HEU-T3D Mechanical Operation and Maintenance

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HEU-T3D MECHANICAL OPERATION AND MAINTENANCE

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EVAPORATIVE-REFRIGERANT SYSTEM

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Overview

One heat exchanger unit (HEU-T3D) and a refrigeration condensing unit (RCU) provide cooling for one module cabinet. The HEU-T3D is located in the computer room, approximately 2 ft (0.6m) from the module cabinet it cools. The RCU is located outside the computer room.

Figure 1 is a simplified diagram of the refrigeration system for a module cabinet supported by an HEU-T3D. Cooling for the module cabinet is accomplished by three systems: a dielectric-coolant system; a refrigerant system; and either a building-water or chilled-water system.

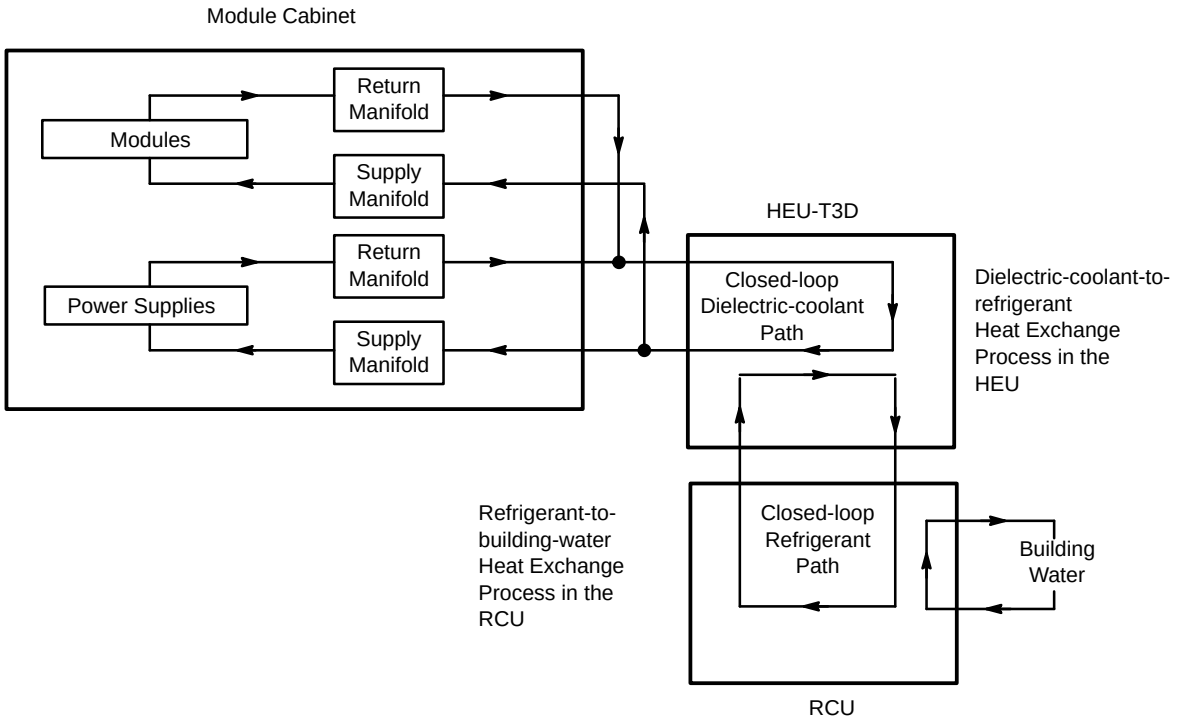


Figure 1. Simplified Refrigeration Diagram

There are two dielectric-coolant piping connections that enable dielectric coolant to circulate between the HEU-T3D and the module cabinet: a supply hose and a return hose. Chilled dielectric coolant is delivered to the module cabinet through the supply hose; warm dielectric coolant is returned to the HEU-T3D through the return hose. The dielectric coolant flows into separate supply and return manifolds: one set for the modules and one set for the power supplies. The dielectric coolant absorbs heat generated by the modules and power supplies in the module cabinet. The dielectric coolant then flows to an evaporator in the HEU-T3D cabinet, where heat transfers from the dielectric coolant to the refrigerant.

The refrigerant absorbs heat from the dielectric coolant, and is then circulated through a water-cooled condenser located in the RCU. In the final stage of cooling the condenser transfers heat from the refrigerant system to either a building-water or chilled-water system installed by the customer. Refrigerant is then recirculated to the evaporator in the HEU-T3D. For more detailed information about the RCU, refer to the RCU operation and maintenance module for the RCU in your computer system configuration.

The HEU-T3D cooling capacity can be adjusted to match the heat load of the module cabinet. If the module cabinet is not configured with a full configuration of modules and power supplies, it may be possible to operate the HEU-T3D with one of its evaporators shut off.

Each HEU-T3D cabinet requires one of the following common sources of commerical electrical power:

- 460 Vac, 3 phase, 60 Hz
- 398 Vac, 3, phase, 50 Hz

Dielectric-coolant System

The dielectric-coolant system comprises the following major components.

- Pump
- Strainers
- Reservoir
- Evaporators

In addition to the major components, different types of service valves are located at various points to add or remove fluids and measure pressure in the refrigeration system. Temperature sensors and pressure transducers are also located at various points to provide protection and monitoring.

The HEU-T3D contains all of the components of the dielectric-coolant system. (The HEU-T3D also contains some of the evaporative-refrigerant system components.)

Figure 2 and Figure 3 show the locations of the major dielectric-coolant system components located in the HEU-T3D. Refer back to these illustrations as you read the descriptions of the dielectric-coolant system components described in the following subsections.

The warning and control system (WACS) on the module cabinet monitors HEU conditions, such as pump operation, temperatures, and pressures. The WACS can remove electrical power from the HEU-T3D cabinet if an abnormal condition exists.

The flow rate of the dielectric coolant is adjusted to support the heat load produced by the module and power supply configuration of the computer system. Table 1 provides flow rates and pressures for the dielectric-coolant system.

Table 1. Dielectric-coolant Capacities

Characteristic	Value
Flow rate	~ 205 gpm
HEU pump capacity	205 gpm
HEU pump pressure	100 ± 10 psig
High-pressure fault limit	145 psig
High-pressure warning limit	135 psig
Dielectric coolant capacity	55 gallons

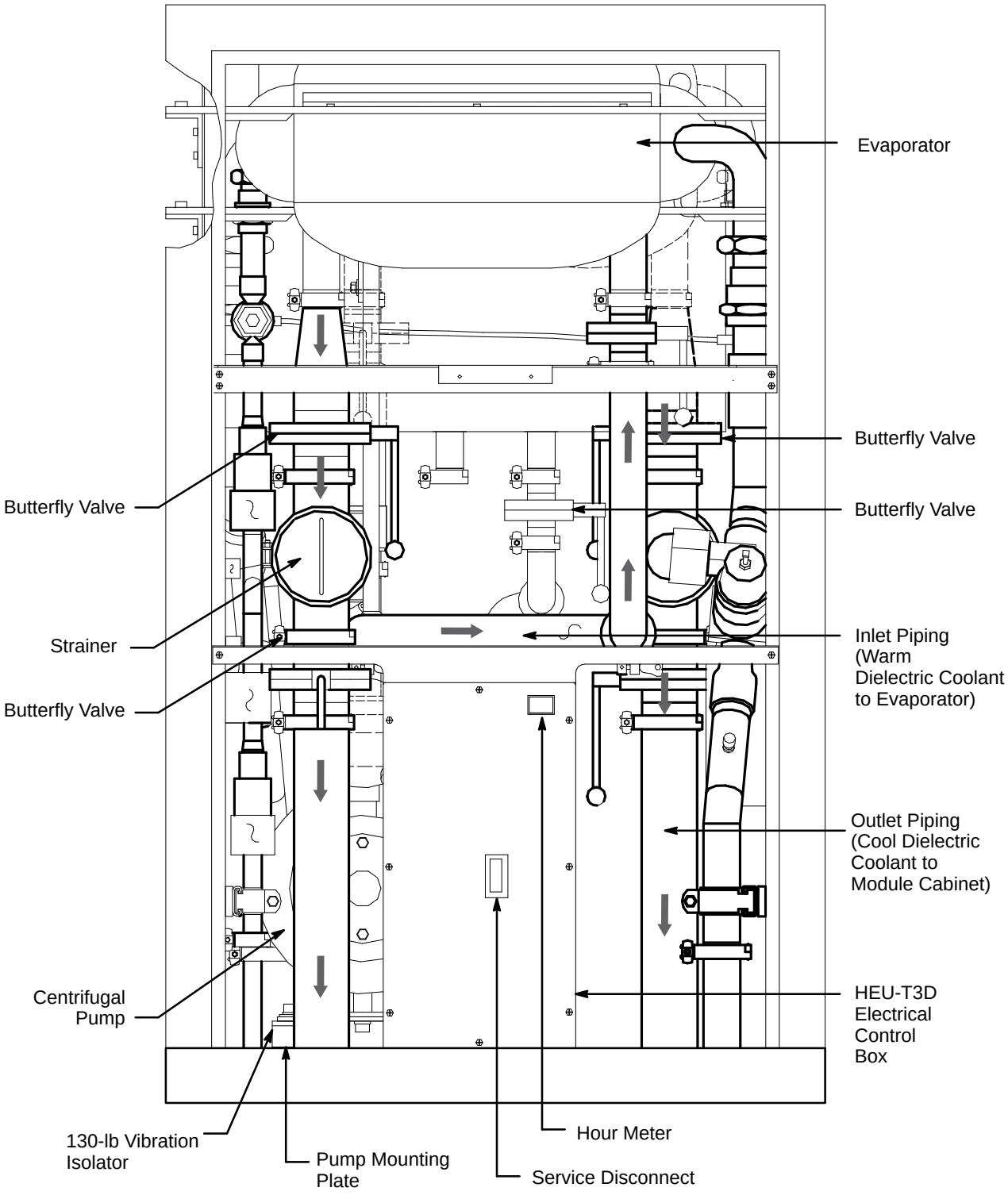


Figure 2. HEU-T3D Dielectric-coolant Component Locations (Left Side View)

