Preparing for a System Installation

HR-04121-0A
CRAY T3E Liquid-cooled Systems
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Figures

Tables

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The "Computer Room Environment" section on page 19 now contains a note about installation requirements that relate to the EMC Directive.

Site Planning Introduction

Proper site planning and preparation is important for the successful installation of your computer system; Cray Research site planning personnel will assist you with the site planning process.

Each site has different site planning characteristics to consider. You can ensure effective site planning by identifying your initial system configuration as well as any upgrade plans.

Qualified electrical and mechanical facility engineers should be involved early in the site planning process. Prior to any site preparation activities, you must prepare electrical and mechanical design drawings to be approved by Cray Research site planning personnel.

Allow 1 to 3 months to plan and prepare your facility for the installation of your computer system. The following subsections describe various considerations and requirements that are involved in the site planning and preparation process.

Site Planning Meetings

Site planning meetings establish communication between you and Cray Research. Site planning personnel will schedule these site planning meetings with you at your facility. The purpose of these meetings is to answer questions and discuss concerns you may have about the site planning and preparation process.

System Installation Overview

The installation of your computer system consists of the following stages:

- Shipping and installing the support equipment
- Preparing the system for shipping
- Transporting the system
- Installing the system
- Starting up and stabilizing the system
- Ensuring system on-site quality
- Preparing system operations

Approximately 4 to 6 weeks prior to system delivery, Cray Research delivers all necessary preshipment equipment. For most CRAY T3E LC systems, the preshipment equipment consists of a water piping kit. You are responsible for receiving and installing the support equipment without the presence or supervision of Cray Research personnel.

Approximately 1 week before delivery, Cray Research prepares the computer system for shipment. Major components are packaged in protective shipping configurations. Cabling and miscellaneous materials are packaged and labeled for shipment.

The system equipment is transported to your facility by a commercial tractor-trailer with air-suspension ride and climate control. For intercontinental shipments, the equipment is transported by commercial cargo-carrying aircraft and then transported to your facility by tractor-trailer.

Under Cray Research supervision, you will unload and move the system equipment into your computer room. If necessary, you must make arrangements for any special equipment (such as forklifts, cranes, or platforms) that you will need to unload the computer system.

Cray Research installation personnel perform the following tasks:

- Position all equipment in designated locations
- Reassemble the computer system
- Connect all logic cables
- Attach water and dielectric-coolant hoses

Upon completion of these tasks, Cray Research personnel perform system start-up and power and cooling stabilization tests. You must provide personnel to correct any problems involving contractor-installed electrical or cooling water circuitry that might occur during these tests.

Upon satisfactory completion of all quality assurance functions, Cray Research declares the system ready for use. At this point, Cray Research personnel install the operating system software to prepare the system for customer acceptance.

Site Evaluation

Site evaluation is important in the site planning and preparation process. The following considerations might help you in your site selection:

- Electrical power quality
- Air quality
- Cooling water quality

  Refer to the cooling water supply specifications on page 25 for additional information on water quality requirements.

- Structural strength

  Examine the floor loading requirements of the computer equipment to ensure that the building structure will support the equipment.

Refer to the *Principles of Computer Room Design*, Cray Research publication number HR-04013, for a complete list and explanation of possible site selection concerns.

Site Access Requirements

Prior to system installation, your site must meet certain site access requirements. This subsection explains these requirements and provides specifications.

For computer system delivery, your building should have a loading dock that is approximately 46 in. to 50 in. (1168 mm to 1270 mm) high. The loading dock should not open directly into the computer room because the computer room environment must be carefully controlled. You should take special precautions when you move equipment if the loading dock or access route has an engraved floor pattern; an engraved pattern could cause vibration damage to computer equipment on casters. The dock access incline should not exceed 10 degrees.

If no loading dock exists or if your loading dock does not meet the requirements, you will have to provide a forklift to unload the computer equipment. Refer to *Forklift Size Requirements for the Handling of Cray Research Equipment*, Site Engineering document number 10658374, for forklift requirements.

If your computer room is on a different level than your loading dock and your building does not have an elevator, you may have to arrange for a crane or other special handling equipment to lift the computer equipment to the same level as your computer room.

The complete access route from the loading dock to the computer room must conform to the following specifications:

Table 1. Dimensions and Weights, Access Route

Item	Shipping Specifications			
	Height	Width	Depth	Weight
CRAY T3E LC Mainframe Cabinet	78.00 in. [a] (1981 mm)	48.00 in. (1219 mm)	125.50 in. [b] (3188 mm)	5,854 lbs [c] (2655 kg)
PC-10 Cabinet	76.00 in. [a] (1930 mm)	34.50 in. (876 mm)	58.75 in. (1492 mm)	1,116 lbs (506 kg)
HEU-WC1 Cabinet	62.00 in. [a] (1575 mm)	36.75 in. (933 mm)	82.00 in. [b] (2083 mm)	1,554 lbs [c] (705 kg)

[a] Add 1.00 in. (25 mm) for rolling height.

[b] Dimensions include ROL-A-LIFTs.

[c] Weight includes ROL-A-LIFTs.

Computer Room Design

Proper computer room design can minimize problems with static electricity, security, personnel safety, and air contamination. The following list contains important design considerations for your computer room:

- Personnel safety
- Security
- Air quality
- Positive air pressure
- Future computer equipment plans
- Seismic vibration
- Raised flooring
- Sound reduction
- Lighting
- Handicapped personnel access
- Layout

Refer to the *Principles of Computer Room Design*, Cray Research publication number HR-04013, for a complete explanation of these considerations and for proper construction procedures.

Network Connections

Cray Research ships a 12-port, twisted-pair concentrator with at least one of the PC-10 cabinets in your system configuration. You may need to provide an Ethernet transceiver to match your network protocol to the system. The transceiver must support IEEE 802.3 and Ethernet version 2.0 specification and use the signal quality error (SQE) heartbeat feature. The available network interfaces for the system are Ethernet, FDDI, HIPPI, and asynchronous transfer mode (ATM).

NOTE: You must place the system workstation (SWS) within 45 ft (13.7 m) of the CRAY T3E LC cabinet and the PC-10 cabinet if you use the standard 50-ft (15.2-m) Ethernet cable that Cray Research supplies.

The maintenance Ethernet network connects the quad Ethernet in the SWS to the concentrator in the PC-10 cabinet. Use the maintenance Ethernet network for maintenance only.

You may connect the customer Ethernet network directly to the twisted-pair connector on the SWS. However, if you wish to connect the customer Ethernet network with an AUI connection to the SWS, you must use an adapter cable (Cray Research part number 90395800 or Sun Microsystems, Inc. part number X981A). Refer to the remote support illustrations in the following subsection.

Remote Support

Remote support is an optional maintenance feature for your system. Cray Research support personnel use a modem as a data communication link to troubleshoot and maintain Cray Research computer systems. If site security regulations permit the use of a modem, contact the local telephone company well in advance of system delivery to arrange for installation of the appropriate telephone line. In the United States of America and Canada, you should install a public-switched dedicated data telephone line, such as a telephone, an X.25 pad, or an ISDN terminal adapter. Cray Research recommends that you install another telephone near the system for general use. For system installations outside the USA and Canada, please contact your account manager for the modem type and telephone line requirements.

Refer to Table 2 for modem requirements and settings and to Figure 1 for an illustration of a remote support configuration with a Microcom® modem.

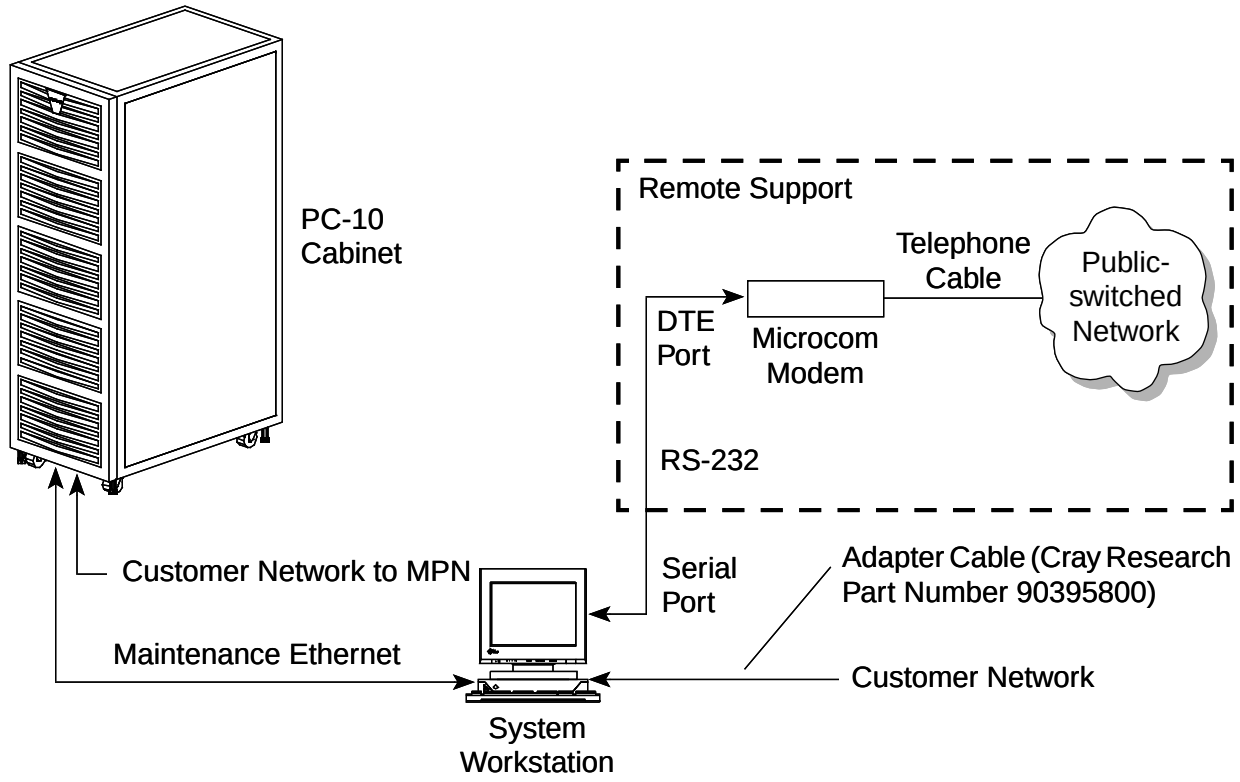
Table 2. Modem Requirements

Option	Specification
FCC registration number	CLB USA-75946-MME
Transmission rate	V.34/V.32/V.42bis (28,800 bps)
Telephone	Standard, with voice-grade line
Telephone connector	RJ11C
Line interface connector	RJ45S
Touch tone/rotary dial	Touch tone preferred
Ringer equivalence	0.8 Bd
External/internal clock	Internal
Grounding	Chassis ground to signal ground
Transmit level	Up to 115.2 kBps
Private/dial-up line	Dial-up line
Receive long space disconnect	Disabled

Table 2. Modem Requirements (continued)

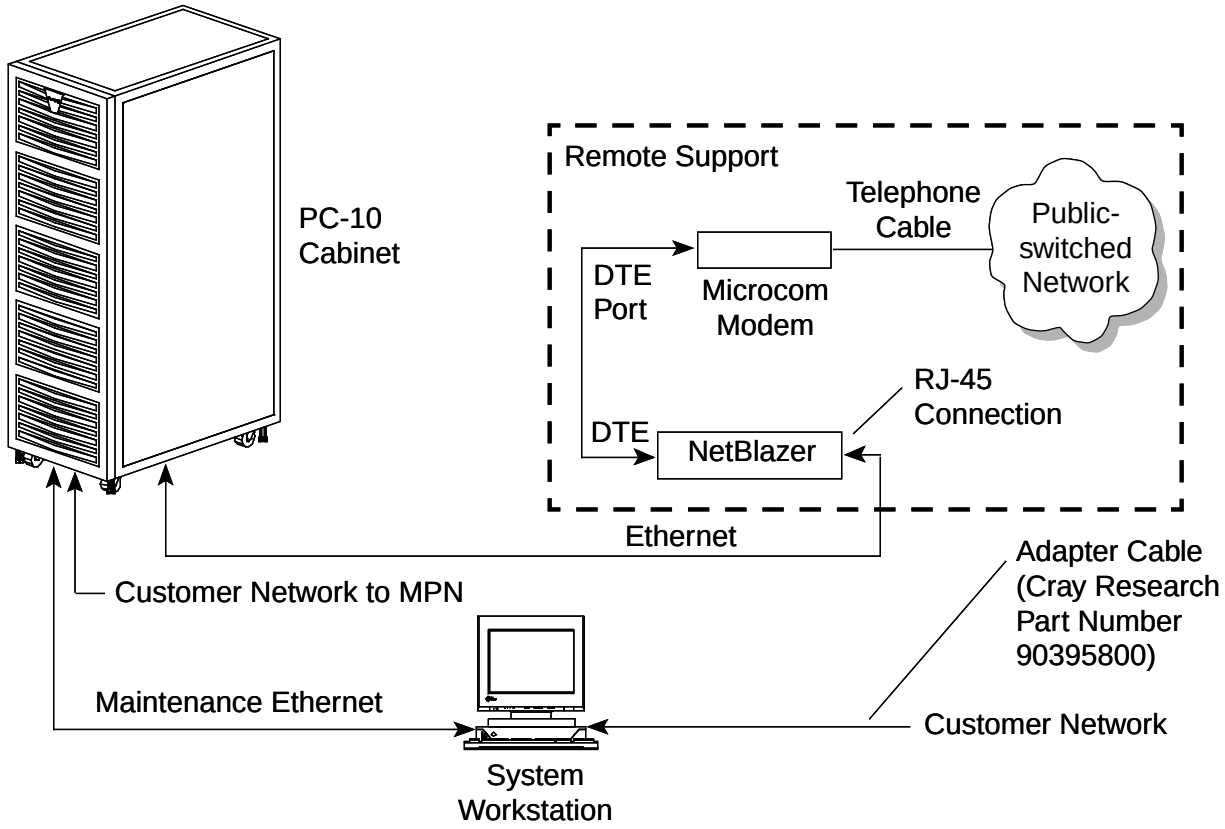
Option	Specification
Transmit long space disconnect	Disabled
Data terminal ready disconnect	Enabled
Carrier fail disconnect	Enabled
Auto-answer/manual-answer	Auto-answer
Make busy in analog loopback	Disabled
Permanent/DTR controlled auto-answer	DTR controlled auto-answer
Synchronous/asynchronous	Asynchronous
9-bit/10-bit/11-bit character	10-bit character

Figure 1. Remote Support, Modem-only Configuration



If you order the optional Telebit® NetBlazer® router, your local Cray Research service representative completes a network request form prior to shipment. A Remote Support network administrator will then assign a registered Internet address to the router. Remote Support administrators and Cray Research Service personnel install and configure the appropriate software on the Telebit NetBlazer router. Figure 2 illustrates a remote support configuration with a Telebit NetBlazer dial-up router.

Figure 2. Remote Support, Optional NetBlazer Configuration



Optional Laser Printer (LP-7)

The optional laser printer (LP-7) connects to the SWS. Figure 3 illustrates the LP-7 laser printer.

