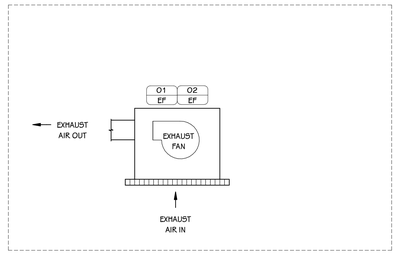
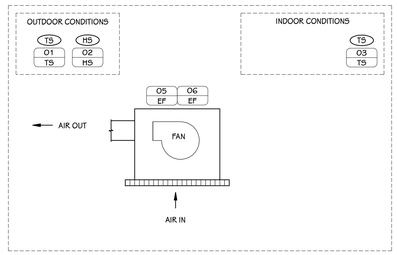


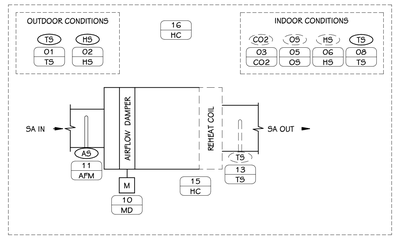
HVAC POWER VENTILATORS - GENERAL EXHAUST

SCALE: NONE



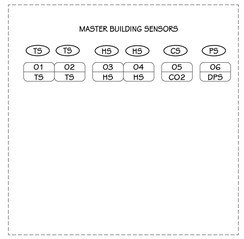
HVAC POWER VENTILATORS - TEMPERATURE CONTROL

