HALL COUNTY JAIL
HVAC REPLACMENT

110 PUBLIC SAFETY DRIVE
GRAND ISLAND, NEBRASKA 68801

INDEX OF DRAWING

M/E COVER SHEET (THIS SHEET)

VICINITY MAP

STRATEGIC DESIGN

STRATEGIC DESIGN, LLC
1207 MURRAY POINT
PLATTSMOUTH NE 68048
402-290-5436
CoA #CA5431

PROFESSIONAL ELECTRICAL ENGINEER
JEFFREY D. [illegible]
E-11819
02/09/2026
STATE OF NEBRASKA

MECHANICAL ENGINEER
Jeffrey S. [illegible]
02/09/2026
STATE OF NEBRASKA

STRATEGIC DESIGN

drawing status
CD SET

project title
Hall County
DOC RTU
Replacement

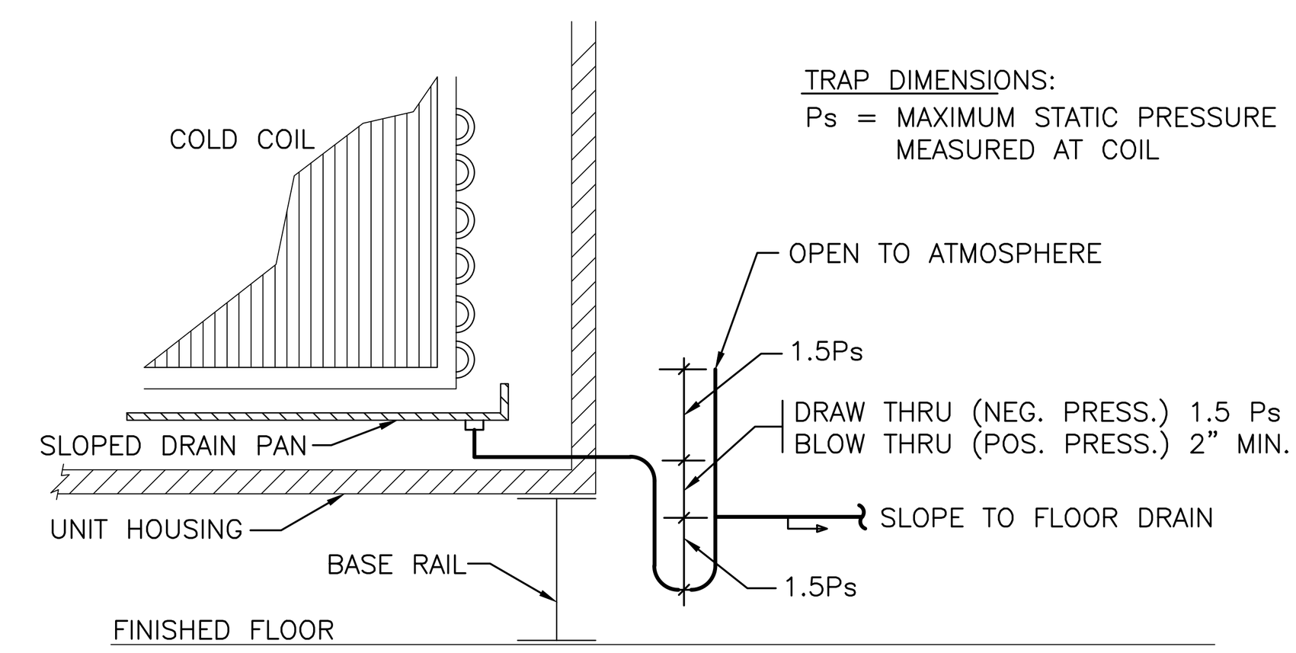
200 South Sycamore Street,
Grand Island, NE 68801

sheet title
Mechanical /
Electrical
Cover Sheet

drawn by	date	scale	revision
am	02-06-2026	None	-

sheet number
M/E

M000



NOTES:
1. TRAP AND DRAIN PIPING SIZE TO BE THE LARGER OF THE DRAIN PAN OUTLET SIZE OR THE FOLLOWING:

COOLING CAPACITY (MBH)	NOMINAL PIPE SIZE
UP TO 200	3/4"
201 TO 450	1"
451 TO 1000	1-1/4"
1001 TO 1500	1-1/2"
1501 TO 3000	2"

2. INSULATE TRAP AND DRAIN PIPING WITH 1/2" CLOSED CELL POLYETHYLENE FOAM INSULATION.

9 — COIL CONDENSATE DRAIN PIPING DETAIL
NO SCALE

MECHANICAL SYMBOLS AND ABBREVIATIONS

NOTE: ALL SYMBOLS AND ABBREVIATIONS SHOWN ARE NOT NECESSARILY USED ON THE DRAWINGS.

SYMBOLS LEGEND

DIVISION 23 - HVAC

GENERAL

SYMBOL	DESCRIPTION
1 G-000	SECTION IDENTIFICATION
1 G-000	DETAIL IDENTIFICATION
	DISCONNECT POINT — DEMO / EXISTING TO REMAIN
	CONNECTION POINT — NEW / EXISTING
1	DEMOLITION KEYED NOTE SYMBOL
1	NEW WORK KEYED NOTE SYMBOL
XXX-1	EQUIPMENT TAG (SEE SCHEDULES, I.E. AHU-1 - AIR HANDLING UNIT)

SHEET METAL

SYMBOL	DESCRIPTION
500x250	RECTANGULAR DUCT SIZE MM (WIDTHxHEIGHT)
200Ø	ROUND DUCT SIZE MM (DIAMETER)
	RECTANGULAR SUPPLY OR OUTSIDE AIR DUCT UP
	RECTANGULAR SUPPLY OR OUTSIDE AIR DUCT DOWN
	RECTANGULAR RETURN, EXHAUST OR RELIEF AIR UP
	RECTANGULAR RETURN, EXHAUST OR RELIEF AIR DOWN
	ROUND SUPPLY OR OUTSIDE AIR DUCT UP
	ROUND SUPPLY OR OUTSIDE AIR DUCT DOWN
	ROUND RETURN, EXHAUST OR RELIEF AIR UP
	ROUND RETURN, EXHAUST OR RELIEF AIR DOWN
VD	MANUAL VOLUME DAMPER
UP	ELEVATION CHANGE IN DIRECTION OF AIRFLOW, UP
DN	ELEVATION CHANGE IN DIRECTION OF AIRFLOW, DOWN
	DIRECTION OF AIRFLOW
	TURNING VANES
	FLEX DUCT
900x300 S-1 / 150	SA DIFFUSER/REGISTER/GRILLE TAG — MMxMM SIZE / L/S TAG
900x300 R-1 / 150	RA DIFFUSER/REGISTER/GRILLE TAG — MMxMM SIZE / L/S TAG
300x300 E-1 / 100	EA (OR RELA) DIFFUSER/REGISTER/GRILLE TAG — MMxMM SIZE / L/S TAG
VAV-1 / 1000	VARIABLE AIR VOLUME BOX TAG — TAG / L/S
300x300 L-1 / 1000	LOUVER TAG — MMxMM SIZE / L/S TAG

TEMPERATURE CONTROLS

SYMBOL	DESCRIPTION
T	THERMOSTAT OR SPACE/DUCT TEMPERATURE SENSOR/TRANSMITTER
H	SPACE/DUCT HUMIDITY SENSOR/TRANSMITTER
P	SPACE/DUCT PRESSURE SENSOR/TRANSMITTER
S	SPACE SENSOR/TRANSMITTER
CO2	SPACE/DUCT CARBON DIOXIDE SENSOR/TRANSMITTER
M	MOTORIZED DAMPER
AMS	AIRFLOW MEASURING STATION
Sp	DUCT STATIC PRESSURE SENSOR

SYMBOLS LEGEND

ABBR.	2-LINE SYMBOL TOP VIEW	2-LINE SYMBOL SIDE VIEW	1-LINE SYMBOL	REMARKS
ISV				ISOLATION VALVE (BALL/BUTTERFLY/GATE – SEE SPECIFICATIONS)
BLV				BALL VALVE
BTV				BUTTERFLY VALVE
GTV				GATE VALVE
GLV				GLOBE VALVE
PLV				PLUG VALVE
CHV				CHECK VALVE (ARROW INDICATES DIRECTION OF FLOW)
			VB	VACUUM BREAKER (ARROW INDICATES DIRECTION OF FLOW)
				HOSE END CONNECTION
				MANUAL BALANCING VALVE
PRV				PRESSURE REDUCING VALVE
				FLOW MEASURING DEVICE
				(FLANGED/SCREWED) PIPE UNION OR FLANGE
				STRAINER
				RELIEF & PRESSURE RELIEF VALVE
				THERMOMETER
				PRESSURE GAGE WITH GAGE COCK
				ARROW INDICATES DOWNWARD PITCH OF PIPE
				ARROW INDICATES DIRECTION OF FLOW
				PIPE ECCENTRIC REDUCER
				PIPE CONCENTRIC REDUCER
				CAPPED END
				PIPE ELBOW UP
				PIPE ELBOW DOWN
				PIPE TEE UP
				PIPE TEE DOWN
				FLEXIBLE CONNECTOR
			EJ	EXPANSION JOINT
				AUTOMATIC FLOW CONTROL VALVE
				THERMOSTATIC EXPANSION VALVE
				WATER HAMMER ARRESTOR
			A	AUTOMATIC AIR VENT
				MANUAL AIR VENT
				TEST PORT
				AUTOMATIC TWO-WAY VALVE
				AUTOMATIC THREE-WAY VALVE
			S	SOLENOID VALVE
				PIPE ALIGNMENT GUIDE
				PIPE ANCHOR
CO			CO	CLEAN-OUT
CO			CO	FLOOR CLEAN-OUT
OS&Y				OUTSIDE SCREW AND YOKE VALVE
				BALL CHECK OR DRIP VALVE
BFP			BFP	BACKFLOW PREVENTER
FS			* FS- *	FLOOR SINK – (* SIZE) FS– (* TYPE)
FD			* FD- *	FLOOR DRAIN – (* SIZE) FD– (* TYPE)
AD			* AD- *	AREA DRAIN – (* SIZE) AD– (* TYPE)
RD			* RD- *	ROOF DRAIN – (* SIZE) RD– (* TYPE)
ERD			* ERD- *	EMERGENCY ROOF DRAIN – (* SIZE) ERD– (* TYPE)
WH			WH- *	WALL HYDRANT – WH–(* TYPE)
YH			YH- *	YARD HYDRANT – YH–(* TYPE)
HB			HB- *	HOSE BIBB – HB–(* TYPE)
NPW			NPW	NON POTABLE WATER (SEE PLANS FOR WATER SYSTEM TYPE)
D			D	DRAIN PIPING
HWS			HWS	HEATING HOT WATER SUPPLY
HWR			HWR	HEATING HOT WATER RETURN
CWS			CWS	CHILLED WATER SUPPLY
CWR			CWR	CHILLED WATER RETURN
CD			CD	CONDENSATE DRAIN

ABBREVIATIONS

GENERAL

AFF	ABOVE FINISHED FLOOR
BFF	BELOW FINISHED FLOOR
FF	FINISHED FLOOR
IE	INVERT ELEVATION
NIC	NOT IN CONTRACT
(E)	EXISTING
(TYP)	TYPICAL

DIVISION 23 - HVAC

ACC	AIR COOLED CONDENSER
AD	ACCESS DOOR
AHU	AIR HANDLING UNIT
AMS	AIRFLOW MEASURING STATION
AS	AIR SEPARATOR
B	BOILER
BCU	BLOWER COIL UNIT
BOD	BOTTOM OF DUCT
CA	COLD AIR
CC	COOLING COIL
CF	CEILING FAN
GCWP	CHILLED GLYCOL WATER PUMP
CH	CHILLER
CHEM	CHEMICAL FEEDER
CONDP	HVAC CONDENSATE PUMP
CP	CONDENSER WATER PUMP
CRAC	COMPUTER ROOM AIR CONDITIONER
CT	COOLING TOWER
CU	CONDENSING UNIT
CWP	CHILLED WATER PUMP
DSS	DUCTLESS SPLIT SYSTEM
EA	EXHAUST AIR
EDH	ELECTRIC DUCT HEATER
EF	EXHAUST FAN
EFT	ELECTRIC FIN TUBE
ERC	ENERGY RECOVERY COIL
ERW	ENERGY RECOVERY WHEEL
ET	EXPANSION TANK
EUH	ELECTRIC UNIT HEATER
EXV	EXHAUST VALVE
F	FURNACE
FC	FLUID COOLER
FCU	FAN COIL UNIT
FD	FIRE DAMPER
FF	FINAL FILTER
FSD	FIRE/SMOKE DAMPER
FT	FIN TUBE
H	HUMIDIFIER
HA	HOT AIR
HC	HEATING COIL
HCWP	HOT/CHILLED WATER PUMP
HGWP	HOT GLYCOL WATER PUMP
HP	HEAT PUMP
HPWP	HEAT PUMP WATER PUMP
HWP	HOT WATER PUMP
HX	HEAT EXCHANGER
IRH	INFRARED RADIANT HEAT
KH	KITCHEN HOOD
L	LOUVER
MAU	MAKEUP AIR UNIT
OA	OUTSIDE AIR
PF	PRE-FILTER
PHC	PREHEAT COIL
PHCP	PREHEAT COIL PUMP
PRV	PRESSURE REDUCING VALVE
PTAC	PACKAGED TERMINAL AIR CONDITIONER
PTHP	PACKAGED TERMINAL HEAT PUMP
RA	RETURN AIR
RAF	RETURN AIR FAN
RELA	RELIEF AIR
RELF	RELIEF AIR FAN
RH	ROOF HOOD
RHC	REHEAT COIL
RM	RADIANT MANIFOLD
SA	SUPPLY AIR
SA	SOUND ATTENUATOR
SAF	SUPPLY AIR FAN
SCP	STEAM CONDENSATE PUMP
SD	SMOKE DAMPER
TOD	TOP OF DUCT
UH	UNIT HEATER
VAV	VARIABLE AIR VOLUME BOX
VD	MANUAL VOLUME DAMPER
VSU	VENTILATION SUPPLY UNIT

ROOFTOP UNIT ENERGY RECOVERY WHEEL SCHEDULE

MARK NUMBER	AREA SERVED	Energy Recovery Wheel Performance: Recovered Capacity Cooling (Btu/hr)	Recovered Capacity Heating (Btu/hr)	ENTERING AIR TEMP TO WHEEL RETURN SUMMER (DB°F/WB°F)	ENTERING AIR TEMP TO WHEEL OUTSIDE SUMMER (DB°F/WB°F)	LEAVING AIR TEMP Cooling (DB°F/WB°F)	ENTERING OUTSIDE AIR TEMP RETURN WINTER (DB°F/WB°F)	ENTERING OUTSIDE AIR TEMP OUTSIDE WINTER (DB°F/WB°F)	LEAVING AIR TEMP Heating (DB°F/WB°F)	WHEEL APD (" W.C.)	% Effectiveness Total Cooling	% Effectiveness Sensible Cooling	% Effectiveness Total Heating	% Effectiveness Sensible Heating	AIRFLOW DATA AIR FLOW CFM	AIRFLOW DATA OA DESIGN CFM	AIRFLOW DATA MIN OCCUPIED OA CFM	TRANE BASIS OF DESIGN	DAIKIN BASIS OF DESIGN	YORK BASIS OF DESIGN	NOTES
RTU-7A	AREA C NORTH REC ROOMS	70.2	151.2	75/63	95/78	80.5/68.1	70/58	-10/-10	45.6/42.6	1.14	69%	72%	73%	74%	1690	1690	1690	TRANE OABD036A4-0000G1KG-A1E00BCAKG5A11B0E401	VALENT VX-12-0-G-A1	RUSKIN	1,2,3,4
RTU-7B	AREA C SOUTH REC ROOMS	70.2	151.2	75/63	95/78	80.5/68.1	70/58	-10/-10	45.6/42.6	1.14	69%	72%	73%	74%	1690	1690	1690	TRANE OABD036A4-0000G1KG-A1E00BCAKG5A11B0E401	VALENT VX-12-0-G-A1	RUSKIN	1,2,3,4

NOTES:
1. PROVIDE UNIT WITH MERV 8 FILTERS ON THE EXHAUST BEFORE THE WHEEL, VFD AND FROST PROTECTION.
2. ENERGY RECOVERY WHEEL SHALL BE PROVIDED AS PART OF THE RTU. SEE RTU SCHEDULE FOR ADDITIONAL INFORMATION.
3. **ALL CONTRACTORS MUST PROVIDE THREE BIDS FOR USING EACH MANUFACTURER LISTED, i.e. THREE BIDS MUST BE PROVIDED ONE BID FOR USING TRANE, ONE BID FOR USING DAIKIN+VALENT, AND ONE BID FOR USING YORK+RUSKIN.**
4. SEE ROOFTOP AND MAKE-UP AIR UNIT SCHEDULE FOR GAS-FIRED HEATING CAPACITY, AIRFLOW DATA, FAN, AND ELECTRICAL INFORMATION.

ROOFTOP AND MAKE-UP AIR UNIT SCHEDULE

MARK NUMBER	AREA SERVED	COOLING: NOMINAL TONNAGE	ORIGINAL SCHEDULED CAPACITY SENSIBLE MBH	ORIGINAL SCHEDULED CAPACITY TOTAL MBH	SENSIBLE MBH	TOTAL MBH	EAT DB/WB DEG F	LAT DB/WB DEG F	HEATING CAPACITY: ORIGINAL HEATING CAPACITY MBH	MAX INPUT/OUTPUT MBH	MIXED EAT DB DEG F	TURNDOWN RATIO OR # OF STAGES	AIRFLOW DATA: AIRFLOW CFM	OA DESIGN CFM	MIN OCCUPIED OA CFM	SUPPLY FAN DATA: TYPE	EXTERNAL STATIC PRESS. IN W.G.	TOTAL STATIC PRESS. IN W.G.	MOTOR HP
RTU-1	NW FEMALE CELLS	7.5	67.1	89.1	69.6	84.4	81.3/66.2	57.44/55.84	180.0	200/162	50.0	2 STAGES	2650	740	740	BC PLENUM, VARIABLE DIRECT DRIVE	1.0	1.148	3.0
RTU-2	NW FEMALE DAYROOMS	15	146.2	177.4	145.0	168.0	78.5/64.3	55.75/54.66	390.0	400/324	60.1	2 STAGES	6190	925	925	BC PLENUM, VARIABLE DIRECT DRIVE	1.0	1.252	3.0
RTU-3	SW Segregation Cells	12.5	108.5	139.4	106.5	132.6	81.8/66.1	56.92/54.9	270.0	250/202.5	48.5	2 STAGES	4115	1190	1190	BC PLENUM, VARIABLE DIRECT DRIVE	1.0	1.340	4.6
RTU-4	SW Segregation Dayroom	15	123.8	145.2	135.5	164.5	77.9/63.7	55.2/53/48	270.0	320/259.2	63.1	2 STAGES	5410	595	595	BC PLENUM, VARIABLE DIRECT DRIVE	1.0	1.210	3.0
RTU-5	NOT USED	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTU-6	MULTIPURPOSE AND LIBRARY ROOMS	10	91.9	129.9	92.8	123.3	86/69	54.3/54.3	270.0	250/202.5	38.7	10:1	2830	1180	1180	DIRECT DRIVE W/VFD	1.0	1.410	1.5
RTU-7A	AREA C NORTH REC ROOMS	-	-	-	-	-	-	-	180	150/120	45.6	10:1	1690	1690	1690	DIRECT DRIVE W/VFD	1.0	2.360	1.5
RTU-7B	AREA C SOUTH REC ROOMS	-	-	-	-	-	-	-	180	150/120	45.6	10:1	1690	1690	1690	DIRECT DRIVE W/VFD	1.0	2.360	1.5
RTU-8	NORTH DORMATORY DAY ROOMS	17.5	146.6	189.3	145.93	192.6	80.6/65.9	55.73/53.89	390	400/324	53.0	2 STAGES	5255	1260	1260	BC PLENUM, VARIABLE DIRECT DRIVE	1.0	1.182	3.0
RTU-9	SOUTH DORMATORY DAY ROOMS	15	112.5	146.9	127.68	167.26	81/66.1	55.66/53.99	270	320/259.2	51.8	2 STAGES	4500	1030	1030	BC PLENUM, VARIABLE DIRECT DRIVE	1.0	1.839	3.0
RTU-10	NE CELLS	12.5	102.3	142.1	103.12	133.12	81.9/66.7	57.21/55.23	270	250/202.5	47.9	2 STAGES	4015	1205	1205	BC PLENUM, VARIABLE DIRECT DRIVE	1.0	1.324	4.6
RTU-11	NE DAY ROOM	15	139.1	179.7	135.99	169.66	80.4/65.8	56.94/55.21	390	400/324	53.5	2 STAGES	5195	1195	1195	BC PLENUM, VARIABLE DIRECT DRIVE	1.0	1.193	3.0
RTU-12	SE CELLS	12.5	106.2	147.3	106.81	133.17	81.7/66.2	57.29/55.25	270	250/202.5	49.0	2 STAGES	4210	1220	1220	BC PLENUM, VARIABLE DIRECT DRIVE	1.0	1.356	3.0
RTU-13	SE DAY ROOM	15	139.9	180.6	135.99	169.66	80.4/65.8	56.94/55.21	390	400/324	53.5	2 STAGES	5195	1195	1195	BC PLENUM, VARIABLE DIRECT DRIVE	1.0	1.193	3.0
RTU-14	CORRIDOR/STORAGE	7.5	69.2	79.8	72.75	80.43	78.6/63.4	55.91/54	180	200/162	62.7	2 STAGES	2910	350	350	BC PLENUM, VARIABLE DIRECT DRIVE	1.0	1.172	3.0

MARK NUMBER	EXHAUST FAN DATA: TYPE	# OF FANS	EXTERNAL STATIC PRESS. IN W.G.	TOTAL STATIC PRESS. IN W.G.	H.P.	COMPRESSOR: # OF COMPRESSORS	TYPE	EER/IEER	UNIT POWER (NOTE THAT ALL UNITS HAVE 2 POWER CONNECTIONS EXCEPT FOR UNITS 7A AND 7B): CONDENSER FANS/ COMPRESSORS CIRCUIT MCA	CONDENSER FANS/ COMPRESSORS CIRCUIT MOP	GAS-HEATING/SUPPLY FANS/EXHAUST FANS/CONTROLS MCA	GAS-HEATING/SUPPLY FANS/EXHAUST FANS/CONTROLS MOP	SINGLE POINT POWER FOR UNITS RTU-7A AND 7B MCA	SINGLE POINT POWER FOR UNITS RTU-7A AND 7B MOP	V/Hz/PH	WEIGHT LBS	PREFABRICATED ROOF CURB MAX HEIGHT IN	TRANE BASIS OF DESIGN	DAIKIN/VALENT BASIS OF DESIGN	YORK/RUSKIN BASIS OF DESIGN	NOTES
RTU-1	FC/DIRECT DRIVE MODULATING	1.0	-	-	-	2.0	SCROLL	11/14.6	16.8	20.0	9.3	10.0	-	-	460/60/3	1210	14" ADAPTABLE ROOF CURB	TRANE YSK090A4S0H	DAIKIN DSG0904LH00078C	YORK KJ090S18R4DEJCE2F1	1 THRU 16, 19
RTU-2	-	-	-	-	-	2.0	SCROLL	10.8/14	28.8	40.0	12.4	15.0	-	-	460/60/3	2330	14" ADAPTABLE ROOF CURB	TRANE YSK180A4S0H	DAIKIN DSG1804DH00182C	YORK KV15S3DP4U1C1SL6G1	1 THRU 16, 19
RTU-3	FC/DIRECT DRIVE MODULATING	-	-	-	-	2.0	SCROLL	10.8/14	27.20	40.00	10.20	15.0	-	-	460/60/3	1460	14" ADAPTABLE ROOF CURB	TRANE YSK150A4S0H	DAIKIN DSG1504LH00120C	YORKK KJ150S24R4DENCD2E1	1 THRU 16, 19
RTU-4	FC/DIRECT DRIVE MODULATING	-	-	-	-	2.0	SCROLL	10.8/14	28.80	40.00	15.40	20.0	-	-	460/60/3	2380	14" ADAPTABLE ROOF CURB	TRANE YSK180A4S0M	DAIKIN DSG1504LH00120C	YORKK KJ150S24R4DENCD2E1	1 THRU 16, 19
RTU-5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTU-6	DIRECT DRIVE W/VFD W/BAROMETRIC RELIEF	1.0	-	0.7	1.0	2.0	21.5	30.0	21.50	30.00	9.10	15.00	-	-	460/60/3	3267	18" ADAPTABLE ROOF CURB	OADG010C3-DAB1GBG00-C1AEA1AE0	DAIKIN DPSC10B	YORK KJ120S24P4DEFCE2E1	1 THRU 16, 19
RTU-7A	DIRECT DRIVE W/VFD W/BAROMETRIC RELIEF	1.0	1.0	2.3	1.5	-	-	-	-	-	-	-	10.20	15.00	460/60/3	1800	18" ADAPTABLE ROOF CURB	TRANE OABD036A4-0000G1KG-A1E00BCAKG5A11B0E401	VALENT VX-12-0-G-A1	RUSKIN	1 THRU 15, 17, 18, 19
RTU-7B	DIRECT DRIVE W/VFD W/BAROMETRIC RELIEF	1.0	1.0	2.3	1.5	-	-	-	-	-	-	-	10.20	15.00	460/60/3	1800	18" ADAPTABLE ROOF CURB	TRANE OABD036A4-0000G1KG-A1E00BCAKG5A11B0E401	VALENT VX-12-0-G-A1	RUSKIN	1 THRU 15, 17, 18, 19
RTU-8	-	-	-	-	-	2.0	35.3	50.0	35.30	50.00	12.90	15.0	-	-	460/60/3	2357	14" ADAPTABLE ROOF CURB	TRANE YSK210A4S0H	DAIKIN DSG1804DH00183C	YORK KV15S3DP4U1C1SL6G1	1 THRU 16, 19
RTU-9	FC/DIRECT DRIVE MODULATING	1.0	-	-	-	2.0	28.8	40.0	28.80	40.00	15.40	20.00	-	-	460/60/3	2380	14" ADAPTABLE ROOF CURB	TRANE YSK180A4S0M	DAIKIN DSG1504LH00120C	YORKK KJ150S24R4DENCD2E1	1 THRU 16, 19
RTU-10	FC/DIRECT DRIVE MODULATING	1.0	-	-	-	2.0	27.2	40.0	27.20	40.00	10.20	15.00	-	-	460/60/3	1460	12" ADAPTABLE ROOF CURB	TRANE YSK150A4S0H	DAIKIN DSG1504LH00120C	YORKK KJ150S24R4DENCD2E1	1 THRU 16, 19
RTU-11	FC/DIRECT DRIVE MODULATING	1.0	-	-	-	2.0	28.8	40.0	28.80	40.00	15.40	20.0	-	-	460/60/3	2400	18" ADAPTABLE ROOF CURB	TRANE YSK180A4S0H	DAIKIN DSG1504LH00120C	YORK KV15S3DP4U1C1SL6G1	1 THRU 16, 19
RTU-12	FC/DIRECT DRIVE MODULATING	1.0	-	-	-	2.0	27.2	40.0	27.20	40.00	10.20	15.00	-	-	460/60/3	1460	14" ADAPTABLE ROOF CURB	TRANE YSK150A4S0H	DAIKIN DSG1504LH00120C	YORKK KJ150S24R4DENCD2E1	1 THRU 16, 19
RTU-13	FC/DIRECT DRIVE MODULATING	1.0	-	-	-	2.0	28.8	40.0	28.80	40.00	15.40	20.00	-	-	460/60/3	2400	18" ADAPTABLE ROOF CURB	TRANE YSK180A4S0H	DAIKIN DSG1504LH00120C	YORK KV15S3DP4U1C1SL6G1	1 THRU 16, 19
RTU-14	FC/DIRECT DRIVE MODULATING	1.0	-	-	-	2.0	16.8	20.0	16.8	20.0	9.3	10.0	-	-	460/60/3	1210	14" ADAPTABLE ROOF CURB	TRANE YSK090A4S0H	DAIKIN DSG0904LH00078C	YORK KJ090S18R4DEJCE2F1	1 THRU 16, 19

NOTES:
1. SUMMER DESIGN CONDITIONS BASED UPON 100 DEG F DB / 78 DEG F WB, WINTER DESIGN CONDITIONS BASED UPON -15 DEG F.
2. PROVIDE ALL UNITS DDC CONTROLLER WITH BACNET COMMUNICATION CARD PREPROGRAMMED APPLICATION FOR HEATING/COOLING, 2" THICK MERV 8 FILTERS PREFILTERS, **SMOKE DETECTOR IN RETURN AIR SECTION**, (1) 115V GFCI SERVICE OUTLET, DISCONNECT SWITCH.
3. UNITS SHALL MEET OR EXCEED THE ABOVE EER'S LISTED WITH R-454B REFRIGERANT.
4. PROVIDE UNIT WITH STAINLESS STEEL DRAIN PANS, HINGED ACCESS DOORS, CLOGGED FILTER SWITCH, HAIL GUARDS ON CONDENSER COILS, 5-YEAR COMPRESSOR WARRANTY, 1-YEAR PARTS WARRANTY.
5. PROVIDE FULLY MODULATING 100% OUTDOOR AIR ECONOMIZER WITH DRY BULB TEMPERATURE CONTROL WITH MOTORIZED OUTDOOR AND RETURN AIR DAMPERS, AND POWERED EXHAUST AIR DAMPERS. PROVIDE ALL UNITS WITH OUTDOOR AIR INTAKE HOOD WITH BIRDSCREEN AND HAIL GUARDS.
6. **PROVIDE WITH INSULATED ADAPTABLE ROOF CURB, ROOF CURB SHALL BE THYBAR RETROMATE STANDARD OR EQUAL.**
7. FULLY INSULATED WALL CONSTRUCTION AND HAVE OUTDOOR INTAKE WITH WEATHER INTAKE HOOD WITH BIRSCREEN.
8. SEE PLANS FOR UNIT ORIENTATION SUPPLY/RETURN LOCATIONS.
9. PROVIDE SUPPLY AIR DISCHARGE SENSOR (WIRED IN UNIT AND MOUNTED IN SUPPLY DUCT), OUTSIDE AIR TEMPERATURE SENSOR, RETURN AIR SENSOR, SUPPLY FAN AIR PROVING MODBUS, BUILDING STATIC PRESSURE SENSOR.
10. **UNIT SHALL HAVE DUAL POINT POWER CONNECTIONS AND TWO DISCONNECT SWITCHES; ONE CIRCUIT ON GENERATOR POWER SHALL SERVE THE GAS-HEATING, SUPPLY FANS, EXHAUST FANS, AND CONTROLS; SECOND CIRCUIT SHALL SERVE THE COMPRESSORS AND CONDENSER FANS. DISCONNECTS SHALL BE PROVIDED BY THE ELECTRICIAN.**
11. PROVIDE DEMAND CONTROL VENTILATION SYSTEM WITH CO2 SENSOR MONITORING WITH WALL MOUNTED CO2 SENSOR KIT.
12. PROVIDE WITH NEEDLE POINT BIPOLAR IONIZATION DOWNSTREAM OF THE FILTERS
13. **THE CONTROLS SHALL CONTROL THE RTU'S AND SMOKE EVACUATION EXHAUST FANS TO COMPLY WITH UUKL SMOKE CONTROL LISTING as required by State Fire Marshal for code compliance for Jails and Prisons that house inmates.**
14. **ALL CONTRACTORS MUST PROVIDE THREE BIDS FOR USING EACH MANUFACTURER LISTED, i.e. THREE BIDS MUST BE PROVIDED ONE BID FOR USING TRANE, ONE BID FOR USING DAIKIN+VALENT, AND ONE BID FOR USING YORK+RUSKIN.**
15. THE ELECTRICAL INFORMATION LISTED IS BASED UPON USING THE TRANE EQUIPMENT, THE CONTRACTOR SHALL BE RESPONSIBLE FOR CHANGES TO WIRING AND CIRCUIT BREAKERS DUE TO USING DAIKIN+VALENT OR YORK+RUSKIN EQUIPMENT.
16. DX COOLING WITH 2-STAGE SCROLL COMPRESSORS, SERVICE VALVES INCLUDING SUCTION AND DISCHARGE VALVES WITH 3-WAY SHUT-OFF VALVES, HIGH AND LOW PRESSURE SWITCHES, FILTER/DRYER KIT, THERMAL EXPANSION VALVE, DISCHARGE TEMPERATURE CONTROL, INDIRECT FIRED NATURAL GAS HEAT WITH SPARK IGNITION, HIGH FAULT SCCR RATING. PHASE AND VOLTAGE MONITOR TO PROTECT UNIT FROM PHASE LOSS/REVERSAL/LOW VOLTAGE.
17. DX COOLING WITH A LEAD DIGITAL SCROLL COMPRESSOR AND ONE ON/OFF SCROLL COMPRESSOR WITH MODULATING HOT GAS REHEAT AND DEHUMIDIFICATION CYCLE, SERVICE VALVES INCLUDING SUCTION AND DISCHARGE VALVES WITH 3-WAY SHUT-OFF VALVES, HIGH AND LOW PRESSURE SWITCHES, FILTER/DRYER KIT, THERMAL EXPANSION VALVE, DISCHARGE TEMPERATURE CONTROL, INDIRECT FIRED NATURAL GAS HEAT WITH SPARK IGNITION, HIGH FAULT SCCR RATING. PHASE AND VOLTAGE MONITOR TO PROTECT UNIT FROM PHASE LOSS/REVERSAL/LOW VOLTAGE. BOTH CIRCUITS FOR **THIS UNIT SHALL BE PLACED ON GENERATOR POWER.**
18. THIS UNIT IS HAS AN ENERGY RECOVERY WHEEL FOR WHEEL PERFORMANCE SEE ROOFTOP UNIT ENERGY RECOVERY WHEEL SCHEDULE.
19. **THE MANUFACTURER OF THE ROOTOP UNIT EQUIPMENT FOR DAIKIN+VALENT AND YORK+RUSKIN SHALL CONFIRM AND COORDINATE THAT THE EQUIPMENT CAN BE PROVIDED WITH A TERMINAL STRIP AS DESCRIBED BELOW IN ORDER TO COMPLY WITH THE SMOKE EVACUATION SYSTEM IN ORDER TO BE TESTED AND CERTIFIED TO COMPLY WITH SMOKE EVACUATION SYSTEM UNDERWRITER LABORATORIES UL 864 LISTING AND THE STATE FIRE MARSHAL.**

ALL HVAC EQUIPMENT INCORPORATED INTO THE SMOKE CONTROL SYSTEM SHALL BE UL864 (UUKL) LISTED FOR SMOKE CONTROL APPLICATIONS. EACH DEVICE SHALL PROVIDE A UL864 LISTED AND COMPATIBLE METHOD FOR THE SMOKE CONTROL SYSTEM TO COMMAND AND MONITOR ALL REQUIRED LIFE SAFETY FUNCTIONS, INCLUDING RUN/STOP, OPEN/CLOSE, POSITION/STATUS FEEDBACK, AND FAULT INDICATION. THE INTERFACE METHOD SHALL BE HARDWIRED I/O, PROVIDED IT COMPLIES WITH THE MANUFACTURER'S UUKL LISTING AND IS ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION (AHJ). WHEN ALTERNATE MANUFACTURERS ARE USED, THEIR EQUIPMENT SHALL MAINTAIN THE SAME UL864 LISTED CONTROL AND MONITORING CAPABILITIES REQUIRED FOR INTEGRATION WITH THE SMOKE EVACUATION SYSTEM. ALL EQUIPMENT MANUFACTURERS FOR DAIKIN+VALENT AND YORK+RUSKIN MUST PROVIDE THE FOLLOWING IN LIEU OF A DDC CONTROLLER: A TERMINAL STRIP INTERFACE WIRED TO THE RTU'S WITH DIRECT CONNECTION TO ALL FANS, DAMPERS, AND COMPRESSORS TO COMPLY WITH UL 864 (UUKL) REQUIREMENTS AND INTERFACE TO THE SMOKE EVACUATION SYSTEM.

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GENERAL DEMOLITION NOTES

1. FULL-TONED EQUIPMENT AND/OR PIPING AND DUCTWORK SHALL BE REMOVED. EXISTING EQUIPMENT AND/OR PIPING AND DUCTWORK TO REMAIN SHALL BE PROTECTED FROM DAMAGE DURING THE DEMOLITION AND NEW CONSTRUCTION PHASES OF THE JOB.

2. LEAVE ALL SPACES, INCLUDING ALL STRUCTURAL SYSTEMS (WHETHER BUILT-IN OR MOVEABLE) IN THE SAME GENERAL CONDITION AS IT IS FOUND AT THE START OF THE WORK. ALL FIXTURES AND EQUIPMENT MOVED OR DISTURBED IN CONNECTION WITH THE NEW WORK SHALL BE PROPERLY INSTALLED IN THE MANNER CORRESPONDING TO THE ORIGINAL METHOD, AND ALL DAMAGE TO EXISTING FIXTURES, INSULATING MATERIALS, AND EQUIPMENT SHALL BE FULLY REPAIRED.

GENERAL NEW CONSTRUCTION NOTES
SECTION 200000 - BASIC MECHANICAL REQUIREMENTS

1. RELATED DOCUMENTS: THE GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS, OTHER CONDITIONS, AND DIVISION-1 GENERAL REQUIREMENTS, ARE APPLICABLE TO ALL CONTRACTS FOR THIS PROJECT.
2. THE DATA GIVEN ON THE DRAWINGS IS AS EXACT AS COULD BE SECURED. OBTAIN EXACT LOCATIONS, MEASUREMENTS, LEVELS, ETC., AT THE SITE AND SHALL SATISFACTORILY ADAPT YOUR WORK TO THE ACTUAL CONDITIONS AT THE BUILDING.
3. VISIT THE JOB SITE PRIOR TO SUBMITTING A BID TO GO OVER THE CONDITIONS AT THE SITE INFORMING YOURSELF OF ALL THE DETAILS.
4. CONNECTIONS TO THE EXISTING SYSTEMS SHALL BE MADE SO THAT THE USE OF THESE SYSTEMS IS NOT INTERRUPTED WITHOUT THE OWNER'S APPROVAL AS TO THE TIME AND DURATION.
5. WHEN THE MAKE OR THE NAME OF ANY ITEM IS MENTIONED IN THESE SPECIFICATIONS OR ON THE PLANS, IT IS DONE FOR THE PURPOSE OF DESCRIBING THE TYPE AND QUALITY OF THE ITEM REQUIRED. ALTERNATIVE MANUFACTURERS FURNISHED AND INSTALLED UNDER THIS CONTRACT SHALL BE EQUAL TO OR GREATER THAN THE PRODUCT SPECIFIED IN ALL RESPECTS IN REGARDDS TO QUALITY, FINISH, AND PURPOSE FOR WHICH THEY ARE TO BE USED, AND THEY SHALL FIT IN THE SPACE PROVIDED.

SECTION 200504 – MECHANICAL APPROVED MANUFACTURERS AND SHOP DRAWINGS

1. GENERAL: THE FOLLOWING MANUFACTURERS HAVE BEEN GIVEN APPROVAL TO BID THEIR MATERIAL AND PRODUCTS. MANUFACTURERS NOT LISTED HERE REQUESTING PRIOER APPROVAL SHALL SUBMIT APPLICABLE PRODUCT INFORMATION TO BE RECEIEVED BY THE ENGINEER NO LATER THAN 10 DAYS BEFORE BID DATE. BEING APPROVDED DOES NOT NEGATE THE REUQIREMENT OF AN APPROVED MANUFACTURER FROM MEEETING THE SPECIFIED PERFORMANCE DATA, ELECTRICAL REQUIREMENTS, SPACE REQUIREMENTS, ET. ALL APPROVED MANUFACTURERS MUST MEET ALL THE REQUIREMENTS OF THE SPECIFIED PRODUCT. DEVIATIONS FROM THE SPECIFIED PRODUCT SHALL BE COORDINATED WITH OTHER TRADES AND ADDED COSTS TO THOSE TRADES SHALL BE AT THE MECHANICAL CONTRACTORS EXPENSE AT NO COST TO THE OWNER, ARCHITECT OR ENGINEER.
2. THE FOLLOWING LIST IS FOR BIDDING PURPOSES ONLY AND IS NOT INTENDED TO INDICATE ITEMS EQUAL IN QUALITY, WORKMANSHIP AND/OR PERFORMANCE. THE LIST FOR PRIOR APPROVAL TO BID THE PROJECT

SECTION 200553 - MECHANICAL IDENTIFICATION

1. DEFINITIONS
   a. CONCEALED: DUCTWORK AND PIPING ABOVE CEILINGS AND IN CHASES, INTERSTITIAL SPACE, AND PIPE SPACES.
   b. EXPOSED: PIPING, DUCTWORK, AND EQUIPMENT EXPOSED TO VIEW IN FINISHED AREAS INCLUDING MECHANICAL AND ELECTRICAL EQUIPMENT ROOMS. ATTICS AND CRAWL SPACES WHERE AIR HANDLING UNITS ARE LOCATED ARE CONSIDERED TO BE MECHANICAL ROOMS. SHAFTS, CHASES, INTERSTITIAL SPACES, UNFINISHED ATTICS, CRAWL SPACES AND PIPE BASEMENTS ARE NOT CONSIDERED FINISHED AREAS.
2. MATERIALS
   a. PIPE AND DUCT MARKERS: PROVIDE PRESSURE SENSITIVE MARKERS, BRADY TYPE B-946, FLEXIBLE FILM IDENTIFICATION MARKERS AND 2" DIRECTIONAL PIPE BANDING TAPE. PROVIDE LEGEND SIZE AND COLOR CODING AS PER ANSI A13.1 STANDARD.
   b. EQUIPMENT LABELS: WHITE PLASTIC LAMINATE WITH BLACK ENGRAVING, FASTEN WITH BRASS SCREWS. PROVIDE LABELS OF UNIFORM SIZE COMMENSURATE WITH THE SIZE OF THE EQUIPMENT TO WHICH ATTACHED, MINIMUM LETTERING HEIGHT 1/8 INCH.
3. PIPING IDENTIFICATION
   a. GENERAL: IDENTIFY PIPING IN CRAWL SPACES, ABOVE CEILINGS, ETC., AS WELL AS EXPOSED TO VIEW. PROVIDE IDENTIFYING MARKINGS AT VALVES AND EQUIPMENT, AT TERMINAL POINTS AND AT BOTH SIDES OF PIPING PASSING THROUGH WALLS AND FLOORS. PROVIDE IDENTIFYING MARKINGS AT 15 FEET O.C. FOR EXPOSED PIPING AND AT 25 FEET O.C. FOR CONCEALED PIPING.
   b. PIPE MARKERS: INSTALL MARKERS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. REMOVE AND REPLACE ALL PIPE MARKERS SHOWING DOG-EARS, BUBBLES OR OTHER FAILURES. INSTALL PIPE MARKERS SO LETTERING IS IN THE MOST LEGIBLE POSITION.
   c. INSTALL PIPING MARKERS WITHIN 3 INCHES OF EACH VALVE TO SHOW PROPER IDENTIFICATION OF PIPE CONTENTS.

