LC Upgrade Procedures

HMU-172-0
CRAY T3E Series System
Last Modified: February 1997

Figures

Tables

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February 1997

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LC Cabinet Upgrade Procedures Overview

This document is designed as a supplement to the engineering documents that you receive with an upgrade to your CRAY T3E LC system. This document provides step-by-step procedures for upgrading your LC cabinet.

Purpose

This document describes procedures for the upgrade of one to several modules. If you install more than one module, repeat the procedures for each additional module. This document also provides procedures for installing an additional LC cabinet including positioning, coolant piping changes, the HEU WACS cable adapter box, cross-over troughs, and new panels.

Use the *LC Single-cabinet Installation* document, publication number HMM-171-0, for detailed procedures on installing the additional cabinet.

Training Requirements

Cray Research personnel who perform these upgrade procedures must have completed the CRAY T3E hardware training courses, T3EHO-S and T3EM.

Tools Required

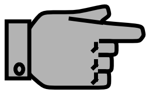
You will need the common hand-held tools that are included with the tool kit for a CRAY T3E LC cabinet.

Document Structure

The document describes the following topics:

- Important safety information
- Installation prework
- Module slot kit installation
- Second LC cabinet installation

- Boundary scan and diagnostic testing
- Operating system changes
- Replacement of the original cabinet



Watch for this symbol. This symbol is used to highlight information for the installer.

Safety Information

Hazard Statements

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

- **Danger** indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.
- **Warning** indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
- **Caution** indicates a potentially hazardous situation that, if not avoided, 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 removal and 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 service 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.

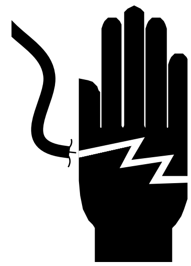
Wrist Strap

Wear a Cray Research-approved wrist strap when you service or handle 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 you remove, install, repair, or maintain the system.

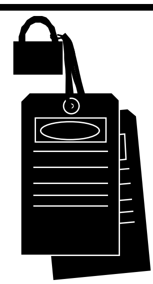
- Do not wear watches or jewelry when you work on a CRAY T3E system cabinet.
- Keep fingers and conductive tools away from high-voltage areas and from high-current areas.



DANGER

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

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



WARNING

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

- Remove all tools from the system cabinets after you service them.
- Several procedures require two people to complete; do not perform the procedure alone.
- Ensure that a qualified electrician has properly installed the power wiring.
- Replace all covers and panels that you removed from the system during service.
- Power off the system only after the system software has been shut down in an orderly manner.

CAUTION

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

Installation Prework

Before you start the upgrade procedure, complete the list of activities in Table 1.

Table 1. Prework Considerations and Verifications

Checkoff	Description
	Ensure that you read the upgrade procedure.
	Ensure that you have the required tools.
	Ensure that you schedule the correct amount of time.
	Ensure you have the correct ESD protective equipment.
	Ensure that you have all the required slot kit parts and modules.
	Ensure that you label the new torus and GigaRing cables. Installation is easier if you label the new cables before you install the rail.
	Inspect the new module(s) for cracked connectors or debris. If the module has any defects, send it to central repair.
	Inspect the module-coolant hoses, O-rings, and quick-disconnect (QD) fittings for defects. Replace defective O-rings or coolant hoses as required. For other repairs, return the module to central repair.

NOTE: Do not begin this upgrade procedure if:

- You do not have all necessary tools available on site
- You do not have all necessary parts available on site
- You have any questions regarding the final I/O channel configuration
- You have any questions regarding module placement
- You are not familiar with the system workstation software `t3ems`

For your new configuration, remember that I/O GigaRing connections are not possible above slot 21 until the Pass 3 clock module is installed.

If you install modules with a different memory capacity, you may have to reposition other modules that are already installed. You should know this configuration before starting the upgrade.

If you are installing modules with a different PE option speed, you may have to reposition other modules that are already installed. You should know this configuration before starting the upgrade.

Reference Publications

Many of the engineering specifications in Table 2 should be available on site to assist you in performing your upgrade. Additional engineering documentation is included with each upgrade shipment.

Table 2. CRAY T3E Reference Documents

Engineering Specification	Description
800599	Wire List, Boundary Scan, Chassis 0-7
800582	Wire List, Clock, Chassis 0-7
800610	Wire List, GigaRing
800628	System Configuration, Logic Module (1 chassis)
800854	System Configuration, Logic Module (2 chassis)
801006	System Configuration, Logic Module (3 chassis)
801038	System Configuration, Logic Module (4 chassis)
801039	System Configuration, Logic Module (5 chassis)
801040	System Configuration, Logic Module (6 chassis)
801041	System Configuration, Logic Module (7 chassis)
801042	System Configuration, Logic Module (8 chassis)
800558	Wire List, Torus Network XYZ-Dimension (chassis 0)
800860	Wire List, Torus Network Y-Dimension (chassis 1)
800995	Wire List, Torus Network Y-Dimension (chassis 2)
801033	Wire List, Torus Network Y-Dimension (chassis 3)
801034	Wire List, Torus Network Y-Dimension (chassis 4)
801035	Wire List, Torus Network Y-Dimension (chassis 5)
801036	Wire List, Torus Network Y-Dimension (chassis 6)
801037	Wire List, Torus Network Y-Dimension (chassis 7)

Module Slot Kit (Standard Configuration)

A module, or slot, upgrade consists of a module slot kit and a PEM. Table 3 lists the parts of the slot kit for each PE module upgrade at the time of publication.

Table 3. Module Upgrade Slot Kit

Part Number	Description	Quantity
15240100	Rail, LC PEM without GigaRing	1
15240200	Rail, LC PEM with GigaRing	1
57218300	Screw, shoulder SCH M6 x 1 8MM x 8MM SST	2
57170001	Cordset, IEC320 20A 250 V	2
15235700	Power supply assembly, LC Chassis	2
15247600	Cable assy, PEM slot control	2
15213601	Cable assy, power supply control	2

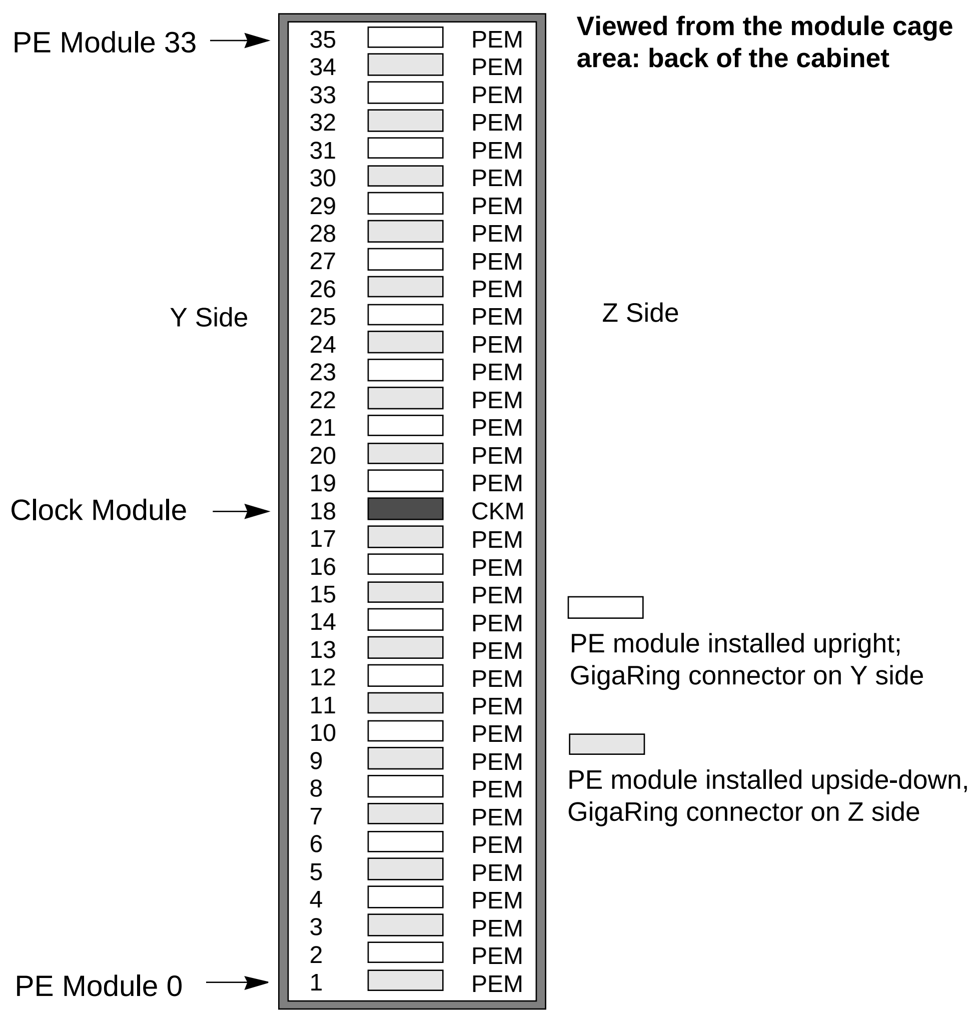
Module Slot Kit Installation

The standard slot kit for an LC cabinet consists of two rails: one with GigaRing connectors and one without GigaRing connectors. Before you install the module rails, determine whether the rail with the GigaRing connectors is on the Y side or Z side of the cabinet; refer to Figure 1.

Before you install each rail, apply the torus identification labels to each ribbon cable. Torus and GigaRing cable labels show the slot, Y side or Z side, and connector location: 12YAD, 12YAE, 11ZAF, 11ZAG, etc. Cabling documentation identifies the cables this way.

NOTE: Remember that module slot numbering and PEM numbering are different. Module slots are numbered from 1 through 35; PEMs are numbered from 0 through 33.

Figure 1. LC Cabinet Module Location

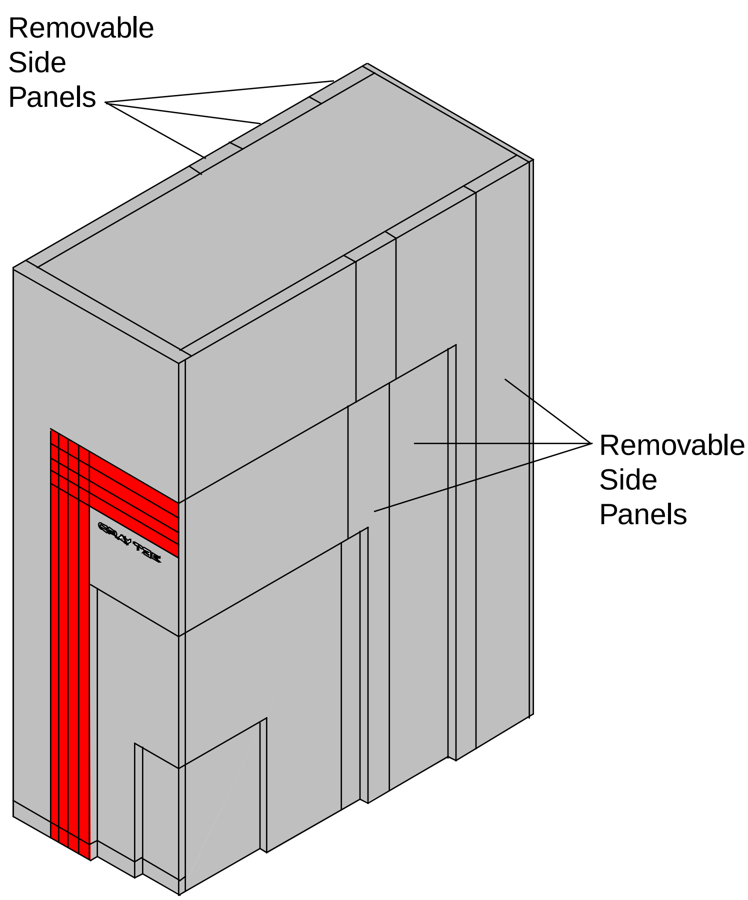


Cabinet Panel and Wiremat Cover Removal

The bottom of each side panel is held in place by magnetic fasteners.

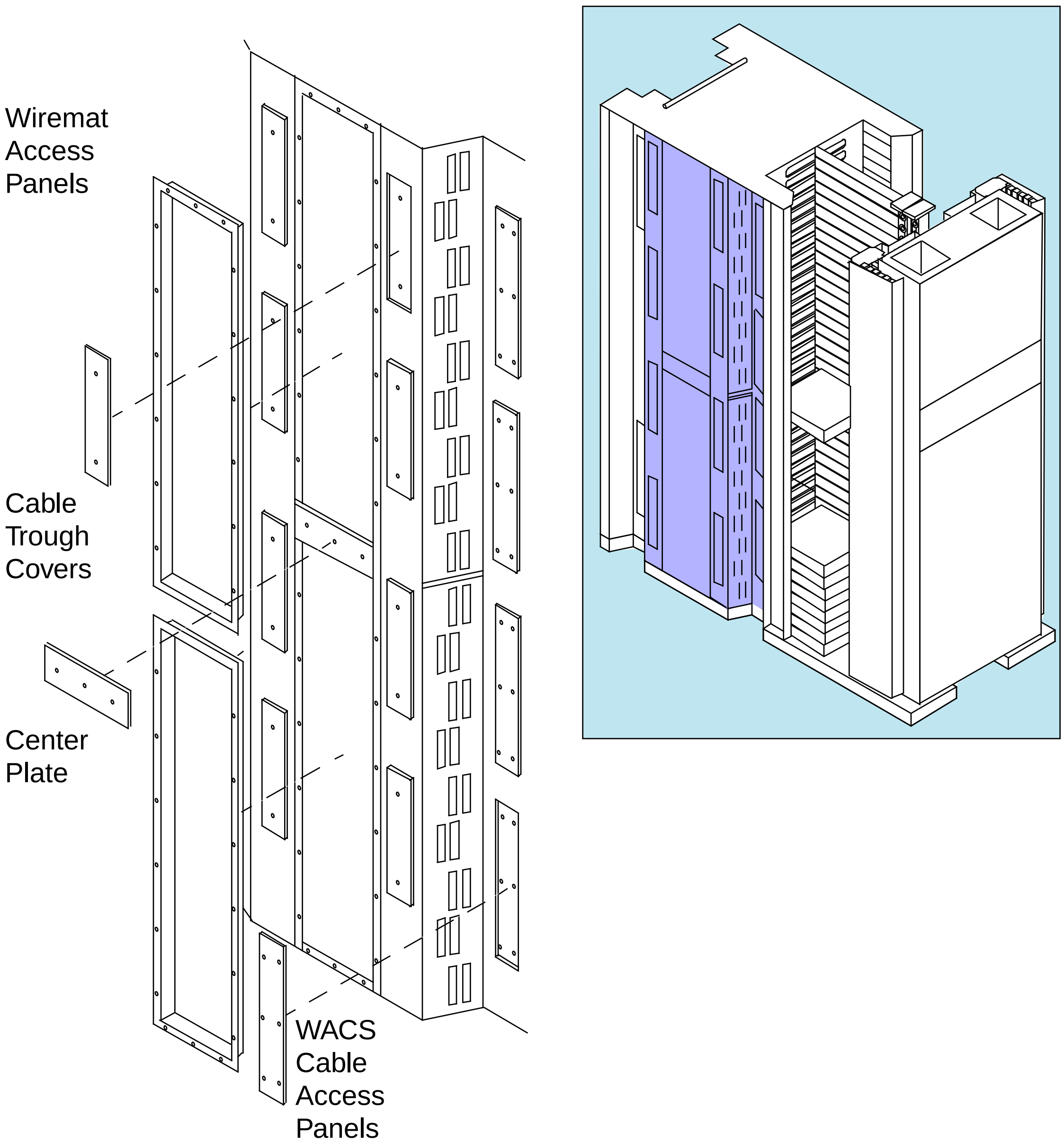
1. Remove the side panels from the cabinet; refer to Figure 2.
   a. Pull the bottom of the panel away from the frame.
   b. Lift the panel straight up.
   c. Place the panel away from the cabinet where it will not be damaged.

Figure 2. Cabinet Side Panels



2. On both the Y and Z side, remove the wiremat access panels, as shown in Figure 3. All access covers are held in place with 1/4-turn captive screws.
   - Center plate
   - Top and bottom wiremat access panels
   - WACS cable access panels

Figure 3. Wiremat Covers



Module Rail

1. Install the new rail (refer to Figure 4) by positioning the rear of the rail over the dowel pins on the center frame support (refer to Figure 5).

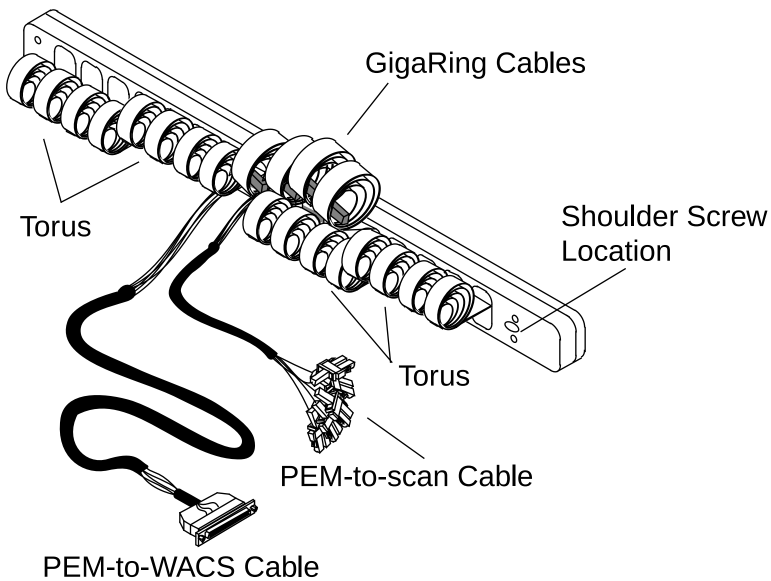
Check again to ensure that you place the rail with GigaRing connectors on the correct side of the cabinet.

When you install rails into module slots 34 and 35:

- Remove the smoke detector and the smoke detector mounting bracket. The mounting bracket is held in place by 2 screws. Install the upper 2 rail sets and replace the smoke detector.

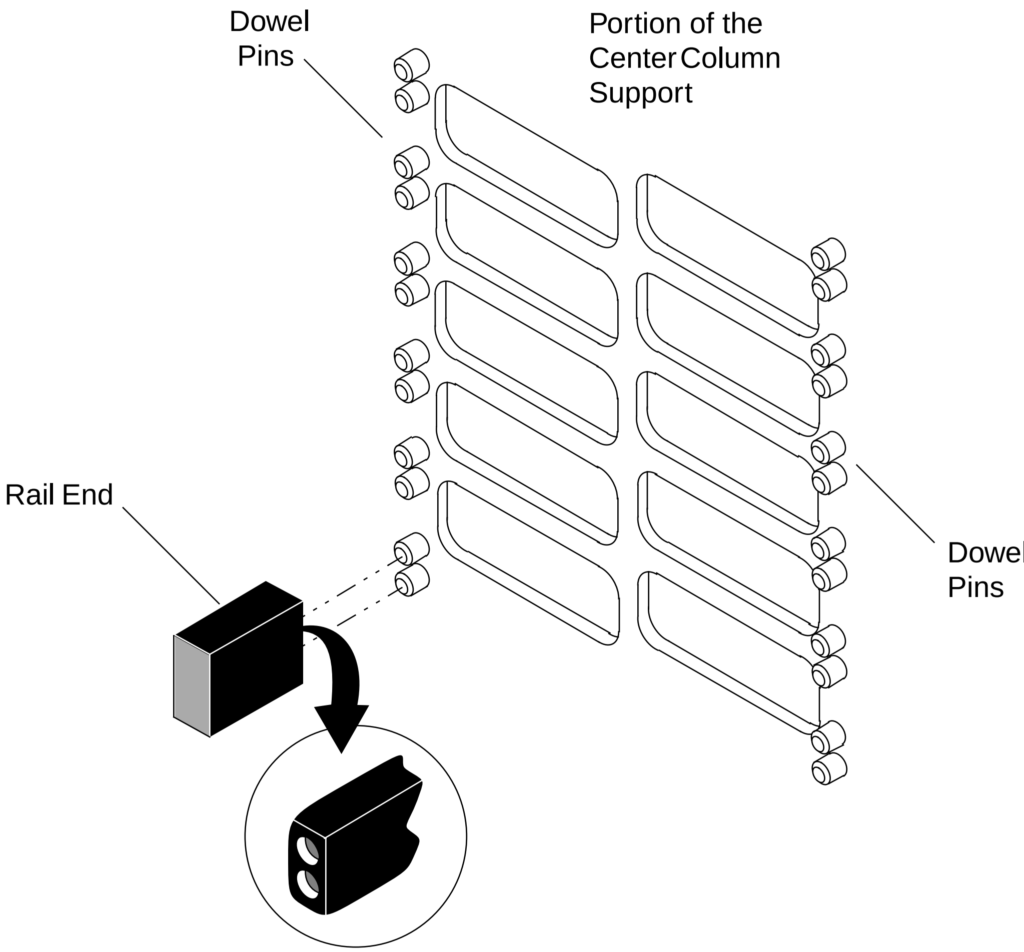
- Install the rails into slot 35 before slot 34. The amount of clearance space diminishes greatly as you add the upper rails.

Figure 4. Module Rail (View from Wiremat Side)



NOTE: As you position the new rail, make sure that ***no*** tiewraps, wires, or cables are caught between the rail and the cabinet frame. Also be sure that ***no*** labels or tape are left on the rail. Even masking tape can alter the position of the rail.

Figure 5. Center Support Column



2. Using a 4-mm hex wrench, secure the front of the rail to the frame of the cabinet with the shoulder screw, P/N 57218300. Refer to Figure 4.