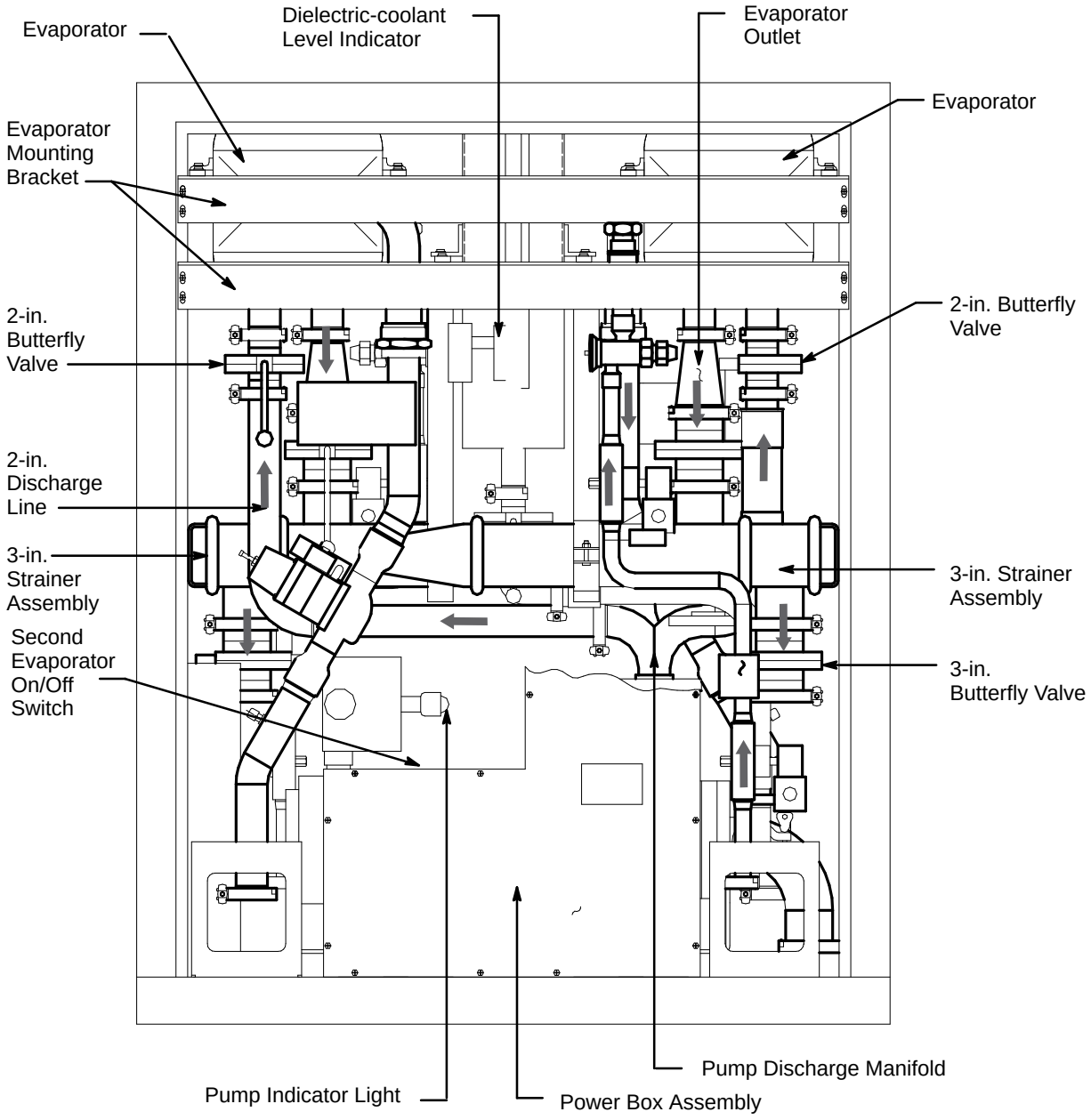


Figure 3. HEU-T3D Dielectric-coolant Component Locations (Front View)

Dielectric-coolant Pump

The dielectric-coolant pump receives warm dielectric coolant through the return hose connection from the module cabinet. It pumps the warm dielectric coolant through a discharge manifold (refer to Figure 3) to both evaporators. For large systems, both evaporators are normally operating; for smaller systems, it may be possible to operate with one evaporator shut off.

The dielectric-coolant pump is a centrifugal unit with a squirrel-cage induction electric motor. The pump and motor are contained in a single 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 automatically lubricated.

The dielectric-coolant pump and motor are mounted on a steel base. The pump has one moving part, the combined rotor-impeller assembly, which is driven by the magnetic field of the induction motor.

The WACS monitors the dielectric-coolant pump to ensure it is operating within specified limits. If the pump is not operating within the specified limits, the WACS initiates a system power down.

The pump motor requires 460-Vac, 3-phase, 60-Hz or 398-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 250 gpm at a pressure of approximately 100 ± 10 psig.

Dielectric-coolant Strainer

The HEU-T3D contains two dielectric-coolant strainers (refer to Figure 3); each contains a filter that removes debris from the dielectric coolant. Each stainless steel strainer is approximately 27 in. (69 cm) long and is located within the HEU cabinet on the outlet of the evaporator. The filters can be removed for cleaning or replacement.

Dielectric-coolant Reservoir

The dielectric-coolant reservoir (refer to Figure 4) contains a reserve supply of dielectric coolant to make up for the loss of coolant that occurs during normal operating conditions. You can visually monitor the dielectric-coolant level in the stainless steel reservoir by viewing the level indicator on the front of the reservoir. You can also monitor the level from the maintenance workstation model E (MWS-E).

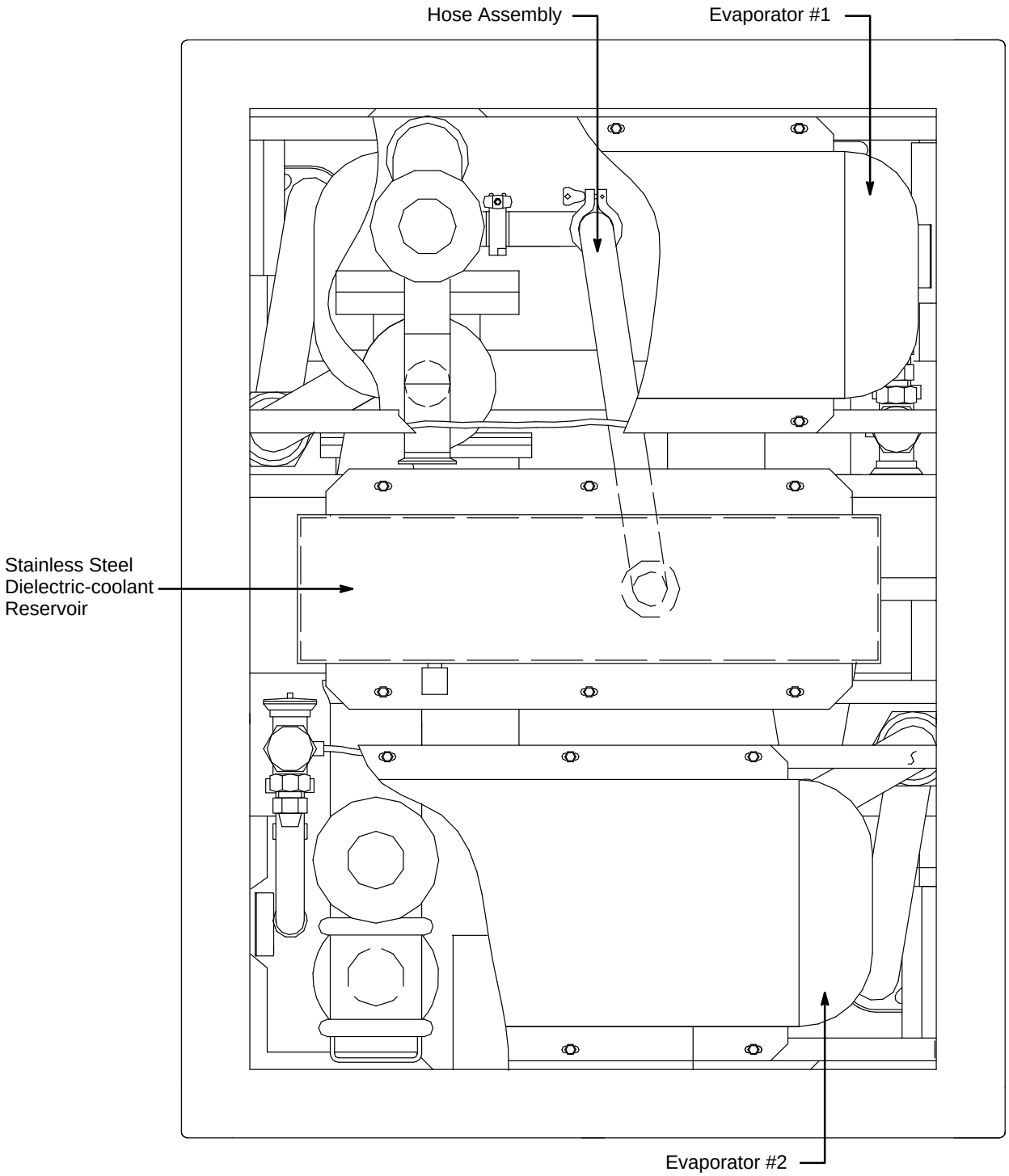


Figure 4. HEU-T3D Dielectric-coolant System Component Locations (Top View)

Evaporators

The HEU-T3D has two evaporators (refer to Figure 2 and Figure 4). The evaporators perform a dielectric-coolant to evaporative-refrigerant heat exchange to remove waste heat from the dielectric coolant circulating between the module cabinet and HEU. Heat generated by the integrated circuits or power supplies is transferred by conduction into the dielectric coolant. The coolant carries the heat to the evaporators in the HEU; the HEU evaporators transfer the heat by conduction into the refrigerant. Pressure in the evaporator is lower than the liquid-line pressure, causing the liquid refrigerant to vaporize and absorb heat.

A switch located on the top of the power box assembly shown in Figure 3 is used to switch the second evaporator (the evaporator located on the end nearest to the Service Disconnect switch) on and off. When the switch is set in the BOTH position, both evaporators are operating. When the switch is set in the ONE position, only evaporator #1 is operating.

Pressure Transducers and Thermistors

Primary and backup thermistors located on the dielectric-coolant return piping under the raised floor monitor the temperature of the dielectric coolant leaving the module cabinet to ensure the temperature does not exceed a high-temperature limit. If a high-temperature condition exists, the thermistors send a signal to the WACS to initiate a system shutdown.

Primary and backup pressure transducers located at the discharge port of the pump monitor the HEU for any high-pressure faults. If the pressure exceeds a high-pressure limit, a transducer sends a signal to the WACS to initiate a shutdown.

Service Valves

Service valves are located on the inlet and outlet piping of the pump, strainers, and evaporators to enable field service personnel to measure the pressure differential between the inlet and outlet of the components. The service valves are Schrader type valves with a valve stem that opens the valve when the stem is depressed. A pressure gauge can be attached to the valve to measure pressure. Pressures can also be monitored from the MWS-E. If the pressure differential between the inlet and outlet of a component exceeds the defined limits, the component may need cleaning or replacing.

Evaporative-refrigerant System

The HEU-T3D contains some components of the closed-loop evaporative-refrigerant system. Figure 5 shows the major components and refrigerant flow paths through the HEU-T3D. Figure 6 and Figure 7 show the physical locations of the refrigerant system components in the HEU-T3D.