4. EQUIPMENT IDENTIFICATION
   a. PROVIDE IDENTIFICATION MARKERS ON AUTOMATIC CONTROLS, CONTROL PANELS, ZONE VALVES, MAGNETIC STARTERS AND RELAYS.
   b. PROVIDE IDENTIFICATION MARKERS ON EXHAUST FANS, SUPPLY FANS, AIR HANDLING UNITS, AND CONNECTING DUCTWORK, INDICATING SERVICE, ZONES, AND DRAWING FAN IDENTIFICATION NUMBERS.

SECTION 221116 – PLUMBING PIPE, PIPE FITTINGS AND ACCESSORIES

1. GENERAL: VERIFY ALL DIMENSIONS BY FIELD MEASUREMENTS. VERIFY THAT ALL PLUMBING FIXTURES SHALL BE INSTALLED IN ACCORDANCE WITH AND ALL APPLICABLE PLUMBING CODES AND REGULATIONS. ALL PIPING, FIXTURES, AND ACCESSORIES SHALL BE INSTALLED PER RECOGNIZED INDUSTRY STANDARDS.
2. GENERAL LOCATIONS AND ARRANGEMENTS: DRAWINGS (PLANS, SCHEMATICS, AND DIAGRAMS) INDICATE THE GENERAL LOCATION AND ARRANGEMENT OF THE PIPING SYSTEMS. SO FAR AS PRACTICAL, INSTALL PIPING AS INDICATED.
3. CONDENSATE DRAIN PIPING: CONDENSATE DRAIN PIPING SHALL BE SCHEDULE 40 PVC, SCHEDULE 40 GALVANIZED STEEL OR TYPE M COPPER TUBING MADE WITH SWEAT FITTINGS OF 95-5 SOLDER. CONNECTIONS TO UNITS SHALL BE WITH A P-TRAP SIZED ACCORDING TO THE DETAIL WITHIN THESE DOCUMENTS. PROVIDE FOR CLEANOUT OF DRAIN PIPING AT ALL POSSIBLE 90 DEGREE ELBOWS. INSTALL CONDENSATE DRAINS WITH A SLOPE OF NO LESS THAN 1/8 INCH PER FOOT. DO NOT ALLOW ANY SAGS OR LOW PLACES TO POCKET.

SECTION 220523 - VALVES & SPECIALTIES

1. GENERAL:
   a. END STYLE OF VALVES TO BE COMPATIBLE WITH PIPING SYSTEM SERVED.
   b. VALVES FOR USE IN DOMESTIC WATER SYSTEMS TO BE TESTED AND CERTIFIED TO NSF/ANSI 61 FOR
   c. "LEAD FREE" COMPLIANCE.
2. BRONZE BALL VALVES: 150 PSIG SWP RATING, 600 PSIG CWP RATING, FULL PORT DESIGN, TWO PIECE FORGED BRONZED BODY, STAINLESS STEEL BALL AND STEM, SOLDER END, PTFE OR TFE SEATS, LEAD FREE VALVE. ACCEPTABLE MANUFACTURERS: APOLLO VALVE, MILWAUKEE VALVE, HAMMOND VALVE.

SECTION 200700 - PIPING AND DUCTWORK INSULATION

1. ALL INSULATION SHALL HAVE FIRE AND SOME HAZARD RATINGS AS TESTED UNDER ASTM E 84, NOT EXCEEDING FLAMESPREAD RATING OF 25 AND SMOKE DEVELOPED RATING OF 50.
2. TAPE USED FOR SEALING PURPOSES SHALL BE 3M EC-1329 UNLESS OTHERWISE RECOMMENDED BY NONCONDUCTIVE COVERING MANUFACTURING.
3. FOR PIPING THAT IS NOT PRE-INSULATED, FIBERGLASS PIPE INSULATION SHALL BE ONE PIECE, MOLDED GLASS FIBERS BONDED WITH PHENOLIC RESIN OR FLEXIBLE ELASTOMERIC COVERED WITH FACTORY-APPLIED VAPOR BARRIER JACKET (ASJ). THERMAL CONDUCTIVITY (K-VALUE) SHALL NOT EXCEED 0.25.
4. FOR ALL REFRIGERANT PIPING PROVIDE EPDM PIPE INSULATION AS CALLED OUT ON THE PLANS.
5. SUPPLY AND RETURN DUCT INSULATION SHALL BE FIBERGLASS BLANKET WITH AN FSK OR PSK VAPOR BARRIER FACING. THERMAL CONDUCTIVITY (K-VALUE) SHALL NOT EXCEED 0.31. DENSITY SHALL BE 0.75 LBS./CUBIC FOOT. 2 INCH FACING TAB. INSULATION, ADHESIVES, JACKET, ETC. MUST COMPLY WITH NFPA AND LOCAL CODES FOR SMOKE DEVELOPED AND FLAME SPREAD RATINGS. INSULATION SHALL BE CERTAINTEED TYPE 150 FOR ALL SURFACE FACED DUCT WRAP AND FOIL REINFORCED KRAFT (FRK) VAPOR BARRIER FACING OR EQUAL.INSULATION SHALL BE CERTAINTEED, KNAUF, MANSVILLE, OR OWENS-CORNING. RETURN AIR DUCT PLENUMS SHALL BE PROVIDED WITH DUCT LINER AS CALLED OUT ON THE PLANS.
6. APPEARANCE OF FINISHED WORK IS OF EQUAL IMPORTANCE WITH ITS MECHANICAL CORRECTNESS AND EFFICIENCY. INSULATION SHALL NOT BE APPLIED UNTIL SYSTEMS ARE TESTED.
7. INSULATION SHALL BE CONTINUOUS THROUGH WALLS, FLOORS, AND CEILINGS UNLESS OTHERWISE SPECIFIED OR SHOWN.

SECTION 233113 - DUCTWORK & DUCTWORK SPECIALTIES

1. DUCTWORK: INSTALL NEW SHEET METAL DUCTWORK PER RECOGNIZED INDUSTRY STANDARDS, COMPLY WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS, METAL AND FLEXIBLE, CURRENT EDITION, JANUARY 1985 AND APPLICABLE LOCAL CODES FOR CONSTRUCTION, THICKNESS, SUPPORTS, BRACING AND ACCESSORIES. ALL EXHAUST, SUPPLY, AND RETURN DUCTWORK SHALL BE STAINLESS STEEL.

2. ALL NEW DUCT CONSTRUCTION MITERED 90 DEGREE ELBOWS SHALL HAVE DOUBLE THICKNESS TURNING VANES.

3. WHERE SHOWN ON THE DRAWINGS, ALL NEW DUCT CONSTRUCTION MITERED 90 DEGREE ELBOWS SHALL HAVE DOUBLE THICKNESS TURNING VANES.

4. BALANCE AIR HANDLING UNITS, ROOF TOP UNITS, DIFFUSERS, REGISTERS AND GRILLES TO NOTED CFM'S. BALANCING REPORT SHALL BE SUBMITTED TO THE ENGINEER.

5. PROVIDE RADIUS TYPE FITTINGS FABRICATED OF MULTIPLE SECTIONS WITH MAXIMUM 15 DEGREE CHANGE OF DIRECTION PER SECTION. UNLESS SPECIFICALLY DETAILED OTHERWISE, (USE 45 DEGREE LATERALS AND 45 DEGREE ELBOWS FOR BRANCH TAKEOFF CONNECTIONS) OR (WHERE 90 DEGREE BRANCHES ARE INDICATED, PROVIDE CONICAL TYPE TEES.

6. ALL ROUND DUCT TAKE-OFF FITTINGS FROM RECTANGULAR DUCTS SHALL BE MADE WITH A SCREW-IN TYPE FITTING. THE MOUNTING GROOVE SHALL BE SO CONSTRUCTED AS TO ASSURE CONSTANT FIE CONTROL. BALANCING DAMPER SHALL BE FACTORY INSTALLED WITH A SPRING-LOADED RETRACTABLE WING NUT FOR EASY READJUSTMENT WHEN NEEDED. FITTING SHALL BE MASTIC SEALED AND TAPED.

7. CONTROL DAMPERS SHALL BE AS FOLLOWS:
   1. FRAME: HAT CHANNEL CONSTRUCTION; 16 GAUGE STAINLESS STEEL OR EPOXY COATED GALVANIZED STEEL.
   2. BLADES: TWO LAYERS OF 22 GAGE TYPE 304 STAINLESS STEEL OR EPOXY COATED GALVANIZED STEEL MECHANICAL JOINED SHEETS OR EXTRUDED ALUMINUM, AIRFOIL SHAPED, 6 IN WIDE.
   3. SEALS: EXTRUDED VINYL BLADE EDGE SEALS AND FLEXIBLE METAL COMPRESSIBLE JAMB SEALS.
   4. BEARINGS:
      A. STAINLESS STEEL CONSTRUCTION: STAINLESS STEEL SLEEVE OR BALL BEARING.
   5. TEMPERATURE RATING: -40 TO 200 DEG F .
   6. PRESSURE AND VELOCITY RATING: 4 IN WG PRESSURE DIFFERENTIAL AT 2000 FPM .
   7. BLADE ARRANGEMENT: ALL CONTROL DAMPERS SHALL BE OPPOSED BLADE, EXCEPT OUTSIDE AIR AND RETURN AIR CONTROL DAMPERS SHALL BE PARALLEL BLADE AND SHALL BE ARRANGED TO PROMOTE MIXING.
   8. ACTUATORS: COORDINATE WITH CONTROLS CONTRACTOR.
   9. EXAMPLE:
      A. STAINLESS STEEL FRAME CONSTRUCTION: RUSKIN CD60 OR EQUAL.

SECTION 255000 - INSTRUMENTATION AND CONTROL FOR HVAC

1. PROVIDE A COMPLETE AUTOMATIC ELECTRIC/ELECTRONIC TEMPERATURE CONTROL SYSTEM INCLUDING ALL WIRING, ETC., REQUIRED FOR A COMPLETE WORKING SYSTEM. THIS SHALL INCLUDE ALL THERMOSTATS, TEMPERATURE TRANSMITTERS, CONTROLLERS, AND DAMPERS, DAMPER OPERATORS, SWITCHES, CONTROL PANELS, AND OTHER ACCESSORY EQUIPMENT ALONG WITH A COMPLETE SYSTEM OF ELECTRICAL WIRING TO FILL THE INTENT OF THE SPECIFICATION AND PROVIDE FOR A COMPLETE AND OPERABLE SYSTEM.

2. ELECTRIC WIRING: ALL CONTROL WIRING SHALL BE FURNISHED AND INSTALLED UNDER THIS SECTION OF THE SPECIFICATIONS. THE TERM "WIRING" SHALL BE CONSTRUED TO INCLUDE THE FURNISHING OF CONDUIT, WIRE, MISCELLANEOUS MATERIALS, AND THE LABOR AS REQUIRED FOR INSTALLATION AND CONNECTION OF THE ELECTRICAL CONTROL DEVICES FURNISHED AS PART OF THE CONTROL SYSTEM OR FURNISHED BY EQUIPMENT SUPPLIERS. ALL WIRING MATERIALS AND INSTALLATION COVERED BY THIS SECTION SHALL BE IN ACCORDANCE WITH THE LATEST REVISION OF THE NATIONAL ELECTRIC CODE (NEC) AND APPLICABLE LOCAL CODES AND SHALL CARRY THE UL LABEL WHERE APPLICABLE. EXPOSED WIRE SHALL BE INSTALLED IN FLEXIBLE CONDUIT OR ELECTRIC METALLIC TUBING. ACCESSIBLE CONCEALED LOW VOLTAGE WIRING SHALL BE LOW VOLTAGE CLASS 2 MULTIPLE CONDUCTOR CABLE AS DEFINED UNDER THE NEC, EXCEPT THAT WHEN A CEILING SPACE IS USED AS A RETURN AIR PLENUM, ALL WIRING MUST BE IN CONDUIT. ALL CABLE SHALL BE FURNISHED WITH INNER CONDUCTOR INSULATION AND JACKET SUITABLE FOR THE APPLICATION AS DESCRIBED IN THE NEC. ALL SPLICES OR JUNCTIONS SHALL BE MADE USING UL APPROVED SOLDERLESS CONNECTORS OF THE SPRING LOCK TYPE.

3. SECTION INCLUDES
   A) PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION
   B) PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION
   C) PRODUCTS NOT FURNISHED OR INSTALLED UNDER BUT INTEGRATED WITH THE WORK OF THIS SECTION
   D) BUILDING AUTOMATION SYSTEM - GENERAL DESCRIPTION
   E) APPROVED CONTROL SYSTEM MANUFACTURES
   F) QUALITY ASSURANCE
   G) CODES AND STANDARDS
   H) SYSTEM PERFORMANCE
   I) SUBMITTAL REQUIREMENTS
   J) WARRANTY REQUIREMENTS
   K) OWNERSHIP OF PROPRIETARY MATERIAL
   L) DEFINITIONS
4. PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION
   A) SECTION 23240 –AIR HANDLING EQUIPMENT
      1. FIELD SENSORS
      2. FIELD MOUNTED OPERATOR INTERFACE DEVICES
5. PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION
   A) SECTION 23611 – DUCTWORK ACCESSORIES
      1. AUTOMATIC DAMPERS
      2. AIRFLOW STATIONS
      3. TERMINAL UNIT CONTROLS
6. PRODUCTS NOT FURNISHED OR INSTALLED UNDER BUT INTEGRATED WITH THE WORK OF THIS SECTION
   A) SECTION 23720 –REFRIGERATION EQUIPMENT
      1. CHILLER CONTROLS
7. BUILDING AUTOMATION SYSTEM - GENERAL DESCRIPTION
   A) PROVIDE AN EXTENSION OF THE EXISTING BUILDING AUTOMATION SYSTEM (BAS) TO INTEGRATE AND CONTROL ALL MECHANICAL EQUIPMENT ASSOCIATED WITH THIS PROJECT. ALL NEW BUILDING CONTROLLERS, AND EQUIPMENT/PLANT CONTROLLERS, SHALL BE INTEGRATED INTO THE EXISTING BAS.
      I. THE EXISTING BAS IS A TRANE SUMMIT SYSTEM
      II. THE UPGRADED BAS SHALL SUPPORT INTEGRATION WITH EXISTING LEGACY EQUIPMENT WITHOUT THE NEED FOR ADDITIONAL GATEWAYS OR CONVERTERS. THE UPGRADED BAS SHALL PROVIDE FULL FUNCTIONALITY EQUIVALENT TO THE ORIGINAL LEGACY SYSTEM, INCLUDING MONITORING, CONTROL, AND ALARM MANAGEMENT. THE BAS MUST SUPPORT THE TRANSITION TO MODERN BAS STANDARDS WHILE MAINTAINING BACKWARD COMPATIBILITY WITH EXISTING EQUIPMENT.
      III. COMPREHENSIVE DOCUMENTATION MUST BE PROVIDED PRIOR TO ACCEPTANCE, DETAILING THE INTEGRATION PROCESS AND ANY SPECIFIC REQUIREMENTS FOR LEGACY EQUIPMENT.
      IV. THE BUILDING AUTOMATION SYSTEM SHALL BE AS INDICATED ON THE DRAWINGS AND DESCRIBED IN THESE SPECIFICATIONS. SYSTEM MUST BE FULLY INTEGRATED AND COORDINATED WITH MECHANICAL EQUIPMENT DDC CONTROLLERS FURNISHED AND INSTALLED IN THE EQUIPMENT MANUFACTURER'S FACTORY AS SPECIFIED IN THOSE SECTIONS. THE INTENT OF THE BAS IS TO INTEGRATE ALL MECHANICAL EQUIPMENT INTO ONE SYSTEM FOR GLOBAL MONITORING, CONTROL, AND ALARMING ASSOCIATED WITH THE BUILDING. IT IS THE BAS MANUFACTURER'S RESPONSIBILITY TO PROVIDE ALL THE DESIGN, ENGINEERING, AND FIELD COORDINATION REQUIRED TO ENSURE ALL EQUIPMENT SEQUENCE OF OPERATIONS ARE MET AS SPECIFIED AND THE DESIGNATED BAS OPERATORS HAVE THE CAPABILITY OF MANAGING THE BUILDING MECHANICAL SYSTEM TO ENSURE OCCUPANT COMFORT WHILE MAINTAINING ENERGY EFFICIENCY.
      V. THE BAS SHALL MEET OPEN STANDARD PROTOCOL COMMUNICATION STANDARDS (AS DEFINED IN SYSTEM COMMUNICATIONS SECTION) TO ENSURE THE SYSTEM MAINTAINS "INTEROPERABILITY" TO AVOID PROPRIETARY ARRANGEMENTS THAT WILL MAKE IT DIFFICULT FOR THE OWNER TO CONSIDER OTHER BAS MANUFACTURERS IN FUTURE PROJECTS.
      VI. DIRECT DIGITAL CONTROL (DDC) TECHNOLOGY SHALL BE USED TO PROVIDE THE FUNCTIONS NECESSARY FOR CONTROL OF MECHANICAL SYSTEMS AND TERMINAL DEVICES ON THIS PROJECT.
      VII. APPROVED VENDORS, PRODUCTS AND WEB SERVICES SHALL COMPLY WITH SOC2 TYPE II AS DEFINED BY THE AICPA. SOC2 TYPE II COMPLIANCE IS A CERTIFICATION THAT CONFIRMS THAT A SERVICE PROVIDER HAS ESTABLISHED AND IMPLEMENTED EFFECTIVE CONTROLS TO SECURE THEIR CLIENTS' DATA IN ACCORDANCE WITH THE TRUST SERVICES CRITERIA (TSC).
         1) SOC2 TYPE II COMPLIANCE PROVIDES ASSURANCE TO CUSTOMERS THAT THE SERVICE PROVIDER HAS ESTABLISHED AND IMPLEMENTED EFFECTIVE SECURITY CONTROLS AND IS COMMITTED TO PROTECTING THEIR DATA.
         2) TO ACHIEVE SOC2 TYPE II COMPLIANCE, THE MANUFACTURER SHALL HAVE COMPLETED AN INDEPENDENT AUDIT TO ASSESS DESIGN AND IMPLEMENTATION OF THEIR CONTROLS, POLICIES, AND PROCEDURES.
      VIII. THE BAS SHALL ACCOMMODATE SIMULTANEOUS MULTIPLE USER OPERATION. ACCESS TO THE CONTROL SYSTEM DATA SHOULD BE LIMITED ONLY BY THE SECURITY PERMISSIONS OF THE OPERATOR ROLE. MULTIPLE USERS SHALL HAVE ACCESS TO ALL VALID SYSTEM DATA. AN OPERATOR SHALL BE ABLE TO LOG ONTO ANY WORKSTATION ON THE CONTROL SYSTEM AND HAVE ACCESS TO ALL APPROPRIATE DATA.
8. APPROVED CONTROL SYSTEM MANUFACTURES
   A) TRANE TRACER®
9. QUALITY ASSURANCE
   A) BAS MANUFACTURER QUALIFICATIONS
      I. THE BAS MANUFACTURER SHALL HAVE AN ESTABLISHED BUSINESS OFFICE WITHIN 50.00 MILES OF THE PROJECT SITE AND MUST PROVIDE 24 HOURS/DAY, 7 DAYS/WEEK RESPONSE IN THE EVENT OF A CUSTOMER WARRANTY OR SERVICE CALL.
      II. THE BAS MANUFACTURER SHALL HAVE FACTORY TRAINED AND CERTIFIED PERSONNEL PROVIDING ALL ENGINEERING, SERVICE, STARTUP, AND COMMISSIONING FIELD LABOR FOR THE PROJECT FROM THEIR LOCAL OFFICE LOCATION. BAS MANUFACTURER SHALL BE ABLE TO PROVIDE TRAINING CERTIFICATIONS FOR ALL LOCAL OFFICE PERSONNEL UPON REQUEST.
      III. THE BAS SHALL BE PROVIDED BY A SINGLE MANUFACTURER AND THIS MANUFACTURER'S EQUIPMENT MUST CONSIST OF OPERATOR WORKSTATION SOFTWARE, WEB-BASED HARDWARE/SOFTWARE, OPEN STANDARD PROTOCOL HARDWARE/SOFTWARE, CUSTOM APPLICATION PROGRAMMING LANGUAGE, GRAPHICAL PROGRAMMING LANGUAGE, BUILDING CONTROLLERS, CUSTOM APPLICATION CONTROLLERS, AND APPLICATION SPECIFIC CONTROLLERS. ALL OTHER PRODUCTS SPECIFIED HEREIN (I.E., SENSORS, VALVES, DAMPERS, ACTUATORS, ETC.) NEED NOT BE MANUFACTURED BY THE BAS MANUFACTURER LISTED IN THIS SPECIFICATION.
      IV. INDEPENDENT REPRESENTATIVES OF BAS MANUFACTURERS ARE NOT ACCEPTABLE. BAS VENDOR MUST BE CORPORATE OWNED ENTITY OF BAS MANUFACTURER.
10. CODES AND STANDARDS
   A) CODES AND STANDARDS: MEET REQUIREMENTS OF ALL APPLICABLE STANDARDS AND CODES, EXCEPT WHEN MORE DETAILED OR STRINGENT REQUIREMENTS ARE INDICATED BY THE CONTRACT DOCUMENTS, INCLUDING REQUIREMENTS OF THIS SECTION.
      I. UNDERWRITERS LABORATORIES: PRODUCTS SHALL BE UL-916-PAZX LISTED.
      II. NATIONAL ELECTRICAL CODE -- NFPA 70.
      III. FEDERAL COMMUNICATIONS COMMISSION -- PART J.
      IV. ASHRAE/ANSI 135-2012 (BACNET) - (SYSTEM LEVEL DEVICES) - BUILDING CONTROLLERS SHALL CONFORM TO THE LISTED VERSION OF THE BACNET SPECIFICATION IN ORDER TO IMPROVE INTEROPERABILITY WITH VARIOUS BUILDING SYSTEM MANUFACTURERS' CONTROL SYSTEMS AND DEVICES.
      V. ASHRAE/ANSI 135-2012 (BACNET) - (UNIT LEVEL DEVICES) - UNIT CONTROLLERS SHALL CONFORM TO THE LISTED VERSION OF THE BACNET SPECIFICATION IN ORDER TO IMPROVE INTEROPERABILITY WITH VARIOUS BUILDING SYSTEM MANUFACTURERS' CONTROL SYSTEMS AND DEVICES.
11. SYSTEM PERFORMANCE
   A) PERFORMANCE STANDARDS. THE BAS SYSTEM SHALL CONFORM TO THE FOLLOWING:
      I. GRAPHIC DISPLAY. THE SYSTEM SHALL DISPLAY A GRAPHIC WITH A MINIMUM OF 20 DYNAMIC POINTS. ALL CURRENT DATA SHALL BE DISPLAYED WITHIN 10 SECONDS OF THE OPERATOR'S REQUEST.
      II. GRAPHIC REFRESH. THE SYSTEM SHALL UPDATE ALL DYNAMIC POINTS WITH CURRENT DATA WITHIN 10 SECONDS.
      III. OBJECT COMMAND. THE MAXIMUM TIME BETWEEN THE COMMAND OF A BINARY OBJECT BY THE OPERATOR AND THE REACTION BY THE DEVICE SHALL BE 5 SECONDS. ANALOG OBJECTS SHALL START TO ADJUST WITHIN 5 SECONDS.
      IV. OBJECT SCAN. ALL CHANGES OF STATE AND CHANGE OF ANALOG VALUES SHALL BE TRANSMITTED OVER THE HIGH-SPEED NETWORK SUCH THAT ANY DATA USED OR DISPLAYED AT A CONTROLLER OR WORKSTATION WILL BE CURRENT WITHIN THE PRIOR 10 SECONDS.
      V. ALARM RESPONSE TIME. THE MAXIMUM TIME FROM WHEN AN OBJECT GOES INTO ALARM TO WHEN IT IS ANNUNCIATED AT THE WORKSTATION SHALL NOT EXCEED 10 SECONDS.
      VI. PROGRAM EXECUTION FREQUENCY. CUSTOM AND STANDARD APPLICATIONS SHALL BE CAPABLE OF RUNNING AS OFTEN AS ONCE EVERY 5 SECONDS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SELECTING EXECUTION TIMES CONSISTENT WITH THE MECHANICAL PROCESS UNDER CONTROL.
      VII. PROGRAMMABLE CONTROLLERS SHALL BE ABLE TO EXECUTE DDC PID CONTROL LOOPS AT A SELECTABLE FREQUENCY FROM AT LEAST ONCE EVERY 5 SECONDS. THE CONTROLLER SHALL SCAN AND UPDATE THE PROCESS VALUE AND OUTPUT GENERATED BY THIS CALCULATION AT THIS SAME FREQUENCY.
      VIII. MULTIPLE ALARM ANNUNCIATIONS. ALL WORKSTATIONS ON THE NETWORK SHALL RECEIVE ALARMS WITHIN 5 SECONDS OF EACH OTHER.
12. SUBMITTAL REQUIREMENTS
   A) BAS MANUFACTURER SHALL PROVIDE SHOP DRAWINGS AND MANUFACTURERS' STANDARD SPECIFICATION DATA SHEETS ON ALL HARDWARE AND SOFTWARE BEING PROVIDED FOR THIS PROJECT. NO WORK MAY BEGIN ON ANY SEGMENT OF THIS PROJECT UNTIL THE ENGINEER AND OWNER HAVE REVIEWED SUBMITTALS FOR CONFORMITY WITH THE PLAN AND SPECIFICATIONS.
      I. PROVIDE ELECTRONIC SUBMITTAL PACKAGE IN PDF FORMAT FOR REVIEW AND APPROVAL.
   B) QUANTITIES OF ITEMS SUBMITTED SHALL BE REVIEWED BY THE ENGINEER AND OWNER. SUCH REVIEW SHALL NOT RELIEVE THE BAS MANUFACTURER OF FURNISHING QUANTITIES REQUIRED BASED UPON CONTRACT DOCUMENTS.
   C) PROVIDE THE ENGINEER AND OWNER, ANY ADDITIONAL INFORMATION OR DATA WHICH IS DEEMED NECESSARY TO DETERMINE COMPLIANCE WITH THE SPECIFICATIONS OR WHICH IS DEEMED VALUABLE IN DOCUMENTING AND UNDERSTANDING THE SYSTEM TO BE INSTALLED.
   D) ALL SHOP DRAWINGS SHALL BE PROVIDED TO THE OWNER ELECTRONICALLY ONCE THEY HAVE BEEN APPROVED AND AS-BUILT DRAWINGS HAVE BEEN COMPLETED.
   E) SUBMIT THE FOLLOWING WITHIN 90 DAYS OF CONTRACT AWARD:
      I. A COMPLETE BILL OF MATERIALS OF EQUIPMENT TO BE USED INDICATING QUANTITIES, MANUFACTURERS AND MODEL NUMBERS.
      II. A SCHEDULE OF ALL CONTROL VALVES INCLUDING THE VALVE SIZE, PRESSURE DROP, MODEL NUMBER (INCLUDING PATTERN AND CONNECTIONS), FLOW, CV, BODY PRESSURE RATING, AND LOCATION.
      III. A SCHEDULE OF ALL CONTROL DAMPERS INCLUDING DAMPER SIZE, PRESSURE DROP, MANUFACTURER, AND MODEL NUMBER.
      IV. PROVIDE ALL MANUFACTURERS' TECHNICAL CUT SHEETS FOR MAJOR SYSTEM COMPONENTS. WHEN TECHNICAL CUT SHEETS APPLY TO A PRODUCT SERIES RATHER THAN A SPECIFIC PRODUCT, THE DATA SPECIFICALLY APPLICABLE TO THE PROJECT SHALL BE HIGHLIGHTED OR CLEARLY INDICATED BY OTHER MEANS. INCLUDE:
         A. BUILDING CONTROLLERS
         B. CUSTOM APPLICATION CONTROLLERS
         C. APPLICATION SPECIFIC CONTROLLERS
         D. OPERATOR WORKSTATIONS
         E. PORTABLE OPERATOR TERMINALS
         F. AUXILIARY CONTROL DEVICES
      V. PROVIDE PROPOSED BUILDING AUTOMATION SYSTEM ARCHITECTURAL DIAGRAM DEPICTING VARIOUS CONTROLLER TYPES, WORKSTATIONS, DEVICE LOCATIONS, ADDRESSES, AND COMMUNICATION CABLE REQUIREMENTS
      VI. PROVIDE DETAILED TERMINATION DRAWINGS SHOWING ALL REQUIRED FIELD AND FACTORY TERMINATIONS, AS WELL AS TERMINAL TIE-INS TO DDC CONTROLS PROVIDED BY MECHANICAL EQUIPMENT MANUFACTURERS. TERMINAL NUMBERS SHALL BE CLEARLY LABELED.
      VII. PROVIDE A SEQUENCE OF OPERATION FOR EACH CONTROLLED MECHANICAL SYSTEM AND TERMINAL END DEVICES.
      VIII. PROVIDE A BACNET PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (PICS) FOR EACH BACNET SYSTEM LEVEL DEVICE (I.E. BUILDING CONTROLLER & OPERATOR WORKSTATIONS) TYPE. THIS DEFINES THE POINTS LIST FOR PROPER COORDINATION OF INTEROPERABILITY WITH OTHER BUILDING SYSTEMS IF APPLICABLE FOR THIS PROJECT.
   F) PROJECT RECORD DOCUMENTS: UPON COMPLETION OF INSTALLATION, SUBMIT THREE (3) COPIES OF RECORD (AS-BUILT) DOCUMENTS. THE DOCUMENTS SHALL BE SUBMITTED FOR APPROVAL PRIOR TO FINAL COMPLETION AND INCLUDE:
      I. PROJECT RECORD DRAWINGS - THESE SHALL BE AS-BUILT VERSIONS OF THE SUBMITTAL SHOP DRAWINGS. ONE SET OF ELECTRONIC MEDIA INCLUDING CAD .DWG AND .PDF DRAWING FILES SHALL BE PROVIDED.
      II. TESTING AND COMMISSIONING REPORTS AND CHECKLISTS SIGNED OFF BY TRAINED FACTORY (EQUIPMENT MANUFACTURERS) AND FIELD (BAS) COMMISSIONING PERSONNEL.
      III. OPERATING AND MAINTENANCE (O & M) MANUALS - THESE SHALL BE AS-BUILT VERSIONS OF THE SUBMITTAL PRODUCT DATA. IN ADDITION TO THE INFORMATION REQUIRED FOR THE SUBMITTALS, OPERATING & MAINTENANCE MANUAL SHALL INCLUDE:
         A. PROCEDURES FOR OPERATING THE BAS INCLUDING LOGGING ON/OFF, ALARM MANAGEMENT, GENERATION OF REPORTS, TRENDS, OVERRIDES OF COMPUTER CONTROL, MODIFICATION OF SETPOINTS, AND OTHER INTERACTIVE SYSTEM REQUIREMENTS.
         B. EXPLANATION OF HOW TO DESIGN AND INSTALL NEW POINTS, NEW DDC CONTROLLERS, AND OTHER BAS HARDWARE.
         C. DOCUMENTATION, INSTALLATION, AND MAINTENANCE INFORMATION FOR ALL THIRD PARTY HARDWARE/SOFTWARE PRODUCTS PROVIDED INCLUDING PERSONAL COMPUTERS, PRINTERS, HUBS, SENSORS, VALVES, ETC.
         D. ORIGINAL ISSUE MEDIA FOR ALL SOFTWARE PROVIDED, INCLUDING OPERATING SYSTEMS, PROGRAMMING LANGUAGE, OPERATOR WORKSTATION SOFTWARE, AND GRAPHICS SOFTWARE.
         E. LICENSES, GUARANTEE, AND WARRANTY DOCUMENTS FOR ALL EQUIPMENT AND SYSTEMS.
   G) TRAINING MANUALS: THE BAS MANUFACTURER SHALL PROVIDE A COURSE OUTLINE AND COPIES OF TRAINING MANUALS AT LEAST TWO WEEKS PRIOR TO THE START OF ANY CORPORATE TRAINING CLASS TO BE ATTENDED BY THE OWNER.
13. WARRANTY REQUIREMENTS
   A) WARRANT ALL WORK AS FOLLOWS:
      I. BAS SYSTEM LABOR AND MATERIALS SHALL BE WARRANTED FREE FROM DEFECTS FOR A PERIOD OF TWELVE (12) MONTHS AFTER FINAL COMPLETION ACCEPTANCE BY THE OWNER. BAS FAILURES DURING THE WARRANTY PERIOD SHALL BE ADJUSTED, REPAIRED, OR REPLACED AT NO CHARGE TO THE OWNER. THE BAS MANUFACTURER SHALL RESPOND TO THE OWNER'S REQUEST FOR WARRANTY SERVICE WITHIN 24 HOURS OF THE INITIATED CALL AND WILL OCCUR DURING NORMAL BUSINESS HOURS (8AM-5PM).
      II. AT THE END OF THE FINAL START-UP/TESTING, IF EQUIPMENT AND SYSTEMS ARE OPERATING SATISFACTORILY TO THE OWNER AND ENGINEER, THE OWNER SHALL SIGN CERTIFICATES CERTIFYING THAT THE BAS IS OPERATIONAL, AND HAS BEEN TESTED AND ACCEPTED IN ACCORDANCE WITH THE TERMS OF THIS SPECIFICATION. THE DATE OF OWNER'S ACCEPTANCE SHALL BE THE START OF THE WARRANTY PERIOD.
      III. TO ENSURE THAT THE OWNER WILL HAVE THE MOST CURRENT OPERATING SYSTEM PROVIDED BY THE MANUFACTURER, THE BAS MANUFACTURER SHALL INCLUDE LICENSING AND LABOR COSTS TO FACILITATE SOFTWARE/FIRMWARE UPDATES THROUGHOUT THE WARRANTY PERIOD AT NO CHARGE TO THE OWNER. THESE UPDATES SHALL INCLUDE UPGRADES FOR FUNCTIONAL ENHANCEMENTS ASSOCIATED WITH THE FOLLOWING: OPERATOR WORKSTATION SOFTWARE, PROJECT SPECIFIC SOFTWARE, GRAPHICS, DATABASE, FIRMWARE UPDATES, AND ALL SECURITY RELATED SERVICE PACKS. WRITTEN AUTHORIZATION BY THE OWNER MUST BE GRANTED PRIOR TO THE INSTALLATION OF THESE UPDATES.
      IV. THE BAS MANUFACTURER SHALL PROVIDE A WEB-ACCESSIBLE USERS NETWORK FOR THE PROPOSED SYSTEM AND GIVE THE OWNER FREE ACCESS TO QUESTION/ANSWER FORUM, USER TIPS, UPGRADES, AND TRAINING SCHEDULES FOR A ONE YEAR PERIOD OF TIME CORRELATING WITH THE WARRANTY PERIOD.

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gm	02-04-2026	None	-

sheet number
M002

M000

14. OWNERSHIP OF PROPRIETARY MATERIAL
A) PROJECT SPECIFIC SOFTWARE AND DOCUMENTATION SHALL BECOME THE OWNER'S PROPERTY UPON PROJECT COMPLETION. THIS INCLUDES THE FOLLOWING:
I. OPERATOR GRAPHIC FILES
II. AS-BUILT HARDWARE DESIGN DRAWINGS
III. OPERATING & MAINTENANCE MANUALS
IV. BAS SYSTEM SOFTWARE DATABASE

15. DEFINITIONS
A) DDC: DIRECT DIGITAL CONTROL
B) I/O: INPUT/OUTPUT.
C) MS/TP: MANAGER SUBORDINATE / TOKEN PASSING.
D) POT: PORTABLE OPERATOR'S TERMINAL.
E) PID: PROPORTIONAL PLUS INTEGRAL PLUS DERIVATIVE.
F) RTD: RESISTANCE TEMPERATURE DETECTOR.
G) BAS/ATC: BUILDING AUTOMATION SYSTEM/AUTOMATIC TEMPERATURE CONTROLS.

16. PRODUCTS INCLUDES:
A) MATERIALS:
B) SYSTEM COMMUNICATION
C) OPERATOR INTERFACE
D) BUILDING CONTROLLER SOFTWARE
E) BUILDING / SYSTEM CONTROLLERS
F) ADVANCED APPLICATION CONTROLLERS:
G) APPLICATION SPECIFIC CONTROLLERS:
H) COOLING PLANT - PUMPING CONTROLLER
I) INPUT/OUTPUT INTERFACE:
J) POWER SUPPLIES:
K) WIRING AND RACEWAYS:

17. MATERIALS:
A) USE NEW PRODUCTS THAT THE MANUFACTURER IS CURRENTLY MANUFACTURING AND THAT HAVE BEEN INSTALLED IN A MINIMUM OF 25 INSTALLATIONS. DO NOT USE THIS INSTALLATION AS A PRODUCT TEST SITE UNLESS EXPLICITLY APPROVED IN WRITING BY THE OWNER OR THE OWNER'S REPRESENTATIVE. SPARE PARTS SHALL BE AVAILABLE FOR AT LEAST FIVE YEARS AFTER COMPLETION OF THIS CONTRACT.

18. SYSTEM COMMUNICATION
A) SYSTEM COMMUNICATIONS
I. EACH WORKSTATION, BUILDING CONTROLLER, AND EQUIPMENT/PLANT CONTROLLER COMMUNICATION INTERFACE SHALL UTILIZE THE BACNET™ PROTOCOL WITH AN ETHERNET (IEEE 802.3) OR RS485 (EIA-485) PHYSICAL INTERFACE AND AN APPROPRIATE DATA LINK TECHNOLOGY AS DEFINED IN ANSI®/ASHRAE® STANDARD 135-2012. (E.G. BACNET OVER IP, BACNET OVER IPV6, BACNET SC, BACNET OVER MS/TP).
II. ALL SYSTEM CONTROLLERS SHALL BE BTL LISTED AS A BACNET BUILDING CONTROLLER (B-BC) AS DEFINED IN ANSI®/ASHRAE® STANDARD 135-2012.
III. THE SYSTEM SHALL SUPPORT BOTH BACNET OVER IP AND BACNET OVER MS/TP, ALLOWING FOR A HYBRID APPROACH TO MEET VARIOUS PERFORMANCE AND COST REQUIREMENTS. SUPPORTING BOTH TWISTED-PAIR AND ETHERNET TOPOLOGIES TO OFFER FLEXIBILITY AND COST-EFFECTIVENESS.
IV. ALL DOCUMENTED STATUS AND CONTROL POINTS, SCHEDULE, ALARM, AND DATA-LOG SERVICES OR OBJECTS SHALL BE AVAILABLE AS STANDARD OBJECT TYPES AS DEFINED IN ANSI®/ASHRAE® STANDARD 135-2012.
V. THE CONTROL SYSTEM SHALL BE CAPABLE OF OBTAINING AND USING DATA FROM A RESTFUL API DATA SERVER (E.G. CURRENT WEATHER, FORECAST WEATHER, ETC.) TO ENHANCE ENERGY EFFICIENCY, COST SAVINGS, AND/OR USER COMFORT. THE CONTROL SYSTEM SHALL ACCOUNT FOR A COMMUNICATION LOSS TO THE API SERVER SUCH THAT THE SYSTEM WILL CONTINUE TO OPERATE.
VI. ALL OPERATOR WORKSTATIONS (B-OWS, B-AWS) AND BUILDING CONTROLLERS (B-BC) SHALL SUPPORT BACNET SECURE CONNECT (BACNET SC), A SECURE AND ENCRYPTED DATALINK LAYER SPECIFICALLY DESIGNED FOR THOSE NETWORKS.
VII. EACH SYSTEM CONTROLLER SHALL COMMUNICATE WITH A NETWORK OF CUSTOM APPLICATION AND APPLICATION SPECIFIC CONTROLLERS UTILIZING ONE OR MORE OF THE INTERFACES DOCUMENTED WITHIN FIELD BUS COMMUNICATIONS BELOW.
B) FIELD BUS COMMUNICATIONS
I. BACNET™
A. ALL EQUIPMENT AND PLANT CONTROLLERS SHALL BE BTL LISTED AS A BACNET APPLICATION SPECIFIC CONTROLLER (B-ASC) OR A BACNET ADVANCED APPLICATION CONTROLLER (B-AAC) AS DEFINED IN ANSI®/ASHRAE® STANDARD 135-2012.
B. ALL COMMUNICATION SHALL CONFORM TO ANSI®/ASHRAE® STANDARD 135-2012.
C. SYSTEM CONTROLLER SHALL FUNCTION AS A BACNET ROUTER TO EACH UNIT CONTROLLER PROVIDING A GLOBALLY UNIQUE BACNET DEVICE ID FOR ALL BACNET CONTROLLERS WITHIN THE SYSTEM.
II. BACNET MS/TP
A. COMMUNICATION BETWEEN SYSTEM CONTROLLER AND EQUIPMENT/PLANT CONTROLLERS SHALL UTILIZE BACNET MS/TP AS DEFINED IN ANSI®/ASHRAE® STANDARD 135-2012.

