Sun™ Modular Datacenter S20/D20 Site Planning Guide

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Sun Microsystems, Inc.
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Preface

This site planning guide describes the issues you must consider when preparing a site for the installation of a Sun™ Modular Datacenter (Sun MD).

This document is written for data center designers, facilities management staff, architects, and installers.

The procedures in this manual are to be performed only when the following external environmental conditions are met:

- Temperature: 10 to 35ºC (50 to 95ºF)
- Relative humidity: 20 to 80%
- Dry weather
- Absence of wind-borne dust and debris

Sun MD systems that require service when these conditions cannot be met must be installed in a protected location or inside a protective structure. Customers are responsible for providing shelter for field service procedures that must be executed during such conditions. For more information about service shelter guidelines, refer to the *Sun Modular Datacenter S20/D20 Product Notes*.

Sun MD systems that will not require service when conditions are outside of the supported operating conditions are not required to be installed in a protective structure. But those systems must adhere to the operating environment limitations that are listed in this guide.

Understanding Sun's Intellectual Property Rights

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Before You Read This Document

To fully use the information in this document, you must have thorough knowledge of the topics discussed in these documents:

- *Important Safety Information for Sun Hardware Systems*
- *Sun Modular Datacenter S20 Safety and Compliance Guide*
- *Sun Modular Datacenter S20 Installation Information for the Authority Having Jurisdiction*

How This Document Is Organized

Chapter 1 provides an overview of the Sun MD and lists its physical specifications. This chapter also provides guidelines for deciding how to populate a Sun MD with payload that adheres to all technical specifications and jurisdictional requirements.

Chapter 2 outlines the process involved in preparing a site for the installation of a Sun MD. This chapter also describes zoning and permitting requirements, scheduling, safety, and staffing considerations and requirements.

Chapter 3 describes how to prepare the physical site for the installation of a Sun MD system. Topics include container positioning, mounting pad requirements, drainage considerations, environmental concerns, and security considerations.

Chapter 4 describes the power requirements that must be satisfied to power up a Sun MD system at your site.

Chapter 5 describes the chilled water requirements that must be satisfied to sufficiently cool a Sun MD system and its payload at your site.

Chapter 6 describes data sources and network connections that must be available to provide data to the servers that populate a Sun MD.

Glossary is a list of words and phrases and their definitions.

Related Documentation

The documents listed are available online through a password-protected web site. Contact your Sun Sales Representative for information about accessing the Sun MD product documentation.

Application	Title	Part Number	Format	Location
General Sun safety information	*Important Safety Information for Sun Hardware Systems*	816-7190	Printed	Shipping kit
Safety and compliance notices	*Sun Modular Datacenter S20 Safety and Compliance Guide*	820-2625-10	PDF	Online
Content to assist an AHJ assess the Sun MD	*Sun Modular Datacenter S20 Installation Information for the Authority Having Jurisdication*	820-3167-10	PDF	Online
Planning and infrastructure support requirements	*Sun Modular Datacenter S20/D20 Site Planning Guide*	820-5806-10	PDF	Online
Product task map and documentation references	*Sun Modular Datacenter S20 Getting Started Guide*	820-2534-10	Printed PDF	Shipping kit Online
Product and functionality overview	*Sun Modular Datacenter S20/D20 Overview*	820-5770-10	PDF	Online
Preinstallation and installation	*Sun Modular Datacenter S20/D20 Installation Guide*	820-5809-10	Printed PDF	Shipping kit Online

