Operation, Maintenance, and Repair

HMM-022-A
HEU-WC1
Last Modified: August1997

Figures

Tables

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Revision A. Corrects incoming-power table and adds new diagrams for incoming power, dielectric coolant flow, and water flow. This version also adds the repair procedure for replacing the heater relay jumpers. This revision obsoletes all previous versions.

HEU-WC1 Overview

The heat exchanger unit (HEU-WC1) removes heat that is generated by the logic modules and power supplies within a Cray Research module cabinet. One HEU-WC1 provides cooling for two module cabinets.

The HEU-WC1 circulates dielectric coolant through the module cabinet to remove the heat. The dielectric coolant absorbs the heat within the module cabinet and then flows to the HEU-WC1 where the heat transfers to customer-supplied chilled water.

The HEU WC-1 is used in conjunction with several Cray Research products including: the CRAY T90™ system with a model E I/O subsystem, the CRAY T3D™ system, and the CRAY T3E™ system.

Safety Information

ESD Precautions

Observe ESD precautions during the entire installation or maintenance process. Required apparel includes an ESD smock and an ESD wrist strap. Do not wear watches or jewelry when you work on an HEU-WC1 cabinet.

CAUTION

Observe all ESD precautions. Failure to do so could result in damage to the equipment.

ESD Smock

Wear a Cray Research-approved static-dissipative smock when servicing or handling an ESD-sensitive device. Completely button the smock and wear it as the outermost layer of clothing. You must have a portion of the smock's sleeves in direct contact with the skin of your arms. Skin contact is essential for a dissipative path-to-earth ground through your wrist strap. Tuck hair that exceeds shoulder length inside the back of the smock.

ESD Shoes

Wear approved static-dissipative shoes or approved dissipative heel straps on both shoes when servicing or handling an ESD-sensitive device. When sensitive equipment is exposed to static discharge, ESD shoes provide a backup to the wrist straps and grounding cords and help prevent an excessive charge from building up on you when you are in contact with conductive flooring. Use dissipative footwear in addition to, not as an alternative to, a wrist strap.

Wrist Strap

Wear a Cray Research-approved wrist strap when servicing or handling an ESD-sensitive device to eliminate possible ESD damage to equipment. Connect the wrist strap cord directly to earth ground.

Hazard Statements

During removal and installation of the computer system parts, be alert for hazard advisory statements. The following list describes the hazard statement signal words:

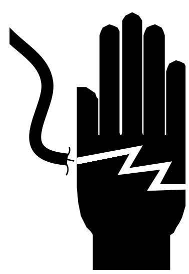
- **Danger** indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.

- **Warning** indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
- **Caution** indicates a potentially hazardous situation that, if not avoided, can result in minor or moderate injury. This signal word is also used to alert personnel against unsafe practices that can result in equipment damage and/or data corruption.

Safety Measures

Observe the following safety measures when you remove, install, repair, or maintain the cabinet.

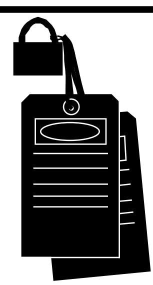
- Do not wear watches or jewelry when you work on the HEU WC-1 cabinet.
- Keep fingers and conductive tools away from high-voltage areas and from high-current areas.



DANGER

Keep fingers and conductive tools away from high-voltage areas. Serious injury or death will occur if these precautions are not followed.

- Set circuit breakers to the OFF or OPEN position, where indicated, before you start the removal and installation process.



WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

- Remove all tools from the cabinet after you have performed service.

- Several procedures require two people to complete; do not perform the procedure alone.
- Replace all covers and panels that you removed from the cabinet during service.
- Some procedures require that you power off the module cabinet, power off the module cabinet only after the system software has been shut down in an orderly manner.

CAUTION
If you power off the system before you halt the operating system, you may lose customer data.

Watch for this symbol. It points out helpful tips regarding the operation and maintenance of the HEU.

Operation

Previously, some Cray Research computer systems required an HEU and a refrigeration condensing unit (RCU) to cool the system. The HEU-WC1 eliminates the need for an RCU because the heat is removed from the dielectric coolant by customer-supplied chilled water instead of the refrigerant.

The HEU-WC1 is located in the computer room, approximately 6 feet (1.8 m) from the module cabinet that it cools. Refer to Figure 1 for an illustration of an HEU-WC1 cabinet. Table 1 provides the specifications for an HEU-WC1.

Figure 1. HEU-WC1 Cabinet

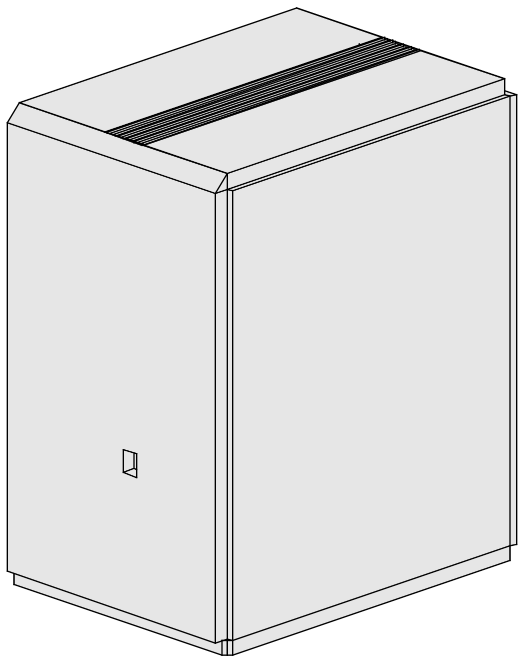


Table 1. HEU-WC1 Specifications

Characteristic	Specification
Height	62.00 in. (1,575 mm)
Width	38.00 in. (965 mm)
Depth	51.00 in. (1,295 mm)
Weight	2,000 lbs (907 kg)
Heat dissipation to air	3.93 kBtu/hr (1.15 kW)

The HEU-WC1 consists of four basic systems: a dielectric-coolant system, a water system, a power distribution system, and a warning and control (WACS) system. These systems work together to efficiently remove heat from the module cabinet.

Cooling Capacity

The HEU-WC1 has a maximum cooling capacity of 80 tons; however, the actual cooling capacity depends on many factors. These factors include the water quality at the site, the water temperature, the dielectric-coolant temperature, and the flow rates. The flow rate of the dielectric coolant is adjusted for each chassis in a system. Table 2 provides dielectric-coolant flow rates and pressures for the HEU and the module cabinet.

The HEU-WC1 cooling capacity can be adjusted to match the heat load of the module cabinet. If the module cabinet does not have a full configuration of modules and power supplies, it may be possible to operate the HEU-WC1 with one of its heat exchangers shut off.

Table 2. Dielectric-coolant Capacities

Characteristic	Value
Flow rate	~200 g.p.m.
Normal pump pressure	100 ±10 psig
High-pressure warning limit	150 psig
High-pressure fault limit	160 psig

The following sections provide information about the four basic systems in the HEU WC-1; an overview of the HEU-WC1 heat removal process is also provided.

Dielectric-cooling System

The HEU-WC1 cooling system consists of a dielectric-cooling system and a water system. This section provides information about the dielectric-cooling system.

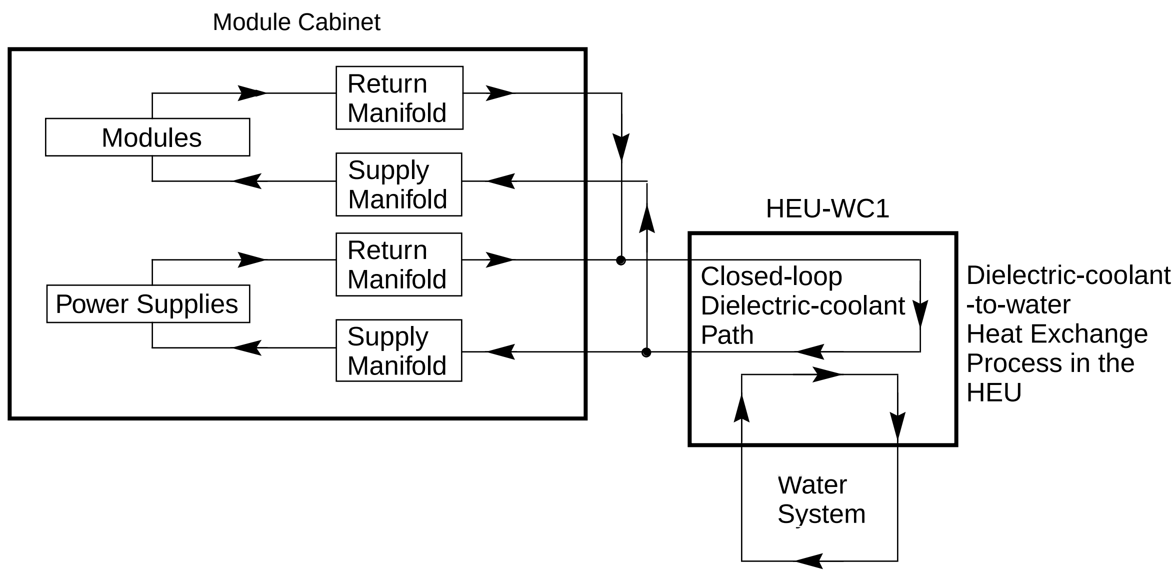
Heat Removal Process

Two systems provide cooling for the module cabinet: the dielectric-coolant system and the water system. The water system is customer supplied and is part of the customer site. Site Engineering determines the specifics of the water system; the systems may vary from site to site. Figure 2 is a simplified diagram of the heat removal process for a module cabinet that is supported by an HEU-WC1.

Two dielectric-coolant piping connections enable dielectric coolant to circulate between the HEU-WC1 and the module cabinet: a supply hose and a return hose. Chilled dielectric coolant flows to the module cabinet through the supply hose; warm dielectric coolant returns to the HEU-WC1 through the return hose.

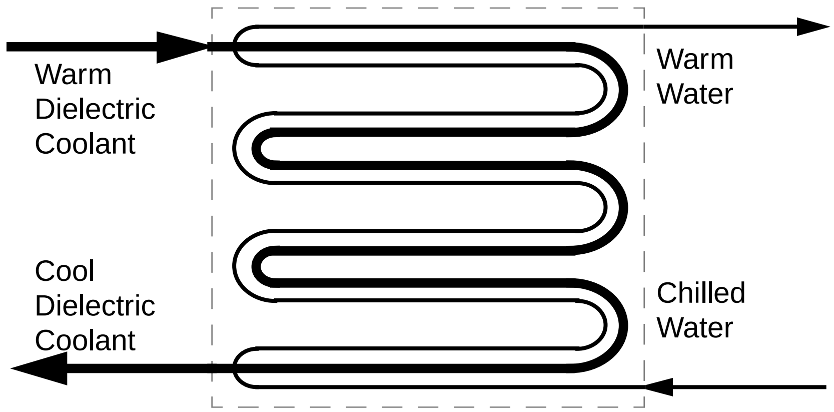
In the module cabinet, dielectric coolant flows into two separate sets of supply and return manifolds: one set for the modules and one set for the power supplies. The dielectric coolant absorbs heat that the modules and power supplies generate in the module cabinet. The dielectric coolant then flows to the heat exchangers in the HEU-WC1 cabinet, where heat transfers from the dielectric coolant to the water system.

Figure 2. Simplified Diagram of the Heat Removal Process



Refer to Figure 3 for an illustration of how dielectric coolant and water work together to remove heat from the system. Warm dielectric coolant and chilled water enter the heat exchanger and flow through adjacent channels. The water and dielectric coolant flow in opposite directions, and the heat is removed from the dielectric coolant by process of convection. The heat transfers from the dielectric coolant to heat exchanger plates, which then transfer the heat to the chilled water.

Figure 3. Heat Exchanger Dielectric-coolant and Water-flow Diagram

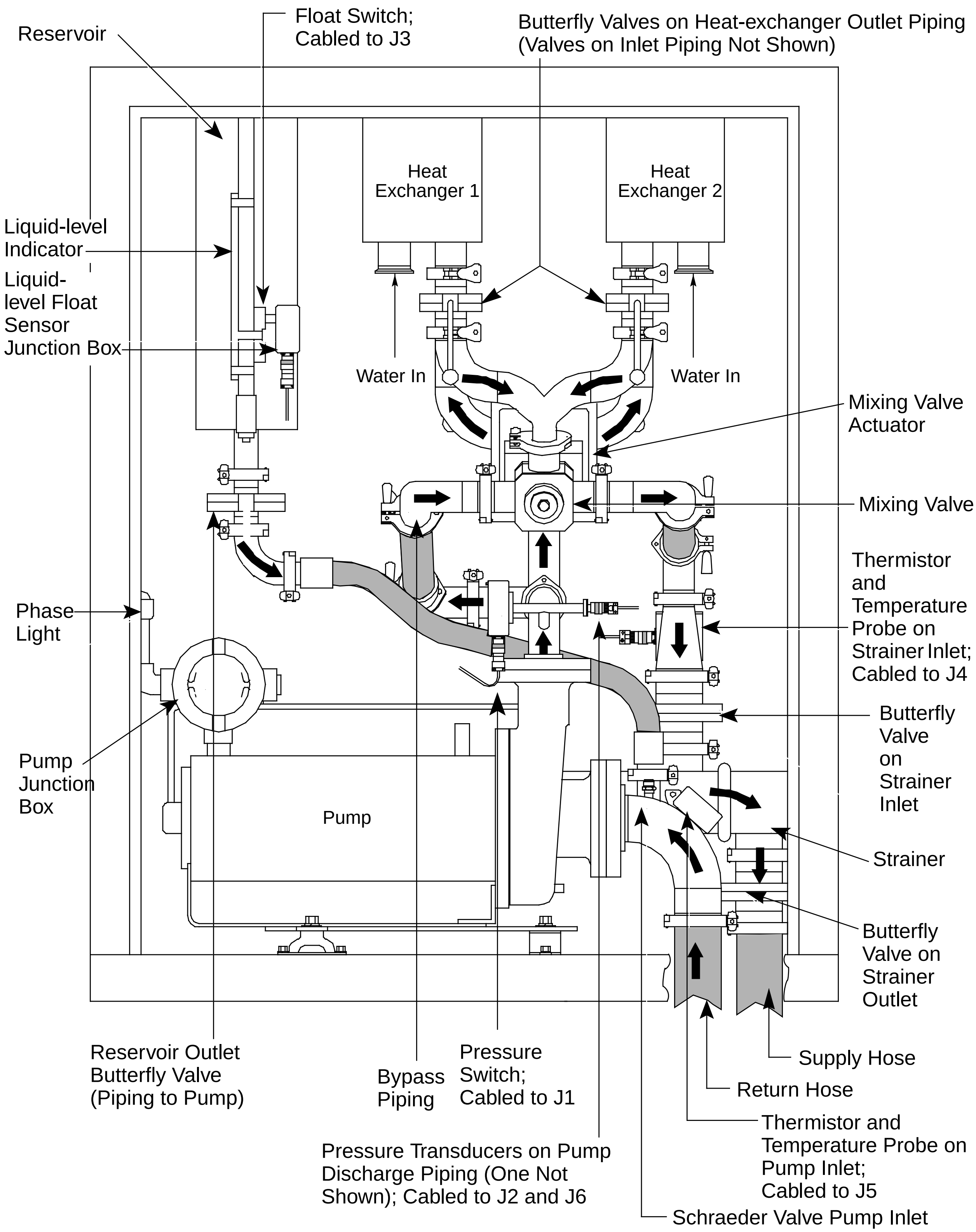


Dielectric-coolant System Components

The dielectric-coolant system consists of the following major components; Figure 4 shows the locations of these components.

- Supply hose and return hose
- Service valves
- Two heat exchangers
- Dielectric-coolant reservoir
- Dielectric-coolant pump
- Dielectric-coolant strainer
- Dielectric-coolant mixing valve and actuator

Figure 4. Dielectric-coolant System and Components



Supply Hoses and Return Hoses

Two dielectric-coolant piping connections circulate dielectric coolant between the HEU and the module cabinet(s): a supply hose and a return hose. The HEU pumps chilled dielectric coolant to the module cabinet through the supply hose; warm dielectric coolant returns through the return hose.

Dielectric-coolant Service Valves

A number of service valves isolate components in the dielectric-coolant circuit. Table 3 describes the type and location of the service valves.

Table 3. Dielectric-coolant Service Valves

Type	Location
1.5-in. butterfly valve	On the reservoir outlet piping
3-in. butterfly valve	On the strainer inlet
3-in. butterfly valve	On the strainer outlet
2-in. butterfly valve	On the dielectric-coolant inlet of heat exchanger #1
2-in. butterfly valve	On the dielectric-coolant outlet of heat exchanger #1
2-in. butterfly valve	On the dielectric-coolant inlet of heat exchanger #2
2-in. butterfly valve	On the dielectric-coolant outlet of heat exchanger #2
Pressure relief valve	On the reservoir
Schraeder valve	On the pump inlet
Schraeder valve	Between the mixing valve and strainer

Butterfly service valves in the HEU-WC1 enable service personnel to isolate components for repair procedures. Schraeder valves enable personnel to drain fluids from the piping and to determine whether the system is pressurized. If you need more information about HEU-WC1 mechanical components, refer to Engineering assembly drawing 12300200.

Heat Exchangers

The HEU-WC1 has two heat exchangers. The dielectric coolant transfers heat (by forced convection) to the heat exchangers. The heat exchangers then transfer the heat (by conduction) into water that flows through the heat exchangers.

Dielectric coolant and water flow through both heat exchangers during normal operation; however, some sites with a partially-configured module cabinet that produces a smaller heat load may be able to operate the system with one heat exchanger shut off. Butterfly valves on the inlet and outlet piping to each heat exchanger enable you to shut off one of the heat exchangers.

Dielectric-coolant Reservoir

The dielectric-coolant reservoir is a stainless steel tank that stores dielectric coolant; the capacity of the reservoir is 14.2 gallons (53.8 liters). The reservoir has a liquid-level indicator mounted on a pipe that contains a float. If the level of dielectric coolant in the reservoir drops below a specified level, a low-level fault switch opens and the HEU control module sends a fault signal to the module cabinet to power down the computer system.

Dielectric coolant in the reservoir enters the system through a hose that is attached to the inlet side of the pump. A butterfly valve in the reservoir outlet to the pump enables field personnel to shut off the flow of dielectric coolant from the reservoir when necessary.

Dielectric-coolant Pump

The dielectric-coolant pump pulls dielectric coolant from the module cabinet and circulates the coolant through the cooling system.

The dielectric-coolant pump is a centrifugal unit with a squirrel-cage induction electric motor. The pump and motor reside in a hermetically sealed unit. The pump has a closed-type impeller that is mounted on one end of the rotor shaft and extends from the motor section into the pump casing. The stator winding is also sealed to isolate it from the dielectric coolant. Bearings are submerged in the dielectric coolant and are lubricated automatically.

The dielectric-coolant pump and motor are mounted on a fabricated steel base. The pump has one moving part, the combined rotor-impeller assembly, which is driven by the magnetic field of the induction motor. Sites with 50-Hz commercial power use a pump with a 7-in. (17.8 cm) impeller; sites with 60-Hz commercial power use a pump with a 6.25-in. (15.9 cm) impeller.

NOTE: The size of the impeller is marked on the pump.

The pump motor requires 200-Vac,3-phase, 50/60- Hz; 480-Vac, 3-phase, 60-Hz; or 390-Vac, 3-phase, 50-Hz input voltage. The motor operates at 3,450 rpm at 60 Hz or 2,875 rpm at 50 Hz. The 20-hp pump circulates dielectric coolant at approximately 200 gpm at a pressure of approximately 100 ±10% psig.

Two pressure transducers and a pressure switch (located on the piping to the heat exchangers) monitor the pump discharge pressure.

Dielectric-coolant Strainer

The dielectric-coolant strainer removes debris from the dielectric coolant. The stainless steel strainer, which is approximately 27 in. (69 cm) long, is located within the HEU cabinet. The strainer can be removed for cleaning or replacement.

Dielectric-coolant Mixing Valve and Actuator

The dielectric-coolant mixing valve has an associated actuator that adjusts the mixture of cold coolant from the heat exchangers and warm coolant from the module cabinet. By adjusting the mixture of cold coolant and warm coolant, the mixing valve provides the desired temperature of the supply coolant to the module cabinet. The unit is controlled by the temperature-regulating module in the HEU WC-1. Figure 5 shows the actuator circuitry.

The microprocessor on the temperature-regulating module, located within the power distribution box, continuously compares the temperature of the dielectric coolant that flows back to the module cabinet with the temperature setting of the dielectric-coolant supply temperature potentiometer (R30). If the coolant is too warm, a triac circuit on the temperature-regulating module activates the 120-Vac counter-clockwise (CCW) signal to open the actuator. The actuator then rotates the valve counterclockwise to bring in more cold coolant from the heat exchangers.

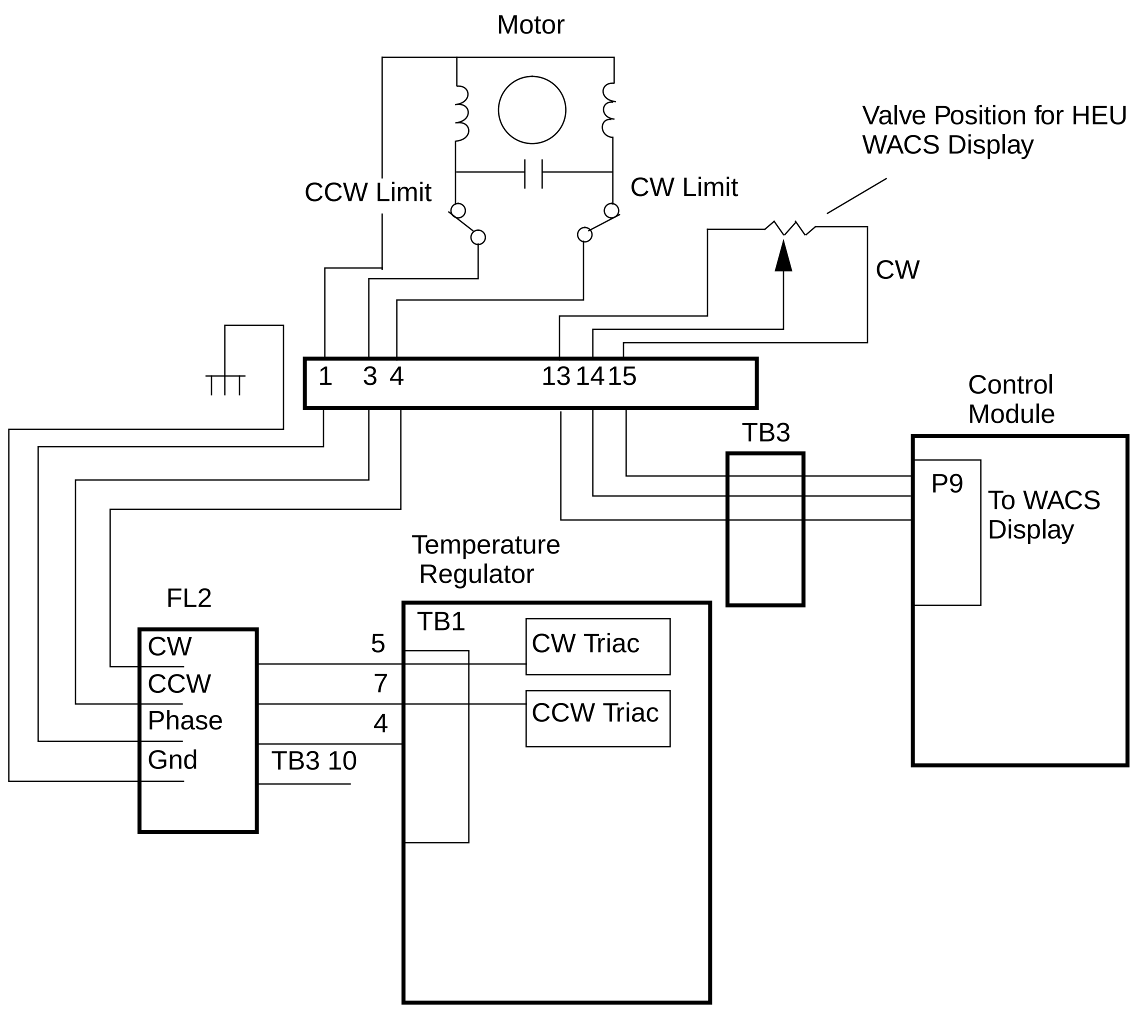
The actuator sends a position signal to the control module from terminals 13, 14, and 15. The control module displays the dielectric-coolant mixing valve position on WACS channel 9. The display value is a percentage (%). When the dielectric-coolant mixing valve position is 100%, the valve is fully open and no warm dielectric coolant mixes with the cold dielectric coolant from the heat exchangers.

