

1 M10.2 HOT WATER VAV BOX

REFER TO SPECIFICATION SECTION 23 09 93 FOR MINIMUM VAV BOX CONTROL BY OCCUPANCY.

VAV BOXES WITH REHEAT COILS

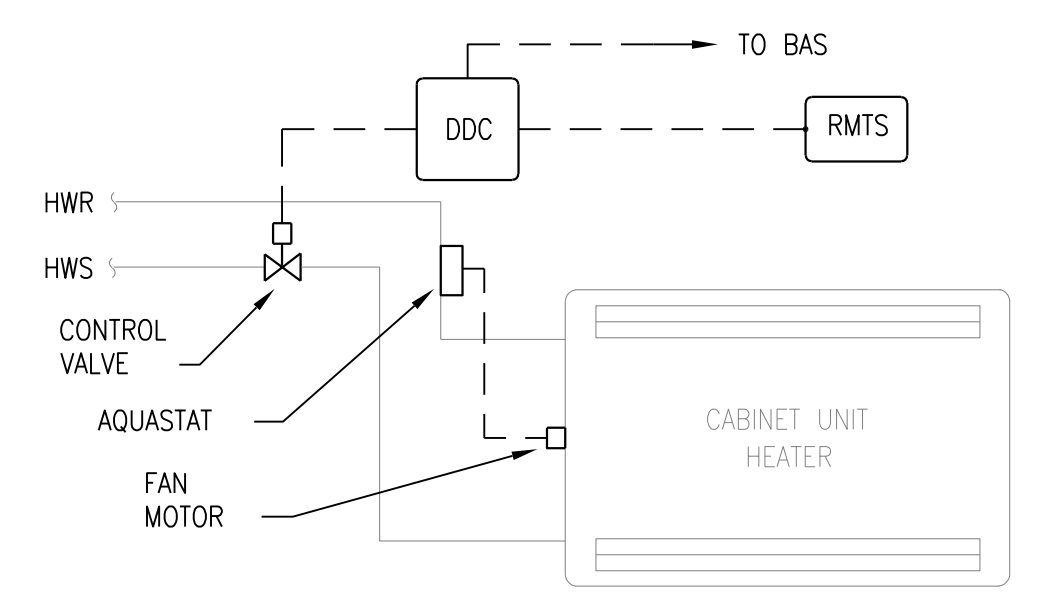
SEQUENCE - HEATING MODE

- On a call for heat, the control valve shall open from 0% to 100%.
- On a further call for heat, the VAV damper shall modulate from minimum setpoint to maximum setpoint.
- Setpoint minus 2 degrees F. = Maximum heating CFM and control valve full open.
- Setpoint minus 2 F. to minus 1 F. = Modulate from heating max to heating min CFM, control valve full open.
- Minus 1 F to Setpoint = modulate control valve closed.
- Setpoint plus 1 F. = Control Valve closed, Modulate from min CFM to max CFM.
- Reverse shall occur on drop in temperature.
- The spring return normally open valve will fail open to full heat.
- Points shall be monitored by the BAS.

SEQUENCE - COOLING MODE

- On a call for cooling, the control valve shall be closed.
- On a further call for cooling, the VAV damper shall modulate from minimum setpoint to maximum setpoint.
- Setpoint plus 2 degrees F. = Maximum cooling CFM and control valve full closed.
- Setpoint plus 1 F. to setpoint = Modulate from cooling max to cooling min CFM, control valve full closed.
- Setpoint to minus 1 degree = Modulate control valve open.
- Reverse shall occur on rise in temperature.
- Points shall be monitored by the BAS.