SCALE: NONE



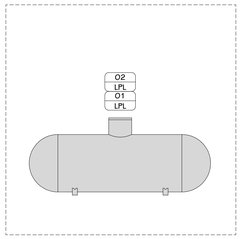
AIR TERMINAL UNITS - SHUT OFF VAV

SCALE: NONE



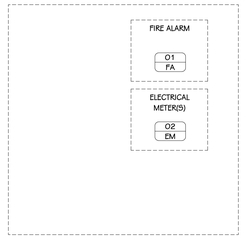
MASTER BUILDING SENSORS

SCALE: NONE



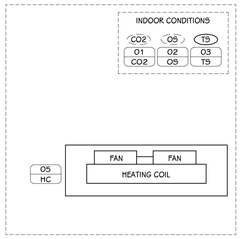
FACILITY LIQUID-PROPANE MONITORING

SCALE: NONE



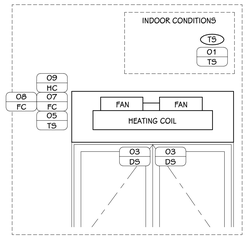
MISCELLANEOUS CONTROL POINTS

SCALE: NONE



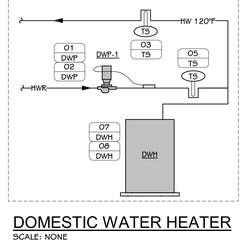
UNIT HEATER - ELECTRIC HEAT

SCALE: NONE



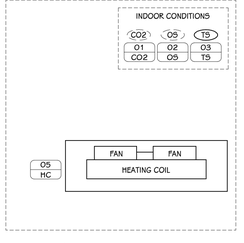
AIR-CURTAIN UNIT - ELECTRIC HEAT

SCALE: NONE



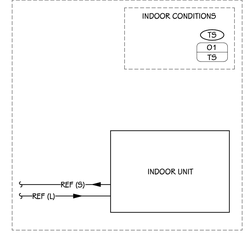
DOMESTIC WATER HEATER

SCALE: NONE



FAN POWERED TERMINAL UNIT - ELECTRIC HEAT

SCALE: NONE



SPLIT SYSTEM HEAT PUMP CONTROLS DIAGRAM

SCALE: NONE

CONTROL POINTS

NUMBER	TAG	DESCRIPTION	DISPLAY ON GRAPHIC	ALARM	REMARKS
MASTER BUILDING SENSORS					
01	T5	OUTDOOR AIR TEMPERATURE	∎	∎	USED FOR GLOBAL POINT
02	T5	OUTDOOR AIR TEMPERATURE	∎	∎	USED FOR GLOBAL POINT
03	H5	OUTDOOR AIR HUMIDITY	∎	∎	USED FOR GLOBAL POINT
04	H5	OUTDOOR AIR HUMIDITY	∎	∎	USED FOR GLOBAL POINT
05	CO2	OUTDOOR AIR CARBON DIOXIDE	∎	∎	USED FOR GLOBAL POINT
06	DP5	BUILDING STATIC PRESSURE	∎		AVERAGE BUILDING STATIC PRESSURE
07	DP5	BUILDING STATIC PRESSURE SETPOINT	∎		
FACILITY LIQUID-PROPANE MONITORING					
01	LPL	LIQUID PROPANE LEVEL (IF PRESENT)	∎	∎	
02	LPL	TOTAL GAS FIRED HX BTU	∎	∎	
03	LPL	TOTAL GAS FIRED HX BTU SETPOINT	∎		
MISCELLANEOUS CONTROL POINTS					
01	FA	FIRE ALARM STATUS	∎	∎	DRY CONTACT
02	EM	ELECTRICAL METER STATUS	∎	∎	BACNET/MODBUS DATA
HVAC POWER VENTILATORS - GENERAL EXHAUST					
01	EF	EXHAUST FAN RUN STATUS	∎	∎	
02	EF	EXHAUST FAN ENABLE/DISABLE	∎		INTERLOCK WITH ASSOCIATED OUTDOOR AIR DAMPER
HVAC POWER VENTILATORS - TEMPERATURE CONTROL					
01	T5	OUTDOOR AIR TEMPERATURE	∎		GLOBAL POINT
02	H5	OUTDOOR AIR HUMIDITY	∎		GLOBAL (INCLUDE ENTHALPY BASED ON T+H)
03	T5	ZONE AIR TEMPERATURE	∎	∎	
04	T5	ZONE TEMPERATURE SETPOINT	∎		
05	EF	FAN RUN STATUS	∎	∎	
06	EF	FAN ENABLE/DISABLE	∎		
DOMESTIC WATER HEATER CONTROL					
01	DWP	PUMP ENABLE/DISABLE	∎		
02	DWP	PUMP STATUS	∎	∎	
03	T5	SUPPLY WATER TEMPERATURE	∎	∎	
04	T5	SUPPLY WATER TEMPERATURE SETPOINT	∎		
05	T5	RETURN WATER TEMPERATURE	∎	∎	
