

MECHANICAL GENERAL NOTES:

1. REFERENCE ARCHITECTURAL, STRUCTURAL, PLUMBING, & ELECTRICAL DRAWINGS, AND SPECIFICATIONS PRIOR TO CONSTRUCTION. CONTRACTOR SHALL VISIT SITE PRIOR TO SUBMITTING BID.

· 10x12 📥

CONDENSATE PIPING

3 PHASE POWER SUPPLY

CHILLED WATER SUPPLY PIPING

CHILLED WATER RETURN PIPING

TEMPERATURE GAUGE AS SPECIFIED

PRESSURE GAUGE AS SPECIFIED

HOT WATER RETURN PIPING

---- HOT WATER SUPPLY PIPING

ELBOW; TURNED UP

TEE CONNECTION, BOTTOM

ELBOW; TURNED DOWN

BALL VALVE AS SPECIFIED

STRAINER AS SPECIFIED

MANUAL AIR VENT

MOTOR STARTER

AIR/SEDIMENT SEPARATOR

NOTE: LEGEND IS FOR REFERENCE ONLY — SYMBOLS/ABBREVIATIONS SHOWN DO NOT NECESSARILY APPLY TO THIS PROJECT.SEE ALSO SHEET T-1.

CONTROL VALVE, ELECTRONIC/ELECTRIC

COMB. VALVE/STRAINER w/ P-T PORTS

FLOW CONTROL VALVE w/ P-T PORTS

PUMP OR CIRCULTOR AS SCHEDULED

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REFRIGERATION PIPING AS SPECIFIED

PRESSURE REDUCING VALVE, 1st STAGE

PRESSURE REDUCING VALVE, 2nd STAGE

GAS PIPING AS SPECIFIED

2. ALL WORK SHALL BE IN STRICT ACCORDANCE WITH THE NC BUILDING CODE & CONTRACTOR. SHALL NOTIFY ENGINEER IN WRITING REGARDING ANY CODE DISCREPANCIES FOUND ON PLANS. CONTRACTOR. IS RESPONSIBLE FOR PERMITS, INSPECTIONS AND FEES. THE CONTROLS CONTRACTOR (C.C.) SHALL PROVIDE ALL CONTROL VALVES, ACTUATORS, DAMPERS, FAN COIL COMBINATION STARTERS. C.C. SHALL PROVIDE ALL LOAD SIDE WIRING ASSOCIATED WITH ALL FAN COIL COMBINATION STARTERS. VALVE TAGS AND LABELING SHALL BE PROVIDED BY THE MECHANICAL CONTRACTOR (M.C.).

3. DO NOT SCALE THESE DRAWINGS; REFER TO LARGEST SCALE ARCHITECTURAL DRAWINGS. THESE DRAWINGS ARE DIAGRAMMATIC ONLY & ARE NOT INTENDED TO SHOW MINOR DETAILS & EXACT LOCATIONS. DESIGN ADJUSTMENTS SHALL BE ANTICIPATED BY THE CONTRACTORS TO PROVIDE A COMPLETE AND OPERATIONAL SYSTEM.

4. "PROVIDE" IS DEFINED AS FURNISH & INSTALL AS PER MANUFACTURERS RECOMMENDATIONS.

5. THE MECHANICAL & CONTROLS CONTRACTOR SHALL COORDINATE THE INSTALLATION OF HVAC EQUIPMENT & CONTROLS WITH GENERAL CONTRACTOR PRIOR TO INSTALLATION TO AVOID CONFLICT. CONTACT ARCHITECT IF ALTERNATE INSTALLATION METHOD IS REQUIRED.

6. SYSTEMS INDICATED ON PLANS ARE DIAGRAMMATIC IN NATURE. CONTRACTOR SHALL EXAMINE SITE CONDITIONS PRIOR TO DUCT CONSTRUCTION AND COORDINATE INSTALLATION WITH OTHER TRADES. CONTRACTOR SHALL PROVIDE NECESSARY HANGERS, FASTENERS ETC. TO PROVIDE A COMPLETE AND WORKING SYSTEM.

7. CONTRACTOR SHALL SEAL ALL DUCTWORK WITH A PAINT ON MASTIC. ALL WALL PENETRATIONS SHALL BE SEALED AIR

8. CONTRACTOR SHALL COORDINATE ALL DUCTWORK, DIFFUSER AND GRILLE LOCATION WITH OTHER CEILING MOUNTED DEVICES SHOWN ON THE ARCHITECTURAL REFLECTED CEILING PLAN.

9. CONTRACTOR SHALL INSTALL BALANCING DAMPERS IN EACH BRANCH DUCT TO PROVIDE PROPER AIRFLOW TO EACH ZONE.

10. LOCATE THERMOSTATS AND TEMPERATURE SENSORS AT 4'-0" A.F.F. (CENTER OF BOX FOR GYP BRD, TOP OF BOX FOR MASONRY) IN LOCATIONS INDICATED ON PLANS.

11. ALL DUCT DIMENSIONS ARE INSIDE CLEAR DIMENSIONS.

12. CONTRACTOR SHALL COORDINATE ALL ROOF AND FLOOR PENETRATION LOCATIONS AND SIZES.

13. FABRICATE AND INSTALL ALL DUCT WORK PER SMACNA 1.5" W.C. PRESSURE. ALL ELBOWS SHALL HAVE 1.5R CENTERLINE. ALL DUCT UNDER SLAB SHALL BE FIBERGLASS.

14. ALL DUCT WORK SHALL BE SUPPORTED WITH METAL STRAPS AT LEAST 1" WIDE AND SHALL BE THE SAME GAUGE OR HEAVIER THAN THE DUCT. STRAPPING SHOULD BE SPACED AT NO MORE THAN 64" APART AND SHALL BE SECURELY FASTENED TO THE BUILDING STRUCTURE.

15. SUSPEND ALL CEILING MOUNT AIR DISTRIBUTION DEVICES FROM STRUCTURE WITH 12 GA. WIRE. ALL HANGERS AND SUPPORTS TO BE INSTALLED PRIOR TO FIREPROOFING OF ROOF STRUCTURE.

16. ALL FLEXIBLE ROUND DUCT SHALL BE PRE—INSULATED DOUBLE WALLED WITH SPIRAL METAL RIB, AND SHALL HAVE MIN. RESISTANCE VALUE OF R-6. MAXIMUM LENGTH SHALL BE 10'-0" UNLESS SHOWN SPECIFICALLY OTHERWISE IN PLAN. SECURE ENDS WITH NYLON BANDS AND TAPE.

17. ALL SUPPLY AND RETURN DUCT SHALL BE INSULATED WITH A MINIMUM OF 2-3/16" 3/4 LB. OR 2" OF 1.0 LB. DENSITY FIBERGLASS WRAP. INSULATED DOUBLE WALLED SPIRAL DUCT SHALL HAVE A MINIMUM INSULATION THICKNESS OF 2" OF 1.5 LB. DENSITY. PIPING INSULATION (REFRIGERANT OR WATER) SHALL BE A MINIMUM OF 1-1/2" THICK OR PER LATEST NC ENERGY CODE, WHICHEVER IS GREATER.

18. MECHANICAL CONTRACTOR SHALL PROVIDE AND INSTALL ALUMINUM JACKET PROTECTIVE COVERING FOR ALL REFRIGERANT PIPE INSULATION INSTALLED ON THE BUILDING EXTERIOR.

19. CABLE TRAY HAS RIGHT-OF-WAY OVER DUCTWORK; SEE ELECTRICAL DRAWINGS FOR LOCATION.

20. SIDEWALL SUPPLY REGISTERS AND RETURN GRILLES ARE TO BE INSTALLED PLUMB AND LEVEL ALONG A COMMON ELEVATION. INSULATE BACK OF ALL LAY-IN CEILING SUPPLY REGISTERS AND DIFFUSERS.

SHALL SHUT DOWN INDOOR AND ASSOCIATED OUTDOOR UNIT WHEN ACTIVATED.

21. PROVIDE FLEXIBLE CONNECTORS ON SUPPLY AND RETURN CONNECTIONS TO HVAC UNITS. 22. PROVIDE AUXILIARY CONDENSATE DRAIN PAN FOR ALL AIR HANDLING UNITS, FAN COIL UNITS, FURNACE WITH COOLING

23. CONDENSATE PIPE SHALL BE HARD DRAWN COPPER. INSTALL WITH PROPER SLOPE AND NO SAGS. COPPER PIPE SHALL BE INSULATED WITH 1/2" THICK CLOSED CELL INSULATION.

COIL, ETC. CONTRACTOR SHALL PROVIDE AND INSTALL WATER LEVEL FLOAT SWITCH IN AUXILIARY DRAIN PAN. FLOAT SWITCH

24. ALL DUCTWORK AND PIPING SHALL BE CONCEALED ABOVE CEILINGS, TRUSSES AND SOFFITS EXCEPT IN MECHANICAL

ROOMS, UTILITY PLATFORMS, AREAS WITH EXPOSED STRUCTURE (NO CEILINGS), AND WHERE NOTED OTHERWISE. 25. CONTROLS CONTRACTOR IS RESPONSIBLE FOR ALL CONTROL WIRING AND CONNECTIONS TO MECHANICAL EQUIPMENT.

26. MECHANICAL CONTRACTOR IS RESPONSIBLE FOR FURNISHING ALL EXTERNAL DISCONNECTS THAT ARE REQUIRED FOR EQUIPMENT PROVIDED UNDER THIS CONTRACT. MECHANICAL CONTRACTOR SHALL FURNISH ALL REQUIRED FUSES FOR ALL FUSED DISCONNECT SWITCHES. COORDINATE DISCONNECT AND FUSE INSTALLATION WITH ELECTRICAL CONTRACTOR. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING DISCONNECT SWITCHES AND FUSES. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL ALL LINE SIDE WIRING AND CONDUIT TO EXTERNALLY OR INTERNALLY MOUNTED DISCONNECTS AND SHALL PROVIDE AND INSTALL LOAD SIDE WIRING AND CONDUIT FROM EXTERNALLY MOUNTED DISCONNECT SWITCHES TO MECHANICAL EQUIPMENT. MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FINAL ELECTRICAL CONNECTIONS TO EQUIPMENT PROVIDED BY THE MECHANICAL CONTRACTOR. SEE "MECHANICAL EQUIPMENT ELECTRICAL CONNECTION DETAIL".

27. DISCONNECT SWITCHES INDICATED TO BE PROVIDED BY MECHANICAL CONTRACTOR SHALL BE HEAVY DUTY NEMA-1 FOR INTERIOR INSTALLATIONS AND HEAVY DUTY NEMA-3R FOR EXTERIOR INSTALLATIONS. SEE ALSO DIVISION 16 SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

28. ALL EXPOSED GAS PIPE AS SHOWN (INTERIOR OR EXTERIOR) SHALL BE SCHEDULE 40 BLACK STEEL PAINTED OSHA YELLOW OR YELLOW FLEXIBLE STAINLESS STEEL. ALL GAS PIPING SHALL BE LABELED WITH THE TYPE OF GAS AND SUPPLY PRESSURE. GAS PIPING CONCEALED IN WALL CAVITY SHALL NOT BE REQUIRED TO BE PAINTED YELLOW. CONTRACTOR SHALL INSTALL GAS PIPE PER INSTALLATION STANDARD MSS SP-58. M.C. SHALL PROVIDE MAPA PRODUCTS PIPE SUPPORTS WITH E-6000 ADHESIVE OR APPROVED EQUALS.

29. MINIMUM GAS PIPING SIZE SHALL BE 3/4" FOR ALL BRANCH LINES. CONTRACTOR SHALL REDUCE TO SMALLER SIZES AT GAS FIRED EQUIPMENT, AS REQUIRED, FOR CONNECTION TO EQUIPMENT.

30. GAS PIPE SIZES INDICATED ON PLANS ARE MINIMUM ALLOWABLE SIZES. CONTRACTOR MAY USE LARGER SIZES THAN

31. MECHANICAL CONTRACTOR MAY USE ROUND DUCT OF EQUIV. AREA IN LIEU OF RECTANGULAR. COOR'D. ROUND DUCT SIZES W/ ENGINEER. USE INSULATED DOUBLE WALLED SPIRAL DUCT WITH PAINT GRIP FINISH WHERE DUCT IS TO BE EXPOSED. 32. MECHANICAL CONTRACTOR SHALL PROVIDE ENGR. WITH AN AIR BALANCE REPORT INDICATING INITIAL AND FINAL READINGS

33. MECHANICAL CONTRACTOR SHALL LABEL ALL EQUIPMENT WITH ENGRAVED PLASTIC LAMINATE, SCREWED TO PIECE OF EQUIPMENT.

AT EACH DIFFUSER AND TOTAL CFM PER UNIT. INCLUDE IN DOCUMENTS PROVIDED TO OWNER AT JOB CLOSEOUT.