Application	Title	Part Number	Format	Location
Service	*Sun Modular Datacenter S20/D20 Service Manual*	820-5810-10	PDF	Online
Administration	*Sun Modular Datacenter S20/D20 Administration Guide*	820-5750-10	PDF	Online
Man page command reference	*Sun Modular Datacenter S20/D20 Reference Manual*	820-5751-10	PDF Man pages	Online With software
Late-breaking and known issues	*Sun Modular Datacenter S20/D20 Product Notes*	820-5808-10	PDF	Online
Supplemental fire suppression	*Sun Modular Datacenter S20 Fire Suppression Guide*	820-2621-10	Printed PDF	Ship with optional component and online
Supplemental fire suppression	*Sun Modular Datacenter S20/D20 Fire Suppression Guide for the NF227 Fire Control Panel*	820-5752-10	Printed PDF	Ship with optional component and online
Supplemental power	*Sun Modular Datacenter S20 PDU and Power Strip Options Guide*	820-2622-10	Printed PDF	Ship with optional component and online
Electrical disconnect kit	*Sun Modular Datacenter S20 Electrical Disconnect Guide*	820-2624-10	Printed PDF	Ship with optional component and online
Fiber cable connectors kit	*Sun Modular Datacenter S20 Fiber Cable Connector Options Guide*	820-3744-10	Printed PDF	Ship with optional component and online
Rack dolly	*Sun Modular Datacenter S20/D20 Rack Dolly Guide*	820-5807-10	Printed PDF	Ship with optional component and online

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Please include the title and part number of your document with your feedback:

Sun Modular Datacenter S20/D20 Site Planning Guide, part number 820-5806-10.

CHAPTER 1

System Overview and Payload Guidelines

This chapter provides an overview of the Sun Modular Datacenter (Sun MD) and the specifications to which the site and the Sun MD payload must conform. It contains the following sections:

Sun MD Overview

The Sun MD is a rapidly deployable, mobile, energy-efficient, and high-density compute platform that can be used to quickly add data center capacity virtually anywhere it's needed.

The Sun MD is a 20-foot shipping container that is available in two configurations.

- The standard configuration (Sun MD S20) ships with eight standard-sized 40-rack unit (RU) racks.
- The deep-rack configuration (Sun MD D20) ships with four standard-sized and three deep-sized 40-rack unit (RU) racks.

A single *infrastructure rack*, which is provided in both configurations, is partially configured with control and management equipment, with space remaining for networking equipment. The general-purpose racks can be populated with any Sun or third-party equipment that adheres to the specifications described in this guide.

Customer-selected equipment including nodes, servers, storage devices, and additional hardware that populates a Sun MD is referred to as *payload*. Payload hardware that does not conform to the specifications described in this chapter is not compatible and is not approved for use in a Sun MD.

When performing site planning tasks, consider how the locations of the external components shown in FIGURE 1-1 impact the decisions you make.