Figure 3. Optional Laser Printer (LP-7)

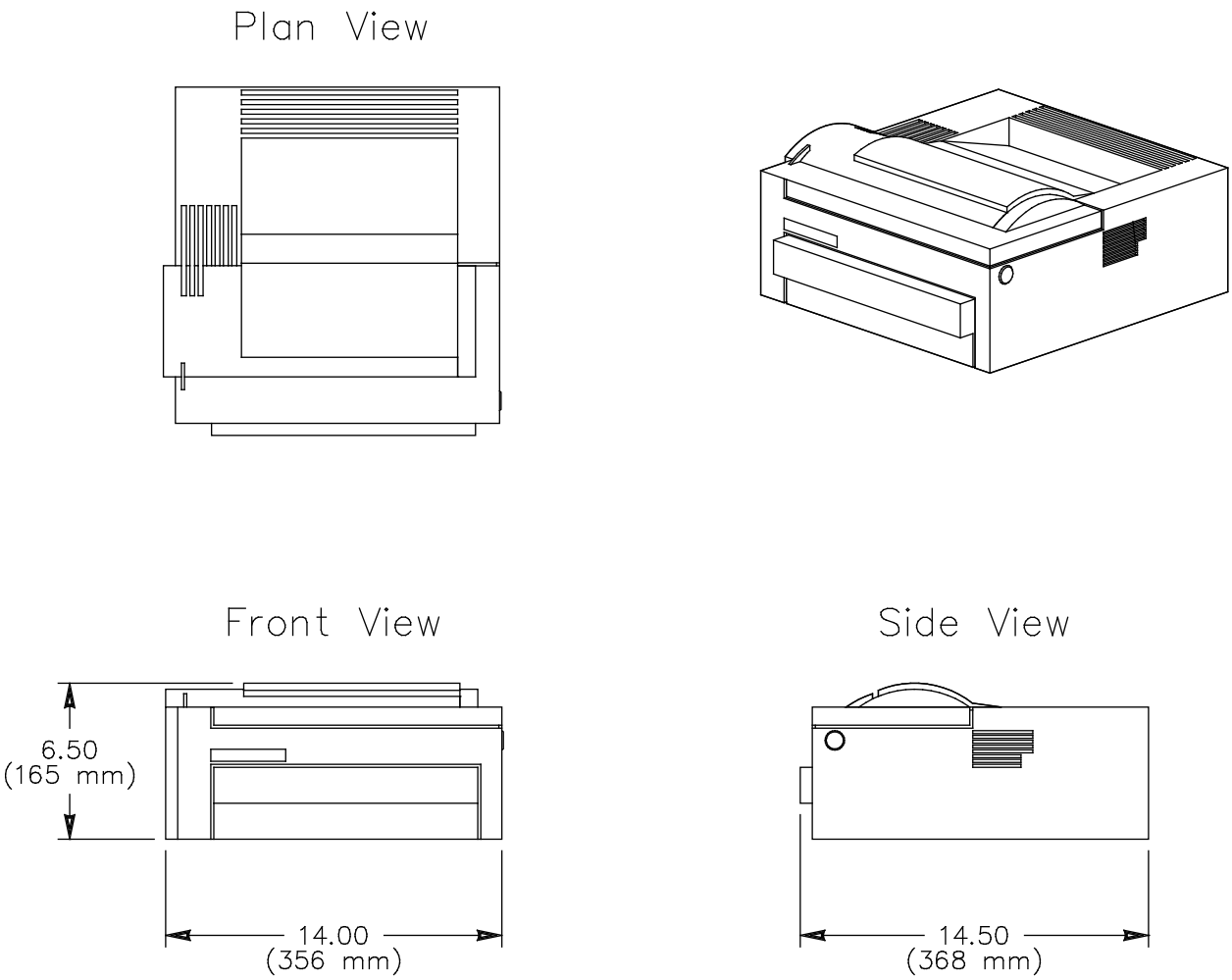


Table 3 lists the physical dimensions, and power and cooling requirements for the optional laser printer (LP-7).

Table 3. Characteristics of Optional Laser Printer (LP-7)

Characteristic	Description
Height	6.50 in. (165 mm)
Width	14.00 in. (356 mm)
Depth	14.50 in. (368 mm)
Weight	16 lbs (7 kg)
Cooling requirement	Ambient air
Heat dissipation to air	610 Btu/hr
Voltage	100 to 120 Vac or 200 to 240 Vac, single phase
Frequency	50 or 60 Hz ± 5%
Circuit breaker	15 amp
Power consumption	180 watts
Power cable	6-ft (1.8-m) pluggable drop cord
Power Receptacles: North America and Japan International	 NEMA #5-15R or equivalent IEC309, single phase, 16 amp

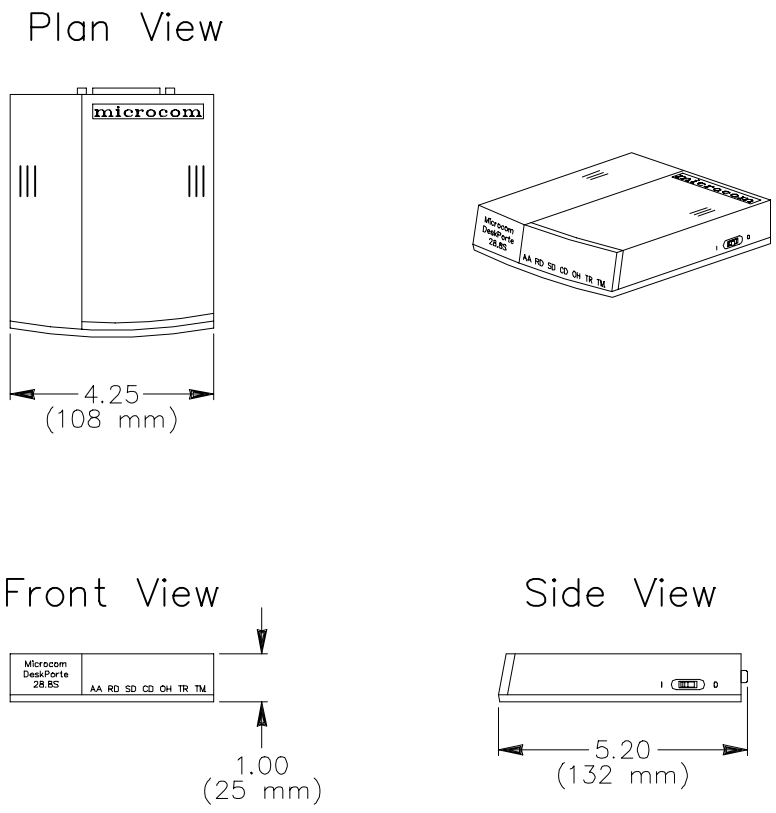
Microcom Modem

The CRAY T3E LC systems that are installed in North America use the Microcom DeskPorte™ 28.8S modem as the standard modem for remote support communications. The Microcom DeskPorte 28.8S modem offers V.fast data transfer at speeds nominally up to 28,800 bps with MNP® Class 10 Adverse Channel Enhancements™ (ACE), and Dynamic Transmit Level Adjustment™ (DTLA). Refer to Table 4 for the modem specifications and to Figure 4 for an illustration of the modem.

Table 4. Modem Specifications

Characteristic	Specification
Height	1.00 in. (25 mm)
Width	4.25 in. (108 mm)
Depth	5.20 in. (132 mm)
Weight	1 lb (0.5 kg)
Cooling requirement	Ambient air
Input voltage	Single phase, 100 – 120 Vac
Frequency	60 Hz
Maximum power requirement	10 watts
Power cable	6-ft (1.8-m) pluggable drop cord
Power receptacle	NEMA #5-15R or equivalent

Figure 4. Microcom Modem



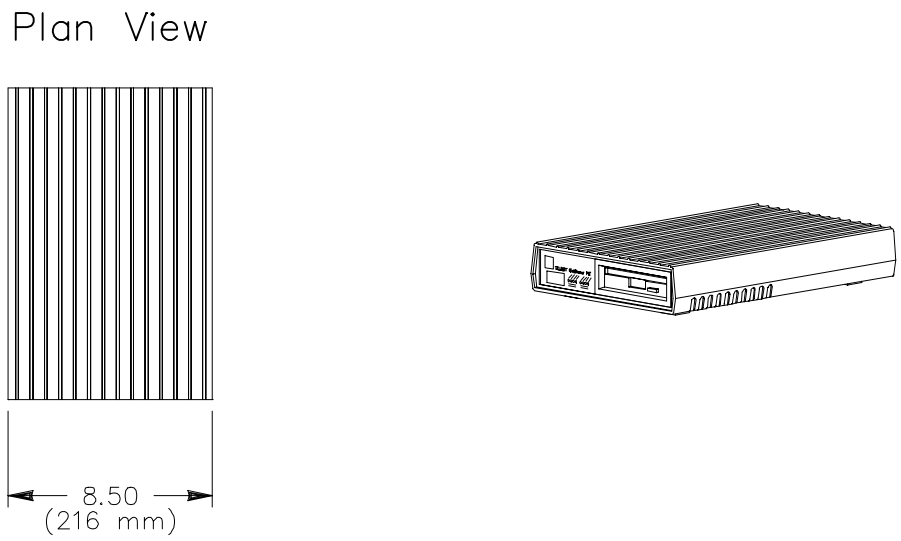
NetBlazer Dial-up Router

Cray Research uses the optional NetBlazer dial-up router model PN2 for remote hardware maintenance, system operation, and system monitoring. You may install the NetBlazer router with the CRAY T3E LC computer system for additional communication security. Table 5 lists the router specifications and Figure 5 illustrates the NetBlazer dial-up router.

Table 5. NetBlazer Dial-up Router Specifications

Characteristic	Specification
Height	2.40 in. (61 mm)
Width	8.50 in. (216 mm)
Depth	13.00 in. (330 mm)
Weight	4 lbs (1.8 kg)
LAN interface	Ethernet (AUI, BNC, 10BaseT), switch select
Input voltage	Single phase, 100 – 120 or 200 – 240 Vac
Frequency	50 or 60 Hz
Maximum power requirement	25 watts
Power cable	8-ft (2.4-m) pluggable drop cord
Power receptacles:	
North America International	NEMA #5-15R or equivalent IEC 309, single phase, 16 amp
Agency approvals:	Safety: UL® 478, CSA C22.2, EN 60950 TUV VDE 805
	Emissions: FCC ER9 USA-74674-MD-E EN55022, TUV Vfg 243

Figure 5. NetBlazer Dial-up Router



Computer Room Environment

Cray Research designs computer equipment to operate within specific ranges of air quality, temperature, and relative humidity levels. Significant variations of these levels in a computer room environment could cause disruptions in equipment operation and decrease the life of the equipment. To ensure proper operation of your computer system, your facility must meet the operational requirements that the following paragraphs describe.

NOTE: Based on the performed tests, the essential requirements of the EMC Directive have been met if this equipment is installed in an industrial area with less than 3V/m radiated disturbance.

The computer system must operate in a controlled computer room environment. Although the requirements outlined in this subsection encompass the overall computer room, they particularly affect air-cooled devices such as disk drives, printers, and graphics display terminals. Therefore, the design and layout of your environmental control equipment (such as computer room air-conditioning units) must ensure that inlet air to the air-cooled device meets the specified environmental requirements.

The computer system requires a computer room environment that is strictly monitored and controlled according to the following parameters:

Temperature	60 ˚F to 83 ˚F (16 ˚C to 28 ˚C) The maximum temperature change in a 1-hour period is 3 ˚F (2 ˚C). The rate of change cannot exceed 10 ˚F (6 ˚C) per hour.
Humidity	35% to 65% relative humidity (noncondensing) The maximum rate of change is 5% per hour.
Dewpoint	70 ˚F (21 ˚C) maximum
Air quality	Monitor and control the computer room air quality. Filter both the incoming, replacement air to the computer room and the circulating air in the computer room. To ensure good air quality, the computer room should receive at least one fresh air change per hour. In addition, maintain positive air pressure in the computer room (as compared to adjacent areas in the facility). Practice good environmental cleanliness and equipment maintenance to minimize airborne particles and to prevent equipment damage. Never allow smoking, food, or beverages in the computer room.

Support Equipment Room Environment

If you plan to install support equipment such as a Cray furnished uninterruptible power system (UPS), refer to your system-specific site planning overview document or consult with your site planning representative for details.

Some customers choose to place their support equipment in the computer room. However, facility constraints sometimes make it necessary to place the support equipment in a support equipment room. The support equipment room must meet the following environmental specifications:

Temperature	65 ˚F to 95 ˚F (18 ˚C to 35 ˚C) The maximum rate of change must not exceed 20 ˚F (11 ˚C) per hour. **NOTE:** If your system uses a UPS, the UPS battery temperature must not exceed a temperature of 77 ˚F (25 ˚C).
Humidity	30% to 80% relative humidity (noncondensing)
Air quality	A clean, dirt- and dust-free environment

Locate the support equipment room as close as possible to the computer room.

Electrical Requirements

Cray Research makes every effort to minimize the effects of power failures and interruptions to the hardware. However, if the computer system experiences repeated power interruptions and fluctuations, it may also experience a higher component failure rate than it would with a stable power source.
Cray Research encourages you to install a stable power source, such as a UPS, to reduce the possibility of component failures.

The CRAY T3E LC mainframe and the HEU-WC1 require one of the following types of voltage and frequency:

- 200 to 240 Vac (+6% to -10%), 3 phase, 50 or 60 Hz
- 400 Vac (± 10%), 3 phase, 50 Hz

NOTE: The HEU-WC1 can operate on 208, 400, or 480 Vac.

The system workstation (SWS) and the optional LP-7 laser printer require 100, 120 or 220 Vac, 50 or 60 Hz single-phase power. PC-10 cabinets require either 200 or 208 Vac, 50 or 60 Hz, 3-phase power; or 400 Vac, 50 Hz, 3-phase power.

An optional uninterruptible power system is available if the existing facility power quality or existing UPS is inadequate. Contact your site planning representative for details about an optional UPS for your site. Table 6 provides additional electrical service requirements.

Table 6. Electrical Service Requirements

Electrical Service	Requirement
Phase imbalance	5% maximum (line-to-line, line-to-line neutral)
Voltage harmonics	5% maximum total, 3% largest
Voltage deviation from sine wave	5% to -10%
Voltage modulation	3% maximum
Transient voltage surges	+5%
Transient voltage sags	-5%
Frequency tolerance	5%
Frequency rate of change	Less than 1.0 Hz during any 10-cycle period

Total kilowatt power requirements depend on system configuration and equipment upgrade plans. Cray Research will provide documentation during the initial site planning meeting that you can use to estimate the power requirements for your specific system configuration.

Equipment Grounding

All Cray Research computer equipment requires a protective power safety-ground system. The power safety-ground system protects personnel from shock hazards and protects the computer equipment from damage caused by electrical malfunctions. Local and national electrical codes regulate the power safety-ground system.

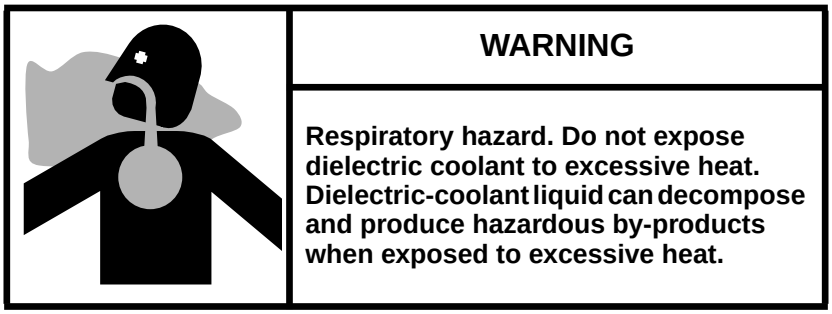
All Cray Research computer equipment also requires a signal reference grid. The signal reference grid establishes an equipotential reference plane for high-frequency digital signals between interconnected computer equipment. Cray Research supplies braided ground straps with all equipment (except graphics display terminals and line printers). You are responsible for connecting the ground straps to the signal reference grid.

Cray Research provides the document *Equipment Grounding for Cray Research Computer Systems*, Site Engineering document number 10658002, during the initial site planning meeting. This document describes the grounding system requirements and identifies alternative methods for providing the signal reference grid. In addition, the document describes electrostatic discharge (ESD) precautions and maintenance of the facility's grounding systems. You must provide, install, and maintain the approved grounding systems as described in the equipment grounding document and this subsection.

Dielectric-coolant Systems

Dielectric coolant is an inert liquid that has insulating and noncorrosive properties. Cray Research computer systems use dielectric coolant (Fluorinert™ liquid) to cool the mainframe chassis (MFC). The dielectric coolant transfers heat from the integrated circuit modules and power supplies within the MFC to the heat exchanger unit.

You must ensure that there is one fresh air change per hour in the computer room and that there are no sources of excessive heat that might cause the dielectric coolant to decompose. Do not permit smoking in the computer room or any other area where the dielectric coolant is used or stored.



Dielectric coolant is a safe product when used properly. Refer to *Safe Use and Handling of Fluorinert Liquid,* Cray Research publication number HR-00306-A, for information on Fluorinert liquid properties and precautionary requirements. All personnel must read this publication before they work in the computer room where the CRAY T3E LC system is located.

