

SEQUENCE OF OPERATIONS - CHILLED WATER SYSTEM

SYSTEM DESCRIPTION
THE CHILLED WATER SYSTEM CONSISTS OF THE FOLLOWING:
• TWO (2) VARIABLE FLOW CHILLED WATER PUMPS WITH VFD.
• ONE (1) MODULATING BYPASS VALVE
• ONE (1) INLINE FLANGED ELECTROMAGNETIC FLOW METER

GENERAL:
THE CHILLED WATER SYSTEM SHALL BE CONNECTED TO THE DDC FOR ENABLE/DISABLE COMMANDS. THE SYSTEM SHALL BE ENABLED UNDER THE FOLLOWING CONDITIONS, ELSE THE SYSTEM SHALL BE DISABLED:

- THE OUTSIDE TEMPERATURE IS 60°F (ADJ.) OR ABOVE DURING THE OCCUPIED PERIOD.
- ANY SPACE TEMPERATURE IS ABOVE 75°F (ADJ.) DURING THE OCCUPIED PERIOD OR ABOVE 78°F DURING THE UNOCCUPIED PERIOD (ADJ.).
- ANY SPACE RELATIVE HUMIDITY IS ABOVE 60% RH (ADJ.).

WHEN ENABLED, THE CHILLED WATER PUMP SHALL OPERATE TO PROVIDE VARIABLE FLOW THROUGH THE BUILDING CHILLED WATER LOOP.

CHILLED WATER LOOP SHUTDOWN
WHEN THE CHILLED WATER SYSTEM IS DISABLED, THE CHILLED WATER PUMP SHALL SHUT DOWN.

CHILLED WATER PUMP START/STOP
THE DDC CONTROLLER SHALL START THE CHILLED WATER PUMP THROUGH A CONTACT CLOSURE OF THE PUMP'S VARIABLE FREQUENCY (VFD) DRIVE RUN-ENABLE CONTACTS.

CHILLED WATER PUMP STATUS
THE DDC CONTROLLER SHALL DETECT CHILLED WATER PUMP RUN STATUS BY AN ON-BOARD VARIABLE FREQUENCY DRIVE STATUS RELAY.

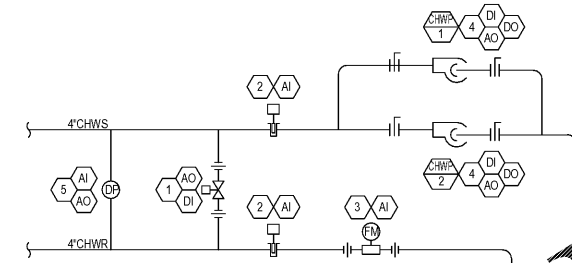
CHILLED WATER PUMP FAILURE
IF THE PUMP START/STOP RELAY IS ENABLED AND THE DDC SYSTEM IS REPORTING THAT THE PUMP IS NOT RUNNING FOR MORE THAN 30 SECONDS (ADJ.), THE DDC CONTROLLER SHALL ANNUNCIATE A CHILLED WATER PUMP FAILURE ALARM TO THE DDC WORKSTATION. ONCE THE PROBLEM HAS BEEN CORRECTED AND THE OPERATOR IS ABLE TO CLEAR THE ALARM FAILURE FROM THE DDC CONTROLLER, THE DDC SHALL RE-ENABLE THE SEQUENCE.

CHILLED WATER PUMP SPEED
THE DDC SYSTEM SHALL MONITOR THE CHILLED WATER SYSTEM DIFFERENTIAL PRESSURE SENSOR. WHEN THE PUMP VARIABLE FREQUENCY DRIVE IS ENABLED, THE DDC SHALL CONTROL THE ANALOG SPEED SIGNAL THAT IS SENT TO THE PUMP VARIABLE FREQUENCY DRIVE TO MAINTAIN A CHILLED WATER DIFFERENTIAL PRESSURE SETPOINT. THE BYPASS VALVE SHALL MODULATE TO MAINTAIN AT LEAST 30% OF THE PUMP SPEED DURING LOW LOAD CONDITION.

WHEN ALL OF THE BUILDING CHILLED WATER TWO WAY VALVES ARE CLOSED AND THE BYPASS VALVE IS FULLY OPEN FOR 30 MINUTES (ADJ.) THEN THE CHILLED WATER PUMP SHALL BE DE-ACTIVATED.

ALARMS:
THE FOLLOWING SOFTWARE ALARMS SHALL BE GENERATED AND DISPLAYED AT THE OPERATOR'S WORKSTATION:

- CHILLED WATER PUMP ALARM (COMMAND AND PUMP STATUS DO NOT MATCH)
- LOW CHW SUPPLY TEMPERATURE (10 DEG F BELOW CURRENT CHW TEMP SET POINT FOR 10 MINS.)
- HIGH CHW SUPPLY TEMPERATURE (10 DEG F ABOVE CURRENT CHW TEMP SET POINT FOR 10 MINS.)
- HIGH CHW SUPPLY TEMPERATURE (10 DEG F ABOVE CURRENT CHW TEMP SET POINT FOR 10 MINS.)



SHEET NOTES

- 1 CHILLED WATER MODULATING BYPASS VALVE.
- 2 TEMPERATURE TRANSMITTER WITH STAINLESS STEEL RTD IMMERSION SENSOR.
- 3 FLANGED INLINE ELECTROMAGNETIC FLOW METER.
- 4 PROVIDE WITH VFD FOR VARIABLE PRIMARY CHILLED WATER CONFIGURATION. REFER TO INLINE CLOSED COUPLED PUMP DETAIL FOR ADDITIONAL INFORMATION.
- 5 DIFFERENTIAL PRESSURE SENSOR.

