

CRAY T3D™ Single Cabinet System Overview

HR-04059

Cray Research, Inc.

Record of Revision

| REVISION | DESCRIPTION |
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Each computer system has slightly different site planning requirements. This section provides detailed site planning information for the CRAY T3D massively parallel single cabinet (SC) computer system, including site access requirements, electrical requirements, system configurations, power wiring requirements, and cooling requirements.

Site Access Requirements

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

Your building should have a loading dock approximately 46 in. to 50 in. (117 cm to 127 cm) high for computer system delivery. 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 moving 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.

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

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

- Minimum ceiling and door height – 80 in. (203 cm)
- Minimum hallway and door width – 60 in. (152 cm)
- Maximum delivery route slope – One unit of height for every six units of length
- Minimum floor-loading per rolling caster – 1,696 lbs (769 kg)

If your computer room is on a different level than your loading dock, you will need an elevator to move the computer system to the proper floor level. If your building doesn't 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.

Electrical Requirements

Cray Research makes every effort to minimize the effects of power failures and interruptions to the hardware. However, if the computer equipment is subjected to repeated power interruptions and fluctuations, it will be susceptible to 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 uninterruptable power system, to reduce the possibility of component failures.

Cray Research computer equipment has certain voltage, frequency, and grounding requirements. The motor-generator sets (MGSs), refrigeration condensing unit (RCU), and heat exchanger unit (HEU-T3D) used with the CRAY T3D SC computer systems require one of the following voltages:

- $460 \pm 10\%$ Vac, 3 phase, 60 ± 3 Hz
- $398 \pm 5\%$ Vac, 3 phase, 50 ± 3 Hz

The CRAY T3D mainframe chassis (MFC) requires 115-Vac or 210- to 250-Vac, 50- or 60-Hz, single-phase power. Table 1 provides the specifications for the electrical services.

Table 1. Electrical Service Requirements

| Electrical Service | Requirement |
|----------------------------------|---|
| Voltage tolerance | $\pm 10\%$ |
| 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 | $\pm 5\%$ |
| Frequency rate of change | Less than 1.0 Hz during any 10-cycle period |

Total kilowatt power requirements depend on system configuration and equipment upgrades. 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.

System Configurations

The CRAY T3D SC computer system has different configurations, depending on customer needs. Each SC cabinet contains a maximum of 256 processing elements, as well as the CPU modules, memory modules, I/O clusters, and the SSD solid-state storage device.

The following subsections describe the standard equipment and separation limits for a standard CRAY T3D SC computer system.

Standard Equipment

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

- Mainframe chassis (MFC)
- Heat exchanger unit (HEU-T3D)
- Motor-generator set (MGS)
- Refrigeration condensing unit (RCU)
- Maintenance workstation (MWS)
- Operator workstation (OWS)
- Disk drives

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

The CRAY T3D SC computer system uses an HEU-T3D to transfer heat generated by the components in the MFC to the RCU. The CRAY T3D SC computer system is configured with a single RCU. This RCU provides cooling for the mainframe and HEU-T3D.

The CRAY T3D SC computer system is configured with either a single motor-generator set (MGS-4) or two MGS-4s paralleled with a motor-generator parallel cabinet (MGPC) to provide power to the mainframe. An optional standby MGS-4 is also available.

The following devices comprise the MWS and the OWS:

- VME-based microcomputer (VBM-2)
- Color graphics display terminal (GDT-200)
- Single display table (TBL-3)

The number of disk drives per system is dependant upon individual customer needs.

Figure 1 illustrates a typical computer room floor plan for a CRAY T3D SC computer system. The system is configured on a 26 ft x 26 ft (7.9 m x 7.9 m) raised floor with 24 in. x 24 in. floor panels.