Cooling Water Supply

Cray Research computer systems require an adequate supply of clean cooling water to the water-cooled heat exchanger units (HEUs). The following information identifies the water quality requirements that are necessary to operate the computer system.

Operational Requirements

The HEU-WC1 accommodates water supply temperatures that range from 40 ˚F to 60 ˚F (4 ˚C to 16 ˚C).

The cooling water temperature, which is measured at the inlet of the HEU, must not vary more than ± 5 ˚F (3 ˚C) from the original start-up temperature. The rate of change must not exceed 5 ˚F (3 ˚C) per 15-minute cycle.

The cooling water flow-rate requirements and pressure-drop values of the HEUs vary, depending on the cooling water supply temperature and the percentage of treatment (antifreeze, corrosion inhibitors, and so on) in the water. During the initial site planning meeting, Cray Research provides flow-rate and pressure-drop values that are based on your system configuration and a water supply temperature of 50 ˚F (10 ˚C).

The HEU-WC1 incorporates a two-way water flow valve. This valve is fully open when the CRAY T3E LC system is operating and fully closed when the CRAY T3E LC system is powered off. Depending on the design of the chilled water system, a method of bypassing chilled water or deenergizing chilled water pumps may be required when the CRAY T3E LC system is not operating.

Cooling Water Quality Requirements

The quality of cooling water in a closed loop cooling water (CLCW) system is critical for the performance and the life of the system. Cooling water of poor quality can cause adverse effects in a water system, such as reduced cooling capacity, increased energy consumption, and premature equipment failure.

Water Quality Problems

The most common problems in cooling systems are the result of one or more of the following causes:

- Corrosion: the dissolution of metals by water.

  Corrosion can be in the form of general corrosion (entire surface) or localized corrosion (pitting), which causes metal perforation and rapid failure. The primary metals that can corrode in CLCW systems are aluminum, steel, and copper. Corrosion of steel and copper is often of a general nature (although it can be pitting); corrosion of aluminum is often in the form of pitting.

- Deposits: insoluble particulate matter in water.

  Insoluble particulate matter settles as a result of low flow velocity or adheres to hot or slime-covered surfaces and results in heat-insulating deposits. In a CLCW system, a deposit is generally iron with small amounts of copper and mineral scales such as calcium carbonate and silt.

- Scale: a deposition of water-insoluble constituents, formed directly on the metal surface.

  These substances change from a soluble state in water to an insoluble state on the metal surface. In a CLCW system, scale is typically calcium carbonate.

- Microbiological: basic organisms such as aerobic bacteria, anaerobic corrosive bacteria, fungi, and algae.

  In CLCW systems, aerobic bacteria cause slime and destruction of nitrite. Anaerobic corrosive bacteria and fungi generally do not grow well in CLCW systems because of the high pH. Algae is not usually a problem either because it requires sunlight to live.

Water Quality Specifications

Table 7 contains water quality specifications that, when followed, contribute to the prevention of system cooling problems.

Table 7. Water Quality Specifications

Parameter	Recommended Limits
pH	9.5 to 10.5
Nitrite (as NO_2)	600 ppm minimum
Molybdate (as MoO_4)	250 ppm minimum
Conductivity	5,000 micromhos/cm @ 77 ˚F (25 ˚C)
Combined sulfate (as Na_2SO_4) and chloride (as NaCl)	500 ppm
Copper	0.2 ppm
Aerobic bacteria	1,000 organisms/m
Anaerobic bacteria	10 organisms/ml
Total hardness (as $CaCO_3$) [a]	10 ppm
Iron [b]	1.0 ppm
Manganese	0.1 ppm
Suspended solids [b]	20 ppm
Turbidity [b]	20 NTU (Nephelometric)

[a] Refer to the “Replacement Water Guidelines” subsection.

[b] Install a side-stream cartridge filter if the limit is exceeded.

Replacement Water Guidelines

Observe the following quality guidelines for replacement water before you add water to your CLCW system.

- Water must be visibly clear and colorless (no haze).
- The iron level must be less than 0.5 ppm and the manganese level less than 0.1 ppm. (This is especially important when you use well water for replacement.)
- Anaerobic bacteria should be less than 10 organisms per ml.
- Aerobic bacteria should be less than 1,000 organisms per ml.
- Either hard or soft replacement water is acceptable, with the following limitations:

  Hard water is acceptable for replacement under the following conditions:

  - The treatment program contains enough polymeric dispersant (nonphosphonate) to handle the hardness in the water. Follow the recommendations of your water treatment supplier.
  - Side-stream filtration (minimum of 1% of the circulation rate) is mandatory.
  - The water replacement rate is less than 10% of the system volume per month. For a water replacement rate that is greater than 10%, use soft water.

  Soft water (less than 10 ppm total hardness as calcium carbonate) that is used for replacement can accommodate any acceptable (nitrite or molybdate based, with or without a polymeric dispersant) treatment program.

Water Quality Terms and Definitions

The following terminology is commonly used in discussions about water quality:

- Mg per liter equals ppm.
- pH: a measure of the hydrogen concentration. It is used to determine if the water has either corrosive or scaling tendencies.
- Nitrite: a commonly used corrosion inhibitor.
- Molybdate: another commonly used corrosion inhibitor.
- Conductivity: a measure of the mineral content in the water. In a nitrite program, high conductivity is generally an indicator of bacterial degradation of the nitrite.
- Sulfate: often an indication of a process or water tower leak into the CLCW system. High sulfates contribute to increased corrosion because of their high conductivity.
- Chloride: an indicator of water softener regeneration problems if the system chloride level is much higher than the chloride level of the replacement water. Increased levels of chloride can increase corrosion and indicate the need for the addition of higher levels of corrosion inhibitors.
- Copper: indicates increased copper corrosion and the need for a higher level of copper corrosion inhibitor.
- Anaerobic bacteria: generally absent in water with a high pH. Take remedial action when you detect 10 organisms/ml or greater.
- Aerobic bacteria: an indicator of slime that can foul equipment. Take remedial action when you detect 1,000 organisms/ml or greater.
- Total hardness: the sum of the calcium and magnesium ions in water. In a soft water program, a hardness of 10 ppm or greater indicates that the hardness is bypassing the softener, that the softener regeneration is improper, or that some contamination from another system is present, such as a cooling tower or city water.
- Iron: excessive iron indicates that corrosion has increased, existing corrosion products have been released by chemical treatment, piping has been added to the CLCW system, or the iron content has increased in the replacement water.

- Manganese: important only if manganese is present in concentrations greater than 0.1 ppm in the replacement water.

- Suspended solids and turbidity: indicates that corrosive products and other contaminants are collecting in the system. Excessive amounts may indicate corrosion, removal of old corrosive products by a chemical treatment program, or the contamination of the CLCW system by another water source. Suspended solids at high velocity can abrade equipment. Settled suspended matter of all types can contribute to deposit attack.

Special Problems in a CLCW System

Because there is no regular blow-down (sediment purge) from a CLCW system, you often need strainers or side-stream filters to remove debris that exists in the system.

In programs using nitrite, bacteria can develop in “dead legs” (unused runs of piping that have been isolated with valves from the rest of the system) where there is no water flow. Contamination may result when “dead legs” are reconnected to the system; the addition of molybdate is recommended in these situations.

The level of bacteria, which may indicate system contamination, is lower in the CLCW system than in the cooling tower water. Although the cooling tower can operate effectively with 100,000 or more organisms per ml, you should take corrective action immediately when total aerobic counts exceed 1,000 organisms per ml in the CLCW system.

The presence of copper and aluminum parts in the same CLCW system requires extra attention in controlling the treatment program. You should avoid the use of aluminum parts whenever possible.

Water Treatment

Before any new computer system is placed into operation, you should flush the CLCW system thoroughly to remove as much suspended material and debris as possible. A chemical detergent cleaning is also desirable.

To avoid CLCW problems later, you should seek the advice of a water treatment specialist early in the design stage of your system, and diligently follow the program that is created for you.

Keys to the Successful Operation of a CLCW System

Use the following tips to successfully operate your CLCW system:

- Use soft water for replacement.
- Maintain adequate levels of molybdate or nitrate for corrosion protection.
- Maintain a pH range of 9.5 to 10.5 to control bacteria and the corrosion of metals.
- Test the cooling water regularly.
- If the cooling water begins to look murky or rusty, treat the system by draining, flushing, refilling, and recharging the system with treatment products.
- As long as the water remains clean and clear and the pH is in the range of 9.5 to 10.5, expect good results from your CLCW system.

Floor Preparation

You must prepare the computer room with a static-dissipative raised-floor system that has a minimum clearance of 12 in. (305 mm) between the subfloor and the top of the raised floor system.

A properly designed and constructed raised floor serves several purposes. It can provide a signal reference grid for your computer system and provide space to route power cables, signal cables, and coolant piping. It can also provide space for airflow that is necessary for equipment cooling. Refer to *Equipment Grounding for Cray Research Computer Systems,* Cray Research Site Engineering document number 10658002.

All Cray Research equipment requires floor cutouts for power wiring, signal-cable entrances, and in some cases, dielectric-hose or water-hose entrances. In addition, some equipment requires reinforcement of the raised floor because of concentrated floor-loading conditions.

System Configurations

A standard CRAY T3E LC computer system consists of the following components:

- One to eight CRAY T3E mainframe cabinets (MFCs)
- PC-10 peripheral cabinet(s)
- One to four heat exchanger units (HEU-WC1)
- System workstation (SWS)

The CRAY T3E LC cabinet houses various configurations of processing elements (PEs), power supplies, a warning and control system, and other components. A single-cabinet configuration may contain up to 256 user PEs; a two-cabinet configuration may contain up to 512 user PEs; and an eight-cabinet configuration may contain up to 2,048 user PEs.

PC-10 cabinets can be configured with the CRAY T3E LC system. A PC-10 cabinet consists of an assortment of air-cooled subracks and an input power subrack. The individual subracks provide input/output capabilities for Cray Research computer systems; the input power subrack provides power to these subracks. Examples of subracks contained in a PC-10 cabinet include the node subrack (NSR-1), the multipurpose node (MPN-1) subrack, the disk subsystem fibre channel (DSF-1) subrack, and a disk subsystem SCSI (DSS-1) subrack.

The heat exchanger unit (HEU-WC1) is a dielectric coolant-to-water heat exchanger that routes dielectric coolant through the CRAY T3E cabinet to absorb heat from the modules and power supplies. After the dielectric coolant absorbs the heat, it flows back to the HEU-WC1, where the heat is transferred to customer-supplied chilled water. One HEU-WC1 can cool up to two liquid-cooled cabinets.

The system workstation is a SPARC® based workstation that provides monitoring, diagnosis, control, and configuration management for Cray Research computer systems. Cray Research provides a table for the SWS.

Figure 6 illustrates a typical floor plan for a one-cabinet CRAY T3E LC system that is placed on 24 in. x 24 in. floor panels. Figure 7 illustrates system configurations that have multiple cabinets.

Figure 6. Floor Plan for a One-cabinet CRAY T3E LC System

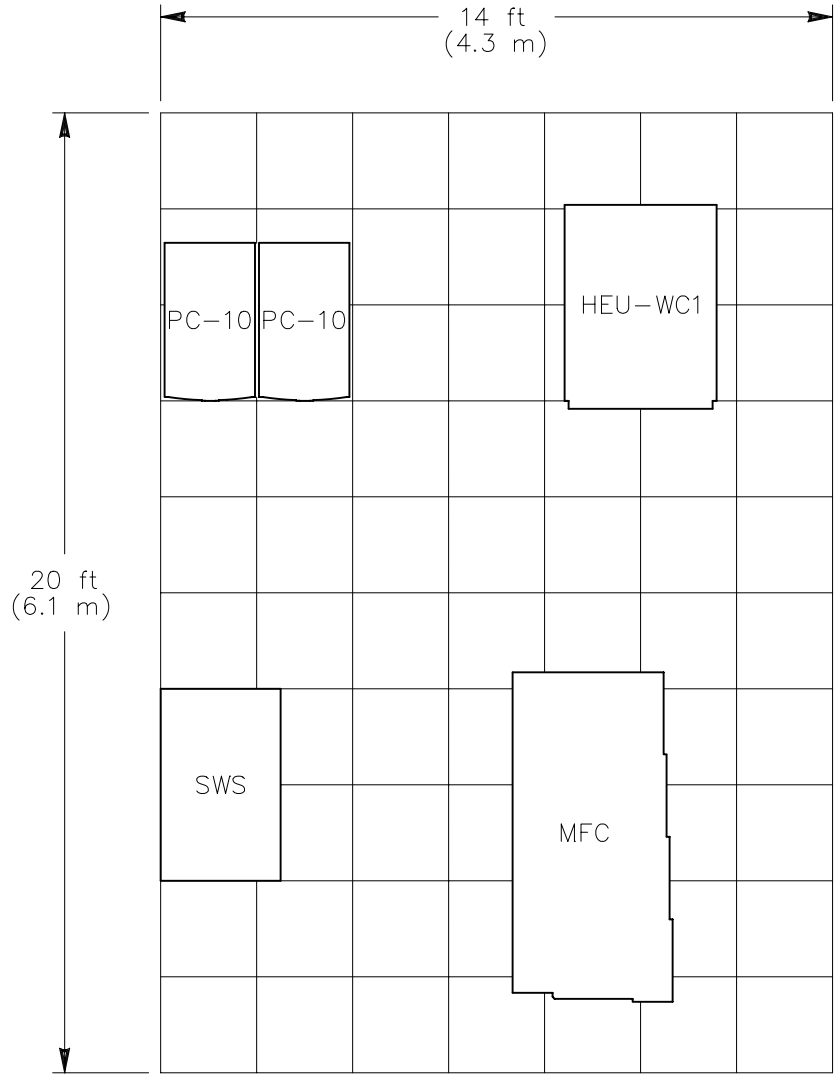
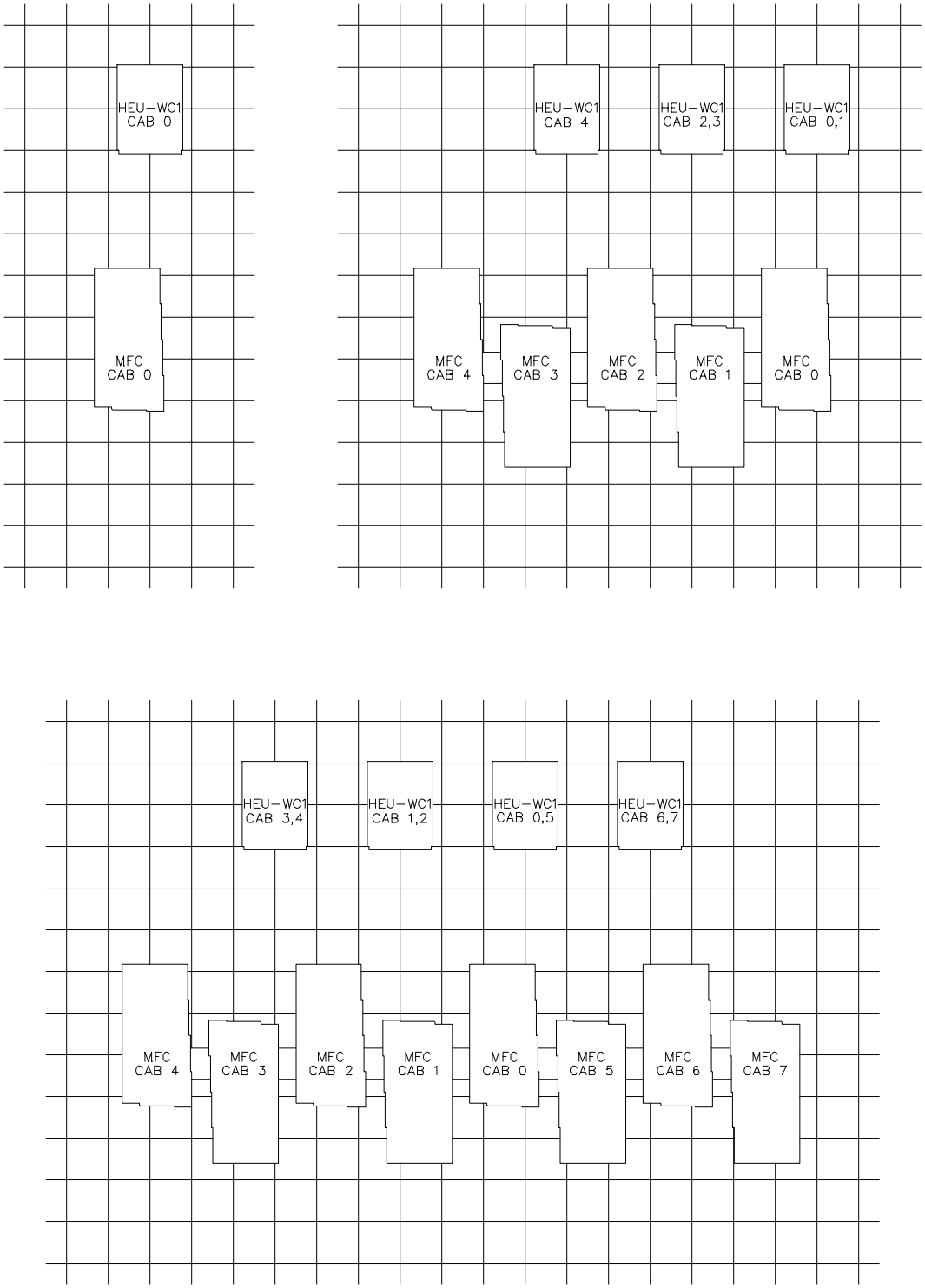


Figure 7. CRAY T3E LC System One-, Five-, and Eight-cabinet Configurations



Equipment Separation Limits

The arrangement of computer equipment within your facility must meet certain placement and separation requirements. You must prepare drawings that specify the arrangement and locations of the computer equipment. Cray Research site planning personnel must review and approve these drawings prior to any site preparation.