19. OPERATOR INTERFACE:
A) PROVIDE BUILDING OPERATOR WEB INTERFACE
I. MANUFACTURER SHALL PROVIDE A USER INTERFACE WITH TIME-OF-DAY SCHEDULES, DATA COLLECTION, DASHBOARDS, REPORTS AND BUILDING SUMMARY, SYSTEM APPLICATIONS, AND SELF-EXPIRING TIMED OVERRIDES. MANUFACTURER SHALL PROVIDE A PUBLISHED USER AND APPLICATIONS GUIDE(S) THAT DETAIL THE SYSTEM APPLICATION OPERATION, CONFIGURATION, SETUP AND TROUBLESHOOTING.
II. THE BUILDING OPERATOR WEB INTERFACE SHALL BE ACCESSIBLE VIA A WEB BROWSER WITHOUT REQUIRING ANY "PLUG-INS" (I.E. JAVA RUNTIME ENVIRONMENT (JRE), ADOBE FLASH).
III. USER ROLES
A. THE SYSTEM SHALL INCLUDE PRE-DEFINED "ROLES" THAT ALLOW A SYSTEM ADMINISTRATOR TO QUICKLY ASSIGN PERMISSIONS TO A USER.
B. USER LOGON/LOGOFF ATTEMPTS SHALL BE RECORDED.
C. THE SYSTEM SHALL PROTECT ITSELF FROM UNAUTHORIZED USE BY AUTOMATICALLY LOGGING OFF FOLLOWING THE LAST KEYSTROKE. THE DELAY TIME SHALL BE USER DEFINABLE.
B) ON-LINE HELP AND TRAINING
I. PROVIDE A CONTEXT SENSITIVE, ON LINE HELP SYSTEM TO ASSIST THE OPERATOR IN OPERATION AND CONFIGURATION OF THE SYSTEM.
II. ON-LINE HELP SHALL BE AVAILABLE FOR ALL SYSTEM FUNCTIONS AND SHALL PROVIDE THE RELEVANT DATA FOR EACH PARTICULAR SCREEN.
C) EQUIPMENT AND APPLICATION PAGES
I. THE BUILDING OPERATOR WEB INTERFACE SHALL INCLUDE STANDARD PAGES FOR ALL EQUIPMENT AND APPLICATIONS. THESE PAGES SHALL ALLOW AN OPERATOR TO OBTAIN INFORMATION RELEVANT TO THE OPERATION OF THE EQUIPMENT AND/OR APPLICATION, INCLUDING:
A. ANIMATED EQUIPMENT GRAPHICS FOR EACH MAJOR PIECE OF EQUIPMENT AND FLOOR PLAN IN THE SYSTEM. THIS INCLUDES:
1. EACH CHILLER, AIR HANDLER, VAV TERMINAL, FAN COIL, BOILER, AND COOLING TOWER. THESE GRAPHICS SHALL SHOW ALL POINTS DYNAMICALLY AS SPECIFIED IN THE POINTS LIST.
2. ANIMATION CAPABILITIES SHALL INCLUDE THE ABILITY TO SHOW A SEQUENCE OF IMAGES REFLECTING THE POSITION OF ANALOG OUTPUTS, SUCH AS VALVE OR DAMPER POSITIONS. GRAPHICS SHALL BE CAPABLE OF LAUNCHING OTHER WEB PAGES.
B. ALARMS RELEVANT TO THE EQUIPMENT OR APPLICATION WITHOUT REQUIRING A USER TO NAVIGATE TO AN ALARM PAGE AND PERFORM A FILTER.
C. HISTORICAL DATA (AS DEFINED IN TREND LOGS SECTION OF CONTROLLER SOFTWARE) FOR THE EQUIPMENT OR APPLICATION WITHOUT REQUIRING A USER TO NAVIGATE TO A DATA LOG PAGE AND PERFORM A FILTER.
II. VAV AIR SYSTEM. AN OPERATOR SHALL BE ABLE TO VIEW AND CONTROL (WHERE APPLICABLE) THE FOLLOWING PARAMETERS VIA THE BUILDING OPERATOR WEB INTERFACE:
A. SYSTEM MODE
B. SYSTEM OCCUPANCY
C. VENTILATION (OUTDOOR AIR FLOW) SETPOINT
D. VENTILATION (OUTDOOR AIR FLOW) STATUS
E. AIR HANDLER STATIC PRESSURE SETPOINT
F. AIR HANDLER STATIC PRESSURE STATUS
G. AIR HANDLER OCCUPANCY STATUS
H. AIR HANDLER SUPPLY AIR COOLING AND HEATING SET POINTS
I. AIR HANDLER MINIMUM, MAXIMUM AND NOMINAL STATIC PRESSURE SETPOINTS
J. VAV BOX MINIMUM AND MAXIMUM FLOW
K. VAV BOX DRIVE OPEN AND CLOSE OVERRIDES
L. VAV BOX OCCUPANCY STATUS
M. VAV BOX AIRFLOW TO SPACE
N. AVERAGE SPACE TEMPERATURE
O. MINIMUM SPACE TEMPERATURE
P. MAXIMUM SPACE TEMPERATURE
D) SYSTEM GRAPHICS. BUILDING OPERATOR WEB INTERFACE SHALL BE GRAPHICALLY BASED AND SHALL INCLUDE AT LEAST ONE GRAPHIC PER PIECE OF EQUIPMENT OR OCCUPIED ZONE, GRAPHICS FOR EACH CHILLED WATER AND HOT WATER SYSTEM, AND GRAPHICS THAT SUMMARIZE CONDITIONS ON EACH FLOOR OF EACH BUILDING AREA INCLUDED IN THIS CONTRACT. INDICATE THERMAL COMFORT ON FLOOR PLAN SUMMARY GRAPHICS USING COLORS TO REPRESENT ZONE TEMPERATURE RELATIVE TO ZONE SET POINT.
I. GRAPHIC IMAGERY – GRAPHICS SHALL USE 3D IMAGES FOR ALL STANDARD AND CUSTOM GRAPHICS. THE ONLY ALLOWABLE EXCEPTIONS WILL BE PHOTO IMAGES, MAPS, SCHEMATIC DRAWINGS, AND SELECTED FLOOR PLANS.
II. ANIMATION. GRAPHICS SHALL BE ABLE TO ANIMATE BY DISPLAYING DIFFERENT IMAGE LIES FOR CHANGED OBJECT STATUS.
III. ALARM INDICATION. INDICATE AREAS OR EQUIPMENT IN AN ALARM CONDITION USING COLOR OR OTHER VISUAL INDICATOR.
E) GRAPHICS LIBRARY. FURNISH A LIBRARY OF STANDARD HVAC EQUIPMENT SUCH AS CHILLERS, AIR HANDLERS, TERMINALS, FAN COILS, UNIT VENTILATORS, ROOFTOP UNITS, AND VAV BOXES, IN 3-DIMENSIONAL GRAPHIC DEPICTIONS. THE LIBRARY SHALL BE FURNISHED IN A FILE FORMAT COMPATIBLE WITH THE GRAPHICS GENERATION PACKAGE PROGRAM.
F) MANUAL CONTROL AND OVERRIDE
I. POINT CONTROL. PROVIDE A METHOD FOR A USER TO VIEW, OVERRIDE, AND EDIT IF APPLICABLE, THE STATUS OF ANY OBJECT AND PROPERTY IN THE SYSTEM. THE POINT STATUS SHALL BE AVAILABLE BY MENU, ON GRAPHICS OR THROUGH CUSTOM PROGRAMS.
II. TEMPORARY OVERRIDES. THE USER SHALL BE ABLE TO PERFORM A TEMPORARY OVERRIDE WHEREVER AN OVERRIDE IS ALLOWED, AUTOMATICALLY REMOVING THE OVERRIDE AFTER A SPECIFIED PERIOD OF TIME.
III. OVERRIDE OWNERS. THE SYSTEM SHALL CONVEY TO THE USER THE OWNER OF EACH OVERRIDE FOR ALL PRIORITIES THAT AN OVERRIDE EXISTS.
IV. PROVIDE A SPECIFIC ICON TO SHOW TIMED OVERRIDE OR OPERATOR OVERRIDE, WHEN A POINT, UNIT CONTROLLER OR APPLICATION HAS BEEN OVERRIDDEN MANUALLY.
G) SCHEDULING. - THE SCHEDULING APPLICATION SHALL PROVIDE GRAPHICAL REPRESENTATION OF THE DAY, WEEK, MONTH AND EXCEPTION EVENTS.
H) ALARM/EVENT NOTIFICATION
I. ALARM/EVENT LOG. THE OPERATOR SHALL BE ABLE TO VIEW ALL LOGGED SYSTEM ALARMS/EVENTS FROM ANY BUILDING OPERATOR WEB INTERFACE.
A. THE OPERATOR SHALL BE ABLE TO SORT AND FILTER ALARMS FROM EVENTS. ALARMS SHALL BE SORTED IN A MINIMUM OF 4 CATEGORIES BASED ON SEVERITY
B. THE OPERATOR SHALL BE ABLE TO ACKNOWLEDGE AND ADD COMMENTS TO ALARMS
C. ALARM/EVENT MESSAGES SHALL USE FULL LANGUAGE, EASILY RECOGNIZED DESCRIPTORS.
II. ALARM SUPPRESSION. ALARMS SHALL BE ABLE TO BE SUPPRESSED BASED ON LOAD/SOURCE RELATIONSHIPS TO PRESENT THE LIKELY ROOT CAUSE TO THE BUILDING OPERATOR AS DESCRIBED IN ASHRAE GUIDELINE 36. LOAD/SOURCE RELATIONSHIPS SHALL BE CONFIGURABLE BY THE USER THROUGH A WEB INTERFACE.
I) REPORTS AND LOGS.
I. THE BUILDING OPERATOR WEB INTERFACE SHALL PROVIDE A REPORTING PACKAGE THAT ALLOWS THE OPERATOR TO SELECT REPORTS.
II. THE BUILDING OPERATOR WEB INTERFACE SHALL PROVIDE THE ABILITY TO SCHEDULE REPORTS TO RUN AT SPECIFIED INTERVALS OF TIME.
III. THE FOLLOWING STANDARD REPORTS SHALL BE AVAILABLE WITHOUT REQUIRING A USER TO MANUALLY CONFIGURE THE REPORT:
A. ALL POINTS IN ALARM REPORT: PROVIDE AN ON DEMAND REPORT SHOWING ALL CURRENT ALARMS.
B. ALL POINTS IN OVERRIDE REPORT: PROVIDE AN ON DEMAND REPORT SHOWING ALL OVERRIDES IN EFFECT.
C. COMMISSIONING REPORT: PROVIDE A ONE-TIME REPORT THAT LISTS ALL EQUIPMENT WITH THE UNIT CONFIGURATION AND PRESENT OPERATION.
D. POINTS REPORT: PROVIDE A REPORT THAT LISTS THE CURRENT VALUE OF ALL POINTS
IV. THE CONTROLS VENDOR SHALL PROVIDE A HARDENING REPORT THAT SUMMARIZES THE PORT CONFIGURATION DETAILS TO ENSURE SITES HAVE NOT BEEN EXPOSED TO THE INTERNET IN ALIGNMENT WITH CYBER SECURITY BEST PRACTICES.

20. BUILDING CONTROLLER SOFTWARE
A) MANUFACTURER SHALL PROVIDE STANDARD APPLICATIONS TO DELIVER HVAC SYSTEM CONTROL. STANDARD APPLICATIONS INCLUDE TIME OF DAY SCHEDULING WITH OPTIMAL START/STOP, VAV AIR SYSTEMS CONTROL, CHILLER PLANT CONTROL, HISTORICAL TREND LOGS AND TRIM AND RESPOND. MANUFACTURER SHALL PROVIDE SYSTEM OPTIMIZATION STRATEGIES FOR FUNCTIONS SUCH AS FAN PRESSURE OPTIMIZATION AND VENTILATION OPTIMIZATION.
B) FURNISH THE FOLLOWING APPLICATIONS SOFTWARE FOR BUILDING AND ENERGY MANAGEMENT. ALL SOFTWARE APPLICATIONS SHALL RESIDE AND RUN IN THE SYSTEM CONTROLLERS. EDITING OF APPLICATIONS SHALL OCCUR AT THE BUILDING OPERATOR INTERFACE.
I. VAV AIR SYSTEMS APPLICATIONS
A. THE BAS SHALL PROVIDE AIR SYSTEM APPLICATIONS THAT COORDINATE AIR HANDLERS (AHU)/ROOFTOP UNITS (RTU) AND VARIABLE AIR VOLUME TERMINAL EQUIPMENT.
B. THE AIR SYSTEM APPLICATIONS SHALL PERFORM THE FOLLOWING FUNCTIONS:
1. START/UP AND SHUTDOWN THE AIR HANDLER SAFELY. ENSURE THE VAV BOXES ARE OPEN SUFFICIENTLY WHEN THE AIR HANDLER IS RUNNING, TO PREVENT DAMAGE TO THE DUCTWORK AND VAV BOXES DUE TO HIGH AIR PRESSURE.
2. FAN PRESSURE OPTIMIZATION (ASHRAE 90.1, GUIDELINE 36) - MINIMIZE ENERGY USAGE BY CONTROLLING SYSTEM STATIC PRESSURE TO THE LOWEST LEVEL WHILE MAINTAINING ZONE AIRFLOW REQUIREMENTS. TRIM AND RESPOND RESET LOGIC SHALL RESET SETPOINT WITHIN THE RANGE OF MIN AND MAX VALUES BASED ON ZONE REQUESTS.
3. DURING COMMISSIONING, AND WITH THE ENGINEER/OWNER, THE CONTROLS CONTRACTOR SHALL CONFIRM THE PERFORMANCE OF FAN PRESSURE OPTIMIZATION BY CONDUCTING A FIELD FUNCTIONAL TEST THAT DEMONSTRATES CRITICAL ZONE RESET.
4. VENTILATION OPTIMIZATION (ASHRAE 62) – PROPERLY VENTILATE ALL SPACES WHILE MINIMIZING OPERATING ENERGY COSTS, USING MEASURED OUTDOOR AIR FLOW. DYNAMICALLY CALCULATE THE SYSTEM OUTDOOR AIR REQUIREMENT BASED ON "REAL TIME" CONDITIONS IN THE SPACES (I.E., NUMBER OF OCCUPANTS, CO2 LEVELS, ETC.) MINIMIZING THE AMOUNT OF UNCONDITIONED OUTDOOR AIR THAT MUST BE BROUGHT INTO THE BUILDING.
5. DEMAND CONTROLLED VENTILATION – THE ACTIVE VENTILATION SETPOINT SHALL MODULATE BETWEEN THE OCCUPIED VENTILATION AND OCCUPIED STANDBY VENTILATION SETPOINT; RESETTING THE SETPOINT BASED ON CO2 LEVELS IN THE SPACE.
6. DISCHARGE AIR TEMPERATURE RESET (ASHRAE 90.1, GUIDELINE 36) - MINIMIZE ENERGY USAGE BY CONTROLLING DISCHARGE AIR TEMPERATURE IN RESPONSE TO BUILDING LOADS AND OUTDOOR AIR TEMPERATURE. TRIM AND RESPOND RESET LOGIC SHALL RESET SETPOINT WITHIN THE RANGE OF MIN AND MAX VALUES BASED ON ZONE REQUESTS.
7. IF APPLICABLE MITIGATION SEQUENCES FOR A2L MILDLY FLAMMABLE REFRIGERANTS, INCLUDING BACNET COV (CHANGE OF VALUE) FUNCTIONALITY AND A2L UNOCCUPIED OVERRIDE TO ENSURE RAPID RESPONSE AND COMPLIANCE WITH SAFETY STANDARDS.
C. THE AIR SYSTEMS APPLICATION SHALL PROVIDE A USER INTERFACE THAT INCLUDES STATUS OF CURRENT SYSTEM OPERATION WITH REAL TIME DATA OF KEY OPERATING PARAMETERS. KEY OPERATING PARAMETERS FOR GUIDELINE 36 INCLUDE:
1. DUCT STATIC PRESSURE
2. DUCT STATIC OPTIMIZATION SETPOINT
3. OUTDOOR AIRFLOW
4. VENTILATION OPTIMIZATION SETPOINT
5. DUCT STATIC OPTIMIZATION MAXIMUM VAV DAMPER/SOURCE VAV BOX
6. VENTILATION OPTIMIZATION MAXIMUM VAV VENT RATIO/SOURCE VAV BOX
7. DISCHARGE AIR TEMPERATURE
8. DISCHARGE AIR TEMPERATURE OPTIMIZATION SETPOINT
9. DUCT STATIC OPTIMIZATION SYSTEM REQUESTS
10. DISCHARGE AIR TEMPERATURE OPTIMIZATION SYSTEM REQUESTS
D. THE AIR SYSTEM APPLICATION STATUS SCREENS SHALL EXPLAIN WHAT OPTIMIZATION CALCULATIONS ARE OCCURRING, CRITICAL PARAMETERS, AND SOURCE EQUIPMENT MEMBERS. THE OPTIMIZATION STATUS, INPUTS, AND RESULTS SHALL BE DISPLAYED FOR VAV VENTILATION OPTIMIZATION (CALCULATING PROPER OUTSIDE AIR INTAKE), VAV DISCHARGE AIR TEMPERATURE OPTIMIZATION (CALCULATING PROPER DISCHARGE AIR TEMPERATURE) AND VAV DUCT STATIC PRESSURE OPTIMIZATION (CALCULATING PROPER FAN STATIC PRESSURE).
E. THE AIR SYSTEMS APPLICATIONS SHALL PROVIDE A USER INTERFACE THAT ENABLES CONFIGURATION CHANGES MADE BY SWIPE AND TYPE FIELDS, SELECTION LIST, AND CHECK BOX ENTRY FOR FEATURE DEFINITION:
1. VAV AUXILIARY NIGHT HEAT
2. VAV SOURCE TEMPERATURE DISTRIBUTION
3. CHANGEOVER SYSTEM CONTROL
4. START/STOP DELAY OPERATION
5. ENABLE/DISABLE OPTIMIZATION STRATEGIES (DUCT STATIC OPTIMIZATION, DISCHARGE AIR TEMPERATURE OPTIMIZATION AND VENTILATION OPTIMIZATION)
F. THE OPERATION OF VAV TERMINAL EQUIPMENT MEMBERS OF THE VAV AIR SYSTEM SHALL BE SELECTED BY CHECK BOX TO OPTIONALLY PARTICIPATE IN THE FOLLOWING FUNCTIONS WHEN FOR GUIDELINE 36 APPLICATIONS:
1. SYSTEM CALCULATIONS (MIN, MAX, AVERAGE)
2. DUCT PRESSURE OPTIMIZATION
3. VENTILATION OPTIMIZATION
4. DRIVE TO MAXIMUM OVERRIDE
5. COMMON SOURCE TEMPERATURE
6. COMMON SPACE
7. DISCHARGE AIR TEMPERATURE OPTIMIZATION
8. HOT WATER TEMPERATURE OPTIMIZATION
9. CHILLED WATER TEMPERATURE OPTIMIZATION
G. THE AIR SYSTEM APPLICATION VENDOR SHALL PROVIDE A PUBLISHED APPLICATIONS GUIDE THAT DETAILS THE AIR SYSTEM APPLICATION OPERATION, CONFIGURATION, SETUP, AND TROUBLESHOOTING. THE APPLICATIONS GUIDE DOCUMENTATION SHALL BE MAINTAINED UNDER VERSION CONTROL, AND UPDATED BY THE MANUFACTURE TO REFLECT MOST RECENT FEATURE UPDATES AS MADE AVAILABLE. CONTENTS OF THE GUIDE SHALL INCLUDE:
1. DESCRIPTION OF SYSTEM OPERATION
2. REQUIRED COMPONENTS
3. SEQUENCES OF OPERATION
4. INSTALLATION
5. CONTROLLER SETUP
6. REQUIRED PROGRAMMING
7. COMMISSIONING
8. OPTIMIZATION STRATEGIES
9. SPECIAL APPLICATIONS
10. TROUBLESHOOTING
H. THE AIR SYSTEM APPLICATION SHALL PRESENT IN PLAIN USER LANGUAGE THE CURRENT OPERATION WITH SOURCE ZONE INFORMATION AND RESET EVENTS.
II. TREND LOGS
A. THE SYSTEM SHALL HARVEST TREND LOGS FOR DEFINED KEY MEASUREMENTS FOR EACH CONTROLLED HVAC DEVICE AND HVAC APPLICATION. TREND LOGS SHALL BE CAPTURED FOR A MINIMUM OF 5 KEY OPERATING POINTS FOR EACH PIECE OF HVAC EQUIPMENT AND HVAC APPLICATION AND STORED FOR NO LESS THAN 1 YEAR AT 15-MINUTE INTERVALS. DATA LOGS SHALL BE CAPABLE OF BEING CONFIGURED ON AN INTERVAL OR CHANGE OF VALUE BASIS.
1. FAN COIL
A) DISCHARGE AIR TEMPERATURE
B) SPACE TEMPERATURE ACTIVE
C) SPACE TEMPERATURE SETPOINT ACTIVE
D) AIR FLOW SETPOINT ACTIVE
E) DISCHARGE AIR FLOW
2. WATER SOURCE HEAT PUMP
A) DISCHARGE AIR TEMPERATURE
B) SPACE TEMPERATURE ACTIVE
C) SPACE TEMPERATURE SETPOINT ACTIVE
D) AIR FLOW SETPOINT ACTIVE
E) DISCHARGE AIR FLOW
3. AIR HANDLING UNIT/ROOFTOP (VAV)
A) DISCHARGE AIR TEMPERATURE
B) DISCHARGE AIR TEMPERATURE SETPOINT ACTIVE
C) SPACE TEMPERATURE ACTIVE
D) COOLING CAPACITY STATUS
E) DISCHARGE AIR FLOW
4. AIR HANDLING UNIT/ROOFTOP (CV)
A) DISCHARGE AIR TEMPERATURE
B) SPACE TEMPERATURE ACTIVE
C) SPACE TEMPERATURE SETPOINT ACTIVE
D) COOLING CAPACITY STATUS
E) HEATING CAPACITY PRIMARY STATUS
F) OUTDOOR AIR DAMPER POSITION
5. VAV BOX
A) DISCHARGE AIR TEMPERATURE
B) SPACE TEMPERATURE ACTIVE
C) SPACE TEMPERATURE SETPOINT ACTIVE
D) AIR FLOW SETPOINT ACTIVE
E) DISCHARGE AIR FLOW
III. TRIM AND RESPOND
A. THE BAS SHALL PROVIDE A SETPOINT RESET APPLICATION PROGRAM BASED ON 'TRIM AND RESPOND' FUNCTIONALITY AS OUTLINED IN ASHRAE GUIDELINE 36.

21. BUILDING / SYSTEM CONTROLLERS
A) THERE SHALL BE ONE OR MORE INDEPENDENT, STANDALONE MICROPROCESSOR BASED SYSTEM CONTROLLERS TO MANAGE THE GLOBAL STRATEGIES DESCRIBED IN CONTROLLER SOFTWARE SECTION.
I. A NEW BUILDING CONTROL UNIT NUMBER 2 (BCU#2) SHALL BE PROVIDED TO REPLACE THE EXISTING BCU#2 THAT IS CURRENTLY DESIGNATED AS THE FIRE SYSTEMS CONTROL UNIT.
II. THE NEW BCU#2 SHALL BE CAPABLE OF COMMUNICATING WITH ALL NEW RTU EQUIPMENT AND ACCESSORIES AND ALL EXISTING EQUIPMENT THAT REMAINS.
III. THE CONTROLS CONTRACTOR SHALL VERIFY ALL EXISTING EQUIPMENT THAT IS CURRENTLY COMMUNICATING WITH BCU#2 AND SHALL REVIEW ALL EXISTING SEQUENCES OF OPERATION TO ENSURE THAT THE NEW BCU IS PROGRAMMED AND CONNECTED TO ALL NEW EQUIPMENT AND RECONNECTED TO ALL EXISTING EQUIPMENT. BEFORE ANY NEW WORK STARTS THE SEQUENCES OF OPERATION (SOO) SHALL BE COPIED FROM THE EXISTING BCU#2. IF A CONTRACTOR PROVIDES AN ALTERNATE CONTROL SYSTEM THE NEW CONTROLS CONTRACTOR SHALL PROGRAM THE NEW CONTROLS TO ENSURE THAT ALL EXISTING EQUIPMENT OPERATES WITH THE SAME SOO BEFORE THE PROJECT STARTS AND THAT THE NEW RTU'S MEET THE SOO AS DESCRIBED WITHIN THESE DOCUMENTS AND SHALL PROVIDE ALL CUSTOM PROGRAMMING AS REQUIRED TO OPERATE THE EQUIPMENT AS DESCRIBED IN THE SOO.
IV. THE CONTROLLER SHALL PROVIDE A USB COMMUNICATIONS PORT FOR CONNECTION TO A PC.
V. THE OPERATING SYSTEM OF THE CONTROLLER SHALL MANAGE THE INPUT AND OUTPUT COMMUNICATIONS SIGNALS TO ALLOW DISTRIBUTED CONTROLLERS TO SHARE REAL AND VIRTUAL POINT INFORMATION AND ALLOW CENTRAL MONITORING AND ALARMS.
VI. ALL SYSTEM CONTROLLERS SHALL HAVE A REAL TIME CLOCK AND SHALL BE ABLE TO ACCEPT A BACNET TIME SYNCHRONIZATION COMMAND FOR AUTOMATIC TIME SYNCHRONIZATION.
VII. DATA SHALL BE SHARED BETWEEN NETWORKED SYSTEM CONTROLLERS.
VIII. SERVICEABILITY – THE SYSTEM CONTROLLER SHALL HAVE A DISPLAY ON THE MAIN BOARD THAT INDICATES THE CURRENT OPERATING MODE OF THE CONTROLLER.
B) CONTROLS MANUFACTURER SHALL PROVIDE SECURE REMOTE ACCESS TO THE BUILDING AUTOMATION SYSTEM (BAS). SECURE REMOTE ACCESS SHALL NOT REQUIRE IP PORTS TO BE "EXPOSED" (I.E. PORT-FORWARDED OR EXTERNAL PUBLIC IP ADDRESSES) TO THE INTERNET. CONTROLS MANUFACTURER SHALL UPDATE SECURE REMOTE ACCESS SOFTWARE AS NECESSARY TO FOLLOW CYBER SECURITY BEST PRACTICES AND RESPOND TO CYBER SECURITY EVENTS.

22. ADVANCED APPLICATION CONTROLLERS:
A) ADVANCE APPLICATION CONTROLLERS SHALL BE USED TO CONTROL ALL EQUIPMENT OR APPLICATIONS OF MEDIUM AND HIGH COMPLEXITY, INCLUDING BUT NOT LIMITED TO AIR HANDLERS, BOILER PLANTS AND CHILLER PLANTS.
B) THE ADVANCED APPLICATION CONTROLLER SHALL BE CAPABLE OF OPERATING AS A STAND-ALONE CONTROLLER OR AS A MEMBER OF A BUILDING AUTOMATION SYSTEM (BAS).
C) WHEN THE ADVANCED APPLICATION CONTROLLER IS OPERATING AS A MEMBER OF A BUILDING AUTOMATION SYSTEM (BAS), THE APPLICATION CONTROLLER SHALL OPERATE AS FOLLOWS:
I. APPLICATION CONTROLLER WILL RECEIVE OPERATION MODE COMMANDS FROM THE BAS NETWORK CONTROLLER. THE BAS COMMANDS SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOW: OCCUPIED HEAT/COOL, UNOCCUPIED HEAT/COOL, MORNING WARM-UP, / PRE-COOL, OCCUPIED BYPASS).
II. APPLICATION CONTROLLER WILL PROVIDE EQUIPMENT STATUS PARAMETERS TO THE BAS THROUGH BACNET COMMUNICATION.
III. APPLICATION CONTROLLER WILL OPERATE AS A STAND-ALONE CONTROLLER IN THE EVENT OF COMMUNICATION FAILURE WITH THE BAS.
IV. IN CASE OF COMMUNICATIONS FAILURE, STAND-ALONE OPERATION SHALL USE DEFAULT VALUES OR LAST KNOWN VALUES FOR REMOTE SENSORS READ OVER THE NETWORK SUCH AS OUTDOOR AIR TEMPERATURE.
D) FOR STAND-ALONE OPERATION OF ADVANCED APPLICATION CONTROLLERS:
I. SHALL OPERATE A SCHEDULE IN A STANDALONE APPLICATION USING A REAL TIME CLOCK WITH A 7 DAY POWER BACKUP.
1. THE CONTROLLER SHALL HAVE A BUILT IN SCHEDULE (ASSESSABLE WITH OR WITHOUT A DISPLAY)
2. SUPPORT WILL BE FOR AT LEAST 3 SCHEDULES WITH UP TO 10 EVENTS FOR EACH DAY OF THE WEEK.
3. EACH OF THE 3 SCHEDULES CAN BE ANALOG, BINARY OR MULTI-STATE
4. THE CONTROLLER SHALL SUPPORT A MINIMUM OF 25 EXCEPTIONS EACH WITH UP TO 10 EVENTS.
II. FOR EASE OF TROUBLESHOOTING, THE CONTROLLER SHALL SUPPORT DATA TREND LOGGING.
1. WITH A MINIMUM OF 20,000 TRENDING POINTS TOTAL ON A CONTROLLER
2. TRENDS SHALL BE CAPABLE OF BEING COLLECTED AT A MINIMUM SAMPLE RATE OF ONCE EVERY SECOND
3. SHALL BE CAPABLE OF TRENDING ALL BACNET POINTS USED BY CONTROLLER
4. TRENDS SHALL BE CAPABLE OF BEING SCHEDULED OR TRIGGERED.
E) TO MEET THE SEQUENCE OF OPERATION FOR EACH APPLICATION, THE CONTROLLER SHALL USE LIBRARY PROGRAMS PROVIDED BY THE CONTROLLER MANUFACTURER THAT ARE EITHER FACTORY LOADED OR DOWNLOADED WITH SERVICE TOOL TO THE CONTROLLER.
F) ENVIRONMENT. CONTROLLER HARDWARE SHALL BE SUITABLE FOR THE ANTICIPATED AMBIENT CONDITIONS.
I. OPERATING CONDITIONS:
1. TEMPERATURE: -40°F TO 158°F (-40°C TO 70°C)
2. RELATIVE HUMIDITY: 5% TO 100% RH (NON-CONDENSING)
II. CONTROLLERS USED INDOORS SHALL BE MOUNTED IN A NEMA 1 ENCLOSURE AT A MINIMUM.
III. CONTROLLERS USED OUTDOORS AND/OR IN WET AMBIENT SHALL BE MOUNTED WITHIN NEMA 4 TYPE WATERPROOF ENCLOSURES, AND SHALL BE RATED FOR OPERATION AT -40° F TO 158° F [-40° C TO 70° C].
G) INPUT/OUTPUT: THE CONTROLLER SHALL HAVE ON BOARD OR THROUGH EXPANSION MODULE ALL I/O CAPABLE OF PERFORMING ALL FUNCTIONALITY NEEDED FOR THE APPLICATION. CONTROLS PROVIDED BY THE EQUIPMENT MANUFACTURE MUST SUPPLY THE REQUIRED I/O FOR THE EQUIPMENT. IN ADDITION OTHER CONTROLS MUST MEET THE FOLLOWING REQUIREMENTS:

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STRATEGIC DESIGN

drawing status
CD SET

project title
Hall County DOC RTU Replacement
200 South Sycamore Street, Grand Island, NE 68801

sheet title
Mechanical Specifications

drawn by	date	scale	revision
gm	02-04-2026	None	-

sheet number
M003

M000

I. SHALL SUPPORT FLEXIBILITY IN VALVE TYPE, THE CONTROLLERS SHALL BE CAPABLE OF SUPPORTING THE FOLLOWING VALVE CONTROL TYPES: 0-10VDC, 0-5VDC, 4-20MA, 24VAC - 2 POSITION.
II. SHALL SUPPORT FLEXIBILITY IN SENSOR TYPE, THE CONTROLLER SHALL BE CAPABLE OF READING SENSOR INPUT RANGES OF 0 TO10V, 0 TO 20MA, 50MS OR LONGER PULSES, 200 TO 20KOHM AND RTD INPUT.
III. SHALL SUPPORT FLEXIBILITY IN SENSOR TYPE, ALL ANALOG OUTPUTS SHALL HAVE THE ADDITIONAL CAPABILITY OF BEING PROGRAMMED TO OPERATE AS UNIVERSAL INPUTS OR PULSE WIDTH MODULATION OUTPUTS.
IV. SHALL SUPPORT FLEXIBILITY IN SENSOR TYPE, THE CONTROLLER AND/OR EXPANSION MODULES SHALL SUPPORT DRY AND WETTED (24VAC) BINARY INPUTS.
V. THE CONTROLLER SHALL SUPPORT PULSE ACCUMULATOR FOR CONNECTING DEVICES LIKE ENERGY METERS.
VI. IN ORDER TO SUPPORT A WIDE RANGE OF DEVICES, THE CONTROLLER'S BINARY OUTPUT SHALL BE ABLE TO DRIVE AT LEAST 10VA EACH.
VII. FOR FUTURE NEEDS, ANY UNUSED I/O THAT IS NOT NEEDED FOR THE FUNCTIONALITY OF THE EQUIPMENT SHALL BE AVAILABLE TO BE USED BY CUSTOM PROGRAMS ON THE CONTROLLER AND BY ANY OTHER CONTROLLER ON THE NETWORK.
VIII. THE CONTROLLER SHALL PROVIDE 24VAC AND 24VDC POWER TERMINALS SENSORS AND OTHER DEVICES REQUIRED.
IX. THE CONTROLLER SHALL PROVIDE A DEDICATED STATIC PRESSURE INPUT.

H) INPUT/OUTPUT EXPANDABILITY – THE CONTROLLER SHALL PROVIDE THE FOLLOWING FUNCTIONALITY IN ORDER TO MEET CURRENT AND FUTURE APPLICATION NEEDS:
I. FOR THE APPLICATION FLEXIBILITY, THE CONTROLLER SHALL BE CAPABLE OF EXPANDING TO A TOTAL OF AT LEAST 100 HARDWARE I/O TERMINATIONS.
II. EXPANSION I/O CAN BE MOUNTED UP TO 650 FT. (200M) FROM CONTROL.
III. FOR OPTIMIZED SYSTEM OPERATION, EXPANSION I/O MUST COMMUNICATE VIA AN INTERNAL CONTROLLER COMMUNICATION BUS (POINT EXPANSION VIA THE BACNET MS/TP NETWORK IS NOT ALLOWED).

I) SERVICEABILITY – THE CONTROLLER SHALL PROVIDE THE FOLLOWING IN ORDER TO IMPROVE SERVICEABILITY OF THE CONTROLLER.
I. DIAGNOSTIC LEDS FOR POWER/NORMAL OPERATION/STATUS, BACNET COMMUNICATIONS, SENSOR BUS COMMUNICATIONS, AND BINARY OUTPUTS. ALL WIRING CONNECTIONS SHALL BE CLEARLY LABELED AND MADE TO BE FIELD REMOVABLE.
II. BINARY AND ANALOG INPUTS AND OUTPUTS SHALL USE REMOVABLE CONNECTORS OR BE CONNECTED TO TERMINAL STRIP EXTERNAL TO THE CONTROL BOX.
III. SOFTWARE SERVICE TOOL CONNECTION THROUGH THE FOLLOWING METHODS: DIRECT CABLE CONNECTION TO THE CONTROLLER, CONNECTION THROUGH ANOTHER CONTROLLER ON BACNET LINK
IV. FOR SAFETY PURPOSES, THE CONTROLLER SHALL BE CAPABLE OF BEING POWERED BY A PORTABLE COMPUTER'S USB PORT FOR THE PURPOSES OF CONFIGURATION, PROGRAMMING AND TESTING PROGRAMS SO THAT THIS WORK CAN BE ACCOMPLISHED WITH THE POWER OFF TO THE ASSOCIATED EQUIPMENT.
V. THE CONTROLLER SOFTWARE TOOL SERVICE PORT SHALL UTILIZE STANDARD OFF-THE-SHELF USB PRINTER CABLE.
VI. CAPABILITIES TO TEMPORARILY OVERRIDE THE BACNET POINT VALUES WITH BUILT-IN TIME EXPIRATION IN THE CONTROLLER.
VII. TO AID IN SERVICE REPLACEMENT, THE CONTROLLER SHALL EASILY ATTACHED TO STANDARD DIN RAIL MOUNTING.
VIII. FOR FUTURE EXPANSION, THE CONTROLLER SHALL BE CAPABLE OF ADDING SEQUENCE OF OPERATION PROGRAMMING UTILIZING SERVICE TOOLS SOFTWARE WITH A GRAPHICAL PROGRAMMING INTERFACE (EDITING OR PROGRAMMING IN LINE CODE IS NOT PERMISSIBLE).
IX. TO AID IN SERVICE REPLACEMENT, THE CONTROLLER SHALL ALLOW FOR SETTING ITS BACNET ADDRESS VIA CONTROLLER MOUNTED ROTARY SWITCHES THAT CORRESPOND TO THE NUMERICAL VALUE OF THE ADDRESS. (DIP SWITCH METHODOLOGIES ARE NOT ALLOWED). SETTING OF THE ADDRESS SHALL BE ACCOMPLISHED WITHOUT THE NEED OF A SERVICE TOOL OR POWER APPLIED TO THE CONTROLLER.
X. CONTROLLER DATA SHALL BE MAINTAINED THROUGH A POWER FAILURE.

J) SOFTWARE RETENTION: ALL CONTROLLER OPERATING PARAMETERS, SETPOINTS, BIOS, AND SEQUENCE OF OPERATION CODE MUST BE STORED IN NON-VOLATILE MEMORY IN ORDER TO MAINTAIN SUCH INFORMATION FOR MONTHS WITHOUT POWER.

K) CONTROLLER MUST MEET THE FOLLOWING AGENCY COMPLIANCE:
I. UL916 PAZX, OPEN ENERGY MANAGEMENT EQUIPMENT
II. UL94-5V, FLAMMABILITY
III. FCC PART 15, SUBPART B, CLASS B LIMIT
IV. BACNET TESTING LABORATORY (BTL) LISTED AS BACNET ADVANCED APPLICATION CONTROLLER (B-AAC)

23. APPLICATION SPECIFIC CONTROLLERS:

A) GENERAL DESCRIPTION
I. APPLICATION SPECIFIC CONTROLLERS (ASC) SHALL BE MICROPROCESSOR-BASED DDC CONTROLLERS WHICH, THROUGH HARDWARE OR FIRMWARE DESIGN, CONTROL SPECIFIED EQUIPMENT. THEY ARE NOT USER PROGRAMMABLE, BUT ARE CUSTOMIZED FOR OPERATION WITHIN THE CONFINES OF THE EQUIPMENT THEY ARE DESIGNED TO SERVE.
II. ZONE CONTROLLERS ARE CONTROLLERS THAT OPERATE EQUIPMENT THAT CONTROL THE SPACE TEMPERATURE OF SINGLE ZONE. EXAMPLES ARE CONTROLLERS FOR VAV, FAN COIL, BLOWER COILS, UNIT VENTILATORS, HEAT PUMPS, AND WATER SOURCE HEAT PUMPS.

B) THE APPLICATION SPECIFIC CONTROLLER SHALL BE CAPABLE OF OPERATING AS A STAND-ALONE CONTROLLER OR AS A MEMBER OF A BUILDING AUTOMATION SYSTEM (BAS).

C) WHEN THE APPLICATION SPECIFIC CONTROLLER IS OPERATING AS A MEMBER OF A BUILDING AUTOMATION SYSTEM (BAS), THE APPLICATION CONTROLLER SHALL OPERATE AS FOLLOWS:
I. APPLICATION CONTROLLER WILL RECEIVE OPERATION MODE COMMANDS FROM THE BAS NETWORK CONTROLLER. THE BAS COMMANDS SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOW: OCCUPIED HEAT/COOL, UNOCCUPIED HEAT/COOL, MORNING WARM-UP, / PRE-COOL, OCCUPIED BYPASS).
II. APPLICATION CONTROLLER WILL PROVIDE EQUIPMENT STATUS PARAMETERS TO THE BAS THROUGH BACNET COMMUNICATION.
III. APPLICATION CONTROLLER WILL OPERATE AS A STAND-ALONE CONTROLLER IN THE EVENT OF COMMUNICATION FAILURE WITH THE BAS.
IV. IN CASE OF COMMUNICATIONS FAILURE STAND-ALONE OPERATION SHALL USE DEFAULT VALUES OR LAST KNOWN VALUES FOR REMOTE SENSORS READ OVER THE NETWORK SUCH AS OUTDOOR AIR TEMPERATURE.

D) STAND-ALONE OPERATION: EACH PIECE OF EQUIPMENT SPECIFIED IN SECTION "A" SHALL BE CONTROLLED BY A SINGLE CONTROLLER AND PROVIDE STAND-ALONE CONTROL IN THE EVENT THAT A BAS IS NOT PRESENT.

E) SOFTWARE
I. TO MEET THE SEQUENCE OF OPERATION FOR EACH ZONE CONTROL, THE CONTROLLER SHALL USE PROGRAMS DEVELOPED AND TESTED BY THE CONTROLLER MANUFACTURER THAT ARE EITHER FACTORY LOADED OR DOWNLOADED WITH SERVICE TOOL TO THE CONTROLLER.
II. FOR CONTROLLING ANCILLARY DEVICES AND FOR FLEXIBILITY TO CHANGE THE SEQUENCE OF OPERATION IN THE FUTURE, THE CONTROLLER SHALL BE CAPABLE RUNNING CUSTOM PROGRAMS WRITTEN IN A GRAPHICAL PROGRAMMING LANGUAGE.

F) ENVIRONMENT: CONTROLLER HARDWARE SHALL BE SUITABLE FOR THE ANTICIPATED AMBIENT CONDITIONS.
I. STORAGE: -55° TO 203° F (-48° TO 95° C) AND 5 TO 95% RH, NON-CONDENSING.
II. OPERATING: -40° TO 158° F (-40 TO 70° C) AND 5 TO 95% RH, NON-CONDENSING.
III. CONTROLLERS USED INDOORS SHALL BE MOUNTED IN A NEMA 1 ENCLOSURE AT A MINIMUM.
IV. CONTROLLERS USED OUTDOORS AND/OR IN WET AMBIENT SHALL BE MOUNTED WITHIN NEMA 4 TYPE WATERPROOF ENCLOSURES, AND SHALL BE RATED FOR OPERATION AT -40° TO 158° F [-40° TO 70° C].

G) INPUT/OUTPUT:
I. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT OF VALVES, THE CONTROLLERS SHALL BE CAPABLE OF SUPPORTING ALL OF THE FOLLOWING VALVE CONTROL TYPES 0-10VDC, 0-5VDC, 4-20MA, 24VAC FLOATING POINT, 24VAC - 2 POSITION (NORMALLY OPEN OR NORMALLY CLOSED).
II. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT OF SENSORS, THE CONTROLLERS SHALL BE CAPABLE OF READING SENSOR INPUT RANGES OF 0 TO10V, 0 TO 20MA, PULSE COUNTS, AND 200 TO 20KOHM.
III. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT OF BINARY DEVICES, THE CONTROLLER SHALL SUPPORT DRY AND WETTED (24VAC) BINARY INPUTS.
IV. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT DEVICES, THE CONTROLLER'S SHALL HAVE BINARY OUTPUT WHICH ARE ABLE TO DRIVE AT LEAST 12VA EACH.
V. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT OF MOTORS, THE CONTROLLER SHALL BE CAPABLE OF OUTPUTTING 24VAC (BINARY OUTPUT), DC VOLTAGE (0 TO 10VDC MINIMUM RANGE) AND PWM (IN THE 80 TO 100 HZ RANGE).
VI. FOR FUTURE NEEDS, ANY I/O THAT IS UNUSED BY FUNCTIONALITY OF EQUIPMENT CONTROL SHALL BE AVAILABLE TO BE USED BY CUSTOM PROGRAM ON THE CONTROLLER AND BY ANOTHER CONTROLLER ON THE NETWORK.
VII. FOR FUTURE EXPANSION AND FLEXIBILITY, THE CONTROLLER SHALL HAVE EITHER ON BOARD OR THROUGH EXPANSION, 20 HARDWARE INPUT/OUTPUT POINTS. EXPANSION POINTS MUST COMMUNICATE WITH THE CONTROLLER VIA AN INTERNAL COMMUNICATIONS BUS. EXPANSION POINTS MUST BE CAPABLE OF BEING MOUNTED UP TO 650FT. (200 M) FROM THE CONTROLLER. EXPANSION POINTS THAT REQUIRE THE BACNET NETWORK FOR COMMUNICATION WITH THE CONTROLLER ARE NOT ALLOWED.