If the coolant is too cold, the triac circuit activates the 120-Vac clockwise (CW) signal to close the actuator. The actuator then rotates the valve clockwise to mix in more warm coolant from the modules with the chilled coolant from the heat exchangers.

When the mixing valve is fully closed (0%), no dielectric coolant is passing through the heat exchangers. During normal operation, the valve opens partially and the WACS displays a percentage between 0 and 100%. The mixing valve remains in its current position as it shuts down. When the HEU powers up, it adjusts the valve by comparing the potentiometer setting with the supply dielectric-coolant temperature.

The temperature-regulating module and mixing valve adjust the mixture of warm and cool dielectric coolant to compensate for variations in water temperature and flow rates. The temperature-regulating module applies power to the actuator for 4 seconds and then removes power for 1 second.

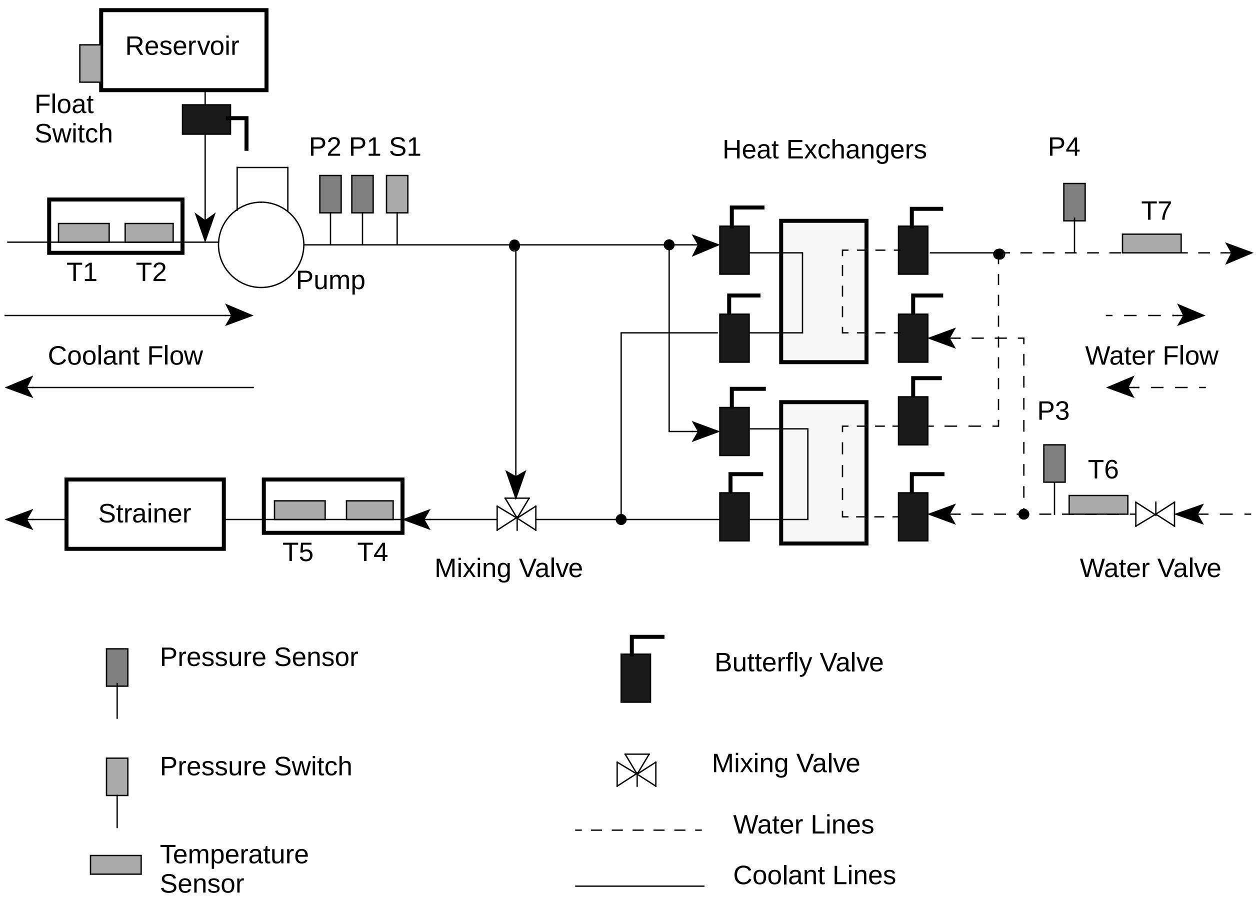
Figure 5. Mixing Valve Actuator Circuitry



Dielectric-coolant Flow

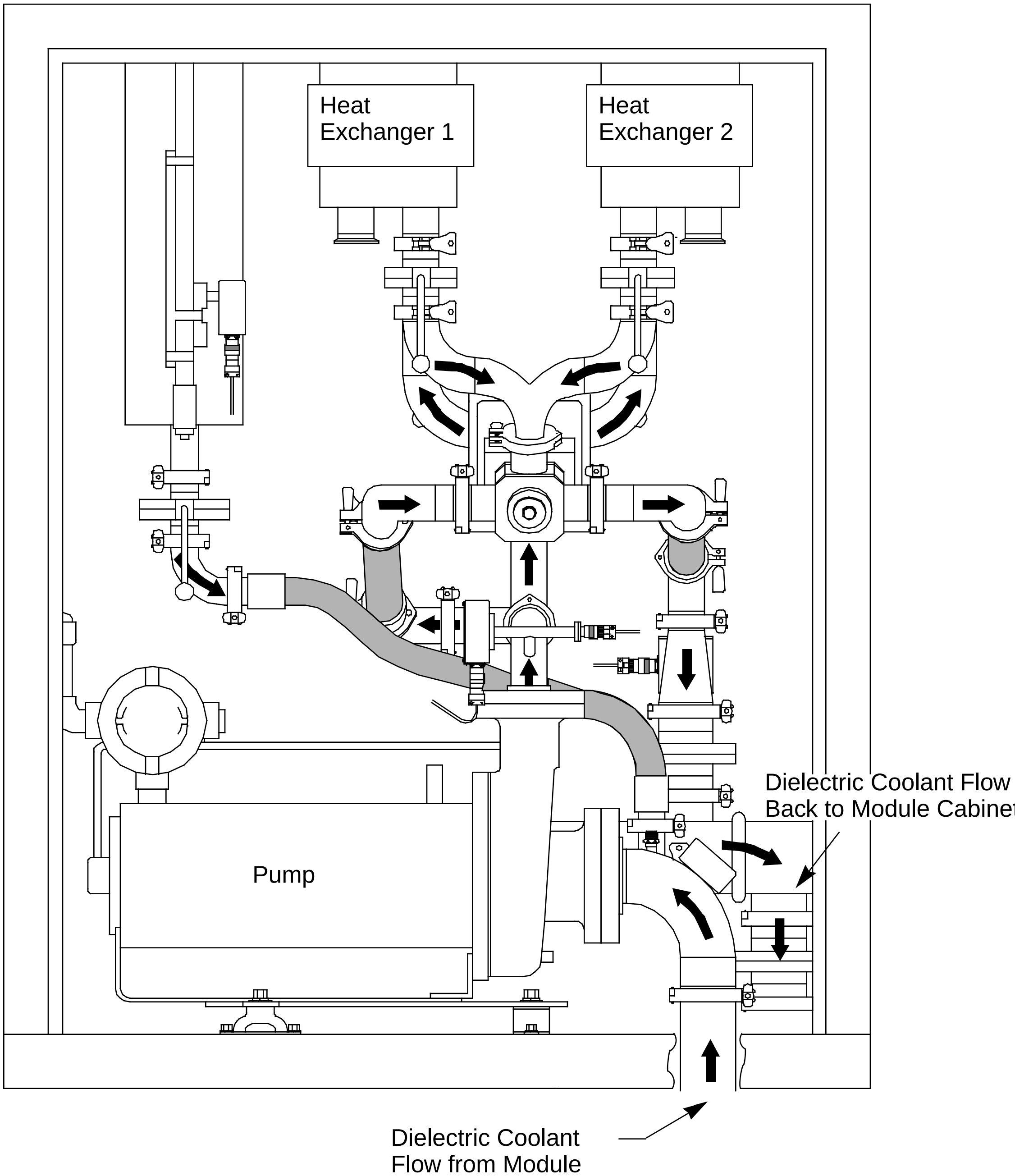
Refer to Figure 6 for an illustration of the cooling system. Warm dielectric coolant from the module cabinet enters the dielectric-coolant pump; dielectric coolant is then pumped to the heat exchangers. Depending upon the temperature of the dielectric coolant as it leaves the heat exchangers, the dielectric-coolant mixing valve may mix some warm dielectric-coolant with the cool dielectric coolant. The dielectric coolant then passes through a strainer and returns to the module cabinet.

Figure 6. HEU-WC1 Heat Removal System Piping Diagram



The arrows in Figure 7 show how dielectric coolant flows through the cooling system.

Figure 7. Dielectric-coolant System Flow



Water System Components

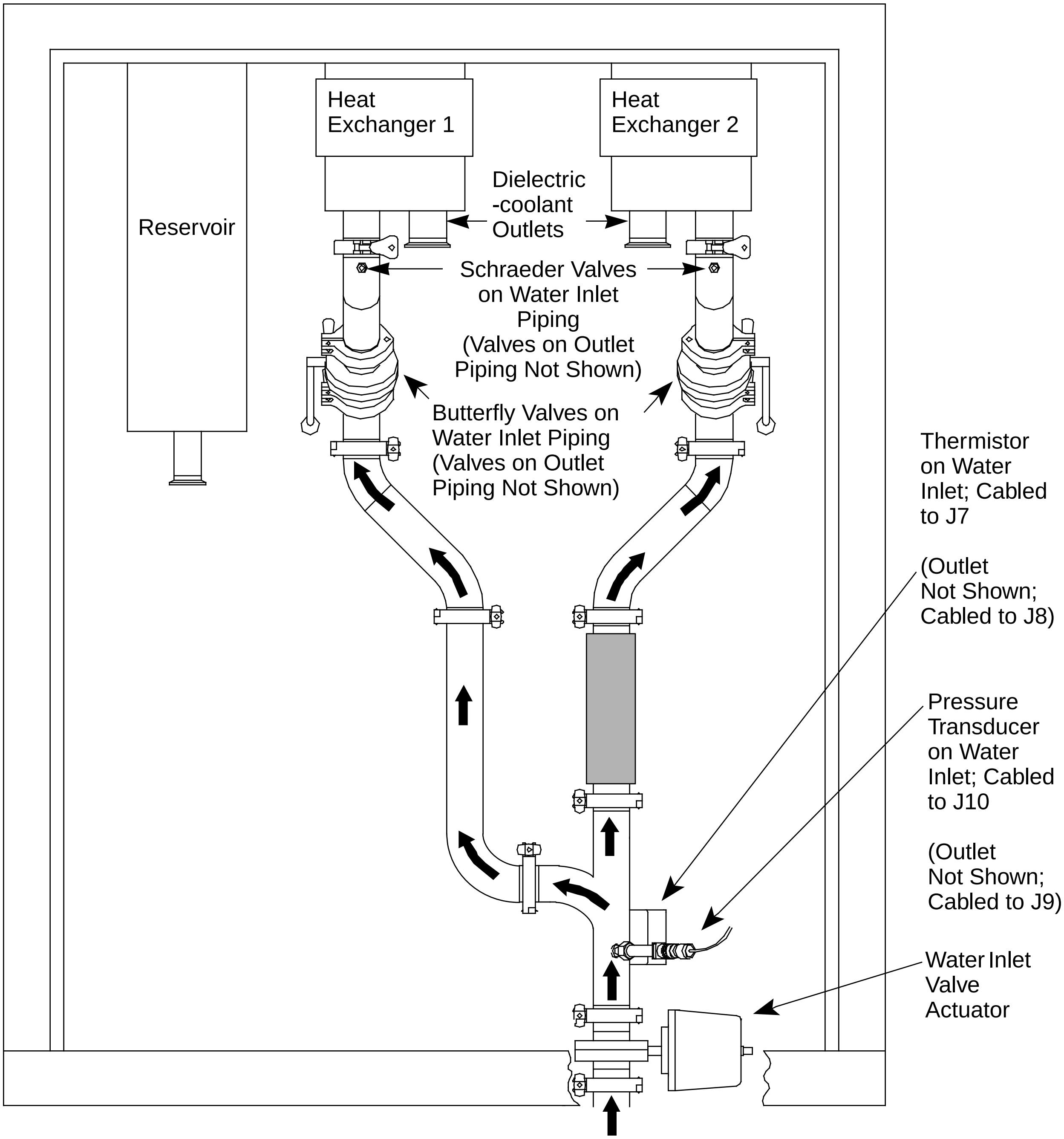
The water system consists of the following major components:

- Water inlet valve and actuator
- Water service valves

Refer to Figure 8 for an illustration of the cooling system. Water flows from the customer water supply to a water inlet valve; the water inlet valve controls the rate of water flow through the cooling system. The faster the water flows through the valve, the cooler the water is in the system.

Water flows from the inlet valve through the heat exchangers, then back to the customer water supply. The butterfly valves can be used to isolate the heat exchanger units from the water supply.

Figure 8. Water System Piping and Components



Water Service Valves

Two water lines connect the HEU and the building water system: a water-inlet supply connection and a water-outlet return connection. The customer needs to install water-inlet and water-outlet shutoff valves in the supply and return lines to isolate the HEU when service is required.

Butterfly service valves in the HEU-WC1 enable service personnel to isolate components for repair procedures. Schraeder valves enable personnel to drain fluids from the piping and to determine whether the system is pressurized. Table 4 describes the type and location of the service valves.

If you need more information about HEU-WC1 mechanical components, refer to Engineering assembly drawing 12300200.

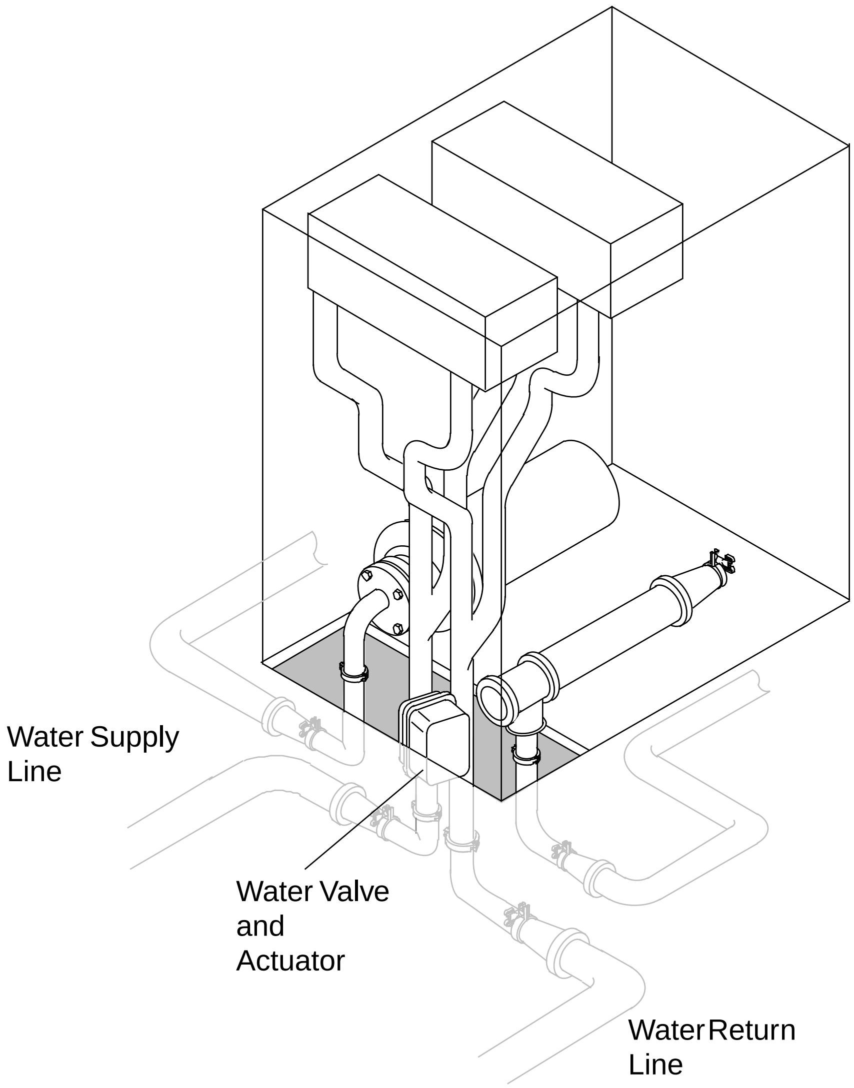
Table 4. Water Service Valves

Type	Location
2-in. butterfly valve	On the water inlet of heat exchanger #1
2-in. butterfly valve	On the water outlet of heat exchanger #1
2-in. butterfly valve	On the water inlet of heat exchanger #2
2-in. butterfly valve	On the water outlet of heat exchanger #2
Schraeder valve	On the water inlet of heat exchanger #1
Schraeder valve	On the water outlet of heat exchanger #1
Schraeder valve	On the water inlet of heat exchanger #2
Schraeder valve	On the water outlet of heat exchanger #2

Water Inlet Valve and Actuator

The water inlet valve and actuator control the flow of water to the HEU-WC1. During operation, the water inlet valve is fully open; when the HEU-WC1 is powered off, the valve is fully closed. The water inlet valve and actuator are located on the water inlet piping near the floor at the rear of the HEU (refer to Figure 9).

Figure 9. Water Valve and Actuator



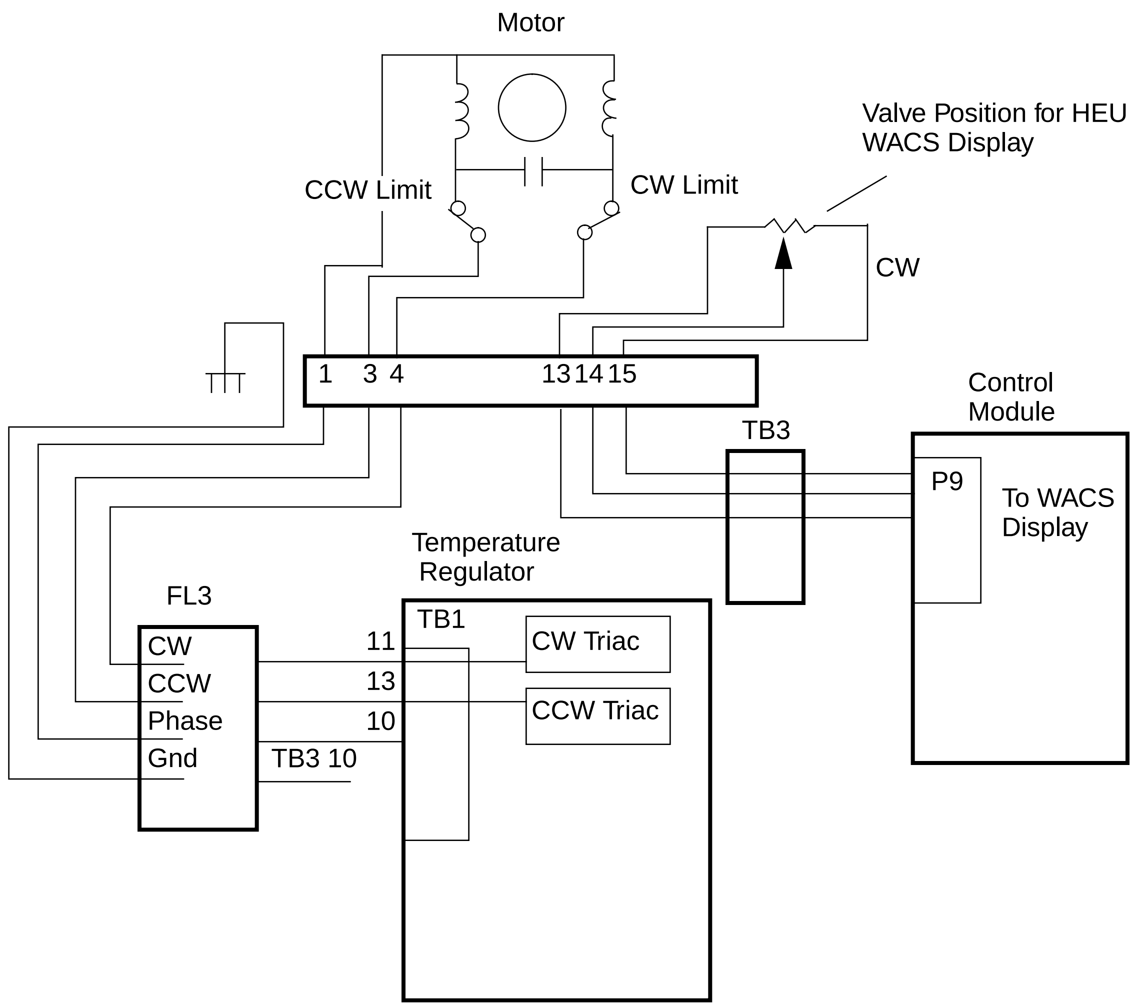
When the HEU-WC1 receives a start signal from the module cabinet, the temperature-regulating module sends a signal to the water inlet valve actuator to open the valve. The actuator then rotates the valve counterclockwise until it is fully open (CCW limit). The actuator takes approximately 30 seconds to fully open the water inlet valve.

When the HEU-WC1 receives a stop signal from the module cabinet, the temperature-regulating module sends a signal to the actuator to close the valve. The actuator then rotates the valve clockwise until it is fully closed (CW limit).

Figure 10 is a valve actuator position-control block diagram; the control and wiring for the actuators on the water inlet valve and the dielectric-coolant mixing valve are the same.

The actuator sends a position signal to the control module from terminals 13, 14, and 15. The control module displays the water inlet valve position on WACS display channel 8. The display value is a percentage (%). When the water inlet valve is fully open, the WACS indicates 100%; when the valve is fully closed, the WACS indicates 0%.

Figure 10. Water Valve Actuator Position Control



Power Distribution System

The power distribution system delivers power to the dielectric-coolant pump, the actuators on two motor-controlled valves, the temperature-regulating module, the control module, and the WACS.

Commercial 3-phase power cables enter the HEU-WC1 through the bottom of the power distribution box. Each HEU cabinet requires one of the following sources of commercial electrical power:

- 200 - 230 Vac, 3-phase, 50/60 Hz, 80 - 70 Amps
- 400 - 460 Vac, 3-phase, 50/60 Hz, 40 - 35 Amps

Depending on the commercial 3-phase power source at your site, different jumper configurations and different pump wiring may be required.

If you need additional power distribution information, refer to the HEU-WC1 Engineering schematic 10625200.

Power Distribution System Components

The power distribution system consists of the following components:

- Contactor (K1)
- Overload heater relay (K2)
- Step-down transformers (T1, T2, and T3)
- Circuit breaker (CB1)
- Four line filters (FL1 through FL4)
- Four fuses (F1 through F4)
- Temperature-regulating module
- Supply temperature potentiometer
- Hour meter
- J1 and RS-232 connectors

Refer to Figure 11 for the power distribution box location. Figure 12 and Figure 13 show the component locations inside the power distribution box, and each component is described in the following subsections.

