

CRAY T3D™ Multiple-cabinet Air-cooled System Overview

HR-04037

**CRAY T3D MCA System Overview
HR-04037**

Cray Research, Inc.

Record of Revision

REVISION	DESCRIPTION
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Introduction

This document provides detailed site planning information for the CRAY T3D multiple-cabinet air-cooled (MCA) computer system. Information about site access requirements, electrical requirements, system configurations, power-wiring requirements, and cooling requirements is provided.

Site Access Requirements

Prior to system installation, ensure that your site meets the site access requirements outlined in the following subsections.

Loading Dock

If your building has a loading dock, it must be approximately 46 in. to 50 in. (1168 mm to 1270 mm) high to facilitate computer system delivery. Ensure that the loading dock does not open directly into the computer room because the computer room environment must be carefully controlled.

If your building does not have a loading dock, or if the loading dock does not meet site engineering specifications, you must 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 information about forklift requirements.

Access Route

The entire access route to your computer room must meet the following requirements:

- Minimum ceiling and door height – 80 in. (2032 mm)
- Minimum hallway and door width – 48 in. (1219 mm)
- Maximum delivery route slope – 1 unit of height for every 6 units of length
- Minimum floor-loading per rolling caster – 1,175 lbs (533 kg)

Take special precautions when moving computer system equipment if the access route has an engraved floor pattern. An engraved pattern could cause vibration damage to computer equipment on rolling casters.

Also, if your computer room is not on the first floor, you will need an elevator, a crane, or other special handling equipment to lift the computer equipment to the same level as your computer room.

Electrical Requirements

Cray Research makes every effort to minimize the effects of power failures and interruptions to the hardware. However, if a computer system experiences repeated power fluctuations or interruptions, it will have a higher component failure rate than it would with a stable power source. Cray Research encourages you to provide a stable power source, such as an uninterruptible power system, to reduce the possibility of component failures.

Cray Research computer equipment has certain voltage and frequency requirements. The mainframe and cooling unit require one of the following 50- or 60-Hz, 3-phase electrical voltages. Refer to Table 1 for additional electrical requirements.

<u>Mainframe</u>	<u>Cooling Unit</u>
208 Vac	208 Vac
400 Vac	380 Vac
480 Vac	415 Vac
	480 Vac

Table 1. CRAY T3D MCA Electrical Requirements

Electrical Characteristic	Requirement
Voltage tolerance	+6% to -10%
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 expansion allowances. Upon request, Cray Research provides documentation that enables you to estimate the power requirements for your specific system configuration.

System Configurations

To meet customer needs, various system configuration options exist for CRAY T3D MCA computer systems. For example, each MCA cabinet may contain 32, 64, 96, or 128 processing elements. The following subsections describe the standard equipment and separation limits for a typical CRAY T3D MCA computer system.

Standard Equipment

A standard configuration of one CRAY T3D MCA computer system consists of the following components:

- Mainframe chassis (MFC)
- Refrigeration condensing unit (RCU-10)

The CRAY T3D MFC houses various configurations of processing elements, memory, and I/O gateways.

The RCU-10 dissipates heat generated by the modules contained in the MFC and input/output subsystem (IOS). The RCU-10 consists of a heat exchanger unit (HEU) and an RCU in one stand-alone unit; the RCU-10 can be cooled by either air or water.

Equipment Separation Limits

The equipment arrangement must meet certain placement and separation requirements. For example, all computer equipment arrangements must meet signal-cable length restrictions. Figure 1 illustrates the maximum equipment separation limits for a typical CRAY T3D MCA computer system.

You must prepare drawings and documents specifying the arrangement and location of the computer equipment. Have these drawings reviewed and approved by Cray Research site planning personnel prior to any site preparation; involve the site planning personnel early in the design stage.