3. Repeat this procedure for the rail on the opposite side.

4. Attach the GigaRing label to the front of the rail that contains the GigaRing connectors.

PEM-to-WACS Cable Connections

Each rail contains a PEM-to-WACS cable (P/N 15214200) which is inserted in the rail's clock connector. You need to route the cable from the wiremat area to the internal bulkhead, which is near the module power supplies.

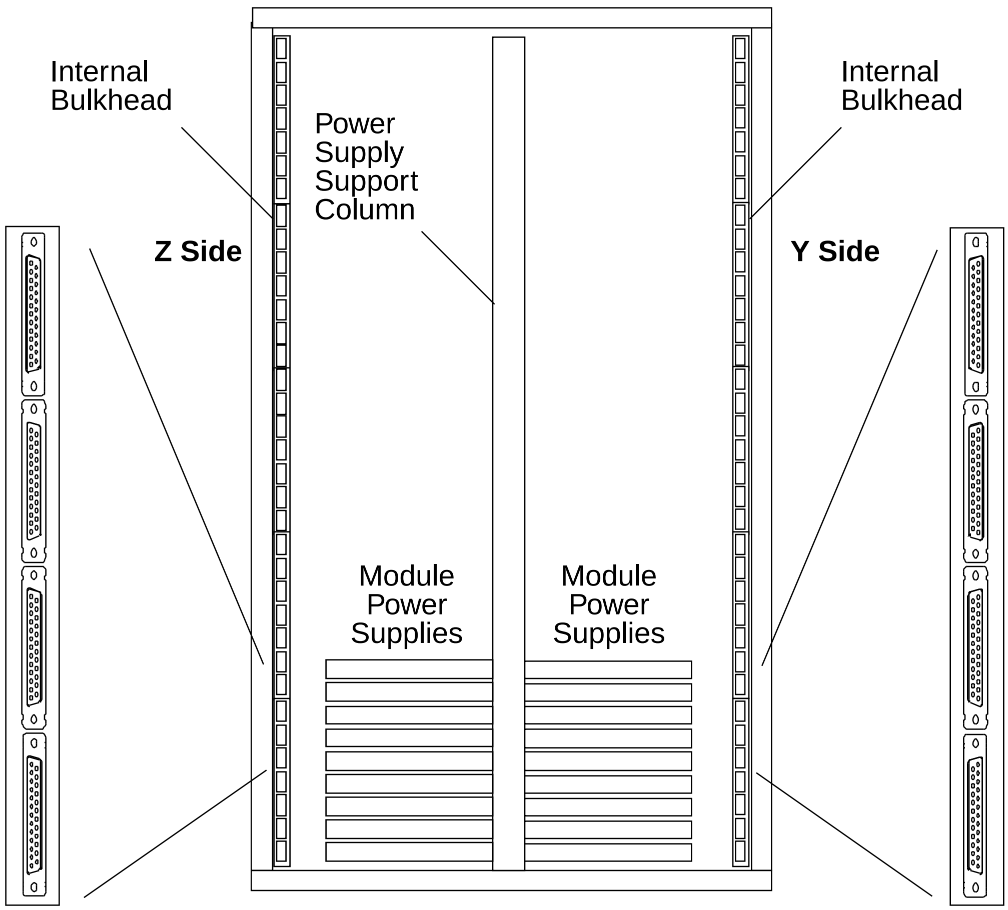
1. On the Z side of the cabinet, carefully remove the tie wrap that holds the PEM-to-WACS cable together.

2. Route the PEM-to-WACS cable through the frame to the internal bulkhead. Use the frame openings on the side of the cabinet to help route the cable to its destination.

3. Using a 3/16-in. socket, attach the PEM-to-WACS cable connector to the internal bulkhead with the aluminum standoffs, washers, and nuts that are supplied. Refer to Figure 6.

NOTE: Do not overtighten the standoff screws.

Figure 6. Internal Bulkhead



4. Repeat this procedure for the PEM-to-WACS cable on the Y side of the cabinet.

WACS Control Cable

Each PEM-to-WACS cable has a corresponding WACS control cable (P/N 15247600) that connects to the internal bulkhead and the interconnect board. **You will install this cable when you install the power supply.**

System Clock Wire Connection

The system clock and GigaRing clock wires are preinstalled in the clock rails. Each system clock and GigaRing clock wire is labeled to show its module slot, connector, and pin location (for example, `023-ybh03` for system clock and `023-ybh07` for GigaRing clock).

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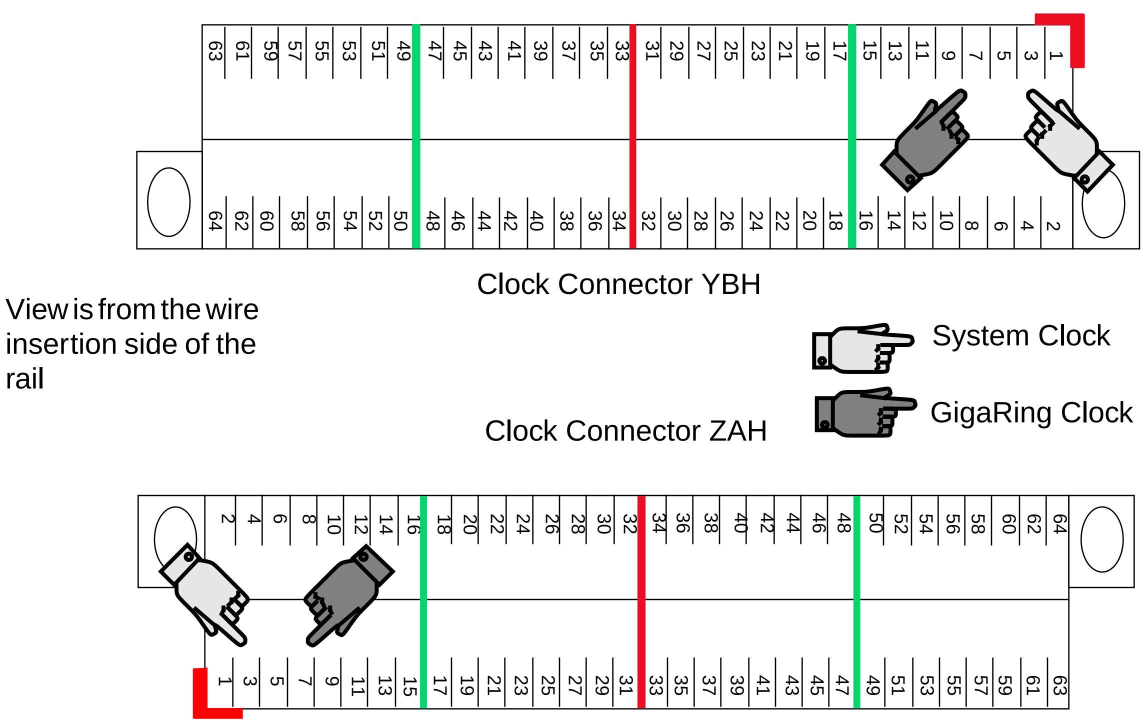
NOTE: If you install more than one slot kit, it may be easier to connect the clock wires as you install each rail rather than after all rails are installed.

Figure 7. Rail Clock Connector

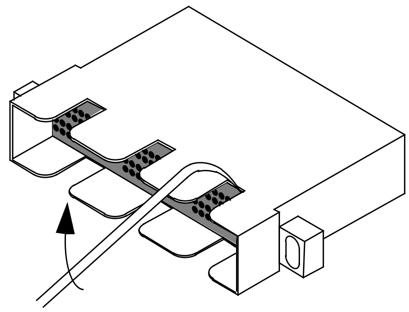


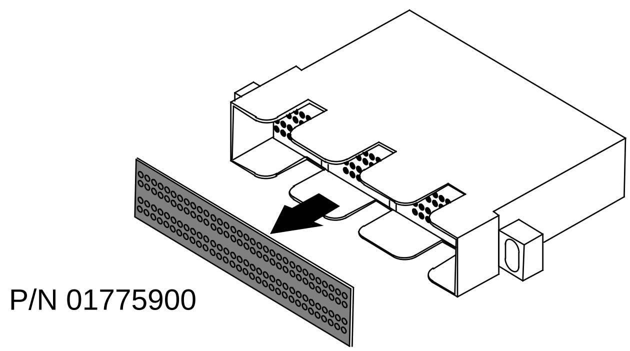
Perform the following steps to insert the clock wire (Figure 9) into the rail clock connector:

1. From the module side of the clock connector, use a dental pick (or some other sharp tool) to carefully remove the plastic pin lock from the clock connector (zah or ybh) of the new rail.

   NOTE: The pin lock is fragile - if it is damaged, replace it as necessary.

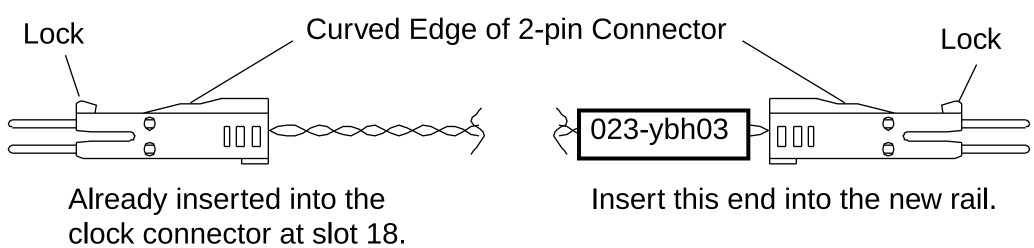
Figure 8. Plastic Pin Lock Removal





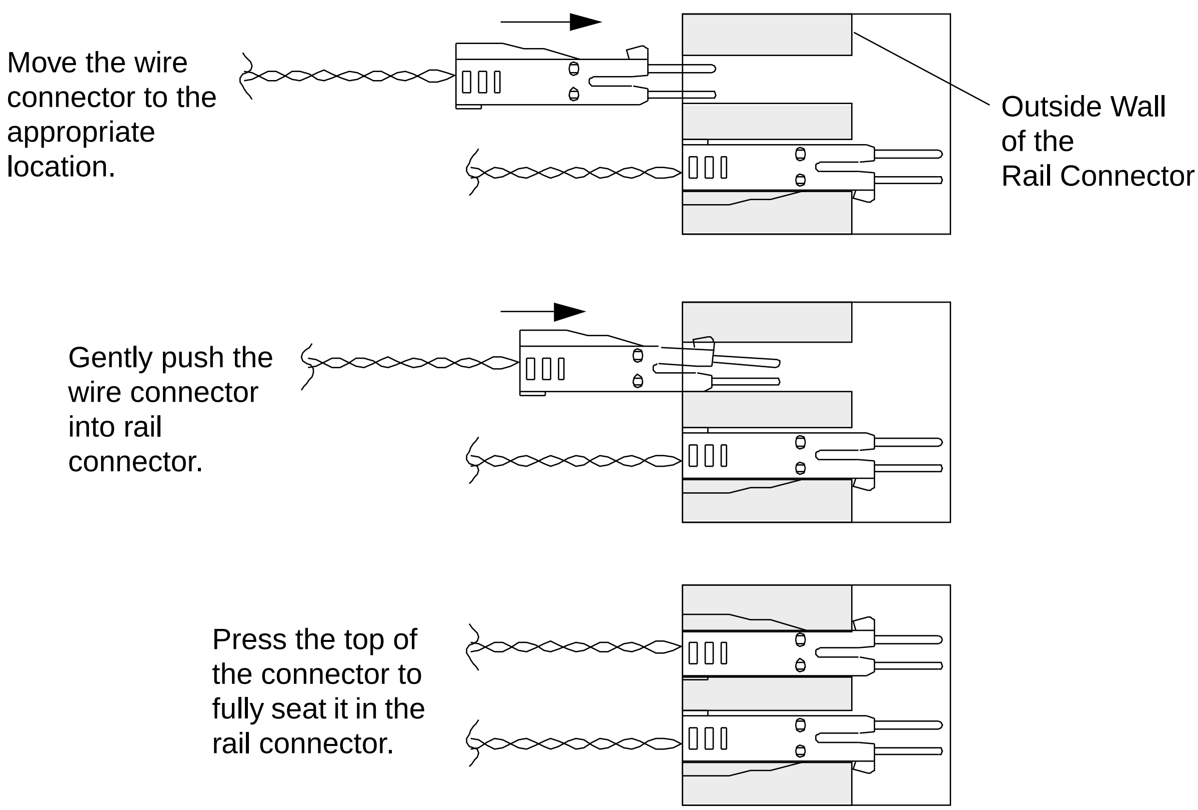
2. Find the correct system clock wire for the new module slot and insert the clock wire into the clock connector; all system clock wires are inserted into connectors 0xx-ybh-03 and 0xx-zah-03. For protection, the pin is covered with black tubing; remove the tubing before inserting the pin.

Figure 9. Clock Wire



3. Use your fingers or an appropriate tool (such as tweezers, hemostats, or a wire insertion tool) to gently push the pin connector of the clock wire into the pin slot: refer to Figure 10. Ensure that you do not damage the wires. Figure 11 shows an alternative wire-insertion method.

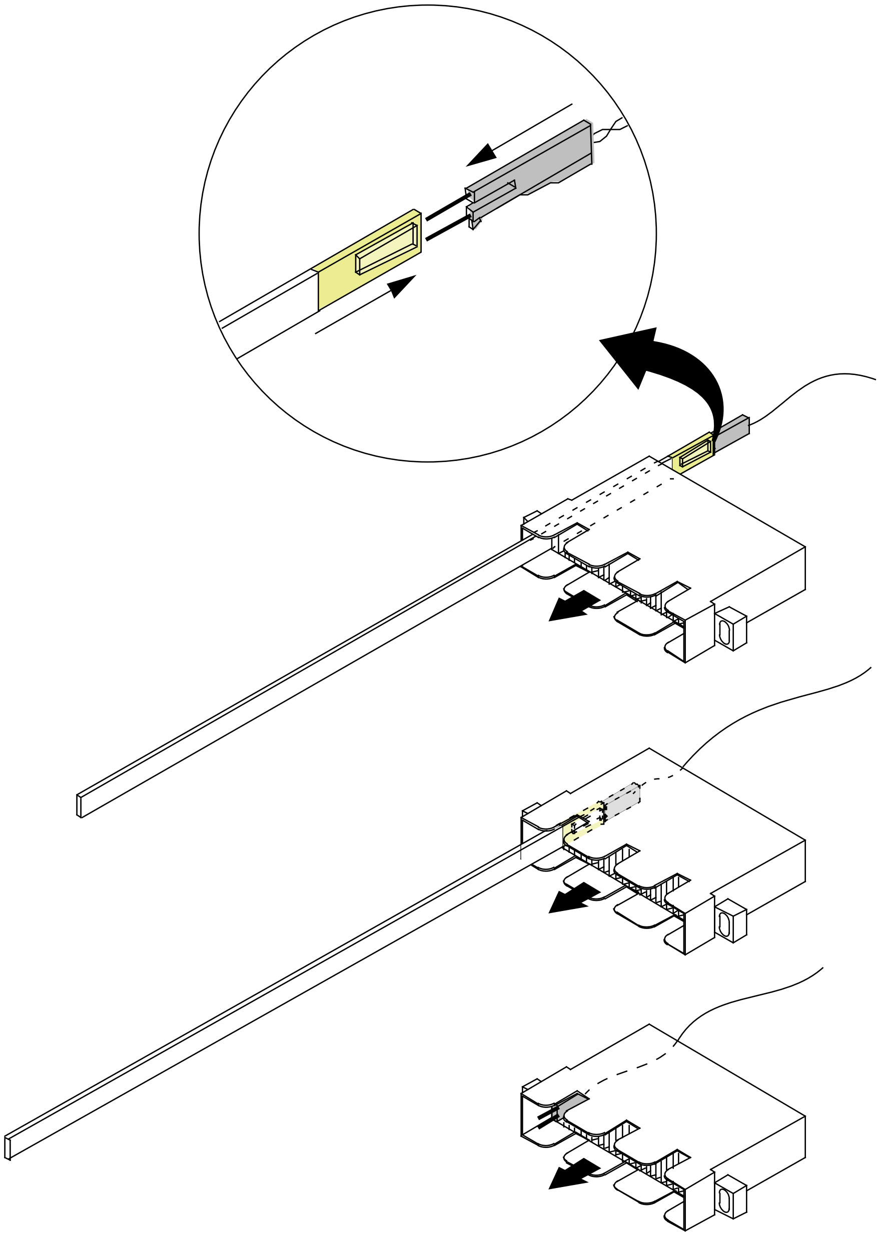
Figure 10. Wire Insertion



NOTE: Diagram shows a cutaway view of the rail connector.

4. Carefully press forward on the top of the wire connector to fully insert the clock pin connector. You should hear it click into place.

Figure 11. Wire Insertion with Metal Rod



GigaRing Clock Wire Connection

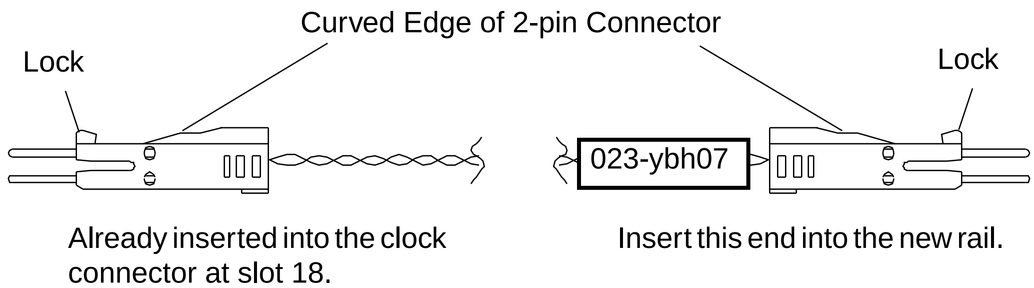
If the rail requires a GigaRing clock wire:

1. Find the correct GigaRing clock wire for the new module slot.

2. Insert the GigaRing clock wire into the clock connector of the new rail; all GigaRing clock wires are inserted into connector xxx-ybh-07 or xxx-zah-07; refer to Figure 7.

Use the same wire insertion procedure that you used for the system clock wire to insert the GigaRing clock wire (refer to Figure 12) into the rail connector.

Figure 12. GigaRing Clock Wire



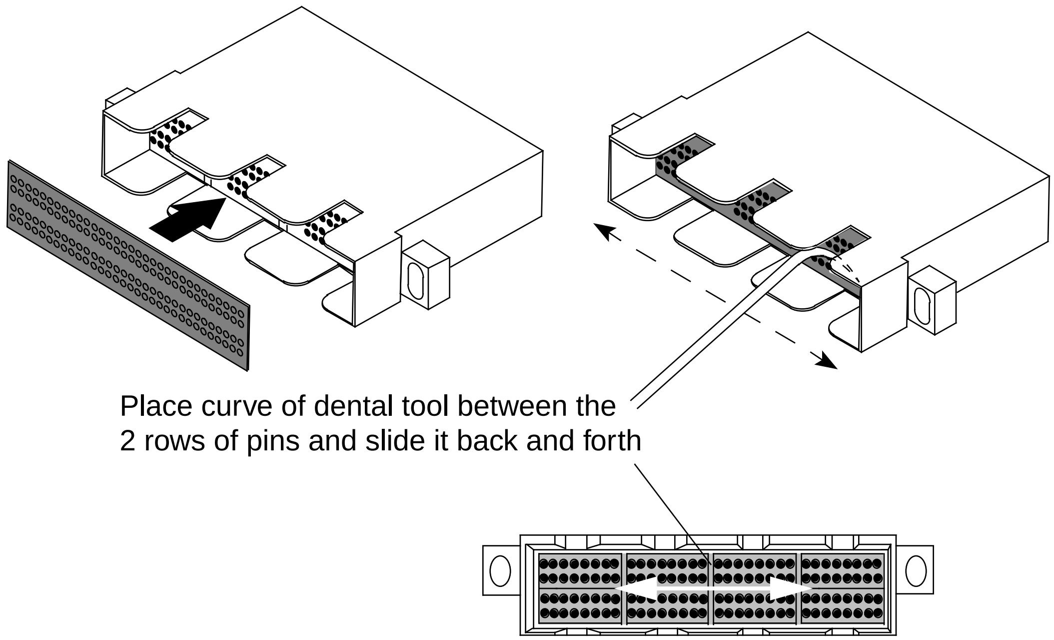
Replacing the Plastic Pin Lock

1. From the module side of the connector, position the pin lock on the connector. Place the rough side toward the pins and the smooth side toward the module. Refer to Figure 13.

2. Use a dental tool to fully insert the pin lock in the connector. Press the curve of the dental tool against the center of the pin lock, between the 2 sets of pins. Then gently slide the dental tool back and forth as you push the pin lock into position. Refer to Figure 13.

3. Ensure that the pins are straight. (If necessary, use a 0.3-mm mechanical pencil to straighten a misaligned pin. Slip the tip of the pencil over the pin and gently bend the pin into the proper position.

Figure 13. Inserting and Seating a Plastic Connector Pin Lock



Boundary Scan Cable Connections

Each rail contains a PEM-to-scan cable (P/N 15214300). This cable is installed into the clock connector and supplies the TCK and TMS signals to the PCB as well as daisy chain scan data (TDI and TDO signals). The following procedure details a single-cabinet upgrade. If you install additional cabinets, refer to boundary scan specification 800599 for the correct slot, connector, and pin locations for connecting the new cabinet(s) to the boundary scan.

