LC System Single-cabinet Installation

HMM-171-A
CRAY T3E™ Series Systems
Last Modified: May 1997

Figures

Tables

Record of Revision

January 1997

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Revision A. Modifies Table 9 and adds Table 10 to clarify HEU and mainframe power, coolant, water, and WACS checks.

LC Installation Overview

This document provides the installation procedures for a CRAY T3E liquid-cooled (LC) cabinet and heat exchanger unit (HEU). This document is written for Cray Research installation personnel; it describes the installation procedures and lists tools necessary to complete the computer system installation.

This document provides installation procedures for a single-cabinet system. Troubleshooting procedures are not within the scope of this document.

The installation process consists of two phases:

- Mechanical installation with power checks
- Cabinet test and check-out

Mechanical Installation

The mechanical installation procedures are intended to assist Cray Research personnel with the installation of a CRAY T3E LC cabinet and heat exchanger unit (HEU). The mechanical installation includes all activities from unloading the equipment to performing quality assurance procedures in preparation for customer acceptance. **Perform the procedures in the order that they are presented whenever possible.**

During the mechanical installation phase, installation personnel ensure that the cabinet power and cooling operate correctly and that the system workstation (SWS) is fully operational.

Installation personnel should have a basic knowledge of computer system power processes. They should also have a basic understanding of the control system and the layout of the various cabinet components.

Electrical Check-out

Electrical check-out consists of off line tests of the computer equipment; perform the electrical check-out after completing the mechanical installation phase.

Safety Information

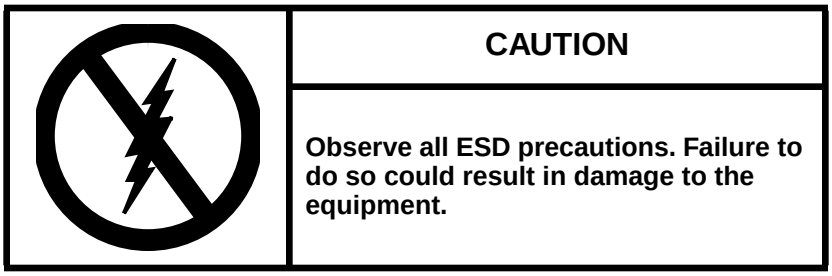
Hazard Statements

During the installation of the computer system, 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, may 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.

ESD Precautions

Observe electrostatic discharge (ESD) precautions during the entire installation process. Required apparel includes an ESD smock, ESD shoes, and an ESD wrist strap. *Safety and ESD Guidelines*, Cray Research publication number HGM-016-A, contains safety information that alerts maintenance and servicing personnel to, and protects them from, potential hazards. **Take the time to read these guidelines**.



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

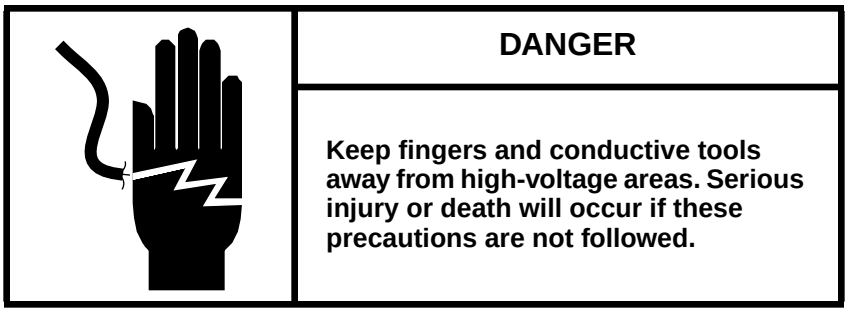
Wear a Cray Research-approved wrist strap when servicing or handling an ESD-sensitive device to eliminate possible ESD damage to equipment. Connect the wrist strap cord directly to earth ground.

Safety Measures

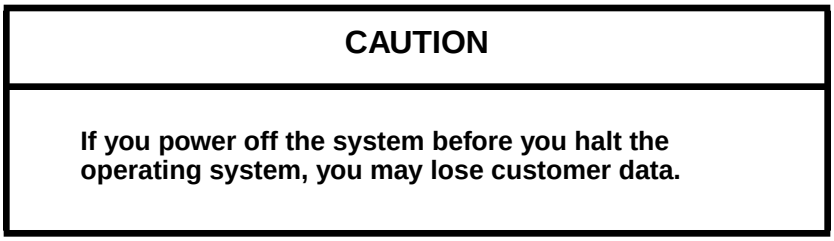
Observe the following safety measures when installing, repairing, or maintaining the system. You should also read these precautions as part of your preinstallation activities.

- Do not wear watches or jewelry when you work on a CRAY T3E system cabinet.

- Several procedures require two people to complete; do not perform the procedure alone.
- Keep fingers and conductive tools away from high-voltage areas and from high-current areas.



- Ensure that a qualified electrician has properly installed the power wiring.
- Set all circuit breakers to the OFF or OPEN position before you start the installation. Remove all tools from the system cabinets after you service them.
- Replace all covers and panels that you removed from the system during installation.
- Power off the system only after the system software has been shut down in an orderly manner.



Preinstallation Activities

Before your computer system arrives, perform the following preinstallation checks to ensure that your site is ready for the cabinet installation.

- Verify that the transit route to the computer room is clear of obstacles.
- Verify that the floor cutouts are complete, correct, and free of sharp edges and burrs.
- Verify that all electrical services meet site planning specifications.
- Verify that the air-conditioning equipment meets site planning specifications.
- Verify that the cooling water supply meets site planning specifications.
- Verify that any extra floor pedestals are correctly placed.

Tools Required

Installation of a CRAY T3E LC cabinet and HEU requires mainly common hand-held tools, which are supplied with the LC cabinet tool kit, P/N 15210200. These tools are available from Cray Research's Customer Service Logistics department or from any hand-tool vendor. Ensure that you have the following additional tools, which are necessary to complete the hardware installation:

- O-ring lubricant (use if available)
- Dielectric coolant pump with 5-ft supply and return hose
- 12-in. channel lock wrench or pipe wrench
- Phase checker
- Dielectric coolant leak detector

Mechanical Installation with Power Checks

The mechanical installation of an LC cabinet and cooling unit includes all activities from unloading the equipment to performing quality assurance procedures in preparation for customer acceptance. When possible, perform all procedures in the order in which Table 1 lists them.

For a list of the parts that ship with the LC cabinet, refer to the Equipment Shipping Notice (ESN).

Table 1. Mechanical Install Procedures

Procedure
Opening the “OPEN FIRST” box
Unloading the computer equipment
Applying protective floor plating
Transporting the system to the designated location
Positioning the LC cabinet and HEU
Removing the cabinet side panels
Removing the cabinet lift assembly
Connecting incoming power wiring to the LC cabinet
Positioning the phase interchange assembly plate
Connecting the customer’s remote alarm
Connecting incoming power wiring to the HEU
Connecting WACS cables to the HEU and the SWS
Connecting the dielectric-coolant piping
Connecting the water hoses
Filling the dielectric-coolant reservoir
Performing LC cabinet electrical checks
Performing HEU electrical checks
Powering up the LC cabinet and HEU
Verifying pressure-sensor operation
Adjusting the dielectric-coolant temperature
HEU ride-through test
Checking the system for leaks
Verifying system power and WACS data
Applying the HEU trim

Opening the "OPEN FIRST" Box

After you inspect the shipping crates and boxes for damage, open the box marked "OPEN FIRST." This box contains up-to-date versions of this document and associated installation documents. This box also includes the following documents that you will refer to during the installation:

- System configuration documentation
- System deviation documentation
- Cable list

To ensure that you have the most accurate information available, use the installation documents from the "OPEN FIRST" box to complete the installation.

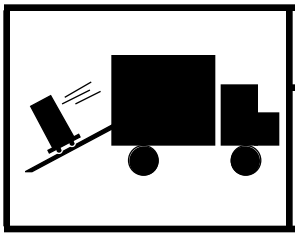
Unloading the Computer System Equipment

Complete:_____(Initials/Date)

Ideally, the transportation vehicle and the loading dock height should be the same. If the loading dock is higher than the vehicle, the vehicle must be blocked and cribbed in order to raise it up to the same level as the loading dock. A platform or ramp may be used to attain the desired level as long as the ramp does not exceed a ratio of 6 units horizontal to 1 unit vertical.

If the computer site does not have a loading dock, arrange for a forklift to remove the computer from the transportation vehicle.

Ensure that a sufficient number of installation personnel are available to help move the computer. Perform all movement of the computer slowly and carefully.



CAUTION

Prevent computer equipment from rolling off the transportation vehicle. Failure to do so could result in serious damage to the computer equipment.

Perform the following steps to unload the computer equipment from the transportation vehicle. Follow any instructions that may be printed on the packing crate.

1. Attach dual-wheeled ROL-A-LIFT assemblies to the computer equipment. Use steering handles for better control.

2. Unload the computer equipment from the transportation vehicle.

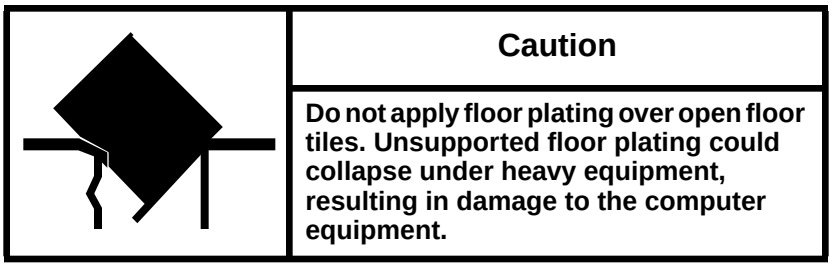
NOTE: If the system shipping or storage environment is significantly colder than the environment in which it will be installed (40 °F [4 °C] or greater disparity), leave the system cabinets in their shipping packaging for at least 24 hours at room temperature before you start the installation. This acclimation prevents damage to the equipment that could result from thermal shock and condensation.

Applying Protective Floor Plating

Complete:_____(Initials/Date)

Before you move the computer cabinet(s) into the computer room, you must place protective floor plating on the computer room floor. Place protective plating in the locations shown in Figure 1 and Figure 2.

Floor plating distributes the weight of the computer system equipment evenly over the floor and prevents damage to the floor tiles.



The positioning of the LC cabinet and HEU is critical for future installation procedures. Refer to Figure 1 and Figure 2 for placement of the equipment.

- Ensure that the distance from the LC cabinet frame to the floor plating on each end is 9 in. (23 cm), minimum. This gives clear access to the lift assemblies.

- Ensure that the distance from the LC cabinet frame to the floor stringers on each side of the cabinet is 20 in. (51 cm), based on a 2 ft x 2 ft floor tile.

- Ensure that the distance from the HEU frame to the floor stringer on each side is 6 in. (15 cm).

Figure 1. Positions for the LC Cabinet and Floor Plating

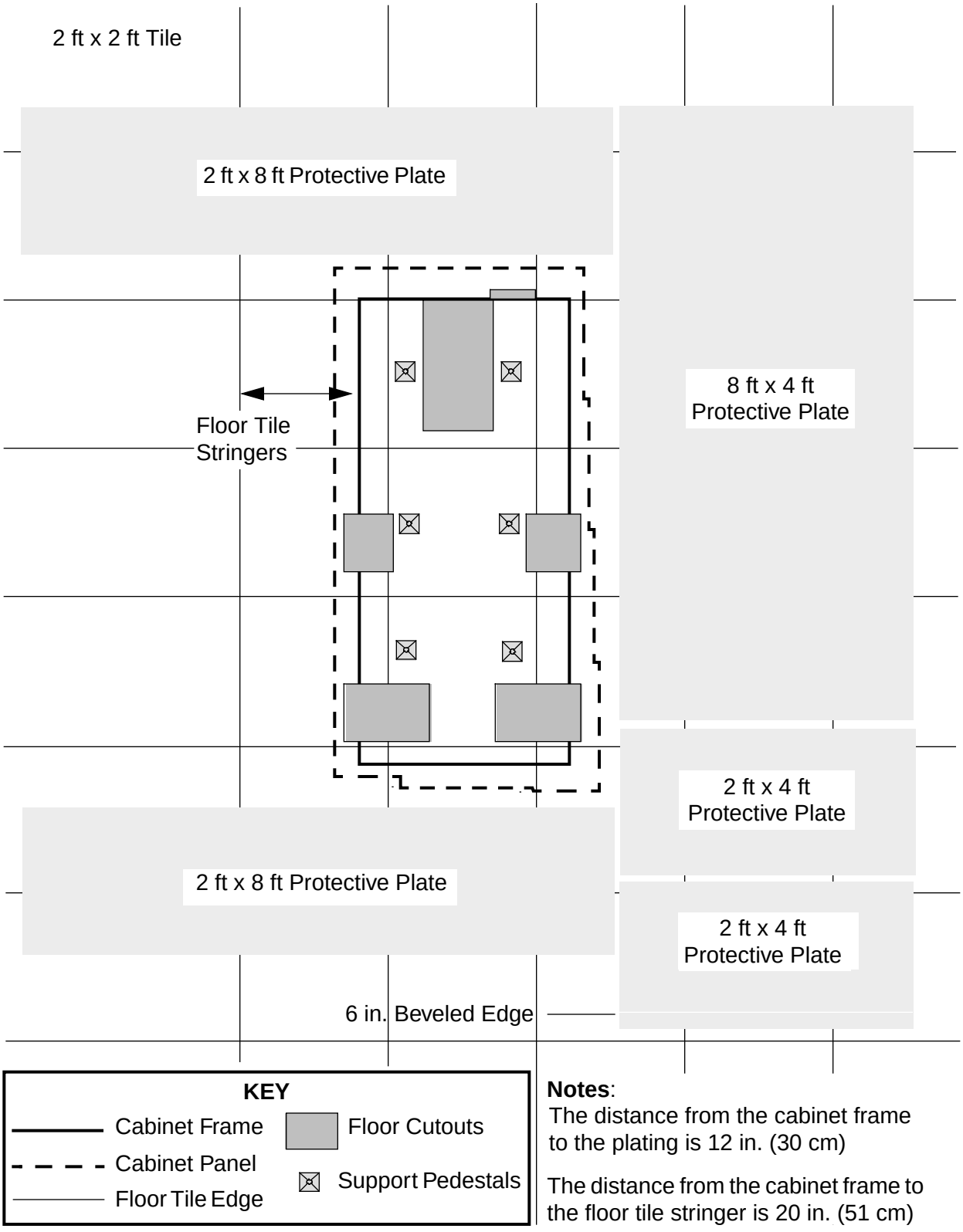
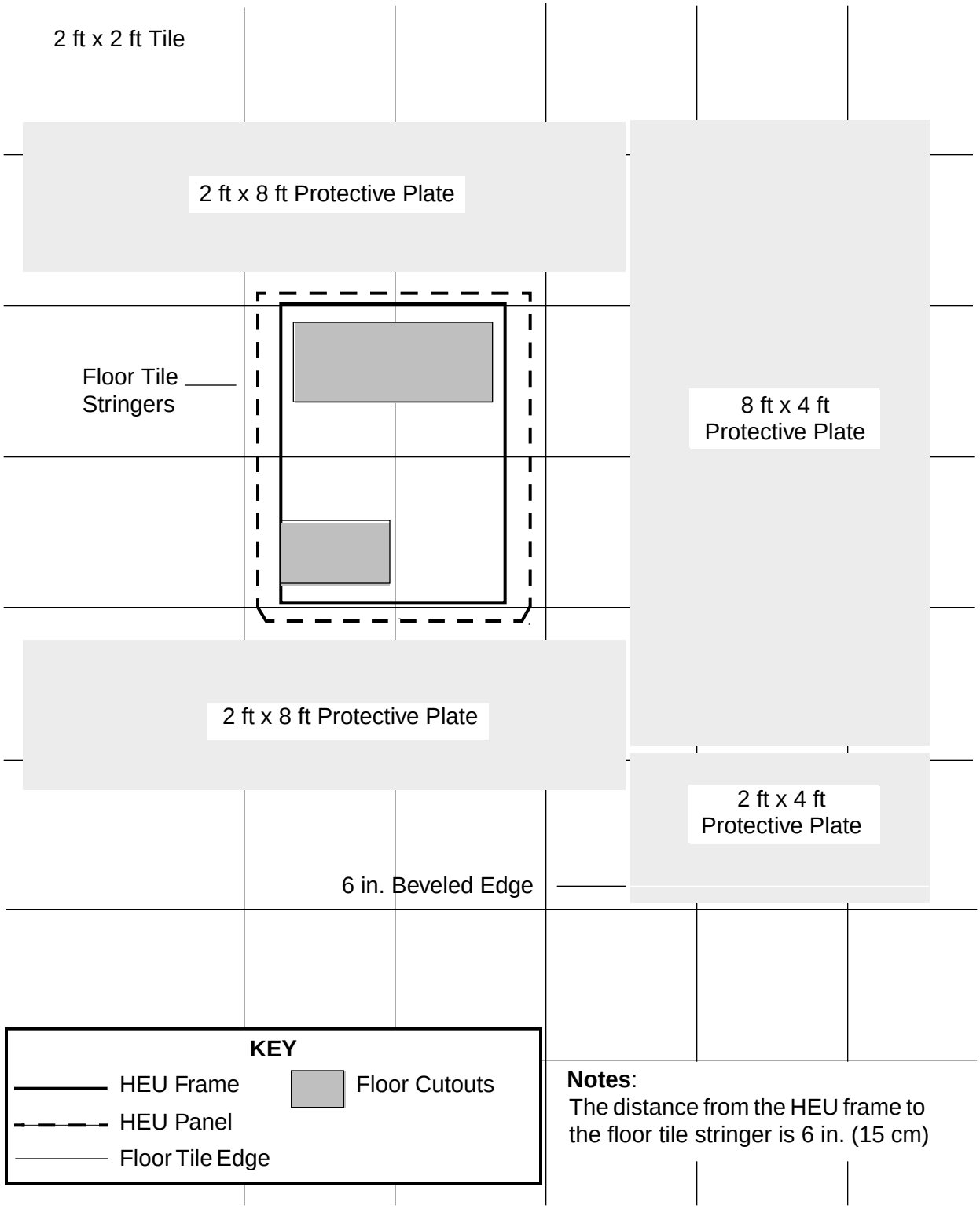