34. CONVENTIONAL FURNACES SHALL HAVE TYPE B VENTS, CONDENSING TYPE SHALL HAVE PVC VENTS.

35. MECHANICAL CONTRACTOR SHALL PROVIDE AND INSTALL CO SENSOR FOR ALL GAS FIRED EQUIPMENT IF A FIRE ALARM SYSTEM IS NOT INCLUDED ON THE PROJECT. COORDINATE WITH EC.

36. M.C. SHALL COORDINATE ALL EXTERIOR MECHANICAL EQUIPMENT LOCATIONS WITH G.C. PRIOR TO INSTALLATION AND SHALL PROVIDE 3'-0" MIN. SERVICE CLEARANCE OR MANUFACTURER'S RECOMMENDATIONS, WHICHEVER IS GREATER, BETWEEN ALL MECHANICAL EQUIPMENT AND ALL OBSTRUCTIONS. IF THERE ARE MECHANICAL ENCLOSURES OR FENCING, M.C. SHALL COORDINATE THE SIZES AND CLEARANCES IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION MANUAL AND PROVIDE 3'-0" MIN. CLEARANCE OR MANUFACTURER'S RECOMMENDED CLEARANCES, WHICHEVER IS GREATER. M.C. SHALL VERIFY AND COORDINATE THAT FENCING BEING PROVIDED BY G.C. IS APPROVED FOR OPERATION WITH THE MECHANICAL EQUIPMENT MANUFACTURER. FENCING AND CLEARANCE DIMENSIONS SHOWN ON THESE PLANS ARE DIAGRAMMATIC ONLY. IF CHANGES TO FENCE SIZES AND UNIT CLEARANCES ARE NEEDED, THE M.C. SHALL BE RESPONSIBLE FOR NOTIFYING THE G.C. AND THE ENGINEER/ARCHITECT.

37. UNIT CONTROLLER OR PROGRAMMABLE THERMOSTAT SHALL HAVE 7 DAY PROGRAMING, TIMED OVER-RIDE AND THE ABILITY TO RUN FANS IN OCCUP. MODE & CYCLE FANS IN UN-OCCUP. MODE.

38. THE M.C. & C.C. SHALL PROTECT EQUIPMENT DURING CONSTRUCTION & BRAZING AS REQ'D. CLEAN ALL EQUIP. SURFACES OF GREASE, DIRT, DUST, & OTHER FOREIGN MATERIALS PRIOR TO PROJECT CLOSEOUT.

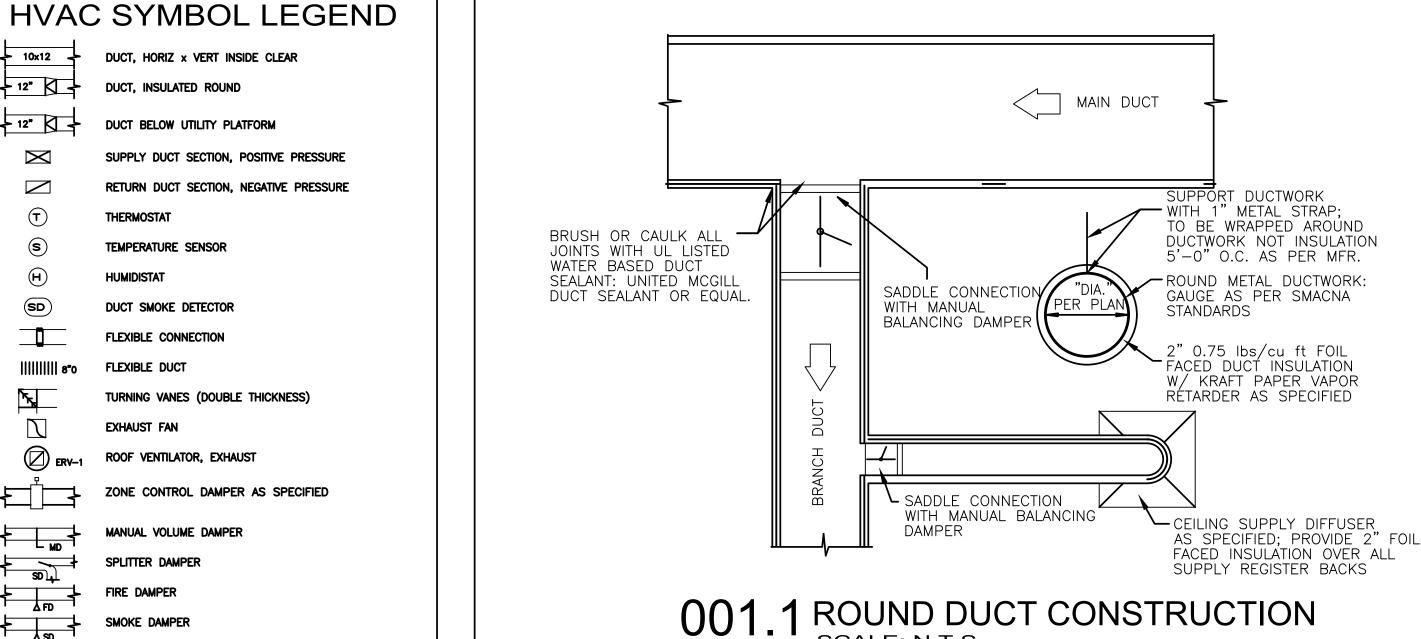
39. MECHANICAL CONTRACTOR SHALL CHANGE UNIT FILTERS AFTER EACH TWO WEEKS OF RUN TIME, AND SHALL LEAVE ONE CHANGE OF FILTERS FOR OWNER TO USE FOR NEXT FILTER CHANGE.

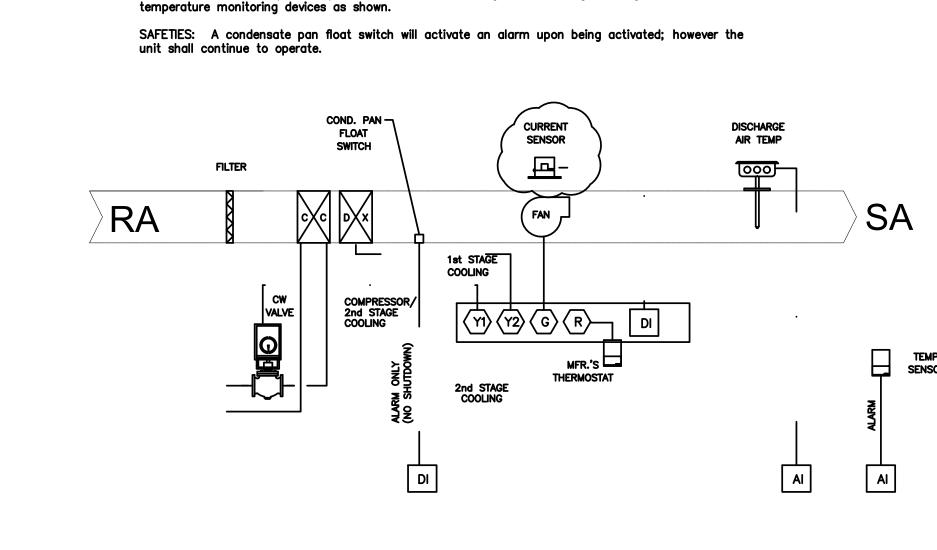
40. MECHANICAL CONTRACTOR SHALL NOT ALLOW DUCTWORK TO CONTACT LAY-IN LIGHT FIXTURES. ROUTE ACCORDINGLY.

41. MECHANICAL CONTRACTOR SHALL INSTALL DUCT MOUNTED SMOKE DETECTORS WHERE INDICATED ON PLANS. IF AN EXISTING FIRE ALARM SYSTEM IS PRESENT, DUCT DETECTORS SHALL BE CONNECTED TO EXISTING FIRE ALARM SYSTEM. MECHANICAL CONTRACTOR SHALL COORDINATE CONNECTION TO FIRE ALARM SYSTEM WITH ELECTRICAL CONTRACTOR AND/OR FIRE ALARM CONTRACTOR. IF A FIRE ALARM SYSTEM IS NOT PRESENT, PROVIDE DETECTOR & ASSOCIATED HORN/STROBE ALARM (HONEYWELL RTS2-AOS MULTI-SIGNALING) AS REQUIRED BY N.C. MECHANICAL CODE SECTION 606.4.1. M.C. IS RESPONSIBLE FOR DUCT ACCESS DOORS UNDER ALL CIRCUMSTANCES.

42. PROVIDE HEAT PUMP WITH CONTROLS TO PREVENT HEAT STRIP FROM OPERATING WHEN OUTSIDE AIR TEMP. IS ABOVE 40°F. HEAT STRIP LOCKOUT SHALL NOT PREVENT HEAT STRIP OPERATION DURING DEFROST. (403.2.4.1.1 NCEC)

43. ALL SUMP PUMPS INDICATED ON THESE PLANS SHALL BE OIL MINDING SUMP PUMPS, UNLESS INDICATED OTHERWISE.





START/STOP: Unit shall run to maintain min. 68°F (adj) year—round temperature.

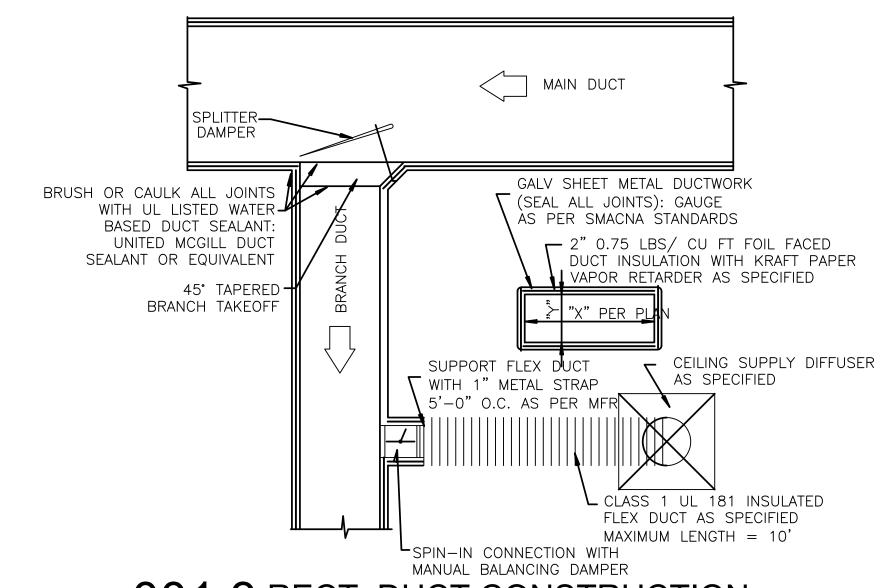
TEMPERATURE CONTROL: MDF unit is provided with manufacturer's thermostat which

controls the two position cooling valve to maintain space temperature for scheduled hours and night setback setpoint after scheduled hours. A second stage DX coil is indexed on by the manufacturer's

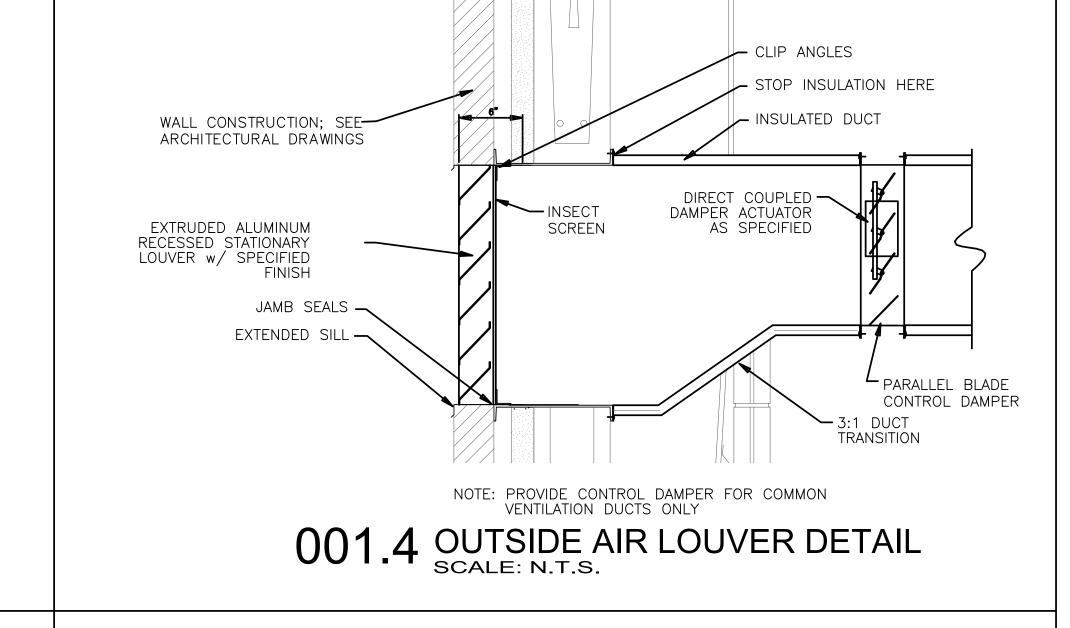
thermostat when the space setpoint cannot be achieved by the first stage cooling coil. Provide

