

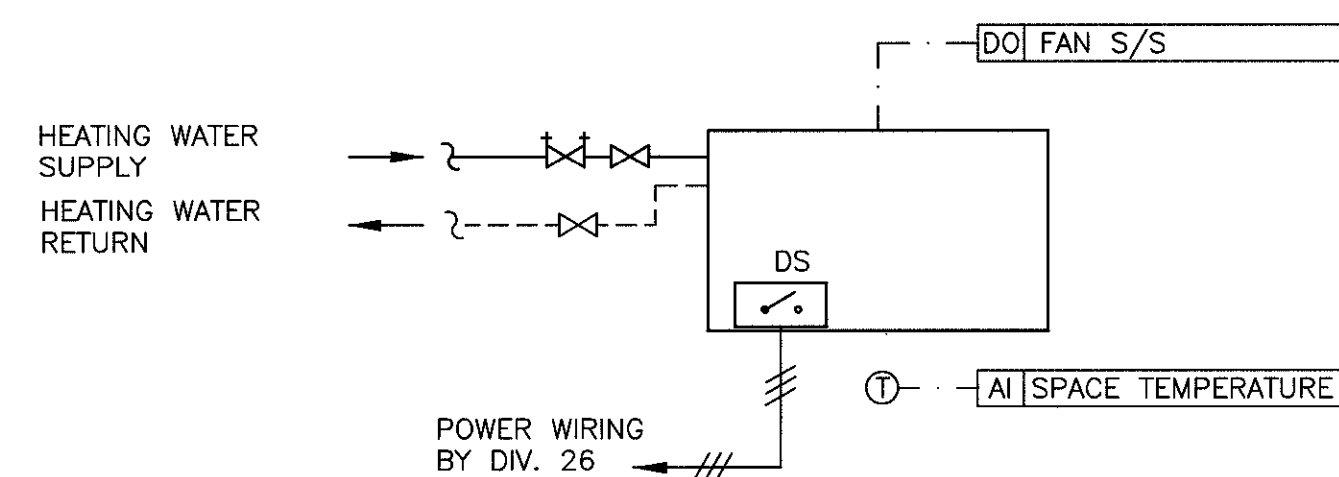
VAV BOX WITH REHEAT COIL AND SUPPLEMENTAL HEATING SEQUENCE OF OPERATION

ALL SET POINTS AND VARIABLES INDICATED IN [SQUARE BRACKETS] SHALL BE EASILY ADJUSTABLE BY THE BUILDING OPERATOR AT THE SYSTEM GRAPHIC.