FIGURE 1-1 Exterior View of a Sun MD

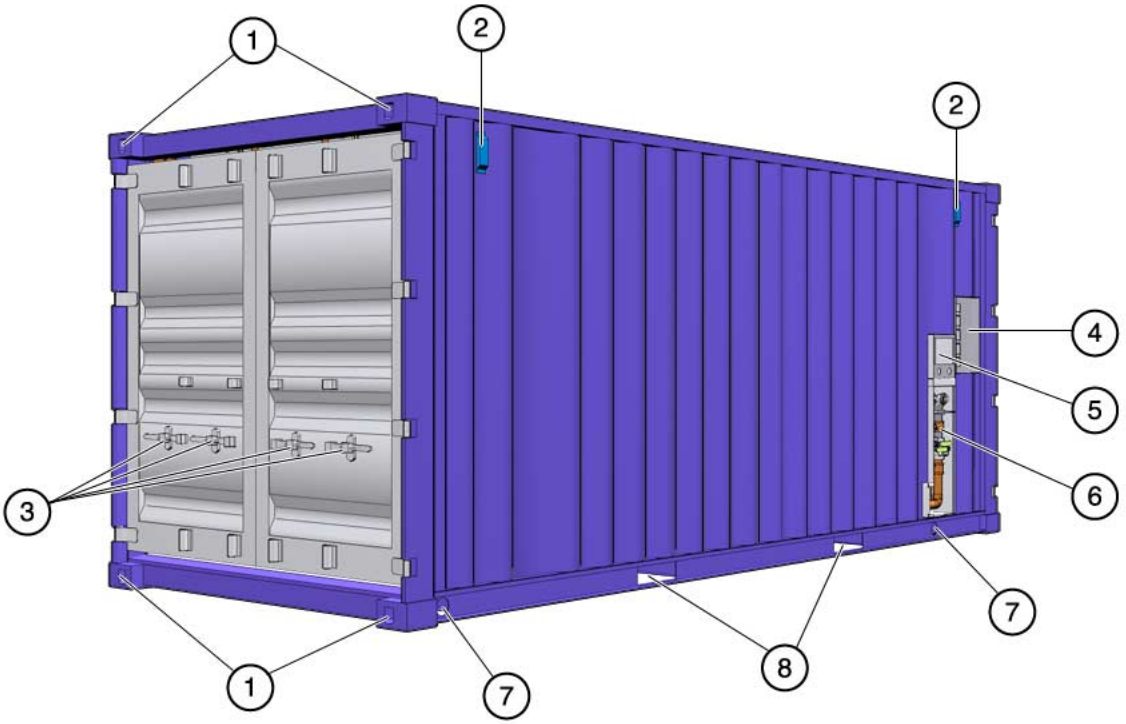


Figure Legend

1	Corner blocks (4 in front, 4 in back)	**5**	Data boxes (1 on right, 1 on left)
2	Air vents (2 on right, 2 on left)	**6**	Water supply and return ports (1 set on right, 1 set on left)
3	Door handles (4 in front, 4 in back)	**7**	Drains (2 on right, 2 on left)
4	Electrical feeder entrance (1 on right, 1 on left)	**8**	Forklift pockets (2 on right, 2 on left)

Note – Before a Sun MD is delivered to the installation site, payload must be identified and customers must have considered any special requirements to be satisfied before installing it. All hardware documentation must be on hand while completing the installation of the Sun MD in preparation for the installation of the payload.

Ensuring Site Compatibility With a Standard Sun MD

When selecting a location for a Sun MD, ensure that the site can accommodate the specifications and requirements described in this section.

Sun MD Specifications

TABLE 1-1 lists the specifications for the ISO TEU shipping container that houses the Sun MD system and its payload. The location where you plan to install the Sun MD must be able to accommodate a container with these specifications.

TABLE 1-1 Sun MD Container Specifications

Attribute	Specification
Dimensions	• Length 20 ft (6.09m) • Width 8 ft (2.44m) • Height 8.5 ft (2.6m)
Maximum weight	• Sun MD container without payload nominal 18000 lbs (8165 kg) • Sun MD with payload does not exceed 34000 lbs (15422 kg)

Site Requirements

TABLE 1-2 lists the site preparation requirements that must be satisfied before a Sun MD is delivered for installation.

TABLE 1-2 Site Requirements for Installing Sun MD

Attribute	Specification
Pad size or space with 5 ft (1.52m) service clearance around the sides of the Sun MD	• Length 30 ft (9.14m) • Width 18 ft (5.49m) • Height 10 ft (3.05m)
Surface preparation	• Flat and level within 1/2 in. (12.7 mm) across four corner fittings • Self-draining
Load and distribution	• No more than 18,000 lbs (8,165 kg) without payload • No more than 34,000 lbs (15,422 kg) fully loaded with payload • 8500 lbs (3856 kg) distributed on 4 corner blocks, depending on weight distribution, in a fully loaded configuration
Mounting	Anchors installed in the pad to secure the Sun MD to the pad (optional) or another appropriate method for securing the unit
Utilities	Determine whether utilities or drains will run under a concrete pad.

Environmental Requirements

TABLE 1-3 lists the conditions that are required for Sun MD operation and servicing. Ensure that the location where you plan to install the Sun MD can satisfy these specifications.

TABLE 1-3 Environmental Requirements

Attribute	Specification
Operating conditions (external)	• Temperature: -29 to 54ºC (-20 to 130ºF) • Humidity: Up to 100% • Doors must remain closed
Operating conditions (internal)	• Temperature: 10 to 35ºC (50 to 95ºF) • Relative humidity, noncondensing: 20 to 80% • Doors must remain closed
Servicing conditions (internal and external)	• Temperature: 10 to 35ºC (50 to 95ºF) • Relative humidity, noncondensing: 20 to 80% • Weather: No rain, sleet, snow, or wind-borne dust or debris • Doors must remain closed during operation except during service activities by Sun or Sun authorized providers

Note – If the external temperature may be outside of the range listed in TABLE 1-3, install the Sun MD in a building or enclosure to ensure that the ambient temperature for the Sun MD is within its operating limits. Refer to the *Sun Modular Datacenter S20/D20 Product Notes* for additional information about service enclosures.