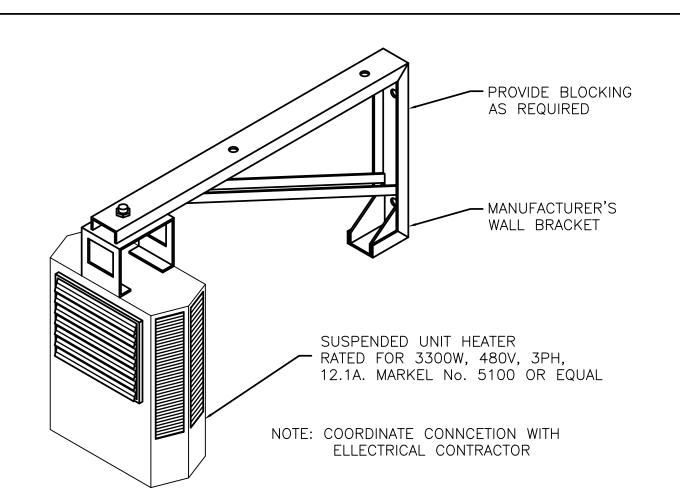
MDF UNIT CONTROL SEQUENCE:

001.2 MDF/IDF UNIT CONTROL DIAGRAM SCALE: N.T.S.

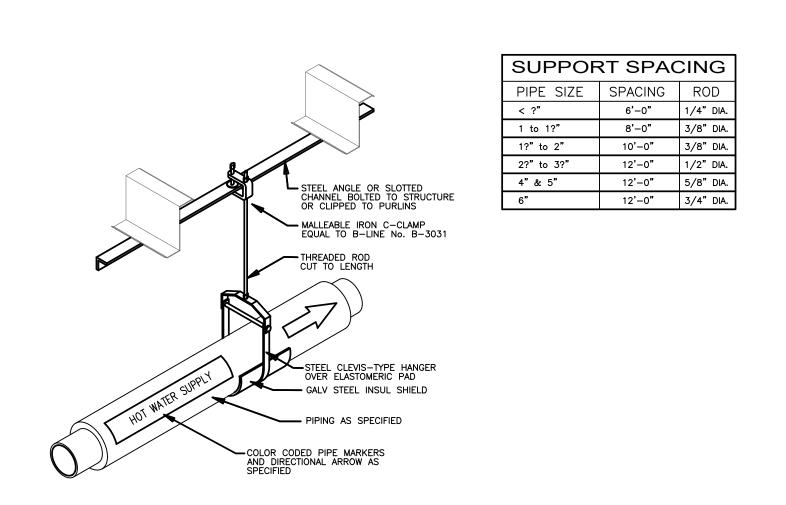


001.3 RECT. DUCT CONSTRUCTION

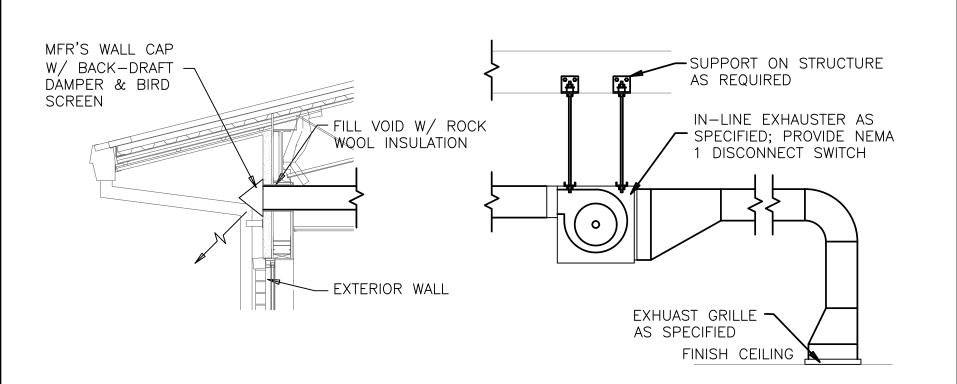




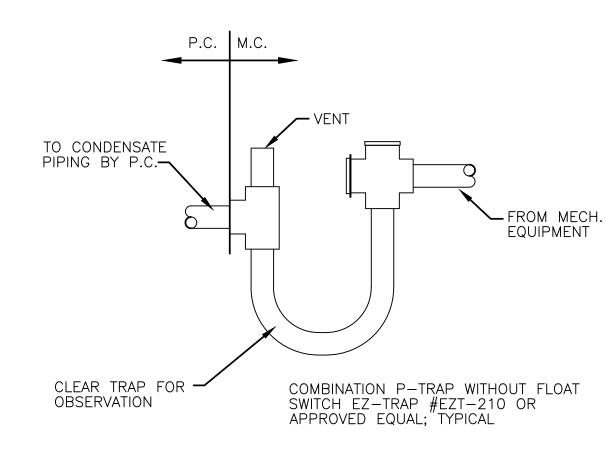
001.5 UNIT HEATER INSTALLATION DETAIL



001.6 HTDRONIC PIPE HANGAR DETAIL



001.7 EXHAUST FAN INSTALLATION DETAIL



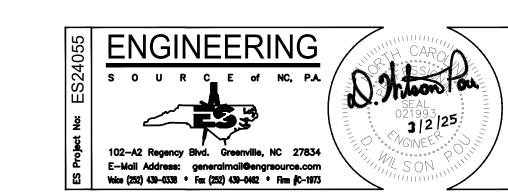
001.8 CONDENSTATE TRAP DETAIL SCALE: N.T.S.

HVAC DRAWING INDEX

M-001	MECHANICAL NOTES, LEGEND, & DETAILS
M-002	MECHANICAL SCHEDULES & DETAILS
M-003	HYDRONIC HEATING SYSTEM FLOW & CONTROL DIAGRA
M-004	CHILLED WATER SYSTEM FLOW & CONTROL DIAGRAM
M 101	MECHANICAL DI AN

MECHANICAL PLAN

MECHANICAL PLATFORM PLAN MECHANICAL PLATFORM PIPING PLAN & BOILER ROOM PLAN



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	LOUVER SCHEDULE									
MARK	SERVICE	SIZE	FREE	CFM	FPM	ELECT	CONTROL	COLOR	MODEL NO./DESCRIPTION	NOTES
LV-5A	CTE BUILDING OUTSIDE AIR	48x36	6.11	3,125	511	120 V	BMS	BY ARCH	RUSKIN ELF375DXH	1-4,6
LV-5B	CTE BUILDING OUTSIDE AIR	48x30	5.26	2,600	495	120 V	BMS	BY ARCH	RUSKIN ELF375DXH	1-4,6
LV-AG	AGRICULTURE LAB EXHAUST AIR	18x18	0.96	1,200	1,250	N/A	N/A	BY ARCH	RUSKIN ELF375DXH	1-4,6
LV-AM	AUTOMOTIVE LAB INTAKE AIR	30x48	5.22	2,600	499	120 V	INTERLOCK WITH EF-C	BY ARCH	RUSKIN ELF375DXH	1-4,6
LV-WA	WELDING LAB INTAKE AIR	72x42	11.15	8,400	754	120 V	INTERLOCK WITH PANEL	BY ARCH	RUSKIN ELF375DXH	1-4,6
LV-WB	WELDING LAB EXHAUST AIR	42X36	5.28	8,400	1591	N/A	N/A	BY ARCH	RUSKIN ELF375DXH	1-4,6

(1) LOUVERS AND DAMPERS MEETING OR EXCEEDING SPECIFIED DATA, MANUFACTURED BY VENT PRODUCTS,

NCA OR CESCO (2) PROVIDE EXTENDED SILL, CLIP ANGLES, & INSECT SCREEN.

(3) SEE DETAILS (4) PROVIDE FACTORY FINISH AS SPECIFIED - (2) COLORS SELECTED BY ARCHITECT.

(5) INSTALL HI/LO COMBUSTION AIR & VENTILATION LOUVERS PER NCSBC VOL. VI. (6) PROVIDE WITH MANUFACTURERS B.D.D.

kW = POWER INPUT (WATTS X 1000)

RLA = RATED LOAD AMPS

OUT = NET I-B-R RATED OUTPUT (MBtuH)
IN = NATURAL GAS/PROPANE INPUT (MBtuH)
EWT = ENTERING WATER TEMP (°F)

LWT = LEAVING WATER TEMP ("F WT = WEIGHT (LBS.)

COMP = CHILLER COMPRESSOR

MCA = MAX CIRCUIT AMPACITY

						A	AIR-COO	LER	LIQU	JID	CH	IILL	ER							
										CON	MP 1	СОМ	IP 2	COM	IP 3	СОМ	P 4			
UNIT	CAP	IPLV	GPM	MIN. FLOW	LWT	EWT	MFR/MODEL NO.	WEIGHT	ELECT	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	MCA	FUSE	NOTES
CH-1	69	16.19	118	93	42	56	TRANE/CGAM070	5700	460V/3PH	25	155	33	215	33	215	25	155	147	200	1-10
(2) SI (3) PI TH	EFERENCE SP EE ALSO EQU ROVIDE WIDE	ECIFICATION SECTION JIPMENT INSTALLAT AMBIENT OPERATION TER, MANUF. ISOLA	ION DETAILS FO ON OPTION, FAC	R ACCESSORIES, CTORY MOUNTED	OPTIONS DISCONNE	, ETC. ECT, ACRO	OSS POWER										CAP EER LWT EWT	= ENERGY = LEAVING = ENTERING	C LWT (ton EFFICIENCY R WATER TEMP G WATER TEMP	ÁTIO (^F) P. (^F)

(4) M.C. SHALL PROVIDE HEAT TAPE ON ALL EXPOSED EXTERIOR HYDRONIC PIPE AND TRACER WRE ON ALL UNDERGROUND HYDRONIC PIPE.

(5) NUMBER OF CONDENSER FANS PER CHILLER IS 10.

(6) PROVIDE WITH LOUVERED SKIRT TO PROTECT COMPRESSORS.

PROVIDE UNIT WITH INSULATED COMPRESSOR SOUND DEADENING OPTION.

PROVIDE CHILLERS WITH FACTORY CHILLER CONTROLS WITH BACNET CARD TO CONNECT TO EXISTING CONTROL SYSTEM-(?? CONTROLS) BUILDING LOOP SIDE OF THE HEAT EXCHANGER DESIGN TEMPERATURES ARE 42F CHWS AND 56F CHWR. (ó) SCHEDULED INFORMATION BASED ON TRANE, YORK AND CARRIER SHALL BE EQUALS.

