO COMPLY WITH BASIS OF DESIGN, INCLUDING PROVIDING MAINTENANCE ACCESS, CLEARANCE, PIPING, SHEET METAL, ELECTRICAL, REPLACEMENT OF OTHER SYSTEM COMPONENTS, BUILDING ALTERATIONS, ETC. SHALL BE INCLUDED IN THE ORIGINAL BASE BID. NO ADDITIONAL COST ASSOCIATED WITH SUBSTITUTED/NON-DESIGN BASIS EQUIPMENT WILL BE APPROVED DURING CONSTRUCTION AND ALL COST WILL BE THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR. THIS INCLUDES ANY MODIFICATIONS TO ANY ASSOCIATED MECHANICAL, PLUMBING, OR ELECTRICAL SYSTEMS REQUIRED BY THIS SPECIFIC MANUFACTURER'S INSTALLATION INSTRUCTIONS.
3.	ALL DUCTWORK SHALL BE GALVANIZED SHEET METAL CONSTRUCTED IN ACCORDANCE WITH THE LATEST SMACNA STANDARDS. ALL SUPPLY, RETURN AND OUTSIDE AIR DUCTWORK SHALL BE WRAPPED WITH 2" THICK DUCT WRAP WITH VAPOR BARRIER. INSULATION (INCLUDING FLEXIBLE DUCT INSULATION) SHALL HAVE A MINIMUM INSTALLED R-VALUE OF 6.0. ROOFTOP UNIT RETURN DUCTWORK AND TRANSFER DUCTS SHALL BE LINED WITH 1" THICK FIBERGLASS DUCT LINER FOR ACOUSTICAL PURPOSES. DUCT DIMENSIONS ON PLANS ARE FREE AREA SIZE.
4.	SUPPLY AND RETURN DUCTWORK LOCATED OUTSIDE THE BUILDING SHALL BE WRAPPED WITH 3" THICK DUCT WRAP WITH VAPOR BARRIER HAVING A MINIMUM INSTALLED R-VALUE OF 8.0. COVER EXTERNAL INSULATION WITH AN ALUMINUM OUTER ENCLOSURE AND SEAL WATER TIGHT.
5.	ALL DUCTWORK SHALL BE SEALED PER THE REQUIREMENTS OF THE NORTH CAROLINA INTERNATIONAL MECHANICAL CODE. SEAL MEDIUM PRESSURE SUPPLY DUCTWORK FOR POSITIVE 3" PRESSURE CLASS, SMACNA SEAL CLASS A, SMACNA LEAKAGE CLASS 4. SEAL LOW PRESSURE SUPPLY, RETURN, OUTSIDE AIR, AND EXHAUST DUCTWORK FOR POSITIVE/NEGATIVE 2" PRESSURE CLASS, SMACNA SEAL CLASS A, SMACNA LEAKAGE CLASS 4.
6.	ALL PIPING, DUCTS, VENTS, ETC. EXTENDING THROUGH WALLS AND ROOF SHALL BE FLASHED AND COUNTERFLASHED IN A WATERPROOF MANNER.
7.	ALL PIPING AND DUCTWORK LOCATIONS SHALL BE COORDINATED WITH THE WORK UNDER OTHER DIVISIONS OF THE SPECIFICATIONS, TO AVOID INTERFERENCE.
8.	THE MECHANICAL CONTRACTOR SHALL BALANCE ALL MECHANICAL SYSTEMS TO THE PERFORMANCE SPECIFICATIONS INDICATED ON PLANS AND PROVIDE THE ENGINEER WITH THREE COPIES OF A COMPLETE TEST AND BALANCE REPORT. THE REPORT IS TO BE ISSUED A MINIMUM OF TWO WEEKS PRIOR TO PROJECT COMPLETION. THE TEST AND BALANCE REPORT WILL BE SUBJECT TO REVIEW AND APPROVAL BY THE ENGINEER. ANY ADDITIONAL TESTING, ADJUSTING AND BALANCING REQUIRED (AT ENGINEER'S REQUEST) AFTER REVIEW OF THE INITIAL REPORT SHALL BE PROVIDED AT NO ADDITIONAL COST. TESTING AND BALANCING CONTRACTOR TO CONFIRM FILTERS ARE CLEAN, AND FREE OF DEBRIS PRIOR TO BEGINNING WORK. THE MECHANICAL CONTRACTOR SHALL REPLACE ANY DIRTY FILTERS, AS NEEDED. TEST AND BALANCE REPORT TO BE COMPLETED BY AN INDEPENDENT, CERTIFIED TEST AND BALANCE CONTRACTOR.
9.	UPON PROJECT COMPLETION, THE MECHANICAL CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE OWNER INSTALLATION INFORMATION INCLUDING RECORD SUBMITTALS (WITH ANY SUBMITTAL REVIEW COSTS) ADDRESSED AND O&M MANUALS FOR EACH PIECE OF EQUIPMENT INCLUDING ALL SELECTED OPTIONS, THE NAME AND ADDRESS OF AT LEAST ONE SERVICE AGENCY, FULL CONTROL SYSTEM O&M AND CALIBRATION INFORMATION INCLUDING WIRING DIAGRAMS, SCHEMATICS, FULL SEQUENCE OF OPERATION, AND PROGRAMMED SEPTIONS. IN ADDITION, THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE TO HIRE A REGISTERED DESIGN PROFESSIONAL TO COMMISSION THE INSTALL SYSTEM AND PROVIDE THE OWNER AND CODE REVIEWER A SEALED STATEMENT OF SYSTEM COMMISSIONING (PER 2018 NCECC APPENDIX C).
10.	PROVIDE A ONE YEAR WARRANTY FOR ALL WORK PERFORMED BEGINNING ON THE DAY THE SYSTEM IS COMPLETELY OPERATIONAL AND ACCEPTABLE BY THE OWNER.
11.	PROVIDE MANUFACTURER'S RECOMMENDED CLEARANCES AROUND ALL EQUIPMENT FOR MAINTENANCE AND FILTER REMOVAL.
12.	CONDENSATE DRAIN PIPING SHALL BE TYPE 'L' HARD DRAWN COPPER AND SHALL BE INSULATED WITH 1 1/2" THICK FIBERGLASS INSULATION WITH A DENSITY OF 1.5 LB. PER CUBIC FOOT. INSULATION SHALL HAVE A FACTORY APPLIED PRESSURIZED VAPOR BARRIER JACKET WITH PRESSURE SENSITIVE ADHESIVE SELF-SEALING LAP. INSULATION AND JACKET SHALL BE RATED FOR INSULATION IN A RETURN AIR PLENUM.
13.	ALL REFRIGERANT PIPE SHALL BE NITROGENIZED ACR COPPER TUBE. SIZE, INSULATE, AND INSTALL REFRIGERANT PIPING PER MANUFACTURER'S RECOMMENDATIONS. REFRIGERANT PIPING INSULATION EXPOSED OUTDOORS SHALL BE COVERED WITH AN OUTER ALUMINUM JACKET.
14.	ANY DEVICE REQUIRING A THERMOSTAT FOR CONTROL SHALL BE FURNISHED WITH A THERMOSTAT WHETHER INDICATED ON THE DRAWINGS OR NOT.
15.	INSTALL THE TOP OF ALL THERMOSTATS, SENSORS, AND SWITCHES AT 4'-0" (MAXIMUM) ABOVE FINISH FLOOR. COORDINATE EXACT THERMOSTAT LOCATION WITH OWNER PRIOR TO INSTALLATION. ANY DEVICE ON A PERIMETER WALL SHALL BE MOUNTED ON A FOAM-FILLED ELECTRICAL BOX, WITH ALL GAPS BETWEEN BOX AND WALL SEALED TO PREVENT INFILTRATION.
16.	CONTRACTOR SHALL VERIFY LOCATION OF ALL ROOF PENETRATIONS WITH ARCHITECT & OWNER PRIOR TO INSTALLATION. NEW ROOF PENETRATIONS MADE THROUGH EXISTING ROOF SYSTEMS SHALL BE VERIFIED WITH THE OWNER'S EXISTING ROOF WARRANTY PRIOR TO INSTALLATION.
17.	ROOF CURBS SHALL ALLOW A MINIMUM OF 8" ABOVE ROOF INSULATION FOR FLASHING, OR AS INDICATED ON THE DRAWINGS, WHICHEVER IS GREATER. IN ADDITION, ALL ROOF CURBS OR EQUIPMENT SUPPORT RAILS THAT SUPPORT EQUIPMENT, PIPING, CONDUIT, ETC. EXPOSED ON THE ROOF SHALL HAVE SUFFICIENT HEIGHT TO MAINTAIN A MINIMUM OF 18" CLEARANCE BELOW SUPPORTED EQUIPMENT FOR ROOF MAINTENANCE.
18.	CONTRACTOR SHALL LOCATE EXHAUST FANS, OUTLETS, AND GAS FLUES A MINIMUM OF 15'-0" FROM ANY OUTSIDE AIR INTAKE.
19.	DRYER VENT WALL CAPS SHALL BE PROVIDED WITH A BACKDRAFT DAMPER. DRYER VENT SHALL NOT EXCEED A TOTAL EQUIVALENT LENGTH OF 35'-0" WITH A 2.5' DEDUCTION FOR EACH 45° BEND AND A 5' DEDUCTION FOR EACH 90° BEND.

COORDINATION DRAWINGS	
THE MECHANICAL CONTRACTOR SHALL ORGANIZE COORDINATION MEETINGS TO DEVELOP A SET OF DRAWINGS WITH ALL CONTRACTORS' ELECTRICAL, MECHANICAL, PLUMBING, FIRE PROTECTION, IT/DATA, AND GENERAL CONTRACTOR). THE MECHANICAL CONTRACTOR WILL HAVE THE LEAD RESPONSIBILITY FOR THE COORDINATION DRAWINGS. THE MECHANICAL CONTRACTOR SHALL PRODUCE THE ORIGINAL DRAWINGS AND FORWARD THE DRAWINGS TO EACH OF THE OTHER CONTRACTORS FOR THEM TO ADD THEIR SYSTEMS TO THIS SET OF COORDINATION DRAWINGS. THE CONTRACTORS WILL DEVELOP THE DRAWINGS IN THIS ORDER: MECHANICAL, FIRE PROTECTION, PLUMBING, ELECTRICAL, IT/DATA (INCLUDING CABLE TRAY) AND GENERAL. THIS SHALL ALSO BE THE ORDER OF PRECEDENCE FOR INSTALLATION OF SYSTEMS. ANY RELOCATION OF SYSTEM ROUTINGS WILL BE FOUND IN THE COORDINATION PHASE AND NOTICED BY EACH OF THE CONTRACTORS. THESE DRAWINGS, WHEN COMPLETED, SHALL BE SIGNED OFF BY ALL OF THE ABOVE LISTED PARTIES. DRAWINGS SHALL BE COMPLETED PRIOR TO FABRICATION AND INSTALLATION OF DUCTWORK AND PIPING SYSTEMS, OR PURCHASE OF EQUIPMENT. THE FOLLOWING ITEMS REPRESENT THE MINIMUM REQUIREMENTS FOR SHOP DRAWINGS AND COORDINATION DRAWINGS.	
1.	ALL SHOP AND COORDINATION DRAWINGS WILL BE 1/4" = 1'-0" SCALE
2.	DRAWINGS WILL BE ORIGINAL DRAWINGS AND NOT OVERLAYS OF THE CONTRACT/DESIGN
3.	COORDINATION DRAWINGS WILL BE DRAWN ON REPRODUCIBLE MATERIAL 40"x26"
4.	COORDINATION DRAWINGS ARE NOT SHOP DRAWINGS AND ARE REQUIRED IN ADDITION TO SHOP DRAWINGS.
5.	ONCE THE COMPLETE COORDINATION DRAWINGS HAVE BEEN COMPLETED, THE MECHANICAL CONTRACTOR SHALL DISTRIBUTE ONE SIGNED SET TO EACH OF THE FOLLOWING CONTRACTORS: ELECTRICAL, PLUMBING, FIRE PROTECTION, AND GENERAL. ADDITIONAL SETS WILL BE SENT TO THE OWNER, ARCHITECT, AND ENGINEER.

COMMISSIONING NOTE	
THIS PROJECT INCLUDES A THIRD PARTY COMMISSIONING AGENT CONTRACTED BY THE OWNER. THE MECHANICAL CONTRACTOR SHALL COORDINATE WITH OWNER'S COMMISSIONING AGENT AND PROVIDE ALL NECESSARY TIME, MATERIALS, AND PROCEDURES REQUIRED FOR A FULLY COMMISSIONED PROJECT. SEE COMMISSIONING REQUIREMENTS IN THE PROJECT MANUAL FOR FURTHER INFORMATION.	
RETURN AIR PLENUM NOTE	
THIS PROJECT WILL UTILIZE THE ABOVE CEILING SPACE FOR A RETURN AIR PLENUM, ALL ABOVE CEILING UTILITIES PROVIDED UNDER THIS PROJECT SHALL BE PLENUM RATED AND HAVE A FLAME SPREAD INDEX NOT MORE THAN 25 AND A SMOKE DEVELOPED INDEX OF NOT MORE THAN 50	
EXISTING UTILITIES IN EXPOSED AREAS NOTE	
<ul style="list-style-type: none"> IN ALL AREAS WITH NEWLY EXPOSED, OPEN TO STRUCTURE SPACE CONTAINING EXISTING UTILITIES, CONTRACTORS SHALL REMOVE EXISTING HANGERS, ATTACHMENTS, FASTENERS, ETC. CONTRACTOR SHALL NOTIFY E.O.R. WHERE THIS IS NOT FEASIBLE. ANYTHING LEFT EXPOSED ABOVE THE CEILING SHALL BE THOROUGHLY CLEANED AND PAINTED TO MATCH STRUCTURE ABOVE. COORDINATE FINAL PAINT COLOR WITH ARCHITECT. 	

ELECTRICAL/MECHANICAL DEMARCATON	
REFER TO DETAIL 11/M-502 FOR MECHANICAL CONTRACTOR'S RESPONSIBILITIES RELATED TO ELECTRICAL DISCONNECTS, STARTERS AND WIRING OF MECHANICAL EQUIPMENT. ALL DISCONNECTS, STARTERS AND WIRING (LOAD SIDE OF DISCONNECTS) SHALL BE FURNISHED AND INSTALLED BY M.C. PRIOR TO ASSEMBLING SHOP DRAWING SUBMITTALS OR ORDERING EQUIPMENT.	

OWNER TRAINING	
ALL EQUIPMENT SHALL BE PROVIDED WITH OWNER TRAINING FROM FACTORY AUTHORIZED AND CERTIFIED TRAINING PERSONNEL. TRAINING SHALL BE PROVIDED WITHIN 5 DAYS OF OWNER ACCEPTANCE OF OPERATIONAL EQUIPMENT. DURATION AND FORMAT OF TRAINING SHALL BE COORDINATED WITH OWNER BUT SHALL BE A MINIMUM OF 8 HRS. (2 4 HR SESSIONS OF ONSITE TRAINING WITH THE REQUIRED OWNER PERSONNEL. MECHANICAL CONTRACTOR SHALL DOCUMENT TRAINING WITH DATE/TIME, DURATION, AND OWNER SIGNATURE.	

MECHANICAL SHEET INDEX	
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M003	MECHANICAL SCHEDULES & VENT. CALCS
M004	MECHANICAL SEQUENCE OF OPERATIONS
M005	MECHANICAL POINTS LIST
M021	LEVEL 1 OVERALL PLAN - MECHANICAL - DEMO
M022	LEVEL 2 OVERALL PLAN - MECHANICAL - DEMO
M023	ROOF OVERALL PLAN - MECHANICAL - DEMO
M031	LEVEL 1 OVERALL PLAN - MECHANICAL PIPING - DEMO
M032	LEVEL 2 OVERALL PLAN - MECHANICAL PIPING - DEMO
M310	LEVEL 1 OVERALL PLAN - MECHANICAL
M120	LEVEL 2 OVERALL PLAN - MECHANICAL
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M220	LEVEL 2 OVERALL PLAN - MECHANICAL PIPING
M501	MECHANICAL DETAILS
M502	MECHANICAL DETAILS
M503	MECHANICAL DETAILS

DEMO CONTRACTOR NOTE	
M.C. SHALL REMOVE ALL EXISTING MECHANICAL EQUIPMENT AND ASSOCIATED DISTRIBUTION SYSTEMS OR UTILITY SERVICES WITHIN THE NOTED SCOPE/PROJECT BOUNDARY INCLUDING BUT NOT LIMITED TO AS NOTED BELOW:	
EQUIPMENT, PIPING, DUCTWORK, DAMPERS, HANGERS, SUPPORTS, EQUIPMENT PADS, CONTROLS, ASSOCIATED CONTROL WIRING, ETC. WITHIN THE NOTED PROJECT BOUNDARY. REFER TO PROJECT DEMOLITION NOTES FOR SPECIFIC REQUIREMENTS.	
ANY EQUIPMENT CONTAINING REFRIGERANT SHALL BE HANDLED ACCORDING TO SECTION 608 OF THE EPA CLEAN AIR ACT, AND SHALL BE PROPERLY SUPERVISED BY AN EPA CERTIFIED TECHNICIAN.	

EQUIVALENT MANUFACTURERS LISTING	
LISTING OF MANUFACTURER'S NAME DOES NOT GUARANTEE APPROVAL. ALL EQUIPMENT MUST MEET OR EXCEED QUALITY AND CAPACITIES OF SPECIFIED EQUIPMENT. FINAL APPROVAL WILL BE BASED ON EQUIPMENT SUBMITTALS. ANY MANUFACTURER NOT LISTED BUT WISHING TO BID THIS PROJECT SHALL SUBMIT A WRITTEN REQUEST A MINIMUM OF 7 DAYS PRIOR TO BID DATE OR AS INDICATED IN THE SPECIFICATIONS. ALL EQUIPMENT LISTED IN THE PROJECT SCHEDULE IS TO BE CONSIDERED DESIGN BASIS EQUIPMENT. PRIOR APPROVAL IS REQUIRED FOR ALL MANUFACTURERS NOT LISTED.	
(ALPHABETICAL ORDER) AIR DISTRIBUTION: CARNES, KRUEGER, METAL-AIR, NAILOR, PRICE, TITUS DDC CONTROL: DISTECH, HONEYWELL, TRANE (ALL IP-BASED) ELECTRIC WALL UNIT: HUBBARD, BESSKO, MARKEL, MODINE, MARK, RAYKALL FANS: COOL, GREENHECK, PENN. SWIN CITY FAN COIL UNITS: CARRIER, INTERNATIONAL, MCQUAY, TEMSPER, TRANE, YORK/JOHNSON FIRE DAMPERS: GREENHECK, NAILOR, NCA, POTTORFF, RUSKIN, SAFE-AIRE LOUVER: GREENHECK, POTTORFF, RUSKIN, SAFE-AIRE PACKAGED ROOFTOP UNITS WITH ENERGY RECOVERY: CARRIER, DAIKIN, TRANE, YORK/JOHNSON SPIRAL DUCTWORK: EASTERN SHEET METAL, HAMLIN, LINDAB, UNITED MCGILL VAV TERMINAL UNITS: CARRIER, ENVIRO-TEC, KRUEGER, NAILOR, PRICE, TITUS, TRANE CONTROL INTEGRATORS: CLIMATE LIC, EMCOR AIRCON, HOFFMAN BUILDING TECHNOLOGIES, MSS SOLUTIONS, TRANE	
NOTE: ALL COST ASSOCIATED WITH SUBSTITUTED/NON-DESIGN BASIS EQUIPMENT TO COMPLY WITH BASIS OF DESIGN, INCLUDING PROVIDING MAINTENANCE ACCESS, CLEARANCE, PIPING, SHEET METAL, ELECTRICAL, REPLACEMENT OF SYSTEM COMPONENTS, BUILDING ALTERATIONS, ETC., SHALL BE INCLUDED IN THE ORIGINAL BASE BID. NO ADDITIONAL COST ASSOCIATED WITH SUBSTITUTED/NON-DESIGN BASIS EQUIPMENT WILL BE APPROVED DURING CONSTRUCTION AND ALL COST WILL BE THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR.	

OWNER TRAINING	
ALL EQUIPMENT SHALL BE PROVIDED WITH OWNER TRAINING FROM FACTORY AUTHORIZED AND CERTIFIED TRAINING PERSONNEL. TRAINING SHALL BE PROVIDED WITHIN 5 DAYS OF OWNER ACCEPTANCE OF OPERATIONAL EQUIPMENT. DURATION AND FORMAT OF TRAINING SHALL BE COORDINATED WITH OWNER BUT SHALL BE A MINIMUM OF 8 HRS. (2 4 HR SESSIONS OF ONSITE TRAINING WITH THE REQUIRED OWNER PERSONNEL. MECHANICAL CONTRACTOR SHALL DOCUMENT TRAINING WITH DATE/TIME, DURATION, AND OWNER SIGNATURE.	

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M503	MECHANICAL DETAILS

MECHANICAL DEMOLITION NOTES	
1. THE MECHANICAL CONTRACTOR SHALL VISIT SITE PRIOR TO BEGINNING WORK TO DETERMINE THE LEVEL OF DEMOLITION REQUIRED AND INCLUDE ALL NECESSARY PRICING IN THEIR BID.	
2. IT IS THE MECHANICAL CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY ALL EXISTING DUCTWORK AND PIPING. ANY DISCREPANCIES BETWEEN EXISTING CONDITIONS	

System Name and Number	Condition Analyzed (impacts Ez)	Occupancy Category	Zone Floor Area Az (sq ft)	Are you using default value for zone population?	Zone Population Pz (people)	Zone Air Distribution Effectiveness Ez	Zone Outdoor Airflow Voz (cfm)	Zone Primary Airflow Vpz (cfm)	Zone Secondary Recirculation Fraction Er	Zone Primary Air Fraction Ep	Outdoor air intake flow provided (measured or design) (cfm)
FCU-01-01	Cooling	Reception areas	846	Yes	25.38	0.80	222				153
FCU-01-02	Cooling		295	Yes	0.00	0.80	0				60
FCU-01-03	Cooling	Laundry rooms, central	348	Yes	3.48	0.80	74				110

System name and number	EX-AHU-1A
Condition analyzed (impacts Ez, Vdz, Vpz and Vps)	Cooling
All zones are included in the VRP calculation	Yes

Zone Name and Number	Occupancy Category	Zone Floor Area Az (sq ft)	Are you using default value for zone population?	Zone Population Pz (people)	Zone Air Distribution Effectiveness Ez	Zone Outdoor Airflow Voz (cfm)	Zone Discharge Airflow Vdz (cfm)	Zone Primary Airflow Vpz (cfm)	Zone Secondary Recirculation Fraction Er	Zone Primary Air Fraction Ep
Reception	Reception areas	221	Yes	6.63	0.80	58.01	660	660	1.00	1.00
Office	Office space	148	Yes	0.74	0.80	15.73	175	175	1.00	1.00
Barber	Barbershop	2,567	Yes	64.18	0.80	794.16	4,500	4,500	1.00	1.00
Restrooms		75	No	0.00	0.80	0.00	50	50	1.00	1.00
Storage	Storage rooms	88	Yes	0.00	0.80	13.20	50	50	1.00	1.00

System area	As (sq ft)	3,099
System population	Ps (people)	71.55
Sum of zone population	sum of Pz (people)	71.54
Occupant diversity	D	1.00
Uncorrected outdoor air intake	Vou (cfm)	704.88
System primary airflow (at condition analyzed)	Vps (cfm)	5,435
Average outdoor air fraction	Xs	0.12

Which method from ASHRAE 62.1 is being used to determine system ventilation efficiency (Ev)?	Table 6-3	
Ventilation efficiency	Ev	0.89
Outdoor air intake flow (required by 62.1)	Vot (cfm)	792
Outdoor air intake flow provided (measured or design)	(cfm)	1,400

System name and number	EX-AHU-1B
Condition analyzed (impacts Ez, Vdz, Vpz and Vps)	Cooling
All zones are included in the VRP calculation	Yes

Zone Name and Number	Occupancy Category	Zone Floor Area Az (sq ft)	Are you using default value for zone population?	Zone Population Pz (people)	Zone Air Distribution Effectiveness Ez	Zone Outdoor Airflow Voz (cfm)	Zone Discharge Airflow Vdz (cfm)	Zone Primary Airflow Vpz (cfm)	Zone Secondary Recirculation Fraction Er	Zone Primary Air Fraction Ep
Reception	Reception areas	301	Yes	9.03	0.80	79.01	600	600	1.00	1.00
Office	Office space	965	Yes	4.83	0.80	102.53	1,225	1,225	1.00	1.00
Locker Room		770	Yes	0.00	0.80	0.00	1,000	1,000	1.00	1.00
Student Lounge/Life	Break rooms (general)	762	Yes	19.05	0.80	176.21	1,005	1,005	1.00	1.00
Dispensary	Occupiable storage rooms for liquids or gels	352	Yes	0.70	0.80	57.20	520	520	1.00	1.00
Beauty Salon	Beauty and nail salon	1,027	Yes	25.68	0.80	795.93	1,425	1,425	1.00	1.00
Restroom		68	No	0.00	0.80	0.00	50	50	1.00	1.00

System area	As (sq ft)	4,245
System population	Ps (people)	59.28
Sum of zone population	sum of Pz (people)	59.28
Occupant diversity	D	1.00
Uncorrected outdoor air intake	Vou (cfm)	968.70
System primary airflow (at condition analyzed)	Vps (cfm)	5,825
Average outdoor air fraction	Xs	0.16