Figure 2. Positions for the HEU and Floor Plating



Transporting the System to the Designated Location

Before transporting your computer system, check the following items to ensure that your site is ready for the cabinet installation.

- Verify that the transit route to the computer room is clear of obstacles.
- Verify that the floor cutouts are complete, correct, and free of sharp edges and burrs.

Cray Research recommends that you leave each system cabinet in its shipping configuration until it reaches its final location. If the cabinet does not fit through the planned access route, you may need to partially disassemble the crate.

The entire route to the computer room should meet the following cabinet requirements:

- Floor loading: maximum weight per cabinet is 4,500 lbs (2,041 kg)
- Rolling cabinet height: 79 in. (2,007 mm)
- Cabinet width with lift assemblies: 48 in. (1,219 mm)
- Overall length: 122.5 in. (3112 mm)
- Maximum incline: 10 degrees (height: length = 1:6)

Refer to the appropriate installation documents for details on other equipment.

Positioning the LC Cabinet and the HEU

Complete:_____(Initials/Date)

Perform the following steps to position the module cabinet and cooling unit.

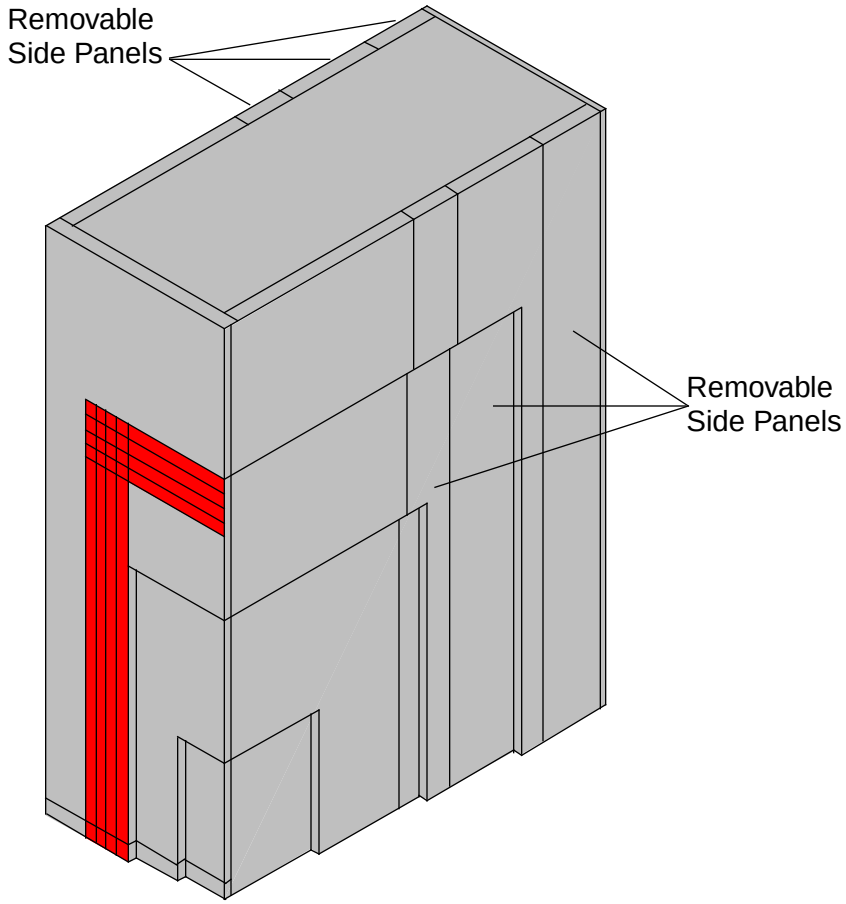
1. Ensure that the floor cutouts for the LC cabinet and cooling unit are the correct size and are free of burrs. Correct any deficiencies in the floor cutouts before positioning the LC cabinet and cooling unit.
2. Ensure that additional floor support pedestals are correctly positioned (refer to Figure 2 for the support pedestal locations). Additional floor pedestals reinforce the computer room floor panels beneath the computer system.
3. Determine where the ground straps for the LC cabinet (normally at the module end) and cooling unit will be attached to the raised-floor signal ground reference system.
4. Move the LC cabinet into the computer room, ensuring that the wheels of the hydraulic lifts remain on the floor plating until you lower the LC cabinet into position.
5. Move the LC cabinet into position over the floor cutouts.
6. Lower the LC cabinet close to the floor surface.
7. Properly align the LC cabinet with the floor tiles as shown in Figure 2.
8. Lower the LC cabinet into place, and again verify LC cabinet alignment with the floor tiles to an accuracy of 1/4 in. (0.6 cm).
9. Remove the shipping container material from the outside of the LC cabinet and dispose of it at the site.
10. Repeat steps 4 through 9 for the HEU.

Removing the Cabinet Side Panels

Complete_____(Initials/Date)

To access the GigaRing™ connectors, ground strap connections, and lift assembly bolts, remove the three side panels on each side of the LC cabinet.

Figure 3. LC Cabinet Side Panels



1. The bottom of each side panel is held in place by magnetic fasteners. Pull the bottom of the panel away from the frame.
2. Lift the panel straight up.
3. Place the panel away from the cabinet where it will not be damaged.
4. Replace the side panels after you complete the installation.

Removing the Cabinet Lift Assembly

Complete:_____(Initials/Date)

After placing the LC cabinet into position, remove the cabinet lift assemblies.

1. Using a 6-mm allen wrench with extension, remove the 8 bolts that secure the lift to the cabinet base plate at the power box end.

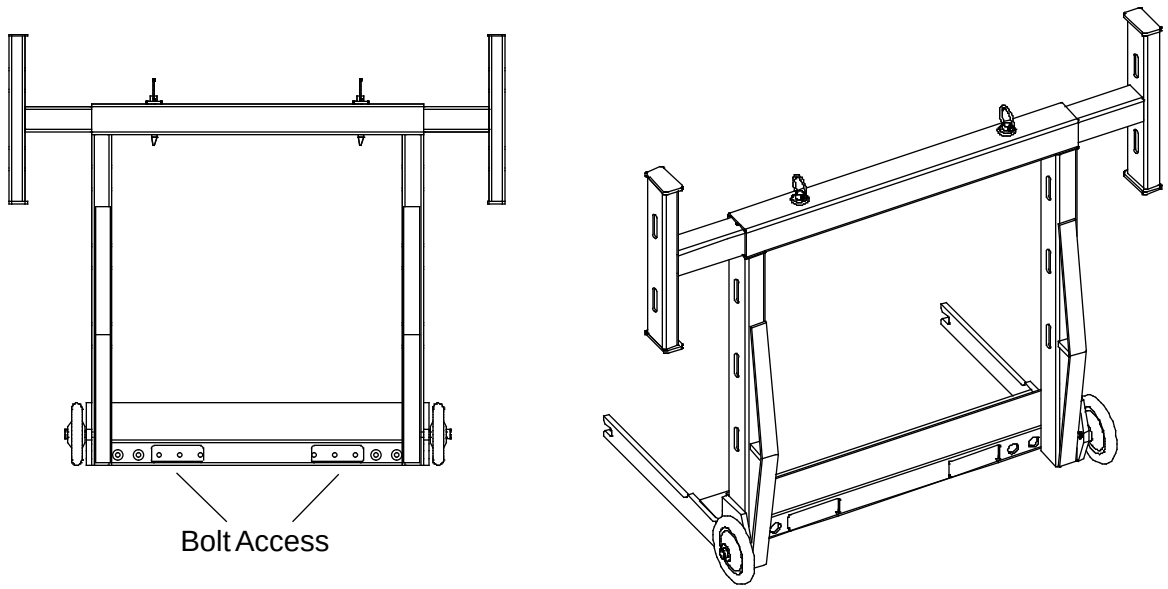
2. Using a 6-mm allen wrench with extension, remove the 10 bolts that secure the lift to the cabinet base plate at the module end.

3. Using a 14-mm allen wrench, remove the bolts that hold the lift to each side of the cabinet. Access to the side-bolts at the power box end is behind the side doors.

4. Save all bolts, washers, lock washers, etc. in a plastic bag; tape the plastic bag to the lift.

5. Return the lift assemblies to Chippewa Falls, WI.

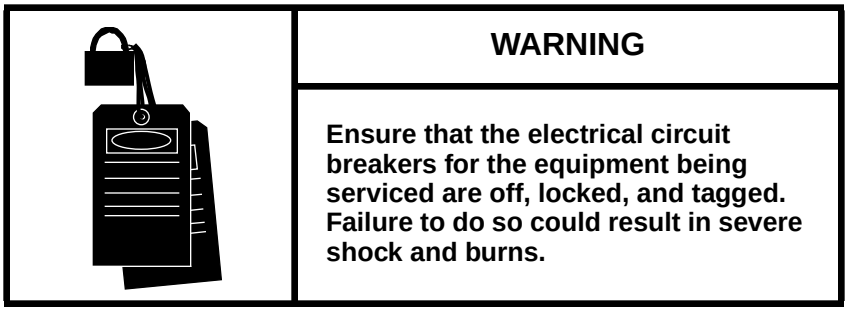
Figure 4. Cabinet Lift Assembly



Connecting Incoming Power Wiring to the LC Cabinet

Complete:_____(Initials/Date)

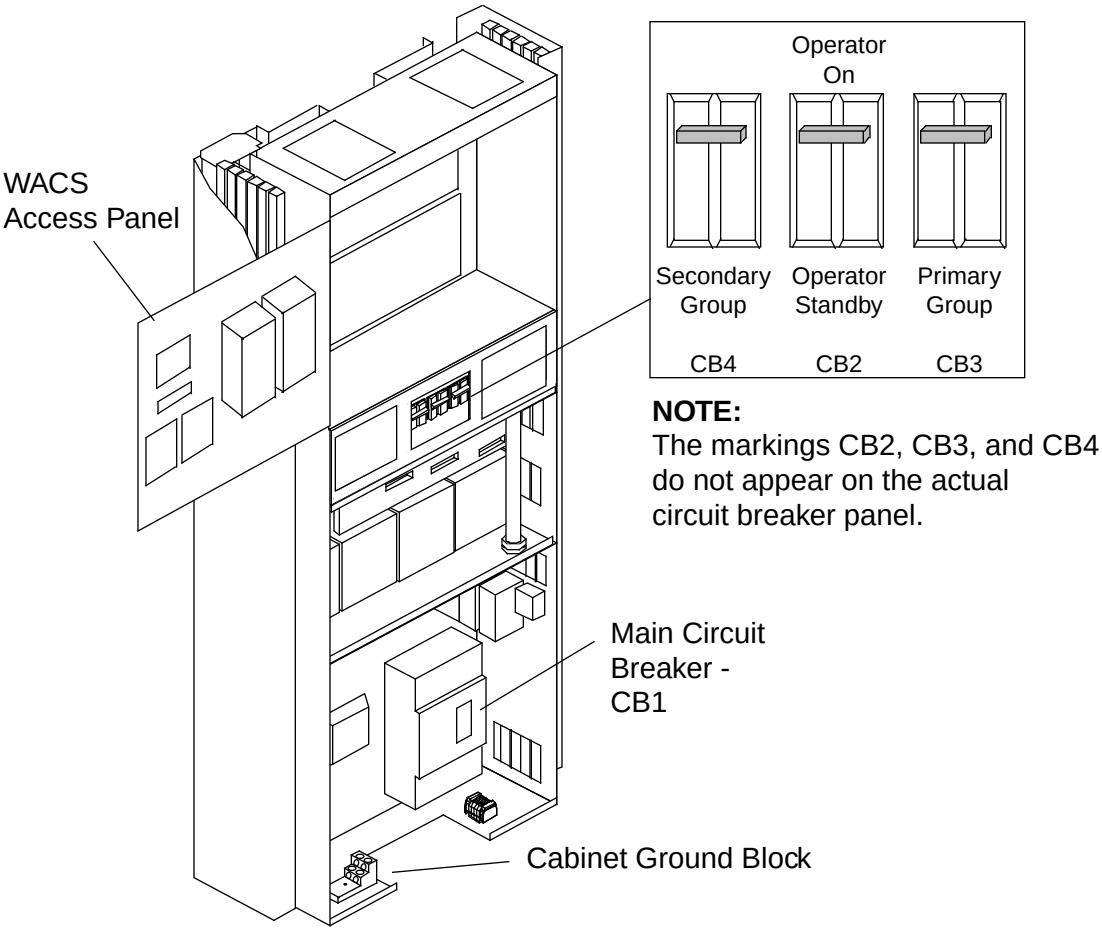
Ensure that the circuit breakers for the LC cabinet on the customer's power panel(s), are open and appropriate lockout/tagout procedures are in place.