H) SERVICEABILITY – THE CONTROLLER SHALL PROVIDE THE FOLLOWING IN ORDER TO IMPROVE SERVICEABILITY OF THE CONTROLLER.
I. DIAGNOSTIC LEDS SHALL INDICATE CORRECT OPERATION OR FAILURES/FAULTS FOR ALL OF THE FOLLOWING: POWER, SENSORS, BACNET COMMUNICATIONS, AND I/O COMMUNICATIONS BUS.
II. ALL BINARY OUTPUT SHALL HAVE LED'S INDICATING THE OUTPUT STATE.
III. ALL WIRING CONNECTORS SHALL REMOVABLE WITHOUT THE USE OF A TOOL.
IV. SOFTWARE SERVICE TOOL CONNECTION THROUGH ALL OF THE FOLLOWING METHODS: DIRECT CABLE CONNECTION TO THE CONTROLLER, CONNECTION THROUGH ANOTHER CONTROLLER ON BACNET LINK
V. FOR SAFETY PURPOSES, THE CONTROLLER SHALL BE CAPABLE OF BEING POWERED BY A PORTABLE COMPUTER FOR THE PURPOSES OF CONFIGURATION, PROGRAMMING, AND TESTING PROGRAMS SO THAT THIS WORK CAN BE ACCOMPLISHED WITH THE POWER OFF TO THE EQUIPMENT.
VI. CAPABILITIES TO TEMPORARILY OVERRIDE OF BACNET POINT VALUES WITH BUILT-IN TIME EXPIRATION IN THE CONTROLLER.
VII. BACNET MAC ADDRESS SHALL BE SET USING DECIMAL (0-9) BASED ROTARY SWITCHES.
1. CONFIGURATION CHANGE SHALL NOT BE MADE IN A PROGRAMMING ENVIRONMENT, BUT RATHER BY A CONFIGURATION PAGE UTILIZING DROPDOWN LIST, CHECK BOXES, AND NUMERIC BOXES.
VIII. FOR EASE OF TROUBLESHOOTING, THE CONTROLLER SHALL SUPPORT BACNET DATA TREND LOGGING.
1. WITH A MINIMUM OF 20,000 TRENDING POINTS TOTAL ON CONTROLLER
2. TRENDS SHALL BE CAPABLE OF BEING COLLECTED AT A MINIMUM SAMPLE RATE OF ONCE EVERY SECOND.
3. SHALL BE CAPABLE OF TRENDING ALL BACNET POINTS USED BY CONTROLLER
4. TRENDS SHALL BE CAPABLE OF BEING SCHEDULED OR TRIGGERED

I) SOFTWARE RETENTION: ALL ZONE CONTROLLER OPERATING PARAMETERS, SETPOINTS, BIOS, AND SEQUENCE OF OPERATION CODE MUST BE STORED IN NON-VOLATILE MEMORY IN ORDER TO MAINTAIN SUCH INFORMATION FOR MONTHS WITHOUT POWER.

J) APPLICATION CONTROLLER SHALL MEET THE FOLLOWING AGENCY COMPLIANCE:
I. UL916 PAZX, OPEN ENERGY MANAGEMENT EQUIPMENT
II. UL94-5V, FLAMMABILITY
III. FCC PART 15, SUBPART B, CLASS B LIMIT
IV. BACNET TESTING LABORATORY (BTL) LISTED AS BACNET APPLICATION SPECIFIC CONTROLLER (B-ASC)

24. ROOFTOP UNIT – SYSTEM CONTROLLER SOFTWARE

A) THE MANUFACTURER OF THE ROOTOP UNIT EQUIPMENT FOR DAIKIN+VALENT AND YORK+RUSKIN SHALL CONFIRM AND COORDINATE THAT THE EQUIPMENT CAN BE PROVIDED WITH A TERMINAL STRIP AS DESCRIBED BELOW IN ORDER TO COMPLY WITH THE SMOKE EVACUATION SYSTEM IN ORDER TO BE TESTED AND CERTIFIED TO COMPLY WITH SMOKE EVACUATION SYSTEM UNDERWRITER LABORATORIES UL 864 LISTING AND THE STATE FIRE MARSHAL.

B) ALL HVAC EQUIPMENT INCORPORATED INTO THE SMOKE CONTROL SYSTEM SHALL BE UL864 (UUKL) LISTED FOR SMOKE CONTROL APPLICATIONS. EACH DEVICE SHALL PROVIDE A UL864-LISTED AND COMPATIBLE METHOD FOR THE SMOKE CONTROL SYSTEM TO COMMAND AND MONITOR ALL REQUIRED LIFE-SAFETY FUNCTIONS, INCLUDING RUN/STOP, OPEN/CLOSE, POSITION/STATUS FEEDBACK, AND FAULT INDICATION. THE INTERFACE METHOD SHALL BE HARDWIRED I/O, PROVIDED IT COMPLIES WITH THE MANUFACTURER'S UUKL LISTING AND IS ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION (AHJ). WHEN ALTERNATE MANUFACTURERS ARE USED, THEIR EQUIPMENT SHALL MAINTAIN THE SAME UL864-LISTED CONTROL AND MONITORING CAPABILITIES REQUIRED FOR INTEGRATION WITH THE SMOKE EVACUATION SYSTEM. ALL EQUIPMENT MANUFACTURERS FOR DAIKIN+VALENT AND YORK+RUSKIN MUST PROVIDE THE FOLLOWING IN LIEU OF A DDC CONTROLLER: A TERMINAL STRIP INTERFACE WIRED TO THE RTU'S WITH DIRECT CONNECTION TO ALL FANS, DAMPERS, AND COMPRESSORS TO COMPLY WITH UL 864 (UUKL) REQUIREMENTS AND INTERFACE TO THE SMOKE EVACUATION SYSTEM.

25. APPLICATION CONTROLLER FOR PACKAGED ROOFTOP UNITS

A) THE ROOFTOP UNIT (RTU) APPLICATION CONTROLLER SHALL BE A MICROPROCESSOR-BASED DDC CONTROLLER WHICH, THROUGH HARDWARE OR FIRMWARE DESIGN, CONTROLS SPECIFIED EQUIPMENT. THE CONTROLLER IS NOT USER PROGRAMMABLE, BUT IS CUSTOMIZED FOR OPERATION WITHIN THE CONFINES OF THE EQUIPMENT IT IS DESIGNED TO SERVE.

B) THE APPLICATION CONTROLLER SHALL BE CAPABLE OF OPERATING AS A STAND-ALONE CONTROLLER OR AS A MEMBER OF A BUILDING AUTOMATION SYSTEM (BAS).

C) WHEN THE APPLICATION CONTROLLER IS OPERATING AS A MEMBER OF A BUILDING AUTOMATION SYSTEM (BAS), THE APPLICATION CONTROLLER SHALL OPERATE AS FOLLOWS:
1. APPLICATION CONTROLLER WILL RECEIVE OPERATION MODE COMMANDS FROM THE BAS NETWORK CONTROLLER. THE BAS COMMANDS SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOW: OCCUPIED HEAT/COOL, UNOCCUPIED HEAT/COOL, MORNING WARM-UP, / PRE-COOL, OCCUPIED BYPASS).
2. APPLICATION CONTROLLER WILL PROVIDE EQUIPMENT STATUS PARAMETERS TO THE BAS THROUGH BACNET COMMUNICATION.
3. APPLICATION CONTROLLER WILL OPERATE AS A STAND-ALONE CONTROLLER IN THE EVENT OF COMMUNICATION FAILURE WITH THE BAS.
4. IN CASE OF COMMUNICATIONS FAILURE STAND-ALONE OPERATION SHALL USE DEFAULT VALUES OR LAST KNOWN VALUES FOR REMOTE SENSORS READ OVER THE NETWORK SUCH AS OUTDOOR AIR TEMPERATURE.

D) SOFTWARE
1. TO MEET THE SEQUENCE OF OPERATION FOR EACH ZONE CONTROL, THE CONTROLLER SHALL USE PROGRAMS DEVELOPED AND TESTED BY THE CONTROLLER MANUFACTURER THAT ARE EITHER FACTORY LOADED OR CUSTOMIZED WITH USE OF SERVICE TOOL NATIVE TO THE CONTROLLER.

E) ENVIRONMENT: CONTROLLER HARDWARE SHALL BE SUITABLE FOR THE ANTICIPATED AMBIENT CONDITIONS.
1. STORAGE: -55° TO 203° F (-48° TO 95° C) AND 5 TO 95% RH, NON-CONDENSING.
2. OPERATING: -40° TO 158° F (-40 TO 70° C) AND 5 TO 95% RH, NON-CONDENSING.
3. CONTROLLERS USED INDOORS SHALL BE MOUNTED IN A NEMA 1 ENCLOSURE AT A MINIMUM.
4. CONTROLLERS USED OUTDOORS AND/OR IN WET AMBIENT SHALL BE MOUNTED WITHIN NEMA 4 TYPE WATERPROOF ENCLOSURES, AND SHALL BE RATED FOR OPERATION AT -40° TO 158° F [-40° TO 70° C].

F) CONTROLLER INPUT/OUTPUT: THE CONTROLLER SHALL HAVE ON BOARD CAPABLE OF PERFORMING ALL FUNCTIONALITY NEEDED FOR THE APPLICATION. CONTROLS PROVIDED BY THE EQUIPMENT MANUFACTURE MUST SUPPLY THE REQUIRED I/O FOR THE EQUIPMENT.
1. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT OF VALVES, THE CONTROLLERS SHALL BE CAPABLE OF SUPPORTING ALL OF THE FOLLOWING OUTPUT TYPES; 0-10VDC, 0-5VDC, 4-20MA, BINARY.
2. FOR FLEXIBILITY IN SELECTION AND REPLACEMENT OF SENSORS, THE CONTROLLERS SHALL BE CAPABLE OF READING SENSOR INPUT RANGES OF 0 TO10V, 0 TO 20MA, PULSE COUNTS, AND 200 TO 20KOHM.

G) SERVICEABILITY – THE CONTROLLER SHALL PROVIDE THE FOLLOWING IN ORDER TO IMPROVE SERVICEABILITY OF THE CONTROLLER.
1. DIAGNOSTIC LEDS SHALL INDICATE CORRECT OPERATION OR FAILURES/FAULTS FOR ALL OF THE FOLLOWING: POWER, SENSORS, BACNET COMMUNICATIONS, AND I/O COMMUNICATIONS BUS.
2. ALL BINARY OUTPUT SHALL HAVE LED'S INDICATING THE OUTPUT STATE.
3. ALL WIRING CONNECTORS SHALL REMOVABLE WITHOUT THE USE OF A TOOL.
4. SOFTWARE SERVICE TOOL CONNECTION THROUGH THE FOLLOWING METHODS: DIRECT CABLE CONNECTION TO THE CONTROLLER, CONNECTION THROUGH ANOTHER CONTROLLER ON BACNET LINK.

H) SOFTWARE RETENTION: ALL ZONE CONTROLLER OPERATING PARAMETERS, SETPOINTS, BIOS, AND SEQUENCE OF OPERATION CODE MUST BE STORED IN NON-VOLATILE MEMORY IN ORDER TO MAINTAIN SUCH INFORMATION FOR MONTHS WITHOUT POWER.
1. CONTROLLER SHALL MEET THE FOLLOWING AGENCY COMPLIANCE:
a. UL916 PAZX, Open Energy Management Equipment
b. UL94-5V, Flammability
c. FCC Part 15, Subpart B, Class B Limit
d. BACnet Testing Laboratory (BTL) listed

26. INPUT/OUTPUT INTERFACE:

A) HARDWIRED INPUTS AND OUTPUTS MAY TIE INTO THE SYSTEM THROUGH BUILDING, CUSTOM APPLICATION, OR ASCS.

B) ALL INPUT POINTS AND OUTPUT POINTS SHALL BE PROTECTED SUCH THAT SHORTING OF THE POINT TO ITSELF, TO ANOTHER POINT, OR TO GROUND WILL CAUSE NO DAMAGE TO THE CONTROLLER. ALL INPUT AND OUTPUT POINTS SHALL BE PROTECTED FROM VOLTAGE UP TO 24V OF ANY DURATION, SUCH THAT CONTACT WITH THIS VOLTAGE WILL CAUSE NO DAMAGE TO THE CONTROLLER.

C) BINARY INPUTS SHALL ALLOW THE MONITORING OF ON/OFF SIGNALS FROM REMOTE DEVICES. THE BINARY INPUTS SHALL PROVIDE A WETTING CURRENT OF AT LEAST 12 MA TO BE COMPATIBLE WITH COMMONLY AVAILABLE CONTROL DEVICES AND SHALL BE PROTECTED AGAINST THE EFFECTS OF CONTACT BOUNCE AND NOISE. BINARY INPUTS SHALL SENSE "DRY CONTACT" CLOSURE WITHOUT EXTERNAL POWER (OTHER THAN THAT PROVIDED BY THE CONTROLLER) BEING APPLIED.

D) PULSE ACCUMULATION INPUT OBJECTS. THIS TYPE OF OBJECT SHALL CONFORM TO ALL THE REQUIREMENTS OF BINARY INPUT OBJECTS AND ALSO ACCEPT UP TO 10 PULSES PER SECOND FOR PULSE ACCUMULATION.

E) ANALOG INPUTS SHALL ALLOW THE MONITORING OF LOW VOLTAGE (0 TO 10 VDC), CURRENT (4 TO 20 MA), OR RESISTANCE SIGNALS (THERMISTOR, RTD). ANALOG INPUTS SHALL BE COMPATIBLE WITH AND FIELD CONFIGURABLE TO COMMONLY AVAILABLE SENSING DEVICES.

F) BINARY OUTPUTS SHALL PROVIDE FOR ON/OFF OPERATION OR A PULSED LOW-VOLTAGE SIGNAL FOR PULSE WIDTH MODULATION CONTROL. BINARY OUTPUTS ON BUILDING AND CUSTOM APPLICATION CONTROLLERS SHALL HAVE STATUS LIGHTS. OUTPUTS SHALL BE SELECTABLE FOR EITHER NORMALLY OPEN OR NORMALLY CLOSED OPERATION.

G) ANALOG OUTPUTS SHALL PROVIDE A MODULATING SIGNAL FOR THE CONTROL OF END DEVICES. OUTPUTS SHALL PROVIDE EITHER A 0 TO 10VDC OR A 4 TO 20 MA SIGNAL AS REQUIRED TO PROVIDE PROPER CONTROL OF THE OUTPUT DEVICE. ANALOG OUTPUTS SHALL NOT EXHIBIT A DRIFT OF GREATER THAN 0.4% OF RANGE PER YEAR.

H) TRI-STATE OUTPUTS. PROVIDE TRI-STATE OUTPUTS (TWO COORDINATED BINARY OUTPUTS) FOR CONTROL OF THREE-POINT FLOATING TYPE ELECTRONIC ACTUATORS WITHOUT FEEDBACK. USE OF THREE-POINT FLOATING DEVICES SHALL BE LIMITED TO ZONE CONTROL AND TERMINAL UNIT CONTROL APPLICATIONS (VAV TERMINAL UNITS, DUCT-MOUNTED HEATING COILS, ZONE DAMPERS, RADIATION, ETC.). CONTROL ALGORITHMS SHALL RUN THE ZONE ACTUATOR TO ONE END OF ITS STROKE ONCE EVERY 24 HOURS FOR VERIFICATION OF OPERATOR TRACKING.

I) SYSTEM OBJECT CAPACITY. THE SYSTEM SIZE SHALL BE EXPANDABLE TO AT LEAST TWICE THE NUMBER OF INPUT/ OUTPUT OBJECTS REQUIRED FOR THIS PROJECT. ADDITIONAL CONTROLLERS (ALONG WITH ASSOCIATED DEVICES AND WIRING) SHALL BE ALL THAT IS NECESSARY TO ACHIEVE THIS CAPACITY REQUIREMENT. THE OPERATOR INTERFACES INSTALLED FOR THIS PROJECT SHALL NOT REQUIRE ANY HARDWARE ADDITIONS OR SOFTWARE REVISIONS IN ORDER TO EXPAND THE SYSTEM.

27. POWER SUPPLIES:

A) CONTROL TRANSFORMERS SHALL BE UL LISTED. FURNISH CLASS 2 CURRENT-LIMITING TYPE OR FURNISH OVERCURRENT PROTECTION IN BOTH PRIMARY AND SECONDARY CIRCUITS FOR CLASS 2 SERVICE IN ACCORDANCE WITH NEC REQUIREMENTS. LIMIT CONNECTED LOADS TO 80% OF RATED CAPACITY.
1. DC POWER SUPPLY OUTPUT SHALL MATCH OUTPUT CURRENT AND VOLTAGE REQUIREMENTS. UNIT SHALL BE FULL-WAVE RECTIFIER TYPE WITH OUTPUT RIPPLE OF 5.0 MV MAXIMUM PEAK-TO-PEAK. REGULATION SHALL BE 1.0% LINE AND LOAD COMBINED, WITH 100-MICROSECOND RESPONSE TIME FOR 50% LOAD CHANGES. UNIT SHALL HAVE BUILT-IN OVERVOLTAGE AND OVERCURRENT PROTECTION AND SHALL BE ABLE TO WITHSTAND A 150% CURRENT OVERLOAD FOR AT LEAST THREE SECONDS WITHOUT TRIP-OUT OR FAILURE.

B) UNIT SHALL OPERATE BETWEEN 0°C AND 50°C (32°F AND 120°F). EM/RF SHALL MEET FCC CLASS B AND VDE 0871 FOR CLASS B AND MIL-STD 810C FOR SHOCK AND VIBRATION.

C) LINE VOLTAGE UNITS SHALL BE UL RECOGNIZED AND CSA APPROVED.

28. WIRING AND RACEWAYS:

D) GENERAL: PROVIDE COPPER WIRING, PLENUM CABLE, AND RACEWAYS AS SPECIFIED IN THE APPLICABLE SECTIONS OF THIS SPECIFICATION.

E) ALL INSULATED WIRE TO BE COPPER CONDUCTORS, UL LABELED FOR 90°C (194°F) MINIMUM SERVICE.

F) FIBER OPTIC CABLE. OPTICAL CABLES SHALL BE DUPLEX 900 MM TIGHT-BUFFER CONSTRUCTION DESIGNED FOR INTRA-BUILDING ENVIRONMENTS. THE SHEATH SHALL BE UL LISTED OFNP IN ACCORDANCE WITH NEC ARTICLE 770. THE OPTICAL FIBER SHALL MEET THE REQUIREMENTS OF FDDI, ANSI X3T9.5 PMD FOR 62.5/125 μM.

29. EXECUTION SECTION INCLUDES
A) EXAMINATION:
B) PROTECTION:
C) COORDINATION:
D) GENERAL WORKMANSHIP:
E) FIELD QUALITY CONTROL:
F) COMMUNICATION WIRING:
G) FIBER OPTIC CABLE:
H) INSTALLATION OF SENSORS:
I) FLOW SWITCH INSTALLATION:
J) WARNING LABELS:
K) IDENTIFICATION OF HARDWARE AND WIRING:
L) CONTROLLERS:
M) PROGRAMMING:
N) CONTROL SYSTEM CHECKOUT AND TESTING:
O) CLEANING:
P) TRAINING:

30. EXAMINATION:

A) THE CONTRACT DOCUMENTS SHALL BE THOROUGHLY EXAMINED FOR COORDINATION OF CONTROL DEVICES, THEIR INSTALLATION, WIRING, AND COMMISSIONING. COORDINATE AND REVIEW MECHANICAL EQUIPMENT SPECIFICATIONS, LOCATIONS, AND IDENTIFY ANY DISCREPANCIES, CONFLICTS, OR OMISSIONS THAT SHALL BE REPORTED TO THE ARCHITECT/ENGINEER FOR RESOLUTION BEFORE ROUGH-IN WORK IS STARTED.

B) THE BAS MANUFACTURER SHALL INSPECT THE JOBSITE IN ORDER TO VERIFY THAT CONTROL EQUIPMENT CAN BE INSTALLED AS REQUIRED, AND ANY DISCREPANCIES, CONFLICTS, OR OMISSIONS SHALL BE REPORTED TO THE ARCHITECT/ENGINEER FOR RESOLUTION BEFORE ROUGH-IN WORK IS STARTED.

31. PROTECTION:

A) THE BAS INSTALLATION CONTRACTOR SHALL PROTECT ALL WORK AND MATERIAL FROM DAMAGE BY THEIR WORK OR PERSONNEL, AND SHALL BE LIABLE FOR ALL DAMAGE THUS CAUSED.

B) THE BAS MANUFACTURER SHALL BE RESPONSIBLE FOR THEIR WORK AND EQUIPMENT UNTIL FINAL INSPECTION, TESTING, AND ACCEPTANCE. THE BAS INSTALLING CONTRACTOR SHALL PROTECT THEIR WORK AGAINST THEFT OR DAMAGE, AND SHALL CAREFULLY STORE MATERIAL AND EQUIPMENT RECEIVED ON SITE THAT IS NOT IMMEDIATELY INSTALLED. THE CONTRACTOR SHALL CLOSE ALL OPEN ENDS OF WORK WITH TEMPORARY COVERS OR PLUGS DURING STORAGE AND CONSTRUCTION TO PREVENT ENTRY OF FOREIGN OBJECTS.

32. COORDINATION:

A) SITE
1. WHERE THE MECHANICAL WORK WILL BE INSTALLED IN CLOSE PROXIMITY TO, OR WILL INTERFERE WITH, WORK OF OTHER TRADES, THE CONTRACTOR SHALL ASSIST IN WORKING OUT SPACE CONDITIONS TO MAKE A SATISFACTORY ADJUSTMENT. IF THE CONTRACTOR INSTALLS HIS/HER WORK BEFORE COORDINATING WITH OTHER TRADES, SO AS TO CAUSE ANY INTERFERENCE WITH WORK OF OTHER TRADES, THE CONTRACTOR SHALL MAKE THE NECESSARY CHANGES IN HIS/HER WORK TO CORRECT THE CONDITION WITHOUT EXTRA CHARGE.
2. COORDINATE AND SCHEDULE WORK WITH ALL OTHER WORK IN THE SAME AREA, OR WITH WORK THAT IS DEPENDENT UPON OTHER WORK, TO FACILITATE MUTUAL PROGRESS.SUBMITTALS. REFER TO THE "SUBMITTALS," SECTION OF THIS SPECIFICATION FOR REQUIREMENTS.

B) TEST AND BALANCE
1. THE CONTRACTOR SHALL FURNISH A SINGLE SET OF ALL TOOLS NECESSARY TO INTERFACE TO THE CONTROL SYSTEM FOR TEST AND BALANCE PURPOSES.
2. THE CONTRACTOR SHALL PROVIDE TRAINING IN THE USE OF THESE TOOLS. THIS TRAINING WILL BE PLANNED FOR A DURATION OF 4 HOURS.
3. IN ADDITION, THE CONTRACTOR SHALL PROVIDE A QUALIFIED TECHNICIAN TO ASSIST IN THE TEST AND BALANCE PROCESS, UNTIL THE FIRST 20 TERMINAL UNITS ARE BALANCED.
4. THE TOOLS USED DURING THE TEST AND BALANCE PROCESS SHALL BE RETURNED TO THE CONTRACTOR AT THE COMPLETION OF THE TESTING AND BALANCING.

C) LIFE SAFETY
1. DUCT SMOKE DETECTORS REQUIRED FOR AIR HANDLER SHUTDOWN SHALL BE SUPPLIED UNDER SECTION 26100 OF THIS SPECIFICATION. THE CONTRACTOR SHALL INTERLOCK SMOKE DETECTORS TO AIR HANDLERS FOR SHUTDOWN AS DESCRIBED IN THE SEQUENCES OF OPERATION FOR THIS PROJECT.
2. SMOKE DAMPERS AND ACTUATORS REQUIRED FOR DUCT SMOKE ISOLATION ARE PROVIDED UNDER SECTION 26100. THE CONTRACTOR SHALL INTERLOCK THESE DAMPERS TO THE AIR HANDLERS AS DESCRIBED IN THE SEQUENCES OF OPERATION FOR THIS PROJECT AS APPLICABLE.
3. FIRE/SMOKE DAMPERS AND ACTUATORS REQUIRED FOR FIRE RATED WALLS ARE PROVIDED UNDER ANOTHER SECTION 26100. CONTROL OF THESE DAMPERS SHALL BE BY 26100

D) COORDINATION WITH CONTROLS SPECIFIED IN OTHER SECTIONS OR DIVISIONS. OTHER SECTIONS AND/OR DIVISIONS OF THIS SPECIFICATION INCLUDE CONTROLS AND CONTROL DEVICES THAT ARE TO BE PART OF OR INTERFACED TO THE CONTROL SYSTEM SPECIFIED IN THIS SECTION. THESE CONTROLS SHALL BE INTEGRATED INTO THE SYSTEM AND COORDINATED BY THE CONTRACTOR AS FOLLOWS:
1. ALL COMMUNICATION MEDIA AND EQUIPMENT SHALL BE PROVIDED AS SPECIFIED IN THE "COMMUNICATION" SECTION OF THIS SPECIFICATION.
2. EACH SUPPLIER OF A CONTROLS PRODUCT IS RESPONSIBLE FOR THE CONFIGURATION, PROGRAMMING, START-UP, AND TESTING OF THAT PRODUCT TO MEET THE SEQUENCES OF OPERATION DESCRIBED IN THIS SECTION.
3. THE CONTRACTOR SHALL COORDINATE AND RESOLVE ANY INCOMPATIBILITY ISSUES THAT ARISE BETWEEN THE CONTROL PRODUCTS PROVIDED UNDER THIS SECTION AND THOSE PROVIDED UNDER OTHER SECTIONS OR DIVISIONS OF THIS SPECIFICATION.

33. GENERAL WORKMANSHIP:

A) INSTALL EQUIPMENT, PIPING, WIRING/CONDUIT, PARALLEL TO BUILDING LINES (I.E. HORIZONTAL, VERTICAL, AND PARALLEL TO WALLS) WHEREVER POSSIBLE.

B) PROVIDE SUFFICIENT SLACK AND FLEXIBLE CONNECTIONS TO ALLOW FOR VIBRATION OF PIPING AND EQUIPMENT.

C) INSTALL ALL EQUIPMENT IN READILY ACCESSIBLE LOCATIONS AS DEFINED BY NATIONAL ELECTRIC CODE (NEC). CONTROL PANELS SHALL BE ATTACHED TO STRUCTURAL WALLS OR PROPERLY SUPPORTED IN A FREE-STANDING CONFIGURATION, UNLESS MOUNTED IN EQUIPMENT ENCLOSURE SPECIFICALLY DESIGNED FOR THAT PURPOSE. PANELS SHALL BE MOUNTED TO ALLOW FOR UNOBSTRUCTED ACCESS FOR SERVICE.

D) VERIFY INTEGRITY OF ALL CONTROL WIRING TO ENSURE CONTINUITY AND FREEDOM FROM SHORTS AND GROUNDS PRIOR TO COMMENCING THE STARTUP AND COMMISSIONING PROCEDURES.

E) ALL CONTROL DEVICE INSTALLATION AND WIRING SHALL COMPLY WITH CONTRACT DOCUMENTS, ACCEPTABLE INDUSTRY SPECIFICATIONS, AND INDUSTRY STANDARDS FOR PERFORMANCE, RELIABILITY, AND COMPATIBILITY. INSTALLATION AND WIRING SHALL BE EXECUTED IN STRICT ADHERENCE TO LOCAL CODES AND STANDARD PRACTICES REFERENCED IN CONTRACT DOCUMENTS.

34. FIELD QUALITY CONTROL:

A) ALL WORK, MATERIALS, AND EQUIPMENT SHALL COMPLY WITH THE RULES AND REGULATIONS OF APPLICABLE LOCAL, STATE, AND FEDERAL CODES AND ORDINANCES AS IDENTIFIED IN CONTRACT DOCUMENTS.

B) BAS MANUFACTURER SHALL CONTINUALLY MONITOR THE FIELD INSTALLATION FOR BUILDING CODE COMPLIANCE AND QUALITY OF WORKMANSHIP. ALL VISIBLE PIPING AND OR WIRING RUNS SHALL BE INSTALLED PARALLEL TO BUILDING LINES AND PROPERLY SUPPORTED.

C) BAS INSTALLING CONTRACTOR(S) SHALL ARRANGE FOR FIELD INSPECTIONS BY LOCAL AND/OR STATE AUTHORITIES HAVING JURISDICTION OVER THE WORK.

35. COMMUNICATION WIRING:

A) ALL CABLING SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. FOLLOW MANUFACTURER'S INSTALLATION RECOMMENDATIONS FOR ALL COMMUNICATION CABLING.

B) DO NOT INSTALL COMMUNICATION WIRING IN RACEWAY AND ENCLOSURES CONTAINING CLASS 1 OR OTHER CLASS 2 WIRING.

C) MAXIMUM PULLING, TENSION, AND BEND RADIUS FOR CABLE INSTALLATION, AS SPECIFIED BY THE CABLE MANUFACTURER SHALL NOT BE EXCEEDED DURING INSTALLATION.

D) CONTRACTOR SHALL VERIFY THE INTEGRITY OF THE ENTIRE NETWORK FOLLOWING CABLE INSTALLATION. USE APPROPRIATE TEST MEASURES FOR EACH PARTICULAR CABLE.

E) WHEN A CABLE ENTERS OR EXITS A BUILDING, A LIGHTING ARRESTOR MUST BE INSTALLED BETWEEN THE LINE AND GROUND.

F) ALL RUNS OF COMMUNICATION WIRING SHALL BE UNSPLICED LENGTH WHEN THE LENGTH IS COMMERCIALLY AVAILABLE.

G) ALL COMMUNICATION WIRING SHALL BE LABELED TO INDICATE ORIGIN AND DESTINATION.

36. FIBER OPTIC CABLE:

A) ALL CABLING SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. MINIMUM CABLE AND UNJACKETED FIBER BEND RADII AS SPECIFIED BY CABLE MANUFACTURER SHALL BE MAINTAINED.

B) MAXIMUM PULLING TENSIONS AS SPECIFIED BY THE CABLE MANUFACTURER SHALL NOT BE EXCEEDED DURING INSTALLATION. POST INSTALLATION RESIDUAL CABLE TENSION SHALL BE WITHIN CABLE MANUFACTURER'S SPECIFICATIONS.

C) FIBER OPTIC CABINETS, HARDWARE, AND CABLE ENTERING THE CABINET SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS' INSTRUCTIONS. MINIMUM CABLE AND UNJACKETED FIBER BEND RADII AS SPECIFIED BY CABLE MANUFACTURER SHALL BE MAINTAINED.

37. INSTALLATION OF SENSORS:

A) SENSORS REQUIRED FOR MECHANICAL EQUIPMENT OPERATION SHALL BE FACTORY INSTALLED AND WIRED AS SPECIFIED IN MECHANICAL EQUIPMENT SPECIFICATIONS. BAS MANUFACTURER SHALL BE RESPONSIBLE FOR COORDINATING THESE CONTROL DEVICES AND ENSURING THE SEQUENCE OF OPERATIONS WILL BE MET. INSTALLATION AND WIRING SHALL BE IN ACCORDANCE WITH THE BAS MANUFACTURER'S RECOMMENDATIONS.

B) SENSORS THAT REQUIRE FIELD MOUNTING SHALL MEET THE BAS MANUFACTURER'S RECOMMENDATIONS AND BE COORDINATED WITH THE MECHANICAL EQUIPMENT THEY WILL BE ASSOCIATED.

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M000

C) MOUNT SENSORS RIGIDLY AND ADEQUATELY FOR THE ENVIRONMENT THE SENSOR WILL OPERATE.
D) ROOM TEMPERATURE SENSORS SHALL BE INSTALLED ON CONCEALED JUNCTION BOXES PROPERLY SUPPORTED BY THE BLOCK WALL FRAMING. FOR INSTALLATION IN DRY WALL CEILINGS, THE LOW VOLTAGE SENSOR WIRING CAN BE INSTALLED EXPOSED AND MUST MEET APPLICABLE NATIONAL AND LOCAL ELECTRICAL CODES.
E) ALL WIRES ATTACHED TO WALL MOUNTED SENSORS SHALL BE SEALED OFF TO PREVENT AIR FROM TRANSMITTING IN THE ASSOCIATED CONDUIT AND AFFECTING THE ROOM SENSOR READINGS.
F) INSTALL DUCT STATIC PRESSURE TAP WITH TUBE END FACING DIRECTLY DOWN-STREAM OF AIR FLOW.
G) INSTALL SPACE STATIC PRESSURE SENSOR WITH STATIC SENSING PROBE APPLICABLE FOR SPACE INSTALLATION WHERE APPLICABLE.
H) SENSORS USED IN MIXING PLENUMS, AND HOT AND COLD DECKS SHALL BE OF THE AVERAGING TYPE. AVERAGING SENSORS SHALL BE INSTALLED IN A SERPENTINE MANNER HORIZONTALLY ACROSS DUCT. EACH BEND SHALL BE SUPPORTED WITH A CAPILLARY CLIP.
I) ALL PIPE MOUNTED TEMPERATURE SENSORS SHALL BE INSTALLED IN MATCHED THERMOWELLS. INSTALL ALL LIQUID TEMPERATURE SENSORS WITH HEAT CONDUCTING FLUID IN THERMAL WELLS FOR ADEQUATE THERMAL CONDUCTANCE.
J) WIRING FOR SPACE SENSORS SHALL BE CONCEALED IN BUILDING DRYWALL. EMT CONDUIT IS ACCEPTABLE WITHIN MECHANICAL EQUIPMENT AND SERVICE ROOMS.
K) INSTALL OUTDOOR AIR TEMPERATURE SENSORS ON NORTH WALL COMPLETE WITH SUN SHIELD AT MANUFACTURER'S RECOMMENDED LOCATION AND COORDINATED WITH ENGINEER.

38. FLOW SWITCH INSTALLATION:
A) COORDINATE INSTALLATION OF FLOW SWITCH WITH MECHANICAL CONTRACTOR WHO WILL BE RESPONSIBLE FOR INSTALLING A THREAD O LET IN STEEL PIPING APPLICATIONS. COPPER PIPE APPLICATIONS WILL REQUIRE THE USE CXCXF TEE, AND NO PIPE EXTENSIONS OR SUBSTITUTIONS WILL BE ALLOWED.
B) MOUNT A MINIMUM OF 5 PIPE DIAMETERS UPSTREAM AND 5 PIPE DIAMETERS DOWNSTREAM, OR TWO FEET, WHICHEVER IS GREATER, FROM PIPE FITTINGS AND OTHER INLINE POTENTIAL OBSTRUCTIONS.
C) INSTALL IN ACCORDANCE WITH MANUFACTURERS' INSTRUCTIONS, WHICH WILL REQUIRE PROPER FLOW DIRECTION, HORIZONTAL ALIGNMENT WITH FLOW SWITCH MOUNTING ON THE TOP OF PIPE.

39. WARNING LABELS:
A) PERMANENT WARNING LABELS SHALL BE AFFIXED TO ALL EQUIPMENT THAT CAN BE AUTOMATICALLY STARTED BY THE BAS SYSTEM.
B) PERMANENT WARNING LABELS SHALL BE AFFIXED TO ALL MOTOR STARTERS AND ALL CONTROL PANELS THAT ARE CONNECTED TO MULTIPLE POWER SOURCES UTILIZING SEPARATE DISCONNECTS.

40. IDENTIFICATION OF HARDWARE AND WIRING:
A) ALL FIELD WIRING AND CABLING, INCLUDING THAT WITHIN FACTORY MOUNTED, AND WIRED CONTROL PANELS AND DEVICES FOR MECHANICAL EQUIPMENT, SHALL BE LABELED AT EACH END WITHIN 2" OF TERMINATION WITH A CABLE IDENTIFIER AND OTHER DESCRIPTIVE INFORMATION FOR TROUBLESHOOTING, MAINTENANCE, AND SERVICE PURPOSES. BAS MANUFACTURER TO COORDINATE THIS LABELING REQUIREMENT WITH MECHANICAL EQUIPMENT MANUFACTURER AS IT RELATES TO CONTROLS.
B) PERMANENTLY LABEL OR CODE EACH POINT OF FIELD TERMINAL STRIPS TO SHOW THE INSTRUMENT OR ITEM SERVED AND CORRELATE THEM TO THE BAS DESIGN DRAWINGS.
C) IDENTIFY CONTROL PANELS WITH MINIMUM 1-CM LETTERS ON LAMINATED PLASTIC NAMEPLATES.
D) IDENTIFIERS SHALL MATCH RECORD DOCUMENTS. ALL PLUG-IN COMPONENTS SHALL BE LABELED SUCH THAT REMOVAL OF THE COMPONENT DOES NOT REMOVE THE LABEL.

41. CONTROLLERS:
A) IF A NEW CONTROLS MANUFACTURER IS APPROVED AND AWARDED THE CONTRACT THE NEW CONTRACTOR SHALL PROVIDE A SEPARATE DDC CONTROLLER FOR INDIVIDUAL HVAC MECHANICAL EQUIPMENT AS REQUIRED TO COPY ALL EXISTING SEQUENCES OF OPERATION AND OPERATE ALL EQUIPMENT WITH THE CURRENT SEQUENCES OF OPERATION.
B) BAS MANUFACTURER SHALL FURNISH AND COORDINATE DDC CONTROLLERS AND CONTROL DEVICES AND ENSURE THAT INSTALLATION AND WIRING ADHERE TO BAS MANUFACTURER'S DESIGN RECOMMENDATIONS. FOR THOSE MECHANICAL EQUIPMENT UNITS THAT DO NOT HAVE FACTORY INSTALLED CONTROLS SPECIFIED, THE BAS MANUFACTURER SHALL FIELD MOUNT CONTROLS AND COORDINATE ALL INSTALLATION AND TERMINATION INFORMATION TO ENSURE THE SPECIFIED SEQUENCE OF OPERATIONS ARE MET.
C) BUILDING CONTROLLERS AND CUSTOM APPLICATION CONTROLLERS SHALL BE SELECTED TO PROVIDE A MINIMUM OF 15% SPARE I/O POINT CAPACITY FOR EACH POINT TYPE (ANALOG OR DIGITAL) FOUND AT EACH LOCATION. IF INPUT POINTS ARE NOT UNIVERSAL, 15% OF EACH TYPE IS REQUIRED. IF OUTPUTS ARE NOT UNIVERSAL, 15% OF EACH TYPE IS REQUIRED. A MINIMUM OF ONE SPARE IS REQUIRED FOR EACH TYPE OF POINT USED IN EACH CONTROLLER.
1. FUTURE USE OF SPARE I/O POINT CAPACITY SHALL REQUIRE PROVIDING THE FIELD INSTRUMENT AND CONTROL DEVICE, FIELD WIRING, ENGINEERING, PROGRAMMING, AND COMMISSIONING. NO ADDITIONAL CONTROLLER BOARDS OR POINT MODULES SHALL BE REQUIRED TO IMPLEMENT USE OF THESE SPARE POINTS.

42. PROGRAMMING:
A) PROVIDE SUFFICIENT INTERNAL MEMORY FOR ALL CONTROLLERS TO ENSURE SPECIFIED SEQUENCE OF OPERATIONS, ALARMING, TRENDING, AND REPORTING REQUIREMENTS ARE ACHIEVED. BAS MANUFACTURER SHALL PROVIDE A MINIMUM OF 25% SPARE MEMORY CAPACITY FOR FUTURE USE.
B) POINT NAMING: SYSTEM POINT NAMES SHALL BE MODULAR IN DESIGN, ALLOWING EASY OPERATOR INTERFACE WITHOUT THE USE OF A WRITTEN POINT INDEX.
C) SOFTWARE PROGRAMMING
1. PROVIDE PROGRAMMING FOR INDIVIDUAL MECHANICAL SYSTEMS TO ACHIEVE ALL ASPECTS OF THE SEQUENCE OF OPERATION SPECIFIED. IT IS THE BAS MANUFACTURER'S RESPONSIBILITY TO ENSURE ALL MECHANICAL EQUIPMENT FUNCTIONS AND OPERATES AS SPECIFIED IN SEQUENCE OF OPERATIONS. PROVIDE SUFFICIENT PROGRAMMING COMMENTS IN CONTROLLER APPLICATION SOFTWARE TO CLEARLY DESCRIBE EACH SECTION OF THE PROGRAM. THE COMMENT STATEMENTS SHALL REFLECT THE LANGUAGE USED IN THE SEQUENCE OF OPERATIONS.

43. BAS OPERATOR'S INTERFACE
A) WHEN OPERATOR WORKSTATION IS SPECIFIED, PROVIDE COLOR GRAPHICS FOR EACH PIECE OF MECHANICAL EQUIPMENT DEPICTING SUFFICIENT I/O TO MONITOR AND TROUBLESHOOT OPERATION. OPERATOR COLOR GRAPHICS SHALL INCLUDE CHILLER PLANT, COOLING TOWER SYSTEM, BOILER PLANT, AIR HANDLING UNITS, ROOFTOP UNITS, VAV TERMINAL BOXES, FAN COIL UNITS, UNIT VENTILATORS, HEAT EXCHANGERS, EXHAUST FANS, ETC. THESE STANDARD GRAPHICS SHALL DEPICT ALL POINTS DYNAMICALLY AS SPECIFIED IN THE POINTS LIST AND/OR INDICATED IN SEQUENCE OF OPERATION.
B) THE BAS MANUFACTURER SHALL PROVIDE ALL THE LABOR NECESSARY TO INSTALL, INITIALIZE, START UP, AND TROUBLE-SHOOT ALL OPERATOR INTERFACE SOFTWARE AND THEIR FUNCTIONS AS DESCRIBED IN THIS SECTION. THIS INCLUDES ANY OPERATING SYSTEM SOFTWARE, THE OPERATOR INTERFACE DATA BASE, AND ANY THIRD PARTY SOFTWARE INSTALLATION AND INTEGRATION REQUIRED FOR SUCCESSFUL OPERATION OF THE OPERATOR INTERFACE.
C) AS PART OF THIS EXECUTION PHASE, THE BAS MANUFACTURER SHALL PERFORM A COMPLETE TEST OF THE OPERATOR INTERFACE.

44. CONTROL SYSTEM CHECKOUT AND TESTING:
A) START-UP TESTING. ALL TESTING IN THIS SECTION SHALL BE PERFORMED BY THE CONTRACTOR AND SHALL MAKE UP PART OF THE NECESSARY VERIFICATION OF AN OPERATING CONTROL SYSTEM. THIS TESTING SHALL BE COMPLETED BEFORE THE OWNER'S REPRESENTATIVE IS NOTIFIED OF THE SYSTEM DEMONSTRATION.
1. THE CONTRACTOR SHALL FURNISH ALL LABOR AND TEST APPARATUS REQUIRED TO CALIBRATE AND PREPARE FOR SERVICE ALL OF THE INSTRUMENTS, CONTROLS, AND ACCESSORY EQUIPMENT FURNISHED UNDER THIS SPECIFICATION.
2. VERIFY THAT ALL CONTROL WIRING IS PROPERLY CONNECTED AND FREE OF ALL SHORTS AND GROUND FAULTS. VERIFY THAT TERMINATIONS ARE TIGHT.
3. ENABLE THE CONTROL SYSTEMS AND VERIFY CALIBRATION OF ALL INPUT DEVICES INDIVIDUALLY. PERFORM CALIBRATION PROCEDURES ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
4. VERIFY ALL BINARY OUTPUT DEVICES (RELAYS, SOLENOID VALVES, TWO-POSITION ACTUATORS AND CONTROL VALVES, MAGNETIC STARTER, ETC.) OPERATE PROPERLY AND NORMAL POSITIONS ARE CORRECT.
5. VERIFY ALL ANALOG OUTPUT DEVICES (I/PS, ACTUATORS, ETC) ARE FUNCTIONAL, THAT STARTAND SPAN ARE CORRECT, AND THAT DIREECTION AND NORMAL POSITIONS ARE CORRECT. THE CONTRACTOR SHALL CHECK ALL CONTROL VALVES AND AUTOATIC DAMPERS TO ENSURE PROPER ACTION AND CLOSURE. THE CONTRACTOR SHALL MAKE ANY NECESSARY ADJUSTMENTS TO VALVE STEM AND DAMPER BLADE TRAVEL.
6. VERIFY THE SYSTEM OPERATION ADHERES TO THE SEQUENCES OF OPERATION. SIMULATE AND OBSERVE ALL MODES OF OPERATION BY OVERRIDING AND VARYING INPUTS AND SCHEDULES. TUNE ALL DDC LOOPS AND OPTIMAL START/STOP ROUTIMES.
7. ALARMS AND INTERLOCKS
A) CHECK EACH ALARM SEPARATELY BY INCLUDING AN APPROPRIATE SIGNAL AT A VALUE THAT WILL TRIP THE ALARM.
B) INTERLOCKS SHALL BE TRIPPED USING FIELD CONTACTS TO CHECK THE LOGIC, AS WELL AS TO ENSURE THAT THE FAIL-SAFE CONDITION FOR ALL ACTUATORS IS IN THE PROPER DIRECTION.
C) INTERLOCK ACTIONS SHALL BE TESTED BY SIMULATING ALARM CONDITIONS TO CHECK THE INITIATING VALUE OF THE VARIABLE AND INTERLOCK ACTION.

