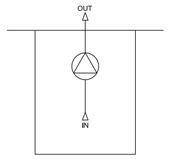



6 SUMP PUMP CONTROL DIAGRAM
NTS

## SEQUENCE OF OPERATIONS
## SUMP PUMP (SP-X)

**General Description**

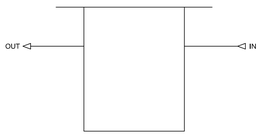
There are two (2) separate sump pumps. One sump pump lifts fluid out of the elevator pit during a leak and discharges to an oil water separator. The other lifts storm water from the foundation and discharges on grade.

### POINTS LIST - SUMP PUMP

| POINT NAME | HARDWARE POINTS AI | AO | BI | BO | SOFTWARE POINTS AV | BV | LOOP | SCHED | TREND | ALARM | SHOWN ON GRAPHIC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PUMPS** | | | | | | | | | | | |
| SP-1 | UNITARY CONTROLS | | | | | | | | | | |
| SP-2 | UNITARY CONTROLS | | | | | | | | | | |

| ALARMS | DESCRIPTION | ALARM | ALARM DELAY |
|---|---|---|---|
| FAILURE | COMMANDED ON, BUT THE STATUS IS OFF | X | 10 MIN. |
| IN HAND | COMMANDED OFF, BUT THE STATUS IS ON | X | 10 MIN. |
| START | PUMP HAS BEEN COMMANDED ON | X | 10 MIN. |

NOTES:
1 SEE STANDARD TRENDING POINTS LIST SCHEDULE ON SHEET M-701 FOR APPLICABLE TREND INTERVALS.




7 OIL WATER SEPARATOR CONTROL DIAGRAM
NTS

## SEQUENCE OF OPERATIONS
## OIL WATER SEPARATOR (OWS)

**General Description**

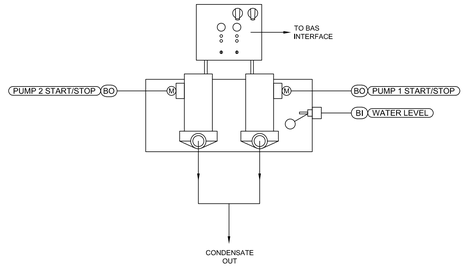
The oil water separator receives fluid from the elevator sump pump and discharges to the sanitary main.

### POINTS LIST - OIL WATER SEPARATOR

| POINT NAME | HARDWARE POINTS AI | AO | BI | BO | SOFTWARE POINTS AV | BV | LOOP | SCHED | TREND | ALARM | SHOWN ON GRAPHIC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PUMPS** | | | | | | | | | | | |
| OWS | UNITARY CONTROLS | | | | | | | | | | |

| ALARMS | DESCRIPTION | ALARM | ALARM DELAY |
|---|---|---|---|
| HIGH LEVEL | FLUID LEVEL IS ABOVE MANUFACTURER'S LIMIT. | X | 10 MIN. |

NOTES:
1 SEE STANDARD TRENDING POINTS LIST SCHEDULE ON SHEET M-701 FOR APPLICABLE TREND INTERVALS.




3 STEAM CONDENSATE PUMP (CP-X) TYPICAL CONTROL DIAGRAM
NTS

## SEQUENCE OF OPERATIONS
## STEAM CONDENSATE PUMP (CP-X) REPLACEMENT WAREHOUSE

**GENERAL DESCRIPTION**

The duplex steam condensate pump with condensate storage tank and manufacturer provided control panel provides steam condensate removal from the steam supply system as shown on the drawings.

**COMPONENT CONTROLS**

**PUMP 1**

The pump shall be activated (subject to the unit manufacturer's standard unitary safeties and controls) upon receiving a water level status.

**PUMP 2**

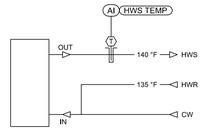
Upon failure of Pump 1, Pump 2 shall be activated (subject to the unit manufacturer's standard safeties and controls) upon receiving a water level status.

