



BUC-EE'S

A DEVELOPMENT OF

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74K - L - 2024 - Q2
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M7.01

MECHANICAL CONTROLS

LSL PROJECT NUMBER: 2024-107.000

BENTON, ARKANSAS

MECHANICAL SYMBOLS

NOTE: THIS IS A MASTER LEGEND AND NOT ALL SYMBOLS, ABBREVIATIONS, ETC. ARE NECESSARILY USED ON THE DRAWINGS.

CONTROLS SYMBOLS AND NOMENCLATURE

	FLUE DAMPER (BOILERS)		HOT GAS REHEAT COIL		RISER DESIGNATION		MOTORIZED DAMPER
	BOILER		COOLING COIL		FIRE DAMPER		BACKDRAFT DAMPER
	COOLING TOWER		FURNACE		FIRE SMOKE DAMPER		VOLUME DAMPER
	CONDENSING UNIT		HEATING COIL		SMOKE DAMPER		HUMIDISTAT
	FLUID COOLER		DAMPER - GENERIC BLADE TYPE		SMOKE DETECTOR		THERMOSTAT
	WATER-COOLED CHILLER		DAMPER - OPPOSED BLADE TYPE		BTU METER		PRESSURE SENSOR
	AIR-COOLED CHILLER		DAMPER - PARALLEL BLADE TYPE		CARBON MONOXIDE SENSOR		POLLUTANT ALARM
	GENERIC HEAT EXCHANGER		FLEXIBLE SENSING ELEMENT		CARBON DIOXIDE SENSOR		POLLUTION STATION
	SHELL AND TUBE HEAT EXCHANGER		AIRFLOW STATION		CONTROL PANEL		REFRIGERANT LEAK SENSOR
	BASIN HEATER		PUMP		CURRENT CIRCUIT RELAY		SENSOR - GENERIC
	GROUND HEAT EXCHANGER		FAN		DIFFERENTIAL PRESSURE SENSOR		STATIC PRESSURE PORT
	HEAT RECOVERY WHEEL		HUMIDIFIER		ELECTRIC METER		SWITCH
			AIR FILTER		FLOW METER, FUEL METER		TEMPERATURE SENSOR
			3-WAY CONTROL VALVE		FLOW SWITCH		WATER METER
			2-WAY CONTROL VALVE		HUMIDITY SENSOR		
			AIRFLOW MEASURING STATION				
			DIRECT EXPANSION COOLING UNIT				
			FURNACE BURNER CONTROLLER				
			SILICON-CONTROLLED RECTIFIER				
			ELECTRIC HEATER CONTROL (MODULATING)				
			ELECTRIC HEATER CONTROLLER (ON/OFF)				
			ELECTRONIC COMMUTATED MOTOR				
			VARIABLE FREQUENCY DRIVE				
			MOTOR STARTER				
			LOW LIMIT TEMPERATURE CONTROLLER (FREEZE/STAT)				
			EMERGENCY PUSH BUTTON				