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 5. Power Distribution Box



Wiring Incoming Power:

NOTE: The following steps may be performed by the customer's certified electrician.

1. Open the front door of the LC cabinet.

NOTE: The access panel to the power box will be removed for the next several procedures. Proceed with caution because power will be applied in stages while this panel is off.

2. Loosen the 1/4 turn fasteners that hold the lower panel box access plate in place and remove it from the power distribution box.

3. Remove the 3 Phillips screws that hold the inlet side cover on the main circuit breaker; remove the cover.

4. Using an 8-mm allen wrench, connect the input wiring to the inlet side of the circuit breaker.

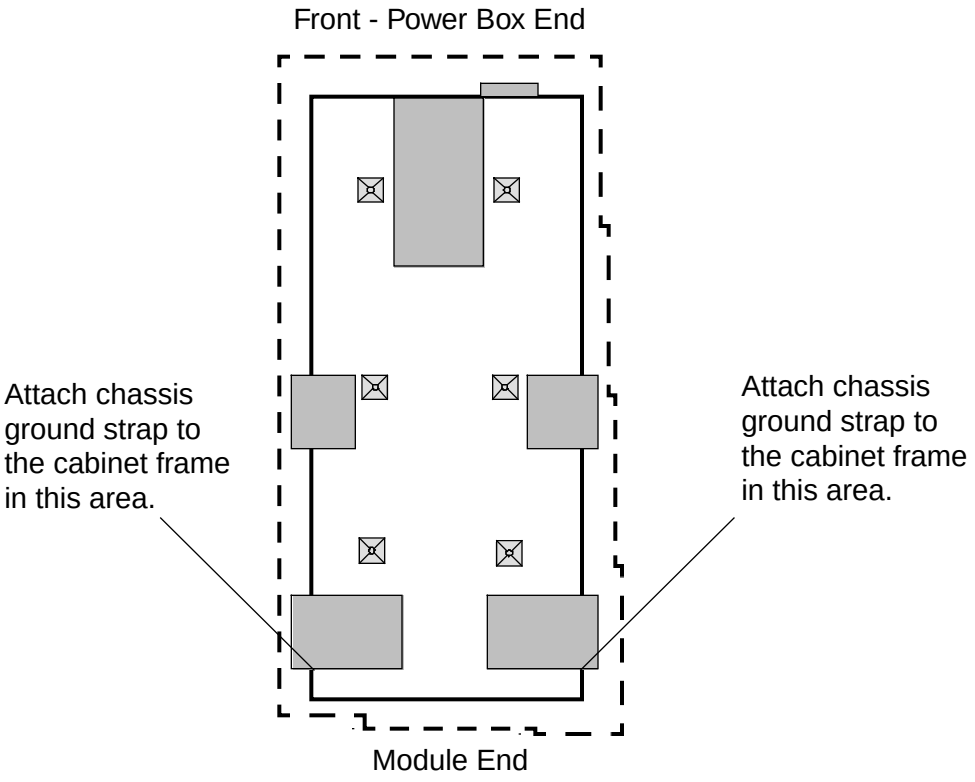
    a. Connect the wiring left-to-right: Neutral (if used), Phase A, Phase B, and Phase C.

    b. Attach the power ground wire to the cabinet ground block.

Grounding the Chassis:

Attach the cabinet ground straps to the Y and Z sides of the cabinet frame and to the raised-floor signal ground reference system according to Cray Research grounding specifications.

Figure 6. LC Cabinet Ground



NOTE: If you need information about system grounding, refer to *Equipment Grounding for Cray Computer Systems*, Site Engineering document number 10658002.

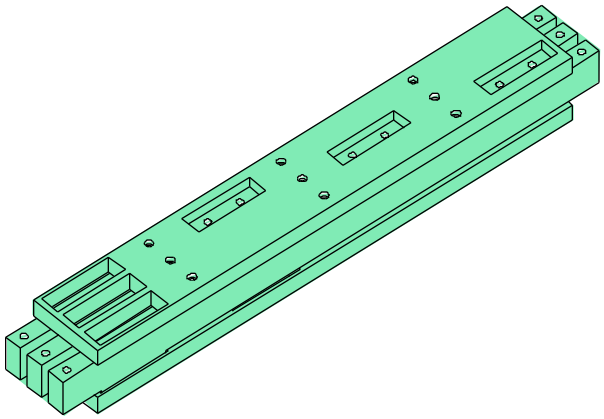
NOTE: Do not reinstall the power box access panel until the initial electrical checks are complete.

Positioning the Phase Interchange Assembly Plate

Complete:_____(Initials/Date)

In this procedure you position the phase interchange assembly plate (PIAP) for either delta (3 phases and ground) or wye (3 phases, neutral, and ground) mode of operation. Figure 7 shows the PIAP.

Figure 7. Phase Interchange Assembly Plate



The LC cabinet ships with the PIAP installed in the correct position. Use the following procedure to change the PIAP if necessary.

Figure 8 and Figure 9 show the PIAP in both the delta and wye configuration.

Removing the PIAP:

1. Ensure that all breakers are open, including the customer's power panel breakers, and all lockout/tagout procedures are in place.

2. Remove the six M6 50-mm hex-drive bolts that secure the PIAP to the power rails (three on each end).

   NOTE: The position of the ring-terminal power lead is important. When you reinstall the PIAP, connect the ring-terminal to the same power bus.

3. Remove the six M6 60-mm hex-drive bolts that connect phases A, B, and C (delta mode) or the neutral line (wye mode) to the power rails.

4. Remove the PIAP and reposition it so the label Y-INPUT faces front for wye mode or the DELTA-INPUT label faces front for delta mode.

Installing the PIAP:

1. Reposition the PIAP and secure it to the outside power rails with the six M6 50-mm hex-drive bolts that you removed earlier.

2. Use the remaining six M6 60-mm hex-drive bolts to secure the PIAP to the power buses. Figure 8 shows the neutral connections for wye mode and Figure 9 shows the phase connections for delta mode.

3. Make sure that all bolts are attached securely.

Figure 8. PIAP: Wye-mode Configuration

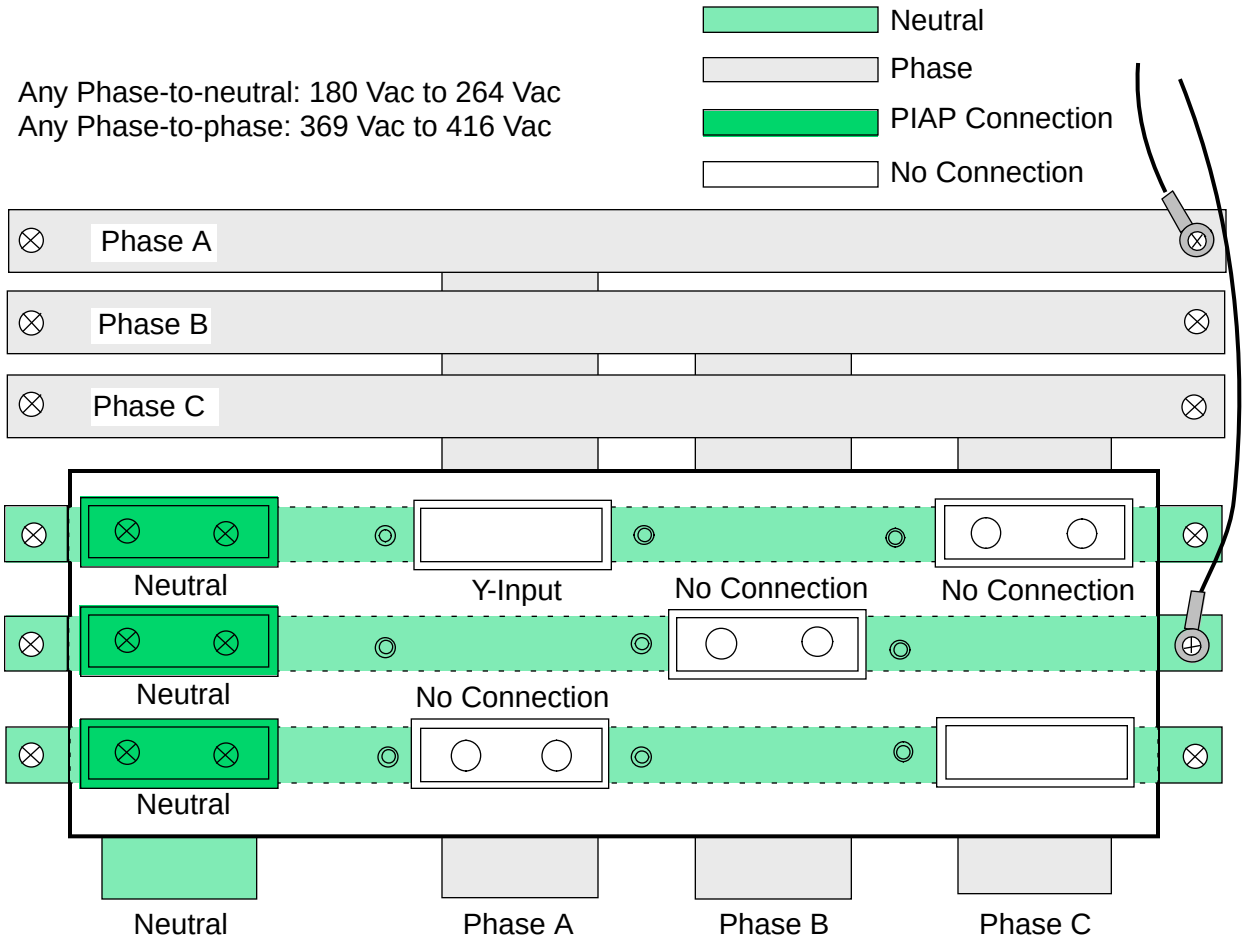
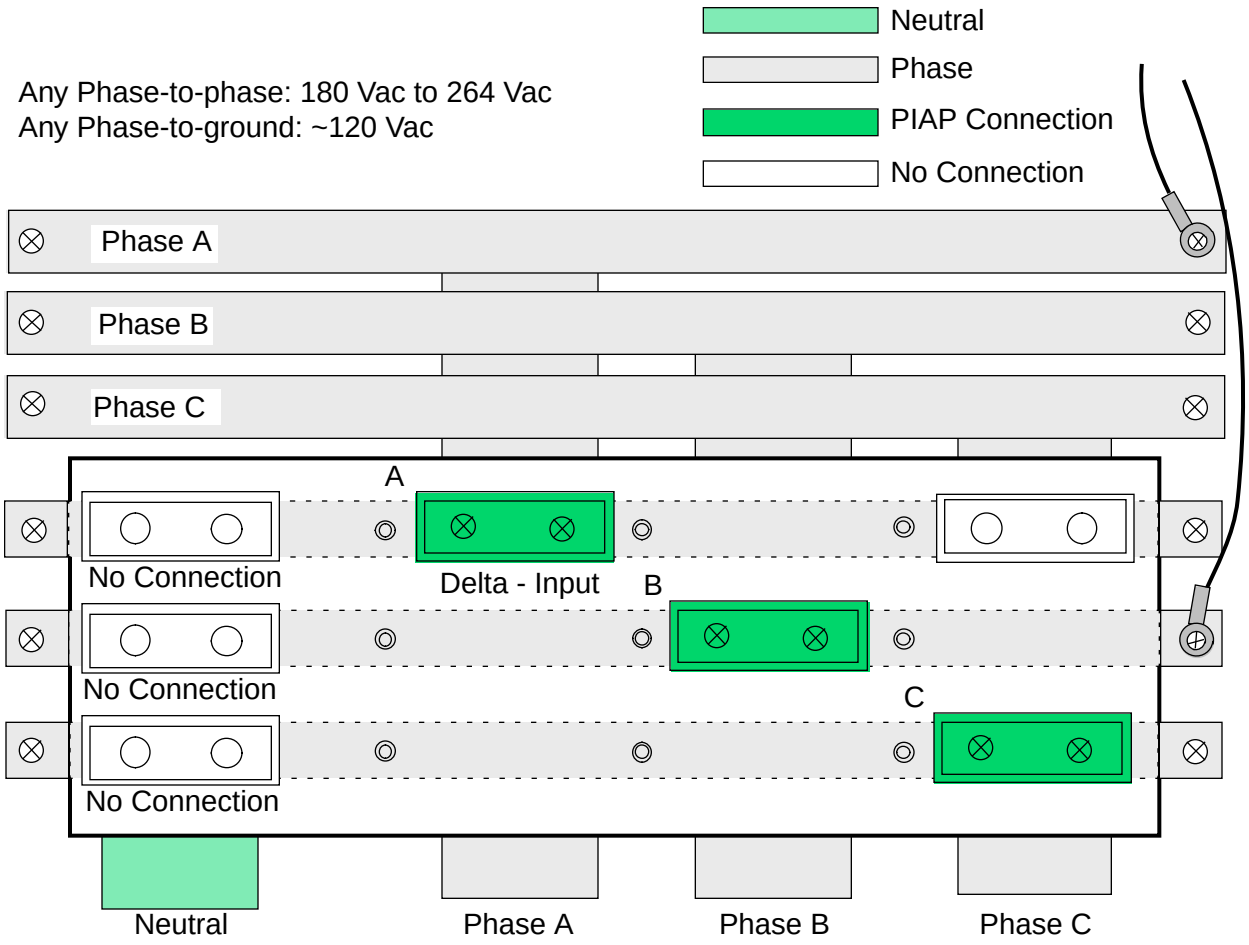


Figure 9. PIAP: Delta-mode Configuration



Connecting the Customer's Remote Alarm

Complete:_____(Initials/Date)

This procedure is required if a remote alarm system will be wired into the CRAY T3E WACS system.