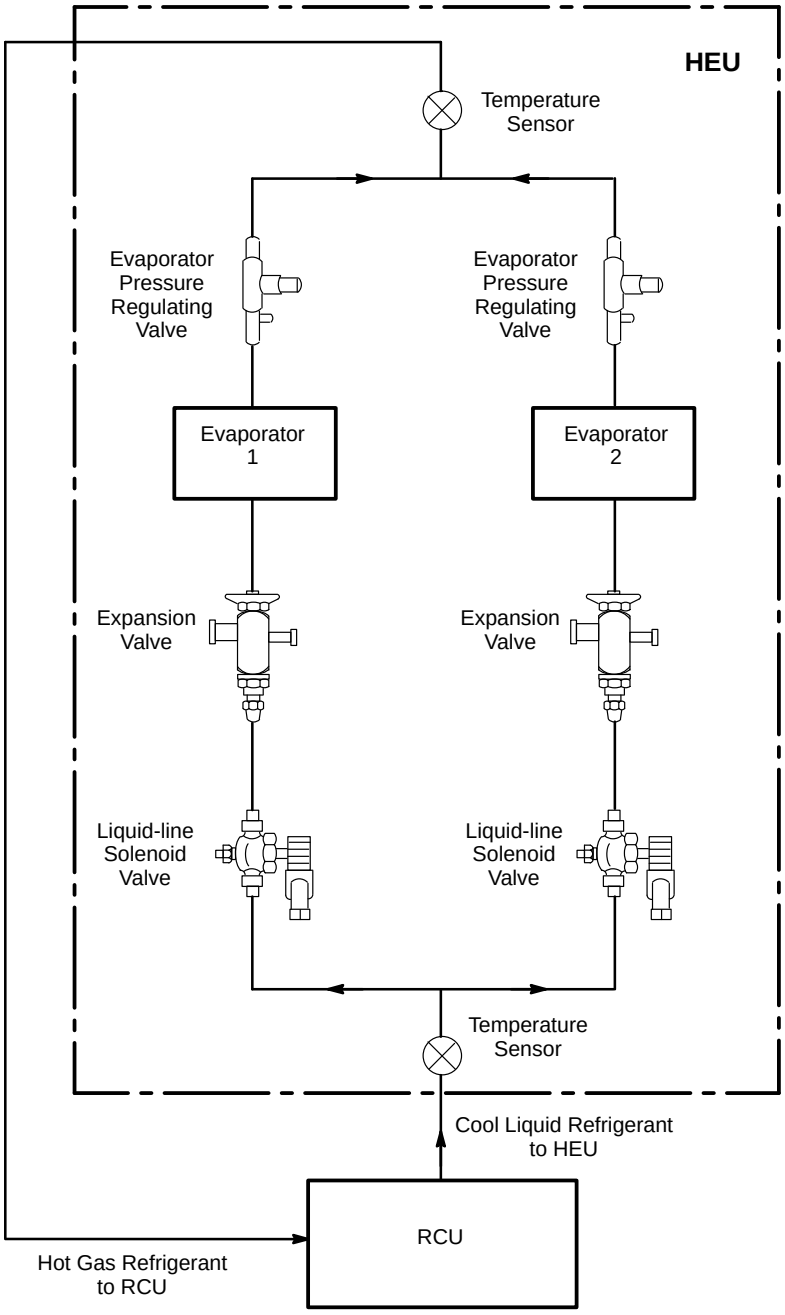


Figure 5. Evaporative Refrigerant Flow Path

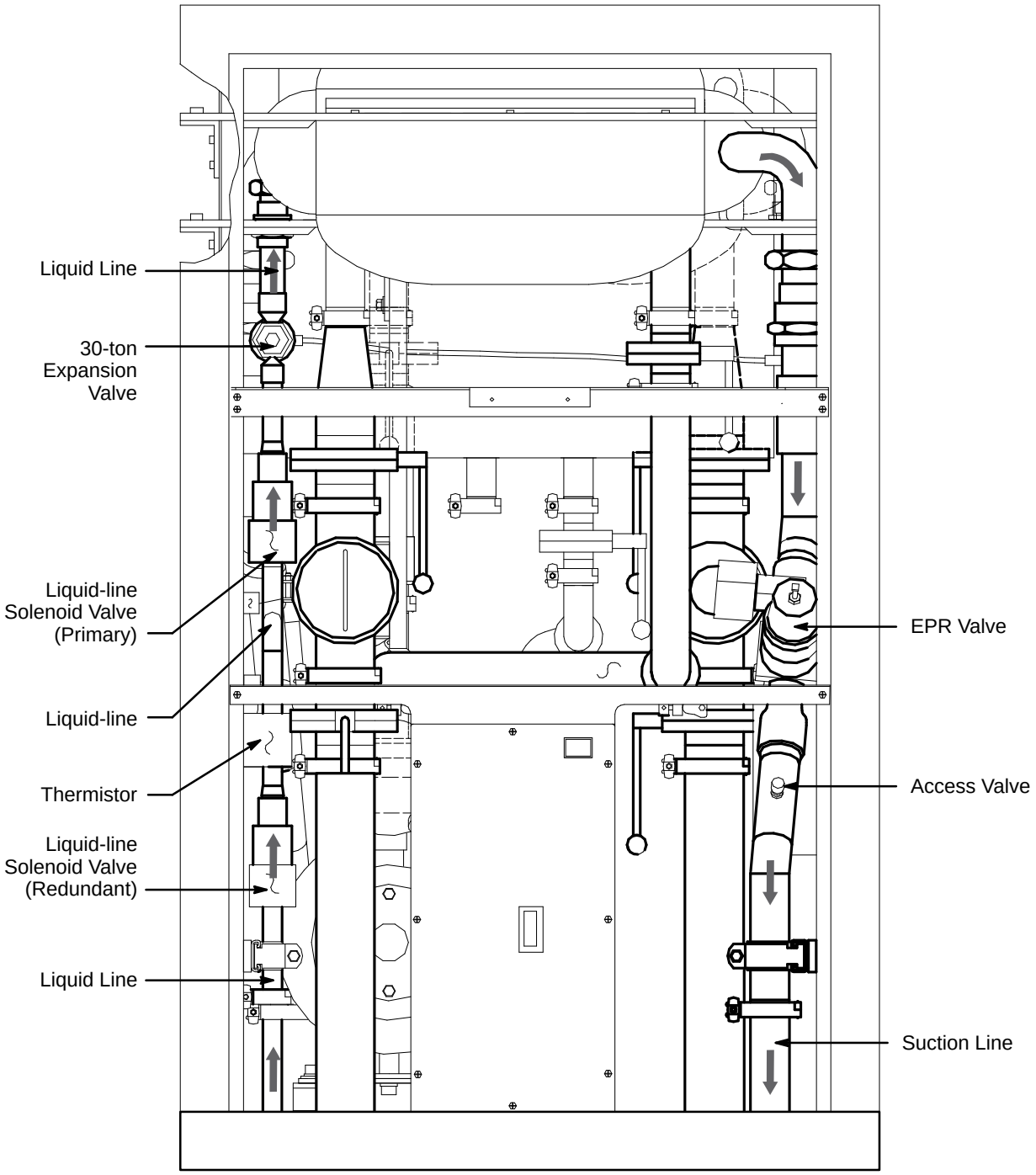


Figure 6. HEU-T3D Evaporative-refrigerant Component Locations (Left Side View)

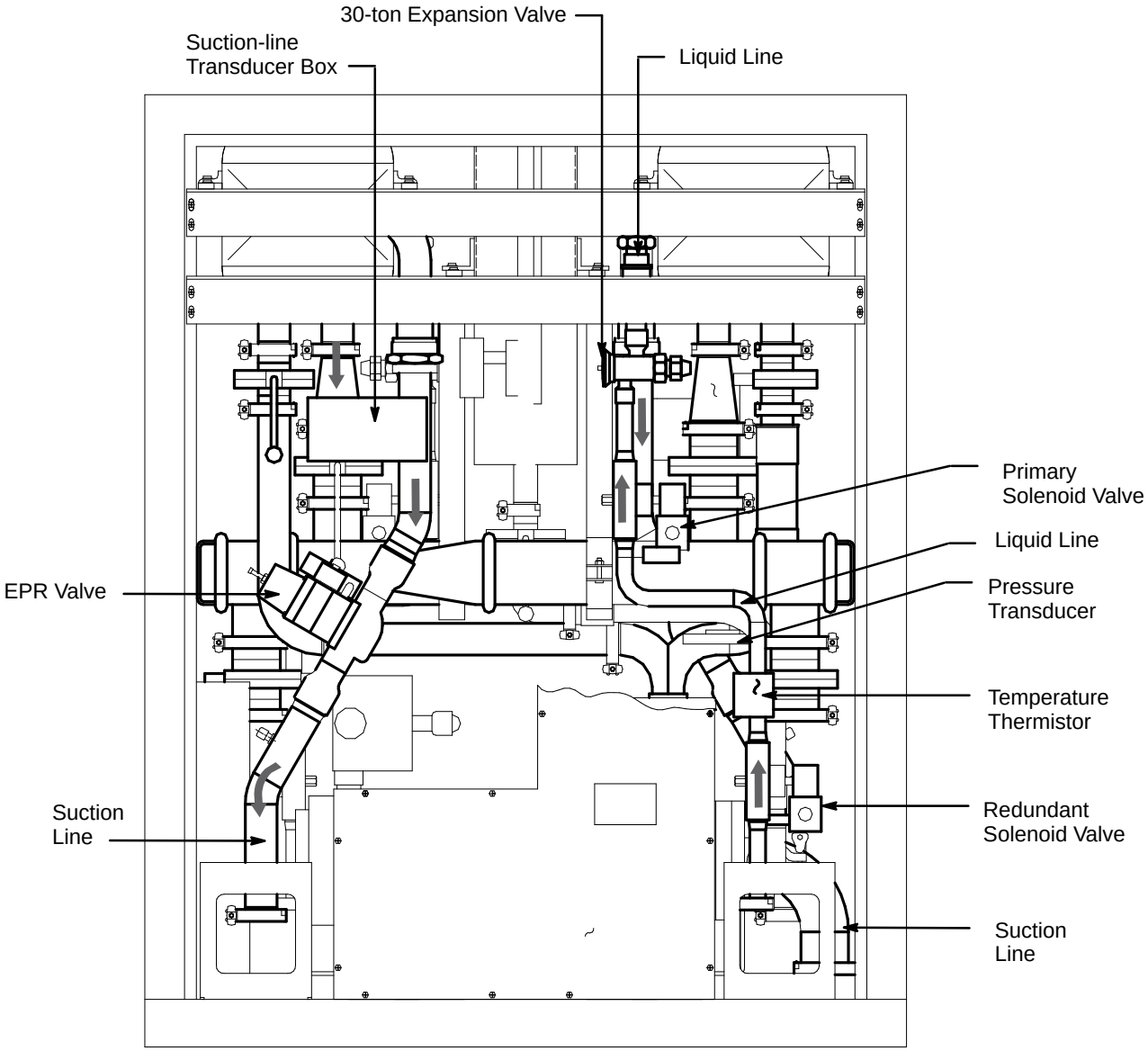


Figure 7. HEU-T3D Evaporative-refrigerant Component Locations (Front View)

Evaporator Pressure-regulating (EPR) Valves

The evaporator pressure-regulating (EPR) valve maintains the desired evaporator pressure of approximately 110 psig. The refrigerant saturation temperature at this pressure is 65 ºF (18 ºC). The HEU-T3D has two EPR valves. An EPR valve is located on the outlet of each evaporator. Figure 8 shows an EPR valve.

Vaporized refrigerant enters the EPR valve through the inlet port and flows between the valve seat and the spring-loaded seat disc. The vaporized refrigerant exits the valve through the outlet port, which is connected to the suction line that returns refrigerant to the compressor.

The EPR valve automatically responds to variations in inlet pressure. If the heat load on the evaporator decreases, gas pressure in the evaporator falls. At a preset minimum regulator pressure, the spring of the EPR valve pushes the disc against the seat. This action decreases the vapor flow through the suction line that maintains the evaporator pressure.

If an increase in heat load causes the evaporator pressure to exceed the valve setting, the pressure pushes the disc away from the seat. This action enables more vapor to flow from the evaporator and returns the pressure to the desired setting.

The manually adjustable spring, located under a protective cap on the EPR valve, regulates the evaporator temperature by controlling the evaporator pressure.