1. OCCUPANCY:
 - a. THE OCCUPANCY MODE FOR EACH VAV TERMINAL UNIT SHALL MATCH THE OCCUPANCY SCHEDULE FOR AHU-1.
 - b. THE TIME SCHEDULE SHALL INCLUDE OPTIMUM START SEQUENCES SO THAT THE ASSOCIATED ZONE IS AT ITS OCCUPIED SETPOINT AT THE START OF THE OCCUPANCY PERIOD.
 - c. DURING OUT OF NORMAL OCCUPANCY TIMES THE OVERRIDE BUTTON ON THE ROOM TEMPERATURE SENSOR SHALL BE PROGRAMMED TO SET THE ZONE TERMINAL UNIT INTO OCCUPANCY MODE FOR A PERIOD OF [2] HOURS. ON ACTIVATION OF THIS BUTTON A CORRESPONDING ACTIVATION SIGNAL SHALL BE SENT TO AHU-1.
 - d. OCCUPIED OVERRIDE MODE, SPACE TEMPERATURE, AIRFLOW AND SETPOINT STATUS WILL BE INDICATED ON THE SYSTEM GRAPHIC FOR EACH VAV TERMINAL UNIT.
2. OCCUPIED MODE TEMPERATURE CONTROL:
 - a. WHEN THE ZONE TEMPERATURE IS BETWEEN THE OCCUPIED HEATING AND COOLING SETPOINTS (INSIDE OF THE BIAS), THE PRIMARY AIR DAMPER WILL BE AT THE MINIMUM 1/8 AND THERE WILL BE NO MECHANICAL HEATING. ON A RISE IN ZONE TEMPERATURE ABOVE THE COOLING SETPOINT, THE PRIMARY AIR DAMPER WILL MODULATE IN ACCORDANCE WITH A PROPORTIONAL PLUS INTEGRAL CONTROL ALGORITHM IN ORDER TO MAINTAIN THE SPACE TEMPERATURE AT ITS SETPOINT. THERE WILL BE NO MECHANICAL HEATING. ON A DROP IN ZONE TEMPERATURE BELOW THE HEATING SETPOINT, THE VAV DAMPER SHALL BE IN ITS MINIMUM POSITION AND THE REHEAT COIL WILL MODULATE IN ACCORDANCE WITH A PROPORTIONAL PLUS INTEGRAL CONTROL ALGORITHM IN ORDER TO MAINTAIN THE SPACE TEMPERATURE AT ITS SETPOINT.
 - b. THE ZONE HEATER VALVE WILL BE OPENED WHENEVER THE REHEAT COIL IS 50% OPEN OR MORE.
 - c. THE OCCUPIED MODE HEATING SETPOINT SHALL BE [20]°C AND THE OCCUPIED COOLING SETPOINT SHALL BE [22]°C.
3. UNOCCUPIED MODE TEMPERATURE CONTROL:
 - a. WHEN IN THIS MODE, WHILE THE ZONE TEMPERATURE IS BETWEEN THE UNOCCUPIED HEATING AND COOLING SETPOINTS (INSIDE OF THE BIAS), THE PRIMARY AIR DAMPER WILL BE CLOSED AND THERE WILL BE NO MECHANICAL HEATING. ON A FALL IN ZONE TEMPERATURE BELOW THE UNOCCUPIED HEATING SETPOINT, THE RADIANT HEATING ZONE CONTROL VALVE SHALL BE OPENED AND CLOSED TO MAINTAIN THE UNOCCUPIED TEMPERATURE SETPOINT IN A SIMILAR WAY TO THE OCCUPIED MODE. ON A RISE IN ZONE TEMPERATURE ABOVE THE UNOCCUPIED COOLING SETPOINT, THE VAV TERMINAL UNIT WILL PROVIDE A "UNOCCUPIED COOLING REQUIRED" SIGNAL TO AHU-1, ENABLING THAT AHU TO START. ONCE OPERATIONAL THE VAV TERMINAL UNIT WILL MODULATE TO MAINTAIN THE UNOCCUPIED TEMPERATURE SETPOINT IN A SIMILAR WAY TO THE OCCUPIED MODE.
 - b. THE VAV TERMINAL UNIT WILL CONTINUE TO OPERATE IN THIS WAY UNTIL THE SETPOINT IS ACHIEVED OR AN OCCUPANCY TIME IS REACHED.
 - c. INITIALLY THE UNOCCUPIED HEATING SET POINT SHALL BE SET TO [16]°C AND THE UNOCCUPIED COOLING SETPOINT SHALL BE SET TO [27]°C.
4. AIR QUALITY OVERRIDE:
 - a. GENERAL: WHILST IN OCCUPANCY OR PURGE MODE THE POSITION OF THE VAV DAMPER SHALL BE OVERRIDDEN IN ORDER TO MAINTAIN THE SPACE CARBON DIOXIDE LEVEL AT OR BELOW ITS COMFORT THRESHOLD.
 - b. CARBON DIOXIDE: IN THE EVENT THAT THE MEASURED CARBON DIOXIDE LEVEL IS [10]% ABOVE ITS SET POINT THEN THE VAV DAMPER POSITION SHALL BE COMMANDED TO MAINTAIN AN AIRFLOW EQUAL TO THE CURRENT AIRFLOW REQUIRED FOR TEMPERATURE CONTROL, PLUS AN ADDITIONAL 20% OF THE MAXIMUM DESIGN AIRFLOW. IF THE MEASURED CO2 LEVEL IS BETWEEN 1200 AND 1400 OF THE MAXIMUM ACCEPTABLE VALUE THEN THE VAV DAMPER POSITION SHALL BE COMMANDED TO MAINTAIN AN AIRFLOW EQUAL TO THE CURRENT AIRFLOW REQUIRED FOR TEMPERATURE CONTROL, PLUS AN ADDITIONAL 50% OF THE MAXIMUM DESIGN AIRFLOW. IF THE MEASURED CARBON DIOXIDE IS 1500 OR MORE OF ITS MAXIMUM ACCEPTABLE LEVEL THEN THE VAV DAMPER POSITION SHALL BE COMMANDED FULLY OPEN. THE CARBON DIOXIDE SET POINT SHALL BE [1200] PPM.
 - c. THE VAV DAMPER POSITION SHALL REMAIN IN ITS OVERRIDE POSITION UNTIL THE MEASURED POLLUTANT IS LESS THAN ITS THRESHOLD VALUE. WHILST OPERATING IN THE OVERRIDE MODE THE RE-HEAT AND SPACE HEATING SYSTEMS SHALL CONTINUE TO OPERATE NORMALLY IN ORDER TO MAINTAIN THE SPACE TEMPERATURE SETPOINT.

