HVAC Replacement

10141 Cash Road
Stafford, TX 77477

INFINITY PROJECT # H20041.00

A PROJECT FOR

HCC Stafford Science & Technology Building

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MECHANICAL ABBREVIATIONS

(E)	EXISTING TO REMAIN
AC	AIR CONDITIONING UNIT
AD	ACCESS DOOR
AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
AL	ACOUSTICAL LINING
AP	ACCESS PANEL
BDD	BACK DRAFT DAMPER
BFC	BELOW FINISHED CEILING
BHP	BRAKE HORSEPOWER
BMS	BUILDING MANAGEMENT SYSTEM
BTU	BRITISH THERMAL UNIT
CA	COMPRESSED AIR
CD	CEILING DIFFUSER
CFM	CUBIC FEET PER MINUTE
CH	CHILLER
CHP	CHILLED WATER PUMP
CHR	CHILLED WATER RETURN
CHS	CHILLED WATER SUPPLY
CO	CLEAN OUT
COND	CONDENSATE DRAIN
CP	CONDENSATE PUMP
CT	COOLING TOWER
CU	CONDENSING UNIT
CUH	CABINET UNIT HEATER
CWP	CONDENSER WATER PUMP
CWR	CONDENSER WATER RETURN
CWS	CONDENSER WATER SUPPLY
DB	DRY BULB
DWP	DOMESTIC WATER PUMP
DX	DIRECT EXPANSION
EAT	ENTERING AIR TEMPERATURE
EF	EXHAUST FAN
ERU	ENERGY RECOVERY UNIT
ESP	EXTERNAL STATIC PRESSURE
ET	EXPANSION TANK
EUH	ELECTRIC UNIT HEATER
EWC	ELECTRIC WATER COOLER
EWT	ENTERING WATER TEMPERATURE
FA	FREE AREA
FCU	FAN COIL UNIT
FD	FIRE DAMPER
FLA	FULL LOAD AMPS
FLR	FLOOR
FOP	FUEL OIL PUMP
FP	FIRE PUMP
FPM	FEET PER MINUTE
FPTU	FAN POWERED TERMINAL UNIT
FSD	COMBINATION FIRE AND SMOKE DAMPER
GPM	GALLONS PER MINUTE
HP	HORSEPOWER
HP	HEAT PUMP
HW	HOT WATER
HWP	HOT WATER PUMP
HWR	HEATING HOT WATER RETURN
HWS	HEATING HOT WATER SUPPLY
HX	HEAT EXCHANGER
HZ	HERTZ
ID	INSIDE DIAMETER
KW	KILOWATT
LAT	LEAVING AIR TEMPERATURE
LB	POUND
LF	LINEAR FEET
LWT	LEAVING WATER TEMPERATURE
MBH	THOUSAND BTU PER HOUR
MOCP	MAXIMUM OVERCURRENT PROTECTION
MOD	MOTOR OPERATED DAMPER
MTD	MOUNTED
MUA	MAKE-UP AIR UNIT
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NK	NECK
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OAHU	OUTSIDE AIR HANDLING UNIT
OAT	OUTSIDE AIR TEMPERATURE
OBD	OPPOSED BLADE DAMPER
OD	OUTSIDE DIAMETER
PBD	PARALLEL BLADE DAMPER
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH (GAUGE)
PTAC	PACKAGED TERMINAL AIR CONDITIONER
RA	RETURN AIR
RAG	RETURN AIR GRILL
RCP	REFLECTED CEILING PLAN
RF	RETURN FAN
RH	RELATIVE HUMIDITY
RHC	REHEAT COIL
RPM	REVOLUTIONS PER MINUTE
SA	SUPPLY AIR
SD	SMOKE DAMPER
SEF	SMOKE EXHAUST FAN
SF	SUPPLY FAN
SP	STATIC PRESSURE
TYP	TYPICAL
UH	UNIT HEATER
UON	UNLESS OTHERWISE NOTED
VAV	VARIABLE AIR VOLUME UNIT
VD	VOLUME DAMPER
VFD	VARIABLE FREQUENCY DRIVE
VTR	VENT THROUGH ROOF
WB	WET BULB
°F	DEGREES FAHRENHEIT

MECHANICAL LEGEND

- BUTTERFLY VALVE
- BALL VALVE
- SWING CHECK VALVE
- GATE VALVE, ANGLE
- THREE WAY CONTROL VALVE
- TWO WAY CONTROL VALVE
- SOLENOID VALVE
- PRESSURE REDUCING VALVE (PRV)
- MANUAL AIR VENT
- BALANCING VALVE
- DIRECTION OF FLOW
- STRAINER
- STRAINER WITH BLOW OFF VALVE
- PIPE RISING UP
- PIPE DROPPING DOWN
- PIPE CAP
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- UNION
- ANCHOR
- GUIDE
- EXPANSION JOINT
- THERMOMETER
- GAS PRESSURE REGULATOR
- STRAINER
- ELECTRICALLY TRACED PIPING
- EXPANSION LOOP (WxH)
- RETURN LINEAR DIFFUSER
- LINEAR DIFFUSER WITH PLENUM
- SUPPLY DIFFUSER
- FLEXIBLE DUCTWORK
- RETURN GRILLE
- EXHAUST GRILLE
- DIRECTION OF FLOW
- THERMOSTAT
- HUMIDISTAT
- PRESSURE SENSOR
- EQUIPMENT DESIGNATION
- AIR OUTLET/INLET DEVICE DESIGNATION

MECHANICAL LEGEND

- POINT OF CONNECTION (NEW TO EXISTING)
- DUCT SIZE (CLEAR INSIDE DIMENSION) FIRST FIGURE INDICATES PLAN SIZE
- ROUND DUCT DIAMETER SIZE (CLEAR INSIDE DIMENSION)
- RECTANGULAR OR SQUARE TO ROUND OR OVAL TRANSITION
- ROUND EXHAUST DUCT UP
- ROUND EXHAUST DUCT DOWN
- ROUND RETURN DUCT UP
- ROUND RETURN DUCT DOWN
- ROUND SUPPLY DUCT UP
- ROUND SUPPLY DUCT DOWN
- RECTANGULAR EXHAUST DUCT UP
- RECTANGULAR EXHAUST DUCT DOWN
- RECTANGULAR RETURN DUCT UP
- RECTANGULAR RETURN DUCT DOWN
- RECTANGULAR SUPPLY DUCT UP
- RECTANGULAR SUPPLY DUCT DOWN
- VOLUME DAMPER (MANUAL)
- FLEXIBLE CONNECTION
- MOTORIZED DAMPER
- SMOKE DAMPER
- FUSIBLE LINK FIRE DAMPER
- MOTORIZED FIRE SMOKE DAMPER
- BACK DRAFT DAMPER
- VANED ELBOW
- RADIUS ELBOW
- ACCESS DOOR (AD)
- BRANCH DUCT TAKE-OFF
- INTERNALLY LINED DUCT

MECHANICAL GENERAL NOTES

1. ALL WORK PERFORMED FOR THIS PROJECT SHALL BE IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL BUILDING CODES, MECHANICAL CODES, ENERGY CODES AND THEIR AMENDMENTS. THE MORE STRINGENT CODE SHALL APPLY.
2. CONTRACTOR SHALL VISIT THE PROJECT SITE TO BECOME FAMILIAR WITH THE EXISTING CONDITIONS. FAILURE TO DO SO SHALL NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FROM PERFORMING WORK PROPERLY.
3. CONTRACTOR IS RESPONSIBLE FOR COORDINATING ALL WORK UNDER THEIR CONTACT PRIOR TO FABRICATION, ROUGH-IN AND FINAL CONNECTION.
4. HVAC AND PIPING WORK IS SHOWN DIAGRAMMATIC IN NATURE. DRAWINGS SHOULD NOT BE SCALED. PROVIDE ALL OFFSETS AND FITTINGS REQUIRED TO FIT WITHIN AVAILABLE SPACE. COORDINATE WORK WITH STRUCTURAL, ARCHITECTURAL, PLUMBING AND ELECTRICAL PRIOR TO INSTALLATION.
5. LOCATE ALL EQUIPMENT TO ALLOW FOR SERVICE ACCESS. COORDINATE LOCATION WITH OTHER TRADES. DO NOT ALLOW ACCESS TO BE ENCROACHED UPON BY CONDUITS, PIPE AND OTHER MATERIALS.
6. PROVIDE ACCESS DOORS FOR ALL EQUIPMENT, VALVES, DAMPERS, ETC. ABOVE ALL NON-LAY-IN CEILINGS FOR MAINTENANCE AND SERVICE.
7. ALL RECTANGULAR AND ROUND DUCTWORK IS TO BE CONSTRUCTED OF GALVANIZED SHEET METAL, UNLESS NOTED OTHERWISE. ALL DUCTWORK SHALL BE CONSTRUCTED PER THE LATEST SMACNA DUCT STANDARDS.
8. ALL DUCTWORK SIZES INDICATED ARE CLEAR INSIDE DIMENSIONS. CONTRACTOR TO ALLOW FOR DUCT LINING AS REQUIRED. IF RESIZING IS REQUIRED IT SHALL BE DONE PER THE EQUAL FRICTION METHOD.
9. DUCT RUN-OUTS TO SUPPLY AIR DIFFUSERS SHALL BE THE SAME SIZE AS THE DIFFUSER NECK.
10. FOR EACH HEATING OR COOLING UNIT PROVIDE A TEMPERATURE SENSING DEVICE. LOCATE DEVICE WHERE SHOWN ON DRAWINGS AND COORDINATE LOCATION WITH ARCHITECT. OTHER WALL DEVICES AND PER ADA GUIDELINES.
11. INSTALL ALL MECHANICAL EQUIPMENT PER MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS. IF CONTRACTOR SUBSTITUTES EQUIPMENT AND AFTER APPROVAL BY THE ENGINEER, THE CONTRACTOR SHALL MAKE ALL NECESSARY MODIFICATIONS TO THE SYSTEM AS REQUIRED TO PROVIDE INSTALLATION AT CONTRACTORS COST.
12. CONTRACTOR TO VERIFY ALL ELECTRICAL CHARACTERISTICS OF MECHANICAL EQUIPMENT WITH ELECTRICAL DRAWINGS BEFORE EQUIPMENT RELEASE.
13. COORDINATE ALL SLEEVE, CHASE AND SLAB BLOCK-PUTS WITH EXISTING STRUCTURE. COORDINATE ACTUAL EQUIPMENT DIMENSION WITH OTHER TRADES.
14. COORDINATE CEILING DIFFUSER FRAME TYPES AND COLORS WITH ARCHITECTURAL CEILINGS.
15. FOR PIPES PASSING THROUGH FIRE RATED WALLS AND FLOORS PROVIDE WITH UL LISTED ASSEMBLIES AND MATERIALS TO OBTAIN REQUIRED FIRE RATING.
16. PROVIDE 1-1/2" ACOUSTICAL LINING ON ALL DUCTWORK WITHIN 10'-0" OF RTU/AHU. ALL OTHER DUCTWORK IS TO BE INSULATED WITH 1-1/2" FIBERGLASS WRAP/INSULATION.
17. PROVIDE ALL TRANSITION AS NECESSARY TO MAKE CONNECTION TO HVAC EQUIPMENT.
18. ALL PIPING, DUCTWORK AND EQUIPMENT SHALL BE SUPPORTED PER THE LATEST EDITION OF SMACNA.
19. PROVIDE DUCT ACCESS DOORS ON ALL MOTORIZED DAMPERS, FIRE DAMPERS, SMOKE DAMPERS, BACKDRAFT DAMPERS AND FIRE/SMOKE DAMPERS.
20. CONTRACTOR SHALL COORDINATE WITH BUILDING MANAGEMENT AND BUILDING ENGINEER FOR ALL BASE BUILDING STANDARDS, DEVICE, CONTROLS AND ALL ASSOCIATED EQUIPMENT AS REQUIRED FOR A COMPLETE INSTALLATION.
21. FLEXIBLE DUCTWORK FOR CONNECTION TO AIR DEVICES SHALL BE LIMITED TO 5'-0" IN LENGTH. FOR LONGER CONNECTIONS USE INSULATED RIGID SPIRAL ROUND DUCTWORK. SPLIT SEAM ROUND DUCTWORK IS NOT ALLOWED.
22. PROVIDE MANUAL VOLUME DAMPERS AT DUCT TAKEOFFS FROM MAINS. DAMPERS SHALL BE LOCATED IN ACCESSIBLE LOCATIONS. AVOID THE INSTALLATION OF DAMPERS AT DIFFUSERS DUE TO NOISE ISSUES.
23. A CERTIFIED BALANCE COMPANY SHALL BE USED TO BALANCE ALL DEVICES TO CFM AND GPM AS REQUIRED ON THE DRAWINGS. PROVIDE BALANCING REPORTS OF ALL EQUIPMENT AND DEVICES TO OWNER.
24. PROVIDE SMACNA DUCT TRANSITIONS TO ALL TERMINAL UNIT INLETS AND OUTLETS FOR CONNECTION TO DUCTWORK.
25. ALL EXHAUST FAN OUTLETS SHALL BE A MINIMUM OF 10' FROM ALL BUILDING AIR INTAKES AND OPENINGS.
26. ALL EXTERIOR BUILDING PENETRATION SHALL BE SEALED WATER TIGHT. ALL INTERIOR WALL AND FLOOR PENETRATIONS FOR DUCTWORK AND PIPING SHALL BE MEET THE FIRE RATING OF THE ARCHITECTURAL PLANS AND WILL BE INSTALLED TO MEET ALL UL ASSEMBLY REQUIREMENTS.
27. PROVIDE MANUAL BALANCE DAMPERS AT EACH BRANCH DUCT TO ALL SUPPLY DIFFUSERS, EXHAUST GRILLS AND DUCTED RETURN GRILLES.
28. PROVIDE 4" CONCRETE HOUSEKEEPING PAD FOR ALL FLOOR MOUNTED AND GRADE MOUNTED EQUIPMENT. UNLESS NOTED OTHERWISE.
29. REFER TO ARCHITECTURAL DRAWINGS FOR EXACT LOUVER LOCATIONS AND COORDINATE LOUVER PLACEMENT WITH ARCHITECT.
30. PROVIDE MOTORIZED DAMPERS ON ALL EXTERIOR BUILDING PENETRATIONS. INTERLOCK WITH RESPECTIVE FANS. DAMPER TO FAIL CLOSED, UNLESS NOTED OTHERWISE.
31. PROVIDE SMOKE DETECTOR/S ON ALL AIR HANDLING EQUIPMENT 2,000 CFM OR GREATER TO MEET ALL NFPA REQUIREMENTS. FOR AIR HANDLING EQUIPMENT 15,000 CFM OR GREATER PROVIDE MOTORIZED ISOLATION DAMPERS ON ALL INLETS AND OUTLETS OF THE UNIT TO MEET ALL NFPA REQUIREMENTS. DAMPERS TO BE INTERLOCKED WITH UNIT.
32. ALL FCU'S SHALL HAVE DISCONNECT SWITCH AT UNIT.
33. ALL AREAS WITH WALLS TO DECK SHALL HAVE PROPER RETURN AIR OPENINGS CUT TO ALLOW FOR 500 FPM RETURN AIR VELOCITY.
34. ALL FAN COIL UNITS AND OUTSIDE AIR UNITS SHALL BE EQUIPPED WITH MERV-8 FILTER.
35. CONSTRUCTION PRE-FILTERS SHALL BE USED ON ANY EXISTING UNITS NOT IN SCOPE AND REMOVED UPON COMPLETION OF PROJECT.
36. ALL FAN COIL UNITS AND OUTSIDE AIR UNITS SHALL BE PROVIDED WITH CONDENSATE DETECTION DEVICE IN OVERFLOW DRAIN PAN.
37. ALL CONDENSATE DRAIN PANS SHALL HAVE DRAIN LINE TO CODE APPROVED LOCATION. PAN SHALL BE INSTALLED AS TO SLOPE TOWARD DRAIN OUTLET.
38. ALL SIDES OF FAN COIL UNITS SHALL BE ACCESSIBLE WITH NOTHING INHIBITING ACCESS PANELS, UNIONS, DRAIN CONNECTIONS, ELECTRICAL CONTROL BOXES OR VALVES.
39. ALL CHILLED WATER CONTROL VALVES, ISOLATION VALVES, BALANCING VALVES AND OTHER VALVES SHALL BE INSTALLED WITH UNIONS ON BOTH SIDES.
40. CONTRACTOR SHALL PROVIDED A TOTAL OF 38 DISCHARGE AIR SENSORS AFTER EVERY HOT WATER COIL AND DAMPER IN MULTI-ZONE AIR HANDLERS.