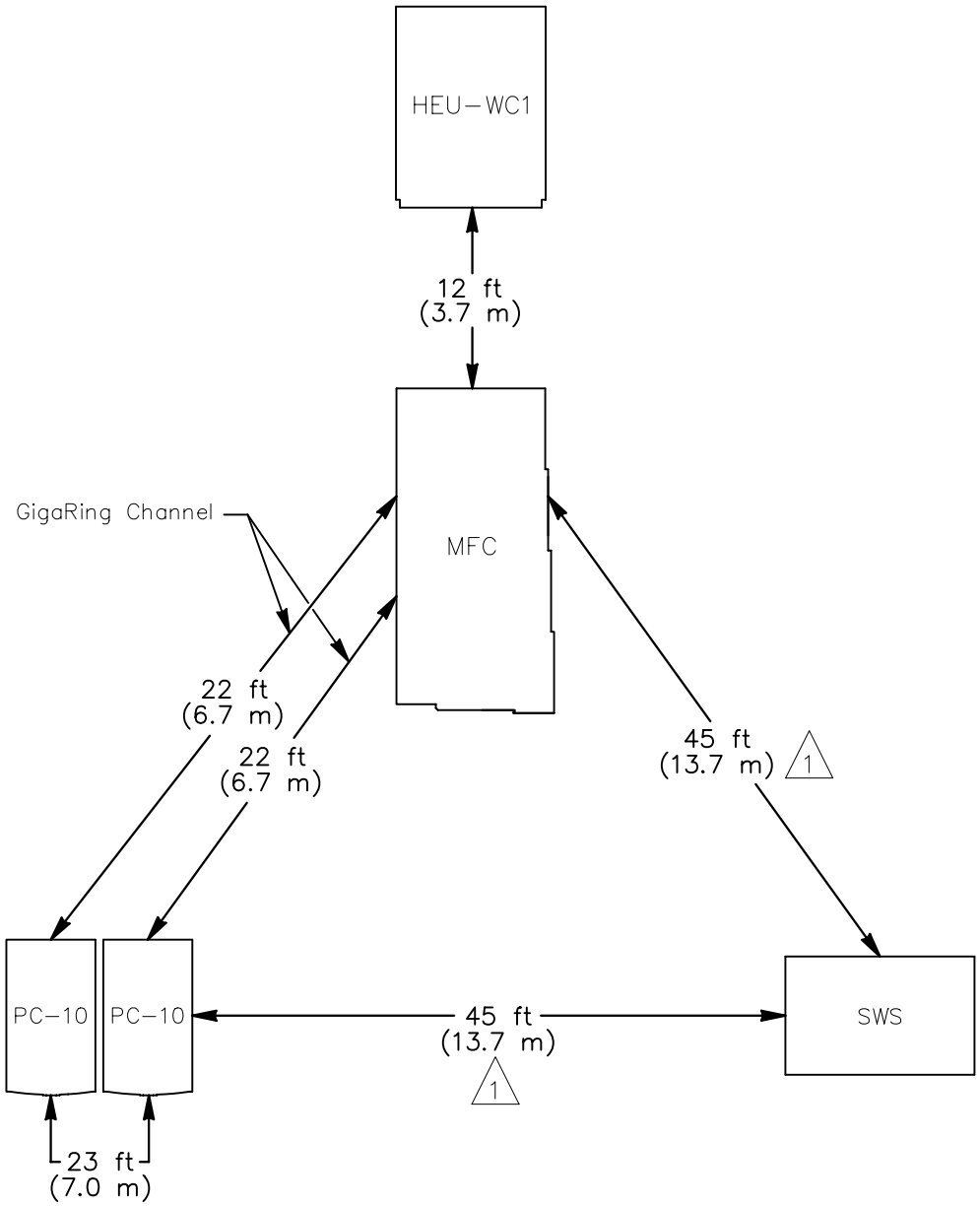
The arrangement of your computer room should be planned with the following considerations:

- Personnel safety
- Maximum system performance
- Satisfactory system installation
- Satisfactory operator and maintenance access

All computer equipment arrangements must meet signal-cable length restrictions.

Figure 8 illustrates the equipment separation limits for the CRAY T3E LC computer system.

Figure 8. Computer System Equipment Separation Limits



1 The standard cable provided with the SWS is 45 ft (13.7 m). Contact your Cray Research account manager to order longer cables.

Power Wiring Requirements

You must install all power wiring for the following CRAY T3E LC computer system components: the CRAY T3E LC mainframe cabinet(s), the HEU-WC1(s), the PC-10 cabinet(s), and the SWS. This subsection provides general power wiring requirements for the CRAY T3E LC computer system. Refer to the specific component site planning and preparation document for additional power wiring requirements.

Figure 9 and Figure 10 illustrate the power wiring for CRAY T3E LC computer systems. Figure 9 provides the power wiring diagram for 200 or 208 Vac input power applications. Figure 10 provides the power wiring diagram for 230/400 Vac input power applications.

As stated previously, each component has specific wiring requirements. However, some general information applies to all circuits:

- Figure 9 and Figure 10 are guides for your electrical design engineer and must not be used as bid documents or working drawings.
- The equipment arrangements in Figure 9 and Figure 10 are not actual equipment layouts.
- Your site preparation design should enable you to add circuits if you plan to upgrade your system.
- All wiring should be prepared according to applicable local and national codes.
- Any circuit breakers that the customer provides must be capable of being locked out to facilitate “Lockout/Tagout” procedures. Delays in system installation may occur if the devices cannot be locked out.
- Cray Research recommends one emergency-off switch at each computer room exit. All emergency-off switches must be wired in series and must interrupt power to the computer equipment and to all air-circulating units in the computer room.
- The customer must provide and install all circuit breakers, circuit breaker panels, magnetic contractors, main power disconnect switches, junction boxes, power wiring, raceways, and conduits.

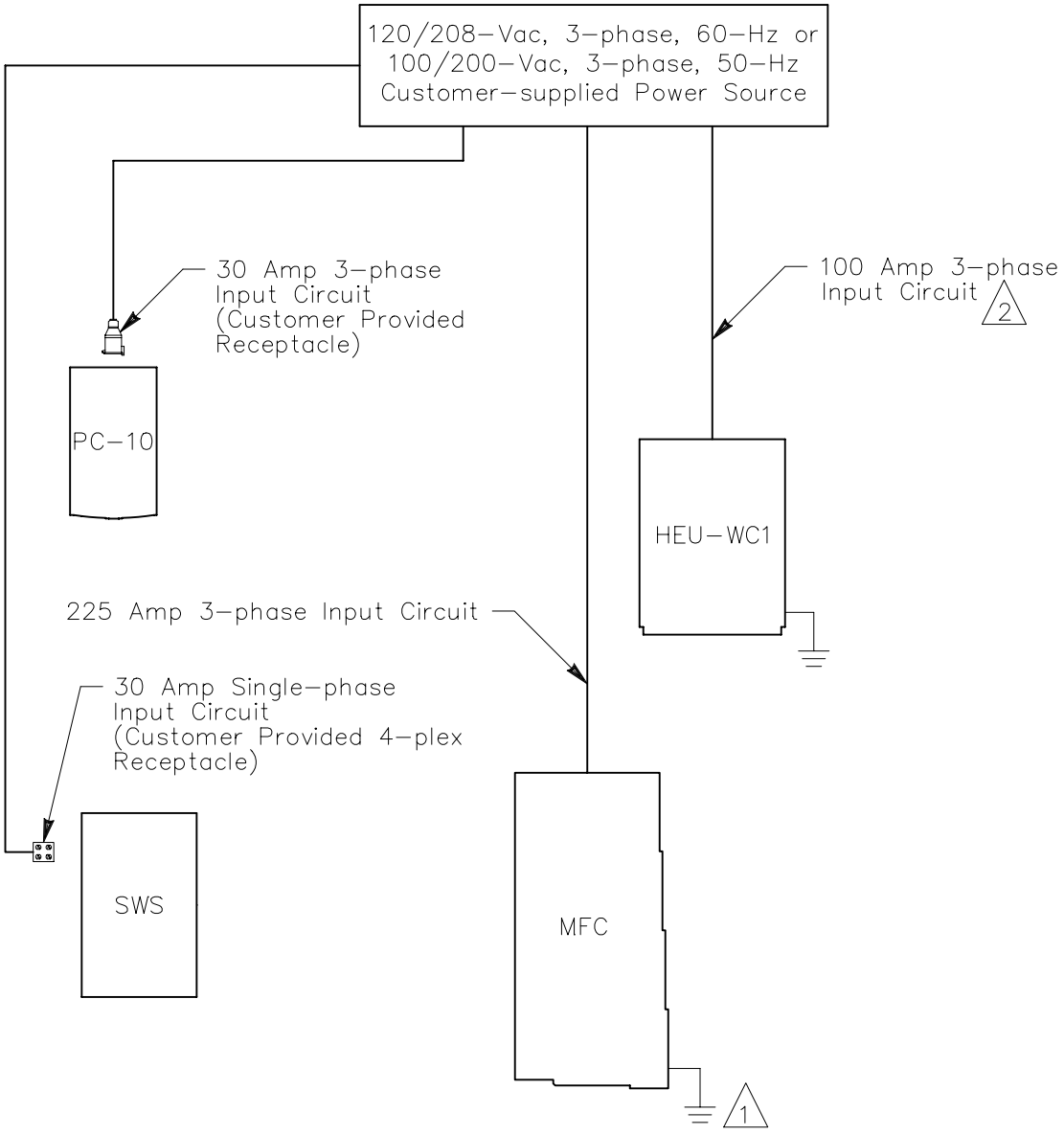
- All conduits or cables that end at computer equipment must be secured with agency-approved fittings at the wire entrance to the equipment cabinet.

- Allow at least 36.00 in. (914 mm) of wire length above the floor surface so that the wire is long enough to connect to the system.

- Cray Research provides separate site planning documents that contain detailed information regarding the input wiring connections to the mainframe cabinet and the HEU-WC1.

All Cray Research computer equipment must be earth grounded. Refer to *Equipment Grounding for Cray Research, Inc. Computer Systems*, Site Engineering document number 10658002, for more information about equipment grounding.

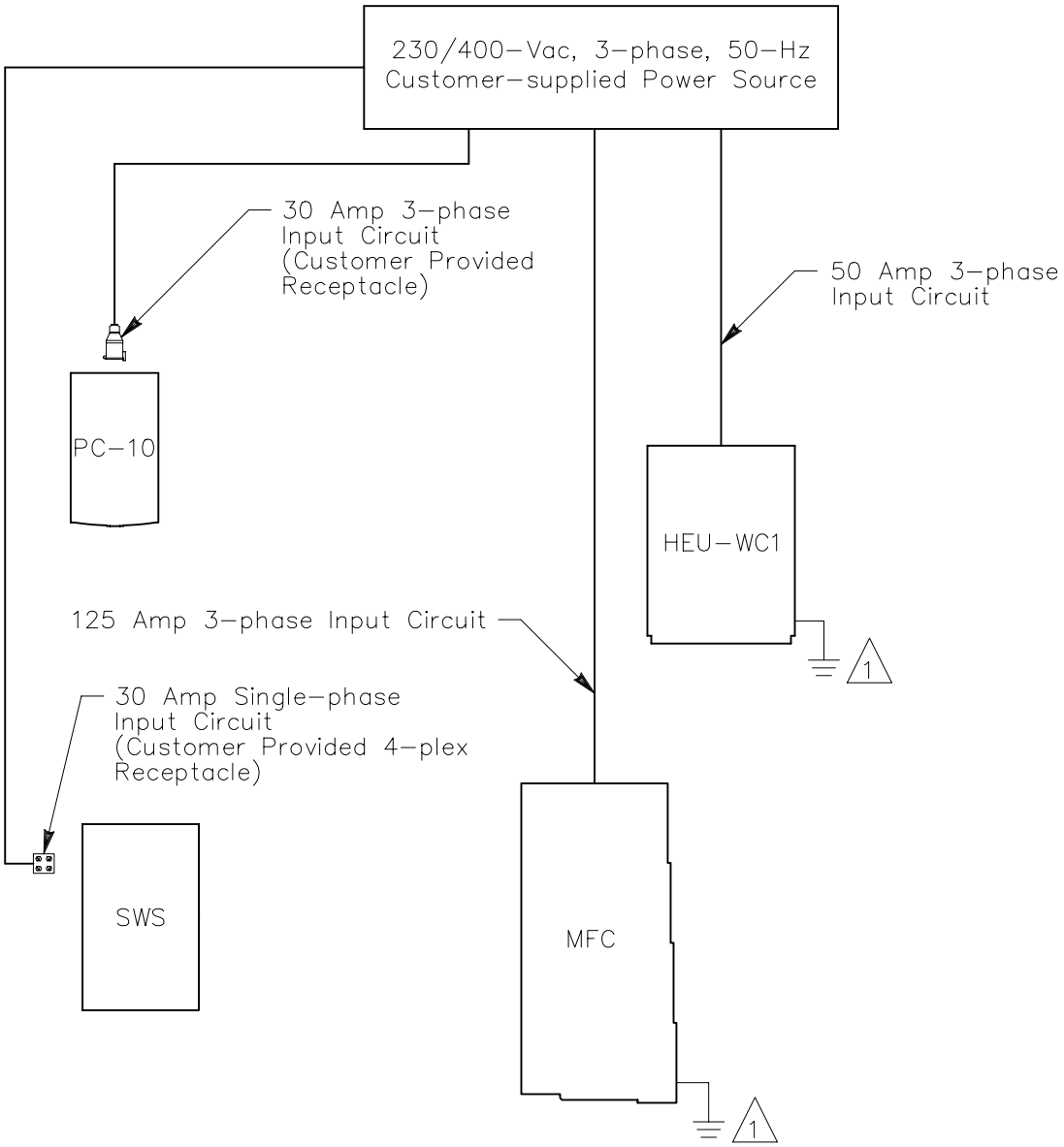
Figure 9. Power Wiring, 120/208 Vac (60 Hz) or 100/200 Vac (50 Hz)



1 Cray Research provides signal reference grid (SRG) braided straps.

2 The HEU–WC1 can also operate from a 480 Vac, 3–phase, 60 Hz power source. A 50 Amp input circuit is required.

Figure 10. Power Wiring, 230/400 Vac (50 Hz)