Figure 11. Power Distribution and Control Box Locations

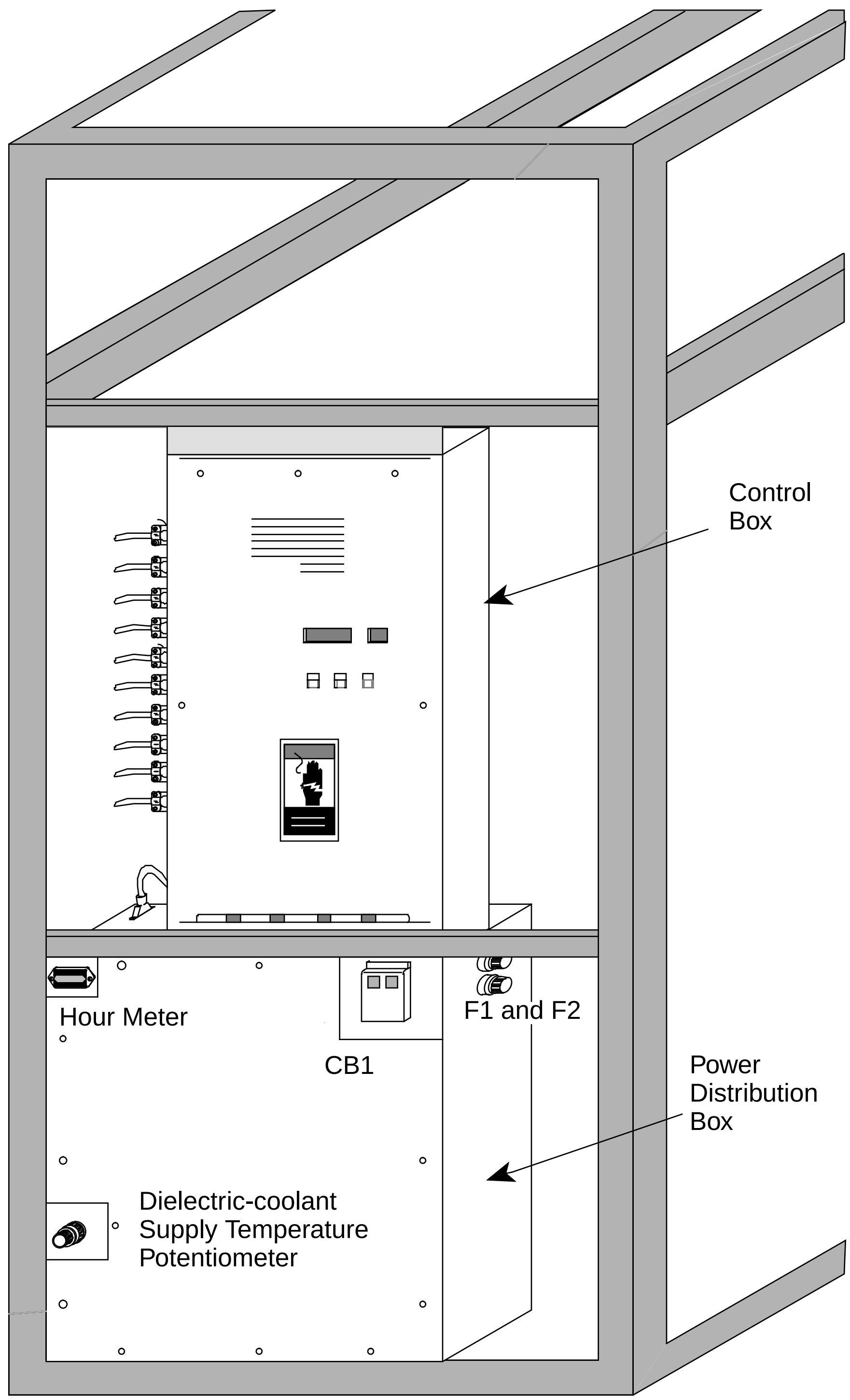


Figure 12. Power Distribution Box (Left Side View)

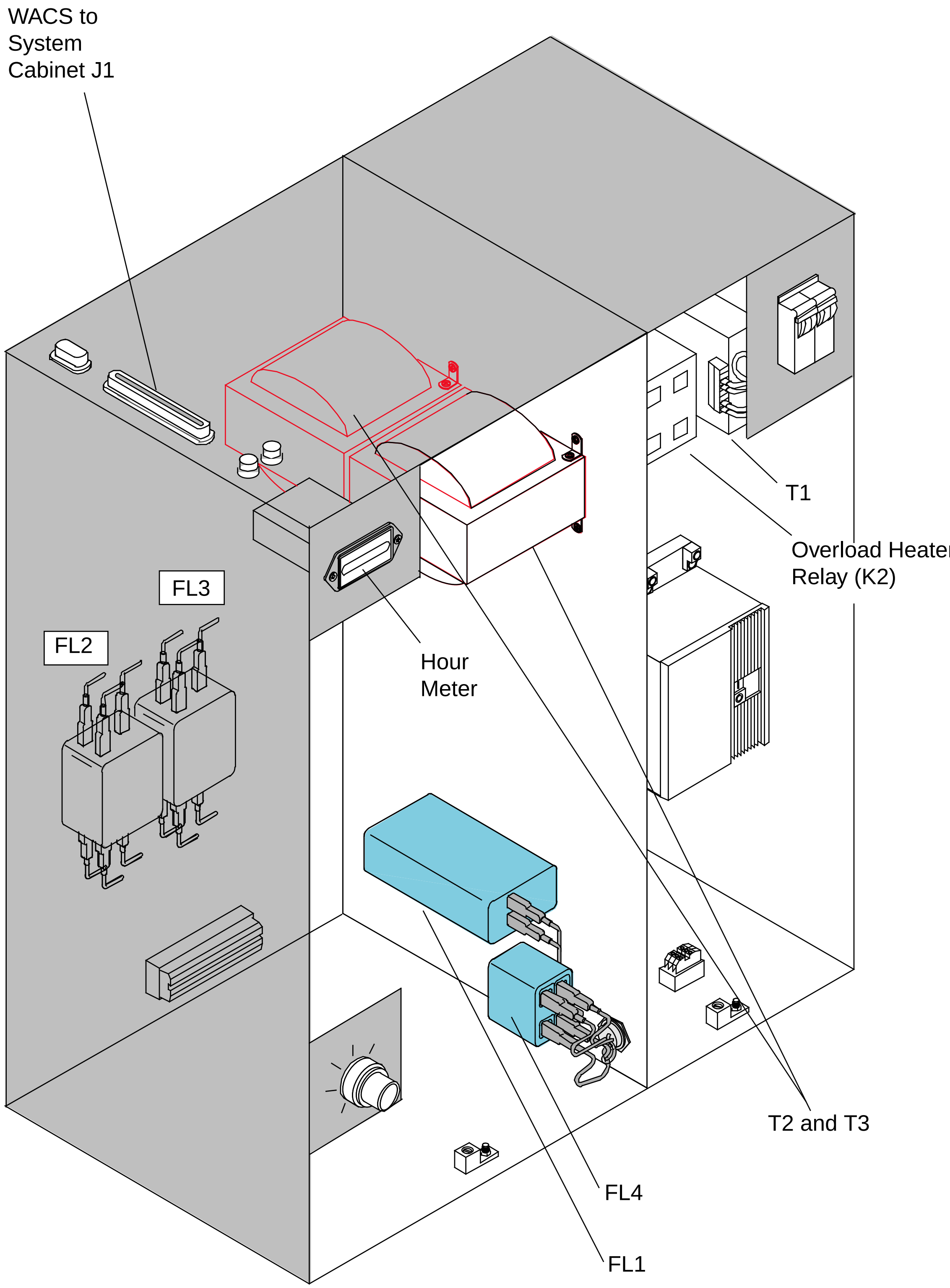
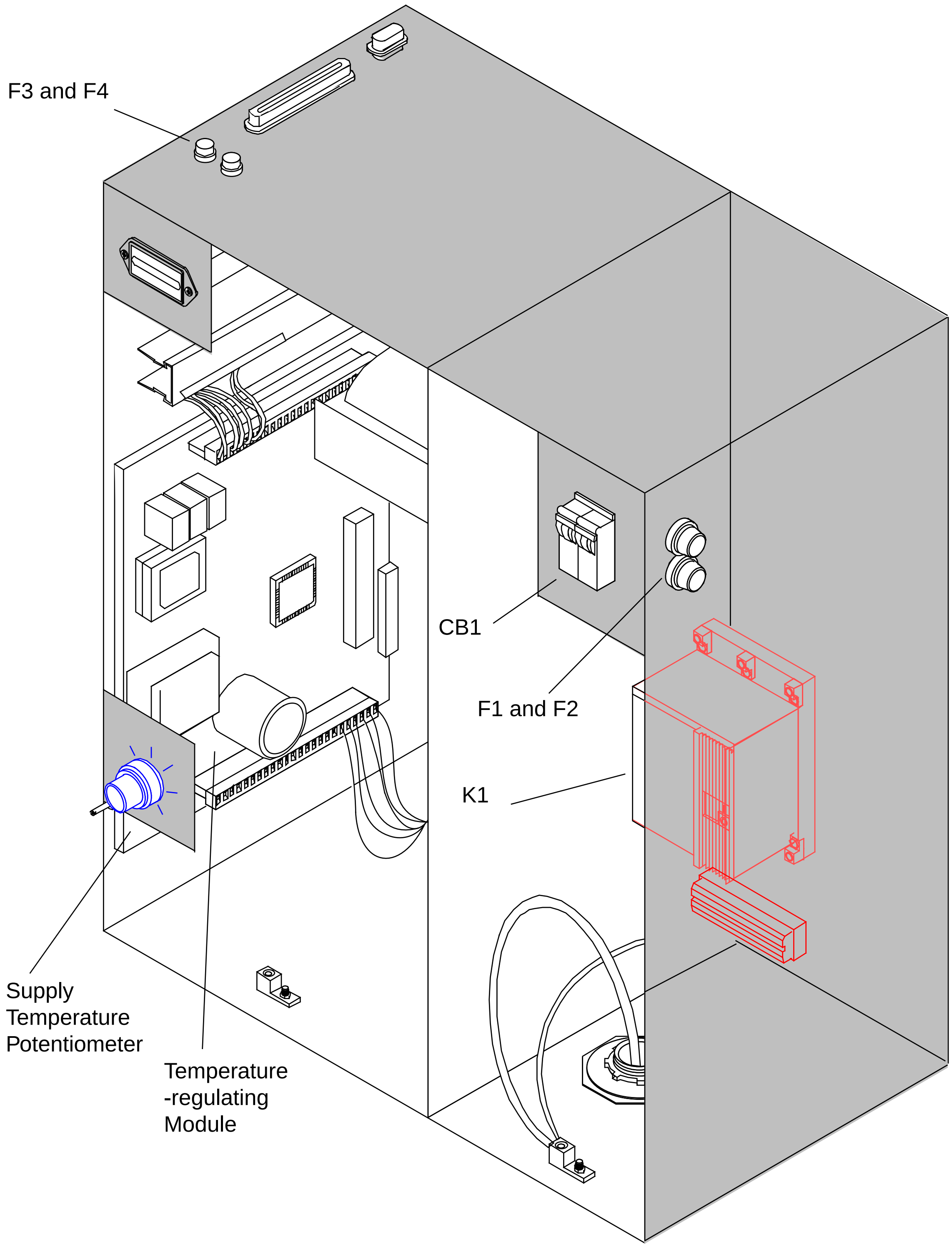


Figure 13. Power Distribution Box (Right Side View)



Contactor K1

Contractor K1 is energized when the module cabinet START button is pressed. When K1 closes, 3-phase power goes to the dielectric-coolant pump through the overload heater relay K2. A 24-Vdc sense signal is then sent to the temperature-regulating module, which controls the water inlet valve actuator and dielectric-coolant mixing valve actuator.

Transformer T1

The T1 step-down transformer reduces the customer-supplied input power to 120-Vac output power for transformer T2 and the actuators on the water inlet valve and dielectric-coolant mixing valve. The jumper configuration for T1 varies, depending on the customer-supplied input voltage. Figure 14 shows the T1 jumper terminal block and Table 5 lists the various jumper positions.

Figure 14. Transformer T1 Jumper Terminal Block

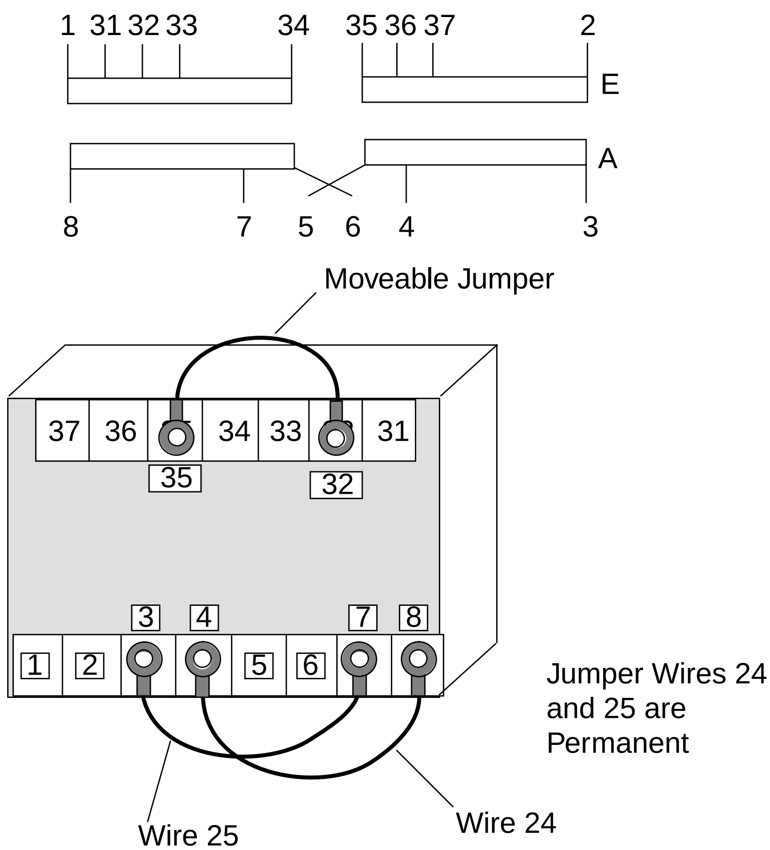


Table 5. Transformer T1 Jumper Positions

Voltage (50/60 Hz)	Jumper
190 - 200	1 and 37, 2 and 32
220 - 230	1 and 36, 2 and 33
380 - 420	32 and 37
435 - 490	33 and 36

Transformer T2

The 120-Vac input power to T2 is stepped down to 9-Vac and 18-Vac output power for the control module. The control module rectifies the 9-Vac and 18-Vac power to the direct current (Vdc) voltages required to operate logic components and sensors.

Circuit Breaker CB1

CB1 is a 2-amp circuit breaker that controls power to the step-down transformer (T1). CB1 is located on the front of the power distribution box.

Line Filter FL1

FL1 filters the 120-Vac power from T1 to protect the control circuits from electrical noise. (Filtering separates one group of frequencies from another group of frequencies.)

Line Filters FL2 and FL3

FL2 is the line filter for the 120-Vac power that operates the motor in the water inlet valve actuator. FL3 is the line filter for the 120-Vac power that operates the motor in the dielectric-coolant mixing valve actuator.

Line Filter FL4

FL4 filters the 24-Vdc signal to the temperature-regulating module, which controls the water and mixing valve actuators. FL4 also filters the HEU fault signal that is sent to the mainframe WACS.

Fuses F1 and F2

F1 and F2 are 5-amp replaceable fuses that are located on the side of the power distribution box. F1 and F2 simultaneously protect CB1 and T1.

Fuses F3 and F4

F3 and F4 are 0.4-amp replaceable fuses that are located on the top of the power distribution box. F3 and F4 protect transformers T2 and T3 respectively.

Overload Heater Relay (K2)

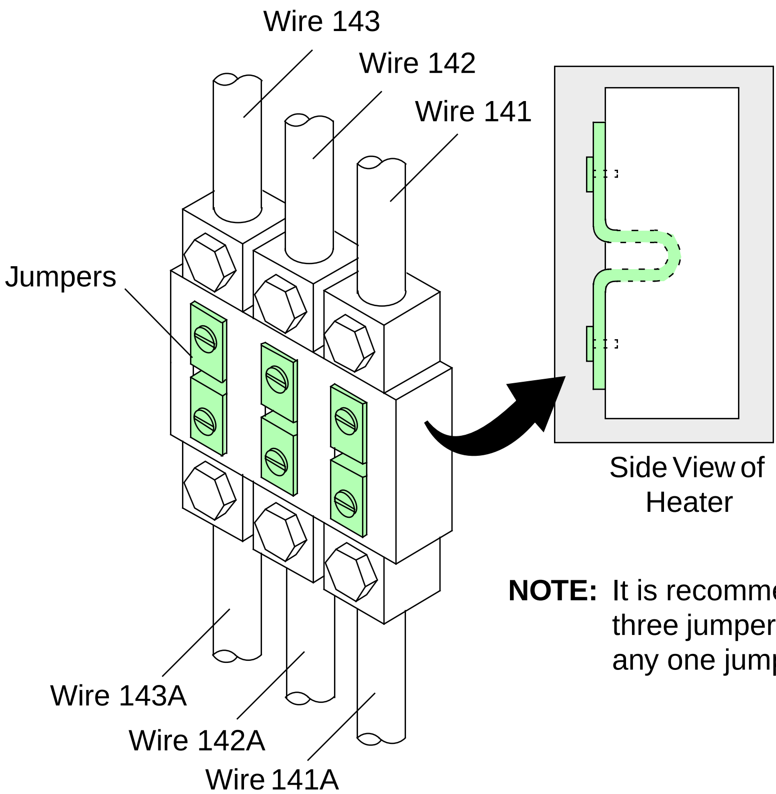
The overload heater relay (K2) is located within the power distribution box, between relay K1 and the pump motor. The overload relay is adjustable to detect a range of 35 to 80 amps. The overload relay opens when the pump draws more amps than the specified value. When open, the overload relay signals the contractor to open and disconnect the pump from the supply voltage. Table 6 lists the jumper selections based on input voltage. Figure 15 shows the overload heater relay and jumper positions.

Table 6. Overload Heater Relay Jumpers

HEU wired for:	Input Current	Heater part number
200 - 230 Vac	80 Amps	15237204 (FH87)
400 - 460 Vac	40 Amps	15237203 (FH79)

NOTE: HEUs with serial numbers 1 through 4 and 6 through 17 do not contain the overload heater relay K2.

Figure 15. Overload Heater Relay



NOTE: It is recommended that all three jumpers be replaced if any one jumper fails.

Terminal Blocks TB3 and TB5

Terminal block TB3 is the terminal block junction for control power.

If the auxiliary contacts on K1 are used to start the building water pumps, the signal is routed through the TB5 terminal block.

Temperature-regulating Module

The temperature-regulating module controls 120-Vac power to operate two valves: the dielectric-coolant mixing valve and the water inlet valve.

Supply Temperature Potentiometer

The supply temperature potentiometer, on the front lower-left corner of the HEU, is used to adjust the temperature of the dielectric-coolant supply.

Hour Meter

The hour meter is on the front of the power distribution box. When the K1 contactor closes, a 24-Vdc signal from the control module operates the hour meter. The meter shuts off when K1 opens.

J1 and RS-232 Connectors

The control cable between the module cabinet and the HEU connects to the J1 connector on the top of the power distribution box. The RS-232 9-pin connector enables the maintenance workstation to connect to the HEU.

NOTE: The RS-232 cable connection is seldom used.

Power Distribution

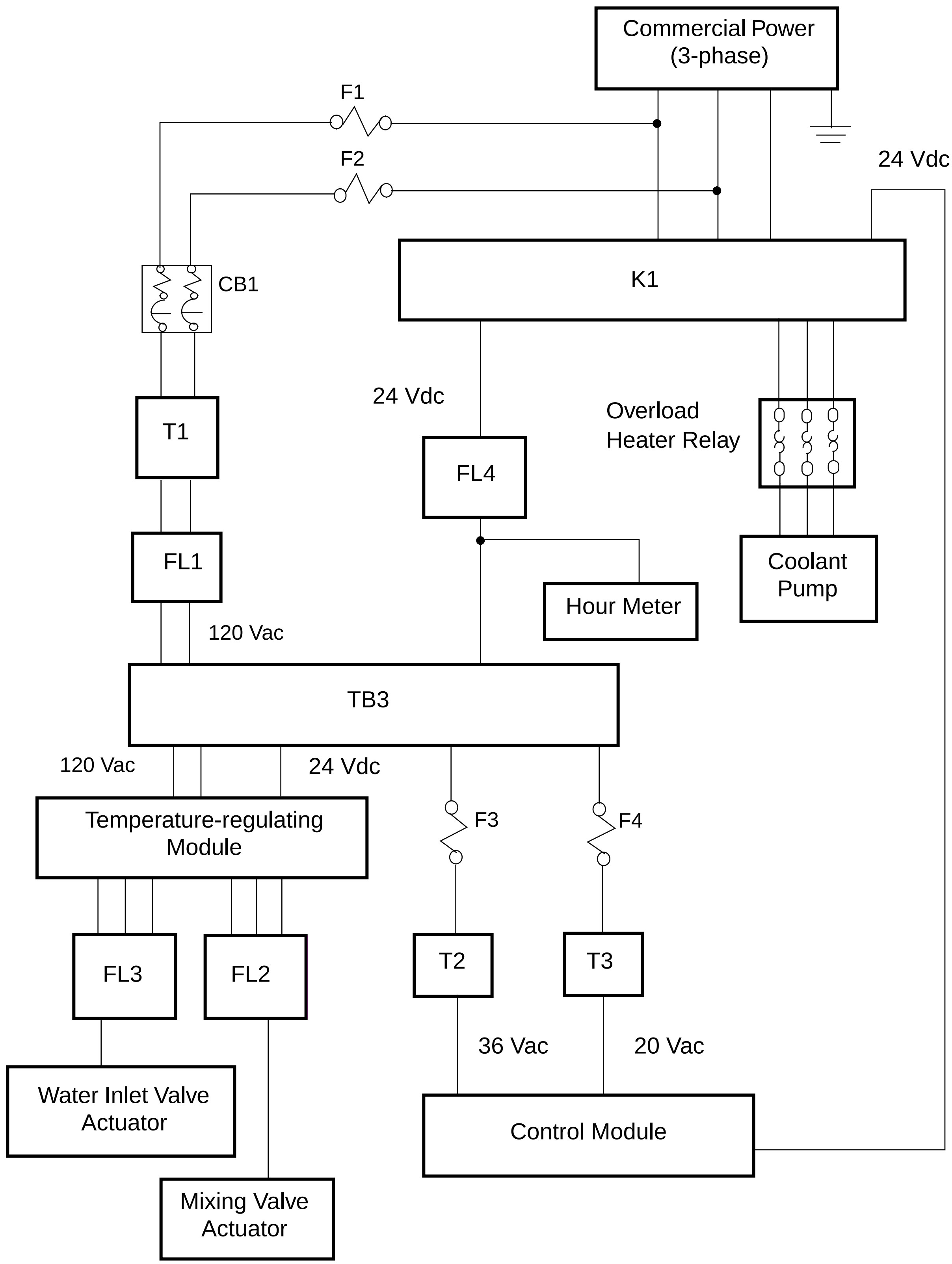
Power enters the HEU-WC1 at the power distribution box; the components described in the previous subsection convert and distribute power to the HEU-WC1 components. Refer to Figure 16 for a block diagram of the HEU-WC1 power distribution.

Power enters the distribution box, where it connects to the contactor K1. From the contactor, 3-phase power is routed to the pump electrical junction box through the overload heater relay K2.