				PΙ	JMF	>	SCH	IED	ULE				
TAG	TYPE	SERVICE	GPM	HEAD	% EFF	HP	RPM	MIN. FLOW	ELECT	FLA	CONTROL	MFR/MODEL	NOTES
CWP-1	END SUCTION CENTRIFUGAL	CW SYSTEM PUMP	62	55	55.2	2.0	1750	32	480V/3PH	3.4	VAR. SPEED	B&G e-1510 1.25BC	1-4
CWP-2	END SUCTION CENTRIFUGAL	CW SYSTEM PUMP	62	55	55.2	2.0	1750	32	480V/3PH	3.4	VAR. SPEED	B&G e-1510 1.25BC	1-4
HWP-1	END SUCTION CENTRIFUGAL	HW SYSTEM PUMP	36	50	59.4	1.5	1800	20	480V/3PH	3.0	VAR. SPEED	B&G e-1510 1.25AD-es	1-4
HWP-2	END SUCTION CENTRIFUGAL	HW SYSTEM PUMP	36	50	59.4	1.5	1800	20	480V/3PH	3.0	VAR. SPEED	B&G e-1510 1.25AD-es	1-4
CHP-1	END SUCTION CENTRIFUGAL	CHILLER 1	118	25	77.1	1.5	1750	118	480V/3PH	3.0	CHILLER ON	B&G e-1510 2AD-es	1-4
	IOTES: 10) REFERENCE SPECIFICATION SECTION 2) IMPELLER SIZING RESPONSIBILITY OF 3) SYSTEM PUMPS SHALL OPERATE IN 4) MAXIMUM HP INDICATED		ABBREVIATIONS: HEAD= FRICTION LOSS (ft) EFF = MIN. PUMP EFFICIENCY (%) GPM = FLOW RATE FLA = PUMP MOTOR FULL LOAD AMPS							•	•		

OOO OGAS PIPING SCHEMATIC
002.2 GAS PIPING SCHEMATIC
SCALE. N. I.S.

DIRT LEG

REGULATOR AS REQD. — NATURAL GAS —

UNION —

GAS BALL VALVE —

* PROVIDE COPPER TUBING

TO VENT REGULATOR AS REQUIRED

GAS SIZING	CALC	CULAT	ΓΙΟΝ	15
EQUIPMENT LIST	MBH	QUANTITY	TOTAL	MBH
B-1	1,000	1	1,00	00
GWH	199	1	19	9
T01	AL CONN	ECTED =	1,19	99
LENGTH OF (GAS LINE	= 200 FT.		

GAS PRESSURE = 2 PSI SIZE OF GAS SERVICE REQUIRED = 1.25 NOTE: ENGINEER SHALL BE NOTIFIED PRIOR TO INSTALLATION OF GAS PIPE IF ANY ONE OF THE ABOVE CALCULATIONS DIFFER FROM THE ACTUAL

INSTALLATION REQUIREMENTS. ENGINEER SHALL HAVE OPPORTUNITY TO REVIEW ACTUAL INSTALLATION

CONDITIONS AND RE-SIZE GAS SERVICE IF REQUIRED

TYPE OF GAS SERVICE = NATURAL GAS OR PROPANE

NOTES:				-		-	•	ABBREVIATIONS:		
B-1	989	1,000	6"	120	150	535	RIELLO/AR-1000	120V / 10A	NATURAL	1-7,9
MARK	OUT	IN	VENT	EWT	LWT	WT	MFR/NODEL	ELECT	FUEL	NOTES
					BOII	_ER	SCHEDULE			

(1) REFERENCE SPECIFICATIONS SECTION 15550
(2) PROVIDE LP/NATURAL GAS COMBINATION FUEL BURNER & BURNER CONTROLS AS SPECIFIED) PROVIDE OUTDOOR RESET SEQUENCING CONTROLLER AS SPECIFIED) BOILERS SHALL BE SUPPLIED W/ ALL SAFETIES & CUT-OFFS REQUIRED BY CODE & NC DEPT. OF LABOR REGULATION PROVIDE BOILERS W/ OUTSIDE AIR AMBIENT TEMP. SETBACK B) PROVIDE BOILERS W/ PACKAGED BOILER STAGING CONTROL FROM MFG. ALTERNATE LEAD/LAG ON A WEEKLY BASIS. (7) PROVIDE BOILER WITH PRIMARY LOOP PUMP, INTERNAL TO THE BOILER. EQUALS MAY PROVIDE EXTERNAL PUMP.
(8) M.C. SHALL REFER TO PLUMBING DRAWING FOR CONNECTING BACK TO DOMESTIC WATER. BOILER SHALL HAVE DOMESTIC WATER PRIORITY SCHEDULING AND PROVIDED WITH DOMESTIC HOT WATER HEATING PACKAGE AND 1000 GAL STORAGE TANK. (9) BOILERS SHALL BE PROVIDED WITH BACNET CARDS TO BE CONNECTED TO BUILDING MANAGEMENT SYSTEM.

	ELEC	TRI	C U	NI [°]	T HEATER S	CHEDU	LE	
TAG(S)	SERVICE	HEAT	BTUH	CFM	MFR / MODEL NO.	ELECT	NOTES	WEIGHT
UH-1	SPRINKLER 532	3.3 KW	11,200	400	MARKEL NO. P3PUH03CA1	480V/3PH/4.0A	1-3	36 LBS
NOTES: (1) PRO\	/IDE MFR'S DISCONNEC	T AND LOW	VOLTAGE THE	ERMOSTA	T — SEE INSTALLATION DETAIL, SHEET M—	001		

	EXHAUST FAN VENTILATOR SCHEDULE												
MARK	CFM	RPM	S.P.	ELECTRICAL	CONTROLS	MODEL NO./DESCRIPTION	NOTES						
EF-A	100	848	0.125	115V / 0.6A	LOCAL	GREENHECK NO. SP-A110 PREMIUM CEILING FAN	1,2,3,7						
EF-B	300	898	0.25	115V / 1.7A	EMS	GREENHECK NO. SP-A410 PREMIUM CEILING FAN	1,2,4,7						
EF-C	2600	860	0.15	115V / 2.7A	LOCAL	GREENHECK NO. SE1-20-428-C6 PREMIUM SIDE WALL PROP FAN	1,2,5,6,7						
EF-D	250	1350	0.125	115V / 0.2A	LOCAL	GREENHECK NO. SE1-08-424-G PREMIUM SIDE WALL PROP FAN	1,2,5,6,7						
EF-G	50	848	0.125	115V / 0.6A	LOCAL	GREENHECK NO. CSP-A110 PREMIUM IN-LINE FAN	1,2,3,7						
EF-H	100	848	0.125	115V / 0.6A	LOCAL	GREENHECK NO. CSP-A110 PREMIUM IN-LINE FAN	1,2,3,7						

(2) UL LISTED HYDRONIC HEATERS MEETING OR EXCEEDING SPECIFICATIONS MANUFACTURED BY

(3) M.C. SHALL PROVIDE HORIZONTAL CEILING BRACKET WITH DUST SHIELD

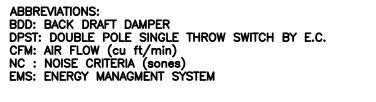
STERLING SHALL BE CONSIDERED EQUAL

(1) MODEL NUMBERS NOTED ARE GREENHECK EQUIPMENT, UNLESS OTHERWISE NOTED. EXHAUST FANS MEETING OR EXCEEDING PERFORMANCE DATA MANUFACTURED BY COOK OR CARNES ARE ACCEPTABLE SUBSTITUTES. ALL FANS SHALL HAVE UL LISTED LABELS AND OPTIONAL MOTOR COVERS. (2) FURNISH AND INSTALL MFR'S SPEED CONTROLLER OR EQUIVALENT & ALL ACCESSORIES

(3) FURNISH AND INSTALL 10"x3" HOODED WALL CAP WITH INTEGRAL FLASHING, BDD, AND BIRD SCREEN, GREENHECK MODEL NO. WC OR EQUIVALENT. (4) FURNISH AND INSTALL 18"x8" HOODED WALL CAP WITH INTEGRAL FLASHING, BDD, AND BIRD SCREEN,

(5) SEE LOUVER SCHEDULE. (6) PROVIDE MANUFACTURER'S WALL MOUNT HOUSING W/ OSHA APPROVED MOTOR GUARD, INSTALLATION COLLAR, AND BDD (7) SEE INSTALLATION DETAIL; SEE ALSO CONTROL SEQUENCE IN SPECIFICATIONS

GREENHECK MODEL NO. WC OR EQUIVALENT.

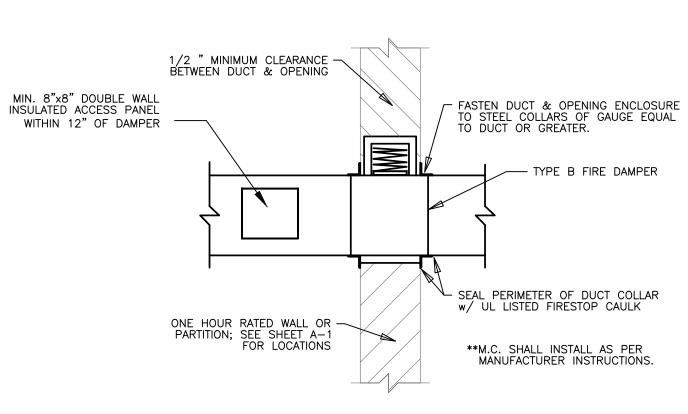


NO	CBC V	ENTILA	TION CALC	ULATIONS	
OCCUPANCY TYPE	SQ. FT.	O.A. PER SQ. FT.	# OF OCCUPANTS	O.A. PER PERSON	TOTAL O.A. CFM
CLASSROOM	10,300	_	120	7.5	900
CTE LAB	14,560	0.18	100	10	3,620
CORRIDOR	2,740	0.06	_	_	165
BATHROOM	950	_	_	_	0
TOTAL REQUIRED FOR BUILDING					4,685
TOTAL PROVIDED FOR BUILDING					5,700 **

** VENTILATION IS SET TO PROVIDE BUILDING WITH POSITIVE PRESSURE.

SAMPLING HOLES FACING DIRECTION OF AIR FLOW -SAMPLING TUBE SHALL EXTEND FULL WIDTH OF DUCT & BE SUPPORTED ON BOTH SIDE ullet DUCT MOUNTED SMOKE DETECTOR. LOCATE AS INDICATED ON PLANS. ← RETURN DUCT ACCESS PANEL W/ HINGE & SINGLE CLASP (MIN. 12"x12") SEAL ALL INSULATION OR LINING PENETRATIONS PER SPECIFICATIONS

002.1 DUCT MOUNTED SMOKE DETECTOR DETAIL SCALE: N.T.S.



002.3 1 HOUR WALL DUCT PENETRATION SCALE: N.T.S.

MECHANICAL SYSTEMS,	SERVICE SYSTEMS AND EQUIPMENT
METHOD	OF COMPLIANCE:
PRESCRIPTIVE ☒	ENERGY COST BUDGET

CLIMATE ZONE: IBC - 4A (BERTIE CO.) THERMAL ZONE WINTER DRY BULB: 22.0°F SUMMER DRY BULB: 95.0°F

INTERIOR DESIGN CONDITIONS WINTER DRY BULB: 70°F SUMMER DRY BULB: 75°F RELATIVE HUMIDITY: 50%

BUILDING HEATING LOAD: 588.8 MBH BUILDING COOLING LOAD: 1019.6 MBH MECHANICAL SPACE CONDITIONING SYSTEM DESCRIPTION OF UNIT: HEATING EFFICIENCY: EXISTING TO REMAIN COOLING EFFICIENCY: SEE SCHEDULE HEAT OUTPUT OF UNIT:

COOLING OUTPUT OF UNIT: SEE SCHEDULE

TOTAL BOILER OUTPUT: EXISTING TO REMAIN (If oversized, state reason) (Over—sized for standard unit sizes and morning warm—up. multi—unit allows for staging)

TOTAL CHILLER OUTPUT: 553.2 MBH (If oversized, state reason)

LIST EQUIPMENT EFFICIENCIES

EQUIPMENT SCHEDULES WITH MOTORS (Not used for mechanical systems) MOTOR HORSEPOWER: NUMBER OF PHASES: MINIMUM EFFICIENCY: MOTOR TYPE: # OF POLES:

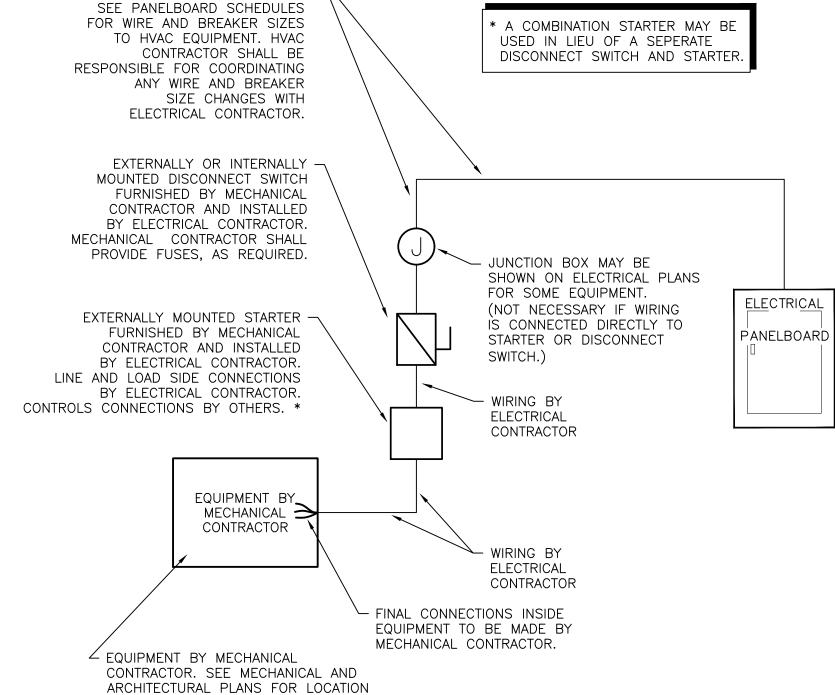
DESIGNER STATEMENT:

BRANCH CIRCUIT AND CONDUIT

BY ELECTRICAL CONTRACTOR.