45. CLEANING:
A) THE BAS MANUFACTURER'S INSTALLING CONTRACTOR(S) SHALL CLEAN UP ALL DEBRIS RESULTING FROM THEIR INSTALLATION ACTIVITIES ON A DAILY BASIS. THE INSTALLATION CONTRACTORS SHALL REMOVE ALL CARTONS, CONTAINERS, CRATES, ETC. UNDER HIS CONTROL AS SOON AS THEIR CONTENTS HAVE BEEN REMOVED. WASTE SHALL BE COLLECTED AND PLACED IN A LOCATION DESIGNATED BY THE OWNER, CONSTRUCTION MANAGER, GENERAL CONTRACTOR, AND/OR MECHANICAL CONTRACTOR.
B) AT THE COMPLETION OF WORK IN ANY AREA, THE INSTALLATION CONTRACTOR SHALL CLEAN ALL OF THEIR WORK, EQUIPMENT, ETC., MAKING IT FREE FROM DUST, DIRT AND DEBRIS.
C) AT THE COMPLETION OF WORK, ALL EQUIPMENT FURNISHED UNDER THIS SECTION SHALL BE CHECKED FOR PAINT DAMAGE. ANY FACTORY FINISHED PAINT THAT HAS BEEN DAMAGED SHALL BE REPAIRED TO MATCH THE ADJACENT AREAS. ANY METAL CABINET OR ENCLOSURE THAT HAS BEEN DEFORMED SHALL BE REPLACED WITH NEW MATERIAL AND REPAINTED TO MATCH THE ADJACENT AREAS.

46. TRAINING:
A) PROVIDE MINIMUM OF (8) HOURS OF OPERATOR TRAINING THROUGHOUT THE CONTRACT PERIOD. TRAINING SHALL CONSIST OF A MINIMUM OF (2) CLASSROOM OR VIRTUAL TRAINING SESSIONS OF (4) HOURS FOR EACH SESSION. THE TRAINING WILL BE PROVIDED FOR PERSONNEL DESIGNATED BY THE OWNER.
B) THESE OBJECTIVES WILL BE DIVIDED INTO LOGICAL GROUPINGS; PARTICIPANTS MAY ATTEND ONE OR MORE OF THESE, DEPENDING ON LEVEL OF KNOWLEDGE REQUIRED:
1. DAY-TO-DAY BAS OPERATORS

47. BAS TROUBLESHOOTING & MAINTENANCE
A) PROVIDE COURSE OUTLINE AND MATERIALS PRIOR TO SCHEDULE TRAINING SESSION. THE INSTRUCTOR(S) SHALL PROVIDE ONE COPY OF TRAINING MATERIAL PER STUDENT.
b) THE INSTRUCTOR(S) SHALL BE FACTORY-TRAINED AND EXPERIENCED IN TEACHING THIS TECHNICAL MATERIAL.

SECTION 255500 – SEQUENCES OF OPERATION (SOO)

1.1 SUMMARY

A. SECTION INCLUDES CONTROL SEQUENCES FOR DDC FOR HVAC SYSTEMS, SUBSYSTEMS, AND EQUIPMENT.

B. THE CONTROLS SHALL MATCH THE EXISTING SEQUENCE OF OPERATIONS FOR ALL EXISTING MECHANICAL EQUIPMENT.

BEFORE THE NEW BUILDING CONTROL UNIT NUMBER 2 (BCU#2) THAT IS CURRENTLY DESIGNATED AS THE FIRE SYSTEMS CONTROL UNIT IS INSTALLED THE SEQUENCE OF OPERATIONS (SOO) PROGRAMMING FOR ALL EQUIPMENT ON THE BCU#2 SHALL BE COPIED AND PREPROGRAMMED INTO THE NEW BCU TO MATCH THE EXISTING SOO FOR NORMAL OPERATION AND FOR THE SMOKE EVACUATION SYSTEM. ONCE THE NEW RTU'S AND CONTROLS HAVE BEEN INSTALLED THE EXISTING SMOKE EVACUATION SYSTEM SHALL BE TESTED AND CERTIFIED TO COMPLY WITH SMOKE EVACUATION SYSTEM UNDERWRITER LABORATORIES UL 864 LISTING AND THE STATE FIRE MARSHAL.

NOTE: BEFORE ANY WORK IS COMPLETED THE CONTROLS CONTRACTOR SHALL VERIFY ALL EXISTING EQUIPMENT THAT IS CURRENTLY COMMUNICATING WITH BCU#2 AND SHALL ENSURE THAT THE NEW BCU IS PROGRAMMED AND CONNECTED ACCORDINGLY.

BELOW IS THE CURRENT SOO FOR THE EQUIPMENT THAT SHALL BE COPIED FROM THE EXISTING BCU#2. IF A CONTRACTOR PROVIDES AN ALTERNATE CONTROL SYSTEM THE NEW CONTROLS CONTRACTOR SHALL COMPLY WITH THE SOO AS DESCRIBED WITHIN THESE DOCUMENTS AND SHALL PROVIDE ALL CUSTOM PROGRAMMING AS REQUIRED TO MEET THE REQUIREMENTS OF THESE SPECIFICATIONS.

1. THE MANUFACTURER OF THE ROOTOP UNIT (RTU) EQUIPMENT FOR DAIKIN+VALENT AND YORK+RUSKIN SHALL CONFIRM AND COORDINATE THAT THE EQUIPMENT CAN BE PROVIDED WITH A TERMINAL STRIP AS DESCRIBED BELOW IN ORDER TO COMPLY WITH THE SMOKE EVACUATION SYSTEM IN ORDER TO BE TESTED AND CERTIFIED TO COMPLY WITH SMOKE EVACUATION SYSTEM UNDERWRITER LABORATORIES UL 864 LISTING AND THE STATE FIRE MARSHAL.

2. ALL HVAC EQUIPMENT INCORPORATED INTO THE SMOKE CONTROL SYSTEM SHALL BE UL864 (UUKL) LISTED FOR SMOKE CONTROL APPLICATIONS. EACH DEVICE SHALL PROVIDE A UL864-LISTED AND COMPATIBLE METHOD FOR THE SMOKE CONTROL SYSTEM TO COMMAND AND MONITOR ALL REQUIRED LIFE-SAFETY FUNCTIONS, INCLUDING RUN/STOP, OPEN/CLOSE, POSITION/STATUS FEEDBACK, AND FAULT INDICATION. THE INTERFACE METHOD SHALL BE HARDWIRED I/O, PROVIDED IT COMPLIES WITH THE MANUFACTURER'S UUKL LISTING AND IS ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION (AHJ). WHEN ALTERNATE MANUFACTURERS ARE USED, THEIR EQUIPMENT SHALL MAINTAIN THE SAME UL864-LISTED CONTROL AND MONITORING CAPABILITIES REQUIRED FOR INTEGRATION WITH THE SMOKE EVACUATION SYSTEM. ALL EQUIPMENT MANUFACTURERS FOR DAIKIN+VALENT AND YORK+RUSKIN MUST PROVIDE THE FOLLOWING IN LIEU OF A DDC CONTROLLER: A TERMINAL STRIP INTERFACE WIRED TO THE RTU'S WITH DIRECT CONNECTION TO ALL FANS, DAMPERS, AND COMPRESSORS TO COMPLY WITH UL 864 (UUKL) REQUIREMENTS AND INTERFACE TO THE SMOKE EVACUATION SYSTEM.

3. GENERAL UL UUKL COMPLIANCE REQUIREMENT
- PROVIDE HVAC EQUIPMENT, CONTROL PANELS, DAMPERS, ACTUATORS, AND ASSOCIATED CONTROLS THAT ARE LISTED AND LABELED UNDER UL CATEGORY CODE UUKL FOR SMOKE CONTROL EQUIPMENT AND COMPLIANT WITH UL 864, STANDARD FOR CONTROL UNITS AND ACCESSORIES FOR FIRE ALARM SYSTEMS.
- ALL COMPONENTS FORMING PART OF THE SMOKE CONTROL OR SMOKE MANAGEMENT SYSTEM SHALL BE FACTORY-LISTED FOR UUKL AND FULLY COMPATIBLE WITH THE BUILDING FIRE ALARM SYSTEM.

4. CONTROLS INTEGRATION REQUIREMENT
- CONTROL SYSTEMS PERFORMING SMOKE CONTROL FUNCTIONS SHALL BE LISTED UNDER UL 864/UUKL AND SHALL INTERFACE WITH THE BUILDING FIRE ALARM SYSTEM USING LISTED AND APPROVED COMMUNICATION METHODS.
- UPON RECEIPT OF FIRE ALARM OR SMOKE CONTROL SIGNALS, THE CONTROLS SHALL PLACE HVAC EQUIPMENT INTO THE COMMANDED SMOKE CONTROL MODE (PRESSURIZE, EXHAUST, PURGE, OR SHUTDOWN) AS REQUIRED BY THE SMOKE CONTROL SEQUENCE OF OPERATIONS.

5. EQUIPMENT REQUIREMENTS
- SUPPLY FANS, RETURN FANS, EXHAUST FANS, AND ANY EQUIPMENT DESIGNATED FOR SMOKE CONTROL OPERATION SHALL INCLUDE UUKL-LISTED CONTROL PACKAGES AND UUKL-LISTED SAFETY INTERLOCKS AND STATUS MONITORING AS REQUIRED BY UL 864 TESTING CRITERIA.
- DAMPERS REQUIRED TO PERFORM SMOKE CONTROL SHALL BE UL 555S (LEAKAGE) AND UL UUKL LISTED AND PROVIDED WITH ACTUATORS TESTED AND APPROVED FOR SMOKE CONTROL APPLICATIONS.

6. POWER & MONITORING REQUIREMENTS
- SMOKE CONTROL SYSTEM COMPONENTS SHALL COMPLY WITH UL 864 REQUIREMENTS FOR POWER SUPPLY MONITORING, SUPERVISION, AND FAIL-SAFE OPERATION.
- THE CONTROL SYSTEM SHALL PROVIDE ALL REQUIRED SUPERVISORY REPORTING, INCLUDING:
  - LOSS OF POWER
  - LOSS OF COMMUNICATION
  - DEVICE FAILURE
  - DAMPER/FAN POSITION FEEDBACK
  - END-SWITCH STATUS
  - FIREFIGHTER'S SMOKE CONTROL PANEL (FSCP) ANNUNCIATION, IF APPLICABLE

7. DOCUMENTATION & TESTING
- CONTRACTOR SHALL SUBMIT UL UUKL LISTING DOCUMENTATION FOR EACH COMPONENT OF THE SMOKE CONTROL SYSTEM.
- PROVIDE A COMPLETE SMOKE CONTROL SEQUENCE OF OPERATIONS SIGNED AND SEALED BY A LICENSED FIRE PROTECTION ENGINEER (FPE), WHERE REQUIRED BY CODE.
- PERFORM FUNCTIONAL ACCEPTANCE TESTING IN ACCORDANCE WITH:
  - IBC SMOKE CONTROL PROVISIONS
  - NFPA 92 (SMOKE CONTROL SYSTEMS)
  - AHJ REQUIREMENTS FOR INTEGRATED SYSTEM TESTING

C. GENERAL EXHAUST FANS:
1. THE EXISTING SEQUENCE OF OPERATION (SOO) FOR EXHAUST FANS EF-20, EF-21, EF-22, AND EF-23 SEQUENCES ARE DESCRIBED WITH THE AIR HANDLING UNITS SEQUENCE OF OPERATION BELOW AND SHALL BE COPIED AND PROGRAMMED INTO THE NEW BUILDING AS DESCRIBED ABOVE

D. SYSTEM SEASONAL CHANGEOVER OPERATION:
1. EXISTING SOO SHALL BE COPIED AND PROGRAMMED INTO THE NEW BUILDING CONTROL UNIT.

E. SMOKE EXHAUST FANS SEF-X
1. EXHAUST FANS USED FOR SMOKE PURGE MANAGEMENT SHALL OPERATE AS SMOKE MANAGEMENT FANS WHEN OPERATED IN THE SMOKE MANAGEMENT MODE OF OPERATION BY THE EMCS SYSTEM.
2. UNDER NORMAL OPERATION (NON-FIRE OR NON-SMOKE MODE) EXHAUST FANS UTILIZED STRICTLY FOR SMOKE MANAGEMENT (SEF) SHALL BE DE-ENERGIZED AND THE MOTORIZED DAMPER AT THE FAN SHALL BE CLOSED.
3. WHEN OPERATED IN THE SMOKE MANAGEMENT MODE OF OPERATION, THE SMOKE EXHAUST FAN'S MOTORIZED (SEF) DAMPER SHALL OPEN AND THE FAN SHALL BE ENERGIZED. WHEN THE SMOKE EXHAUST FAN RUNS, A MOTORIZED DAMPER AT A ROOF HOOD ASSOCIATED WITH THAT SMOKE EXHAUST FAN SHALL OPEN TO PROVIDE MAKE-UP AIR. THE MOTORIZED DAMPER AT THE ROOF HOOD SHALL RETURN TO THE CLOSED POSITION WHEN THE SMOKE EXHAUST FAN IS OFF.

F. SMOKE MANAGEMENT SYSTEM CONTROL
1. THE FIRE ALARM CONTRACTOR WILL PROVIDE DRY CONTACTS IN THE FIRE ALARM PANEL FOR EACH SMOKE ZONE. THE BAS CONTRACTOR SHALL TIE INTO THE FIRE ALARM PANEL SO THE BAS RECOGNIZES WHICH SMOKE ZONE IS IN ALARM. COORDINATE FIRE ALARM PANEL AND CONTACT LOCATIONS WITH THE FIRE ALARM PANEL WITH THE FIRE ALARM CONTRACTOR.
2. BASED ON INDICATION OF ALARM IN ANY ZONE, BAS SHALL INITIATE CONTROL SEQUENCES ACCORDING TO THE "SMOKE MANAGEMENT SYSTEM ZONE SUMMARY" ON DRAWING M6.1 AND THE ASSOCIATED "PRESSURIZATION" AND 'EVACUATION/EXHAUST" MODES.
3. SMOKE CONTROL ZONES ARE INDICATED ON DRAWING M6.1.
4. PROVIDE ALL WIRING AND SEQUENCING FOR STATUS MONITORING AND MANUAL OVERRIDE OPERATION OF "PRESSURIZATION" AND "EVACUATION/EXHAUST" OF EACH SMOKE ZONE. WIRE MANUAL OPERATION TO FIREFIGHTER'S CONTROL PANEL (BAS). SEE "FIREFIGHTER'S CONTROL PANEL FUNCTIONS" PARAGRAPH BELOW.

G. FIREFIGHTER'S CONTROL PANEL FUNCTIONS
1. BY THE BUILDING AND MECHANICAL CODES, THE SMOKE CONTROL SYSTEM IS REQUIRED TO HAVE A FIREFIGHTER'S CONTROL PANEL FOR MANUAL CONTROL AND OVERRIDE OF THE AUTOMATIC CONTROL OF THE ENGINEERED SMOKE MANAGEMENT SYSTEM. THE "PANEL" IS TO BE DESIGNED TO GRAPHICALLY DEPICT THE BUILDING ARRANGEMENT AND SMOKE MANAGEMENT SYSTEM CONTROL ZONES. REFERENCE SHEET M6. 1. STATUS OF EACH SMOKE CONTROL ZONE SHALL BE INDICATED BY LAMPS AND APPROPRIATE LEGENDS.
A. THE CODE ALLOWS THE FIREFIGHTER'S CONTROL PANEL FUNCTIONS TO BE ACCOMPLISHED AND DISPLAYED ON THE BAS. FOR THIS PROJECT, ALL FIREFIGHTERS CONTROL PANEL FUNCTIONS SHALL BE PERFORMED AT / BY THE BAS. REFERENCES TO SWITCHES IN THIS PARAGRAPH REGARDING PANEL FUNCTIONS SHALL BE SYNONYMOUS WITH AN OVERRIDE PICKBOX ON THE DEDICATED FIREFIGHTER'S CONTROL PANEL GRAPHIC DISPLAY.
B. IN AN ATTEMPT TO REPLICATE THE FIREFIGHTER'S CONTROL PANEL, THE BUILDING SHALL BE DEPICTED ON A MAXIMUM OF 2 SCREENS WIDE. AREAS A AND B SHALL APPEAR ON 1 SCREEN, AND AREA C SHALL APPEAR ON THE 2ND SCREEN.
2. INDICATE GENERAL LOCATION OF ALL FANS, AIR-HANDLING UNITS AND ROOFTOP UNITS CONTROLLED BY THE SYSTEM.
3. STATUS INDICATORS BY SHALL BE PROVIDED FOR ALL SMOKE-CONTROL AIR HANDLING EQUIPMENT BY PILOT LAMP TYPE INDICATORS AS FOLLOWS:
A. SUPPLY, RETURN AND EXHAUST FANS AND DAMPERS IN NORMAL STATUS: WHITE.
B. SUPPLY, RETURN AND EXHAUST FANS AND DAMPERS IN OFF OR CLOSED STATUS: RED.
C. SUPPLY RETURN AND EXHAUST FANS AND DAMPERS IN ON OR OPEN STATUS: GREEN.
D. SUPPLY, RETURN AND EXHAUST FANS AND DAMPERS IN FAULT STATUS: PULSING YELLOW / AMBER.
E. PROVIDE PROVISION FOR TESTING THE PILOT LAMPS ON THE BAS BY MEANS OF ONE OR MORE "LAMP TEST" MOMENTARY PUSH BUTTONS OR OTHER SELF-RESTORING MEANS.
4. ON-OFF-AUTO SWITCH AND PILOT LAMP REQUIREMENTS:

STRATEGIC DESIGN
STRATEGIC DESIGN, LLC
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STRATEGIC DESIGN

drawing status
CD SET

project title
Hall County DOC RTU Replacement
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sheet title
Mechanical Specifications

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gm	02-04-2026	None	-

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M005

M000

SECTION 255500 – SEQUENCES OF OPERATION (SOO)

1.1 SUMMARY

A. SECTION INCLUDES CONTROL SEQUENCES FOR DDC FOR HVAC SYSTEMS, SUBSYSTEMS, AND EQUIPMENT.

B. THE CONTROLS SHALL MATCH THE EXISTING SEQUENCE OF OPERATIONS FOR ALL EXISTING MECHANICAL EQUIPMENT.

BEFORE THE NEW BUILDING CONTROL UNIT NUMBER 2 (BCU#2) THAT IS CURRENTLY DESIGNATED AS THE FIRE SYSTEMS CONTROL UNIT IS INSTALLED THE SEQUENCE OF OPERATIONS (SOO) PROGRAMMING FOR ALL EQUIPMENT ON THE BCU#2 SHALL BE COPIED AND PREPROGRAMMED INTO THE NEW BCU TO MATCH THE EXISTING SOO FOR NORMAL OPERATION AND FOR THE SMOKE EVACUATION SYSTEM. ONCE THE NEW RTU'S AND CONTROLS HAVE BEEN INSTALLED THE EXISTING SMOKE EVACUATION SYSTEM SHALL BE TESTED AND CERTIFIED TO COMPLY WITH SMOKE EVACUATION SYSTEM UNDERWRITER LABORATORIES UL 864 LISTING AND THE STATE FIRE MARSHAL.

NOTE: BEFORE ANY WORK IS COMPLETED THE CONTROLS CONTRACTOR SHALL VERIFY ALL EXISTING EQUIPMENT THAT IS CURRENTLY COMMUNICATING WITH BCU#2 AND SHALL ENSURE THAT THE NEW BCU IS PROGRAMMED AND CONNECTED ACCORDINGLY.

BELOW IS THE CURRENT SOO FOR THE EQUIPMENT THAT SHALL BE COPIED FROM THE EXISTING BCU#2. IF A CONTRACTOR PROVIDES AN ALTERNATE CONTROL SYSTEM THE NEW CONTROLS CONTRACTOR SHALL COMPLY WITH THE SOO AS DESCRIBED WITHIN THESE DOCUMENTS AND SHALL PROVIDE ALL CUSTOM PROGRAMMING AS REQUIRED TO MEET THE REQUIREMENTS OF THESE SPECIFICATIONS.

1. **THE MANUFACTURER OF THE ROOTOP UNIT (RTU) EQUIPMENT FOR DAIKIN+VALENT AND YORK+RUSKIN SHALL CONFIRM AND COORDINATE THAT THE EQUIPMENT CAN BE PROVIDED WITH A TERMINAL STRIP AS DESCRIBED BELOW IN ORDER TO COMPLY WITH THE SMOKE EVACUATION SYSTEM IN ORDER TO BE TESTED AND CERTIFIED TO COMPLY WITH SMOKE EVACUATION SYSTEM UNDERWRITER LABORATORIES UL 864 LISTING AND THE STATE FIRE MARSHAL.**

2. **ALL HVAC EQUIPMENT INCORPORATED INTO THE SMOKE CONTROL SYSTEM SHALL BE UL864 (UUKL) LISTED FOR SMOKE CONTROL APPLICATIONS. EACH DEVICE SHALL PROVIDE A UL864-LISTED AND COMPATIBLE METHOD FOR THE SMOKE CONTROL SYSTEM TO COMMAND AND MONITOR ALL REQUIRED LIFE-SAFETY FUNCTIONS, INCLUDING RUN/STOP, OPEN/CLOSE, POSITION/STATUS FEEDBACK, AND FAULT INDICATION. THE INTERFACE METHOD SHALL BE HARDWIRED I/O, PROVIDED IT COMPLIES WITH THE MANUFACTURER'S UUKL LISTING AND IS ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION (AHJ). WHEN ALTERNATE MANUFACTURERS ARE USED, THEIR EQUIPMENT SHALL MAINTAIN THE SAME UL864-LISTED CONTROL AND MONITORING CAPABILITIES REQUIRED FOR INTEGRATION WITH THE SMOKE EVACUATION SYSTEM. ALL EQUIPMENT MANUFACTURERS FOR DAIKIN+VALENT AND YORK+RUSKIN MUST PROVIDE THE FOLLOWING IN LIEU OF A DDC CONTROLLER: A TERMINAL STRIP INTERFACE WIRED TO THE RTU'S WITH DIRECT CONNECTION TO ALL FANS, DAMPERS, AND COMPRESSORS TO COMPLY WITH UL 864 (UUKL) REQUIREMENTS AND INTERFACE TO THE SMOKE EVACUATION SYSTEM.**

3. GENERAL UL UUKL COMPLIANCE REQUIREMENT
   - PROVIDE HVAC EQUIPMENT, CONTROL PANELS, DAMPERS, ACTUATORS, AND ASSOCIATED CONTROLS THAT ARE LISTED AND LABELED UNDER UL CATEGORY CODE UUKL FOR SMOKE CONTROL EQUIPMENT AND COMPLIANT WITH UL 864, STANDARD FOR CONTROL UNITS AND ACCESSORIES FOR FIRE ALARM SYSTEMS.
   - ALL COMPONENTS FORMING PART OF THE SMOKE CONTROL OR SMOKE MANAGEMENT SYSTEM SHALL BE FACTORY-LISTED FOR UUKL AND FULLY COMPATIBLE WITH THE BUILDING FIRE ALARM SYSTEM.
4. CONTROLS INTEGRATION REQUIREMENT
   - CONTROL SYSTEMS PERFORMING SMOKE CONTROL FUNCTIONS SHALL BE LISTED UNDER UL 864/UUKL AND SHALL INTERFACE WITH THE BUILDING FIRE ALARM SYSTEM USING LISTED AND APPROVED COMMUNICATION METHODS.
   - UPON RECEIPT OF FIRE ALARM OR SMOKE CONTROL SIGNALS, THE CONTROLS SHALL PLACE HVAC EQUIPMENT INTO THE COMMANDED SMOKE CONTROL MODE (PRESSURIZE, EXHAUST, PURGE, OR SHUTDOWN) AS REQUIRED BY THE SMOKE CONTROL SEQUENCE OF OPERATIONS.
5. EQUIPMENT REQUIREMENTS
   - SUPPLY FANS, RETURN FANS, EXHAUST FANS, AND ANY EQUIPMENT DESIGNATED FOR SMOKE CONTROL OPERATION SHALL INCLUDE UUKL-LISTED CONTROL PACKAGES AND UUKL-LISTED SAFETY INTERLOCKS AND STATUS MONITORING AS REQUIRED BY UL 864 TESTING CRITERIA.
   - DAMPERS REQUIRED TO PERFORM SMOKE CONTROL SHALL BE UL 555S (LEAKAGE) AND UL UUKL LISTED AND PROVIDED WITH ACTUATORS TESTED AND APPROVED FOR SMOKE CONTROL APPLICATIONS.
6. POWER & MONITORING REQUIREMENTS
   - SMOKE CONTROL SYSTEM COMPONENTS SHALL COMPLY WITH UL 864 REQUIREMENTS FOR POWER SUPPLY MONITORING, SUPERVISION, AND FAIL-SAFE OPERATION.
   - THE CONTROL SYSTEM SHALL PROVIDE ALL REQUIRED SUPERVISORY REPORTING, INCLUDING:
     - LOSS OF POWER
     - LOSS OF COMMUNICATION
     - DEVICE FAILURE
     - DAMPER/FAN POSITION FEEDBACK
     - END-SWITCH STATUS
     - FIREFIGHTER'S SMOKE CONTROL PANEL (FSCP) ANNUNCIATION, IF APPLICABLE
7. DOCUMENTATION & TESTING
   - CONTRACTOR SHALL SUBMIT UL UUKL LISTING DOCUMENTATION FOR EACH COMPONENT OF THE SMOKE CONTROL SYSTEM.
   - PROVIDE A COMPLETE SMOKE CONTROL SEQUENCE OF OPERATIONS SIGNED AND SEALED BY A LICENSED FIRE PROTECTION ENGINEER (FPE), WHERE REQUIRED BY CODE.
   - PERFORM FUNCTIONAL ACCEPTANCE TESTING IN ACCORDANCE WITH:
     - IBC SMOKE CONTROL PROVISIONS
     - NFPA 92 (SMOKE CONTROL SYSTEMS)
     - AHJ REQUIREMENTS FOR INTEGRATED SYSTEM TESTING

C. GENERAL EXHAUST FANS:
   1. THE EXISTING SEQUENCE OF OPERATION (SOO) FOR EXHAUST FANS EF-20, EF-21, EF-22, AND EF-23 SEQUENCES ARE DESCRIBED WITH THE AIR HANDLING UNITS SEQUENCE OF OPERATION BELOW AND SHALL BE COPIED AND PROGRAMMED INTO THE NEW BUILDING AS DESCRIBED ABOVE

D. SYSTEM SEASONAL CHANGEOVER OPERATION:
   1. EXISTING SOO SHALL BE COPIED AND PROGRAMMED INTO THE NEW BUILDING CONTROL UNIT.

E. SMOKE EXHAUST FANS SEF-X
   1. EXHAUST FANS USED FOR SMOKE PURGE MANAGEMENT SHALL OPERATE AS SMOKE MANAGEMENT FANS WHEN OPERATED IN THE SMOKE MANAGEMENT MODE OF OPERATION BY THE EMCS SYSTEM.
   2. UNDER NORMAL OPERATION (NON-FIRE OR NON-SMOKE MODE) EXHAUST FANS UTILIZED STRICTLY FOR SMOKE MANAGEMENT (SEF) SHALL BE DE-ENERGIZED AND THE MOTORIZED DAMPER AT THE FAN SHALL BE CLOSED.
   3. WHEN OPERATED IN THE SMOKE MANAGEMENT MODE OF OPERATION, THE SMOKE EXHAUST FAN'S MOTORIZED (SEF) DAMPER SHALL OPEN AND THE FAN SHALL BE ENERGIZED. WHEN THE SMOKE EXHAUST FAN RUNS, A MOTORIZED DAMPER AT A ROOF HOOD ASSOCIATED WITH THAT SMOKE EXHAUST FAN SHALL OPEN TO PROVIDE MAKE-UP AIR. THE MOTORIZED DAMPER AT THE ROOF HOOD SHALL RETURN TO THE CLOSED POSITION WHEN THE SMOKE EXHAUST FAN IS OFF.

F. SMOKE MANAGEMENT SYSTEM CONTROL
   1. THE FIRE ALARM CONTRACTOR WILL PROVIDE DRY CONTACTS IN THE FIRE ALARM PANEL FOR EACH SMOKE ZONE. THE BAS CONTRACTOR SHALL TIE INTO THE FIRE ALARM PANEL SO THE BAS RECOGNIZES WHICH SMOKE ZONE IS IN ALARM. COORDINATE FIRE ALARM PANEL AND CONTACT LOCATIONS WITH THE FIRE ALARM PANEL WITH THE FIRE ALARM CONTRACTOR.
   2. BASED ON INDICATION OF ALARM IN ANY ZONE, BAS SHALL INITIATE CONTROL SEQUENCES ACCORDING TO THE "SMOKE MANAGEMENT SYSTEM ZONE SUMMARY" ON DRAWING M6.1 AND THE ASSOCIATED "PRESSURIZATION" AND 'EVACUATION/EXHAUST" MODES.
   3. SMOKE CONTROL ZONES ARE INDICATED ON DRAWING M6.1.
   4. PROVIDE ALL WIRING AND SEQUENCING FOR STATUS MONITORING AND MANUAL OVERRIDE OPERATION OF "PRESSURIZATION" AND "EVACUATION/EXHAUST" OF EACH SMOKE ZONE. WIRE MANUAL OPERATION TO FIREFIGHTER'S CONTROL PANEL (BAS). SEE "FIREFIGHTER'S CONTROL PANEL FUNCTIONS" PARAGRAPH BELOW.

G. FIREFIGHTER'S CONTROL PANEL FUNCTIONS
   1. BY THE BUILDING AND MECHANICAL CODES, THE SMOKE CONTROL SYSTEM IS REQUIRED TO HAVE A FIREFIGHTER'S CONTROL PANEL FOR MANUAL CONTROL AND OVERRIDE OF THE AUTOMATIC CONTROL OF THE ENGINEERED SMOKE MANAGEMENT SYSTEM. THE "PANEL" IS TO BE DESIGNED TO GRAPHICALLY DEPICT THE BUILDING ARRANGEMENT AND SMOKE MANAGEMENT SYSTEM CONTROL ZONES. REFERENCE SHEET M6. 1. STATUS OF EACH SMOKE CONTROL ZONE SHALL BE INDICATED BY LAMPS AND APPROPRIATE LEGENDS.
      A. THE CODE ALLOWS THE FIREFIGHTER'S CONTROL PANEL FUNCTIONS TO BE ACCOMPLISHED AND DISPLAYED ON THE BAS. FOR THIS PROJECT, ALL FIREFIGHTERS CONTROL PANEL FUNCTIONS SHALL BE PERFORMED AT / BY THE BAS. REFERENCES TO SWITCHES IN THIS PARAGRAPH REGARDING PANEL FUNCTIONS SHALL BE SYNONYMOUS WITH AN OVERRIDE PICKBOX ON THE DEDICATED FIREFIGHTER'S CONTROL PANEL GRAPHIC DISPLAY.
      B. IN AN ATTEMPT TO REPLICATE THE FIREFIGHTER'S CONTROL PANEL, THE BUILDING SHALL BE DEPICTED ON A MAXIMUM OF 2 SCREENS WIDE. AREAS A AND B SHALL APPEAR ON 1 SCREEN, AND AREA C SHALL APPEAR ON THE 2ND SCREEN.
   2. INDICATE GENERAL LOCATION OF ALL FANS, AIR-HANDLING UNITS AND ROOFTOP UNITS CONTROLLED BY THE SYSTEM.
   3. STATUS INDICATORS BY SHALL BE PROVIDED FOR ALL SMOKE-CONTROL AIR HANDLING EQUIPMENT BY PILOT LAMP TYPE INDICATORS AS FOLLOWS:
      A. SUPPLY, RETURN AND EXHAUST FANS AND DAMPERS IN NORMAL STATUS: WHITE.
      B. SUPPLY, RETURN AND EXHAUST FANS AND DAMPERS IN OFF OR CLOSED STATUS: RED.
      C. SUPPLY RETURN AND EXHAUST FANS AND DAMPERS IN ON OR OPEN STATUS: GREEN.
      D. SUPPLY, RETURN AND EXHAUST FANS AND DAMPERS IN FAULT STATUS: PULSING YELLOW / AMBER.
      E. PROVIDE PROVISION FOR TESTING THE PILOT LAMPS ON THE BAS BY MEANS OF ONE OR MORE "LAMP TEST" MOMENTARY PUSH BUTTONS OR OTHER SELF-RESTORING MEANS.
   4. ON-OFF-AUTO SWITCH AND PILOT LAMP REQUIREMENTS:
      A. PROVIDE ONE ON-OFF-AUTO SWITCH TO CONTROL THE "SMOKE PRESSURIZATION" MODE FOR EACH SMOKE MANAGEMENT SYSTEM ZONE.
      B. PROVIDE ONE ON-OFF-AUTO SWITCH TO CONTROL THE 'SMOKE EVACUATION/EXHAUST" MODE FOR EACH SMOKE MANAGEMENT SYSTEM ZONE.
      C. PROVIDE ONE SET OF PILOT LAMP STATUS INDICATORS FOR EACH OF THE FOLLOWING EQUIPMENT GROUPINGS FOR EACH OF SMOKE MANAGEMENT SYSTEM ZONE:
         1) ROOFTOP UNITS AND AIR-HANDLING UNITS..
         2) VARIABLE AIR VOLUME TERMINAL UNITS.
         3) GENERAL EXHAUST FANS.
         4) DEDICATED SMOKE EXHAUST FANS.
         5) SMOKE DAMPERS AND DEDICATED SMOKE CONTROL DAMPERS.
      D. CONTROL ACTION AND PRIORITIES: THE BAS ACTIONS SHALL BE AS FOLLOWS:
         1) ON-OFF / OPEN-CLOSE CONTROL ACTIONS SHALL HAVE THE HIGHEST PRIORITY OF ANY CONTROL POINT WITHIN THE BUILDING. ONCE ISSUED FROM THE BAS NO AUTOMATIC OR MANUAL CONTROL FROM ANY OTHER CONTROL POINT WITHIN THE BUILDING SHALL CONTRADICT THE CONTROL ACTION.
         2) WHERE AUTOMATIC MEANS IS PROVIDED TO INTERRUPT NORMAL, NON-EMERGENCY EQUIPMENT OPERATION OR PRODUCE A SPECIFIC RESULT TO SAFEGUARD THE BUILDING OR EQUIPMENT (I.E., DUCT FREEZESTATS, DUCT SMOKE DETECTORS, HIGH-TEMPERATURE CUT-OUTS, TEMPERATURE ACTUATED LINKAGES OR SIMILAR DEVICES), SUCH MEANS SHALL BE CAPABLE OF BEING OVERRIDEN BY THE BAS CONTROL ACTION AND THE LAST CONTROL ACTION AS INDICATED BY EACH BAS SWITCH POSITION SHALL PREVAIL. EXCEPTION: POWER DISCONNECTS AS REQUIRED BY THE ELECTRICAL CODE.
         3) ONLY THE AUTO POSITION OF EACH THREE-POSITION BAS SWITCH SHALL ALLOW AUTOMATIC OR MANUAL CONTROL ACTION FROM OTHER CONTROL POINTS WITHIN THE BUILDING. THE AUTO POSITION SHALL BE THE NORMAL, NON-EMERGENCY, BUILDING CONTROL POSITION. WHEN THE GAS IS IN THE AUTO POSITION, THE ACTUAL STATUS OF THE DEVICE (ON, OFF) SHALL CONTINUE TO BE INDICATED BY THE STATUS INDICATORS DESCRIBED ABOVE.
      E. RESPONSE TIME: SMOKE-CONTROL SYSTEM ACTIVATION SHALL BE INITIATED IMMEDIATELY AFTER RECEIPT OF AN APPROPRIATE AUTOMATIC OR MANUAL ACTIVATION COMMAND. SMOKE-CONTROL SYSTEMS SHALL ACTIVATE INDIVIDUAL COMPONENTS (SUCH AS DAMPERS AND FANS) IN THE SEQUENCE NECESSARY TO PREVENT PHYSICAL DAMAGE TO THE FANS, DAMPERS, DUCTWORK OR OTHER EQUIPMENT.