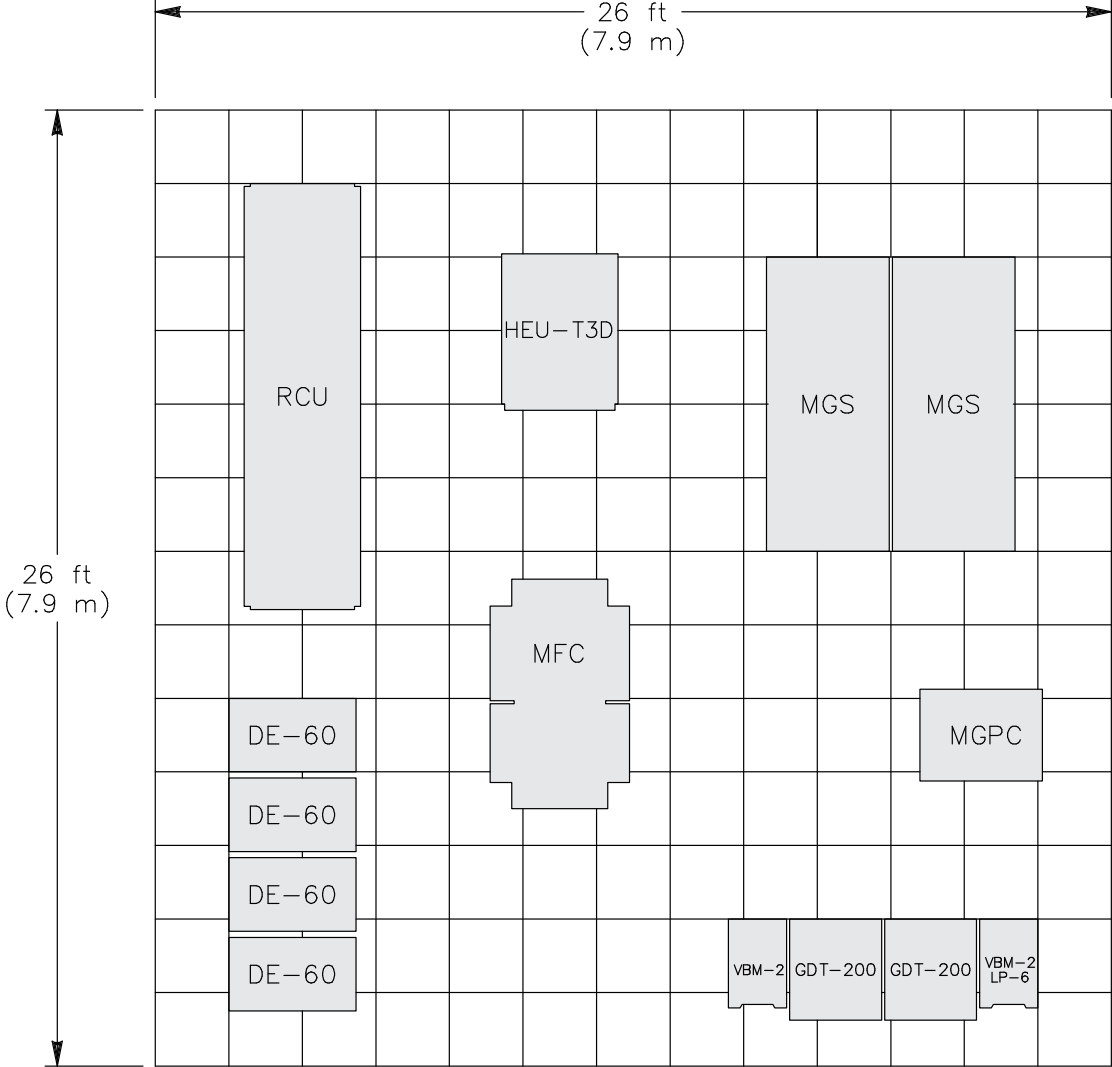


Figure 1. CRAY T3D SC Typical Computer Room Floor Plan

Equipment Separation Limits

The arrangement of computer equipment within the facility must meet certain placement and separation requirements. You must prepare drawings and documents specifying detailed information about the arrangement and location of the computer equipment. These drawings must be reviewed and approved by Cray Research site planning personnel prior to any site preparation. You should involve the site planning personnel early in the design stage.

The following general criteria should be considered when arranging your computer room:

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

All arrangements must meet signal cable and refrigeration piping length restrictions. You should also design the 400-Hz power wiring lengths to minimize voltage drops.