ROOFTOP UNIT CONTROL MATRIX

CONTROL FEATURE	UNITS	RTU 1 SETPOINT OR Y/N	RTU 2 SETPOINT OR Y/N	POINT TYPE INTERFACE WITH DDC (READ/WRITE)	NOTES
BUILDING AUTOMATION SYSTEM (BAS)					
BAS MONITORING AND MANAGEMENT INTERFACE		Y	Y	BACNET	A
SETPOINTS					
COOLING - OCCUPIED SETPOINT	°F	75	75	READWRITE	
COOLING - UNOCCUPIED SETPOINT	°F	80	80	READWRITE	
DEAD BAND - MINIMUM HEATING AND COOLING TEMPERATURE SETPOINT DIFFERENCE	°F	5	5	READWRITE	
DEHUMIDIFICATION SETPOINT - HUMIDITY SENSOR FEEDBACK	% RH	50%	50%	READWRITE	B
PROGRAMMED CONTROL FEATURES					
HVAC SYSTEM OCCUPIED/UNOCCUPIED MODE - SCHEDULED THROUGH BAS		Y	Y	READ	B
REMOTE TEMPERATURE SENSOR		Y	Y	READ	B
EQUIPMENT ACCESSORIES AND CONTROL MODULES					
OUTSIDE AIR DAMPER - MOTOR OPERATED (MODULATING)		Y	Y	READ POSITION	F
INTEGRATED ECONOMIZER - DIFFERENTIAL ENTHALPY ENABLE (OA ENTHALPY < RA ENTHALPY)	BTULB	Y	Y	READ	C, E
ECONOMIZER FAULT DETECTION AND DIAGNOSTICS (FDD) SYSTEM		Y	Y	READ	C, E
RELIEF - BAROMETRIC DAMPER		Y	Y	READ	F
COOLING COIL (DX - STAGED)		Y	Y	READ STATUS	G
SUPPLY FAN CONTROL METHODS					
CYCLE WITH LOADS DURING OCCUPIED HOURS		Y	Y		
CYCLE WITH LOADS DURING UNOCCUPIED HOURS		Y	Y		
VARIABLE VOLUME - STAGED FAN CONTROL IN RESPONSE TO ACTIVE COOLING COIL STAGES		Y	Y	READ STATUS	F, J
SAFETIES, INTERLOCKS, AND ALARMS					
SPACE TEMPERATURE > 85° F (ADJ.)		Y	Y	READ	D
FIRE ALARM CONTROL PANEL - SAFETY SHUTDOWN INTERLOCK		Y	Y	READ	
CONDENSATE OVERFLOW SWITCH		Y	Y	READ	D

DIV. 23 CONTRACTOR SHALL PROVIDE CONTROL PANEL(S), WIRING, THERMOSTAT(S), TEMPERATURE SENSOR(S), HUMIDISTAT(S), AND/OR CO2 SENSOR(S) WHERE SHOWN ON THE DRAWINGS AND AS REQUIRED TO FACILITATE THE SCHEDULED CONTROL MODULES AND SEQUENCES 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:

- PROVIDE UNIT WITH FACTORY MOUNTED DDC CONTROLS AND INTEGRATE INTO THE BAS. BAS SHALL PROVIDE REMOTE SETPOINT ADJUSTMENT, SCHEDULING, AND MONITORING OF THE POINTS LISTED IN THE SCHEDULE FOR EACH UNIT.
- DIVISION 23 CONTRACTOR SHALL PROVIDE DEVICE.
- IF SETPOINT VALUE IS LISTED, IT INDICATES ECONOMIZER HIGH-LIMIT SHUTOFF. UNIT SHALL BE IN ECONOMIZER IF CONDITIONS ARE LESS THAN SETPOINT. THE FOLLOWING SENSORS SHALL DETERMINE ECONOMIZER ON POINT: OUTSIDE AIR HUMIDITY; DIVISION 23 PROVIDED AS PART OF ECONOMIZER CONTROL MODULE. RETURN AIR HUMIDITY; DIVISION 23 PROVIDED AS PART OF ECONOMIZER CONTROL MODULE.
- DEVICE SHALL BE FACTORY MOUNTED AND PRE-WIRED FOR OPERATION SUBJECT TO THE ONBOARD CONTROLLER.
- PROVIDE UNIT WITH AN FDD SYSTEM CONSISTING OF PERMANENTLY INSTALLED OUTSIDE AIR, SUPPLY AIR, AND RETURN AIR TEMPERATURE SENSORS. THE UNIT CONTROLLER SHALL AT A MINIMUM BE CAPABLE OF PROVIDING SYSTEM STATUS OF ECONOMIZER, COMPRESSOR, HEATING, MIXED AIR LOW LIMIT ALARM, AND SENSOR VALUES. EACH OPERATING MODE SHALL BE CAPABLE OF INDEPENDENTLY OPERATING FOR TESTING. THE SYSTEM SHALL REPORT FAULTS TO AN APPLICATION ACCESSIBLE BY SERVICE PERSONNEL. THE FOLLOWING FAULTS SHALL BE DETECTED: AIR TEMPERATURE SENSOR FAILURE, ECONOMIZER ENABLE/DISABLED WHEN ECONOMIZER SHOULD BE OFF/ON, RESPECTIVELY, DAMPER NOT MODULATING, AND EXCESS OUTSIDE AIR.
- EQUIPMENT MANUFACTURER SHALL PROVIDE MODULATING DAMPER AND CONTROLS CAPABLE OF ADJUSTING THE DAMPER POSITION TO MAINTAIN THE SCHEDULED OUTSIDE AIR ON THE DRAWINGS ACROSS ALL FAN SPEEDS. DIV. 23 CONTRACTOR SHALL PROGRAM MULTIPLE DAMPER POSITION SETPOINTS IN THE FIELD DURING TESTING AND BALANCING TO MAINTAIN MINIMUM VENTILATION WHEN NOT IN ECONOMIZER. DAMPER SHALL BE CLOSED DURING UNOCCUPIED HOURS.
- UNITARY CONTROLLER SHALL MODULATE AND/OR CYCLE SUPPLY FAN SPEED SETTING AND COIL CAPACITY STAGES SUBJECT TO THE INTERNAL SAFETIES AND SEQUENCES TO MAINTAIN SCHEDULED SETPOINTS.
- PROVIDE STAGED FAN CONTROL WITH MINIMUM 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.

