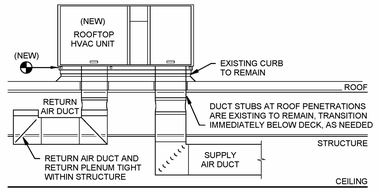
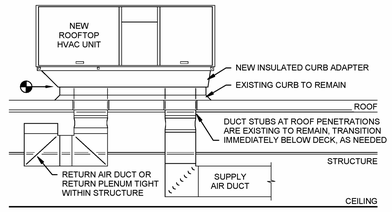


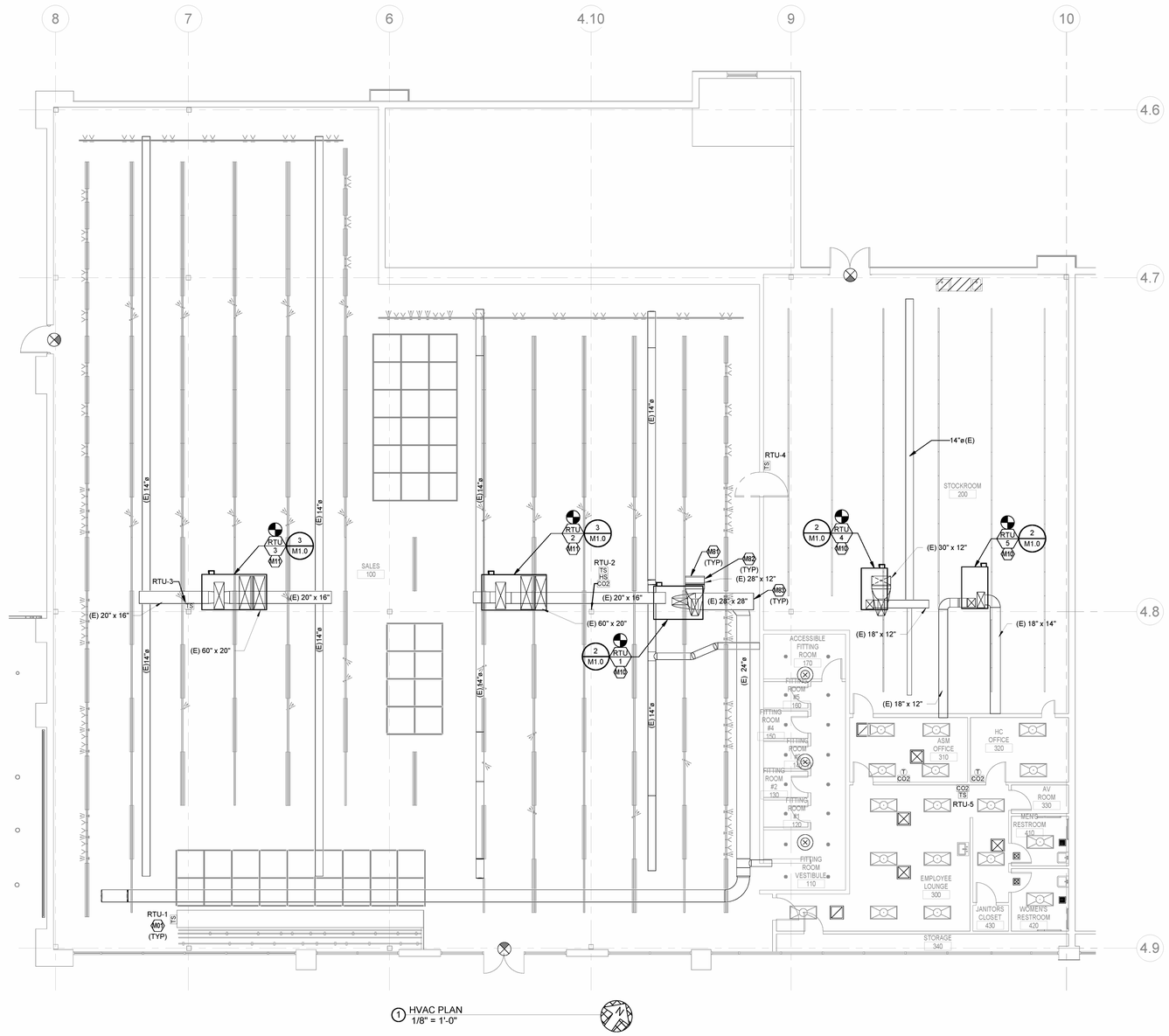
NOTES:
1. COORDINATE EXISITING CURB AND ROOF PENETRATION DIMENSIONS. REFER TO PLANS FOR DUCT SIZES AND TRANSITION AS REQUIRED IN ROOF CURB TO RTU SUPPLY AND RETURN OPENINGS.

② ROOFTOP UNIT - EXISTING CURB DETAIL
NTS



NOTES:
1. CURB ADAPTER SHALL INCLUDE ALL REQUIRED SUPPLY AND RETURN DUCT TRANSITIONS TO ENABLE THE NEW ROOFTOP TO BE INSTALLED WITHOUT NECESSITATING DUCT MODIFICATIONS BELOW THE ROOF.
2. INSTALL ADAPTER CURB AND ROOFTOP UNIT IN A MANNER THAT ENSURES A WEATHER TIGHT INSTALLATION.

③ ROOFTOP UNIT - CURB ADAPTER DETAIL
NTS



① HVAC PLAN
1/8" = 1'-0"

KEYNOTES ARE PROTOTYPICAL. MISSING KEYNOTE NUMBERS INDICATE A PROTOTYPICAL NOTE IS NOT USED OR REMOVED.

MECHANICAL PLAN NOTES

M01 ALL THERMOSTATS AND SENSORS ARE EXISTING TO REMAIN. FIELD-VERIFY DEVICE OPERATION AND IF NECESSARY, COORDINATE REPLACEMENTS WITH EMS VENDOR PRIOR TO CONSTRUCTION. NEW DEVICES SHALL BE FURNISHED BY EMS VENDOR AND INSTALLED BY DIVISION 26, UNLESS NOTED OTHERWISE.

M10 PROVIDE NEW ROOFTOP UNIT AS SCHEDULED ON EXISTING CURB. PROVIDE A NEW SET OF MERV 13 AIR FILTERS IN UNIT BEFORE TURNING SYSTEM OVER TO OWNER.

M11 PROVIDE NEW ROOFTOP UNIT AS SCHEDULED WITH CURB ADAPTER ON EXISTING CURB. PROVIDE A NEW SET OF MERV 13 AIR FILTERS IN UNIT BEFORE TURNING SYSTEM OVER TO OWNER.