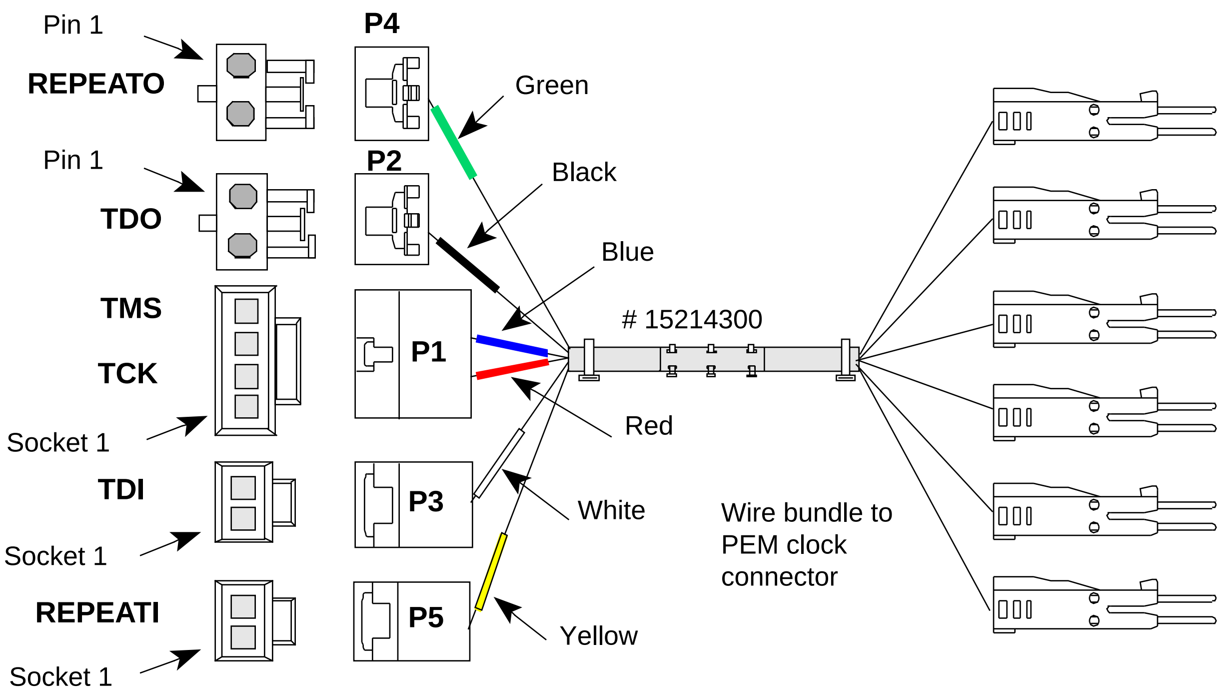
1. On the Z side of the cabinet, carefully remove the tie wrap from the PEM-to-scan cable. Refer to Figure 14.

   NOTE: The following procedure describes how to make changes to the cabling for boundary scan. If you install several slot kits, do all boundary scan cable changes at one time.

2. Refer to the following subsections to make the cable connections for the TCK/TMS, TDI, TDO, RepeatI, and RepeatO signals as necessary.

3. After making the connections on the Z side, repeat these steps for the Y side of the cabinet.

Figure 14. PEM-to-scan Cable



TCK and TMS Connections

The clock module sends both the TCK and TMS0/1 signals via cable P/N 15237700 to each module rail. This cable is bundled with the system clock and GigaRing clock wires. Each cable is marked with the module slot location and the pin connector is covered with black tubing.

1. Find the correct connector in the wire bundle for the new rail(s), remove the black tubing, and plug it into connector P1 of the PEM-to-scan cable.

If your upgrade includes additional cabinets, you will route TCK and TMS 2 through TMS 15 to the other cabinets from the boundary scan master per the reconfiguration specification.

TDI and TDO Daisy Chain Connections

The next steps refer to two module rails: the term *old rail* refers to the last (top) module rail before the upgrade; the term *new rail* refers to the new rails that you install as part of the upgrade.

1. On the PEM-to-scan cable, remove the *TDO >RepeatI* wire, P/N 15223802, from the TDO connector (P2) of the *old* rail.

2. Connect it to the black connector (P2) on the topmost *new* rail.

3. Connect the black connector (P2) from the *old* rail to the white connector (P3) on the new rail directly above the *old* rail.

4. Connect the black connector (P2) from that new rail to the white connector (P3) of the next higher rail.

5. Continue connecting the black connector from one rail to the white connector of the next highest rail until all rails are connected.

   NOTE: The black connector on the topmost *new* rail has already been used for the *TDO > RepeatI* signal. Figure 15 shows how to connect the daisy chain.

The following example shows some of the boundary scan disconnects and connects from engineering upgrade specification 801111 (LC 128 to LC 256).

Disconnect

001-ybh56	15214300, yellow	15223802	017-ybh54	black	REPEATI < TDOM

Connect

018-yaf41	15237700 P2	019-ybh52	15214300, red	1-68 TCK FO > TCKM
018-yae30	P3	019-ybh51	blue	1-34 TMS FO > TBSMb
017-ybh54	15214300, black	019-ybh53	white	TDOM > TDIM
018-yaf40	15237700 P2	020-ybh52	15214300, red	1-68 TCK FO > TCKM
018-yae29	P3	020-ybh51	blue	1-34 TMS FO > TBSMb
019-ybh54	15214300, black	020-ybh53	white	TDOM > TDIM
018-yaf39	15237700 P2	021-ybh52	15214300, red	1-68 TCK FO > TCKM
018-yae28	P3	021-ybh51	blue	1-34 TMS FO > TBSMb
020-ybh54	15214300, black	021-ybh53	white	TDOM > TDIM

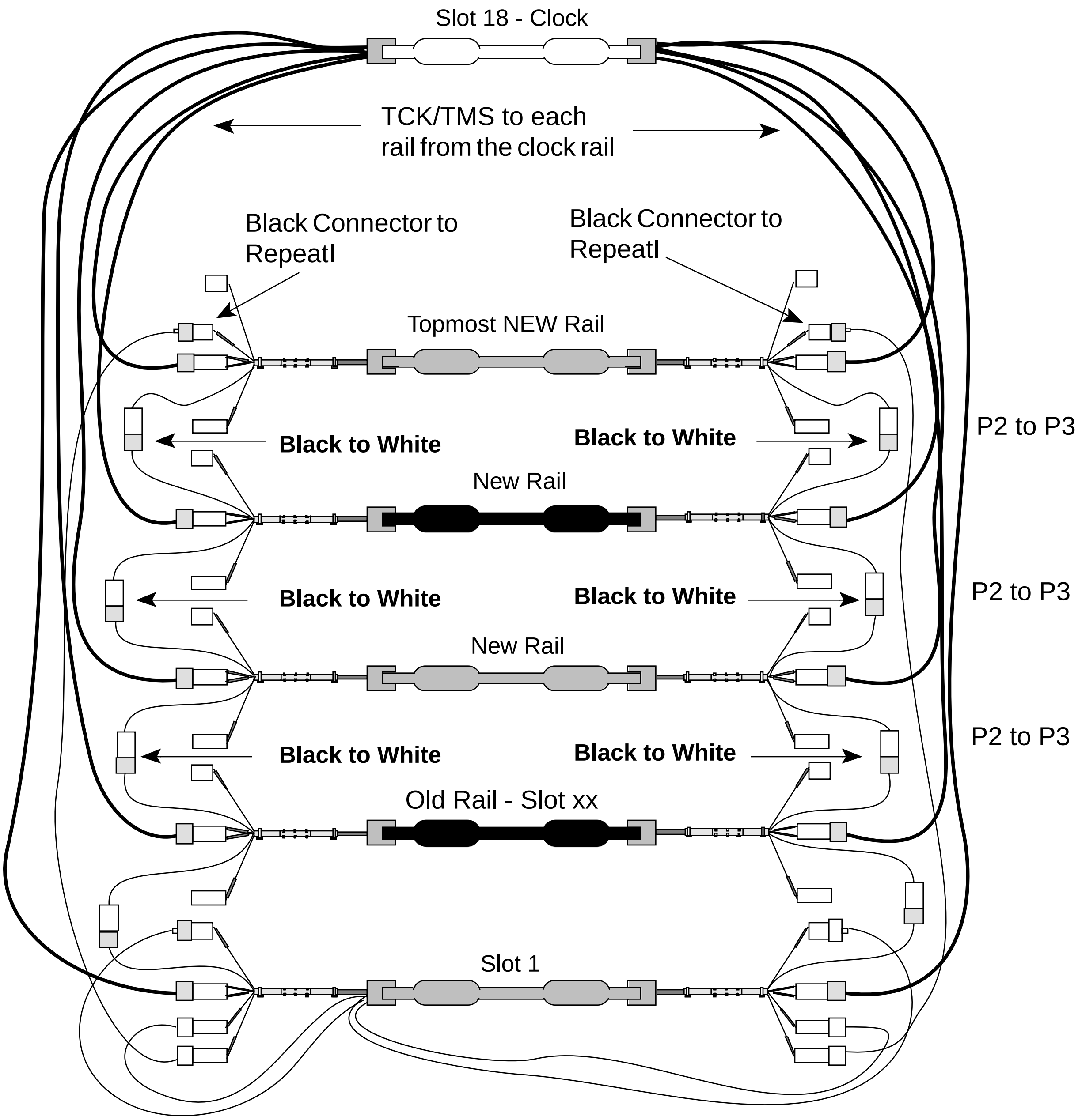
Disconnect

001-zah56	15214300, yellow	15223802	017-zah54	black	REPEATI < TDOM

Connect

018-zaf23	15237700 P2	019-zah52	15214300, red	1-68 TCK FO > TCKM
018-zae23	P3	019-zah51	blue	1-34 TMS FO > TBSMb
017-zah54	15214300, black	019-zah53	white	TDOM > TDIM
018-zaf22	15237700 P2	020-zah52	15214300, red	1-68 TCK FO > TCKM
018-zae22	P3	020-zah51	blue	1-34 TMS FO > TBSMb
019-zah54	15214300, black	020-zah53	white	TDOM > TDIM

Figure 15. Boundary Scan Daisy Chain



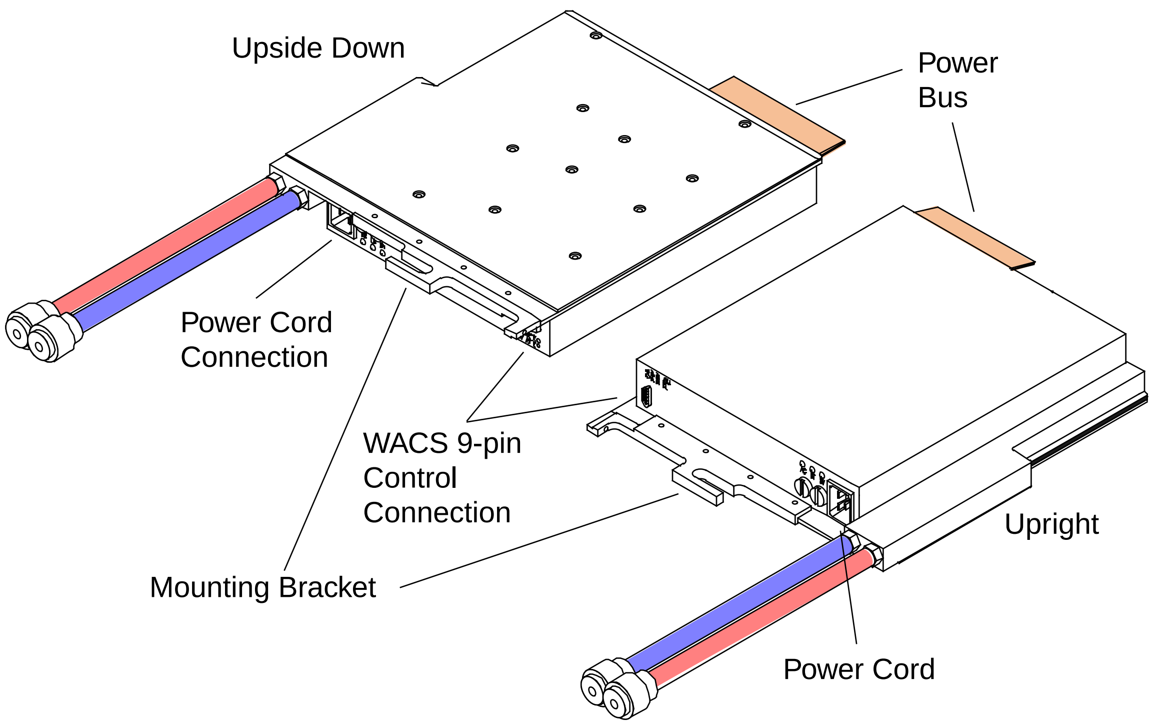
Module Power Supply Installation

Each module upgrade kit contains two power supply assemblies. If you install more than one module, install the power supplies on one side of the cabinet before you work on the opposite side.

Power Supply Installation

1. Determine whether the power supply assembly is installed upright or upside down (refer to Figure 16).

Figure 16. Module Power Supply



2. Slide the new power supply assembly into the chassis between the center support column and the cabinet frame.

3. Use a 3-mm hex wrench to install the holding screw into the center support column. The holding screw is part of the power supply assembly.

   NOTE: The holding screw does not thread into the column. It is placed there to prevent backward movement of the power supply during module installation.

4. Use a short flat-bladed screwdriver to connect the 9-pin WACS power supply control cable (P/N 15213601; refer to Figure 17) to the power supply and the interconnect board. Do not overtighten the thumb screws. Refer to Table 4 for the correct connector location on the interconnect board.

Figure 17. Power Supply Control Cable

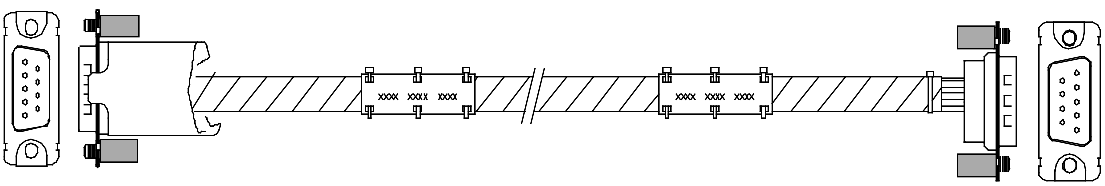
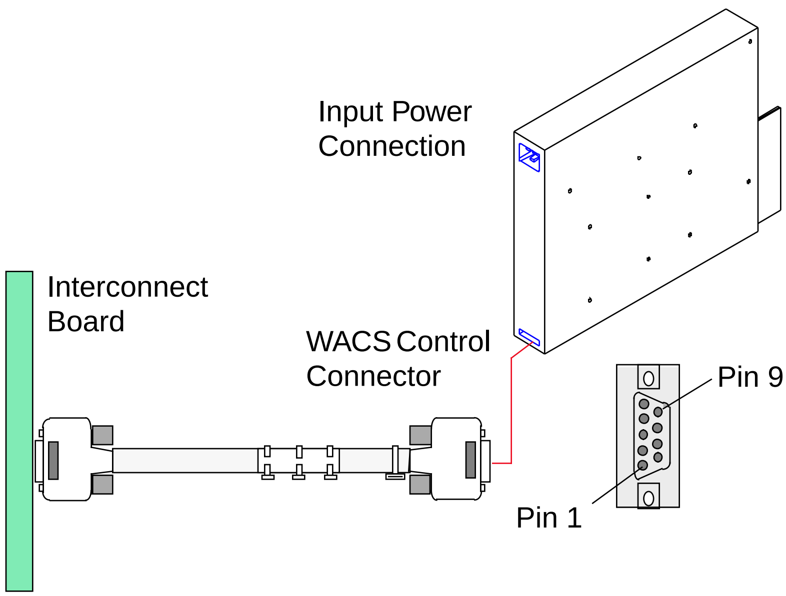


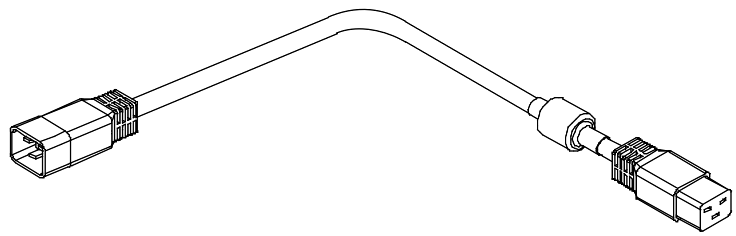
Figure 18. Power Supply-to-Interconnect Board



5. Connect the power supply power cord (P/N 57170001: refer to Figure 19) to the power supply and the power rail.

   NOTE: Ensure that the module slot number and the power supply number correspond.

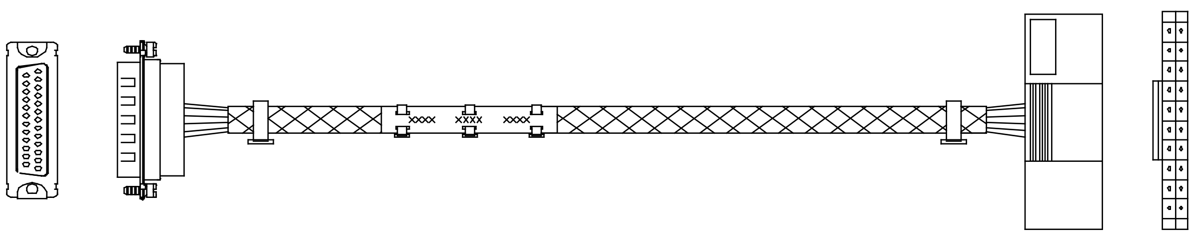
Figure 19. Power Cord



6. Connect the coolant hoses to the manifolds; red for the return hose and blue for the supply hose.

7. Connect the 25-pin connector end of the WACS control cable (P/N 15247600; refer to Figure 20) to the internal bulkhead; this cable attaches to the PEM-to-WACS cable that was installed previously.

Figure 20. PEM-to-WACS Control Cable



8. Route the cable to the appropriate connector on the interconnect board.

9. Connect the 20-pin flat connector to the interconnect board. Be sure the connector locks in place. Table 4 shows the connector locations for both the module and power supply control cables.

Table 4. Interconnect Board

					Y Side		Z Side	
A36	A37	A38	A39	A40	Power Supply Control Cable	WACS Control Cable	Power Supply Control Cable	WACS Control Cable
Module Slot								
1	9	17	25	33	J1	J2	J3	J4
2	10	18	26	34	J5	J6	J7	J8
3	11	19	27	35	J9	J10	J11	J12
4	12	20	28		J13	J14	J15	J16
5	13	21	29		J17	J18	J19	J20
6	14	22	30		J21	J22	J23	J24
7	15	23	31		J25	J26	J27	J28
8	16	24	32		J29	J30	J31	J23

10. Repeat this procedure for the second power supply on the other side of the cabinet.

NOTE: The clock module in slot 18 has only one PCB power supply. This power supply resides on the Z side of the cabinet and connects to interconnect board A38 at connectors J7 and J8. There is no connection from the Y side of the cabinet to J5 and J6.

GigaRing Cable Connection

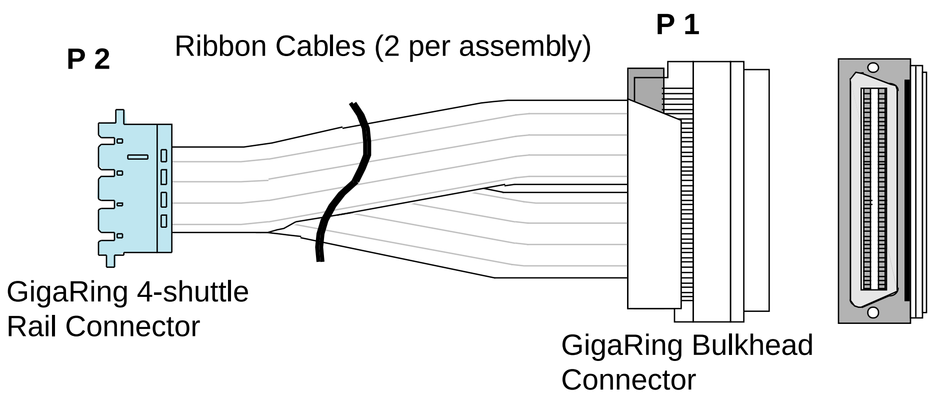
NOTE: For your new configuration, remember that I/O GigaRing connections are not possible above slot 21 until the Pass 3 clock module is installed.

1. If you are adding new GigaRing channels, use a 1.5-mm hex wrench to remove the screws and connector covers on the GigaRing bulkheads for the new cables.

   NOTE: Newer systems use a self-adhesive die-cut copper tape instead of the connector cover. Remove the tape and discard it.