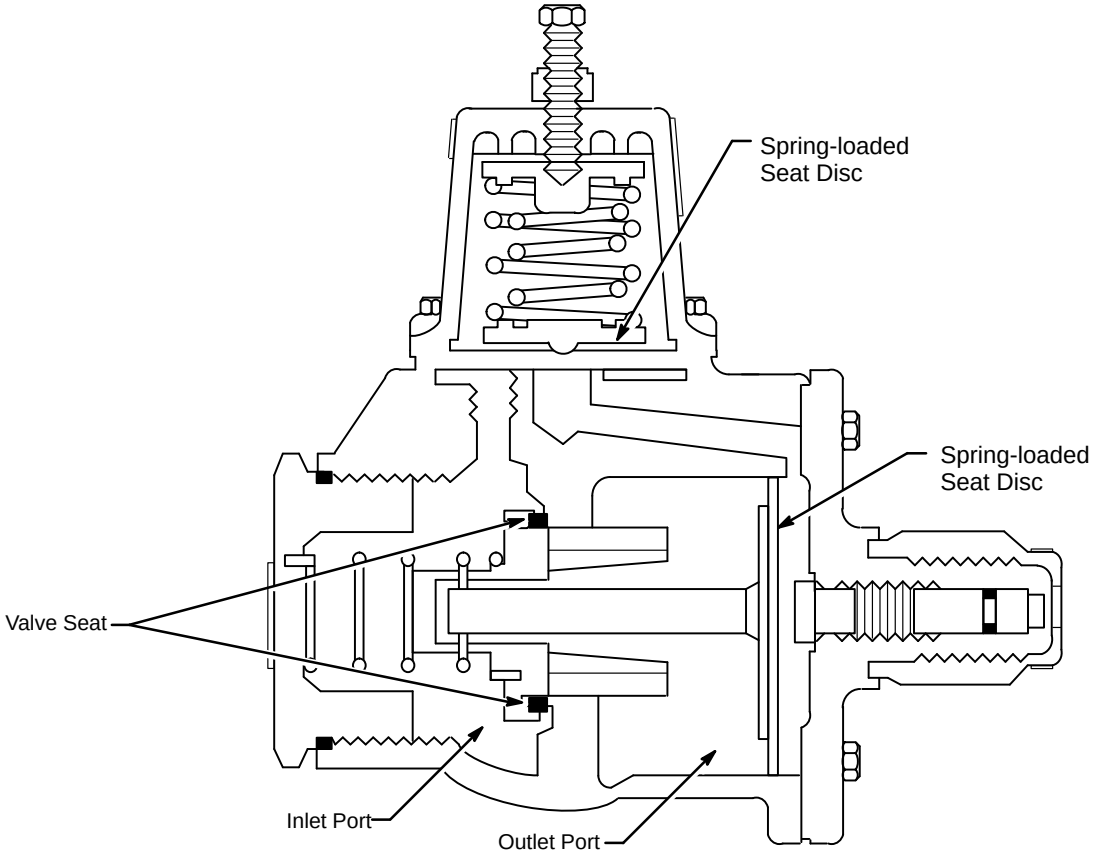


Figure 8. Evaporator Pressure-regulating Valve

The access valve on the EPR valve is a quick-disconnect valve for pressure measurements. A cap seats and protects the valve stem.

Primary and Redundant Liquid-line Solenoid Valves

The solenoid valve (shown in Figure 9) is an electromechanical device that controls refrigerant flow. The valve consists of a body and an iron-core plunger seated in the valve orifice. The valve is controlled by a solenoid coil. When the solenoid is energized, the plunger lifts and opens the valve. During normal operation, the solenoid is energized.

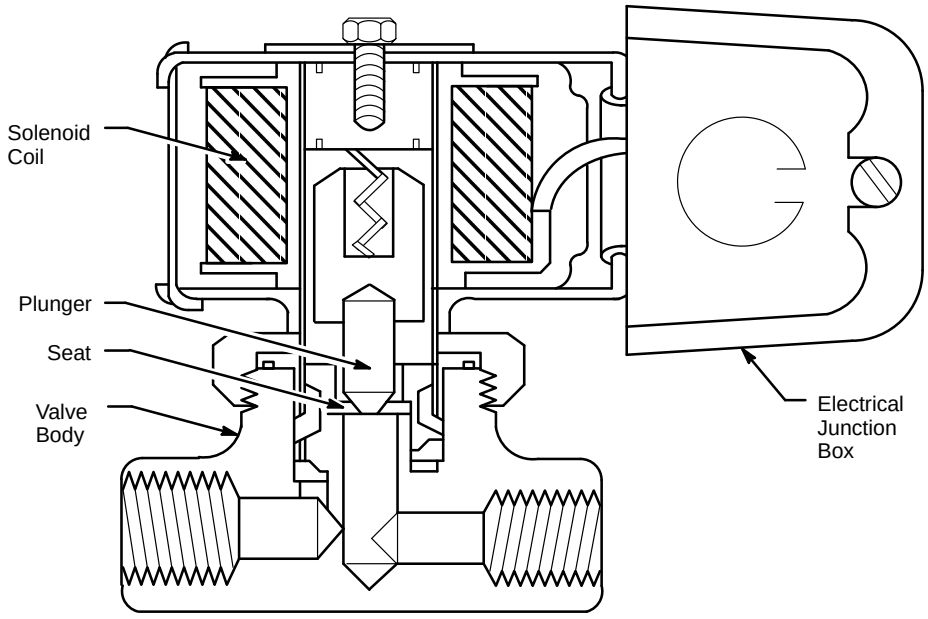


Figure 9. Solenoid Valve

The HEU-T3D has two sets of liquid-line solenoid valves; a primary and redundant solenoid valve on the liquid line to each evaporator. The primary and redundant liquid-line solenoid valves (refer to Figure 6) provide a backup in case one solenoid fails to close when de-energized.

Three switches on the WACS control the solenoids during normal operation. The switches control both the primary and redundant liquid-line solenoid valves. The STOP switch de-energizes the solenoid, preventing refrigerant flow. The START switch energizes the solenoid during normal operation, enabling refrigerant to flow. The Cooling Bypass switch is a momentary-contact switch that energizes the solenoid without applying power to the modules. The START switch and the Cooling Bypass switch are ORed together on the WACS.

Expansion Valve

The HEU-T3D has two expansion valves. An expansion valve (refer to Figure 10) controls the rate of refrigerant flow into each of the evaporators. The expansion valve contains a small orifice through which liquid refrigerant flows. The pressure drop across the orifice causes the liquid to begin changing to a vapor that absorbs heat.

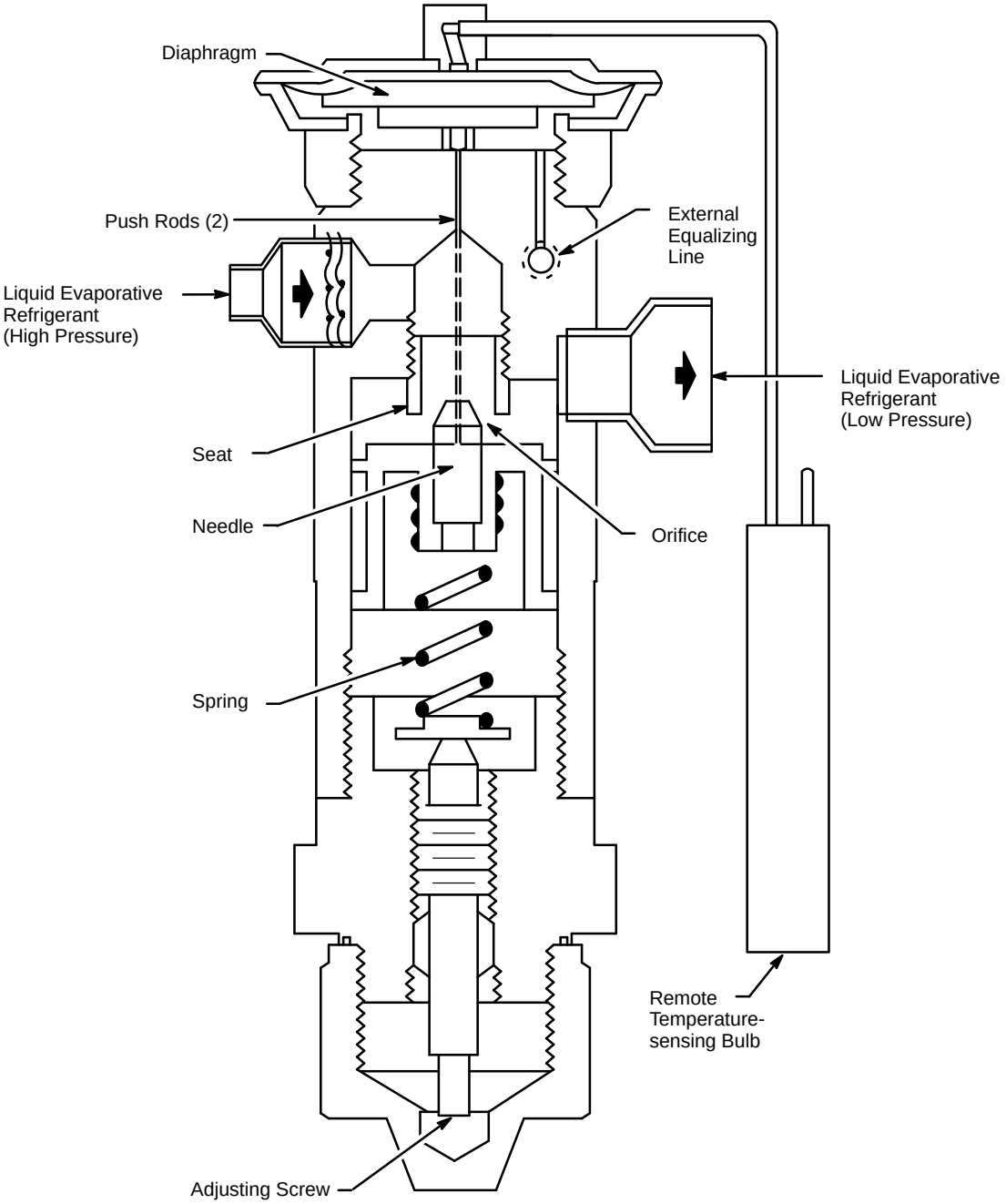


Figure 10. Expansion Valve

Liquid refrigerant enters the expansion valve and flows between the valve needle and valve seat, exiting into the evaporator as a low-pressure liquid.

The refrigerant, at a minimum pressure of 95 psig as set by the EPR valve, absorbs heat in the evaporator and vaporizes, carrying the heat away from the computer system.

The diaphragm within the valve moves as it is acted on by three forces: the remote temperature-sensing bulb pressure, the gas pressure in the evaporator, and the adjustable spring. Two parallel push rods transfer diaphragm movement to the needle.

The remote temperature-sensing bulb and its connecting tube also contain pressurized refrigerant. The bulb is located near the outlet end of the evaporator to sense the temperature of the gas leaving the evaporator. The pressure of the gas in the bulb is transmitted through the connecting tube to the top of the diaphragm.

By monitoring the temperature with the sensing-bulb pressure and the evaporator pressure drop, the expansion valve automatically adjusts to ensure a constant refrigerant vapor temperature (superheat temperature) in the gas leaving the evaporator.

The adjusting screw at the bottom of the expansion valve provides for manual adjustment of the expansion valve spring pressure. The spring pressure sets the refrigerant flow rate through the evaporator. The amount of liquid refrigerant entering the evaporator controls the refrigerant superheat.

The external equalizing line provides a path for evaporator outlet pressure to the underside of the expansion valve. This pressure offsets outlet pressure from the expansion valve and enables more precise control by the remote temperature-sensing bulb.

Pressure Transducers and Thermistors

Pressure transducers and thermistors on the suction and liquid lines monitor and regulate the flow of refrigerant to the evaporators. Refrigerant system pressures and temperatures are also monitored by the WACS and can be remotely monitored using the MWS-E.

Service Valves

Service valves in the HEU-T3D are located in the liquid and suction lines to enable service personnel to attach pressure gauges to measure refrigerant system pressures at various locations. Refrigerant system temperatures can be measured manually using a temperature probe.

Preventive Maintenance Procedures

Table 2 shows the preventive maintenance procedures for a heat exchanger unit. Customer agreements or site variables may require that you tailor PM guidelines to meet specific needs of the customer.

Table 2. Heat Exchanger Unit PM Index

PMP Number	Time Required (in hours)	Dedicated Time Required?	Procedure	Page
M1	0.1	No	Checking the Dielectric-coolant Level	21
A1	0.5	Yes	Cleaning and Inspecting the Heat Exchanger Unit	23

CHECKING THE DIELECTRIC-COOLANT LEVEL

M1

PMP Number M1
Time Required 0.1 hour
Procedure

1. Remove the HEU access panels.

2. For the stainless steel storage reservoir, check the dielectric-coolant level indicator along the side of the reservoir to verify the dielectric-coolant level. The dielectric-coolant level should be at 3/4 of full. The maximum level for the system is at 7/8 of full.

3. If necessary, add dielectric coolant according to the procedure described later in the “Field Repair Procedures” section.