PROJECT DESIGN CONDITIONS

CLIMATE CONDITIONS	WEATHER STATION	REFERENCE	BUILDING OPERATING HOURS:
WEATHER STATION:	LITTLE ROCK CLINTON, AR	2021 ASHRAE	MONDAY - FRIDAY 24/7
CLIMATE ZONE:	3A		SATURDAY 24/7
ASHRAE HEATING:	99.6%	20.1 °F DB	SUNDAY 24/7
DESIGN HEATING CONDITIONS:	20.1 °F DB		HOLIDAY 24/7
HUMIDIFICATION:	99.6%	5 °F DB 7.2 g/lb 26.5 °F DB	
ASHRAE COOLING:	0.4%	98.5 °F DB 77.0 °F WB	
DESIGN COOLING CONDITIONS:	98.5 °F DB 77 °F WB		
DEHUMIDIFICATION:	0.4%	77.2 °F DB 143.1 g/lb 85.2 °F DB	

SPACE / UNIT DESCRIPTION	COOLING / DE-HUMIDIFICATION	HEATING	HUMIDIFICATION	ZONE VENTILATION RESET	SPACE OPERATING HOURS OCCUPIED / UNOCCUPIED	NOTES
	OCC UNOCC MAX MIN	OCC UNOCC MIN MAX	MIN MAX	CONTROL BASE MAXIMUM	M-F SAT SUN	
SALES (AHU 1, AHU 2, AHU 3, AHU 4)	75 80 50% NA	70 60 NA	NA NA	NA NA NA	TBD TBD TBD	A - C
BACK OF HOUSE (AHU 5, AHU 7, AHU 8, AHU 9)	75 80 NA NA	70 60 NA NA	NA NA	NA NA NA	TBD TBD TBD	A - C
KITCHEN (AHU 6)	75 80 NA NA	70 60 NA NA	NA NA	NA NA NA	TBD TBD TBD	A - C
VESTIBULE (AHU 10, AHU 11, AHU 12)	85 90 NA NA	60 55 NA NA	NA NA	NA NA NA	TBD TBD TBD	A - C
ICE ROOM 148, TOOL ROOM 149 (FCU 1)	75 80 NA NA	70 60 NA NA	NA NA	NA NA NA	TBD TBD TBD	A - C
ICE ROOM 149 (FCU 2)	72 NA 55% NA	NA NA	NA NA	NA NA NA	TBD TBD TBD	A - C
ELECTRICAL ROOM 145 (RTU 2)	72 NA 55% NA	NA NA	NA NA	NA NA NA	TBD TBD TBD	A - C
146 BOILER ROOM (EF 4, FCU 2)	85 85 NA NA	55 55 NA NA	NA NA	NA NA NA	TBD TBD TBD	A - C
147 FUEL ALLEY (EF 6)	85 NA NA NA	55 55 NA NA	NA NA	NA NA NA	TBD TBD TBD	A - C
156 PUMP ROOM, 157 FILTER ROOM (EF 2)	85 85 NA NA	55 55 NA NA	NA NA	NA NA NA	TBD TBD TBD	A - C
WARE WASH 120 (EF 1)	75 NA NA NA	NA NA	NA NA	NA NA NA	TBD TBD TBD	A - C
1 ROOM 144 REDUNDANT SYSTEM (EF 1)	75 NA NA NA	NA NA	NA NA	NA NA NA	TBD TBD TBD	A - C
ELECTRICAL ROOM 145 REDUNDANT SYSTEM (EF 3)	85 NA NA NA	NA NA	NA NA	NA NA NA	TBD TBD TBD	A - C