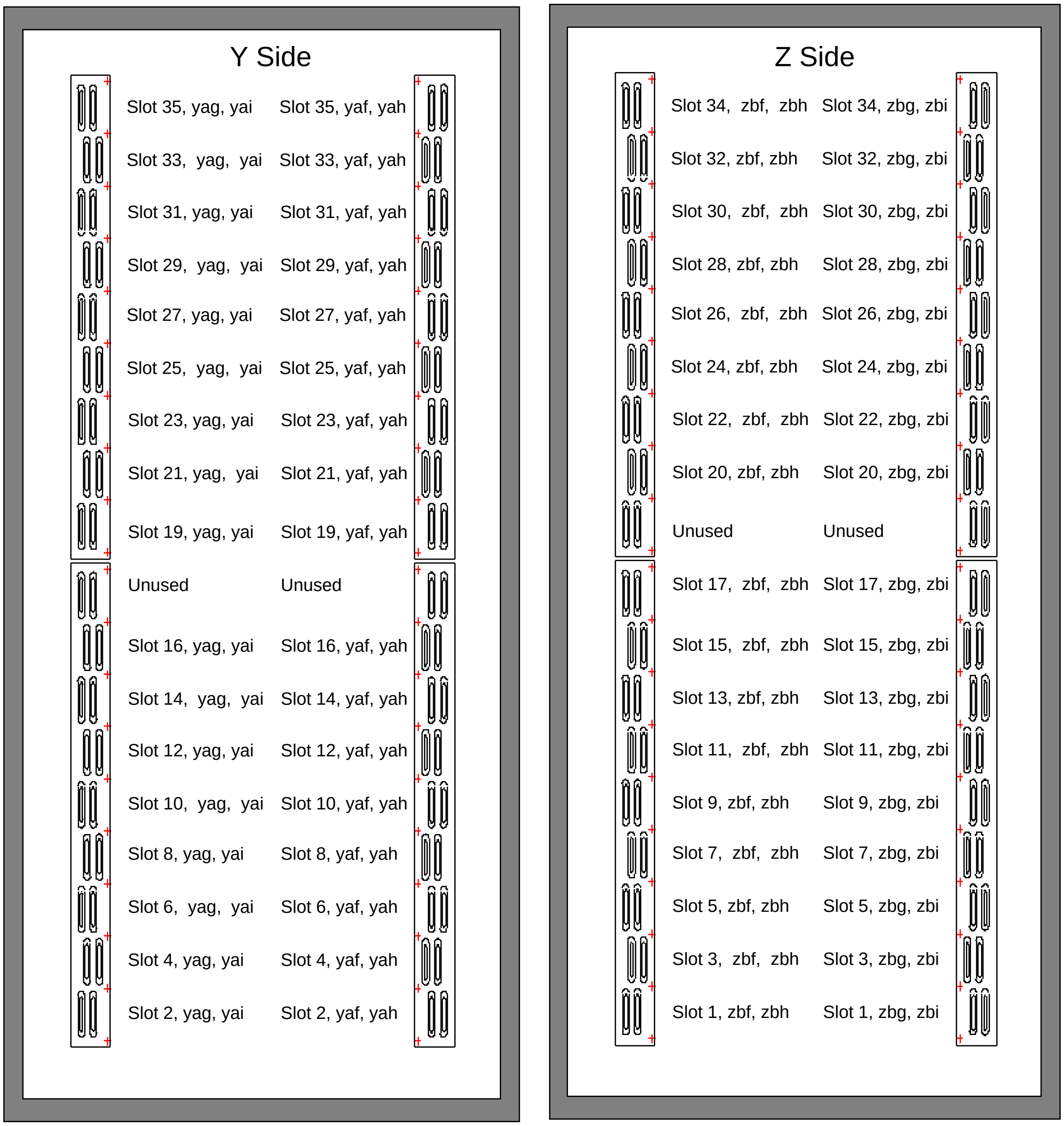
2. Remove the tie wrap that coils each GigaRing cable.

Figure 21. GigaRing Cable



3. Route the GigaRing cables to the appropriate bulkhead. Refer to Figure 22.

Figure 22. GigaRing Bulkhead Connection



4. Position the cable connector in the bulkhead and secure it using a 1/4-in. deep-well socket for the jackscrew, washer, and nut provided. The jackscrews may be either male or female. Depending on the cable definition (NRI, NRO, PRI, or PRO) secure the cable connector to the bulkhead using either the male or the female jackscrew (refer to Table 5).

Table 5. I/O Bulkhead GigaRing Connections

Connector Location	Definition	Jackpost Screw Reference (on bulkhead)
zbf or yaf	Negative Ring In – NRI	Female
zbh or yah	Negative Ring Out – NRO	Male
zbi or yai	Positive Ring In – PRI	Female
zbg or yag	Positive Ring Out – PRO	Male

5. Connect any loopback cables as defined by the new system configuration.

   NOTE: In some cabinets, GigaRing loopback connections are made in the wiremat, behind the bulkheads, via loopback adapters (P/N 15255500).

6. If applicable, connect customer I/O GigaRing channels(s) to the new rail slots. Refer to the system configuration document for the exact locations.

Torus Cable Connection

The upgrade specification, which is also called “reconfiguration,” includes the new torus configuration. Use this specification to perform the disconnects and reconnects of the torus network.

NOTE: Before making any changes to the torus network, be sure that you apply the correct module slot/connector labels to the new torus cables.

Table 6 contains torus disconnect/connect examples from engineering upgrade specification, 801111 (LC128 to LC256).

Table 6. Reconfiguring the Torus

Disconnect			
Chassis-Slot-Conn	Chassis-Slot-Conn	Cable Part Numbers	Dimension
0-17-yaa	0-17-yaj	15112904(x2)	X dimension
0-10-yab	0-14-yab	15112905(x2)	Z dimension
0-11-yab	0-15-yab	15112905(x2)	Z dimension
0-12-yab	0-16-yab	15112905(x2)	Z dimension
0-13-yab	0-17-yab	15112905(x2)	Z dimension
0-10-yak	0-14-yak	15112905(x2)	Z dimension
0-11-yak	0-15-yak	15112905(x2)	Z dimension
0-12-yak	0-16-yak	15112905(x2)	Z dimension
0-13-yak	0-17-yak	15112905(x2)	Z dimension
0-10-ybf	0-14-ybf	15112905(x2)	Z dimension
Connect			
0-17-yaa	0-21-yaa	15112904(x2)	X dimension
0-19-yaa	0-20-yaa	15112904(x2)	X dimension
0-22-yaa	0-25-yaa	15112904(x2)	X dimension
0-23-yaa	0-24-yaa	15112904(x2)	X dimension
0-26-yaa	0-29-yaa	15112904(x2)	X dimension
0-19-yad	0-19-ybd	15112906/15128901	Y dimension
0-20-yad	0-20-ybd	15112906/15128901	Y dimension
0-21-yad	0-21-ybd	15112906/15128901	Y dimension
0-22-yad	0-22-ybd	15112906/15128901	Y dimension

Figure 23 shows torus cables and connectors, with emphasis on the connector alignment grooves. The diagram also identifies the connector blocks, which are colored to indicate the type of torus cable. Table 7 defines the colors of the torus cable rail connectors.

Table 7. Torus Cable Color Chart

Cable	Length	Part Number	Connector Block Color
X dimension	13 in. (33 cm)	15112904	Gray
Y dimension	23 in. (58 cm)	15112906	Green
Z dimension	24 in. (61 cm)	15112905	Blue
Inverted Y	23 in. (58 cm)	15128901	Red

It is possible to connect the torus cables upside down despite the alignment grooves. Study the sides of the connectors to determine the subtle differences that will help you identify the pin/groove side when you cannot see the pin/grooves easily.

Complete one side of the cabinet at a time. To upgrade your torus configuration:

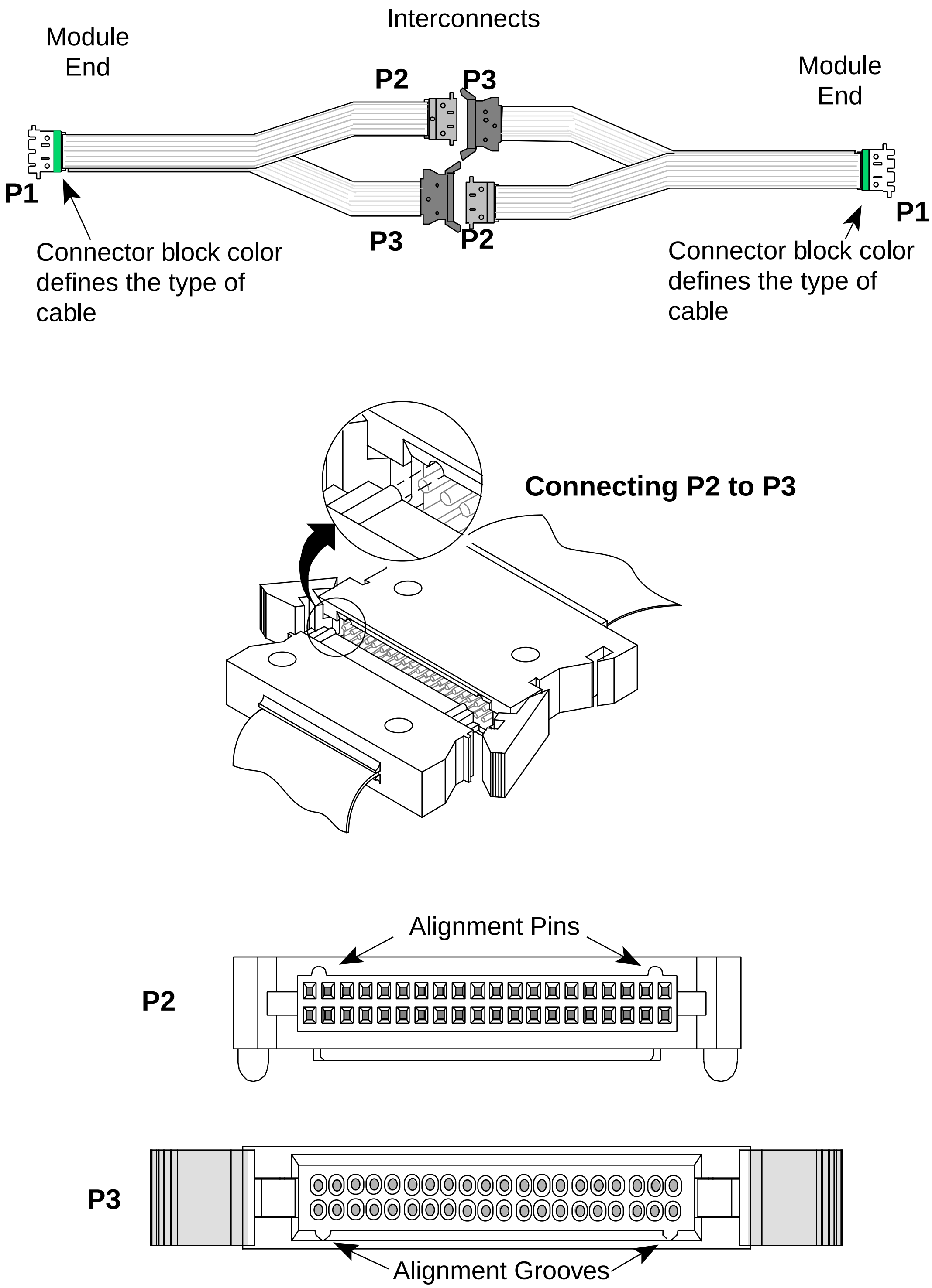
1. Disconnect the torus cables per the reconfiguration specification.
2. Reconnect the torus cables per the reconfiguration specification.

NOTE: If your upgrade involves additional LC cabinets, reconfigure the torus cables after you install all new hardware.

To make cable connection easier between cabinets it is best to route the crossover torus cables (which connect cabinets) out the cable trough openings before installing the cable troughs. This way, when you install the cable troughs, all the crossover cables are available and ready to be placed inside the cable trough.

Refer to "Cable Trough Installation" for the procedure on installing the cable troughs.

Figure 23. Torus Cable Connectors



Module Insertion

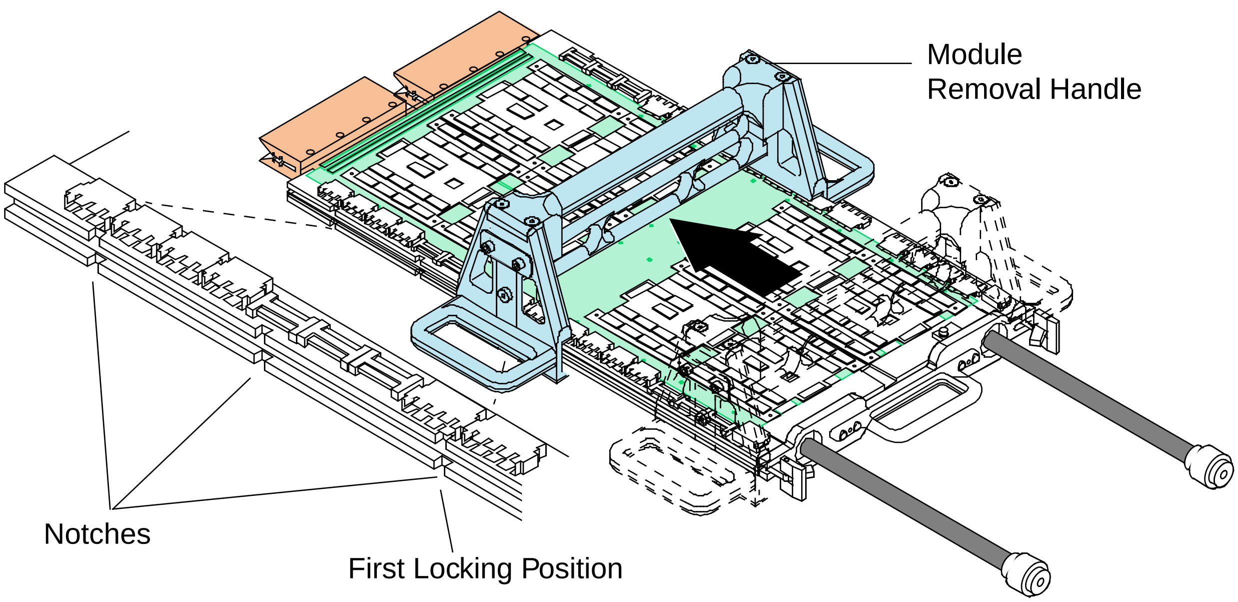
Installing the Module

Before you insert the module, determine whether you need to place it upright or upside down in the cabinet. Match the GigaRing tag on the module to the GigaRing tag on the rail.

1. Inspect the module slot and connectors using a flashlight. Check for wires that stick out between the connectors on the module rails.

2. Slide the module removal handle over the new module, as shown in Figure 24, until in locks into the first locking position on the cold plate.

Figure 24. Module with Removal Handle



3. Install 4 metal cams into the module to pull the shuttles into the module connectors (inside guides).

4. Lift the module by the handles and carefully position the module into the rails.

5. Slowly insert the module until it contacts the module removal handle. Slide the module removal handle gently toward you as you continue to insert the module. When you feel that you can control the module without the module removal handle tool, slide the tool completely off the module.

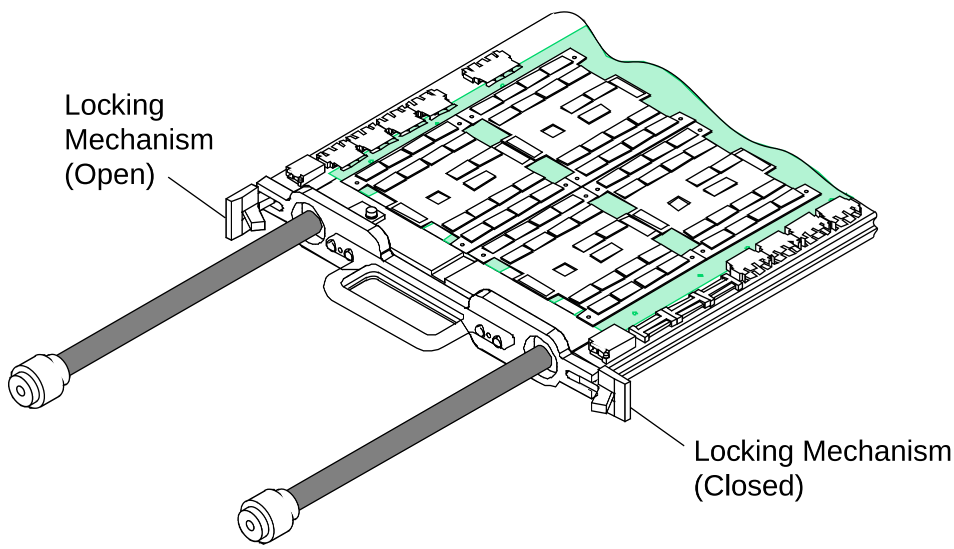
6. Continue to insert the module until the module power buses slide over the power supply power blades.

   NOTE: You may need to apply some force to properly seat the module. Be careful not to over-force the module and damage it or the connectors.

7. After you insert the module, close the mechanical locks. **You must close the mechanical locks before you continue**.

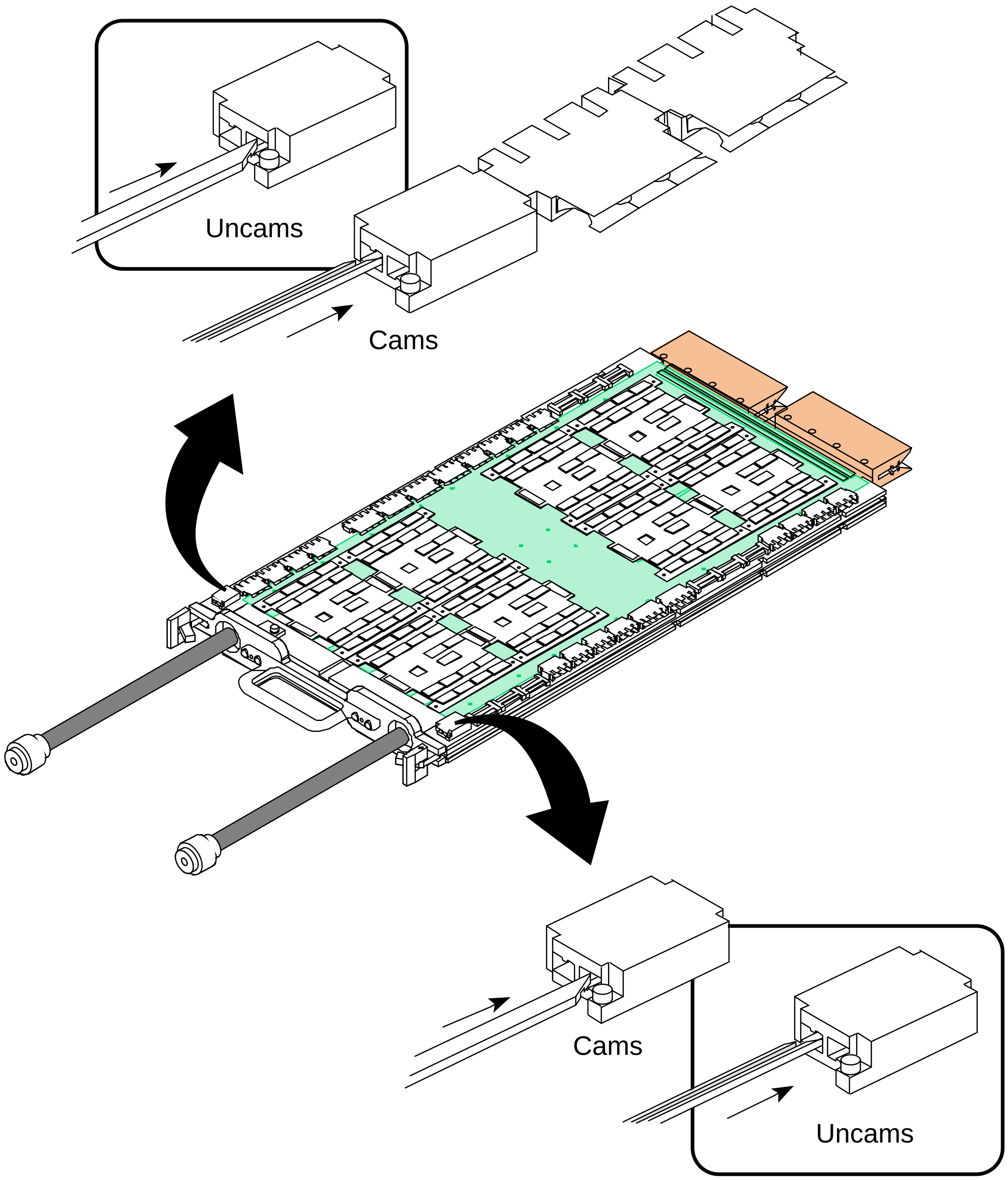
   NOTE: If the mechanical locks do not close, pull the module out and insert it again.

Figure 25. Module Handle Locking Mechanism



8. Engage the module sliders by removing the cams. Insert the camming tool into the outside guides of the module connectors; refer to Figure 26. Hold the camming tool near the connector guides to avoid damaging the tool. Be sure all module sliders in each row of connectors engage in the proper position.

Figure 26. Module Insertion



9. Insert the plastic shuttle retainers (cams) to hold the shuttles in place.

10. Connect the module coolant hoses.

11. Repeat this procedure for each module that you install.

NOTE: This is a good time to move modules if you are installing new modules with different memory capacities or clock speeds.

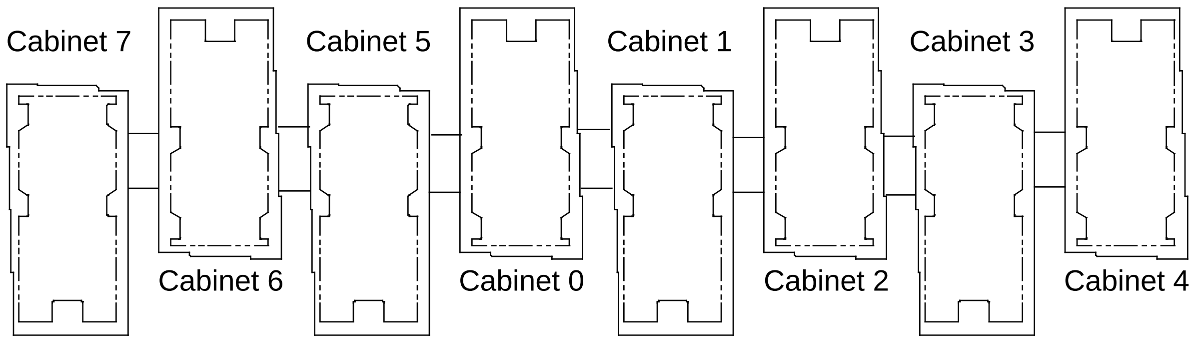
Installation of Additional Cabinets

Installing a second cabinet is the same as installing a single cabinet with the exception of the cabinet placement, under-floor piping, and cable crossway assemblies. This document describes placement of the second cabinet, underfloor coolant piping changes, and the addition of the cable crossway assemblies (cable troughs).

The second cabinet in a two-cabinet configuration faces the opposite direction to the first. The two cabinets connect via cable troughs (cable crossway assemblies) between the cabinets. Torus cables connect between cabinets through the cable troughs.