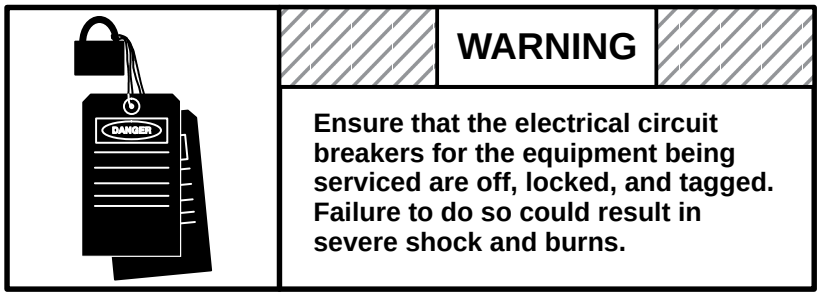
4. Replace the HEU access panels.

5. Repeat this procedure for each HEU in the system.

CLEANING AND INSPECTING THE HEAT EXCHANGER UNIT

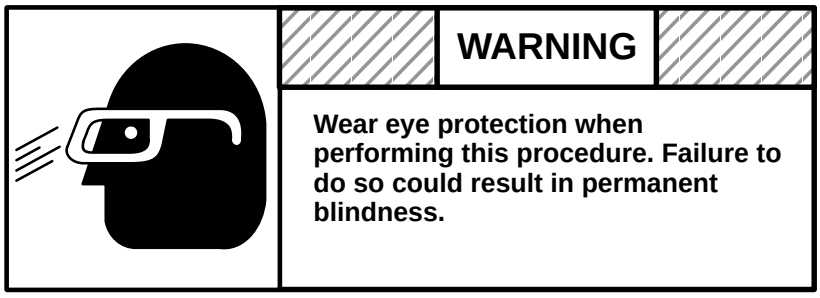
A1

PMP Number A1
Time Required 0.5 hour
Procedure



1. Power down the system at the WACS.

2. Remove the HEU panels.



3. Close the inlet and outlet valves to the HEU strainer assembly. Refer to Figure 11. When the butterfly valve lever is horizontal, the valve is closed.

4. Unscrew the bolts on the HEU strainer assembly clamp using a hex (allen) wrench.

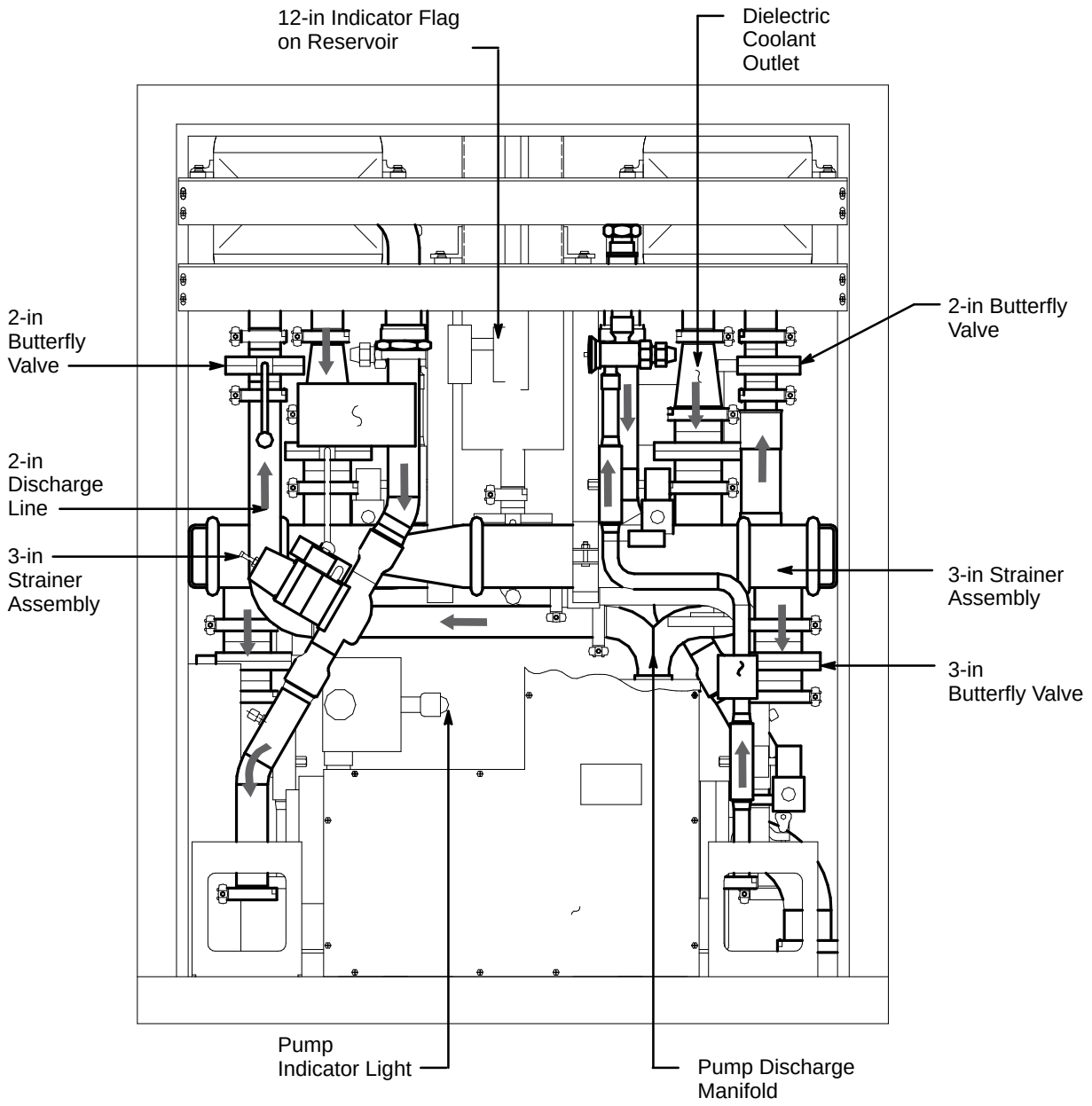


Figure 11. HEU Strainer Assembly Location

5. Remove the strainer clamp and slowly withdraw the strainer from the housing. Use a one-gallon container to catch any dielectric coolant that drains from the filter housing.

6. Inspect the strainer for dirt and metal particles; clean if necessary. If metal particles are found, investigate the source of the metal particles. Clean the strainer by rinsing it with a small amount of dielectric coolant in a pail. If necessary, brush dirt or particles from the strainer using a soft-bristle brush.

7. Carefully reinstall the strainer.

8. Replace the strainer clamp and tighten the strainer clamp bolts securely using a hex (allen) wrench.

9. Open the inlet and outlet valves to the strainer assembly. The butterfly valve levers are turned downward 90 degrees to open the inlet and outlet valves to the strainer assembly. (When the inlet and outlet butterfly valve levers are in line with the hose, the inlet and outlet valves are open.)

10. Inspect and clean the interior of the HEU. Use a vacuum to remove debris from the interior of the HEU.

11. Examine the fluid lines and refrigerant fittings for leaks, and repair.

12. Replace the HEU panels.

13. Return the system to normal operation if no other PMPs require the system to be powered down.

Field Repair Procedures

Table 3 describes the field repair procedures for a heat exchanger unit.

Table 3. Heat Exchanger Unit Field Repair Procedures

Procedure Title	Time Required	Page
Dielectric-coolant Replenishment	0.5 Hour	27
Dielectric-coolant Strainer Replacement	1.0 Hour	31
Pump Replacement	3.0 Hours	33
Evaporator Replacement	2.0 Hours	43
Liquid-level Indicator Replacement	1.0 Hour	49
Dielectric-coolant Leak Detection	1.0 Hour	53

DIELECTRIC-COOLANT REPLENISHMENT

Summary

Add dielectric coolant to the system when fluid levels are low. Add dielectric coolant at any time, even if the system is running. Determine whether you need to add dielectric coolant by:

- Performing weekly refrigeration inspections to check for dielectric-coolant loss.
- Checking the dielectric-coolant level in the storage reservoir by opening a side panel and looking at the coolant level through the blue Plexiglass reservoir. The liquid level, while the HEU is running, should be 2 inches above the warning sensor float. When the float reaches a predetermined level, it sets off an alarm at the MWS-E or WACS panel.
- Monitoring the dielectric-coolant level using the storage tank liquid-level indicator.

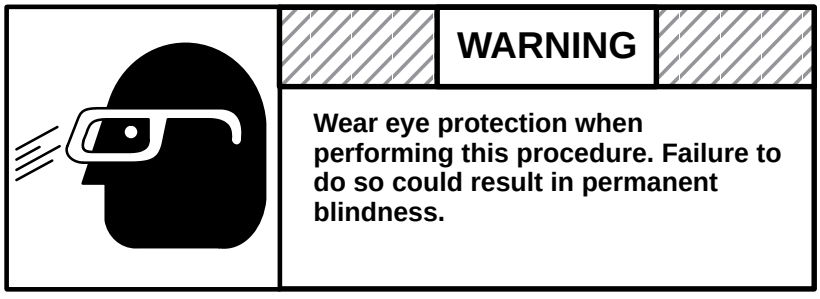
Refer to Figure 12 for the location of the parts of the HEU discussed in this procedure.

Time

0.5 Hour

Tools

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



Procedure

1. Remove the HEU right side service panel.

2. Remove the protective cap from the filler port located at the top right corner of the storage reservoir.

3. Attach the outlet dielectric-coolant pump hose to the filler port of the storage reservoir.

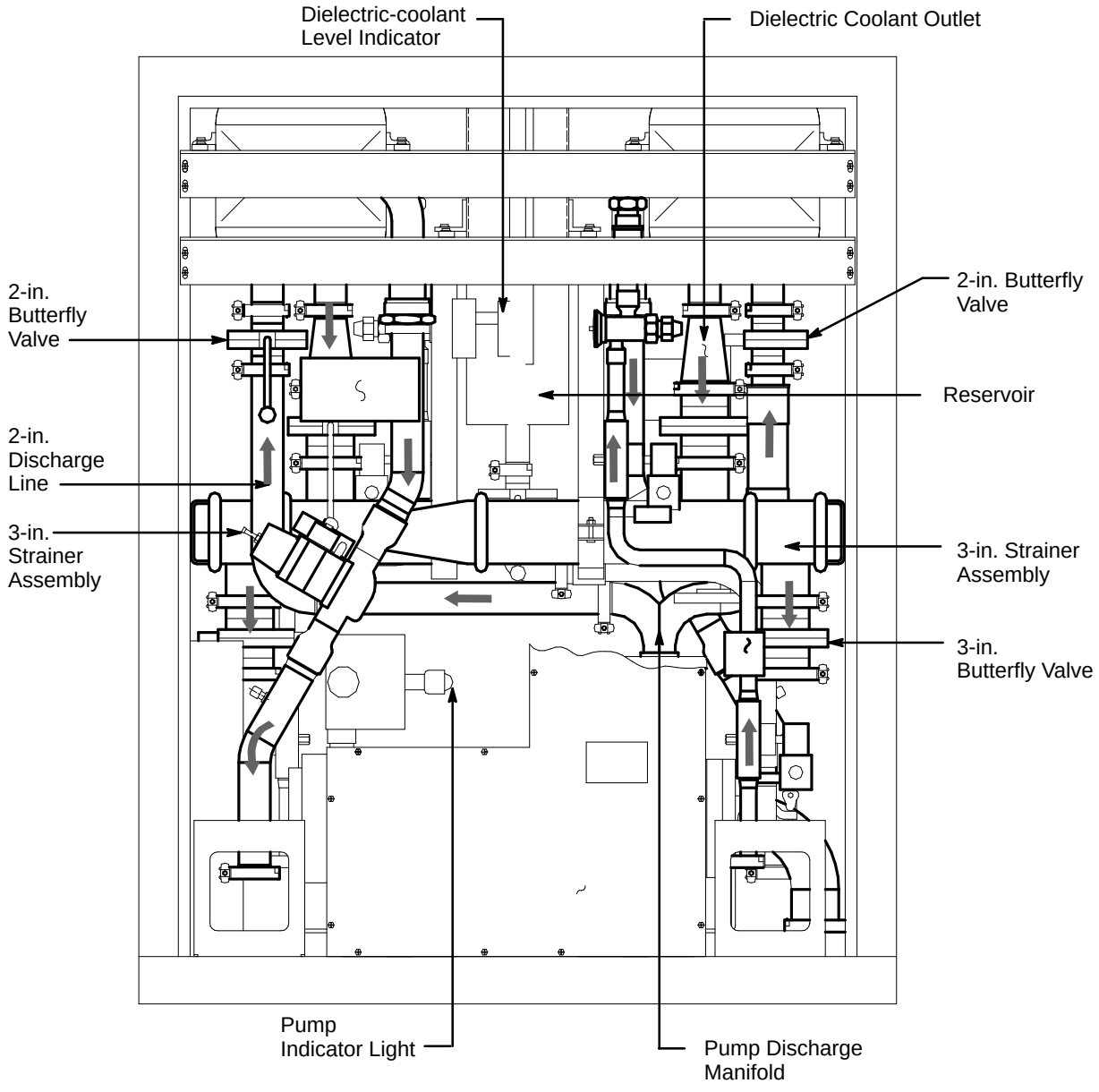


Figure 12. Dielectric-coolant Reservoir Location

4. Place the inlet dielectric-coolant pump hose 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 storage reservoir, prime the dielectric-coolant pump by filling the output hose with dielectric coolant before connecting the hose to the filler port.