M81 DUCT MOUNTED SMOKE DETECTORS ARE EXISTING AND SHALL REMAIN. SMOKE DETECTORS SHALL SHUT-DOWN UNIT UPON ALARM. VERIFY SMOKE DETECTORS ARE OPERATIONAL AND COORDINATE REPLACEMENT WITH DIVISION 28 AS NECESSARY.

M82 RETURN AIR DUCTWORK IS EXISTING AND SHALL REMAIN UNLESS NOTED OTHERWISE. CLEAN EXISTING RETURN AIR DUCTWORK AND GRILLES AT COMPLETION OF CONSTRUCTION.

M83 SUPPLY AIR DUCTWORK IS EXISTING AND SHALL REMAIN UNLESS NOTED OTHERWISE. CLEAN EXISTING SUPPLY AIR DUCTWORK AND REGISTERS AT COMPLETION OF CONSTRUCTION.

THE DUCTWORK LAYOUT INDICATED ON THE DRAWINGS IS SCHEMATIC AND SHOWS DESIGNED INTENT ONLY. PRIOR TO FABRICATION AND INSTALLATION OF DUCTWORK, DIVISION 23 SHALL HAVE A QUALIFIED, EXPERIENCED SKETCHER PREPARE AND SUBMIT SHEET METAL SHOP DRAWINGS. SHOP DRAWINGS SHALL TAKE INTO ACCOUNT ALL EXISTING CONDITIONS, INCLUDING BUT NOT LIMITED TO, STRUCTURAL MEMBERS, CONDUITS AND PIPING TO REMAIN. SHOP DRAWINGS SHALL ALSO TAKE INTO ACCOUNT ALL NEW DESIGN CONDITIONS, INCLUDING BUT NOT LIMITED TO, STRUCTURAL MEMBERS, PIPING, CEILINGS, SOFFIT HEIGHTS, AND LIGHT FIXTURES.

SHOP DRAWINGS SHALL INDICATE ALL REVISIONS TO THE LAYOUT REQUIRED TO ACCOMMODATE THE EXISTING CONDITIONS AND/OR MAINTAIN THE CEILING HEIGHTS AND CLEARANCES REQUIRED. NOTIFY THE ARCHITECT AND ENGINEER OF ANY LOCATION WHERE THE DESIGN INTENT CANNOT BE MET PRIOR TO FABRICATION AND INSTALLATION OF DUCTWORK. REVISIONS TO DUCTWORK, EQUIPMENT, CONDUIT AND/OR PIPING REQUIRED BY CONTRACTOR'S FAILURE TO SUBMIT PROPERLY PREPARED SHOP DRAWINGS SHALL BE THE RESPONSIBILITY OF DIVISION 23 AT NO ADDITIONAL COST TO THE CLIENT OR DELAY TO THE PROJECT SCHEDULE.

GENERAL CONTRACTOR IS RESPONSIBLE FOR PROVIDING TO ARCHITECT, ENGINEER, LANDLORD, AND BUILDING OFFICIAL/INSPECTOR A FINAL TEST AND BALANCE REPORT PER THE SPECIFICATIONS. PROVIDE TEST AND BALANCE REPORT TO ARCHITECT, ENGINEER, AND LANDLORD PRIOR TO THE FINAL BUILDING INSPECTION.

LANDLORD REQUIREMENTS:
LANDLORD APPROVED ROOFING CONTRACTOR SHALL BE RESPONSIBLE FOR MAKING ALL CUTS THROUGH THE EXISTING ROOF, MODIFYING EXISTING OPENINGS, AND/OR ALTERING CURB FLASHING AT GENERAL CONTRACTOR'S EXPENSE. COORDINATE WITH GENERAL CONTRACTOR.

EMS CONTROLS:
CONTRACTORS ARE RESPONSIBLE FOR COORDINATING ALL EQUIPMENT CONTROLS WITH EMS VENDOR PRIOR TO PURCHASE AND INSTALLATION. CONTRACTORS SHALL COORDINATE WITH EMS VENDOR TO PROVIDE ALL NECESSARY EQUIPMENT AND ACCESSORIES FOR A FULLY FUNCTIONING SYSTEM.

TEMPERATURE CONTROLS:
EMS VENDOR SHALL FURNISH SENSORS AND CONTROL COMPONENTS AS INDICATED ON PLANS AND AS NECESSARY TO ACCOMPLISH THE INTENT OF THE DRAWINGS. ALL CONTROLS SHALL BE TIED INTO THE EMS SYSTEM UNLESS NOTED OTHERWISE.

GENERAL CONTRACTOR SHALL INSTALL CARRIER FURNISHED TEMPORARY THERMOSTATS AND FEED THE WIRING DOWN INTO THE SPACE FOR START UP AND CONTROL OF RTU(S) UNTIL THE EMS SYSTEM IS OPERABLE. REFER TO M3.0 FOR CARRIER CONTACT INFORMATION.

INSTALL DUCTWORK AND PIPING AS TIGHT TO STRUCTURE AS POSSIBLE. COORDINATE WITH OTHER TRADES TO AVOID CONFLICTS. COORDINATE INSTALLATION OF DUCTWORK AND PIPING TO AVOID CONFLICTS WITH ELECTRICAL PANELS, LIGHTING FIXTURES, ETC. DO NOT INSTALL DUCTWORK BELOW THE BOTTOM OF THE LIGHT FIXTURES.

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brr

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Stamp:

PROFESSIONAL ENGINEER
I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

NAME: GRANT CAMPBELL
LICENSE #: 60506
SIGNATURE:
DATE: 03/03/2025

Issued For:
BID/PERMIT

Issue Date:
01/20/2025

Revisions:

NO.	REASON	DATE
1	REV 1	03/03/25

PROJECT MANAGER:
HEI
CHECKED BY:
HEI
DRAWN BY:
HEI

Project Number:
62301542

Sheet Title:
MECHANICAL PLAN AND DETAILS

Sheet Number:
M1.0

GRANT T. CAMPBELL

ROOFTOP UNIT (DX COOLING, ELEC HEAT) CONTROL MATRIX

CONTROL FEATURE	UNITS	RTU-1 SETPOINT OR Y/N	RTU-2 SETPOINT OR Y/N	RTU-3 SETPOINT OR Y/N	RTU-4 SETPOINT OR Y/N	RTU-5 SETPOINT OR Y/N	POINT TYPE INTERFACE WITH DDC (READ/WRITE)	NOTES
BUILDING AUTOMATION SYSTEM (BAS)								
ENERGY MANAGEMENT SYSTEM INTERFACE		Y	Y	Y	Y	Y	BACNET	A
SETPOINTS								
COOLING - EFFECTIVE OCCUPIED COOLING SETPOINT	°F	74	74	74	74	74	READ/WRITE	
COOLING - EFFECTIVE UNOCCUPIED COOLING SETPOINT	°F	79	79	79	79	79	READ/WRITE	
COOLING - MINIMUM COOLING SUPPLY AIR TEMPERATURE (SAT) SETPOINT	°F	50	50	50	50	50	READ/WRITE	
COOLING - LOCKOUT TEMPERATURE SETPOINT	°F	55	55	55	55	55	READ/WRITE	
DEAD BAND - MINIMUM HEATING AND COOLING TEMPERATURE SETPOINT DIFFERENCE	°F	5	5	5	5	5		
HEATING - EFFECTIVE OCCUPIED HEATING SETPOINT	°F	69	69	69	69	69	READ/WRITE	
HEATING - EFFECTIVE UNOCCUPIED HEATING SETPOINT	°F	59	59	59	59	59	READ/WRITE	
HEATING - MAXIMUM HEATING SUPPLY AIR TEMPERATURE (SAT) SETPOINT	°F	120	120	120	120	120	READ/WRITE	
DEHUMIDIFICATION SETPOINT - HUMIDITY SENSOR FEEDBACK	% RH	55	55	55	N/A	N/A	READ/WRITE	
ECONOMIZER - HIGH OUTSIDE AIR TEMPERATURE (OAT) LOCKOUT SETPOINT	°F	75	75	75	75	75	READ/WRITE	
PROGRAMMED CONTROL FEATURES								
HVAC SYSTEM OCCUPIED/UNOCCUPIED MODE - EMS INTERFACE		Y	Y	Y	Y	Y	READ	A
HVAC SYSTEM OCCUPIED/UNOCCUPIED MODE - PROGRAMMABLE THERMOSTAT (TEMPORARY)		Y	Y	Y	Y	Y	READ	DIV 23
REMOTE TEMPERATURE SENSOR		Y	Y	Y	Y	Y	READ	EMS
REMOTE HUMIDITY SENSOR		Y	Y	Y	N	N	READ	EMS
REMOTE CO2 SENSOR		Y	Y	Y	Y	Y	READ	EMS
DEMAND CONTROL VENTILATION (DCV) HIGH ALARM SETPOINT - CO2 SENSOR FEEDBACK	PPM	750	750	750	N/A	N/A	READ/WRITE	M
DEMAND LIMITING SEQUENCE		Y	Y	Y	Y	Y	WRITE	R
EQUIPMENT ACCESSORIES AND CONTROL MODULES								
OUTSIDE AIR DAMPER - MOTOR OPERATED (MODULATING)		Y	Y	Y	Y	Y	READ/WRITE	M, N
INTEGRATED ECONOMIZER - DIFFERENTIAL ENTHALPY ENABLE (OA ENTHALPY < RA ENTHALPY)	BTU/LB	Y	Y	Y	Y	Y	READ/WRITE	G, H
ECONOMIZER FAULT DETECTION AND DIAGNOSTICS (FDD) SYSTEM		Y	Y	Y	Y	Y	READ	P
RELIEF - BAROMETRIC DAMPER		N	N	N	Y	Y		
RELIEF - CONSTANT VOLUME POWERED EXHAUST FAN		Y	Y	Y	N	N	READ STATUS	O, P
COOLING COIL (DX - STAGED)		Y	Y	Y	Y	Y	READ STATUS	E, F
DEHUMIDIFICATION - HOT GAS REHEAT		Y	Y	Y	N	N	READ STATUS	L
HEATING COIL (ELECTRIC)		Y	Y	Y	Y	Y	READ STATUS	J, K
SUPPLY FAN CONTROL METHOD								
ON DURING OCCUPIED HOURS		Y	Y	Y	Y	Y		B
CYCLE WITH LOADS DURING UNOCCUPIED HOURS		Y	Y	Y	Y	Y		B
UNIT START AND FAN OFF DELAY		Y	Y	Y	Y	Y		B
CONSTANT VOLUME FAN CONTROL		N	N	N	Y	Y	READ STATUS	B
VARIABLE VOLUME - 2-SPEED FAN CONTROL		Y	Y	Y	N	N	READ STATUS	C
OPTIMUM START SEQUENCE		Y	Y	Y	Y	Y		P
SAFETIES, INTERLOCKS, AND ALARMS								
SUPPLY AIR SMOKE DETECTOR - FIRE SAFETY SHUTDOWN		Y	Y	Y	Y	Y	READ	D
RETURN AIR SMOKE DETECTOR - FIRE SAFETY SHUTDOWN		Y	Y	Y	Y	Y	READ	D
LOW LIMIT FREEZESTAT - FREEZE PROTECTION SAFETY SHUTDOWN		Y	Y	Y	Y	Y	READ	D, P
SAFETY CHAIN - SAFETY SHUTDOWN		Y	Y	Y	Y	Y	READ	D
SAT ALARM - SAFETY SHUTDOWN		Y	Y	Y	Y	Y	READ	D
SPT ALARM - SAFETY SHUTDOWN		Y	Y	Y	Y	Y	READ	D
FIRE ALARM CONTROL PANEL - FIRE SAFETY SHUTDOWN INTERLOCK		Y	Y	Y	Y	Y	READ	D, P

EMS VENDOR SHALL PROVIDE CONTROL PANEL, RELAYS, THERMOSTATS, TEMPERATURE SENSORS, HUMIDTY SENSORS, AND/OR CO2 SENSORS WHERE SHOWN ON THE DRAWINGS AND AS REQUIRED TO FACILITATE THE SCHEDULED SEQUENCE OF OPERATION. EACH UNIT SHALL CONTROL BASED ON ITS OWN INTERNAL SAFETIES, TIME DELAYS, AND SEQUENCES UNLESS NOTED OTHERWISE. COORDINATE WITH OWNER FINAL BUILDING AND EQUIPMENT SCHEDULES DURING STARTUP. REFERENCE DIVISION SPECIFICATIONS FOR INDIVIDUAL DEVICE REQUIREMENTS.

NOTES:

A. EMS SHALL PROVIDE REMOTE SETPOINT ADJUSTMENT, SCHEDULING, AND MONITORING OF THE POINTS LISTED IN THE SCHEDULE FOR EACH UNIT. THE RTU SHALL BE SCHEDULED WITH A MINIMUM OF AN OCCUPIED AND UNOCCUPIED SCHEDULE. ADDITIONAL UNIT SCHEDULES SHALL BE AVAILABLE FOR REMOTE IMPLEMENTATION IF REQUIRED.

B. THE SUPPLY FAN SHALL RUN CONTINUOUSLY IN OCCUPIED MODE AND SHALL CYCLE ON AND OFF IN UNOCCUPIED MODE. A UNIT START DELAY IS USED WHEN TRANSITIONING FROM UNOCCUPIED TO OCCUPIED. FAN OFF DELAY ALLOWS THE SUPPLY FAN TO CONTINUE TO OPERATE AFTER HEATING AND COOLING STOPS.