POINTS	HARDWARE				SOFTWARE						
	AI	AO	DI	DO	HA	LA	SA	TL	SP	SC	IL
SPACE TEMPERATURE	X						X		X	X	X
ACTIVE SETPOINT										X	
REHEAT CONTROL VALVE									X		
VAV CONTROL DAMPER		X							X		
DISCHARGE AIR TEMPERATURE	X								X	X	
OCCUPANCY SENSOR				X					X		
AIR FLOW	X								X		



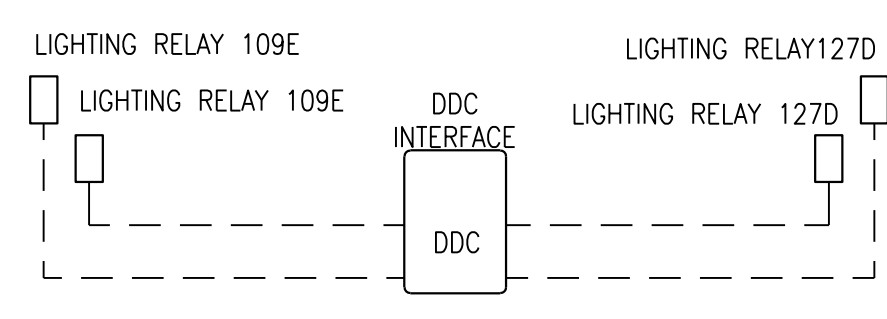
2 M10.2 HOT WATER CABINET UNIT HEATER

CABINET UNIT HEATER WITH DIGITAL STAT - TWO POSITION CONTROL VALVE & AQUASTAT

SEQUENCE

- Two position control valve shall open and close to satisfy space temperature setpoint of 66 F. (adjustable).
- Fan shall cycle on and off through control relay from aquastat setpoint of 90 F. (adjustable).
- The spring return normally open valve will fail open to full heat.
- Space setpoint shall not exceed 60 Deg. F.
- When outdoor air temperature exceeds 45 deg. F. the unit shall be off.
- Points shall be monitored by the BAS.

POINTS	HARDWARE				SOFTWARE						
	AI	AO	DI	DO	HA	LA	SA	TL	SP	SC	IL
SPACE TEMPERATURE	X						X		X	X	
CONTROL VALVE		X									



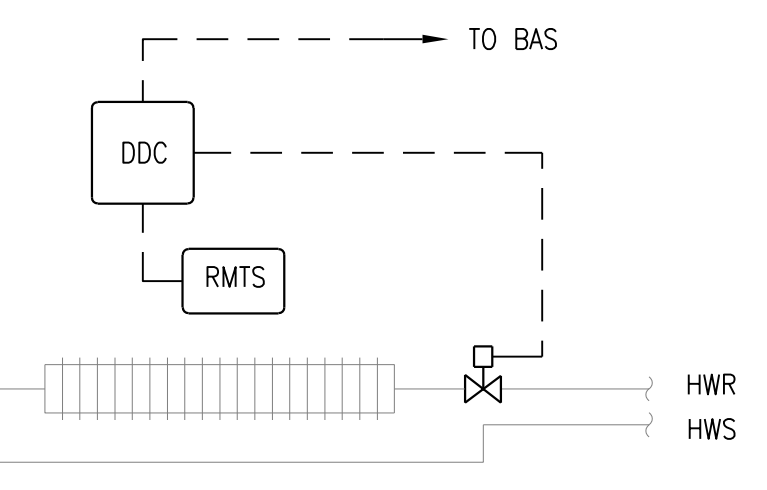
2 M10.2 LIGHTING CONTROL RELAY

LIGHTING CONTROLS

SEQUENCE

- Each lighting zone shall have a lighting relay
- Label zones as to area and system served
- Provide control schedules for each system category and zone location.
- Map(s) shall indicate status and current control status for each control zone
- Indicate run time for each zone.
- Points shall be monitored by the BAS.