NOTES:
A. ZONE LEVEL SET POINT CONDITIONS SHALL BE AS SCHEDULED UNLESS OTHERWISE SCHEDULED OR NOTED ON THE DRAWINGS FOR ROOM SPECIFIC SPACE CONDITIONS.
B. ZONE LEVEL OCCUPANCY HOUR SCHEDULE SHALL BE PER BUILDING OPERATING HOURS UNLESS OTHERWISE SCHEDULED.
C. ZONE LEVEL CONTROLS SHALL BE CAPABLE OF OPERATING WITH INDEPENDENT OCCUPANCY SCHEDULES.

FUEL IDF CABINET MONITORING:

REFER TO FE DRAWINGS FOR BAS MONITORING IDF VAULT REQUIREMENTS.

GENERAL

TS OAT

HS OAH

ELECTRICITY

EM E-KWH

EM E-KW

E-ELEC

REQUIREMENTS FOR MEASUREMENT AND VERIFICATION PLAN

CONTRACTOR SHALL COORDINATE POINTS REQUIRED TO IMPLEMENT MEASUREMENT AND VERIFICATION PLAN WITH THE CONTROLS DRAWINGS. THE PARAGRAPHS BELOW REPRESENT DESIGN INTENT.

- REFERENCE MEASUREMENT AND VERIFICATION PLAN FOR ALL SYSTEMS THAT SHALL BE MONITORED BY THE BAS.
- PROVIDE VFD MONITORING AND MOTOR KW TRENDING AT BAS.
 - INSTANTANEOUS (KW)
 - HISTORICAL PEAK (KW)
 - RESETTABLE KW/h
 - RUNTIME TRACKING FOR KW/h PER RATE PERIOD