C. VIA FACTORY VFD, THE CARRIER SYSTEMVU CONTROLLER SHALL DETERMINE FAN SPEED REQUIRED FOR HEATING AND COOLING. FACTORY VFD SHALL CONTROL TO 2 FAN SPEEDS. LOW SPEED SHALL NOT EXCEED 66% OF FULL SPEED AND SHALL DRAW NO MORE THAN 40% OF FAN POWER AT FULL SPEED. DURING FAN ONLY OR SINGLE STAGE COOLING, SUPPLY FAN SHALL OPERATE AT LOW SPEED. DURING HEATING, SECOND STAGE COOLING, DEHUMIDIFICATION OR FULL ECONOMIZER OPERATION, FAN SHALL OPERATE AT HIGH SPEED.

D. IF A LOCAL UNIT CONTROL ALARM IS ACTIVE, THE SUPPLY FAN TURNS OFF IMMEDIATELY REGARLESS OF OCCUPANY STATE OR DEMAND.

E. COOLING STAGES ARE CONTROLLED BY THE RTU OPEN COOLING CONTROL PID LOOP AND COOLING STAGES CAPACITY ALGORITHM. THEY CALCULATE THE REQUIRED NUMBER OF STAGES NEEDED TO SATISFY THE SPACE BY COMPARING THE SPACE TEMPERATURE TO THE EFFECTIVE OCCUPIED COOLING SETPOINT IN OCCUPIED MODE AND THE EFFECTIVE UNOCCUPIED COOLING SETPOINT IN UNOCCUPIED MODE. THE FOLLOWING CONDITIONS MUST BE TRUE FOR THE COOLING ALGORITHM TO OPERATE:
   - THE OUTDOOR AIR TEMPERATURE IS GREATER THAN THE COOLING LOCKOUT TEMPERATURE SETPOINT.
   - THE SUPPLY FAN HAS BEEN ON FOR AT LEAST 30 SECONDS.
   - THE UNIT HAS A VALID SUPPLY AIR TEMPERATURE INPUT.
   - THE UNIT HAS A VALID SPACE TEMPERATURE INPUT.
   - HEATING MODE IS NOT ACTIVE AND THE TIME GUARD BETWEEN MODES HAS EXPIRED.
   - ECONOMIZER IS UNAVAILABLE OR ECONOMIZER IS ACTIVE AND THE FOLLOWING ARE TRUE: (1) ECONOMIZER IS GREATER THAN 85% OPEN, (2) SUPPLY AIR TEMPERATURE IS GREATER THAN 5 DEGREES ABOVE THE MINIMUM COOLING SAT SETPOINT, AND (3) SPACE TEMPERATURE IS GREATER THAN 0.5 DEGREES ABOVE THE EFFECTIVE OCCUPIED TEMPERATURE SETPOINT.

   WHEN THE COOLING ALGORITHM PRECONDITIONS ARE MET, THE COMPRESSORS ARE ENERGIZED IN STAGES, AS APPLICABLE. ANTI-RECYCLE TIMERS ARE EMPLOYED TO PROTECT THE EQUIPMENT FROM SHORT-CYCLING. THERE ARE FIXED THREE-MINUTE MINIMUM ON-TIMES AND FIVE-MINUTE OFF-TIMES FOR EACH COMPRESSOR OUTPUT.

F. DURING COMPRESSOR OPERATION, THE RTU OPEN CONTROL LOGIC MAY REDUCE THE NUMBER OF ACTIVE STAGES IF THE SUPPLY AIR TEMPERATURE FALLS BELOW THE MINIMUM COOLING SAT SETPOINT. A COMPRESSOR STAGED OFF IN THIS FASHION MAY BE STARTED AGAIN AFTER THE NORMAL TIME-GUARD PERIOD HAS EXPIRED IF THE SUPPLY AIR TEMPERATURE HAS INCREASED ABOVE THE MINIMUM COOLING SAT SETPOINT.

G. THE SYSTEM SHALL UTILIZE THE FACTORY MODULATING ECONOMIZER FOR FREE COOLING WHEN OUTDOOR AIR CONDITIONS ARE SUITABLE. FOR THE ECONOMIZER TO OPERATE DURING OCCUPIED HOURS, THE FOLLOWING CONDITIONS MUST BE TRUE:
   - OUTDOOR AIR TEMPERATURE IS LESS THAN THE SPACE TEMPERATURE AND LESS THAN THE ECONOMIZER HIGH OAT LOCKOUT SETPOINT.
   - THE INDOOR FAN HAS BEEN ON FOR AT LEAST 30 SECONDS.
   - THE UNIT HAS A VALID SUPPLY AIR TEMPERATURE INPUT.
   - THE UNIT HAS A VALID SPACE TEMPERATURE INPUT.
   - OUTDOOR AIR ENTHALPY IS LESS THAN THE SPACE ENTHALPY. (ENTHALPY STATUS SHALL READ "LOW".)

   IF ANY OF THE PRECEDING CONDITIONS ARE NOT TRUE AND THE SUPPLY FAN IS ON HIGH SPEED, THE ECONOMIZER SHALL BE SET TO THE DCV MINIMUM OUTDOOR AIR DAMPER POSITION (TBD BY TAB CONTRACTOR). IF ANY OF THE PRECEDING CONDITIONS ARE NOT TRUE AND THE SUPPLY FAN IS ON LOW SPEED, THE ECONOMIZER SHALL BE SET TO THE LOW FAN ECONOMIZER MINIMUM DAMPER POSITION (TBD BY TAB CONTRACTOR). IF ALL OF THE PRECEDING CONDITIONS ARE TRUE, THE ECONOMIZER PID LOOP SHALL MODULATE THE DAMPER. THE ECONOMIZER POSITION SHALL BE REDUCED AS THE SUPPLY AIR TEMPERATURE FALLS TO WITHIN 5 DEGREES OF THE MINIMUM COOLING SAT SETPOINT, BUT SHALL NEVER CLOSE BELOW THE DCV MINIMUM OUTDOOR AIR DAMPER POSITION.

H. DURING UNOCCUPIED HOURS, UNOCCUPIED FREE COOLING SHALL BE ENABLED. THE ECONOMIZER SHALL REMAIN CLOSED UNLESS THE FOLLOWING CONDITIONS ARE TRUE:
   - OUTDOOR AIR TEMPERATURE IS BELOW THE ECONOMIZER HIGH OAT LOCKOUT SETPOINT.
   - OUTDOOR AIR TEMPERATURE IS LESS THAN THE SPACE TEMPERATURE
   - OUTDOOR AIR ENTHALPY IS LESS THAN THE SPACE ENTHALPY. (ENTHALPY STATUS SHALL READ "LOW".)