1. Ensure that circuit breakers CB1, CB2, CB3, and CB4 are open.
2. Locate TB1 (remote terminal block) in the lower right corner of the power distribution box.
3. Connect the remote alarm system as necessary:

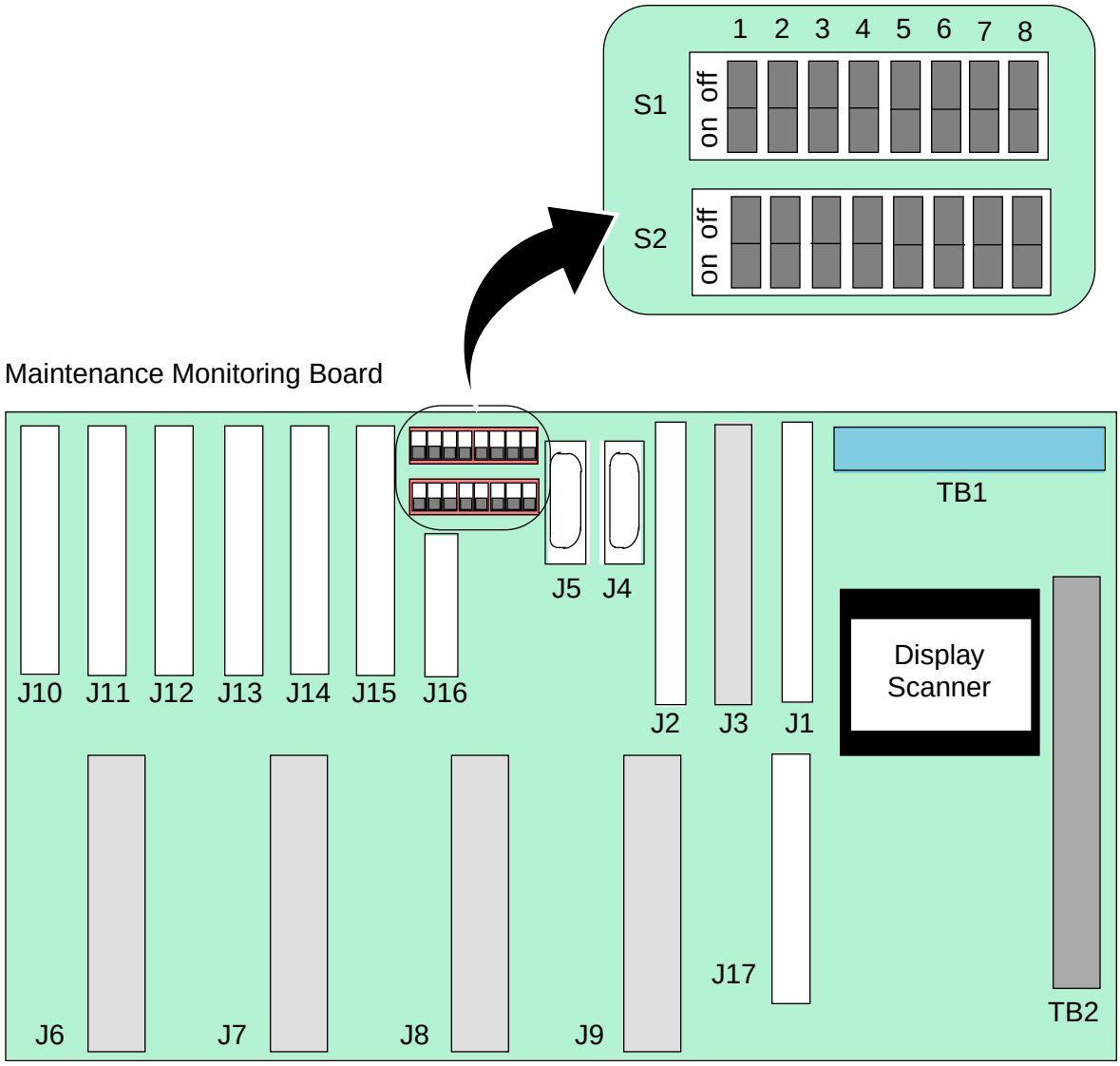
   - Connector 1 - common
   - Connector 2 - normally closed
   - Connector 3 - normally open
   - Connector 4 - ground

4. Set the DIP switches on switch S1 (refer to Figure 10) of the maintenance monitoring system (MMS) board for remote alarm:

   - S3 - Remote horn, sound on alarm
   - S4 - Remote polarity contacts for remote alarm

     On for normally closed (NC)
     Off for normally open (NO)

Figure 10. WACS MMS Board

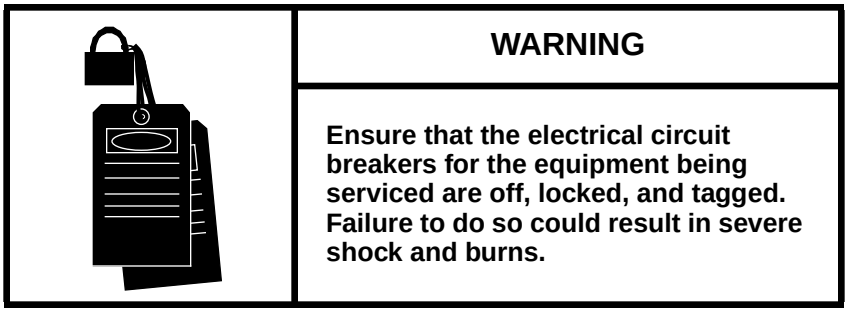


Connecting Incoming Power Wiring to the HEU

Complete:_____(Initials/Date).

Ensure that the circuit breakers on the customer's power panel(s), for the HEU, are open and appropriate lockout/tagout procedures are in place.

NOTE: This procedure may be performed by the customer's certified electrician.



1. Remove the front cover of the HEU power box.
2. Route the inlet wiring through the cutouts in the floor and HEU cabinet into the control box.
3. Attach the inlet power wires to the contactor.

NOTE: Correct phasing is important for the operation of the pump. Ensure that you install the wiring left to right in the contactor: phase A, phase B, and phase C.

4. Attach the HEU cabinet ground strap to the ground block and to the raised-floor signal ground reference system according to Cray Research grounding specifications.

NOTE: If you need information about system grounding, refer to *Equipment Grounding for Cray Computer Systems*, Site Engineering document number 10658002.

Connecting the WACS Cables for the HEU and the SWS

Complete:_____(Initials/Date)

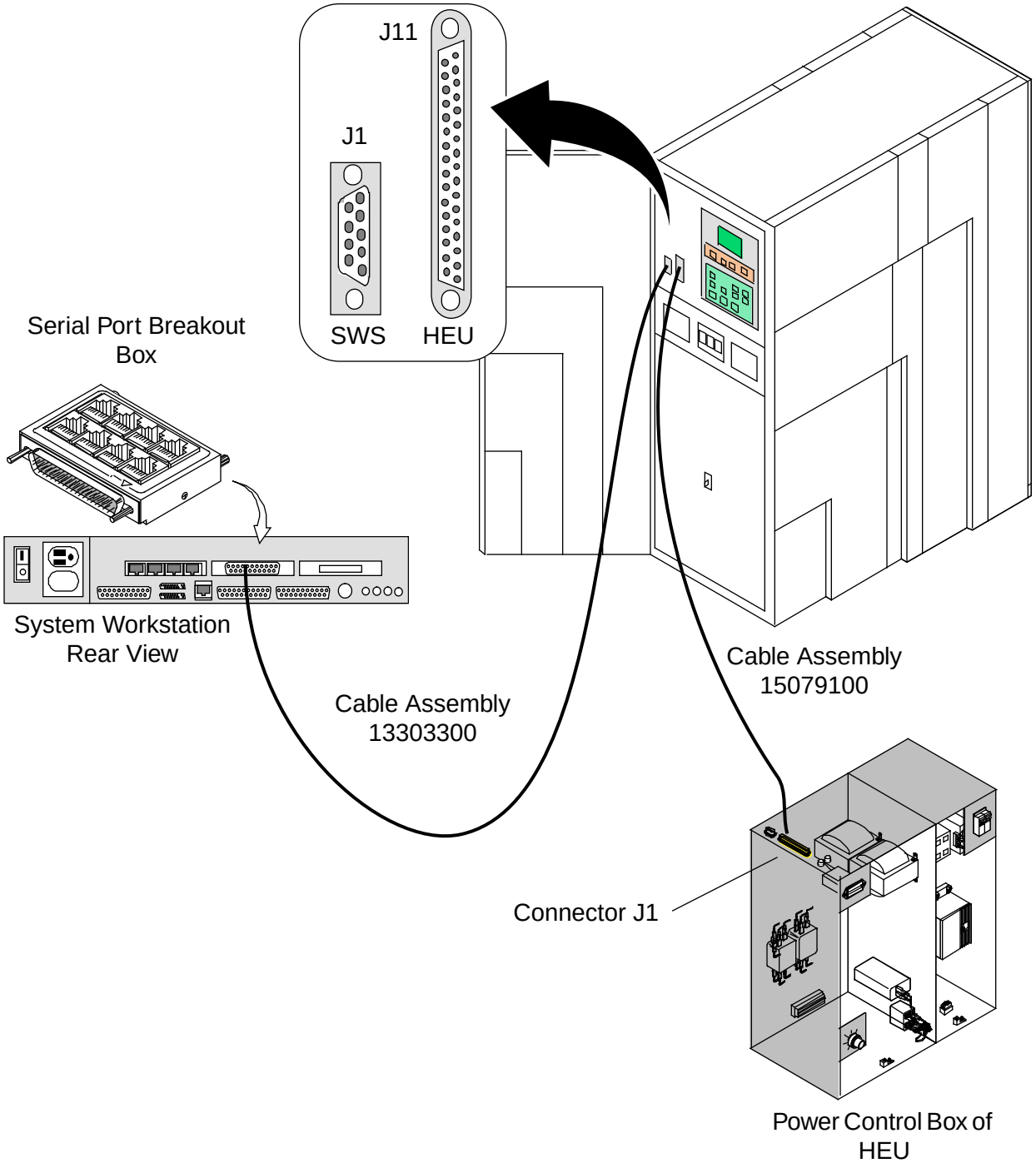
WACS information from the HEU and the LC cabinet is reported to the system workstation; refer to Figure 11.

1. Using cable P/N 15079100, connect one end to connector J11 on the WACS access panel of the LC cabinet.
2. Route the cable under the floor to the HEU.
3. Connect the other end of the cable to connector J1 on the power control box of the HEU.

NOTE: For two-cabinet installations, each LC cabinet requires a cable from the LC cabinet to the HEU. A special Y-adapter connector board in the HEU accommodates the two cables.

4. Using cable P/N 13303300, connect one end to the 9-pin connector J1 on the WACS access panel.
5. Route the cable under the floor to the system workstation.
6. Connect the RJ45 connector on the other end of the cable to the serial SBus multiport card at the rear of the system workstation.

Figure 11. WACS Cable Connections



Connecting the Dielectric-coolant Piping

Complete:_____(Initials/Date)

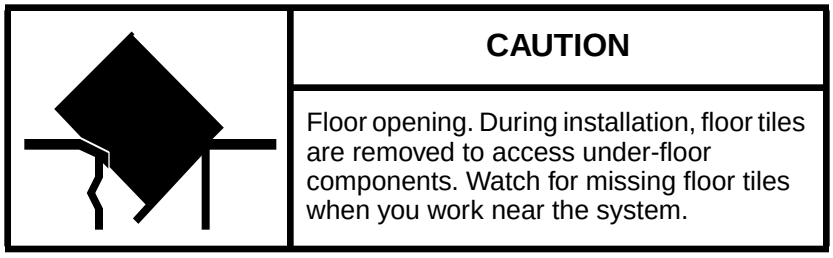
All coolant piping consists of two pipe kits: one for the LC cabinet and one for the HEU. This procedure includes an exploded diagram of the supply and return lines for both kits. Table 2 and Table 3 list the parts for both the inlet and outlet cabinet piping.

Before you assemble each piece, check the condition of all O-rings and gaskets. Replace any O-ring or gasket that is damaged.

All piping pieces are held together with clamps. Position a gasket between pieces and secure the two pieces with a clamp. Use the clamp-handle socket to tighten each clamp.

When you work with valves, position the valve so that the handle is in-line when the valve is open and cross-line when the valve is closed.

NOTE: Some piping pieces may already be connected when they arrive at your site. Any end caps that you remove during the procedure stay on site.



Connecting the Cabinet piping:

1. Remove as many floor tiles as necessary to access the underside of the LC cabinet and the HEU.
2. Place the O-rings onto the ferrules and apply a small amount of O-ring lubricant, if it is available.
3. Screw the inlet ferrules (item #5 in Table 2) into the bottom of the two supply manifolds. Do not overtighten them.
4. Assemble the inlet pipe kit as shown in Figure 12.
5. Attach the inlet piping to the inlet ferrules.

6. Screw the outlet ferrules (item #14 in Table 3) into the bottom of the two return manifolds. Do not overtighten.

7. Assemble the outlet pipe kit as shown in Figure 12.

8. Attach the outlet piping to the outlet ferrules.

9. Position the coolant piping as shown in Figure 14 to complete the pipe runs to the HEU. As shown, coolant piping runs are positioned to exit either the front or rear of the cabinet, based on the placement of the HEU.

10. Visually inspect the coolant piping for any possible problems.

Figure 12. Underfloor Coolant Piping - LC Cabinet

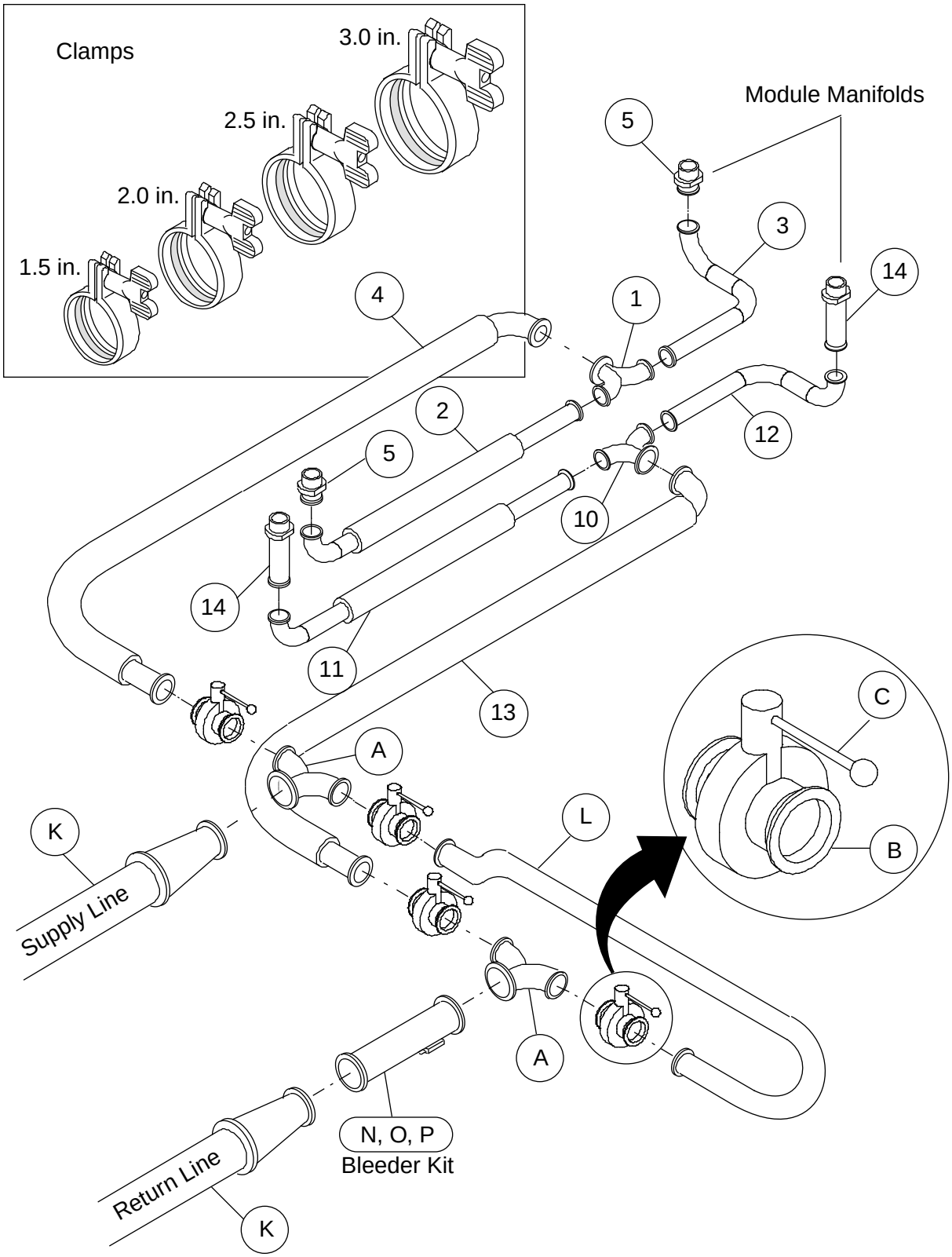


Table 2. Inlet Pipe Kit - LC Cabinet

Item	Part Number	Quantity	Description
1	15225900	1	Pipe assembly tee, 1.5 in.
2	15226300	1	Pipe assembly, flex
3	15226700	1	Pipe assembly, inlet
4	15226100	1	Hose assembly, flex
5	15226400	2	Adapter, Ferrule - short
6	01036700	1	Clamp, cast hinged 2 in.
7	01037200	1	Gasket, 2 in.
8	01036703	4	Clamp, cast hinged 1.5 in.
9	01037204	4	Gasket, 1.5 in.