1 CONTROLS SCHEMATIC — VAV TERMINAL UNIT CONTROLS

SCALE : N.T.S.

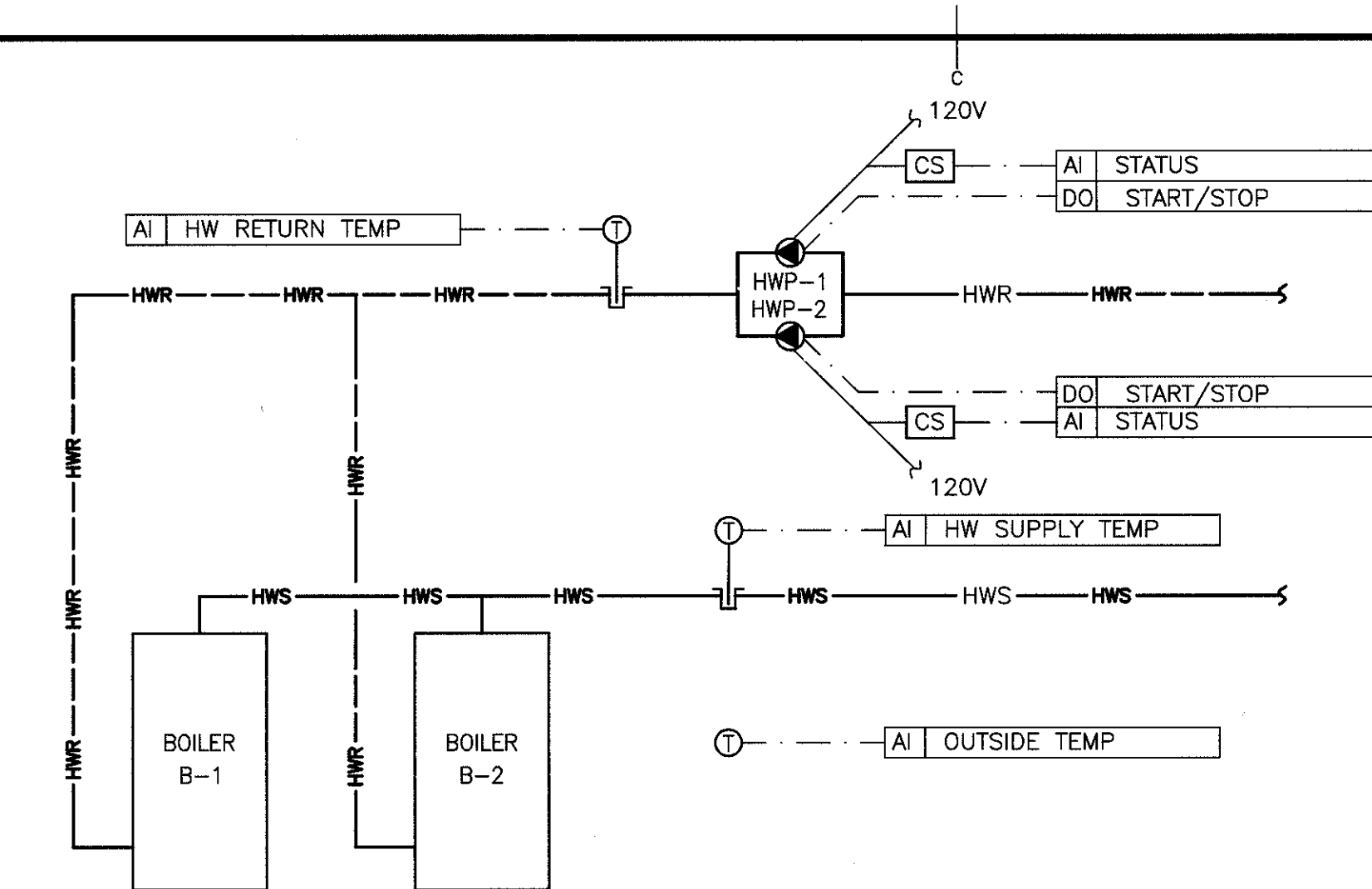


SEQUENCE OF OPERATION:

1. WHEN SPACE TEMPERATURE DROPS BELOW SETPOINT VALUE, FAN STARTS.
2. WHEN SPACE TEMPERATURE HAS REACHED 2°C ABOVE SETPOINT, FAN STOPS.

2 CONTROLS SCHEMATIC — OR UNIT HEATER

SCALE : N.T.S.

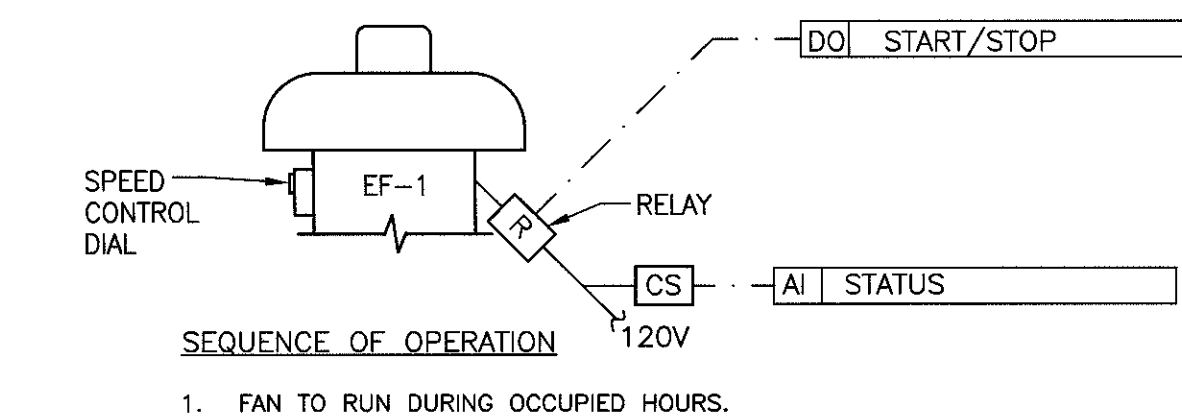


SEQUENCE OF OPERATION

1. WHEN OUTDOOR AIR TEMPERATURE IS 10°C OR BELOW, OR THERE IS A CALL FOR HEAT FROM ANY ZONE, LEAD PUMP SHALL RUN.
2. HWP-1 AND HWP-2 SHALL SWAP LEAD/LAG STATUS WEEKLY FOR EVEN RUN TIMES.
3. IF LEAD PUMP SHOULD FAIL, LAG PUMP SHALL START AND GENERATE AN ALARM.
4. CONTROL OF BOILERS IS TO REMAIN AS IS.

3 CONTROLS SEQUENCE — BOILER PUMPS

SCALE : N.T.S.