### POINTS LIST SCHEDULE (CP-X)

| POINT NAME | HARDWARE POINTS AI | AO | BI | BO | SOFTWARE POINTS AV | BV | LOOP | SCHED | TREND | ALARM | SHOWN ON GRAPHIC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PUMPS** | | | | | | | | | | | |
| PUMP 1 START/STOP | | | | X | | | | | X | | X |
| PUMP 2 START/STOP | | | | X | | | | | X | | X |
| **RECEIVER** | | | | | | | | | | | |
| WATER LEVEL | | | | X | | | | | X | | X |

| ALARMS | DESCRIPTION | ALARM | ALARM DELAY |
|---|---|---|---|
| COMMON ALARM | ALL APPLICABLE UNITARY ALARMS | X | 10 MIN. |
| HIGH WATER LEVEL ALARM | IF THE WATER LEVEL IS ABOVE THE STANDARD UNITARY SETPOINT VALUE | X | 5 MIN. |
| CONDENSATE PUMP START/STOP | COMMANDED ON, BUT THE STATUS IS OFF | X | 10 MIN. |

NOTES:
1 SEE STANDARD TRENDING POINTS LIST SCHEDULE ON SHEET M-701 FOR APPLICABLE TREND INTERVALS.




4 DOMESTIC ELECTRIC WATER HEATER CONTROL DIAGRAM
NOT TO SCALE

## SEQUENCE OF OPERATIONS
## DOMESTIC ELECTRIC WATER HEATER (WH-1)

**GENERAL DESCRIPTION**

The domestic hot water system consists of an electric water heater and recirculating pumps. Point-of-use mixing valves will provide anti-scald protection at their respective fixtures. A hot water recirculation pumps will serve the hot water heater. The water heaters are used to heat water for Building 165 domestic hot water system as shown on the drawings.

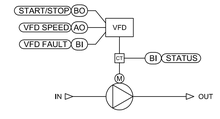
**Run Conditions**
The domestic electric water heater shall operate continuously.

**Hot Water Supply Temperature Setpoint**
The hot water supply temperature setpoint shall be a fixed setpoint of 140˚F (adj.).

### POINTS LIST - DOMESTIC STEAM TO WATER HEATER (WH-1)

| POINT NAME | HARDWARE POINTS AI | AO | BI | BO | SOFTWARE POINTS SETPOINT | AV | BV | LOOP | SCHED | TREND | ALARM | SHOWN ON GRAPHIC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WATER SIDE** | | | | | | | | | | | | |
| WH-1 HWS TEMPERATURE | X | | | | | | | | | X | X | X |
| **SETPOINTS** | | | | | | | | | | | | |
| WH-1 HWS TEMPERATURE SETPOINT | | | | | 140˚F | X | | | | | X | X |

| ALARMS | DESCRIPTION | ALARM | ALARM DELAY |
|---|---|---|---|
| WH-1 HIGH HWS TEMPERATURE | IF THE HWS TEMPERATURE IS GREATER THAN 145 ˚F (ADJ.) FOR GREATER THAN 5 MINUTES | X | 10 MIN. |
| WH-1 LOW HWS TEMPERATURE | IF THE HWS TEMPERATURE IS LESS THAN 135 ˚F (ADJ.) FOR GREATER THAN 5 MINUTES | X | 10 MIN. |




5 RECIRCULATING PUMP CONTROL DIAGRAM
NTS

## SEQUENCE OF OPERATIONS
## HOT/COLD WATER RECIRCULATION PUMPS (RP-X)

**General Description**

The inline recirculating pumps are used to recirculate the associated hot or cold water back to the domestic water heater and the service entrance as shown on the drawings.

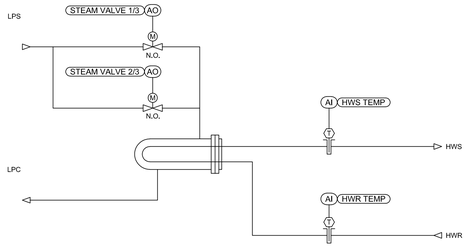
**Run Conditions**

The hot/cold water recirculation pumps shall operate continuously.

### POINTS LIST SCHEDULE - RECIRCULATION PUMP (RP-X)

| POINT NAME | HARDWARE POINTS AI | AO | BI | BO | SOFTWARE POINTS AV | BV | LOOP | SCHED | TREND | ALARM | SHOWN ON GRAPHIC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PUMPS** | | | | | | | | | | | |
| CWR PUMP STATUS | | | X | | | | | | X | X | X |
| HWR PUMP STATUS | | | X | | | | | | X | X | X |
| CWR PUMP START/STOP | | | | X | | | | | X | | X |
| HWR PUMP START/STOP | | | | X | | | | | X | | X |
| CWR PUMP FLOW RATE | | | X | | | | | | X | X | |
| HWR PUMP FLOW RATE | | | X | | | | | | X | X | |
| CWR PUMP FLOW RATE | X | | | | | | | | X | X | X |
| HWR PUMP FLOW RATE | X | | | | | | | | X | X | X |
| HWR/CWR TEMPERATURE | X | | | | | | | | X | X | X |