MECHANICAL SHEET LIST

SHEET NUMBER	SHEET NAME
M00.01	MECHANICAL COVER SHEET
M00.02	MECHANICAL SCHEDULES
M00.03	MECHANICAL SPECIFICATIONS
M02.01	MECHANICAL PLAN - A
M02.02	MECHANICAL PLAN - B
M60.01	MECHANICAL DETAILS

MECHANICAL DEMOLITION NOTES

1. DEMOLITION WORK SHALL BE PERFORMED TO ACCOMPLISH REPLACEMENT WORK WITH A MINIMUM AMOUNT OF SYSTEM DOWNTIME.
2. SCHEDULE ALL SHUTDOWNS AND DEMOLITION WORK IN ADVANCE WITH OWNER.
3. CONTRACTOR SHALL BE RESPONSIBLE TO VERIFY THE CONDITION OF EXISTING EQUIPMENT, EXACT SIZES AND LOCATION OF EXISTING DUCT, PIPING, EQUIPMENT, ETC. BEFORE DEMOLITION WORK BEGINS. REPORT ANY DISCREPANCIES BETWEEN FIELD CONDITIONS AND PLANS TO ARCHITECT AND ENGINEER PRIOR TO THE START OF DEMOLITION WORK.
4. CONTRACTOR SHALL REMOVE EXISTING HVAC EQUIPMENT, ASSOCIATED MATERIALS, AND SUPPORTS AS INDICATED. ALL UNUSED EQUIPMENT AND MATERIALS SHALL BE REMOVED BACK TO THE SOURCE. PATCH EXISTING CONDITIONS TO REMAIN AS NECESSARY.
5. CONTRACTOR SHALL VERIFY CLEARANCE REQUIREMENTS AND ROUTING OF NEW SYSTEMS PRIOR TO FABRICATION AS RISES, DROPS, AND OFFSETS MAY BE NECESSARY BECAUSE OF EXISTING FIELD CONDITIONS.
6. CONTRACTOR SHALL COORDINATE ALL CEILING REMOVAL THAT IS NOT INDICATED TO BE REMOVED WITH OTHER TRADES. NOTIFY ARCHITECT AND OWNER PRIOR TO CEILING REMOVAL. REMOVE ONLY THAT PORTION NECESSARY TO ACCESS AND COMPLETE THE WORK. UPON COMPLETION THE CEILING IS TO BE REPLACED TO MATCH EXISTING.
7. FOR ANY WORK REQUIRED OUTSIDE OF THE PRIMARY LIMITS OF CONSTRUCTION, CONTRACTOR SHALL ADHERE TO THE OWNER'S INFECTION CONTROL PROCEDURES. NOTIFY ARCHITECT AND OWNER PRIOR TO ANY WORK THAT WOULD IMPACT OCCUPANTS. ISOLATE AND REMOVE ONLY THAT AREA NECESSARY TO ACCESS AND COMPLETE THE WORK. UPON COMPLETION CLEAN THE AREA, REMOVE ANY TEMPORARY ISOLATION, AND REPLACED EFFECTED MATERIALS TO MATCH EXISTING.
8. BALANCING CONTRACTOR SHALL MEASURE AND RECORD EXISTING SYSTEMS AFFECTED BY THIS RENOVATION PRIOR TO ANY DEMOLITION WORK. MEASUREMENTS SHALL INCLUDE SUPPLY AND RETURN AIR FLOWS AT EXISTING AIR HANDLING UNITS; SUPPLY, RETURN AND EXHAUST AIR FLOW AT ALL DUCT MAINS AND BRANCHES SERVING EXISTING AREAS TO REMAIN; AND THE FLOW AT PUMPS. BALANCING CONTRACTOR SHALL NOTIFY THE OWNER AND ENGINEER OF ALL DEFICIENCIES FOUND IN ANY OF THE SYSTEMS.
9. EXISTING AIR DISTRIBUTION SYSTEMS SHALL BE REBALANCED TO MEET THE EXISTING AIR FLOW AS WELL AS THE FLOW REQUIREMENTS INDICATED IN THE CONSTRUCTION DOCUMENTS.
10. CONTRACTOR SHALL PATCH AND REPAIR ANY EXISTING DUCTWORK FOUND TO HAVE AIR LEAKS OR MISSING INSULATION FOR EXISTING HVAC SYSTEMS IN AREA OF WORK.

CODE SUMMARY

A. **APPLICABLE CODES INCLUDE BUT ARE NOT LIMITED TO:**
1. CITY OF STAFFORD MECHANICAL CODE: 2009 IMC, WITH AMENDMENTS
2. CITY OF STAFFORD BUILDING CODE: 2009 IBC, WITH AMENDMENTS
3. CITY OF STAFFORD COMMERCIAL ENERGY CONSERVATION CODE: 2009 IECC WITH AMENDMENTS

B. **HVAC DESIGN CRITERIA**
1. INDOOR TEMPERATURE: 75°F COOLING; 73°F HEATING
2. OUTDOOR DESIGN CONDITIONS (HOUSTON, TEXAS) PER 2009 IECC COH AMENDMENTS, TABLE 302.2:
   a. 96°F DB, 80°F WB SUMMER; 28°F DB WINTER
   b. 3059 DEGREE DAYS COOLING; 1371 DEGREE DAYS HEATING
   c. CLIMATE ZONE 2A

C. **OUTSIDE AIR REQUIREMENTS- HOUSTON AMENDMENTS, IMC TABLE 4-1**

1.	OFFICES:	0.06 CFM /SQ FT + 5 CFM/ PERSON
2.	RECEPTION:	0.06 CFM /SQ FT + 5 CFM/ PERSON
3.	CORRIDOR:	0.06 CFM /SQ FT
4.	CONFERENCE:	0.06 CFM /SQ FT + 5 CFM/ PERSON

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STATE OF TEXAS
NICHOLAS W. BADKE
124969
LICENSED
PROFESSIONAL ENGINEER
03/23/20

No.	Description	Date
	ISSUE FOR PERMIT	03/23/20

HCC Stafford Science & Technology Building

HVAC Replacement

MECHANICAL COVER SHEET

Project Number	H20041.00
Date	03/12/20
Drawn By	EFW
Checked By	NWB

M00.01

Scale 1/8" = 1'-0"

AHU SCHEDULE

EQUIPMENT		SERVICE	LOCATION	UNIT			TOTAL AIR FLOW	MIN OUTSIDE AIRFLOW	SUPPLY FAN					HYDRONIC COOLING COIL										HYDRONIC HEATING COIL							AIR FILTER		ELECTRICAL DATA		EMERGENCY POWER	VARIABLE SPEED	OPERATIONAL WEIGHT (LBS.)	NOTES
														EAT		LAT		CAPACITY																				
TYPE	NUMBER			MANUFACTURER	MODEL	TYPE			CFM	EXT. S.P. (IN.W.G.)	RPM	BHP	HP	DB (°F)	WB (°F)	DB (°F)	WB (°F)	TOTAL MBH	SENSIBLE MBH	GPM	EWT (°F)	LWT (°F)	P.D. WATER (FT.H2O)	EAT (°F)	LAT (°F)	CAPACITY MBH	GPM	EWT (°F)	LWT (°F)	P.D. WATER (FT. H2O)	FACE VELOCITY (FPM)	MERV	VOLTAGE	PHASE				
OAI	3	AHU-3 AHU-5	MECH A159	JOHNSON CONTROLS	SOLUTION-XTI-36x54	HORIZONTAL	3525	3525	3525	0.5	3032	2.15	3	97	77	55	54	285.5	169.9	40.8	42	56	9.6	20	50	114.2	11.4	180	160	4.3	500	8	460	3	NO	YES	1950	1,2,3,4,5

NOTES:

1. PROVIDE WITH FACTORY MOUNTED DISCONNECT.
2. PROVIDE AUXILIARY DRAIN PAN AND FLOAT SWITCH TO DEENERGIZE UNIT IF CONDENSATE COLLECTS IN DRAIN PAN.
3. PROVIDE LITTLE GIANT CONDENSATE PUMP, 115V/SINGLE PHASE. INTERLOCK CONDENSATE PUMP WITH AHU.
4. UNIT CONSTRUCTION SHALL BE 2" FOAM DOUBLE WALL.
5. PROVIDE HINGED ACCESS DOORS ON FILTER, COIL, AND FAN SECTIONS.