Two phases of the customer-supplied power are routed through fuses F1 and F2 before the contactor connection. From these fuses, the power flows through the main circuit breaker (CB1) and then to the transformer T1, where the incoming power is stepped down to 120-Vac. This stepped-down power is routed through a line filter, which filters out any electrical noise. The 120-Vac power then connects to the terminal block TB3.

From TB3, the 120-Vac power routes through fuses F3 and F4 to transformers T2 and T3. These transformers step down the voltage once more and convert it to two voltages: 36-Vac and 20-Vac. Both of these voltages are routed to the control module.

Figure 16. HEU-WC1 Power Distribution Block Diagram



The control module receives these voltages and converts them into DC voltages. The control module provides the following voltages:

- 12-Vdc power to the pressure transducers
- 4-Vdc power to the temperature sensors
- 24-Vdc power to the dewpoint monitors (optional)
- 24-Vdc power to the temperature-regulating module
- 24-Vdc power to the hour meter through the K1 contactor

The 24-Vdc power that connects to the K1 contactor from the control module is routed to the line filter FL4. From this filter, the 24-Vdc power connects to the terminal block TB3, which routes the 24-Vdc power to the hour meter.

Terminal block TB3 also routes 120-Vac power to the temperature-regulating module. This module routes the CW and CCW triac signals to the mixing valve actuator and the water input valve actuator through line filters FL2 and FL3.

Warning and Control System

The HEU-WC1 warning and control system (WACS) monitors the HEU-WC1 for any warning or fault conditions. If an out-of-range condition exists, the WACS displays a high- or low-fault or warning signal on the display panel at the front of the control box. The WACS also sends warning and fault signals to the module cabinet.

The WACS system consists of the following components:

- Control module
- WACS display panel
- WACS sensors

Control Module

The control module receives 9-Vac and 18-Vac power from the T2 step-down transformer to generate the direct current (Vdc) voltages that operate the logic components and sensors.

The control module has three relays that are used for fault conditions. K1 is the pump on/off sense, K9 is the low-level fault, and K10 is the high discharge pressure fault.

- K1 is closed if the pump is operating. If the pump is not operating, K1 opens and the WACS sends a signal to the module cabinet to power down the system.

- K9 is closed if the dielectric-coolant level is at normal operating levels. If the level of dielectric coolant is below its limit, K9 opens and the WACS sends a signal to the module cabinet to power down the system.

- K10 is closed if the pump discharge pressure is within limits. If the discharge pressure rises above 160 psig, K10 opens to power down the system.

A microprocessor on the control module monitors the conditions within the HEU-WC1. Table 7 provides the HEU on limits, which are the conditions that the HEU controller monitors when the module cabinet is powered up. Table 7 provides the HEU off limits, which are the conditions that the HEU controller monitors when the module cabinet is powered down.

All of the conditions listed in Table 7 and Table 8 are displayed on the WACS display. However, only three warning and fault LEDs illuminate on the mainframe WACS: DISCHARGE PRESSURE, BACKUP LOW LEVEL, and DISCHARGE SWITCH. The Main Pump On LED illuminates when the pump is on.

The control module also has an RS-232 port that can connect the system workstation and the HEU.

Table 7. Monitored Conditions (On Limits)

Channel	Condition	Description	Limits	
			Warning High (Low)	Fault High (Low)
1	Fluorinert supply temperature	Thermistor that measures the temperature of dielectric coolant to the module cabinet	N/A	N/A
2	Fluorinert return temperature	Thermistor that measures the temperature of dielectric-coolant from the module cabinet	N/A	N/A
3	Discharge pressure	Pressure transducer that measures the dielectric-coolant pressure at the outlet of the pump	150 psig (-10 psig)	160 psig (-16 psig)
4	Water supply temperature	Thermistor that measures the temperature of water as it enters the HEU	N/A	N/A
5	Water return temperature	Thermistor that measures the temperature of water as it leaves the HEU	N/A	N/A
6	Water supply pressure	Pressure transducer that measures the pressure of water as it enters the HEU	N/A	N/A
7	Water return pressure	Pressure transducer that measures the pressure of water as it leaves the HEU	N/A	N/A
8	Water valve position	Indicates the valve is closed (0%) or open (100%)	N/A	N/A
9	Fluorinert valve position	Indicates the position of the valve as a %	N/A	N/A
10	Not used			
11	Not used			
	Backup low level	Float switch that indicates when the HEU reservoir has reached the 0% level	N/A	Open Switch
	Backup high level	Not used		
	Discharge switch[a]	Pressure monitor that shuts down the HEU if the discharge pressure reaches the fault level	N/A	180 psig
	Self-test 1	5-V self-test on the HEU controller	5.5 V (4.5 V)	6.0 V (4.0 V)
	Self-test 2	4-V reference voltage test	4.08 V (3.92 V)	4.12 V (3.88 V)
	Self-test 3	Ground voltage test	0.1 V	0.15 V
	Main pump on	Pump on/off sense	N/A	Pump Off

[a] To reset this fault condition, you need to power off the HEU, then power it on.

Table 8. Monitored Conditions (Off Limits)

Channel	Condition	Description	Limits	
			Warning High (Low)	Fault High (Low)
1	Fluorinert supply temperature	Thermistor that measures the temperature of dielectric coolant to the module cabinet	N/A	N/A
2	Fluorinert return temperature	Thermistor that measures the temperature of dielectric-coolant from the module cabinet	N/A	N/A
3	Discharge pressure	Pressure transducer that measures the dielectric-coolant pressure at the outlet of the pump	40 psig (-16 psig)	50 psig (-20 psig)
4	Water supply temperature	Thermistor that measures the temperature of water as it enters the HEU	N/A	N/A
5	Water return temperature	Thermistor that measures the temperature of water as it leaves the HEU	N/A	N/A
6	Water supply pressure	Pressure transducer that measures the pressure of water as it enters the HEU	N/A	N/A
7	Water return pressure	Pressure transducer that measures the pressure of water as it leaves the HEU	N/A	N/A
8	Water valve position	Indicates the valve is closed (0%) or open (100%)	N/A	N/A
9	Fluorinert valve position	Indicates the position of the valve as a %	N/A	N/A
10	Not used			
11	Not used			
	Backup low level	Float switch that indicates when the HEU reservoir has reached the 0% level	N/A	N/A
	Backup high level	Not used		
	Discharge switch[a]	Pressure monitor that shuts down the HEU if the discharge pressure reaches the fault level	N/A	180 psig
	Self-test 1	5-V self-test on the HEU controller	N/A	N/A
	Self-test 2	4-V reference voltage test	N/A	N/A
	Self-test 3	Ground voltage test	N/A	N/A
	Main pump on	Pump on/off sense	N/A	N/A

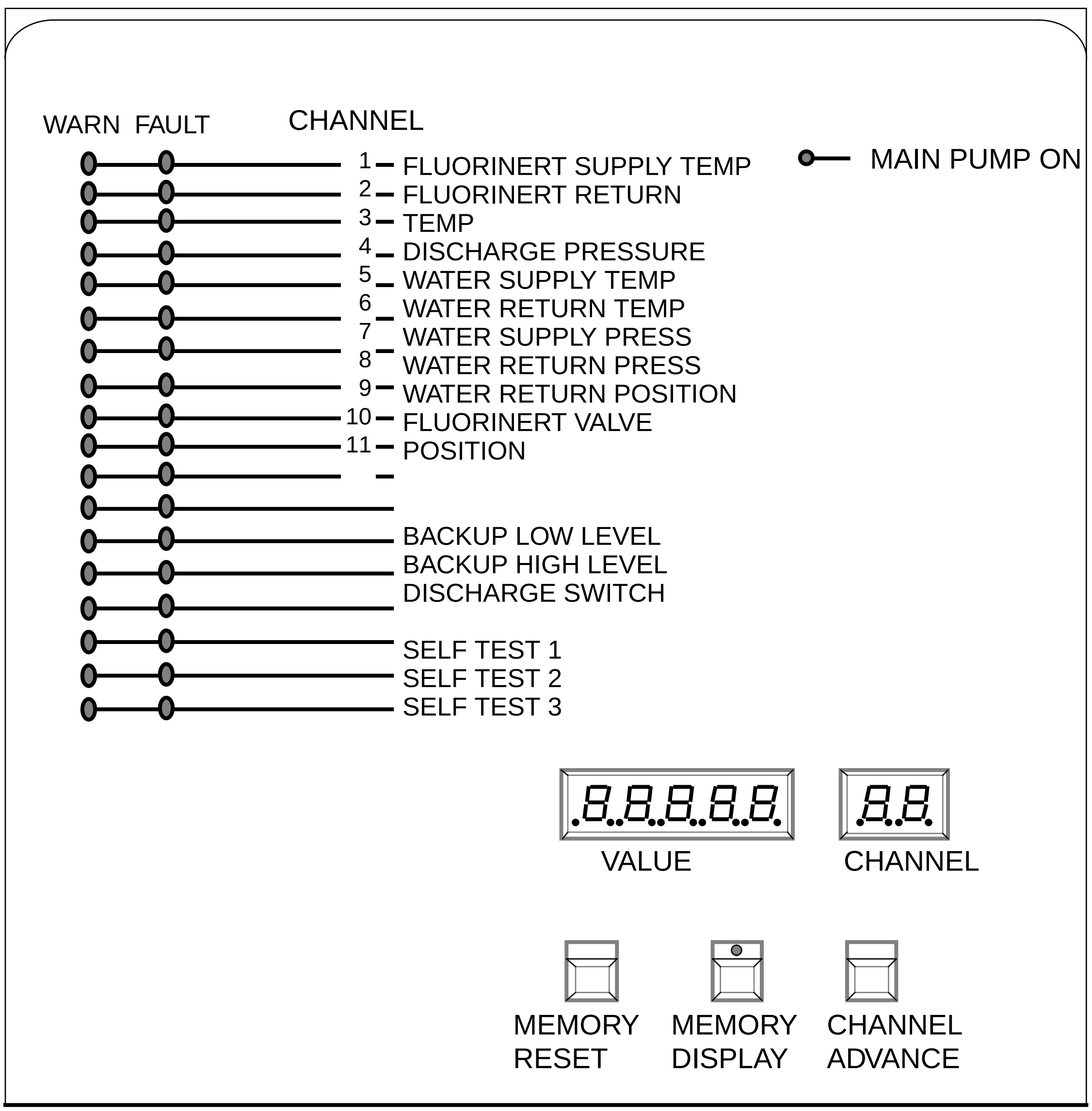
[a] To reset this fault condition, you need to power off the HEU, then power it on.

WACS Display Panel

The WACS display panel displays the monitored condition and its value. The display panel enables you to check the status of certain conditions. If a warning or fault condition exists, the corresponding LED under WARN or FAULT illuminates. The monitored conditions have corresponding channel numbers, as shown in Figure 17.

The display panel has two display fields: VALUE and CHANNEL. The CHANNEL field displays the channel number; the corresponding monitored value displays in the VALUE field.

Figure 17. Warning and Control Display Panel



The display panel has three switches: MEMORY RESET, MEMORY DISPLAY, and CHANNEL ADVANCE.

The MEMORY RESET switch erases any warning or fault information from memory.

The MEMORY DISPLAY switch enables you to view any warning or fault conditions that are stored in WACS memory. When this switch is depressed, the VALUE and CHANNEL fields show the channel numbers and their corresponding fault values of any warnings and/or faults that occurred.

When this MEMORY DISPLAY switch is not depressed, the VALUE and CHANNEL fields display current information.

The CHANNEL ADVANCE switch increments the illuminated channel number by one when pressed. You can check the status of any of the monitored conditions by incrementing the channel number.

WACS Sensors

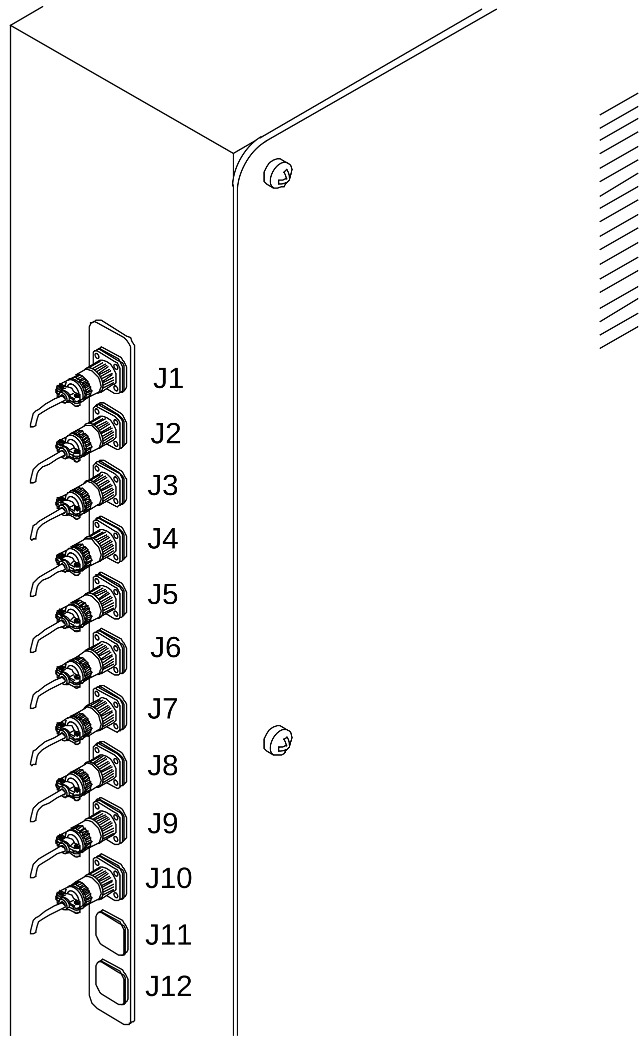
Sensors within the HEU-WC1 monitor the water and dielectric-coolant temperature and pressure conditions. The control module receives input from the sensors through cables that connect to jacks J1 through J10; these cables are located on the side of the control box (refer to Figure 18). Table 9 describes the function of each of the sensors in the HEU-WC1.

Table 9. WACS Sensors

Connector	Monitored Condition	Sensor Type	Function
J1	Discharge pressure	Pressure switch	If pressure rises to 180 psig, the switch opens to power down the system
J2	Discharge pressure[a]	Pressure transducer	Monitors the discharge pressure from the pump **NOTE:** The HEU control module does not receive signals from this sensor.
J3	Reservoir level	Float switch	Monitors the dielectric-coolant level of the reservoir
J4	Supply temperature (two sensors)	Temperature probe sensor (immersion type)	Monitors the temperature of dielectric coolant flowing to the module cabinet at the strainer inlet
J4	Supply temperature (two sensors)	Temperature sensor (surface mount)	Monitors the temperature of dielectric coolant flowing to the module cabinet at the strainer inlet
J5	Suction temperature (two sensors)	Temperature probe sensor (immersion type)	Monitors the temperature of the dielectric coolant at the pump inlet
J5	Suction temperature (two sensors)	Temperature sensor (surface mount)	Monitors the temperature of the dielectric coolant at the pump inlet
J6	Discharge pressure	Pressure transducer	Monitors the discharge pressure from the pump
J7	Water-in temperature	Temperature sensor (surface mount)	Monitors the temperature of water as it enters the HEU
J8	Water-out temperature	Temperature sensor (surface mount)	Monitors the temperature of water as it leaves the HEU
J9	Water-in pressure	Pressure transducer	Monitors the pressure of water as it enters the HEU
J10	Water-out pressure	Pressure transducer	Monitors the pressure of water as it leaves the HEU
J11	Not used		
J12	Not used		

[a] The pressure transducer that connects to J2 sends a signal directly to the module cabinet WACS through the J1 connector on the top of the power distribution box.

Figure 18. Control Box Sensor Cable Connections



Dielectric-coolant Level Float Switch

The dielectric-coolant level float switch is closed for normal operation. If the level of dielectric coolant in the reservoir drops below the fault level, the float switch opens and the control module sends a fault signal to the module cabinet WACS to power down the system.

Discharge Pressure Switch

The discharge pressure switch is open for normal operation. If the discharge pressure rises to 180 psig, the switch closes and the control module sends a fault signal to the module cabinet WACS to power down the system.

Pressure Transducers

The HEU-WC1 has four pressure transducers that operate on 12-Vdc input power from the control module. The four pressure transducers are: discharge pressure (sent to the module cabinet WACS only), discharge pressure (HEU WC-1 WACS), water-in pressure, and water-out pressure. The WACS displays dielectric-coolant discharge pressure and water inlet and outlet pressures on different channels of the WACS display.

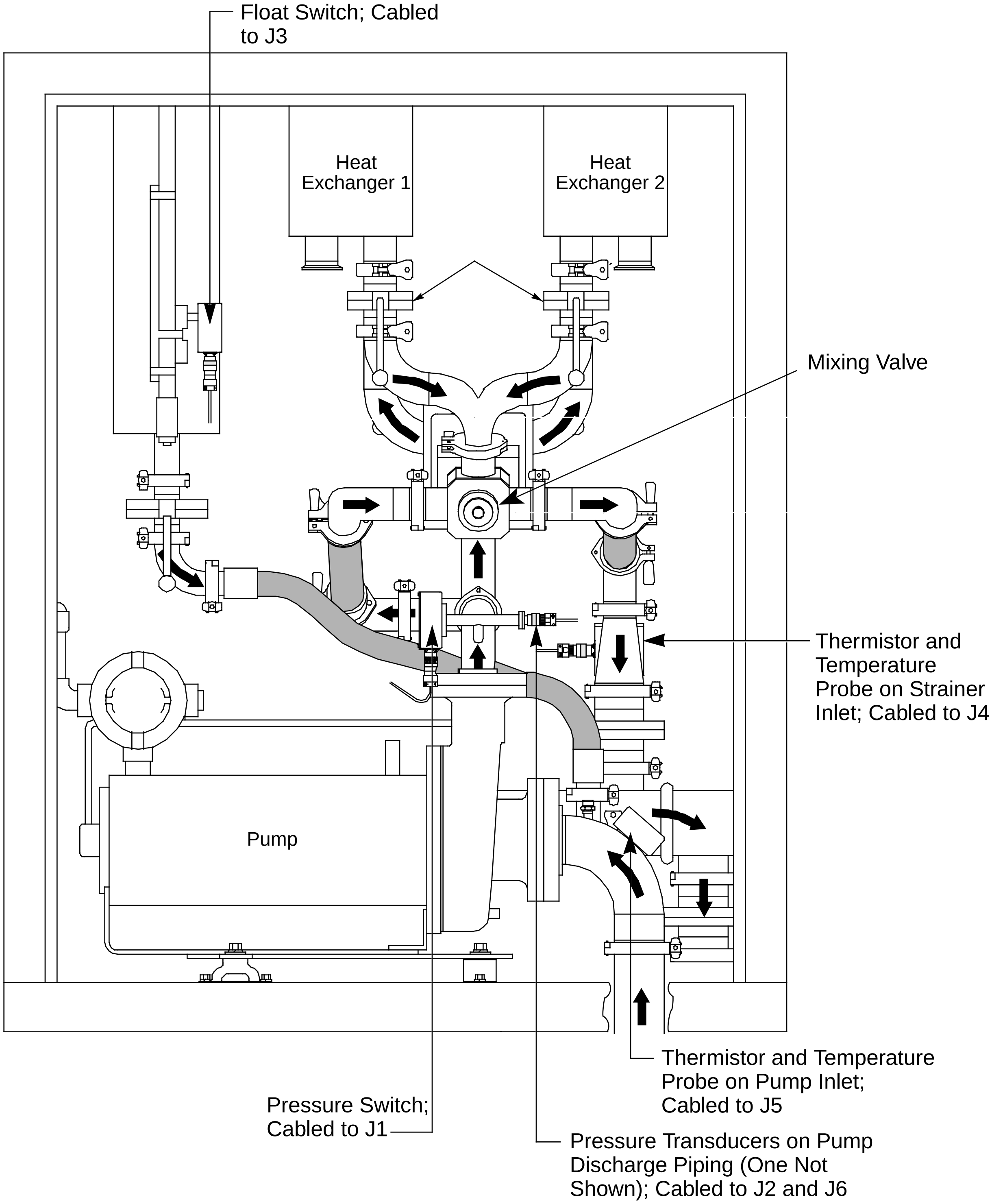
Temperature Sensors

The HEU-WC1 has five surface-mounted thermistors and two immersion-type temperature probes that operate on 4-Vdc input power from the control module. The WACS displays dielectric-coolant and water temperatures on different channels of the WACS display.

Monitoring and Control

Sensors within the HEU-WC1 provide input to the control module and temperature-regulating module, which control the temperatures and pressures of the dielectric coolant and water that flow through the two heat exchangers in the HEU. Refer to Figure 19 for an illustration of the monitoring and control sensor locations.

Figure 19. Monitoring and Control Sensor Locations



A microprocessor on the temperature-regulating module compares the temperature of the dielectric coolant flowing to the module cabinet with the setting on the dielectric-coolant supply temperature potentiometer. The potentiometer is located on the front of the power distribution box. (Refer again to Figure 11 for an illustration of the power distribution box and the potentiometer.)

The temperature-regulating module adjusts the position of the dielectric-coolant mixing valve continually to obtain the desired dielectric-coolant supply temperature. A microprocessor on the control module monitors system temperatures and pressures for fault conditions. If a fault condition exists, relays on the control module send a signal to the module cabinet WACS to power down the system.

You can check system operating parameters at the WACS display panel on the front of the control box. In addition, an RS-232 connection on the top of the power distribution box enables you to monitor system operating parameters from a maintenance workstation.

Figure 20 is a schematic diagram of the sensor locations; Table 10 identifies the sensors. Figure 21 is a block diagram of the control system. For additional information, refer to the HEU-WC1 Engineering schematic 10625200 and the temperature-regulating module Engineering schematic, number 31470800. Contact the Hardware Product Support department to obtain a copy of these schematics.