Which method from ASHRAE 62.1 is being used to determine system ventilation efficiency (Ev)?	Appendix A	
Ventilation efficiency	Ev	0.80
Outdoor air intake flow (required by 62.1)	Vot (cfm)	1,615
Outdoor air intake flow provided (measured or design)	(cfm)	1,700

System name and number	EX-AHU-2B
Condition analyzed (impacts Ez, Vdz, Vpz and Vps)	Cooling
All zones are included in the VRP calculation	Yes

Zone Name and Number	Occupancy Category	Zone Floor Area Az (sq ft)	Are you using default value for zone population?	Zone Population Pz (people)	Zone Air Distribution Effectiveness Ez	Zone Outdoor Airflow Voz (cfm)	Zone Discharge Airflow Vdz (cfm)	Zone Primary Airflow Vpz (cfm)	Zone Secondary Recirculation Fraction Er	Zone Primary Air Fraction Ep
Office	Office space	2,065	Yes	10.33	0.80	219.40	2,490	2,490	1.00	1.00
Restroom		92	No	0.00	0.80	0.00	50	50	1.00	1.00
Reception	Reception areas	1,051	Yes	31.53	0.80	275.89	1,350	1,350	1.00	1.00
Dispensary	Occupiable storage rooms for liquids or gels	413	Yes	0.83	0.80	67.11	550	550	1.00	1.00
Message Lab	Classrooms (age 9 plus)	4,647	Yes	162.65	0.80	2730.11	6,375	6,375	1.00	1.00

System area	As (sq ft)	8,268
System population	Ps (people)	205.33
Sum of zone population	sum of Pz (people)	205.32
Occupant diversity	D	1.00
Uncorrected outdoor air intake	Vou (cfm)	2,634.01
System primary airflow (at condition analyzed)	Vps (cfm)	10,815
Average outdoor air fraction	Xs	0.24

Which method from ASHRAE 62.1 is being used to determine system ventilation efficiency (Ev)?	Appendix A	
Ventilation efficiency	Ev	0.81
Outdoor air intake flow (required by 62.1)	Vot (cfm)	3,252
Outdoor air intake flow provided (measured or design)	(cfm)	3,275

VAV WITH HOT WATER REHEAT TERMINAL UNIT SCHEDULE

H	MANUFACTURER	MODEL NO.	INLET SIZE	PRIMARY AIRFLOW			AIR SIDE			HEATING COIL				PIPE RUNOUT	VOLTAGE	PHASE	DUCT RUNOUT SIZE	REMARKS
				MAX CFM	MIN CFM	MIN CFM	EAT(db)	LAT(db)	E.W.T.	L.W.T.	ROWS	BTUH	G.P.M.					
LEVEL 01																		
VAV-1A-01	ENVIRO-TEC	SDR	5	175	55	90	55.0 °F	95.0 °F	180	150	2	3890	0.3	3/4"	120	1	8	
VAV-1A-02	ENVIRO-TEC	SDR	5	100	30	50	55.0 °F	95.0 °F	180	150	2	2160	0.2	3/4"	120	1	8	
VAV-1B-01	ENVIRO-TEC	SDR	10	1000	300	500	55.0 °F	95.0 °F	180	150	2	21600	1.5	3/4"	120	1	12	
VAV-1B-02	ENVIRO-TEC	SDR	8	600	180	300	55.0 °F	95.0 °F	180	150	2	12960	0.9	3/4"	120	1	10	
VAV-1B-03	ENVIRO-TEC	SDR	5	115	35	60	55.0 °F	95.0 °F	180	150	2	2600	0.2	3/4"	120	1	8	
VAV-1B-04	ENVIRO-TEC	SDR	10	1005	305	505	55.0 °F	95.0 °F	180	150	2	21820	1.5	3/4"	120	1	12	
VAV-1B-05	ENVIRO-TEC	SDR	6	300	90	150	55.0 °F	95.0 °F	180	150	2	4680	0.5	3/4"	120	1	8	
VAV-1B-06	ENVIRO-TEC	SDR	8	510	155	255	55.0 °F	95.0 °F	180	150	2	10200	0.8	3/4"	120	1	10	
VAV-1B-07	ENVIRO-TEC	SDR	8	470	145	235	55.0 °F	95.0 °F	180	150	2	10160	0.7	3/4"	120	1	10	
LEVEL 02																		
VAV-2B-01	ENVIRO-TEC	SDR	6	300	90	150	55.0 °F	95.0 °F	180	150	2	6480	0.5	3/4"	120	1	8	
VAV-2B-02	ENVIRO-TEC	SDR	8	400	120	200	55.0 °F	95.0 °F	180	150	2	8640	0.6	3/4"	120	1	8	
VAV-2B-03	ENVIRO-TEC	SDR	8	450	135	225	55.0 °F	95.0 °F	180	150	2	9720	0.7	3/4"	120	1	10	
VAV-2B-04	ENVIRO-TEC	SDR	8	600	180	300	55.0 °F	95.0 °F	180	150	2	12960	0.9	3/4"	120	1	10	
VAV-2B-05	ENVIRO-TEC	SDR	10	1000	300	500	55.0 °F	95.0 °F	180	150	2	21600	1.5	3/4"	120	1	12	
VAV-2B-06	ENVIRO-TEC	SDR	8	600	180	300	55.0 °F	95.0 °F	180	150	2	12960	0.9	3/4"	120	1	10	
VAV-2B-07	ENVIRO-TEC	SDR	12	1485	450	745	55.0 °F	95.0 °F	180	150	2	32190	2.2	3/4"	120	1	14	
VAV-2B-08	ENVIRO-TEC	SDR	6	390	120	195	55.0 °F	95.0 °F	180	150	2	8430	0.6	3/4"	120	1	8	
VAV-2B-09	ENVIRO-TEC	SDR	6	250	75	125	55.0 °F	95.0 °F	180	150	2	5400	0.4	3/4"	120	1	8	
VAV-2B-10	ENVIRO-TEC	SDR	8	500	150	250	55.0 °F	95.0 °F	180	150	2	10800	0.8	3/4"	120	1	10	
REHEAT VAV BOX SCHEDULE NOTES:																		
1. MINIMUM INLET PRESSURE TO BOX SHALL BE 0.75"W.G.																		
2. MAXIMUM PRESSURE DROP THRU BOX (INCLUDING COIL) SHALL BE 0.25" S.P.																		
3. FURNISH BOXES WITH: DDC CONTROLS, ACoustical LINING, THERMOSTAT, CONTROL VOLTAGE TRANSFORMER AND BE U.L. LABELED.																		
4. DDC CONTROLS SHALL BE FURNISHED TO THE BOX MANUFACTURER BY THE CONTROLS VENDOR. BOX MANUFACTURER SHALL FACTORY MOUNT AND WIRE CONTROLS. INSTALLATION OF CONTROLS SHALL INCLUDE CONTROLS TRANSFORMER, CONTROL BOARD, AIR FLOW PROBE, CONTROL COVER, AND ALL WIRING AND LABOR FOR A COMPLETE AND OPERATIONAL SYSTEM.																		
5. PROVIDE MINIMUM NEC CODE REQUIRED 36" CLEARANCE ON CONTROLS ENCLOSURES, AND ASSOCIATED CLEARANCE ACCESS, PROVIDE CODE REQUIRED DISCONNECT.																		
6. MECHANICAL CONTRACTOR SHALL EXTEND CONTROL POWER WIRING (120 V) FROM J-BOX TO VAV BOX. 120 V J-BOX BY ELECTRICAL CONTRACTOR, WIRING FROM J-BOX AND FINAL CONNECTION TO UNIT BY MECHANICAL CONTRACTOR. COORDINATE LOCATION OF 120 V J-BOXES WITH ELECTRICAL CONTRACTOR.																		
7. PROVIDE 2-WAY AND/OR 3-WAY HOT WATER CONTROL VALVES AS NOTED ON PLANS																		

FAN POWERED VARIABLE AIR VOLUME TERMINAL UNIT HOT WATER HEAT SCHEDULE

SYMBOL	MANUFACTURER	MODEL	PRIMARY AIRFLOW			ELECTRICAL DATA		HEATING COIL			PIPE RUNOUT	DUCT SIZE RUNOUT	REMARKS			
			MAX (CFM)	MIN (CFM)	FAN (CFM)	FAN (HP)	VOLT	PH	ROWS	BTUH				GPM	LAT (F)	
LEVEL 01																
FPB-1A-01	ENVIRO-TEC	VFR	1500	375	600	1/4	120	1	2	42120	2.9	95	3/4"	1211	14	
FPB-1A-02	ENVIRO-TEC	VFR	1500	375	600	1/4	120	1	2	42120	2.9	95	3/4"	1211	14	
FPB-1A-03	ENVIRO-TEC	VFR	1500	375	600	1/4	120	1	2	42120	2.9	95	3/4"	1211	14	
FPB-1B-01	ENVIRO-TEC	VFR	350	90	140	1/13	120	1	2	9940	0.7	95	3/4"	804	8	
FPB-1B-02	ENVIRO-TEC	VFR	675	170	270	1/13	120	1	2	19010	1.3	95	3/4"	804	10	
FPB-1B-03	ENVIRO-TEC	VFR	800	200	320	1/6	120	1	2	22470	1.5	95	3/4"	1006	12	
FPB-1D-01	ENVIRO-TEC	VFR	300	75	120	1/13	120	1	2	8430	0.6	95	3/4"	604	8	
FPB-1D-02	ENVIRO-TEC	VFR	1650	1650	660	1/4	120	1	2	87320	9.9	90	1"	1211	14	CONSTANT VOLUME
FPB-1D-03	ENVIRO-TEC	VFR	1500	375	600	1/4	120	1	2	42120	2.9	95	3/4"	1211	14	
FPB-1D-04	ENVIRO-TEC	VFR	1600	400	640	1/4	120	1	2	44930	3.0	95	3/4"	1211	14	
FPB-1D-05	ENVIRO-TEC	VFR	1500	375	600	1/4	120	1	2	42120	2.9	95	3/4"	1211	14	
FPB-1D-06	ENVIRO-TEC	VFR	2660	2660	1065	1/2	120	1	2	140810	9.4	90	1-1/4"	1418	14	ELLIPTICAL CONSTANT VOLUME
LEVEL 02																
FPB-2B-01	ENVIRO-TEC	VFR	1140	285	460	1/4	120	1	2	32190	2.2	95	3/4"	1011	12	
FPB-2B-02	ENVIRO-TEC	VFR	450	115	180	1/13	120	1	2	12750	0.9	95	3/4"	804	10	
FPB-2B-03	ENVIRO-TEC	VFR	990	250	400	1/6	120	1	2	28080	1.9	95	3/4"	1006	12	
FPB-2B-04	ENVIRO-TEC	VFR	1050	265	420	1/4	120	1	2	29600	2.0	95	3/4"	1011	12	
FPB-2B-05	ENVIRO-TEC	VFR	1110	280	445	1/4	120	1	2	31320	2.1	95	3/4"	1011	12	
FPB-2B-06	ENVIRO-TEC	VFR	600	150	240	1/13	120	1	2	16550	1.2	95	3/4"	804	10	

SEQUENCE OF OPERATION

A COMPLETE AND OPERATIONAL DDC CONTROL SYSTEM (BAS) SHALL BE INSTALLED IN ACCORDANCE WITH THE SPECIFICATIONS (SECTION 230900) AND AS INTENDED ON THESE PLANS. ALL CONTROL POINTS AND EQUIPMENT SEQUENCES OF OPERATION LISTED IN SPECIFICATION SECTION 230900 SHALL BE CONSIDERED IN ADDITION TO THOSE LISTED HERE. IN THE EVENT THAT THE VERBAGE IS IN CONFLICT OR CONTRADICTS THE REQUIREMENTS LISTED HERE, THE QUESTION SHALL BE ASKED BEFORE BIDDING OR THE MORE STRINGENT SHALL APPLY AT THE ENGINEER'S DISCRETION.

MECHANICAL CONTRACTOR SHALL REVIEW ALL EQUIPMENT SUBMITTALS WITH CONTROLS CONTRACTOR AND COORDINATE REQUIREMENTS PRIOR TO SUBMITTING EQUIPMENT SUBMITTALS FOR REVIEW BY EOR. SUBMITTALS SHALL INDICATE CONTROLS CONTRACTOR APPROVAL ON ON EQUIPMENT SUBMITTAL.

GENERAL BUILDING AUTOMATION SYSTEM (BAS) SHALL PROVIDE PROGRAMMED/TIMED OPERATION OF THE BUILDING HVAC SYSTEM AND SYSTEM COMPONENTS BY PLACING THE SYSTEM IN "OCCUPIED" OR "UNOCCUPIED" MODES BASED ON THE OWNERS OPERATING SCHEDULE. UNOCCUPIED MODE WILL BE A MANUAL OPERATION THROUGH THE BAS, OR AS SCHEDULED BY THE OWNER. COORDINATE WITH OWNER FOR FINAL HOURS OF OPERATION. UNOCCUPIED WILL BE FOR THE REMAINING HOURS. MINIMUM ZONES FOR OCCUPANCY SETTINGS SHALL BE GROUPED AS FOLLOWS:
1. EK-AHU-1A
2. EK-AHU-1B
3. RTU-1
4. FCU ZONES
5. MERS
6. REMAINING BUILDING

BAS SHALL BE WEB (IP) BASED TO ALLOW INTERNET ACCESS FOR REMOTE OPERATION OF ALL SYSTEM FUNCTIONS. BAS SHALL ALLOW GLOBAL OPERATION OF COOLING AND HEATING SETPOINTS. BAS SHALL ALSO ALLOW EITHER ZONE BY ZONE OR GLOBAL OVERRIDE OF SYSTEM EQUIPMENT OPERATION WHILE IN THE UNOCCUPIED MODE. OVERRIDE SHALL ACTIVATE ALL SYSTEM EQUIPMENT REQUIRED FOR PROPER OPERATION OR OVERRIDE EQUIPMENT TO MAINTAIN "OCCUPIED" SPACE CONDITIONS IN THE OVERRIDE ZONE FOR A TIME PERIOD OF 2 HOURS (ADJ.). TIME PERIOD SHALL BE ADJUSTABLE THROUGH THE BAS. ALL BAS COMPONENTS SUCH AS JACE CONTROLLERS, AHU CONTROLLERS, PUMP CONTROLLERS, ETC. SHALL BE FURNISHED WITH A LOCAL UPS WITH SURGE SUPPRESSION SIZED FOR DEVICE CONNECTED WATTAGE, VOLTAGE AND 2 HR. BATTERY OPERATION, UNLESS NOTED OTHERWISE THE OCC. & UNOCCO C/COOL CLG / 60F HTG)

EXISTING SEQUENCE OF OPERATIONS IN GREY (ITALICIZED TEXT)

VARIABLE VOLUME (SINGLE ZONE) AIR HANDLING UNITS (EK-AHU-1A,1B,2B)

ALL UNITS SHALL BE STOPPED/STARTED ON A PROGRAMMED BASIS THROUGH THE BAS.

WHILE IN THE OCCUPIED MODE, SUPPLY FAN(S) SHALL BE STARTED AND STOPPED BY BAS. UPON PROOF OF AIR FLOW THRU THE SUPPLY FAN, THE SUPPLY FAN SPEED SHALL BE CONTROLLED VIA THE ASSOCIATED VFD AND DUCT MOUNTED STATIC PRESSURE SENSOR. THE STATIC PRESSURE SENSOR SETPOINT SHALL BE RESET USING A TRIM AND RESPOND ALGORITHM BASE ON ZONE AIRFLOW REQUIREMENTS FROM A LOW SETTING OF (0.75" TO 1.5") (ADJ.) ON A CALL FOR ZONE AIRFLOW. THE DIFFERENTIAL SHALL BE ADJUSTED TO ALLOW FOR THE BUILDING PRESSURE TO REMAIN POSITIVE. BUILDING PRESSURE SHALL BE MONITORED AND AT ANY TIME THE RETURN AIR FAN SPEED SHALL BE ADJUSTED TO MAINTAIN A POSITIVE PRESSURE SETPOINT IN THE UNIT (AIR MIXING SECTION 0.1" WC (ADJ.)). THE UNIT RETURN DAMPER AND RELIEF DAMPERS SHALL BE MODULATED TO PROVIDE THE OA AIRFLOW SEQUENCE NOTED BELOW. EACH UNIT SHALL BE PROVIDED WITH A PRESSURIZATION SENSOR LOCATED AS INDICATED ON THE PLANS

RETURN FAN SHALL BE STARTED AND STOPPED WITH SUPPLY FAN, AND SHALL BE MODULATED BASED ON TRACKING THE SUPPLY AIR FLOW MONITORING STATION WITH A CONSTANT DIFFERENTIAL OFFSET UTILIZING THE RETURN AIRFLOW STATION AND SHALL BE EQUAL TO THE BUILDING EXHAUST ASSOCIATED WITH THAT ZONE. THE DIFFERENTIAL SHALL BE ADJUSTED TO ALLOW FOR THE BUILDING PRESSURE TO REMAIN POSITIVE. BUILDING PRESSURE SHALL BE MONITORED AND AT ANY TIME THE RETURN AIR FAN SPEED SHALL BE ADJUSTED TO MAINTAIN A POSITIVE PRESSURE SETPOINT IN THE UNIT (AIR MIXING SECTION 0.1" WC (ADJ.)). THE UNIT RETURN DAMPER AND RELIEF DAMPERS SHALL BE MODULATED TO PROVIDE THE OA AIRFLOW SEQUENCE NOTED BELOW. EACH UNIT SHALL BE PROVIDED WITH A PRESSURIZATION SENSOR LOCATED AS INDICATED ON THE PLANS

A DISCHARGE AIR SENSOR SHALL CONTROL UNIT COOLING AND HEATING CONTROL VALVES TO MAINTAIN THE UNIT SUPPLY AIR TEMPERATURE PER THE FOLLOWING SUPPLY AIR TEMPERATURE (SAT) RESET SCHEDULE:

SUPPLY AIR TEMPERATURE RESET: WHEN COOLING IS REQUIRED, CONTROL MODULE SHALL MONITOR ALL VAV TERMINALS AND RECALCULATE SUPPLY AIR TEMPERATURE BASED ON THE MOST DEMANDING ZONE WITHIN THE SETPOINT RANGE (55 °F AND 65 °F @ 60 °F INITIAL). FOR EVERY COOLING REQUEST AT THE ZONE LEVEL, SETPOINT WILL BE TRIMMED BY 0.5 °F (ADJUSTABLE) AND WHEN NO REQUESTS ARE PRESENT, 1 °F (ADJUSTABLE) WILL BE ADDED TO THE SETPOINT. SUPPLY AIR TEMPERATURE SETPOINT IS OVERRIDDEN AND SUPPLY AIR TEMPERATURE DEFAULTS TO 55 °F IF THE RETURN AIR RELATIVE HUMIDITY RISES ABOVE 60% RH (ADJUSTABLE). SETPOINT REMAINS 55 °F UNTIL RETURN AIR RELATIVE HUMIDITY FALLS BELOW 55% RH (ADJUSTABLE).

BAS SHALL PROVIDE ECONOMIZER OPERATION TO PROVIDE "FREE COOLING" WHEN OUTDOOR AIR CONDITIONS ALLOW. UPON BAS DETERMINATION THAT OUTSIDE AIR ENTHALPY IS BELOW RETURN AIR ENTHALPY (2 °F DEADBAND) IN COOLING MODE, THE OUTSIDE AIR, RETURN AIR AND RELIEF AIR DAMPERS SHALL MODULATE TO MAINTAIN UNIT DISCHARGE AIR TEMPERATURE. IF "ECONOMIZER" CONTROL IS INSUFFICIENT TO MAINTAIN DISCHARGE AIR TEMPERATURE, THE UNIT COOLING CYCLE SHALL OPERATE AS OUTLINED ABOVE. UPON A DROP IN DISCHARGE AIR TEMPERATURE BELOW SETPOINT, THE OUTSIDE AIR AND RELIEF AIR DAMPERS SHALL MODULATE CLOSED UNTIL THE MINIMUM OUTSIDE AIR POSITION IS REACHED. BUILDING PRESSURE SHALL BE MONITORED AND DAMPERS SHALL BE ADJUSTED TO PREVENT AN OVERPRESSURIZATION OF THE SPACE WHERE THE BUILDING PRESSURE SENSORS ARE LOCATED.

CONTROLS SHALL PROVIDE FOR OPTIMAL MORNING WARM-UP AND NIGHT SETBACK DURING UNOCCUPIED TIMES. UPON UNIT START-UP, IF RETURN AIR TEMPERATURE IS BELOW 55 °F (ADJ) OR ABOVE 75 °F (ADJ), THE OUTSIDE AIR DAMPERS SHALL REMAIN CLOSED AND THE HEATING OR COOLING CONTROL VALVES SHALL OPEN TO THE HEATING OR COOLING COILS AS REQUIRED TO RAISE OR LOWER THE RETURN AIR TEMPERATURE. WHEN RETURN AIR TEMPERATURE RISES ABOVE 65 °F (ADJ) OR FALLS BELOW 70 °F (ADJ), THE UNIT SHALL BE CONTROLLED AS OUTLINED ABOVE.

WHILE IN THE UNOCCUPIED MODE, THE UNIT SUPPLY FAN SHALL BE OFF. THE CHILLED WATER AND HOT WATER CONTROL VALVES SHALL BE CLOSED TO THE UNIT AND THE TERMINAL UNIT SPACE TEMPERATURE SETPOINTS SHALL BE SET TO UNOCCUPIED SETTINGS OF 60° FOR HEATING (ADJ) AND 85° FOR COOLING (ADJ). UPON A CALL FOR HEATING OR COOLING TO MEET UNOCCUPIED SETPOINTS, THE UNIT FAN SHALL BE STARTED AND THE HEATING OR CHILLED WATER CONTROL VALVES SHALL BE OPENED TO THE HEATING OR COOLING COIL AS REQUIRED BY THE SPACE TEMPERATURE. THE BOILER PLANT OR CHILLER PLANT SHALL ALSO BE STARTED AS REQUIRED TO SATISFY SETPOINTS. THE UNIT AND ASSOCIATED CENTRAL PLANT SHALL OPERATE FOR A MINIMUM OF 30 MINUTES OR AS REQUIRED TO SATISFY UNOCCUPIED SETPOINT) AND SHALL NOT BE ALLOWED TO RESTART FOR A MINIMUM OF 15 MINUTES FOLLOWING SATISFACTION OF UNOCCUPIED SETPOINT AND SYSTEM SHUT-DOWN.

OUTSIDE AIR INTAKE SHALL BE PROVIDED WITH (2) MOTORIZED DAMPERS (1) SIZED FOR MINIMUM OUTSIDE (0-POSITION) AND (1) SIZED FOR THE REMAINING CO2 CONTROL AND ECONOMIZER OUTSIDE AIRFLOW (MODULATING), ON UNIT START UP, THE O.A. DAMPERS SHALL REMAIN CLOSED UNTIL THE RETURN AIR TEMPERATURE RISES ABOVE 65° (ADJ) OR FALLS BELOW 70° (ADJ). ONCE RETURN AIR TEMPERATURE IS SATISFIED, THE MINIMUM O.A. INTAKE DAMPER SHALL BE OPEN WHILE THE AIR HANDLING UNIT IS IN THE OCCUPIED MODE. DAMPER SHALL OPEN TO MAINTAIN THE MINIMUM OUTSIDE AIRFLOW. DAMPER SHALL REMAIN CLOSED WHILE THE UNIT IS IN THE UNOCCUPIED MODE. BAS SHALL BE CAPABLE OF OPENING AND CLOSING OUTSIDE AIR DAMPERS.

CO2 SENSOR MOUNTED IN THE SPACE (RETURN DUCT FOR VERIFICATION ONLY) SHALL MODULATE THE OUTSIDE AIR DAMPER BASED ON CO2 LEVELS IN THE SPACE. THE O.A. DAMPERS SHALL MODULATE AS REQUIRED TO MAINTAIN A SPACE CO2 LEVEL OF 700 PPM ABOVE THE OUTSIDE AIR CO2 LEVEL. AN ALARM SHALL BE ACTIVATED IF THE SPACE CO2 LEVEL RISES ABOVE 1200 PPM. OA SHALL BE RESET DOWN TO BELOW MIN OA SETPOINT WITH A SETTING EQUAL TO THE ASSOCIATED SYSTEM EXHAUST AIRFLOW RATE BASED ON POLLING ALL ROOM CO2 SENSORS AND ADJUSTING OA MIN DAMPER POSITION DOWN UNTIL ALL SPACE CO2 SENSORS REMAIN WITHIN ALLOWABLE RANGE AS NOTED ABOVE. PROVIDE MEANS OF MANUAL OVERRIDE DURING DCV/CO2 CONTROLS SEQUENCE BY LOCAL USER INPUT.

SMOKE DETECTOR SHALL BE PROVIDED IN THE RETURN DUCT (UPSTREAM OF THE OUTSIDE AIR DUCT CONNECTION). DETECTOR SHALL SHUT DOWN ALL UNIT FANS UPON ACTIVATION, SEND ALARM TO BAS.

A FREEZE-STAT SHALL BE LOCATED IN THE MIXED AIR STREAM TO SHUT-DOWN SUPPLY FAN IF THE MIXED AIR TEMPERATURE FALLS BELOW 40°, AND CHW AND HW CONTROLS VALVES. FREEZE-STAT SHALL HAVE MANUAL RESET ONLY. (FREEZESTAT SHALL BE LOCATED DOWNSTREAM OF PREHEAT COIL). SEND ALARM TO BAS.