Table 3. Outlet Pipe Kit - LC Cabinet

Item	Part Number	Quantity	Description
10	15225900	1	Pipe assembly tee, 1.5 in.
11	15226301	1	Pipe assembly, flex
12	15226600	1	Pipe assembly, outlet
13	15226100	1	Hose assembly, flex
14	15226700	2	Adapter, Ferrule - long
15	01036700	1	Clamp, cast hinged 2 in.
16	01037200	1	Gasket, 2 in.
17	01036703	4	Clamp, cast hinged 1.5 in.
18	01037204	4	Gasket, 1.5 in.

Connecting the HEU piping:

1. Remove as many floor tiles as necessary to access the underside of the LC cabinet and the HEU. Attach two butterfly valves (item B in Table 4) to the outside fittings of a T-pipe (item A in Table 4). Repeat for the second T-pipe and valves.

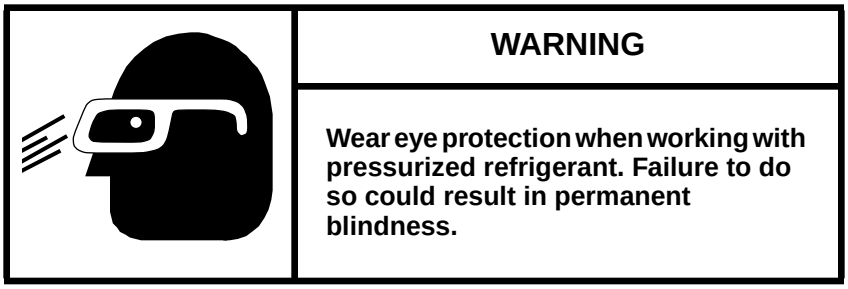
   NOTE: When you position the valve T-pipe assemblies, consider the rotation of the handle and the ease of access.

2. Attach one end of each valve/T-assembly to the outlet and inlet pipes from the LC cabinet; refer to Figure 12.

3. Attach the 6-ft loopback hose (item L in Figure 12) to the other end of each valve/T-assembly.

   NOTE: If you install a second LC cabinet, do not use the 6-ft loopback hose. The second cabinet attaches to the other end of the valve/T-assemblies.

4. Bleed off the dry nitrogen in the 15-ft coolant hoses by removing the safety cap and pushing in on the valve.



5. Remove the end caps from both of the 15-ft coolant hoses (item K).

6. Attach one of the 15-ft flex hoses (item K) to the center of the valve/T-assembly for the supply line to the LC cabinet.

7. Route the coolant hose to the HEU.

8. Assemble the return-line bleeder kit (items N, O, and P); refer to Figure 12.

9. Attach the kit to the center of the T-pipe for the coolant return line from the LC cabinet.

10. Attach the other 15-ft coolant hose to the bleeder kit.

11. Route the hose to the HEU.

12. Attach the two 90° coolant elbows, item M, to the pump and strainer in the HEU; refer to Figure 13.

13. Attach the coolant return hose to the elbow that you attached to the pump.

14. Attach the coolant supply hose to the elbow that you attached to the strainer.

15. Visually inspect the coolant piping for any possible problems.

Table 4. HEU Pipe Kit

Item	Part Number	Quantity	Description
HEU coolant parts			
A	15226000	2	Pipe assy, tee 2 in.x 3 in.
B	01037500	4	Valve, butterfly with seal 2 in,
C	01037400	4	Handle, butterfly valve, 2 in.
D	01036700	9	Clamp, cast hinged 2 in.
E	01036702	4	Clamp, cast hinged 2.5 in.
F	01036701	7	Clamp, cast hinged 3 in.
G	01037200	9	Casket, Viton 2 in.
H	01037202	4	Gasket, Viton 2.5 in.
I	01037201	11	Gasket, Viton 3 in.
J	01036800	2	Cap, end 2 in. (not used if the loopback hose is used)
K	12207402	2	Hose assy, flex 3.5 ID (15-ft coolant hoses)
L	15226100	1	Hose assy, flex (6-ft loopback hose)
M	13065201	2	Line, outlet Fluorinert 3 in. x 13.9 in. (90° elbow for inlet and outlet coolant hoses at the HEU)
Return line bleeder kit			
N	12937900	1	Adapter, fill/drain
O	01031400	1	Coupling, self sealing male
P	51928810	1	O'ring, 468IDX.078W
Water line kit			
Q	12207403	2	Hose assy, flex 3.5 ID 72 in. long (water hoses)
R	01017807	2	Insulator, closed cell 4.50 (insulation that covers the water hoses)
S	13195500	2	Joint, 90° reduced 3.0 x 2.0
T	01048102	4	Reducer, concentric GC 3 x 2.5 SST (may not be necessary)

Figure 13. HEU Coolant Piping

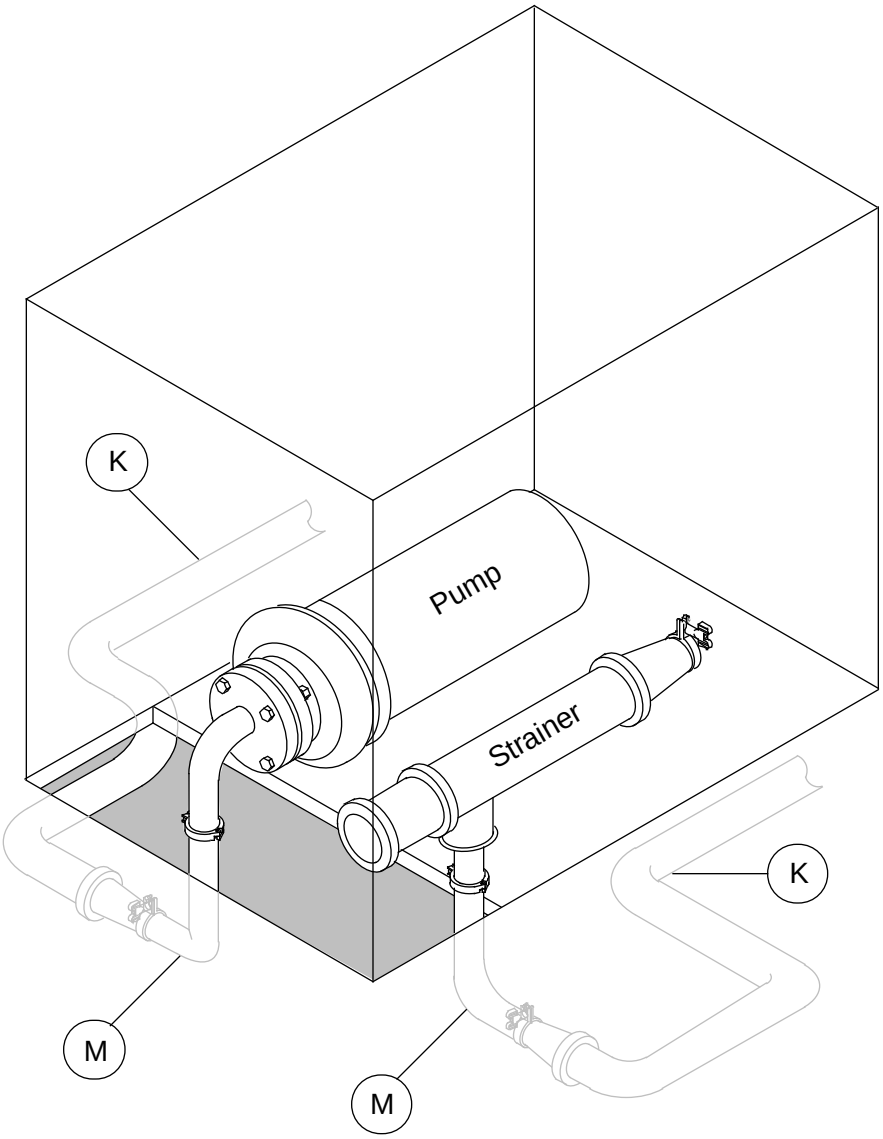
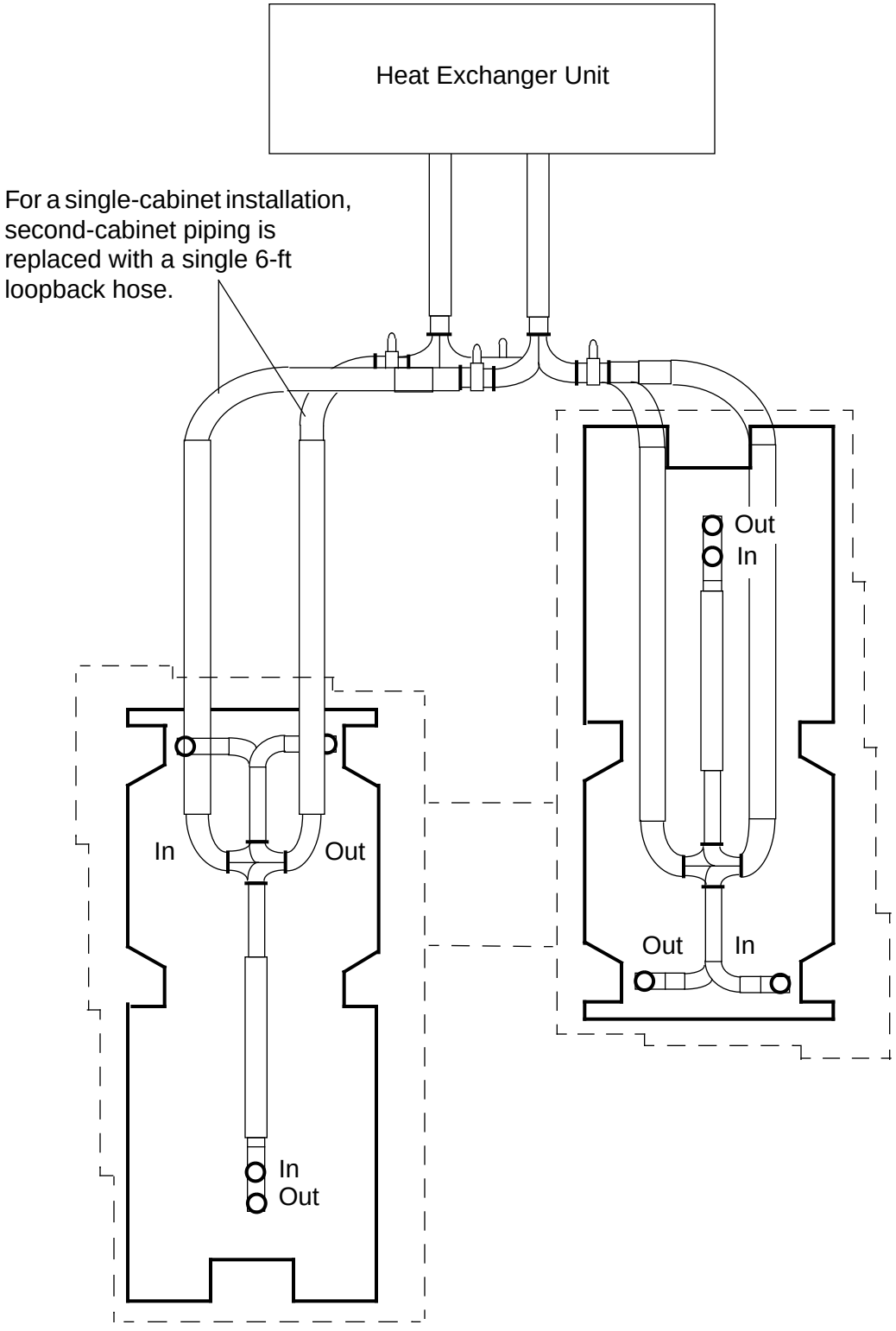


Figure 14. LC Cabinet Piping - Two Cabinets



Connecting the Water Hoses

Complete:_____(Initials/Date)

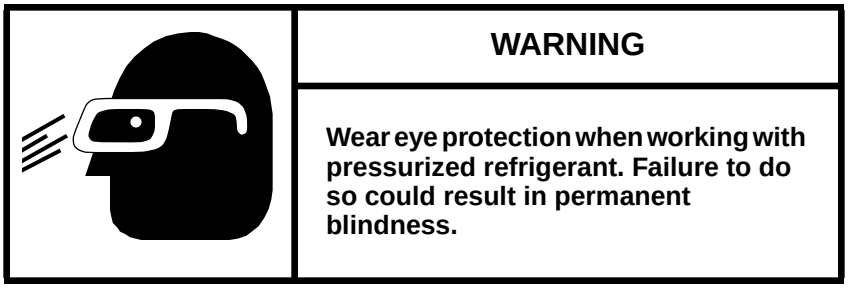
Two identical water hoses (item Q in Table 4) connect the customer's water source to the cooling unit: a supply hose and a return hose.

NOTE: When the HEU is deinstalled, power is removed while the water inlet valve is fully open. This allows the installers to circulate water through the HEU and bleed off excess air prior to normal operation.

Installing the Hoses:

1. Locate the building water supply and return connections under the raised floor. If the supply and return connections are not labeled, contact the site maintenance supervisor for assistance.

2. Bleed off the dry nitrogen in each water hose by removing the safety cap and pushing in on the valve.



3. Remove the end caps from both of the 6-ft coolant hoses, item Q.

4. Cover the water hoses with the insulator (item R in Table 4) if it is not already installed.

5. Ensure that the water-hose gaskets are pliable and properly seated when you connect the water hoses to the HEU and the customer's water lines.

6. Connect the two 90° elbow/reducers (item S) to the supply and return lines within the HEU, as shown in Figure 15.

7. Connect one end of the hose to the cooling unit water-return elbow, as shown in Figure 15.

8. Connect the other end of the water hose to the customer's water-return receptacle under the raised floor. Ensure that the hose is not kinked.

9. Connect one end of the second hose to the cooling unit water-supply elbow as shown in Figure 15.

10. Connect the other end of the water hose to the customer's water-supply receptacle under the raised floor. Ensure that the hose is not kinked.

Bleeding off Excess Air:

1. Remove the caps from the heat-exchanger Schraeder valves on the water lines. There is one valve on each supply- and return-water line.

2. Connect a drain hose to the Schraeder valve.

   NOTE: This procedure is easier if performed by two people.