POINTS LIST - GLOBAL BUILDING MONITORING

POINT ID	DESCRIPTION	POINT TYPE	UNITS	ACCURACY	TRENDING INTERVAL	ENERGY DASHBOARD DISPLAY	STATUS ALARM	ALARM RANGE	NOTES
GENERAL									
DATE		AV	MMDD/YYYY			X			
TIME		AV	HHMM			X			
BUILDING SENSORS									
OAT	OUTSIDE AIR DRY BULB TEMPERATURE	AI	°F	SPEC	15 MIN.	X			
OAWB	OUTSIDE AIR WET BULB TEMPERATURE	AV	°F		15 MIN.				A
OAH	OUTSIDE AIR RELATIVE HUMIDITY	AI	%	SPEC	15 MIN.	X			
COOLER-T	WALK-IN COOLER TEMPERATURE	AI	°F	SPEC	15 MIN.		X	COOLER-T < 40°F	
FREEZER-T	WALK-IN FREEZER TEMPERATURE	AI	°F	SPEC	15 MIN.		X	FREEZER-T < 32°F	
ELECTRICITY METERING									
E-KW	ELECTRIC DEMAND	AV	KW	±1.0%	15 MIN.	X			B
E-KW-P	ELECTRIC PEAK HISTORICAL DEMAND	AV	KW		15 MIN.				C
E-KWH	ELECTRIC CONSUMPTION	AV	KWH	±1.0%	15 MIN.	X			B
E-KWH-P	ELECTRIC KWH PER RATE PERIOD	AV	KWH		15 MIN.	X			D
E-PF	ELECTRIC POWER FACTOR	AV			15 MIN.				B
E-MB	ELECTRIC IMBALANCE	AV			15 MIN.				B
GENERATOR MONITORING									
G-V-L1 L2	GENERATOR L1-L2 VOLTS	AV	V		15 MIN.				F
G-V-L2 L3	GENERATOR L2-L3 VOLTS	AV	V		15 MIN.				F
G-V-L3 L1	GENERATOR L3-L1 VOLTS	AV	V		15 MIN.				F
G-V-L1 N	GENERATOR L1-N VOLTS	AV	V		15 MIN.				F
G-V-L2 N	GENERATOR L2-N VOLTS	AV	V		15 MIN.				F
G-V-L3 N	GENERATOR L3-N VOLTS	AV	V		15 MIN.				F
G-AMP-L1	GENERATOR L1 AMPS	AV	A		15 MIN.				F
G-AMP-L2	GENERATOR L2 AMPS	AV	A		15 MIN.				F
G-AMP-L3	GENERATOR L3 AMPS	AV	A		15 MIN.				F
G-FREQ	GENERATOR FREQUENCY	AV	HZ		15 MIN.				F
G-KW-T	GENERATOR TOTAL KW	AV	KW		15 MIN.				F
G-KW-PERC	GENERATOR PERCENT OF RATED KW	AV	%		15 MIN.				F
G-PF-T	GENERATOR TOTAL POWER FACTOR	AV			15 MIN.				F
G-PF-L1	GENERATOR L1 POWER FACTOR	AV			15 MIN.				F
G-PF-L2	GENERATOR L2 POWER FACTOR	AV			15 MIN.				F
G-PF-L3	GENERATOR L3 POWER FACTOR	AV			15 MIN.				F
G-P-OIL	GENERATOR OIL PRESSURE	AV			15 MIN.				F
G-COOL-T	GENERATOR COOLANT TEMPERATURE	AV	°F		15 MIN.				F
G-V-BATT	GENERATOR BATTERY VOLTAGE	AV	V		15 MIN.				F
G-SWITCH	GENERATOR MASTER SWITCH POSITION	AV			15 MIN.				F
G-START-T	GENERATOR TOTAL NUMBER OF STARTS	AV			15 MIN.				F
G-H-T	GENERATOR TOTAL HOURS	AV	HHMM		15 MIN.				F
G-L-H-T	GENERATOR TOTAL LOADED HOURS	AV	HHMM		15 MIN.				F
G-UL-H-T	GENERATOR TOTAL UNLOADED HOURS	AV	HHMM		15 MIN.				F
G-KWH-T	GENERATOR TOTAL KWH	AV	KWH		15 MIN.				F
G-START-DATE	GENERATOR LAST START DATE	AV	MMDD/YYYY						F
G-RUN-T	GENERATOR LAST RUN TIME	AV	HHMM						F
G-DATE	GENERATOR CURRENT DATE	AV	MMDD/YYYY						F
G-T	GENERATOR CURRENT TIME	AV	HHMM						F
OTHER									
IT-RM-ACCESS	IT ROOM ACCESS DOOR CONTACT	BI							G

NOTES:

- PERFORM PSYCHROMETRIC CALCULATION TO OBTAIN VALUE BASED ON OUTSIDE AIR DRY BULB TEMPERATURE (OAT) AND OUTSIDE AIR RELATIVE HUMIDITY (OAH).
- CALCULATE TOTAL UTILITY USE FROM THE SUM OF ALL METERS AND SUBMETERS SERVING END USE. EXCLUDE SUBMETERS ALREADY INCLUDED IN AN UPSTREAM METER.
- TREND HISTORICAL PEAK FOR A MINIMUM PERIOD OF 12 MONTHS.
- COORDINATE WITH THE OWNER REGARDING THE TIME PERIOD USED TO CALCULATE THE CONSUMPTION PER PERIOD.
- POINT SHALL BE OBTAINED FROM THE GENERATOR.
- DOOR CONTACT PROVIDED BY DIVISION 26. CONTACT SHALL MONITOR AND LOG ACCESS TO IT ROOM.