THE ASSOCIATED HOT WATER PUMP SERVING THE HOT WATER PREHEAT COIL SHALL BE ACTIVATED WHEN THE OAT DROPS TO 45° F (ADJ.) AND THE PREHEAT COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN A MINIMUM COIL DISCHARGE AIR TEMPERATURE PER THE RESET SCHEDULE, MAX 52F (ADJ.)

STATIC PRESSURE RESET SHALL BE PROVIDED TO POLL ALL VAV TERMINAL UNITS AND ADJUST STATIC PRESSURE SETPOINT DOWN UNTIL (1) TERMINAL UNIT IS IN FULL COOLING DAMPER POSITION

DUCT MOUNTED SMOKE DETECTORS: SMOKE DETECTOR SHALL BE PROVIDED IN THE RETURN DUCT PRIOR TO THE OUTSIDE AIR DUCT CONNECTION. DETECTOR SHALL INTERFACE WITH FIRE ALARM SYSTEM AND SHUT-DOWN UNIT FANS UPON ACTIVATION. A NOTIFICATION ALARM SHALL BE GENERATED WHEN A SMOKE DETECTOR IS ACTIVATED. SMOKE DETECTORS SHALL BE INDICATED ON EQUIPMENT GRAPHICS WITH WHICH DETECTOR IS ASSOCIATED.

DUCTWORK STATIC PRESSURE H/CO LIMITS MEDIUM PRESSURE SUPPLY: -2.75" LOW PRESSURE SUPPLY: -2.00" LOW PRESSURE RETURN: -2.00"

VARIABLE AIR VOLUME BOXES A TEMPERATURE SENSOR SHALL BE UTILIZED TO MAINTAIN SPACE TEMPERATURE SETPOINT OF 75° (ADJ.) ON RISE IN SPACE TEMPERATURE ABOVE SETPOINT. THE VOLUME DAMPER SHALL OPEN AS REQUIRED TO MAINTAIN SPACE TEMPERATURE. ON DROP IN SPACE TEMPERATURE BELOW SETPOINT, THE VOLUME DAMPER SHALL CLOSE UNTIL THE MINIMUM DAMPER POSITION IS REACHED. THE HOT WATER CONTROL VALVE SHALL BE MODULATED OPEN TO THE HEATING COIL AND THE TERMINAL UNIT DAMPER SHALL OPEN TO THE MIN. CFM AS INDICATED IN THE SCHEDULE. AS THE TEMPERATURE RISES ABOVE SET POINT THE HOT WATER CONTROL VALVE SHALL CLOSE AND THE DAMPER SHALL RETURN TO THE MINIMUM POSITION.

WHEN WARM AIR IS SENSED BY THE TERMINAL UNIT DURING MORNING WARM UP, THE DAMPER SHALL RESPOND TO THE SPACE TEMPERATURE. THE TERMINAL UNIT DAMPER SHALL OPEN ON A CALL FOR HEATING AND SHALL REMAIN CLOSED IF THE SPACE TEMPERATURE IS AT OR ABOVE OCCUPIED SETPOINT.

THE TEMPERATURE SENSOR SHALL BE PROVIDED WITH AN OVERRIDE FUNCTION THAT WILL PLACE THE SYSTEM IN THE OCCUPIED MODE FOR A PERIOD OF UP TO 2 HOURS. THE OVERRIDE SHALL ACTIVATE THE SYSTEM AHU AND THE HEATING OR COOLING CENTRAL PLANT AS REQUIRED TO MAINTAIN SPACE TEMPERATURE. TEMPERATURE SENSORS SHALL BE PROVIDED WITH A 5°F DEADBAND BETWEEN HEATING AND COOLING SETPOINTS.

FAN COIL UNITS FAN COIL UNITS SHALL BE STOPPED/STARTED ON A PROGRAMMED BASIS THROUGH THE BAS.

WHILE IN THE OCCUPIED MODE, THE SUPPLY FAN SHALL OPERATE CONTINUOUSLY. A WALL MOUNTED TEMPERATURE SENSOR SHALL BE UTILIZED TO MAINTAIN SPACE TEMPERATURE OF 76° (ADJ.). CHILLED WATER CONTROL VALVE SHALL MODULATE OPEN TO THE COIL ON A RISE IN TEMPERATURE ABOVE SENSOR SETPOINT. AS THE TEMPERATURE SPACE FALLS BELOW SETPOINT, CHILLED WATER CONTROL VALVE SHALL CLOSE AND HOT WATER CONTROL VALVE SHALL MODULATE OPEN TO MAINTAIN SPACE TEMPERATURE.

WHILE IN THE UNOCCUPIED MODE, THE UNIT SUPPLY FAN SHALL BE OFF. THE CHILLED WATER AND HOT WATER CONTROL VALVES SHALL BE CLOSED TO THE UNIT AND THE SPACE TEMPERATURE SETPOINTS SHALL BE SET TO UNOCCUPIED SETTINGS OF 60° FOR HEATING (ADJ) AND 85° FOR COOLING (ADJ). UPON A CALL FOR HEATING OR COOLING TO MEET UNOCCUPIED SETPOINTS, THE UNIT FAN SHALL BE STARTED AND THE HEATING OR CHILLED WATER CONTROL VALVES SHALL BE OPENED TO THE HEATING OR COOLING COIL AS REQUIRED BY THE SPACE TEMPERATURE. THE BOILER PLANT OR CHILLER PLANT SHALL ALSO BE STARTED AS REQUIRED TO SATISFY SETPOINTS. THE UNIT AND ASSOCIATED CENTRAL PLANT SHALL OPERATE FOR A MINIMUM OF 30 MINUTES OR AS REQUIRED TO SATISFY UNOCCUPIED SETPOINT) AND SHALL NOT BE ALLOWED TO RESTART FOR A MINIMUM OF 15 MINUTES (ADJ.) FOLLOWING SATISFACTION OF UNOCCUPIED SETPOINT AND SYSTEM SHUT-DOWN.

DRAIN PAN FLOAT ALARM SHALL BE INTERLOCKED WITH UNIT OPERATION, AND SHALL SHUTDOWN UNIT UPON BEING ACTIVATED, SEND ALARM TO BAS.

BAS SHALL PROVIDE ECONOMIZER OPERATION TO PROVIDE "FREE COOLING" WHEN OUTDOOR AIR CONDITIONS ALLOW. UPON BAS DETERMINATION THAT OUTSIDE AIR ENTHALPY IS BELOW RETURN AIR ENTHALPY (2 °F DEADBAND) IN COOLING MODE, THE OUTSIDE AIR, RETURN AIR DAMPERS SHALL MODULATE TO MAINTAIN UNIT DISCHARGE AIR TEMPERATURE. IF "ECONOMIZER" CONTROL IS INSUFFICIENT TO MAINTAIN DISCHARGE AIR TEMPERATURE, THE UNIT COOLING CYCLE SHALL FUNCTION AS OUTLINED ABOVE. UPON A DROP IN DISCHARGE AIR TEMPERATURE BELOW SETPOINT, THE OUTSIDE AIR DAMPER SHALL MODULATE CLOSED UNTIL THE MINIMUM OUTSIDE AIR POSITION IS REACHED. BUILDING PRESSURE SHALL BE MONITORED AND ASSOCIATED RELIEF FAN SHALL BE OPERATED TO PREVENT AN OVERPRESSURIZATION OF THE SPACE WHERE THE SPACE PRESSURE SENSORS ARE LOCATED (1 FOR EACH FCU).

MISC. EXHAUST FANS PROVIDE WALL SWITCHES, WALL THERMOSTATS, INTERLOCKS, ETC. AS INDICATED ON THE FAN SCHEDULE TO CONTROL FANS AS INDICATED ON PLANS.

TOILET AND LOCKER ROOM EXHAUST FANS FANS SHALL OPERATE ON A PROGRAMMED SCHEDULE BY BAS.

DUCTLESS SPLIT SYSTEMS: UNITS SHALL PROVIDE COOLING ON A CONTINUOUS BASIS. SUPPLY FAN SHALL RUN CONTINUOUSLY AND COOLING CYCLE SHALL CYCLE WITH A CALL FOR COOLING TO MAINTAIN ROOM TEMPERATURE SETPOINT OF 75 °F (ADJ.). UNITS SHALL BE PROVIDED WITH STANDALONE FACTORY CONTROLS.

IF PROVIDED THE EMERGENCY BACK UP FAN SHALL BE ACTIVATED IF THE ROOM TEMPERATURE RISES ABOVE 85 °F, AND GENERATE AN ALARM UPON AN EQUIPMENT FAILURE OF THE PRIMARY D.S.S.

IF NO EMERGENCY BACK FAN IS PROVIDED AND THE ROOM TEMPERATURE RISES ABOVE 85 °F, AN ALARM SHALL BE SENT TO THE BAS UPON AN EQUIPMENT FAILURE OF THE PRIMARY D.S.S.

CO2 ROOM SENSOR DCV SEQUENCE: CO2 SENSOR MOUNTED IN THE SPACE (RETURN DUCT FOR VERIFICATION ONLY) SHALL MODULATE THE OUTSIDE AIR DAMPER BASED ON CO2 LEVELS IN THE SPACE. THE O.A. DAMPERS SHALL MODULATE AS REQUIRED TO MAINTAIN A SPACE CO2 LEVEL OF 700 PPM ABOVE THE OUTSIDE AIR CO2 LEVEL. AN ALARM SHALL BE ACTIVATED IF THE SPACE CO2 LEVEL RISES ABOVE 1200 PPM. OA SHALL BE RESET DOWN TO BELOW MIN OA SETPOINT WITH A SETTING EQUAL TO THE ASSOCIATED SYSTEM EXHAUST AIRFLOW RATE BASED ON POLLING ALL ROOM CO2 SENSORS AND ADJUSTING OA MIN DAMPER POSITION DOWN UNTIL ALL SPACE CO2 SENSORS REMAIN WITHIN ALLOWABLE RANGE AS NOTED ABOVE.

PACKAGED ROOFTOP UNIT (W/ RRV): RTU-1 ALL UNITS SHALL BE STOPPED/STARTED ON A PROGRAMMED BASIS THROUGH THE BAS.

UNIT SHALL BE CONTROLLED FROM THE FACTORY INTERNAL CONTROLS/PROGRAMMING TO MAINTAIN NEUTRAL AIR - AS SCHEDULED.

ASSOCIATED OUTSIDE AIR MOTOR OPERATED DAMPER SHALL CYCLE OPEN/CLOSED BASED ON UNIT OPERATION, AND SHALL BE PROVIDED WITH END SWITCH FOR DAMPER POSITION INDICATION VIA BAS.

THE ASSOCIATED RELIEF AIR MOTOR OPERATED DAMPER SHALL OPERATE BASED ON BUILDING PRESSURE TO MAINTAIN A POSITIVE PRESSURE OF .01" WC (ADJ.).

UNIT SHALL BE SCHEDULED THROUGH THE BAS TO OPERATE DURING ALL OCCUPIED TIMEFRAMES.

OCCUPIED MODE: THE RTU SHALL BE ENABLED WHENEVER BUILDING IS IN OCCUPIED MODE TO PROVIDE VENTILATION TO THE BUILDING. THE RTU SHALL NOT RUN WHEN BUILDING IS IN NIGHT SETBACK/UNOCCUPIED OPERATION AS THIS MODE IS FOR TEMPERATURE CONTROL ONLY AND VENTILATION IS NOT REQUIRED. ONCE ENABLED THE OUTSIDE AND EXHAUST AIR INTAKE DAMPERS SHALL BE COMMANDED OPEN. ONCE THEIR ASSOCIATED DAMPER HAS BEEN PROVEN OPEN THEN THE RTU SUPPLY FAN AND EXHAUST FANS SHALL BE ALLOWED TO START THROUGH A HARD-WIRED INTERLOCK. IT SHALL NOT BE POSSIBLE FOR FANS TO OPERATE WITHOUT THEIR ASSOCIATED DAMPER STATUS PROVEN OPEN. ONCE SUPPLY AND EXHAUST FAN STATUS HAS BEEN PROVEN, THE HEAT WHEEL SHALL BE ENABLED TO BEGIN ROTATION.

DISCHARGE TEMPERATURE CONTROL: FOR THE COMPRESSOR OR ELECTRIC HEAT TO BE ALLOWED, SUPPLY FAN STATUS SHALL BE PROVEN. THE DISCHARGE AIR TEMPERATURE SETPOINT WILL BE RESET LINEARLY BASED ON RETURN AIR TEMPERATURE. AT A RETURN AIR TEMPERATURE OF 85° F (ADJ.) THE DISCHARGE AIR SETPOINT SHALL BE AT THE LOW LIMIT, 55° F (ADJ.) AND AT A RETURN AIR TEMPERATURE OF 75° F (ADJ.) THE DISCHARGE SETPOINT SHALL BE AT THE HIGH LIMIT, 70° F (ADJ.). THE DISCHARGE AIR SETPOINT SHALL BE LIMITED TO ITS HIGH AND LOW RESET SETPOINTS, THERE SHALL BE A DEADBAND BETWEEN THE ACTUAL HEATING AND COOLING SETPOINTS SUCH THAT CYCLING BETWEEN HEATING AND COOLING DOES NOT OCCUR. ON A RISE IN DISCHARGE TEMPERATURE ABOVE THE DISCHARGE COOLING SETPOINT THE COMPRESSORS SHALL BE STAGED TO MAINTAIN THE COOLING SETPOINT. ON A DROP IN DISCHARGE TEMPERATURE BELOW THE DISCHARGE HEATING SETPOINT THE ELECTRIC HEAT COIL SIGNAL SHALL BE MODULATED TO MAINTAIN THE HEATING SETPOINT.

HEAT WHEEL CONTROL: WHEN THE RTU IS ENABLED, THE HEAT WHEEL SHALL BE ENABLED UNLESS THE FOLLOWING CONDITIONS OCCUR. WHEN THE RTU IS IN COOLING MODE AND THE OUTSIDE AIR TEMPERATURE IS BELOW THE CURRENT DISCHARGE SETPOINT OR THE RTU IS IN HEATING MODE AND THE OUTSIDE AIR TEMPERATURE IS ABOVE THE CURRENT DISCHARGE HEATING SETPOINT, THEN THE HEAT WHEEL SHALL BE DISABLED AND THE HEAT WHEEL BYPASS DAMPERS SHALL BE OPENED SUCH THAT THE AIRFLOW IS ALLOWED TO BYPASS THE HEAT WHEEL. WHEN OUTSIDE AIR CONDITIONS ARE NO LONGER FAVORABLE, THE HEAT WHEEL WILL BE ENABLED AND THE BYPASS DAMPER CLOSED.

DEHUMIDIFICATION CONTROL: ON A RISE IN THE RETURN AIR HUMIDITY ABOVE THE DEHUMIDIFICATION MODE (60% ADJ.) FOR 5 MINUTES (ADJ.), THEN THE RTU SHALL BE IN DEHUMIDIFICATION MODE. DURING DEHUMIDIFICATION MODE, THE COMPRESSORS SHALL BE CYCLED TO MAINTAIN A COOLING COIL DISCHARGE SETPOINT OF 50° (ADJ.) AND THE ELECTRIC REHEAT COIL SHALL BE STAGED TO MAINTAIN THE CURRENT DISCHARGE AIR SETPOINT AS DESCRIBED ABOVE. ANY ADDITIONAL ZONE REHEAT REQUIRED DUE TO DEHUMIDIFICATION MODE WILL BE ACCOMPLISHED BY THE INDIVIDUAL INDOOR UNIT HEATING SEQUENCE OF OPERATION. DEHUMIDIFICATION MODE SHALL BE DISABLED WHEN THE RETURN HUMIDITY FALLS BELOW THE DEHUMIDIFICATION SETPOINT, MINUS THE DEADBAND SETPOINT (5% ADJ.).

FIRE ALARM SHUTDOWN: IF THE ASSOCIATED FIRE ALARM CONTACT OR DUCT DETECTORS ARE IN ALARM CONDITION, THEN THE RTU SHALL BE SHUTDOWN THROUGH HARD-WIRE INTERLOCK. THE FANS SHALL BE DISABLED, AND THE DAMPERS CLOSED. AN INPUT AT THE CONTROLLER SHALL MONITOR THE FIRE ALARM STATUS AND ANNUNCIATE AN ALARM TO THE BAS.

ALARMS: SUPPLY/EXHAUST FAN ALARMS: FAN IS COMMANDED TO RUN AND NO STATUS IS RECEIVED COMPRESSOR STAGE ALARMS: COMPRESSOR STAGE IS COMMANDED TO RUN AND NO STATUS IS RECEIVED DISCHARGE TEMPERATURE ALARM: DISCHARGE TEMPERATURE IS 10° (ADJ.) ABOVE THE DISCHARGE COOLING SETPOINT OR 10° (ADJ.) BELOW THE DISCHARGE HEATING SETPOINT FOR 30 MIN. (ADJ.) WATER TEMPERATURE ALARM: IF THE COMPRESSOR IS RUNNING AND THE WATER TEMPERATURE DIFFERENTIAL IS NOT GREATER THAN 10° (ADJ.) IF THE WATER LEVEL IN THE CONDENSATE PAN RISES TO ACTIVATE THE ALARM, THE RTU SHALL BE DISABLED.

CONTROL SYSTEM NOTES

- 1. SEE SPECIFICATIONS (SECTION 23 09 00) FOR ADDITIONAL REQUIREMENTS.
2. THE SEQUENCE OF OPERATION OF OPERATION AND POINTS LIST IS INTENDED TO COMMUNICATE THE MINIMUM REQUIREMENTS AND GENERAL DESIGN INTENT TO THE CONTROLS CONTRACTOR AND IS NOT INTENDED TO BE A FULLY DEVELOPED OR COMPLETE SEQUENCE OF OPERATION. IN THE CONTROLS SUBMITTAL THE CONTROLS CONTRACTOR SHALL FULLY DEVELOP THE SEQUENCE OF OPERATIONS FOR ALL SYSTEMS IDENTIFIED AN SHALL PRESENT ALL SETPOINTS, CONTROL PARAMETERS, TIME DELAYS, ALARM POINTS, ETC. AS REQUIRED TO COMPLY WITH THE DESIGN INTENT. THE CONTROLS CONTRACTOR SHALL INCORPORATE STANDARD FEATURES SUCH AS MINIMUM RUN TIME DELAYS AND DEAD BANDS TO PREVENT SHORT CYCLING. ALL MONITORED POINTS SHALL INCLUDE EARLY HIGH/LOW ALARM NOTIFICATIONS PRIOR TO REQUIRED CORRECTIVE ACTIONS OR UNIT SHUT-DOWNS. CONTROL CONTRACTOR SHALL SPECIFY IN THE CONTROL SUBMITTAL FAIL SAFE POSITION FOR QUIT OR RANGE, FAIL SAFE POSITIONING FOR OPEN CIRCUITS OR LOSS OF COMMUNICATION.
3. SYSTEM SHALL USE GLOBAL OUTSIDE AIR TEMPERATURE AND HUMIDITY SENSORS FOR PRIMARY SYSTEM OPERATION. LOCAL OUTSIDE AIR TEMPERATURE AND HUMIDITY SENSORS SHALL BE PROVIDED FOR SYSTEM OPERATION UPON LOSS OF NETWORK COMMUNICATION.
4. ALL CONTROL SETPOINTS SHALL BE ADJUSTABLE AND TRENDBLE. INDICATED TEMPERATURE SETPOINTS SHOULD BE USED FOR ORIGINAL SYSTEM SET-UP. ANY CHANGES IN SETPOINT SETTINGS REQUIRED FOR INTENDED SYSTEM OPERATION SHALL BE NOTED ON AS-BUILT CONTROL DRAWINGS.
5. FLOW SWITCHES OR ADJUSTABLE TIME CURRENT SWITCHES SHALL BE PROVIDED IN THE PIPING OF EACH PUMP TO VERIFY PUMP STATUS.
6. IONIZATION TYPE DUCT SMOKE DETECTORS SHALL BE FURNISHED AND WIRED TO THE FIRE ALARM SYSTEM BY THE ELECTRICAL CONTRACTOR. MECHANICAL CONTRACTOR SHALL INSTALL DETECTORS IN THE DUCT AND WIRE UNIT FROM FIRE ALARM SYSTEM (DRY CONTACTS) FOR UNIT SHUT-DOWN UPON ACTIVATION.
7. ELECTRICAL CONTRACTOR SHALL PROVIDE DEDICATED 120V CIRCUITS IN A J-BOX FOR THE CONTROL POWER. CONTROLS CONTRACTOR SHALL EXTEND 120V POWER FROM J-BOX TO CONTROL PANELS, DAMPER ACTUATORS, TRANSFORMERS, ETC. AS REQUIRED FOR OPERATION OF CONTROL SYSTEM.
8. BAS SHALL ALLOW GLOBAL OPERATION OF HOT WATER CONTROL VALVES.
9. ALL CONTROL PANELS AND COMPONENTS SHALL BE UL LISTED
10. LOCATE MAIN DDC CONTROL PANEL(S) MECHANICAL ROOMS AS INDICATED ON PLANS COORDINATE EXACT LOCATION PANEL WITH ALL OTHER TRADES PRIOR TO INSTALLATION.
11. OUTDOOR TEMP/HUMIDITY SENSOR SHALL BE PROVIDED WITH AN ACCURACY OF +/- .25%
12. PROOF OF STATUS FOR UTILITY BEING MONITORED SHALL BE ACCOMPLISHED DIRECTLY, NOT INDIRECTLY, VIA CURRENT SENSOR MONITORING FOR PROOF OF STATUS
12. ALL AVAILABLE POINTS SHALL BE INTEGRATED BACK TO THE BAS FROM ASSOCIATED DEVICES, EQUIPMENT, I.E. VFDs, CHILLERS, PDU's, ETC.

CONTROL SYSTEM NOTES

- A. DIRECT DIGITAL CONTROL (DDC) TECHNOLOGY SHALL BE USED TO PROVIDE THE FUNCTIONS NECESSARY FOR CONTROL OF MECHANICAL SYSTEMS.
B. THE CONTROL SYSTEM SHALL BE DESIGNED SUCH THAT IN THE EVENT OF A NETWORK COMMUNICATION FAILURE, OR THE LOSS OF ANY OTHER CONTROLLER, THE CONTROL SYSTEM SHALL CONTINUE TO INDEPENDENTLY OPERATE UNDER CONTROL.
C. OWNER SHALL PROVIDE WAN/LAN CONNECTION TO THE BUILDING AUTOMATION SYSTEM.
D. NIAGRA PROTOCOL SHALL BE USED FOR WORKBENCH TO DAEMON COMMUNICATION.
E. UNIT LEVEL CONTROLLERS SHALL USE BACNET MSTP PROTOCOL. CONTROLLERS SHALL BE BACNET BTL CERTIFIED.
F. THE SYSTEM MUST BE PROVIDED, INSTALLED, WIRED AND PROGRAMED BY THE MANUFACTURER'S LOCAL FACTORY OFFICE OR INDEPENDENT CONTROLS SPECIFIC CONTRACTOR. BIDS BY WHOLESALERS, CONTRACTORS OR FRANCHISED DEALERS OR ANY OTHER FIRM WHOSE PRINCIPLE BUSINESS IS NOT THAT OF MANUFACTURING AND INSTALLING BUILDING AUTOMATION SYSTEM IS NOT ACCEPTABLE.
G. PROVIDE ONE YEAR PARTS AND LABOR WARRANTY OF THE BAS.
H. PROVIDE 8HR (2) 4HR SESSIONS OF OWNER'S TRAINING AT JOBSITE ON THE BUILDING AUTOMATION SYSTEM OPERATION.
THE SYSTEM SHALL HAVE THE FOLLOWING FUNCTIONS:
A. TIME OF DAY SCHEDULING INCLUDING OPTIMAL START/STOP, HOLIDAY AND EXCEPTION SCHEDULES.
B. TIMED OVERRIDE BASED ON DURATION LIMIT OR FIXED UNTIL RELEASED.
C. DATA LOGGING AND TRENDDING.
D. USER SECURITY LEVEL ASSIGNMENT.
E. SYSTEM AND ALARMS REPORTS.
F. FLOOR PLANS, SYSTEM, EQUIPMENT GRAPHICS WITH DYNAMIC DATA DISPLAY.
G. ALARM E-MAIL ROUTING.
H. GLOBAL NAVIGATION ICONS TO MANAGE ALARMS, USER CREDENTIALS, HELP FUNCTIONS.
I. SUPPORT A MINIMUM OF 10 CONCURRENT USERS.
J. FULL SEQUENCE OF OPERATION PAGE
K. ONE CLICK TRENDS) NEXT TO EACH POINT MIN 2 WEEKS OF DATA
L. EQUIPMENT DATA PAGE

THE SYSTEM SHALL HAVE THE FOLLOWING PROGRAMMING STANDARD APPLICATIONS:

- A. DEMAND CONTROL VENTILATION OPTIMIZATION AS DEFINED BY ASHRAE 62.1.