DX HEAT PUMP SPLIT SYSTEM SCHEDULE

EQUIPMENT			MANUFACTURER MODEL NUMBER			INDOOR UNIT															OUTDOOR UNIT									
						COOLING COIL									REVERSE CYCLE HEATING			ELECTRICAL INFORMATION							ELECTRICAL INFORMATION					
									EAT		LAT		CAPACITY																	
TYPE	NUMBER	SERVICE	MANUFACTURER	INDOOR UNIT	OUTDOOR UNIT	CFM	OA CFM	FACE VELOCITY (FPM)	DB (°F)	WB (°F)	DB (°F)	WB (°F)	SENSIBLE MBH	TOTAL MBH	REFRIGERANT	CAPACITY MBH	EAT (°F)	LAT (°F)	VOLTAGE	PHASE	MCA	MOP	OPERATING WEIGHT (LBS.)	TYPE	NUMBER	AMBIENT TEMPERATURE	EER/ HSPF	VOLTAGE	PHASE	MCA	MOP	OPERATING WEIGHT (LBS.)	NOTES
FCU	1	SECURITY OFFICES	YORK	DHR36NDB21S	DHR36CSB21S	875	235	500	83.6	69.5	55	54	19.9	28	R-410A	17.1	68	86	208	1	2.9	15	102	ACCU	1	105	10 / 9	208	1	16.5	25	172	1,2,3
FCU	2	COMP. CONTROL	YORK	DHR36NDB21S	DHR36CSB21S	875	100	500	78.3	65.1	56	54	18.5	25.6	R-410A	17.1	68	88	208	1	2.9	15	102	ACCU	2	105	10 / 9	208	1	16.5	25	172	1,2,3
FCU	3	STUDIO	YORK	JCI AHD040	YVAHP072B41S	3720	110	500	66.5	55.5	49	48	62.0	62.5	R-410A	51.2	70	87	460	3	5.1	15	585	ACCU	3	105	12.7 / 3.3 COP	460	3	12.3	20	451	1,2,3,4
FCU	4	CONT./VIDEO/SOUND	YORK	JCI AHD030	YVAHP072B41S	3105	140	500	66.8	55.8	50	49	60.0	62.0	R-410A	51.2	70	90	460	3	4.7	15	585	ACCU	4	105	12.7 / 3.3 COP	460	3	12.3	20	451	1,2,3,4
FCU	5	OFFICES	YORK	DHR36NDB21S	DHR36CSB21S	875	100	500	78.2	65.1	55	54	18.4	25.6	R-410A	17.1	68	86	208	1	2.9	15	102	ACCU	5	105	10 / 9	208	1	16.5	25	172	1,2,3
FCU	6	W127	YORK	DHP24NWB21S	DHP24CSB21S	635	0	500	80	67	55	54	18.0	24.0	R-410A	27.0	70	96	208	1	0.6	15	31	ACCU	6	105	10.2 / 8.4	208	1	16.5	25	172	1,2,3
FCU	7	W108	YORK	DHR24NDB21S	DHR24CSB21S	618	0	500	80	67	55	54	18.7	24.0	R-410A	27.0	70	97	208	1	1.8	15	80	ACCU	7	105	12 /	208	1	16.5	25	172	1,2,3

NOTES:

1. PROVIDE WITH SINGLE POINT CONNECTION AND FACTORY MOUNTED DISCONNECT.
2. PROVIDE WITH MERV 8 FILTER.
3. PROVIDE AUXILIARY DRAIN PAN AND FLOAT SWITCH TO DEENGERGIZE UNIT IF CONDENSATE COLLECTS IN DRAIN PAN.
4. PROVIDE WITH EKEXV140-US EXPANSION VALVE KIT. PROVIDE SEPARATE 120V CIRCUIT FOR EXPANSION VALVE KIT.

PIPE RUN-OUT SIZES

GPM (MIN-MAX)	PIPE SIZES (ø)
0 - 3	3/4"
3.1 - 6	1"
6.1 - 11	1-1/4"
11.1 - 17	1-1/2"
17.1 - 35	2"
35.1 - 65	2-1/2"
65.1 - 110	3"
110.1 - 230	4"
230.1 - 700	6"

DUCT INSULATION SCHEDULE

DUCT INSULATION	TYPE	MIN./ INSTALLED INSULATION VALUE	MIN. THICKNESS	MIN. NOMINAL DENSITY	CONCEALED					EXPOSED IN NON-SERVICE SPACES					EXPOSED IN SERVICE/ MECHANICAL ROOMS					NOTES
					SUPPLY	RETURN	EXHAUST	OUTSIDE AIR	JACKET	SUPPLY	RETURN	EXHAUST	OUTSIDE AIR	JACKET	SUPPLY	RETURN	EXHAUST	OUTSIDE AIR	JACKET	
ABOVE GROUND/ OUTDOOR/ PLENUM	MINERAL FIBER BLANKET	R-6	2	1-1/2	X	X	X	X	FSK											
	MINERAL FIBER BOARD	R-6	2	3						X	X	X	X	ALUMINUM SMOOTH MIN. 0.016".	X	X	X	X	PVC 3 MILS THICK.	1
	DOUBLE WALL, INSULATED	R-6	NOTE 2	NOTE 2																
ABOVE GROUND/ OUTDOOR ROUND/ FLAT-OVAL/ RECTANGULAR DUCT	MINERAL FIBER BLANKET	R-6	1-1/2	3/4	X	X	X	X	FSK											
	MINERAL FIBER BOARD	R-6	1-1/2	2																
	MINERAL FIBER BOARD	R-6	2	3											X	X	X	X	PVC 3 MILS THICK.	1
	DOUBLE WALL, INSULATED	R-6	NOTE 2	NOTE 2						X	X	X	X	FSK						
INDOOR PLENUM	MINERAL FIBER BLANKET	R-3.5	1-1/2	3/4	X	X	X	X	FSK											
	MINERAL FIBER BOARD	R-3.5	2	3						X	X	X	X	ALUMINUM SMOOTH MIN. 0.016".	X	X	X	X	PVC 3 MILS THICK.	1
	DOUBLE WALL, INSULATED	R-3.5	NOTE 2	NOTE 2																
INDOOR ROUND/ FLAT-OVAL/ RECTANGULAR DUCT	MINERAL FIBER BLANKET	R-3.5	1-1/2	3/4	X	X	X	X	FSK											
	MINERAL FIBER BOARD	R-3.5	1-1/2	2																
	MINERAL FIBER BOARD	R-3.5	2	3											X	X	X	X	PVC 3 MILS THICK.	1
	DOUBLE WALL, INSULATED	R-3.5	NOTE 2	NOTE 2						X	X	X	X	NONE						

NOTES:

1. REFER TO SPECIFICATIONS FOR ADDITONAL INSULATION REQUIREMENTS AND JACKET DETAILS.
2. REFER TO SPECIFICATONS FOR REQUIREMENTS OF DOUBLE WALLED DUCT.
3. AIR CONDITIONING AND REFRIGERATION PIPE AND TUBING LINES SHALL BE INSULATED WITH ACR TYPE INSULATION HAVING A THERMAL RESISTIVITY OF NOT LESS THAN R-4.

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LICENSED
PROFESSIONAL ENGINEER
03/23/20

No.	Description	Date
	ISSUE FOR PERMIT	03/23/20

HCC Stafford Science & Technology Building

HVAC Replacement

MECHANICAL SCHEDULES

Project Number	H20041.00
Date	03/12/20
Drawn By	EFW
Checked By	NWB

M00.02

Scale 12" = 1'-0"

MECHANICAL SPECIFICATIONS

SECTION 23 31 13 – METAL DUCT

A. MANUFACTURERS: MCGILL AIRFLOW LLC., SEMCO LLC., SHEET METAL CONNECTORS, INC.

B. TRANSVERSE JOINTS: SELECT JOINT TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 3-1, "ROUND DUCT TRANSVERSE JOINTS," FOR STATIC-PRESSURE CLASS, APPLICABLE SEALING REQUIREMENTS, MATERIALS INVOLVED, DUCT-SUPPORT INTERVALS, AND OTHER PROVISIONS IN SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE.

C. TRANSVERSE JOINTS IN DUCTS LARGER THAN 60 INCHES IN DIAMETER: FLANGED.

D. LONGITUDINAL SEAMS: SELECT SEAM TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 3-2, "ROUND DUCT LONGITUDINAL SEAMS," FOR STATIC-PRESSURE CLASS, APPLICABLE SEALING REQUIREMENTS, MATERIALS INVOLVED, DUCT-SUPPORT INTERVALS, AND OTHER PROVISIONS IN SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE." FABRICATE ROUND DUCTS LARGER THAN 90 INCHES IN DIAMETER WITH BUTT-WELDED LONGITUDINAL SEAMS.

E. FABRICATE FLAT-OVAL DUCTS LARGER THAN 72 INCHES IN WIDTH (MAJOR DIMENSION) WITH BUTT-WELDED LONGITUDINAL SEAMS.

F. TEES AND LATERALS: SELECT TYPES AND FABRICATE ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 3-5, "90 DEGREE TEES AND LATERALS," AND FIGURE 3-6, "CONICAL TEES," FOR STATIC-PRESSURE CLASS, APPLICABLE SEALING REQUIREMENTS, MATERIALS INVOLVED, DUCT-SUPPORT INTERVALS, AND OTHER PROVISIONS IN SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE."

G. SHEET METAL MATERIALS
- A. GENERAL MATERIAL REQUIREMENTS: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE" FOR ACCEPTABLE MATERIALS, MATERIAL THICKNESS, AND DUCT CONSTRUCTION METHODS UNLESS OTHERWISE INDICATED. SHEET METAL MATERIALS SHALL BE FREE OF PITTING, SEAM MARKS, ROLLER MARKS, STAINS, DISCOLORATIONS, AND OTHER IMPERFECTION.
- B. GALVANIZED SHEET STEEL: COMPLY WITH ASTM A 653/A 653M. GALVANIZED COATING DESIGNATION: G60. FINISHES FOR SURFACES EXPOSED TO VIEW: MILL PHOSPHATIZED.
- C. CARBON-STEEL SHEETS: COMPLY WITH ASTM A 1008/A 1008M, WITH OILED, MATTE FINISH FOR EXPOSED DUCTS.
- D. ALUMINUM SHEETS: COMPLY WITH ASTM B 209 ALLOY 3003, H14 TEMPER; WITH MILL FINISH FOR CONCEALED DUCTS, AND STANDARD, ONE-SIDE BRIGHT FINISH FOR DUCT SURFACES EXPOSED.
- E. REINFORCEMENT SHAPES AND PLATES: ASTM A 36/A 36M, STEEL PLATES, SHAPES, AND BARS; BLACK AND GALVANIZED.
- F. TIE RODS: GALVANIZED STEEL, 1/4-INCH MINIMUM DIAMETER FOR LENGTHS 36 INCHES OR LESS; 3/8-INCH MINIMUM DIAMETER FOR LENGTHS LONGER THAN 36 INCHES.

H. FIBROUS-GLASS DUCT LINER: COMPLY WITH ASTM C 1071, NFPA 90A, OR NFPA 90B; AND WITH NAIMA AH124, "FIBROUS GLASS DUCT LINER STANDARD."
- A. MANUFACTURERS: JOHNS MANVILLE; A BERKSHIRE HATHAWAY COMPANY., KNAUF INSULATION, OWENS CORNING.OPTION FOR THERMAL CONDUCTIVITY IN FIRST TWO SUBPARAGRAPHS BELOW EXCEEDS THE VALUES IN ASTM C 1071. IF RETAINING, VERIFY AVAILABILITY OF PERFORMANCE WITH DUCT LINER MANUFACTURERS.
- B. TYPE I, FLEXIBLE: 0.27 BTU X IN./H X SQ. FT. X DEG F AT 75 DEG F MEAN TEMPERATURE. TYPE II, RIGID: 0.23 BTU X IN./H X SQ. FT. X DEG F AT 75 DEG F MEAN TEMPERATURE, ANTIMICROBIAL EROSION-RESISTANT COATING: APPLY TO THE SURFACE OF THE LINER THAT WILL FORM THE INTERIOR SURFACE OF THE DUCT TO ACT AS A MOISTURE REPELLENT AND EROSION-RESISTANT COATING. ANTIMICROBIAL COMPOUND SHALL BE TESTED FOR EFFICACY BY AN NRTL AND REGISTERED BY THE EPA FOR USE IN HVAC SYSTEMS.
- C. WATER-BASED LINER ADHESIVE: COMPLY WITH NFPA 90A OR NFPA 90B AND WITH ASTM C 916.LOW PRESSURE DUCT WILL BE CONSTRUCTED IN 2 INCH WG. MEDIUM PRESSURE DUCT SHALL BE CONSTRUCTED TO 4.0 IN WG.