Figure 2 illustrates the equipment separation limits for the CRAY T3D SC computer system.

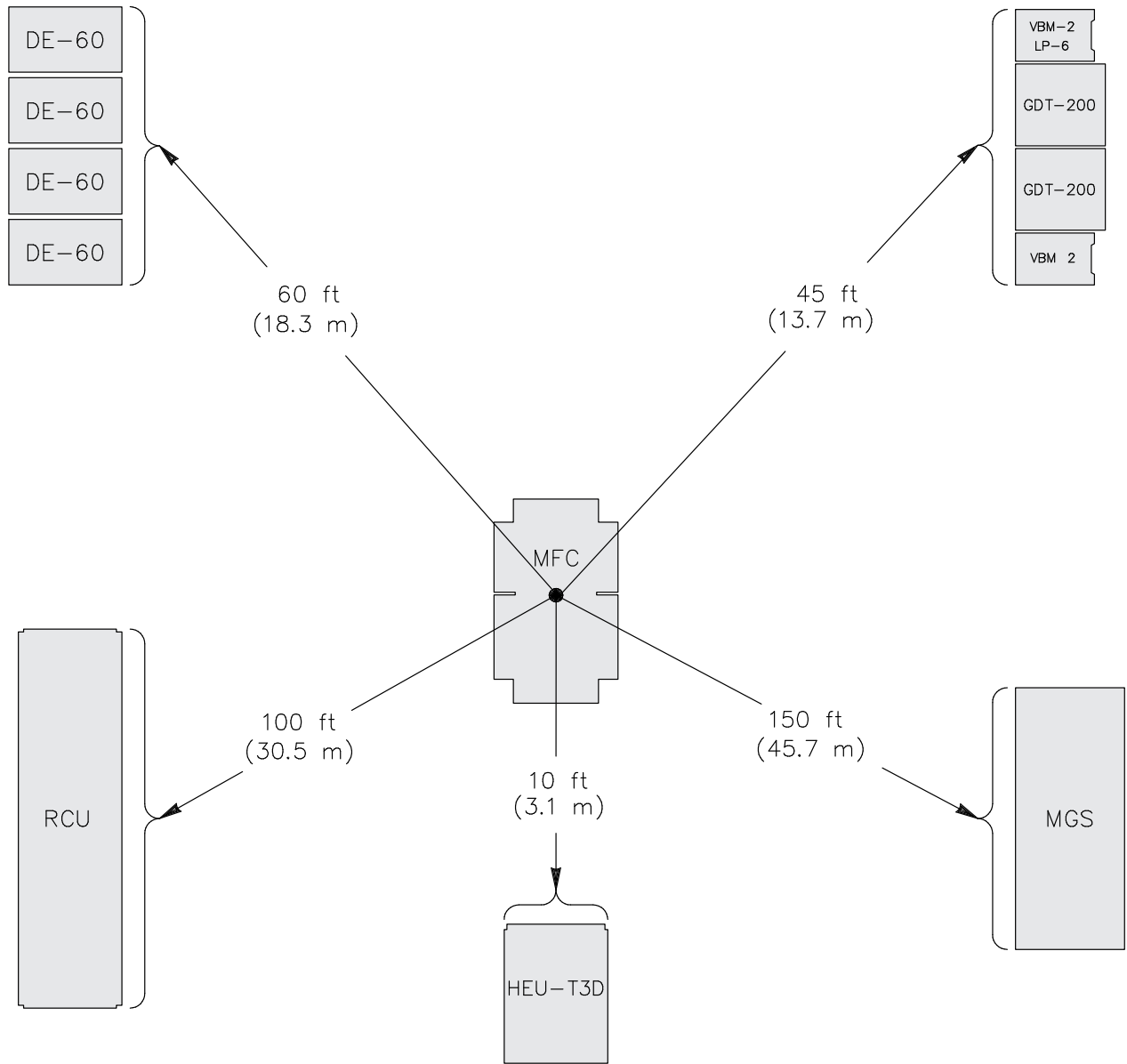


Figure 2. CRAY T3D SC Separation Limits

Power Wiring Requirements

You must install all power and control wiring for the CRAY T3D MFC, HEU-T3D, MGSs, MGPC (if configured), and RCUs.