GENERAL NOTES:

- 1. A USER INTERFACE SHALL BE PROVIDED THAT PERMITS INTERACTION WITH THE NETWORK VIA DYNAMIC COLOR GRAPHICS WITH EACH MECHANICAL SYSTEM, BUILDING FLOOR PLAN, AND CONTROL DEVICE DEPICTED BY POINT-AND-CLICK GRAPHICS.
2. ALL INTEGRATION FROM EXTERIOR SYSTEMS LIGHTING CONTROLS, ETC) SHALL BE INCLUDED WITH THE SCOPE OF THIS PROJECT AS DEFINED WITH IN THIS PROJECT OR AS IMPLIED THROUGH NOTES AND OTHER DIVISIONS BY APPLICABLE TRADES (DIVISION 23, 22, 26, 28)
3. PROVIDE GRAPHICS REVIEW WITH OWNER PRIOR TO FINAL SYSTEM COMMISSIONING AND TURNOVER
4. ALL EXTERIOR CONNECTIONS TO EXTERNAL WAN/LAN SHALL BE COORDINATED WITH OWNER IT DEPARTMENT
5. FINAL INTEGRATION INTO EXTERNAL WEB BAS ACCESS PLATFORM SHALL BE COORDINATED WITH OWNER
6. PROVIDE REQUIRED HARDWIRED ALARM OUTPUTS FOR BOILER SYSTEM ALARMS



03/10/2025

CENTRAL PIEDMONT COMMUNITY COLLEGE
WELLNESS COSMETOLOGY PROGRAM RENOVATIONS

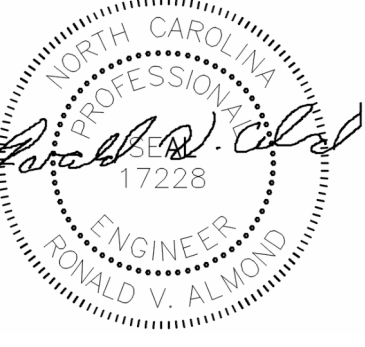
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PRINCIPAL IN CHARGE: RVA
PROJECT ARCHITECT: MVO
DRAWN BY: SMP, AJC

SHEET TITLE: MECHANICAL SEQUENCE OF OPERATIONS

SHEET NO. PROJ. NO. 023145.00

M004



CENTRAL PIEDMONT COMMUNITY COLLEGE
**WELLNESS COSMETOLOGY PROGRAM
RENOVATIONS**
3210 CPCC WEST CAMPUS DRIVE CHARLOTTE, NC 28208
SCO ID: 23-28961-02A

SHEET ISSUE:

NO.	DATE	DESCRIPTION	BY
A	12/11/2024	CONSTRUCTION DOCUMENTS	MPS
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E	03/10/2025	BID SET (SCO REVIEW)	MPS

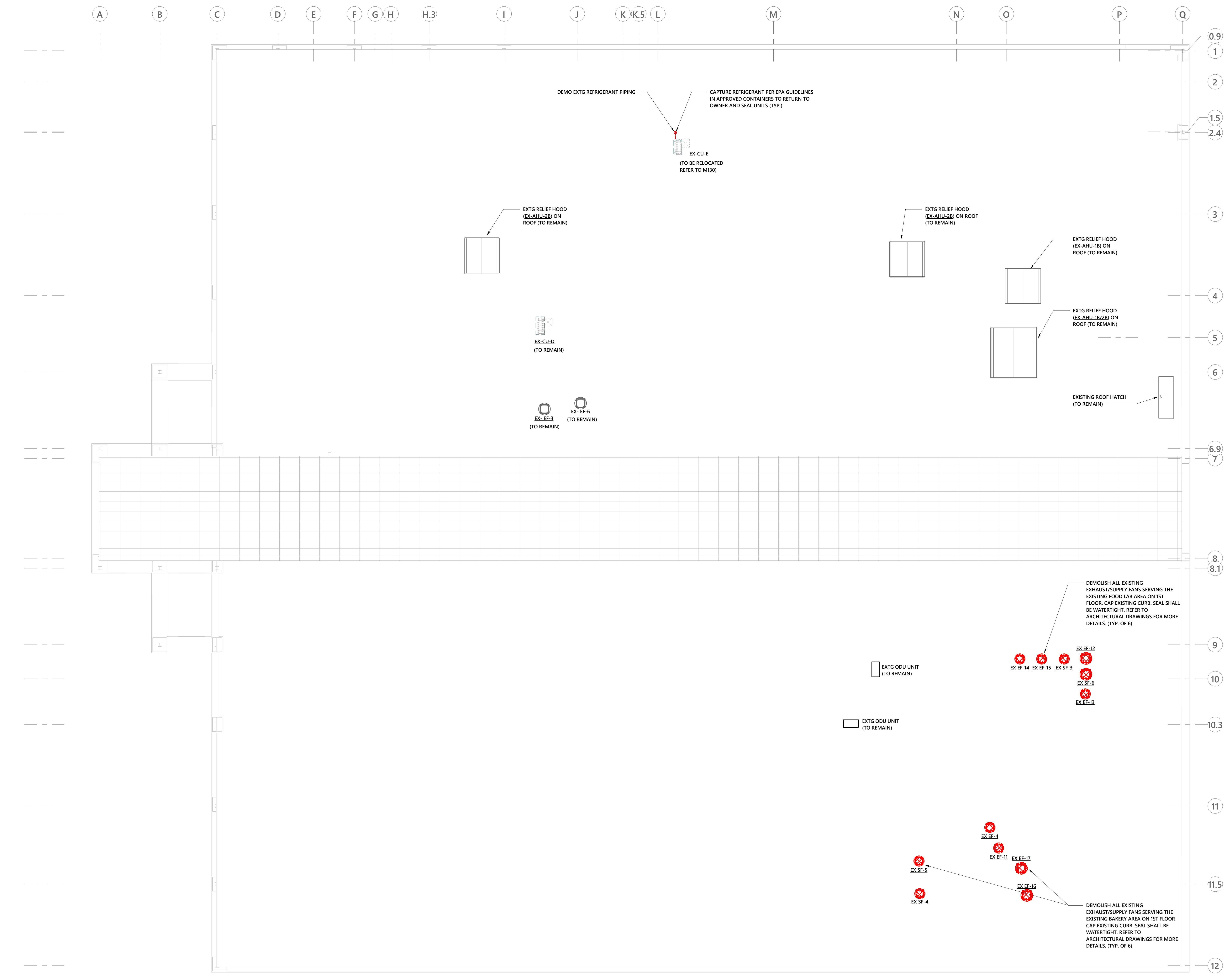
PRINCIPAL IN CHARGE: RVA
PROJECT ARCHITECT: MVO
DRAWN BY: SMP, AJC

SHEET TITLE:
**ROOF OVERALL PLAN
- MECHANICAL - DEMO**

SHEET NO. PROJ. NO.
023145.00

M023

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1 ROOF - PLAN - MECHANICAL - DEMO
1/8" = 1'-0"

SHEET ISSUE:

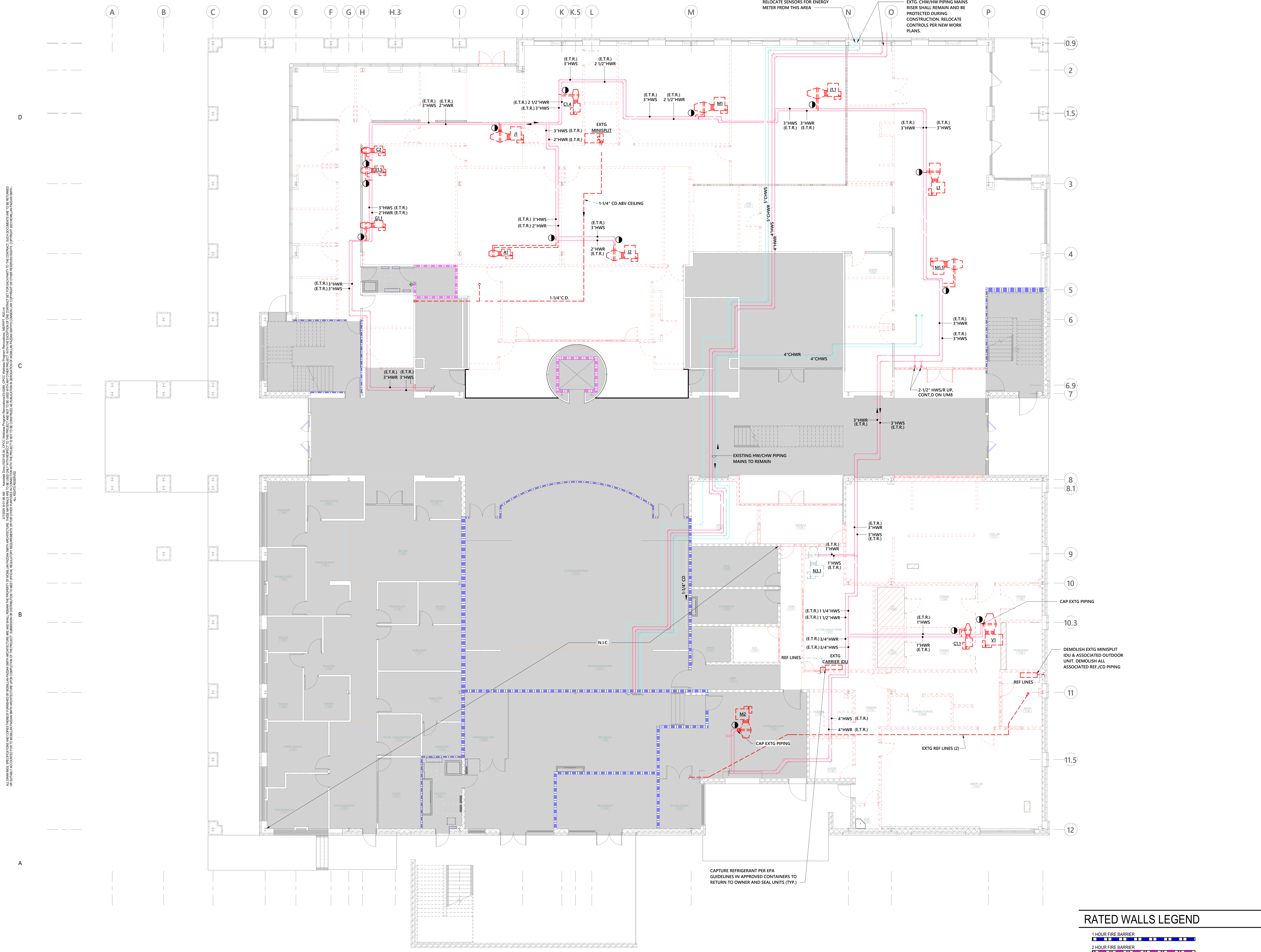
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PRINCIPAL IN CHARGE: RVA
 PROJECT ARCHITECT: MVO
 DRAWN BY: Author

SHEET TITLE:
**LEVEL 1 OVERALL
 PLAN - MECHANICAL
 PIPING - DEMO**

SHEET NO. PROJ. NO.
 023145.00

M031



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1 LEVEL 01 - FLOOR PLAN - MECHANICAL PIPING - DEMO
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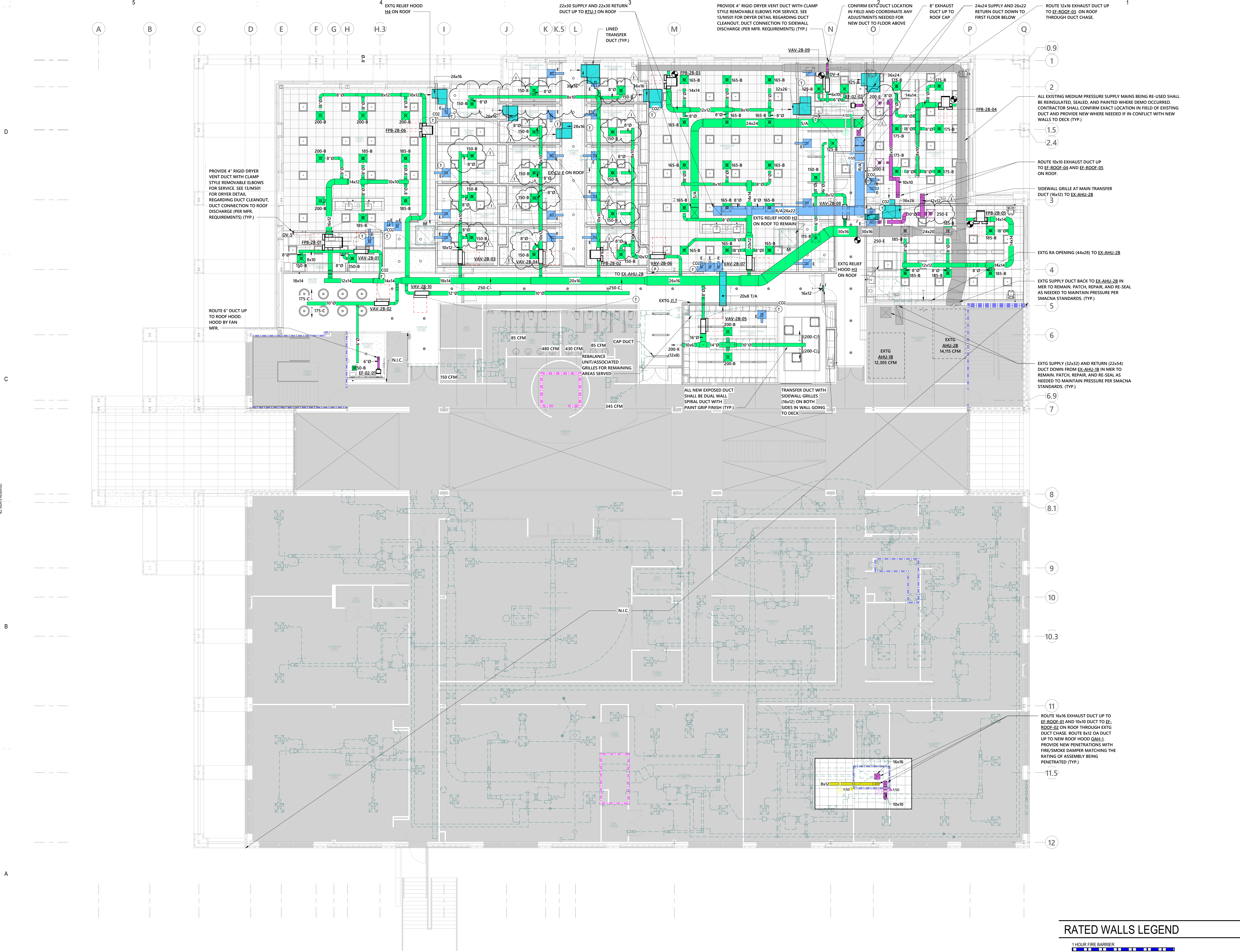
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E	03/10/2025	BID SET (SCO REVIEW)	MPS
F	03/25/2025	ADDENDUM 01	MPS
H	04/17/2025	ADDENDUM 03	MPS
I	04/24/2025	ADDENDUM 04	MPS

PRINCIPAL IN CHARGE: RVA
 PROJECT ARCHITECT: MVO
 DRAWN BY: SMP, AJC

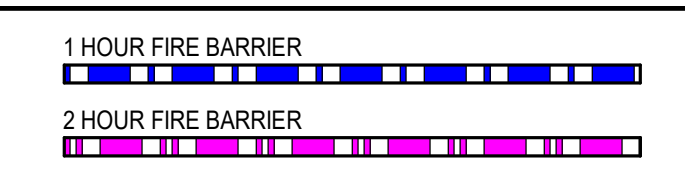
SHEET TITLE:
**LEVEL 2 OVERALL
 PLAN - MECHANICAL**

SHEET NO. PROJ. NO.
 023145.00

M120



RATED WALLS LEGEND



1 LEVEL 02 - FLOOR PLAN - MECHANICAL
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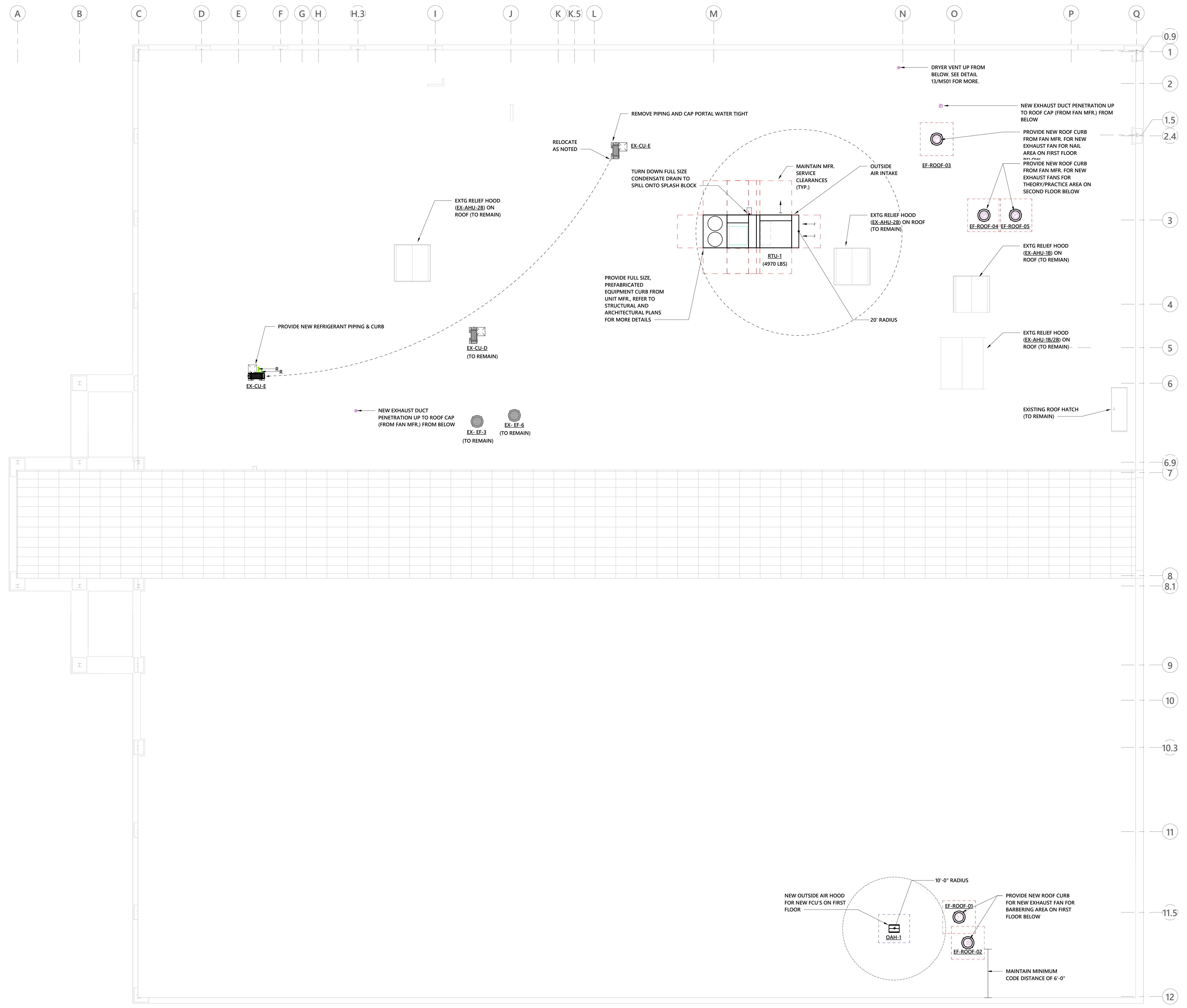
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PROJECT ARCHITECT: MVO
DRAWN BY: SMP, AJC

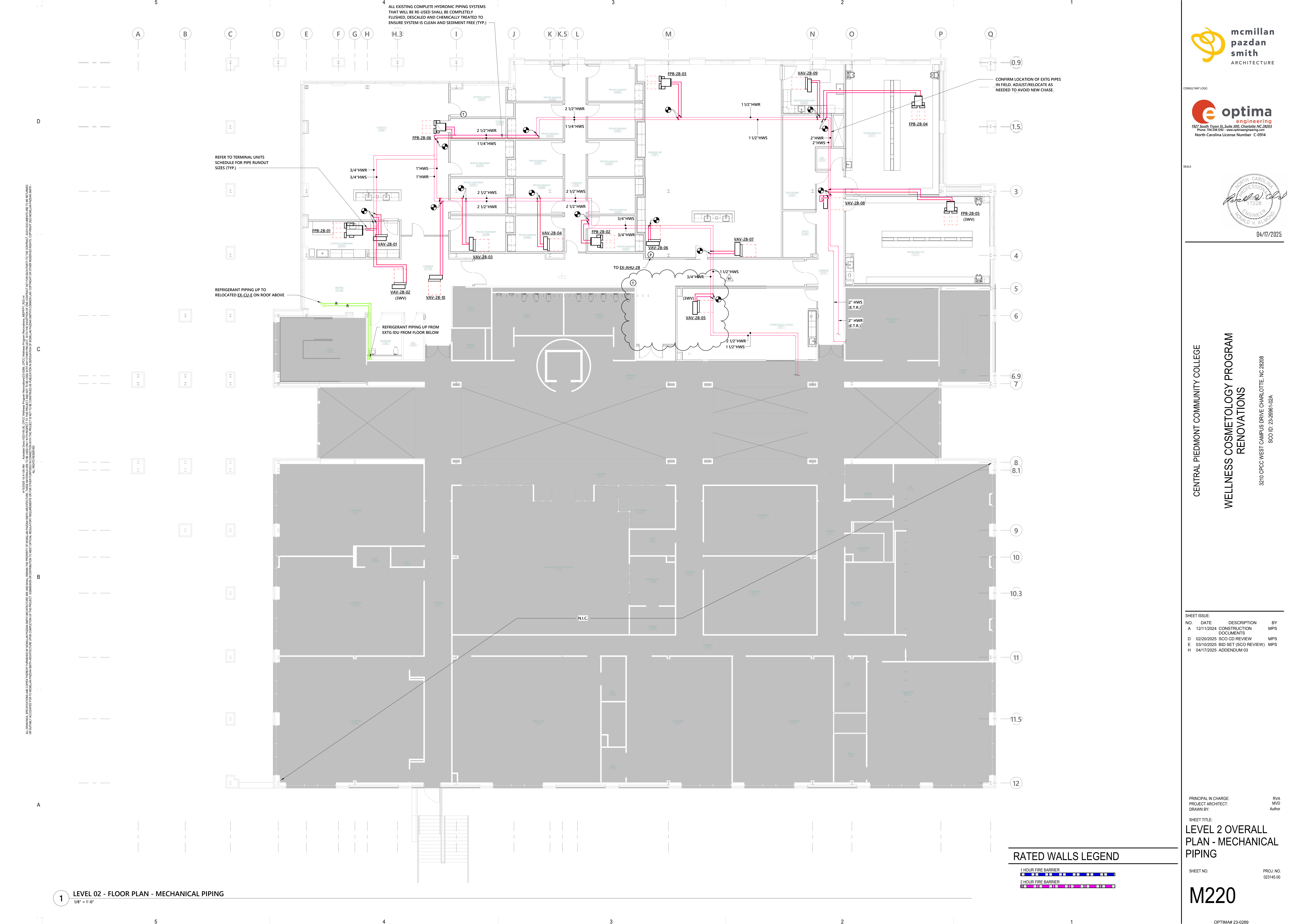
SHEET TITLE:
**ROOF OVERALL PLAN
- MECHANICAL**

SHEET NO. PROJ. NO.
023145.00

M130

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ALL EXISTING COMPLETE HYDRONIC PIPING SYSTEMS THAT WILL BE RE-USED SHALL BE COMPLETELY FLUSHED, DESCALED AND CHEMICALLY TREATED TO ENSURE SYSTEM IS CLEAN AND SEDIMENT FREE (TYP.)

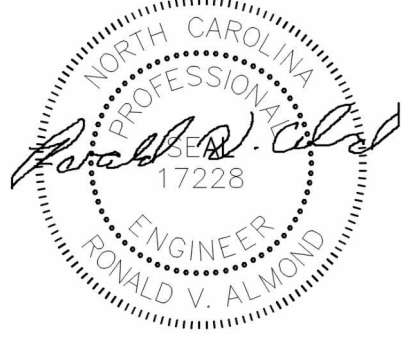
REFER TO TERMINAL UNITS SCHEDULE FOR PIPE RUNOUT SIZES (TYP.)

REFRIGERANT PIPING UP TO RELOCATED EX-CLE ON ROOF ABOVE

REFRIGERANT PIPING UP FROM EXTG IDU FROM FLOOR BELOW

CONFIRM LOCATION OF EXTG PIPES IN FIELD. ADJUST/RELOCATE AS NEEDED TO AVOID NEW CHASE.