Consider the following general criteria when arranging your computer room:

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

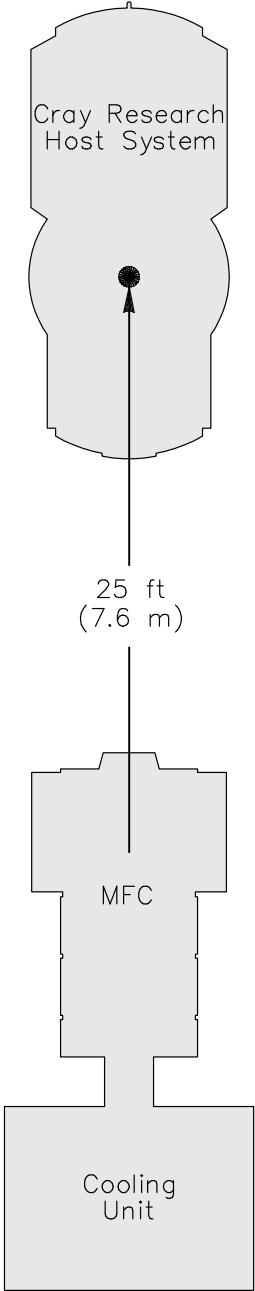


Figure 1. CRAY T3D MCA Separation Limits

Power-wiring Requirements

You must provide and install all power wiring, circuit breakers, and circuit breaker panels. Refer to Figure 2 for a CRAY T3D MCA computer system wiring diagram.

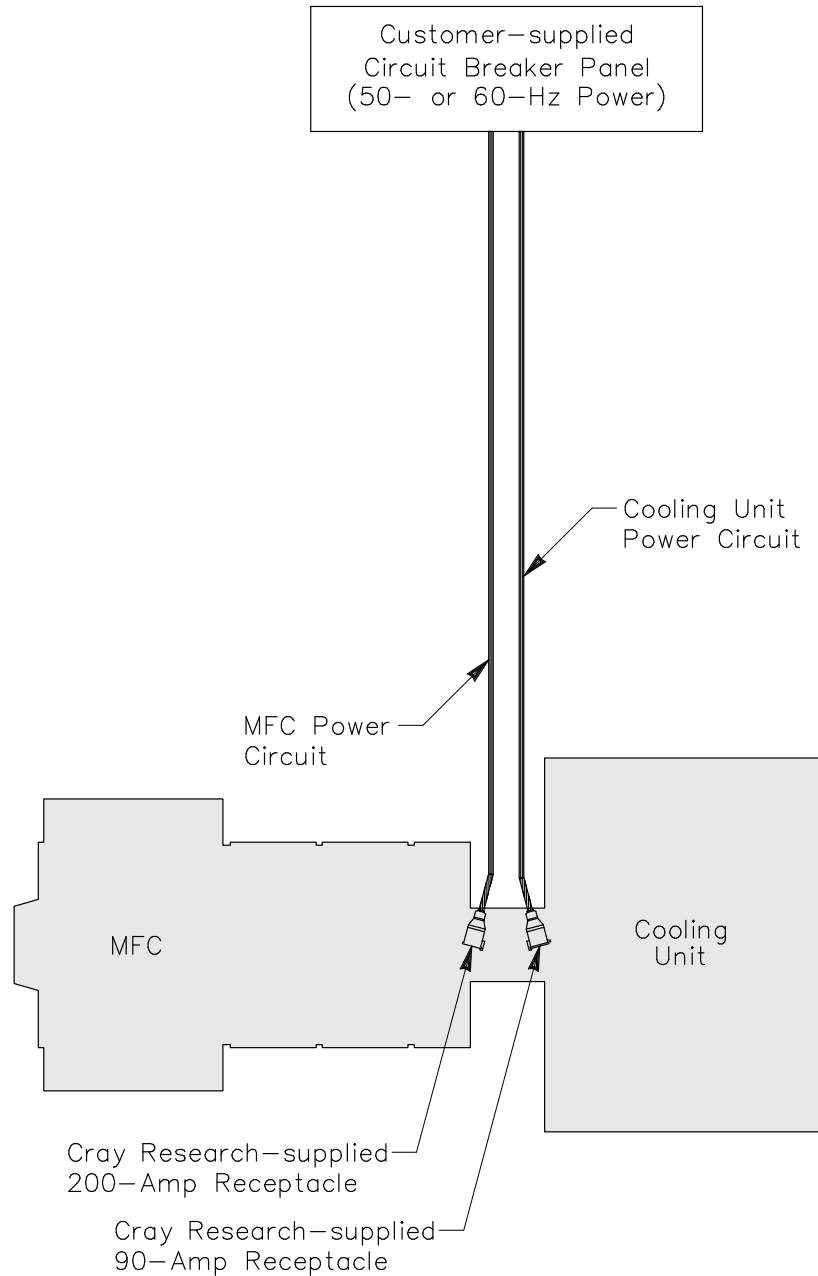


Figure 2. CRAY T3D MCA Computer System Wiring Diagram

The following list provides additional power-wiring information.