Figure 27shows a full eight-cabinet configuration.

Figure 27. Eight-cabinet Configuration



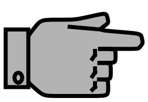


Figure 28 and Figure 29 show the placement of either one or two additional cabinets. **The correct alignment between cabinets is critical.**

Before additional cabinets are installed, Site Planning supplies the site with a full-scale floor template of an LC cabinet. Use this template to determine the exact location of the add-on cabinet and to mark floor tiles for cutouts. Use the *LC Single-cabinet Installation* document, publication number HMM-171-0, for complete procedures on installing the additional cabinet.

Figure 28. Two-cabinet Layout

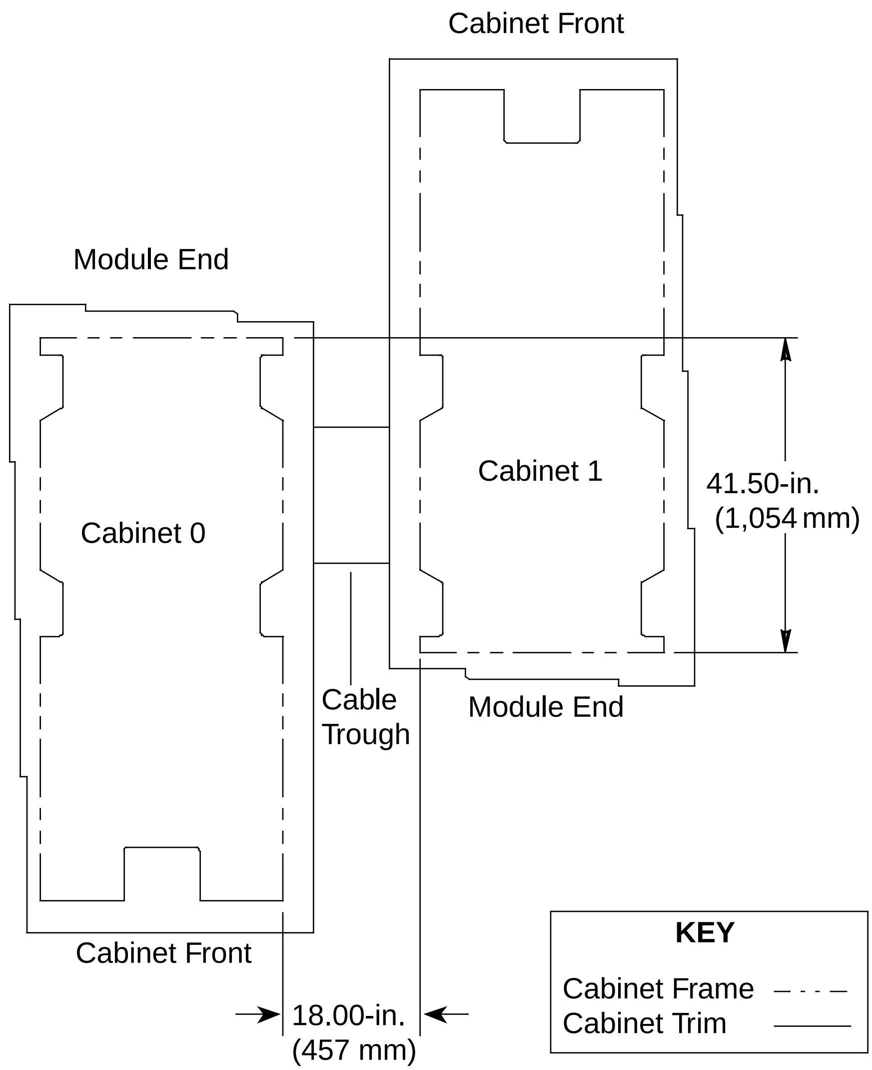
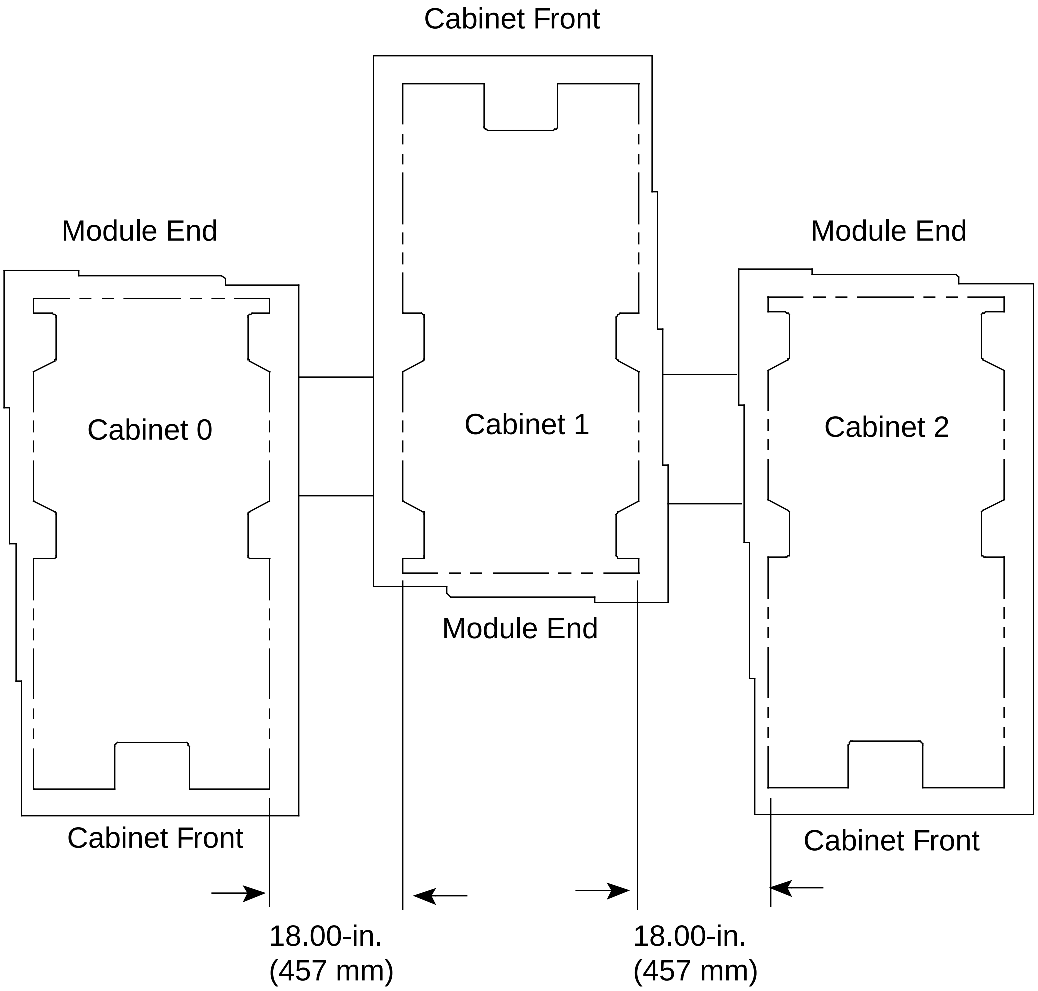


Figure 29. Three-cabinet Layout



Coolant Piping Installation

Use the following procedures to make the coolant connections between the original and new cabinet.

Figure 30 shows the final layout of the underfloor piping for a two-cabinet configuration.

Figure 30. Two-cabinet Coolant Piping

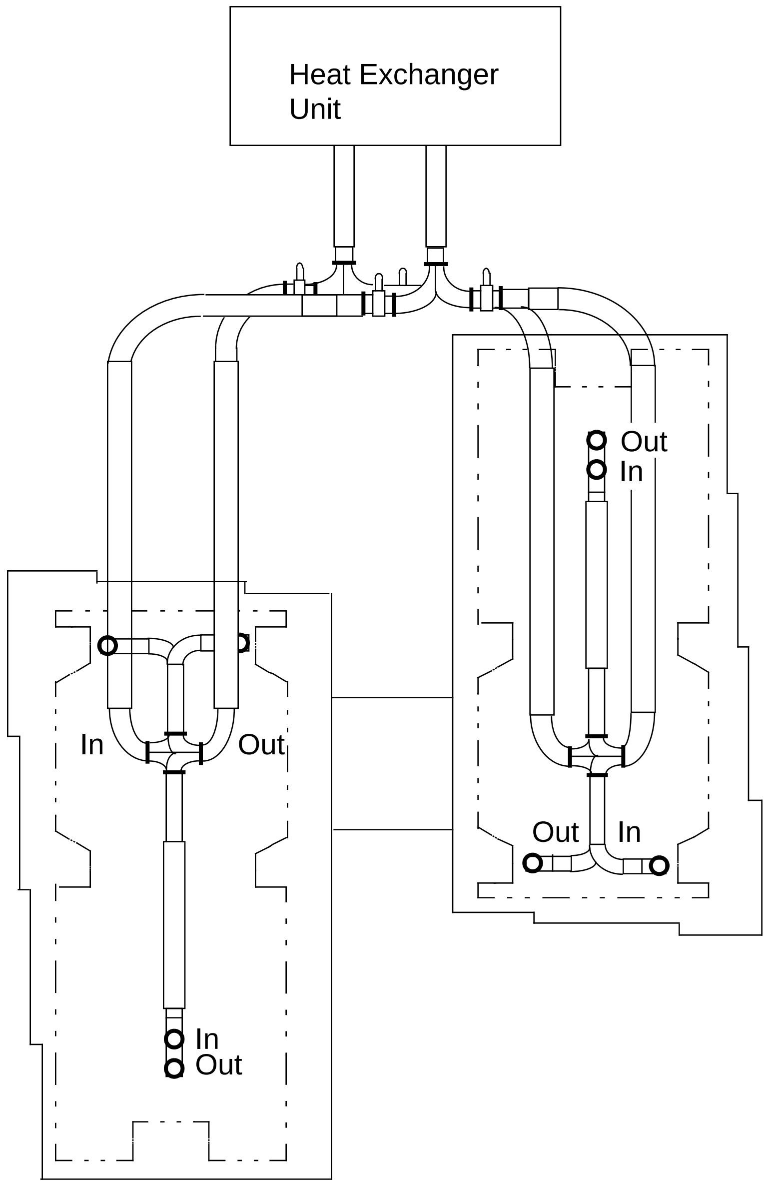
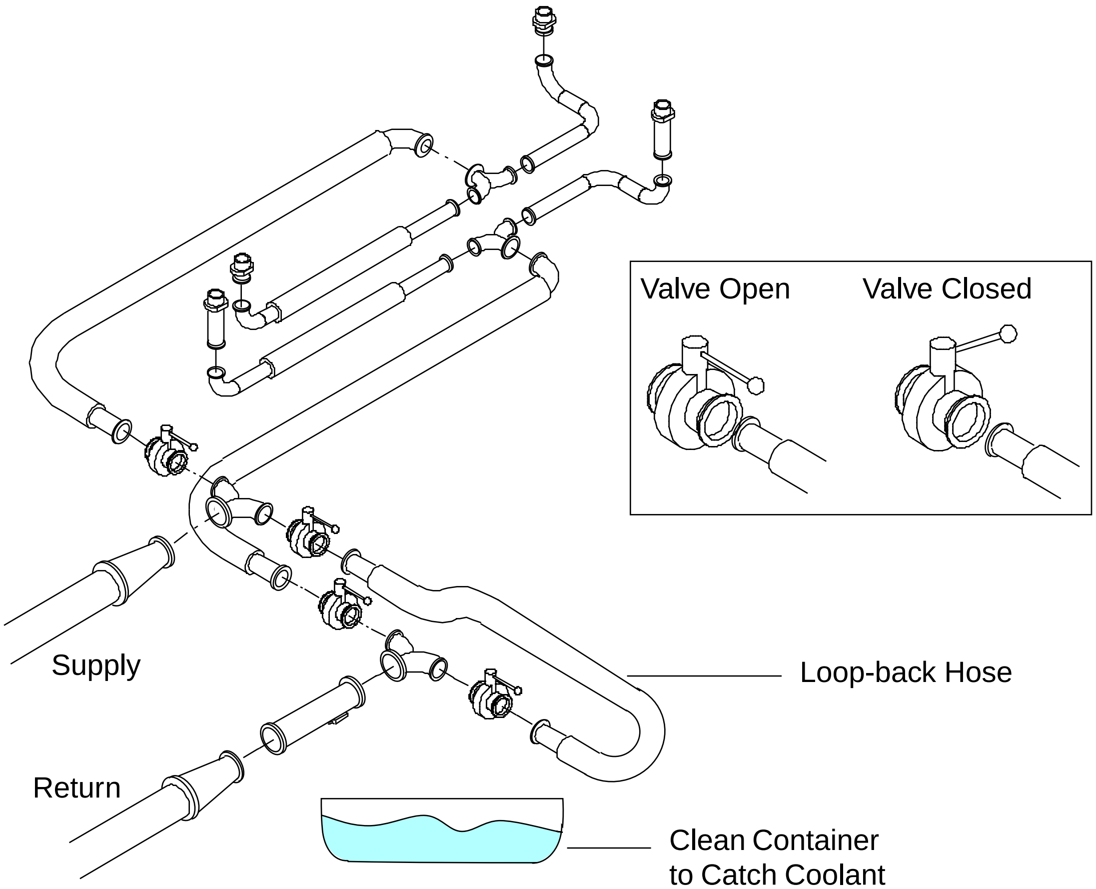


Figure 31 shows an exploded view of the pipe connections for the two cabinets.

Figure 31. LC Cabinet Coolant Piping with Loop-back Hose



When the first cabinet was installed, a 6-ft. (~3 meter) coolant hose was looped back-to-back between the butterfly valve T-pipe assemblies for the supply and return lines from the HEU. You will disconnect this loopback hose and attach the new cabinet coolant hoses to the T-pipe assemblies. Refer to Figure 31.

1. Power off the HEU and the LC cabinet.

2. Remove as many floor tiles as necessary to expose the coolant T-pipe valve assemblies.

3. Close both sets of valves for the supply and return lines (two valves per line).

   NOTE: In the closed position, the handle is positioned perpendicular to the coolant pipes. Refer to Figure 31.

4. Place a large clean container under one end of the loopback hose.

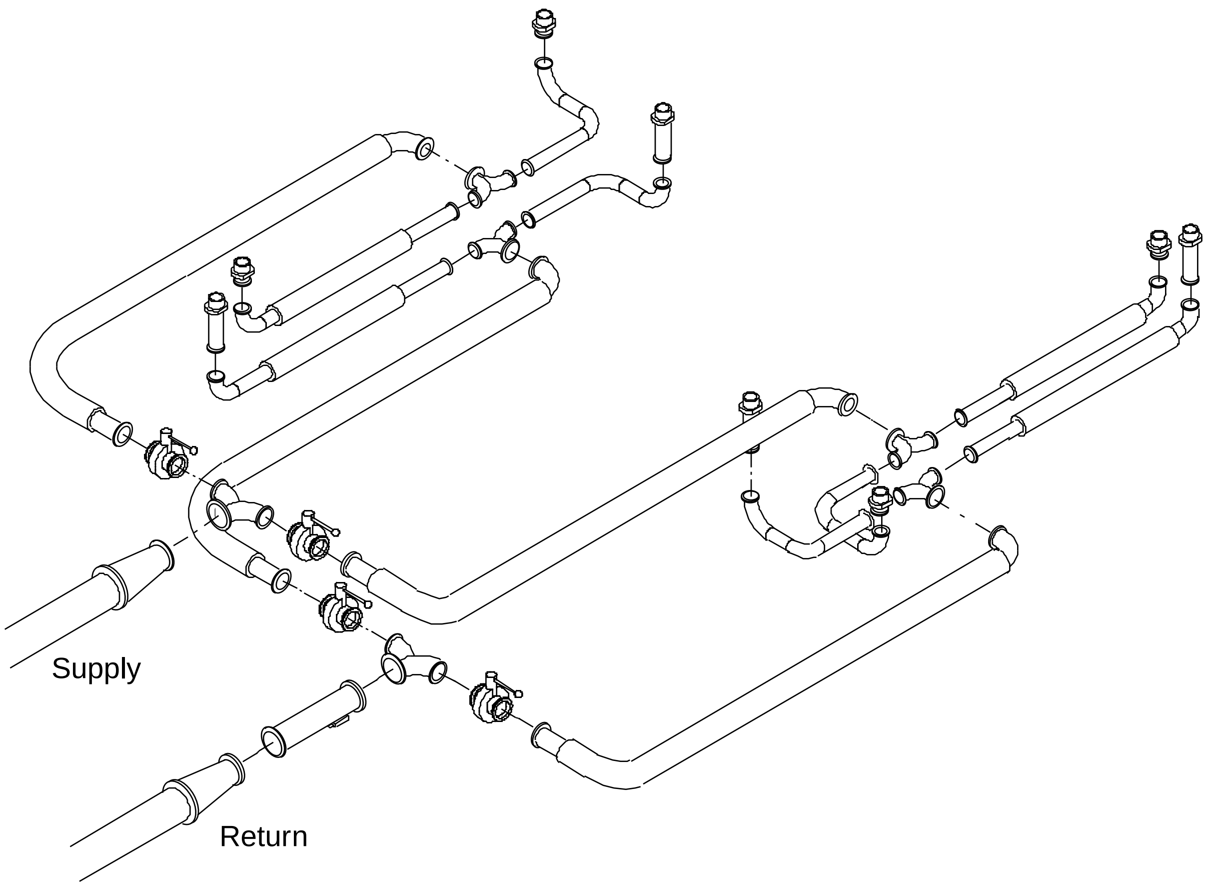
5. Remove the clamps that secure the 6-ft. loopback hose to the T-pipe valve assemblies.

As soon as you open the first clamp, coolant flows out of the loopback hose. Be prepared to capture as much coolant as possible. The loopback hose holds approximately 2 gallons (7.6 liters) of coolant.

6. Remove the 6-ft. loopback coolant hose.

NOTE: Cap both ends of the hose and store the hose on site.

Figure 32. LC Cabinet Coolant Piping for Two Cabinets



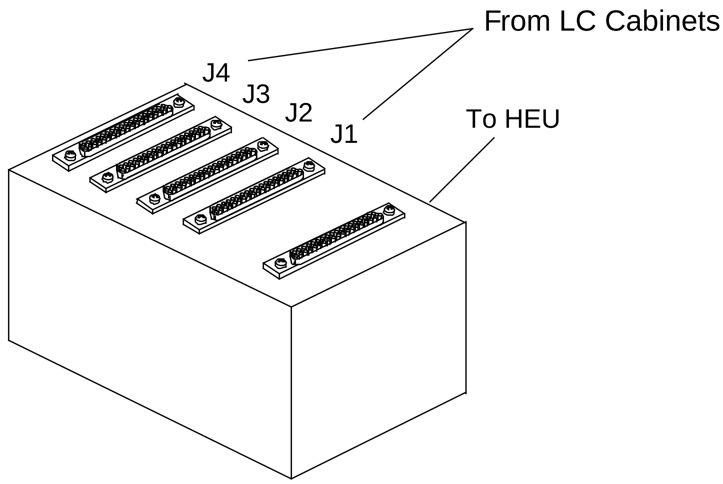
7. Clamp the 6-ft. supply hose from the new cabinet to the supply-line valve assembly. Refer to Figure 32.

8. Clamp the 6-ft. return hose from the new cabinet to the return-line valve assembly.

HEU WACS Cable Adapter Box

Before filling the new LC cabinet with coolant you must connect a WACS cable between the new cabinet and the HEU. To facilitate connection of multiple LC cabinet WACS cables to one HEU, an adapter box (refer to Figure 33) is installed under the floor. You must connect the original WACS cable and the new WACS cable to this adapter box.