1 Cray Research provides signal reference grid (SRG) braided straps.

System Cooling Requirements

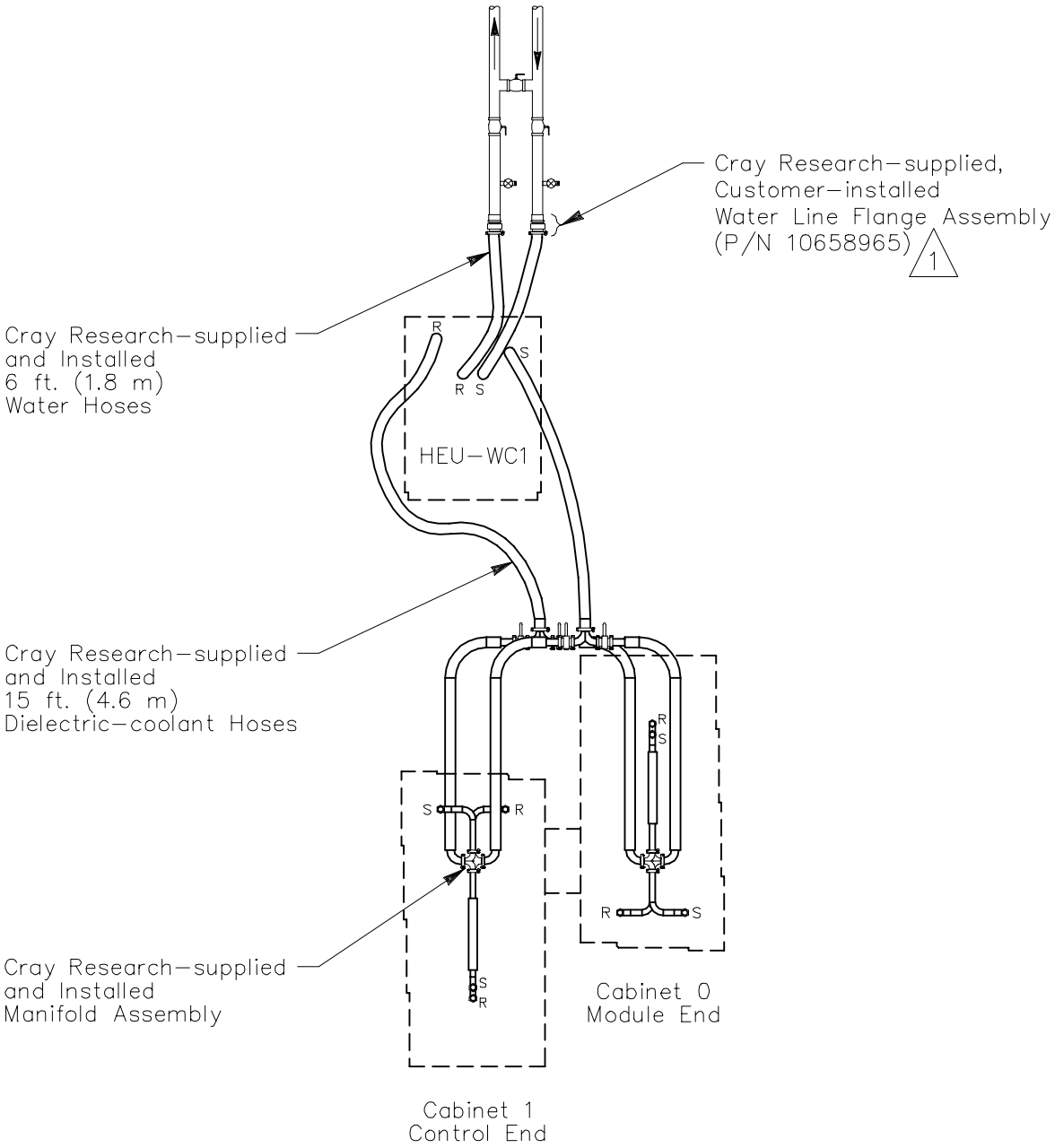
The CRAY T3E LC computer system uses a dielectric-coolant to customer chilled water cooling technique that requires special Cray Research-provided piping and hoses. Refer to Figure 11 for an illustration of the water line and dielectric-coolant assemblies.

In order to connect the customer-supplied water pipes to the HEU-WC1, a Cray Research-supplied water line flange assembly is required on both the supply and return water lines. The customer installs these flange assemblies, which are shipped to the customer site 4 to 6 weeks prior to system installation.

The customer connections can be made with either a 3 1/8-in. (79-mm) copper tube using a brazed connection or with the Cray Research supplied 3-in. (76-mm) national pipe thread (NPT) fitting. Refer to Figure 12 for an illustration of the required HEU-WC1 water piping.

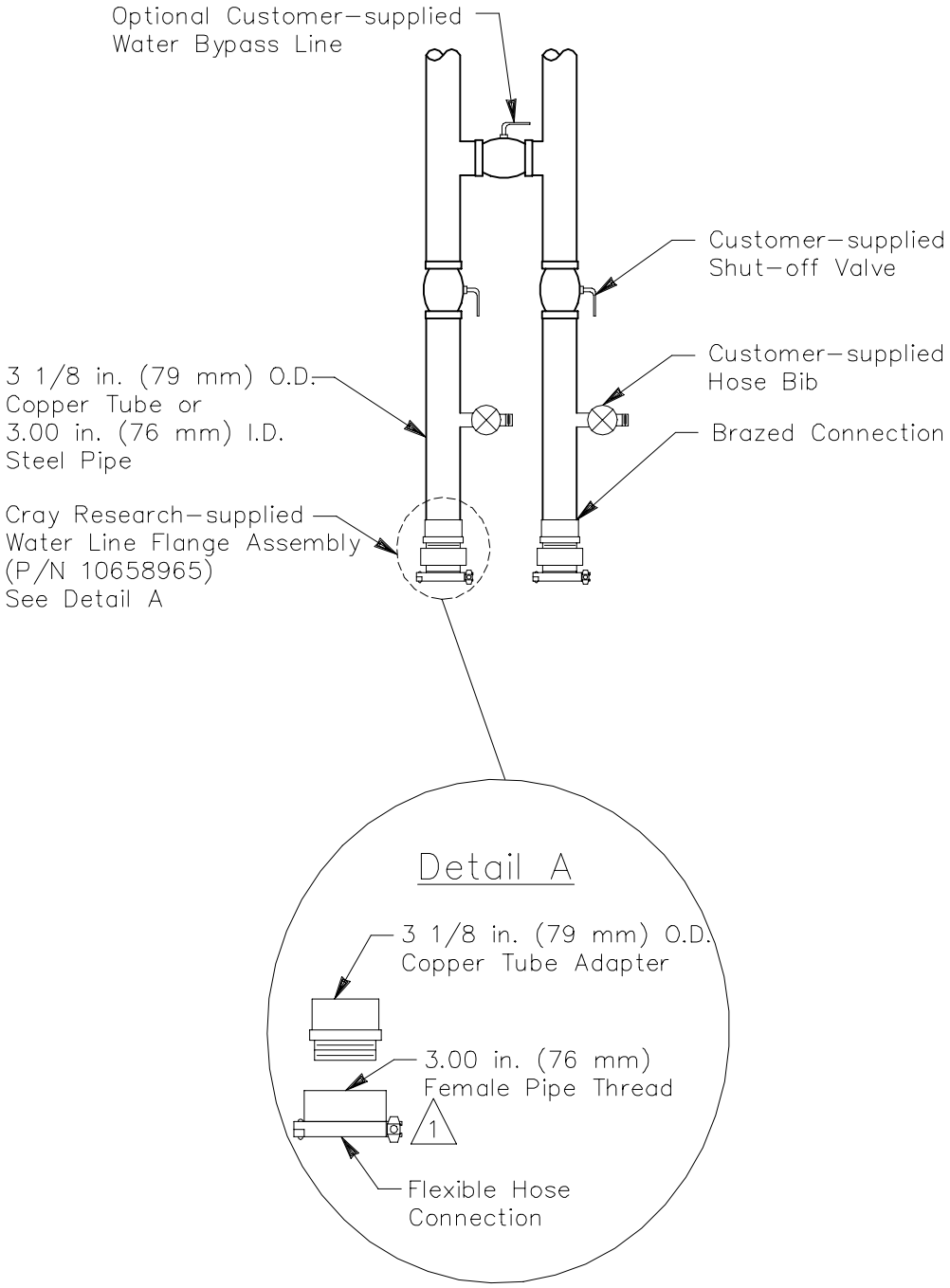
Flexible hoses and manifold assemblies are required to complete the dielectric-coolant network between the HEU-WC1 and the CRAY T3E LC mainframe cabinet. Flexible hoses are also required to complete the water piping between the flange assemblies and the HEU-WC1. Cray Research supplies and installs all flexible hoses for the dielectric coolant and water at the time of system installation.

Figure 11. Water- and Dielectric-coolant Assemblies



1 The exact water line flange assembly location depends on site conditions. The final location must be approved by Cray Research to ensure that the Cray Research–supplied hoses will fit.

Figure 12. HEU-WC1 Water Line Flange Assembly



1 Depending on the type of customer water piping used, the connection to the Cray Research–supplied water line flange assembly may be made with a copper–to–copper brazed connection or with a customer–provided steel 3.00 in (76mm) Male National Pipe Thread (MNPT).

CRAY T3E Liquid-cooled Mainframe Cabinet

The CRAY T3E liquid-cooled (LC) system can be configured as either a single-cabinet or multiple-cabinet system. Single-cabinet configurations consist of one mainframe cabinet and one heat exchanger unit (HEU-WC1). Multiple-cabinet configurations consist of from two to eight cabinets; one HEU-WC1 is assigned to every two cabinets.

Table 8 provides the specifications for a CRAY T3E LC mainframe cabinet. Refer to Figure 13 for an illustration of the CRAY T3E LC mainframe cabinet.

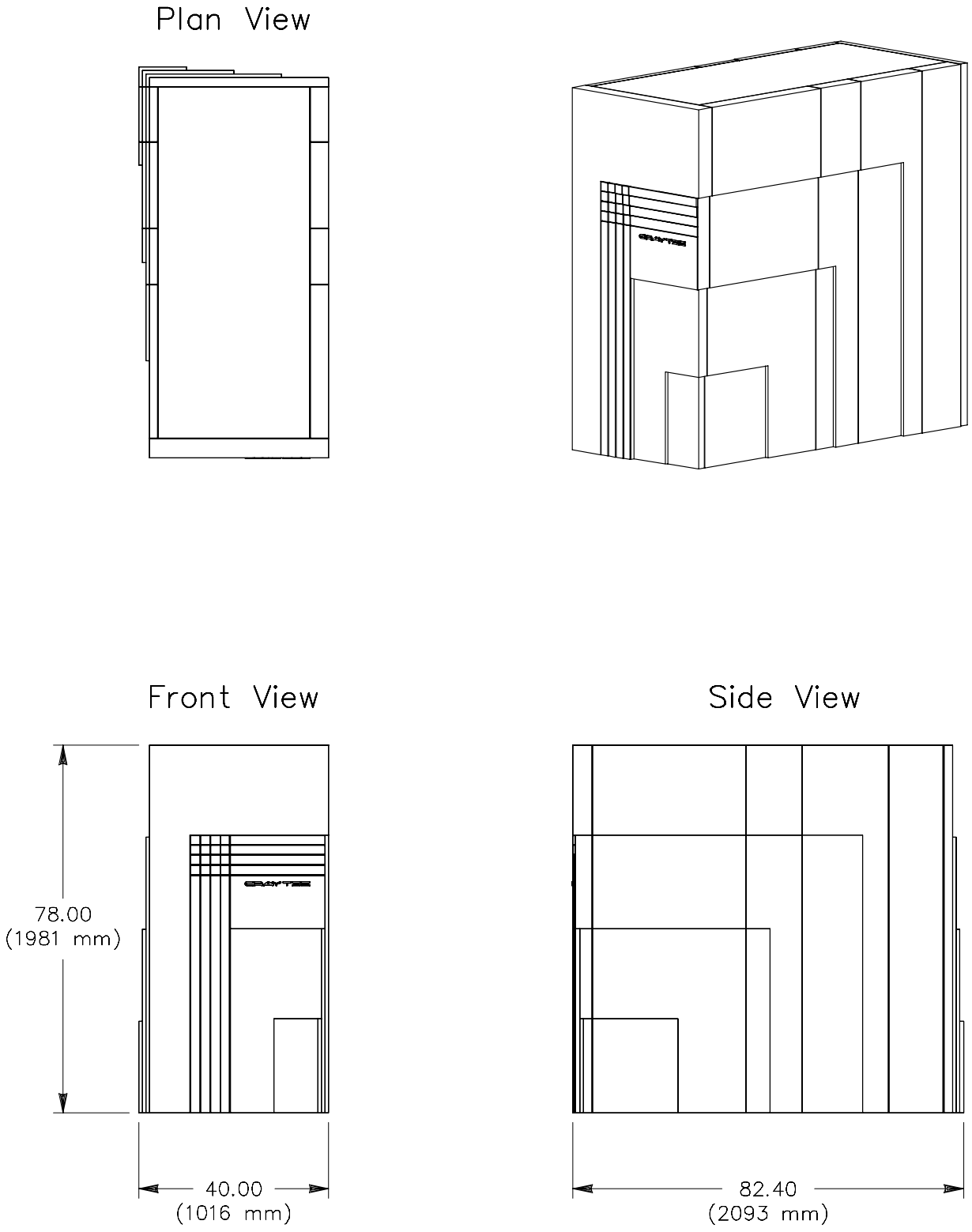
Table 8. CRAY T3E LC Mainframe Cabinet Specifications

Characteristic	Specification
Height	78.00 in. (1981 mm)
Width	40.00 in. (1016 mm)
Depth	82.40 in. (2093 mm)
Operational weight (maximum)	5,124 lbs. (2324 kg)
Access requirement	36.00 in. (914 mm) on all sides
Heat dissipation to air (maximum)	7.61 kBTU/hr (2.23 kW)
Cooling requirement	Dielectric coolant
Input voltage	200 to 240 Vac, 3 phase or 400 Vac, 3 phase [a]
Frequency	47 to 63 Hz
Hold-up time	60 milliseconds at full load
Input wiring connection	Compression lugs

[a] The system chassis have been tested for compliance with operation at +6% and -10%, 200 to 240 Vac, and +/- 10%, 400 Vac for short periods of time.

NOTE: Total kilowatt power requirements depend on system configuration and expansion allowances. Cray Research provides documentation that outlines the power requirements for your specific computer system configuration.

Figure 13. CRAY T3E LC Mainframe Cabinet



Shipping Configuration

Cray Research ships the CRAY T3E LC mainframe cabinet as a single unit on lifts that Cray Research provides. Table 9 provides the shipping configuration specifications. Refer to Figure 14 for an illustration of the CRAY T3E LC mainframe cabinet shipping configuration, including dimensions.