6. Fill the storage reservoir to approximately 2 inches above the float inside the reservoir.

7. Remove the hose from the filler port, spilling as little dielectric coolant as possible, and drain the dielectric coolant into the container.

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

9. Remove the input dielectric-coolant hose from the container of dielectric coolant and close the container.

10. Replace the HEU right side service panel.

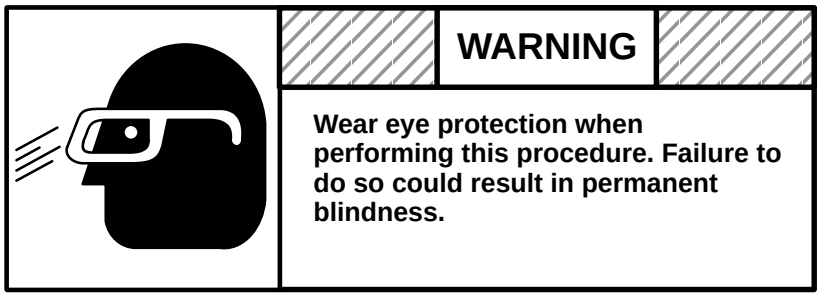
DIELECTRIC-COOLANT STRAINER REPLACEMENT

Summary Replace the in-line strainer if it becomes filled with debris.

Time Approximately 1.0 Hour

Tools

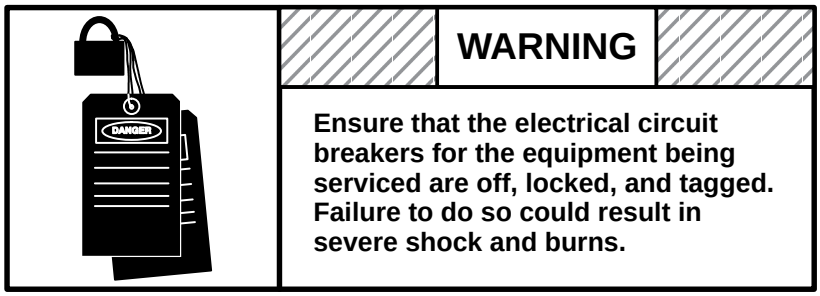
- Clean pail (gallon capacity or more)
- Allen wrench
- Protective eye wear



Procedure

Removing the Dielectric-coolant Filter

1. Power off the module cabinet and allow the RCU to cycle down.



2. Remove the side service panels on the HEU.

3. Close the butterfly valve handles on the inlet and outlet of the strainer assembly. When the handle is horizontal, the valve is closed.

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

5. Remove the clamp on the outlet of the access port to the strainer.

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

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

Installing the Dielectric-coolant Filter

1. Insert the new strainer filter inside the strainer assembly.

2. Close and latch the clamp on the access cover to the strainer assembly.

3. Open the butterfly valve handles on the inlet and outlet of the strainer assembly. When the handle is vertical, the valve is open.

4. Press the Cooling Bypass switch on the WACS panel to replenish the dielectric-coolant loop.

5. Add dielectric coolant to the system if necessary; refer to the “Dielectric-coolant Replenishment” procedures in this section.

6. Replace the side service panels on the HEU.

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

PUMP REPLACEMENT

Summary

If a pump breaks, leaks, or otherwise shows signs of damage, replace it using the following procedure.

Refer to Figure 13 and Figure 14 to identify component locations referred to in this procedure.

NOTE: The following procedure requires two people. Be sure a second person is available to help before you start.

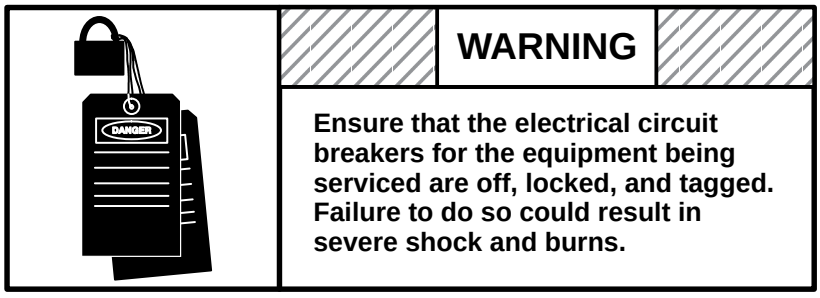
Time

Approximately 3.0 Hours

Tools

- Gauge manifold
- Phillips and flat-blade screwdrivers
- Empty dielectric-coolant container
- Anti-seize compound
- Linerless rubber splicing tape (CRI part #01399000)
- Large adjustable wrench
- Heavy gauge wires (2), 4-ft minimum length
- Voltage meter
- Heat shrink sleeves

Procedure



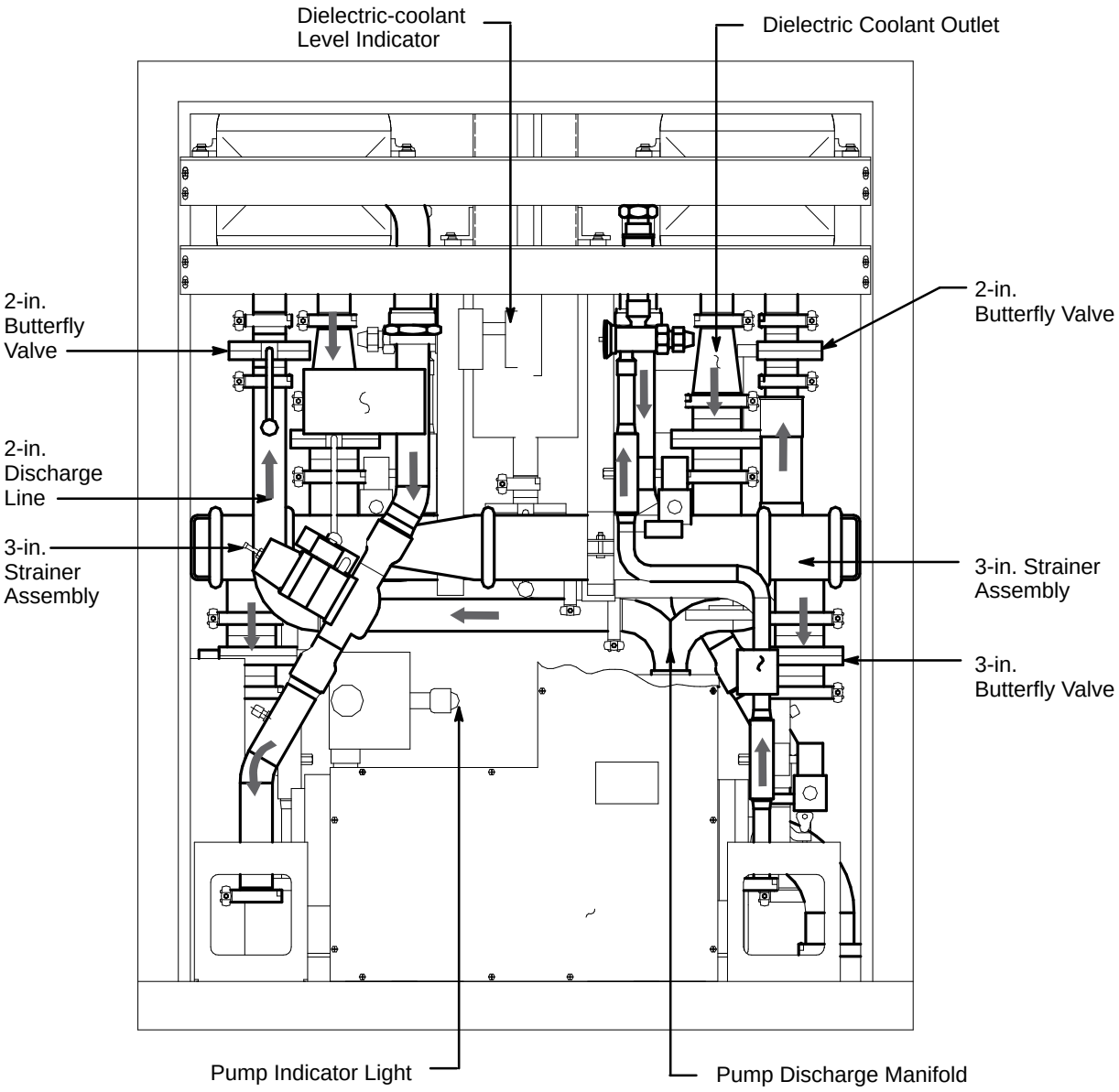


Figure 13. HEU-T3D Component Locations (Left Side View)