To the best of my knowledge and belief, the design of this building complies with the mechanical systems, service systems and equipment requirements of the 2012 North Carolina

energy conservation code. NAME: D. WILSON POU, P.E. TITLE: PRESIDENT



002.4 MECHANICAL EQUIPMENT ELECTRICAL CONNECTION DETAIL SCALE: N.T.S.

RETURN FLEX DUCT SCHEDULE								
CFM	SIZE (DIA.)							
0 - 100	6"							
101 - 200	8"							
201 - 400	10"							
401 - 700	12"							
701 — 1000	14"							
1001 - 1600	16"							
OVER 1600	NOT USED							
	•							

FLEX SUPPLY DUCT SCHEDULE				
CFM	SIZE (DIA.)			
0 - 60	5"			
61 - 130	6"			
131 - 250	8"			
251 - 450	10"			
451 – 750	12"			

ACCESS DOOR SCHEDULE		
DUCT SIZE	ACCESS DOOR	
UP TO 16" WIDE	12" x 12"	
17" TO 22"	16" x 16"	
24" & UP	18" x 18"	
LOUVER ACCESS	36" x 24"	
REFER TO SPECIFICATIONS SECTION 15800		

	AIR DISTRIBUTION SCHEDULE							
MARK	FACE SIZE	NECK SIZE	MFR/MODEL	CFM/FPM	NC	REMARKS		
Α	24"x24"	9"x9"/10"ø	PRICE/AMD	300/500	<25	LAY-IN CEILING DIFFUSER WITH 4-WAY DEFLECTION; ALUMINUM CONSTRUCTION		
AG	24"x24"	9"x9"/10"ø	PRICE/AMD	275/500	<25	SURFACE MOUNTED CEILING DIFFUSER WITH 4-WAY DEFLECTION; ALUMINUM CONSTRUCTION. PROVIDE WITH INTEGRAL DAMPER.		
В	24"x24"	6"x6"/8"ø	PRICE/AMD	200/500	<20	LAY-IN CEILING DIFFUSER WITH 4-WAY DEFLECTION; ALUMINUM CONSTRUCTION		
BG	24"x24"	6"x6"/8"ø	PRICE/AMD	200/500	<20	SURFACE MOUNTED CEILING DIFFUSER WITH 4-WAY DEFLECTION; ALUMINUM CONSTRUCTION. PROVIDE WITH INTEGRAL DAMPER.		
С	12"x12"	6"x6"/6"ø	PRICE/AMD	100/500	<20	LAY-IN CEILING DIFFUSER WITH 4-WAY DEFLECTION; ALUMINUM CONSTRUCTION		
D	8"x27"	6"x24"	PRICE/AHCD1D	500/500	<25	DUCT MOUNTED DRUM LOUVER WITH OPPOSED BLADE DAMPER AND POLE OPERATOR; ALUMINUM CONSTRUCTION		
G	3.5"x24"	10 " ø	PRICE/LBNH26B	300/700	<30	SURFACE MOUNTED CEILING DIFFUSER WITH ALUMINUM CONSTRUCTION. PROVIDE WITH INTEGRAL DAMPER.		
DC	36"x36"	34"x34"	PRICE/151	6000/700	<30	SURFACE MOUNTED, SIDEWALL INDUSTRIAL LOUVERED FACE SUPPLY GRILLE, ALUMINUM CONSTRUCTION W/ LOCKING ADJUSTABLE BLADES @ 1-1/2" O.C. BLADES SHALL BE HORIZONTAL (PARALLEL W/ FINISHED FLOOR) AND SHALL BE SET TO 30° TOWARDS THE CEILING.		
R1	24"x24"	12"x12"	PRICE/80TB	550/650	<20	LAY-IN EGG CRATE FACE RETURN WITH BLADES @ 1/2" O.C. ALUMINUM CONSTRUCTION		
R1G	24"x24"	12"x12"	PRICE/80DAL	550/650	<20	SURFACE MOUNTED EGG CRATE FACE RETURN WITH BLADES @ 1/2" O.C. ALUMINUM CONSTRUCTION. PROVIDE WITH INTEGRAL DAMPER.		
R2	24"x24"	22"x22"	PRICE/80TB	2000/700	<20	LAY-IN EGG CRATE FACE RETURN WITH BLADES @ 1/2" O.C. ALUMINUM CONSTRUCTION		
R2G	24"x24"	22"x22"	PRICE/80DAL	2000/700	<20	SURFACE MOUNTED EGG CRATE FACE RETURN WITH BLADES @ 1/2" O.C. ALUMINUM CONSTRUCTION. PROVIDE WITH INTEGRAL DAMPER.		
R3	26"x18"	18"x18"	PRICE/635D	1800/600	<20	SIDEWALL REGISTER WITH BLADES @ 1/2" O.C. ALUMINUM CONSTRUCTION. PROVIDE WITH INTEGRAL DAMPER.		

OF ALL EQUIPMENT.

(1) ALL FINISHES TO BE WHITE EXCEPT WHERE NOTED. (2) KRUEGER, METAL*AIRE, TUTTLE & BAILEY, TITUS & CARNES ARE CONSIDERED EQUIVALENTS. (3) PROVIDE SQUARE TO ROUND TRANSITIONS WHERE REQUIRED.

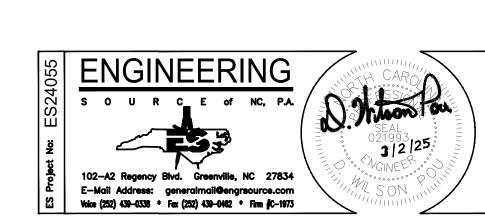
(4) PROVIDE WHITE FINISH FASTENERS AS REQUIRED. (5) PROVIDE MANUFACTURER'S LEVER OPERATED GRILLE MOUNTED DAMPER FOR ALL SUPPLY GRILLES/DIFFUSERS

THAT ARE INDICATED TO BE PROVIDED WITH INTEGRAL DAMPER. (6) PROVIDE 2" FOIL FACED INSULATION OVER ALL SUPPLY REGISTER BACKS.

(7) M.C. SHALL PROVIDE RADIATION DAMPERS WHERE REQUIRED.

(8) VALUES LISTED ARE MAXIMUM VALUES. (9) PROVIDE INSECT SCREEN FOR TYPE "XS".

* CONTRACTOR TO PROVIDE AND INSTALL RADIATION DAMPER AND THERMAL BLANKET. PROVIDE RETURN GRILLES WITH OPTIONAL STEEL FRAME.

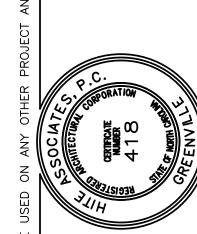


BDD: BACK DRAFT DAMPER

FPM: VELOCITY (ft/min)
NC: NOISE CRITERIA

OBD: OPPOSED BLADE DAMPER

HITE ARCHITECTI



IG FOR Chool

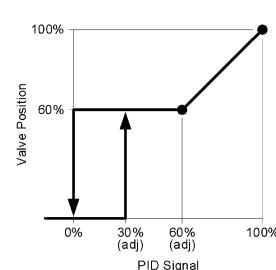
Project No. 22351

IVI

FAN COIL UNIT WITH OUTSIDE AIR (CHW/HW)

Occupied Mode Operation

- A. Safety Devices: Safeties shall be in operation at all times (Fan in auto, hand, override, etc).
- 1. Fire Alarm Shutdown: When the fire alarm is active, stop fan via fire alarm system shut down relay. BAS shall return valves to the off positions. Generate an alarm. safety shall be hardwired and require manual reset (via fire alarm system control panel).
- 2. Float Switch: When the float switch is active, stop fan and return valves to off positions. Generate an alarm. Safety shall be hardwired and require manual reset (via graphics). Float switch shall be installed by BAS contractor on auxiliary drain pan. Coordinate with equipment. 3. After all safeties have cleared, allow Fan Coil Unit fan operation.
- B. Fan 1. The fan shall run continuously. Determine fan status through a current sensor. If a fan fails to start as commanded, generate an alarm.
- a. Fan shall have a cooling fan speed and a heating fan speed. See equipment schedule for values. 2. Determine fan status through a current sensor. If a fan fails to start as commanded, generate an alarm.
- 3. After fan status has been proven, allow remainder of Occupied Mode Operation below.
- C. Outside Air Dampers 1. Index all building common outside air dampers to the open position.
- D. Heating (HW)/Cooling (CHW) Coils
- 1. Open/close/modulate the cooling valve to maintain the space at the cooling setpoint (72°F, adj), in accordance with the PID chart below.



- 2. Modulate the heating valve to maintain the space at the heating setpoint (68°F, adj).
- 3. Provide a minimum 2°F (non-adj) deadband between cooling and heating setpoints. E. Dehumidification
- 1. If the space temperature is satisfied and relative humidity in the space rises above 65% (adj), slow fan speed to heating fan speed, open the cooling valve to 100%, and modulate the reheat valve to maintain the space at the cooling setpoint. The unit shall return to normal operation when the space relative humidity falls below 55% (adj).
- 2. If space humidity remains above 65% (adj) for 15 minutes (adj), generate an alarm.
- 1. Generate an alarm for belt change when fan runtime exceeds user input maximum (8,000 hours, adj).
- G. Additional Control Requirements
- Provide with wall module. a. Wall module shall read space temperature, space humidity, and space CO2 levels (CO2 readings shall be from duct mounted

Unoccupied Mode Operation

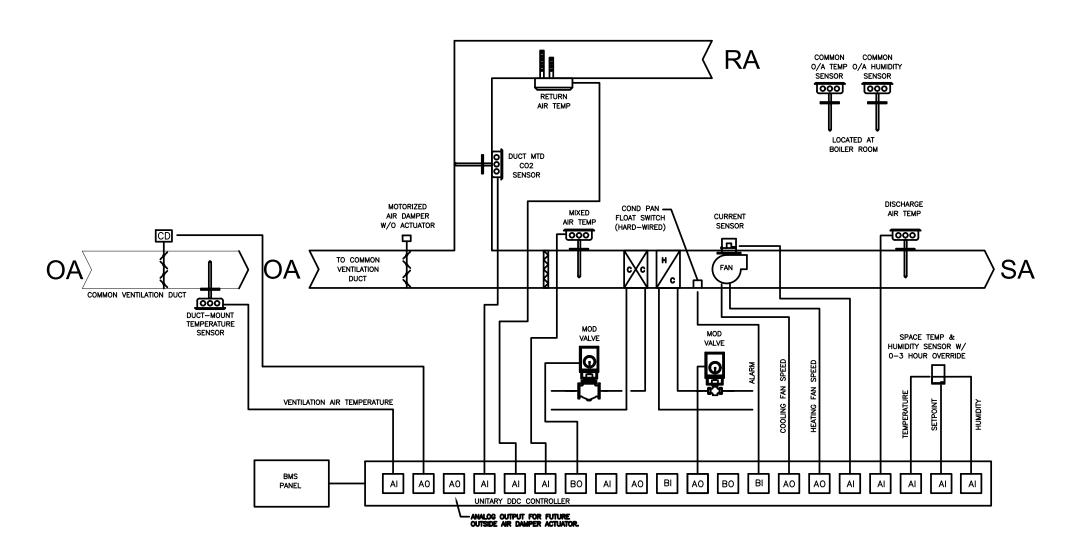
- A. Unit shall operate as described above in Occupied Mode Operation, except:
 - 1. Fan mode shall be cycle with heating and cooling, without circulation regardless of user selection, valves shall modulate to maintain heating/cooling setpoint, and common outside air damper shall be in off position.
 - 2. Increase cooling setpoint to 78°F (unoccupied cooling setpoint, adj) and decrease heating setpoint to 62°F (unoccupied heating setpoint,
 - 3. If the occupancy override is pressed, or the space temperature rises above the unoccupied cooling setpoint, or falls below the unoccupied
 - heating setpoint, place the unit into preoccupancy mode. The unit shall control to the occupied setpoints. 4. The unit shall return to unoccupied operation when occupied setpoints are reached, the minimum runtime of 30 minutes (adj) has been met, and the occupancy override expires.
- Preoccupancy Mode Operation
- A. Unit shall enter preoccupancy period prior to occupied period in accordance with the following:
- 1. Unit shall enter Preoccupancy Mode one hour (owner adjustable) prior to Occupied Mode Schedule. B. Unit shall operate as described in Occupied Mode Operation above, except:
- 1. Dampers shall be in off position. Minimum outside air shall not be introduced.
- 2. Fan shall cycle with heating and cooling, without circulation regardless of user selection, valves shall modulate to maintain heating/cooling setpoint.
- C. Once temperature setpoint is reached, unit shall continue to operate in Preoccupancy Mode until BMS schedule changes to Occupied Mode