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04/17/2025

CENTRAL PIEDMONT COMMUNITY COLLEGE
 WELLNESS COSMETOLOGY PROGRAM
 RENOVATIONS
 3210 CPCC WEST CAMPUS DRIVE CHARLOTTE, NC 28208
 SCO ID: 23-28861-02A

SHEET ISSUE:

NO.	DATE	DESCRIPTION	BY
A	12/11/2024	CONSTRUCTION DOCUMENTS	MPS
D	02/20/2025	SCO CD REVIEW	MPS
E	03/10/2025	BID SET (SCO REVIEW)	MPS
H	04/17/2025	ADDENDUM 03	

PRINCIPAL IN CHARGE: RVA
 PROJECT ARCHITECT: MVO
 DRAWN BY: Author

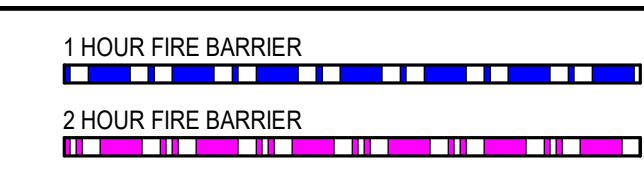
SHEET TITLE:
**LEVEL 2 OVERALL
 PLAN - MECHANICAL
 PIPING**