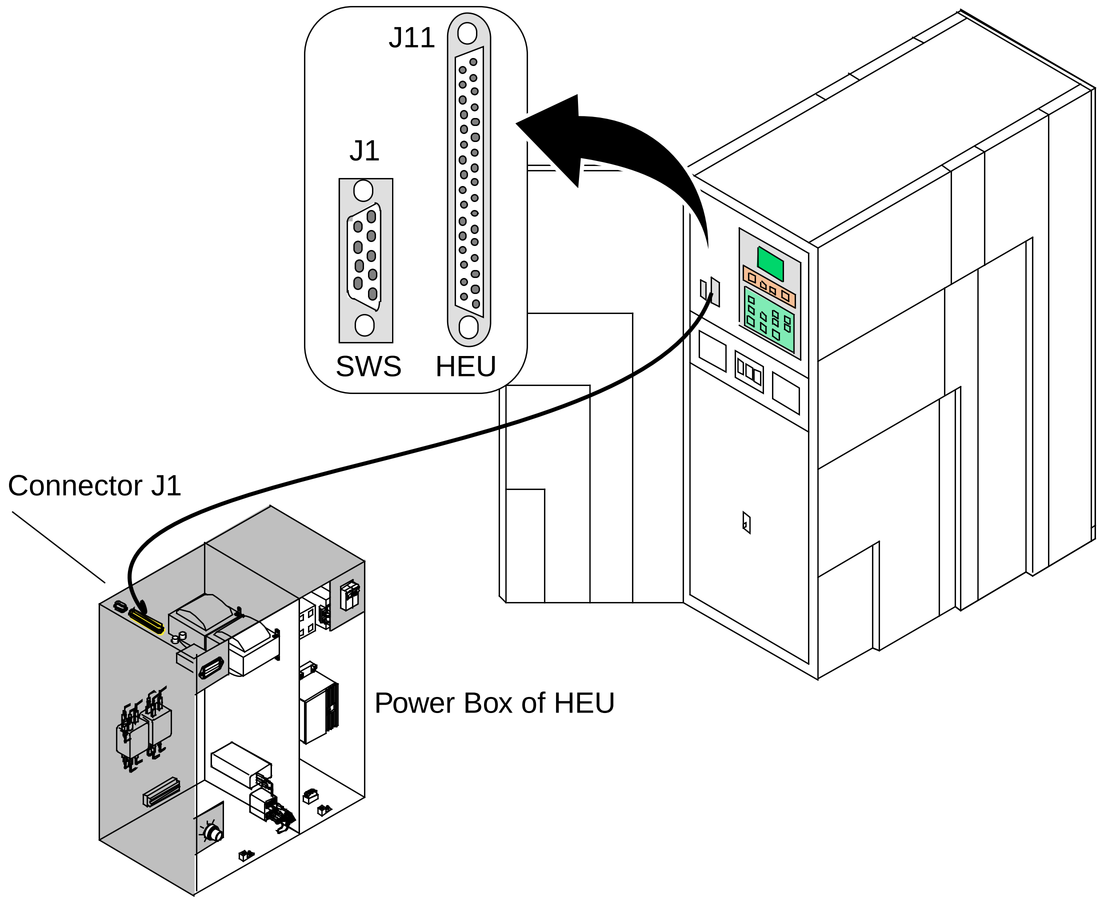
Figure 33. HEU WACS Adapter Box



1. Open the front door of the HEU.

2. Remove the WACS cable of the original cabinet from connector J1 on the power box of the HEU.

Figure 34. HEU WACS Original Cabinet Connections



3. Place the adapter box under the floor close to the HEU.

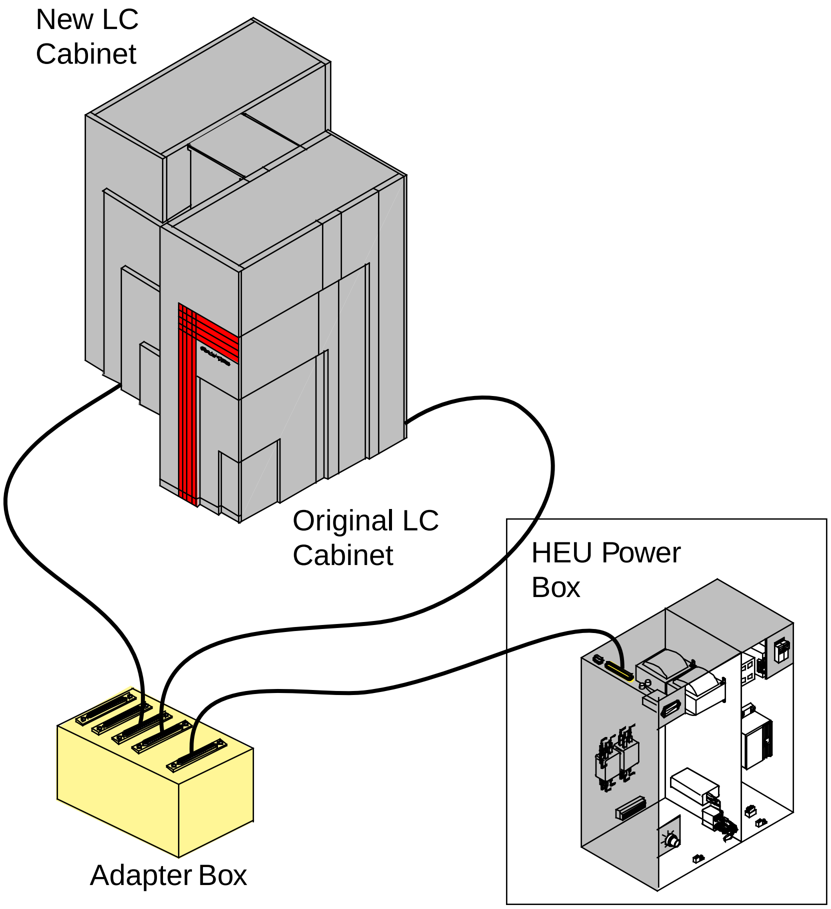
4. Reconnect the original cabinet's WACS cable to connector J1 on the adapter box.

5. Connect a second WACS cable to connector J11 on the WACS access panel of the new cabinet.

6. Route the other end of the WACS cable to connector J2 of the adapter box.

7. Connect a new WACS cable from the HEU connector of the adapter box to connector J1 on the power box of the HEU.

Figure 35. HEU WACS Cabling with Adapter Box



Filling the New Cabinet with Dielectric Coolant

1. Open the valves that control the new cabinet. **Do not open** the valves that lead to the original cabinet.

   NOTE: As soon as you open the valves, coolant flows from the HEU to the new cabinet; this drains the HEU reservoir.

2. Remove the filler cap from the HEU reservoir.

3. Place the suction hose from the coolant-filler pump inside the dielectric-coolant barrel and place the drain hose in the reservoir.

4. Turn on the coolant pump. As you pump the coolant into the HEU reservoir it flows from the HEU into the new LC cabinet until it reaches the same level in both.

You can attach a coolant hose (from the spares kit) to the uppermost quick-disconnect (QD) fitting on any manifold to bleed excess air from the manifolds as coolant enters. Failure to bleed off excess air may cause an air block within the manifolds. Be ready to disconnect the coolant hose if coolant flows from it.

NOTE: Before you continue with this procedure, ensure that the new LC cabinet completed all electrical checks and is ready for power-on.

5. Remove the lock and tags from the HEU.

6. Turn on circuit breakers CB1 through CB4 at the new LC cabinet.

7. Turn on circuit breaker CB1 at the HEU.

8. Press the COOLING BYPASS switch on the new LC cabinet.

    a. Each time you press the switch, the coolant level should drop. Keep the reservoir approximately half full of coolant during this procedure.

    b. Continue filling the reservoir and the new LC cabinet by pressing the cooling bypass switch.

9. When the cabinet is completely charged, leave the HEU reservoir approximately two-thirds full; that is, all floats in the liquid-level indicator are turned up.

10. Open the valves that control the original cabinet.

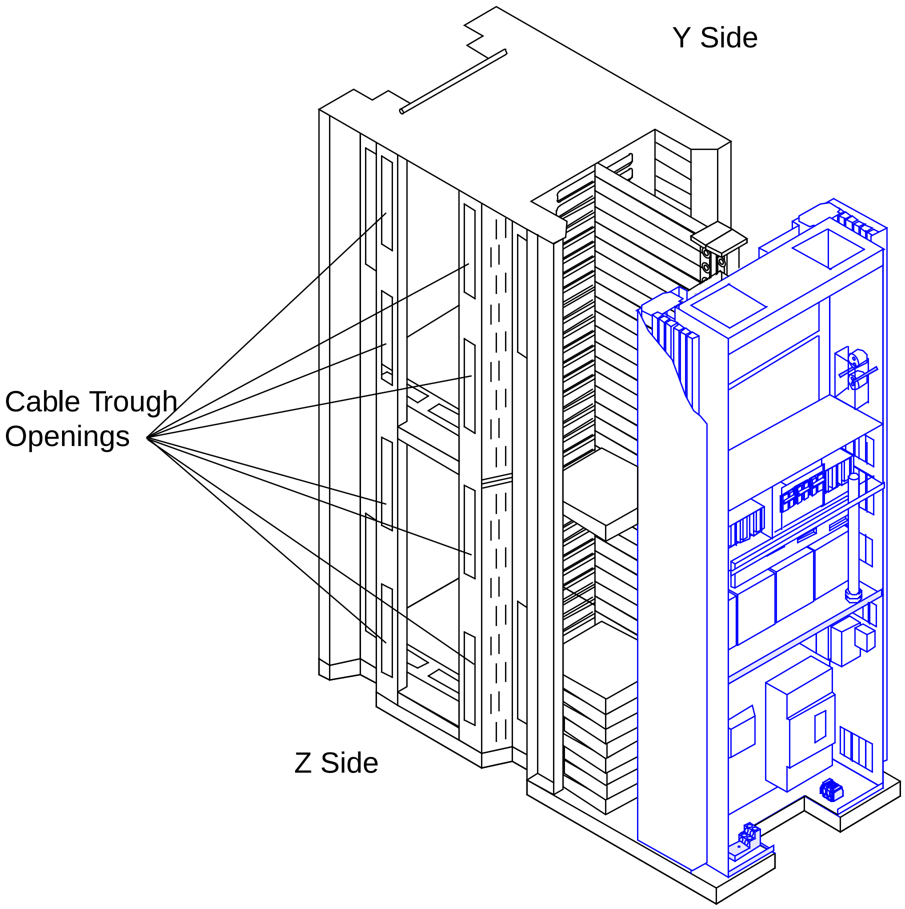
11. Power on the original cabinet.

12. Check the coolant level in the reservoir and make adjustments as required.

Cable Trough Installation

Each cabinet has 8 openings per side for the cable trough hardware. Figure 36 shows the location of the troughs on the Z side of the cabinet.

Figure 36. LC Cabinet Cable-trough Openings



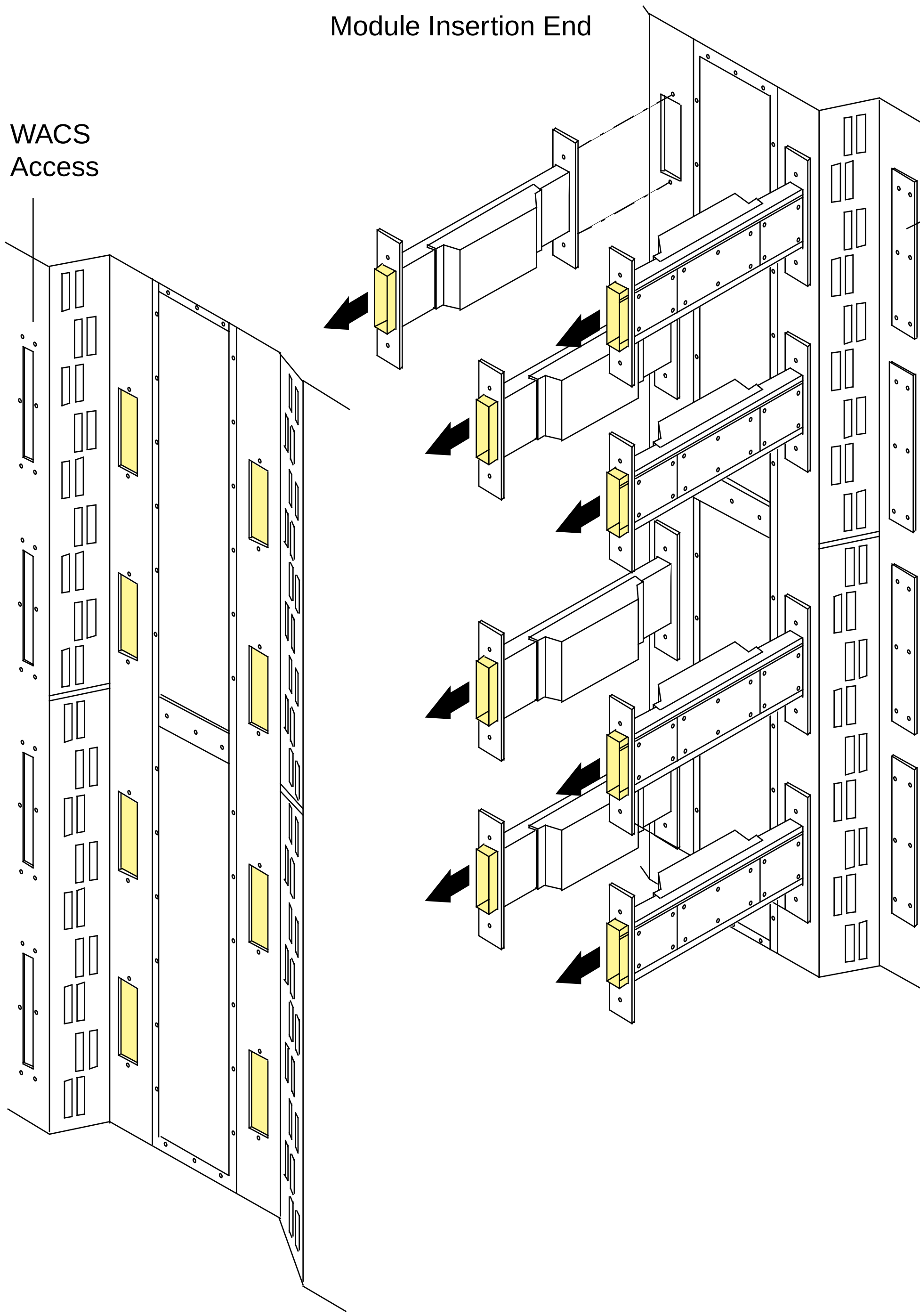
1. Use a 4-mm hex wrench to remove the 16 screws and 8 cover plates from both cabinets.

   NOTE: It is helpful at this point to route any torus crossover cables through the trough openings in both cabinets.

2. Use a Phillips screwdriver to remove the center access cover from each cable trough; this provides access for the torus cable connections.

3. Use the screws that you removed earlier to insert the 8 cable troughs into the cabinet openings and secure them in place; refer to Figure 37. Place the torus crossover cables into the troughs as you install them.

Figure 37. Cable Trough



Connecting the System Clock to the Additional Cabinet

With the addition of a second cabinet, you must wire the system clock from cabinet 0 to cabinet 1. The clock wire originates on the Zside of cabinet 0 and routes to the Z side of cabinet 1.

1. Remove the modules at locations 19 and 20 in cabinet 0. Place them in an ESD-safe environment.
2. Remove the wire pass-through cover from the center support plate just above slot 18.
3. Connect the clock wire between cabinet 0 and cabinet 1: route the wire from the Z side of cabinet 0 through the wire trough in the center support plate and into cabinet 1 through one of the crossover troughs.

Table 8 lists the master system clock fanout from cabinet 0 to additional LC cabinets.

Table 8. Master Clock Fanout

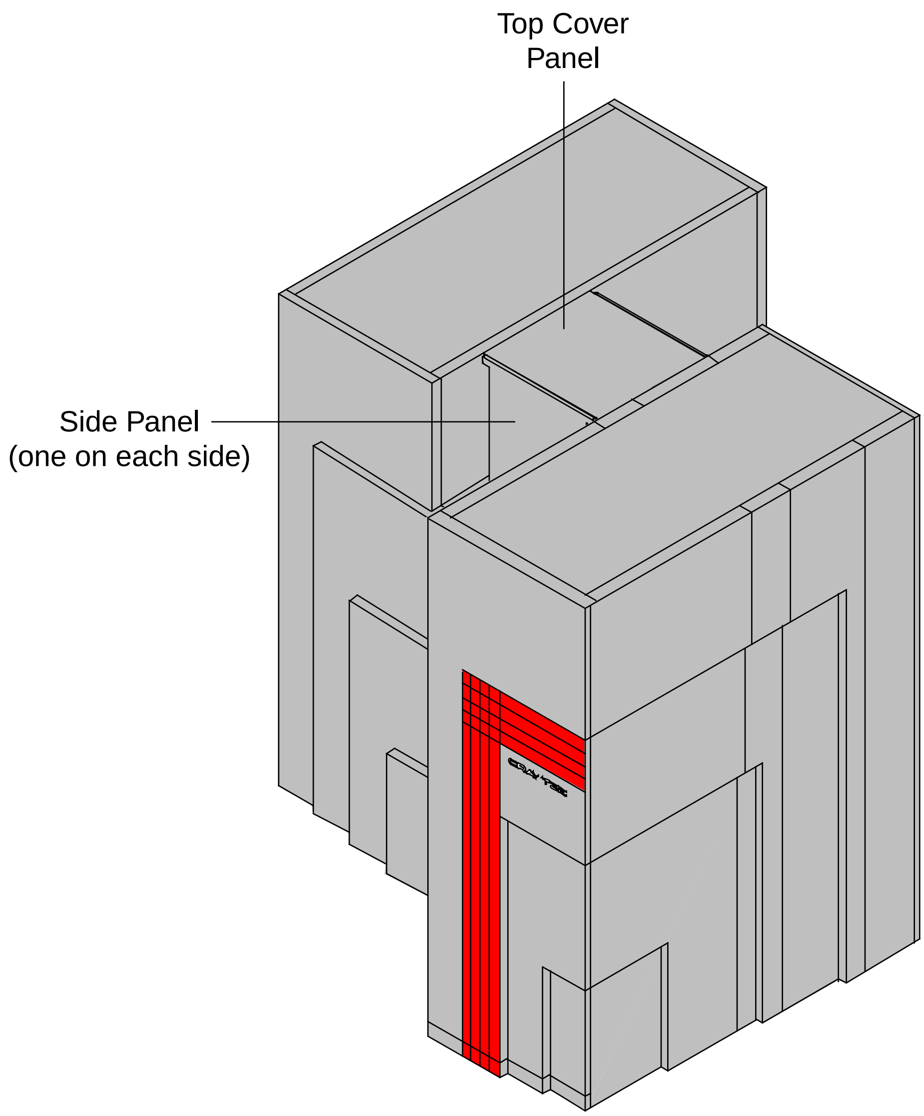
Source	Destination	Signal
018-zai07	118-zah03	Master SysClock to CKM1
018-zai52	118-zah07	Ground Drain
018-zai08	218-zah03	Master SysClock to CKM2
018-zai53	218-zah07	Ground Drain
018-zai011	318-zah03	Master SysClock to CKM3
018-zai54	318-zah07	Ground Drain
018-zai012	418-zah03	Master SysClock to CKM4
018-zai55	418-zah07	Ground Drain
018-zai019	518-zah03	Master SysClock to CKM5
018-zai56	518-zah07	Ground Drain
018-zai020	618-zah03	Master SysClock to CKM6
018-zai57	618-zah07	Ground Drain
018-zai023	718-zah03	Master SysClock to CKM7
018-zai58	718-zah07	Ground Drain

4. Replace the wire pass-through cover.
5. Install the modules at locations 19 and 20 in cabinet 0.

Adding new Cabinet Panels

After all the hardware is installed, the cables are reconfigured, and the system is checked out, install the new cover panels over the crossover cable assemblies. Figure 38 shows the top and side panel covers.

Figure 38. Crossover Panels



1. Position the top cover panel (P/N 15230880) on top of the crossover assemblies between the cabinets.

2. The side panels (P/N 15230900) hang straight down from the top panel. Place each side panel in place by hooking the top of the side panel over the extended edge of the top cover panel.

Updating the Configuration and Running Boundary Scan Tests

After you complete the mechanical installation of the module slot upgrades, you are ready to prepare the system for operation. Complete the boundary scan and offline diagnostic testing whether you installed one new module or an additional cabinet. Use the following procedure. If you need a more detailed procedure, start with Step 1 below.

- Check the following switches on the cabinet:
  - Ensure that the voltage margins are set to normal on all cabinets.
  - Ensure that the clocks are set to normal on cabinet 0.
  - Ensure that the boundary scan hard enable switch is set to enable on cabinet 0.
- In nwacs, update the WACS configuration if you added additional cabinets.

NOTE: If you only added modules to an existing cabinet, nwacs updates automatically. Verify that nwacs reports the new modules.

For information on reconfiguring nwacs, refer to *xelog, xcfg, and nwacs User Information*, publication HDM-012-D.

- In t3ems:
  - Change the number of PEs via the t3ems configuration window.
  - Disable I/O ports that do not connect to GigaRing channels.

For information on reconfiguring your new system via t3ems, refer to CRAY T3E *Offline Diagnostic Maintenance System*, publication HDM-135-0.

A more detailed procedure for running boundary scan and offline diagnostics follows.

At the time of this publication, the procedure consists of the following tasks:

1. Ensure that all system connections are complete, including GigaRing, WACS, and Ethernet connections.

2. Ensure that the nodes (MPN and SPN) are powered up.

   Firmware that resides in each node initiates power-up self-tests and broadcasts the IP address. The SWS then recognizes the nodes and downloads VxWorks onto the nodes.

3. Ensure that the SWS is powered up.

4. Ensure that the MPNs and SPNs are checked out with appropriate tests.

5. Ensure that the CRAY T3E system is powered up.

6. Check the following switch settings on the CRAY T3E LC system:

   - Ensure that the margins are set to normal.
   - Ensure that the clocks are set to normal; cabinet 0 affects all other cabinets.
   - Ensure that the boundary scan hard enable switch is set to enable.

7. Log in at the SWS as `craydiag.`

   NOTE: You **must** log in as craydiag to change the t3e_config file.

8. Run the GigaRing channel clearing utility for each GigaRing channel that connects to your system. For example:

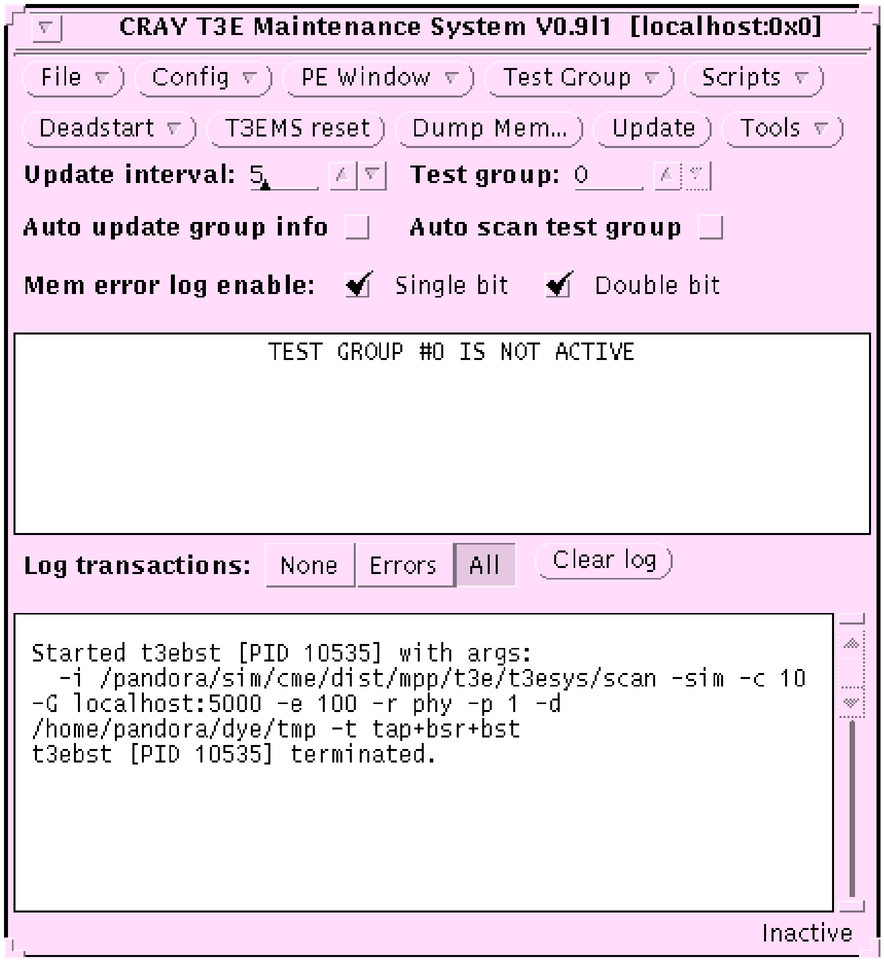
   ```
   sws# /opt/CYRIsws/bin/ring_clear -i sn6303-mpn0
   ```

   (where `sn6303-mpn`*0* is the name of the MPN on the ring).