06	T5	RETURN WATER TEMPERATURE SETPOINT	∎		
07	DWH	DOMESTIC WATER HEATER STATUS	∎		
08	DWH	ALARM STATUS (IF PRESENT)	∎	∎	
UNIT HEATER - ELECTRIC HEAT CONTROL					
01	CO2	ZONE CO2 (IF PRESENT)	∎	∎	REFER TO FLOOR PLANS FOR LOCATIONS
02	O5	OCCUPANCY SENSOR (IF PRESENT)	∎		REFER TO ELECTRICAL LIGHTING PLANS
03	T5	ZONE AIR TEMPERATURE	∎	∎	REFER TO FLOOR PLANS FOR LOCATIONS
04	T5	ZONE TEMPERATURE SETPOINT	∎		
05	HC	HEATING CONTROL ON/OFF (EACH STAGE)	∎		
FAN POWERED TERMINAL UNIT - ELECTRIC HEAT CONTROL					
01	CO2	ZONE CO2 (IF PRESENT)	∎	∎	REFER TO FLOOR PLANS FOR LOCATIONS
02	O5	OCCUPANCY SENSOR (IF PRESENT)	∎		REFER TO ELECTRICAL LIGHTING PLANS
03	T5	ZONE AIR TEMPERATURE	∎	∎	REFER TO FLOOR PLANS FOR LOCATIONS
04	T5	ZONE TEMPERATURE SETPOINT	∎		
05	HC	HEATING CONTROL ON/OFF (EACH STAGE)	∎		
AIR TERMINAL UNITS - SHUT OFF VAV					
01	T5	OUTDOOR AIR TEMPERATURE	∎		GLOBAL POINT
02	H5	OUTDOOR AIR HUMIDITY	∎		GLOBAL (INCLUDE ENTHALPY BASED ON T+H)
03	CO2	ZONE CO2 (IF PRESENT)	∎	∎	
04	CO2	ZONE CO2 SETPOINT (IF PRESENT)	∎		
05	O5	OCCUPANCY SENSOR (IF PRESENT)	∎		
06	H5	ZONE HUMIDITY (IF PRESENT)	∎	∎	
07	H5	ZONE HUMIDITY SETPOINT (IF PRESENT)	∎		
08	T5	ZONE AIR TEMPERATURE	∎	∎	
09	T5	ZONE TEMPERATURE SETPOINT	∎		
10	MD	AIR DAMPER	∎	∎	TRI-STATE FLOATING POINT OR PROPORTIONAL
11	AFM	SUPPLY AIR FLOW	∎	∎	
12	AFM	SUPPLY AIR FLOW SETPOINT	∎		
13	T5	DISCHARGE AIR TEMPERATURE (IF PRESENT)	∎	∎	
14	T5	DISCHARGE AIR TEMPERATURE SETPOINT (IF PRESENT)	∎		
15	HC	ELECTRIC HEATING STAGING/MODULATION (IF PRESENT)	∎		POINT FOR EACH STAGE
16	HC	AUXILIARY HEATING UNIT	∎		
AIR-CURTAIN UNIT					
01	T5	ZONE AIR TEMPERATURE	∎	∎	REFER TO FLOOR PLANS FOR LOCATIONS
02	T5	ZONE TEMPERATURE SETPOINT	∎		
03	D5	DOOR SWITCH	∎		MAGNETIC DOOR SWITCH FOR EACH DOOR PANEL
04	D5	DOOR STATUS (OPEN/CLOSED)	∎		BACNET DATA
05	T5	INLET TEMPERATURE	∎		BACNET DATA
06	T5	INLET TEMPERATURE SETPOINT	∎		BACNET DATA
07	FC	SUPPLY FAN ENABLE/DISABLE	∎		BACNET DATA
08	FC	SUPPLY FAN ENABLE/DISABLE	∎		DRY CONTACT
09	HC	HEATING CONTROL ON/OFF	∎		BACNET DATA
10	HC	HEATING CONTROL ON/OFF	∎		DRY CONTACT
SPLIT SYSTEM HEAT PUMP					
01	T5	ZONE AIR TEMPERATURE	∎	∎	MODBUS DATA
02	T5	ZONE TEMPERATURE SETPOINT	∎		MODBUS DATA