SECTION 23 07 13– DUCT INSULATION

1. MINERAL-FIBER BLANKET INSULATION: MINERAL OR GLASS FIBERS BONDED WITH A THERMOSETTING RESIN. COMPLY WITH ASTM C 553, TYPE II AND ASTM C 1290, TYPE III WITH FACTORY-APPLIED FSK JACKET. FACTORY-APPLIED JACKET REQUIREMENTS ARE SPECIFIED IN "FACTORY-APPLIED JACKETS" ARTICLE.
2. MANUFACTURERS: JOHNS MANVILLE; A BERKSHIRE HATHAWAY COMPANY., KNAUF INSULATION, OWENS CORNING.
3. FIRE-RATED BLANKET: HIGH-TEMPERATURE, FLEXIBLE, BLANKET INSULATION WITH FSK JACKET THAT IS TESTED AND CERTIFIED TO PROVIDE A 2-HOUR FIRE RATING BY AN NRTL ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION.
4. MANUFACTURERS: JOHNS MANVILLE; A BERKSHIRE HATHAWAY COMPANY, NELSON FIRESTOP; A BRAND OF EMERSON INDUSTRIAL AUTOMATION, THERMAL CERAMICS.
5. ADHESIVES:
   - A. MATERIALS SHALL BE COMPATIBLE WITH INSULATION MATERIALS, JACKETS, AND SUBSTRATES AND FOR BONDING INSULATION TO ITSELF AND TO SURFACES TO BE INSULATED UNLESS OTHERWISE INDICATED.
   - B. ADHESIVE: COMPLY WITH MIL-A-24179A, TYPE II, CLASS I.
   - C. MANUFACTURERS: ARMACELL LLC., FOSTER BRAND; H. B. FULLER CONSTRUCTION PRODUCTS, K-FLEX USA.
6. SEALANTS:
   - A. SEALANTS MANUFACTURERS: CHILDERS BRAND; H. B. FULLER CONSTRUCTION PRODUCTS., EAGLE BRIDGES - MARATHON INDUSTRIES, FOSTER BRAND; H. B. FULLER CONSTRUCTION PRODUCTS.
7. FACTORY-APPLIED JACKETS:
   - A. MANUFACTURERS: CHILDERS BRAND; H. B. FULLER CONSTRUCTION PRODUCTS.
   - B. TAPES MANUFACTURERS: IDEAL TAPE CO., INC., AN AMERICAN BILTRITE COMPANY, KNAUF INSULATION, VENTURE TAPE.

SECTION 23 05 29 – HANGERS AND SUPPORTS FOR HVAC

1. METAL PIPE HANGERS AND SUPPORTS CARBON-STEEL PIPE HANGERS AND SUPPORTS:
   - A. DESCRIPTION: MSS SP-58, TYPES 1 THROUGH 58, FACTORY-FABRICATED COMPONENTS, GALVANIZED METALLIC
   - B. COATINGS: PREGALVANIZED OR HOT DIPPED, NONMETALLIC
   - C. COATINGS: PLASTIC COATING, JACKET, OR LINER.
   - D. PADDED HANGERS: HANGER WITH FIBERGLASS OR OTHER PIPE INSULATION PAD OR CUSHION TO SUPPORT BEARING SURFACE OF PIPING, HANGER RODS: CONTINUOUS-THREAD ROD, NUTS, AND WASHER MADE OF STAINLESS STEEL.
2. TRAPEZE PIPE HANGERS:
   - A. DESCRIPTION: MSS SP-69, TYPE 59, SHOP- OR FIELD-FABRICATED PIPE-SUPPORT ASSEMBLY MADE FROM STRUCTURAL CARBON-STEEL SHAPES WITH MSS SP-58 CARBON-STEEL HANGER RODS, NUTS, SADDLES, AND U-BOLTS.
3. THERMAL-HANGER SHIELD INSERTS
   - A. INSULATION-INSERT MATERIAL FOR COLD PIPING: ASTM C 552, TYPE II CELLULAR GLASS WITH 100-PSIG OR ASTM C 591, TYPE VI, GRADE 1 POLYISOCYANURATE WITH 125-PSIG MINIMUM COMPRESSIVE STRENGTH AND VAPOR BARRIER.
   - B. INSULATION-INSERT MATERIAL FOR HOT PIPING: WATER-REPELLENT TREATED, ASTM C 533, TYPE I CALCIUM SILICATE WITH 100-PSIG, ASTM C 552, TYPE II CELLULAR GLASS WITH 100-PSIG OR ASTM C 591, TYPE VI, GRADE 1 POLYISOCYANURATE WITH 125-PSIG MINIMUM COMPRESSIVE STRENGTH.
4. FOR TRAPEZE OR CLAMPED SYSTEMS:
   - A. INSERT AND SHIELD SHALL COVER ENTIRE CIRCUMFERENCE OF PIPE.
5. FOR CLEVIS OR BAND HANGERS:
   - A. INSERT AND SHIELD SHALL COVER LOWER 180 DEGREES OF PIPE.
   - B. INSERT LENGTH: EXTEND 2 INCHES BEYOND SHEET METAL SHIELD FOR PIPING OPERATING BELOW AMBIENT AIR TEMPERATURE.
   - C. DESCRIPTION: WELDED, SHOP- OR FIELD-FABRICATED EQUIPMENT SUPPORT MADE FROM STRUCTURAL CARBON-STEEL SHAPES.
6. STRUCTURAL STEEL:
   - A. ASTM A 36/A 36M, CARBON-STEEL PLATES, SHAPES, AND BARS; BLACK AND GALVANIZED.
7. GROUT:
   - A. ASTM C 1107, FACTORY-MIXED AND -PACKAGED, DRY, HYDRAULIC-CEMENT, NONSHRINK AND NONMETALLIC GROUT; SUITABLE FOR INTERIOR AND EXTERIOR APPLICATIONS.
     - a. PROPERTIES: NONSTAINING, NONCORROSIVE, AND NONGASEOUS.
     - b. DESIGN MIX: 5000-PSI, 28-DAY COMPRESSIVE STRENGTH.

SECTION 23 08 00 – COMMISSIONING OF HVAC

1. CERTIFY THAT HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT HAVE BEEN INSTALLED, CALIBRATED, AND STARTED AND ARE OPERATING ACCORDING TO THE CONTRACT DOCUMENTS AND APPROVED SHOP DRAWINGS AND SUBMITTALS.
2. CERTIFY THAT HVAC&R INSTRUMENTATION AND CONTROL SYSTEMS HAVE BEEN COMPLETED AND CALIBRATED, THAT THEY ARE OPERATING ACCORDING TO THE CONTRACT DOCUMENTS AND APPROVED SHOP DRAWINGS AND SUBMITTALS, AND THAT PRETEST SET POINTS HAVE BEEN RECORDED.
3. CERTIFY THAT TAB PROCEDURES HAVE BEEN COMPLETED AND THAT TAB REPORTS HAVE BEEN SUBMITTED, DISCREPANCIES CORRECTED, AND CORRECTIVE WORK APPROVED.
4. SET SYSTEMS, SUBSYSTEMS, AND EQUIPMENT INTO OPERATING MODE TO BE TESTED ACCORDING TO APPROVED TEST PROCEDURES (E.G., NORMAL SHUTDOWN, NORMAL AUTO POSITION, NORMAL MANUAL POSITION, UNOCCUPIED CYCLE, EMERGENCY POWER, AND ALARM CONDITIONS).
5. MEASURE CAPACITIES AND EFFECTIVENESS OF SYSTEMS, ASSEMBLIES, SUBSYSTEMS, EQUIPMENT, AND COMPONENTS, INCLUDING OPERATIONAL AND CONTROL FUNCTIONS TO VERIFY COMPLIANCE WITH ACCEPTANCE CRITERIA.
6. TEST SYSTEMS, ASSEMBLIES, SUBSYSTEMS, EQUIPMENT, AND COMPONENTS OPERATING MODES, INTERLOCKS, CONTROL RESPONSES, AND RESPONSES TO ABNORMAL OR EMERGENCY CONDITIONS, AND RESPONSE ACCORDING TO ACCEPTANCE CRITERIA.
7. CONSTRUCTION CHECKLISTS: PREPARE AND SUBMIT DETAILED CONSTRUCTION CHECKLISTS FOR HVAC&R SYSTEMS, SUBSYSTEMS, EQUIPMENT, AND COMPONENTS.
8. PERFORM TESTS USING DESIGN CONDITIONS, WHENEVER POSSIBLE.
9. SIMULATED CONDITIONS MAY, WITH APPROVAL OF ARCHITECT, BE IMPOSED USING AN ARTIFICIAL LOAD WHEN IT IS IMPRACTICAL TO TEST UNDER DESIGN CONDITIONS. BEFORE SIMULATING CONDITIONS, CALIBRATE TESTING INSTRUMENTS. PROVIDE EQUIPMENT TO SIMULATE LOADS. SET SIMULATED CONDITIONS AS DIRECTED BY COMMISSIONING COORDINATOR AND DOCUMENT SIMULATED CONDITIONS AND METHODS OF SIMULATION. AFTER TESTS, RETURN CONFIGURATIONS AND SETTINGS TO NORMAL OPERATING CONDITIONS.
10. COMMISSIONING TEST PROCEDURES MAY DIRECT THAT SET POINTS BE ALTERED WHEN SIMULATING CONDITIONS IS IMPRACTICAL, COMMISSIONING TEST PROCEDURES MAY DIRECT THAT SENSOR VALUES BE ALTERED WITH A SIGNAL GENERATOR WHEN DESIGN OR SIMULATING CONDITIONS AND ALTERING SET POINTS ARE IMPRACTICAL. IF TESTS CANNOT BE COMPLETED BECAUSE OF A DEFICIENCY OUTSIDE THE SCOPE OF THE HVAC&R SYSTEM, DOCUMENT THE DEFICIENCY AND REPORT IT TO OWNER. AFTER DEFICIENCIES ARE RESOLVED, RESCHEDULE TESTS.
11. IF SEASONAL TESTING IS SPECIFIED, COMPLETE APPROPRIATE INITIAL PERFORMANCE TESTS AND DOCUMENTATION AND SCHEDULE SEASONAL TESTS.
12. COORDINATE SCHEDULE WITH, AND PERFORM THE FOLLOWING ACTIVITIES AT THE DIRECTION OF, COMMISSIONING COORDINATOR.
13. COMPLY WITH CONSTRUCTION CHECKLIST REQUIREMENTS, INCLUDING MATERIAL VERIFICATION, INSTALLATION CHECKS, START-UP, AND PERFORMANCE TESTS REQUIREMENTS SPECIFIED IN SECTIONS SPECIFYING HVAC SYSTEMS AND EQUIPMENT.
14. PROVIDE TECHNICIANS, INSTRUMENTATION, TOOLS, AND EQUIPMENT TO COMPLETE AND DOCUMENT THE FOLLOWING: PERFORMANCE TESTS,DEMONSTRATION OF A SAMPLE OF PERFORMANCE TESTS, COMMISSIONING TESTS, COMMISSIONING TEST DEMONSTRATIONS.

SECTION 23 05 48.13 – VIBRATION CONTROLS FOR HVAC

A. AIR HANDLERS, FURNACES, FANS AND FAN COILS SHALL BE SUSPENDED OR SUPPORTED WITH SPRING ISOLATOR UNLESS INTERNALLY ISOLATED.

B. PROVIDE FLEXIBLE DUCT CONNECTIONS AT ALL AIR HANDLERS, ROOFTOP UNITS AND FANS, UNLESS INTERNALLY ISOLATED.

C. PIPE: ALL PIPING SHALL BE VIBRATION ISOLATED WITHIN 50 FT OF VIBRATING EQUIPMENT. FIRST 3 HANGERS SHALL BE SAME DEFLECTION AS EQUIPMENT ISOLATORS (BUT MAXIMUM OF 2"); REMAINING HANGERS SHALL BE 0.75" DEFLECTION SPRING OR SPRING+RUBBER. FIRST 2 HANGERS CLOSEST TO EQUIPMENT SHALL BE POSITIONING OR PRE-COMPRESSED TYPE, TO PREVENT LOAD TRANSFER TO EQUIPMENT FLANGES WHEN PIPE IS FILLED.