   NOTE: As noted in FN #2242a, use only the released version of the ring_clear command, which is located in /opt/CYRIsws/bin. The virtual channel (VC) mask is incorrect for some variations of ring_clear commands. The VC mask on the send side is set to use specific paths, which may cause SCX DMA packet timeouts.

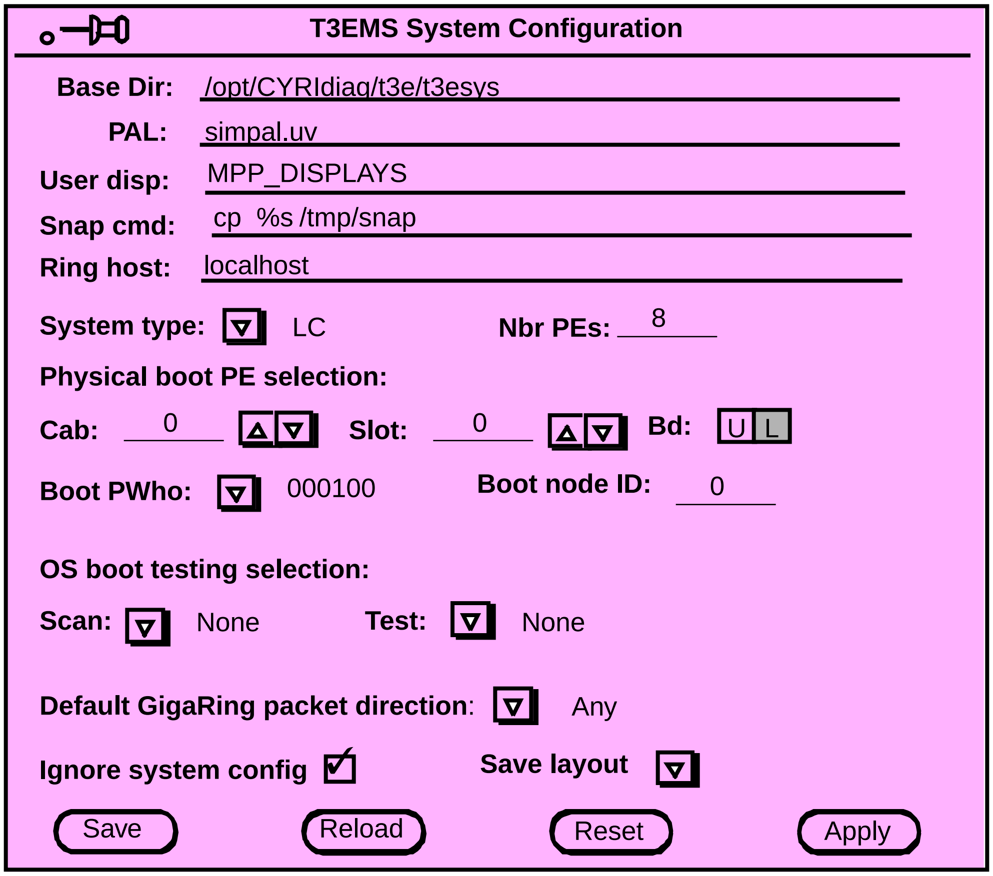
9. In an open space on the SWS window, click the middle mouse button to bring up the t3ems pull-down menu; or type `t3ems &` at the prompt in a terminal window. Figure 39 shows the t3ems main window.

Figure 39. T3EMS Main Window



10. Select the system configuration button. The system configuration window appears as shown in Figure 40.

Figure 40. System Configuration Window



11. Change the number of PEs to the new configuration (Nbr PEs:___).

12. Bring up the PE configuration window and make sure the Mem config setting is correct for **all** PEs.

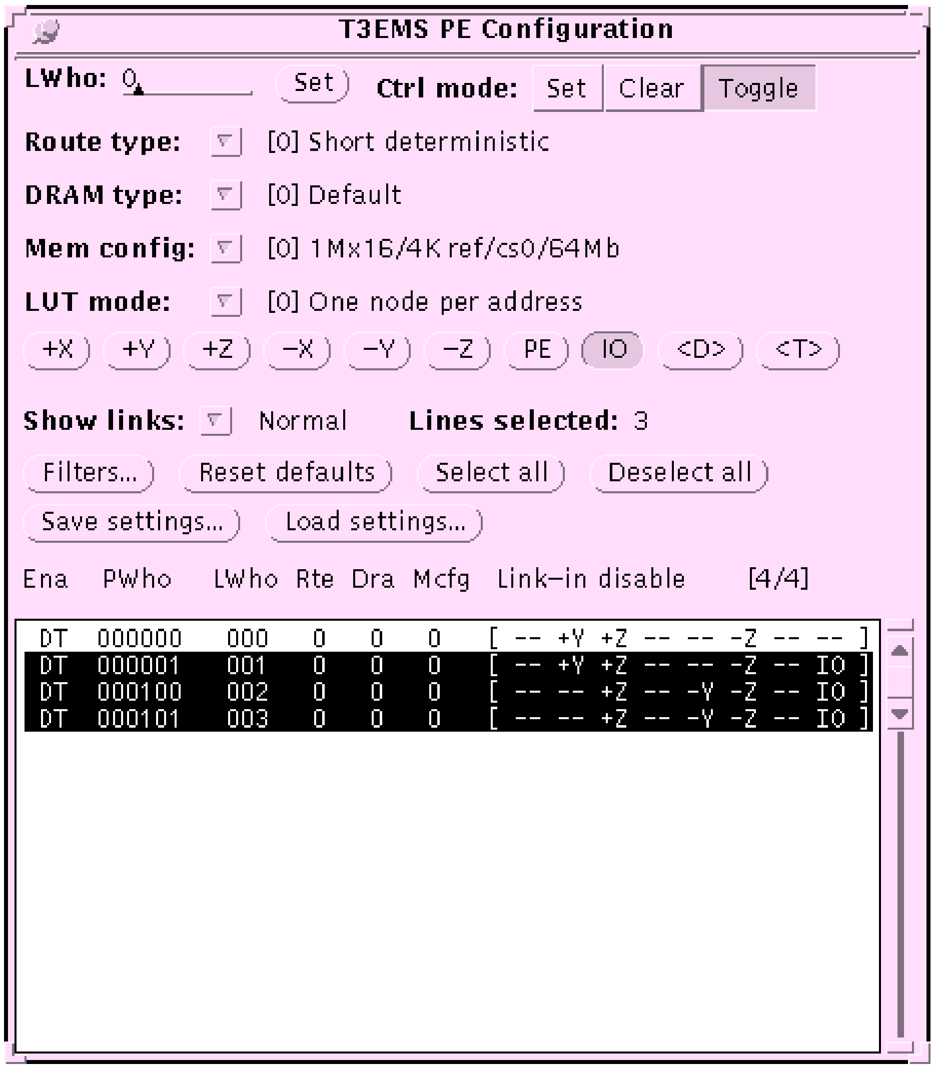
13. Disable the I/O ports on all PEs that do not connect to GigaRing channels:

    a. Under the Config menu item in the T3EMS main window, select PE configuration. The PE configuration window appears. Refer to Figure 41.

    b. In the bottom half of the PE configuration window, click the cursor to select the PEs where you will disable the I/O ports.

    c. Click on the IO button to disable the I/O ports on the selected PEs. The letters IO appear in the rightmost column after the selected PEs to signify that the I/O ports are disabled (as shown in Figure 41).

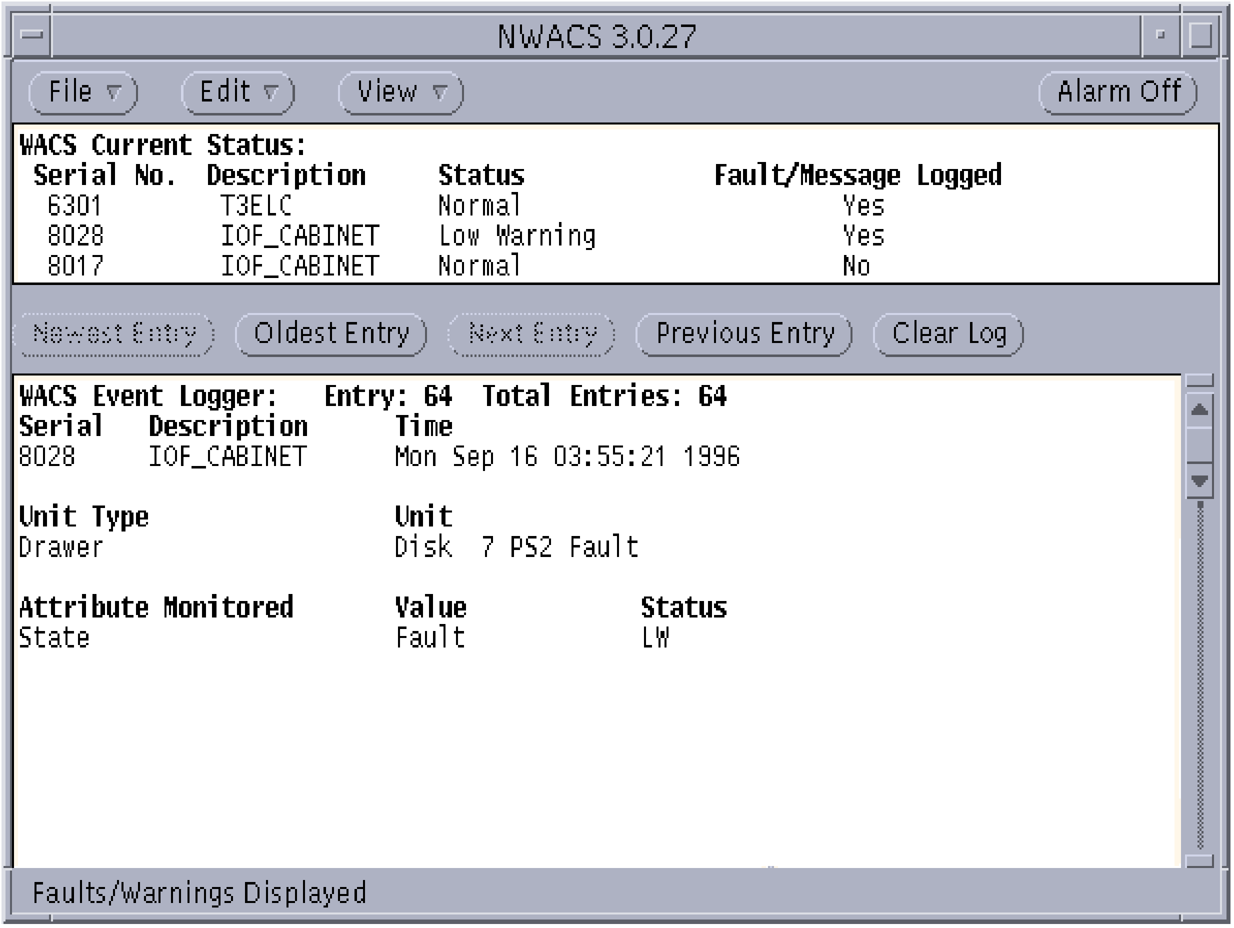
Figure 41. PE Configuration Window



14. Save your changes by clicking on the Save button in the System Configuration window.

15. Bring up the nwacs program. Refer to Figure 42.

Figure 42. NWACS - Main Scree



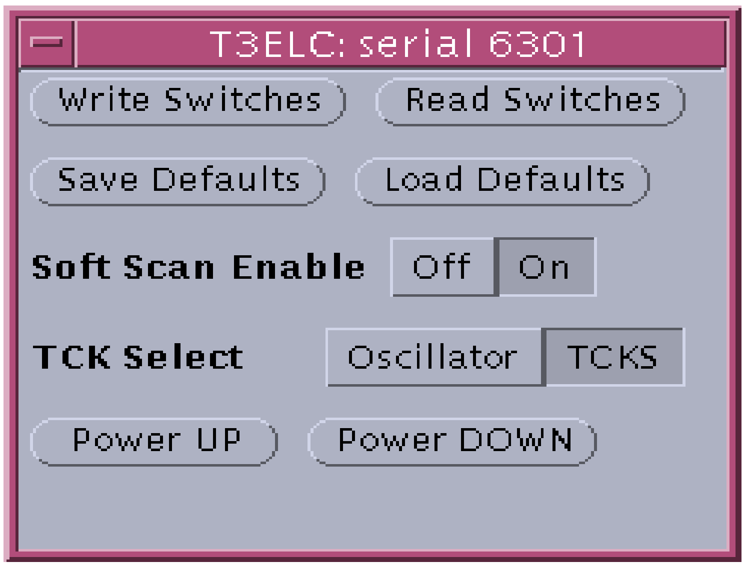
16. In nwacs, set the CRAY T3E soft switches, Figure 43, for boundary scan operation:

    a. Set the Soft Scan Enable switch (formerly the Testmode switch) to ON.

    b. Set the TCK Select (test clock select soft switch) to TCKS.

    c. Press the Write Switches button.

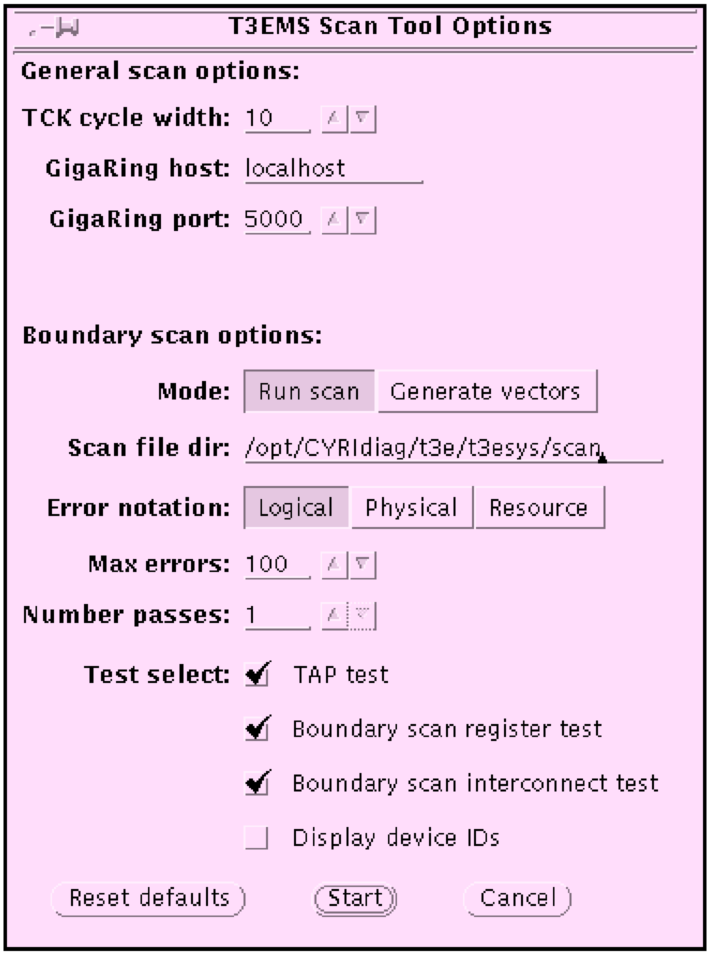
Figure 43. NWACS Soft Switches



17. Under the Tools menu item in the t3ems main window, select Boundary Scan. When the T3EMS Scan Tool Options window appears, click on the Start button to run boundary scan. Figure 44 shows the T3EMS Scan Tool Options window.

    NOTE: Run boundary scan at normal volts, as noted in FN #2228.

Figure 44. T3EMS Scan Tool Options Window



NOTE: Boundary Scan will automatically generate new vectors for the additional PEs.

18. When boundary scan is complete, close the window.

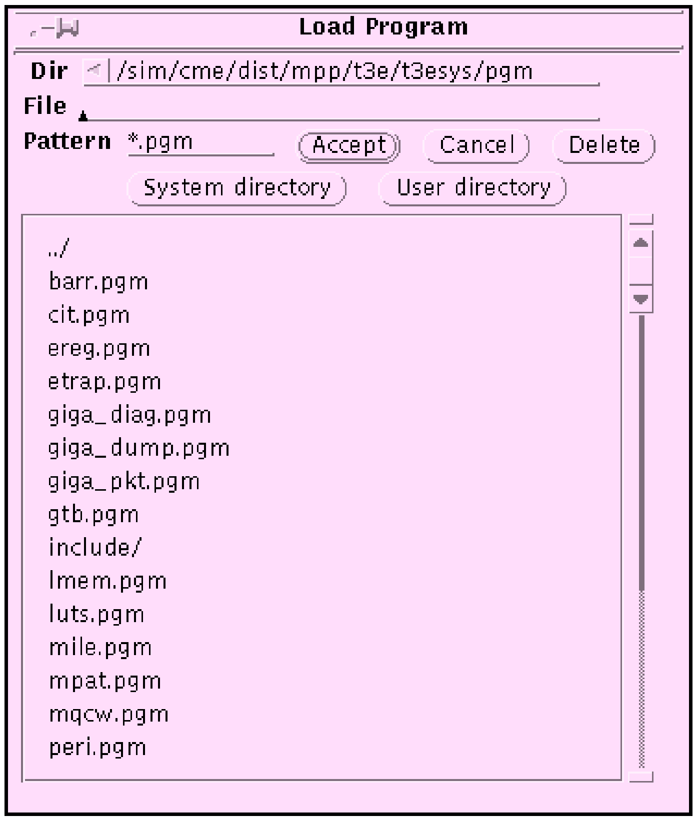
19. Under the Tools menu item in the t3ems main window, select Scan clear (t3etap) to reset the clock for normal operation.

20. If necessary, run the GigaRing channel-clearing utility (ring_clear) again.

Running Offline Diagnostic Tests

1. Under the Scripts menu item in the T3EMS main window, select Load & Run. The Load Program window appears, as shown in Figure 45.

Figure 45. Load Program Window



2. Run the giga_diag.pgm diagnostic. (The giga_diag.pgm diagnostic offers a series of interactive windows that contain program choices. The following list contains a current set of program choices; base your choices on the status of the diagnostic when you run it and on any site-specific needs.)

    a. Select the giga_diag.pgm diagnostic from the Load Program window and click on the Accept button.

    b. When the Section Selects window appears, click on the Done button.

    c. When the SCX Node Select window appears, ensure that the correct target node ID(s) are entered, then click on Done.

d. When the Target Router Selects window appears, click on Done.

e. When the Number Of Passes To Run window appears, change the pass count to 1 and click on Done. The diagnostic will then run.

f. When the diagnostic completes, proceed to the next step.

3. Run the mile.pgm command buffer. This starts the offline diagnostic suite that is listed in Table 9. This diagnostic offers a series of interactive windows that contain program choices. The following list contains a current set of program choices; base your choices on the version of the diagnostic that you are using and on any system-specific needs:

NOTE: The mile.pgm command buffer performs deadstart functions, which clear memory and load PAL (Privileged Architecture Language) code.

a. Select the mile.pgm command buffer from the Load Program window and click on the Accept button.

b. In the first window, click on the Done button to start the diagnostic suite with the todt test.

c. The next window enables you to choose which tests run. Click on Done; you will run all of the tests.

NOTE: For cit to run under mile.pgm, the rings must be initialized and the IO ports on all PEs (except the PEs on modules that connect to GigaRing channels) must be disabled.

d. The next window enables you to choose whether the program will log single-bit errors (SBEs) or stop when it detects an SBE. Select the button that logs SBEs, then click on Done.

e. The next window enables you to choose whether to dump the SBE information to a file. Select Yes, then click on Done.

f. The next window enables you to choose whether the suite will run once or continuously. Select Single, then click on Done.

g. The next window enables you to choose the margins (clock speed and power margin). Select Normal/Normal, then click on Done.

The diagnostic suite runs now.

h. When the diagnostics complete, close the window.