GENERAL CONDITIONS

GENERAL NOTES:

1. CONTROL CONTRACTOR SHALL PROVIDE ALL ASSOCIATED HARDWARE AND PROGRAMMING TO MEET THE FUNCTIONAL INTENT OF THE SEQUENCE OF OPERATIONS. POINT LISTS SHALL BE A GUIDE TO THE POINTS REQUIRED FOR CONTROL SYSTEMS. FINAL HARDWARE AND SOFTWARE POINTS, SHALL BE DETERMINED BY THAT REQUIRED OF THE SEQUENCE OF OPERATIONS. SET UP TRENDS FOR POINTS SCHEDULED, AND ALL FINAL POINTS SHALL BE TRENDABLE.
2. CONTROL CONTRACTOR TO UPDATE POINTS LIST BASED ON FACTORY PROVIDED CONTROLS.
3. CONTROL CONTRACTOR SHALL HAVE EQUIPMENT ABLE TO RUN IN STAND-ALONE MODE WITH DEFAULT SETTINGS (ADJUSTABLE) UPON COMMUNICATION LOSS.

1. DEFINITIONS
   A. DDC: DIRECT DIGITAL CONTROL.
   B. VAV: VARIABLE AIR VOLUME.
   C. UNIT CONTROLLER: FIELD INSTALLED CONTROLLER PROVIDED BY CONTROL CONTRACTOR TO CONTROL EQUIPMENT, OR FIELD INSTALLED CONTROLLER BY CONTROL CONTRACTOR TO CONTROL FACTORY INSTALLED CONTROLS.
2. GENERAL REQUIREMENTS FOR SEQUENCES
   A. SETPOINTS:
      a. ALL SETPOINTS INDICATED ARE TO BE ADJUSTABLE. IT IS EXPECTED THAT SETPOINT ADJUSTMENTS AND CONTROL LOOP TUNING SHALL BE REQUIRED TO PROVIDE OPTIMUM SYSTEM OPERATION BASED ON REQUIREMENTS OF THE BUILDING. THE CONTROL CONTRACTOR SHALL WORK WITH THE BALANCING CONTRACTOR TO PROVIDE THE FINAL SYSTEM SETPOINT ADJUSTMENTS AND CONTROL LOOP TUNING AFTER THE SYSTEM IS IN OPERATION AND BUILDING IS IN USE.
      b. IN ADDITION TO INDIVIDUAL ROOM TEMPERATURE SETPOINT ADJUSTMENTS, PROVIDE GLOBAL SETPOINT ADJUSTMENT CAPABILITIES, BY AREA, FOR ROOM TEMPERATURE TO ALLOW OWNER TO QUICKLY CHANGE ROOM TEMPERATURE SETPOINTS GLOBALLY INSTEAD OF INDIVIDUALLY.
   B. ANTI-CYCLING:
      a. WHEN HVAC EQUIPMENT OR A SEQUENCE IS SPECIFIED TO BE STARTED AND STOPPED BY A TEMPERATURE, HUMIDITY, PRESSURE SETPOINT OR ANY OTHER CONTROLLED VARIABLE, THERE SHALL BE AN ADJUSTABLE DIFFERENTIAL SETPOINT THAT SHALL BE SET TO PREVENT SHORT CYCLING OF THE SYSTEMS AND EQUIPMENT DUE TO MINOR CHANGES IN THE CONTROLLED VARIABLE. TEMPERATURE DIFFERENTIAL SETPOINTS SHALL BE SET AT 2º F AND NON-TEMPERATURE SETPOINTS SHALL BE SET AT 10% OF THE CONTROLLED RANGE UNLESS OTHERWISE SPECIFIED. SETPOINTS SHALL INDICATE WHEN THE PROCESS SHOULD BE TURNED ON. COOLING DIFFERENTIALS SHALL BE SET FOR BELOW SETPOINT AND HEATING DIFFERENTIALS SHALL BE SET ABOVE SETPOINT AND WILL BE USED TO TURN THE PROCESS OFF. PROVIDE MINIMUM RUNTIME TIMERS FOR LOADS THAT ARE CYCLED TO PREVENT OVER-CYCLING. TIMERS SHALL BE SET AS SPECIFIED OR AS NEEDED TO PREVENT DAMAGE OR EXCESSIVE WEAR TO THE EQUIPMENT. UNLESS OTHERWISE SPECIFIED IN THE INDIVIDUAL CONTROL SEQUENCES, FANS AND PUMPS SHALL HAVE A MINIMUM RUNTIME ON TIMERS OF 15 MINUTES (ADJ.) AND OFF TIMERS OF 5 MINUTES (ADJ.). SAFETIES SHALL OVERRIDE RUNTIME TIMERS.
   C. DEAD BANDS:
      a. PROVIDE DEAD-BANDS FOR ALL DDC CONTROL LOOPS TO PREVENT CONSTANT HUNTING OF OUTPUT SIGNALS TO CONTROLLED DEVICES. DEAD-BANDS SHALL BE SET TO PROVIDE ADEQUATE CONTROL AROUND SETPOINT.
   D. ALARMS:
      a. PROVIDE ALL ALARMED POINTS WITH ADJUSTABLE TIME DELAYS TO PREVENT NUISANCE TRIPPING UNDER NORMAL OPERATION AND ON EQUIPMENT START-UP.
   E. EQUIPMENT START/STOP FAILURE STATES:
      a. ALL START/STOP POINTS FOR EQUIPMENT SHALL UTILIZE NORMALLY OPEN CONTACTS UNLESS LOCKED OUT SPECIFICALLY IN THE INDIVIDUAL CONTROL SEQUENCES.
   F. VARIABLE FREQUENCY DRIVE (VFD) MOTOR RUN STATUS:
      a. WHEN FURNISHED BY THE UNIT MANUFACTURER, USE THE VFD PROGRAMMABLE RELAY DRY CONTACT OUTPUT TO PROVE MOTOR RUN STATUS AND DETECT BELT LOSS OR COUPLING BREAK. IF A BYPASS CONTACTOR IS PROVIDED WITH THE VFD, PROVIDE AN ADJUSTABLE CURRENT SWITCH AND WIRE IT IN PARALLEL WITH THE VFD OUTPUT FOR PROVING MOTOR STATUS.