POINTS	HARDWARE				SOFTWARE						
	AI	AO	DI	DO	HA	LA	SA	TL	SP	SC	IL
ACTIVE SETPOINT										X	
LIGHTING CONTROL RELAY (4)					X				X		



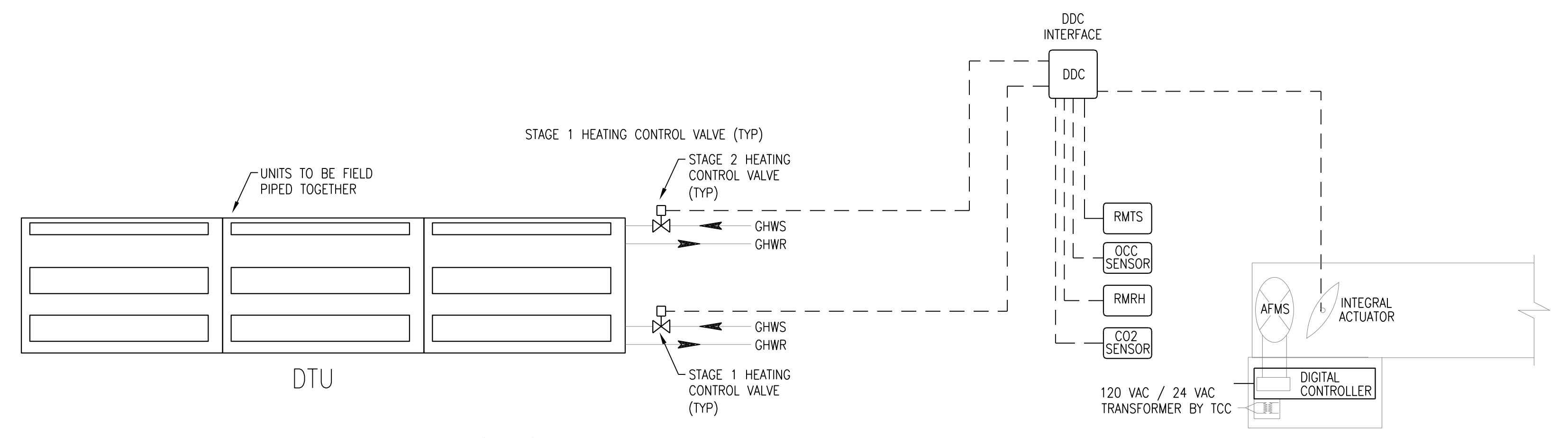
4 M10.2 HYDRONIC FIN TUBE RADIATION OR CONVECTOR

FIN-TUBE RADIATION - TWO POSITION CONTROL VALVE

SEQUENCE

- Set-point minus 1.5 degrees F. = Control Valve full open.
- Minus 1.5 Deg F. to Set-point = Modulate control valve to full open.
- Set-Point to plus 1 deg F. = Control Valve closed.
- Reverse shall occur on a drop in temperature.
- The spring return, normally open valve will fail open to full heat.
- Points shall be monitored by BAS.

POINTS	HARDWARE				SOFTWARE						
	AI	AO	DI	DO	HA	LA	SA	TL	SP	SC	IL
SPACE TEMPERATURE	X						X		X	X	
CONTROL VALVE		X									
ACTIVE SET-POINT									X	X	



5 M10.2 DISPLACEMENT-INDUCTION UNIT (DTU)

HVAC DISPLACEMENT TERMINAL UNITS (DTU'S)

A. Central Control Panel: Provide monitoring, alarm and control functions as indicated on the Point List. A unitary controller shall be used to interface into the DTU's.

B. General Requirements: Two heating control valves will be provided for each room. The first control valve shall control the Displacement Terminal Unit heating coil (Stage 1) and the second control valve will control the inside Displacement Terminal Units heating coils (Stage 2). Each room shall be provided with one cooling control valve to control chilled water to the cooling coil at the DTU.

1 During the occupied heating cycle, the Stage 2 control valve shall modulate open and closed in response to the room thermostat to satisfy room conditions. The occupied setpoint shall be 70 degrees for heating and 76 degrees for dehumidification (adjustable). If Stage 2 cannot maintain room setpoint then the Stage 1 control valve shall modulate open to satisfy the room thermostat.