   IF ALL OF THE PRECEDING CONDITIONS ARE TRUE AND THE SPACE TEMPERATURE RISES 1 DEGREE ABOVE THE EFFECTIVE UNOCCUPIED COOLING SETPOINT, THE SUPPLY FAN SHALL START AND THE ECONOMIZER DAMPER SHALL OPEN AS NECESSARY TO COOL THE SPACE. THE DAMPER SHALL REMAIN OPEN UNTIL THE SPACE IS SATISFIED OR THE PRECEDING CONDITIONS ARE NO LONGER TRUE. IF ANY OF THE PRECEDING CONDITIONS ARE NOT TRUE, THE ECONOMIZER SHALL CLOSE COMPLETELY.

J. HEATING STAGES ARE CONTROLLED BY THE RTU OPEN HEATING CONTROL PID LOOP AND HEATING STAGES CAPACITY ALGORITHM. THEY CALCULATE THE REQUIRED NUMBER OF STAGES NEEDED TO SATISFY THE SPACE BY COMPARING THE SPACE TEMPERATURE TO THE EFFECTIVE OCCUPIED HEATING SETPOINT IN OCCUPIED MODE AND THE EFFECTIVE UNOCCUPIED HEATING SETPOINT IN UNOCCUPIED MODE. THE FOLLOWING CONDITIONS MUST BE TRUE FOR THE HEATING ALGORITHM TO OPERATE:
   - OUTDOOR AIR TEMPERATURE IS LESS THAN THE HEATING LOCKOUT TEMPERATURE SETPOINT.
   - THE SUPPLY FAN HAS BEEN ON FOR AT LEAST 30 SECONDS.
   - THE UNIT HAS A VALID SUPPLY AIR TEMPERATURE INPUT.
   - THE UNIT HAS A VALID SPACE TEMPERATURE INPUT.
   - COOLING MODE AND ECONOMIZER ARE NOT ACTIVE AND THE TIME GUARD BETWEEN MODES HAS EXPIRED.

   WHEN THE HEATING ALGORITHM PRECONDITIONS ARE MET, THE HEAT IS ENERGIZED IN STAGES, AS APPLICABLE. ANTI-RECYCLE TIMERS ARE EMPLOYED TO PROTECT THE EQUIPMENT FROM SHORT-CYCLING. THERE ARE FIXED ONE-MINUTE MINIMUM ON AND OFF TIMES FOR EACH HEATING OUTPUT.

K. DURING HEATING OPERATION, THE RTU OPEN CONTROL LOGIC MAY REDUCE THE NUMBER OF ACTIVE STAGES IF THE SUPPLY AIR TEMPERATURE EXCEEDS THE MAXIMUM HEATING SAT SETPOINT. A HEAT STAGE TURNED OFF IN THIS FASHION MAY BE STARTED AGAIN AFTER THE NORMAL TIME-GUARD PERIOD HAS EXPIRED IF THE SUPPLY AIR TEMPERATURE HAS DECREASED BELOW THE MAXIMUM HEATING SAT SETPOINT.

L. THE SYSTEM SHALL UTILIZE HUMIDITY SENSORS IN THE SALES AREA, STOCKROOM, AND EMPLOYEE LOUNGE. DEHUMIDIFICATION IS CONTROLLED BY THE RTU OPEN CONTROL DEHUMIDIFICATION SYSTEM. DURING OCCUPIED AND UNOCCUPIED MODE, THE FOLLOWING CONDITIONS MUST BE TRUE FOR THE DEHUMIDIFICATION SYSTEM TO OPERATE:
   - OUTDOOR AIR TEMPERATURE IS LESS THAN THE SPACE TEMPERATURE.
   - THE INDOOR FAN HAS BEEN ON FOR AT LEAST 30 SECONDS.
   - THE UNIT HAS A VALID SUPPLY AIR TEMPERATURE INPUT.
   - THE UNIT HAS A VALID SPACE TEMPERATURE INPUT.
   - THE UNIT HAS A VALID SPACE RELATIVE HUMIDITY SENSOR INPUT.
   - HEAT MODE IS NOT ACTIVE AND THE TIME GUARD BETWEEN MODES HAS EXPIRED.

   IF ALL OF THE PRECEDING CONDITIONS ARE TRUE AND ANY ZONE RISES ABOVE THE DEHUMIDIFICATION SETPOINT, THE RTU OPEN SHALL ENABLE DEHUMIDIFICATION MODE AND ENERGIZE THE HUMIDI-MIZER OUTPUT FOR ALL UNITS SERVING THAT ZONE. DEHUMIDIFICATION MODE SHALL CONTINUE UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW THE DEHUMIDIFICATION SETPOINT BY A 5% FIXED HYSTERESIS.

M. THE SYSTEM SHALL UTILIZE A CO2 SENSOR FOR THE SALES AREA, FITTING ROOM, STOCKROOM AND EACH OFFICE (HIGHEST READING WILL BE TAKEN FOR OFFICE DCV CONTROL). DCV IS CONTROLLED BY THE INDOOR AIR CO2 ALGORITHM. THE ALGORITHM CALCULATES THE CO2 MINIMUM DAMPER POSITION USING A PID LOOP. THE CALCULATED CO2 MINIMUM DAMPER POSITION IS THEN COMPARED AGAINST THE DCV MINIMUM POSITION SETPOINT AND THE GREATEST VALUE BECOMES THE FINAL MINIMUM DAMPER POSITION. DURING OCCUPIED HOURS, THE INDOOR AIR CO2 SEQUENCE SHALL BE ENABLED. THE FOLLOWING CONDITIONS MUST BE TRUE FOR THE INDOOR AIR CO2 ALGORITHM TO OPERATE:
   - THE SUPPLY FAN HAS BEEN ON FOR AT LEAST 30 SECONDS.
   - THE UNIT HAS A VALID CO2 SNESOR READING.

   IF ALL OF THE PRECEDING CONDITIONS ARE TRUE, THE FACTORY OUTDOOR AIR DAMPER SHALL MODULATE BETWEEN ITS MINIMUM (ABS. MIN. O/A) AND MAXIMUM (MIN. O/A CFM) POSITION (TBD BY TAB CONTRACTOR). THE SYSTEM SHALL START TO MODULATE THE DAMPER OPEN WHEN CO2 LEVEL RISES TO 100 PPM (ADJUSTABLE) ABOVE AMBIENT CO2 LEVEL (400 PPM) AND SHALL CONTINUE TO OPEN TO ITS MAXIMUM POSITION AS CO2 LEVEL RISES TO AND ABOVE THE DCV HIGH ALARM SETPOINT. AS THE CO2 LEVEL DROPS, THE DAMPER SHALL START TO MODULATE TO ITS MINIMUM POSITION. DURING UNOCCUPIED HOURS, THE INDOOR AIR CO2 SEQUENCE SHALL BE DISABLED.

