ROOFTOP UNIT (DX COOLING, GAS 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	72	72	72	72	72	READ/WRITE	
COOLING - EFFECTIVE UNOCCUPIED COOLING SETPOINT	°F	77	77	77	77	77	READ/WRITE	
COOLING - LOCKOUT TEMPERATURE SETPOINT	°F	55	55	55	55	55	READ/WRITE	
DEAD BAND - MINIMUM HEATING AND COOLING TEMPERATURE SETPOINT DIFFERENCE	°F	2	2	2	2	2		
HEATING - EFFECTIVE OCCUPIED HEATING SETPOINT	°F	70	70	70	70	70	READ/WRITE	
HEATING - EFFECTIVE UNOCCUPIED HEATING SETPOINT	°F	60	60	60	60	60	READ/WRITE	
DEHUMIDIFICATION SETPOINT - HUMIDITY SENSOR FEEDBACK	% RH	55	55	55	55	55	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	Y	Y	READ	EMS
REMOTE CO2 SENSOR		Y	Y	Y	Y	N	READ	EMS
DEMAND CONTROL VENTILATION (DCV) HIGH ALARM SETPOINT - CO2 SENSOR FEEDBACK	PPM	750	750	750	750	N/A	READ/WRITE	M
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		Y	Y	Y	Y	Y		
RELIEF - CONSTANT VOLUME POWERED EXHAUST FAN		N	N	Y	Y	Y	READ STATUS	O, P
LOW AMBIENT CONTROL KIT	°F	N	N	N	N	N		
COOLING COIL (DX - STAGED)		Y	Y	Y	Y	Y	READ STATUS	E, F
DEHUMIDIFICATION - HOT GAS REHEAT		Y	Y	Y	Y	Y	READ STATUS	L
HEATING COIL (NATURAL GAS)		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
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
GAS VALVE SAFETY		Y	Y	Y	Y	Y	READ	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.

ROOFTOP UNIT SCHEDULE (NATURAL GAS HEAT)

MARK	MANUFACTURER	MODEL	NOMINAL TONNAGE	SUPPLY FAN				COOLING COIL										HEAT EXCHANGER						MIN. O/A CFM	ABS. MIN. O/A CFM	ELECTRICAL					WEIGHT (LBS)	NOTES
				CFM	MIN HP	ESP (IN)	VFD (Y/N)	TH (MBH)	SH (MBH)	EAT DB (°F)	EAT WB (°F)	LAT DB (°F)	LAT WB (°F)	REFR TYPE	MIN EER	MIN IEER (SEER)	MIN NO STAGES	MIN OUTPUT (MBH)	NOM INPUT (MBH)	EAT DB (°F)	LAT DB (°F)	MIN EFF (%)	MIN NO STAGES			MCA	MOCP	VOLTAGE	PHASE	DISCONNECT TYPE		
RTU 1	CARRIER	48HCFD08	7.5	3000	0.00	1.30	Yes	83.5	61.0	77.4	65.1	58.5	56.1	R-454B	11.2	-	2	103.0	125.0	60.0	91.8	80	2	300	150	19	25	480	3	NF	920	A-Q, S, T
RTU 2	CARRIER	48HCFD14	12.5	4400	0.00	1.53	Yes	140.0	97.0	80.5	67.6	60.1	57.7	R-454B	10.8	-	2	148.0	180.0	60.0	91.1	80	2	1100	575	34	40	480	3	NF	1041	A-T
RTU 3	CARRIER	48HCFD14	12.5	4400	0.00	1.53	Yes	140.0	97.0	80.5	67.6	60.1	57.7	R-454B	10.8	-	2	148.0	180.0	60.0	91.1	80	2	1100	575	34	40	480	3	NF	1041	A-T
RTU 4	CARRIER	48GCDA04	3	1000	0.00	0.96	Yes	29.3	23.6	78.3	63.3	56.4	53.2	R-454B	14.0	14.0	1	54.0	67.0	60.0	110.0	80	2	150	150	10	15	480	3	NF	580	A-Q, S, T
RTU 5	CARRIER	48GCDA05	4	1300	0.00	1.08	Yes	43.6	31.0	80.0	66.0	57.9	55.1	R-454B	14.0	14.0	1	54.0	67.0	60.0	98.5	80	2	325	325	10	15	480	3	NF	640	A-Q, S, T