Each device has specific electrical requirements; however, some general information applies to all circuits. Figure 3 illustrates the basic power wiring diagram for the CRAY T3D SC computer system with an MGS. Figure 4 illustrates the basic control wiring for the CRAY T3D SC computer system with two MGSs and an MGPC. The following list provides additional information.

- Figure 3 and Figure 4 are guides for your electrical design engineer and must not be used as bid documents or working drawings.
- The equipment arrangements shown in Figure 3 and Figure 4 do not represent actual equipment layouts.
- All wiring should be prepared according to applicable local and national codes.
- The maximum 400-Hz voltage drop from the MGS to the MFC should not exceed 2%. Verify that the wire sizes and quantity of conductors meet this requirement.
- All circuit breakers, circuit breaker panels, magnetic contactors, main power disconnect switches, junction boxes, power wiring, raceways, and conduits must be provided and installed by you.
- Conduit or raceways used for 400-Hz power distribution must be aluminum or nonferrous.
- Circuit breakers used for 400-Hz power distribution can be 50- or 60-Hz rated, but must be sized for 400-Hz application.
- The minimum suggested control wiring size is #14 AWG (2.5 mm²).
- Your site preparation design should allow for circuit additions proportionate to system upgrade plans.
- Cray Research recommends the installation of one emergency off switch at each computer room exit. All emergency off switches should be wired in series and should interrupt power to the computer equipment and to all air-circulating units in the computer room.
- Secure all conduits ending at computer equipment with approved fittings at the equipment wiring entrance.

- Refer to Cray Research supplied site planning documentation for detailed point-to-point diagrams for all wiring connections to the CRAY T3D MFC, HEU-T3D, RCU, MGS, and MGPC.
- Allow a minimum of 36.00 in. (91 cm) of excess wire length above the floor surface to ensure adequate wire length for system connection.