- Each CRAY T3D MCA mainframe chassis and each cooling unit requires one power circuit; the power circuits must be 3-phase, 4-wire circuits. Protect the circuits with a high-instantaneous-rated circuit breaker that can tolerate a short-term current inrush. Circuit breaker size depends on the voltage selected, as identified in Table 2 and Table 3.

NOTE: If you need additional information regarding equipment current inrush, contact your regional or international site planning representative.

- Cray Research supplies the mainframe and cooling unit receptacles. Contact your site planning representative to have these receptacles shipped to your site.
- Use Figure 2 as a guide for your electrical design engineer. Do not use this figure as a bid document or as a working drawing.
- The equipment arrangement shown in Figure 2 is not an actual equipment layout.
- Prepare all wiring according to applicable local and national codes.
- Wherever possible, route all cables at 90 degree angles to minimize crosstalk (unwanted signals from an adjacent circuit). Do not route power and logic cables in parallel bundles.
- You must provide and install all circuit breakers, circuit breaker panels, magnetic contacts, main power disconnect switches, junction boxes, power wiring, wiring raceways, and conduits.
- Ensure that your site design allows for circuit additions proportionate to system expansion plans.
- Cray Research recommends that you install one emergency power-off switch at each computer room exit. All emergency power-off switches should interrupt power to the computer equipment and to all air-circulating units in the computer room.
- Earth ground all Cray Research equipment. Refer to *Site Planning and Preparation*, Cray Research publication number HR-04036-0A, for detailed requirements.

Table 2. Recommended CRAY T3D MCA Mainframe Power and Wiring Specifications

Voltage	Amperage	Minimum Wire Size	
		AWG	mm ²
208 Vac	200 A	3/0	70
400 Vac	100 A	3	25
480 Vac	90 A	3	25

NOTE: The mainframe power receptacle must extend approximately 2 ft (0.6 m) above the floor cutout between the mainframe and cooling unit.

Table 3. Recommended Cooling Unit Power and Wiring Specifications

Voltage	Amperage	Minimum Wire Size	
		AWG	mm ²
208 Vac	90 A	3	25
380 Vac	60 A	6	16
415 Vac	50 A	8	10
480 Vac	40 A	8	10

NOTE: The cooling unit power receptacle must extend approximately 6 ft (1.8 m) above the floor cutout between the mainframe and cooling unit.

Cray Research supplies a separate receptacle to connect power to the mainframe chassis; your site planning representative supplies this receptacle prior to system delivery. The receptacle plugs into the mainframe through the floor cutout between the mainframe and cooling unit; the receptacle must extend approximately 2 ft (0.6 m) above the floor cutout.

The mainframe chassis must be connected to a high-frequency signal reference grid with Cray Research-supplied braided straps and clamps. Refer to *Equipment Grounding for Cray Research, Inc. Computer Systems*, Cray Research Site Engineering document number 10658002, for more information about equipment grounding.

Cray Research supplies a separate receptacle to connect power to the cooling unit; your site planning representative supplies this receptacle prior to system delivery. The receptacle plugs into the cooling unit through the floor cutout between the mainframe and the cooling unit; the receptacle must extend approximately 6 ft (1.8 m) above the floor cutout.

Cooling Requirements

The CRAY T3D MCA computer system can be either air cooled or water cooled. The following subsections provide the cooling requirements for air-cooled and water-cooled operation.

Air-cooled Systems

Your computer room must be properly cooled to prevent computer system interruptions. Consult with your site planning representative to ensure that your computer room meets all site planning requirements for air-cooled operation.

Water-cooled Systems

For water-cooled systems, you must install water piping in the underfloor area within 4 ft (1.2 m) of the floor cutout between the mainframe and cooling unit. Cray Research supplies flexible hoses with quick-disconnect couplings to connect the cooling unit to the facility piping connectors. It is your responsibility to supply one of the following types of quick-disconnect connectors:

- Aeroquip connector – part number FD45-1086-16-16
- Parker connector – part number BH8-61
- Hansen connector – part number B8-K36

Pressure Relief Vent Line

The connection at the RCU-10 cooling unit accepts a 7/8-in. (22 mm) outside diameter (OD) copper pipe.