Figure 20. Sensor Location Schematic

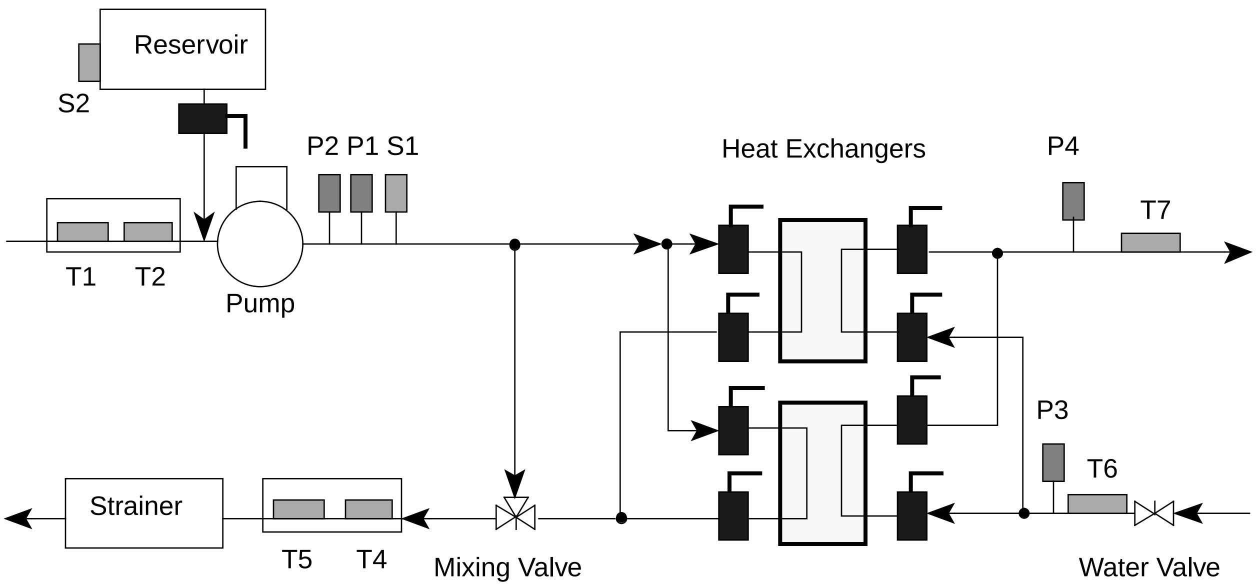
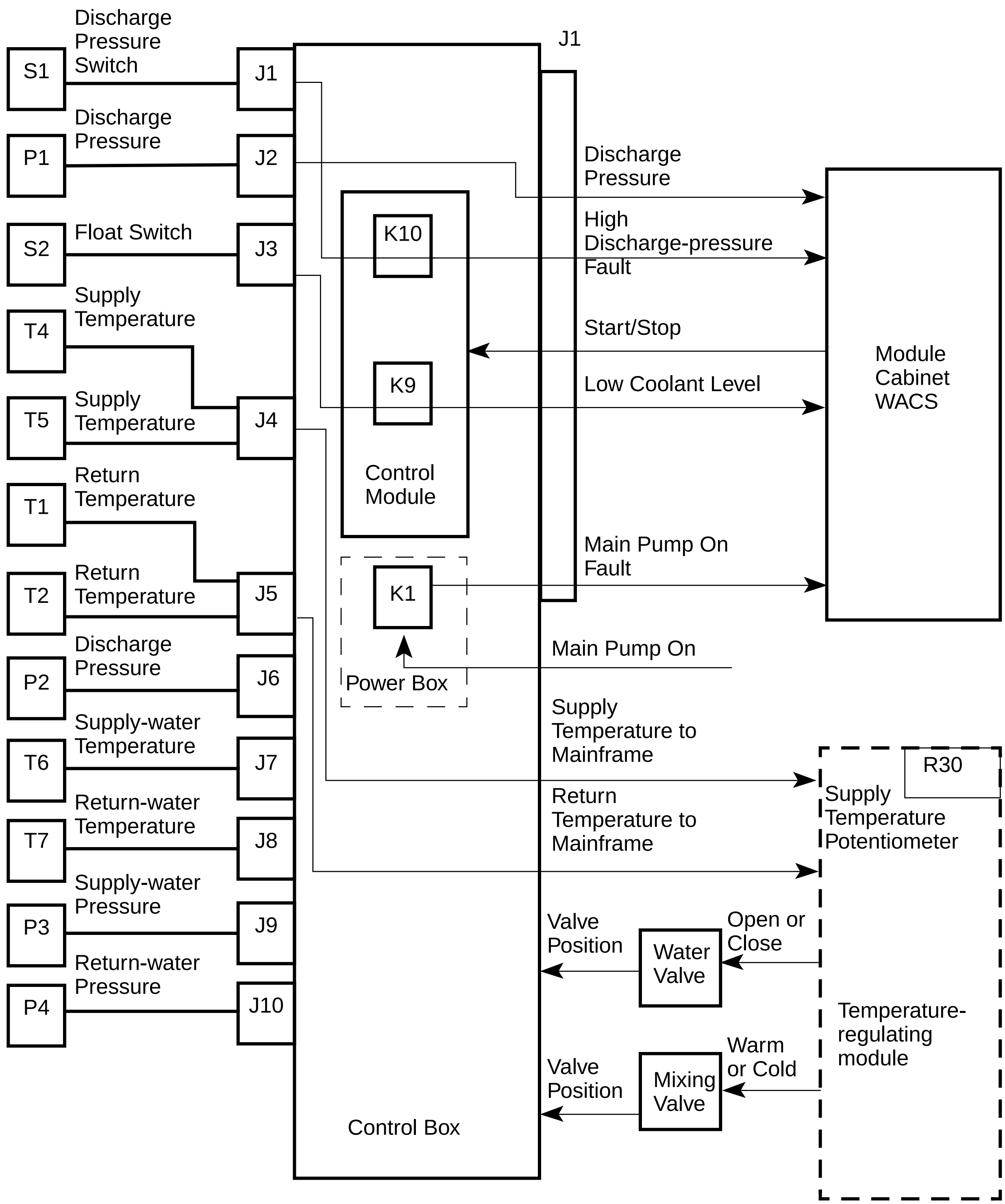


Table 10. Sensor Identification

Identifier	Description	WACS Channel
S1	Float switch	
S2	Discharge pressure switch	
P1	Discharge pressure transducer (to module cabinet WACS only)	
P2	Discharge pressure transducer (to HEU WC-1 WACS only)	3
P3	Water supply-line pressure transducer	6
P4	Water return-line pressure transducer	7
T1	Return-line dielectric-coolant temperature probe	
T2	Return-line dielectric-coolant thermistor	2
T4	Supply-line dielectric-coolant temperature probe	
T5	Supply-line dielectric-coolant thermistor	1
T6	Water supply-line thermistor	4
T7	Water return-line thermistor	5

Figure 21. Control System Block Diagram

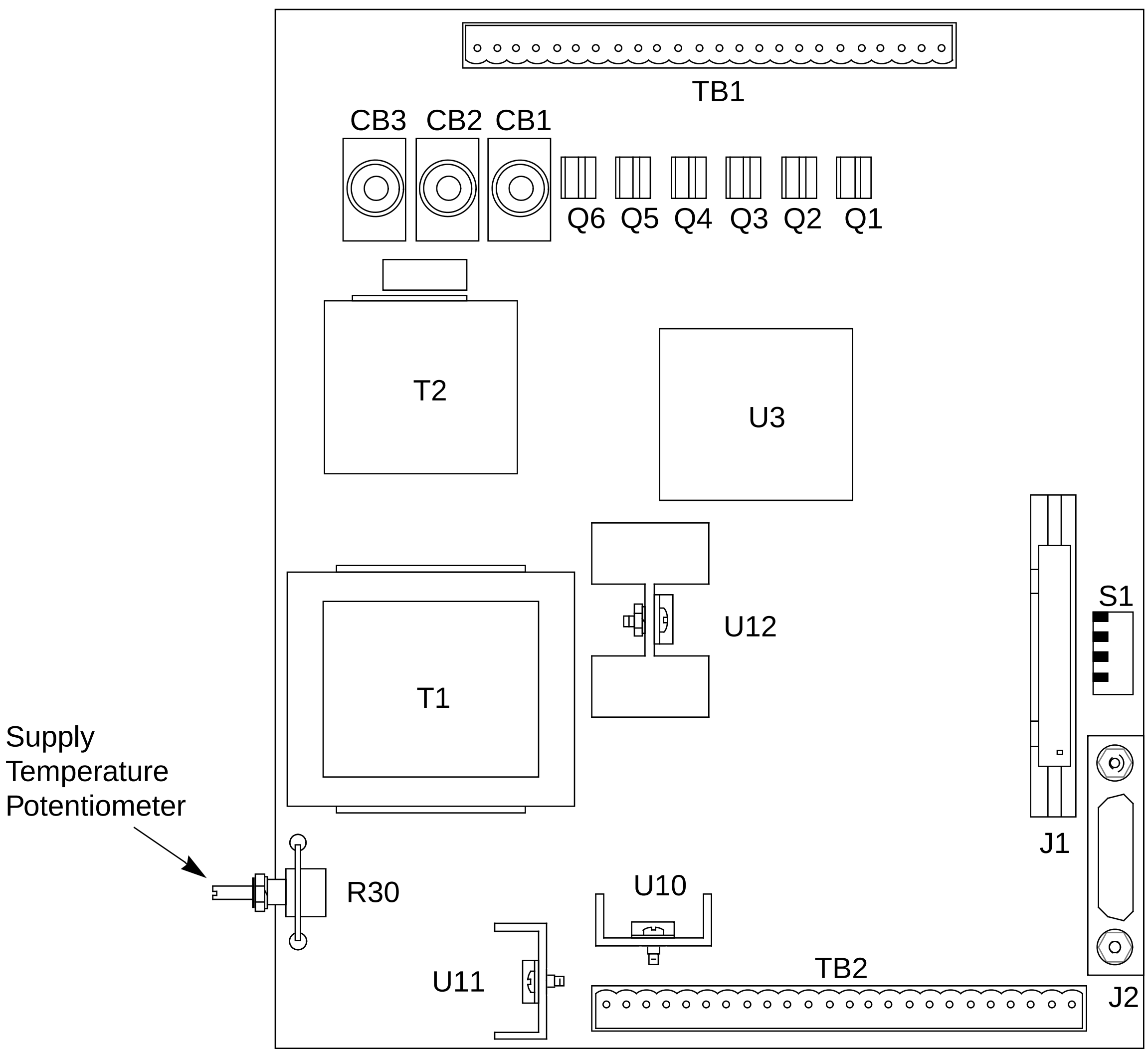


Temperature-regulating Module

The temperature-regulating module (refer to Figure 22) controls 120-Vac power to operate two valves: the dielectric-coolant mixing valve and the water inlet valve. An actuator assembly on each valve contains a motor that rotates the valve in either a clockwise (CW) or a counterclockwise (CCW) direction.

Each actuator assembly receives three power connections: a CW input, a CCW input, and a phase input. A microprocessor (U3) on the temperature-regulating module controls the position of each valve by using triac circuits (Q1 through Q6). The microprocessor enables specific triac circuits to activate either the CW or the CCW input.

Figure 22. Temperature-regulating Module



Three circuit breakers on the temperature-regulating module protect the circuits. CB1, CB2, and CB3 are pop-up type circuit breakers that you can reset if necessary; however, you need to replace the entire temperature-regulating module if any of the circuit breakers is defective. CB1 protects transformer T1, which provides power to the logic components. CB2 protects transformer T2, which provides power to the triac circuits. CB3 protects the actuator motors.

The dielectric-coolant temperature potentiometer (R30) on the front of the power distribution box is part of the temperature-regulating module, not a separate component. The temperature-regulating module also has a 4-position switch (S1) that is reserved for programming options.

Power-up and Power-down Sequences

The following subsections describe the sequence of events that occurs when you power up or power down the system. Refer to Figure 23 for an illustration of the HEU-WC1 electrical component locations.

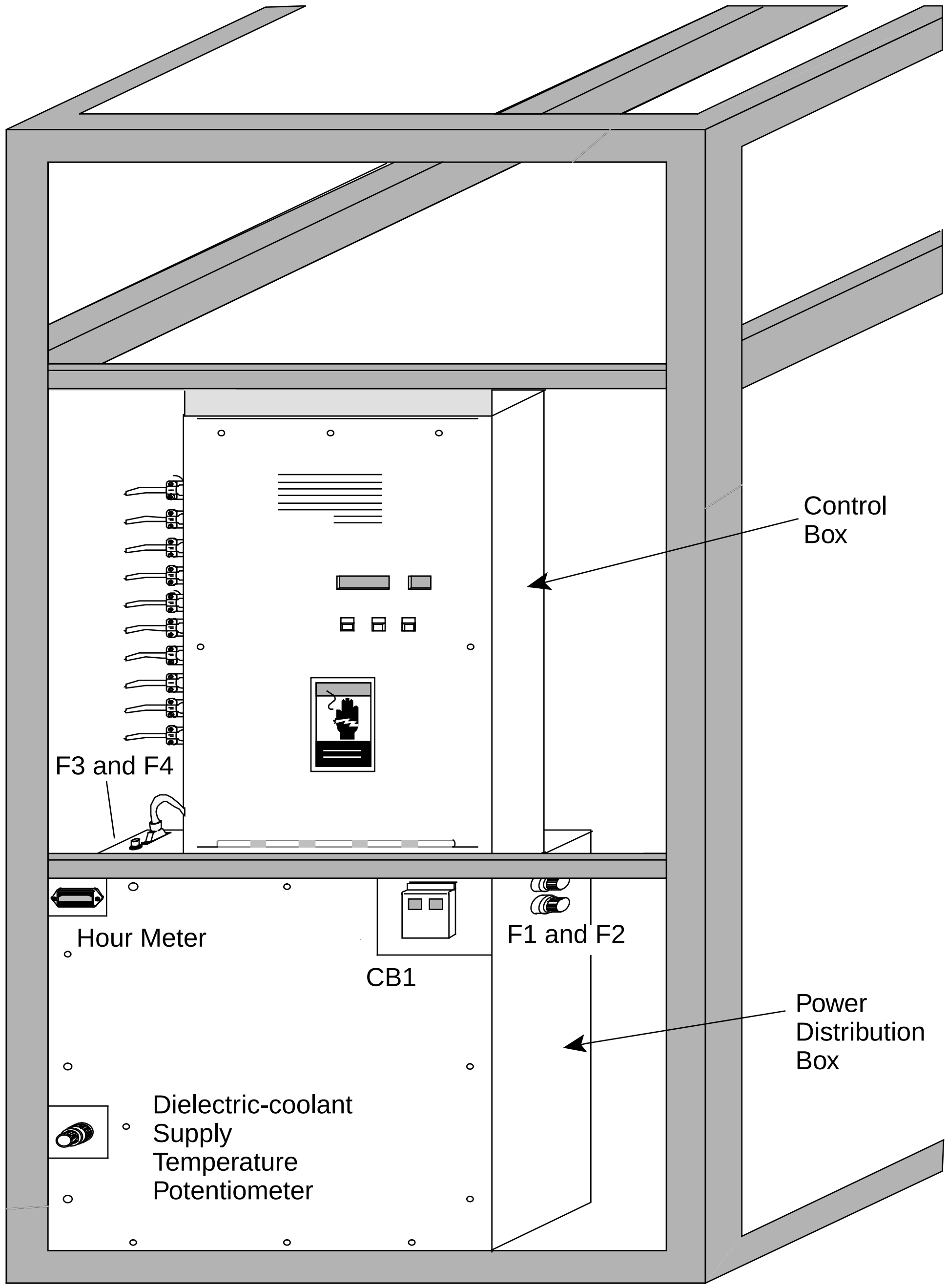
Power-up Sequence

1. Place the HEU wall circuit breaker in the ON position to apply power to the HEU-WC1.

2. Place the CB1 circuit breaker in the ON position to apply power to the T1 transformer and to power the 120-Vac circuits in the HEU.

   At this time, the control module, temperature-regulating module, and all sensors in the HEU-WC1 have power to begin monitoring the heat exchange system. However, the flow of dielectric coolant and water does not begin until you press the START button on the module cabinet.

Figure 23. Power Distribution and Control Box Locations



3. Press the START button on the module cabinet. This sends a start signal to the HEU to close the K1 contactor and to apply 3-phase power to the dielectric-coolant pump. The dielectric-coolant pump starts circulating dielectric coolant between the module cabinet and the HEU-WC1.

4. The temperature-regulating module sends a signal to open the water inlet valve. When the water valve opens, water starts circulating between the HEU-WC1 and the building water system.

NOTE: A set of auxiliary contacts on K1 provides a method for sending a start signal to the customer's water pumps. This feature ensures that the customer's water system pumps are on when the HEU-WC1 starts transferring waste heat from module cabinet to the building water system.

The temperature-regulating module starts regulating the temperature of dielectric coolant that flows back to the module cabinet by adjusting the position of the dielectric-coolant mixing valve.

Power-down Sequence

Press the STOP button on the module cabinet. This sends a stop signal to the HEU to open the K1 contactor and to remove power from the dielectric coolant pump. The temperature-regulating module then closes the water inlet valve.

Troubleshooting

Refer to Table 11 for a troubleshooting chart. If you suspect that one of the problems described in this table exists with your HEU-WC1, try to isolate the cause of the problem by using the suggestions for corrective action.

Table 11. Troubleshooting Chart

Problem	Symptoms	Cause	Corrective Action(s)
High dielectric-coolant supply temperature	High module temperatures	Plugged or corroded heat exchanger(s)	Replace the heat exchanger(s).
		Butterfly valve(s) partially closed	Place all valves in the fully open position.
		HEU water supply temperature too high	The customer must repair the problem to meet Cray Research building chilled-water specifications.
		Dielectric-coolant mixing valve does not operate	Check the pop-up circuit breakers on the temperature-regulating module and reset them if possible. Check the thermistors for correct readings. Replace the temperature-regulating module. Replace the mixing valve and actuator assembly.
		Supply temperature potentiometer setting too high	Adjust the potentiometer setting.
Low dielectric-coolant supply temperature	Low module temperatures	Supply temperature potentiometer setting too low	Adjust the potentiometer setting.
		HEU water supply temperature too low	Shut off one heat exchanger.
		Dielectric-coolant mixing valve does not operate	Check the pop-up circuit breakers on the temperature regulating module and reset them if possible. Check the thermistors for correct readings. Replace the temperate-regulating module. Replace the mixing valve and actuator assembly.

Table 11. Troubleshooting Chart (continued)

Problem	Symptoms	Cause	Corrective Action(s)
Discharge pressure switch	High discharge pressure	Plugged strainer	Clean or replace the strainer.
		Butterfly valve(s) partially closed	Place all valves in the fully open position.
High discharge pressure	High discharge pressure	Plugged strainer	Clean or replace the strainer.
		Butterfly valve(s) partially closed	Place all butterfly valves in the fully open position.
Low discharge pressure	Low discharge pressure	System dielectric-coolant level is low	Add dielectric coolant and check the entire system for leaks.
		Pump is not operating	Ensure that the pump is on and check the phase light for loss of phase.
		Bad pump	Check the pump and replace it if necessary.
HEU pump warning	Low-pressure fault	Pump shuts off; possible bad pump	Ensure that the pump is on and check the phase light for loss of phase. Replace the pump if necessary.
	Low liquid level	Bad pump	Check the pump and replace it if necessary.
HEU pump fault	High-pressure fault	Strainer filter plugged	Clean or replace the strainer.
HEU reservoir level	Low liquid level	Leak in dielectric-coolant system	Perform leak inspection of the entire system, including the module cabinet and HEU, and repair leaks. Add dielectric coolant as needed.

Table 11. Troubleshooting Chart (continued)

Problem	Symptoms	Cause	Corrective Action(s)
Water supply temperature and pressure	High pressure on heat exchanger water-inlet and low pressure on water outlet	Plugged heat exchanger	Replace the heat exchanger.
	Low pressure on water inlet and outlet piping	Water-inlet valve does not open	Check the pop-up circuit breakers on the temperature-regulating module and reset them if possible. Replace the temperature-regulating module. Replace the water-inlet valve and actuator assembly.
		Butterfly valve(s) on heat exchanger water inlet/outlet partially closed	Place all valves on both heat exchangers in the fully open position.
	High water-inlet temperature	HEU water supply temperature too high	The customer must repair the problem to meet Cray Research building chilled-water specifications.
Self test	WACS system fault	Control module does not receive correct power	Measure the 9-Vac and 18-Vac output from T2, and replace T2 if necessary. Replace the control module.
Backup low level	Low dielectric-coolant level	Leak in dielectric-coolant system	Perform leak inspection of the entire system, including the module cabinet and HEU, and repair leaks. Add dielectric coolant as needed.
Backup high level	Not used		

Preventive Maintenance Procedures

The following preventive maintenance (PM) procedures are necessary to ensure that the HEU-WC1 continues to operate safely and efficiently. Customer agreements or site variables may require that you schedule the procedures listed in Table 1 to meet specific customer needs. None of these PM procedures requires dedicated time.

The table contains a column labeled “PMP Number.” The PMP number is a designation that indicates the recommended frequency for performing the procedure. The W stands for weekly, M for monthly, and S for semiannually.

Table 12. Preventive Maintenance Index

PMP Number	Time Required	Dedicated Time?	Procedure Title
W1	0.5 hours	No	Completing a Weekly Cooling System Report
M1	0.1 hours	No	Visually Checking the Dielectric-coolant Level
S1	0.5 hours	No	Inspecting the Dielectric-coolant Pump

Completing Weekly Cooling-system Report - W1

Time Required: 0.5 hours

Use the *nwacs* software application on the maintenance workstation (MWS) to gather data to complete a weekly cooling-system report for the HEU-WC1. Submit a weekly report that includes the following cooling-system parameters:

- Dielectric-coolant pump discharge pressure
- Dielectric-coolant supply temperature
- Dielectric-coolant return temperature
- Water-inlet temperature and pressure
- Water-outlet temperature and pressure

An RS-232 jack, located on the top of the power distribution box, enables you to connect the HEU-WC1 to a workstation to gather performance data, which you can use to create a performance log.

Visually Checking the Dielectric-coolant Level - M1

Time Required: 0.1 hours

The reservoir level indicator has an orange flag that indicates normal dielectric-coolant level; a white flag indicates that the reservoir is empty.

1. Remove the HEU-WC1 service panels to expose the reservoir.

2. Remove the filler cap from the top of the reservoir.

3. Using a flashlight, visually verify that the dielectric-coolant level in the reservoir is between 3/4 and 7/8 full. If necessary, add dielectric coolant according to the procedure described later in the “Field Repair Procedures.”

4. Replace the filler cap and the HEU service panels.

Inspecting the Dielectric-coolant Pump - S1

Time Required: 0.5 hours

1. Remove the service panel next to the pump.
2. Inspect the pump for excessive vibration and unusual noises. Excessive vibration or unusual noises may indicate an internal problem with the pump or may indicate loose mounting hardware.
3. If possible, immediately correct any problem that you find during the pump inspection. If the problem requires more time to correct, talk to the customer to schedule maintenance.
4. Replace the service panel.

Field Repair Procedures

Table 13 lists the field repair procedures for an HEU-WC1. Table 14 describes part numbers for field replaceable components in an HEU-WC1. Refer to Table 14 to identify the parts you need to complete a specific repair procedure.

Table 13. Field Repair Procedures

Procedure Title	Time Required	Page
Dielectric-coolant Leak Detection	1.0 hours	63
Dielectric-coolant Replenishment	0.5 hours	65
Strainer Filter Cleaning and Replacement	1.0 hours	68
Pump Replacement	3.0 hours	71
Heat Exchanger Replacement	1.0 hours	78
Liquid-level Indicator and Float Replacement	1.0 hours	82
Surface-mounted Thermistor Replacement	0.5 hours	86
Immersion-type Temperature Probe Replacement	0.5 hours	88
Pressure Transducer Replacement	0.5 hours	90
Pressure Switch Replacement	0.5 hours	93
CB1 Circuit Breaker Replacement	0.5 hours	96
Control Module Replacement	1.0 hours	98
Temperature-regulating Module Replacement	1.0 hours	100
Dielectric-coolant Mixing Valve and Actuator Replacement	1.0 hours	103
Water Inlet Valve and Actuator Replacement	1.0 hours	107
Heater Relay Replacement	1.0 hours	110

Table 14. Field Replaceable Component Part Numbers

Part Number	Part Name	Designator
01461100	Auxiliary side-mount control module (for K1 contactor)	
01349201	Circuit breaker, 1 amp (for control module)	CB2
01498402	Circuit breaker, 2 amp (for 120-Vac control)	CB1
12112701	Contactor assembly (includes auxiliary control module 01461100)	K1
01460900	Contactor assembly (does not include auxiliary control module 01461100)	
13193800	Dielectric-coolant mixing valve and actuator assembly	
01709601	Discharge pressure control switch, 180 psi	S1
01039700	Float (for liquid-level indicator)	
01039800	Float switch	S2
13187700	Fuse, 5 amp	F1, F2
13097100	Heat exchanger	
31473000	HEU Control module	
01407000	Hour meter	
55003300	Immersion-type 1.5-in. temperature probe	T1, T4
01039600	Indicator, 12-in. flag	
13195200	Line filter for power to dielectric-coolant valve actuator	FL2
13195200	Line filter for power to water inlet valve actuator	FL3
01390600	Line filter for 120-Vac power	FL1
13195200	Line filter for 24-Vdc power	FL4
01492402	Pressure transducer 0 through 200 psi	P1 - P4
01035802	Pump, 6.25-in. impeller for sites with 60-Hz commercial power	
01035800	Pump, 7-in. impeller for sites with 50-Hz commercial power	
51686401	Step-down transformer (for control module)	T2
01485800	Step-down transformer (for 120-Vac power)	T1
13195701	Strainer filter 25-micron	
13195700	Strainer filter 177-micron	
01386200	Surface-mounted thermistor	T2, T3, T5 - T7
31470000	Temperature-regulating module	
01037503	Valve, butterfly with seal 1.5-in.	
01037500	Valve, butterfly with seal 2-in.	
01037501	Valve, butterfly with seal 3-in.	
13095200	Valve, pressure relief	
13193700	Water inlet valve and actuator assembly	
01036300	2-in. flange gasket	
01036301	3-in. flange gasket	
01037204	1.5-in. gasket	
01037200	2-in. gasket	
01037201	3-in. gasket	

Dielectric-Coolant Leak Detection

If you need to add more than 2 gallons (7.58 liters) of dielectric coolant to the computer system in a month, the system has a leak. You must identify the cause of the dielectric-coolant leak and correct the problem. While the computer system is powered up, perform the following dielectric-coolant leak detection procedure.