SHEET NO. PROJ. NO.
 023145.00

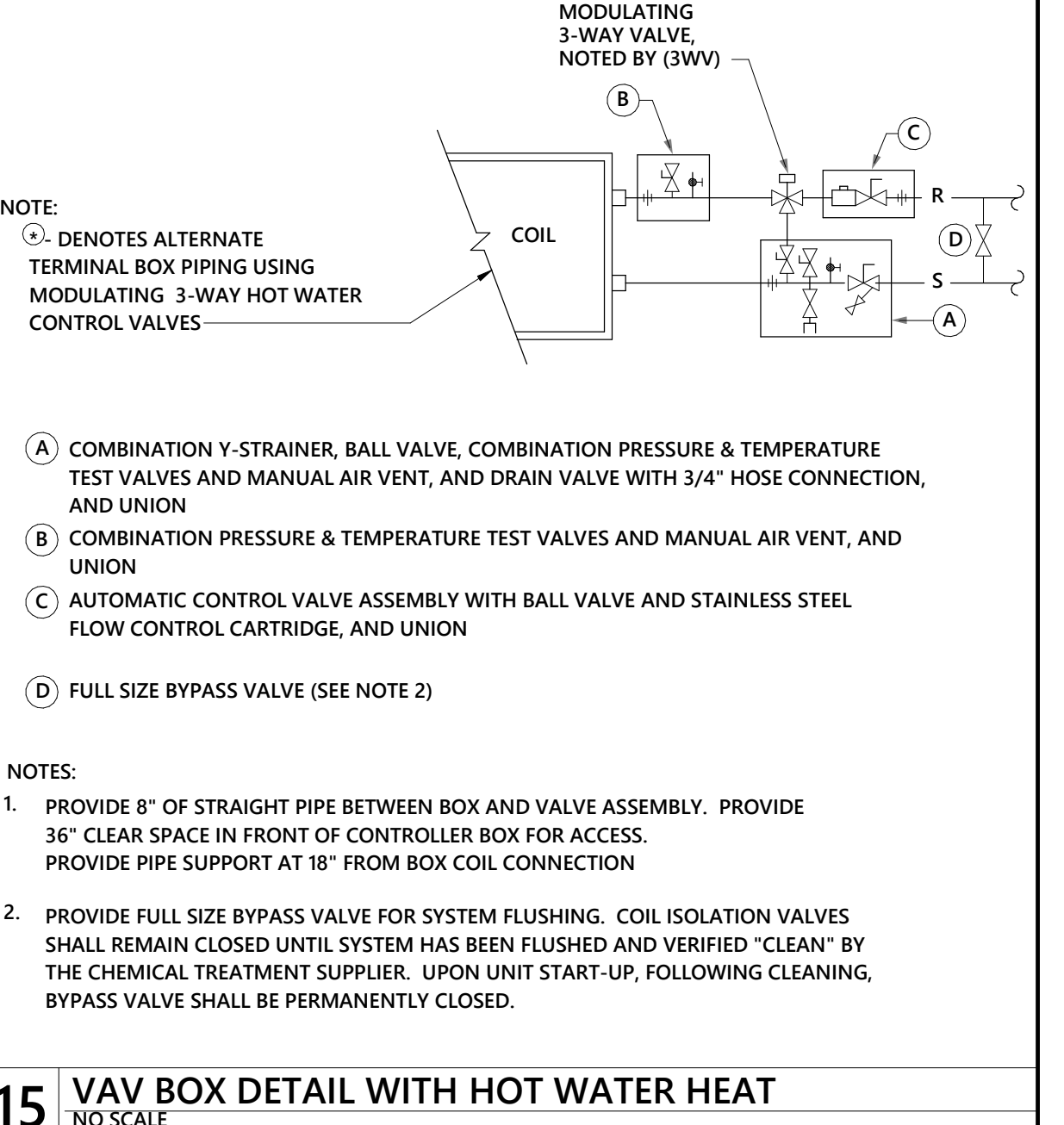
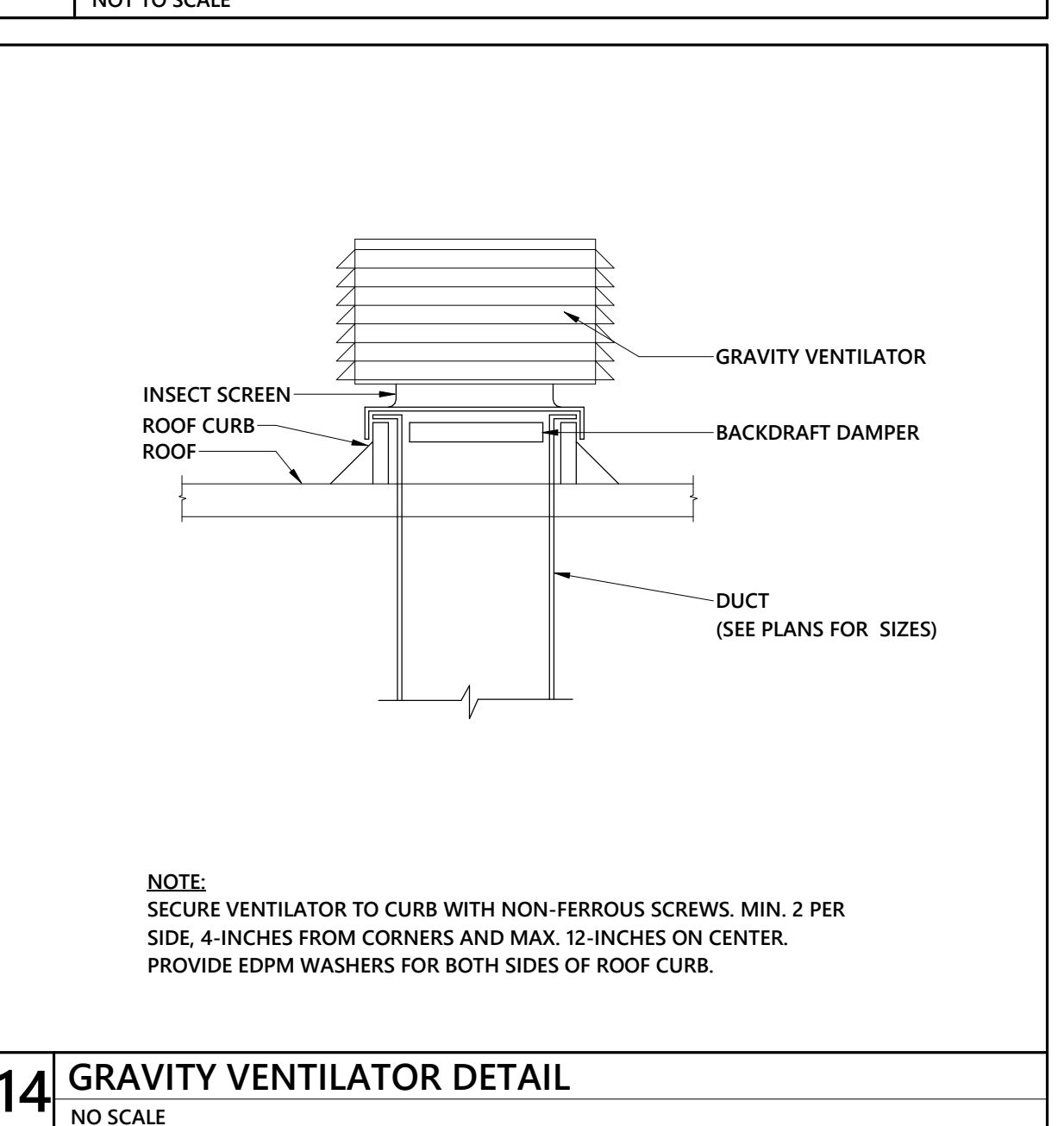
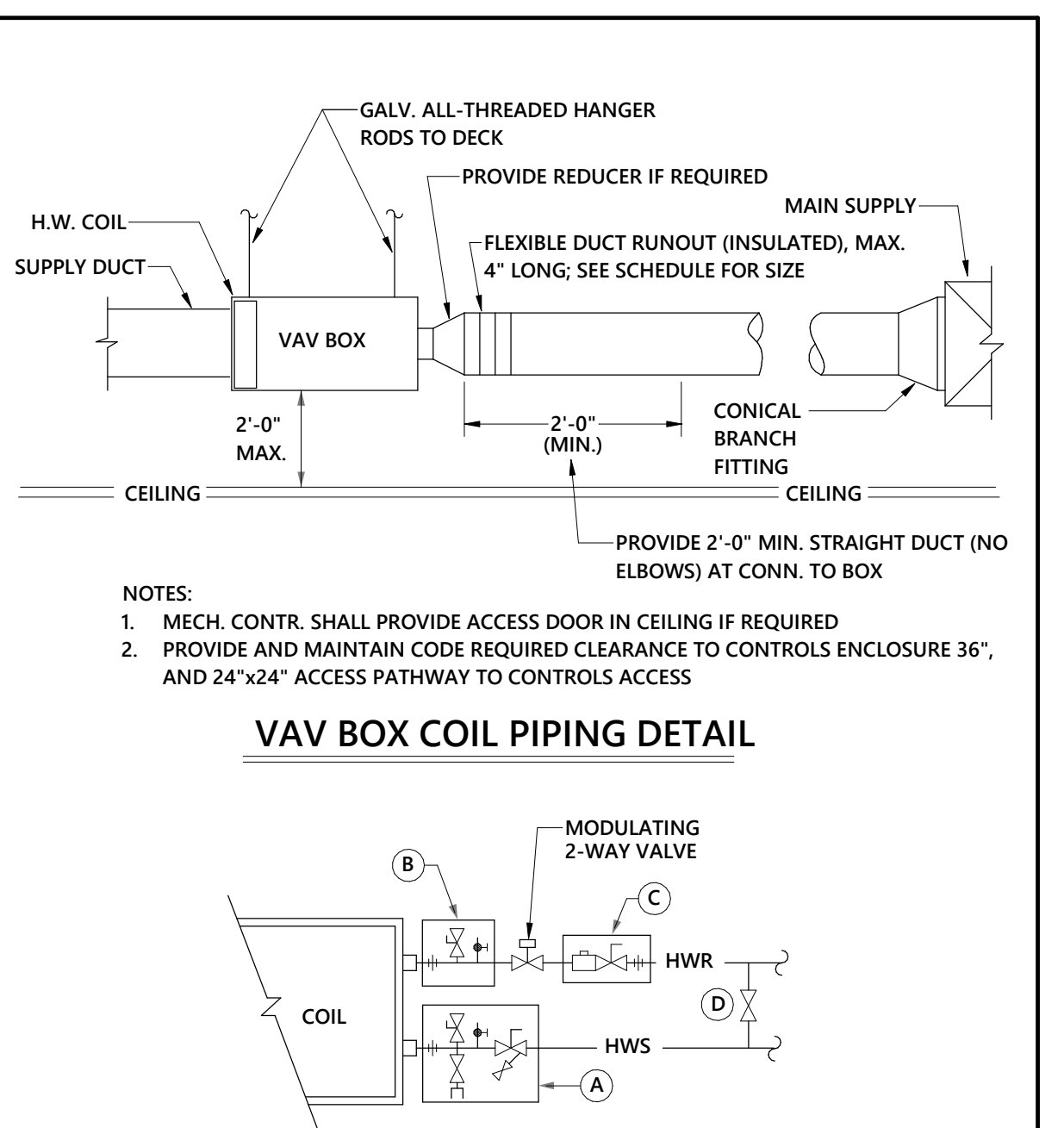
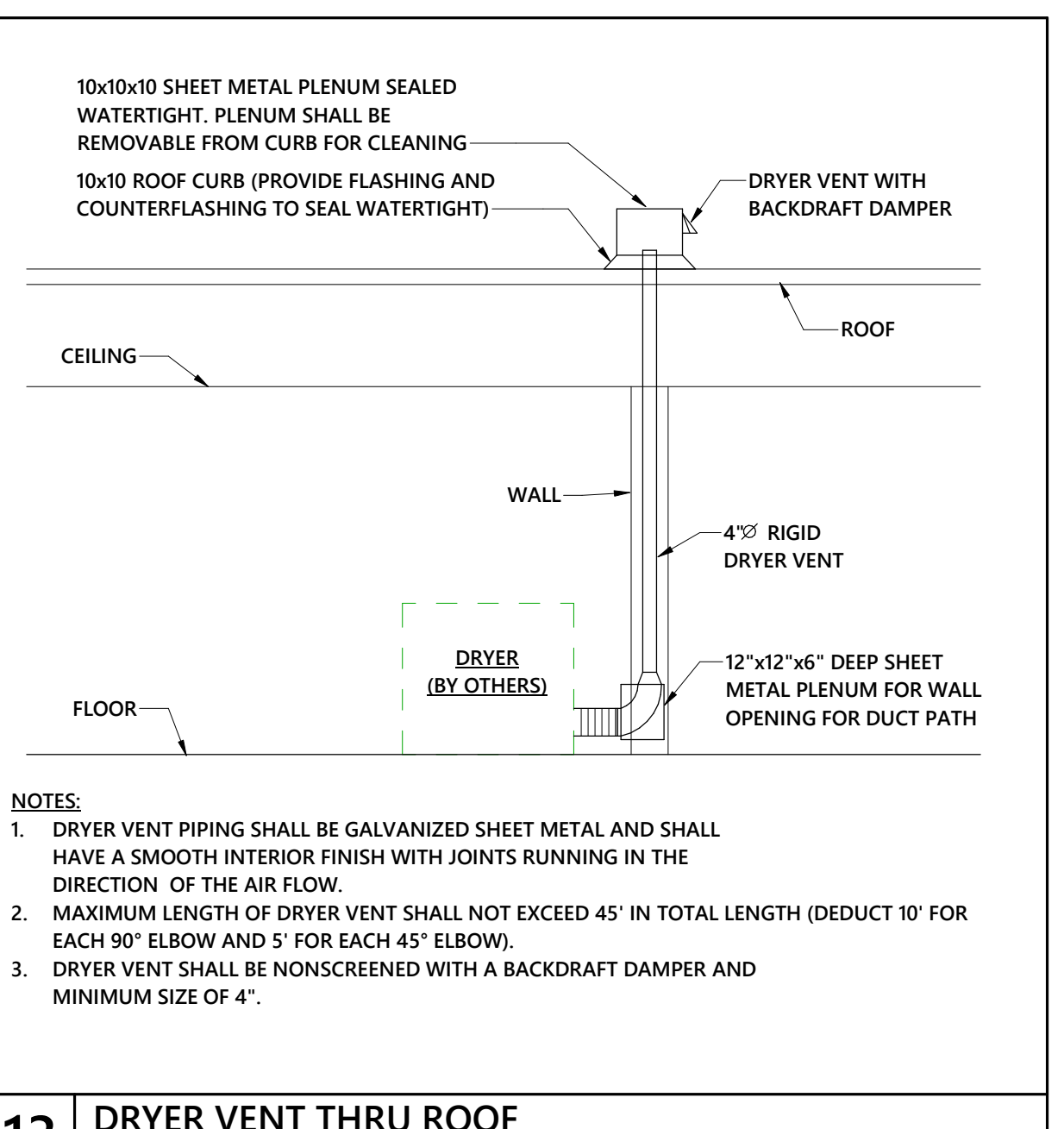
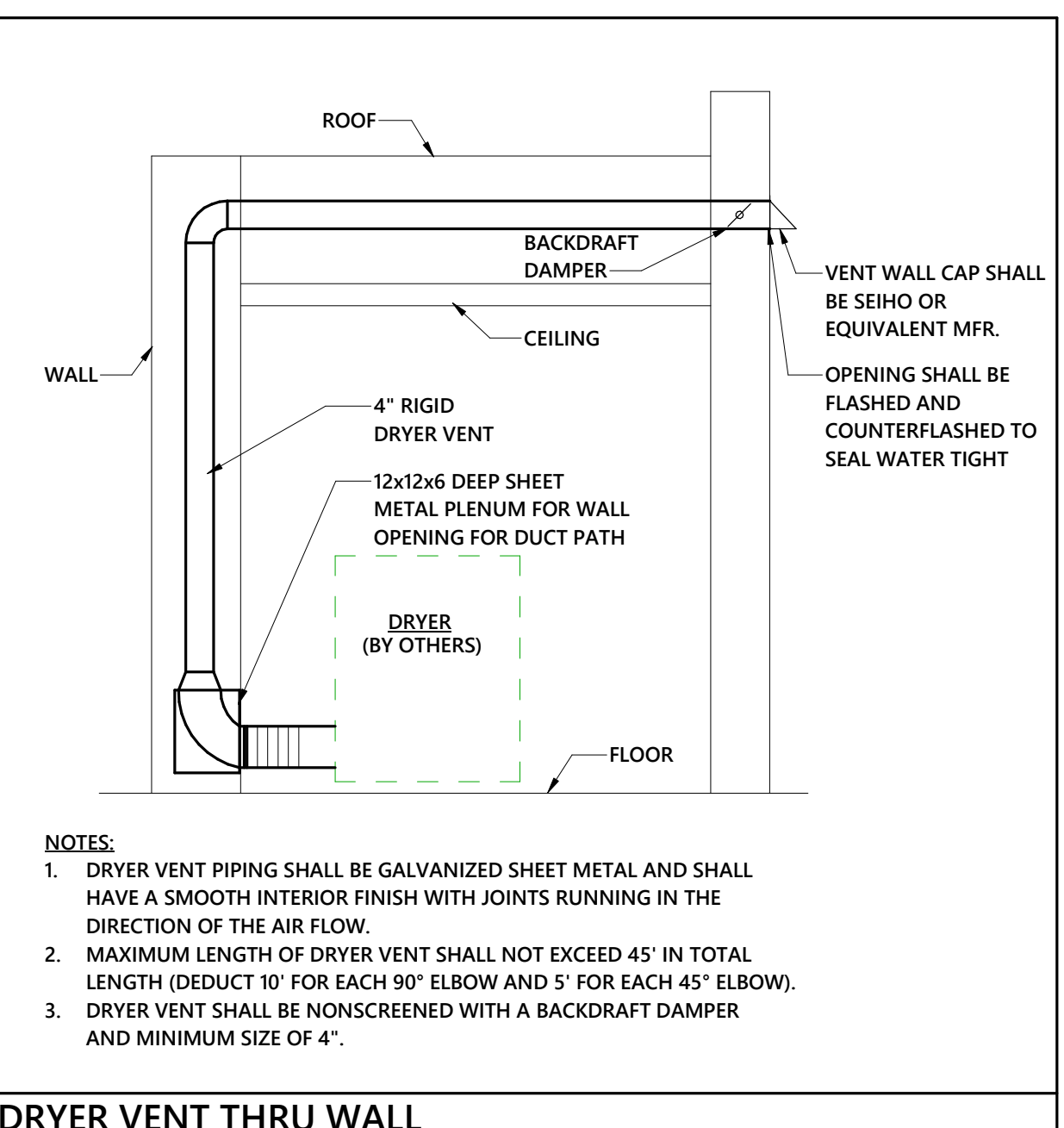
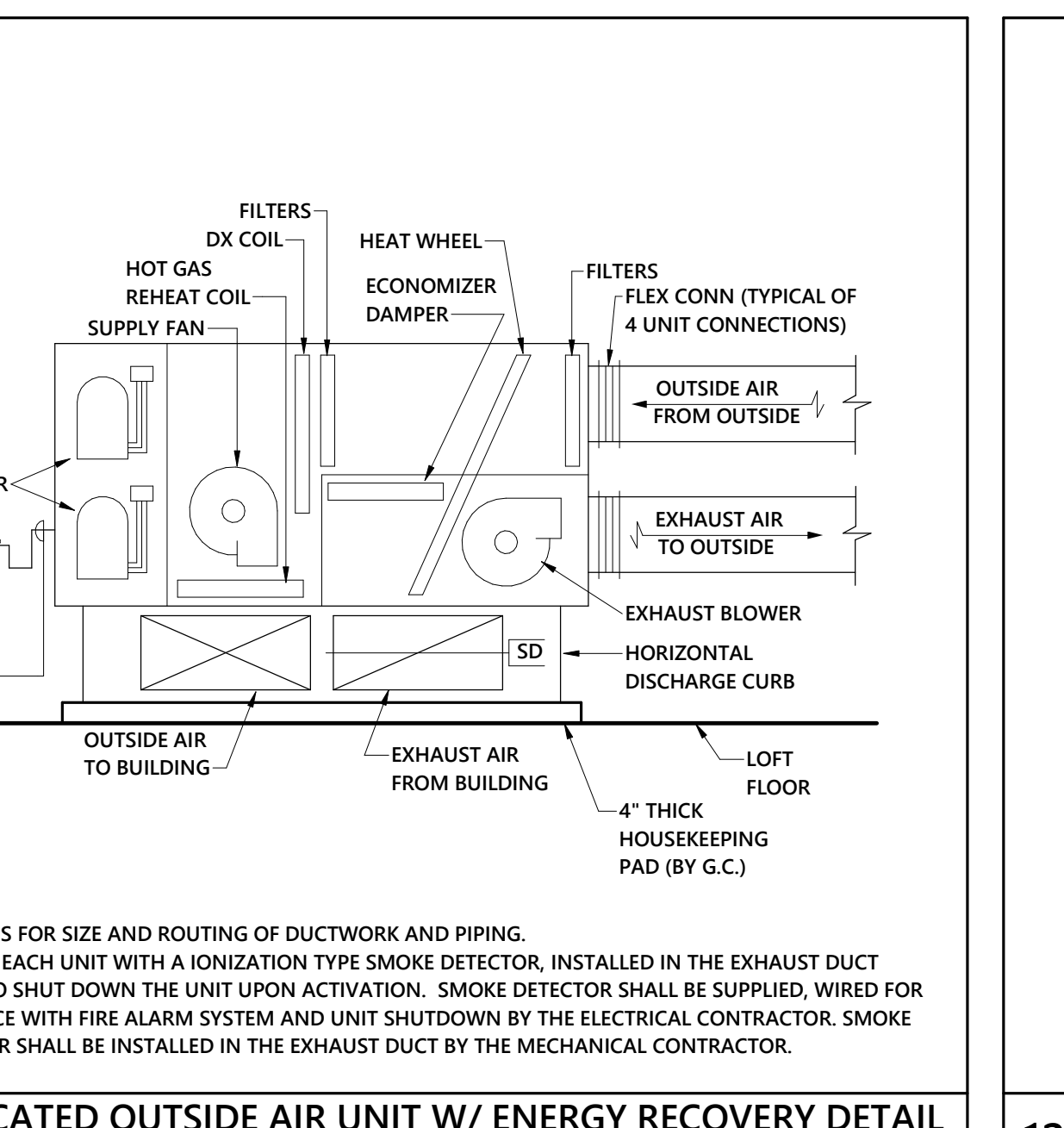
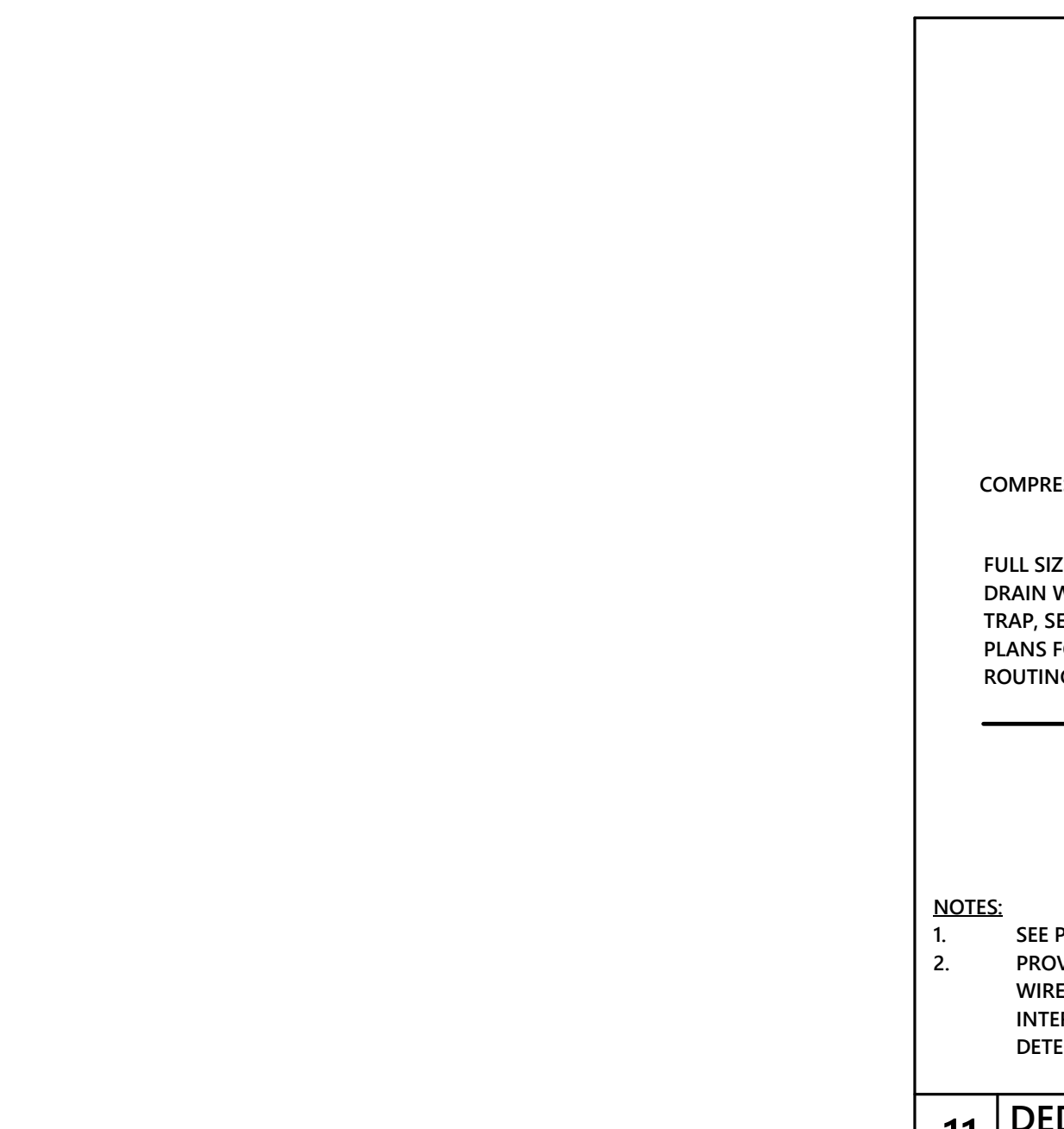
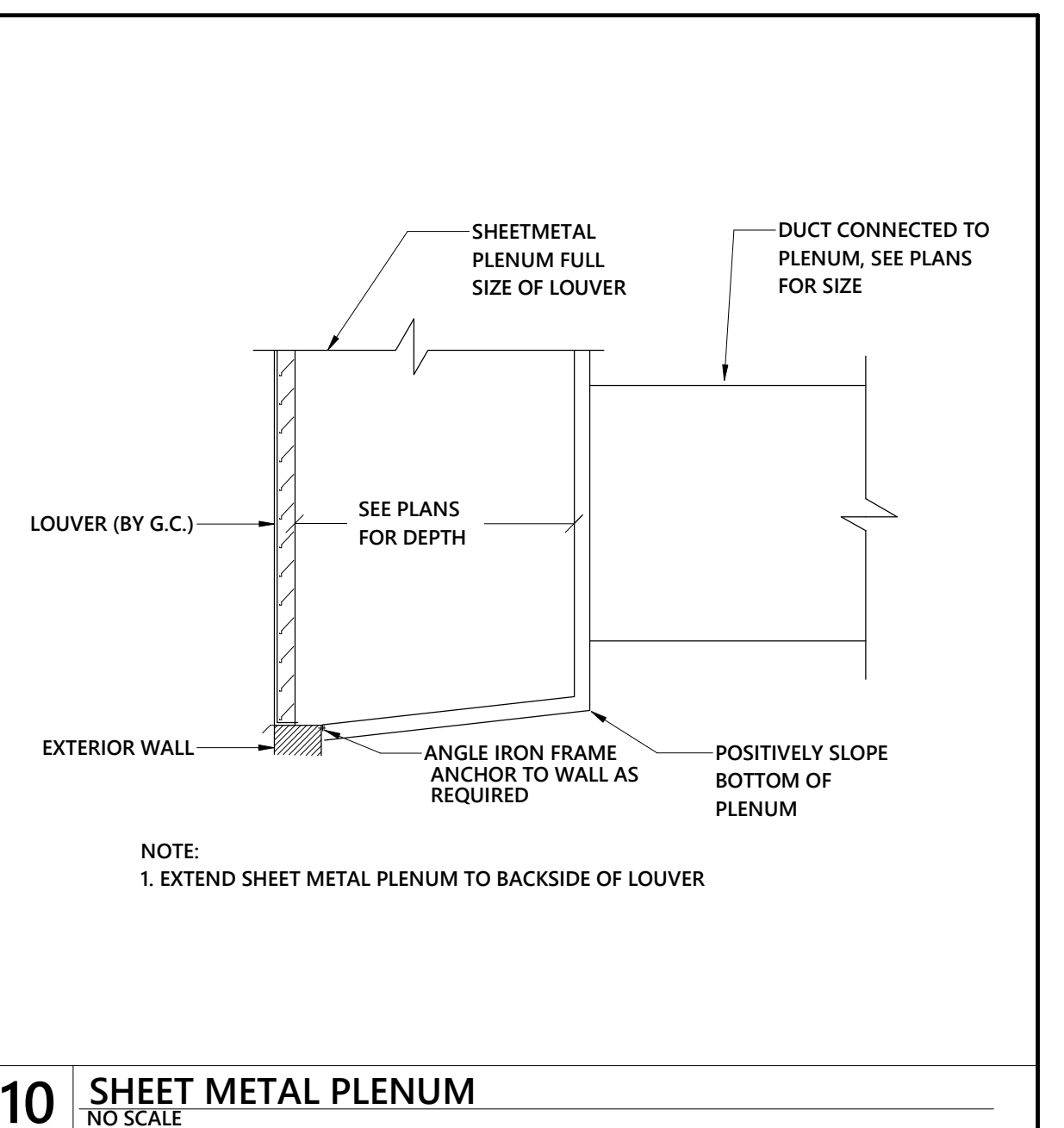
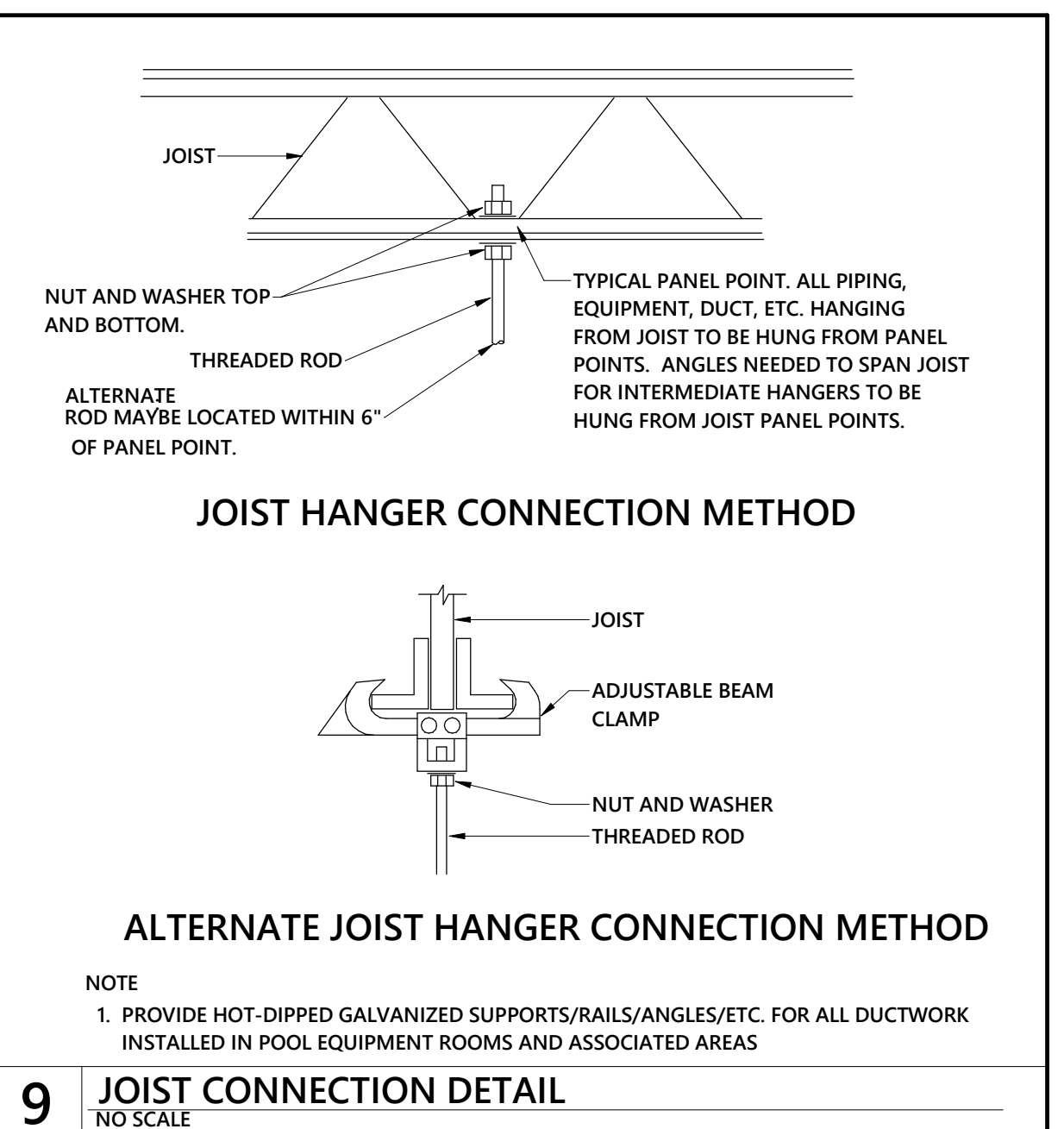