Cooling Water Supply Requirements

The cooling unit requires water ranging from 40 °F (4 °C) to a maximum of 85 °F (29 °C). The cooling water must satisfy the requirements identified in *Water Quality Requirements*, Cray Research Site Engineering document number 10658280.

When in water-cooled mode with pure water, the maximum flow rate at 40 °F (4 °C) is approximately 4 g.p.m. (0.91 m³/hr), and at 85 °F (29 °C) is approximately 31 g.p.m. (7.04 m³/hr). Limit water pressure to 100 psi (689 kPa).

Site Readiness Checklist

Refer to Table 4 for a site readiness checklist. Use this checklist as a guide only; additional preparation issues might exist at your site.

Table 4. Site Readiness Checklist

Yes	No	Site Readiness Question	Comments
		Have you established the equipment layout? Does the layout satisfy the equipment separation limit requirements?	
		Has Cray Research approved the layout?	
		Have you ordered the floor cutout templates from Cray Research?	
		What is the height of the raised floor (subfloor to the top of the raised-floor panel)? _____	
		Have you determined an installation date? Installation date: _____	
		Have you made arrangements for badges for the installation personnel? Will escorts be necessary?	
		Have you determined the method of unloading the computer system (equipment and personnel)?	
		Have you identified an access route to the system location?	
		Is the access route from the unloading area to the system location clear of obstacles?	
		Does the access route satisfy the access requirements outlined at the beginning of this document?	
		If applicable to your site, is the access to the loading dock clear?	
		If applicable to your site, are the interior elevator measurements adequate for the system?	
		If applicable to your site, are the elevator door measurements adequate for the system?	
		If applicable to your site, is the elevator weight capacity adequate for the system?	
		If applicable to your site, is the ramp slope adequate for the system?	

Table 4. Site Readiness Checklist (continued)

Yes	No	Site Readiness Question	Comments
		Are all floor cutouts free of burrs and sharp edges?	
		Are all additional floor support pedestals in place?	
		Have you removed any underfloor stringers that may interfere with the installation process?	
		Is the computer room underfloor area clean?	
		Do any of the subfloor structures show signs of corrosion?	
		Have you sealed the concrete subfloor?	
		Do any unsealed areas exist in the underfloor that could allow plenum pressure to escape?	
		Is the computer room floor level?	
		Have you installed the CRAY T3D mainframe and cooling unit input power circuits?	
		Have you checked the cooling ports (for the hose connections) for obstructions?	
		Are the cooling lines insulated?	
		Are the circuit breaker panels and receptacles properly labeled?	
		Is the water piping bonded to the signal reference grid?	
		Will the raised-floor stringer system act as the signal reference grid?	
		If you do not use a raised-floor system, how will the signal reference grid be constructed?	
		Have you made provisions to tie the braided ground straps to the pedestals of all Cray Research computer room equipment? If a raised-floor stringer system is not used, how is the signal reference grid constructed?	
		Are the raised-floor tiles conductive? (100,000 to 1,000,000 ohms of surface resistivity.)	
		Has the computer room been tested to verify compliance with class 100,000 standards?	
		Have you tested the air handlers?	
		Are the air handlers and air filters clean?	

Table 4. Site Readiness Checklist (continued)

Yes	No	Site Readiness Question	Comments
		Does the computer room have positive air pressure?	
		Is the replacement air to the computer room adequately filtered to meet Cray Research specification limits?	
		Does the computer room have proper humidity control as specified in <i>Site Planning and Preparation</i> , Cray Research publication number HR-04036-0A?	
		Is the computer room vapor-sealed?	
		Have you tested the cooling water pumps?	
		Have you installed the cooling water strainer (with bypass)? What is the strainer mesh size? _____	
		Have you installed the water pressure, temperature, and flow monitors?	
		Does the cooling water meet the specifications outlined in <i>Water Quality Requirements</i> , Site Engineering document number 10658280?	
		If applicable to your site, have you load-tested the 50- or 60-Hz power conditioner?	
		Have you installed dedicated telephone lines for remote maintenance?	
		Are the ceiling tiles a nonshedding, vapor-barrier type?	
		Does the service personnel office meet the standards outlined in <i>Site Planning and Preparation</i> , Cray Research publication number HR-04036-0A?	
		Is one of the following fire suppression systems used? Halon Underfloor Above floor Sprinklers Preaction Wet-type	