Graphical Interface

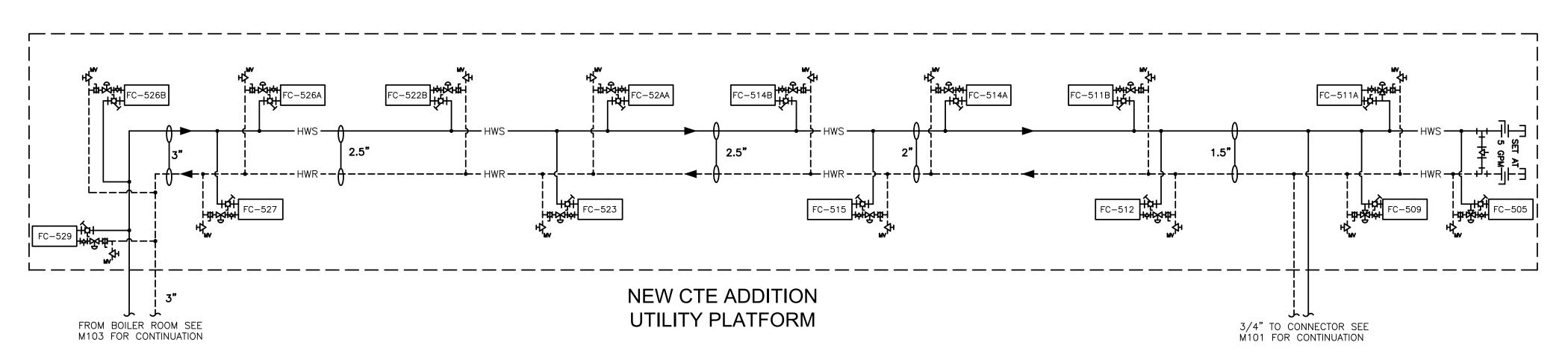
- A. Provide a graphical display for the unit ventilator, with a schematic of the unit and the following points. System on/off
- Occupancy status Float switch(es) and fire alarms
- Supply fan on/off, mode, and runtime Supply fan status and alarm
- Outside and return air damper commands HW / CHW coil valve commands
- CHW valve PID open/closed/modulate setpoints
- Dehumidification mode enable/disable limits • Belt runtime and time to next change
- Space temperature and heating/cooling setpoints Space temperature setpoint max and min limits
- Space override status
- Space humidity, alarm, and alarm setpoint (where applicable) • Space CO2 level, alarm, and alarm setpoint (where applicable)

Supply air temperature B. Provide a tabular graphical display for the following points:

- Associated exhaust fan(s) status, on/off/alarm, speed command, speed feedback, fault and fault text
- Associated common outside air isolation damper open/closed



003.3 TYPICAL FAN COIL CONTROL DIAGRAM



003.1 HOT WATER PIPING FLOW DIAGRAM

HOT WATER (HW) PLANT, PRI-SEC W/ DEDICATED PRIMARY PUMPS, ON/OFF STAINLESS STEEL BOILERS

- A. The HW plant shall operate:
- 1. There is a call for heating from the HVAC system (either heating or dehumidification call)], or
- 2. There is a freezestat trip for any piece of equipment utilizing HW. Then 3. Start lead HW boiler and start lead primary pump.

Load = $(500/12,000) \times Flow \times (HWR - HWS)$ to Building)

B. Calculate building capacity (in MBH) using the following formula:

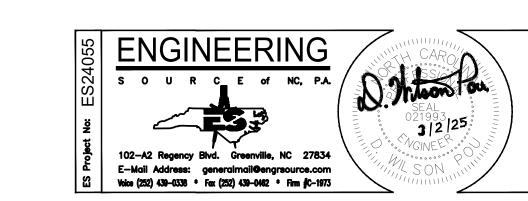
- A. Safety Devices: Safeties shall be in operation at all times (HW boiler/Pump in auto, hand, override, etc).
 - 1. Remote Emergency Power Off (EPO) Shutdown: When the EPO is pressed, stop boilers and pumps. Generate an alarm. Safety shall be hardwired to boilers, networked to pumps, and require manual reset.
- 2. After all safeties have cleared, allow HW plant operation.
- B. Primary HW Pumps (PHWP)
- 1. BAS shall control primary HW pumps (PHWP). Upon HW boiler start command, BAS shall start pump and prove flow for 2 minutes (adj) prior to starting the HW boiler. Upon HW boiler stop command, HW boiler shall be stopped, and pump shall continue to run until
- temperatures inside HW boiler have stabilized (5 minutes, adj) prior to stopping pump. 2. Determine pump status through a current sensor. If a pump fails to start as commanded, generate an alarm.
- C. HW Boilers General
 - a. Internal safeties (high pressure/temperature safety, flow safeties, etc) to protect equipment shall be provided by factory as required. In addition, provide the following points:
- A) Provide with hardwired HW boiler start/stop. 2. Staging (PID Control)
- a. HW boilers will operate in a lead/lag fashion.
- b. When HW plant is enabled, enable PID and stage HW boilers on/off to maintain HWS setpoint.
- A) Stage 1: Lead HW boiler B) Stage 2: Lag HW boiler
- C) PID shall be tuned to minimize fluctuations in HWS temperature while not creating excessive start/stops of HW boilers. HW boilers shall remain off for 15 minutes (adj) prior to staging on again.
- 3. Scheduled and Failover Rotation
- a. HW boiler shall rotate weekly (adj.) automatically. Via graphics, user shall be able to:
- A) Select which HW boiler shall be lead and lag on the next rotation.
- B) Schedule the day of week and hour of day to rotate HW boiler. C) Override rotation and keep lead/lag as-is.
- D) Rotate HW boiler immediately. E) Ability to "lockout" HW boiler for servicing, to prevent rotation to that HW boiler.
- b. Failover
- A) If the lead HW boiler fails, generate an alarm. Disable failed HW boiler and rotate lag HW boiler into lead. Operation shall continue as
- described above. If lag HW boiler is already running, do not disable and restart on rotation to lead. B) Failed HW boiler shall remain off until alarm is manually cleared (via graphic). Once cleared, HW boiler shall enter and remain in lag
- position until next rotation. D. Secondary HW Pumps (SHWP)
- General a. Occupied Mode Operation
- A) Secondary HW pump(s) shall run when there is any call for heating or dehumidification. Determine pump(s) status through a current sensor. If a pump(s) fails to start as commanded, generate an alarm.
- b. Unoccupied Mode Operation A) Secondary HW pump(s) shall run when the HW plant is enabled. Determine pump(s) status through a current sensor. If a pump(s)
- c. The pump(s) speed shall modulate to maintain differential pressure (DP) setpoint. All pumps shall operate at the same speed. A) Single DP sensor plants: The BAS shall modulate pump speed to satisfy the DP sensor setpoint (to be determined by TAB, initially 10
- psig, adj). If DP sensor signal goes to zero or infinity, generate an alarm and pump speed shall fail to last known speed. 1) Note to TAB contractor: final DP setpoint shall be sufficient to keep critical circuit CHW coil valve between 85 and 95% open. B) Reference the floorplans for DP sensor location(s).
- d. If any DP sensor is 2 psi (adj) below setpoint for 20 minutes (adj), generate an alarm.

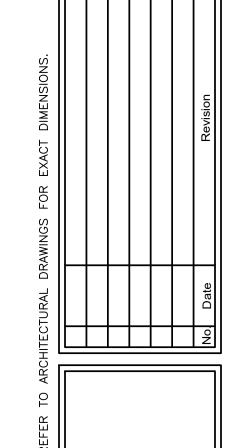
- a. Pumps shall operate in a lead/lag fashion.
- b. Limit pump ramp speeds (up and down) to prevent pressure blips during staging on and off.
- c. If the lead pump runs for 15 minutes (adj) above 95% speed (adj), stage on lag pump. Pump speeds should synchronize after approximately five minutes.
- d. If the lead and lag pump run for 15 minutes (adj) below 40% speed (adj), stage off lag pump. Ramp lag pump speed to minimum speed (0%) before stopping.
- a. Pump shall rotate weekly automatically. Via graphics, user shall be able to:
- C) Select which pump shall be lead and lag on the next rotation.
- D) Schedule the day of week and hour of day to rotate pump. E) Override rotation and keep lead/lag as-is.
- F) Rotate pumps immediately.
- G) Ability to "lockout" pump for servicing, to prevent rotation to that pump.
- A) If the lead pump fails, generate an alarm. Disable failed pump and rotate lag pump into lead. Operation shall continue as described above. If lag pump is already running, do not stop and restart on rotation to lead.
- B) Failed pump shall remain off until alarm is manually cleared (via graphic). Once cleared, pump shall enter and remain in lag position
- E. Effective HWS Temperature Setpoint 1. The following items will control the effective HWS temperature setpoint, in order of decreasing priority:
- a. Cold-End Corrosion Temperature Setpoint (Cast-Iron Boilers only)
- b. Operator Override
- 2. The HWS temperature to the building shall be controlled to the effective HWS temperature setpoint. If the HWS temperature is +/-10°F (adj) from effective setpoint for 15 minutes (adj), generate an alarm. Disable HWS temperature alarm when staging HW boilers.
- 3. Cold-End Corrosion Temperature Setpoint (Cast-Iron Boilers only): provide a minimum HWS return water temperature setpoint of 140°F (hardcoded, non-adj) to prevent possible cold-end corrosion of boiler. HWS shall control the boilers to ensure return water temperature does not drop below setpoint.