Table 9. LC Cabinet Offline Diagnostics

Test	Pass Count at Normal Clock and Normal Margins
The following test runs alone under the *T3EMS scripts*	
giga_diag	1
The following tests run under the *mile.pgm* command buffer	
todt (time_of_day_test)	1,000
ereg (E-register local test)	40
barr (Barrier/Eureka test)	50
lmem (Local memory test) **NOTE:** Preset the config file for correct memory size.	2
peri (PE random instruction test)	2,000
rchip (Basic router test)	10
xnet (Network test)	50
luts (Look-up table)	5
mqcw (Message test)	3,000
gtb (Global translation test)	4
segt (Segment translation test)	5
etrap (Error trap test)	100
pst (Processor stall test)	20
rmem (Remote memory test)	1
rlo	2,000
cit	5
qnt (GigaRing network test)	5

Conclusion (Operating System Changes)

This completes the mechanical upgrade procedures for the CRAY T3E system. You must now copy the t3e_config file to the appropriate directory (currently from /opt/CYRIdiag/config/t3e_config to /opt/CYRIos/1.0/config/t3e_config) and complete the software portions of the upgrade. Refer to the *UNICOS/mk Configuration Reference Manual*, SG-2603, for details.

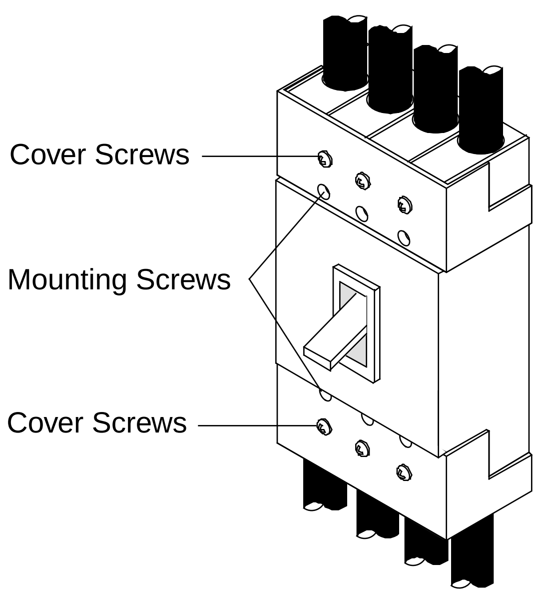
Appendix: Replacement of the Original LC Cabinet

A second method of upgrading your LC cabinet is to completely replace the original cabinet. The following procedures outline the steps for removing the original cabinet and installing the replacement. After you remove the original cabinet, install the replacement cabinet according to the procedures in *LC Single-cabinet Installation*, publication number HMM-171-0.

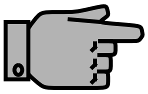
Disconnecting Incoming Power

1. Power off the LC cabinet by pressing the STOP switch.
2. Open circuit breakers CB1, CB2, CB3, and CB4.
3. At the HEU, open circuit breaker CB1.
4. Open the customer's incoming power circuit breakers and secure the breakers with the appropriate lockout/tagout tags for the LC cabinet and the HEU.
5. Use a Phillips screwdriver to remove the power access panel on the front of the LC cabinet (1/4-turn screws).
6. Use a Phillips screwdriver to remove the 3 screws that secure the bottom cover on circuit breaker CB1 (main power input).

Figure 46. Main Circuit Breaker



7. Using an 8-mm hex wrench, remove the incoming power wiring and place it under the floor.

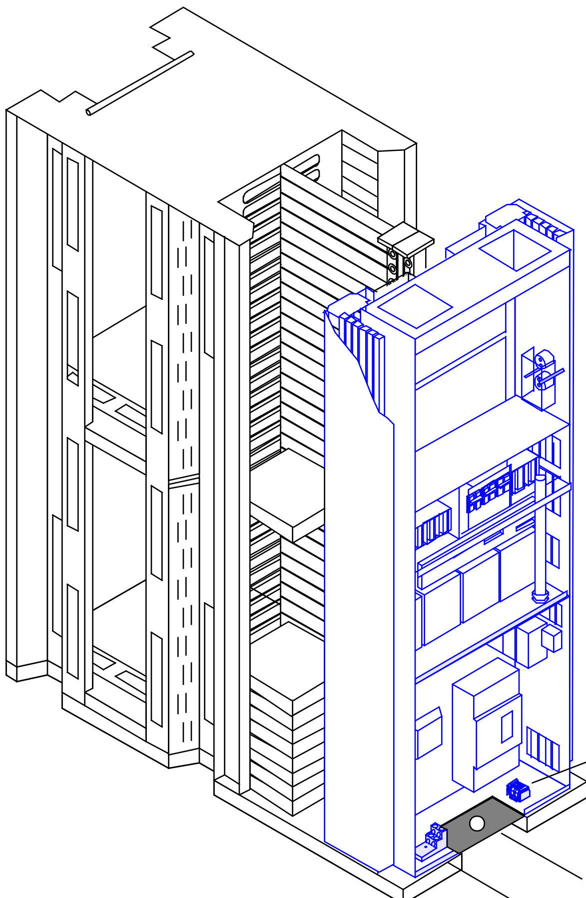


NOTE: In some cases a certified electrician must perform this step.

8. Remove the power plate and retain it for the replacement cabinet. Refer to Figure 47.

9. Disconnect the remote alarm wiring if it is installed (label each wire for placement).

Figure 47. LC Cabinet Power Box



Disconnecting the Cabinet Cabling

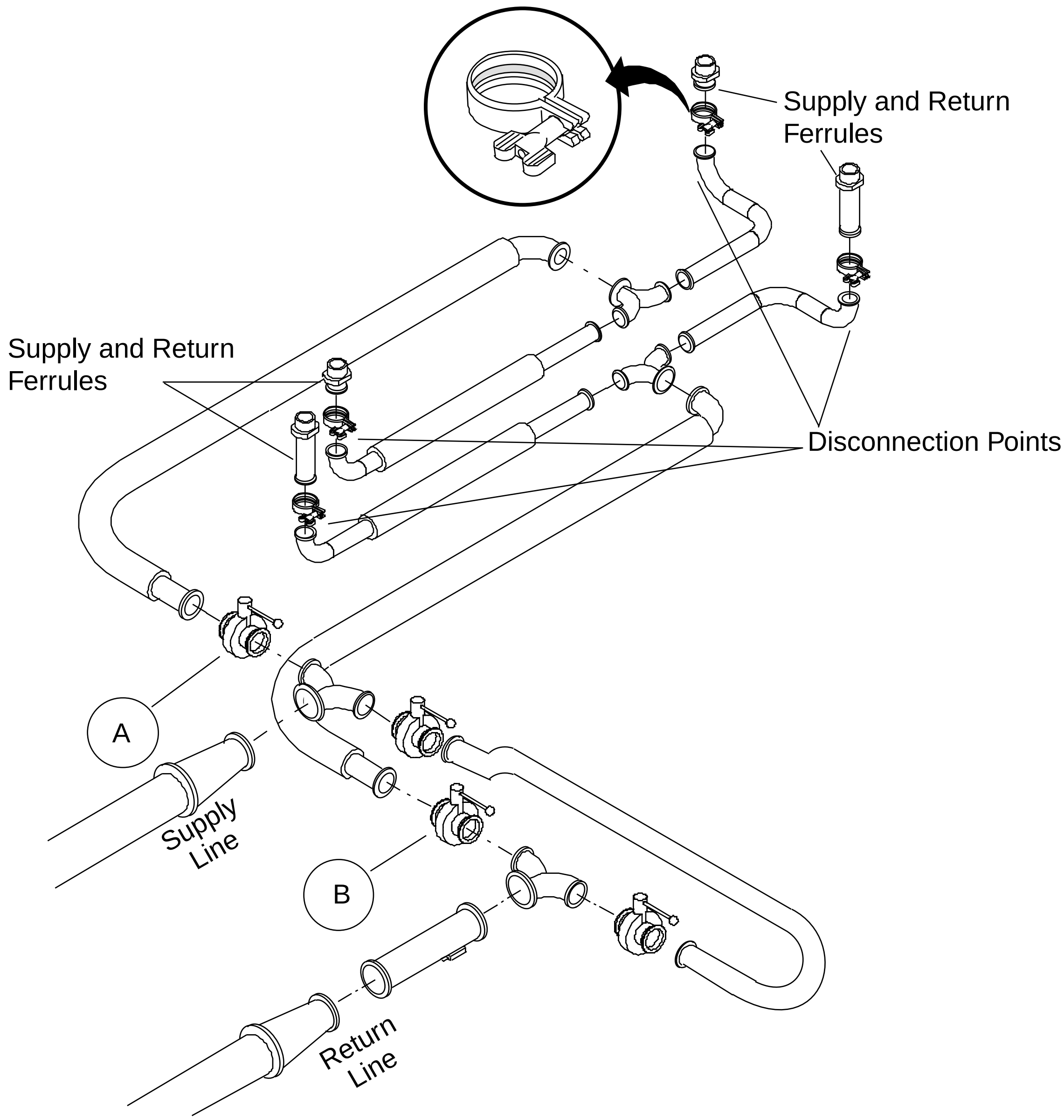
1. Remove the side panels from the LC cabinet and place them in a safe location.
2. Remove any external GigaRing cables and place them under the floor. Be sure that the cables are labeled with their locations for reinstall.
3. Remove the cabinet ground straps. Retain the screws for the replacement cabinet and store the straps under the floor.
4. Remove the LC cabinet WACS-to-SWS cable and place it under the floor.
5. Remove the LC cabinet WACS-to-HEU cable and place it under the floor.

Draining the Dielectric Coolant

For the following steps, refer to Figure 48 and Figure 49.

1. Remove as many floor tiles as necessary to provide access to the coolant shut-off valves.
2. Close the shut-off valves marked A and B in Figure 48 to isolate the LC cabinet.

Figure 48. Under-floor Coolant Piping



3. Drain the module manifolds.

   a. Remove the module coolant hoses of the module at slot 1 from the manifolds.

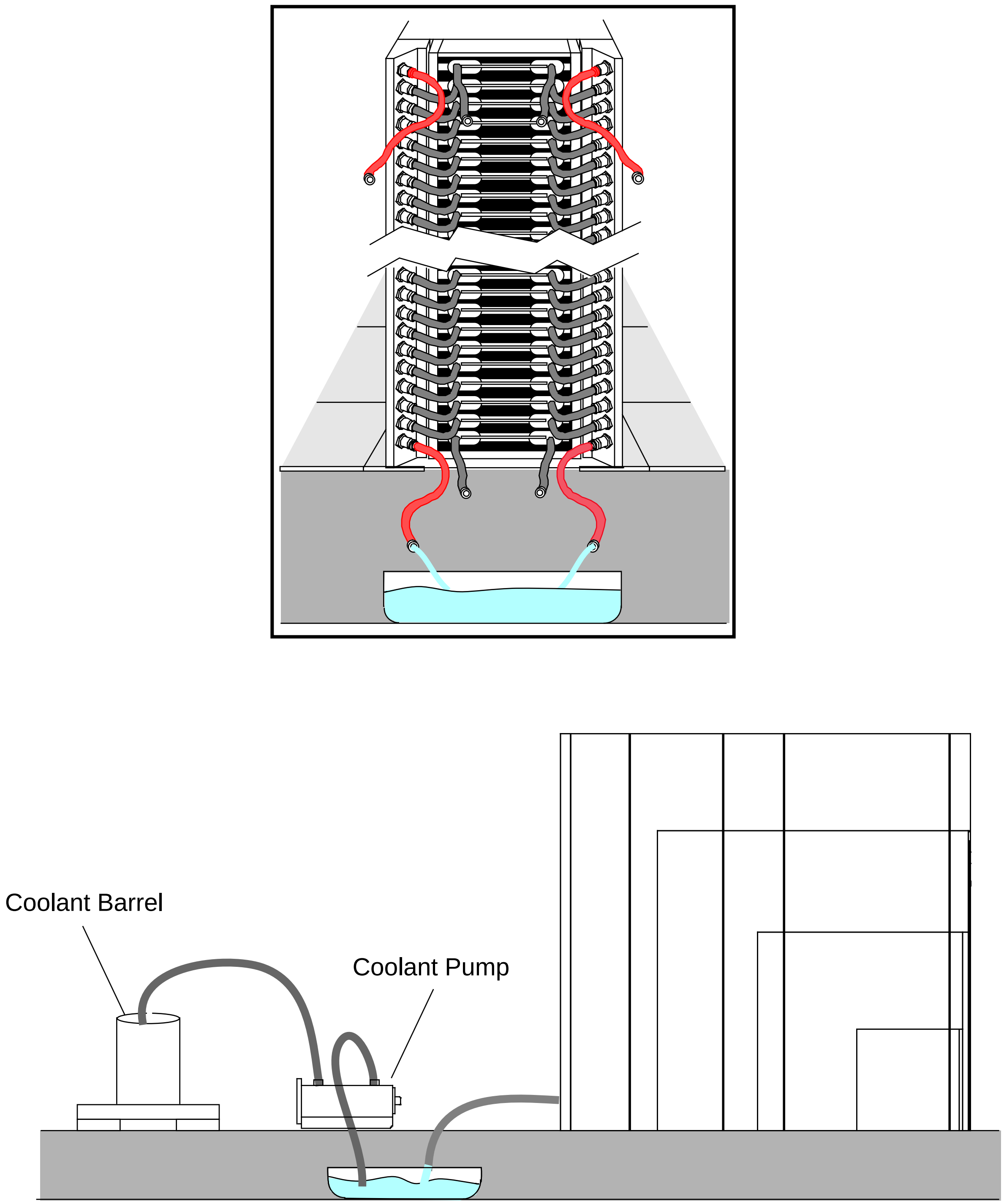
   b. Remove the floor tile(s) directly in front of the module cage area.

   c. Place a catch pan on the subfloor.

   d. Place the empty coolant barrel next to the LC cabinet.

e. Place the coolant pump supply hose into the catch pan and the discharge hose into the barrel.

Figure 49. Draining the Module Manifolds



As soon as you perform the following steps, coolant will flow from the manifolds into the catch pan. Pump the coolant from the catch pan into the barrel.

f. To drain the modules and module manifolds, connect spare coolant hoses (P/N 15130404) to the supply and return manifolds at slot 1. Position the open ends so that draining coolant flows into the catch pan.

g. Start the coolant pump to remove coolant from the drain pan.

h. Connect spare coolant hoses (P/N 15130404) to the supply and return manifolds at slot 35.

To slow the flow of coolant into the catch pan, remove the spare coolant hoses from slot 1.

i. When the manifolds are drained, remove all 4 spare coolant hoses. Reconnect the module hoses at slot 1.

4. Drain the remainder of the cabinet.

a. Place the catch pan under the coolant valves marked A and B.

b. Move the coolant barrel and pump so the supply hose reaches the catch pan.

As soon as you perform the following steps, coolant will flow from the power supply manifolds and the supply and return lines into the catch pan. Pump the coolant from the catch pan into the barrel.

c. Slowly loosen the clamps that connect the LC cabinet supply and return lines to the valves you already closed.

Be sure you loosen the clamp on the <u>cabinet</u> side of the valve, NOT the HEU side.

d. To force air into the manifolds and lines, connect spare coolant hoses (P/N 15130404) to the top QD fittings on the supply and return power supply manifolds.

NOTE: To drain as much coolant as possible, lift the supply and return lines under the cabinet and let gravity drain the lines.

e. When the manifolds and coolant lines are drained, remove the spare coolant hoses from the manifolds and tighten the clamps on the valves.

5. Disconnect the LC cabinet supply and return lines at the manifold ferrules under the cabinet (4 fittings). Figure 48 shows the disconnect points.

6. Remove the supply and return ferrules from the manifolds.

   NOTE: Check all gaskets and O-rings. Replace any defective parts.

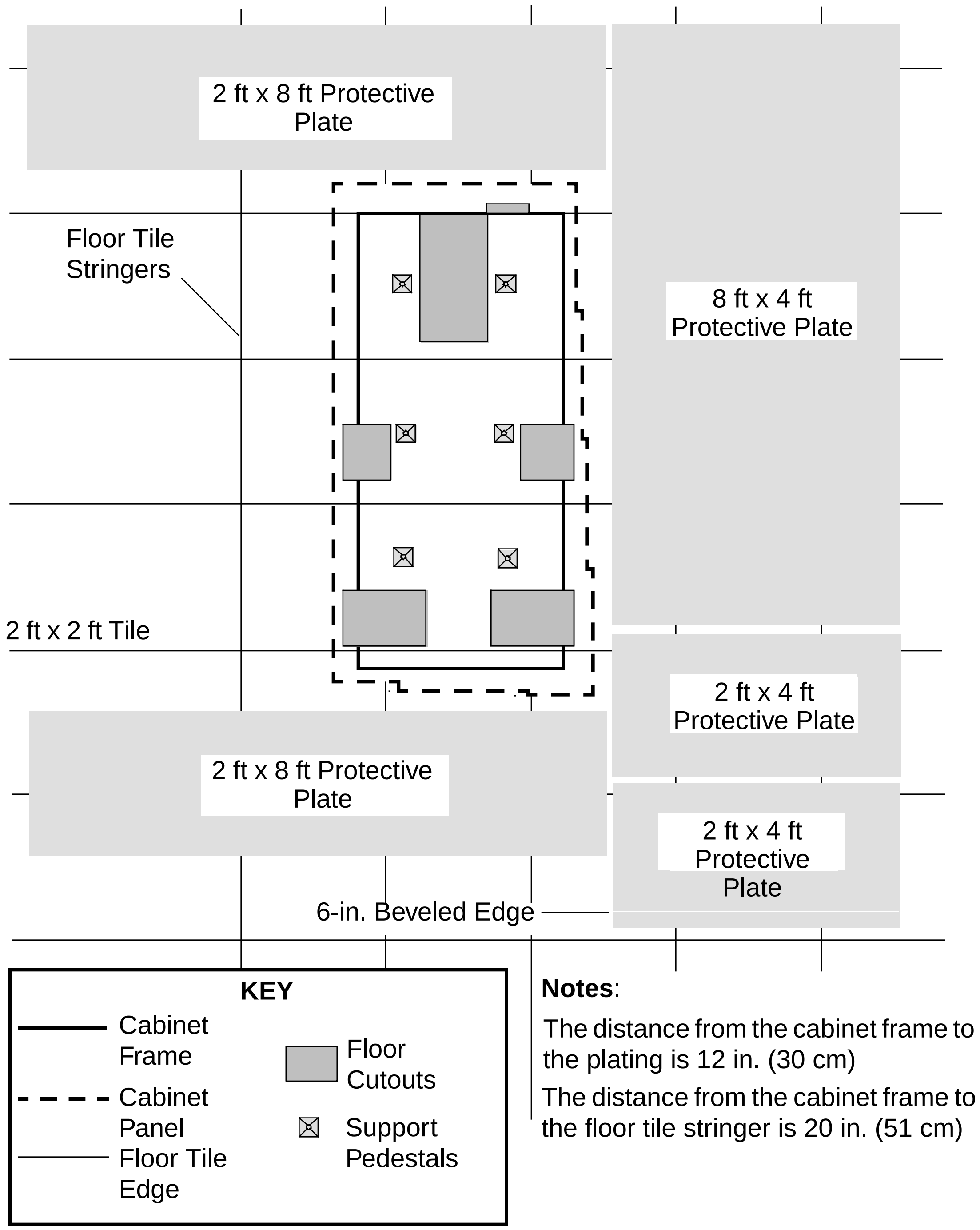
7. Apply plastic protective caps to the manifold openings under the cabinet.

NOTE: The original LC cabinet should now be isolated from the system and the HEU.

Cabinet Movement

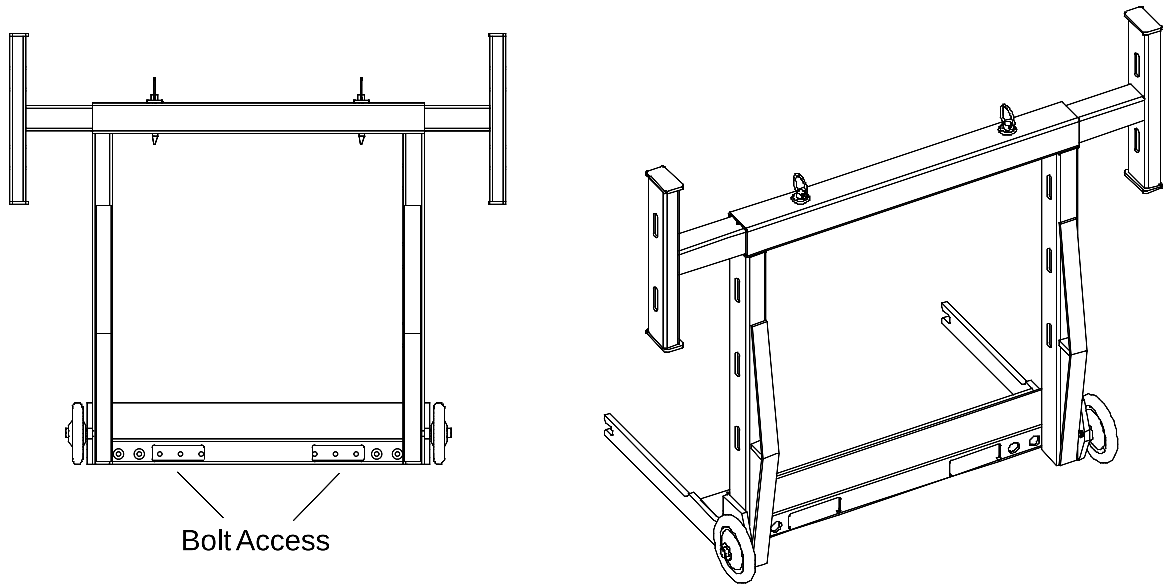
1. Place the protective floor plating around the LC cabinet and in the computer room. Refer to Figure 50.

Figure 50. Protective Floor Plating



2. Attach the cabinet lift assemblies, as shown in Figure 51, to the front and back of the LC cabinet.

Figure 51. Cabinet Lift Assemblies



3. Attach the Rol-A-Lifts to the lift assemblies.

4. Move the LC cabinet to its staging area.

5. Remove the Rol-A-Lifts and attach them to the replacement cabinet.

6. Move the replacement cabinet into the computer room.

Use the *LC Single-cabinet Installation* document, publication number HMM-171-0, to complete the installation of the replacement cabinet.