For information about additional environmental- and weather-related considerations, refer to "Environmental- and Weather-Related Considerations" on page 20.

Ensuring Payload Compatibility in a Standard Sun MD Unit

When selecting payload for use in a Sun MD, ensure that all components and services align with the specifications and requirements described in this section.

Rack Compatibility

TABLE 1-4 lists the specifications of the racks that are used in a Sun MD.

TABLE 1-4 Sun MD Rack Specifications

Attribute	Specification
General	Industry-standard, 40-rack unit (RU), 19-inch racks
Dimensions	• Height 40 RU (70 in. or 178 cm) • Width 19 in. (48.26 cm) EIA/RETMA (Electronic Industries Alliance/Radio Electronics Television Manufacturers Association) • Usable depth, standard rack 30.75 in. (78.11 cm) • Usable depth, deep rack 46.25 in. (117.5 cm)
Weight per rack	1900 lbs. net payload and cable capacity per rack (861.83 kg)
Power	• 190–220 VAC, 3-phase, 50/60 Hz (low voltage) • 220/380–240/415 VAC, 3-phase, 50/60 Hz (high voltage)
Cooling	Front to back

TABLE 1-4 Sun MD Rack Specifications *(Continued)*

Attribute	Specification
Mounting	Standard 19-in. mounting applications per EIA RS-310-D front and back rails
Mounting hardware	Cage nut style rackrail and hardware
Distribution inside the Sun MD container	Potential for a total of eight standard-sized racks, or seven racks for the deep-rack configuration, distributed as follows: • Standard configuration (Sun MD S20): Seven racks (racks 2–8) are available for payload (servers, storage, network, and other compute equipment). These racks support 40 RUs each of rack space with a maximum depth of 30.75 in. • Deep-rack configuration (Sun MD D20): Six racks (racks 2–7) are available for payload. These racks support 40 RUs each of rack space. Standard racks have a maximum depth of 30.75 in. (78.11 cm). Deep racks have a maximum depth of 46.25 in. (117.5 cm). • 25 RU in rack 1 for customer-defined networking equipment. • 15 RU in rack 1 is reserved for control equipment, the emergency power off (EPO), and the dehumidifier.

Power Options and Requirements

TABLE 1-5 lists the power options and requirements that must be satisfied to support payload in the Sun MD. Specific payload power requirements must be determined by a qualified electrician.

TABLE 1-5 Power Options and Requirements of Sun MD

Attribute	Options and Requirements
Source	Commercial utility, on site utility power generation, stand-alone power generator, or any combination of these
Low-voltage configuration	• Input voltage: 110/190 to 127/220 VAC, 3-phase, 50/60 Hz • Internally distributed voltage: 110 to 127 VAC 1-phase 50/60 Hz and 190 to 220 VAC, 3 Phase, 50/60 Hz

TABLE 1-5 Power Options and Requirements of Sun MD *(Continued)*

Attribute	Options and Requirements
High-voltage configuration	• Input voltage: 220/380 to 240/415 VAC, 3-phase, 50/60 Hz • Internally distributed voltage: 220 to 240 VAC 1 phase 50/60 Hz and 220/380 to 240/415 VAC, 3-phase, 50/60 Hz
Total load supported	• Standard configuration (8 racks and heat exchangers): 200kW • Deep-rack configuration (7 racks and heat exchangers): 175kW In either configuration, as much as 17kW is from Sun MD, and as much as 5kW of thermal loading due to environmental contributors.
Power dissipation per rack for payload	No more than 25kW

Note – Single-phase power is distributed only for dedicated use such as lights and the dehumidifier. No general purpose single-phase outlets are available.

Water Supply Requirements

The water that is supplied to maintain the internal operating temperature of the Sun MD must satisfy the specifications listed in TABLE 1-6.