2 During the un-occupied cycle, the heating Stage 1 and Stage 2 control valves shall modulate open and closed in sequence in response to the room thermostat to satisfy unoccupied room conditions. The unoccupied setpoint shall be 5 degrees below occupied setpoint (adjustable). If the unoccupied heating setpoint cannot be maintained, the room air supply control damper shall open and the rooftop or indoor DOAS unit shall operate as per sequence 1/M10.1. In the heating-warmup cycle, the room air supply control damper shall open and the rooftop or indoor DOAS unit shall be operated as per its sequence.

3 During the occupied cooling cycle, the occupied setpoint shall be 72 degrees for cooling and 76 degrees for dehumidification (adjustable).

4 During the un-occupied cycle, The unoccupied setpoint shall be 5 degrees above occupied setpoint (adjustable). If the unoccupied cooling setpoint cannot be maintained, the room air supply control damper shall open and the rooftop or indoor DOAS unit shall operate as per its control sequence. In the cool-down cycle, the room volume control damper or VAV Box shall open and the rooftop or indoor DOAS unit shall be operated as per its sequence.

C. Air Supply Control by Occupancy: Provide control of the Room VAV box based on Occupancy detectors.

1 Stand-by Control (Supply Fan "On", No Occupant in Room): When the room is indexed to Unoccupied by the occupancy detector through the DDC Central System, the room volume control damper or VAV box will go to its unoccupied cfm/flow setting which is 25% of Max cfm. The volume control damper or VAV Box Damper shall modulate open if required for the room sensor to maintain the standby setting of 70 F +/- 4 (adjustable) heating, 72 F +/- 4 (adjustable) cooling.

2 Occupied Control: When the room is indexed to Occupied by the Occupancy Detector, the room volume control damper or VAV Box Damper shall go open and the room sensor will maintain occupied room temperature setting as indicated previously.

3 DOAS Unit: Based on the CO2 sensor in the room, reduce or increase the outside air cfm supplied by the unit supply fan to maintain a maximum of 1200 ppm (adjustable) CO2 level.

POINTS	HARDWARE				SOFTWARE						
	AI	AO	DI	DO	HA	LA	SA	TL	SP	SC	IL
HEATING CONTROL VALVE STAGE 1	X	X							X	X	
HEATING CONTROL VALVE STAGE 2	X	X				X			X	X	
C.O.2						X					
OCCUPANCY SENSOR					X						
VAV CONTROL DAMPER		X							X	X	
SPACE TEMPERATURE/HUMIDITY	X						X			X	X
ACTIVE SETPOINT										X	
VAV CFM	X								X		

ADDITIONAL CONTROLS SCOPE

A. OTHER CONTROLS NOT SHOWN ON PLANS: (REFER TO SPEC SECTION 23 09 93 FOR OTHER MISC SYSTEM CONTROLS TO BE INTEGRATED INTO EMS SYSTEM)

1. REMOVE PNEUMATICS TUBING AND CONTROLS BACK TO THE SOURCE OR NEAREST BRANCH FOR EQUIPMENT BEING REMOVED OR REPLACED.

REVISIONS

HVAC Replacement and Deferred Maintenance - Phase 3
CROOKED LAKE ELEMENTARY SCHOOL
 Anoka-Hennepin Schools I.S.D. No. 11
 2939 Bunker Lake Blvd NW
 Andover, MN 55304

SIGNATURE / SEAL
 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.

 Blayne Parkos, PE
 TYPED OR PRINTED NAME
 October 27, 2021
 DATE
 4 6 3 0
 LICENSE NUMBER

KEYPLAN

DRAWN BY
 GEG
 CHECKED BY
 BJP
 ISSUED FOR
 CONSTRUCTION DOCUMENTS
 ISSUE DATE
 OCTOBER 27, 2021
 SHEET NAME

MECHANICAL CONTROL DIAGRAMS
 ATSR PROJECT NO.
 19039.2
 REVISION NO.
 SHEET NUMBER