Table 9. Mainframe Cabinet Shipping Configuration Specifications

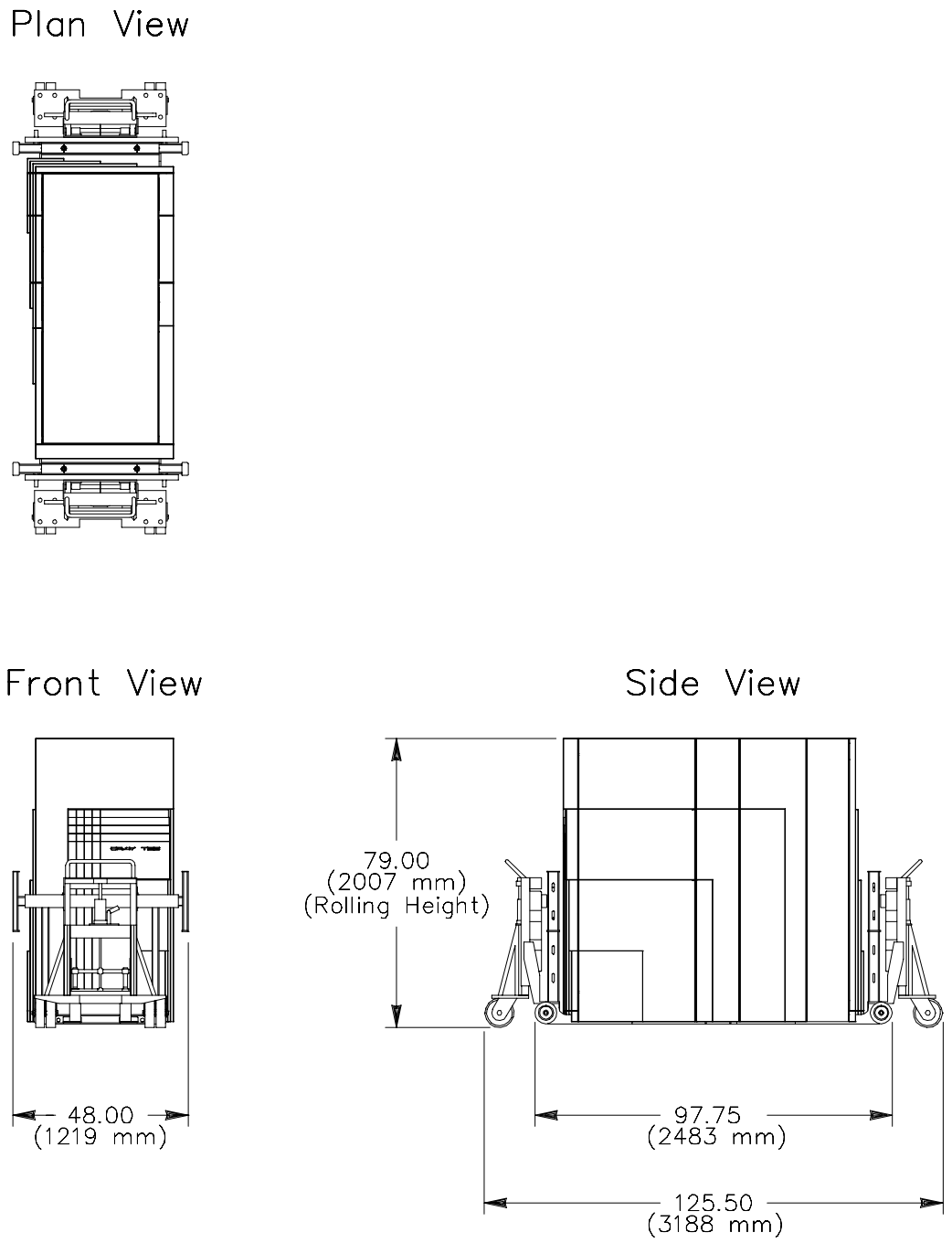
Characteristic	Specification
Height	78.00 in. (1981 mm) [a]
Width	48.00 in. (1219 mm)
Depth	125.50 in. (3188 mm) [b]
Weight	5,854 lbs (2655 kg) [c]

[a] Add 1.00 in. (25 mm) for rolling height.

[b] Dimension includes ROL-A-LIFTs.

[c] Weight includes ROL-A-LIFTs.

Figure 14. CRAY T3E LC Cabinet Shipping Configuration



Floor Preparation

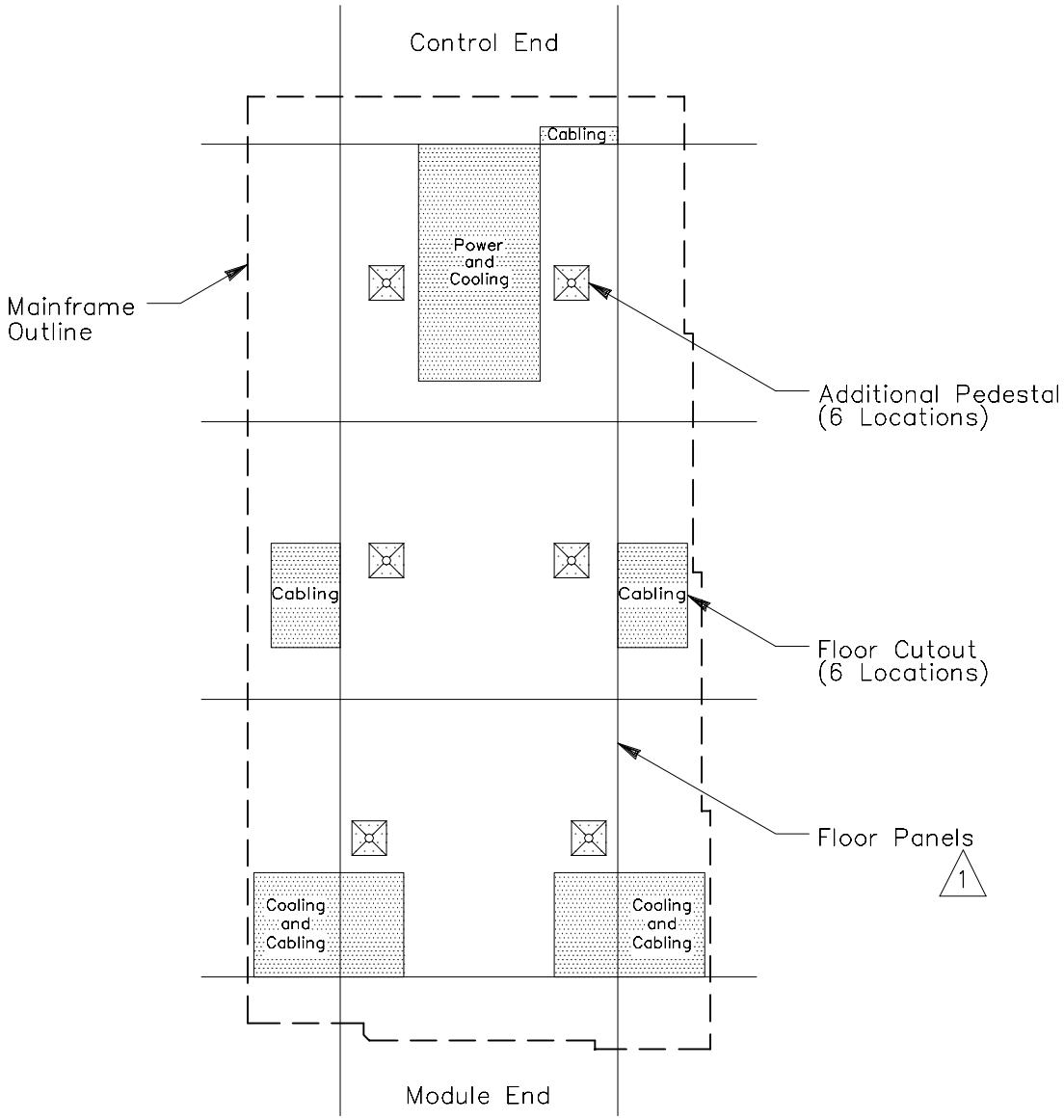
Before your system is delivered, you must prepare the raised floor for the CRAY T3E LC mainframe cabinet installation. Cray Research recommends a minimum clearance of 12 in. (305 mm) between the subfloor and the underside of the raised-floor panels. Clearances of less than the recommended 12 in. (305 mm) must be reviewed by Cray Research site planning personnel.

You must also prepare the six floor cutouts and install the six additional floor support pedestals. (You may need to install additional floor support pedestals, depending on the raised floor system.) To prevent damage to system connections, these floor cutouts must be free of sharp edges and burrs.

NOTE: Cray Research provides full-scale templates that may be used to prepare the CRAY T3E LC mainframe cabinet floor cutouts and to determine the floor support pedestal locations.

Refer to Figure 15 for an illustration of the floor cutouts and the additional floor support pedestal locations for the CRAY T3E LC mainframe cabinet.

Figure 15. CRAY T3E LC Cabinet Floor Cutouts



1 24-inch (610 mm) floor panels are shown. Floor cutouts and additional pedestal locations will differ for other floor panel sizes and for multiple cabinet configurations.

Heat Exchanger Unit (HEU-WC1)

The heat exchanger unit (HEU-WC1) removes the heat that the logic modules and power supplies generate within a Cray Research module cabinet. The HEU-WC1 circulates dielectric coolant through the module cabinet to remove the heat. The dielectric coolant absorbs the heat within the module cabinet and then flows to the HEU-WC1 where the heat transfers to customer-supplied water.

Table 10 provides the specifications for the HEU-WC1. Refer to Figure 16 for an illustration of the HEU-WC1.

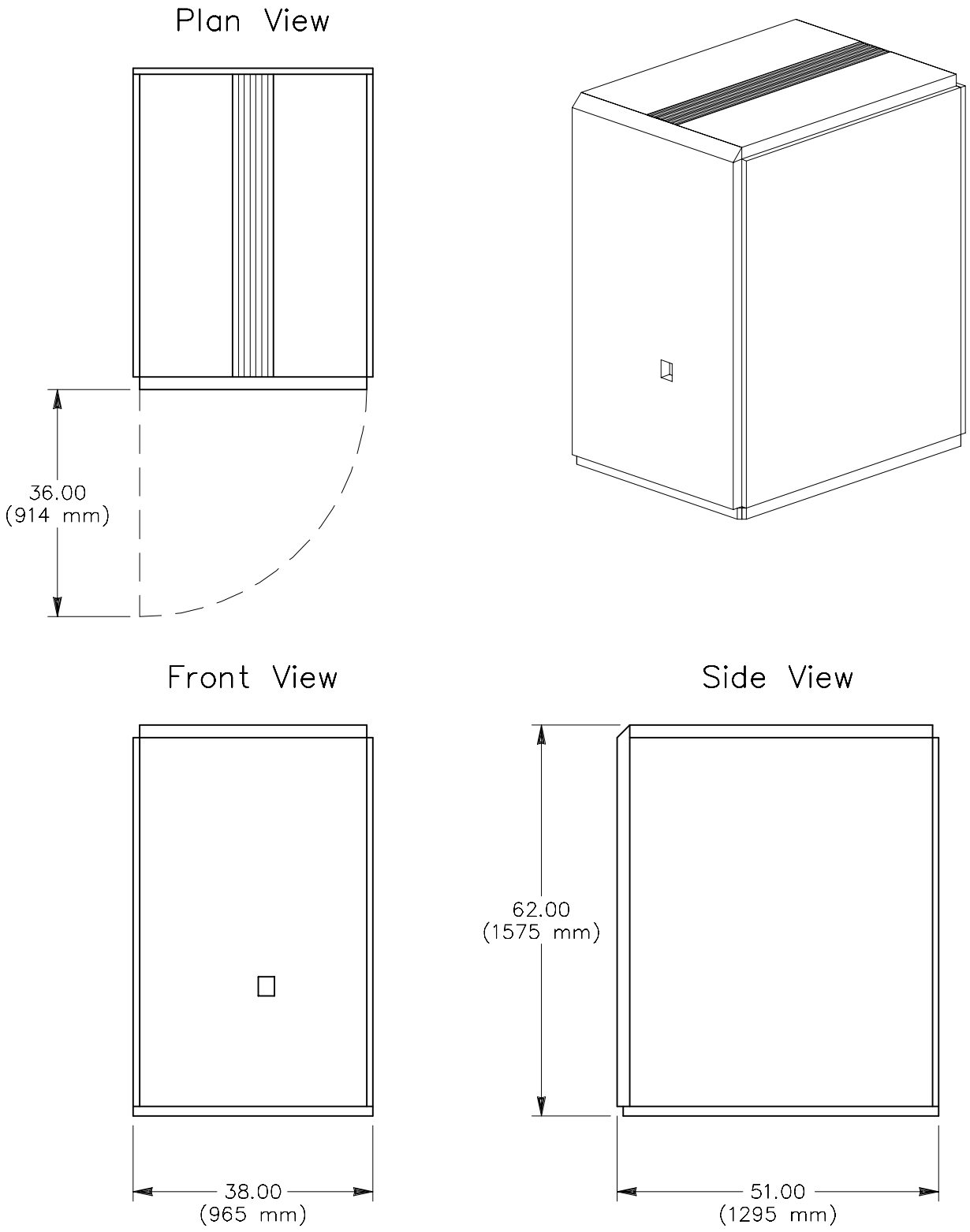
Table 10. HEU-WC1 Specifications

Characteristic	Specification
Height	62.00 in. (1575 mm)
Width	38.00 in. (965 mm)
Depth	51.00 in. (1295 mm)
Weight	1,557 lbs (706 kg)
Access requirements	36.00 in. (914 mm) on all sides
Heat dissipation to air	3.93 kBTU/hr (1.15 kW)
Cooling requirement	Customer-supplied cooling water
Input voltage	400/480 or 200/208 Vac, 3 phase [a]
Frequency	50 or 60 Hz ± 5%
Input wiring connections	Compression lugs

[a] The HEU has been tested for compliance with operation at +6% and -10%, 200 to 240 Vac, and +/- 10%, 400 Vac for short periods of time.

Refer to Figure 18 for the location of the floor cutouts for the HEU-WC1 cabinet.

Figure 16. Heat Exchanger Unit (HEU-WC1)



Shipping Configuration

Cray Research ships the HEU-WC1 cabinet as a single unit on lifts that Cray Research provides. Table 11 lists the shipping configuration specifications. Refer to Figure 17 for an illustration of the HEU-WC1 cabinet shipping configuration, which includes dimensions.

Table 11. HEU-WC1 Cabinet Shipping Configuration Specifications

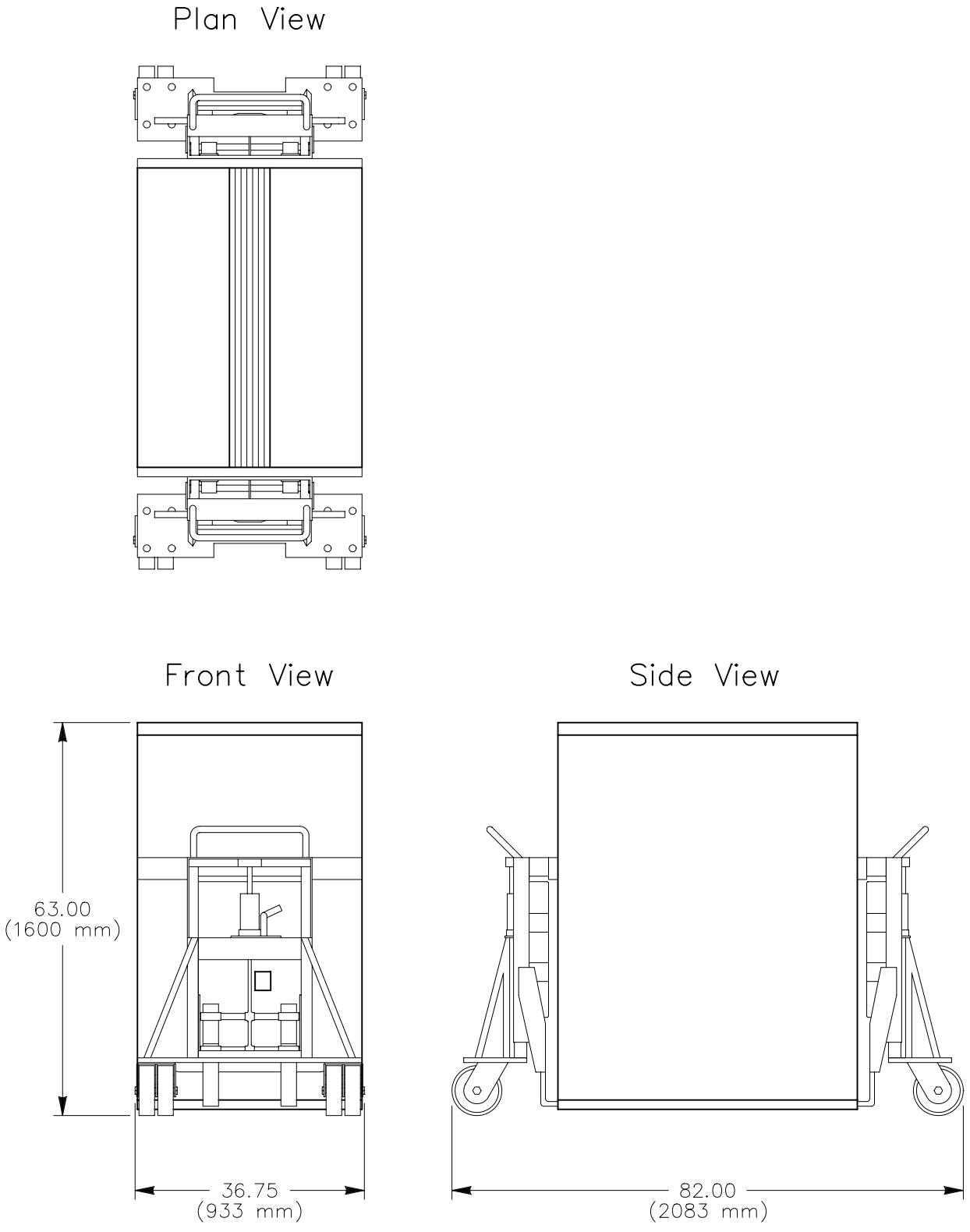
Characteristic	Specification
Height	62.00 in. (1575 mm) [a]
Width	36.75 in. (933 mm) [b]
Depth	82.00 in. (2083 mm) [b]
Weight	1,554 lbs (705 kg) [c]

[a] Add 1.00 in. (25 mm) for rolling height.