MODEL NUMBERS SHALL NOT BE CONSIDERED COMPLETE AND MATERIAL SHALL NOT BE ORDERED BY MANUFACTURER AND MODEL NUMBERS 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. PROVIDE LOW LEAK DRY-BULB ECONOMIZER WITH BAROMETRIC RELIEF DAMPER.
C. PROVIDE HAIL GUARDS, HINGED ACCESS PANELS, AND THRU THE BASE ELECTRICAL CONNECTIONS.
D. EQUIPMENT SIZED FOR 105 °F AMBIENT TEMPERATURE.
E. PROVIDE MERV 13 THROWAWAY AIR FILTERS IN UNITS AT STARTUP. REPLACE WITH NEW MERV 13 FILTERS PRIOR TO TESTING AND BALANCING.
F. SPECIFIED FAN ESP ACCOUNTS FOR DUCT LOSSES EXTERNAL TO UNIT.
H. PROVIDE WITH FACTORY RTU OPEN CONTROLS WITH ALL REQUIRED FACTORY SENSORS FOR INTERLOCK WITH FIELD SUPPLIED EMS.
J. DISCONNECT SWITCH FURNISHED BY DIVISION 16 CONTRACTOR.
K. STARTERS FOR ALL MOTORS SHALL BE FURNISHED INTEGRAL WITH UNIT.
L. COORDINATE SIZE OF CONDUCTOR TERMINATION LUGS WITH CONDUCTOR SIZES SHOWN ON ELECTRICAL DRAWINGS.
M. PROVIDE FACTORY INSTALLED UN-POWERED DUPLEX RECEPTACLE MOUNTED ON UNIT FOR FIELD WIRING.
N. COOLING COIL LAT IS LEAVING AIR TEMPERATURE OF COIL.
O. SELECT EQUIPMENT FOR ELEVATION OF 955 FEET ABOVE SEA LEVEL.
P. PROVIDE HEATER TO MEET OR EXCEED SCHEDULED MINIMUM MBH OUTPUT. NOMINAL INPUT IS BASED ON LISTED MANUFACTURER'S STANDARD PRODUCT. COORDINATE EQUIPMENT GAS LOAD WITH PLUMBING CONTRACTOR IF DIFFERENT FROM THAT SCHEDULED. MEET MINIMUM EFFICIENCY SCHEDULED.
Q. PROVIDE UNIT WITH FACTORY INSTALLED BACNET OPEN BOARD CONTROLLER WITH SUPPLY AND OUTSIDE AIR TEMPERATURE SENSORS. COORDINATE ALL CONTROLS WITH EMS VENDOR PRIOR TO PURCHASE.
R. PROVIDE CARRIER HUMIDIMZIER COILS FOR DEHUMIDIFCATION CONTROL SEQUENCE.
S. PROVIDE WITH 2-SPEED INDOOR FAN (VFD) CONTROLLER.
T. PROVIDE CARRIER #CRDISKIT001A00 HAND HELD 2-SPEED VFD DISPLAY KIT FOR INTERFACING WITH 2-SPEED VFD CONTROLLER. PROVIDE ONLY ONE KIT FOR INTERFACING WITH ALL 2-SPEED UNITS.

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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 1-3	RTU 1-3	-	-	0.97	9,446	0.119	173	7.41	2,492	1,295	2,500	GEN NOTES
RTU 4	RTU 4	-	-	0.84	1,341	0.039	18	3.33	133	N/A	150	GEN NOTES
RTU 5	RTU 5	-	-	0.94	2,398	0.120	10	0.00	305	N/A	325	GEN NOTES
								TOTALS	2,929	1,295	2,975	

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. 100% OA SYSTEMS (Vot = ∑all zones Voz): WHEN ONE AIR HANDLER SUPPLIES ONLY OUTDOOR AIR TO ONE OR MORE ZONES. EACH ZONE IS INDIVIDUALLY CALCULATED WITH ITS WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS (HEATING/COOLING).
5. 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.

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

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TECHNICAL SUPPORT
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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 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.

SEQUENCE OF OPERATION

A. ROOFTOP UNIT CONTROL (RTU-X)

Refer to Rooftop Unit Control Matrix for sequence of operations.

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.

ROBERT W. HARRIS

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