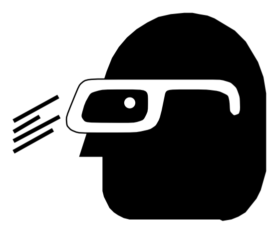
Depending on the leak rate and pressure of the system, you can repair leaks using a variety of methods. For most leaking components, replace either the component or the component seal. You can eliminate other leaks by tightening a loose connection. After you identify the leaking component, refer to the appropriate repair procedure in this section for information about how to replace that component.

Time Required

- Approximately 1.0 hours

Tools

- Halogen leak detector
- Protective eyewear



WARNING

Wear eye protection when you work with pressurized refrigerant. Failure to do so could result in permanent blindness.

1. Check all of the couplings to the dielectric-coolant manifolds in the module cabinet for any visible leaks at the manifold couplings. Repair or replace connections as required.

2. Check the module cold-plate hose connections for any visible leaks at the fittings on the module cold plate. Repair or replace connections as required.

3. Check hose connections on the power supplies for any visible leaks between the power supplies and the power supply manifolds. Repair or replace connections as required.

4. Check hose connections in the HEU-WC1 for any visible leaks at the connectors and flanges. Clean or replace seals as required.

5. Check hose connections under the floor for any visible leaks at the connectors and flanges. Clean or replace seals as required.

6. Use a halogen leak detector to scan the entire dielectric-coolant system, including the following components:

   - The HEU-WC1 cabinet (plus hoses, pumps, valves, and fittings)
   - All ball valve couplings
   - All under-floor hoses and connections
   - All module and power supply connections and hoses
   - All module and power supply manifolds
   - All manifold bleed-off valves
   - All thermistor and pressure transducers

7. Use the halogen leak detector to scan the conduit that encloses the HEU-WC1 pump power leads. Scan the conduit from its origin to the point where it connects to the HEU-WC1 pump. Correct any deficiencies as needed.

Dielectric-coolant Replenishment

Add dielectric coolant to the system when the coolant level is low. You can add dielectric coolant at any time, even if the system is running. Perform the following tasks to determine whether you need to add dielectric coolant:

- Check the dielectric-coolant level indicator on the side of the HEU-WC1 reservoir. The orange flags indicate the level of the dielectric coolant in the reservoir.

- Before you add dielectric coolant, use a flashlight to verify that the dielectric-coolant level in the HEU-WC1 reservoir is low. The liquid level should be approximately 3/4 full while the HEU-WC1 is running.

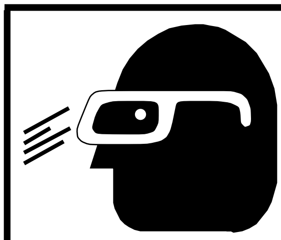
Refer to Figure 24 for the dielectric-coolant reservoir component locations.

Time Required

- Approximately 0.5 hours

Tools

- Container of dielectric coolant (FX-74)
- Dielectric-coolant pump
- Flashlight
- Large adjustable wrench
- Panel removal tool
- Protective eyewear



WARNING

Wear eye protection when you work with pressurized refrigerant. Failure to do so could result in permanent blindness.

1. Remove the HEU-WC1 top service panel.

2. Remove the cap from the filler port located on the top of the dielectric-coolant reservoir.

3. Insert the outlet hose of the dielectric-coolant pump in the filler port of the reservoir.

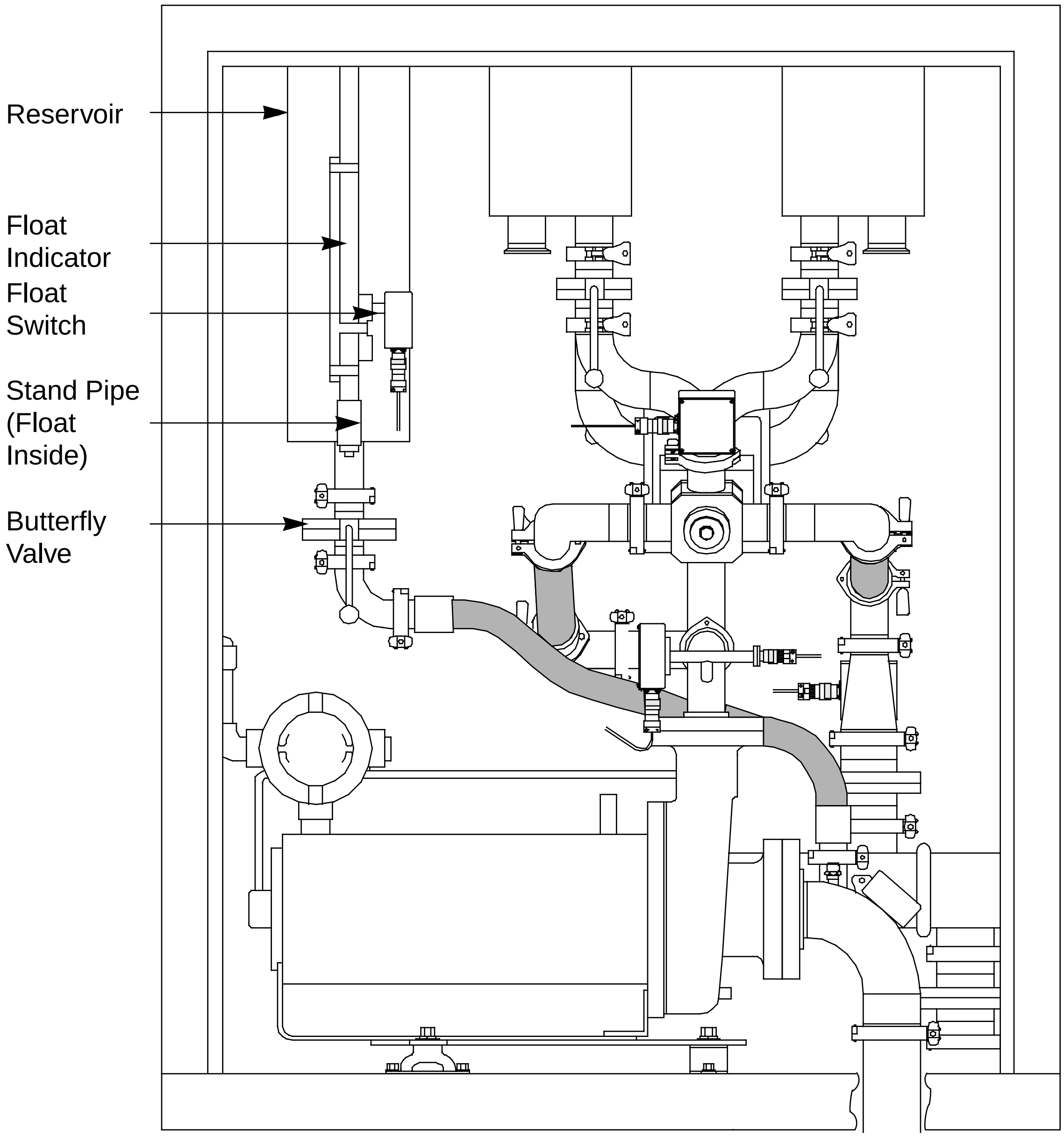


Figure 24. Dielectric-coolant Reservoir Component Locations

4. Place the input hose of the dielectric-coolant pump in a container of dielectric coolant.

5. Turn on the dielectric-coolant pump.

NOTE: If you do not get a positive flow of dielectric coolant through the pump into the reservoir, prime the dielectric-coolant pump by filling the output hose with dielectric coolant before you connect the hose to the filler port.

6. Fill the HEU-WC1 reservoir approximately 3/4 full.

7. Remove the hose from the filler port of the reservoir, then drain the dielectric coolant into the container.

8. Replace the cap on the filler port and tighten it by hand.

9. Remove the input hose of the dielectric-coolant pump from the container of dielectric coolant, then close the container.

10. Replace the HEU-WC1 top service panel.

Strainer Filter Cleaning and Replacement

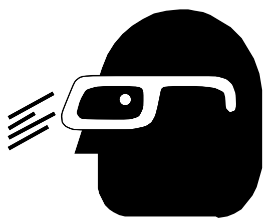
An accumulation of debris in the dielectric-coolant filter can restrict the flow of dielectric coolant. Under normal operating conditions, you should be able to clean the strainer filter if it fills with debris. Replace the filter if you cannot clean it.

Time Required

- Approximately 1.0 hours

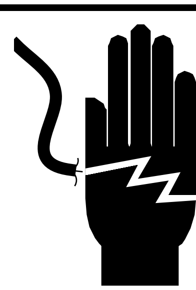
Tools

- Adjustable wrench
- Clean pail
- Panel removal tool
- Protective eyewear



WARNING

Wear eye protection when you work with pressurized refrigerant. Failure to do so could result in permanent blindness.



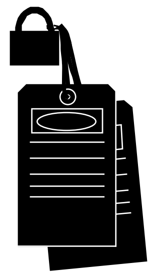
WARNING

Remove all rings, watches, and other jewelry before you perform this procedure. Failure to so could result in severe shock and burns.

Removing the Dielectric-coolant Filter

1. Power off the module cabinet at the WACS panel.
2. Place the HEU CB1 circuit breaker in the OFF position.
3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.

4. Lock and tag the HEU-WC1 wall circuit breaker.



WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

5. Remove the side and rear service panels on the HEU-WC1.

6. Close the butterfly valve handles on the inlet and outlet of the strainer assembly.

   NOTE: The butterfly valves are variable-position valves. Turn the handle counterclockwise to loosen the lock and close the valve. The valve is closed when the handle is horizontal; lock the handle by turning it clockwise.

7. Place a clean pail under the access port on the short end of the strainer assembly.

8. Use an adjustable wrench to remove the clamp on the outlet of the access port to the strainer.

9. Remove the access port cover and drain the dielectric coolant into the pail.

10. Pull the access port handle to remove the strainer filter from the strainer assembly.

11. Wash the filter in a pail of clean dielectric coolant. If necessary, replace the filter.

Installing the Dielectric-coolant Filter

1. Insert the new or cleaned strainer filter in the strainer assembly.
2. Replace the access port cover.
3. Close and tighten the clamp on the access cover to the strainer assembly.
4. Open the butterfly valve handles on the inlet and outlet of the strainer assembly. When the handle is vertical, the valve is open.
5. Remove the lock and tag from the HEU-WC1 wall circuit breaker and turn on the breaker.
6. Place the HEU CB1 circuit breaker in the ON position.
7. Press the Cooling Bypass switch on the module cabinet WACS panel to replenish the dielectric-coolant loop.
8. Check for and repair any dielectric-coolant leaks, then add dielectric coolant to the system. For information about adding dielectric coolant, refer to the “Dielectric-coolant Replenishment” procedure in this section.
9. Replace the side and rear service panels on the HEU-WC1.
10. Power on the module cabinet at the WACS panel.

Pump Replacement

If a pump breaks, leaks, or otherwise shows signs of damage, replace it using the following procedure. Refer to Figure 25 to identify components referred to in this procedure.

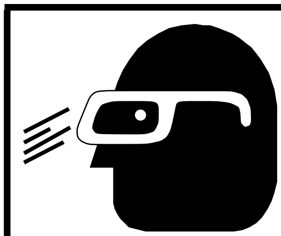
NOTE: This procedure requires two people. Before you start, be sure a second person is available to help replace the pump.

Time Required

- Approximately 3.0 hours

Tools

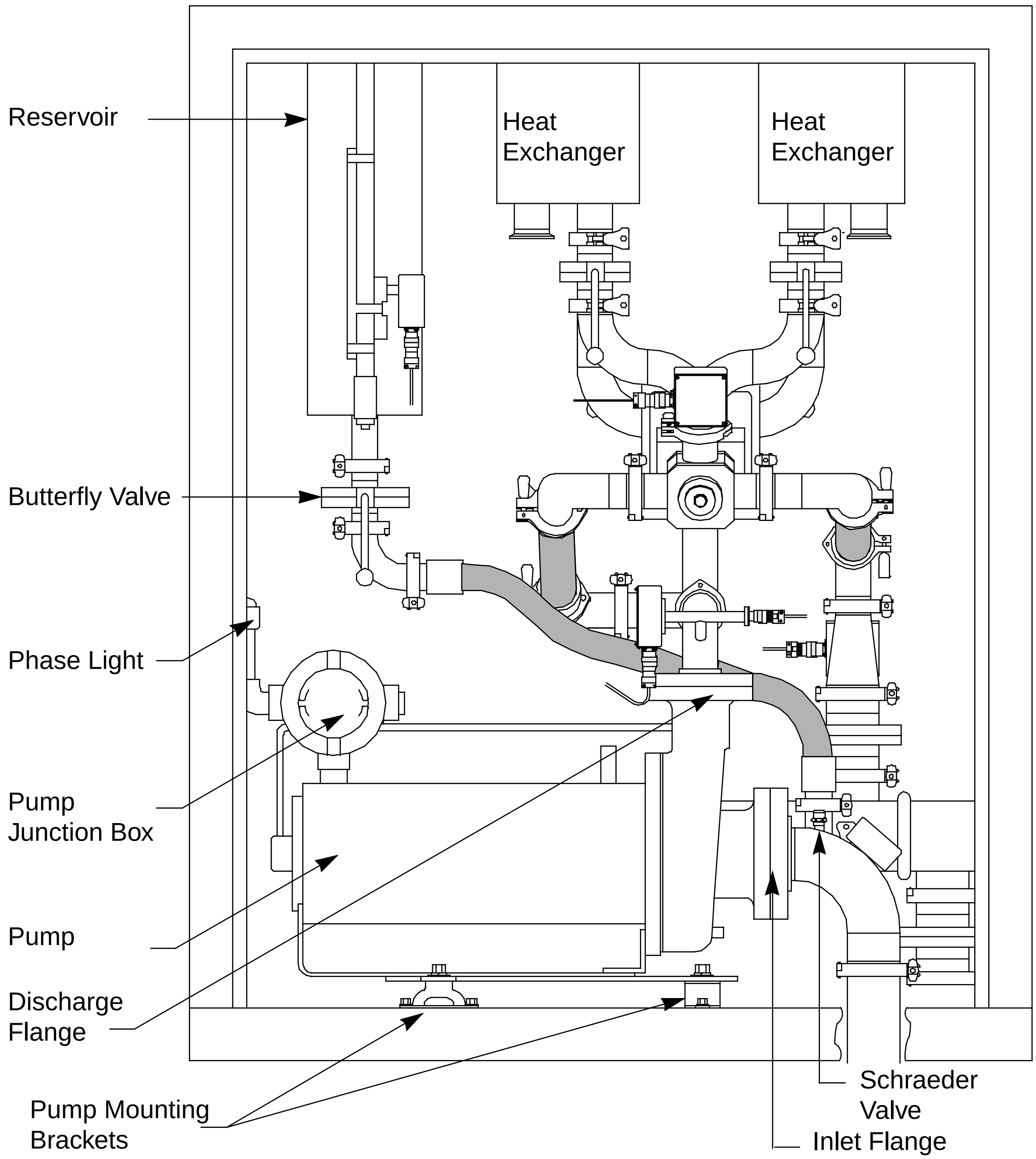
- Anti-seize compound
- Empty dielectric-coolant container or clean pail
- Heat shrink sleeves
- Heavy-gauge wires (2), 4-ft minimum length
- Large adjustable wrench
- Linerless rubber splicing electrical tape (CRI part # 01399000)
- Manifold gauge
- Panel removal tool
- Phillips and flat-blade screwdrivers
- Protective eyewear
- Teflon tape
- Voltage meter



WARNING

Wear eye protection when working with pressurized refrigerant. Failure to do so could result in permanent blindness.

Figure 25. HEU-WC1 Component Locations

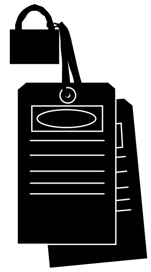


Removing a Pump

1. Power off the module cabinet at the WACS panel.
2. Place the HEU CB1 circuit breaker in the OFF position.

3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.

4. Lock and tag the HEU-WC1 wall circuit breaker.



WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

5. Remove the side and rear panels from the HEU-WC1.

6. Close the following butterfly valves: the reservoir outlet valve, the inlet valve to the circulation pump, the inlet and outlet valves of both heat exchangers, and the inlet valve to the strainer. To close these valves, pull the valve handles out and rotate them clockwise 90° into the final locking position.

NOTE: A butterfly valve handle has four possible locking positions. These four positions, which regulate the flow of dielectric coolant. Most field sites run the cooling system with the butterfly valve handle in the fully open position.

7. Connect a manifold-gauge hose to the Schraeder valve located on the top of the pump inlet manifold and drain the dielectric coolant into an empty dielectric-coolant container or into a clean pail.

8. Open the junction box on the top of the pump.

9. Use a long screwdriver or similar tool to loosen the junction box cap.

10. Record the location of each wire on the replacement pump.

11. Disconnect all electrical connections.

12. Slide the conduit out of the connector at the side of the junction box: loosen the nut on the conduit, then slide the wires out of the junction box.

13. Detach the green ground cable from the bottom of the pump.

14. Remove the four bolts from the pump inlet flange.

15. To hold the discharge flange out of the way as you remove the pump, wrap a heavy-gauge wire around the elbow of the assembly and the HEU-WC1 chassis.

16. Remove the two adjustment bolts that hold the pump to the mounting brackets.

17. Remove the bolt from the rubber shock mount on the front left side of the pump.

18. Carefully remove the pump through the side of the HEU-WC1 chassis.

Installing a Pump

1. Transfer the hardware (bolts, suction line, gaskets, etc.) from the defective pump to the replacement pump.

2. Apply anti-seize compound to all flange bolts.

3. Slide the replacement pump in through the side of the HEU-WC1 chassis.

4. Attach the green ground cable to the pump.

5. Remove the wire that holds the inlet flange assembly away from the pump.

6. Position the inlet flange assembly and screw in the four bolts to secure it in place.

7. Remove the wire that holds the discharge flange away from the pump.

8. Inspect the discharge flange gasket for damage, then install it on the discharge flange.

9. Position the discharge flange and screw in the four bolts to secure it. Torque all bolts to 25 ft-lb.

10. Replace the bolt on the rubber shock mount on the front left side.

11. Replace the two adjustment bolts that hold the pump to the mounting plate, and torque the bolts to 25 ft-lb.

12. Insert the wires into the junction box and apply a heat shrink sleeve to each wire (the heat shrink will be used in Step 14).

13. Reconnect the electrical connections as marked during the pump removal.

CAUTION
Ensure that the black and purple wires remain as a pair. Wire number 41 matches with wire number 1, wire number 42 matches with wire number 2, and so on. If wires are not properly matched, the pump will rotate backwards and will be damaged.

14. Wrap the wire connections with linerless rubber splicing electrical tape. For protection from electrical current, use enough tape to form a ball at the end of each wire. Cover each tape ball with a heat shrink sleeve.

15. Close the junction box.

16. Open the following butterfly valves: the reservoir outlet valve, the inlet valve to the circulation pump, the inlet and outlet valves of both heat exchangers, and the inlet valve to the strainer. Check for and repair any dielectric-coolant leaks before you proceed to the next step.

17. Add dielectric coolant to the reservoir to replace coolant that was lost when you removed the pump. If necessary, refer to the “Dielectric-coolant Replenishment” procedure in this section.

18. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the breaker.

19. Place the HEU CB1 circuit breaker in the ON position.

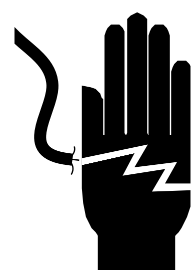
NOTE: Before you power on the system at the module cabinet, ask a second person to assist you while you perform the following step to ensure that you attache the wires on the pump motor for the correct phase rotation.

CAUTION
Be sure that the phase light above the pump illuminates. If the light does not illuminate, the phase rotation is not synchronized. Running the system with the phase rotation not synchronized will damage the pump.

20. Press the Cooling Bypass switch at the WACS panel on the module cabinet while another person checks that the phase light is illuminated and that there are no leaks located on the junction box above the pump. If the phase light does not illuminate, either the pump does not have power or the phase rotation is not synchronized. If the phase rotation is not synchronized, use the procedure below to correct the phase rotation. If any leaks are detected, repair them at this time.

    a. Place the HEU CB1 circuit breaker in the OFF position.

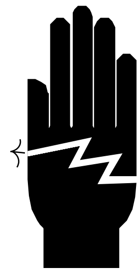
    b. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.



WARNING

Turn off the HEU-WC1 wall circuit breaker(s) before you perform the remainder of this procedure. Failure to do so could result in severe shock and burns.

c. Lock and tag the HEU-WC1 wall circuit breaker.



WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

d. Open the junction box and swap any two of the three black and purple wires on the terminal block in the lower left corner.

e. Remove the lock and tag from the circuit breaker and reapply power to the HEU-WC1.

f. Press the Cooling Bypass switch while another person watches the light above the pump. If the light illuminates, the phases are synchronized and the pump is rotating in the desired direction.

If the light is off, the pump is still rotating backwards. Repeat Steps a through f until the light illuminates and the phase rotation is synchronized.

Powering On the Module Cabinet

1. Power on the module cabinet at the WACS panel.

2. Recheck for dielectric-coolant leaks and water leaks.

3. Replace the HEU-WC1 service panels.

Heat Exchanger Replacement

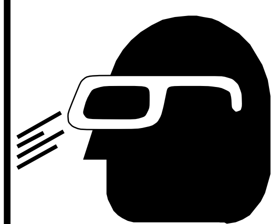
If a heat exchanger leaks or is corroded, replace it using the following procedure.

Time Required

- Approximately 1.0 hours

Tools

- Container of dielectric coolant (FX-74)
- Dielectric-coolant pump
- Empty dielectric-coolant container or clean pail
- Large adjustable wrench
- Manifold gauge
- Panel removal tool
- Protective eyewear



WARNING

Wear eye protection when you work with pressurized refrigerant. Failure to do so could result in permanent blindness.

Removing a Heat Exchanger

1. Power off the module cabinet at the WACS panel.
2. Place the HEU CB1 circuit breaker in the OFF position.
3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel. Lock and tag the HEU-WC1 wall circuit breaker.

WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

4. Remove the side and top service panels from the HEU-WC1.

5. Close the dielectric coolant and water inlet and outlet butterfly valves on the heat exchanger that is being replaced (there are 4 valves). To close the valves, pull the valve handles out and rotate them clockwise 90° into the final locking position.

   NOTE: A locking butterfly valve handle has four possible locking positions, which regulate the flow of dielectric coolant. Most field sites run the cooling system with the butterfly valve handle in the fully open position.

6. Connect a manifold-gauge hose to the Schraeder valve, which is located between the butterfly valve and the heat exchanger, on either the inlet or the outlet side. Drain the dielectric coolant into a clean pail or empty dielectric-coolant container until the heat exchanger you are replacing is empty.

7. Use the water bib-type drain which is located between the butterfly valve and the heat exchanger to drain all the water from the heat exchanger that you are replacing.

8. Use an adjustable wrench to loosen the C clamps on the pipes to the heat exchanger.

9. Disconnect the dielectric-coolant and water pipes to the heat exchanger.

10. Use an adjustable wrench to remove the four bolts that secure the heat exchanger to the HEU-WC1 chassis.

11. Remove the heat exchanger.

Installing a Heat Exchanger

1. Position the replacement heat exchanger on the HEU-WC1 chassis.

2. Use an adjustable wrench to replace the four bolts that secure the heat exchanger to the HEU-WC1 chassis.

3. Connect the dielectric-coolant and water pipes to the heat exchanger.

4. Use an adjustable wrench to tighten the C clamps on the pipes to the heat exchanger.

5. Open the dielectric coolant and water inlet and outlet butterfly valves (there are 4 valves) by rotating each valve handle until it is parallel to the pipe.