TABLE 1-6 Inlet Water Requirements for Sun MD

Attribute	Specification
Source	Dedicated stand-alone chiller or heater, or facility-supplied chilled or heated water
Flow rate	Range, depending on payload: • Standard configuration: 45–65 gal. (170–246 L) per minute • Deep-rack configuration: 37–57 gal. (140–216 L) per minute
Supply temperature	No lower than 18ºC (64ºF) and no higher than 22ºC (72ºF)
Supply pressure	50 pound-force per square inch gauge (PSIG) or 3.45 Bar nominal, not to exceed 80 PSIG or 5.44 Bar **Note -** System wide, pressure might drop as much as 4–5 PSID.
Supply and return connections	2-in. National Pipe Taper (NPT) female pipe fittings **Note -** Using supply and return tubing with less than a 2-in. diameter might result in reduced pressure. It is important that you adhere to the 2-in. NPT recommendation.

Note – Flow rates and supply pressure will vary depending on the installed payload and the operating environment. Work with a licensed HVAC contractor or Sun Service to determine your site's specific requirements. Refer to Chapter 5 for information about determining the maximum chilled coolant temperature based on payload and flow rate.

Network Specifications

TABLE 1-7 lists the networking components and options that are available with the Sun MD. Security recommendations are also listed.

TABLE 1-7 Network Specifications for Sun MD

Attribute	Specification
Data boxes	Total of 2, one on each side of the unit
Available configurations	• 8 RJ-45 connectors • 8 LC connectors • 4 RJ-45 and 4 LC connectors • Bulk cable pass-through (a pair of ports, each of which accommodate up to nine cables passing directly to a Sun MD)
Core components	• Service connections • Chiller in and out signals • Alarm out signal • Fire suppression system status signal
Supported connection types	RJ-45 and LC Fibre Channel connection ports
Security requirements	Conduit to protect data cables from the source to the Sun MD
Option	Bulk cable back pass-through plate for routing up to 18 cables

CHAPTER 2

Site Planning Process

This chapter outlines the process and time lines involved in preparing a site for the installation of a Sun MD. This chapter also describes zoning and permit requirements, scheduling, safety, and staffing considerations and requirements.

This chapter contains the following sections:

Understanding Zoning and Permit Requirements

The final decision to authorize the installation, power up, and use of a Sun MD rests with the local regulatory, safety, and zoning authority for the designated site. The Sun MD product documentation refers to this entity as the *Authority Having Jurisdiction* (*AHJ*).

Customers are responsible for identifying, understanding, and complying with all ordinances and regulations that might affect the installation and operation of a Sun MD unit and the hardware contained within it. They must comply with all local, national, and international codes, and they must ensure that their payload conforms to the physical specifications described in this document. Customers are also responsible for obtaining all appropriate permits and for ensuring that professionally licensed and bonded contractors are used during the design, building, and installation phases of a Sun MD project.

Customers are encouraged to thoroughly research jurisdictional requirements and codes prior to ordering a Sun MD, particularly in the areas of fire and safety codes, building codes, plumbing, space requirements, and electrical codes. As described in "Scheduling Tasks to Be Completed Prior to Delivery" on page 12, this planning should begin as early as possible.

By the time the Sun MD is to be installed, all required permits must be in process, and copies of all related paperwork must be on site on installation day.

Scheduling Tasks to Be Completed Prior to Delivery

The amount of time that is required to perform the tasks that must be completed before a Sun MD is delivered depends on a number of factors. Be sure to allocate sufficient time for the planning, permitting, building, installation, and inspection phases of the project. It is critical that you work with experienced and licensed contractors during each of these phases.

Previous installations have shown that obtaining appropriate permits may take several months depending on the locality. Therefore, begin the process well in advance of the delivery of a Sun MD system.

In addition, consider that new construction or the placement of a structure like a Sun MD might require structure and installation design approval. Generally, there will also be inspections during and after installation to ensure compliance with building codes.

Failure to obtain the correct permits can result in fines and penalties, and in some cases the demolition of unauthorized construction if it cannot be corrected to meet local code requirements.

Identifying Site Planning Tasks

The site planning process involves the tasks listed in TABLE 2-1.