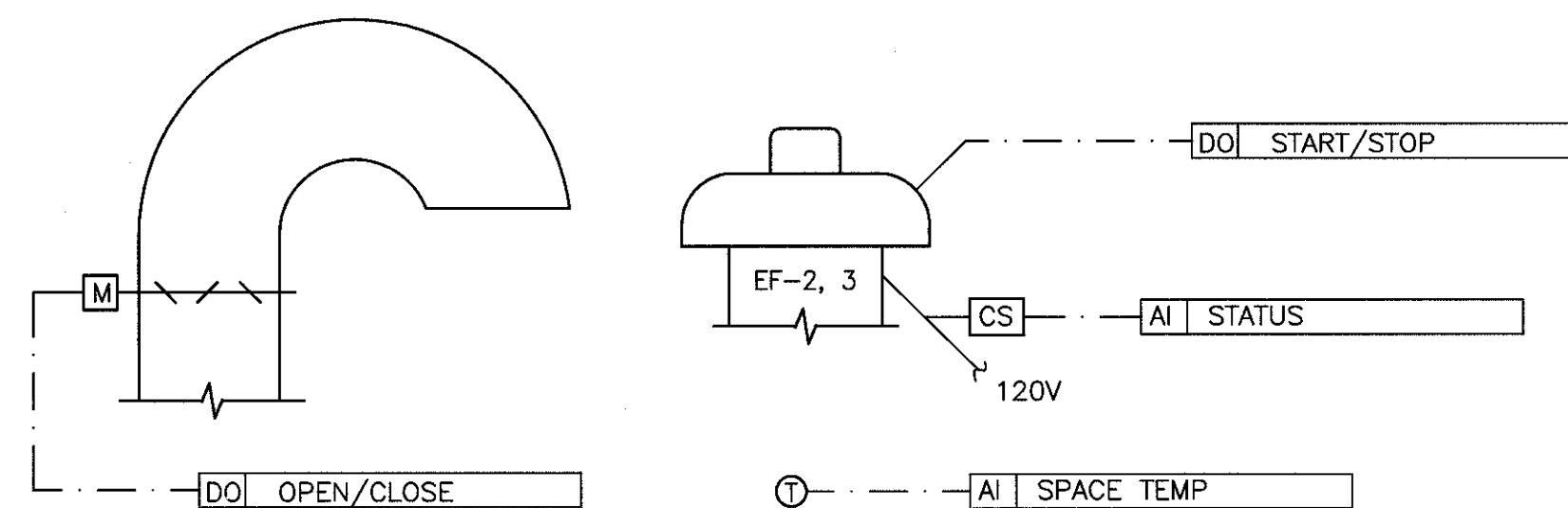


SEQUENCE OF OPERATION

1. FAN TO RUN DURING OCCUPIED HOURS.

4 CONTROLS SEQUENCE — EF-1

SCALE : N.T.S.

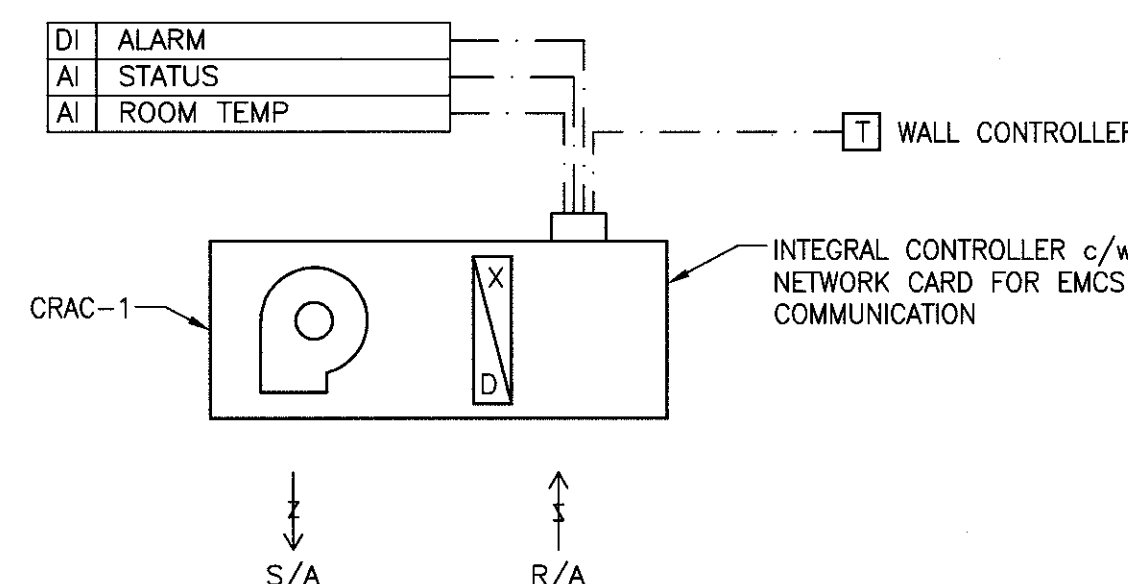


SEQUENCE OF OPERATION

1. ON A CALL FOR COOLING (INTERNAL TEMP S.P. = 25°C) FAN TO RUN AND DAMPER TO OPEN.

5 CONTROLS SEQUENCE — EF-2 & EF-3

SCALE : N.T.S.