[b] Dimension includes ROL-A-LIFTs.

[c] Weight includes ROL-A-LIFTs.

Figure 17. HEU-WC1 Shipping Configuration



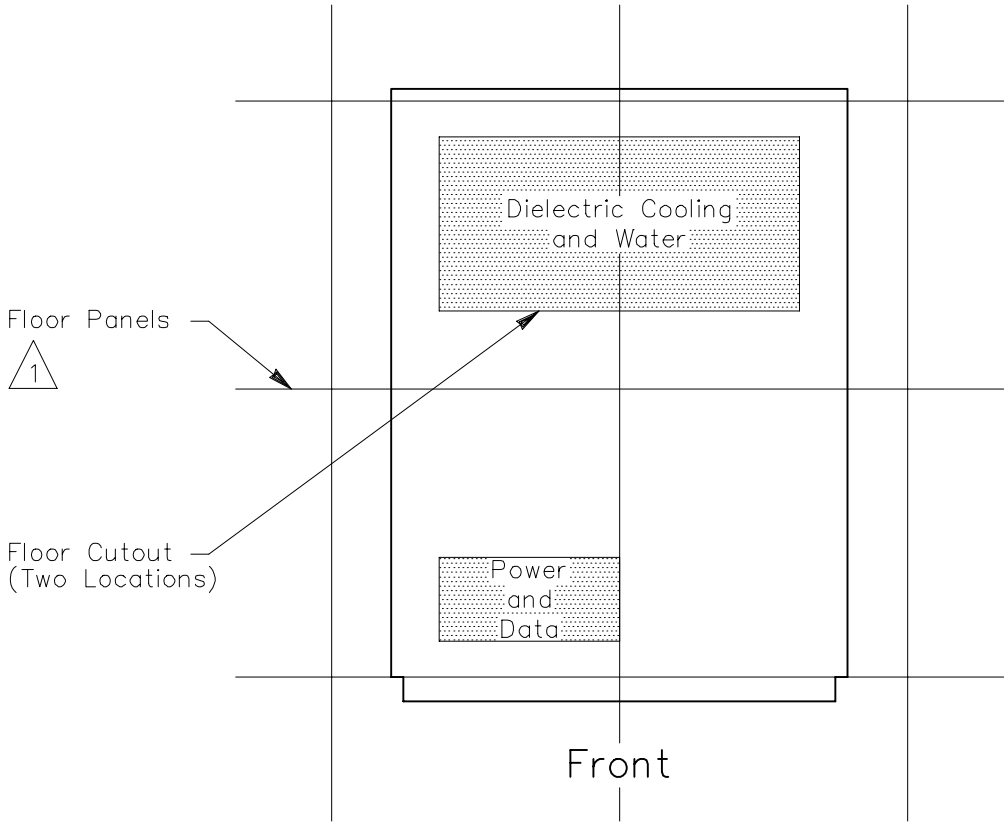
Floor Preparation

Prior to system delivery, you must prepare the raised floor for the HEU-WC1 cabinet installation.

You must prepare two floor cutouts. Floor cutouts provide openings for data, power, water, and dielectric-coolant connections. To prevent damage to these system connections, ensure that the floor cutouts are free of sharp edges and burrs. Refer to Figure 18 for an illustration of the floor cutouts.

NOTE: Cray Research provides full-scale templates that you may use to prepare the HEU-WC1 cabinet floor cutouts.

Figure 18. HEU-WC1 Cabinet Floor Cutouts



1 The heat exchanger unit is shown on 24–in. (610–mm) floor panels. Floor cutouts may differ for other floor panel sizes.

Peripheral Cabinet (PC-10)

Each CRAY T3E LC system includes a minimum of one PC-10 cabinet. Each PC-10 cabinet contains an input power subrack and various air-cooled subracks that provide input/output and data storage capabilities. The input/output subracks network the CRAY T3E LC computer system, customer devices, user workstations, peripheral controllers, and various industry-standard communication channels. Depending on your peripheral requirements, the PC-10 cabinet can contain any combination of the following subracks:

- Node subrack (NSR-1)
- Multipurpose node (MPN-1)
- Disk subsystem fibre channel (DSF-1)
- Disk subsystem SCSI (DSS-1)
- Fiber-optic extender (FOX-1)
- Ethernet concentrator
- Micro Annex™ communications server
- GigaRing™ bulkhead

Table 12 provides the specifications for a PC-10 cabinet. Refer to Figure 19 for an illustration of the PC-10 cabinet.

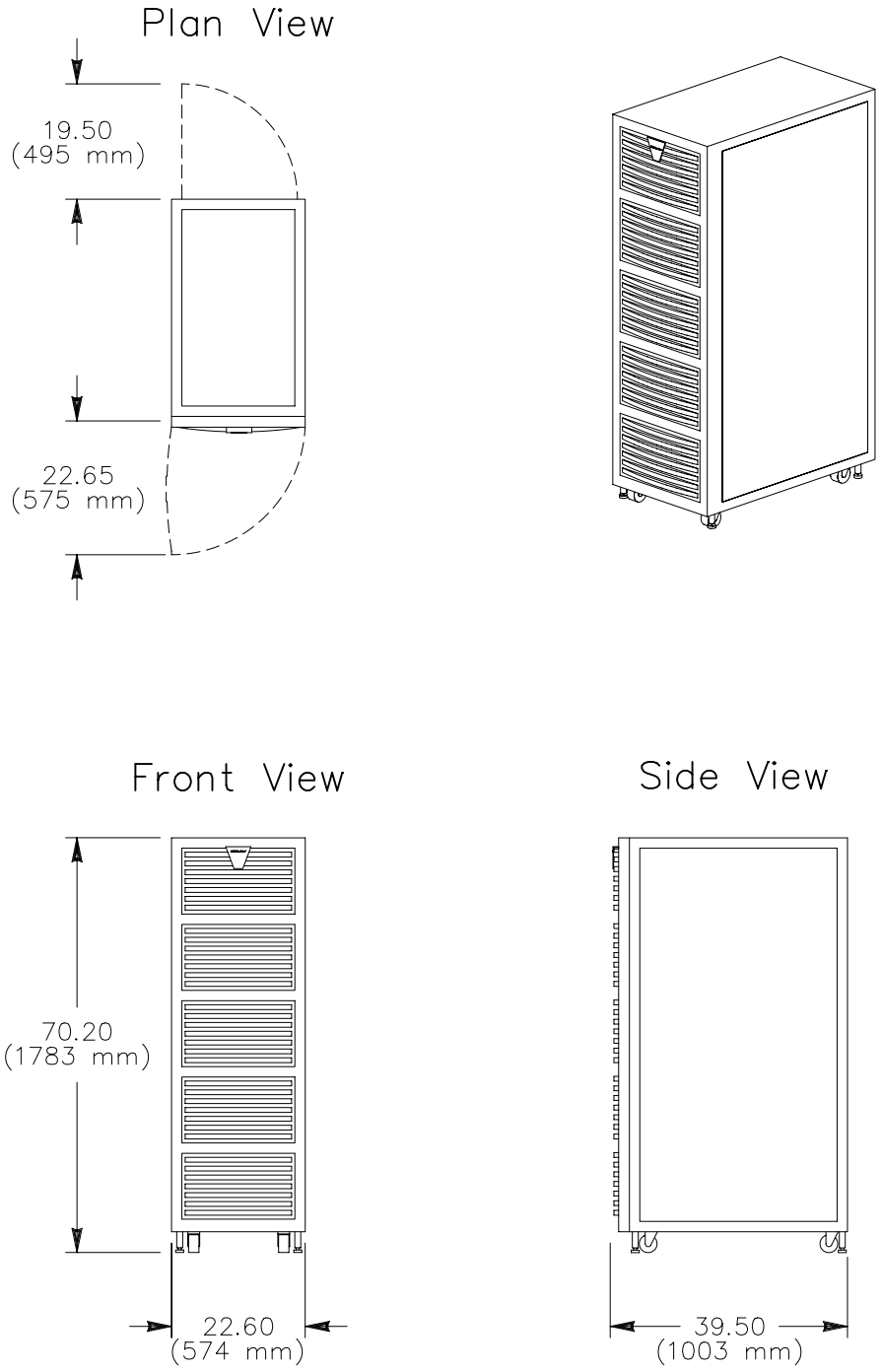
Table 12. PC-10 Specifications

Characteristic	Specification
Height	70.20 in. (1783 mm)
Width	22.60 in. (574 mm)
Depth	39.50 in. (1003 mm)
Weight (maximum)	951 lbs. (431 kg)
Access requirements	36.00 in. (914 mm) front and back
Heat dissipation to air (maximum)	17.06 kBtu/Hr (5.00 kW)
Cooling requirement	Ambient air
Airflow (maximum)	2700 cfm (1.27 m^3/s)
Acoustical noise level	67 dba at 3.3 ft (1.0 m)
Input voltage	200 to 240 Vac, 50/60 Hz, 3 phase 400 Vac, 50 Hz, 3 phase
Power requirement (maximum)	5.26 kVA (5.00 kW)
Hold-up time	16 milliseconds

Table 12. PC-10 Specifications (continued)

Characteristic	Specification
Power cable	8-ft. (2.4-m) pluggable drop cord
Power receptacle	208 Vac: Hubbell® 430C9W 400 Vac: Hubbell 532C6W

Figure 19. PC-10 Cabinet



Shipping Configuration

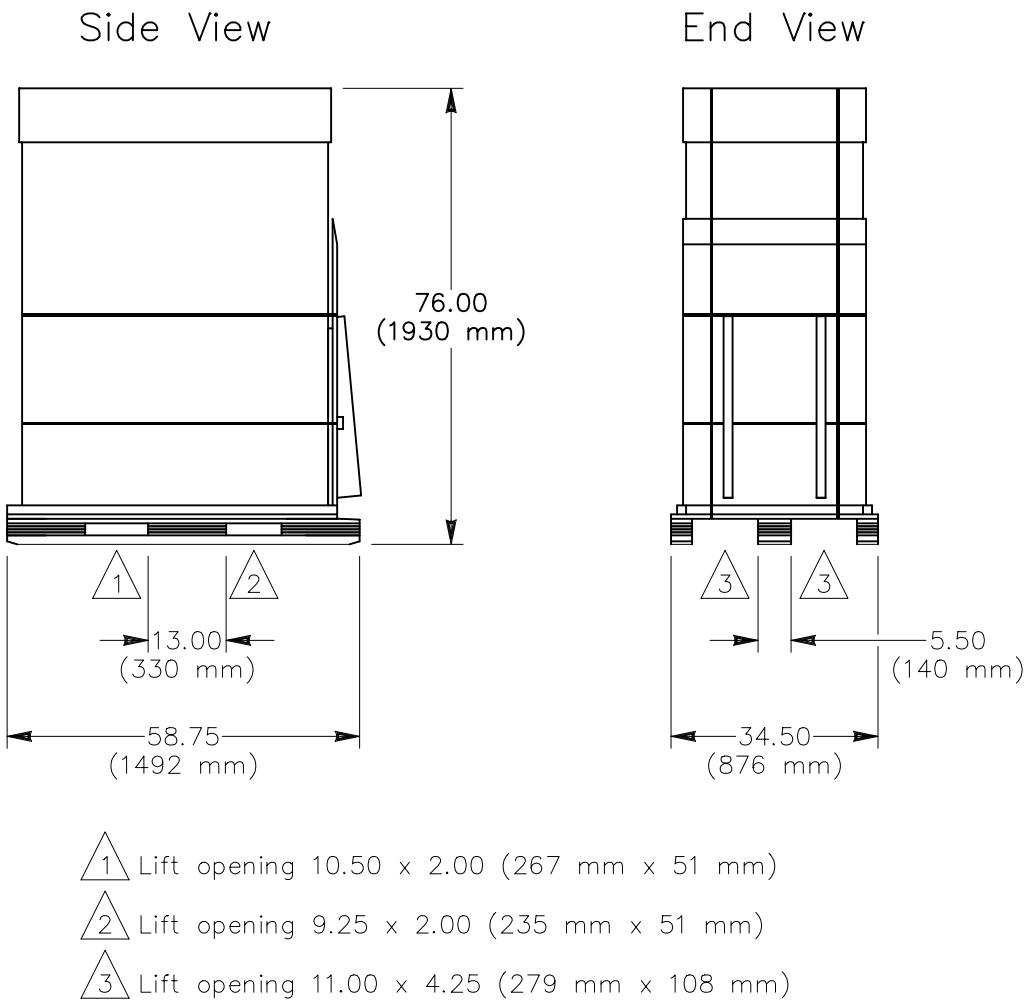
Table 13 provides the PC-10 cabinet shipping configuration specifications.

Table 13. PC-10 Cabinet Shipping Configuration Specifications

Characteristic	Specification
Height	76.00 in. (1930 mm)
Width	34.50 in. (876 mm)
Depth	58.75 in. (1492 mm)
Weight	1,116 lbs (506 kg)

Refer to Figure 20 for an illustration of the PC-10 cabinet shipping crate, which includes dimensions. Each PC-10 cabinet is shipped in a separate shipping crate. Cray Research provides an attached ramp to facilitate the removal of the cabinet from the shipping crate. You must provide a pallet jack to move each shipping crate to the system location.

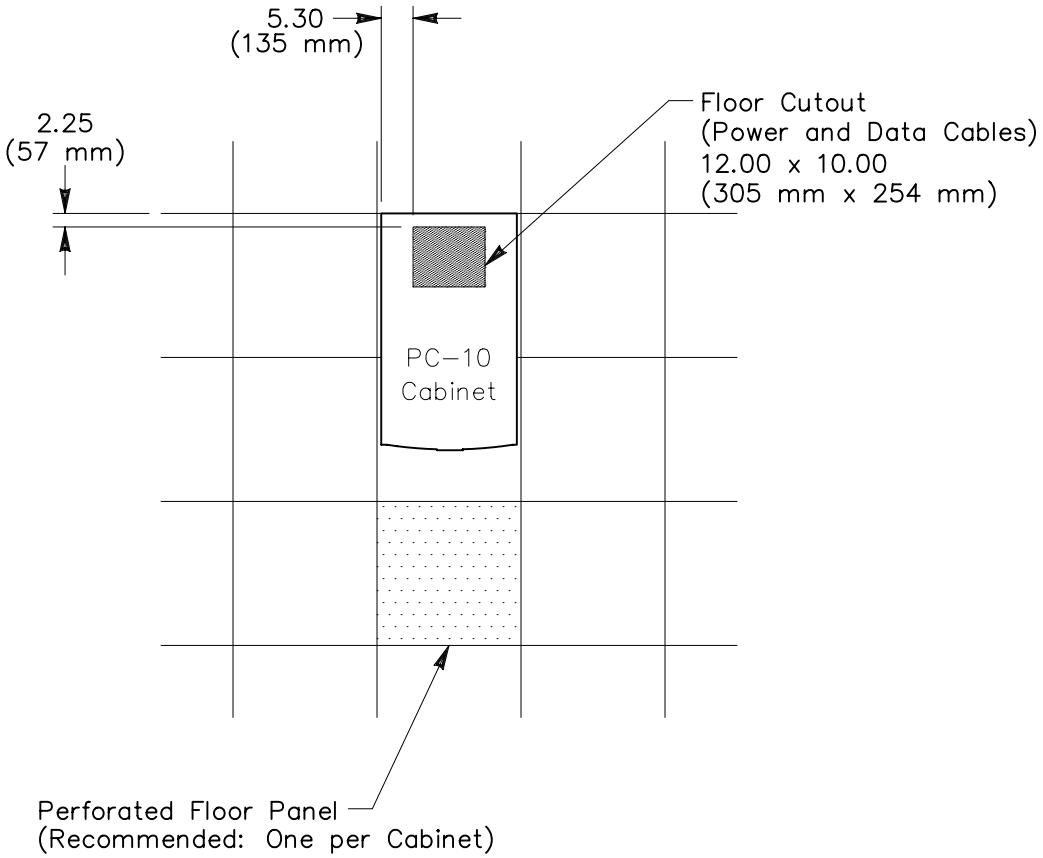
Figure 20. PC-10 Cabinet Shipping Configuration



Floor Preparation

Refer to Figure 21 for the location of the PC-10 floor cutout. Each cabinet requires a floor cutout for the entry of data and power cables. Cray Research recommends the placement of a perforated floor panel in front of each cabinet (as shown in Figure 21) when the cabinet is located on a raised floor with a pressurized underfloor area. This perforated floor panel provides additional cooling air to the PC-10 cabinet.