D. ELASTOMERIC MOUNT IN A STEEL FRAME WITH UPPER AND LOWER STEEL HANGER RODS:
- A. MANUFACTURERS: KINETICS NOISE CONTROL, INC., MASON INDUSTRIES, INC., NOVIA; A DIVISION OF C&P.
- B. FRAME: STEEL, FABRICATED WITH A CONNECTION FOR AN UPPER THREADED HANGER ROD AND AN OPENING ON THE UNDERSIDE TO ALLOW FOR A MAXIMUM OF 30 DEGREES OF ANGULAR LOWER HANGER-ROD MISALIGNMENT WITHOUT BINDING OR REDUCING ISOLATION EFFICIENCY, DAMPENING ELEMENT: MOLDED, OIL-RESISTANT RUBBER, NEOPRENE, OR OTHER ELASTOMERIC MATERIAL WITH A PROJECTING BUSHING FOR THE UNDERSIDE OPENING PREVENTING STEEL TO STEEL CONTACT.

E. COMBINATION COIL-SPRING AND ELASTOMERIC-INSERT HANGER WITH SPRING AND INSERT IN COMPRESSION:
- A. MANUFACTURERS: KINETICS NOISE CONTROL, INC., MASON INDUSTRIES, INC., NOVIA; A DIVISION OF C&P.
- B. FRAME: STEEL, FABRICATED FOR CONNECTION TO THREADED HANGER RODS AND TO ALLOW FOR A MAXIMUM OF 30 DEGREES OF ANGULAR HANGER-ROD MISALIGNMENT WITHOUT BINDING OR REDUCING ISOLATION EFFICIENCY.
- C. OUTSIDE SPRING DIAMETER: NOT LESS THAN 80 PERCENT OF THE COMPRESSED HEIGHT OF THE SPRING AT RATED LOAD.
- D. MINIMUM ADDITIONAL TRAVEL: 50 PERCENT OF THE REQUIRED DEFLECTION AT RATED LOAD.
- E. LATERAL STIFFNESS: MORE THAN 80 PERCENT OF RATED VERTICAL STIFFNESS.
- F. OVERLOAD CAPACITY: SUPPORT 200 PERCENT OF RATED LOAD, FULLY COMPRESSED, WITHOUT DEFORMATION OR FAILURE.
- G. ELASTOMERIC ELEMENT: MOLDED, OIL-RESISTANT RUBBER OR NEOPRENE. STEEL-WASHER-REINFORCED CUP TO SUPPORT SPRING AND BUSHING PROJECTING THROUGH BOTTOM OF FRAME.
- H. ADJUSTABLE VERTICAL STOP: STEEL WASHER WITH NEOPRENE WASHER "UP-STOP" ON LOWER THREADED ROD.
- I. SELF-CENTERING HANGER ROD CAP TO ENSURE CONCENTRICITY BETWEEN HANGER ROD AND SUPPORT SPRING COIL.

SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

1. PIPING MANUFACTURERS: BRIMAR INDUSTRIES, INC., CRAFTMARK PIPE MARKERS., SETON IDENTIFICATION PRODUCTS.
2. GENERAL REQUIREMENTS FOR MANUFACTURED PIPE LABELS: PREPRINTED, COLOR-CODED, WITH LETTERING INDICATING SERVICE, AND SHOWING FLOW DIRECTION ACCORDING TO ASME A13.1.
3. PRETENSIONED PIPE LABELS: PRECOILED, SEMIRIGID PLASTIC FORMED TO [PARTIALLY COVER] [COVER FULL] CIRCUMFERENCE OF PIPE AND TO ATTACH TO PIPE WITHOUT FASTENERS OR ADHESIVE.
4. SELF-ADHESIVE PIPE LABELS: PRINTED PLASTIC WITH CONTACT-TYPE, PERMANENT-ADHESIVE BACKING.
5. PIPE LABEL CONTENTS: INCLUDE IDENTIFICATION OF PIPING SERVICE USING SAME DESIGNATIONS OR ABBREVIATIONS AS USED ON DRAWINGS; ALSO INCLUDE PIPE SIZE AND AN ARROW INDICATING FLOW DIRECTION,
6. FLOW-DIRECTION ARROWS: INTEGRAL WITH PIPING SYSTEM SERVICE LETTERING TO ACCOMMODATE BOTH DIRECTIONS OR AS SEPARATE UNIT ON EACH PIPE LABEL TO INDICATE FLOW DIRECTION, LETTERING SIZE: SIZE LETTERS ACCORDING TO ASME A13.1 FOR PIPING.
7. VALVE TAGS:
   - A. MANUFACTURERS: BRIMAR INDUSTRIES, INC., CRAFTMARK PIPE MARKERS., SETON IDENTIFICATION PRODUCTS.
   - B. DESCRIPTION: STAMPED OR ENGRAVED WITH 1/4-INCH LETTERS FOR PIPING SYSTEM ABBREVIATION AND 1/2-INCH NUMBERS.
   - C. TAG MATERIAL: BRASS, 0.032-INCH MINIMUM THICKNESS, AND HAVING PREDRILLED OR STAMPED HOLES FOR ATTACHMENT HARDWARE, FASTENERS: BRASS WIRE-LINK CHAIN.

SECTION 23 05 93 – TESTING, ADJUSTING, AND BALANCING FOR HVAC
EXECUTION

1. REPORT DEFICIENCIES DISCOVERED BEFORE AND DURING PERFORMANCE OF TAB PROCEDURES. OBSERVE AND RECORD SYSTEM REACTIONS TO CHANGES IN CONDITIONS. RECORD DEFAULT SET POINTS IF DIFFERENT FROM INDICATED VALUES.
2. PERFORM SYSTEM-READINESS CHECKS OF HVAC SYSTEMS AND EQUIPMENT TO VERIFY SYSTEM READINESS FOR TAB WORK.
3. GENERAL PROCEDURES FOR TESTING AND BALANCING:
   - A. PERFORM TESTING AND BALANCING PROCEDURES ON EACH SYSTEM ACCORDING TO THE PROCEDURES CONTAINED IN NEBB'S "PROCEDURAL STANDARDS FOR TESTING, ADJUSTING, AND BALANCING OF ENVIRONMENTAL SYSTEMS", SMACNA'S "HVAC SYSTEMS - TESTING, ADJUSTING, AND BALANCING" AND IN THIS SECTION. CUT INSULATION, DUCTS, PIPES, AND EQUIPMENT CABINETS FOR INSTALLATION OF TEST PROBES TO THE MINIMUM EXTENT NECESSARY FOR TAB PROCEDURES.
   - B. MARK EQUIPMENT AND BALANCING DEVICES, INCLUDING DAMPER-CONTROL POSITIONS, VALVE POSITION INDICATORS, FAN-SPEED-CONTROL LEVERS, AND SIMILAR CONTROLS AND DEVICES, WITH PAINT OR OTHER SUITABLE, PERMANENT IDENTIFICATION MATERIAL TO SHOW FINAL SETTINGS.
   - C. TAKE AND REPORT TESTING AND BALANCING MEASUREMENTS IN INCH-POUND (IP)UNITS.
   - D. VERIFY FINAL SYSTEM CONDITIONS.

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

1. TEST MOTORS IN ACCORDANCE WITH NEMA MG 1, INCLUDING WINDING RESISTANCE, NO-LOAD SPEED AND CURRENT, LOCKED ROTOR CURRENT, INSULATION HIGH-POTENTIAL TEST, AND MECHANICAL ALIGNMENT TESTS. INSTALL SECURELY ON FIRM FOUNDATION. MOUNT BALL BEARING MOTORS WITH SHAFT IN ANY POSITION. INSTALL ENGRAVED PLASTIC NAMEPLATES. GROUND AND BOND MOTORS.
2. SINGLE-PHASE MOTORS: PERMANENT SPLIT-CAPACITOR TYPE, WHERE AVAILABLE; OTHERWISE, USE SPLIT-PHASE START/CAPACITOR RUN OR CAPACITOR START/CAPACITOR RUN MOTOR. TERMINAL LUGS TO MATCH BRANCH CIRCUIT CONDUCTOR QUANTITIES, SIZES AND MATERIALS.
3. THREE-PHASE MOTORS: NEMA MG 1, DESIGN B, PREMIUM -EFFICIENCY SQUIRREL-CAGE INDUCTION MOTOR, WITH WINDINGS TO ACCOMPLISH STARTING METHODS AND NUMBER OF SPEEDS INDICATED. SERVICE FACTOR: 1.15 UNLESS OTHERWISE INDICATED ON DRAWINGS. ENCLOSURE: MEET CONDITIONS OF INSTALLATION UNLESS SPECIFIC ENCLOSURE IS SPECIFIED OR INDICATED. DESIGN FOR CONTINUOUS OPERATION IN 40 DEGREES C ENVIRONMENT, WITH TEMPERATURE RISE IN ACCORDANCE WITH NEMA MG 1 LIMITS FOR INSULATION CLASS, SERVICE FACTOR, AND MOTOR ENCLOSURE TYPE. INSULATION SYSTEM: NEMA CLASS F . MOTOR FRAMES: NEMA STANDARD T-FRAMES OF STEEL, ALUMINUM, OR CAST IRON WITH END BRACKETS OF CAST IRON OR ALUMINUM WITH STEEL INSERTS. THERMISTOR SYSTEM (MOTOR FRAME SIZES 254T AND LARGER): THREE PTC THERMISTORS EMBEDDED IN MOTOR WINDINGS AND EPOXY ENCAPSULATED SOLID STATE CONTROL RELAY WITH WIRING TO TERMINAL BOX. BEARINGS: GREASE LUBRICATED ANTI-FRICTION BALL BEARINGS WITH HOUSINGS EQUIPPED WITH PLUGGED PROVISION FOR RELUBRICATION, RATED FOR MINIMUM ABMA 9, L-10 LIFE OF 200,000 HOURS. CALCULATE BEARING LOAD WITH NEMA MINIMUM V-BELT PULLEY WITH BELT CENTER LINE AT END OF NEMA STANDARD SHAFT EXTENSION. STAMP BEARING SIZES ON NAMEPLATE. SOUND POWER LEVELS: CONFORM TO NEMA MG 1. TERMINAL LUGS TO MATCH BRANCH CIRCUIT CONDUCTOR QUANTITIES, SIZES AND MATERIALS.

SECTION 23 09 23.11 - CONTROL VALVES

1. PRESSURE-INDEPENDENT BALL VALVES NPS 2 AND SMALLER:
   - A. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING: BELIMO AIRCONTROLS (USA), INC, HCI; HYDRONICS COMPONENTS INC, DANFOSSUBPARAGRAPHS BELOW ARE BASED ON BELIMO'S "PICCV SERIES."
   - B. PERFORMANCE: PRESSURE RATING: 600 PSIG FOR NPS 1 AND 400 PSIG FOR NPS 1-1/2 AND NPS 2., CLOSE-OFF PRESSURE OF 200 PSIG, PROCESS TEMPERATURE RANGE: BETWEEN ZERO TO 212 DEG F, RANGEABILITY: 100 TO 1.
   - C. INTEGRAL PRESSURE REGULATOR: LOCATED UPSTREAM OF BALL TO REGULATE PRESSURE, TO MAINTAIN A CONSTANT PRESSURE DIFFERENTIAL WHILE OPERATING WITHIN A PRESSURE DIFFERENTIAL RANGE OF 5 TO 50 PSIG.
   - D. BODY: FORGED BRASS, NICKEL PLATED, AND WITH THREADED ENDS.
   - E. BALL: CHROME-PLATED BRASS.
   - F. STEM AND STEM EXTENSION: CHROME-PLATED BRASS, BLOWOUT-PROOF DESIGN.
   - G. STEM SLEEVE OR OTHER APPROVED MEANS TO ALLOW VALVE TO BE OPENED AND CLOSED WITHOUT DAMAGING FIELD-APPLIED INSULATION AND INSULATION VAPOR BARRIER SEAL.
   - H. BALL SEATS: REINFORCED PTFE.
   - I. STEM SEAL: REINFORCED PTFE PACKING RING STEM SEAL WITH THREADED PACKING RING FOLLOWER TO RETAIN THE PACKING RING UNDER DESIGN PRESSURE WITH THE LINKAGE REMOVED. ALTERNATIVE MEANS, SUCH AS EPDM O-RINGS, ARE ACCEPTABLE IF EQUIVALENT CYCLE ENDURANCE CAN BE ACHIEVED.
   - J. FLOW CHARACTERISTIC: EQUAL PERCENTAGE.
2. CONTROL VALVES
   - A. INSTALL PIPE REDUCERS FOR VALVES SMALLER THAN LINE SIZE. POSITION REDUCERS AS CLOSE TO VALVE AS POSSIBLE BUT AT DISTANCE TO AVOID INTERFERENCE AND IMPACT TO PERFORMANCE. INSTALL WITH MANUFACTURER-RECOMMENDED CLEARANCE.
   - B. INSTALL FLANGES OR UNIONS TO ALLOW DROP-IN AND -OUT VALVE INSTALLATION. WHERE INDICATED, INSTALL CONTROL VALVE WITH THREE-VALVE BYPASS MANIFOLD TO ALLOW FOR CONTROL VALVE ISOLATION AND REMOVAL WITHOUT INTERRUPTING SYSTEM FLOW BY PROVIDING MANUAL THROTTLING VALVE IN BYPASS PIPE.