H. SMOKE MANAGEMENT SYSTEM CONTROL SEQUENCES
   1. ALL ROOFTOP UNITS, BLOWER COIL UNITS AND AIR HANDLING UNIT AHU-3 ARE PROVIDED WITH TWO PRIMARY ELECTRICAL POWER SUPPLIES. ONE POWER SUPPLY SHALL SERVE THE SUPPLY FAN AND CONTROL CIRCUIT ONLY, AND THE SECOND ELECTRICAL POWER SUPPLY SHALL SERVE THE BALANCE OF THE ROOFTOP UNIT'S ELECTRICAL REQUIREMENTS. THE TWO PRIMARY ELECTRICAL POWER SUPPLIES WILL ALLOW FOR SUPPLY FAN OPERATION ONLY (ALLOW THE COMPRESSORS AND CONDENSER FANS TO BE LOCKED OUT IN THE EVENT THE ROOFTOP UNITS ARE PUT INTO SMOKE MANAGEMENT SEQUENCE).
   2. THE BAS SHALL PROVIDE THE ABILITY TO MANUALLY CONTROL OR OVERRIDE OF AUTOMATIC CONTROL FOR MECHANICAL SMOKE CONTROL SYSTEMS. "SMOKE CONTROL SYSTEM" SHALL INCLUDE THE ROOFTOP OR AIR HANDLING UNIT SUPPLY FANS, SMOKE EXHAUST FANS, GRAVITY MAKE-UP HOODS AND ASSOCIATED MOTORIZED DAMPERS AND DAMPERS OF THE SMOKE MANAGEMENT SYSTEM THROUGH ZONE OVERRIDE SWITCHES VIA THE FIREFIGHTER'S CONTROL PANEL GRAPHIC DISPLAY.
   3. GENERAL SMOKE EVENT SEQUENCE:
      A. THE ZONE OF SMOKE GENERATION (ZONE OF INITIAL DETECTION OF SMOKE) SHALL BE EXHAUSTED (NEGATIVELY PRESSURIZED) BY OPERATING THAT ZONE IN 100% SMOKE EVACUATION EXHAUST MODE VIA THE FOLLOWING SEQUENCE:
         1) NORMAL OPERATION OF ALL THE ROOFTOP UNITS WITHIN THE ZONE SHALL BE INTERRUPTED AND THE SUPPLY AND ECONOMIZER EXHAUST FANS SHALL STOP.
         2) ALL THE ROOFTOP UNITS OUTSIDE AIR DAMPERS SHALL CLOSE, THE RETURN AIR DAMPERS AND THE RELIEF AIR DAMPERS (AS APPLICABLE) SHALL CLOSE.
         3) SMOKE EXHAUST FAN (SEF-X) DAMPERS SHALL OPEN, AND ALL THE SMOKE EXHAUST FANS (SEF-X) WITHIN THAT ZONE SHALL BE ENERGIZED. WHEN THE SMOKE EXHAUST FAN RUNS, A MOTORIZED DAMPER AT A ROOF HOOD ASSOCIATED WITH THAT SMOKE EXHAUST FAN SHALL OPEN TO PROVIDE MAKE-UP AIR. THE MOTORIZED DAMPER AT THE ROOF HOOD (H-X) SHALL RETURN TO THE CLOSED POSITION WHEN THE SMOKE EXHAUST FAN IS OFF.
      B. ALL ZONES ADJACENT TO THE ZONE OF SMOKE GENERATION SHALL BE PRESSURIZED BY OPERATING IN 100% SUPPLY MODE VIA THE FOLLOWING SEQUENCE:
         1) ALL THE ROOFTOP UNITS OUTSIDE AIR DAMPERS SHALL BE FULLY OPENED, ALL THE ROOFTOP UNITS RETURN AIR DAMPERS AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL CLOSE.
         2) THE COMPRESSORS IN ALL THE ROOFTOP UNITS SHALL BE DE-ENERGIZED (LOCKED OUT) AND THE SUPPLY FAN(S) SHALL BE ENERGIZED. ENERGIZING OF THE SUPPLY FAN(S) SHALL OVERRIDE ANY FACTORY MOUNTED CONTROL SAFETY SHUT DOWN COMMANDS.
         3) ALL THE GENERAL EXHAUST FANS (NON-SMOKE EXHAUST FANS EF-X) SHALL BE DE-ENERGIZED.
      C. IF SMOKE SPREADS BEYOND THE INITIAL ZONE OF SMOKE GENERATION TO AN ADJACENT ZONE, THAT ZONE SHALL SWITCH FROM PRESSURIZATION MODE TO EXHAUST MODE.
      D. REFER TO THE SMOKE MANAGEMENT OPERATION MATRIX AND SMOKE ZONES ON SHEET M6.1 FOR ADDITIONAL INFORMATION.
      E. DAMPER END POSITION SWITCHES AND SUPPLY AND EXHAUST FAN SAIL SWITCHES SHALL BE USED FOR VERIFICATION PURPOSES. DAMPER POSITION AND SUPPLY AND EXHAUST FAN OPERATION SHALL BE INDICATED ON THE BAS.
   4. SMOKE ZONE AB1 CONTROL SEQUENCES:
      A. PRESSURIZATION MODE: NOT APPLICABLE FOR THIS SYSTEM.
      B. EVACUATION/EXHAUST MODE:
         1) DEDICATED SMOKE EXHAUST FANS SEF-1, SEF-1A AND SEF-3 SHALL BE ON AND THEIR MOTORIZED DAMPERS SHALL BE OPEN.
         2) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-8, H-8A AND H-10) MOTORIZED DAMPERS SHALL BE OPENED.
         3) GENERAL EXHAUST FANS (NON-SMOKE (EF-1, EF-2, EF-4, EF-5, EF-6) EXHAUST FANS) SHALL BE ENERGIZED. GENERAL EXHAUST FAN EF-3 SHALL BE OFF.
         4) CLOSE THE 10-INCH ROUND SMOKE DAMPER IN THE SUPPLY DUCT AT TB-24 (ROOM A175).
         5) CLOSE THE 18 / 14 SMOKE DAMPER IN THE RETURN DUCT AT STORAGE ROOM A162.
         6) CLOSE THE 22 / 16 SMOKE DAMPER IN THE RETURN DUCT LOCATED JUST OUTSIDE OF MASTER CONTROL — ROOM P223.
         7) CLOSE THE 28 / 14 SMOKE DAMPER IN THE SUPPLY DUCT LOCATED JUST OUTSIDE OF MASTER CONTROL — ROOM P223.
         8) CLOSE THE 8 / 8 SMOKE DAMPER IN THE EXHAUST DUCT AT THE SOUTH WAIL OF INMATE ROOM—ROOM A141.
         9) CLOSE THE 42 / 16 SMOKE DAMPER IN THE RETURN DUCT AT THE SOUTH WALL OF INMATE ROOM—ROOM A141.
         10) CLOSE THE 8 / 8 SMOKE DAMPER IN THE EXHAUST DUCT AT THE NORTH WALL OF SECURITY ELECTRONICS — ROOM A138.
         11) CLOSE THE 10 / 8 SMOKE DAMPER IN THE EXHAUST DUCT LOCATED AT THE WEST WALL OF SHOWER ROOM — ROOM A133.
         12) CLOSE THE 8 / 6 SMOKE DAMPER IN THE EXHAUST DUCT LOCATED AT THE WEST WALL OF SHOWER ROOM — ROOM A127.
      C. NORMAL MODE:
         1) AIR HANDLING UNIT AHU-3 SHALL OPERATE ACCORDING TO THE NORMAL HVAC SEQUENCE OF OPERATION.
         2) DEDICATED SMOKE EXHAUST FANS SEF-1, SEF-1A AND SEF-3 SHALL BE OFF AND THEIR MOTORIZED DAMPERS SHALL BE CLOSED.
         3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-8, H-8A AND H-10) MOTORIZED DAMPERS SHALL BE CLOSED.
         4) GENERAL EXHAUST FANS (NON-SMOKE (EF-1, EF-2, EF-4, EF-5 AND EF-6) EXHAUST FANS) SHALL OPERATE ACCORDING TO THEIR NORMAL SEQUENCE OF OPERATION.
         5) THE 10-INCH ROUND SMOKE DAMPER IN THE SUPPLY DUCT AT TB-21 (ROOM A175) SHALL BE MAINTAINED OPEN.
         6) THE 18 / 14 SMOKE DAMPER IN THE RETURN DUCT AT STORAGE — ROOM A162 SHALL BE MAINTAINED OPEN.
         7) THE 22 / 16 SMOKE DAMPER IN THE RETURN DUCT LOCATED JUST OUTSIDE OF MASTER CONTROL — ROOM A223 SHALL BE MAINTAINED OPEN.
         8) THE 28 / 14 SMOKE DAMPER IN THE SUPPLY DUCT LOCATED JUST OUTSIDE OF MASTER CONTROL — ROOM A223 SHALL BE MAINTAINED OPEN.
         9) THE 8 / 8 SMOKE DAMPER IN THE EXHAUST DUCT AT THE SOUTH WALL OF INMATE ROOM — ROOM A14B SHALL BE MAINTAINED OPEN.
         10) THE 42 / 16 SMOKE DAMPER IN THE RETURN DUCT AT THE SOUTH WALL OF INMATE ROOM — ROOM A14B SHALL BE MAINTAINED OPEN.
         11) THE 8 / 8 SMOKE DAMPER IN THE EXHAUST DUCT AT THE NORTH WALL OF SECURITY ELECTRONICS — ROOM A138 SHALL BE MAINTAINED OPEN.
         12) THE 10 / B SMOKE DAMPER IN THE EXHAUST DUCT LOCATED AT THE WEST WALL OF SHOWER ROOM — ROOM A133 SHALL BE MAINTAINED OPEN.
         13) THE B / 6 SMOKE DAMPER IN THE EXHAUST DUCT LOCATED AT THE WEST WALL OF SHOWER ROOM — ROOM A127 SHALL BE MAINTAINED OPEN.
   5. SMOKE ZONE A2 CONTROL SEQUENCES:

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200 South Sycamore Street, Grand Island, NE 68801

sheet title
Mechanical Specifications

drawn by	date	scale	revision
gm	02-04-2026	None	-

sheet number
M006

5. SMOKE ZONE A2 CONTROL SEQUENCES:
   A. PRESSURIZATION MODE: NOT APPLICABLE FOR THIS SYSTEM.
   B. EVACUATION/EXHAUST MODE:
      1) DEDICATED SMOKE EXHAUST FANS SEF-2 SHALL BE ON AND ITS MOTORIZED DAMPER SHALL BE OPEN.
      2) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-9 AND H-9A) MOTORIZED DAMPERS SHALL BE OPENED. NOTE THAT HOODS H-9 AND H-9A BOTH NEED TO OPERATE WITH SEF-2.
      3) GENERAL EXHAUST FANS (NON-SMOKE (EF-9 AND F-10) EXHAUST FANS) SHALL BE ENERGIZED.
      4) CLOSE THE 9 / 6 SMOKE DAMPER IN THE SUPPLY DUCT AT SALLYPORT - (ROOM A199).
      5) CLOSE THE 20 / 18 SMOKE DAMPER IN THE SUPPLY DUCT OFF AHU-2.
      6) CLOSE THE TWO (2) - 26 / 26 SMOKE DAMPERS LOCATED BEHIND THE 26 X 26 RETURN GRILLES IN THE RETURN DUCT ON THE NORTH WAIL OF WORK RELEASE — ROOM A214.
      7) CLOSE THE 30 / 12 SMOKE DAMPER IN THE RETURN DUCT LOCATED ON THE NORTH WALL OF WORK RELEASE — ROOM A214.
   C. NORMAL MODE:
      1) AIR HANDLING UNIT AHU-2 SHALL OPERATE ACCORDING TO THE NORMAL HVAC SEQUENCE OF OPERATION.
      2) DEDICATED SMOKE EXHAUST FANS SEF-2 SHALL BE OFF AND THEIR MOTORIZED DAMPERS SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-9 AND H-9A) MOTORIZED DAMPERS SHALL BE CLOSED.
      4) GENERAL EXHAUST FANS (NON-SMOKE (EF-9 AND EF-10) EXHAUST FANS) SHALL OPERATE ACCORDING TO THEIR NORMAL SEQUENCE OF OPERATION.
      5) THE 9 / 6 SMOKE DAMPER IN THE SUPPLY DUCT AT SALLYPORT - (ROOM A199) SHALL BE MAINTAINED OPEN.
      6) THE 20/18 SMOKE DAMPER IN THE SUPPLY DUCT OF AHU-2 SHALL BE MAINTAINED OPEN.
      7) THE TWO (2) - 26/26 SMOKE DAMPERS LOCATED BEHIND THE 26 X 26 RETURN GRILLES IN THE RETURN DUCT ON THE NORTH WALL OF WORK RELEASE — ROOM A214 SHALL BE MAINTAINED OPEN.
      8) THE 30 / 12 SMOKE DAMPER IN THE RETURN DUCT LOCATED ON THE NORTH WALL OF WORK RELEASE— ROOM P214 SHALL BE MAINTAINED OPEN.
6. SMOKE ZONE A3 CONTROL SEQUENCES:
   A. PRESSURIZATION MODE:
      1) AHU-3 SHALL BE SET FOR 100 PERCENT SUPPLY AIR. OUTDOOR AIR AND RETURN AIR DAMPERS SHALL BE 100% OPEN AND THE RELIEF AIR DAMPER SHALL BE 100% CLOSED.
      2) DRIVE TERMINAL BOXES TB-22, TB-23 AND TB-27 100% OPEN.
   B. EVACUATION/EXHAUST MODE: NOT APPLICABLE FOR THIS SYSTEM.
   C. NORMAL MODE:
      1) AIR HANDLING UNIT AHU-3 SHALL OPERATE ACCORDING TO THE NORMAL HVAC SEQUENCE OF OPERATION.
7. SMOKE ZONE C1 CONTROL SEQUENCES:
   A. PRESSURIZATION MODE:
      1) ROOFTOP UNITS RTU-1 AND RTU-2 SHALL BE SET FOR 100 PERCENT SUPPLY AIR. OUTDOOR AIR DAMPER SHALL BE 100% OPEN1 RETURN AIR AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL BE 100% CLOSED. THE DX COOLING STAGES OF THE ROOFTOP UNITS SHALL BE LOCKED OUT. INTEGRAL RTU ECONOMIZER EXHAUST FAN SHALL BE LOCKED OUT.
      2) DEDICATED SMOKE EXHAUST FANS SEF-4 AND SEF-5 SHALL BE OFF AND THEIR MOTORIZED DAMPERS SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-11 AND H-12) MOTORIZED DAMPERS SHALL BE CLOSED.
      4) GENERAL EXHAUST FANS (NON-SMOKE (EF-15 AND EF-16) EXHAUST FANS) SHALL BE DE-ENERGIZED.
      5) SMOKE DAMPERS ON RTU-2 RETURN AIR SYSTEM CLOSED. FIVE DAMPERS TOTAL.
   B. EVACUATION/EXHAUST MODE:
      1) ROOFTOP UNITS RTU-1 AND RTU-2 SHALL BE SHUT DOWN, AND THEIR OUTDOOR AIR, RETURN AIR AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL BE 100% CLOSED. THE DX COOLING STAGES OF THE ROOFTOP UNITS SHALL BE LOCKED OUT. INTEGRAL RTU ECONOMIZER EXHAUST FAN SHALL BE LOCKED OUT.
      2) DEDICATED SMOKE EXHAUST FANS SEF-4 AND SEF-5 SHALL BE ON AND THEIR MOTORIZED DAMPERS SHALL BE OPEN.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-11 AND H-12) MOTORIZED DAMPERS SHALL BE OPENED.
      4) GENERAL EXHAUST FANS (NON-SMOKE (EF-15 AND EF-16) EXHAUST FANS) SHALL BE ENERGIZED.
      5) SMOKE DAMPERS ON RTU-2 RETURN AIR SYSTEM CLOSED. FIVE DAMPERS TOTAL.
   C. NORMAL MODE:
      1) ROOFTOP UNITS RTU-1 AND RTU-2 SHALL OPERATE ACCORDING TO NORMAL HVAC SEQUENCES OF OPERATION.
      2) DEDICATED SMOKE EXHAUST FANS SEF-4 AND SEF-5 SHALL BE OFF AND THEIR MOTORIZED DAMPERS SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-11 AND H-12) MOTORIZED DAMPERS SHALL BE CLOSED.
      4) GENERAL EXHAUST FANS (NON-SMOKE (EF-15 AND EF-16) EXHAUST FANS) SHALL OPERATE ACCORDING TO THEIR NORMAL SEQUENCE OF OPERATION.
      5) SMOKE DAMPERS ON RTU-2 RETURN AIR SYSTEM OPEN. FIVE DAMPERS TOTAL.
8. SMOKE ZONE C2 CONTROL SEQUENCES:
   A. PRESSURIZATION MODE:
      1) ROOFTOP UNITS RTU-3 AND RTU-4 SHALL BE SET FOR 100 PERCENT SUPPLY AIR. OUTDOOR AIR DAMPER SHALL BE 100% OPEN, RETURN AIR AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL BE 100% CLOSED. THE DX COOLING STAGES OF THE ROOFTOP UNITS SHALL BE LOCKED OUT. INTEGRAL RTU ECONOMIZER EXHAUST FAN SHALL BE LOCKED OUT.
      2) DEDICATED SMOKE EXHAUST FANS SEF-6 AND SEF-7 SHALL BE OFF AND THEIR MOTORIZED DAMPERS SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-13 AND H-14) MOTORIZED DAMPERS SHALL BE CLOSED.
      4) GENERA! EXHAUST FAN (NON-SMOKE (EF-14) EXHAUST FANS) SHALL BE DE-ENERGIZED.
      5) SMOKE DAMPERS ON RTU-4 RETURN AIR SYSTEM CLOSED. FIVE DAMPERS TOTAL.
   B. EVACUATION/EXHAUST MODE:
      1) ROOFTOP UNITS RTU-3 AND RTU-4 SHALL BE SHUT DOWN, AND THEIR OUTDOOR AIR, RETURN AIR AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL BE 100% CLOSED. THE DX COOLING STAGES OF THE ROOFTOP UNITS SHALL BE LOCKED OUT. INTEGRAL RTU ECONOMIZER EXHAUST FAN SHALL BE LOCKED OUT. .
      2) DEDICATED SMOKE EXHAUST FANS SEF-6 AND SEF-7 SHALL BE ON AND THEIR MOTORIZED DAMPERS SHALL BE OPEN.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-13 AND H-14) MOTORIZED DAMPERS SHALL BE OPENED.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-14) EXHAUST FANS) SHALL BE ENERGIZED.
      5) SMOKE DAMPERS ON RTU-4 RETURN AIR SYSTEM CLOSED. FIVE DAMPERS TOTAL.
   C. NORMAL MODE:
      1) ROOFTOP UNITS RTU-3 AND RTU-4 SHALL OPERATE ACCORDING TO NORMAL HVAC SEQUENCES OF OPERATION.
      2) DEDICATED SMOKE EXHAUST FANS SEF-6 AND SEF-7 SHALL BE OFF AND THEIR MOTORIZED DAMPERS SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-13 AND H-14) MOTORIZED DAMPERS SHALL BE CLOSED.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-14) EXHAUST FANS) SHALL OPERATE ACCORDING TO ITS NORMAL SEQUENCE OF OPERATION.
      5) SMOKE DAMPERS ON RTU-4 RETURN AIR SYSTEM OPEN. FIVE DAMPERS TOTAL.
9. SMOKE ZONE C3 (HOUSING UNIT AREA “D”) CONTROL SEQUENCES:
   A. PRESSURIZATION MODE:
      1) ROOFTOP UNITS RTU-6, RTU-7A, RTU-7B AND RTU-14 SHALL BE SET FOR 100 PERCENT SUPPLY AIR. OUTDOOR AIR DAMPER SHALL BE 100% OPEN, RETURN AIR AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL BE 100% CLOSED. THE DX COOLING STAGES OF THE ROOFTOP UNITS SHALL BE LOCKED OUT. INTEGRAL RTU ECONOMIZER EXHAUST FAN SHALL BE LOCKED OUT.
         A) NOTE THAT RTU-7A AND 76 ARE HEAT ONLY UNITS.
      2) DEDICATED SMOKE EXHAUST FANS SEF-12 THROUGH SEF-15 SHALL BE OFF AND THEIR MOTORIZED DAMPERS SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-21 THROUGH H-25) MOTORIZED DAMPERS SHALL BE CLOSED.
      4) GENERAL EXHAUST TAN (NON-SMOKE (EF-12 AND EF-13) EXHAUST FANS) SHALL BE DE-ENERGIZED.
      5) PROVIDE RELAY(S) TO CONTROL THE OPERATION OF THE INSULATED COILING DOORS AT INDOOR / OUTDOOR RECREATION AREAS: ROOMS C103, C107, C116 AND C123. WHEN IN PRESSURIZATION MODE, THESE 4 COILING DOORS SHALL BE CLOSED. THIS SMOKE CONTROL SHALL HAVE PRIORITY OVER ALL OTHER CONTROLS FOR THESE DOORS.
   B. EVACUATION/EXHAUST MODE:
      1) ROOFTOP UNITS RTU-6, RTU-7A, RTU-7B AND RTU-14 SHALL BE SHUT DOWN, AND THEIR OUTDOOR AIR, RETURN AIR AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL BE 100% CLOSED. THE DX COOLING STAGES OF THE ROOFTOP UNITS SHALL BE LOCKED OUT. INTEGRAL RTU ECONOMIZER EXHAUST TAN SHALL BE LOCKED OUT.
         A) NOTE THAT RTU-7A AND 7B ARE HEAT ONLY UNITS.
      2) DEDICATED SMOKE EXHAUST FANS SEF-12 THROUGH SEF-15 SHALL BE ON AND THEIR MOTORIZED DAMPERS SHALL BE OPEN.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-21 THROUGH H-25) MOTORIZED DAMPERS SHALL BE OPENED. NOTE: HOODS H-23 AND H-24 BOTH NEED TO OPERATE WITH FAN SEF-14.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-12 AND EF-13) EXHAUST FANS) SHALL BE ENERGIZED.
      5) PROVIDE RELAY(S) TO CONTROL THE OPERATION OF THE INSULATED COILING DOORS AT INDOOR / OUTDOOR RECREATION AREAS: ROOMS C103, C107, C116 AND C123. WHEN IN EVACUATION / EXHAUST MODE, THESE 4 COILING DOORS SHALL BE CLOSED. THIS SMOKE CONTROL SHALL HAVE PRIORITY OVER ALL OTHER CONTROLS FOR THESE DOORS.
   C. NORMAL MODE:
      1) ROOFTOP UNITS RTU-6, RTU-7A, RTU-76 AND RTU-14 SHALL OPERATE ACCORDING TO NORMAL HVAC SEQUENCES OF OPERATION.
      2) DEDICATED SMOKE EXHAUST FANS SEF-12 THROUGH SEF-15 SHALL BE OFF AND THEIR MOTORIZED DAMPERS SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-21 THROUGH H-25) MOTORIZED DAMPERS SHALL BE CLOSED.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-12 AND EF-13) EXHAUST FANS) SHALL OPERATE ACCORDING TO THEIR NORMAL SEQUENCE OF OPERATION.
      5) THE INSULATED COILING DOORS AT INDOOR / OUTDOOR RECREATION AREAS — ROOMS C103, C107, CL 16 AND C123 SHALL BE OPERATED BY THEIR MANUAL CONTROLS.
10. SMOKE ZONE C4: NOT USED.
11. SMOKE ZONE C5CONTROL SEQUENCES:
   A. PRESSURIZATION MODE:
      1) ROOFTOP UNITS RTU-8 AND RTU-9 SHALL BE SET FOR 100 PERCENT SUPPLY AIR. OUTDOOR AIR DAMPER SHALL BE 100% OPEN, RETURN AIR AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL BE 100% CLOSED. THE DX COOLING STAGES OF THE ROOFTOP UNITS SHALL BE LOCKED OUT. INTEGRAL RTU ECONOMIZER EXHAUST FAN SHALL BE LOCKED OUT.
      2) DEDICATED SMOKE EXHAUST FANS SEF-8 AND SEF-9 SHALL BE OFF AND THEIR MOTORIZED DAMPERS SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-15 AND H-16) MOTORIZED DAMPERS SHALL BE CLOSED.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-19) EXHAUST FANS) SHALL BE DE-ENERGIZED.
      5) SMOKE DAMPERS IN TRANSFER DUCTS AT ROOMS CG102 AND CH102 CLOSED.
   B. EVACUATION/EXHAUST MODE:
      1) ROOFTOP UNITS RTU-8 AND RTU-9 SHALL BE SHUT DOWN, AND THEIR OUTDOOR AIR, RETURN AIR AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL BE 100% CLOSED. THE DX COOLING STAGES OF THE ROOFTOP UNITS SHALL BE LOCKED OUT. INTEGRAL RTU ECONOMIZER EXHAUST FAN SHALL BE LOCKED OUT.
      2) DEDICATED SMOKE EXHAUST FANS SEF-8 AND SEF-9 SHALL BE ON AND THEIR MOTORIZED DAMPERS SHALL BE OPEN.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-15 AND H-16) MOTORIZED DAMPERS SHALL BE OPENED.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-19) EXHAUST FANS) SHALL BE ENERGIZED.
      5) SMOKE DAMPERS IN TRANSFER DUCTS AT ROOMS CG102 AND CH102 OPEN.
   C. NORMAL MODE:
      1) ROOFTOP UNITS RTU-8 AND RTU-9 SHALL OPERATE ACCORDING TO NORMAL HVAC SEQUENCES OF OPERATION.
      2) DEDICATED SMOKE EXHAUST FANS SEF-8 AND SEF-9 SHALL BE OFF AND THEIR MOTORIZED DAMPERS SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOODS (H-15 AND 11-16) MOTORIZED DAMPERS SHALL BE CLOSED.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-19) EXHAUST FANS) SHALL OPERATE ACCORDING TO ITS NORMAL SEQUENCE OF OPERATION.
      5) SMOKE DAMPERS IN TRANSFER DUCTS AT ROOMS CG102 AND CH102 OPEN.
12. SMOKE ZONE C6CONTROL SEQUENCES:
   A. PRESSURIZATION MODE:
      1) ROOFTOP UNITS RTU-10 AND RTU-11 SHALL BE SET FOR 100 PERCENT SUPPLY AIR. OUTDOOR AIR DAMPER SHALL BE 100% OPEN, RETURN AIR AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL BE 100% CLOSED. THE DX COOLING STAGES OF THE ROOFTOP UNITS SHALL BE LOCKED OUT. INTEGRAL RTU ECONOMIZER EXHAUST FAN SHALL BE LOCKED OUT.
      2) DEDICATED SMOKE EXHAUST FAN SEF-10 SHALL BE OFF AND THEIR MOTORIZED DAMPERS SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOOD (H-17) MOTORIZED DAMPER SHALL BE CLOSED.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-17) EXHAUST FANS) SHALL BE DE-ENERGIZED.
      5) SMOKE DAMPERS ON RTU-11 RETURN AIR SYSTEM CLOSED. FIVE DAMPERS TOTAL.
   B. EVACUATION/EXHAUST MODE:
      1) ROOFTOP UNITS RTU-10 AND RTU-11 SHALL BE SHUT DOWN, AND THEIR OUTDOOR AIR, RETURN AIR AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL BE 100% CLOSED. THE DX COOLING STAGES OF THE ROOFTOP UNITS SHALL BE LOCKED OUT. INTEGRAL RTU ECONOMIZER EXHAUST FAN SHALL BE LOCKED OUT.
      2) DEDICATED SMOKE EXHAUST FAN SEF-10 SHALL BE ON AND ITS MOTORIZED DAMPER SHALL BE OPEN.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOOD (H-17) MOTORIZED DAMPER SHALL BE OPENED.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-17) EXHAUST FANS) SHALL BE ENERGIZED.
      5) SMOKE DAMPERS ON RTU-11 RETURN AIR SYSTEM CLOSED. FIVE DAMPERS TOTAL.
   C. NORMAL MODE:
      1) ROOFTOP UNITS RTU-10 AND RTU-11 SHALL OPERATE ACCORDING TO NORMAL HVAC SEQUENCES OF OPERATION.
      2) DEDICATED SMOKE EXHAUST FAN SEF-10 SHALL BE OFF AND ITS MOTORIZED DAMPER SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOOD (H-17) MOTORIZED DAMPER SHALL BE CLOSED.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-17) EXHAUST FANS) SHALL OPERATE ACCORDING TO ITS NORMAL SEQUENCE OF OPERATION.
      5) SMOKE DAMPERS ON RTU-11 RETURN AIR SYSTEM OPEN. FIVE DAMPERS TOTAL.
13. SMOKE ZONE C7 CONTROL SEQUENCES:
   A. PRESSURIZATION MODE:
      1) ROOFTOP UNITS RTU-12 AND RTU-13 SHALL BE SET FOR 100 PERCENT SUPPLY AIR. OUTDOOR AIR DAMPER SHALL BE 100% OPEN, RETURN AIR AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL BE 100% CLOSED. THE DX COOLING STAGES OF THE ROOFTOP UNITS SHALL BE LOCKED OUT. INTEGRAL RTU ECONOMIZER EXHAUST FAN SHALL BE LOCKED OUT.
      2) DEDICATED SMOKE EXHAUST FAN SFF-11 SHALL BE OFF AND ITS MOTORIZED DAMPER SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOOD (H-18) MOTORIZED DAMPER SHALL BE CLOSED.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-18) EXHAUST FANS) SHALL BE DE-ENERGIZED.
      5) SMOKE DAMPERS ON RTU-13 RETURN AIR SYSTEM CLOSED. FIVE DAMPERS TOTAL.
   B. EVACUATION/EXHAUST MODE:
      1) ROOFTOP UNITS RTU-12 AND RTU-13 SHALL BE SHUT DOWN, AND THEIR OUTDOOR AIR, RETURN AIR AND RELIEF AIR DAMPERS (AS APPLICABLE) SHALL BE 100% CLOSED. THE DX COOLING STAGES OF THE ROOFTOP UNITS SHALL BE LOCKED OUT. INTEGRAL RTU ECONOMIZER EXHAUST FAN SHALL BE LOCKED OUT.
      2) DEDICATED SMOKE EXHAUST FAN SEF-11 SHALL BE ON AND ITS MOTORIZED DAMPER SHALL BE OPEN.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOOD (H-18) MOTORIZED DAMPER SHALL BE OPENED.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-18) EXHAUST FANS) SHALL BE ENERGIZED.
      5) SMOKE DAMPERS ON RTU-13 RETURN AIR SYSTEM CLOSED. FIVE DAMPERS TOTAL.
   C. NORMAL MODE:
      1) ROOFTOP UNITS RTU-12 AND RTU-13 SHALL OPERATE ACCORDING TO NORMAL HVAC SEQUENCES OF OPERATION.
      2) DEDICATED SMOKE EXHAUST FAN SEF-11 SHALL BE OFF AND ITS MOTORIZED DAMPER SHALL BE CLOSED.
      3) SMOKE EXHAUST SYSTEM MAKE-UP AIR HOOD (H-18) MOTORIZED DAMPER SHALL BE CLOSED.
      4) GENERAL EXHAUST FAN (NON-SMOKE (EF-18) EXHAUST FANS) SHALL OPERATE ACCORDING TO ITS NORMAL SEQUENCE OF OPERATION.
      5) SMOKE DAMPERS ON RTU-13 RETURN AIR SYSTEM OPEN. FIVE DAMPERS TOTAL.

I. ROOFTOP AIR CONDITIONING UNITS WITH POWER EXHAUST (RTU-X):

1. ALL SMOKE DETECTORS (INCLUDING DUCT-MOUNTED DETECTORS) SHALL BE FURNISHED BY DIVISION 17. DUCT-MOUNTED DETECTORS SHALL BE PHYSICALLY INSTALLED BY DIVISION 15, WIRED BY DIVISION 17. DETECTOR POWER AND SUPERVISORY AND REMOTE ANNUNCIATION BY DIVISION 17.
2. SAFETY SEQUENCES - AIR HANDLING SYSTEMS (ROOFTOP UNITS)
   A. FANS:
      1) ALL ROOFTOP UNITS 2,000 CEM OR OVER SHALL STOP UPON SUPPLY DUCT SMOKE DETECTION IN THE LOCAL AREA BUT SHALL BE CAPABLE OF BEING OVERRIDDEN BY THE EMCS SYSTEM WHEN SMOKE MANAGEMENT SEQUENCE OCCURS.
3. PROVIDE A TEMPERATURE SENSOR CAPABLE OF PROVIDING STAGED HEATING AND COOLING IN ADDITION TO AUTOMATIC HEATING / COOLING CHANGEOVER. THE TEMPERATURE SENSOR IS GENERALLY LOCATED IN THE RETURN DUCTS. REFER TO THE DRAWINGS FOR LOCATIONS.
4. SAFETY CONTROLS: PROVIDE DISCHARGE AIR SENSOR/CONTROLLER TO PREVENT THE DISCHARGE AIR FROM FALLING BELOW 45 DEGREES F (ADJ). THE DISCHARGE AIR LOW

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LIMIT CONTROLLER SHALL OVERRIDE ALL OTHER CONTROLS TO MODULATE OUTSIDE AIR DAMPERS CLOSED AND RETURN AIR DAMPERS OPEN IF THE DISCHARGE AIR TEMPERATURE FALLS BELOW THIS SETTING.

5. MINIMUM AND MAXIMUM OUTDOOR AIR DAMPER POSITION CONTROL: PROVIDE A MINIMUM DAMPER POSITION POTENTIOMETER AND A MAXIMUM DAMPER POSITION POTENTIOMETER ON THE ECONOMIZER SECTION. THE MINIMUM DAMPER POSITION POTENTIOMETER SHALL MAINTAIN THE MINIMUM AMOUNT OF AIRFLOW AS REQUIRED FOR OCCUPANT VENTILATION IN NON-ECONOMIZER MODES OF OPERATION.
   A. THE TEMPERATURE CONTROL CONTRACTOR SHALL WORK IN CONJUNCTION WITH THE BALANCING CONTRACTOR TO ADJUST I SET THE MINIMUM POSITION POTENTIOMETER TO ALLOW THE MINIMUM AMOUNT OF OUTDOOR AIR, AS REQUIRED BY THE ROOFTOP UNIT SCHEDULE. THE MAXIMUM POSITION SHALL BE 100% OPEN
6. OUTDOOR AIR DRY BULB SENSOR:
   A. THE ECONOMIZER CONTROLLER SHALL ACCEPT INPUT FROM AN OUTDOOR AIR DRY BULB SENSOR. WHEN THE OUTDOOR AIR DRY BULB RISES ABOVE THE OUTDOOR DRY BULB CHANGEOVER SET POINT, THE OUTDOOR-AIR DAMPER SHALL MOVE TO ITS MINIMUM POSITION. THE OUTDOOR DRY BULB CHANGEOVER SET POINT SHALL BE SET WITH THE OUTDOOR DRY BULB SET POINT POTENTIOMETER ON THE ECONOMIZER CONTROLLER.
7. UNOCCUPIED MODE (HEATING): NOT APPLICABLE 24 HOUR OPERATION.
8. UNOCCUPIED MODE (COOLING): NOT APPLICABLE 24 HOUR OPERATION.
9. COOLING MODE: THE FAN SHALL RUN CONTINUOUSLY. THE ECONOMIZER SHALL BE THE FIRST STAGE OF COOLING. WHEN FREE COOLING IS AVAILABLE, THE OUTDOOR-AIR DAMPER SHALL BE POSITIONED TO PROVIDE A 55 F SUPPLY-AIR TEMPERATURE INTO THE ZONE IN ACCORDANCE WITH THE FOLLOWING:
   A. IF THE MIXED-AIR TEMPERATURE IS BELOW THE LOWER END OF THE SET POINT (APPROXIMATELY 50 F), THEN THE OUTSIDE-AIR DAMPERS WILL BE MODULATED TO THE MINIMUM POSITION.
   B. IF THE MIXED-AIR TEMPERATURE IS WITHIN THE RANGE OF 50 TO 56 F OR ABOVE, THE DAMPERS WILL HOLD THEIR CURRENT POSITION. IF THE MIXED-AIR TEMPERATURE IS ABOVE 56 F, THEN THE OUTSIDE-AIR DAMPERS WILL MODULATE OPEN UNTIL THE MIXED AIR TEMPERATURE IS WITHIN RANGE, OR THEY MODULATE TO THE FULLY OPEN POSITION. UP TO 100% OUTDOOR AIR MAY BE SUPPLIED TO SATISFY THE SENSOR I THERMOSTAT SETPOINT. IF OUTSIDE AIR CANNOT SATISFY THE THERMOSTAT SETPOINT, STAGE COMPRESSOR(S) TO MEET COOLING LOAD.
   C. IF THE OUTSIDE AIR DRY BULB TEMPERATURE IS TOO HIGH, THE OUTSIDE AIR DAMPERS WILL MODULATE TO MINIMUM POSITION, AND MECHANICAL COOLING SHALL BE UTILIZED. THE OUTDOOR-AIR DAMPER WILL BE MAINTAINED AT ITS MINIMUM POSITION AT THE TIME THE COMPRESSOR IS STARTED.
   D. A POWER EXHAUST FAN IS PROVIDED. THE POWERED EXHAUST FAN SHALL BE ENERGIZED WHEN THE OA DAMPER IS APPROXIMATELY 30% OPEN (ADJ). THE RELIEF AIR DAMPER SHALL BE BAROMETRIC,
   E. NOTE THAT COOLING SEQUENCE DOES NOT APPLY TO RTU-7A ARID 7B AS THEY ARE HEAT ONLY UNITS,
10. HEATING MODE:
   A. THE FAN SHALL RUN CONTINUOUSLY. THE OUTDOOR-AIR DAMPER SHALL BE MAINTAINED IN THE MINIMUM POSITION AS REQUIRED FOR BUILDING VENTILATION, WHEN THE THERMOSTAT IS CALLING FOR HEATING, STAGE THE GAS-FIRED HEATER AS REQUIRED TO MAINTAIN THE THERMOSTAT SETTING OF 72°F (ADJ.).
11. REFER TO PARAGRAPH TITLED "SMOKE MANAGEMENT OPERATION" FOR ADDITIONAL ROOFTOP UNIT SEQUENCE OF OPERATION.

J. BLOWER COIL UNIT BC-1. CONSTANT VOLUME BLOWER COIL UNIT WITH PRE-FILTER, HOT WATER HEATING COIL, DX COOLING COIL, AND AIR-COOLED CONDENSING UNIT CU-1:
1. THIS SYSTEM HAS LOW AMBIENT CONTROLS WHICH ALLOWS COMPRESSOR OPERATION DOWN TO 40 DEGREES F.
2. HEATING AND COOLING OUTPUT SHALL BE CONTROLLED BY A ROOM THERMOSTAT / TEMPERATURE SENSOR TO MAINTAIN THE DESIRED ROOM TEMPERATURE.
3. THE BLOWER COIL UNIT SHALL RUN CONTINUOUSLY 24 HOURS PER DAY 7 DAYS PER WEEK.
4. PROVIDE FAN STATUS AND FILTER MONITORING.
5. PROVIDE A MANUAL PUSH-BUTTON CONTROL WHICH PLACES THIS SYSTEM IN EITHER THE "NORMAL" MODE OR "PRESSURIZATION" MODE OF OPERATION.
   A. 'NORMAL' MODE IS THE NORMAL MODE OF OPERATION WHERE THE SYSTEM CONTROL IS GENERALLY FOR SPACE COMFORT,
   B. PRESSURIZATION MODE IS USED WHEN ANY OF THE ADJACENT AREAS ARE GASSED. IN THE PRESSURIZATION MODE, THE MASTER CONTROL ROOM WILL GO POSITIVE TO PREVENT GAS FROM ENTERING THE ROOM, MOUNT THIS PUSH BUTTON CONTROL ADJACENT TO THE ROOM TEMPERATURE SENSOR. LABEL THE BUTTONS AS "NORMAL OPERATION" AND "POSITIVE PRESSURE"
6. PROVIDE A MINIMUM POSITION POTENTIOMETER OR OTHER MEANS TO SET THE MINIMUM POSITION OF THE MOTORIZED OUTDOOR AIR DAMPER SERVING BC-1. THE MINIMUM DAMPER POSITION SHALL MAINTAIN THE MINIMUM AMOUNT OF AIRFLOW AS REQUIRED FOR OCCUPANT VENTILATION.
7. NORMAL OCCUPIED OPERATION:
   A. UPON SYSTEM START UP, SUPPLY FAN SHALL BE ENABLED.
   B. WHEN COOLING IS REQUIRED, THE DX COIL, AND CONDENSING UNIT SHALL BE ENERGIZED AND THE SUPPLY FAN SHALL BE CYCLED TO MAINTAIN THE THERMOSTAT SETPOINT (75 DEGREES F).
   C. WHEN HEATING IS REQUIRED, THE BLOWER COIL UNIT HOT WATER VALVE SHALL BE MODULATED AND THE SUPPLY FAN SHALL BE CYCLED AS REQUIRED TO MAINTAIN THE SPACE TEMPERATURE SENSOR SETPOINT (72 DEGREES F).
   D. WHEN BC-1 RUNS, OPEN THE MOTORIZED OUTSIDE AIR DAMPER TO ITS MINIMUM POSITION AS TO PROVIDE VENTILATION AIR TO THE SPACE (APPROXIMATELY 40 CFM). THE MOTORIZED RETURN DAMPER SHALL BE SET TO RETURN APPROXIMATELY 360 CFM.
8. PRESSURIZATION MODE:
   A. WHEN PLACED INTO THE PRESSURIZATION MODE, THE OUTSIDE AIR DAMPER SHALL BE OPENED 100%, AND THE RETURN DAMPER SHALL BE FULLY CLOSED. THE SYSTEM WILL REMAIN IN THIS MODE OF OPERATION UNTIL THE "NORMAL" BUTTON IS DEPRESSED.
9. CONDENSATE OVERFLOW DETECTION:
   A. PROVIDE FLOAT SWITCH FOR FIELD INSTALLATION IN THE AUXILIARY DRAIN PAN TO DETECT A HIGH CONDENSATE WATER LEVEL. WHEN THE FLOAT SWITCH RISES, THE NORMALLY CLOSED INPUT SHALL OPEN A CORRESPONDING SET OF BINARY INPUT TERMINALS. THIS SHALL CAUSE THE FAN TO DISABLE, AND THE CONTROL VALVE TO CLOSE. THE FLOAT SWITCH WILL CLOSE WHEN THE HIGH CONDENSATE LEVEL RECEDES, BUT THE CONTROLLER MUST BE MANUALLY RESET BEFORE NORMAL UNIT OPERATION CAN OCCUR. INSTALLATION OF THE FLOAT SWITCHES SHALL BE WORK OF THIS SECTION AND SHALL BE PERFORMED BY THE TEMPERATURE CONTROL CONTRACTOR.

K. BLOWER COIL UNIT BC-2. CONSTANT VOLUME BLOWER COIL UNIT WITH PRE-FILTER, ELECTRIC HEATING COIL, DX COOLING COIL, AND AIR-COOLED CONDENSING UNIT CU-2:
1. THE SEQUENCE OF OPERATION AND CONTROL COMPONENTS FOR THIS SYSTEM SHALL BE IDENTICAL TO THAT OF THE BC-1 SYSTEM EXCEPT THE TEMPERATURE SENSOR NEEDS TO BE CAPABLE OF STAGING 2 STEPS OF ELECTRIC RESISTANCE HEAT IN LIEU OF A HOT WATER COIL.

L. THE AHU-1 "SYSTEM" IS A VARIABLE AIR VOLUME REHEAT SYSTEM. THE SUPPLY AND EXHAUST FANS ARE EACH PROVIDED WITH A VARIABLE FREQUENCY DRIVE. SYSTEM COMPONENTS INCLUDE AHU-1, EF-20, CC-1, HC-1, VFD-1, VFD-2, TB-XX, FPTB-XX AND PRE- AND FINAL-FILTERS.
1. PROVIDE AN ENERGY MANAGEMENT AND CONTROL SYSTEM (EMCS) CONTROL POINT TO SWITCH THE SYSTEM TO/FROM OCCUPIED/UNOCCUPIED TIME SCHEDULE PROGRAM.
2. SAFETY CONTROLS:
   A. PROVIDE DISCHARGE AIR LOW LIMIT CONTROLLER TO PREVENT THE DISCHARGE AIR TEMPERATURE FROM FALLING BELOW 40 DEGREES F (ADJ.). THE DISCHARGE AIR LOW-LIMIT CONTROLLER SHALL OVERRIDE ALL OTHER CONTROLS TO MODULATE OUTSIDE AIR DAMPERS TO 100% SHUTOFF IF DISCHARGE AIR TEMPERATURE FALLS BELOW THIS SETTING. FAN STOPPAGE SHALL BE REPORTED TO THE EMCS.
   B. PROVIDE A PRESSURE SWITCH ACROSS EACH FILTER SECTION TO ALARM THE EMCS, AND A CURRENT-SENSING RELAY TO MONITOR THE STATUS OF EACH FAN.
   C. A SUPPLY AIR SMOKE DETECTOR (SEE DIVISION 17) LOCATED IN THE SUPPLY DUCTWORK OF THE UNIT SHALL STOP THE FAN AND ALSO TO PROVIDE SIGNALS FOR FIRE ALARM SYSTEM.
3. OUTSIDE AIR DAMPER CONTROL:
   A. AIR HANDLING UNIT AHU-1'S OUTSIDE AIR DAMPER SHALL BE POSITIONED TO PROVIDE 3150 CFM OF OUTSIDE AIR. THIS OUTSIDE AIR QUANTITY IS BASED ON OCCUPANCY AND/OR EXHAUST AIR MAKE-UP.
4. OCCUPIED MODE:
   A. MORNING WARM-UP MODE: UPON SYSTEM STARTUP, THE SUPPLY FAN SHALL OPERATE CONTINUOUSLY. THE SUPPLY FAN VFD SHALL MODULATE TO MAINTAIN THE SUPPLY DUCT STATIC PRESSURE SETPOINT. THE OUTDOOR AND RELIEF AIR DAMPERS OF THE UNIT SHALL REMAIN CLOSED, UNIT RETURN AIR DAMPER SHALL REMAIN OPEN. THE HEATING VALVE WILL MODULATE TO MAINTAIN A HEATING DISCHARGE AIR TEMPERATURE SETPOINT OF 65 DEG F. ALL VAV TERMINAL UNITS SHALL BE AT THE REHEAT MINIMUM POSITION. THE SYSTEM SHALL OPERATE IN THIS MODE UNTIL THE RETURN AIR TEMPERATURE SETPOINT REACHES 72 DEG F (ADJUSTABLE). UPON RETURN AIR TEMPERATURE REACHING SETPOINT, UNIT OUTDOOR AIR DAMPER SHALL OPEN TO ITS MINIMUM POSITION.
   B. NORMAL OCCUPIED OPERATION:
      1) THE SUPPLY FAN SHALL RUN CONTINUOUSLY. THE EMCS SHALL MODULATE THE SUPPLY FAN TO MAINTAIN SUPPLY DUCT STATIC PRESSURE SETPOINT. WHEN THE STATIC PRESSURE AS SENSED IS BELOW THE SETPOINT, THE CONTROL SYSTEM SHALL CAUSE THE VARIABLE FREQUENCY DRIVE TO INCREASE THE SUPPLY FAN SPEED UNTIL THE STATIC PRESSURE SETPOINT HAS BEEN RE-ESTABLISHED. THE REVERSE SHALL OCCUR IF THE STATIC PRESSURE IN THE DUCT WERE TO RISE ABOVE THE SETPOINT. THE INITIAL STATIC PRESSURE SETPOINT SHALL BE 1.0 IN W.G.
      2) EXHAUST FAN EF-20 SHALL BE MODULATED USING DIRECT SPACE PRESSURIZATION CONTROL. DIFFERENTIAL PRESSURE BETWEEN LOBBY A101 SHALL BE REFERENCED TO THE OUTDOORS.
      3) WHEN OUTDOOR AIR IS SUITABLE FOR FREE COOLING THE DISCHARGE AIR TEMPERATURE SENSOR SHALL MODULATE THE UNITS OUTDOOR AND RETURN AIR DAMPERS THROUGH A MIXED AIR LOW LIMIT TEMPERATURE SENSOR TO MAINTAIN 53 DEGREES F (ADJUSTABLE). WHEN OUTDOOR AIR IS NOT SUITABLE AND CHILLED WATER IS AVAILABLE, THE CHILLED WATER COIL VALVE SHALL BE MODULATED TO MAINTAIN SETPOINT.
      4) IN HEATING MODE, THE EMCS SHALL MODULATE THE CONTROL VALVE ON THE HEATING COIL TO MAINTAIN A SUPPLY AIR TEMPERATURE OF 55 DEG F (ADJUSTABLE).
      5) ENSURE THAT THE ECONOMIZER, HYDRONIC HEATING COIL, AND HYDRONIC COOLING COIL CONTROLS HAVE COMMON INPUTS AND DO NOT OVERLAP IN FUNCTION.
5. UNOCCUPIED MODE:
   A. THE SUPPLY AND EXHAUST FANS SHALL BE OFF, THE EMCS SHALL MAINTAIN THE OUTSIDE-AIR AND RELIEF-AIR DAMPERS CLOSED AND RETURN-AIR DAMPERS 100 PERCENT OPEN. THE SYSTEM SHALL AUTOMATICALLY BE INDEXED TO OCCUPIED OPERATION IF ANY OF THE SPACE TEMPERATURE SENSORS FALL BELOW THEIR ADJUSTABLE NIGHT SETBACK TEMPERATURE SETTING OR IS OCCUPANCY OVERRIDDEN.