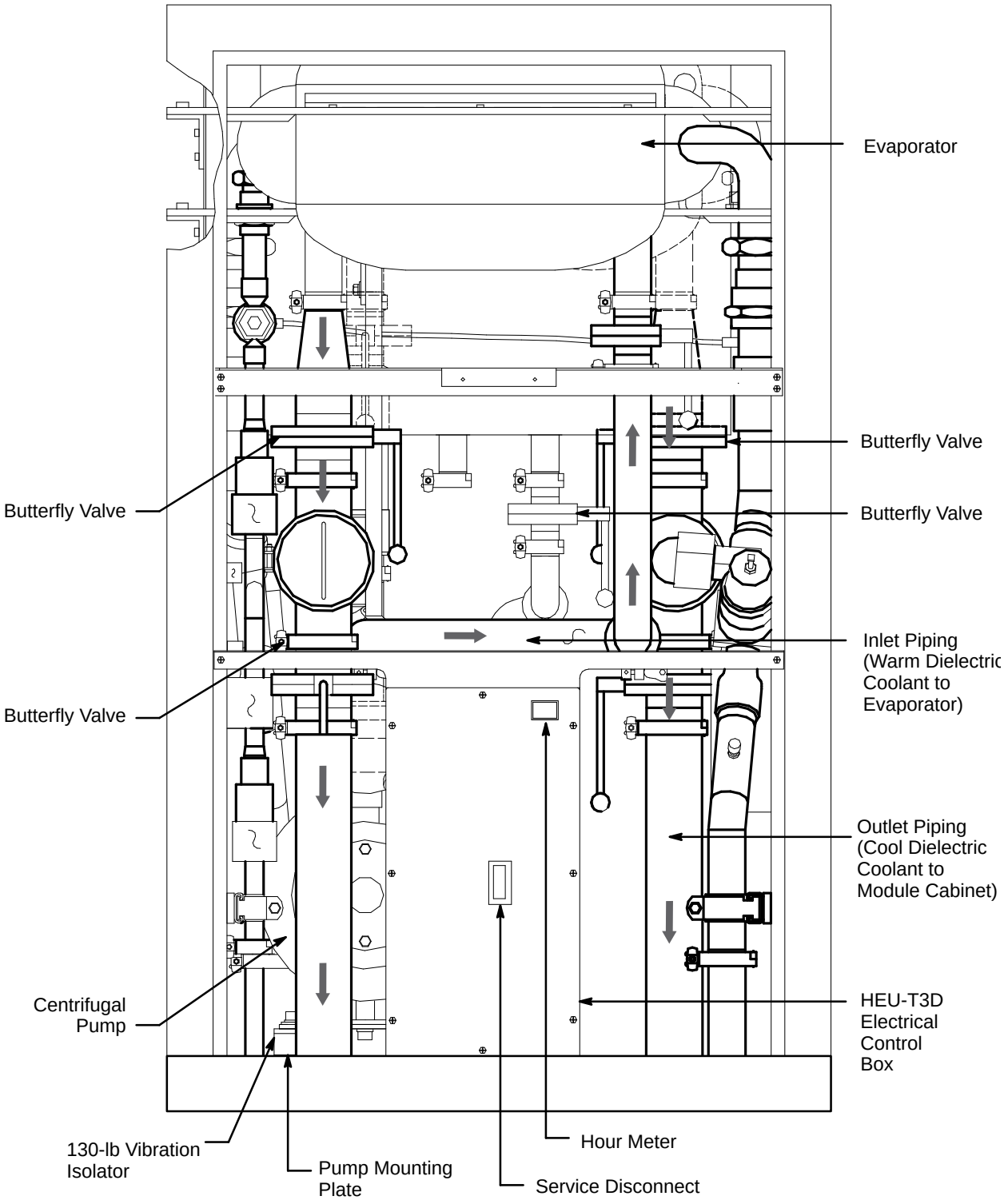
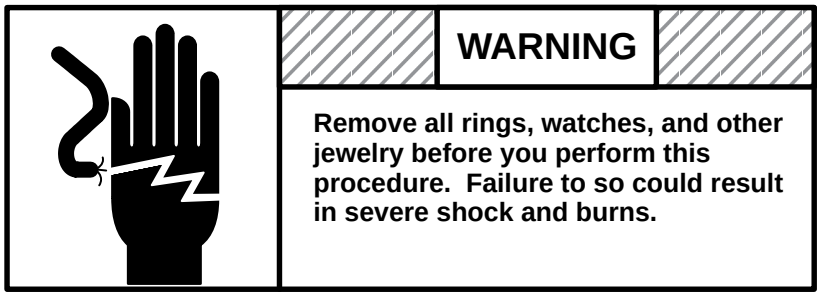


Figure 14. HEU-T3D Component Locations (Front View)

Removing a Pump

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

2. Turn off the power to the HEU at the wall breaker.



3. Remove the side and rear panels from the HEU.

4. Close the evaporator inlet valves located on the outlet side of the HEU circulation pump. Pull the valve handle out, and rotate the valve handle clockwise 90° to the final locking position.

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

5. Close the storage reservoir outlet valve by pulling the valve handle out and rotating the valve handle clockwise 90° to the final locking position.

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

7. Open the junction box on the top of the HEU pump. Use a long screwdriver shaft or similar tool to loosen the junction box cap.

8. Detach all electrical connections. Be sure to record the location of each phase wire for proper reconnection of the replacement pump.

9. Slide the conduit out of the connector at the side of the junction box. To do so, loosen the nut on the conduit, then slide the phase wires out of the junction box.

10. Remove the four nuts on the pump-discharge flange assembly.

11. Hold the discharge-flange assembly away from the pump by using a heavy-gauge wire wrapped around the elbow of the assembly and a storage reservoir tank bracket. This will keep the discharge-flange assembly out of the way when you remove the pump.

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

13. Disconnect the HEU main breaker box assembly located in the front of the HEU enclosure by performing the following steps:

    a. Turn off the Service Disconnect switch located on the front panel of the main breaker box assembly.

    b. Unscrew the two Phillips screws located on the top of the main breaker box assembly attaching it to the HEU enclosure.

    c. Remove the eight Phillips screws on the front panel of the main breaker box assembly and remove the front panel.

    d. As a safety precaution, verify that the power is off by using a voltage meter and measuring the voltage across the input terminals.

    e. Unscrew the two hex bolts located on the bottom panel within the main breaker box assembly.

14. Move the main breaker box assembly to the left as far as the flexible conduit beneath the box allows. This creates enough space to remove the pump through the front of the HEU enclosure.

15. Close the red outlet dielectric-coolant hose connection at the module cabinet by pulling the flow valve lever out and rotating it counterclockwise 90° to the locking position. This will keep the dielectric coolant in the module cabinet and prevent coolant loss when you perform the next step.

16. Remove the cast hinge clamp from around the dielectric-coolant pump input manifold. Quickly install a sealer disc inside the clamp to plug the dielectric-coolant pump manifold. This will eliminate excessive loss of dielectric coolant and allow access for pump removal.

17. Remove the four pump inlet manifold flange assembly bolts.

18. Hold the inlet manifold flange assembly away from the HEU pump using a heavy-gauge wire wrapped around the inlet manifold flange assembly and the HEU chassis. This will keep the inlet manifold flange assembly out of the way when you remove the HEU pump.

19. Let the red return dielectric-coolant hose from the module cabinet drop below the computer room floor to create room to remove the HEU pump through the front of the HEU enclosure.

20. Remove the four bolts holding the HEU pump to its support bracket.

21. Carefully lift the pump out through the front of the HEU enclosure.

Installing a Pump

After removing a defective pump, replace it using this procedure.

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

2. Apply anti-seize compound to all flange bolts to enable removal of the pump again if necessary.

3. Slide the replacement pump into place from front to back and tighten down the shock mount bolts securely.

4. Attach the green ground cable to the pump.

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

6. Connect the red return dielectric-coolant hose from the module cabinet to the pump inlet manifold flange assembly.

7. Position the pump inlet manifold flange assembly and screw in the four bolts to secure it in place.

8. Remove the wire that suspends the pump discharge flange assembly away from the pump.

9. Inspect the discharge flange gasket for damage before installing it on the discharge flange assembly.

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

11. Reopen the red outlet dielectric-coolant hose on the module cabinet by pulling the flow valve handle out and rotating the valve clockwise 90° to the locking position. This restores the dielectric coolant flow path to the chassis.

12. Thread the phase wires into the junction box and attach the electrical connections as marked during the removal of the HEU pump.

CAUTION

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

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

14. Close the junction box.

15. Pump dielectric coolant back into the reservoir. Refer to "Dielectric-coolant Replenishment" in this section.

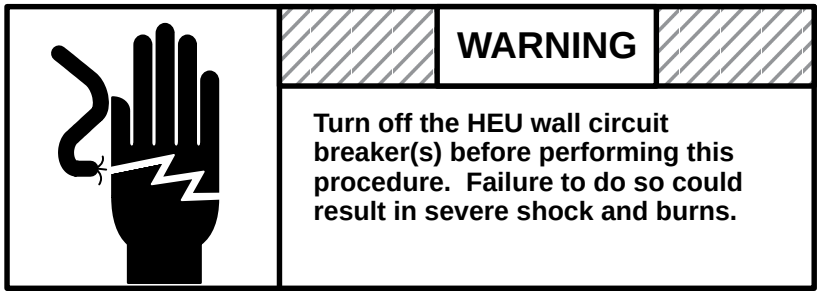
16. Open the discharge and intake butterfly valves and check for puddles of dielectric coolant on the bottom of the HEU, which may indicate a leak. Repair leaks before proceeding to the next step.

17. Turn on the main wall breaker.

CAUTION

When performing the next step, have another person watch the light above the pump. Be sure the light above the pump illuminates. If the light does not illuminate, the phase rotation is out of sync. Running the system with the phase rotation out of sync will damage the pump.

18. Press the Cooling Bypass switch at the WACS panel on the module cabinet while another person watches the light above the pump on the junction box. If the light does not illuminate, the phase rotation is out of sync. If the phase rotation is out of sync, correct the phase rotation using the following procedure:



a. Turn off the main wall breaker.

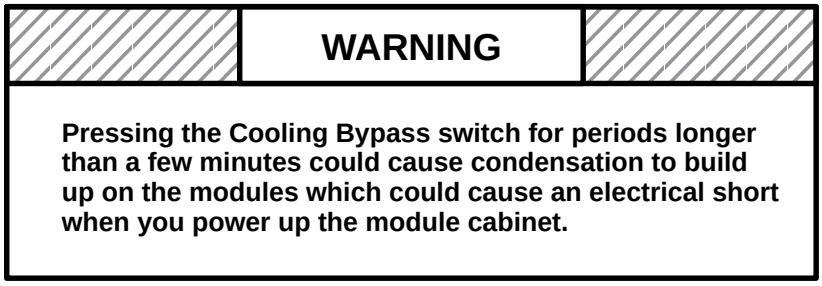
b. Open the junction box and swap any two of the three black and purple wires on the terminal block in the lower left hand corner.

c. Press the Cooling Bypass switch while another person watches the light above the pump. If the light illuminates, the phases are in sync and the pump is rotating in the desired direction. If the light is off, the pump is still rotating backwards.

d. Repeat Steps a through c until the light illuminates and the phase rotation is in sync.

19. Check for dielectric-coolant leaks and repair any leaks.

20. Press the cooling-bypass button on the WACS panel for a few minutes.



21. Check again for dielectric-coolant leaks and make repairs if necessary.

22. Turn on the main wall breaker.

23. Replace the HEU side panels.

24. Power up the module cabinet.

EVAPORATOR REPLACEMENT

Summary

Replace a damaged or defective evaporator using the following procedures. Both evaporators in the HEU are removed and installed using the steps described in this procedure.

NOTE: This procedure requires two people. Have a second person available before you start.

Time

Approximately 2.0 Hours

Tools

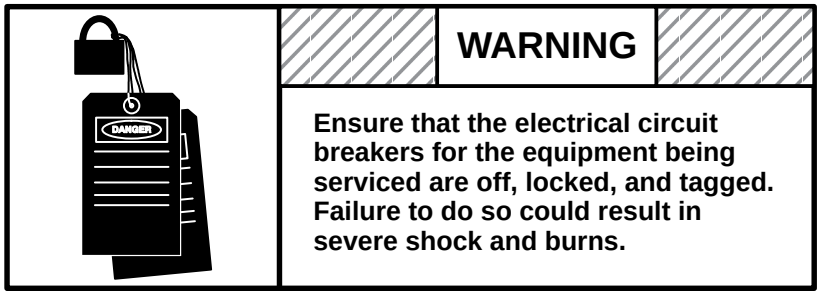
- Large adjustable wrenches (2)
- Pipe wrench
- Manifold-gauge hose
- Empty dielectric-coolant container
- Vacuum pump
- O-rings
- Halogen detector
- Small adjustable wrench
- Insulating tape
- Tie straps
- Protective eye wear

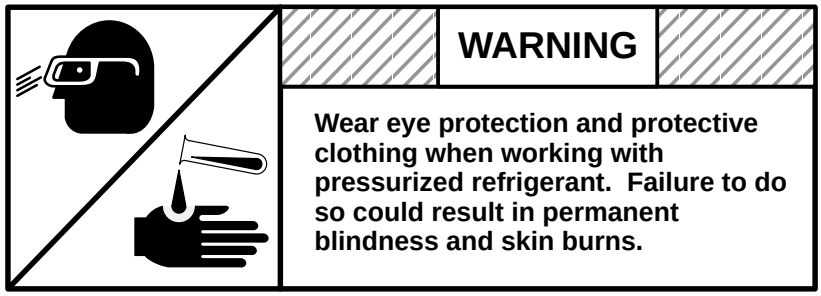
Procedure

Removing an Evaporator

1. Power off the module cabinet at the WACS panel and let the refrigeration condensing unit (RCU) idle down.

2. Turn off the power to the HEU at the wall breaker.





3. Shut off the liquid-line valves in the HEU for the evaporator you are replacing.

4. Close the red outlet dielectric-coolant hose from the module cabinet by pulling the flow valve handle out and rotating the valve handle counterclockwise 90° to the locking position.