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

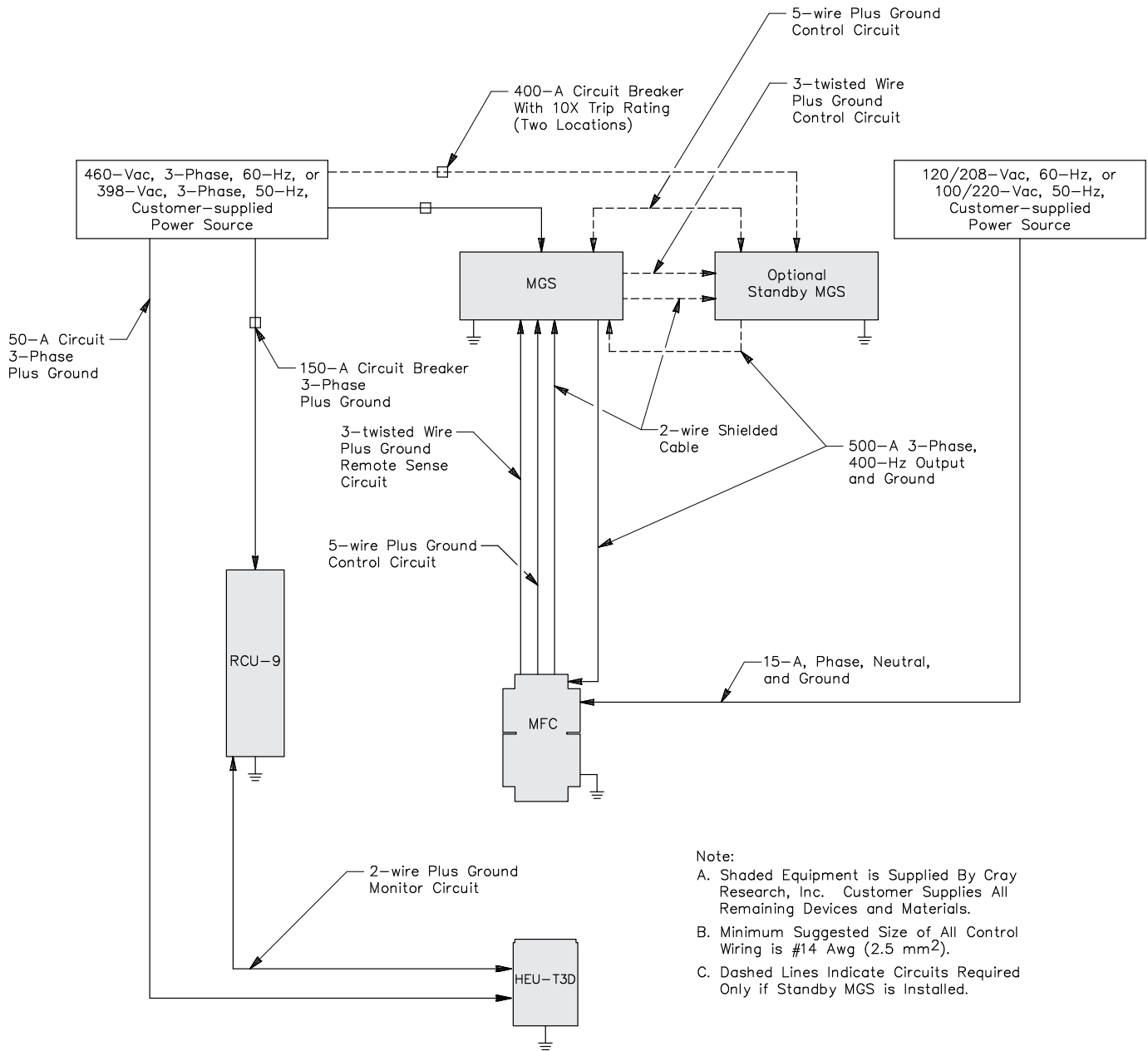


Figure 3. CRAY T3D SC Basic Power and Control Wiring with One MGS

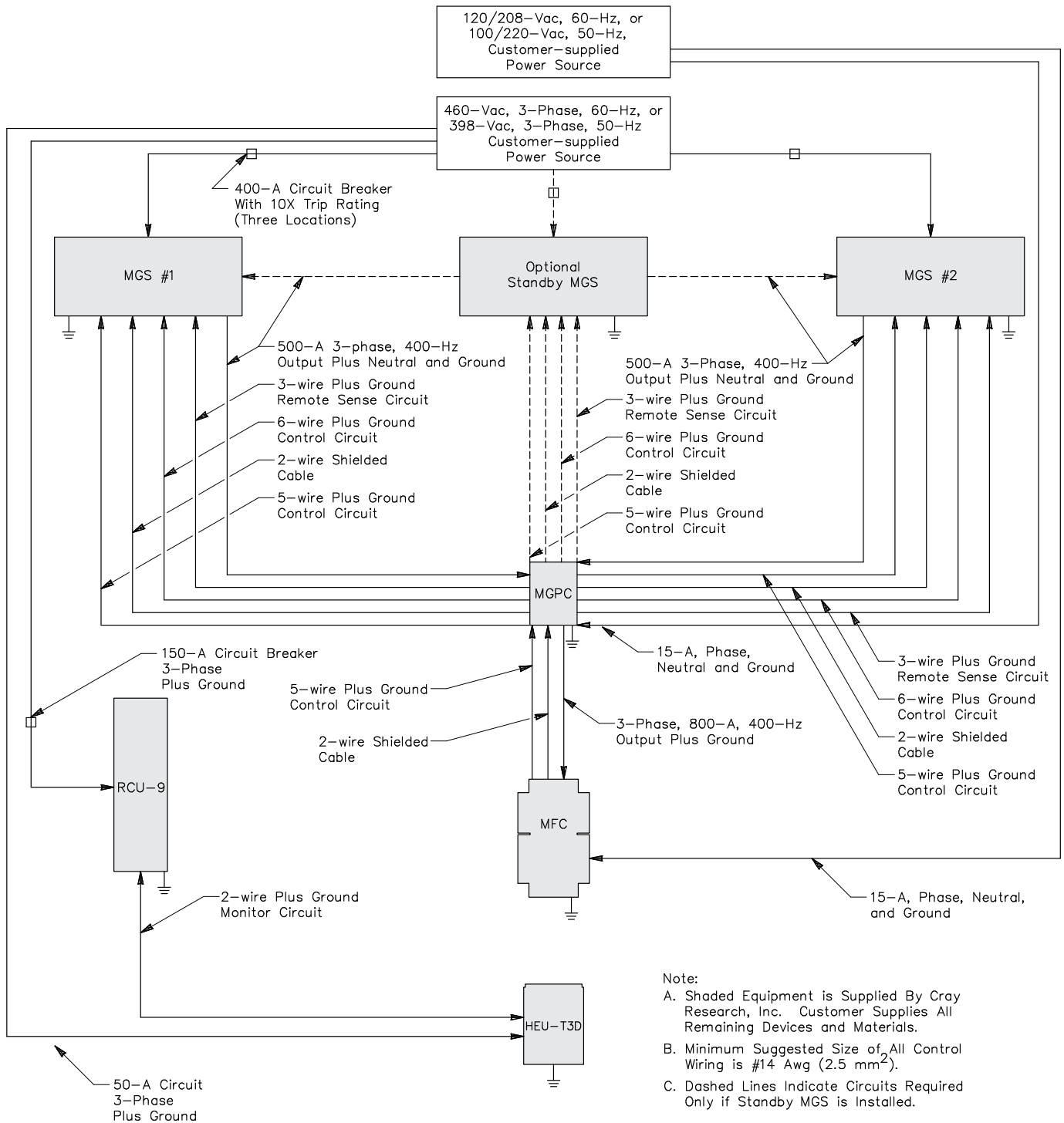


Figure 4. CRAY T3D SC Basic Power and Control Wiring with Two MGSs and an MGPC

Cooling Requirements

The CRAY T3D SC computer system uses a dielectric-cooling technique that requires special piping and hoses. Dielectric-coolant hoses are required between the HEU-T3D and the MFC. Refrigeration piping is required between the HEU-T3D and the RCU. Refer to the “Cooling Water Requirements” in *Site Planning and Preparation*, Cray Research publication number HR-04036, for more information about cooling water requirements.

Dielectric-coolant Hoses

Flexible hoses are required to complete the dielectric-coolant network between the mainframe chassis and the HEU-T3D. Cray Research supplies and installs all flexible hoses for the dielectric coolant during system installation. Figure 5 illustrates the standard arrangement of dielectric-coolant hoses for the CRAY T3D SC computer system.