   G. VARIABLE FREQUENCY DRIVE (VFD) MINIMUM SPEED:
      a. THE VFD START-UP TECHNICIAN SHALL WORK WITH THE TEMPERATURE CONTROL CONTRACTOR TO DETERMINE THE MINIMUM SPEED REQUIRED FOR THE MOTOR CONTROLLED BY THE VFD TO PROVIDE COOLING OF THE MOTOR AS INSTALLED TO PREVENT HEAT RELATED PROBLEMS. THIS MINIMUM SPEED SHALL BE SET IN THE VFD CONTROLLER.
   H. CURRENT SWITCH SETUP:
      a. WHEN CURRENT SWITCHES ARE USED FOR PROVING FAN OR PUMP STATUS, THEY SHALL BE SET UP SO THAT THEY WILL DETECT BELT OR COUPLING LOSS BY THE REDUCTION IN CURRENT DRAW ON LOSS OF COUPLED LOAD. THE CURRENT SWITCH SET UP SHALL BE REDONE BY THE CONTROL CONTRACTOR AFTER THE BALANCING WORK IS COMPLETE.
   I. DAMPER INTERLOCKS FOR FAN SYSTEMS WITH STARTERS:
      a. FOR TWO POSITION MOTORIZED CONTROL DAMPERS SERVING FAN SYSTEMS WITH STARTERS, PROVIDE END SWITCHES FOR THE CONTROL DAMPERS WHEN INDICATED IN THE SEQUENCE OF OPERATION. THE DAMPER INTERLOCK SHALL BE HARDWIRED IN SUCH A WAY THAT THE DAMPER SHALL OPEN IF THE FAN STARTER HAND / OFF / AUTO SWITCH IS IN THE HAND OR IN THE AUTO POSITION AND BEING CALLED TO START. AFTER THE DAMPER END SWITCH HAS PROVEN THE DAMPER OPEN, A HARDWIRE INTERLOCK FROM THE END SWITCH TO THE STARTER SHALL CAUSE THE FAN TO START.
   J. DAMPER INTERLOCKS FOR FAN SYSTEMS WITH VFDS
      a. FOR FAN SYSTEMS WITH VFD'S AND TWO POSITION MOTORIZED CONTROL DAMPERS, PROVIDE END SWITCHES FOR THE DAMPER WHEN INDICATED IN THE SEQUENCE OF OPERATION. THE DAMPER INTERLOCK SHALL BE HARDWIRED INTERLOCKED TO THE SAFETY CIRCUIT(S) OF THE VFD TO PREVENT THE FAN FROM STARTING UNTIL THE DAMPER IS PROVEN OPEN. THIS INTERLOCK SHALL PREVENT THE FAN FROM RUNNING IN EITHER THE VFD OR BYPASS (IF PROVIDED) MODE.
   K. FAN INTERLOCKING:
      a. PROVIDE INTERLOCKS BETWEEN SUPPLY, RELIEF, AND EXHAUST FAN SYSTEMS AS SPECIFIED. DDC CONTROLLED, INTERLOCKS SHALL BE DONE THROUGH DDC START/STOP POINTS UNLESS OTHERWISE SPECIFIED IN INDIVIDUAL CONTROL SEQUENCES. IF NOT DDC CONTROLLED, INTERLOCKS SHALL BE ACCOMPLISHED VIA HARDWIRE INTERLOCKS BETWEEN FAN STARTERS OR VFD'S.
   L. SAFETIES AND PRE-ALARM SHUT-DOWNS:
      a. PROVIDE HARD WIRING IN CONDUIT FOR ALL SAFETIES AND FIRE ALARM SHUT-DOWNS TO MOTOR STARTERS OR VFD'S WITH DDC SYSTEM ANNUNCIATION THRU AUXILIARY CONTACTS ON SAFETY RELAYS. DESCRIPTION OF REQUIRED SAFETIES AND FIRE ALARM SHUT-DOWN SEQUENCES ARE SPECIFIED SEPARATELY FOR EACH SYSTEM.
   M. CONTROL PANELS:
      a. ALL COMPONENTS REQUIRED FOR CONTROL OF SYSTEMS SHALL BE INSTALLED IN TEMPERATURE CONTROL PANELS. PROVIDE A SERVICE SHUTDOWN SWITCH ON THE FRONT FACE OF PANEL TO ALLOW MAINTENANCE PERSONNEL TO SHUT-DOWN THE SYSTEM IN AN ORDERLY MANNER WITHOUT INITIATING FALSE ALARMS.
   N. VFD INTERLOCKS:
      a. FOR MOTORS CONTROLLED BY VFDS WHICH HAVE A LOCAL DISCONNECT SWITCH AT THE MOTOR DOWNSTREAM OF THE VFD, INTERLOCK THE VFD OPERATION WITH THE LOCAL DISCONNECT SWITCH LOCATED NEAR THE FAN MOTOR. TURN OFF THE VFD WHENEVER THE LOCAL MOTOR DISCONNECT SWITCH IS TURNED OFF. PROVIDE LIMIT SWITCH OR AUXILIARY SWITCH AT LOCAL MOTOR DISCONNECT.
3. SMOKE DETECTION SYSTEMS
   A. DIVISION 28 WILL PROVIDE DUCT SMOKE DETECTORS AT THE FOLLOWING LOCATIONS:
      a. RETURN AIR DUCTWORK/PLENUMS FOR UNITS OR PLENUMS WITH AIR FLOW RATES GREATER THAN 2,000 CFM. SEE SCHEDULE ON DRAWINGS.
      b. SUPPLY AIR DUCTWORK/PLENUMS FOR UNITS OR PLENUMS WITH AIR FLOW RATES GREATER THAN 2,000 CFM. SEE SCHEDULE ON DRAWINGS.
   B. DIVISION 28 WILL PROVIDE FIRE ALARM CONTROL MODULES LOCATED WITHIN 3 FEET OF EQUIPMENT CONTROL PANELS, WHERE EQUIPMENT IS REQUIRED TO SHUT DOWN WHEN SMOKE IS DETECTED.