3. Position a clean container under the drain hose to catch the air and water mixture.

4. Open the water supply valve on the customer's water line to allow water to circulate within the HEU.

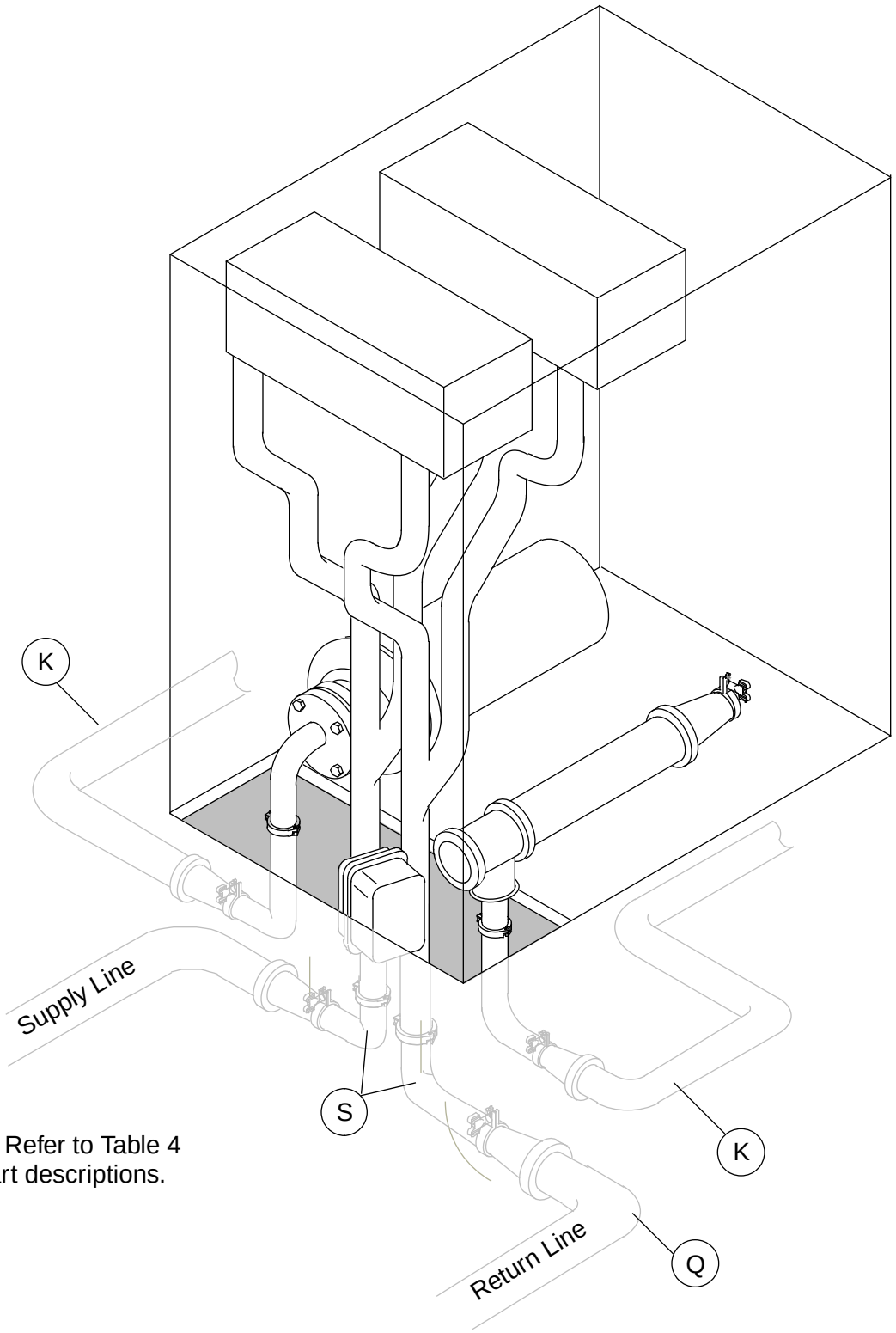
5. When a solid stream of water emits from the drain hose, open the customer's return-line water valve.

6. Repeat this process for all four Schraeder valves.

7. Remove the drain hoses and replace the Schraeder valve caps.

8. Check for any leaks; take corrective action.

Figure 15. Water Lines



Note: Refer to Table 4 for part descriptions.

Filling the Dielectric-coolant Reservoir

Complete:_____(Initials/Date)

The majority of dielectric coolant can be pumped into the HEU reservoir and LC cabinet before the system is powered on.

Filling the HEU and LC Cabinet:

1. Open all coolant valves on the HEU and under the floor.
2. Remove the filler cap from the reservoir.
3. Place the suction hose from the pump inside the dielectric-coolant barrel and the drain-hose end in the reservoir.
4. Turn on the coolant pump.

   NOTE: You can attach a coolant hose, found in the spares kit, to the upper most quick-disconnect (QD) fitting on any manifold to bleed excess air out of the manifolds as coolant enters. Failure to bleed off excess air may cause an air block within the manifolds. Be ready to disconnect if coolant flows from the hose.

5. Pump the coolant into the reservoir. Coolant flows from the HEU into the LC cabinet until both are equally full.

After Power-on Procedure:

NOTE: Perform this procedure after power has been applied to the LC cabinet and the HEU.

1. Turn on circuit breakers CB1 through CB4 at the LC cabinet.
2. Turn on circuit breaker CB1 at the HEU.
3. Press the COOLING BYPASS switch on the LC cabinet.
4. Each time you press the switch, the coolant level should drop. Keep the reservoir approximately half full of coolant during this procedure.
5. Continue filling the reservoir and LC cabinet by pressing the cooling bypass switch.

NOTE: You can easily check the coolant level in the LC cabinet by depressing the topmost quick-disconnect fitting on the module supply manifold. If you use the spare coolant hose as a bleed-off hose, be ready to disconnect as soon as coolant flows from the hose.

6. When the system is completely charged, leave the reservoir approximately two-thirds full and all floats in the liquid-level indicator are turned up.

Performing LC Cabinet Electrical Checks

The following electrical checks encompass incoming power, WACS DC power, and WACS reference power. Before you proceed, ***ensure that all cabinet and module power supply circuit breakers are turned off.***

Complete:_____(Initials/Date)

Checking Incoming Power:

1. Turn on the circuit breaker(s) at the customer's power panel.
2. Using a digital voltmeter, measure the input to the LC cabinet at circuit breaker CB1. Record your readings in Table 5. Take corrective action for any reading that is not within specifications.
3. Turn on circuit breaker CB1.
4. Measure voltage at the output of the phase interchange assembly plate. Any significant drop in voltage compared to the input at the circuit breaker indicates a problem with a line filter or with circuit breaker CB1. Take corrective action before proceeding with other install procedures. Record your readings in Table 5.

   NOTE: Specifically, measure the ring-terminal connections on the power buses. These connections are direct wired to the input of circuit breaker CB2. The correct reading for delta mode is ~208 Vac between phases. The correct reading for wye mode is ~208 Vac between a phase and neutral.

5. Turn off circuit breaker CB1.

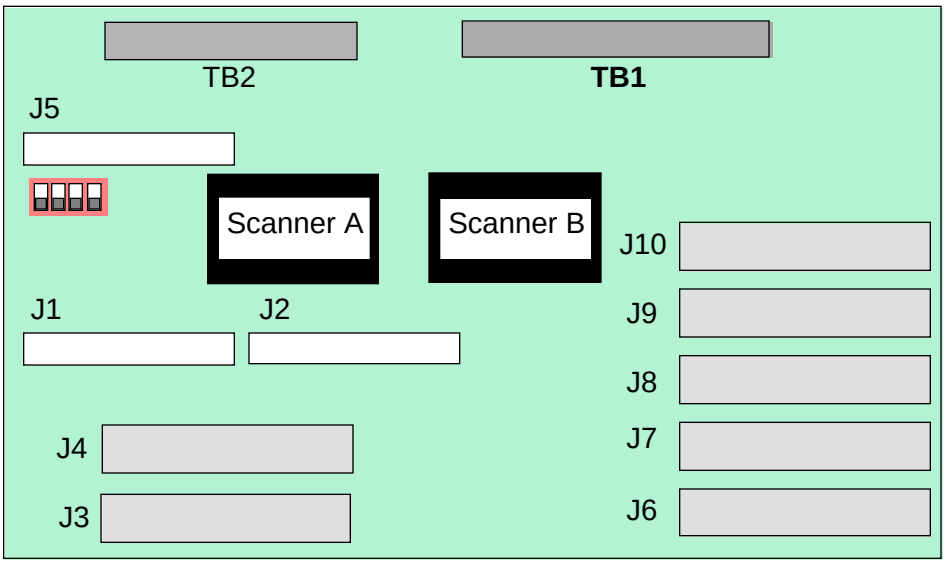
Verifying WACS Output DC Power:

This procedure checks the output of the primary and secondary WACS power supply groups.

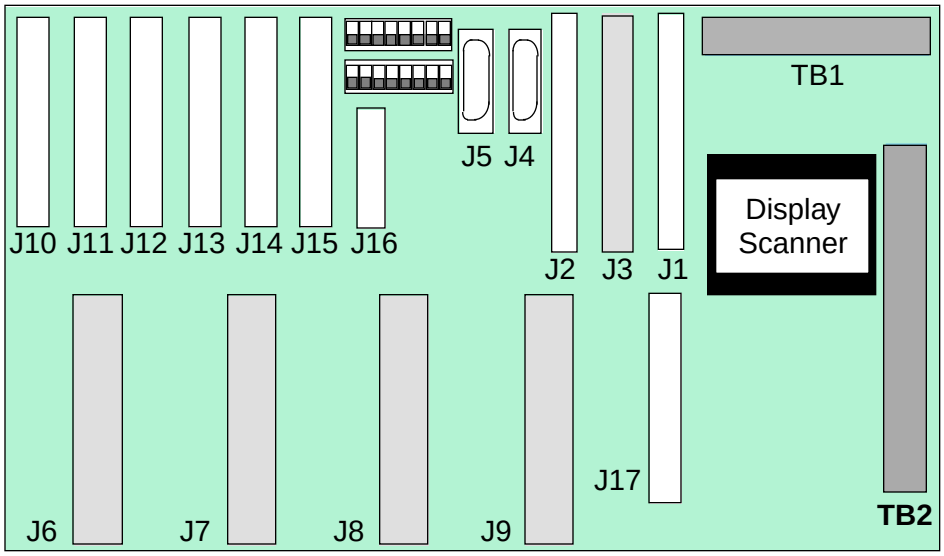
1. Open the WACS access panel cover.
2. Remove power input terminal strips TB2 from the MMS board and TB1 from the CCS board; refer to Figure 16.

Figure 16. CCS and MMS Boards

Critical Control System Board



Maintenance Monitoring Board



3. Turn on circuit breakers CB1, CB2, CB3, and CB4.

4. Measure the output of the primary and secondary power supply groups at connector TB2 for the MMS board. Record your readings in Table 5.

   NOTE: The output from the primary and secondary groups powers both the MMS and CCS boards.

5. Turn off circuit breaker CB2.

6. Reconnect power input terminal connectors TB2 and TB1 on the MMS and CCS boards.

7. Close the WACS access panel cover.

8. Turn off circuit breaker CB1.

9. Reinstall the power panel access cover you removed during one of the earlier procedures. Secure it with enough 1/4-turn screws to hold the panel in place; the panel will be removed again later.

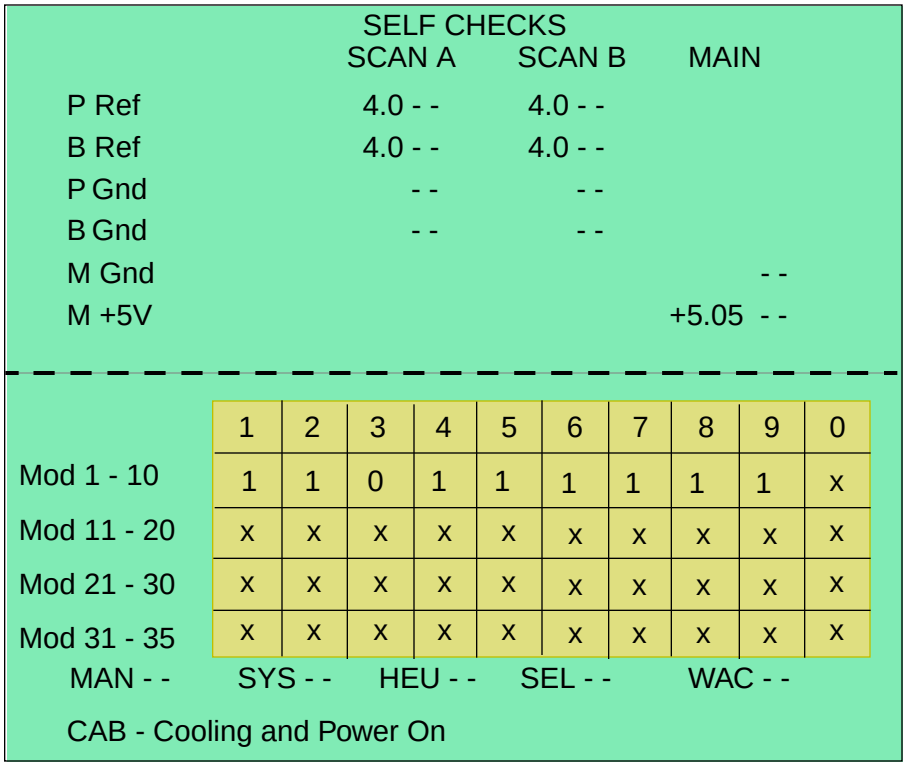
Table 5. LC Cabinet Electrical Checks

Circuit Breaker CB1 (Input)			
Voltage (Phase to phase) 3 phase wires and ground DELTA	A to B		180 to 240 Vac
	A to C		180 to 240 Vac
	B to C		180 to 240 Vac
	A to Ground		90 to 125 Vac
	B to Ground		90 to 125 Vac
	C to Ground		90 to 125 Vac
Voltage (phase to neutral) 3 phase wires, neutral and ground WYE	A to B		360 to 440 Vac
	A to C		360 to 440 Vac
	B to C		360 to 440 Vac
	A to Neutral		180 to 240 Vac
	B to Neutral		180 to 240 Vac
	C to Neutral		180 to 240 Vac
Phase Interchange Assembly Plate			
Voltage (phase to phase) DELTA	A to B		180 to 240 Vac
	A to C		180 to 240Vac
	B to C		180 to 240 Vac
	A to Ground		90 to 125 Vac
	B to Ground		90 to 125 Vac
	C to Ground		90 to 125 Vac
Voltage (phase to neutral) WYE	A to B		360 to 440Vac
	A to C		360 to 440 Vac
	B to C		360 to 440 Vac
	A to Neutral		180 to 240 Vac
	B to Neutral		180 to 240 Vac
	C to Neutral		180 to 240 Vac
WACS DC Power Supply Groups			
Primary Power Supply Group	Pin 1 to pin 4		+24 Vdc± 5%
	Pin 1 to pin 7		+12 Vdc± 5%
	Pin 1 to pin 10		-12 Vdc± 5%
Secondary Power Supply Group	Pin 2 to pin 5		+24 Vdc± 5%
	Pin 2 to pin 8		+12 Vdc± 5%
	Pin 2 to pin 11		-12 Vdc± 5%

WACS Reference Voltage:

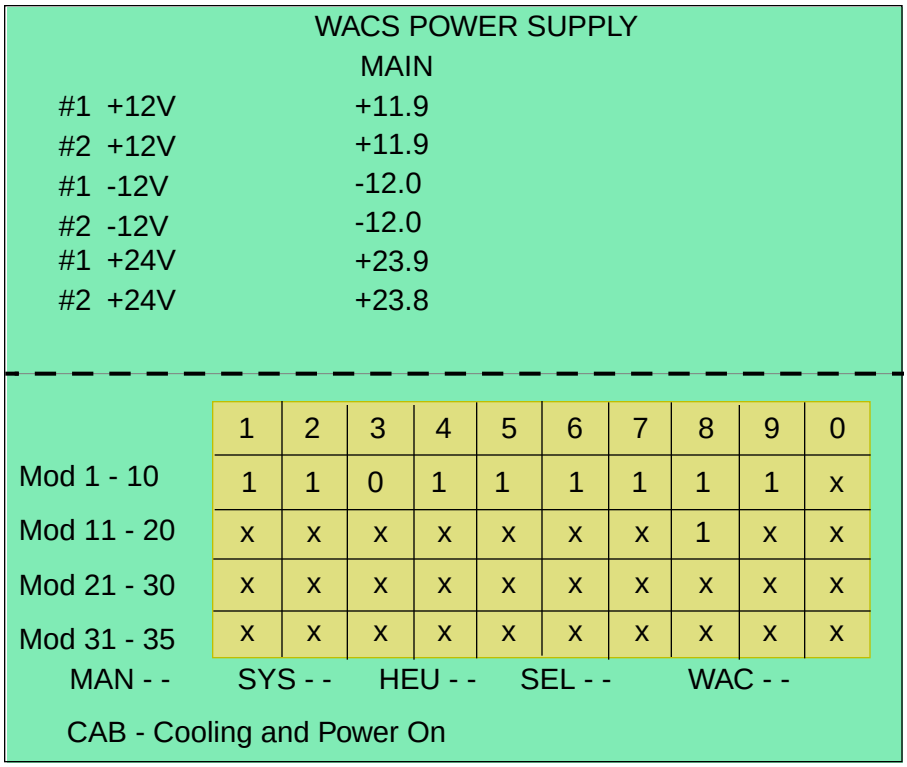
1. Turn on circuit breakers CB1 through CB4.
2. Verify the WACS reference voltage via the WACS SELF CHECKS page on the WACS display; refer to Figure 17.