Figure 21. PC-10 Floor Cutout



System Workstation

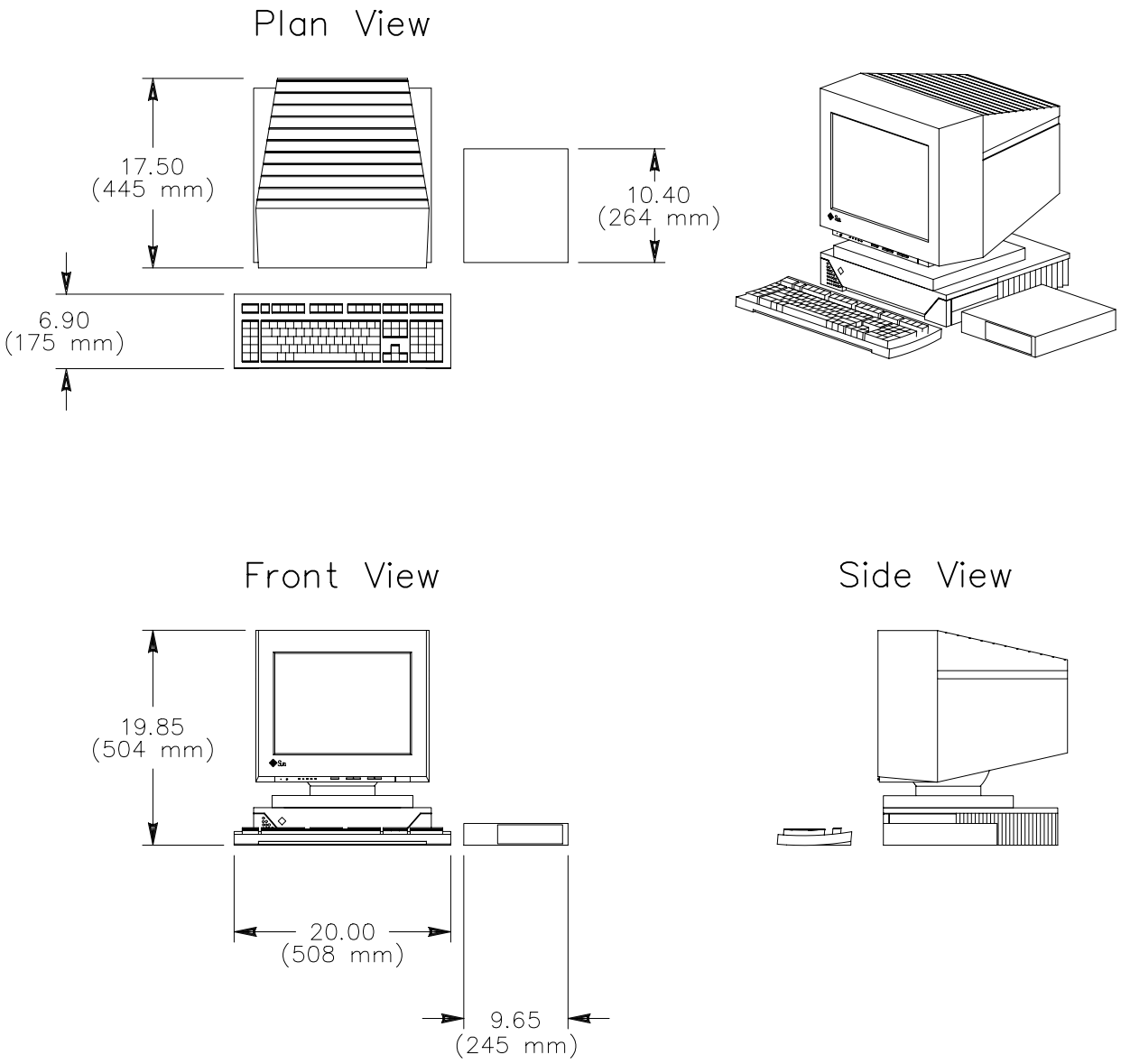
The system workstation is a SPARC based Sun™ workstation that provides monitoring, diagnosis, control, and configuration management for the Cray Research computer systems. Cray Research provides a table (TBL-4) for the SWS, which can connect to an optional laser printer (LP-7).

Refer to Table 14 for the SWS specifications and to Figure 22 for an illustration of an SWS.

Table 14. SWS Specifications

Characteristic	Specification
Height	19.85 in. (504 mm)
Width	30.00 in. (762 mm)
Depth	25.50 in. (648 mm)
Weight	79 lbs (36 kg)
Heat dissipation to air (maximum)	2,010 Btu/hr (600 W)
Cooling requirement	Ambient air
Input voltage	100 to 120 or 200 to 240 Vac, single phase
Power requirement	600 W
Frequency	50 or 60 Hz
Power cable	8-ft (2.4-m) pluggable drop cord
Power receptacle: North America and Japan International	 NEMA #5-15R or equivalent IEC 309, single phase, 16 amp

Figure 22. System Workstation (SWS)



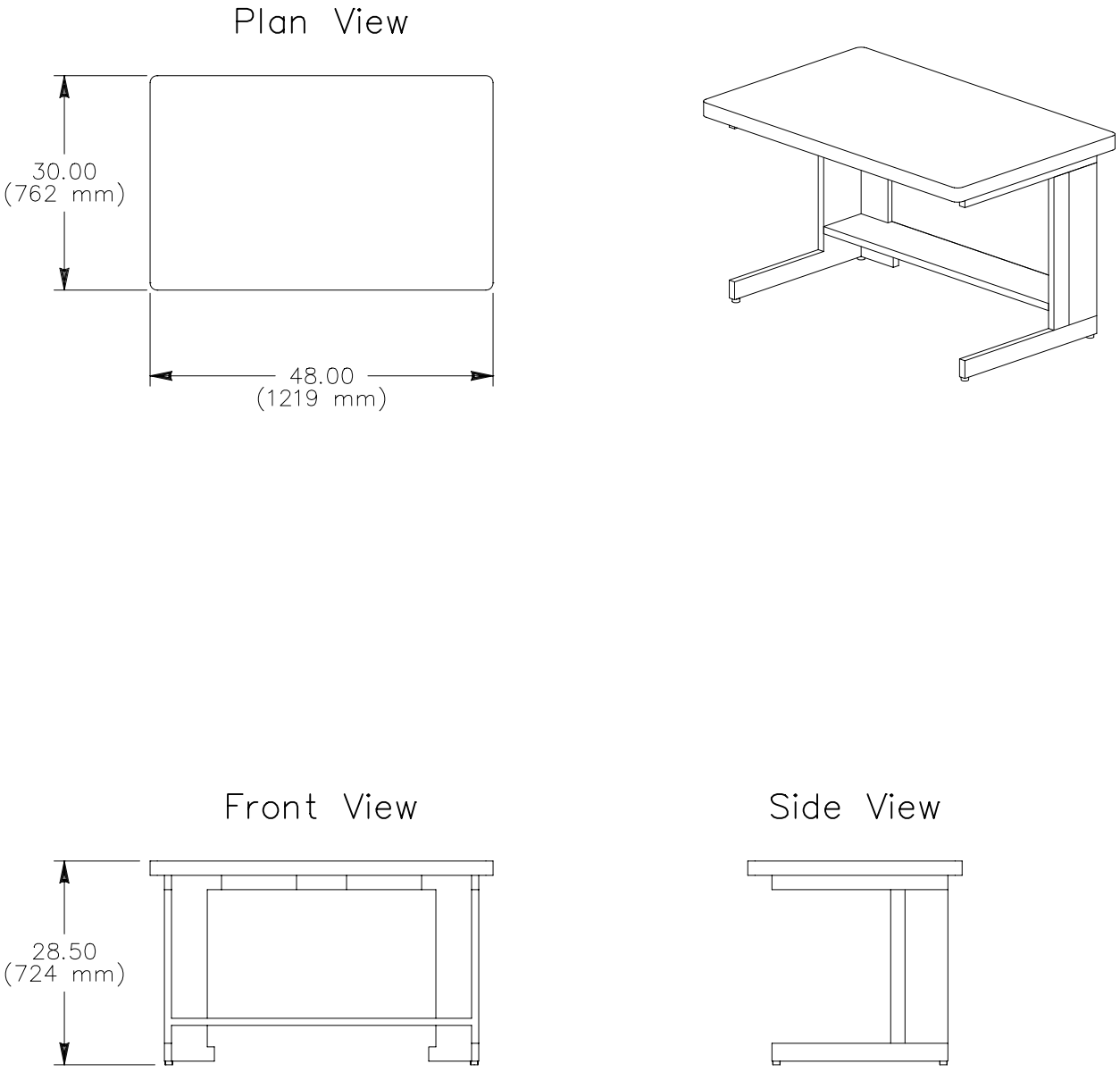
Support System Table (TBL-4)

The support system table (TBL-4) accommodates the SWS.
Refer to Table 15 for the TBL-4 specifications and to Figure 23 for an illustration of a TBL-4.

Table 15. TBL-4 Specifications

Characteristic	Specification
Height	28.50 in. (724 mm)
Width	48.00 in. (1219 mm)
Depth	30.00 in. (762 mm)
Weight	85 lbs (39 kg)

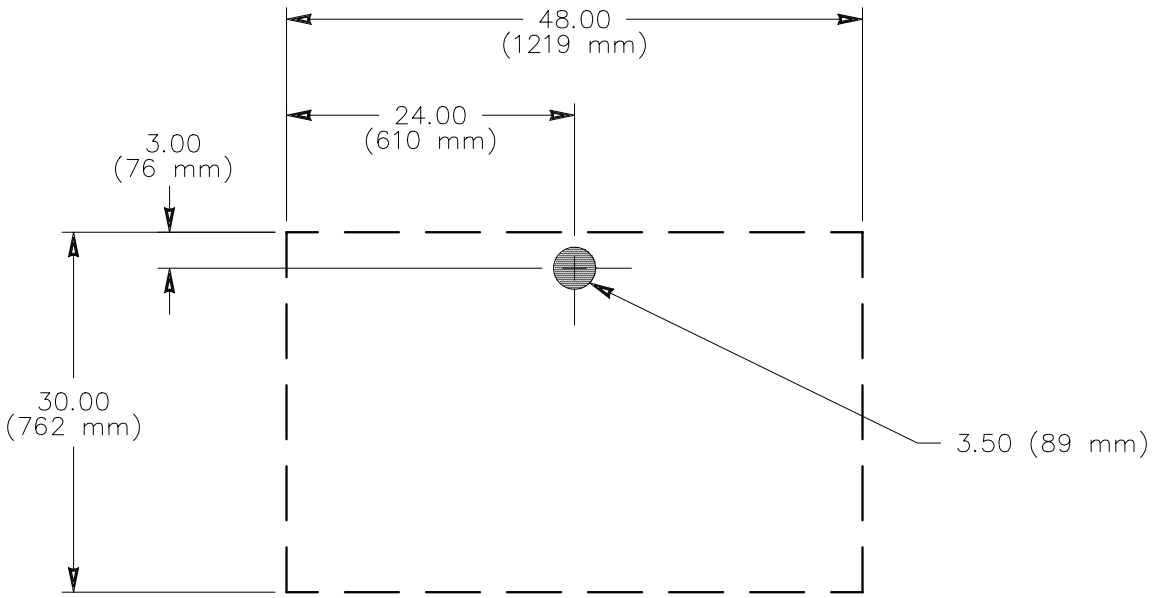
Figure 23. Support System Table (TBL-4)



Floor Preparation

As shown in Figure 24, each TBL-4 requires a 3.50-in. (89-mm) diameter floor cutout for the entry of power and data cables. The floor cutouts must be free of sharp edges and burrs to prevent damage to these system connections.

Figure 24. TBL-4 Floor Cutout



Site Planning Checklist

Table 16 provides a site planning checklist that you can use as an organizational tool during the site planning and preparation process. During the planning process, you might find additional preparation issues at your site that the checklist does not include. To discuss your site plans and to resolve these issues, contact a Cray Research site planning representative by one of the methods listed in the summary of this document.

Table 16. Site Planning Checklist

Yes	No	Planning Issue	Comments
		Have you determined the system configuration? Configuration:_____	
		Have you determined the installation date? Date:_____	
		What is the total number of system cabinets?	
		Have you established the system location?	
		Does the equipment floor layout meet the equipment maintenance access requirements?	
		Is the equipment positioned so that the exhaust air of one heat-rejecting device does not enter the air inlet of another?	
		Have you identified an access route to the final system location?	
		Does the access route meet the access requirements provided in Table 1?	
		Does the access route meet the floor-loading requirements for the system?	
		Have you made provisions to cover irregular or engraved floor patterns along the access route to reduce vibration of the system while moving it?	
		Will customer assistants be available to help Cray Research personnel unload, unpack, and move the system during delivery?	
		Does your loading dock meet standard freight-carrier truck requirements? If not, have you allocated a forklift for delivery? Contact your site planning representative if you have concerns about your loading dock.	
		Is a pallet jack available on-site to move the PC-10 cabinet in its shipping crate to the final system location?	

Table 16. Site Planning Checklist (continued)

Yes	No	Planning Issue	Comments
		Do the pallet-jack fork dimensions meet the requirements for the shipping crate?	
		Are the elevator and elevator door dimensions adequate?	
		Is the elevator weight capacity adequate?	
		Does each ramp in the access route have an incline that is less than 10 degrees?	
		Has the operating voltage for the CRAY T3E LC cabinet(s), HEU cabinet, and PC-10 cabinet(s) been determined?	
		Have the power receptacles for the PC-10 cabinet(s) been ordered?	
		Are the circuit breakers for all cabinets properly installed and labeled?	
		Are the power receptacles located within 2 ft (0.6 m) of each PC-10 cabinet footprint? Are all receptacles properly installed and labeled?	
		Are the floor cutouts properly positioned and free of sharp edges?	
		Are the recommended perforated floor panels properly positioned?	
		Are the receptacles for the optional router, modem, or peripherals properly wired, positioned, and labeled?	
		Is the system workstation located within 45 ft (13.7 m) of the CRAY T3E LC cabinet and the PC-10 cabinet to meet the standard cable length requirement?	
		Is the computer room floor rated for the system floor loading?	
		Does the computer room environment meet the Cray Research specifications for temperature and humidity?	
		Can the computer room environment be properly maintained within the specifications listed in the “Computer Room Environment” subsection?	
		Is additional fire suppression equipment required?	
		Have dedicated telephone lines for remote maintenance been installed in the proper locations?	
		Have the required network connections been installed for the system?	
		Have the required network connections (if any) been installed for the system workstation?	

Table 16. Site Planning Checklist (continued)

Yes	No	Planning Issue	Comments
		Have all required network addresses been established?	
		Have system administrators and operators enrolled in the necessary Cray Research training courses?	

Summary

Now that you understand the basic configurations and requirements of the CRAY T3E LC computer system, you can make appropriate plans for your site. Cray Research site planning representatives are available for consultation regarding site planning and preparation. You may contact a Cray Research site planning representative by any of the following methods:

- Phone +1 715 726 2820, or the USA: 1 800 284 2729, extension 62820
- Fax +1 715 726 2969
- E-mail *site@cray.com*
- Web site *http://site.cray.com*

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