5. Close the dielectric-coolant return ball valve at the base of the module cabinet.

6. Close the storage reservoir outlet valve by pulling the valve handle out and rotating the valve clockwise 90° to the final locking position. Make sure you close the correct valve to isolate the desired dielectric-coolant circuit.

7. Close the butterfly valve between the evaporator and the HEU pump.

8. Close the discharge butterfly valve on the evaporator output to the strainer and system piping.

9. Remove the nut covering the stem on the bottom of the liquid-line solenoid valves. The first liquid-line solenoid valve is directly below the expansion valve. The second liquid-line solenoid valve is below and to the right of the first solenoid valve on the same liquid-line pipe.

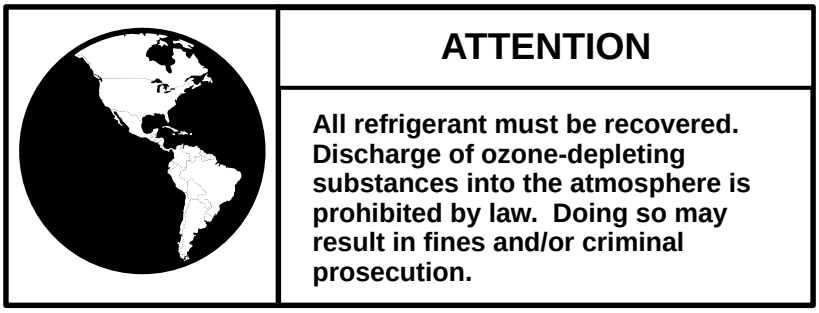
10. Manually open both liquid-line solenoid valves by turning the square valve stems clockwise. Opening the valves equalizes refrigerant pressure in the evaporator.

11. Wait until the compressor pumps the system down to 10 psi; check the compressor gauge located in the RCU.

12. Close the suction service valve on the RCU.

13. Manually close both liquid-line solenoid valves by turning the square valve stems counterclockwise.

14. Reclaim refrigerant from the refrigerant lines in the HEU.



15. Attach a manifold-gauge hose to the Schraeder valve located on the pump inlet manifold. Use a tie strap to secure its upper end to the chassis frame above the evaporator. This hose is an air inlet line.

16. Open the inlet butterfly valve of the evaporator.

17. Remove the clamp on the outlet of the strainer access port. Hold a pail under the port and drain dielectric coolant into it. Control flow by opening and closing the butterfly valve above it.

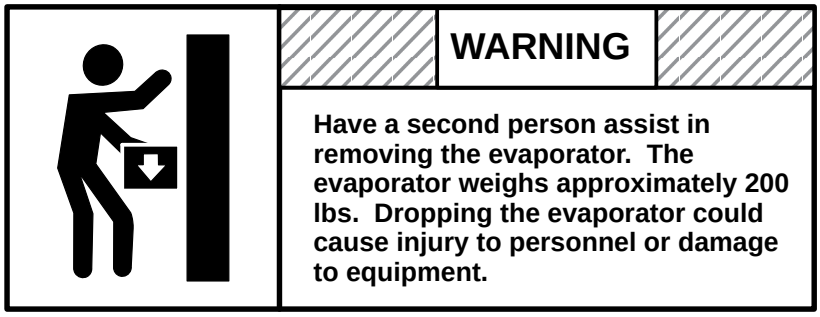
18. Remove the evaporator using the following procedure:

    a. Unscrew the two hex nuts that attach the refrigerant R-22 lines to the evaporator. To prevent the tubing from twisting, hold the stationary nut firmly with a wrench as you turn the other nut.

       NOTE: The two hex nuts in the previous substep are of irregular size; the site may need to order, from a tool supplier, two adjustable wrenches large enough to unscrew the nuts.

b. Unclamp the two clamps holding the evaporator and the dielectric-coolant lines together. One clamp is between the output of the evaporator and the butterfly valve lever. The other clamp is between the input of the evaporator and the butterfly valve lever.

c. Remove the six hex bolts that secure the evaporator to the brackets of the HEU, letting it rest on its brackets.



d. Remove the evaporator support bracket closest to the storage reservoir. Remove the two hex bolts that attach the support bracket to the HEU chassis frame.

19. Remove the evaporator.

Installing an Evaporator

1. Position the replacement evaporator on the bracket attached to the HEU chassis frame.

2. While another person supports the evaporator, slide the second support bracket into place and bolt it to the HEU chassis frame. This will enable the second person to set the replacement evaporator on the two support brackets without danger of dropping the evaporator.

3. Screw in the six bolts that attach the evaporator to the bracket.

4. Clamp the inlet and outlet dielectric-coolant lines onto the new evaporator, making sure to put the Teflon washers in place.

5. Check the O-rings inside the hex nuts of the refrigerant lines of the evaporator and replace the O-rings if cracked or worn. (Coat the O-rings with a small amount of refrigeration oil or vacuum grease before reassembly.)

6. Attach the refrigerant lines to the replacement evaporator. To prevent the tubing from twisting, hold the stationary nut firmly with one wrench while turning the other nut.

7. Using two vacuum pumps, evacuate the refrigeration lines for a minimum of 4 hours. Attach one pump to the liquid-line service valve on the RCU and the other pump to the suction line on the evaporator.

8. Manually open the liquid-line solenoid valves located under the expansion valve.

9. Open the two butterfly valves under the evaporator to allow the dielectric coolant to circulate through the evaporator. Also open the storage reservoir butterfly valve.

10. Open the liquid-line service valve at the RCU to allow the liquid refrigerant to leave the RCU and flow through the liquid-line solenoid valve.

11. Add dielectric coolant to the storage reservoir if necessary.

12. Re-open the red outlet dielectric-coolant hose on the module cabinet by pulling the flow valve handle out and rotating the valve clockwise 90° to the locking position. This restores the dielectric coolant flow path to the computer system.

13. Power on the HEU at the wall breaker.

14. Manually close each liquid-line solenoid valve by turning the valve stem counterclockwise.

15. Press the Cooling Bypass switch on the WACS panel for 10–20 seconds. This starts the pump, which rebuilds refrigerant pressure in the HEU and recirculates dielectric coolant into the evaporator.

16. Use the halogen detector to check for leaks in the refrigeration line. Repair any leaks before proceeding to the next step.

17. Use the halogen detector to check for leaks in the dielectric-coolant lines. Repair any leaks before proceeding to the next step.

18. If there are no leaks, replace the HEU side service panels.

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

LIQUID-LEVEL INDICATOR REPLACEMENT

Summary Replace the liquid-level indicator if it is defective.

Time Approximately 1.0 Hour

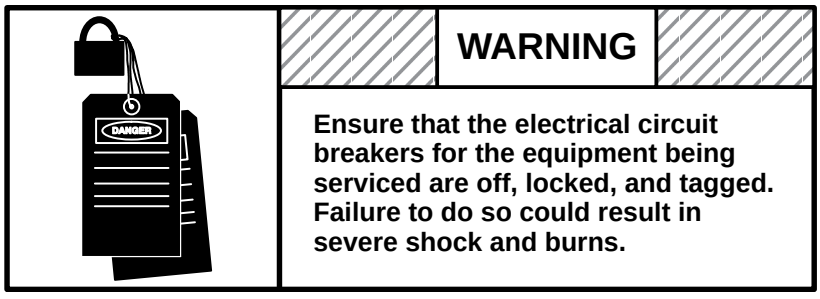
Tools

- Clean pail (gallon capacity or more)
- Hex (allen) wrench
- Panel removal tool
- Dielectric-coolant pump
- Large adjustable wrench
- Container of dielectric coolant (FX-74)
- Phillips and flat-blade screwdrivers
- RTV silicone

Procedure

Removing a Liquid-level Indicator

1. Power off the module cabinet and let the RCU pump down.



2. Remove the HEU right side service panel.

3. Remove the protective cap from the filler port located at the top right corner of the storage reservoir tank.

4. Insert the inlet dielectric-coolant pump hose through the filler port into the storage reservoir tank.

5. Place the outlet dielectric-coolant pump hose in an empty dielectric-coolant container.

6. Turn on the dielectric-coolant pump and drain the level of dielectric coolant below the liquid-level float indicator.

7. Disconnect the electrical wiring within the electrical junction box and lower the junction box out of the way. Make sure you record the location of each wire removed inside the junction box.

8. Using the large adjustable wrench, unscrew the liquid-level indicator assembly from the storage reservoir tank. (The float and the coupling are one unit and come out at the same time.)

Installing a Liquid-level Indicator

1. Coat the threads of the replacement liquid-level indicator assembly with RTV silicone to prevent the assembly from leaking.

2. Attach the liquid-level indicator assembly to the storage reservoir tank and tighten it carefully.

   NOTE: Over-tightening the indicator may cause the reservoir to crack.

3. Connect the electrical sensor wires of the replacement liquid-line indicator assembly to the wires inside the electrical junction box. Replace the wires in the locations recorded during removal of the liquid-level indicator.

4. Attach the dielectric-coolant pump outlet hose to the filler port of the storage reservoir tank.

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

6. Turn on the dielectric-coolant pump and replenish the dielectric coolant. (If more dielectric coolant is needed, repeat Steps 4 and 5 using a new container of dielectric coolant.)

7. Replace the protective cap on the filler port of the storage reservoir tank.

8. Restore power to the computer system and check for leaks around the liquid-line indicator fitting.

9. After ensuring that there are no leaks, replace the right side panel of the HEU enclosure.

DIELECTRIC-COOLANT LEAK DETECTION

Summary

If dielectric coolant is lost at greater than 1 quart per month, you must identify and repair the component causing the leak. Perform this procedure with the system powered up.

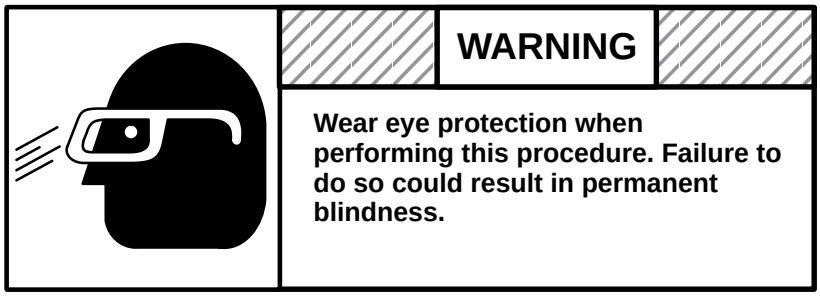
You may repair leaks using a variety of methods, depending on the leak rate and pressure. For most leaking components, replace either the component or a seal. You can eliminate other leaks by tightening a loose connection. Refer to the appropriate repair procedure after you identify the leaking component.

Time

Approximately 1.0 Hour

Tools

- Halogen leak detector
- Protective eye wear



Procedure

1. Check the couplings to the following manifolds in the module cabinet:

    - Inlet module manifold
    - Outlet module manifold
    - Inlet power supply manifold
    - Outlet power supply manifold

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

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

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

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

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

    - Entire HEU cabinet, 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 enclosing the HEU pump power leads. Scan the conduit from the point it connects to the HEU pump back to its origin.