SEQUENCE OF OPERATIONS

AREA CONTROL:

1. AREA CONTROL: A USER SELECTABLE NUMBER OF EQUIPMENT CONTROLLERS SHALL BE CAPABLE OF BEING COMBINED INTO CONTROLLED AREAS, ALLOWING FOR CONTROLLING SCHEDULES, ZONE SETPOINTS, AND OPERATION OF MULTIPLE EQUIPMENT CONTROLLERS FROM A SINGLE LOCATION. THE FOLLOWING AREAS SHALL BE COORDINATED WITH OWNER AND OWNER'S REPRESENTATIVE PRIOR TO SETUP:
   A. RTU-101
   B. RTU-102A, RTU-102B
   C. 24 HRDAY: CONTROLLERS REQUIRING 24HR/DAY OPERATION

MASTER BUILDING SENSORS:

1. THE UNIT CONTROLLER SHALL MONITOR THE FOLLOWING FOR BUILDING CONTROL:
   A. TWO OUTDOOR AIR TEMPERATURE SENSORS WITH AUTO FAIL OVER SHOULD ONE SENSOR FAIL.
      a. AVERAGE OF BOTH SHOULD BE DISPLAYED, UNLESS ONE HAS FAILED. AN ALARM SHALL BE ACTIVE ON A FAILED SENSOR.
   B. TWO OUTDOOR AIR RELATIVE HUMIDITY SENSOR WITH AUTO FAIL OVER SHOULD ONE SENSOR FAIL.
      a. AVERAGE OF BOTH SHOULD BE DISPLAYED, UNLESS ONE HAS FAILED. AN ALARM SHALL BE ACTIVE ON A FAILED SENSOR.
   C. ONE OUTDOOR AIR CO2 SENSOR.
   D. AVERAGE BUILDING STATIC PRESSURE OF ALL SENSORS WITHIN BUILDING.

FACILITY LIQUID PROPANE MONITORING CONTROLS:

1. PROVIDE UNIT CONTROLS FOR FACILITY NATURAL-GAS MONITORING.
2. PROPANE TANK VOLUME (IF PRESENT): MONITOR THE LIQUID PROPANE LEVEL WITHIN THE PROPANE TANK.
3. PROPANE LOW LEVEL ALARM: PROVIDE ALARM IF CALCULATED TOTAL OF ALL ROOFTOP UNIT GAS FIRED HX BTU EXCEEDS AN ADJUSTABLE MONTHLY LIMIT. CALCULATED TOTAL SHALL RESET ON A MONTHLY BASIS.

MISCELLANEOUS CONTROL POINTS:

1. PROVIDE UNIT CONTROLS FOR MONITORING MISCELLANEOUS CONTROL POINTS.
2. FIRE ALARM SYSTEM MONITORING: THE UNIT CONTROLLER SHALL MONITOR THE GENERAL ALARM RELAYS FROM THE FIRE ALARM SYSTEM.
3. ELECTRICAL POWER MONITORING AND CONTROL: THE FOLLOWING ITEMS ARE CONTROLLED BY FACTORY INSTALLED CONTROLS WHICH SHALL BE INTEGRATED INTO THE BUILDING DDC SYSTEM FOR ALARMING, MONITORING, AND TRENDING AS FOLLOWS:
   A. MAINS METERING (SET TO UTILITY METER READ DATES)
      a. CURRENT PER PHASE
         • MAX CURRENT, PER PHASE
         • PRESENT CURRENT DEMAND, PER PHASE
         • MAX CURRENT DEMAND, PER PHASE

SEQUENCE OF OPERATIONS (CONT'D)

MISCELLANEOUS CONTROL POINTS (CONT'D):

   b. ENERGY (KWH)
   c. REAL POWER (KW) PER PHASE
      • POWER FACTOR TOTAL
   d. POWER FACTOR PER PHASE
   e. VOLTAGE
      • LINE TO LINE AND AVERAGE LINE TO LINE OF 3 PHASES
      • LINE TO NEUTRAL AND AVERAGE LINE TO NEUTRAL OF 3 PHASES
   f. FREQUENCY (PHASE A)
   B. ALARM SETPOINTS:
      a. VOLTAGE OVER/UNDER
      b. CURRENT OVER/UNDER
      c. PHASE LOSS A
      d. PHASE LOSS B
      e. PHASE LOSS C

HVAC POWER VENTILATORS - GENERAL EXHAUST CONTROLS (SEE MECHANICAL EQUIPMENT SCHEDULE SHEETS):

1. PROVIDE UNIT CONTROLS FOR HVAC POWER VENTILATORS - GENERAL EXHAUST CONTROL OPERATION.
2. RUN CONDITIONS - INTERLOCKED: THE FAN SHALL RUN WHENEVER THE OUTDOOR AIR DAMPER FOR RTU-101 IS PROVEN OPEN.