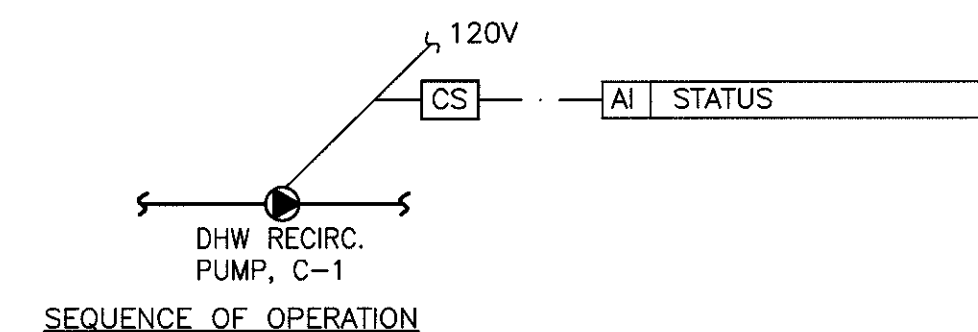


SEQUENCE OF OPERATION

1. CRAC UNIT TO RUN BASED ON A CALL FOR COOLING FROM WALL CONTROLLER (NO EMCS INPUT).
2. EMCS TO RECEIVE INPUTS FROM THE CRAC UNIT CONTROLLER AND BE DISPLAYED IN EMCS GRAPHIC.

6 CONTROLS SEQUENCE — COMPUTER ROOM A/C

SCALE : N.T.S.

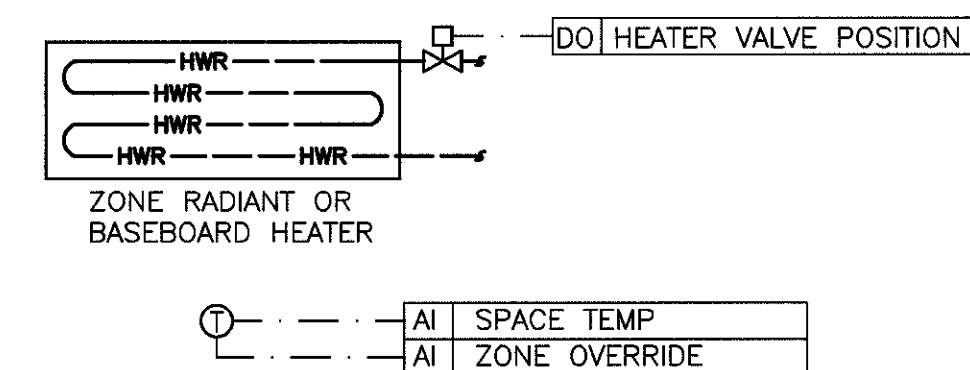


SEQUENCE OF OPERATION

1. PUMP TO RUN CONTINUOUS (MOTOR STARTER BY ELECTRICAL).
2. EMCS TO MONITOR STATUS.

7 CONTROLS SEQUENCE — DHW RECIRC. PUMP

SCALE : N.T.S.



SEQUENCE OF OPERATION

1. OCCUPANCY: AS PER VALVE SCHEMATIC.
2. TEMPERATURE CONTROL:
 - a) ON A CALL FOR HEAT, VALVE TO OPEN.
 - b) OCCUPIED/UNOCCUPIED SET POINTS AS PER VAV SCHEMATIC.

8 CONTROLS SEQUENCE — HEATING ZONES

SCALE : N.T.S.

1	ISSUED FOR TENDER	JUN. 4 2015
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ARGO BUILDING
BEDFORD INSTITUTE
OF OCEANOGRAPHY

DARTMOUTH, NS

drawing dessin

MECHANICAL
CONTROLS
SHEET 1

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Tender Soumission

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