M. THE AHU-2 "SYSTEM" IS A VARIABLE AIR VOLUME REHEAT SYSTEM. THE SUPPLY AND EXHAUST FANS ARE EACH PROVIDED WITH A VARIABLE FREQUENCY DRIVE. SYSTEM COMPONENTS INCLUDE AHU-2, EF-21, CC-2, HC-2, VFD-3, VFD-4, TB-XX, FPTB-XX AND PRE- AND FINAL-FILTERS,
1. THE SEQUENCE OF OPERATION AND CONTROL COMPONENTS FOR THIS SYSTEM SHALL BE IDENTICAL TO THAT OF THE AHU-1 SYSTEM. THE ONLY DIFFERENCES ARE AS NOTED BELOW:
   A. OUTSIDE AIR DAMPER CONTROL UNDER NORMAL OCCUPIED OPERATION
      1) AIR HANDLING UNIT AHU-2'S OUTSIDE AIR DAMPER SHALL BE POSITIONED TO PROVIDE 945 CFM OF OUTSIDE AIR, THIS OUTSIDE AIR QUANTITY IS BASED ON OCCUPANCY AND / OR EXHAUST AIR MAKE-UP.
   B. EXHAUST FAN EF-21 SHALL BE MODULATED USING DIRECT SPACE PRESSURIZATION CONTROL, DIFFERENTIAL PRESSURE BETWEEN CORRIDOR A209 SHALL BE REFERENCED TO THE OUTDOORS,

N. THE AHU-3 "SYSTEM" IS A VARIABLE AIR VOLUME REHEAT SYSTEM. THE SUPPLY AND EXHAUST FANS ARE EACH PROVIDED WITH A VARIABLE FREQUENCY DRIVE. SYSTEM COMPONENTS INCLUDE AHU-3, EF-22, CC-3, HC-3, VFD-5, VFD-6, T8-XX, FPTB-XX AND PRE- AND FINAL-FILTERS.
1. THE SEQUENCE OF OPERATION AND CONTROL COMPONENTS FOR THIS SYSTEM SHALL BE IDENTICAL TO THAT OF THE AHU-1 SYSTEM. THE ONLY DIFFERENCES ARE AS NOTED BELOW:
   A. OUTSIDE AIR DAMPER CONTROL:
      1) AIR HANDLING UNIT AHU-3'S OUTSIDE AIR DAMPER SHALL BE POSITIONED TO PROVIDE 1890 CFM OF OUTSIDE AIR. THIS OUTSIDE AIR QUANTITY IS BASED ON OCCUPANCY AND / OR EXHAUST AIR MAKE-UP.
   B. EXHAUST FAN EF-22 SHALL BE MODULATED USING DIRECT SPACE PRESSURIZATION CONTROL. DIFFERENTIAL PRESSURE BETWEEN BOOKING A148 SHALL BE REFERENCED TO SALLYPORT 8101.
   C. SUPPLY DUCT STATIC PRESSURE SENSOR MUST BE LOCATED ON THE INLET SIDE THE 28 / 14 SMOKE DAMPER IN THE SUPPLY DUCT LOCATED JUST OUTSIDE OF MASTER CONTROL — ROOM A223.
   D. THE RETURN DUCT STATIC PRESSURE SENSOR MUST BE LOCATED ON THE INLET SIDE OF THE 42 / 16 SMOKE DAMPER IN THE RETURN DUCT AT THE SOUTH WALL OF INMATE ROOM — ROOM A141.

O. THE AHU-4 "SYSTEM" IS A SINGLE ZONE CONSTANT VOLUME SYSTEM. SYSTEM COMPONENTS INCLUDE AHU-4, EF-23, CC 4, HC-4, AND PRE- AND FINAL-FILTERS.
1. SAFETY CONTROLS:
   A. PROVIDE MIXED AIR SENSOR/LOW LIMIT CONTROLLER TO PREVENT THE MIXED AIR TEMPERATURE FROM FALLING BELOW 42 DEGREES F (ADJ.). THE MIXED AIR LOW LIMIT CONTROLLER SHALL OVERRIDE ALL OTHER CONTROLS TO MODULATE THE OUTSIDE AIR DAMPERS TO 100% SHUT IF THE MIXED AIR TEMPERATURE FALLS BELOW THIS SETTING. FAN STOPPAGE SHALL BE REPORTED TO THE CENTRAL OPERATORS STATION. MANUAL RESET SHALL BE REQUIRED FOR RESTARTING OF THE FANS.
   B. PROVIDE A PRESSURE SWITCH ACROSS EACH FILTER SECTION TO ALARM THE EMCS, AND A CURRENT SENSING RELAY TO MONITOR THE STATUS OF EACH FAN.
   C. A SUPPLY AIR SMOKE DETECTOR (SEE ELECTRICAL) LOCATED IN THE SUPPLY DUCTWORK OF THE UNIT SHALL STOP THE FAN AND ALSO TO PROVIDE SIGNALS FOR FIRE ALARM SYSTEM.
2. THE DDC SYSTEM SHALL SELECT OCCUPIED/UNOCCUPIED CONTROL MODE.
   1. UNOCCUPIED MODE: THE OUTSIDE AIR DAMPER SHALL BE FULLY CLOSED, AND THE RETURN DAMPER FULLY OPEN. THE FAN SHALL BE CYCLED AND THE HEATING COIL CONTROL VALVE MODULATED AS REQUIRED TO MAINTAIN A REDUCED SPACE TEMPERATURE.
   2. OCCUPIED MODE: THE OUTSIDE AND RETURN AIR DAMPERS SHALL BE CONTROLLED AS FOLLOWS:
      A. WHEN THE SUPPLY FAN IS OFF, THE OUTSIDE AIR DAMPER SHALL BE CLOSED, AND THE RETURN AIR DAMPER SHALL BE OPEN. WHEN THE OUTDOOR AIR TEMPERATURE IS SUITABLE, THE EMCS SHALL USE ECONOMIZER CONTROLS TO UTILIZE THE OUTDOOR AIR FOR SPACE COOLING.
      B. WHEN THE SUPPLY FAN IS ON, THE OUTSIDE AIR DAMPER SHALL OPEN TO THE MINIMUM POSITION SHOWN ON THE SCHEDULE AS REQUIRED FOR VENTILATION. AIR HANDLING UNIT AHU-4'S OUTSIDE AIR DAMPER SHALL BE POSITIONED TO PROVIDE 2440 CFM OF OUTSIDE AIR. THIS OUTSIDE AIR QUANTITY IS BASED ON OCCUPANCY AND I OR EXHAUST AIR MAKE-UP.
      C. A ROOM TEMPERATURE SENSOR SHALL (THROUGH A MIXED AIR LOW LIMIT CONTROLLER) MODULATE THE MIXED AIR DAMPERS, AND THE CHILLED AND HOT WATER CONTROL VALVES IN SEQUENCE TO MAINTAIN THE SPACE TEMPERATURE SETPOINT.
   3. SPACE PRESSURIZATION (EXHAUST FAN EF-23): THE OUTSIDE AND RETURN AIR DAMPERS ARE GENERALLY CONTROLLED TO MAINTAIN A MIXED AIR TEMPERATURE. THE EXHAUST AIR DAMPER (LOCATED ON THE DISCHARGE OF THE EXHAUST FAN EF-23) SHALL BE SET BY THE BALANCING CONTRACTOR BY MEASURING THE RELATIVE SPACE PRESSURE AND ADJUSTING THE POSITION (SETTING A MAXIMUM LIMIT OF BUILDING AIR THAT CAN BE EXHAUSTED) OF THE EXHAUST AIR DAMPER AS NEEDED TO MAINTAIN POSITIVE SPACE PRESSURIZATION (APPROXIMATELY 0.1 IN WC). THE EXHAUST FAN IS ESSENTIALLY ON/OFF CONTROL WITH THE FAN BEING STARTED WHEN THE SPACE PRESSURE IS APPROXIMATELY 0.03 IN WC AND SHALL SHUT OFF WHEN THE SPACE PRESSURE IS APPROXIMATELY 0.10 IN WC (ADJ.). MEASURE SPACE PRESSURE IN ROOM A192.

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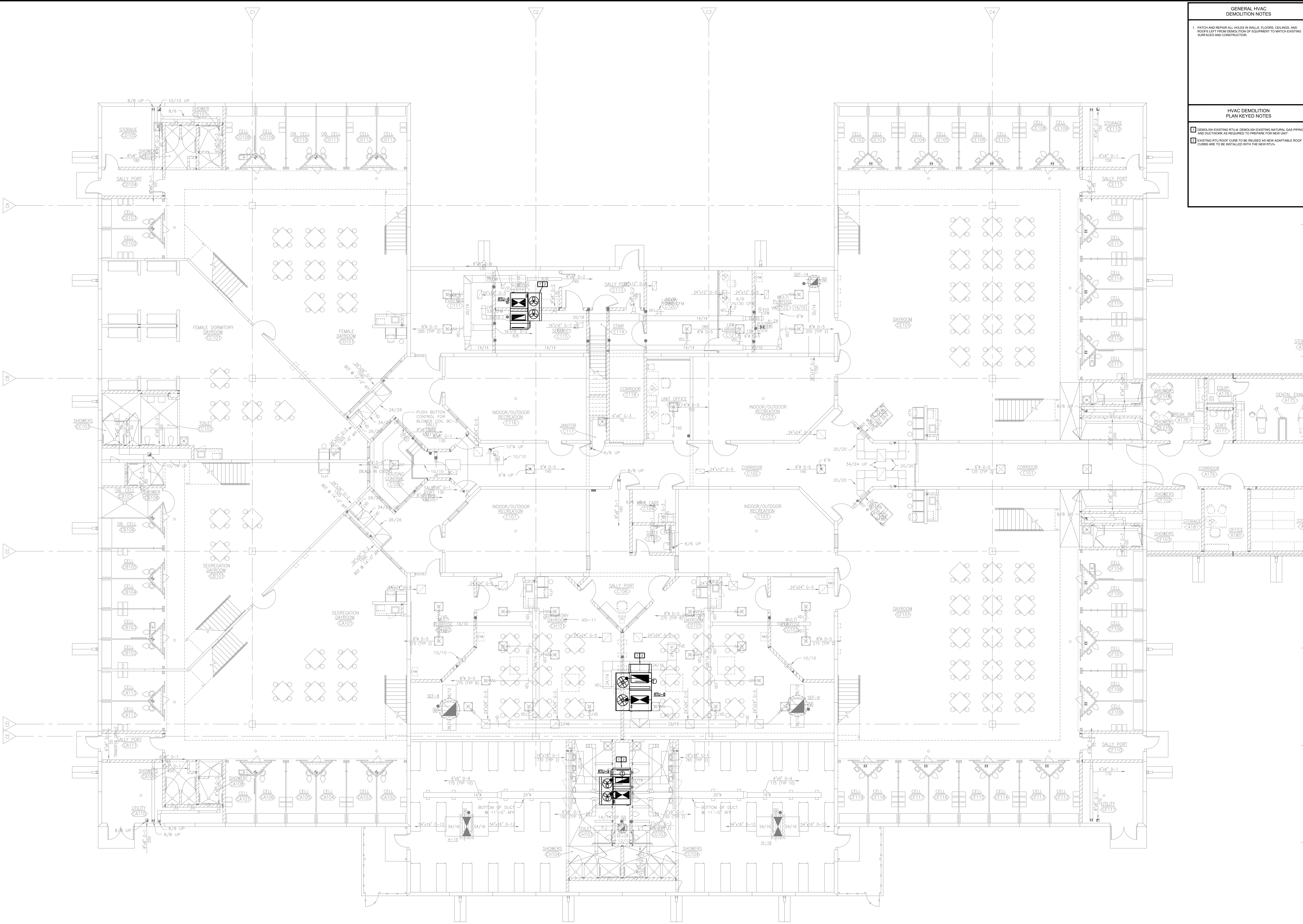

Plan North

1 HVAC Plan - First Level - Area C - Demolition

SCALE: 1/8" = 1'-0"

GENERAL HVAC DEMOLITION NOTES

1. PATCH AND REPAIR ALL HOLES IN WALLS, FLOORS, CEILINGS, AND ROOFS LEFT FROM DEMOLITION OF EQUIPMENT TO MATCH EXISTING SURFACES AND CONSTRUCTION.

HVAC DEMOLITION PLAN KEYED NOTES

1. DEMOLISH EXISTING RTU-#, DEMOLISH EXISTING NATURAL GAS PIPING AND DUCTWORK AS REQUIRED TO PREPARE FOR NEW UNIT.
2. EXISTING RTU ROOF CURB TO BE REUSED AS NEW ADAPTABLE ROOF CURBS ARE TO BE INSTALLED WITH THE NEW RTU's.

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HVAC Plan Demolition First Level Area C

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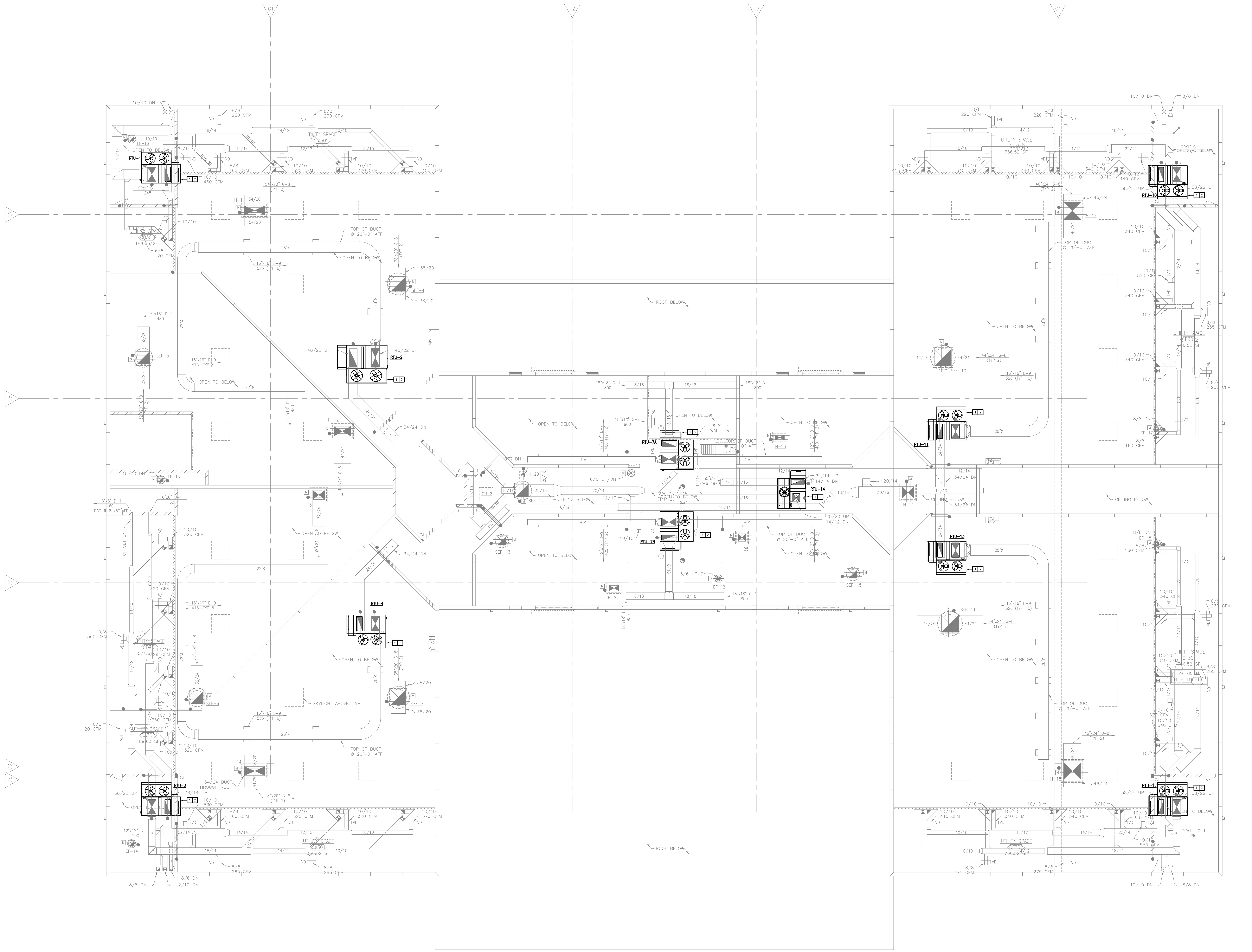

Plan North

1 HVAC Plan - Utility Level - Area C - Demolition
SCALE: 1/8" = 1'-0"

GENERAL HVAC DEMOLITION NOTES

1. PATCH AND REPAIR ALL HOLES IN WALLS, FLOORS, CEILINGS, AND ROOFS LEFT FROM DEMOLITION OF EQUIPMENT TO MATCH EXISTING SURFACES AND CONSTRUCTION.

HVAC DEMOLITION PLAN KEYED NOTES

1. DEMOLISH EXISTING RTU-#, DEMOLISH EXISTING NATURAL GAS PIPING AND DUCTWORK AS REQUIRED TO PREPARE FOR NEW UNIT.
2. EXISTING RTU ROOF CURB TO BE REUSED AS NEW ADAPTABLE ROOF CURBS ARE TO BE INSTALLED WITH THE NEW RTU's.

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HVAC Plan Demolition Utility Level Area C

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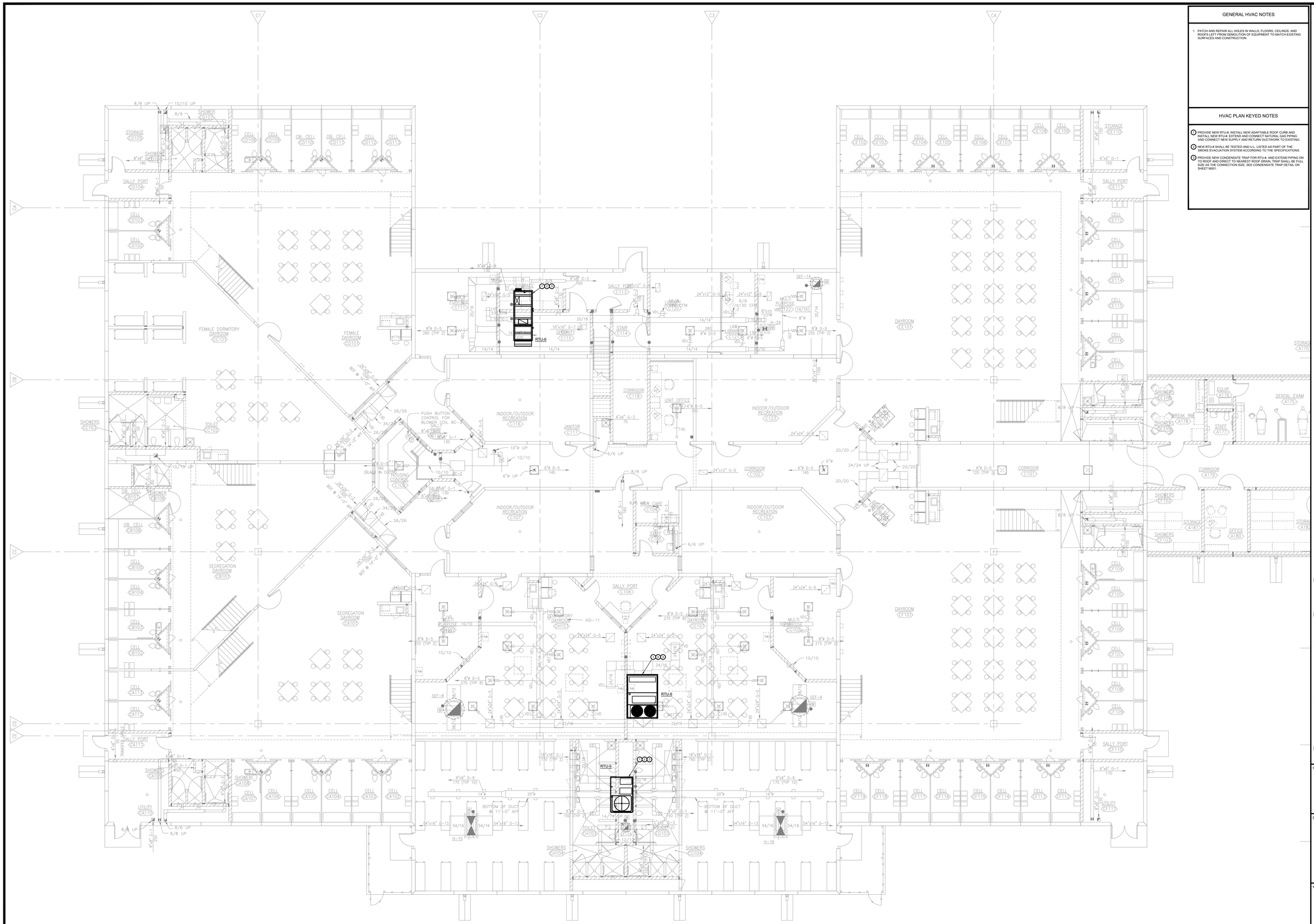

1 HVAC Plan - First Level - Area C - New Work
SCALE: 1/8" = 1'-0"

GENERAL HVAC NOTES

1. PATCH AND REPAIR ALL HOLES IN WALLS, FLOORS, CEILINGS, AND ROOFS LEFT FROM DEMOLITION OF EQUIPMENT TO MATCH EXISTING SURFACES AND CONSTRUCTION.

HVAC PLAN KEYED NOTES

1. PROVIDE NEW RTU-#. INSTALL NEW ADAPTABLE ROOF CURB AND INSTALL NEW RTU-#. EXTEND AND CONNECT NATURAL GAS PIPING AND CONNECT NEW SUPPLY AND RETURN DUCTWORK TO EXISTING.
2. NEW RTU-# SHALL BE TESTED AND U.L. LISTED AS PART OF THE SMOKE EVACUATION SYSTEM ACCORDING TO THE SPECIFICATIONS.
3. PROVIDE NEW CONDENSATE TRAP FOR RTU-#, AND EXTEND PIPING ON TO ROOF AND DIRECT TO NEAREST ROOF DRAIN. TRAP SHALL BE FULL SIZE AS THE CONNECTION SIZE. SEE CONDENSATE TRAP DETAIL ON SHEET M001.

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HVAC Plan New Work First Level Area C

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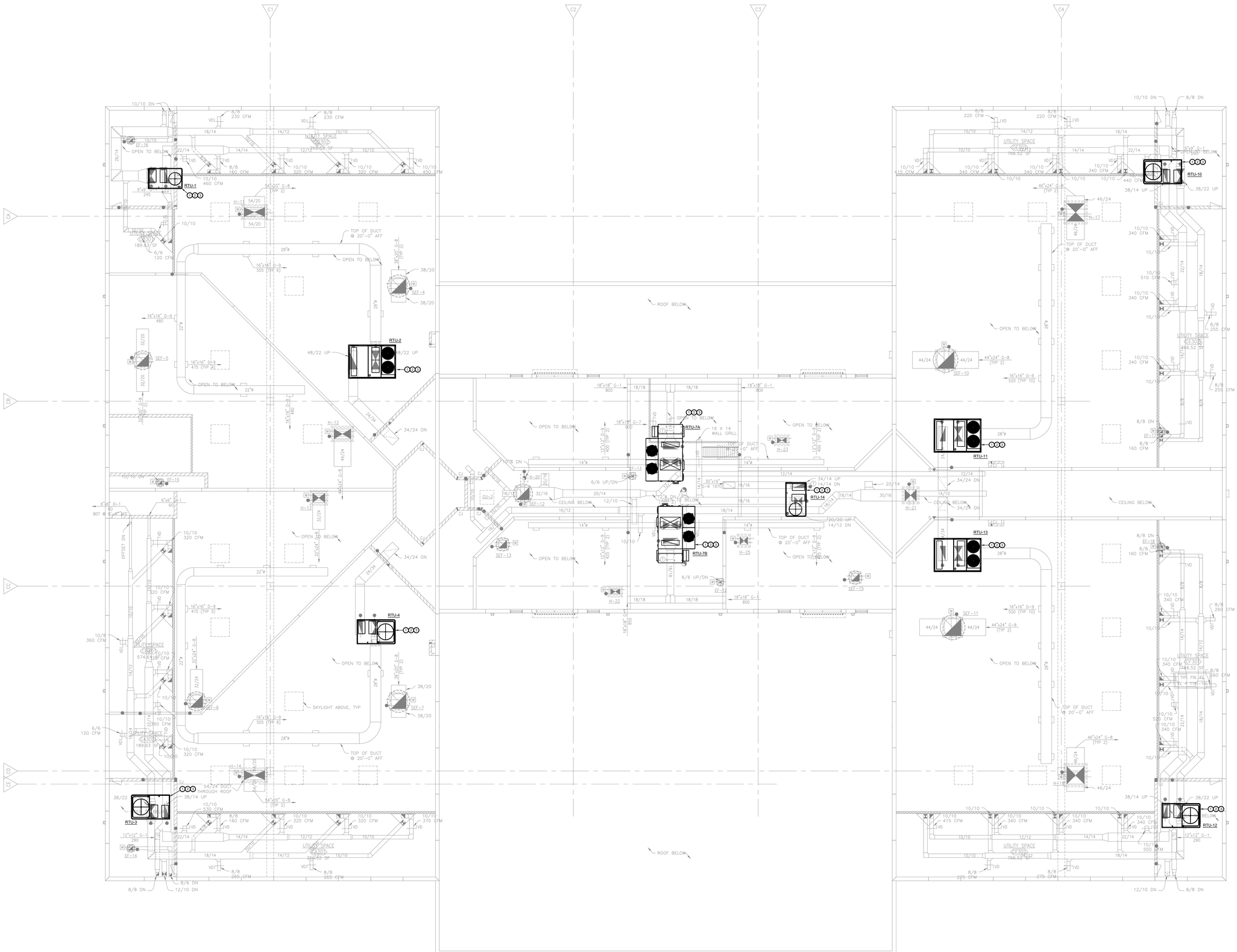
M101

M000



Plan North

1 HVAC Plan -Utility Level - Area C - New Work

SCALE:1/8" = 1'-0"

GENERAL HVAC NOTES

1. PATCH AND REPAIR ALL HOLES IN WALLS, FLOORS, CEILINGS, AND ROOFS LEFT FROM DEMOLITION OF EQUIPMENT TO MATCH EXISTING SURFACES AND CONSTRUCTION.

HVAC PLAN KEYED NOTES

1. PROVIDE NEW RTU-#. INSTALL NEW ADAPTABLE ROOF CURB AND INSTALL NEW RTU-#. EXTEND AND CONNECT NATURAL GAS PIPING AND CONNECT NEW SUPPLY AND RETURN DUCTWORK TO EXISTING.
2. NEW RTU-# SHALL BE TESTED AND U.L. LISTED AS PART OF THE SMOKE EVACUATION SYSTEM ACCORDING TO THE SPECIFICATIONS.
3. PROVIDE NEW CONDENSATE TRAP FOR RTU-#, AND EXTEND PIPING DN TO ROOF AND DIRECT TO NEAREST ROOF DRAIN. TRAP SHALL BE FULL SIZE AS THE CONNECTION SIZE, SEE CONDENSATE TRAP DETAIL ON SHEET M001.

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Hall County DOC RTU Replacement

200 South Sycamore Street, Grand Island, NE 68801

sheet title

HVAC Plan New Work Utility Level Area C

drawn by	date	scale	revision
JH	02-04-2026	1/8" = 1'-0"	

sheet number

M103

M000

GENERAL ELECTRICAL NOTES

1. FOR ALL CONDUIT AND OTHER ITEMS PENETRATING A FIRE RATED WALL, PROVIDE UL LISTED THROUGH PENETRATION FIRE STOPPING SYSTEM THAT IS SPECIFIC TO THE WALL CONSTRUCTION ASSEMBLY AND COMPLIANT WITH ASTM E814. INSTALL SYSTEM IN STRICT COMPLIANCE WITH THE FIRE STOPPING MANUFACTURER'S U.L. APPROVED DETAIL.
2. ANY ITEMS DAMAGED BY THE CONTRACTOR SHALL BE REPLACED BY THE CONTRACTOR, AT NO ADDITIONAL COST TO THE OWNER.
3. PROVIDE ADDITIONAL SUPPORTS AS REQUIRED TO INDEPENDENTLY SUPPORT ALL EXISTING TO REMAIN.
4. REMOVE AND REINSTALL CEILING TILES AS NEEDED TO DISCONNECT, RECONNECT, AND INSTALL NEW ELECTRICAL MATERIALS TO FEED NEW MECHANICAL EQUIPMENT.
5. PROPERLY SEAL ALL ROOF PENETRATION BOTH OUTSIDE AND INSIDE THE CONDUITS TO PREVENT LEAKAGE AND CONDENSATION.
6. ALL CIRCUITING AND PANEL INFORMATION REFERENCED ON THESE DRAWINGS WAS ACQUIRED FROM EXISTING FACILITY DRAWINGS. FIELD VERIFY ALL INFORMATION PRIOR TO STARTING WORK.

ELECTRICAL PLAN KEYED NOTES

1. EXISTING RTU IS BEING REPLACED LIKE FOR LIKE. CONNECT AND ENERGIZE NEW EQUIPMENT WITH EXISTING CIRCUITS. VERIFY LIKE FOR LIKE REPLACEMENTS HAVE THE CORRECT VOLTAGE AND SAME OR LOWER AMPERAGE REQUIREMENTS. WHERE CIRCUITING REQUIREMENTS FOR NEW MECHANICAL EQUIPMENT ACTUALLY INCREASE, PROVIDE UPSIZED BREAKER, CONDUCTORS, CONDUIT, ETC. AS NEEDED TO POWER NEW EQUIPMENT. WHERE EXISTING ELECTRICAL CIRCUITING IS SHOWING SIGNS OF WEAR, AGE, OVERHEATING, OR OTHER DEFECTS, REPLACE WITH NEW MATERIALS AS REQUIRED. REUSE EXISTING DUCT DETECTOR, OR REPLACE WHERE NEEDED TO MAINTAIN THE SMOKE CONTROL SYSTEM INTEGRITY.
2. REMOVE AND REINSTALL GFI WP RECEPTACLE ON NEW RTU. MAINTAIN EXISTING CIRCUITING. (NOT SHOWN), FROM PANEL NLC2
3. MODIFY FUSING IN MCC-SE FOR THE FOLLOWING RTUS, PER THE EQUIPMENT ELECTRICAL SCHEDULE, REUSE EXISTING WIRING, DISCONNECT, AND CONDUIT. (RTU-6, RTU-9)
4. RTU-6 AIR CONDITIONING IS CURRENTLY BEING FED BY A 35A CIRCUIT BREAKER IN PANEL NHCM. CHANGE OUT BREAKER TO 30A. REUSE EXISTING WIRING, DISCONNECT, AND CONDUIT, AND FUSE PER THE EQUIPMENT ELECTRICAL SCHEDULE.
5. RTU-9 AIR CONDITIONING IS CURRENTLY BEING FED BY A 40A CIRCUIT BREAKER IN PANEL NHCM. CHANGE OUT BREAKER TO 50A, AND UPSIZE WIRING/CONDUIT IF NEEDED. REUSE EXISTING DISCONNECT, AND FUSE PER THE EQUIPMENT ELECTRICAL SCHEDULE.

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project title
Hall County DOC RTU Replacement
200 South Sycamore Street, Grand Island, NE 68801

sheet title
Elec Plan First Level Area C

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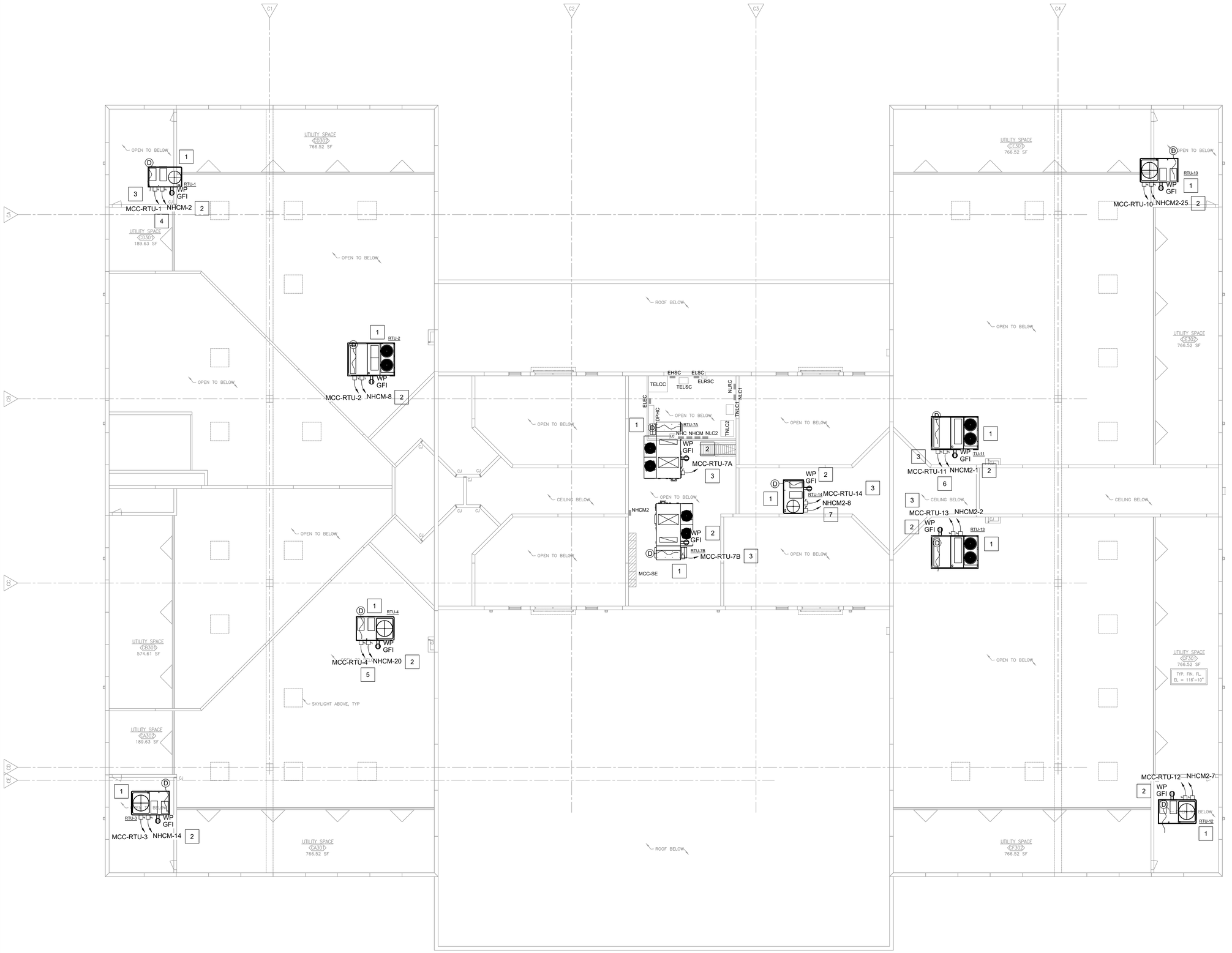
ACS	01-06-2026	1/8" = 1'-0"	-

sheet number
E101

MD101 HVAC PLAN DEMOLITION FIRST LEVEL AREA C
MD103 HVAC PLAN DEMOLITION UTILITY LEVEL AREA C
M101 HVAC PLAN NEW WORK FIRST LEVEL AREA C
M103 HVAC PLAN NEW WORK UTILITY LEVEL AREA C
E101 ELEC PLAN FIRST LEVEL AREA C
E103 ELEC PLAN UTILITY LEVEL AREA C
E001 ELECTRICAL SPECS & EQUIPMENT SCHEDULE

Plan North

1 Electrical Plan - First Level - Area C
SCALE: 1/8" = 1'-0"



Plan North

1 Electrical Plan - Utility Level - Area C

SCALE: 1/8" = 1'-0"

GENERAL ELECTRICAL NOTES

1. FOR ALL CONDUIT AND OTHER ITEMS PENETRATING A FIRE RATED WALL, PROVIDE UL LISTED THROUGH PENETRATION FIRE STOPPING SYSTEM THAT IS SPECIFIC TO THE WALL CONSTRUCTION ASSEMBLY AND COMPLIANT WITH ASTM E814. INSTALL SYSTEM IN STRICT COMPLIANCE WITH THE FIRE STOPPING MANUFACTURER'S U.L. APPROVED DETAIL.
2. ANY ITEMS DAMAGED BY THE CONTRACTOR SHALL BE REPLACED BY THE CONTRACTOR, AT NO ADDITIONAL COST TO THE OWNER.
3. PROVIDE ADDITIONAL SUPPORTS AS REQUIRED TO INDEPENDENTLY SUPPORT ALL EXISTING TO REMAIN.
4. REMOVE AND REINSTALL CEILING TILES AS NEEDED TO DISCONNECT, RECONNECT, AND INSTALL NEW ELECTRICAL MATERIALS TO FEED NEW MECHANICAL EQUIPMENT.
5. PROPERLY SEAL ALL ROOF PENETRATION BOTH OUTSIDE AND INSIDE THE CONDUITS TO PREVENT LEAKAGE AND CONDENSATION.
6. ALL CIRCUITING AND PANEL INFORMATION REFERENCED ON THESE DRAWINGS WAS ACQUIRED FROM EXISTING FACILITY DRAWINGS. FIELD VERIFY ALL INFORMATION PRIOR TO STARTING WORK.

ELECTRICAL PLAN KEYED NOTES

1. EXISTING RTU IS BEING REPLACED LIKE FOR LIKE. CONNECT AND ENERGIZE NEW EQUIPMENT WITH EXISTING CIRCUITS. VERIFY LIKE FOR LIKE REPLACEMENTS HAVE THE CORRECT VOLTAGE AND SAME OR LOWER AMPERAGE REQUIREMENTS. WHERE CIRCUITING REQUIREMENTS FOR NEW MECHANICAL EQUIPMENT ACTUALLY EXCEEDS EXISTING CIRCUITING, PROVIDE CONDUCTORS, CONDUIT, ETC. AS NEEDED TO POWER NEW EQUIPMENT. WHERE EXISTING ELECTRICAL CIRCUITING IS SHOWING SIGNS OF WEAR, AGE, OVERHEATING, OR OTHER DEFECTS, REPLACE WITH NEW MATERIALS AS REQUIRED. REUSE EXISTING DUCT DETECTOR, OR REPLACE WHERE NEEDED TO MAINTAIN THE SMOKE CONTROL SYSTEM INTEGRITY.
2. REMOVE AND REINSTALL GFI WP RECEPTACLE ON NEW RTU. MAINTAIN EXISTING CIRCUITING, (NOT SHOWN), FROM PANEL NLC2.
3. MODIFY FUSING IN MCC-EE FOR THE FOLLOWING RTUS, PER THE EQUIPMENT ELECTRICAL SCHEDULE. REUSE EXISTING WIRING, DISCONNECT, AND CONDUIT. (RTU-1, RTU-7A, RTU-7B, RTU-11, RTU-13, AND RTU-14.
4. RTU-1 AIR CONDITIONING IS CURRENTLY BEING FED BY A 25A CIRCUIT BREAKER IN PANEL NHCM. CHANGE OUT BREAKER TO 25A. REUSE EXISTING WIRING, DISCONNECT, AND CONDUIT, AND FUSE PER THE EQUIPMENT ELECTRICAL SCHEDULE.
5. RTU-4 AIR CONDITIONING IS CURRENTLY BEING FED BY A 50A CIRCUIT BREAKER IN PANEL NHCM. CHANGE OUT BREAKER TO 40A. REUSE EXISTING WIRING, DISCONNECT, AND CONDUIT, AND FUSE PER THE EQUIPMENT ELECTRICAL SCHEDULE.
6. RTU-11 AIR CONDITIONING IS CURRENTLY BEING FED BY A 50A CIRCUIT BREAKER IN PANEL NHCM. CHANGE OUT BREAKER TO 40A. REUSE EXISTING WIRING, DISCONNECT, AND CONDUIT, AND FUSE PER THE EQUIPMENT ELECTRICAL SCHEDULE.
7. RTU-14 AIR CONDITIONING IS CURRENTLY BEING FED BY A 30A CIRCUIT BREAKER IN PANEL NHCM. CHANGE OUT BREAKER TO 25A. REUSE EXISTING WIRING, DISCONNECT, AND CONDUIT, AND FUSE PER THE EQUIPMENT ELECTRICAL SCHEDULE.

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E103

ELECTRICAL SPECIFICATIONS

260000 - GENERAL ELECTRICAL REQUIREMENTS

1. CONTRACTOR SHALL COMPLY WITH ALL STATE AND LOCAL CODES AND ORDINANCES.
2. CONTRACTOR SHALL MAKE APPLICATION FOR OBTAIN AND PAY FOR ALL REQUIRED PERMITS AND CERTIFICATES OF INSPECTION.
3. THE OWNER WILL HAVE FIRST RIGHT OF SALVAGE FOR ITEMS REMOVED. CONTRACTOR SHALL DISPOSE OF ITEMS REMOVED IF NOT SALVAGED.
4. PROVIDE PRODUCT DATA SUBMITTALS FOR FIRE-ALARM DEVICES.
5. WARRANTIES
   A. THE CONTRACTOR SHALL WARRANT ALL MATERIALS, WORKMANSHIP, AND EQUIPMENT AGAINST DEFECTS FOR A PERIOD OF ONE YEAR AFTER THE DATE OF SUBSTANTIAL COMPLETION. CERTAIN EQUIPMENT SHALL BE WARRANTED BEGINNING AT THE TIME OF FINAL ACCEPTANCE OR FOR LONGER PERIODS OF TIME AS SPECIFIED IN THOSE DIVISIONS OF THE PROJECT MANUAL. THE CONTRACTOR SHALL REPAIR OR REPLACE, AT NO ADDITIONAL COST TO THE OWNER, ANY ITEM WHICH MAY BECOME DEFECTIVE WITHIN THE WARRANTY PERIOD. ANY MANUFACTURERS' WARRANTIES CONCERNING ANY ITEM INSTALLED WILL RUN TO THE BENEFIT OF THE OWNER. THE CONTRACTOR AGREES NOT TO VOID OR IMPAIR, OR TO ALLOW SUB-CONTRACTORS TO VOID OR IMPAIR, ANY WARRANTIES REGARDING PRODUCTS OR ITEMS INSTALLED AS PART OF THIS PROJECT. THE REPAIR OF FAULTY WORKMANSHIP SHALL BE CONSIDERED TO BE INCLUDED IN THE CONTRACT.
6. EQUIPMENT ELECTRICAL CONNECTIONS
   A. ELECTRICAL CONNECTIONS IDENTIFIED ARE FOR THE SPECIFIC EQUIPMENT MANUFACTURER AND MODEL SCHEDULED, AND INCLUDES EQUIPMENT FURNISHED BY THIS TRADE OR FURNISHED BY OTHER TRADES AS PART OF THESE CONTRACT DOCUMENTS. IF THE CONTRACTOR CHOOSES TO PROVIDE EQUIPMENT FROM A DIFFERENT MANUFACTURER OR MODEL THAN THAT SCHEDULED BUT LISTED AS EQUIVALENT IN THE SPECIFICATIONS, OR OTHERWISE ACCEPTED BY THE ARCHITECT/ENGINEER, THE CONTRACTOR SHALL INCLUDE ELECTRICAL CONNECTION REVISIONS ASSOCIATED WITH THAT MANUFACTURER'S ELECTRICAL CONNECTION REQUIREMENTS IN THEIR BID.