N. EQUIPMENT MANUFACTURER SHALL PROVIDE MODULATING DAMPER AND CONTROLS CAPABLE OF ADJUSTING THE DAMPER POSITION BASED ON DEMAND CONTROL VENTILATION TO MAINTAIN THE SCHEDULED OUTSIDE AIR AS SHOWN ON THE DRAWINGS. TAB CONTRACTOR SHALL COORDINATE DAMPER POSITION SETPOINTS IN FIELD DURING TESTING AND BALANCING TO MAINTAIN MINIMUM VENTILATION WHEN NOT IN ECONOMIZER. DAMPER SHALL BE CLOSED DURING UNOCCUPIED HOURS.

O. POWERED EXHAUST FAN SHALL STAGE ON AND OFF ACCORDING TO DAMPER POSITION.

P. DEVICE SHALL BE FACTORY MOUNTED AND PRE-WIRED FOR OPERATION SUBJECT TO THE RTU OPEN CONTROLLER.

R. UPON RECEIPT OF SIGNAL TO TRIM ELECTRICAL DEMAND, THE COOLING TEMPERATURE SETPOINT SHALL RESET UP BY A MINIMUM OF 4° F (ADJ.). THE HEATING TEMPERATURE SETPOINT SHALL RESET DOWN BY A MINIMUM OF 4° F OR MORE (ADJ.)

ROOFTOP UNIT SCHEDULE (DX COOLING, ELECTRIC HEATING)

MARK	MANUFACTURER	MODEL	NOMINAL TONS	SUPPLY FAN			COOLING COIL											HEATING COIL				MIN	ABS	ELECTRICAL			WEIGHT	NOTES
				CFM	ESP (IN)	BHP	TH (MBH)	SH (MBH)	EAT (°F DB)	EAT (°F WB)	LAT (°F DB)	LAT (°F WB)	REFR TYPE	MIN EFF (EER)	MIN EFF (IEER)	MIN EFF (SEER)	MIN NO STAGES	MIN OUT (MBH)	NOM (KW)	EAT (°F DB)	LAT (°F DB)	O/A CFM	MIN O/A	V/PH	MCA	MOCP	(LBS)	
RTU-1	CARRIER	50FE-N12	10	4,000	0.7	2.3	115.4	93	75.3	62	53.1	51.7	R-454B	11.2	15.2	-	2	116.5	38.3	63	90	300	155	460/3	72	80	1026	A - X
RTU-2	CARRIER	50FE-N16	15	5,000	0.7	1.6	172	119.5	78.8	66.1	56.7	54.9	R-454B	11	14.7	-	2	209.8	61.5	46.5	85	1415	730	460/3	90	100	1553	A - X
RTU-3	CARRIER	50FE-N16	15	5,000	0.7	1.6	172	119.5	78.8	66.1	56.7	54.9	R-454B	11	14.7	-	2	209.8	61.5	46.5	85	1415	730	460/3	90	100	1553	A - X
RTU-4	CARRIER	50FE-A06	5	1,800	0.7	1.0	59.2	42.7	78	65.6	56	54.8	R-454B	-	-	14	1	77.4	22	50.2	90	425	N/A	460/3	39	40	590	A - S, W, X
RTU-5	CARRIER	50FE-A04	3	2,000	0.7	0.5	32	28.1	76.9	60.6	55.2	51	R-454B	-	-	14	1	33.7	10.6	64	90	75	N/A	460/3	19	20	506	A - S, W, X

MODEL NUMBERS AND NOMINAL TONS LISTED SHALL NOT BE CONSIDERED COMPLETE AND MATERIAL SHALL NOT BE ORDERED BY MANUFACTURER, MODEL NUMBERS, OR NOMINAL TONS ONLY. REVIEW THE COMPLETE DESCRIPTION, NOTES AND SPECIFICATIONS TO DETERMINE THE EXACT MATERIAL AND ACCESSORIES TO BE ORDERED. THE MANUFACTURERS LISTED ARE THE BASIS FOR THE DESIGN.

NOTES:

A. REFER TO ROOFTOP UNIT CONTROL MATRIX FOR CONTROL FEATURES, MODULES, AND ACCESSORIES THAT SHALL BE PROVIDED WITH THE EQUIPMENT.
B. EQUIPMENT SIZED FOR 95.9°F AMBIENT TEMPERATURE.
C. PROVIDE 2 INCH MERV 13, EFFICIENT PLEATED THROWAWAY AIR FILTERS.
D. DISCONNECT SWITCH FURNISHED BY DIVISION 23 CONTRACTOR.
E. STARTERS FOR ALL MOTORS SHALL BE FURNISHED INTEGRAL WITH UNIT.
F. PROVIDE FACTORY MOUNTED VARIABLE FREQUENCY DRIVE OR 2-SPEED MOTOR TO FACILITATE STAGED FAN SPEED CONTROL.
G. PROVIDE SHAFT GROUNDING SYSTEM ON MOTOR. REFER TO MOTOR SPECIFICATION FOR ADDITIONAL INFORMATION.
H. PROVIDE SINGLE POINT POWER CONNECTION.
J. COORDINATE SIZE OF CONDUCTOR TERMINATION LUGS WITH CONDUCTOR SIZES SHOWN ON ELECTRICAL DRAWINGS.
K. PROVIDE 125 VAC, 20 AMP DUPLEX CONVENIENCE RECEPTACLE MOUNTED TO UNIT READY FOR FIELD WIRING WITH A COVER UL LISTED FOR WET AND DAMPER LOCATIONS WHEN IN USE.
L. SPECIFIED FAN ESP ACCOUNTS FOR DUCT LOSSES EXTERNAL TO UNIT.
M. PROVIDE MOTOR HORSEPOWER TO OVERCOME INTERNAL UNIT STATIC PRESSURE DROP PLUS SPECIFIED EXTERNAL STATIC PRESSURE DROP. NOMINAL MOTOR HP SHALL BE NO LARGER THAN THE FIRST AVAILABLE NOMINAL MOTOR SIZE GREATER THAN THE REQUIRED BHP.
O. DIVISION 23 SHALL PROVIDE ROOF CURB ADAPTER FROM EXISTING CURB PENETRATION TO NEW UNIT. COORDINATE CURB ADAPTER TYPE WITH EXISTING CURB CONDITIONS AND EQUIPMENT MANUFACTURER.
P. SCHEDULED WEIGHT IS THE MAXIMUM ALLOWABLE OPERATING WEIGHT OF THE EQUIPMENT.
Q. COOLING COIL LAT IS LEAVING AIR TEMPERATURE OF COIL.
R. PROVIDE GUARDS TO PROTECT CONDENSER COIL FROM HAIL OR OTHER DAMAGE.
S. PROVIDE HEATER TO MEET OR EXCEED SCHEDULED MINIMUM MBH OUTPUT. NOMINAL KW IS BASED ON LISTED MANUFACTURER'S STANDARD PRODUCT. COORDINATE EQUIPMENT POWER SUPPLY WITH ELECTRICAL CONTRACTOR IF DIFFERENT FROM THAT SCHEDULED.
U. ABS. MIN. O/A IS THE ABSOLUTE MINIMUM OUTSIDE AIR CFM USING VENTILATION RESET OR DEMAND CONTROL VENTILATION.
W. PROVIDE UNIT WITH FACTORY INSTALLED CARRIER SYSTEMVU CONTROLLER WITH SUPPLY AND OUTSIDE AIR TEMPERATURE SENSORS. COORDINATE ALL CONTROLS WITH EMS VENDOR PRIOR TO PURCHASE.
X. PROVIDE WITH DUCT SMOKE DETECTOR WIRE HARNESS KIT FOR EMS INTERFACE. SMOKE DETECTORS SHALL SHUT DOWN UNIT UPON ALARM.