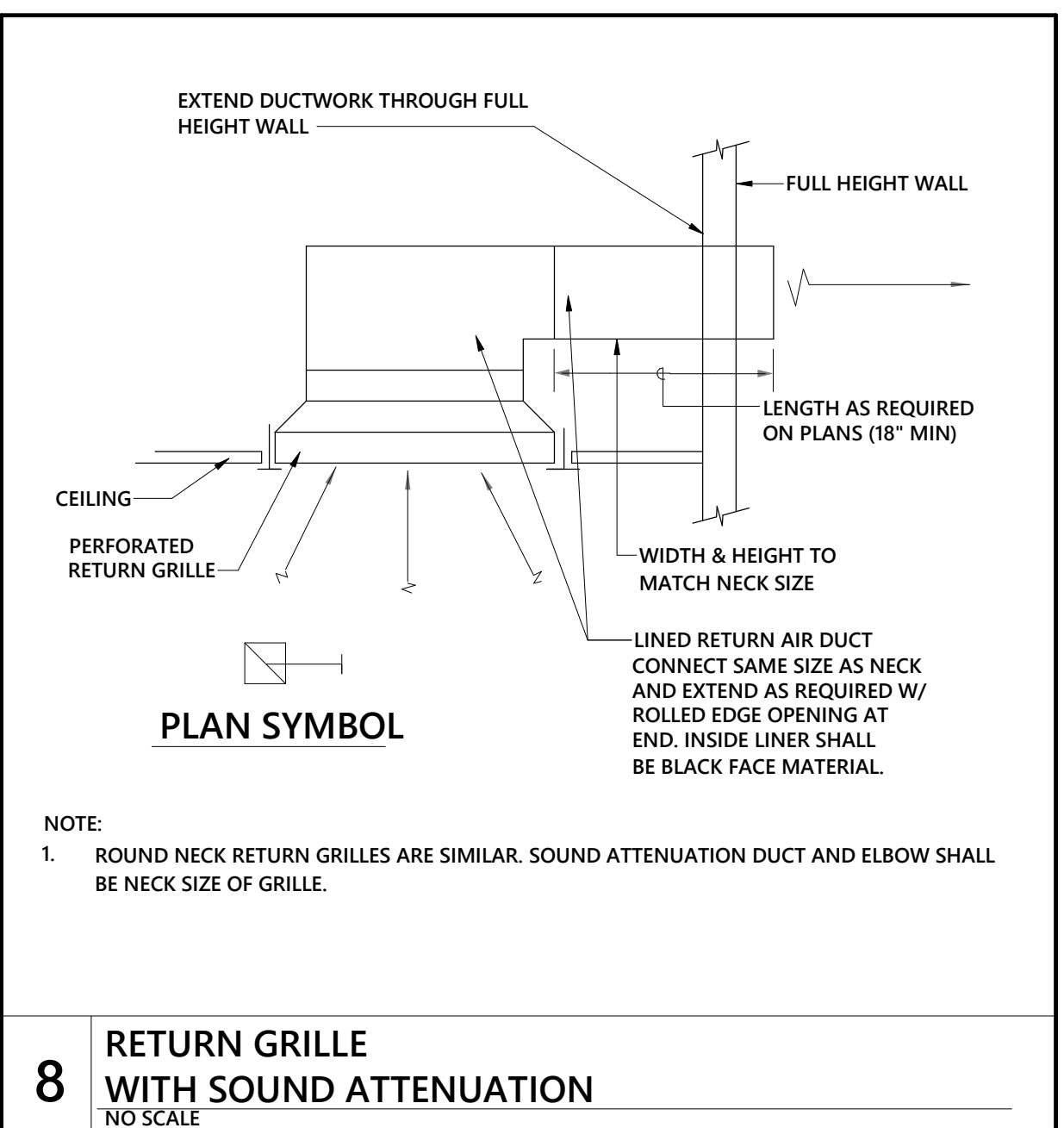
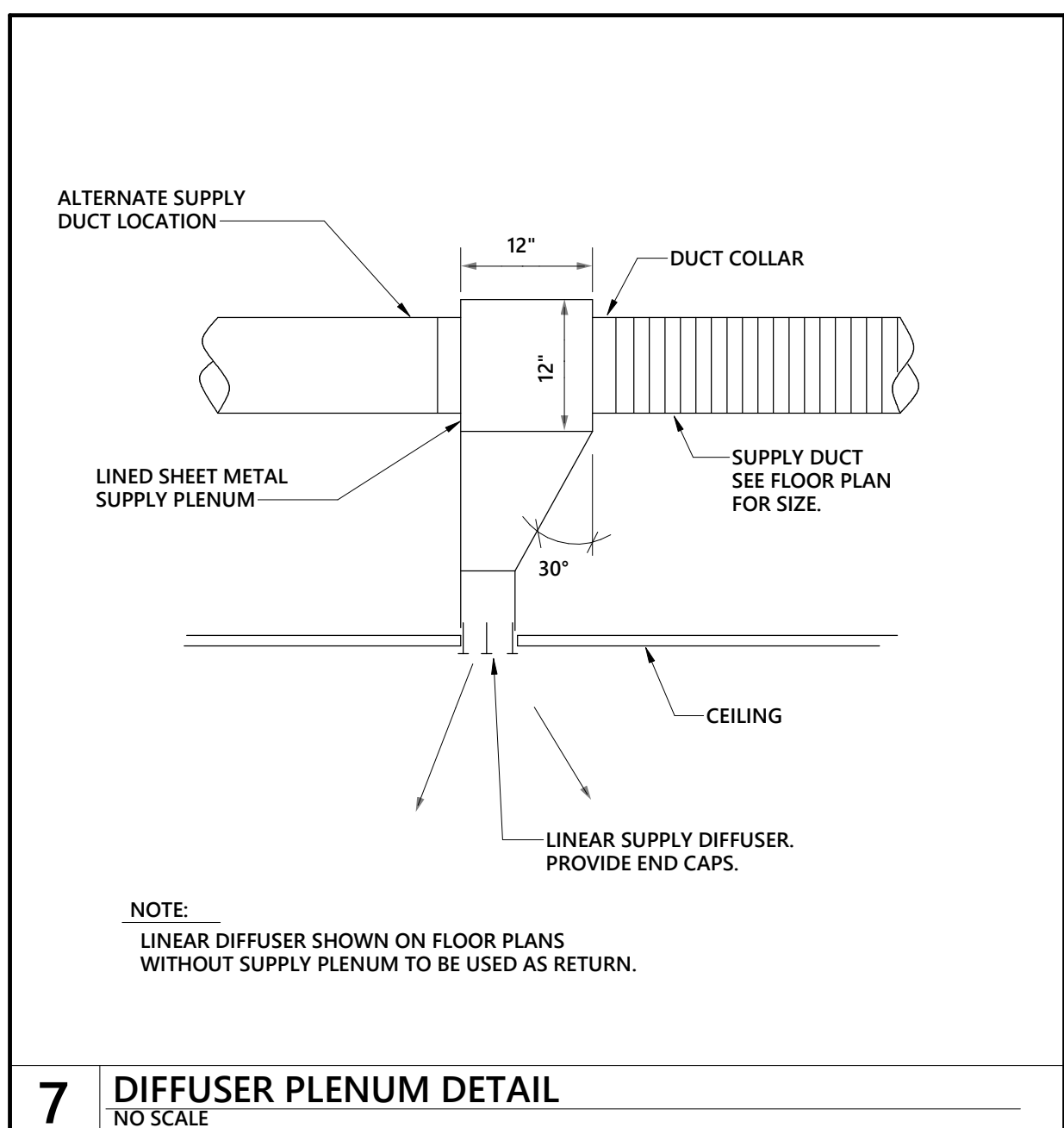
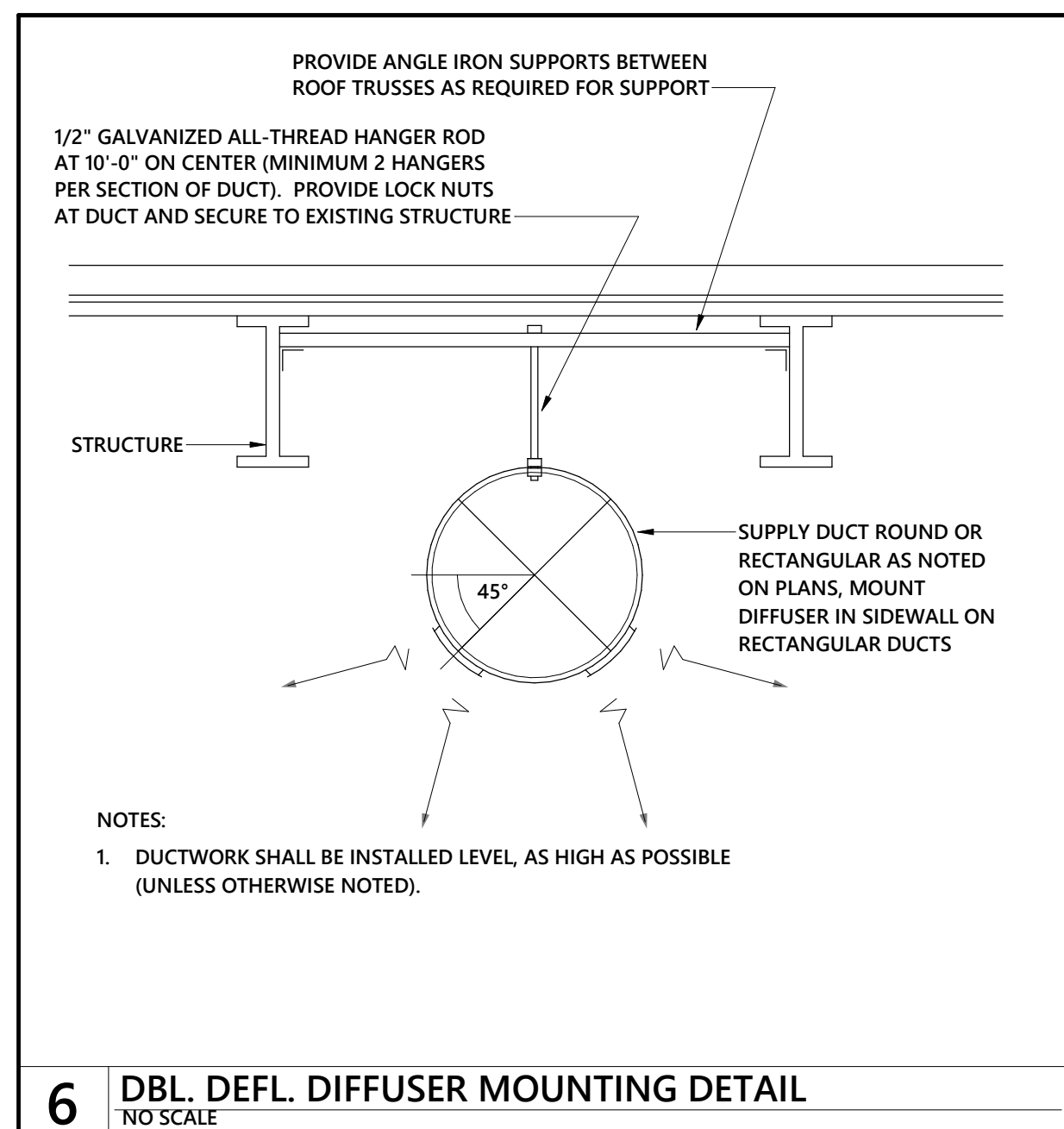
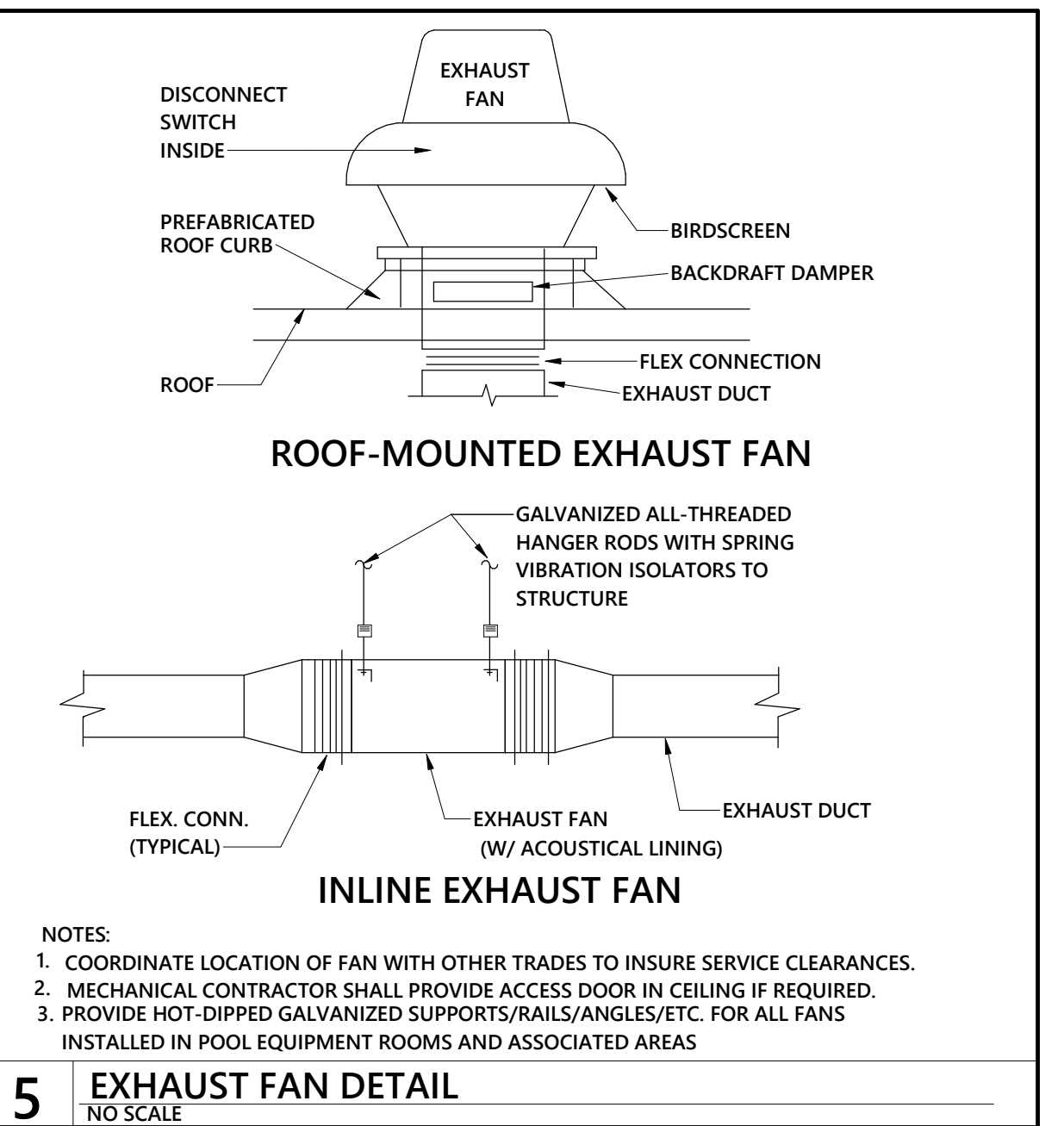
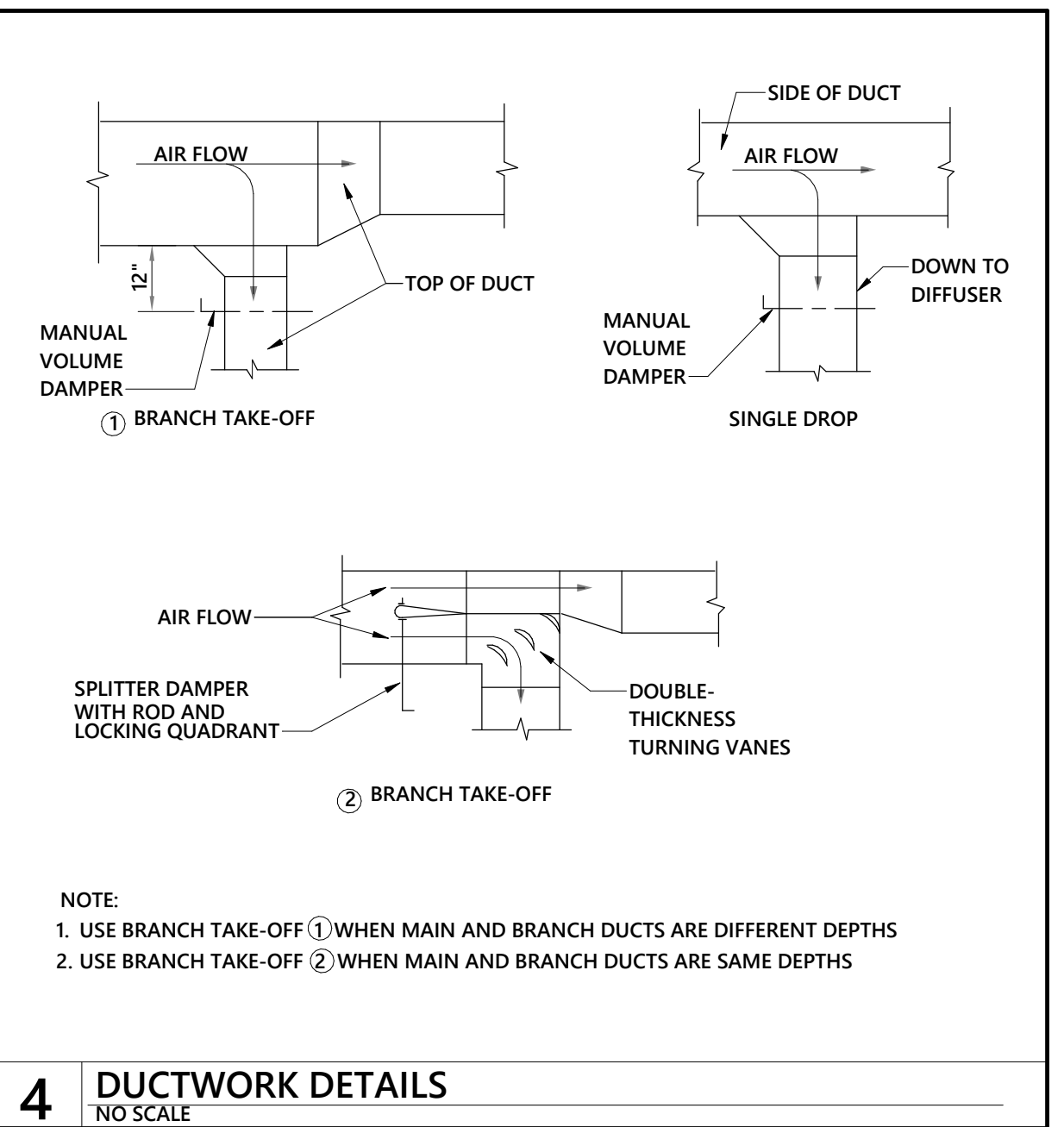
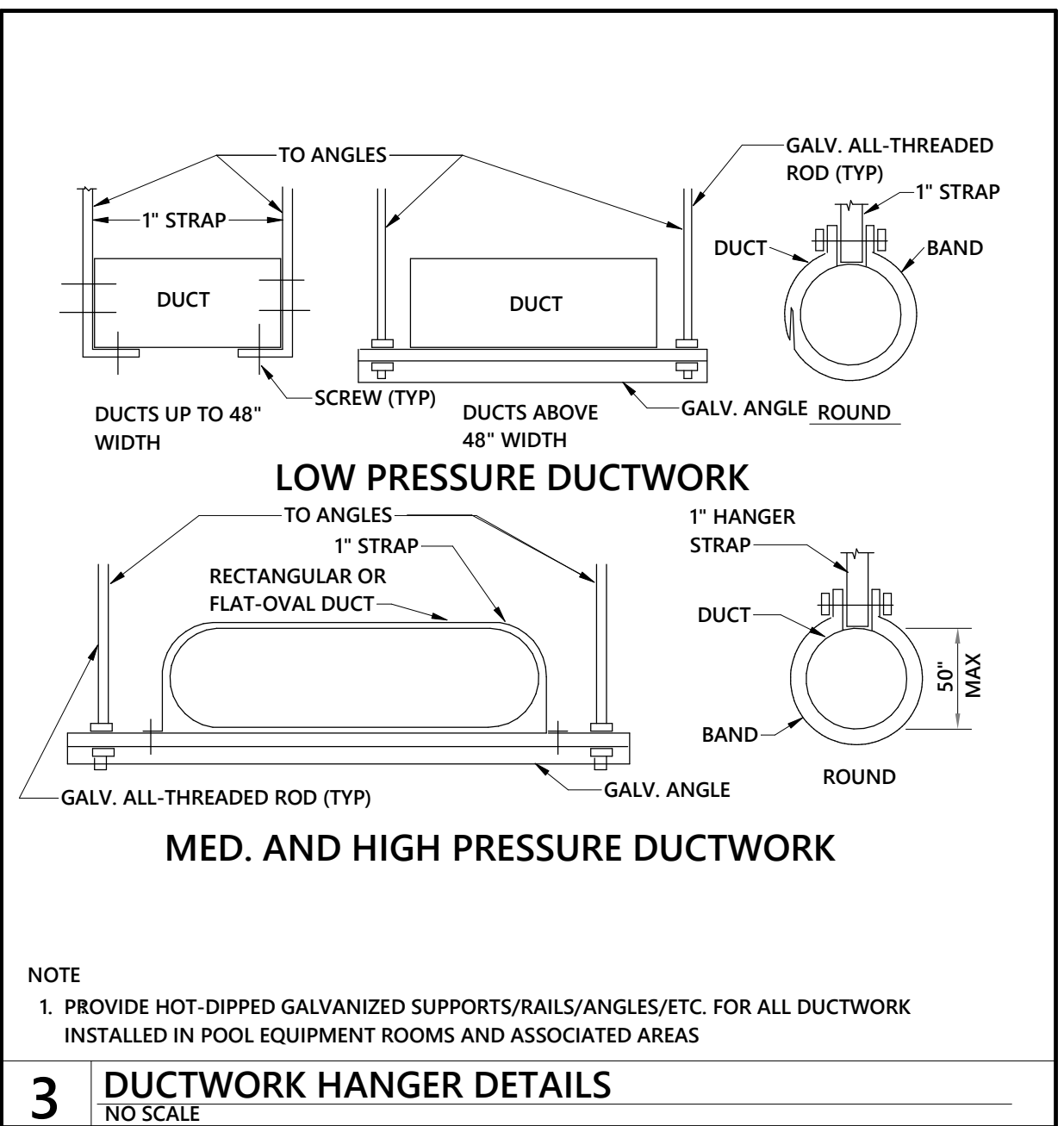
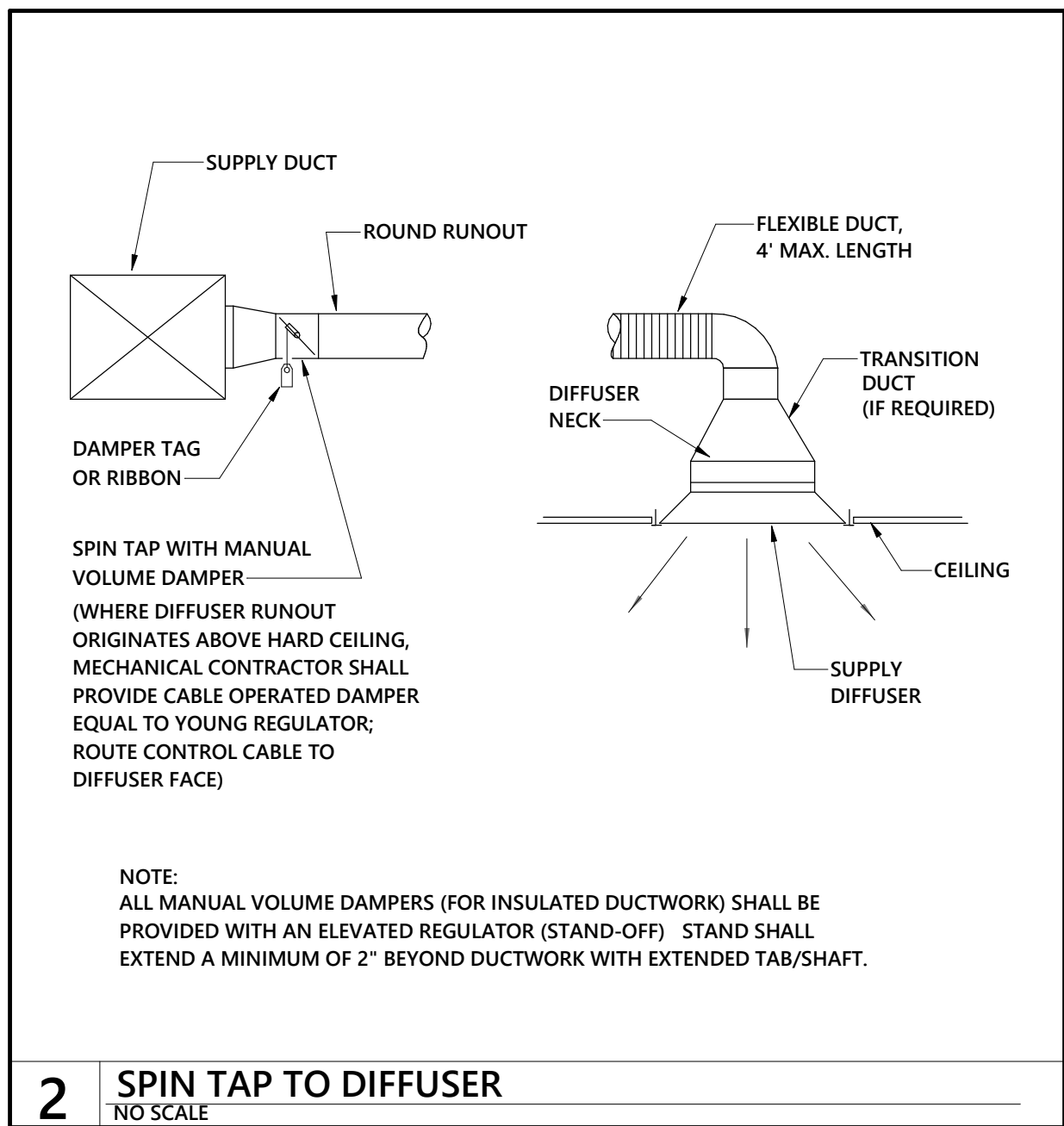
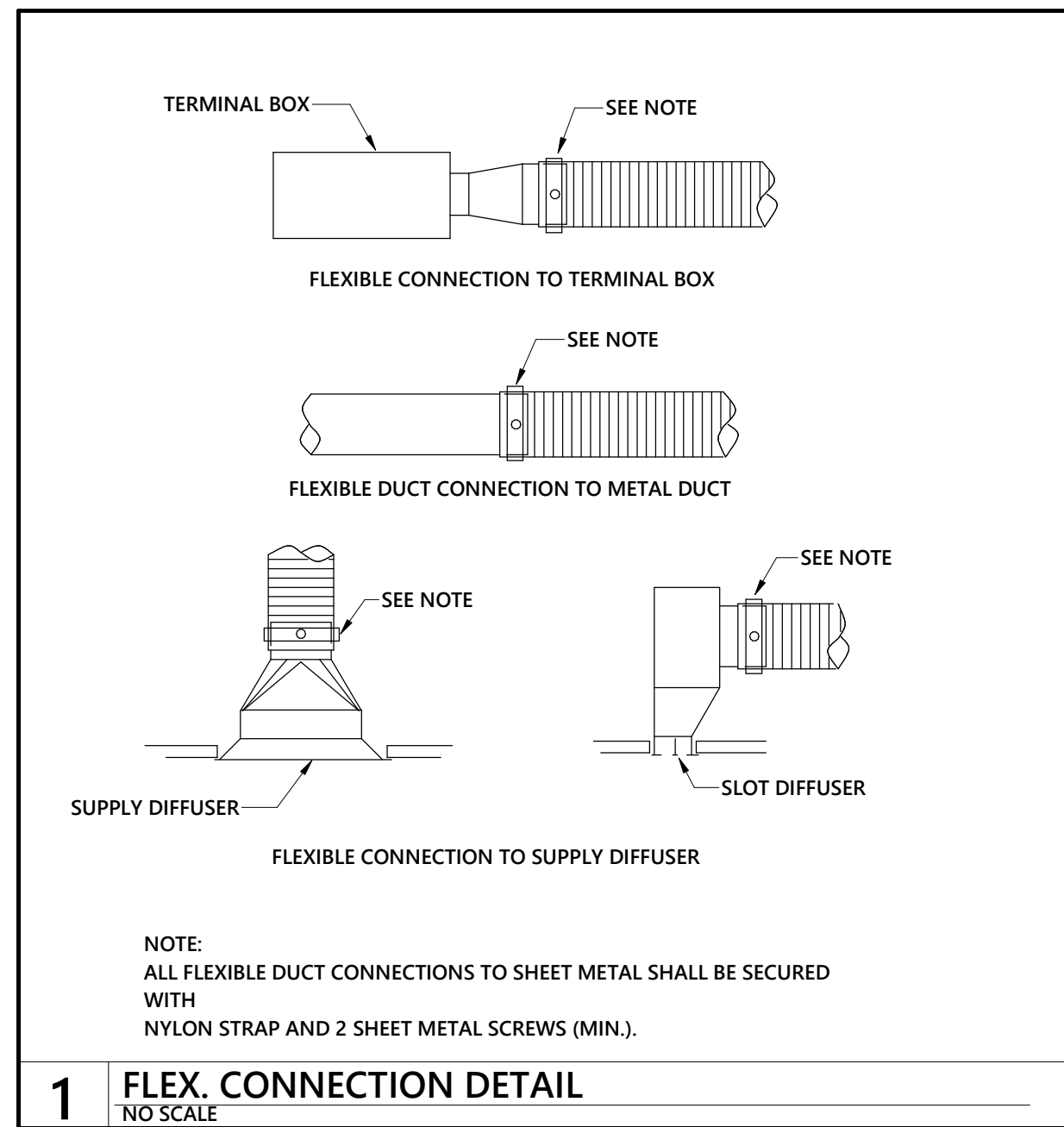
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OPTIMA# 23-0289