Figure 17. WACS SELF CHECKS Page



3. Verify the outputs of the WACS power supply groups via the WACS POWER SUPPLY page display; refer to Figure 18.

Figure 18. WACS POWER SUPPLY Page



Performing HEU Electrical Checks

Complete:_____(Initials/Date)

Power phasing, the correct jumper placement on transformer T1, wiring of the pump, and the correct heater jumpers are critical to the operation of the HEU.

1. Ensure that all 50/60 Hz breakers for the HEU are open and locked out.
2. Remove the front panels from the control box and the power box.
3. Remove connector P12 on the control board.
4. Remove TB1 from the temperature control board.
5. Close the customer's circuit breaker and CB1 on the HEU.
6. Use the phase checker to check for correct phasing at the contactor in the power box. Make the necessary changes if the phasing is not correct.

   Do not proceed until the power phasing is correct. Before making any changes, ensure that the HEU and customer circuit breakers are open.

7. Once the phasing is correct, close circuit breaker CB1 and the customer's circuit breaker.
8. Measure the input voltage at the contactor in the power box of the HEU; record the findings in Table 6.

Table 6. HEU Electrical Checks

Incoming Power		Reading	Range
Incoming Power (200 - 230 Vac)	A to B		180 to 240 Vac
	A to C		180 to 240 Vac
	B to C		180 to 240 Vac
	A to ground		90 to 125 Vac
	B to ground		90 to 125 Vac
	C to ground		90 to 125 Vac
Incoming Power (400 Vac)	A to B		360 to 440 Vac
	A to C		360 to 440 Vac
	B to C		360 to 440 Vac
	A to ground		180 to 240 Vac
	B to ground		180 to 240 Vac
	C to ground		180 to 240 Vac
Incoming Power (480 Vac)	A to B		440 to 500 Vac
	A to C		440 to 500 Vac
	B to C		440 to 500 Vac
	A to ground		260 to 290 Vac
	B to ground		260 to 290 Vac
	C to ground		260 to 290 Vac
Verify voltage levels on connector P12			
Pin	Pin		Voltage
15 to	13		18 Vac ±3 Vac
14 to	13		9 Vac ±3 Vac
10 to	13		18 Vac ±3 Vac
11 to	13		9 Vac ±3 Vac
Verify/adjust the 4.0 V reference voltage			4 Vdc

Based on the input power at the HEU, the jumpers on transformer T1 may need to be changed. Table 7 lists the jumper positions for transformer T1. Figure 19 shows the jumper strips.

Verify that the correct pump heater jumpers are installed as listed in Table 8. The extra jumpers are inside the power box. Figure 20 shows the location of the jumpers.

9. To make changes to the transformer jumpers and/or the heater jumpers:

    - Open circuit breaker CB1 on the HEU
    - Lockout/tagout the customer's circuit breaker

Table 7. Transformer T1 Jumper Positions

Voltage (50/60 Hz)	Jumper
575 - 550	34 and 35
525 - 500	33 and 35
480	32 and 35
460 - 440	33 and 36
415	33 and 37
400	32 and 37
380	31 and 36
230 - 220	1 and 36, 2 and 33
200 - 190	1 and 37, 2 and 32

Figure 19. Transformer T1 Jumper

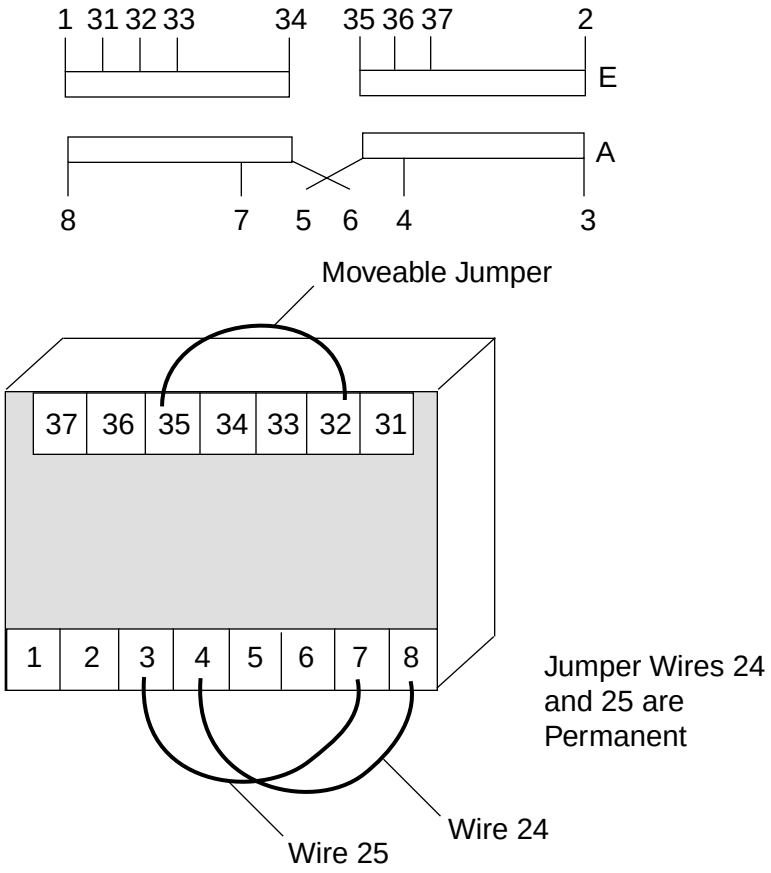
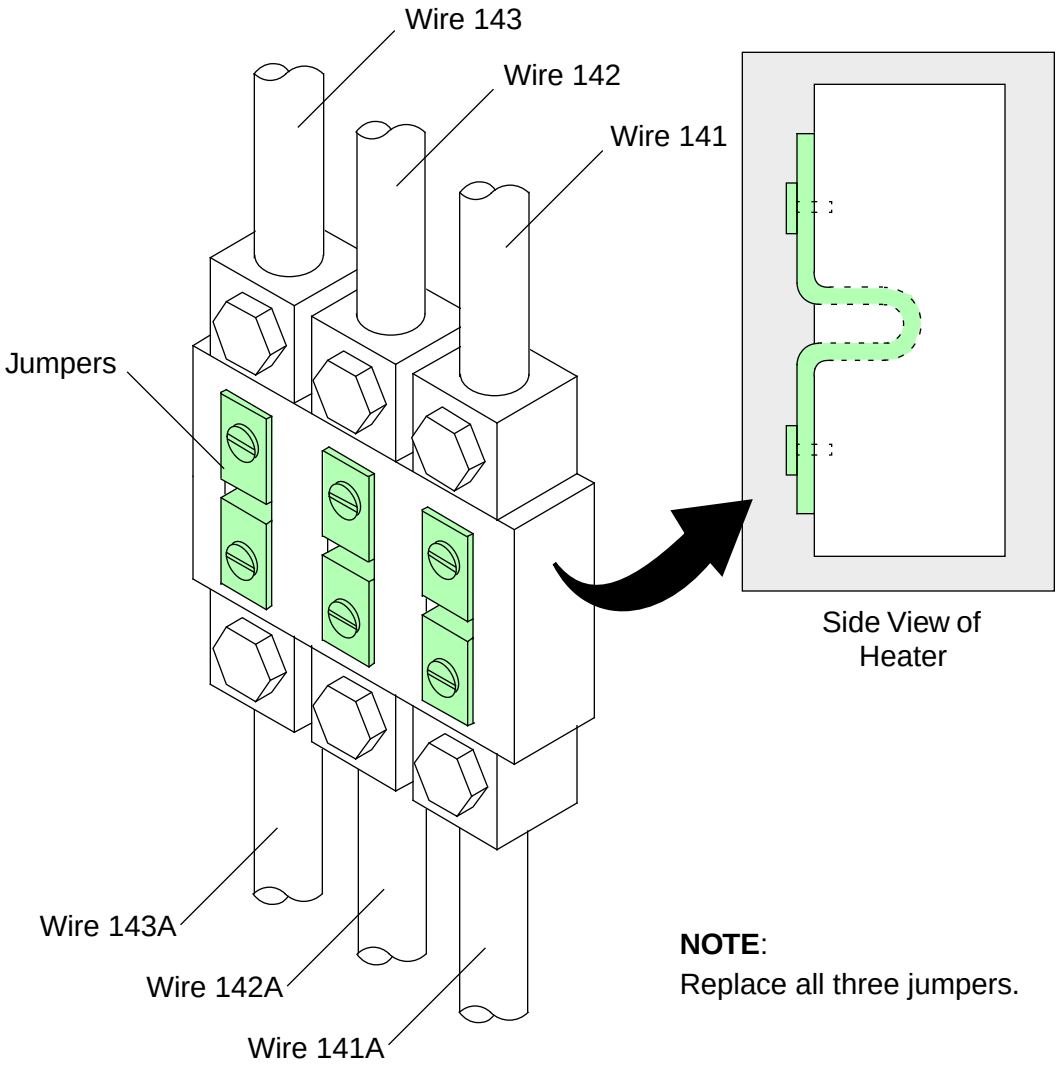


Table 8. Pump Heater Jumpers

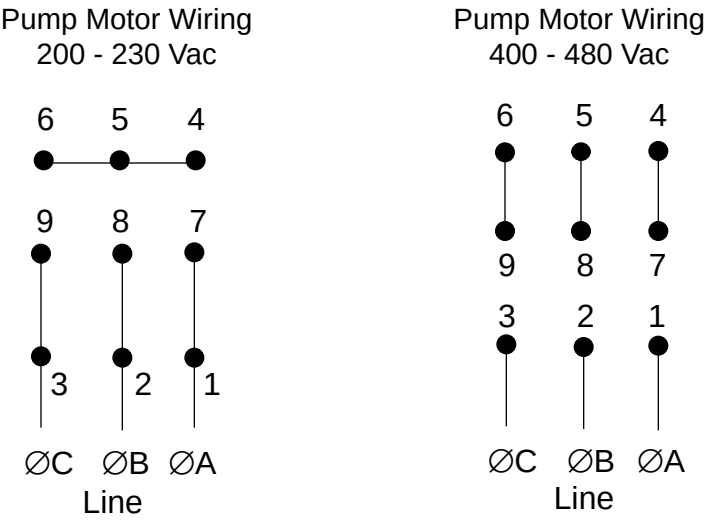
HEU wired for:	Heater part number
200 - 230 Vac	15237204 (FH87)
400 - 480 Vac	15237203 (FH79)

Figure 20. Pump-heater Jumpers



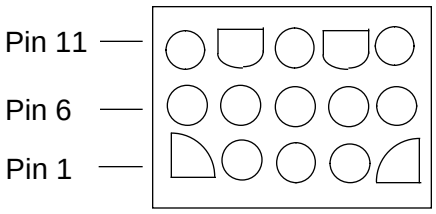
10. Verify that the HEU WC-1 pump-motor wiring is correct for the input voltage; refer to Figure 21.

Figure 21. Pump Motor Wiring



11. Close circuit breaker CB1 on the HEU and the customer's circuit breaker.

Figure 22. Control Board Connector P12



12. Measure the voltage levels at control board cable connector P12 and record them in Table 6.

13. Open circuit breaker CB1 on the HEU.

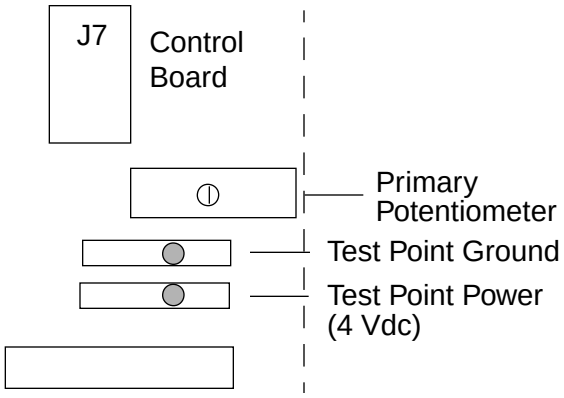
14. Reconnect cable P12.

15. Reconnect TB1 to the temperature control board.

16. Close circuit breaker CB1.

17. Verify the 4.0 Vdc WACS reference voltage on the control board; adjust the voltage if necessary. Figure 23 shows the location of the test point.

Figure 23. Control Board - Reference Voltage Test Point



18. Replace the covers on the power and control boxes.

Powering Up the LC Cabinet and HEU

Complete:_____(Initials/Date)

At this point, the system is ready for module power-on.

1. Close circuit breakers CB1 through CB4.
2. Close all module power supply circuit breakers where modules reside.

   NOTE: Verify that the power supplies are receiving input power. The green LED on each power supply should be on.

3. Press the START switch on the WACS panel. The red LED indicator for each PC board turns on.
4. Monitor the WACS module page displays for any faults or warnings. Take corrective action if required.