OUTSIDE AIR REQUIREMENTS, IMC-2018 (IP)

SYSTEM DESIGNATION	SYSTEM TAB NAME OR LIST 'SINGLE'	SINGLE-ZONE SYSTEMS ONLY: SINGLE-ZONE SYSTEM ASSOCIATED VENTILATION ZONE	SINGLE-ZONE SYSTEMS ONLY: SINGLE ZONE WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS [Ez]	MULTI-ZONE SYSTEMS ONLY: SYSTEM VENTILATION EFFICIENCY [Ev]	FLOOR AREA SERVED BY SYSTEM [As] (SF)	SYSTEM AVERAGED AREA-BASED OUTDOOR AIR RATE (CFM/SF)	SYSTEM POPULATION [Ps] (PEOPLE)	SYSTEM AVERAGED PEOPLE-BASED OUTDOOR AIR RATE (CFM/P)	REQUIRED OA INTAKE FLOW [Vot] (CFM)	REQUIRED DCV OA INTAKE FLOW [Vot] (CFM)	DESIGN OA INTAKE FLOW [Vot] (CFM)	NOTES
RTU-1	SINGLE ZONE	SOLAR ZONE	0.80	-	1,015	0.120	15.225	7.50	295	152	300	
RTU-2,3	MULTIZONE (RTU-2,3)	-	-	0.92	11,612	0.116	167.655	7.50	2,825	1,458	2,830	
RTU-4	SINGLE ZONE	STOCKROOM	0.80	-	2,822	0.120	0	0.00	423	423	425	
RTU-5	MULTIZONE (RTU-5)	-	-	1.00	1,059	0.049	4.295	5.00	73	52	75	
								TOTALS	3,617	2,085	3,630	

GENERAL NOTES:
1. VENTILATION CALCULATIONS BASED ON IMC-2018.
2. SYSTEM POPULATIONS BASED ON MAX SEATING AND/OR CODE MAXIMUM VALUES.
3. SINGLE ZONE SYSTEMS (Vot = Voz): SYSTEM VENTILATION EFFICIENCY CALCULATION IS NOT REQUIRED FOR SINGLE ZONE SYSTEMS. WORST CASE AIR DISTRIBUTION EFFECTIVENESS BETWEEN HEATING AND COOLING MODES OF OPERATION IS SHOWN IN TABLE.
4. MULTI-ZONE RECIRCULATING SYSTEMS: CALCULATOR USED TO DETERMINE VENTILATION AIRFLOW IN COMPLIANCE WITH IMC-2018 VRP AND ASHRAE 62.1-2016 APPENDIX A. VENTILATION RATE SHOWN IS ACTUAL CALCULATED WITH CORRECTION FACTORS INCLUDED. EACH ZONE IS CALCULATED WITH ITS WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS (HEATING/COOLING) AS PART OF CALCULATIONS TO FIND Ev.

PROJECT DESIGN CONDITIONS

CLIMATE CONDITONS

WEATHER STATION:		EAGAN, MN					
CLIMATE ZONE:		6A					
HEATING (DB):	99.6%	-10.6	°F				
DESIGN HEATING CONDITIONS (DB):		-10.6	°F				
HUMIDIFICATION (DP/ HR/ MCDB):	99.6%	-18.9	°F/	2.0	gr/lb	-9.4	°F
COOLING (DB/MCWB):	0.4%	90.9	°F	73.3	°F		
DESIGN COOLING CONDITIONS (DB/ MCWB):		81.8	°F	76.8	°F		
DEHUMIDIFICATION (DP/ HR/ MCDB):	0.4%	73.6	°F/	129.3	gr/lb	83.6	°F

BUILDING OPERATING HOURS:

MONDAY - FRIDAY	TBD BY OWNER
SATURDAY	TBD BY OWNER
SUNDAY	TBD BY OWNER
HOLIDAY	TBD BY OWNER

UNIT / SPACE DESCRIPTION	SET POINTS: COOLING / DE-HUMIDIFICATION OCC °F	UNOCC °F	MAX RH %	MIN RH %	HEATING OCC °F	HEATING UNOCC °F	HUMIDIFICATION MIN RH %	HUMIDIFICATION MAX RH %	ZONE VENTILATION RESET CONTROL METHOD	BASE PPM	MAXIMUM PPM	SPACE OPERATING HOURS OCCUPIED / UNOCCUPIED M-F	SAT	SUN	NOTES
RTU-1 SOLAR ZONE	74	79	55%	NA	69	59	NA	NA	CO2	400	750	TBD	TBD	TBD	A-D
RTU-2 SALES FLOOR	74	79	55%	NA	69	59	NA	NA	CO2	400	750	TBD	TBD	TBD	A-D
RTU-3 SALES FLOOR	74	79	55%	NA	69	59	NA	NA	CO2	400	750	TBD	TBD	TBD	A-D
RTU-4 STOCKROOM	74	79	55%	NA	69	59	NA	NA	N/A	N/A	N/A	TBD	TBD	TBD	A-D
RTU-5 BOH	74	79	55%	NA	69	59	NA	NA	NA	NA	NA	TBD	TBD	TBD	B-D

NOTES:
A. ZONE LEVEL VENTILATION RESET / DEMAND CONTROL VENTILATION (DCV) CONTROL METHOD: CARBON DIOXIDE SENSOR (CO2).
B. ZONE LEVEL SET POINT CONDITIONS SHALL BE AS SCHEDULED UNLESS OTHERWISE SCHEDULED OR NOTED ON THE DRAWINGS FOR ROOM SPECIFIC SPACE CONDITIONS.
C ZONE LEVEL OCCUPANCY HOUR SCHEDULE SHALL BE PER BUILDING OPERATING HOURS UNLESS OTHERWISE SCHEDULED.
D. ZONE LEVEL CONTROLS SHALL BE CAPABLE OF OPERATING WITH INDEPENDENT OCCUPANCY SCHEDULES.