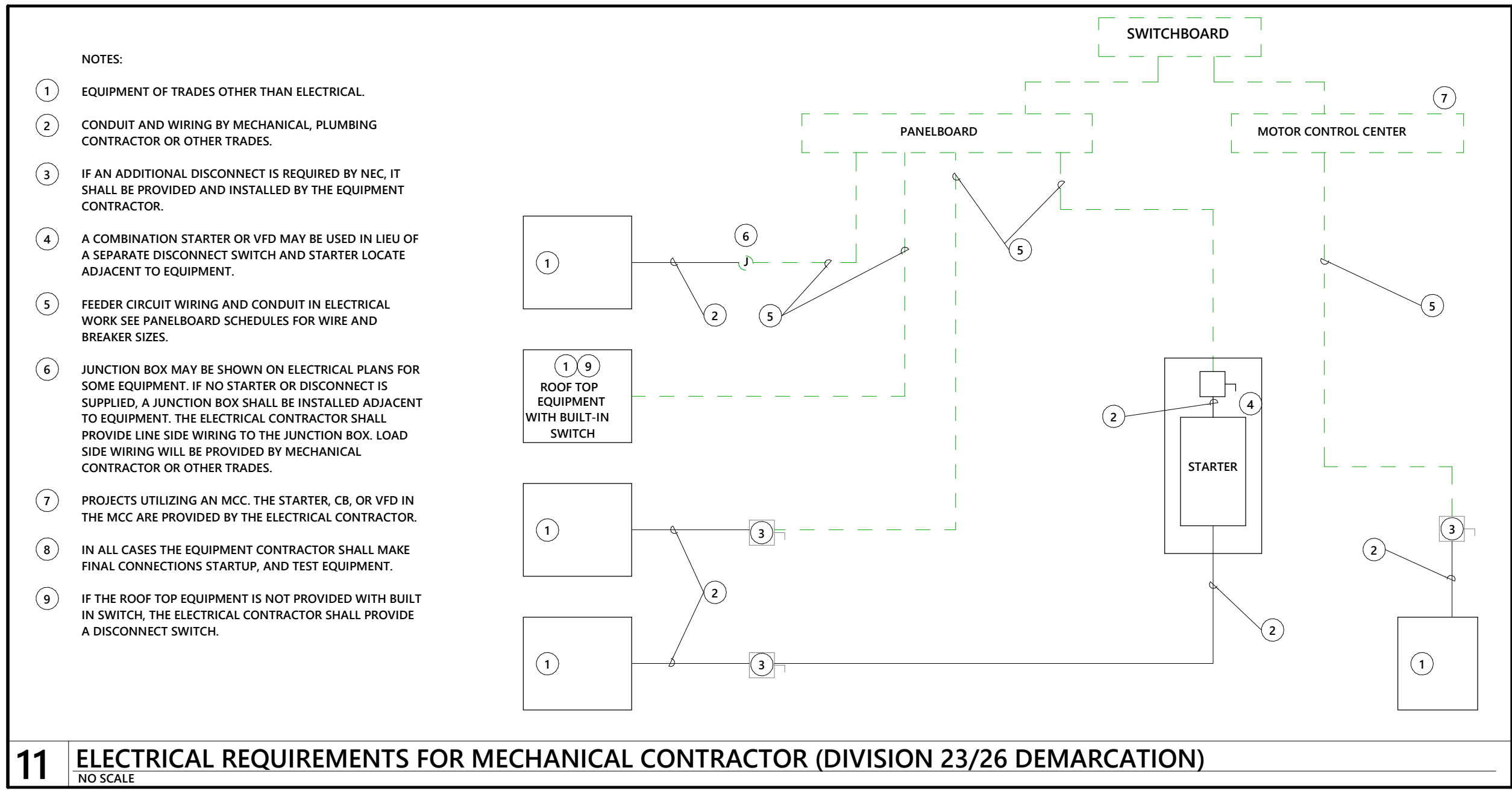
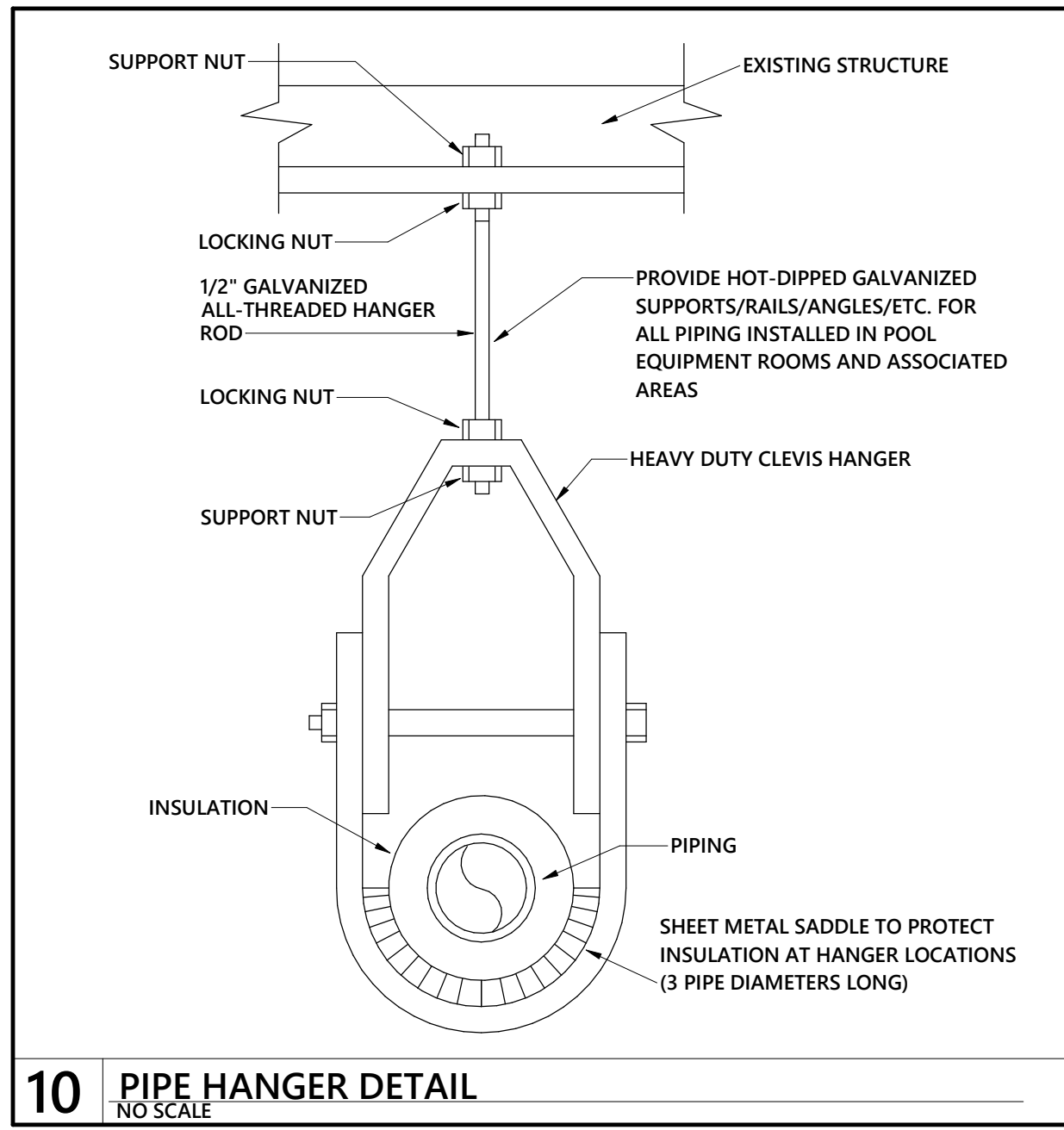
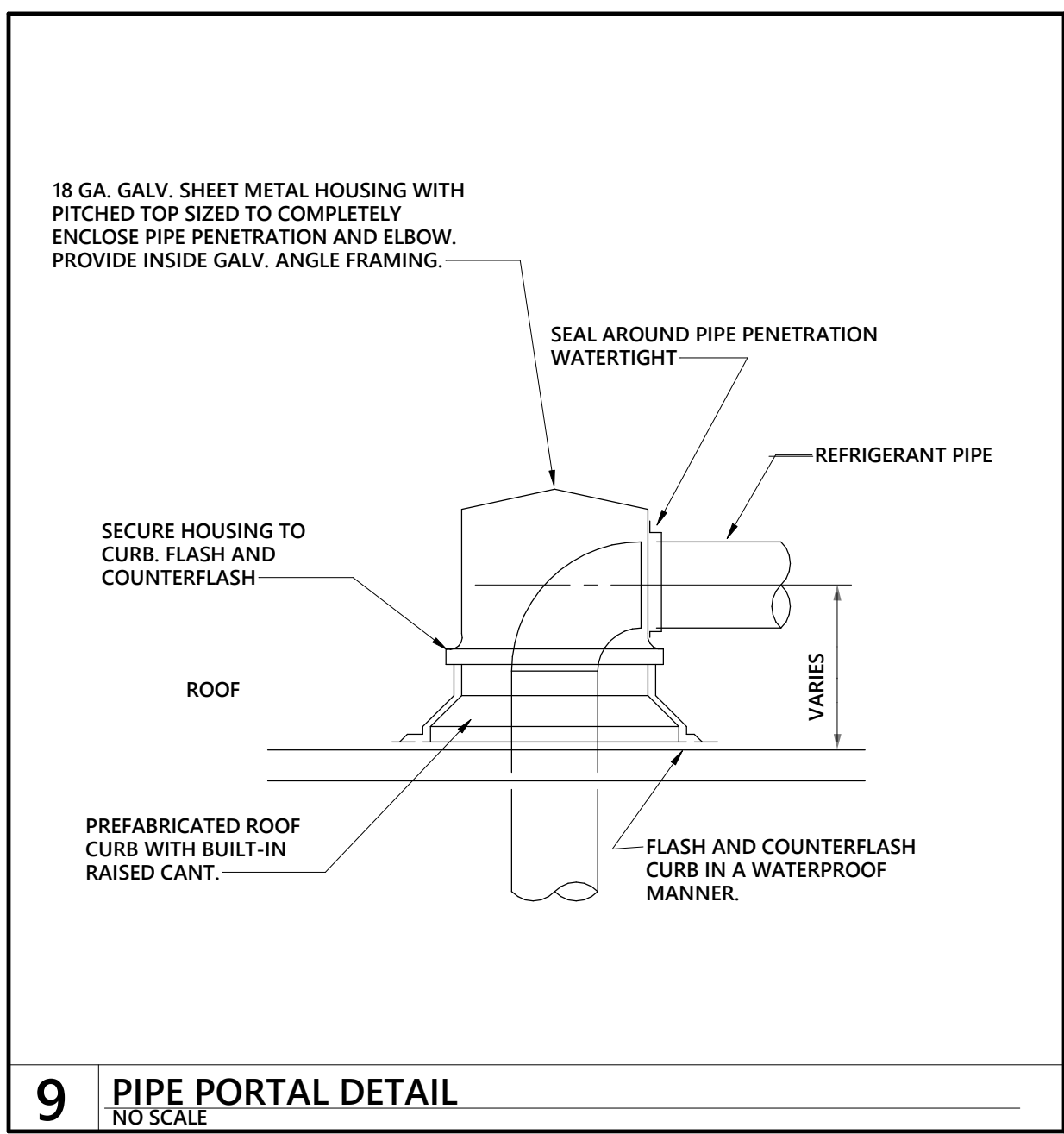
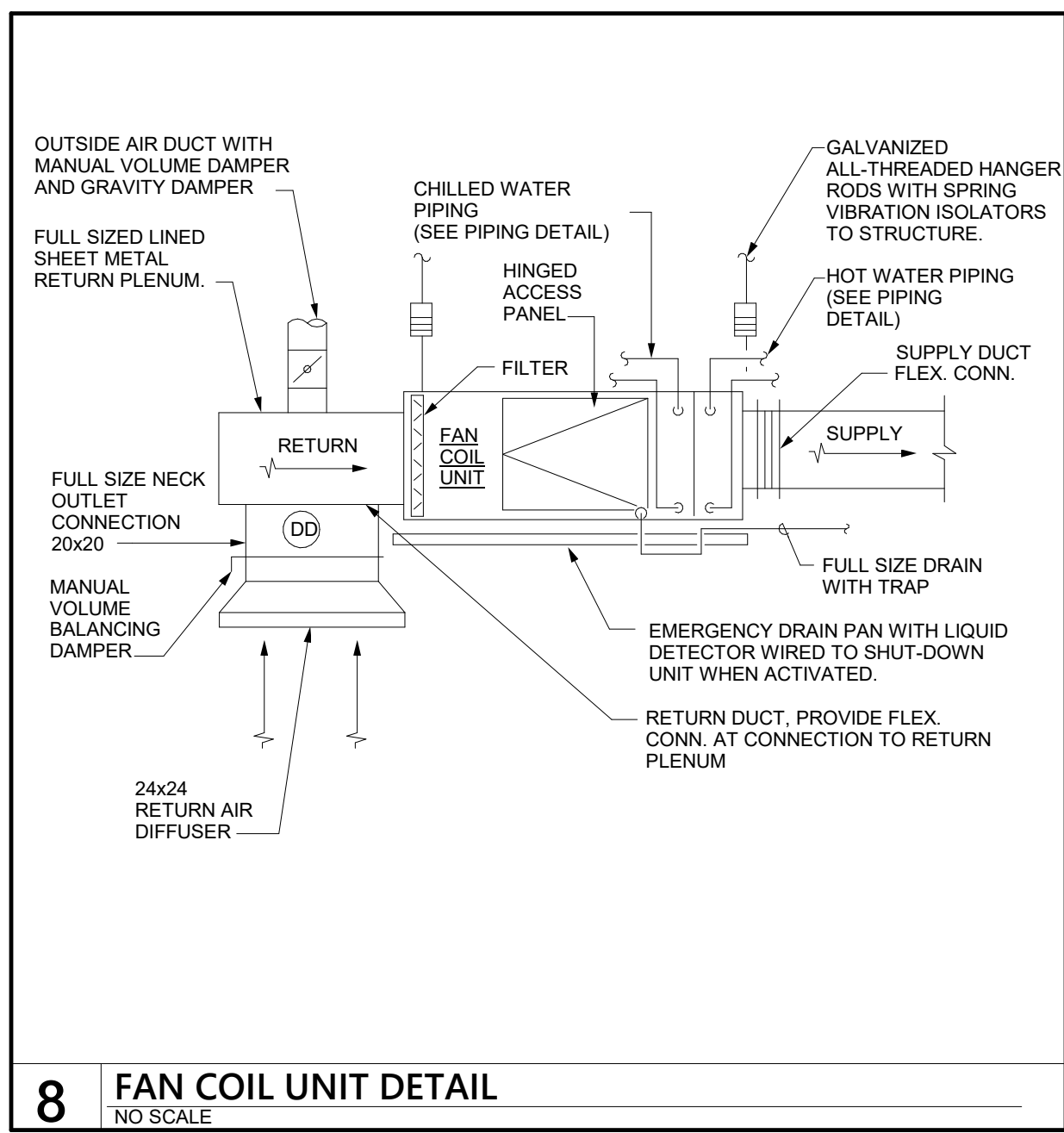
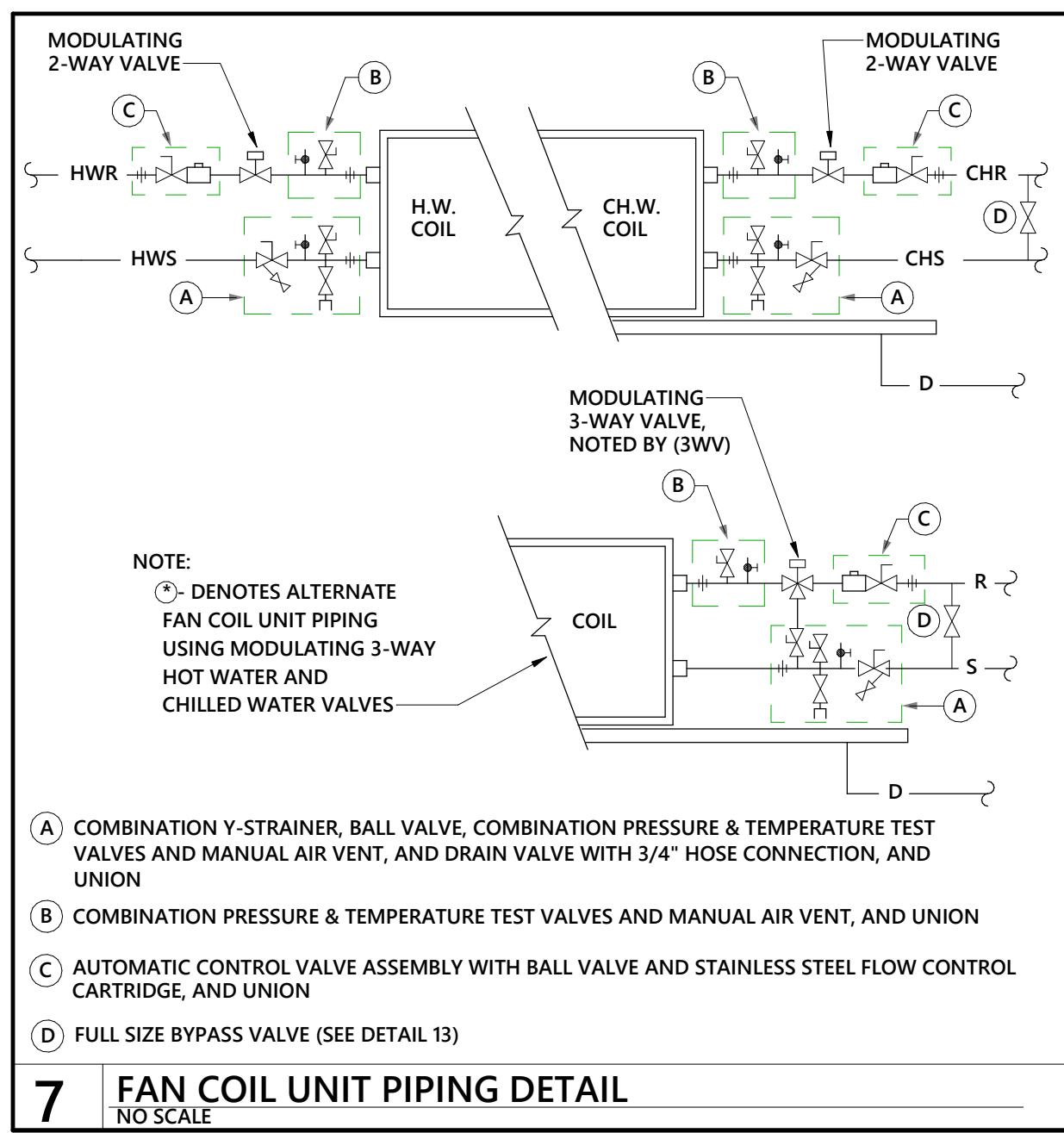
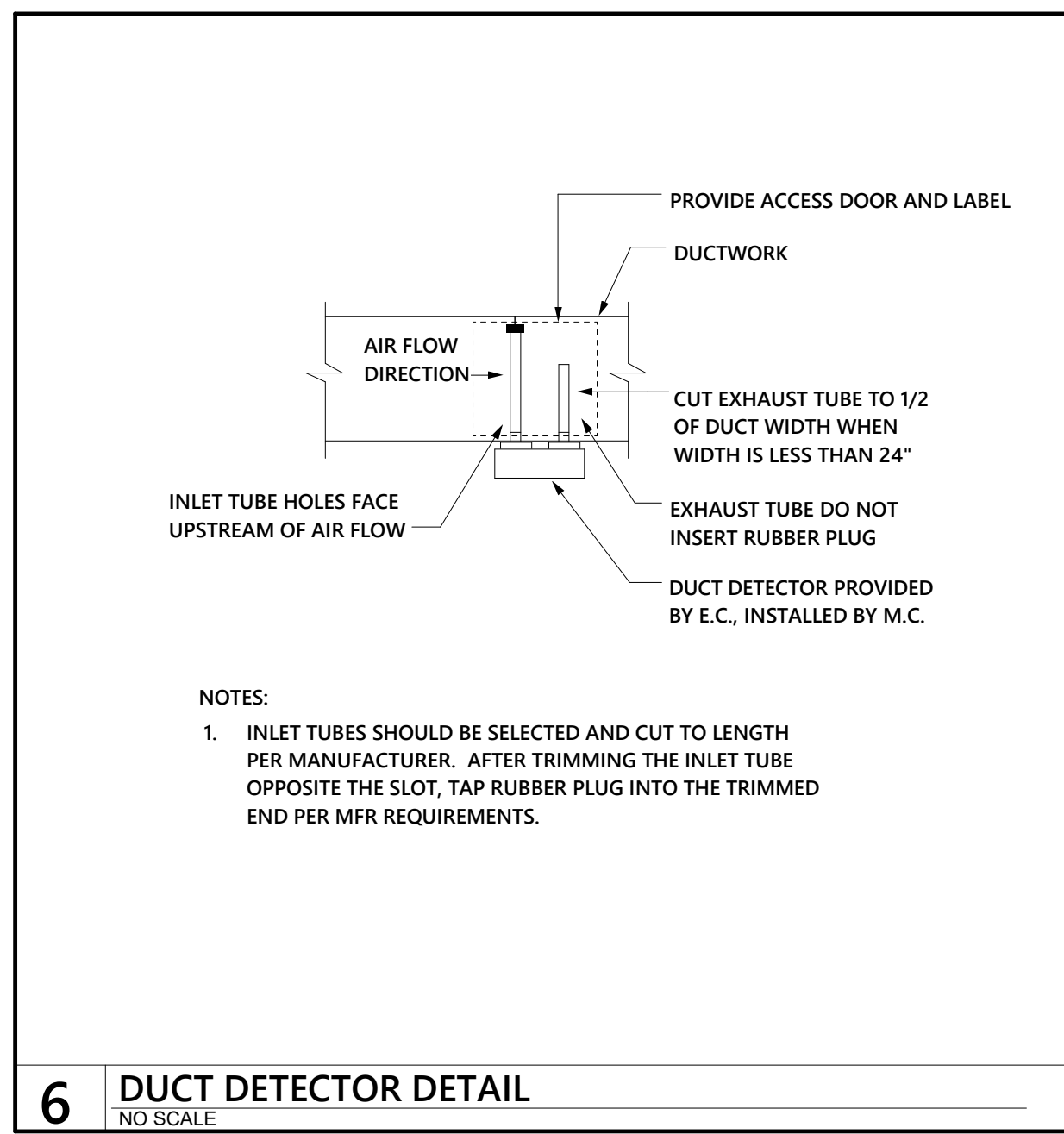
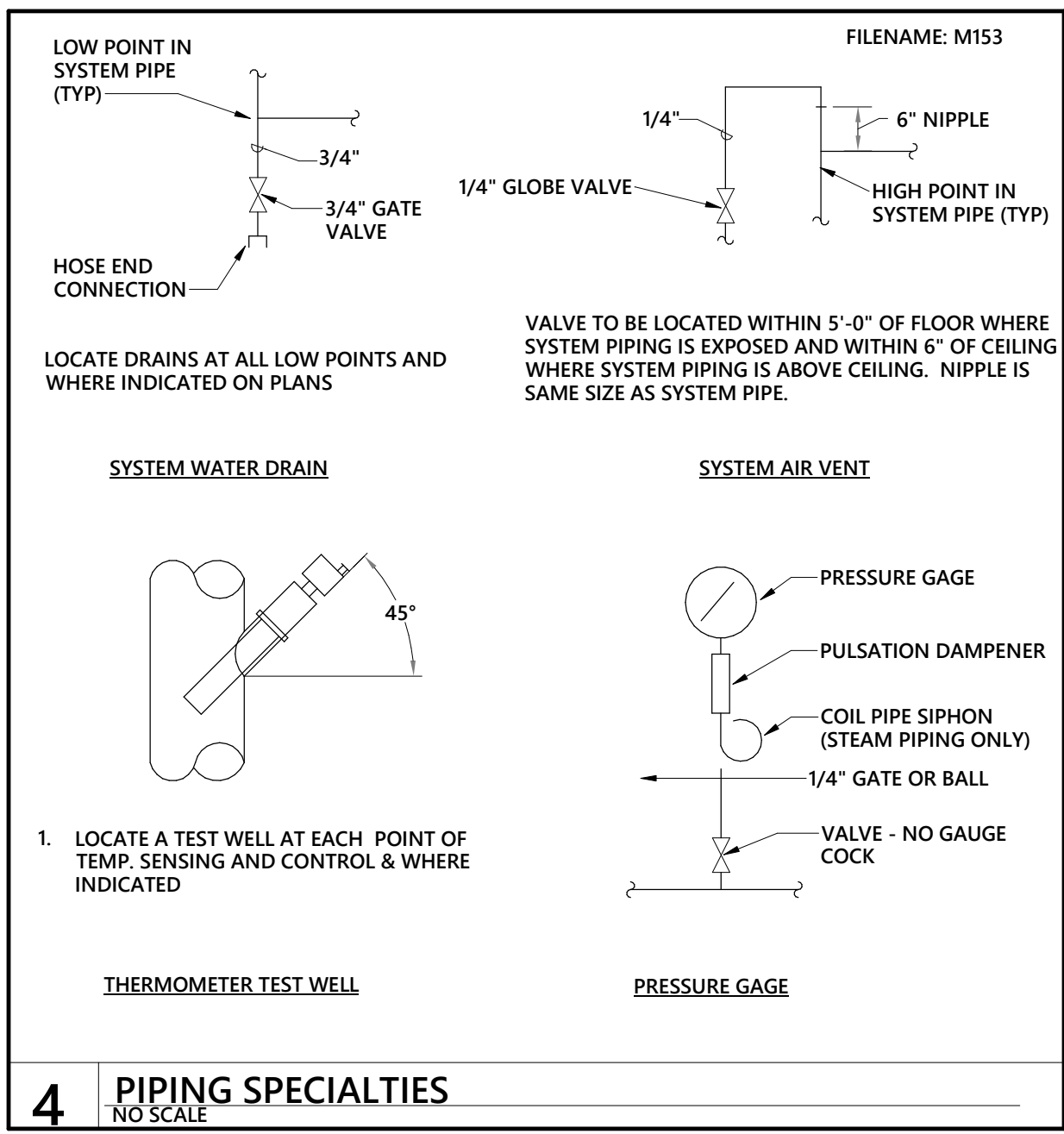
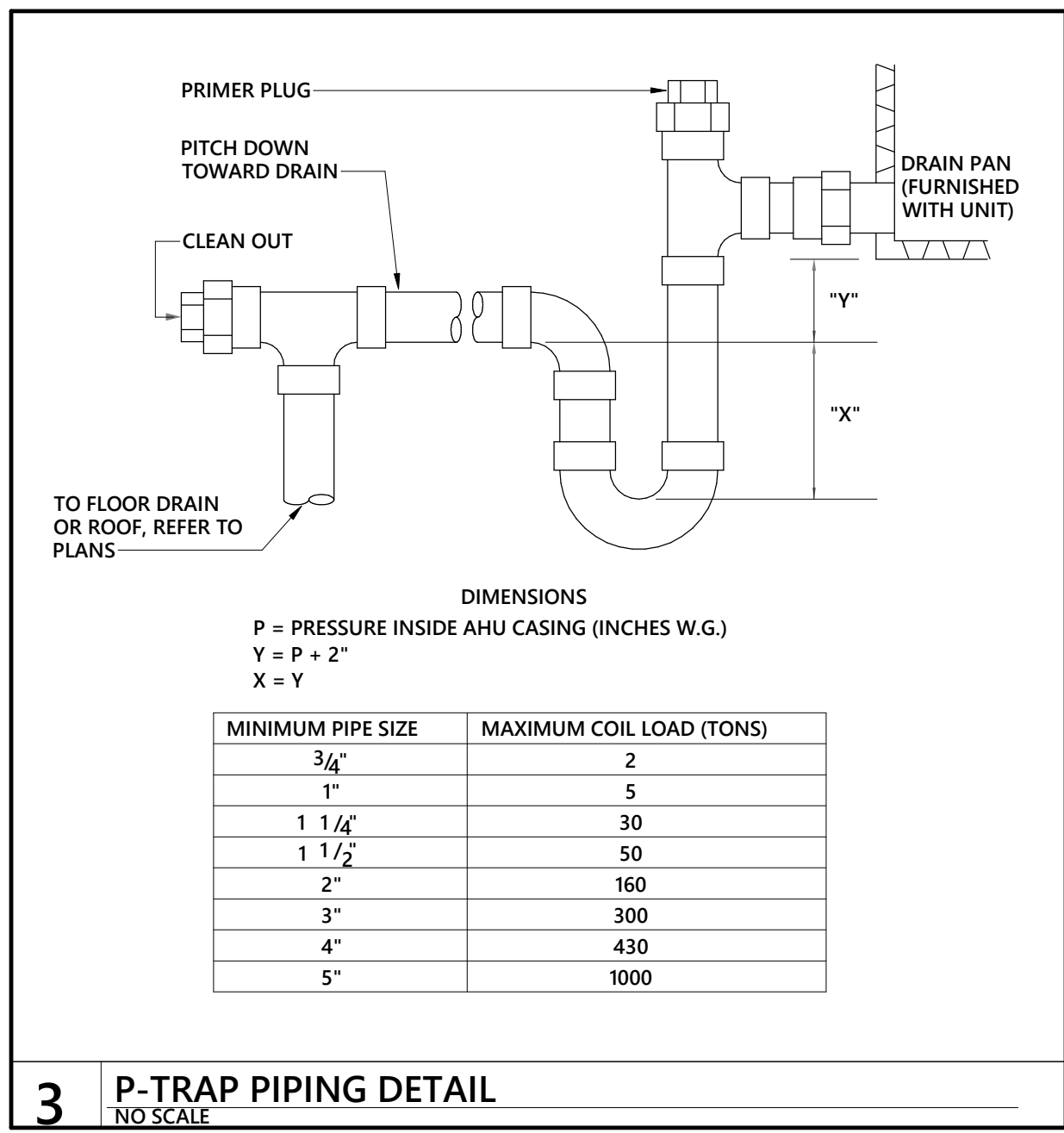
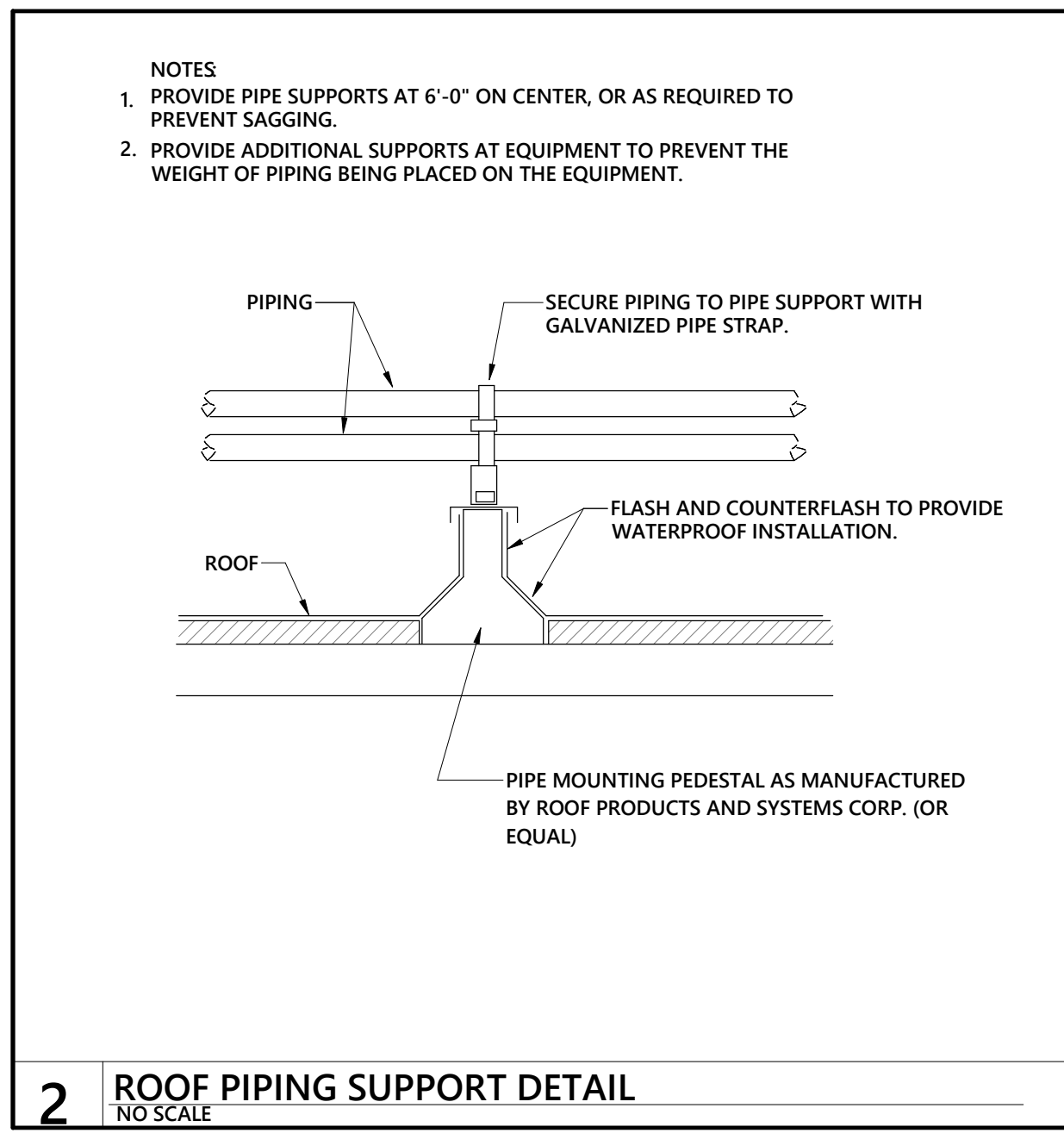
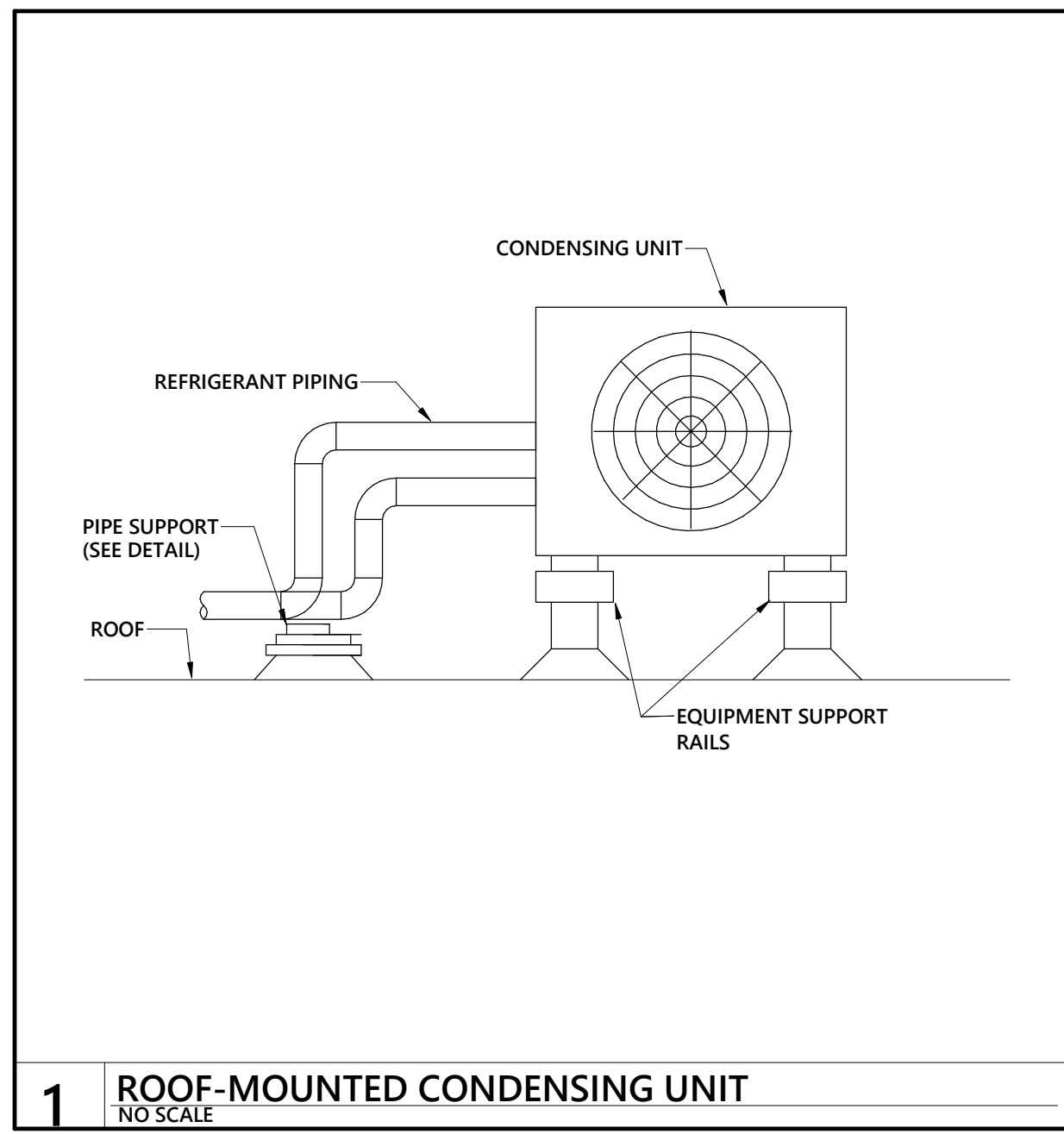
RATED WALLS LEGEND



1 LEVEL 02 - FLOOR PLAN - MECHANICAL PIPING
 1/8" = 1'-0"



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SHEET ISSUE:

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