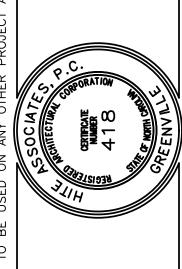
Graphical Interface

- A. Provide a graphical display for the HW plant, with a schematic of the plant and the following points: HW boiler start/stop
- System on/off
- Number of HW calls required for enable setpoint
- EPO and fire alarms • Pump status, on/off/alarm, speed command, speed feedback, fault and fault text (each pump/VFD)
- Current lead/lag pump, next rotation time, next lead/lag pump (upcoming rotation) and ability to adjust all.
- Pump accumulated runtime and runtime reset (each pump) HW boiler EWT and LWT (each HW boiler)
- Current lead/lag HW boiler, next rotation time, next lead/lag HW boiler (upcoming rotation) and ability to adjust all. • HW boiler accumulated runtime and runtime reset (each HW boiler)
- HW boiler load (each HW boiler, in MBH)
- HW boiler percent capacity (each HW boiler, in percent) • Differential pressure and setpoint (each DP sensor)
- HW supply and return temperatures to building
- HW supply temperature setpoint and alarm HW bridge temperature
- HW secondary flow (in GPM) HW secondary bypass valve command
- HW secondary bypass mixed water temperature Building HW Load (in MBH) Effective HWS temperature setpoint and alarm
- Chart for HW OAT reset, with four points shown on chart B. Provide a graphical table for the HW System Terminal Load, with the following points:
- Equipment Name
- HW valve position Terminal load
- Dehumidification status/call
- Freeze protection status/call Criticality ranking

003.2 HOT WATER PLANT CONTROL SEQUENCE







003

004.1 CHILLED WATER PIPING FLOW DIAGRAM

NOTES:

- 1) THIS DETAIL IS DIAGRAMATIC ONLY; SEE PLANS AND DETAILS FOR ACTUAL PIPING AND DEVICES
- 2) REFERENCE SPECIFICATION SECTION 15966 FOR PUMP STAGING CONTROLLER

CHILLED WATER (CHW) PLANT, PRI-SEC W/ DEDICATED PRIMARY PUMPS, AIR-COOLED CHILLERS A. The CHW plant shall operate and provide CHW to the building: 1. There is a call for cooling from the HVAC system, and 2. The Building Loop CHWR temperature is greater than or equal to 46°F. Then 3. Enable lead chiller and start lead primary pump. B. Calculate building capacity (in tons) using the following formula: Load = $(500/12,000) \times Flow \times (CHWR - CHWS to Building)$ A. Primary CHW Pumps (PCHWP)

- 1. Chiller shall control its own primary CHW pump via factory controls. Upon chiller enable command, chiller shall start pump and prove flow prior to starting the chiller. Upon chiller disable command, chiller shall stop, and pump shall continue to run until temperatures/pressures inside chiller have stabilized prior to stopping pump. 2. Determine pump status through a current sensor. If a pump fails to start as commanded,
- generate an alarm. Enable command for chiller shall be used as proxy for the CHW pump start. Provide delay to prevent nuisance alarms. B. Chillers

a. Chiller shall be provided with factory controls. Factory controls shall be sufficient and robust enough to allow chiller to operate nearly independently from the BAS. In general, factory controls will stage/modulate compressors, stage/modulate fans, and adjust capacity control to maintain CHW setpoint. Sequences as described below are for the interface between the BAS and factory controls and not intended to fully describe the chiller operation. Internal safeties (high/low pressure safeties, flow safeties, freeze protection, etc) to protect equipment shall be provided by factory as required, in addition to safeties listed below. Factory controls shall be configured/programmed to achieve the sequence as written below. Unless explicitly stated otherwise, factory will provide all control points, both hardware and software, as shown on the accompanying schematic or called for in sequence, and wire points back to factory controls. The BAS contractor will interface with the chiller to obtain data for trending, alarming, and graphics purposes. In

A) Provide with connection to BAS network. B) Provide with chiller entering water (EWT) and leaving water temperatures (LWT) and communicate values over BAS network.

C) Provide with chiller capacity (in percent) and communicate value over BAS network. D) Provide with writable point for CHW setpoint and communicate/adjust value over BAS E) Provide with hardwired chiller enable/disable.

2. Staging (Percent Capacity) a. Chillers shall operate in a lead/lag/lag fashion. A) The lead chiller shall remain enabled so long as the CHW plant is enabled.

b. Stage on first lag chiller if:

addition, provide the following points:

General

A) The lead chiller runs for 30 minutes (adj) above 95% capacity (adj) per factory controls, B) The lead chiller runs for 30 minutes (adj) above 95% capacity (adj) per calculated

C) The CHWS temperature to building is 2°F (adj) above setpoint for 30 minutes (adj). Chiller will via factory controls reach CHW setpoint. Fluctuations in CHWS temperature to building will not exceed 15 minutes. Lag chiller shall remain on for 15 minutes (adj) prior to staging off again.

c. Stage off lag chiller if: A) If the lead and lag chiller run for 30 minutes (adj) below 40% capacity (adj) per factory B) If the lead and lag chiller run for 30 minutes (adj) below 40% capacity (adj) per calculated capacity.

Chiller will ramp down and turn off via factory controls. Fluctuations in CHWS temperature to building will not exceed 15 minutes. First lag chiller shall remain off for 30 minutes (adj) prior to staging on again. d. Stage on second lag chiller if:

A) The lead and first lag chillers both run for 30 minutes (adj) above 95% capacity (adj) per B) The lead and first lag chillers both run for 30 minutes (adj) above 95% capacity (adj) per calculated capacity, or

C) The CHWS temperature to building is 2°F (adj) above setpoint for 30 minutes (adj). Chiller will via factory controls reach CHW setpoint. Fluctuations in CHWS temperature to building will not exceed 15 minutes. Second lag chiller shall remain on for 15 minutes (adj) prior to staging off again.

e. Stage off second lag chiller if: A) If all chillers run for 30 minutes (adj) below 40% capacity (adj) per factory controls, or B) If all chillers run for 30 minutes (adj) below 40% capacity (adj) per calculated capacity. Chiller will ramp down and turn off via factory controls. Fluctuations in CHWS

temperature to building will not exceed 15 minutes. First lag chiller shall remain off for 30 minutes (adj) prior to staging on again.

3. Scheduled and Failover Rotation a. Chillers CH-1 and CH-2 shall be lead and first lag during Occupied Mode Operation and shall rotate weekly (adj.) automatically. CH-3 shall be second lag chiller during Occupied Mode Operation. CH-3 shall be lead chiller during Unoccupied Mode Operation and CH-1 and CH-2 shall be first lag and second lag chillers and shall rotate weekly (adj.) automatically. Via graphics, user shall be able to:

A) Select which chiller shall be lead, first lag, and second lag on the next rotation. B) Schedule the day of week and hour of day to rotate chiller.

C) Override rotation and keep lead/lag/lag as-is.

to lead and rotate second lag chiller to first lag chiller.

pumps shall operate at the same speed.

D) Rotate pumps immediately.

General

D) Rotate chiller immediately. E) Ability to "lockout" chiller for servicing, to prevent rotation to that chiller.

b. Failover A) Chillers CH-1 and CH-2 shall be lead or first lag chillers. CH-3 shall always be second lag chiller in Occupied Mode Operation unless there is a chiller failure. B) If the lead chiller fails, generate an alarm. Disable failed chiller and rotate first lag chiller into lead and second lag chiller to first lag position. Operation shall continue as described above. If lag chiller is already running, do not disable and restart on rotation

C) If the first lag chiller fails, generate an alarm. Disable failed chiller and rotate second lag chiller to first lag position. Operation shall continue as described above. If second lag chiller is already running, do not disable and restart on rotation as first lag until failed

D) Failed chiller shall remain off until alarm is manually cleared (via graphic). Once cleared, chiller shall enter and remain in lag position until next rotation. C. Secondary CHW Pumps (SCHWP)

 a. Occupied Mode Operation A) Secondary CHW pump(s) shall run when there is any call for CHW. Determine pump(s) status through a current sensor. If a pump(s) fails to start as commanded, generate an alarm. b. Unoccupied Mode Operation

A) Secondary CHW pump(s) shall run when the CHW plant is enabled. Determine pump(s) status through a current sensor. If a pump(s) fails to start as commanded, generate an c. The pump(s) speed shall modulate to maintain differential pressure (DP) setpoint. All

A) Single DP sensor plants: The BAS shall modulate pump speed to satisfy the DP sensor setpoint (to be determined by TAB, initially 10 psig, adj). If DP sensor signal goes to zero or infinity, generate an alarm and pump speed shall fail to last known speed. 1) Note to TAB contractor: final DP setpoint shall be sufficient to keep critical circuit CHW coil valve between 85 and 95% open. B) Reference the floorplans for DP sensor location(s).

C) If any DP sensor is 2 psi (adj) below setpoint for 20 minutes (adj), generate an alarm. 2. Staging a. Pumps shall operate in a lead/lag fashion.

b. Limit pump ramp speeds (up and down) to prevent pressure blips during staging on and c. If the lead pump runs for 15 minutes (adj) above 95% speed (adj), stage on lag pump.

Pump speeds should synchronize after approximately five minutes. d. If the lead and lag pump run for 15 minutes (adj) below 40% speed (adj), stage off lag pump. Ramp lag pump speed to minimum speed (0%) before stopping.

3. Scheduled and Failover Rotation a. Pumps shall rotate weekly (adj.) automatically. Via graphics, user shall be able to: A) Select which pump shall be lead and lag on the next rotation B) Schedule the day of week and hour of day to rotate pump. C) Override rotation and keep lead/lag as-is.

E) Ability to "lockout" pump for servicing, to prevent rotation to that pump.

A) If the lead pump fails, generate an alarm. Disable failed pump and rotate lag pump into lead. Operation shall continue as described above. If lag pump is already running, do not stop and restart on rotation to lead.

B) Failed pump shall remain off until alarm is manually cleared (via graphic). Once cleared, pump shall enter and remain in lag position until next rotation.

D. Effective CHWS Temperature Setpoint 1. The following items will control the effective CHWS temperature setpoint, in order of

decreasing priority. Display the active mode on the graphics. a. Operator Override

b. Dehumidification (fixed setpoint) c. Energy Savings (calculated setpoint)

2. The effective CHWS temperature setpoint shall be communicated to chiller factory controls. If the CHWS temperature is +/-2°F (adj) from effective setpoint for 15 minutes (adj), generate an alarm. Disable CHWS temperature alarm when staging chillers. 3. Dehumidification a. On a call for dehumidification from any piece of equipment utilizing CHW, CHW plant shall

enter dehumidification mode. b. CHWS temperature setpoint shall be 42°F (adj).

c. If there is no call for dehumidification from any piece of equipment utilizing CHW for 30 minutes, CHW plant shall leave dehumidification mode. E. Freeze Protection

1. On a freezestat trip for any piece of equipment utilizing CHW, enable SCHWP operation. Chillers shall remain off.

Graphical Interface A. Provide a graphical display for the CHW plant, with a schematic of the plant and the following

 System on/off • Number of CHW calls required for enable setpoint EPO and fire alarms

• Pump status, on/off/alarm, speed command, speed feedback, fault and fault text (each • Current lead/lag pump, next rotation time, next lead/lag pump (upcoming rotation) and ability to

 Chiller enable/disable Chiller EWT and LWT (each chiller)

Pump accumulated runtime and runtime reset (each pump)

• Chiller load (tons), percent run load amps (RLA), and percent capacity (each chiller, via hardwire or BAS network connection) Chiller percent capacity (each chiller, calculated) Chiller CHW setpoint (each chiller)

• Chiller pressures, temperatures, alarms, and other data via BAS network connection (each

• Current lead/first lag/second lag chiller, next rotation time, next lead/first lag/second lag chiller (upcoming rotation) and ability to adjust all.

• Chiller accumulated runtime and runtime reset (each chiller) Differential pressure and setpoint (each DP sensor) CHW supply and return temperatures to building

 Building CHW Load (in tons) • Effective CHWS temperature mode, setpoint, and alarm

• Dehumidification CHWS temperature setpoint • Chart for CHW OAT reset, with four points shown on chart CHW bridge temperature

B. Provide a graphical table for the CHW System Terminal Load, with the following points: Equipment Name CHW valve position

• Dehumidification status/call • Freeze protection status/call Criticality ranking

Terminal load

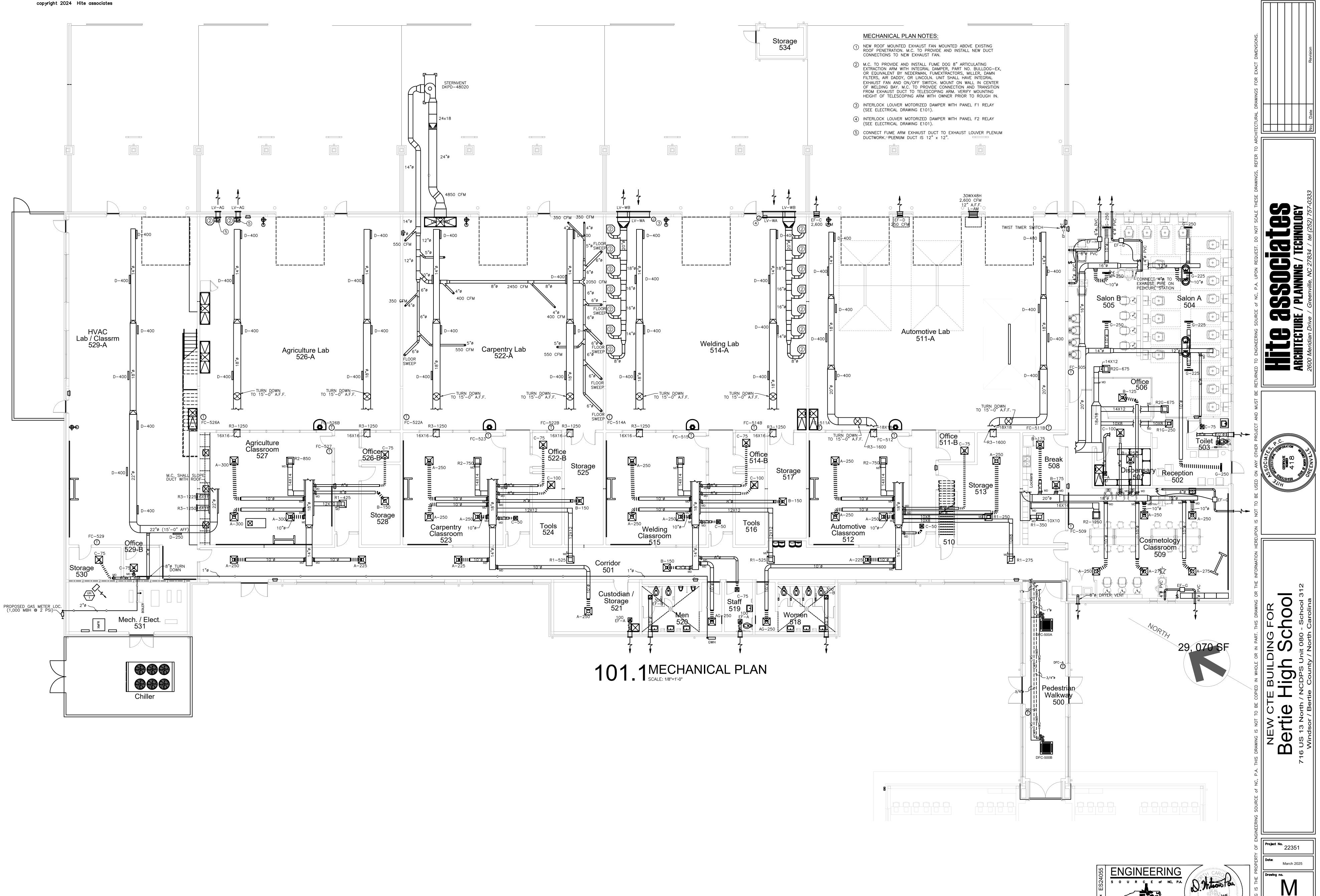
CHW building flow (in GPM)