CARRIER UNIT STARTUP REQUIREMENTS

INSTALLING CONTRACTOR SHALL COMPLETE THE PRE-START CHECKLIST AND EMAIL JENNIFER.TYE@COMFORTSYSTEMSUSA.COM TWO WEEKS PRIOR TO SCHEDULING EQUIPMENT STARTUP.

COORDINATE EQUIPMENT STARTUP WORK WITH COMFORT SYSTEMS USA
EMAIL: JENNIFER.TYE@COMFORTSYSTEMSUSA.COM, OFFICE: (317) 246-5176

DEPARTMENT MANAGER
EMAIL: KLORI.KARAMDAD@COMFORTSYSTEMSUSA.COM, OFFICE: 317-246-4656

TECHNICAL SUPPORT
EMAIL: RICK.FARRIS@COMFORTSYSTEMSUSA.COM, MOBILE: 317-638-5363 X4454

PRE-START CHECKLIST (VERIFY FOR ALL UNITS)
- ☐ VERIFY ALL ITEMS ON THE EQUIPMENT ORDER RECEIVED.
- ☐ VERIFY ALL PACKAGING MATERIAL REMOVED FROM THE UNIT.
- ☐ VERIFY CURB GASKETS PROPERLY INSTALLED.
- ☐ VERIFY ROOFTOP UNIT INSTALLED LEVEL AND PROPERLY ALIGNED WITH CURB.
- ☐ VERIFY DUCTWORK/FABRIC DUCT COMPLETELY INSTALLED PER MECHANICAL PLANS.
- ☐ VERIFY OA HOOD INSTALLED. AIR INLET SCREEN INSTALLED.
- ☐ VERIFY POWER EXHAUST ACCESSORY INSTALLED. (IF APPLICABLE)
- ☐ VERIFY CLEAN PLEATED FILTERS INSTALLED, MINIMUM MERV 8 RATING.
- ☐ VERIFY CONDENSATE DRAIN LINE INSTALLED. MINIMUM 2" DEEP TRAP. DRAIN PAN CHECK/LEVEL.
- ☐ VERIFY SUPPLY FAN ROTATES FREELY IN THE HOUSING.
- ☐ VERIFY PULLEYS ALIGNED AND BELT TENSION CORRECT.
- ☐ VERIFY SMOKE DETECTORS INSTALLED IN DUCTWORK, CLEANED AND TESTED.
- ☐ VERIFY GAS METER INSTALLED AND GAS AVAILABLE FROM THE UTILITY. GAS PIPING COMPLETED, CHECKED FOR LEAKS AND PURGED (IF APPLICABLE).
- ☐ VERIFY GAS PIPING DRIP LEG INSTALLED PROPERLY. (DOWNSTREAM OF SHUTOFF VALVE AND NO INTERFERENCE WITH ACCESS DOOR)
- ☐ VERIFY FLUE HOOD INSTALLED.
- ☐ VERIFY JOBSITE POWER SUPPLY MATCHES THE VOLTAGE ON THE UNIT DATA PLATE.
- ☐ VERIFY ELECTRIC POWER CONNECTED TO UNIT VIA THE ACCESS PROVIDED. IF NOT, DATE POWER WILL BE AVAILABLE ____________
- ☐ VERIFY NO WIRES TOUCHING REFRIGERANT LINES OR SHARP EDGES.
- ☐ VERIFY ELECTRIC CONNECTORS AND TERMINALS TIGHT.
- ☐ VERIFY THRU-THE-CURB UTILITY CONNECTIONS COMPLETE.
- ☐ VERIFY UNIT TRANSFORMER PRIMARY TAPPED FOR JOBSITE VOLTAGE.
- ☐ VERIFY VENSTAR THERMOSTAT INSTALLED IN THE RETURN AIR DUCT DROP AND WIRED FOR TEMPORARY UNIT OPERATION.

EMS INSTALLATION CHECKLIST

ITEMS ON EMS CHECK-OFF LIST MUST BE COMPLETED PRIOR TO EMS AND GBS COMMISSIONING AT THE END OF THE JOB. SOME ITEMS LISTED BELOW MAY NOT BE APPLICABLE.

COORDINATE EQUIPMENT STARTUP WORK WITH COMFORT SYSTEMS USA.
EMAIL: PAUL.SAWYER@COMFORTSYSTEMSUSA.COM
OFFICE: 317-246-5170

EMS CHECKLIST
- ☐ REVIEW EMS PRINT SET AND INSTALL EMS OPUS PANEL AND LCP AS DESCRIBED IN THE EMS PRINT SET.
- ☐ REVIEW EMS PRINT SET AND PULL ALL WIRE AND TERMINATE ON DEVICES AS DESCRIBED IN THE EMS PRINT SET.
- ☐ REVIEW EMS PRINT SET AND INSTALL ALL EMS HVAC CONTROLS AS DESCRIBED IN THE EMS PRINT SET.
- ☐ REVIEW EMS PRINT SET AND INSTALL ALL EMS LIGHTING CONTROLS AS DESCRIBED IN THE EMS PRINT SET.
- ☐ REVIEW EMS PRINT SET AND WATTSTOPPER SUBMITTAL AND INSTALL THE WATTSTOPPER LIGHTING SYSTEM AND PULL ALL WIRE AS DESCRIBED IN THE EMS PRINT SET AND WATTSTOPPER SUBMITTAL.

SEQUENCE OF OPERATIONS:

A. ROOFTOP UNIT CONTROL (RTU-X)

Refer to Rooftop Unit Control Matrix for sequence of operations.

EMS CONTROLS:
CONTRACTORS ARE RESPONSIBLE FOR COORDINATING ALL EQUIPMENT CONTROLS WITH EMS VENDOR PRIOR TO PURCHASE AND INSTALLATION. CONTRACTORS SHALL COORDINATE WITH EMS VENDOR TO PROVIDE ALL NECESSARY EQUIPMENT AND ACCESSORIES FOR A FULLY FUNCTIONING SYSTEM.

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brr

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PROFESSIONAL ENGINEER
I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.
NAME: GRANT CAMPBELL
LICENSE #: 60506
SIGNATURE:
DATE: 03/03/2025

Issued For: BID/PERMIT

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