TABLE 2-1 Site Planning Task Map

Task	Descriptions and Where to Find Information
1. Choose a location for the Sun MD	Consider space requirements, proximity to utilities, and future expansion requirements. For information, refer to "Deciding Where to Position the Sun MD" on page 15.
2. Begin the permitting process	Engage licensed contractors, research zoning requirements, request permits from the Authority Having Jurisdiction (AHJ).
3. Design the mounting pad (if needed)	Consider load specifications and surface preparation. For information, refer to "Mounting Pad Considerations" on page 18.
4. Assess environmental and event protection requirements	Identify environmental- and weather-related considerations and assess natural disaster preparedness requirements. For information, refer to "Ensuring Environmental and Event Protection" on page 19.
5. Identify redundancy requirements	Consider requirements to provide redundancy in the areas of power, chilled water, and network supply.
6. Identify security requirements	Consider the level of security required at the site and follow the security standards and practices for your company. For example, solutions supporting applications with high availability requirements require heightened security. For information, refer to "Providing Security for the Site and Container" on page 23.
7. Identify power requirements	Consider the power requirements of the Sun MD and the payload installed in it. Also consider how you will provide power to the site, how you will maintain power in the event of a failure, and the level of voltage protection that is required. For more information, refer to Chapter 4.
8. Identify chilled water requirements	Decide how you will supply chilled water to the Sun MD, and consider whether the source and the water it supplies satisfy the Sun MD chilled-water requirements. For more information, refer to Chapter 5.
9. Identify networking requirements	Learn about the cabling and networking requirements of the Sun MD, and assess the options for providing network connectivity (LAN, WAN, or SAN) to the Sun MD. For more information, refer to Chapter 6.

Understanding Safety Guidelines

Specific safety-related considerations are provided in all of the Sun MD product manuals with the procedures that require them. However, during the planning phase of a Sun MD project, you should create a general training and education plan. Everyone who will be involved in the design, installation, and servicing of the Sun MD system and its components must be aware of the following safety guidelines:

- The Sun MD system and its components must be positioned, installed, and serviced in accordance with the local safety codes and regulations that are in force at the installation site.
- All staff must be trained on and familiar with the safety precautions in the *Sun Modular Datacenter S20 Safety and Compliance Guide*.
- Mechanical or electrical modifications cannot be made to the equipment. Sun Microsystems, Inc. is not responsible for regulatory compliance of a modified Sun product.
- No smoking or smoke, dust, or fine particulate-producing equipment should be positioned within 20 feet (6 meters) of the Sun MD, as this could compromise the integrity of the Fire Control System contained inside the Sun MD.

Ensuring That Required Staff Are Available

To ensure that a Sun MD is properly installed, administered, and serviced, and that it functions as designed, it is critical that all work is performed by experienced professionals. These people should be experts in the areas of moving, engineering, building, code interpretation, power, chilling, and networking.

Before the Sun MD unit is delivered, ensure that experienced and trained staff are available to install, administer, and service the Sun MD equipment and payload. To assist them with their work, ensure that all product documentation for the payload is available at the Sun MD installation site.

If experienced staff are not available within your company to service and maintain the Sun MD's special systems (for example, the fire suppression system), contract with a licensed and bonded contractor with experience in a given area.

CHAPTER 3

Site Preparation

This chapter describes how to prepare the physical site for the installation of a Sun MD. Topics include container positioning, mounting pad requirements, drainage considerations, environmental concerns, and security considerations.

Deciding Where to Position the Sun MD

Deciding where to position the Sun MD container is the first decision you must make when preparing for a Sun MD delivery. Possible options include parking lots, underground garages, warehouses, or field locations.

The placement of a Sun MD must be approved by the Authority Having Jurisdiction (AHJ) and the property's landlord. It is advisable to have at least two site options available for review by the AHJ and landlord should the primary location not be approved.

In addition to gaining necessary approvals of the desired site, consider the requirements and issues that are described in the following sections:

Note – Sun Services offers a Site Assessment Service to help with the planning.

Ingress and Egress Requirements

The location you select for the Sun MD must be large enough accommodate the Sun MD. In addition, there must be enough space around the container to install, service, maintain, and potentially upgrade the unit and its payload. For example, if the Sun MD is to be installed in a warehouse, ensure that the warehouse doors are large enough to accommodate it. Also consider whether there is sufficient room for handling devices such as a forklift, side-loading truck, or crane.

TABLE 3-1 lists the specifications for the International Organization for Standardization (ISO) twenty-foot equivalent unit (TEU) shipping container that houses the Sun MD, as well as the required space requirements to satisfy ingress and egress requirements.