| ALARMS | DESCRIPTION | ALARM | ALARM DELAY |
|---|---|---|---|
| CWR PUMP FAILURE | COMMANDED ON, BUT THE STATUS IS OFF | X | 10 MIN. |
| CWR PUMP IN HAND | COMMANDED OFF, BUT THE STATUS IS ON | X | 10 MIN. |
| CWR PUMP RUNTIME EXCEEDED | STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT | X | 10 MIN. |
| CWR PUMP HIGH/LOW FLOW RATE | IF THE FLOW RATE EXCEEDS A USER DEFINABLE LIMT | X | 10 MIN. |
| HWR PUMP FAILURE | COMMANDED ON, BUT THE STATUS IS OFF | X | 10 MIN. |
| HWR PUMP IN HAND | COMMANDED OFF, BUT THE STATUS IS ON | X | 10 MIN. |
| HWR PUMP RUNTIME EXCEEDED | STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT | X | 10 MIN. |
| HWR PUMP HIGH/LOW FLOW RATE | IF THE FLOW RATE EXCEEDS A USER DEFINABLE LIMIT | X | 5 MIN. |
| LOW HWR / CWR TEMPERATURE | IF THE HWR / CWR TEMPERATURE IS LESS / GREATER THAN 124˚F / 67˚F | X | 5 MIN. |




1 HEATING HOT WATER HEAT EXCHANGER CONTROL DIAGRAM
NTS

## SEQUENCE OF OPERATIONS
## STEAM TO HOT WATER HEAT EXCHANGER (HX-X)

**General Description**

The steam to hot water shell and tube heat exchanger is used to heat water for the heating hot water system and its components as shown on the drawings.

**Run Conditions**

The heat exchanger system shall be enabled to run whenever a definable number of hot water coils need heating and outside air temperature is less than 65˚F (adj.). To prevent short cycling, the heat exchanger shall run for and be off for minimum adjustable times (both user definable). The heat exchanger system shall also run for freeze protection whenever outside air temperature is less than 38˚F (adj.).

**Hot Water Supply Temperature Setpoint**

The hot water supply temperature setpoint shall be a fixed setpoint of 160˚F (adj.).

**Heat Exchanger 1/3 - 2/3 Steam Valves - Hot Water Control**

The controller shall measure the hot water supply temperature and modulate the two steam valves in sequence to maintain its setpoint

The steam valves shall be enabled whenever the heat exchanger is called to run AND hot water supply temperature is below its setpoint.

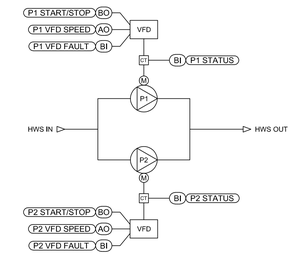
The steam valves shall open to 100% (adj.) whenever the heat exchanger is in freeze protection due to low outside air temperature. The steam valves shall close whenever the hot water supply temperature rises from 160˚F to 180˚F (adj.).

### POINTS LIST - HEAT EXCHANGER (HX-X)

| POINT NAME | HARDWARE POINTS AI | AO | BI | BO | SOFTWARE POINTS SETPOINT | AV | BV | LOOP | SCHED | TREND | ALARM | SHOWN ON GRAPHIC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **STEAM SIDE** | | | | | | | | | | | | |
| STEAM VALVE 1/3 | | X | | | | | | | | | | X |
| STEAM VALVE 2/3 | | X | | | | | | | | | | X |
| **WATER SIDE** | | | | | | | | | | | | |
| HWS TEMPERATURE | X | | | | | | | | | X | | X |
| HWR TEMPERATURE | X | | | | | | | | | X | | X |
| **SETPOINTS** | | | | | | | | | | | | |
| OUTSIDE AIR TEMPERATURE | | | | | SEE SEQ. | X | | | | | | X |
| HWS TEMPERATURE SETPOINT | | | | | 160˚F | X | | | | | | X |
| HWR TEMPERATURE SETPOINT | | | | | 140˚F | X | | | | | | X |

| ALARMS | DESCRIPTION | ALARM | ALARM DELAY |
|---|---|---|---|
| HIGH HWS TEMPERATURE | IF THE HWS TEMPERATURE IS GREATER THAN 180 ˚F (ADJ.) | X | 10 MIN. |
| LOW HWS TEMPERATURE | IF THE HWS TEMPERATURE IS LESS THAN 120 ˚F (ADJ.) | X | 10 MIN. |

NOTES:
1 SEE STANDARD TRENDING POINTS LIST SCHEDULE ON SHEET M-701 FOR APPLICABLE TREND INTERVALS




2 RECIRCULATING PUMP CONTROL DIAGRAM
NTS

## SEQUENCE OF OPERATIONS
## HEATING HOT WATER PUMPS

**General Description**

The inline pumps will operate as lead/standby to provide heating hot water to the AHU preheat coils and VAV reheat coils as shown on the drawings. 1 primary pump(s) will operate as lead, while the remaining pump will operate as standby and is to be activated upon shutdown or failure of the primary pump.