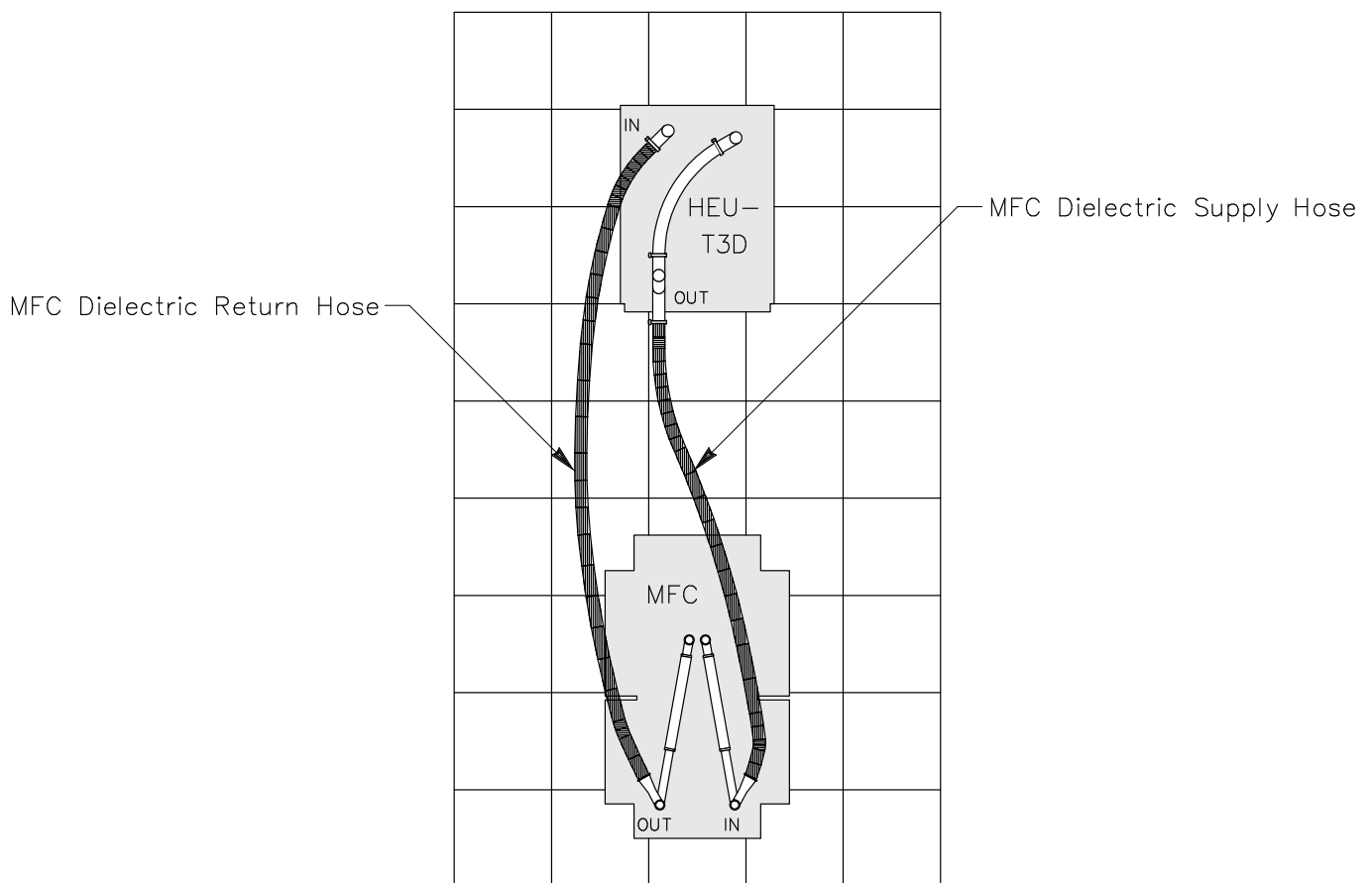


Figure 5. CRAY T3D SC Dielectric-coolant Hoses

Refrigeration Piping

The HEU-T3D is cooled by a refrigerant-cooling technique that uses refrigeration piping to distribute the refrigerant liquid and return the refrigerant vapor to the RCU. Your mechanical design engineering staff must prepare working drawings that provide details about planned refrigeration piping.

Approximately 8 weeks prior to the delivery of the computer system, Cray Research will deliver the RCU and a special refrigeration piping component kit to your facility. This kit consists of special manifold assemblies but does not include all refrigeration piping and materials necessary to prepare the facility.