SECTION 23 05 23.12 – BALL VALVES FOR HVAC PIPING

1. PRODUCTS: TWO-PIECE BRASS BALL VALVES WITH FULL PORT AND STAINLESS-STEEL TRIM: MANUFACTURERS: HAMMOND VALVE, KITZ CORPORATION, MILWAUKEE VALVE COMPANY.
2. DESCRIPTION: STANDARD: MSS SP-110, SWP RATING: 150 PSIG, CWP RATING: 600 PSIG, BODY DESIGN: TWO PIECE, BODY MATERIAL: FORGED BRASS, ENDS: THREADED, SEATS: PTFE, STEM: STAINLESS STEEL, BALL: STAINLESS STEEL, VENTED, PORT: FULL.

SECTION 23 21 13 – HYDRONIC PIPING

1. PRODUCTS:
   - A. MANUFACTURERS: ANVIL INTERNATIONAL, STAR PIPE PRODUCTS, VICTAULIC COMPANY.
   - B. GROOVED-END COPPER FITTINGS: ASTM B 75, COPPER TUBE OR ASTM B 584, BRONZE CASTING. GROOVED-END-TUBE COUPLINGS: RIGID PATTERN UNLESS OTHERWISE INDICATED; GASKETED FITTING. DUCTILE-IRON HOUSING WITH KEYS MATCHING PIPE AND FITTING GROOVES, PRELUBRICATED EPDM GASKET RATED FOR MINIMUM 230 DEG F FOR USE WITH HOUSING, AND STEEL BOLTS AND NUTSVERIFY THAT FITTINGS IN "COPPER OR BRONZE PRESSURE-SEAL FITTINGS" PARAGRAPH BELOW ARE AVAILABLE FOR PIPE SIZES REQUIRED FOR PROJECT.
2. COPPER OR BRONZE PRESSURE-SEAL FITTINGS:
   - A. MANUFACTURERS: NIBCO INC., VIEGA LLC.
   - B. MINIMUM 200-PSIG WORKING-PRESSURE RATING AT 250 DEG.
   - C. WROUGHT-COPPER UNIONS: ASME B16.22.
3. STEEL PIPE AND FITTINGS:
   - A. MANUFACTURERS: ANVIL INTERNATIONAL, GRINNELL MECHANICAL PRODUCTS, VICTAULIC COMPANY.
   - B. JOINT FITTINGS: ASTM A 536, GRADE 65-45-12 DUCTILE IRON; ASTM A 47/A 47M, GRADE 32510 MALLEABLE IRON; ASTM A 53/A 53M, TYPE F, E, OR S, GRADE B FABRICATED STEEL; OR ASTM A 106/A 106M, GRADE B STEEL FITTINGS WITH GROOVES OR SHOULDERS CONSTRUCTED TO ACCEPT GROOVED-END COUPLINGS; WITH NUTS, BOLTS, LOCKING PIN, LOCKING TOGGLE, OR LUGS TO SECURE GROOVED PIPE AND FITTINGS.
   - C. COUPLINGS: DUCTILE- OR MALLEABLE-IRON HOUSING AND EPDM GASKET OF CENTRAL CAVITY PRESSURE-RESPONSIVE DESIGN; WITH NUTS, BOLTS, LOCKING PIN, LOCKING TOGGLE, OR LUGS TO SECURE GROOVED PIPE AND FITTINGS.
4. JOINING MATERIALS:
   - A. DIELECTRIC FITTINGS: FITTINGS IN "DIELECTRIC UNIONS" PARAGRAPH BELOW ARE AVAILABLE IN NPS 1/2 TO NPS 2 (DN 15 TO DN 50). AND NIPPLES MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY ONE OF THE FOLLOWING: WATTS, WILKINS, ZURN INDUSTRIES, LLC.

SECTION 23 21 16 – HYDRONIC PIPING SPECIALTIES

1. BRONZE, CALIBRATED-ORIFICE, BALANCING VALVES
   - A. MANUFACTURERS: ARMSTRONG PUMPS, INC., BELL & GOSSETT; A XYLEM BRAND., TACO COMFORT SOLUTIONS, INC., VICTAULIC COMPANY.
   - B. BODY: BRONZE, BALL OR PLUG TYPE WITH CALIBRATED ORIFICE OR VENTURI.
   - C. BALL: BRASS OR STAINLESS STEEL.
   - D. PLUG: RESILANT
   - E. SEAT: PTFE.
   - F. END CONNECTIONS: THREADED OR SOCKET.
   - G. PRESSURE GAGE CONNECTIONS: INTEGRAL SEALS FOR PORTABLE DIFFERENTIAL PRESSURE METER.
   - H. HANDLE STYLE: LEVER, WITH MEMORY STOP TO RETAIN SET POSITION.
   - I. CWP RATING:MAXIMUM OPERATING TEMPERATURE: 250 DEG F.
2. AUTOMATIC FLOW-CONTROL VALVES
   - A. MANUFACTURERS: CALEFFI, FLOW DESIGN, INC, FLOWCON AMERICAS LLC, GRISWOLD CONTROLS.
3. AIR-CONTROL DEVICES
   - A. AIR VENTS AID IN SYSTEM FILLING. AIR REMOVAL AFTER INITIAL STARTUP IS ACCOMPLISHED BY AIR SEPARATOR OR BOILER DIP-TUBE.
   - B. LEAKAGE FROM AUTOMATIC AIR VENTS MAY CAUSE DAMAGE TO CEILINGS AND OTHER FINISHED SURFACES. MANUAL AIR VENTS MAY BE PREFERRED OVER AUTOMATIC AIR VENTS IN FINISHED SPACES.
   - C. AIR VENT MANUFACTURERS: AMTROL, INC., APOLLO FLOW CONTROLS; CONBRACO INDUSTRIES, INC., ARMSTRONG PUMPS, INC.
   - D. EXPANSION TANKS: MANUFACTURERS: AMTROL, INC., ARMSTRONG PUMPS, INC, BELL & GOSSETT; A XYLEM BRAND.
   - E. IN-LINE AIR SEPARATORS MANUFACTURERS: AMTROL, INC., ARMSTRONG PRODUCTS, INC., BELL & GOSSETT; A XYLEM BRAND.

SECTION 23 07 19 – HVAC PIPING INSULATION

1. PIPE INSULATIONS, MASTICS AND JACKETS LOCATED IN ENVIRONMENTAL AIR PLENUMS SHALL HAVE MAXIMUM FLAME SPREAD INDEX OF 25 AND MAXIMUM SMOKE DEVELOPED INDEX OF NOT EXCEEDING 50 IN ACCORDANCE WITH ASTM E84.
2. PRIMARY CONDENSATE DRAINS:
   - A. INSIDE BUILDINGS- 3/4" ARMAFLEX FOR ENTIRE LENGTH. NO INSULATION REQUIRED OUTDOORS. INSULATION OF SECONDARY (OVERFLOW) CONDENSATE DRAINS NOT REQUIRED.
3. REFRIGERANT SUCTION PIPING:
   - A. 1" ARMAFLEX. PAINT OUTDOOR PORTIONS WITH MANUFACTURER'S RECOMMENDED WATER RETARDANT ULTRAVIOLET SOLAR RADIATION PROTECTIVE COATING.

SECTION 23 81 26 - SPLIT-SYSTEM AIR-CONDITIONERS

1. MANUFACTURERS: TRANE, AAON, JCI (YORK), DAIKIN, CARRIER, LENNOX OR APPROVED EQUAL.
2. DX FAN COIL UNITS:
   - A. FACTORY PAINTED GALVANIZED STEEL, INSULATED CASING; SLOPED DRAIN PAN; FILTER RACK; MULTISPEED BLOWER, CONTROL TRANSFORMER, SUPPLY AND RETURN DUCT FLANGES, COPPER COIL/ALUMINUM FINS, AND MANUFACTURER'S STANDARD EXPANSION VALVE OR METERING DEVICE. COIL FACTORY MATCHED TO CONDENSING UNIT.
3. AIR COOLED CONDENSING UNITS:
   - A. UL OR CSA LISTED AND ARI CERTIFIED. COPPER TUBE, ALUMINIUM FIN COILS. PROVIDE WITH CRANKCASE HEATERS, OVERLOAD PROTECTION, TIME DELAY RELAY, FILTER DRIER, SIGHT GLASS, AND ANTI-SHORT CYCLE RELAY. ALL UNITS LARGER THAN 10 TONS SHALL BE PROVIDED WITH DUAL COMPRESSORS.

SECTION 23 23 00 – REFRIGERANT PIPING

1. SIZE PER A/C UNIT MANUFACTURER'S RECOMMENDATION, INCLUDING REQUIREMENT FOR LONG LINE APPLICATIONS. PROVIDE SOLENOID VALVES, TRAPS AND/OR ACCUMULATOR WHEN RECOMMENDED BY CONDENSING UNIT VENDOR, SUCH AS FOR UNDERGROUND LINES. USE FACTORY SEALED LINE SETS, UNLESS SIZE OR DISTANCE EXCEEDS FACTORY SET AVAILABILITY. ROUTE HIDDEN FROM VIEW. INSULATE SUCTION LINE. SEAL WALL PENETRATIONS.
2. **COPPER TUBING**: ASTM B280, TYPE ACR HARD DRAWN OR ANNEALED. FITTINGS: ASME B16.22 WROUGHT COPPER. JOINTS: BRAZE, AWS A5.8 BCUP SILVER/PHOSPHORUS/COPPER ALLOY WITH MELTING RANGE 1190 TO 1480 DEGREES F. UNIONS, FLANGES, AND COUPLINGS: COPPER PIPE: BRONZE, SOLDERED JOINTS.