260500 - COMMON WORK RESULTS FOR ELECTRICAL

1. THE ELECTRICAL CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF THE GENERAL CONDITIONS, SUPPLEMENTAL GENERAL CONDITIONS OF THE PROJECT SPECIFICATIONS, AND CONTRACT DOCUMENTS.
2. DEFINITIONS AND STANDARDS:
   A. DEFINITIONS: INSTRUCTIONS SUCH AS "PROVIDE THE OUTLETS." SHALL MEAN THE SAME AS THOUGH THE WORDS "THE CONTRACTOR SHALL "PRECEDE EACH SUCH INSTRUCTION. "PROVIDE" SHALL MEAN "FURNISH AND INSTALL".
   B. STANDARDS FOR MATERIALS: MATERIALS SHALL BE NEW EXCEPT AS OTHERWISE STATED, AND SHALL CONFORM WITH THE CURRENT APPLICABLE INDUSTRY STANDARDS, NEMA STANDARDS, AND UNDERWRITERS' LABORATORIES STANDARDS.
3. COORDINATE ARRANGEMENT, MOUNTING, AND SUPPORT OF ELECTRICAL EQUIPMENT WITH OTHER TRADES.
4. STEEL PIPE SLEEVES: ASTM A 53/A 53M, TYPE E, GRADE B, SCHEDULE 40, GALVANIZED STEEL, PLAIN ENDS.
5. PROVISIONS SHALL BE MADE FOR SAFE DELIVERY AND SECURE STORAGE OF ALL MATERIALS.
6. WORK SHALL BE PERFORMED TO CLIENT SAFETY STANDARDS, NFPA 70E, AND OSHA REGULATIONS. WORK SHALL BE ACCOMPLISHED WITH AFFECTED CIRCUITS DE-ENERGIZED.
7. ONLY QUALIFIED, PROPERLY TRAINED, AND LICENSED PERSONNEL SHALL PERFORM THIS WORK.
8. WORK SHALL CONFORM TO CLIENT FACILITY STANDARDS.
9. PROVIDE NECESSARY LABOR, MATERIALS, EQUIPMENT, AND ACCESSORIES FOR THE ELECTRICAL SYSTEMS TO BE INSTALLED ACCORDING TO MANUFACTURER INSTRUCTIONS. INSTALLATIONS SHALL BE IN A NEAT AND WORKMEN LIKE MANNER BY SKILLED AND COMPETENT ELECTRICIANS IN CONFORMANCE WITH THE STANDARD PRACTICES OF THE ELECTRICAL INDUSTRY. GOOD WORKMANSHIP AND APPEARANCE ARE CONSIDERED EQUAL TO PROPER OPERATION.
10. MATERIALS SHALL BE SPECIFICALLY INTENDED AND UL LISTED FOR THEIR APPLICATION.
11. MATERIALS SHALL BE SUITABLY RATED FOR THEIR OPERATING ENVIRONMENT FOR WET LOCATIONS, SUNLIGHT EXPOSURE, TEMPERATURE RANGES, AND OTHER ENVIRONMENTAL VARIABLES. WORK THAT PIERCES WATERPROOFING SHALL BE INSTALLED TO MAINTAIN THE INTEGRITY OF THE WATERPROOFING.
12. PROVIDE CORE DRILLING, CHANNELING, CUTTING, PATCHING, SLEEVES, ETC. AS REQUIRED FOR INSTALLATION OF ELECTRICAL EQUIPMENT. SEAL HOLES, FIREPROOFING WHERE NECESSARY, AND REFINISH REPAIR WORK TO ORIGINAL CONDITION WHERE DAMAGED BY ELECTRICAL WORK.
13. COORDINATE AND DIRECT THE PROGRESS OF ELECTRICAL WORK TO CONFORM TO THE OWNER'S SCHEDULE AND THE PROGRESS OF THE WORK OF THE OTHER TRADES. THE SUCCESSFUL COMPLETION OF THIS WORK WILL REQUIRE PHASED INSTALLATIONS OF TEMPORARY AND NEW WORK. PROVIDE TEMPORARY LIGHTING AND POWER AS REQUIRED BY OWNER.
14. AT COMPLETION OF WORK, DELIVER COMPLETED PROJECT RECORD DOCUMENTS MARKED WITH FIELD CHANGES TO THE ARCHITECT/OWNER.
15. COMPLY WITH NECA 1.
16. RIGHT OF WAY - GIVE TO RACEWAYS AND PIPING SYSTEM INSTALLED AT A REQUIRED SLOPE.
17. APPLY FIRESTOPPING TO ELECTRICAL PENETRATIONS OF FIRE-RATED FLOOR AND WALL ASSEMBLIES.
18. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: LISTED AND LABELED AS DEFINED IN NFPA 70, ARTICLE 100.
19. INCIDENTAL EQUIPMENT:
   A. CONTRACTOR SHALL PROVIDE ELECTRICAL CONNECTIONS AND DISCONNECTS FOR INCIDENTAL EQUIPMENT. CONNECTIONS INCLUDE REQUIRED LINE VOLTAGE BRANCH CIRCUITS, FIRE ALARM, VOICE COMMUNICATIONS, AND CENTRAL DATA NETWORK COMMUNICATIONS. "INCIDENTAL EQUIPMENT" SHALL MEAN EQUIPMENT FURNISHED BY THIS TRADE, OR FURNISHED BY OTHER TRADES UNDER THESE PROJECT DOCUMENTS, THAT IS NOT SPECIFICALLY IDENTIFIED OR LOCATED ON THE PLANS. EXAMPLES INCLUDE, BUT ARE NOT LIMITED TO, BUILDING MANAGEMENT CONTROL PANELS AND FIRE-ALARM REMOTE POWER SUPPLIES. COORDINATE REQUIREMENTS WITH EQUIPMENT PROVIDED AND OTHER ASSOCIATED TRADES.
20. SCHEDULED EQUIPMENT:
   A. PRIOR TO ORDERING AND INSTALLING MATERIAL AND ELECTRICAL EQUIPMENT, VERIFY THAT SCHEDULED CONNECTION REQUIREMENTS ARE CONSISTENT WITH EQUIPMENT BEING PROVIDED. THIS SHALL INCLUDE EQUIPMENT FURNISHED BY THIS TRADE OR FURNISHED BY OTHER TRADES UNDER THESE PROJECT DOCUMENTS. VERIFICATION IS NECESSARY DUE TO THE UNCERTAINTY OF FINAL EQUIPMENT SELECTION PROVIDED BY OTHER TRADES, INCLUDING, BUT NOT LIMITED TO: ELEVATORS, MECHANICAL EQUIPMENT, ETC.

260519 - CONDUCTORS AND CABLES FOR ELECTRICAL

1. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: LISTED AND LABELED AS DEFINED IN NFPA 70, ARTICLE 100, BY A TESTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, AND MARKED FOR INTENDED USE. COMPLY WITH NFPA 70.
2. COPPER CONDUCTORS: COMPLY WITH NECA WC70 AND UL RATING.
3. CONDUCTOR INSULATION: COMPLY WITH NEMA WC 70 FOR TYPES THHN-THWN.
   A. WIRING TERMINATIONS IN LIGHT FIXTURES AND TRANSFORMERS SHALL BE RATED 90C AS REQUIRED BY THE MANUFACTURER.
4. CONNECTORS AND SPLICES: FACTORY-FABRICATED CONNECTORS AND SPLICES OF SIZE, AMPACITY RATING, MATERIAL, TYPE, AND CLASS FOR APPLICATION AND SERVICE INDICATED.
5. FEEDERS AND BRANCH CIRCUITS: TYPE THHN-THWN, SINGLE CONDUCTORS IN RACEWAY.
6. CONCEAL CABLES IN FINISHED WALLS, CEILINGS, AND FLOORS, UNLESS OTHERWISE INDICATED. ROUTE CABLES IN CONDUIT WHEN REQUIRED BY THE APPLICABLE SPECIFICATION SECTION.
7. PROVIDE DEDICATED NEUTRALS FOR ALL BRANCH CIRCUITS.
8. SIZING: MINIMUM SIZE #12, EXCEPT FOR CONTROL OR SIGNAL CIRCUITS, WHICH MAY BE #14 WHERE THE MANUFACTURER'S REQUIREMENTS ALLOW.

260526 - GROUNDING AND BONDING FOR ELECTRICAL

1. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: LISTED AND LABELED AS DEFINED IN NFPA 70, ARTICLE 100, BY A TESTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, AND MARKED FOR INTENDED USE. COMPLY WITH UL 467 FOR GROUNDING AND BONDING MATERIALS AND EQUIPMENT.
2. CONDUCTORS:
   A. INSULATED CONDUCTORS: COPPER WIRE OR CABLE INSULATED FOR 600 V UNLESS OTHERWISE REQUIRED BY APPLICABLE CODE OR AUTHORITIES HAVING JURISDICTION.
   B. BARE COPPER CONDUCTORS:
      a. SOLID CONDUCTORS: ASTM B 3.
      b. STRANDED CONDUCTORS: ASTM B 8.
      c. BONDING CABLE: 28 KCMIL, 14 STRANDS OF NO. 17 AWG CONDUCTOR, 1/4 INCH IN DIAMETER.
      d. BONDING CONDUCTOR: NO. 4 OR NO. 6 AWG, STRANDED CONDUCTOR.
      e. BONDING JUMPER: COPPER TAPE, BRAIDED CONDUCTORS, TERMINATED WITH COPPER FERRULES; 1-5/8 INCHES WIDE AND 1/16 INCH THICK.
      f. GROUND BAR: RECTANGULAR BARS OF ANNEALED COPPER, 1/4-BY-4 INCHES IN CROSS SECTION, UNLESS OTHERWISE INDICATED; WITH INSULATORS. LENGTH AS REQUIRED TO ACCOMMODATE TERMINATIONS.
3. CONNECTORS: LISTED AND LABELED BY A NATIONALLY RECOGNIZED TESTING LABORATORY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION FOR APPLICATIONS IN WHICH USED, AND FOR SPECIFIC TYPES, SIZES, AND COMBINATIONS OF CONDUCTORS AND OTHER ITEMS CONNECTED.
4. GROUND RODS: COPPER-CLAD STEEL; 3/4 INCH IN DIAMETER BY 10 FEET IN LENGTH.
5. INSTALL INSULATED EQUIPMENT GROUNDING CONDUCTORS WITH ALL FEEDERS AND BRANCH CIRCUITS.
6. ROUTE GROUNDING CONDUCTORS ALONG SHORTEST AND STRAIGHTEST PATHS POSSIBLE, UNLESS OTHERWISE INDICATED OR REQUIRED BY CODE. AVOID OBSTRUCTING ACCESS OR PLACING CONDUCTORS WHERE THEY MAY BE SUBJECTED TO STRAIN, IMPACT, OR DAMAGE.
7. GROUND CONNECTIONS SHALL HAVE CLEAN CONTACT SURFACES, TINNED, AND SWEATED WHILE BOLTING. INSTALL GROUND CONDUCTORS IN CONDUIT. NON-CONDUCTIVE SURFACES SUCH AS PAINT SHALL BE REMOVED.

260529 - HANGERS AND SUPPORTS FOR ELECTRICAL

1. COMPLY WITH NFPA 70.
2. DESIGN SUPPORTS CAPABLE OF SUPPORTING COMBINED WEIGHT OF SUPPORTED EQUIPMENT AND ITS CONTENTS.
3. SUPPORTS SHALL BE ADEQUATE IN TENSION, SHEAR, AND PULLOUT FORCE TO RESIST MAXIMUM LOADS CALCULATED OR IMPOSED FOR THIS PROJECT, WITH A MINIMUM STRUCTURAL SAFETY FACTOR OF FIVE TIMES THE APPLIED FORCE.
4. RACEWAY AND CABLE SUPPORTS: AS DESCRIBED IN NECA 1 AND NECA 101.
5. CONDUIT AND CABLE SUPPORT DEVICES: STEEL AND MALLEABLE-IRON HANGERS, CLAMPS, AND ASSOCIATED FITTINGS, DESIGNED FOR TYPES AND SIZES OF RACEWAY OR CABLE TO BE SUPPORTED.
6. SPACE SUPPORTS FOR CONDUIT AS REQUIRED BY NFPA 70. MINIMUM ROD SIZE SHALL BE 1/4 INCH IN DIAMETER.
7. INSTALL TRAPEZE-TYPE SUPPORTS FABRICATED WITH STEEL SLOTTED SUPPORT SYSTEM, SIZED SO CAPACITY CAN BE INCREASED BY AT LEAST 25 PERCENT IN FUTURE WITHOUT EXCEEDING SPECIFIED DESIGN LOAD LIMITS. SECURE RACEWAYS AND CABLES TO THESE SUPPORTS WITH TWO-BOLT CONDUIT CLAMPS.
8. SUPPORT JUNCTION BOXES [AND LIGHT FIXTURES] DIRECTLY FROM STRUCTURE INDEPENDENTLY OF CONDUITS OR OTHER TRADES. SUPPORTING SHALL ENSURE THE CEILING SYSTEMS HAVE NO VISIBLE BOWING OR DEFLECTION.
9. STEEL MATERIAL SHALL BE USED FOR DRY LOCATIONS.
10. PROVIDE 4" HIGH CONCRETE BASES FOR FLOOR-MOUNTED DIVISION 26 EQUIPMENT. CONSTRUCT CONCRETE BASES 4 INCHES LARGER IN BOTH DIRECTIONS THAN SUPPORTED UNIT, AND SO ANCHORS WILL BE A MINIMUM OF 10 BOLT DIAMETERS FROM EDGE OF THE BASE. USE 3000-PSI, 28-DAY COMPRESSIVE-STRENGTH CONCRETE.

260533 - RACEWAYS AND BOXES FOR ELECTRICAL

1. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: LISTED AND LABELED AS DEFINED IN NFPA 70, ARTICLE 100, BY A TESTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, AND MARKED FOR INTENDED USE.
2. DRAWINGS ARE DIAGRAMMATIC. ALL BENDS, BOXES, FITTINGS, COUPLINGS ARE NOT NECESSARILY SHOWN. SUPPLY AS NECESSARY TO COMPLY WITH NFPA 70.
3. RIGID STEEL CONDUIT: ANSI C80.1.
4. EMT: ANSI C80.3.
5. LFMC: FLEXIBLE STEEL CONDUIT WITH PVC JACKET.
6. FITTINGS FOR CONDUIT (INCLUDING ALL TYPES AND FLEXIBLE AND LIQUIDTIGHT), EMT, AND CABLE: NEMA FB 1; LISTED FOR TYPE AND SIZE RACEWAY WITH WHICH USED, AND FOR APPLICATION AND ENVIRONMENT IN WHICH INSTALLED.
   a. FITTINGS FOR EMT: STEEL OR DIE-CAST, SET-SCREW OR COMPRESSION TYPE.
7. SHEET METAL OUTLET AND DEVICE BOXES: NEMA OS 1.
8. CONCEAL CONDUIT WITHIN FINISHED WALLS, CEILINGS, FLOORS, AND BELOW EXTERIOR GRADES UNLESS SURFACE MOUNTING IS SPECIFICALLY INDICATED ON PLANS.
9. CONDUIT SHALL BE ROUTED PARALLEL OR PERPENDICULAR WITH THE BUILDING WALLS. SUPPORT CONDUIT AS REQUIRED BY THE NATIONAL ELECTRICAL CODE.
10. KEEP RACEWAYS ABOVE AND 6" OR MORE HORIZONTALLY AWAY FROM PARALLEL RUNS OF FLUES AND STEAM OR HOT-WATER PIPES.
11. INSTALL SEALS ON THE INTERIOR OF CONDUITS WHERE THE CONDUIT PASSES BETWEEN TWO SPACES WITH SIGNIFICANTLY DIFFERENT ENVIRONMENT OR TEMPERATURE CONDITIONS.
12. PROVIDE EXPANSION TYPE FITTINGS FOR CONDUITS WHICH CROSS EXPANSION JOINTS.
13. RACEWAY APPLICATION:
   A. OUTDOOR EXPOSED: RIGID STEEL CONDUIT.
   B. CONNECTION TO VIBRATING EQUIPMENT (INCLUDING TRANSFORMERS AND HYDRAULIC, PNEUMATIC, ELECTRIC SOLENOID, OR MOTOR-DRIVEN EQUIPMENT): LFMC.
   C. OUTDOOR BOXES AND ENCLOSURES, ABOVEGROUND: NEMA 250, TYPE 3R.
   D. INDOOR: EMT.
14. MINIMUM RACEWAY SIZE: 3/4-INCH TRADE SIZE, 1-INCH TRADE SIZE FOR VOICE AND DATA COMMUNICATIONS.
15. PAINT JUNCTION BOX COVERS WITH THE FOLLOWING FINISHES BY BRANCH/SYSTEM.
   • FIRE ALARM SYSTEM: RED.
   • LOW VOLTAGE/DATA: WHITE.
   • NURSE CALL SYSTEM: BLUE.
16. INSTALL PULL WIRES IN EMPTY RACEWAYS. USE POLYPROPYLENE OR MONOFILAMENT PLASTIC LINE WITH NOT LESS THAN 200-LB TENSILE STRENGTH. LEAVE AT LEAST 12 INCHES OF SLACK AT EACH END OF PULL WIRE.

260541 - UNDERGROUND ELECTRICAL CONSTRUCTION

1. BEFORE PERFORMING TRENCHING WORK, LOCATE SERVICES, A CIVIL SURVEY, OR GROUND PENETRATING RADAR SHALL BE PERFORMED. SITE WORK SHALL BE PERFORMED WITH EXTREME CARE TO NOT DAMAGE OR INTERRUPT UTILITIES. VERIFY WITH OWNER THAT ALL EASEMENTS ARE ALLOWABLE.
2. GRASS AND PLANTS ARE TO BE REPLACED BY THE END OF THE PROJECT. TREES SHALL NOT BE REMOVED UNLESS APPROVED BY THE OWNER AND THE AHJ. TREES AND PLANTS SHALL BE PROPERLY CARED FOR DURING CONSTRUCTION TO ALLOW FOR RE-PLANTING. REFER TO CIVIL DRAWINGS AS APPLICABLE.
3. RIGID POLYVINYL CHLORIDE CONDUIT (PVC) SHALL BE PERMITTED FOR DIRECT BURIAL AND BELOW GRADE APPLICATIONS IN ACCORDANCE WITH ARTICLE OF 352 OF THE NATIONAL ELECTRICAL CODE. SCHEDULE 80 SHALL BE USED IN EXTERIOR DIRECT BURIAL APPLICATIONS. SCHEDULE 40 SHALL BE PERMITTED FOR APPLICATIONS IN CONCRETE ENCASED DUCTBANK AND BURIAL BENEATH A BUILDING SLAB.
4. WATERPROOF AND CORROSION RESISTANT SEALING COMPOUNDS ARE REQUIRED.
5. TRANSITION TO GALVANIZED RMC HALF-LAP WRAPPED WITH PVC TAPE BEFORE TRANSITION FROM UNDERGROUND TO ABOVE GROUND. GALVANIZED RMC SHALL BE PROVIDED FROM A MINIMUM OF 5' OUTSIDE THE BUILDING FOUNDATION TO THE TERMINATION WITHIN THE BUILDING.
6. SEAL CONDUITS AT BUILDING ENTRANCES AND OUTDOOR TERMINATIONS WITH A SUITABLE NON-HARDENING COMPOUND. A LINK SEAL OR PIPE WRAPPING SEAL SHALL BE USED AT ALL LOCATIONS WHERE METALLIC CONDUIT DIRECTLY CONTACTS CONCRETE.
7. CONDUITS SHALL BE INSTALLED NO LESS THAN 12" FROM OTHER UTILITY SYSTEMS AND SHALL BE INSTALLED ABOVE EXISTING WATER, SEWER, ETC. LINES. A MINIMUM OF 3' BURIAL DEPTH SHALL APPLY UNLESS OTHERWISE APPROVED. A MINIMUM OF 24" UNDER A BUILDING SLAB IS PERMITTED.
8. PROVIDE DETECTABLE WARNING TAPE AT HALF OF THE DEPTH WITH RED COLOR FOR POWER OR ORANGE COLOR FOR DATA.
9. PULLBOX AND COVER MATERIAL SHALL BE WEATHERPROOF, NON-SKID WITH CORROSION AND TAMPER RESISTANT HARDWARE. COVER SHALL HAVE MOLDED LETTERING PER TRADED WITH RECESSED HOOK EYES. PULLBOXES SHALL COMPLY WITH ANSI 77 TIER 22 LOADING. PROVIDE PULLING IRONS 0.875" DIAMETER GALVANIZED STEEL BAR WITH EXPOSED TRIANGULAR-SHAPED OPENING. PULLBOX SHALL HAVE OPEN BOTTOM. POLYMER CONCRETE PULLBOXES SHALL BE MOLDED OF SAND, AGGREGATE, AND POLYMER RESIN, AND REINFORCED WITH STEEL OR FIBERGLASS.
10. PULLBOXES SHALL BE INSTALLED ON 12" THICK LEVEL BED OF 90% COMPACTED GRANULAR FILL, WELL GRADED FROM 1" SIEVE TO #4 SIEVE. GRANULAR FILL SHALL BE COMPACTED WITH A MINIMUM OF FOUR PASSES WITH A PLATE COMPACTOR.
11. ELECTRICAL DUCTS SHALL BE SLOPED TO DRAIN TOWARDS PULLBOXES AND AWAY FROM EQUIPMENT. PITCH NO LESS THAT 4" PER 100'.
12. CONDUITS SHALL NOT BE INSTALLED UNDER ROADWAYS OR PAVED SURFACES UNLESS DUCTBANK OR BORING DETAILS ARE PROVIDED AT SPECIFIC LOCATIONS.
13. NO WORK SHALL BE PERFORMED WITH NEW OR EXISTING MANHOLES UNLESS DETAILS AND DETAILED REQUIREMENTS ARE SPECIFICALLY ON THE DRAWINGS.
14. UPON INSTALLATION OF CONDUITS, A FLEXIBLE MANDREL WITH A MINIMUM DIAMETER OF 1/2" LESS THAN THE INSIDE DIAMETER OF THE CONDUIT SHALL BE TESTED FOR OUT OF ROUND CONDITIONS. OUT OF ROUND CONDITIONS SHALL BE REPLACED TO THE SATISFACTION OF THE ENGINEER AT NO COST TO THE OWNER. A BRUSH WITH STIFF BRISTLES AND A DIAMETER SLIGHTLY LARGER THAN THE CONDUIT SHALL BE PULLED THROUGH EACH DUCT TO REMOVE THE LOOSENED PARTICLES.

260553 - ELECTRICAL IDENTIFICATION

1. COORDINATE IDENTIFICATION NAMES, COLORS, AND OTHER FEATURES WITH REQUIREMENTS IN THE CONTRACT DOCUMENTS, AND WITH THOSE REQUIRED BY CODES. USE CONSISTENT DESIGNATIONS THROUGHOUT PROJECT. MATCH EXISTING OWNER STANDARDS WHERE APPLICABLE.
2. CONDUCTOR IDENTIFICATION MATERIALS: COLORED TAPE: VINYL, SELF-ADHESIVE TYPE.
3. WIRING DEVICE WALL PLATE LABELS: MACHINE-PRINTED, ADHESIVE TAPE LABEL, CLEAR WITH BLACK LETTERS.
   A. RECEPTACLE WALL PLATES: LIST PANEL AND BRANCH CIRCUIT NUMBER. WHERE SERVED FROM A GFCI CIRCUIT BREAKER, INDICATE LETTER “G” AT THE END OF THE CIRCUIT NUMBER DESIGNATION.
   B. LIGHT SWITCH WALL PLATES: WHERE TWO OR MORE SWITCHES ARE GANGED TOGETHER, PROVIDE DESCRIPTION OF AREA OR FUNCTION FOR EACH SWITCH.
4. EQUIPMENT IDENTIFICATION LABELS: ENGRAVED OR MELAMINE LABEL: ADHESIVE BACKED, WITH WHITE OR BLACK LETTERS ON A COLORED BACKGROUND. MINIMUM LETTER HEIGHT SHALL BE 3/8 INCH.
   A. BACKGROUND COLOR: MATCH OWNER’S STANDARD.
   B. MECHANICAL EQUIPMENT: PROVIDE LABEL INDICATING EQUIPMENT NAME AS WELL AS PANEL NAME AND CIRCUIT NUMBER FEEDING THE EQUIPMENT. LOCATE ON EQUIPMENT DISCONNECT. LOCATE LABEL WITHIN SITE OF THE EQUIPMENT.
   C. PANELBOARDS, SWITCHBOARDS, SWITCHGEAR, TRANSFER SWITCHES, ENCLOSED CIRCUIT BREAKERS, AND MOTOR CONTROL CENTERS: LABEL SHALL IDENTIFY EQUIPMENT NAME, SYSTEM BRANCH, VOLTAGE, AND SOURCE “FED FROM”.
   D. TRANSFORMERS: LABEL SHALL IDENTIFY EQUIPMENT NAME, SYSTEM BRANCH, AND SOURCE “FED FROM”.
5. EXISTING PANELBOARD DIRECTORIES: PROVIDE UPDATED-TYPED CIRCUIT DIRECTORIES FOR EXISTING PANELS AFFECTED. EXISTING DISTRIBUTION PANELS, SWITCHBOARDS, AND MOTOR CONTROL CENTERS SHALL INCLUDE ENGRAVED LABELS AT CIRCUIT BREAKERS.
6. LABEL JUNCTION BOX COVERS LOCATED ABOVE ACCESSIBLE CEILINGS OR IN UNFINISHED SPACES WITH BLACK PERMANENT INK MARKER INDICATING PANEL AND CIRCUIT NUMBER, OR EQUIVALENT SYSTEM INFORMATION. PROVIDE LABELING OF SYSTEM NAME ON COVERS FOR SYSTEMS ENCLOSED IN CONDUIT. FOR EXAMPLE “NURSE CALL” LABEL COVER NURSE CALL. WHERE CONDUIT IS EXPOSED AND PAINTED, PROVIDE LABEL ON INSIDE OF JUNCTION BOX COVER. [IN ADDITION TO LABELING, PAINT JUNCTION BOX COVERS.] REFER TO RACEWAY AND BOXES FOR ELECTRICAL SPECIFICATION FOR COLOR CODE.
7. FIRE/SMOKE BARRIER PENETRATION LABELING: AFFIX LABEL AT EVERY RATED FIRE/SMOKE BARRIER PENETRATED WITH ELECTRICAL SYSTEMS, CONDUIT, AND SYSTEMS PATHWAYS.
8. CONDUCTOR COLOR-CODING FOR PHASE IDENTIFICATION. COLOR SHALL BE FACTORY APPLIED:
   a. COLORS FOR 208/120V CIRCUITS:
      • PHASE A: BLACK.
      • PHASE B: RED.
      • PHASE C: BLUE.
      • NEUTRAL: WHITE.
      • GROUND - GREEN
   b. COLORS FOR 480/277V CIRCUITS:
      • PHASE A: BROWN.
      • PHASE B: ORANGE.
      • PHASE C: YELLOW.
      • NEUTRAL: GRAY.
      • GROUND - GREEN
   c. WIRING FOR CONTROL SYSTEMS SHALL BE COLOR CODED IN ACCORDANCE WITH THE WIRING DIAGRAMS FURNISHED WITH THE EQUIPMENT.
   d. CONDUCTORS NO. 2 AWG AND SMALLER SHALL BE FACTORY COLOR CODED. WIRE NO. 1 AWG AND LARGER MAY BE COLOR CODED BY FIELD PAINTING OR COLOR TAPING A 6 INCH LENGTH OF THE EXPOSED END.
   e. NEUTRAL IDENTIFICATION: WHERE INDIVIDUAL (DEDICATED) NEUTRAL CONDUCTORS ARE REQUIRED FOR SINGLE-PHASE 120 VOLT AND 277 VOLT BRANCH CIRCUITS, NEUTRAL CONDUCTOR SHALL HAVE FACTORY APPLIED COLOR STRIPE (TRACER) ALONG THE LENGTH OF THE CONDUCTOR, WITH TRACER COLOR TO MATCH ASSOCIATED PHASE CONDUCTOR.

262416 - PANELBOARDS

1. PROVIDE PRODUCT DATA FOR EACH TYPE OF PANELBOARD. INCLUDE DIMENSIONS AND MANUFACTURERS' TECHNICAL DATA ON FEATURES, PERFORMANCE, ELECTRICAL CHARACTERISTICS, RATINGS, AND FINISHES.
2. OBTAIN PANELBOARDS, OVERCURRENT PROTECTIVE DEVICES, COMPONENTS, AND ACCESSORIES FROM SINGLE SOURCE FROM SINGLE MANUFACTURER. PROVIDE BY ONE OF THE FOLLOWING MANUFACTURERS: EATON, GE, SIEMENS, OR SQUARE D.
3. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES ARE LISTED AND LABELED AS DEFINED IN NFPA 70 BY A QUALIFIED TESTING AGENCY, AND MARKED FOR INTENDED LOCATION AND APPLICATION. COMPLY WITH NEMA PB 1, NECA-407, AND NFPA 70.
4. COORDINATE LAYOUT AND INSTALLATION OF PANELBOARDS AND COMPONENTS WITH OTHER CONSTRUCTION THAT PENETRATES WALLS OR IS SUPPORTED BY THEM. COORDINATE INSTALLATION OF FLUSH MOUNTED PANELBOARDS WITH ARCHITECTURAL WALL DEPTHS. MAINTAIN REQUIRED WORKSPACE CLEARANCES, DEDICATED ELECTRICAL SPACE, AND REQUIRED CLEARANCES FOR EQUIPMENT ACCESS DOORS AND PANELS.
5. ENCLOSURES SHALL BE RATED FOR ENVIRONMENTAL CONDITIONS AT INSTALLED LOCATION. INDOOR DRY AND CLEAN LOCATIONS SHALL BE RATED FOR NEMA 250, TYPE 1. OUTDOOR LOCATIONS SHALL BE RATED FOR NEMA 250, TYPE 3R. DISTRIBUTION PANELBOARDS SHALL HAVE A SECURED DOOR WITH VAULT-TYPE LATCH WITH TUMBLER LOCK; KEYED ALIKE. PROVIDE DIRECTORY CARD INSIDE PANELBOARD DOOR MOUNTED IN METAL FRAME WITH TRANSPARENT PROTECTIVE COVER. COORDINATE FLUSH AND SURFACE MOUNTING TYPES AS SCHEDULED OR AS REQUIRED TO ACCOMMODATE CONSTRUCTION.
6. PHASE, NEUTRAL, AND GROUND BUSES SHALL BE OF HARD-DRAWN COPPER, 98 PERCENT CONDUCTIVITY MATERIAL. EQUIPMENT GROUND BUS SHALL BE ADEQUATE FOR FEEDER AND BRANCH-CIRCUIT EQUIPMENT GROUNDING CONDUCTORS; BONDED TO BOX.
7. WHERE UTILIZED AS SERVICE EQUIPMENT, PROVIDE WITH NRTL LABELED FOR USE AS SERVICE EQUIPMENT.
8. PANELBOARDS SHALL BE FULLY RATED TO INTERRUPT SYMMETRICAL SHORT-CIRCUIT CURRENT AVAILABLE AT TERMINALS. SERIES-RATINGS ARE NOT ACCEPTABLE
9. DISTRIBUTION PANELBOARDS SHALL COMPLY WITH NEMA PB 1, POWER AND FEEDER DISTRIBUTION TYPE. PROVIDE BOLT-ON CIRCUIT BREAKERS FOR BRANCH OVERCURRENT PROTECTIVE DEVICES FOR CIRCUIT BREAKER FRAME SIZES 125 A AND SMALLER. PROVIDE BOLT-ON CIRCUIT BREAKERS OR PLUG-IN CIRCUIT BREAKERS WHERE INDIVIDUAL POSITIVE-LOCKING DEVICE REQUIRES MECHANICAL RELEASE FOR REMOVAL FOR BRANCH OVERCURRENT PROTECTIVE DEVICES FOR CIRCUIT BREAKER FRAME SIZES LARGER THAN 125 A.
10. PROVIDE LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS THAT COMPLY WITH NEMA PB 1, LIGHTING AND APPLIANCE BRANCH-CIRCUIT TYPE. PROVIDE BOLT-ON CIRCUIT BREAKERS, REPLACEABLE WITHOUT DISTURBING ADJACENT UNITS, FOR BRANCH OVERCURRENT PROTECTIVE DEVICES.
11. PROVIDE MOLDED-CASE CIRCUIT BREAKER (MCCB) THAT COMPLY WITH UL 489, WITH INTERRUPTING CAPACITY TO MEET AVAILABLE FAULT CURRENTS.
12. PROVIDE THERMAL-MAGNETIC CIRCUIT BREAKERS WITH INVERSE TIME-CURRENT ELEMENT FOR LOW-LEVEL OVERLOADS AND INSTANTANEOUS MAGNETIC TRIP ELEMENT FOR SHORT CIRCUITS. PROVIDE ADJUSTABLE MAGNETIC TRIP SETTING FOR CIRCUIT-BREAKER FRAME SIZES 250A AND LARGER.
13. PROVIDE ADJUSTABLE INSTANTANEOUS-TRIP CIRCUIT BREAKERS WITH MAGNETIC TRIP ELEMENT WITH FRONT-MOUNTED, FIELD-ADJUSTABLE TRIP SETTING.
14. PROVIDE GFCI CIRCUIT BREAKERS WITH SINGLE AND TWO-POLE CONFIGURATIONS.
15. PROVIDE A TYPED DIRECTORY TO INDICATE INSTALLED CIRCUIT LOADS INCORPORATING OWNER'S FINAL ROOM DESIGNATIONS. LABEL EACH PANELBOARD WITH A NAMEPLATE IDENTIFYING EQUIPMENT NAME, BRANCH, VOLTAGE, AND SOURCE "FED FROM". LABEL EACH BRANCH CIRCUIT DEVICE IN DISTRIBUTION PANELBOARDS WITH A NAMEPLATE. NAMEPLATE SHALL BE ENGRAVED OR MELAMINE LABEL, ADHESIVE-BACKED WITH WHITE LETTERS ON A BLACK BACKGROUND. MINIMUM LETTER HEIGHT SHALL BE 3/8" INCH.
16. INSTALL SPARE CONDUITS CONCEALED IN WALL TO FLUSH MOUNT PANELBOARDS FOR FUTURE BRANCH CIRCUITING SERVED FROM PANELBOARD.
17. PROVIDE [INTEGRAL] [EXTERNAL] SPD LISTED TO UL 1499, THIRD EDITION OR MOST RECENT EDITION ON ALL LIFE SAFETY AND EMERGENCY PANELBOARDS, AS WELL AS ALL OTHER LOCATIONS INDICATED ON PLANS, WITH THE FOLLOWING RATINGS:
   A. SHORT CIRCUIT CURRENT RATING (SCCR): 200 KA
   B. NOMINAL DISCHARGE CURRENT (In): 20 KA
   C. PEAK SINGLE-IMPULSE SURGE CURRENT RATING FOR SERVICE ENTRANCE EQUIPMENT: 150 KA PER MODE, 300 KA PER PHASE
   D. PEAK SINGLE-IMPULSE SURGE CURRENT RATING FOR PANELBOARDS: 50 KA PER MODE, 100 KA PER PHASE
   E. VOLTAGE PROTECTION RATING (VPR): [1200 V FOR 480Y/277V] [AND] [700V FOR 208Y/120V]
   F. PROTECTION MODES: LINE TO LINE, LINE TO NEUTRAL, LINE TO GROUND, AND NEUTRAL TO GROUND
18. PANELBOARD SHALL BE CONVERTIBLE TO ADD FEED THROUGH LUGS, SUB-FEED BREAKERS, OR MAIN BREAKERS IN THE FUTURE.
19. PANELBOARD COVERS SHALL BE HINGED TO ALLOW KEYED ACCESS TO PANEL INTERIOR.
20. CIRCUIT BREAKERS WITH FRAME SIZES 400A AND SMALLER SHALL BE CURRENT-LIMITING.
21. CIRCUIT BREAKERS SHALL HAVE READILY VISIBLE LABELS LISTING THE TYPE AND ALL RATINGS

262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1. PROVIDE SPARE FUSES EQUAL TO 10% OF QUANTITY INSTALLED BUT NO FEWER THAN THREE OF EACH SIZE AND TYPE TO MAINTENANCE DEPARTMENT OR MOUNTED NEAR NEW DISCONNECT.
2. DISCONNECT SWITCHES SHALL BE TYPE HD UNLESS THEY ARE REQUIRED TO BE MOTOR-RATED.
3. FUSIBLE DISCONNECTS SHALL BE PROVIDED WITH CLASS R REJECTION CLIPS.
4. CIRCUIT BREAKERS SHALL BE MOLDED-CASE, THERMAL-MAGNETIC TYPE, WITH INTERRUPTING CAPACITY TO MEET AVAILABLE FAULT CURRENTS. CIRCUIT BREAKERS RATED LARGER THAN 250A SHALL HAVE AN ELECTRONIC TRIP UNIT WITH ADJUSTABLE L-S-I SETTINGS UNLESS THEY ARE SERVED BY A 208V SECONDARY TRANSFORMER RATED LESS THAN 125kVA.
5. ENCLOSURES: NEMA TYPE SUITABLE FOR THE SURROUNDING AREA AND CONDITIONS.
6. MANUFACTURER OF SWITCHES AND CIRCUIT BREAKERS SHALL BE SAME AS PANELBOARDS AND TRANSFORMERS.

EQUIPMENT ELECTRICAL SCHEDULE

ROOFTOP EQUIPMENT		VOLTS	POLE	CIRCUIT BREAKER	HP	DISCONNECT SIZE	DISCONNECT FUSE SIZE	REMARKS
LABEL	NAME							
RTU -1	ROOF TOP UNIT #1 FANS & HTR	460V	3	15A		30A	10A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 3/4" C.
	ROOF TOP UNIT #1 COOLING	460V	3	20A		30A	20A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 3/4" C.
RTU-2	ROOF TOP UNIT #2 FANS & HTR	460V	3	15A		30A	15A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 3/4" C.
	ROOF TOP UNIT #2 COOLING	460V	3	40A		60A	40A	PROVIDE (3) #8 AWG CU, (1) #10 AWG CU GRND, IN 3/4" C.
RTU-3	ROOF TOP UNIT #3 FANS & HTR	460V	3	15A		30A	15A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 3/4" C.
	ROOF TOP UNIT #3 COOLING	460V	3	40A		60A	40A	PROVIDE (3) #8 AWG CU, (1) #10 AWG CU GRND, IN 3/4" C.
RTU-4	ROOF TOP UNIT #4 FANS & HTR	460V	3	20A		30A	20A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 3/4" C.
	ROOF TOP UNIT #4 COOLING	460V	3	40A		60A	40A	PROVIDE (3) #8 AWG CU, (1) #10 AWG CU GRND, IN 3/4" C.
RTU-5	(NOT USED)	-	-	-	-	-	-	-
RTU-6	ROOF TOP UNIT #6 FANS & HTR	460V	3	15A		30A	15A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 1/2" C.
-	ROOF TOP UNIT #6 COOLING	460V	3	30A		30A	30A	PROVIDE (3) #10 AWG CU, (1) #10 AWG CU GRND, IN 3/4" C.
RTU-7A	ROOF TOP UNIT #7A FANS & HTR	460V	3	15A		30A	15A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 1/2" C.
RTU-7B	ROOF TOP UNIT #7B FAMS & HTR	460V	3	15A		30A	15A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 1/2" C.
RTU-8	ROOF TOP UNIT #8 FANS & HTR	460V	3	15A		30A	15A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 1/2" C.
	ROOF TOP UNIT #8 COOLING	460V	3	50A		60A	50A	PROVIDE (3) #6 AWG CU, (1) #10 AWG CU GRND, IN 1" C.
RTU-9	ROOF TOP UNIT #9 FANS & HTR	460V	3	20A		30A	20A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 3/4" C.
	ROOF TOP UNIT #9 COOLING	460V	3	40A		60A	40A	PROVIDE (3) #8 AWG CU, (1) #10 AWG CU GRND, IN 3/4" C.
RTU-10	ROOF TOP UNIT #10 FANS & HTR	460V	3	15A		30A	15A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 3/4" C.
	ROOF TOP UNIT #10 COOLING	460V	3	40A		60A	40A	PROVIDE (3) #8 AWG CU, (1) #10 AWG CU GRND, IN 3/4" C.
RTU-11	ROOF TOP UNIT #11 FANS & HTR	460V	3	20A		30A	20A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 3/4" C.
	ROOF TOP UNIT #11 COOLING	460V	3	40A		60A	40A	PROVIDE (3) #8 AWG CU, (1) #10 AWG CU GRND, IN 3/4" C.
RTU-12	ROOF TOP UNIT #12 FANS & HTR	460V	3	15A		30A	15A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 3/4" C.
	ROOF TOP UNIT #12 COOLING	460V	3	40A		60A	40A	PROVIDE (3) #8 AWG CU, (1) #10 AWG CU GRND, IN 3/4" C.
RTU-13	ROOF TOP UNIT #13 FANS & HTR	460V	3	20A		30A	20A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 3/4" C.
	ROOF TOP UNIT #13 COOLING	460V	3	40A		60A	40A	PROVIDE (3) #8 AWG CU, (1) #10 AWG CU GRND, IN 3/4" C.
RTU-14	ROOF TOP UNIT #14 FANS & HTR	460V	3	15A		30A	10A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 3/4" C.
	ROOF TOP UNIT #14 COOLING	460V	3	20A		30A	20A	PROVIDE (3) #12 AWG CU, (1) #12 AWG CU GRND, IN 3/4" C.

NOTES:

1. REUSE ALL EXISTING DISCONNECTS, CONDUCTORS, AND CONDUIT WHERE APPLICABLE. IF NEW DISCONNECT, CONDUCTORS, OR CONDUIT IS NEEDED, PROVIDE AS SHOWN IN THIS SCHEDULE.
2. CONDUCTOR AND CONDUIT SIZES SHOWN ARE SPECIFIED ONLY FOR USE WHERE REPLACEMENTS ARE NEEDED, OR EXISTING MATERIALS ARE NOT PROPERLY SIZED FOR NEW LOADS.
3. SEE MECHANICAL EQUIPMENT SCHEDULES FOR ADDITIONAL INFORMATION. COORDINATE ELECTRICAL REQUIREMENTS WITH MECHANICAL CONTRACTOR AND MANUFACTURER'S SPECIFICATIONS.

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ELECTRICAL SPECS & EQUIPMENT SCHEDULE

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