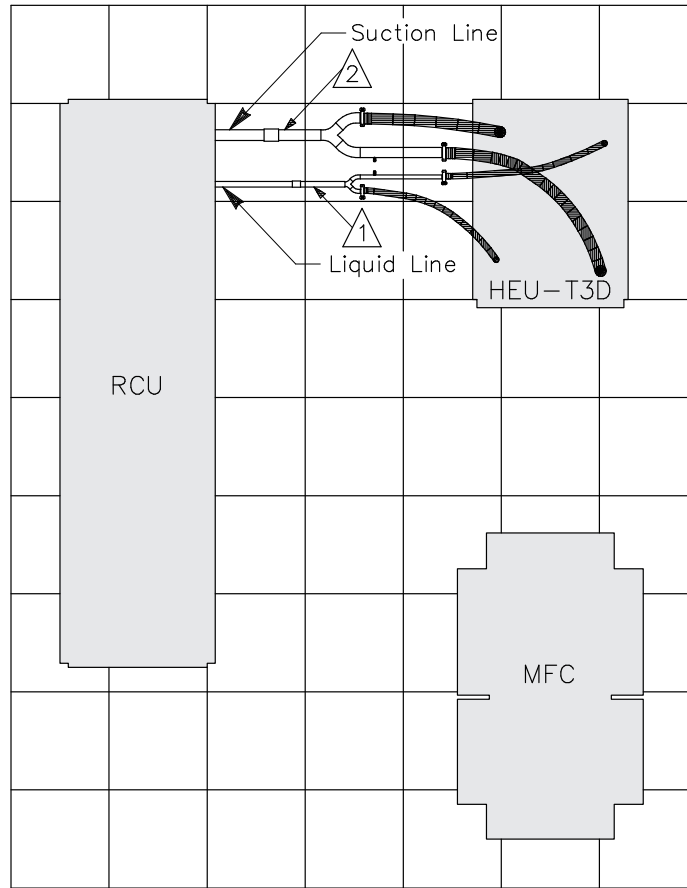
General Requirements

Figure 6 illustrates the refrigeration piping requirements for the HEU-T3D used with the CRAY T3D SC computer system. You are responsible for installing the special refrigeration components and the RCU used with your computer system. You must supply and install all piping, couplings, and elbows needed to prepare the facility refrigeration piping for the computer installation. You must also test the refrigeration piping and prepare for final connection before delivery of the computer system.

Cray Research provides *Refrigeration Piping and Component Installation Requirements*, Site Engineering document number 10650228, during the initial site planning meeting. This document describes the required materials, proper installation procedures, leak testing procedures, and evacuation procedures that must be followed by your facility personnel.

At the time of the computer system installation, Cray Research supplies and installs the flexible refrigeration hoses required to complete the refrigeration piping network. In addition, Cray Research installation personnel will charge the refrigeration system, adjust all controls and valves, and apply power to initialize operation of the RCU. You must supply an adequate amount of R-22 refrigerant to fully charge the system.

The refrigeration piping from the RCU to the computer equipment must not exceed the total equivalent linear piping restriction of 100 ft (30.5 m), including directional and elevational changes. Directional changes in pipe routing should be minimal. If directional changes are necessary, the pipes should be routed at 45° angles. All refrigeration piping elbows must be the long-radius type.



NOTES:



-  Liquid Line Flange Assembly, Cray Research part number 12277800
-  Suction Line Flange Assembly, Cray Research part number 12277900

Figure 6. CRAY T3D SC Piping Locations for the Heat Exchanger Unit (HEU-T3D)

Changes in pipe routing elevation should also be minimal. When the refrigeration piping must be routed vertically, the vertical rise must not exceed 25 ft (7.6 m). In most instances, an extended vertical rise requires the construction of a double riser within the suction line. In this case, Cray Research site planning personnel provide the preferred design for the double riser.

The following notes pertain to Figure 6.

- You must supply, route, and install the liquid-line and suction-line piping between the HEU and the RCU. These items must conform to Cray Research engineering requirements and must be approved by Cray Research site planning personnel.
- Refrigerant-grade piping components and materials for the refrigeration piping network must be installed in accordance with the requirements illustrated in Figure 6 and with Cray Research engineering requirements. Any variations of the piping network requirements must be approved by Cray Research site planning personnel.
- Piping support clamps must have a compressible insert between the clamp and the refrigeration piping.
- All refrigeration piping and components must be assembled by you using silver solder and silver soldering techniques according to Cray Research engineering requirements.
- All refrigeration piping and components must be leak tested, evacuated, and prepared for service by you.
- All suction-line piping must be insulated by you after it passes all tests.

Refer to the *Refrigeration Piping and Component Installation Requirements*, Site Engineering document number 10650228, for more information about the installation requirements.

You must supply and install all piping materials, couplings, and elbows needed to interconnect the Cray Research-supplied components. In addition, you must test and prepare the refrigerant and cooling water piping for final connection prior to delivery of the computer system.