SECTION 23 82 19 – FAN COIL UNITS

1. MANUFACTURERS: JOHNSON CONTROLS, INC./ YORK , TRANE, CARRIER OR APPROVED EQUAL.
2. FAN COIL UNIT CONFIGURATIONS: ROW SPLIT.
3. NUMBER OF COOLING COILS: ONE-PIPE SYSTEM.
4. COIL SECTION INSULATION: 1-INCH-THICK, FOIL-COVERED, CLOSED-CELL FOAM COMPLYING WITH ASTM C 1071 AND ATTACHED WITH ADHESIVE COMPLYING WITH ASTM C 916.
5. SURFACE-BURNING CHARACTERISTICS: INSULATION AND ADHESIVE SHALL HAVE A COMBINED MAXIMUM FLAME-SPREAD INDEX OF 25 AND SMOKE-DEVELOPED INDEX OF 50 WHEN TESTED ACCORDING TO ASTM E 84 BY A QUALIFIED TESTING AGENCY.
6. DRAIN PANS: STAINLESS STEEL. FABRICATE PANS AND DRAIN CONNECTIONS TO COMPLY WITH ASHRAE 62.1. DRAIN PANS SHALL BE REMOVABLE.
7. CHASSIS: GALVANIZED STEEL WHERE EXPOSED TO MOISTURE, WITH BAKED-ENAMEL FINISH AND REMOVABLE ACCESS PANEL OR, WITH POWDER-COAT FINISH AND REMOVABLE ACCESS PANEL. FLOOR-MOUNTING UNITS SHALL HAVE LEVELING SCREWS.
8. CABINET: STEEL WITH FACTORY PRIME COATING, READY FOR FIELD PAINTING. STEEL RECESSING FLANGES FOR RECESSING FAN COIL UNITS INTO CEILING OR WALL.
9. FILTERS: MINIMUM ARRESTANCE AND A MINIMUM EFFICIENCY REPORTING VALUE (MERV) ACCORDING TO ASHRAE 52.2 AND ALL ADDENDUMS, MERV RATING: 6 WHEN TESTED ACCORDING TO ASHRAE 52.2, PLEATED COTTON-POLYESTER MEDIA: 90 PERCENT ARRESTANCE AND MERV 7.
10. HYDRONIC COILS: COPPER TUBE, WITH MECHANICALLY BONDED ALUMINUM FINS SPACED NO CLOSER THAN 0.1 INCH, RATED FOR A MINIMUM WORKING PRESSURE OF 200 PSIG AND A MAXIMUM ENTERING-WATER TEMPERATURE OF 220 DEG F. INCLUDE MANUAL AIR VENT AND DRAIN VALVE.
11. INDOOR REFRIGERANT COILS: COPPER TUBE, WITH MECHANICALLY BONDED ALUMINUM FINS SPACED NO CLOSER THAN 0.1 INCH AND BRAZED JOINTS AT FITTINGS. COMPLY WITH AHRI 210/240, AND LEAK TEST TO MINIMUM 450 PSIG FOR A MINIMUM 300-PSIG WORKING PRESSURE. INCLUDE THERMAL EXPANSION VALVE.
12. ELECTRIC-RESISTANCE HEATING COILS: NICKEL-CHROMIUM HEATING WIRE, FREE OF EXPANSION NOISE AND HUM, MOUNTED IN CERAMIC INSERTS IN A GALVANIZED-STEEL HOUSING; WITH FUSES IN TERMINAL BOX FOR OVERCURRENT PROTECTION AND LIMIT CONTROLS FOR HIGH-TEMPERATURE PROTECTION. TERMINATE ELEMENTS IN STAINLESS-STEEL MACHINE-STAKED TERMINALS SECURED WITH STAINLESS-STEEL HARDWARE.
13. FAN AND MOTOR BOARD: REMOVABLE.
14. FAN: FORWARD CURVED, DOUBLE WIDTH, CENTRIFUGAL; DIRECTLY CONNECTED TO MOTOR. THERMOPLASTIC OR PAINTED-STEEL WHEELS, AND ALUMINUM, PAINTED-STEEL, OR GALVANIZED-STEEL FAN SCROLLS.
15. MOTOR: PERMANENTLY LUBRICATED, MULTISPEED; RESILIENTLY MOUNTED ON MOTOR BOARD. COMPLY WITH REQUIREMENTS IN SECTION 230513 "COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT."
16. WIRING TERMINATION: CONNECT MOTOR TO CHASSIS WIRING WITH PLUG CONNECTION.
17. FACTORY, HYDRONIC PIPING PACKAGE: ASTM B 88, TYPE L COPPER TUBE WITH WROUGHT-COPPER FITTINGS AND BRAZED JOINTS. LABEL PIPING TO INDICATE SERVICE, INLET, AND OUTLET. TWO-WAY, MODULATING CONTROL VALVE FOR CHILLED-WATER COIL.
18. TWO-PIECE BALL VALVES: BRONZE BODY WITH FULL-PORT, CHROME-PLATED BRONZE BALL; PTFE OR TFE SEATS; AND 600-PSIG MINIMUM CWP RATING AND BLOWOUT-PROOF STEM.
19. CALIBRATED-ORIFICE BALANCING VALVES: BRONZE BODY, BALL TYPE; 125-PSIG WORKING PRESSURE, 250 DEG F MAXIMUM OPERATING TEMPERATURE; WITH CALIBRATED ORIFICE OR VENTURI, CONNECTIONS FOR PORTABLE DIFFERENTIAL PRESSURE METER WITH INTEGRAL SEALS, THREADED ENDS, AND A MEMORY STOP TO RETAIN SET POSITION. AUTOMATIC FLOW-CONTROL VALVE: BRASS OR FERROUS-METAL BODY; 300-PSIG WORKING PRESSURE AT 250 DEG F; WITH REMOVABLE, CORROSION-RESISTANT, TAMPERPROOF, SELF-CLEANING PISTON SPRING; FACTORY SET TO MAINTAIN CONSTANT INDICATED FLOW WITH PLUS OR MINUS 10 PERCENT OVER DIFFERENTIAL PRESSURE RANGE OF 2 TO 80 PSIG. Y-PATTERN HYDRONIC STRAINERS: CAST-IRON BODY (ASTM A 126, CLASS B); 125-PSIG WORKING PRESSURE; WITH THREADED CONNECTIONS, BOLTED COVER, PERFORATED STAINLESS-STEEL BASKET, AND BOTTOM DRAIN CONNECTION. INCLUDE MINIMUM NPS 1/2 HOSE-END, FULL-PORT, BALL-TYPE BLOWDOWN VALVE IN DRAIN CONNECTION.

SECTION 23 09 23.01 - BUILDING CONTROL SYSTEM FOR HVAC

1. DDC HVAC CONTROLS
   - A. PROVIDE SYSTEM CONSISTING OF TEMPERATURE SENSORS, CONTROL VALVES, DAMPERS AND OPERATORS, INDICATING DEVICES, INTERFACE EQUIPMENT, LOW VOLTAGE TRANSFORMERS AND WIRING, APPARATUS, RELAYS AND ACCESSORIES TO OPERATE MECHANICAL SYSTEMS AND PERFORM FUNCTIONS SPECIFIED.
   - B. ELECTRICAL CONTROL INTERLOCKS ARE THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR.
   - C. MOTOR STARTERS ARE FURNISHED BY DIVISION 26, UNLESS INTEGRAL WITH EQUIPMENT.
   - D. PROVIDE 120 VOLT POWER TO SYSTEM CONTROLLERS AND TRANSFORMERS.
   - E. CONTROL CABLING SHALL BE PLENUM RATED. INSTALL CONDUIT AND ELECTRICAL WIRING IN ACCORDANCE WITH DIVISION 26 REQUIREMENTS.
2. UPGRADE EXISTING CONTINUUM BAS TO ECO-STUXURE BY SCHNEIDER ELECTRIC.
3. CONNECT NEW DX SPLIT SYSTEMS AND OUTSIDE AIR HANDLING UNIT BEING REPLACED AS PART OF THIS PROJECT SCOPE TO NEW ECO-STRUXURE BAS. EXISTING DDC SYSTEM IS CONTINUUM BY SCHNEIDER ELECTRIC TO BE UPGRADED TO ECO- STRUXURE.

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PROFESSIONAL ENGINEER
03/23/20

No.	Description	Date
	ISSUE FOR PERMIT	03/23/20

HCC Stafford Science & Technology Building

HVAC Replacement

MECHANICAL SPECIFICATIONS

Project Number	H20041.00
Date	03/12/20
Drawn By	EFW
Checked By	NWB

M00.03

Scale	1/8" = 1'-0"

SHEET NOTES

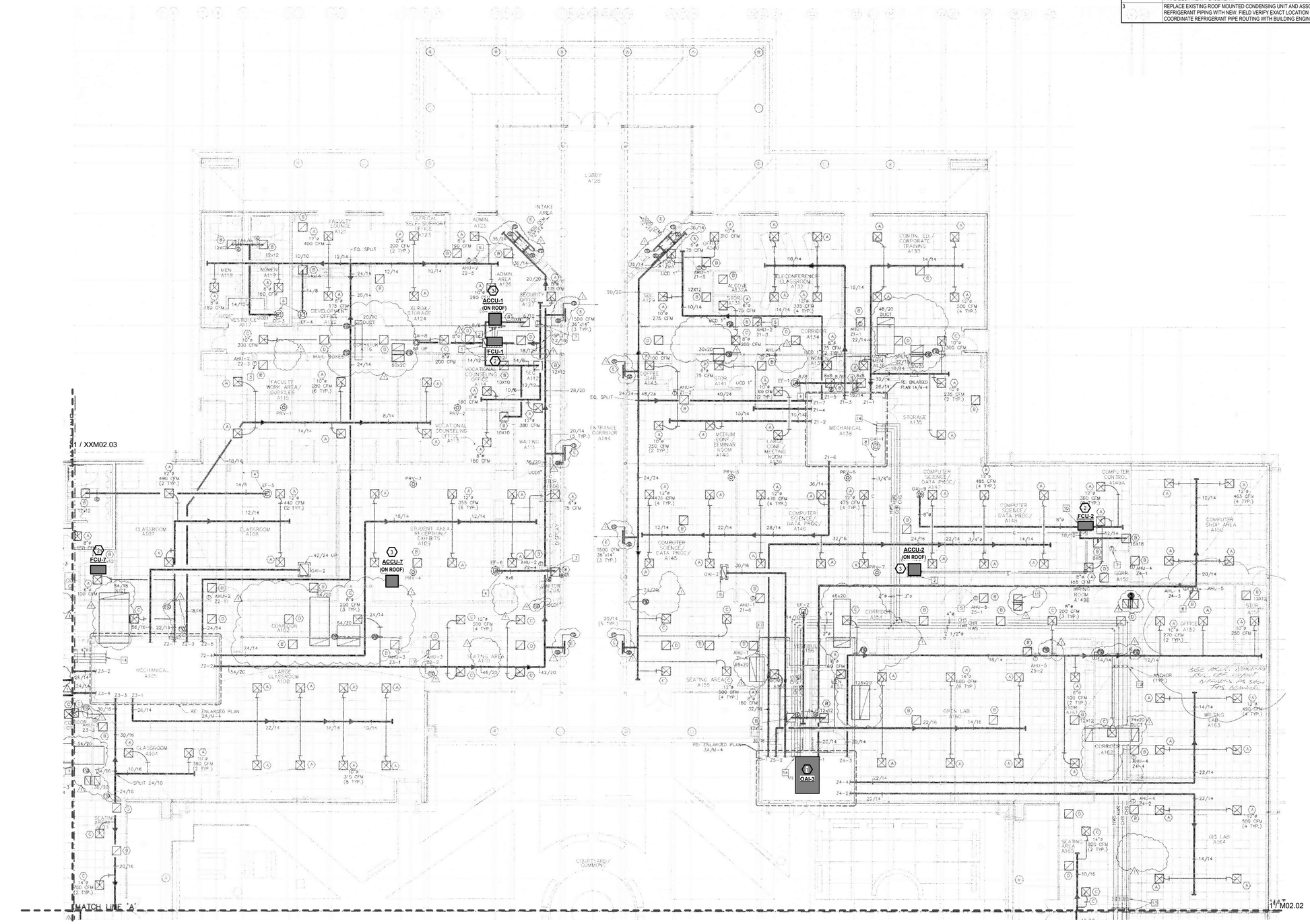
A. CONTRACTOR SHALL CONDUCT FIELD SURVEY TO VERIFY ALL EXISTING CONDITIONS ASSOCIATED WITH SCOPE OF WORK PRIOR TO SUBMITTING BIDS. ANY ADDITIONAL WORK REQUIRED ASSOCIATED WITH FAILURE TO PERFORM A FIELD SURVEY PRIOR TO SUBMITTING BIDS SHALL BE AT NO ADDITIONAL COST TO THE OWNER.

B. RECONNECT TO EXISTING ELECTRICAL SERVING EXISTING EQUIPMENT. CONTRACTOR SHALL VERIFY EXISTING CONDUIT, WIRE, AND BREAKER IS SUFFICENT TO NEW EQUIPMENT

C. CONTRACTOR SHALL COORDINATE SCHEDULE OF WORKING HOURS FOR REPLACEMENT OF EXISTING EQUIPMENT WITH FACILITIES ENGINEER AND FACILITIES MANAGEMENT PRIOR TO INSTALLATION.

KEYNOTES

KEYNOTE	DESCRIPTION
1	REPLACE EXISTING CHILLED WATER OUTSIDE AIR HANDLING UNIT WITH NEW. CONTRACTOR TO PROVIDE TRANSITIONS AS NECESSARY TO CONNECT TO EXISTING DUCTWORK. MAINTAIN ALL MANUFACTURER REQUIRED CLEARANCES. CONNECT TO EXISTING CHILLED WATER PIPING AND EXISTING HOT WATER PIPING. PROVIDE NEW PIPING ACCESSORIES AS NOTED IN DETAILS AND SPECIFICATIONS.
2	REPLACE EXISTING FAN COIL UNIT WITH NEW. FIELD COORDINATE EXACT LOCATION WITH EXISTING CONDITIONS AND BUILDING ENGINEER. MAINTAIN ALL MANUFACTURER'S RECOMMENDED CLEARANCES. CONTRACTOR TO PROVIDE TRANSITIONS AS NECESSARY TO CONNECT TO EXISTING DUCTWORK. CONNECT TO EXISTING CONDENSATE DRAIN PIPING ROUTED TO MECHANICAL ROOM FLOOR DRAIN. COORDINATE EXACT REFRIGERANT ROUTING WITH BUILDING ENGINEER AND EXISTING CONDITIONS. MANUFACTURER TO SIZE REFRIGERANT PIPING BASED ON FINAL EQUIPMENT PLACEMENT.
3	REPLACE EXISTING ROOF MOUNTED CONDENSING UNIT AND ASSOCIATED REFRIGERANT PIPING WITH NEW. FIELD VERIFY EXACT LOCATION OF EXISTING. COORDINATE REFRIGERANT PIPE ROUTING WITH BUILDING ENGINEER.