**MODES OF OPERATION**

**NORMAL OPERATING MODE:**

The pumps shall be in normal operating mode at all times unless overridden by the other modes outlined in this sequence.

**STANDBY MODE:**

Backup mode shall be activated upon failure of the lead pump. Backup mode shall be disabled by manual reset and the system will reset to normal operation.

**COMPONENT CONTROLS**

**LEAD PUMP**

**NORMAL OPERATING MODE:**

The controller shall modulate the pump to maintain the differential pressure setpoint as determined by final test and balance. The VFDs minimum speed shall not drop below 20%.

**STANDBY MODE:**

The pump shall be off.

**STANDBY PUMP**

**NORMAL OPERATING MODE:**

The pump shall be off.

**STANDBY MODE:**

The controller shall modulate the pump to maintain the differential pressure setpoint as determined by final test and balance. The VFDs minimum speed shall not drop below 20%.

### POINTS LIST - HEATING HOT WATER PUMPS

| POINT NAME | HARDWARE POINTS AI | AO | BI | BO | SOFTWARE POINTS AV | BV | LOOP | SCHED | TREND | ALARM | SHOWN ON GRAPHIC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PUMPS** | | | | | | | | | | | |
| DIFFERENTIAL PRESSURE | X | | | | | | | | X | | X |
| PUMP 1 VFD SPEED | | X | | | | | | | X | | X |
| PUMP 2 VFD SPEED | | X | | | | | | | X | | X |
| PUMP 1 STATUS | | | X | | | | | | X | | X |
| PUMP 1 VFD FAULT | | | X | | | | | | | X | X |
| PUMP 2 STATUS | | | X | | | | | | X | | X |
| PUMP 2 VFD FAULT | | | X | | | | | | | X | X |
| PUMP 1 START/STOP | | | | X | | | | | X | | X |
| PUMP 2 START/STOP | | | | X | | | | | X | | X |
| DIFFERENTIAL PRESSURE SETPOINT | | | | | X | | | | | | X |
| OUTSIDE AIR TEMP | | | | | X | | | | | | X |

| ALARMS | DESCRIPTION | ALARM | ALARM DELAY |
|---|---|---|---|
| PUMP 1 FAILURE | COMMANDED ON, BUT THE STATUS IS OFF | X | 10 MIN. |
| PUMP 1 IN HAND | COMMANDED OFF, BUT THE STATUS IS ON | X | 10 MIN. |
| PUMP 1 RUNTIME EXCEEDED | STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT | X | 10 MIN. |
| PUMP 2 FAILURE | COMMANDED ON, BUT THE STATUS IS OFF | X | 10 MIN. |
| PUMP 2 IN HAND | COMMANDED OFF, BUT THE STATUS IS ON | X | 10 MIN. |
| PUMP 2 RUNTIME EXCEEDED | STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT | X | 10 MIN. |
| HIGH DIFFERENTIAL PRESSURE | STATUS DIFFERENTIAL PRESSURE IS 25% GREATER THAN SETPOINT | X | 5 MIN. |
| LOW DIFFERENTIAL PRESSURE | STATUS DIFFERENTIAL PRESSURE IS 25% LESS THAN SETPOINT | X | 5 MIN. |

NOTES:
1 SEE STANDARD TRENDING POINTS LIST SCHEDULE ON SHEET M-701 FOR APPLICABLE TREND INTERVALS

1
SHEET REVISED AND REISSUED.

| Revision # | Date |
|---|---|
| ⚠ ASI #1 | 09/10/2019 |

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Office of Construction and Facilities Management

VA U.S. Department of Veteran Affairs

SHEET TITLE: MECHANICAL CONTROLS VI

APPROVED: PROJECT DIRECTOR

PROJECT PHASE: BID DOCUMENTS

FULLY SPRINKLERED

PROJECT TITLE: CONSTRUCT REPLACEMENT WAREHOUSE

PROJECT LOCATION: 500 AZ-89, PRESCOTT, AZ 86301

DATE: 04/23/2019

CHECKED BY: JES

DRAWN BY: JAD

VA PROJECT NUMBER: 649-414

BUILDING NUMBER: 165

DRAWING NUMBER: 165-M-706

Dwg. 116 OF 145

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