1 CHILLED WATER SYSTEM CONTROLS DIAGRAM SCHEMATIC

SEQUENCE OF OPERATIONS - HEATING HOT WATER SYSTEM

SYSTEM DESCRIPTION
THE HOT WATER SYSTEM CONSISTS OF THE FOLLOWING:
• TWO (2) VARIABLE FLOW HOT WATER PUMPS WITH VFD.
• ONE (1) MODULATING BYPASS VALVE
• ONE (1) INLINE FLANGED ELECTROMAGNETIC FLOW METER
• AIR TERMINAL UNITS WITH HOT WATER REHEAT

GENERAL:
THE HOT WATER SYSTEM SHALL BE CONNECTED TO THE DDC FOR ENABLE/DISABLE COMMANDS. THE SYSTEM SHALL BE ENABLED UNDER THE FOLLOWING CONDITIONS, ELSE THE SYSTEM SHALL BE DISABLED:

- SCHEDULED OCCUPIED PERIOD WITH OUTSIDE AIR TEMPERATURE LESS THAN 50 DEG F.
- WHENEVER ANY ZONE DEMANDS HOT WATER DURING OCCUPIED OR UNOCCUPIED PERIODS (REGARDLESS OF OUTSIDE AIR TEMPERATURE OR BUILDING TEMPERATURE OR HUMIDITY CONTROL).

WHEN ENABLED, THE HOT WATER PUMP SHALL OPERATE TO PROVIDE VARIABLE FLOW THROUGH THE BUILDING HOT WATER LOOP.

HOT WATER LOOP SHUTDOWN
WHEN THE HOT WATER SYSTEM IS DISABLED, THE HOT WATER PUMP SHALL SHUT DOWN.

HOT WATER PUMP START/STOP
THE DDC CONTROLLER SHALL START THE HOT WATER PUMP THROUGH A CONTACT CLOSURE OF THE PUMP'S VARIABLE FREQUENCY (VFD) DRIVE RUN-ENABLE CONTACTS.

HOT WATER PUMP STATUS
THE DDC CONTROLLER SHALL DETECT HOT WATER PUMP RUN STATUS BY AN ON-BOARD VARIABLE FREQUENCY DRIVE STATUS RELAY.

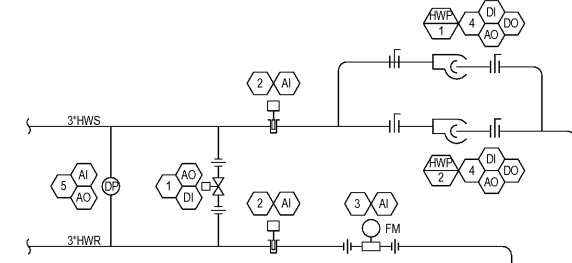
HOT WATER PUMP FAILURE
IF THE PUMP START/STOP RELAY IS ENABLED AND THE DDC SYSTEM IS REPORTING THAT THE PUMP IS NOT RUNNING FOR MORE THAN 30 SECONDS (ADJ.), THE DDC CONTROLLER SHALL ANNUNCIATE A HOT WATER PUMP FAILURE ALARM TO THE DDC WORKSTATION. ONCE THE PROBLEM HAS BEEN CORRECTED AND THE OPERATOR IS ABLE TO CLEAR THE ALARM FAILURE FROM THE DDC CONTROLLER, THE DDC SHALL RE-ENABLE THE SEQUENCE.

HOT WATER PUMP SPEED
THE DDC SYSTEM SHALL MONITOR THE HOT WATER SYSTEM DIFFERENTIAL PRESSURE SENSOR. WHEN THE PUMP VARIABLE FREQUENCY DRIVE IS ENABLED, THE DDC SHALL CONTROL THE ANALOG SPEED SIGNAL THAT IS SENT TO THE PUMP VARIABLE FREQUENCY DRIVE TO MAINTAIN A HOT WATER DIFFERENTIAL PRESSURE SETPOINT. THE BYPASS VALVE SHALL MODULATE TO MAINTAIN AT LEAST 30% OF THE PUMP SPEED DURING LOW LOAD CONDITION.

WHEN ALL OF THE BUILDING HOT WATER TWO WAY VALVES ARE CLOSED AND THE BYPASS VALVE IS FULLY OPEN FOR 30 MINUTES (ADJ.) THEN THE HOT WATER PUMP SHALL BE DE-ACTIVATED.

ALARMS:
THE FOLLOWING SOFTWARE ALARMS SHALL BE GENERATED AND DISPLAYED AT THE OPERATOR'S WORKSTATION:

- HOT WATER PUMP ALARM (COMMAND AND PUMP STATUS DO NOT MATCH)
- LOW HW SUPPLY TEMPERATURE (10 DEG F BELOW CURRENT HW TEMP SET POINT FOR 10 MINS.)
- HIGH HW SUPPLY TEMPERATURE (10 DEG F ABOVE CURRENT HW TEMP SET POINT FOR 10 MINS.)



SHEET NOTES

- 1 HOT WATER MODULATING BYPASS VALVE.
- 2 TEMPERATURE TRANSMITTER WITH STAINLESS STEEL RTD IMMERSION SENSOR.
- 3 FLANGED INLINE ELECTROMAGNETIC FLOW METER.
- 4 PROVIDE WITH VFD FOR VARIABLE PRIMARY HOT WATER CONFIGURATION. REFER TO INLINE CLOSED COUPLED PUMP DETAIL FOR ADDITIONAL INFORMATION.
- 5 DIFFERENTIAL PRESSURE SENSOR.

2 HOT WATER SYSTEM CONTROLS DIAGRAM SCHEMATIC

ISSUE DATE	ISSUE FOR
2018.05.25	BID

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