6. Remove the cap on the filler port of the HEU-WC1 reservoir.

7. Insert the outlet hose of the dielectric-coolant pump in the filler port of the reservoir.

8. Place the inlet hose of the dielectric-coolant pump into a container of dielectric coolant.

9. Turn on the dielectric-coolant pump.

NOTE: If you do not get a positive flow of dielectric coolant through the pump into the reservoir, prime the dielectric-coolant pump by filling the output hose with dielectric coolant before you connect the hose to the filler port.

10. Fill the HEU-WC1 reservoir approximately 3/4 full.

11. Remove the hose from the filler port of the reservoir, and drain the dielectric coolant into the container.

12. Replace the cap on the filler port and tighten it by hand.

13. Remove the input hose of the dielectric-coolant pump from the container of dielectric coolant, then close the container.

14. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the circuit breaker.

15. Place the HEU CB1 circuit breaker in the ON position.

Powering On the Module Cabinet

1. Press the cooling-bypass button on the WACS panel for 5 to 10 seconds.

CAUTION
If you press the Cooling Bypass switch for a period longer than 10 seconds, condensation could build up and cause an electrical short circuit.

2. Check for and repair dielectric-coolant leaks and water leaks.
3. Power on the module cabinet at the WACS panel.
4. Recheck for dielectric-coolant leaks and water leaks.
5. Replace the HEU-WC1 service panels.

Liquid-level Indicator and Float Replacement

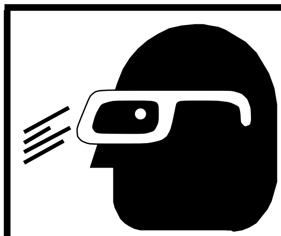
Replace both the liquid-level indicator and the float if either is defective.

Time Required

- Approximately 1.0 hours

Tools

- Container of dielectric coolant (FX-74)
- Dielectric-coolant pump
- Empty dielectric-coolant container or clean pail
- Large adjustable wrench
- Panel removal tool
- Pencil
- Phillips and flat-blade screwdrivers
- Protective eyewear
- Teflon tape



WARNING

Wear eye protection when you work with pressurized refrigerant. Failure to do so could result in permanent blindness.

Removing a Liquid-level Indicator and Float

1. Power off the module cabinet at the WACS panel.

2. Place the HEU CB1 circuit breaker in the OFF position.

3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.

4. Lock and tag the HEU-WC1 wall circuit breaker.

WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

5. Remove the HEU-WC1 service panels.
6. Remove the cap from the filler port located on the top of the HEU-WC1 reservoir.
7. Insert the inlet hose of the dielectric-coolant pump through the filler port in the HEU-WC1 reservoir.
8. Place the outlet hose of the dielectric-coolant pump in an empty dielectric-coolant container.
9. Turn on the dielectric-coolant pump and drain the reservoir.
10. Use a pencil to mark the location of the liquid-level float sensor on the side of the stand pipe that contains the float, then remove the indicator.
11. Use a Phillips screwdriver to remove the screws that hold the cover on the liquid-level float sensor junction box, then remove the cover.
12. Record the location of each wire inside the junction box before you remove it.
13. Disconnect the electrical wiring in the sensor junction box, and move the junction box out of the way.
14. Use a large adjustable wrench to remove the plug from the bottom of the stand pipe, then remove the float from the stand pipe.

Installing a Liquid-level Indicator and Float

1. Use a flat-blade screwdriver to install the new indicator at the position you marked when you removed the old indicator.
2. Reconnect the electrical sensor wires to the correct wires inside the sensor junction box.
3. Use a Phillips screwdriver to replace the sensor junction box cover.
4. Check the new float to ensure that you insert it with the *up arrow* in the correct direction.
5. Insert the replacement float in the stand pipe.
6. Wrap the threads of the stand pipe plug with Teflon tape to prevent the assembly from leaking.
7. Tighten the stand pipe plug with an adjustable wrench.
8. Insert the outlet hose of the dielectric-coolant pump into the filler port on top of the HEU-WC1 reservoir.
9. Insert the inlet hose of the dielectric-coolant pump into the dielectric-coolant container.
10. Turn on the dielectric-coolant pump.

    NOTE: If you do not get a positive flow of dielectric coolant through the pump into the reservoir, prime the dielectric-coolant pump by filling the output hose with dielectric coolant before you connect the hose to the filler port.

11. Fill the HEU-WC1 reservoir approximately 3/4 full.
12. Remove the hose from the filler port of the reservoir, then drain the dielectric coolant into the container.
13. Replace the cap on the filler port and tighten it by hand.
14. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the circuit breaker.
15. Place the HEU CB1 circuit breaker in the ON position.

Powering On the Module Cabinet

1. Press the cooling-bypass button on the WACS panel for 5 to 10 seconds.

CAUTION
If you press the Cooling Bypass switch for a period longer than 10 seconds, condensation could build up and cause an electrical short circuit.

2. Check for and repair any dielectric-coolant leaks.
3. Power on the module cabinet at the WACS panel.
4. Recheck for dielectric-coolant leaks and water leaks.
5. Replace the HEU-WC1 service panels.

Surface-mounted Thermistor Replacement

The HEU-WC1 has five surface-mounted thermistors. They are located on the inlet piping to the pump, the outlet piping from the heat exchangers, the inlet piping to the strainer, the inlet water pipe, and the outlet water pipe.

Time Required

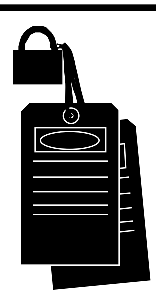
- Approximately 0.5 hours

Tools

- Panel removal tool
- Phillips screwdriver
- Solder and heat shrink sleeves
- Soldering iron

Removing a Thermistor

1. Power off the module cabinet at the WACS panel.
2. Place the HEU CB1 circuit breaker in the OFF position.
3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.
4. Lock and tag the HEU-WC1 wall circuit breaker.



WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

5. Remove HEU-WC1 service panels as required.
6. Use a Phillips screwdriver to remove the cover on the temperature sensor box.
7. Use a Phillips screwdriver to remove the defective thermistor.

8. Record the wire positions before you remove the defective thermistor.

9. Use a soldering iron to disconnect the wires from the defective thermistor.

Installing a Thermistor

1. Use the soldering iron to connect the wires on the new thermistor to the correct wires on the signal cable.

2. Use a Phillips screwdriver to attach the thermistor.

3. Replace the cover on the temperature sensor box.

4. Replace the HEU-WC1 service panels.

5. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the circuit breaker.

6. Place the HEU CB1 circuit breaker in the ON position.

7. Power on the module cabinet at the WACS panel.

Immersion-type Temperature Probe Replacement

The HEU-WC1 has two immersion-type temperature probes. The temperature probes are located in the temperature sensor boxes on the inlet piping to the pump, and on the inlet piping to the strainer.

Time Required

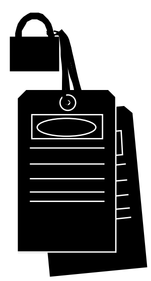
- Approximately 0.5 hours

Tools

- Adjustable wrench
- Panel removal tool
- Phillips screwdriver
- Solder and heat shrink sleeves
- Soldering iron

Removing a Temperature Probe

1. Power off the module cabinet at the WACS panel.
2. Place the HEU CB1 circuit breaker in the OFF position.
3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.
4. Lock and tag the HEU-WC1 wall circuit breaker.



WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

5. Remove the HEU-WC1 service panels as required.
6. Close the appropriate service valves to isolate the section of the piping that contains the temperature probe.

7. Use a Phillips screwdriver to remove the cover on the temperature sensor box.

8. Record the wire positions before you remove the defective probe.

9. Use a soldering iron to disconnect the wires from the defective temperature sensor.

NOTE: Ensure that the replacement temperature probe is within reach.

10. Use an open-end wrench to loosen the temperature probe, then unscrew the temperature probe.

11. Place your thumb over the probe opening on the pipe to stop dielectric coolant from leaking.

Installing a Temperature Probe

1. Ensure that the O-ring is on the replacement temperature probe.

2. Screw the temperature probe into the opening by hand, then tighten the probe with an open-end wrench.

3. Use the soldering iron to connect the wires on the new temperature probe to the correct wires on the signal cable.

4. Replace the cover on the temperature sensor box.

5. Open the service valves that you closed to isolate the section of piping containing the temperature probe.

6. Replace the HEU-WC1 service panels.

7. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the circuit breaker.

8. Place the HEU CB1 circuit breaker in the ON position.

9. Power on the module cabinet at the WACS panel.

Pressure Transducer Replacement

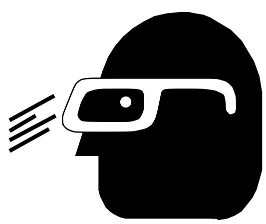
The HEU-WC1 has four pressure transducers that measure the pressure of dielectric coolant and water in the system. Two pressure transducers are located on the discharge piping from the dielectric-coolant pump, one transducer is located on the inlet water piping, and one transducer is located on the outlet water piping. All four pressure transducers are 0-to 200- psi models with a 1-to-6 Vdc output.

Time Required

- Approximately 0.5 hours

Tools

- Adjustable wrench
- Empty dielectric-coolant container or clean pail
- Panel removal tool
- Protective eyewear



WARNING

Wear eye protection when working with pressurized refrigerant. Failure to do so could result in permanent blindness.

Removing a Pressure Transducer

1. Power off the module cabinet at the WACS panel.
2. Place the HEU CB1 circuit breaker in the OFF position.
3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.
4. Lock and tag the HEU-WC1 wall circuit breaker.

WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

5. Remove HEU-WC1 service panels as required.

6. Close the appropriate valves to isolate the defective pressure transducer.

7. Rotate the cable connector 1/2 turn to disconnect the electrical cable from the pressure transducer.

8. Place a dielectric coolant container or a clean pail under the pressure transducer to catch any dielectric coolant that drains from the opening.

NOTE: Ensure that the replacement temperature probe is within reach.

9. Use an adjustable wrench to remove the defective pressure transducer.

10. Place your thumb over the transducer opening on the pipe to stop dielectric coolant from leaking.

Installing a Pressure Transducer

1. Check to ensure that the O-ring is on the new pressure transducer.

2. Use an adjustable wrench to install the new pressure transducer.

3. Rotate the cable connector 1/2 turn to reconnect the electrical cable to the new pressure transducer.

4. Open the valves you closed to isolate the pressure transducer.

5. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the circuit breaker.

6. Place the HEU CB1 circuit breaker in the ON position.

7. Power on the module cabinet at the WACS panel.

8. Check for and repair any dielectric-coolant leaks before you replace the service panels.

Pressure Switch Replacement

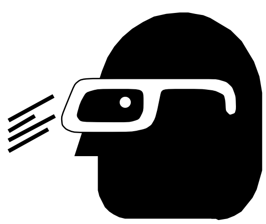
The HEU-WC1 has a pressure switch mounted in the discharge pipe that comes from the dielectric-coolant pump.

Time Required

- Approximately 0.5 hours

Tools

- Adjustable wrench
- Empty dielectric-coolant container or clean pail
- Panel removal tool
- Phillips screwdriver
- Protective eyewear
- Teflon tape



WARNING

Wear eye protection when working with pressurized refrigerant. Failure to do so could result in permanent blindness.

Removing a Pressure Switch

1. Power off the module cabinet at the WACS panel.
2. Place the HEU CB1 circuit breaker in the OFF position.
3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.
4. Lock and tag the HEU-WC1 wall circuit breaker.

WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

5. Remove HEU-WC1 service panels as required.
6. Close the appropriate valves to isolate the pressure switch.
7. Use a Phillips screwdriver to remove the cover from the pressure switch electrical junction box.
8. Disconnect the two wires on the pressure switch and record the wire positions for reference when you reconnect the wires to the new pressure switch.
9. Place a dielectric-coolant container or clean pail under the pressure switch to catch any coolant from the opening.

NOTE: Ensure that the replacement temperature probe is within reach.

10. Use an adjustable wrench to remove the defective pressure switch.
11. Place your thumb over the transducer opening on the pipe to stop the dielectric coolant from leaking.

Installing a Pressure Switch

1. Wrap the threads on the new pressure switch with Teflon tape.
2. Use an adjustable wrench to install the new pressure switch.
3. Connect the two wires to the new pressure switch.
4. Replace the junction box cover.
5. Open the valves you closed to isolate the pressure switch.
6. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the circuit breaker.

7. Place the HEU CB1 circuit breaker in the ON position.

8. Power on the module cabinet at the WACS panel.

9. Check for and repair any dielectric-coolant leaks before you replace the service panels.

CB1 Circuit Breaker Replacement

The CB1 circuit breaker, located on the front of the power distribution box, controls the HEU-WC1 120-Vac circuit.

Time Required

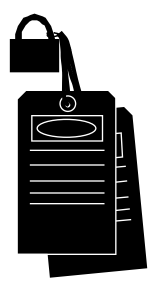
- Approximately 0.5 hours

Tools

- Panel removal tool
- Phillips screwdriver

Removing CB1

1. Power off the module cabinet at the WACS panel.
2. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.
3. Lock and tag the HEU-WC1 wall circuit breaker.



WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

4. Open the front service panel to access the power distribution box.
5. Use a Phillips screwdriver to remove the power distribution box cover.
6. Use a Phillips screwdriver to remove the two screws that hold the CB1 mounting bracket to the power distribution box.
7. Record the terminal positions for the wires that are connected to CB1. Two wires connect to the line side (input) and two wires connect to the load side (output).

8. Loosen, but do not remove, the screws that connect the two input wires and the two output wires to the CB1 circuit breaker.

9. Slide the CB1 circuit breaker from its mounting bracket.

Installing CB1

1. Slide the replacement CB1 circuit breaker onto its mounting bracket.

2. Reconnect the two input wires and two output wires to the replacement circuit breaker.

3. Use a screwdriver to tighten the input and output wires securely.

4. Attach the CB1 mounting bracket to the power distribution box.

5. Replace the cover on the power distribution box.

6. Close the front access panel.

7. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the circuit breaker.

8. Place the HEU CB1 circuit breaker in the ON position.

9. Power on the module cabinet at the WACS panel.

Control Module Replacement

The HEU-WC1 control module is mounted to the control box access panel.

Time Required

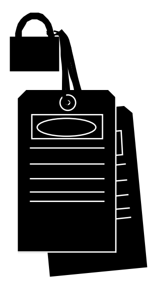
- Approximately 1.0 hours

Tools

- Panel removal tool
- Phillips screwdriver
- 5/16-in. nutdriver

Removing the Control Module

1. Power off the module cabinet at the WACS panel.
2. Place the HEU CB1 circuit breaker in the OFF position.
3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.
4. Lock and tag the HEU-WC1 wall circuit breaker.



WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

5. Open the front service panel to access the HEU-WC1 control box.
6. Use a Phillips screwdriver to remove the screws on the control box access panel.
7. Open the control box access panel.
8. Record the connector locations of all the cable assemblies that are connected to the control module.

9. Disconnect the signal cable plugs from the control module jacks.

10. Use a nutdriver to remove the eight 5/16-in. nuts and washers that hold the control module to the control box access panel.

Installing a Control Module

1. Position the replacement control module on the control box access panel.

2. Replace and tighten the eight nuts and washers that secure the module to the access panel.

3. Reconnect all cables to the correct jacks on the new module.

4. Close the control box access panel.

5. Replace the screws on the control box access panel.

6. Close the front service panel.

7. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the circuit breaker.

8. Place the HEU CB1 circuit breaker in the ON position.

9. Power on the module cabinet at the WACS panel.

Temperature-regulating Module Replacement

The HEU-WC1 temperature-regulating module is located in the power distribution box. Figure 26 shows the temperature-regulating module.

Time Required

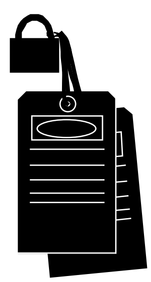
- Approximately 1.0 hours

Tools

- Adjustable wrench
- Hex (allen) wrench set
- Phillips screwdriver
- Small flat-blade screwdriver

Removing a Temperature-regulating Module

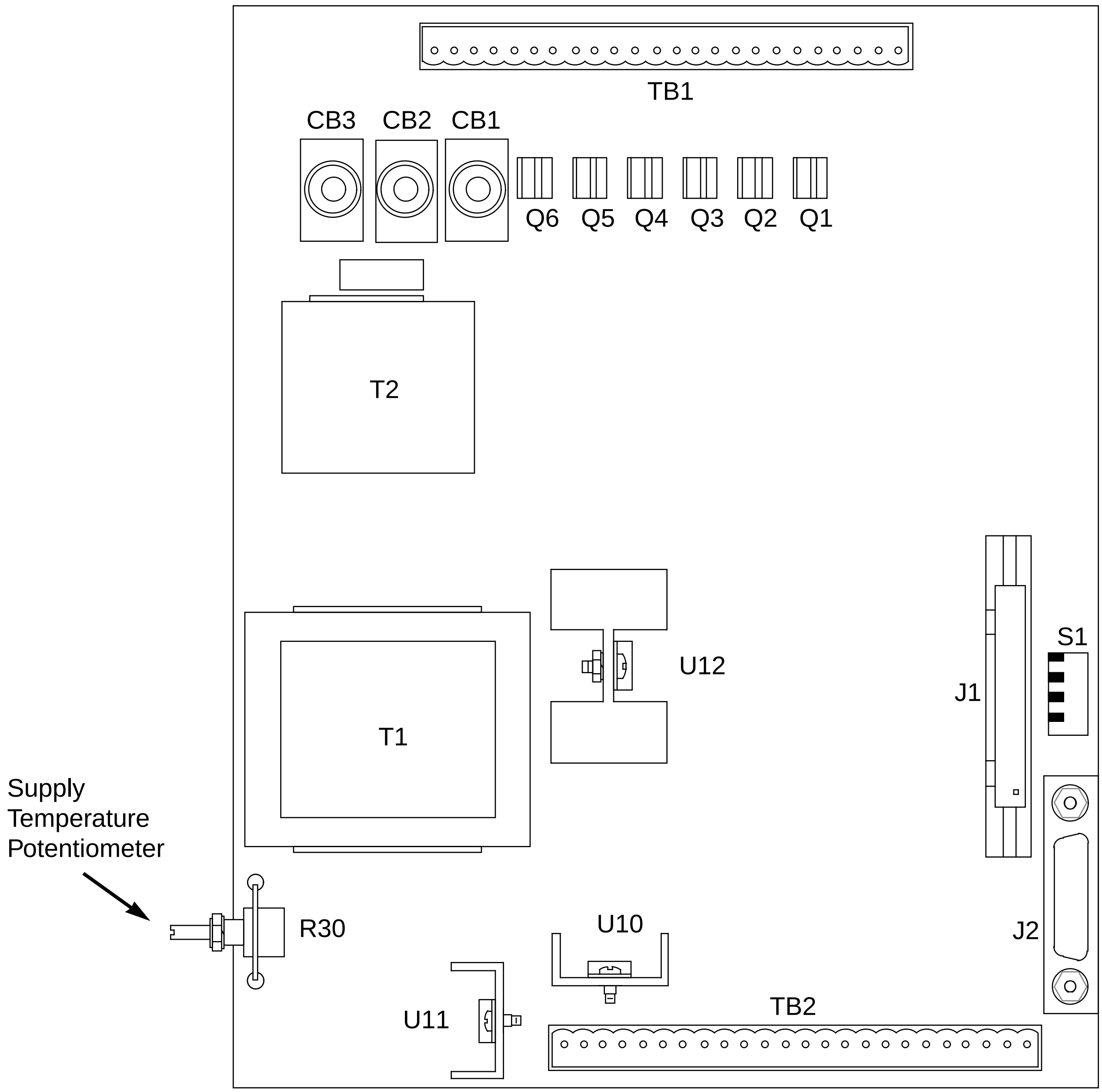
1. Power off the module cabinet at the WACS panel.
2. Place the HEU CB1 circuit breaker in the OFF position.
3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.
4. Lock and tag the HEU-WC1 wall circuit breaker.



WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

Figure 26. Temperature-regulating Module



5. Open the front service panel to access the HEU-WC1 power distribution box.

6. Use a Phillips screwdriver to remove the power distribution box cover.

7. Use a small hex wrench to remove the knob on the temperature potentiometer. Use a wrench to remove the retaining nut that mounts the potentiometer to the front panel. The potentiometer is located on the lower left front side of the power distribution box.

8. Record the terminal position of all wires connected to the TB1 and TB2 terminal blocks that are located on the temperature-regulating module.

9. Disconnect the cables from J1 and J2.

10. Use a small flat-blade screwdriver to disconnect the wires from TB1 and TB2 on the module.

11. Use a Phillips screwdriver to remove the six screws and washers that hold the temperature-regulating module to the side of the power distribution box.

Installing a Temperature-regulating Module

1. Position the replacement temperature-regulating module in the power distribution box.

2. Replace the six screws and washers that hold the temperature-regulating module to the side of the power distribution box.

3. Reconnect the wires to TB1 and TB2. Ensure that the wires are connected to the correct terminal blocks.

4. Reconnect the cables to J1 and J2.

5. Replace the retaining nut and the knob on the temperature potentiometer.

6. Replace the cover on the power distribution box.

7. Close the front service panel.

8. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the circuit breaker.

9. Place the HEU CB1 circuit breaker in the ON position.

10. Power on the module cabinet at the WACS panel.

Dielectric-coolant Mixing Valve and Actuator Replacement

Replace the 3-way mixing valve and actuator as an assembly. Figure 27 shows the input and output wiring terminals for the actuator.

Time Required

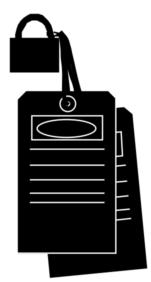
- Approximately 1.0 hours

Tools

- Empty dielectric-coolant container or clean pail
- Flat-blade screwdriver
- Hex (allen) wrench set
- Large adjustable wrench
- Panel removal tool

Removing a Dielectric-coolant Mixing Valve and Actuator

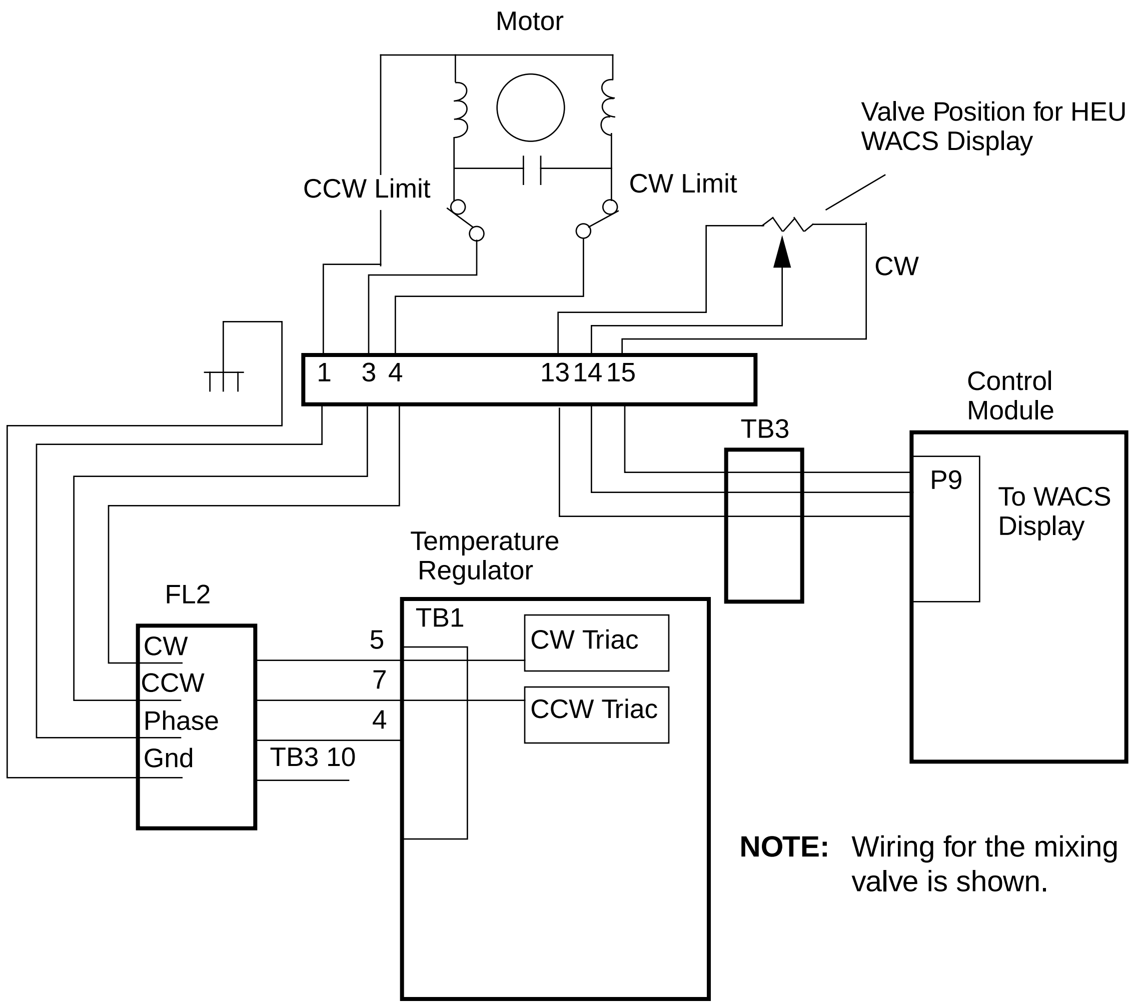
1. Power off the module cabinet at the WACS panel.
2. Place the HEU CB1 circuit breaker in the OFF position.
3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.
4. Lock and tag the HEU-WC1 wall circuit breaker.



WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

Figure 27. Valve Actuator 120-Vac Wiring Diagram



5. Remove both side access service panels.
6. Use a hex wrench to remove the cover from the valve actuator.
7. Record the terminal positions of the three input and three output wires to the actuator.
8. Disconnect the six wires from the actuator.
9. Remove the input and output cable assemblies from the actuator.
10. Close the six butterfly valves on the dielectric-coolant piping from both heat exchangers (two per heat exchanger), the inlet to the pump, and the inlet to the strainer to isolate the valve.
11. Connect a manifold-gauge hose to the Schraeder valve located on the top of the pump inlet manifold and drain the dielectric coolant into an empty dielectric-coolant container or into a clean pail.
12. Use an adjustable wrench to loosen the three C clamps that connect the mixing valve to the HEU-WC1 pipes.
13. Remove the valve and actuator as an assembly.

Installing a Dielectric-coolant Mixing Valve and Actuator

1. Attach the replacement mixing valve and actuator to the dielectric-coolant pipes and tighten the C clamps.
2. Open the six butterfly valves you closed to isolate the mixing valve.
3. Use a hex wrench to remove the cover from the replacement valve actuator.
4. Connect the input and output cable assemblies to the actuator.
5. Connect the six wires to the actuator. Ensure that the wires are connected to the correct actuator terminals.
6. Replace the cover on the valve actuator.
7. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the circuit breaker.
8. Place the HEU CB1 circuit breaker in the ON position.

9. Power on the module cabinet at the WACS panel.

10. Inspect the dielectric-coolant piping and mixing valve connections for leaks. Repair leaks and replenish dielectric coolant if necessary.

11. Replace both side access service panels.

Water Inlet Valve and Actuator Replacement

Replace the 2-way water inlet valve and actuator as an assembly. Refer to Figure 27 for the input and output wiring terminals for the actuator.

Time Required

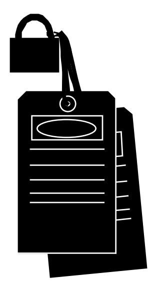
- Approximately 1.0 hours

Tools

- Empty dielectric-coolant container or clean pail
- Flat-blade screwdriver
- Hex (allen) wrench set
- Large adjustable wrench
- Panel removal tool

Removing a Water Inlet Valve and Actuator

1. Power off the module cabinet at the WACS panel.
2. Place the HEU CB1 circuit breaker in the OFF position.
3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.
4. Lock and tag the HEU-WC1 wall circuit breaker.



WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

5. Remove the side and rear service panels.
6. Shut off the water flow to the HEU-WC1 at the customer-installed shut off valves.
7. Close the four butterfly valves on the water piping from both heat exchangers to isolate the water inlet valve.
8. Drain the remaining water from the HEU-WC1 at the water bib-type connection located under the raised floor.
9. Use an adjustable wrench to loosen the C clamps on the water inlet valve.
10. Use an adjustable wrench to loosen the C clamps that connect the water inlet valve to the HEU-WC1 pipes.
11. Remove the valve and actuator as an assembly.
12. Use a hex wrench to remove the cover from the valve actuator.
13. Record the terminal position of the three input and three output wires to the actuator.
14. Disconnect the six wires from the actuator.
15. Remove the input and output cable assemblies from the actuator.

Installing a Water Inlet Valve and Actuator

1. Remove the cover from the replacement actuator.
2. Connect the input and output cable assemblies to the actuator.
3. Connect the six wires to the actuator. Ensure that the wires are connected to the correct actuator terminals.
4. Replace the cover on the valve actuator.
5. Attach the replacement water inlet valve and actuator to the water inlet piping and tighten the C clamps.
6. Open the four butterfly valves you closed to isolate the water inlet valve.
7. Open the customer-installed shut off valves to restore water flow to the HEU-WC1.

8. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the circuit breaker.

9. Place the HEU CB1 circuit breaker in the ON position.

10. Power on the module cabinet at the WACS panel.

11. Inspect the water inlet piping and valve connections for leaks. Repair leaks and replenish dielectric coolant as required.

12. Replace the side and rear access service panels.

Heater Relay Jumper Replacement

When you replace a bad heater relay jumper, it is recommended that you replace all three relay jumpers.

Time Required

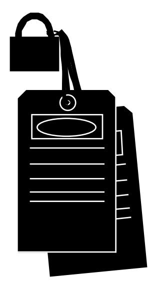
- Approximately 1.0 hours

Tools

- Flat-blade screwdriver

Removing the bad Heater Relay Jumpers

1. Power off the module cabinet at the WACS panel.
2. Place the HEU CB1 circuit breaker in the OFF position.
3. Turn off the power to the HEU-WC1 at the wall circuit breaker panel.
4. Lock and tag the HEU-WC1 wall circuit breaker.



WARNING

Ensure that the electrical circuit breakers for the equipment being serviced are off, locked, and tagged. Failure to do so could result in severe shock and burns.

5. Remove the screws that secure the cover to the power box. Set the cover off to the side is a secure location.
6. Locate the heater relay K2 and remove the six screws that secure the relay jumpers to the heater block.
7. Remove all three heater relay jumpers.

Installing the new Relay Jumpers

1. Insert the 3 new relay jumpers into the heater block.

2. Secure the jumpers in place using the same six screws removed earlier.
3. Replace the power box cover.
4. Remove the lock and tag from the HEU-WC1 wall circuit breaker, then turn on the circuit breaker.
5. Place the HEU CB1 circuit breaker in the ON position.
6. Power on the module cabinet at the WACS panel.

Cables

The following section details the cables used within the HEU WC-1. Each cable is shown with a point to point connector pin assignment table.

Figure 28. Cable Assy, Bendix 4C-Bendix 4C 60'

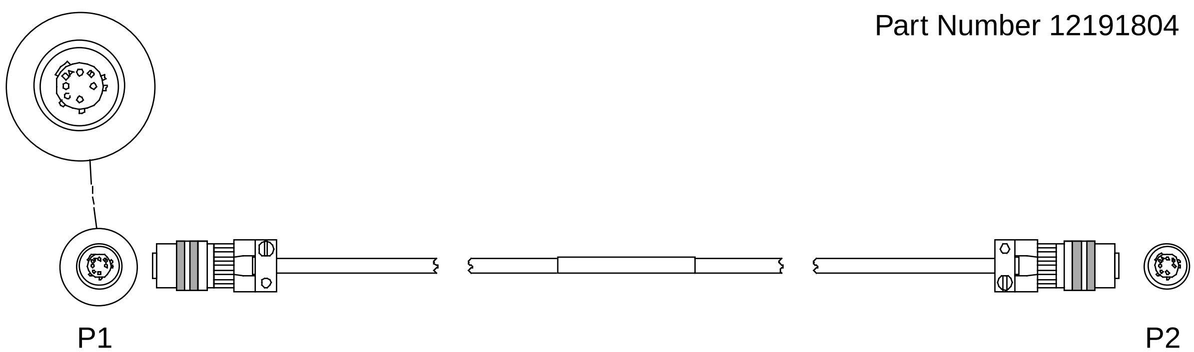


Figure 29. Cable Assy, HEU WACS Power H2O

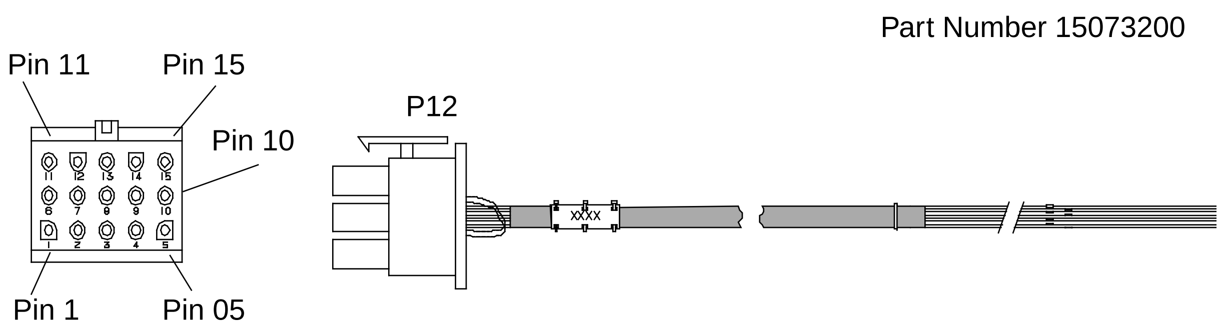


Table 15. HEU WACS Power H2O

Wire Number	To	From
1	P12 - 15	TB4 - 1B
2	P12 - 14	TB4 - 8B
3	P12 - 13	TB4 - 3B
4	P12 - 11	TB4 - 10B
5	P12 - 10	TB4 - 6B
6	P12 - 1	TB3 - 10B
7	P12 - 12	P12 - 2
8	P12 - 4	P12 - 3

Figure 30. Cable Assy, Pressure Switch H2O

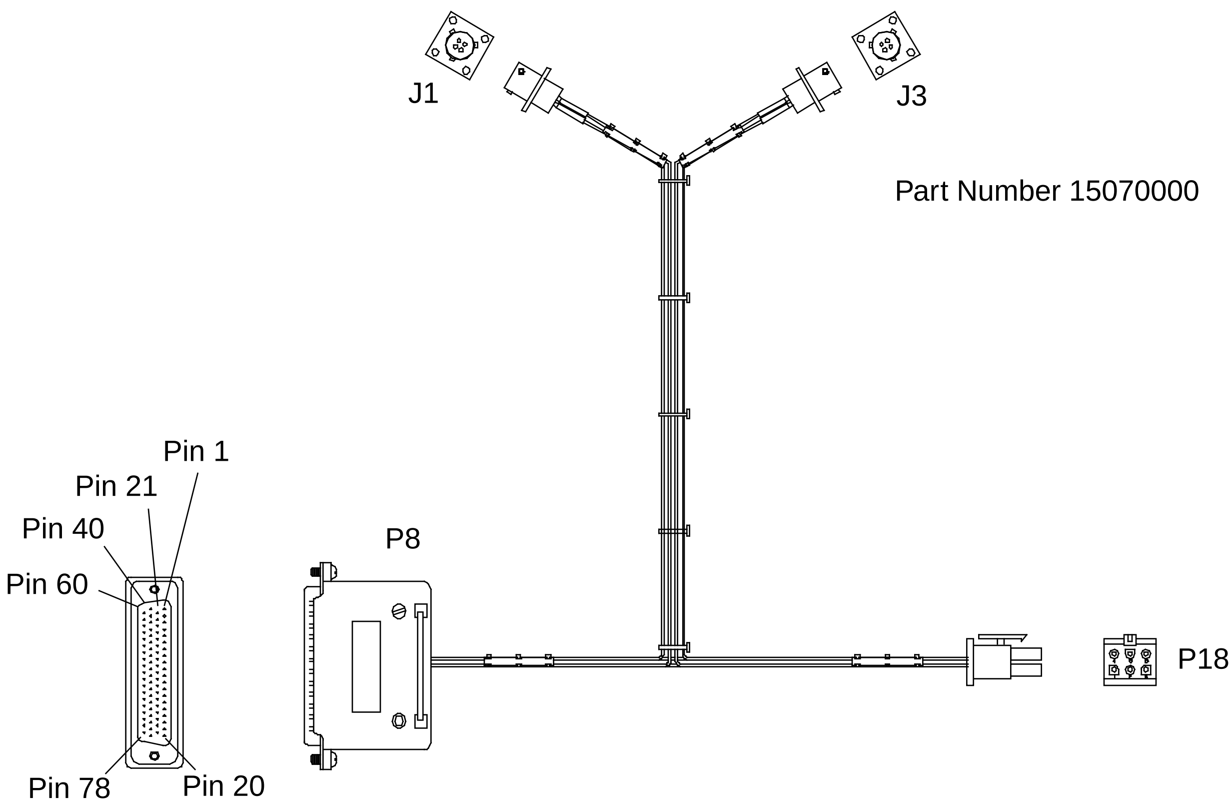


Table 16. Pressure Switch H2O

Wire Number	To	From
1	P8 - 28	J3 - D
2	P8 - 45	J3 - C
3	P8 - 46	P18 - 4
4	J1 - A	P18 - 4
5	P8 - 29	P18 - 5
6	J1 - C	P18 - 5

Figure 31. Cable Assy, Pressure Temp H2O

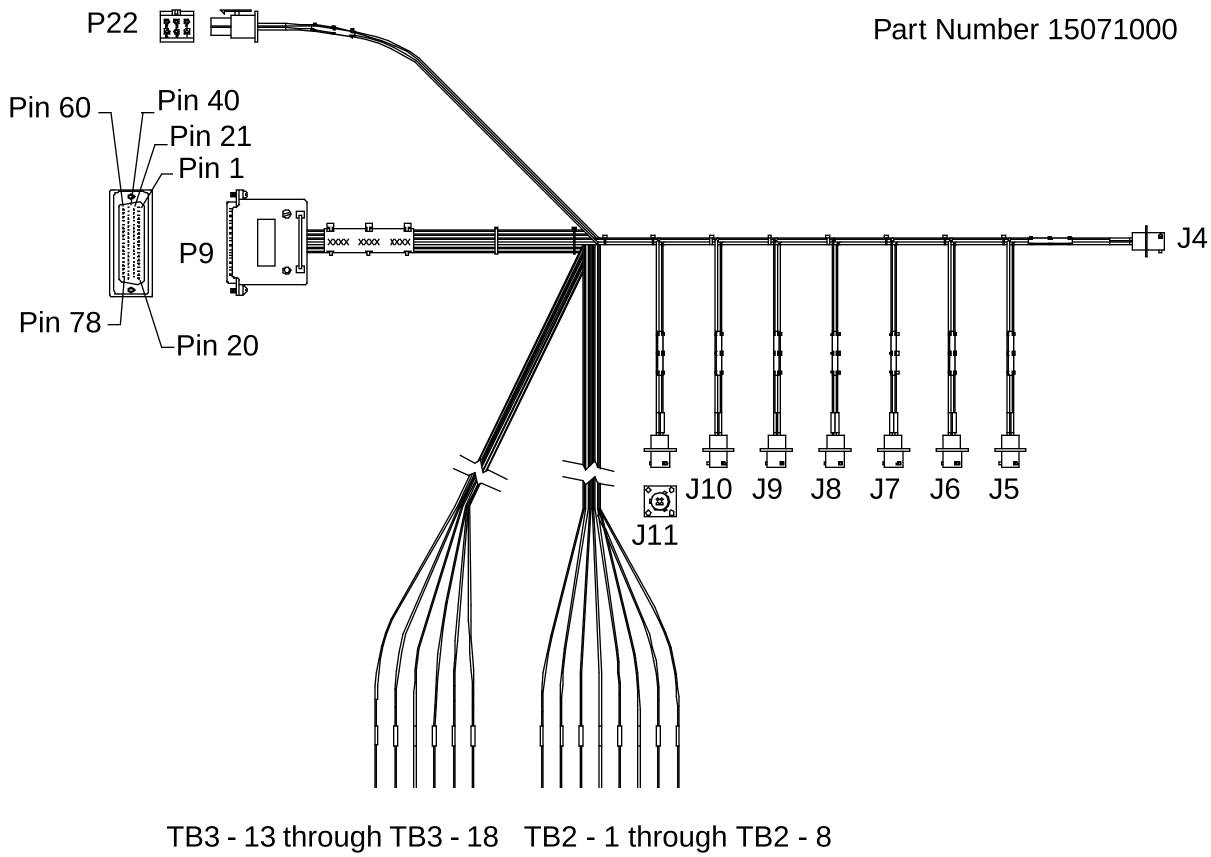


Table 17. Pressure Temp H2O

Wire Number	To	From	Wire Number	To	From
1	P9 - 2	J4 - A	21	P9 - 49	J10 - A
2	P9 - 3	J4 - B	22	P9 - 52	J10 - B
3	P9 - 6	P9 - 8	23	P9 - 53	J10 - D
4	P9 - 10	J5 - A	24	P9 - 55	P9 - 56
5	P9 - 11	J5 - B	25	P9 - 57	TB3 - 13
6	P9 - 14	P9 - 16	26	P9 - 60	TB3 - 14
7	P9 - 17	J6 - A	27	P9 - 61	TB3 - 15
8	P9 - 20	J6 - B	28	P9 - 63	P9 - 64
9	P9 - 21	J6 - D	29	P9 - 65	TB3 - 16
10	P9 - 23	P9 - 24	30	P9 - 68	TB3 - 17
11	P9 - 26	J7 - A	31	P9 - 69	TB3 - 18

Table 17. Pressure Temp H2O (continued)

Wire Number	To	From	Wire Number	To	From
12	P9 - 27	J7 - B	32	P9 - 71	P9 - 72
13	P9 - 30	P9 - 32	33	J4 - C	TB2 - 7
14	P9 - 34	J8 - A	34	J4 - D	TB2 - 8
15	P9 - 35	J8 - B	35	J5 - C	TB2 - 3
16	P9 - 38	P9 - 40	36	J5 - D	TB2 - 4
17	P9 - 41	J9 - A	37	J11 - A	TB2 - 5
18	P9 - 44	J9 - B	38	J11 - B	TB2 - 6
19	P9 - 45	J9 - D	39	P22 - 1	TB2 - 1
20	P9 - 47	P9 - 48	40	P22 -2	TB2 - 2
			Key	P22 - 5	-

Figure 32. Cable Assy, HEU RS232 Port H2O

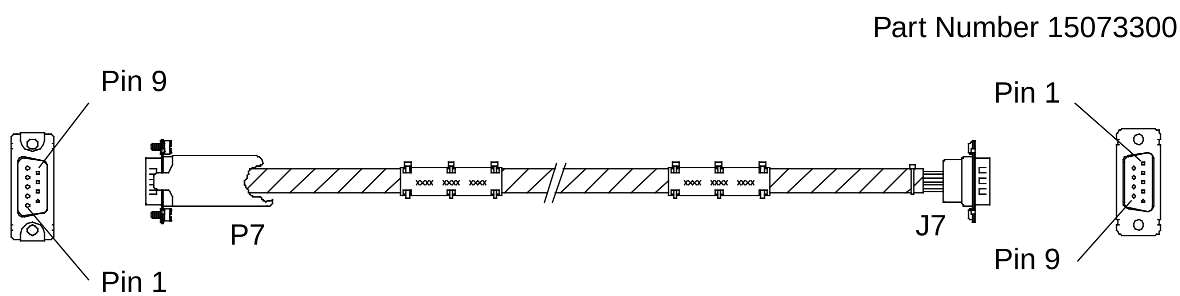


Table 18. HEU RS232 Port H2O

Wire Number	To	From
1	P7 - 1	J7 - 1
2	P7 - 2	J7 - 2
3	P7 - 3	J7 - 3
4	P7 - 4	J7 - 4
5	P7 - 5	J7 - 5
6	P7 - 6	J7 - 6
7	P7 - 7	J7 - 7
8	P7 - 8	J7 - 8
9	P7 - 9	J7 - 9

Figure 33. Cable Assy, HEU Pump H2O

Part Number 15073400

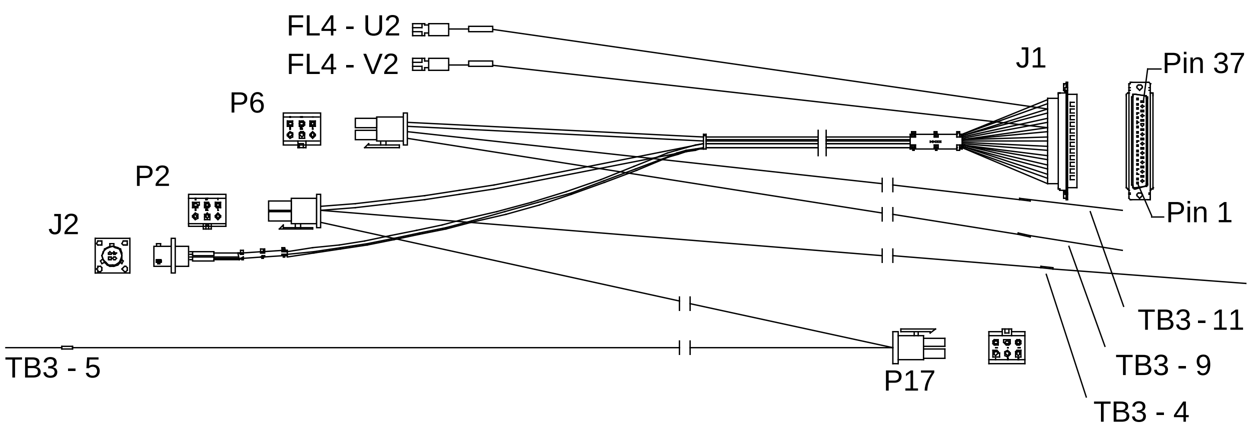


Table 19. HEU Pump H2O

Wire Number	To	From	Wire Number	To	From
1	J1 - 32	FL4 - U2	11	J1 - 30	P6 - 2
2	J1 - 31	FL4 - V2	12	P6 - 5	TB3 - 11
3	J1 - 13	J1 - 14	13	P6 - 6	TB3 - 9
4	J1 - 27	J1 - 28	14	P17 - 3	P17 - 4
5	J1 - 33	J1 - 34	15	P17 - 5	TB3 - 5
6	J1 - 35	P2 - 2	16	J1 - 21	J2 - A
7	J1 - 36	P2 - 3	17	J1 - 23	J2 - D
8	P2 - 4	TB3 - 4	18	J1 - 22	J1 - 25
9	P2 - 5	P17 - 2	19	J1 - 22	J2 - B
10	J1 - 29	P6 - 1	Key Pin	P2 - 1	-
			Key Pin	P17 - 1	-
			20	J1 - 8	J1 - 15
			21	J1 - 11	J1 - 16
Resistor Chart					
1	J1 - 3	J1 - 4			
2	J1 - 5	J1 - 6			
3	J1 - 17	J1 - 18			
4	J1 - 19	J1 - 20			
5	J1 - 7	J1 - 8			
6	J1 - 10	J1 - 11			

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