1 **MECHANICAL PLAN - A**
1/16" = 1'-0"

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HCC Stafford Science & Technology Building

HVAC Replacement

MECHANICAL PLAN - A

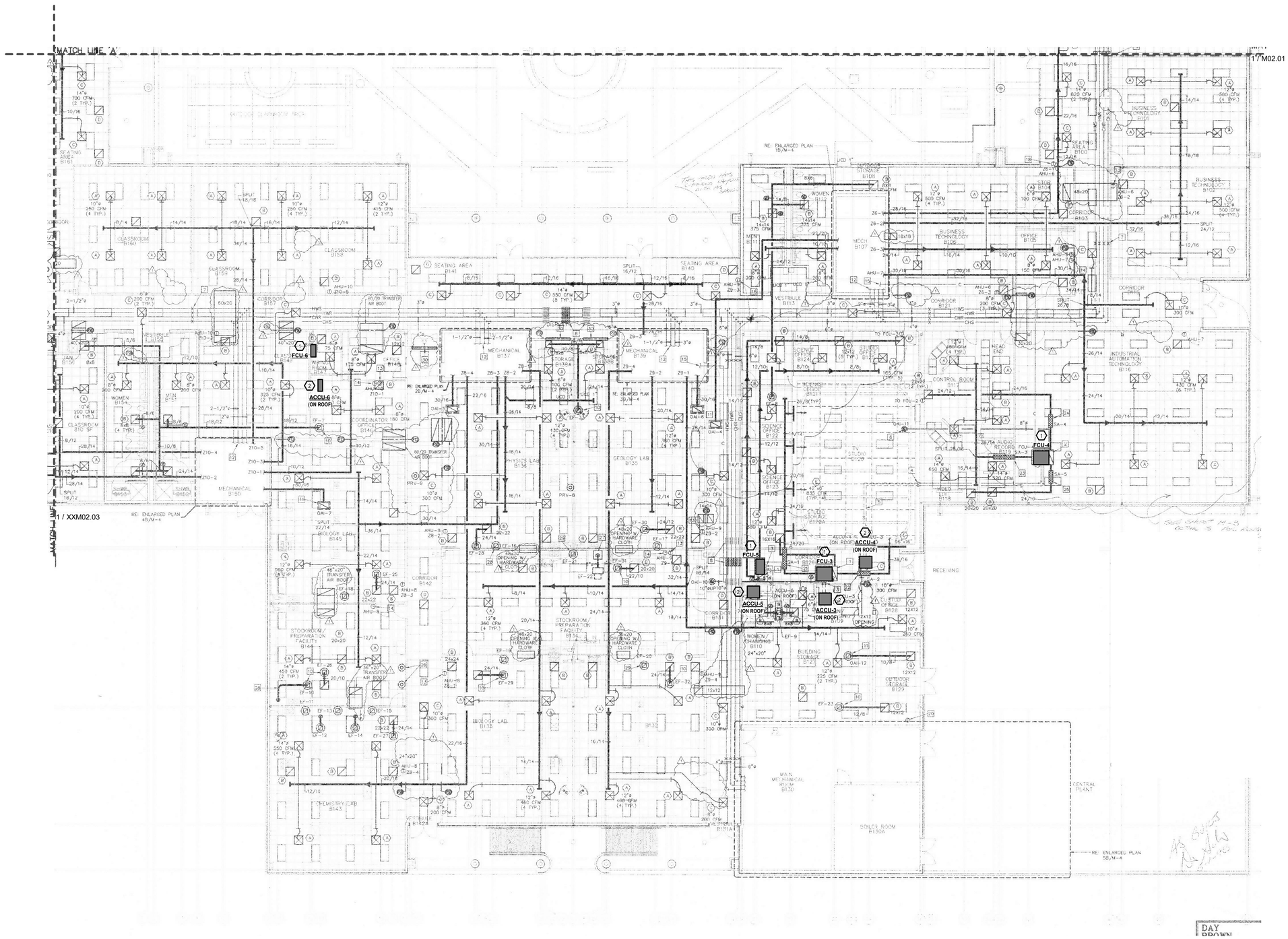
Project Number	H20041.00
Date	03/12/20
Drawn By	EFW
Checked By	NWB

M02.01

Scale: As indicated

KEYNOTES

KEYNOTE	DESCRIPTION
1	REPLACE EXISTING FAN COIL UNIT WITH NEW. FIELD COORDINATE EXACT LOCATION WITH EXISTING CONDITIONS AND BUILDING ENGINEER. MAINTAIN ALL MANUFACTURER'S RECOMMENDED CLEARANCES. CONTRACTOR TO PROVIDE TRANSITIONS AS NECESSARY TO CONNECT TO EXISTING DUCTWORK. CONNECT TO EXISTING CONDENSATE DRAIN PIPING ROUTED TO MECHANICAL ROOM FLOOR DRAIN. COORDINATE EXACT REFRIGERANT ROUTING WITH BUILDING ENGINEER AND EXISTING CONDITIONS. MANUFACTURER TO SIZE REFRIGERANT PIPING BASED ON FINAL EQUIPMENT PLACEMENT.
2	REPLACE EXISTING ROOF MOUNTED CONDENSING UNIT AND ASSOCIATED REFRIGERANT PIPING WITH NEW. FIELD VERIFY EXACT LOCATION OF EXISTING. COORDINATE REFRIGERANT PIPE ROUTING WITH BUILDING ENGINEER.



1 **MECHANICAL PLAN - B**
1/16" = 1'-0"

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HCC Stafford Science & Technology Building

HVAC Replacement

MECHANICAL PLAN - B

Project Number	H20041.00
Date	03/12/20
Drawn By	EFW
Checked By	NWB

M02.02

Scale 1/16" = 1'-0"

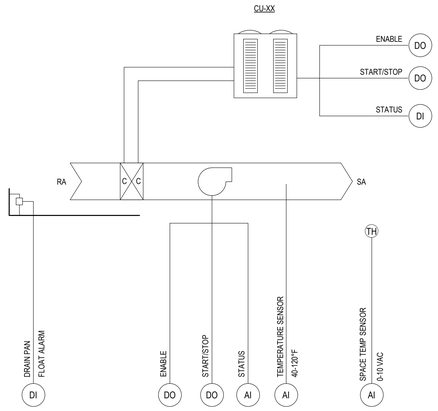
DX SPLIT SYSTEM

UNIT ENABLE:
WHEN BOTH THE HARDWIRED AND NETWORK UNIT ENABLE SWITCHES ARE ON, THE CONTROL SEQUENCE WILL BE ENABLED.

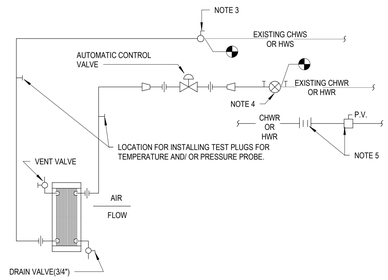
OCCUPIED MODE:
OCCUPANCY MODE WILL BE CONTROLLED VIA A NETWORK INPUT (ADJ. BY OWNER). DURING OCCUPIED MODE, THE THREE SPEED SUPPLY FAN WILL BE STARTED AND WILL CYCLE TO MAINTAIN TEMPERATURE. THE CONDENSING UNIT/ HEAT PUMP WILL MODULATE IN SEQUENCE TO MAINTAIN THE ZONE TEMPERATURE SETPOINT.

UNOCCUPIED MODE:
THE UNIT WILL CYCLE ON TO MAINTAIN UNOCCUPIED ZONE SETPOINTS DURING UNOCCUPIED PERIODS.

ADDITIONAL POINTS MONITORED BY THE BMS:
- FILTER STATUS
- DISCHARGE AIR SMOKE DETECTOR (IF SUPPLY AIR IS GREATER THAN 2000 CFM)



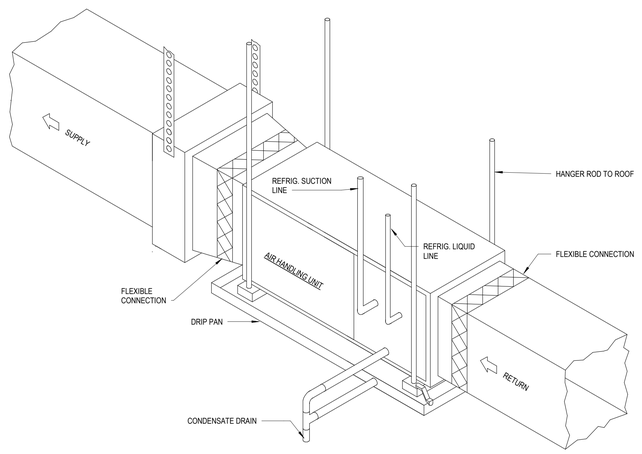
7 DX FCU W/O HEATING COIL CONTROLS
NOT TO SCALE



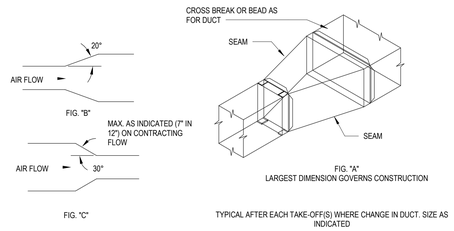
NOTES:

1. INSTALL FLOW METER ACCORDING TO MANUF. REQUIREMENTS.
2. INSTALL PIPING COUNTER FLOW TO AIR FLOW.
3. HOT WATER SUPPLY: BALL VALVE UP TO 2", BUTTERFLY VALVE 2-1/2" AND UP.
4. HOT WATER RETURN: CIRCUIT SETTER BALANCING VALVE WITH POSITIVE SHUT-OFF UP TO 2".
5. FLOW METER WITH PLUG VALVE - 3" TO 6", FLOW METER WITH BUTTERFLY VALVE - 8" AND UP.

PIPING ARRANGEMENT - 2-WAY DUCT MOUNTED CONTROL VALVE HYDRONIC COIL DETAIL
6
NOT TO SCALE

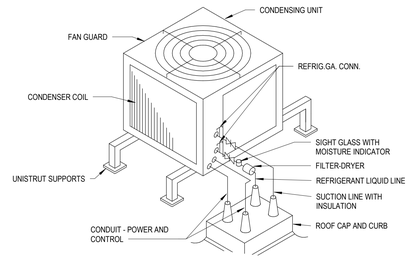


5 HORIZONTAL AIR HANDLING UNIT DETAIL
NOT TO SCALE

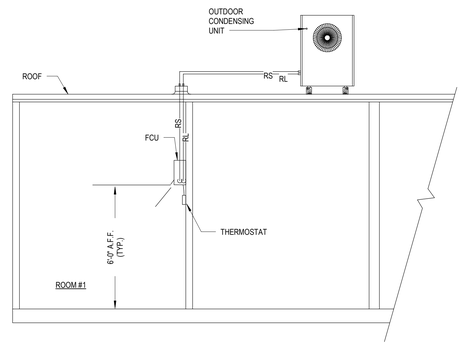


TYPICAL AFTER EACH TAKE-OFF(S) WHERE CHANGE IN DUCT. SIZE AS INDICATED

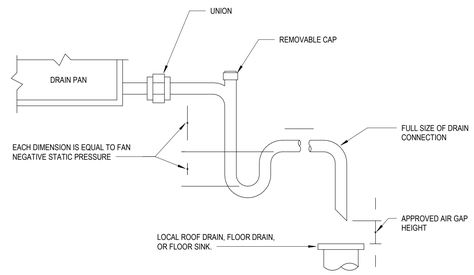
4 DUCT TRANSITION DETAIL
NOT TO SCALE



3 DX CONDENSING UNIT MOUNTED ON ROOF
NOT TO SCALE



2 DUCTLESS SPLIT SYSTEM CONDENSING UNIT DETAIL
NOT TO SCALE



1 CONDENSATE DRAIN DETAIL
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