HVAC POWER VENTILATORS - TEMPERATURE CONTROLS (SEE MECHANICAL EQUIPMENT SCHEDULE SHEETS):

1. PROVIDE UNIT CONTROLS FOR HVAC POWER VENTILATORS - TEMPERATURE CONTROL OPERATION.
2. RUN CONDITIONS - SCHEDULED: THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
   A. OCCUPIED MODE: THE UNIT SHALL MAINTAIN
      a. A 76ºF (ADJ.) COOLING SETPOINT
      b. A 68ºF (ADJ.) HEATING SETPOINT.
   B. UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL MAINTAIN
      a. A 60ºF (ADJ.) COOLING SETPOINT.
      b. A 60ºF (ADJ.) HEATING SETPOINT.
3. FAN: THE FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN BY THE UNIT CONTROLLER, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME
4. ALARM SETPOINTS:
   A. HIGH ZONE TEMP: IF THE ZONE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
   B. LOW ZONE TEMP: IF THE ZONE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

DOMESTIC WATER HEATER SYSTEM CONTROLS:

1. PROVIDE UNIT CONTROLS FOR DOMESTIC WATER HEATER SYSTEM OPERATION. SYSTEM IS A COMBINATION OF DOMESTIC HOT WATER HEATER(S), CONSTANT VOLUME INLINE HOT WATER RETURN PUMP AND TEMPERATURE SENSORS.
2. DOMESTIC HOT WATER: THE UNIT CONTROLLER SHALL MONITOR THE DOMESTIC HOT WATER SUPPLY AND RETURN TEMPERATURE.
3. RUN CONDITIONS - SCHEDULED: THE UNIT CONTROLLER SHALL RUN THE DOMESTIC HOT WATER LOOP PUMP ACCORDING TO A USER DEFINABLE TIME SCHEDULE.
4. ALARM SETPOINTS:
   A. LOW DOMESTIC HOT WATER SUPPLY TEMPERATURE: IF THE DOMESTIC HOT WATER SUPPLY TEMPERATURE IS LESS THAN A USER DEFINABLE AMOUNT (ADJ.)
   B. HIGH DOMESTIC HOT WATER SUPPLY TEMPERATURE: IF THE DOMESTIC HOT WATER SUPPLY OR STORAGE TEMPERATURE IS MORE THAN A USER DEFINABLE AMOUNT (ADJ.)
   C. LOW DOMESTIC HOT WATER RETURN TEMPERATURE: IF THE DOMESTIC HOT WATER RETURN TEMPERATURE IS LESS THAN A USER DEFINABLE AMOUNT (ADJ.)

UNIT HEATER - ELECTRIC HEATING CONTROLS (SEE MECHANICAL EQUIPMENT SCHEDULE SHEETS):