Verifying Pressure-sensor Operation

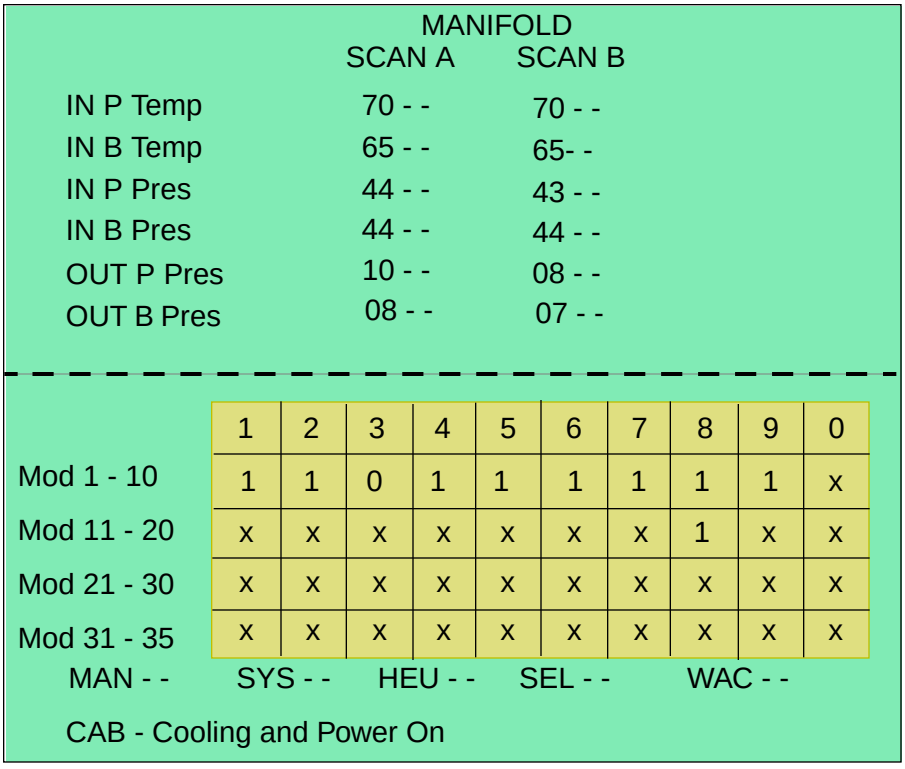
Complete:_____(Initials/Date)

To verify the operation of the pressure transducers, coolant must be flowing through the LC cabinet. Make sure that all the module power supply circuit breakers are off.

Pressure Sensor Operation:

1. Close circuit breakers CB1 through CB4.
2. Press the START switch on the WACS panel.
3. Monitor the WACS MANIFOLD page display; refer to Figure 24. The inlet pressure should be 35 to 45 psi.

Figure 24. WACS Manifold Page Display



4. Decrease coolant flow by adjusting the inlet valve under the floor; a one-half turn should be sufficient. Monitor the WACS page display to ensure that the reading varies.
5. Reset the inlet valve to its previous position. Set for an inlet pressure of 35 to 45 PSI. Wait for the pressure to stabilize before continuing.

Adjusting the Dielectric-coolant Temperature

Complete:_____(Initials/Date)

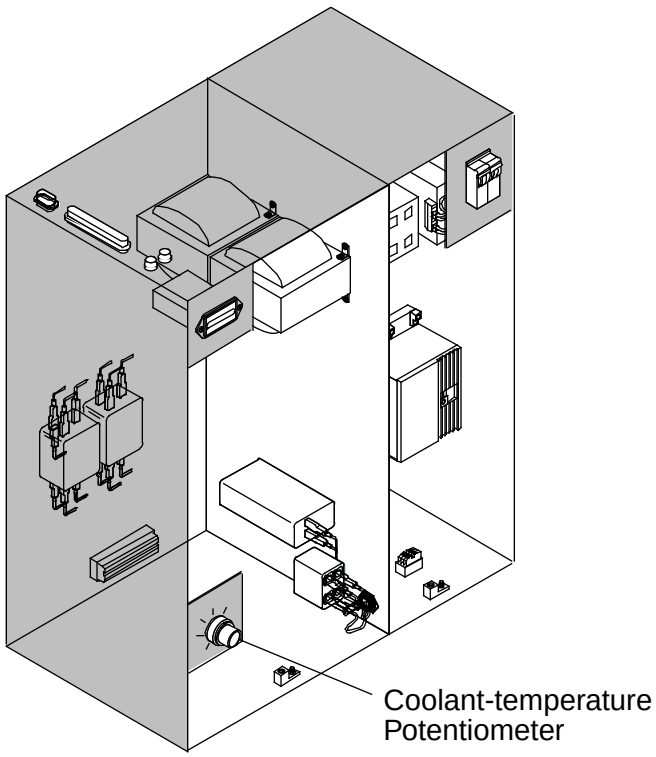
NOTE: The LC cabinet should run for approximately 20 minutes before you make this adjustment.

1. Monitor the coolant inlet temperature on the WACS MANIFOLD page display; refer to Figure 24.

2. Adjust the coolant-temperature potentiometer on the power box of the HEU, as shown in Figure 25, to achieve an inlet coolant temperature of 70° to 80° F on the upper PCB.

   - If you have trouble maintaining a temperature of 70° to 80° F, the coolant is too cold. Close down one of the heat exchangers in the HEU.

Figure 25. HEU Power Box



NOTE: To double-check the WACS reading, use a multimeter with a temperature probe. Check the temperature of the coolant at the power supply's supply manifold on the thermistor housing block.

HEU Ride-through Test

Complete:_____(Initials/Date)

This procedure checks the power ride-through capability of the HEU.

1. With power applied to the HEU, open and close circuit breaker CB1 (off, then on), as fast as you can; the results should be:

   - The pump turns off and then on
   - The HEU WACS sounds a buzzer and indicates a warning
   - The HEU stays up and running

2. If the HEU powers off, take corrective action to fix the problem.

Checking the System for Leaks

You can perform this procedure while the system is running and stabilizing.

Complete:_____(Initials/Date)

1. Using a halogen leak detector, scan the entire dielectric-coolant system, including the following components:

   - The HEU-WC1 cabinet (plus hoses, pumps, valves, fittings, and especially new connections)
   - 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

2. Check all water hose connections for leaks (customer supply and return lines, HEU connections, HEU valves, and any new connections).

Verifying System Power and WACS Data

Allow the system to run for approximately 2 hours before you take these readings. Record your readings in Table 9 and Table 10.

After you complete the HEU and LC cabinet checks, generate a WACS dump from the SWS.

Complete:_____(Initials/Date)

Table 9. HEU Power, Water, and Fluorinert Checks

HEU Power Checks		
Voltage (Phase to phase) 3 phase wires and ground	A to B	
	A to C	
	B to C	
	A to Ground	
	B to Ground	
	C to Ground	
Amps	Phase A	
	Phase B	
	Phase C	
HEU Water Checks		
Inlet Pressure		PSI
Outlet Pressure		PSI
Inlet Temperature		F
Outlet Temperature		F
Inlet Gallons per Minute		GPM
Outlet Gallons per Minute		GPM
HEU Fluorinert Checks		
Pump Discharge Pressure (approximately 100 ±10 pounds)		PSI
Heat Exchanger #1	Inlet Temperature	F
	Outlet Temperature	F
Heat Exchanger #2 (if used)	Inlet Temperature	F
	Outlet Temperature	F

Table 10. Mainframe Power, Coolant, and WACS Checks

Mainframe Power Checks		
Voltage (Phase to phase) Delta 3 phase wires and ground	A to B	
	A to C	
	B to C	
	A to Ground	
	B to Ground	
	C to Ground	
Voltage (phase to neutral) Wye 3 phase wires, neutral and ground	A to B	
	A to C	
	B to C	
	A to Neutral	
	B to Neutral	
	C to Neutral	
Amps	Phase A	
	Phase B	
	Phase C	
	Neutral	
Mainframe Coolant Data Checks		
Inlet Temperature	Primary Thermistor	F
	Backup Thermistor	F
Inlet Pressure	Primary Transducer	PSI
	Backup Transducer	PSI
Outlet Pressure	Primary Transducer	PSI
	Backup Transducer	PSI
Mainframe WACS Checks		
Smoke Detector	Primary	
	Backup	
Dewpoint Monitor	Primary	

NOTE: You may also read the WACS information from the WACS manifold and WACS system page displays.

Applying the HEU Trim

Complete:_____(initials date)

1. Position the side panels on the lower frame and snap them into place.
2. Position the top covers and snap them into place.
3. Position the rear panel and snap it into place.
4. Position the front panel and snap it into place.

Cabinet Readiness and Electrical Check-out

The electrical check-out procedures in this section describe how to perform electrical testing of a CRAY T3E LC cabinet. Perform the procedures in the order shown in Table 11.

Field service personnel should have experience in running diagnostics and troubleshooting a mainframe chassis.

Table 11. Electrical Checkout Procedures

Procedure
Connecting GigaRing Cables within and outside the LC cabinet
Verifying LC cabinet readiness
Performing the local/remote power-on test
Testing the LC cabinet with boundary scan
Testing the LC cabinet with off-line diagnostics (normal margins only)

Connecting GigaRing Cables Within and Outside the LC Cabinet

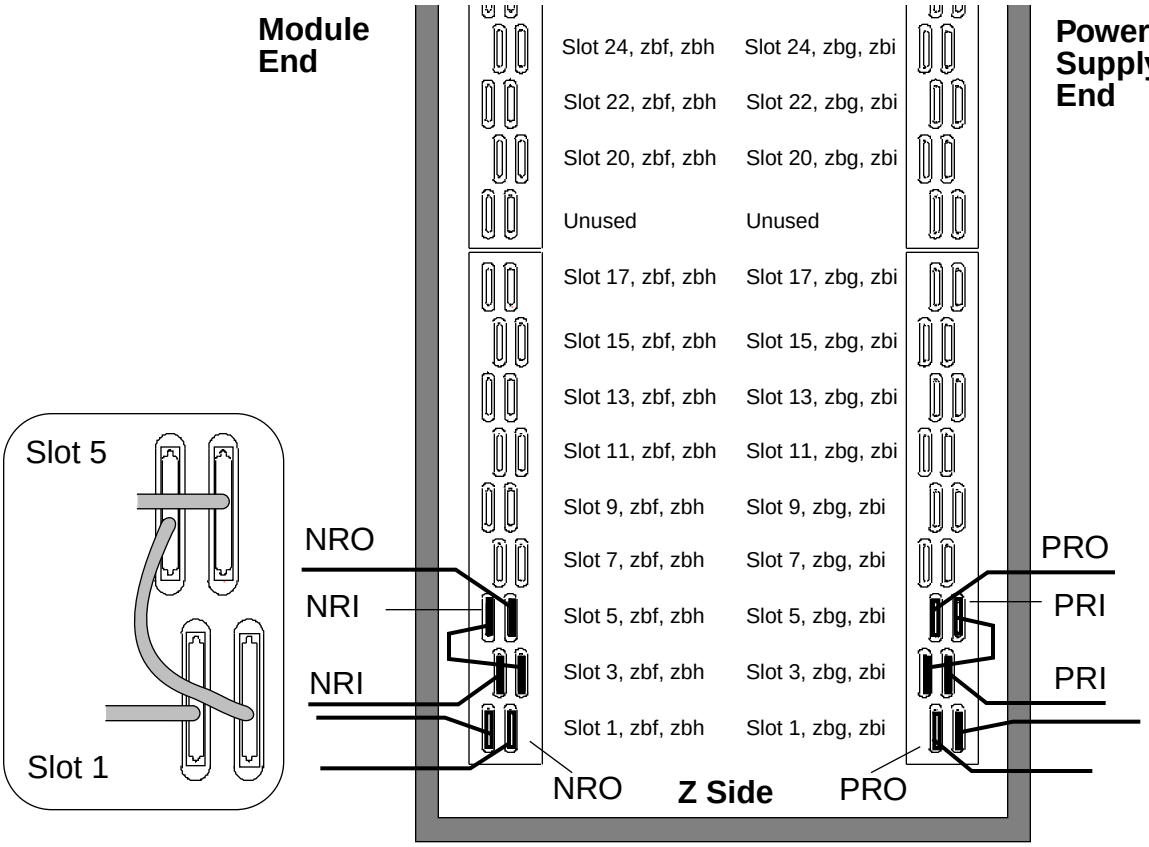
Complete:_____(Initials/Date)

Because many system configurations are available, only the standard 32-PE node configuration is shown below. For the exact positions of the GigaRing cables, refer to the system configuration document.

Module-to-module connections inside the LC cabinet may be in place when you receive the system. You must install external connections from the LC cabinet to the PC-10 cabinet (refer to Figure 26).

For the example below, the modules in slots 3 and 5 are on the same ring. The boundary scan master is also the system support module and is attached to the module in slot 1.

Figure 26. GigaRing Connection



Verifying LC Cabinet Readiness

Complete:_____(Initials/Date)

1. Ensure that all system connections are complete.
2. Ensure that mechanical setup and install is complete.
3. Replace all covers and panels removed during the installation.
4. Ensure that the final HEU and LC cabinet checklist are complete.
5. Ensure that the WACS cable is connected.
6. Ensure that the HEU cable is connected.
7. Ensure that all required GigaRing cables are connected.
8. Ensure that the SWS installation is complete.
9. Ensure that the PC-10 is installed and connected.
10. Ensure that the MPN is powered up and booted.
11. Check margin, clock, and boundary scan switch positions.

Performing the Local/Remote Power-on Test

Complete:_____(Initials/Date)

Close the following circuit breakers:

- CB1 through CB4
- All module power supply breakers for properly installed modules

Local Operation:

1. On the WACS switch panel, set the REMOTE ENABLE switch in local mode.
2. Press the START switch.

   The system is now powered on. All PCBs should show power as viewed from the WACS page displays and the red LED on each PCB should be illuminated.
3. Press the STOP switch.

Remote Operation:

1. On the WACS switch panel, set the REMOTE ENABLE switch in remote mode.
2. Bring up nwacs on the SWS.
3. Click on the POWER UP button.
4. Click on the Write Switches button.
5. Verify that the cabinet powered on by viewing the WACS display under nwacs.

Testing the LC Cabinet with Boundary Scan

Complete:_____(Initials/Date)

Complete the boundary scan test: t3ebst

Complete the boundary scan clear test: Scan clear (t3etap)

Testing the LC Cabinet with Offline Diagnostics

Complete the following diagnostics to check the operation of the LC cabinet. Run these diagnostics at normal margins; fast and slow clock speeds or high and low voltage margins are not necessary.

When the diagnostics complete, close the window and check off the individual diagnostics from the Offline Diagnostic Testing checklist in the *Installation Checklist*, HMM-225.

Table 12. Offline Diagnostic Testing

Test	The following tests run under the *mile.pgm* command buffer	Pass Count
giga_diag	Run as stand alone	1
todt	Tests the time-of-day clock	1,000
ereg	Tests basic E register operations	40
barr	Tests the barrier and eureka synchronization circuitry	50
lmem	Tests local memory operations, SECDED, stream buffering, and cache coherence (preset the config file for correct memory size)	2
peri	Tests the microprocessor stall timeout function and the PROD function	2,000
rchip	Tests the network router	10
xnet	Tests the interconnect network and the global E-register operations	50
luts	Tests the remote memory look-up tables	5
mqcw	Tests the message queue control word	3,000
gtb	Tests the global address translation process	4
segt	Tests the segment translation table	5
etrap	Tests the software generated errors that are trapped by the C option	100
pst	Tests the microprocessor stall timeout function and the PROD function	20
rmem	Tests remote memory operations	1
rlo	Tests random local operations	2,000
cit	Tests the GigaRing client option	5