CHW building bypass valve command

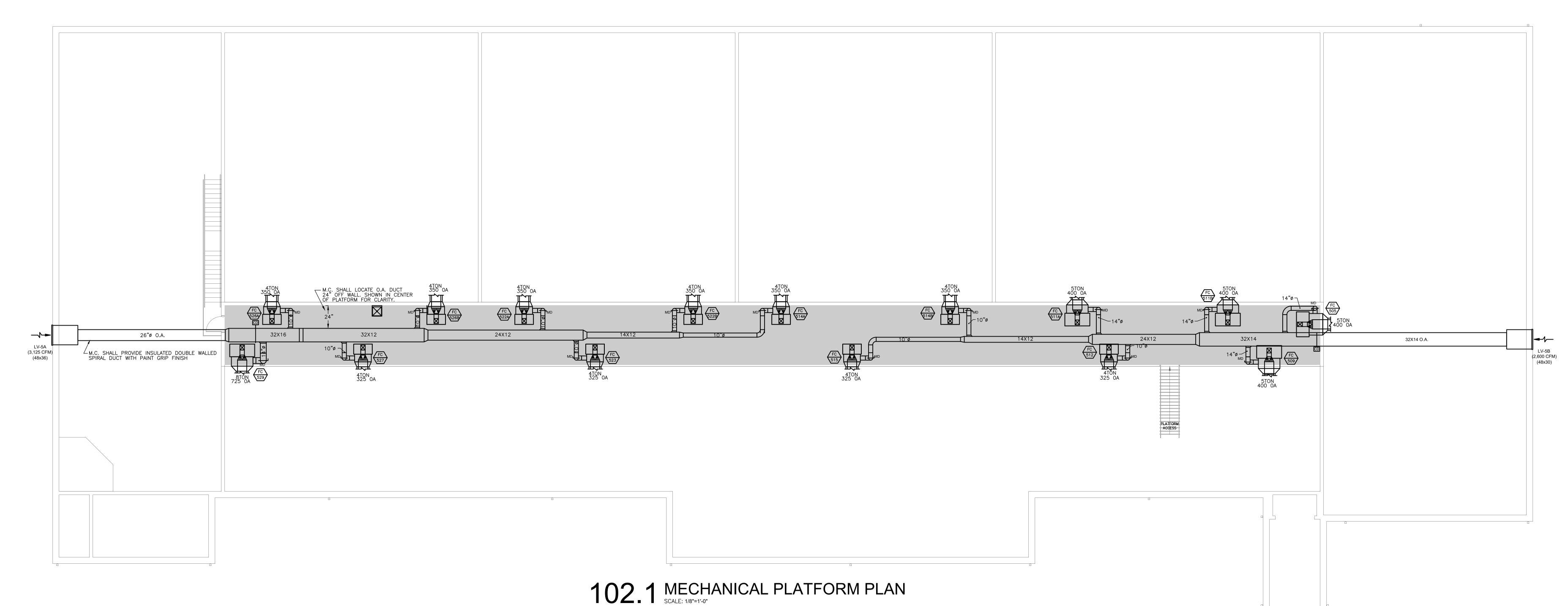
CHW building bypass mixed water temperature

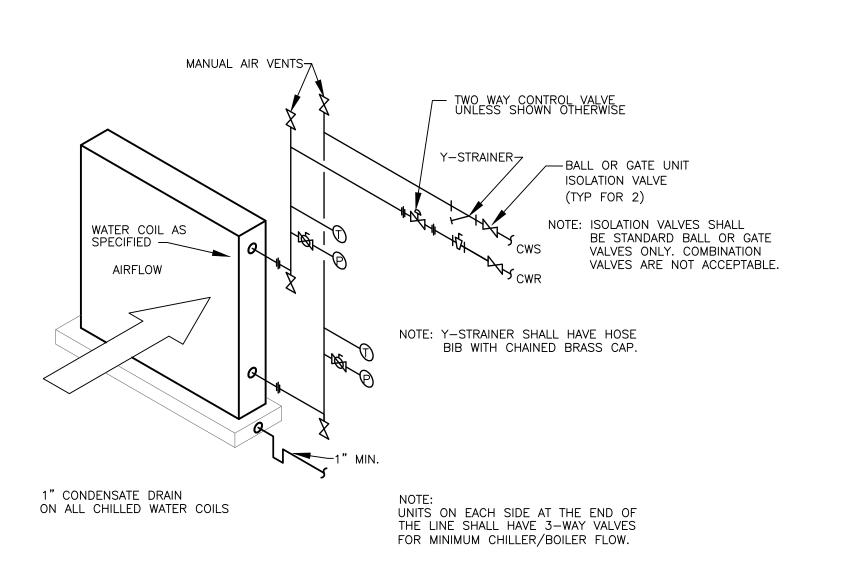
ENGINEERING

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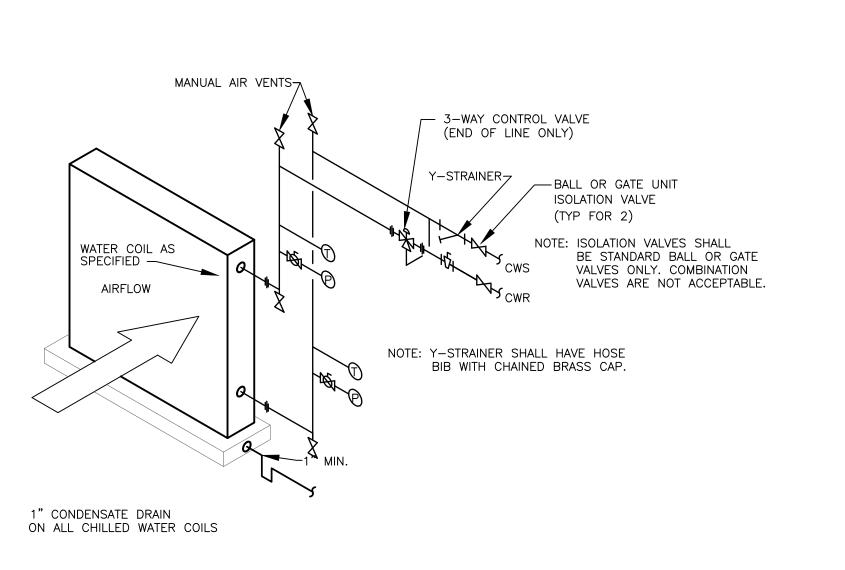


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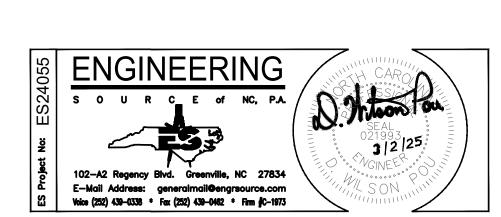




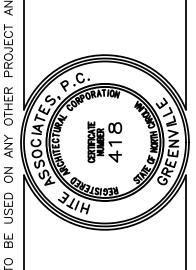
102.2 2-WAY VALVE COIL PIPING DETAIL SCALE: N.T.S.



102.3 3-WAY VALVE COIL PIPING DETAIL SCALE: N.T.S.



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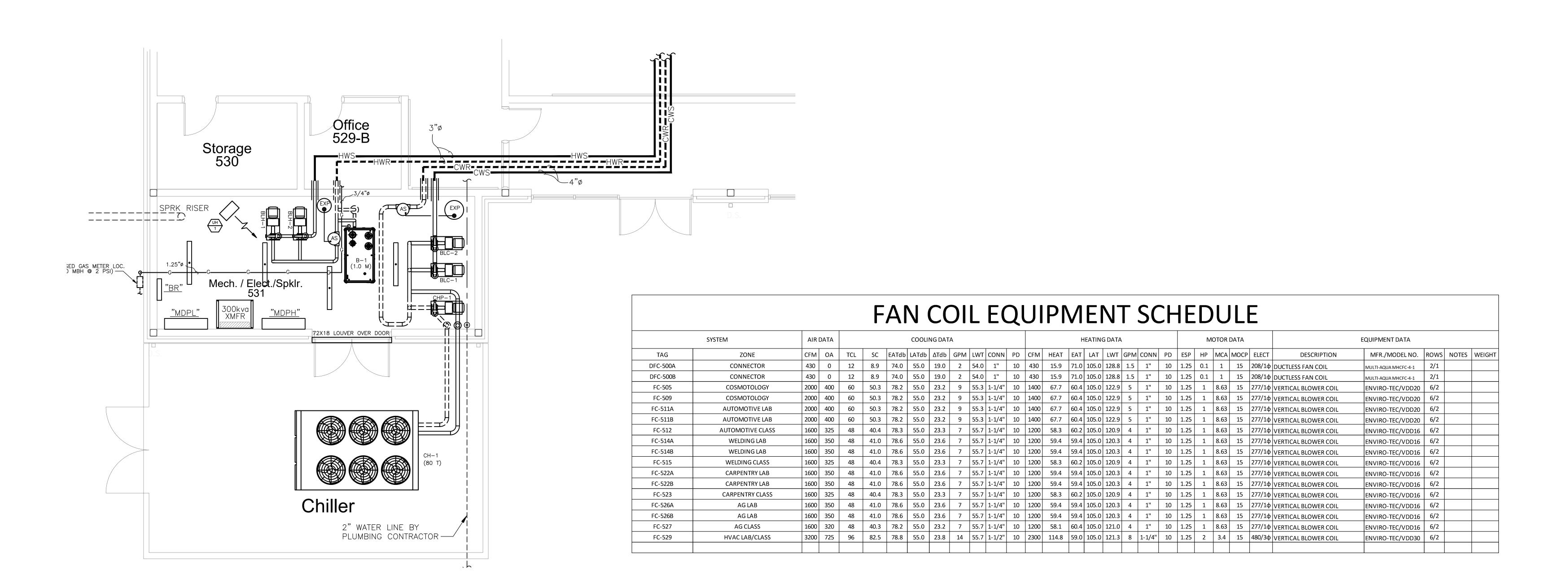
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March 2025

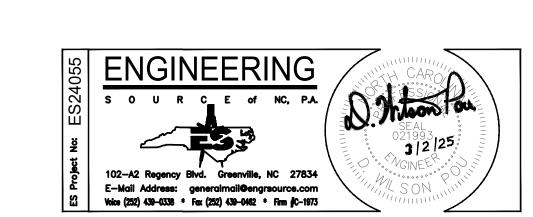
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IM 102

103.1 MECHANICAL PLATFORM PIPING PLAN SCALE: 1/8"=1'-0"



103.2 BOILER ROOM PIPING PLAN SCALE: 1/8"=1'-0"



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Project No.
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March 2025

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