1. PROVIDE UNIT CONTROLS FOR UNIT HEATER OPERATION.
2. RUN CONDITIONS - SCHEDULED: THE UNIT SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS. THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
   A. OCCUPIED MODE: THE UNIT SHALL MAINTAIN:
      a. A 68ºF (ADJ.) HEATING SETPOINT.
   B. STANDBY MODE (IF PRESENT): THE UNIT SHALL MAINTAIN
      a. A 60ºF (ADJ.) HEATING SETPOINT.
   C. UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL MAINTAIN:
      a. A 55ºF (ADJ.) HEATING SETPOINT.
3. START/STOP, CONTROLLED DEVICES SHALL RESPOND AS FOLLOWS::
   A. WHEN INDEXED TO STOP: ELECTRIC HEAT OFF, DISABLE SUPPLY FAN.
   B. WHEN INDEXED TO START: ENABLE SUPPLY FAN WITH OPERATION OF SYSTEM TO RESUME AFTER START-UP DELAY.
4. ZONE SETPOINT ADJUST (IF PRESENT): THE OCCUPANT SHALL BE ABLE TO ADJUST THE ZONE TEMPERATURE HEATING AND COOLING SETPOINTS AT THE ZONE SENSOR. A ZONE SETPOINT ADJUST LOCKOUT ENABLE/DISABLE SHALL BE PROVIDED.
5. ZONE UNOCCUPIED OVERRIDE (IF PRESENT): A TIMED LOCAL OVERRIDE CONTROL SHALL ALLOW AN OCCUPANT TO OVERRIDE THE SCHEDULE AND PLACE THE UNIT INTO AN OCCUPIED MODE FOR AN ADJUSTABLE PERIOD OF TIME. AT THE EXPIRATION OF THIS TIME, CONTROL OF THE UNIT SHALL AUTOMATICALLY RETURN TO THE SCHEDULE. A ZONE UNOCCUPIED OVERRIDE LOCKOUT ENABLE/DISABLE SHALL BE PROVIDED.
6. ZONE STANDBY MODE (ZONES WITH OCCUPANCY SENSORS): THE UNIT CONTROLLER SHALL MONITOR THE OCCUPANCY STATUS OF THE ZONES LIGHTING SYSTEM OCCUPANCY SENSORS AND MAINTAIN STANDBY SETPOINTS WHEN OCCUPANCY IS NOT SENSED AND SCHEDULING CALLS FOR OCCUPANCY. WHEN SCHEDULING CALLS FOR OCCUPANCY AND ZONE STANDBY MODE EXCEEDS AN ADJUSTABLE AMOUNT OF HOURS, PLACE ZONE INTO UNOCCUPIED MODE UNTIL NEXT COMMAND FOR OPTIMAL START OR ZONE UNOCCUPIED OVERRIDE IS ACTIVATED. USER ADJUSTABLE TIME DELAYS SHALL BE PROVIDED FOR ENABLING AND DISABLING ZONE STANDBY MODE BASED ON OCCUPANCY STATUS.
7. ZONE OPTIMAL START (NOT USED): THE UNIT SHALL NOT USE AN OPTIMAL START ALGORITHM FOR MORNING START-UP BASED ON THE TIME NECESSARY FOR THE ZONE TO REACH ITS OCCUPIED SETPOINT FOR HEATING OPERATION.
8. SUPPLY FAN(S): THE SUPPLY FAN(S) SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN BY THE FACTORY INSTALLED CONTROLLER, UNLESS SHUTDOWN ON SAFETIES.
9. SUPPLY FAN CONTROL: THE UNIT CONTROLLER SHALL MONITOR THE HEATING DEMAND OF THE ZONE SENSOR AND ENABLE THE SUPPLY FAN TO MAINTAIN THE ZONE HEATING SETPOINT.
10. ELECTRIC HEATING COIL: THE UNIT CONTROLLER SHALL MEASURE THE ZONE TEMPERATURE AND STAGE/MODULATE THE HEATING COIL ON DROPPING ZONE TEMPERATURE BASED ON A PROPORTIONAL ALGORITHM, TO MAINTAIN ITS HEATING SETPOINT, UNLESS SHUTDOWN ON SAFETIES.
   A. THE HEATING SHALL BE ENABLED WHENEVER:
      a. ZONE TEMPERATURE IS LESS THAN ITS HEATING SETPOINT AND THE ASSOCIATED TERMINAL UNIT COOLING DEMAND IS LESS THAN 50% (ADJ.).
      b. OUTSIDE AIR TEMPERATURE IS LESS THAN 65ºF (ADJ.).
      c. AND THE FAN IS ON.
11. ALARM SETPOINTS:
   A. LOW ZONE TEMP: IF THE ZONE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT.

FAN POWERED TERMINAL UNIT - ELECTRIC HEATING CONTROLS (SEE MECHANICAL EQUIPMENT SCHEDULE SHEETS):

1. PROVIDE UNIT CONTROLS FOR FAN POWERED TERMINAL UNIT OPERATION.
2. RUN CONDITIONS - SCHEDULED: THE UNIT SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS. THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
   A. OCCUPIED MODE: THE UNIT SHALL MAINTAIN:
      a. A 68ºF (ADJ.) HEATING SETPOINT.
   B. STANDBY MODE (IF PRESENT): THE UNIT SHALL MAINTAIN
      a. A 60ºF (ADJ.) HEATING SETPOINT.
   C. UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL MAINTAIN:
      a. A 55ºF (ADJ.) HEATING SETPOINT.
3. ZONE SETPOINT ADJUST (IF PRESENT): THE OCCUPANT SHALL BE ABLE TO ADJUST THE ZONE TEMPERATURE HEATING AND COOLING SETPOINTS AT THE ZONE SENSOR. A ZONE SETPOINT ADJUST LOCKOUT ENABLE/DISABLE SHALL BE PROVIDED.
4. ZONE UNOCCUPIED OVERRIDE (IF PRESENT): A TIMED LOCAL OVERRIDE CONTROL