TABLE 3-1 Sun MD Container and Ingress and Egress Requirements

Attribute	Specification
Sun MD container dimensions	• Length 20 ft (6.09m) • Width 8 ft (2.44m) • Height 8.5 ft (2.6m)
Space required to allow a 5-ft (1.52-m) service clearance on all sides	• Length 30 ft (9.14m) • Width 18 ft (5.49m) • Height 10 ft (3.05m) or more for crane access

Note – Consult with the AHJ to determine if any additional clearances might be required at your site.

Additional Equipment Space Requirements

In addition to providing space for the Sun MD, also consider the space required to accommodate any additional equipment that is to be installed. For example, the mounting pad might need to be large enough to accommodate the installation and maintenance of a stand-alone chiller, generator, UPS, or any other ancillary equipment that might be installed.

Further, consider whether additional space is required to accommodate modifications to the site. For example, if you plan to install a raised section of pad or another type of platform to facilitate moving equipment in and out of the Sun MD, allocate enough space for the platform and a ground-level path around the platform.

Proximity to Utilities and Drains

When choosing a location for a Sun MD, consider the pad's proximity to required utilities like power, chilled water, and network connections. While required utilities can be brought to nearly any site you select, there is a potential for increased costs and decreased efficiency when a Sun MD is located far from the source of a utility.

Note – Consult with the AHJ and licensed contractors for information about the utility codes that will be enforced at your site.

Power

The most common configuration for supplying power to the Sun MD involves using a centralized electrical service and power distribution panel where the main power service and generator power service come to the site. From there, power can be distributed to the Sun MD and ancillary equipment. While it is a good practice to position the Sun MD close to the power panel, it is not required.

When deciding where to position the Sun MD pad relative to the proposed power supply, consult with the AHJ. Also consider the cost involved in running cables for long distances and the requirement to protect power cables from the source to the container.

Water Supply

To supply the water that is used to cool the Sun MD, you can leverage existing facility-supplied chilled water and return channels, set up a dedicated stand-alone chiller, or use a combination of the two to provide redundancy.

Whichever method you use, consider the cost of piping and routing over a long distance when deciding where to position the Sun MD pad. In addition, consider how positioning the container far from the source of the chilled water will impact the efficiency of the chilled water source. For more information, refer to Chapter 5.

Proper Drainage

Choose a location for the Sun MD that will enable you to collect or dispose of any coolant that might exit the unit's floor drains due to dehumidifier runoff or the unlikely event of a water leak. Refer to FIGURE 1-1 for the location of the Sun MD drains.

Also consider the drainage requirements created by rain runoff or melting snow, which may build up between the Sun MD and adjacent structures.

Expansion Requirements

When choosing an installation site for a Sun MD, carefully consider the space and accessibility requirements that might arise with the future expansion of the deployment. For example, consider whether the location you choose will enable additional Sun MD units to be positioned side by side, and whether backup chillers or generators can be easily added to the site. Also consider whether the location will enable you to leverage infrastructure that is created to support the current installation.

Mounting Pad Considerations

If you plan to install your Sun MD on a mounting pad, in addition to ensuring that it adheres to the specifications listed in TABLE 1-2 in "Site Requirements" on page 4, ensure that the path that will be used for transporting heavy equipment into and out of the Sun MD is level, yet self-draining. The path must provide easy and safe access for those who are transporting heavy equipment into and out of the unit.

In addition, embed ground anchors into the pad to enable the Sun MD unit to be welded, bolted, or otherwise secured to the pad.

Note – Work with a licensed building contractor to ensure that your pad will satisfy the weight and surface preparation requirements described in this section.

Note – Before the installers moor the unit, ensure that the corners of the Sun MD are squared and that the container faces are parallel. To ensure that you are prepared to do this, have a copy of the *Sun Modular Datacenter S20/D20 Installation Guide* available onsite so you can follow the procedure for this task.

Ensuring Environmental and Event Protection

TABLE 3-2 lists the acceptable temperature ranges for the Sun MD. It also describes the environmental-control components that are installed in a standard Sun MD unit. These components control attributes and conditions like internal pressure, humidity, flooding, fire suppression, and shock and vibration.

TABLE 3-2 Acceptable Temperature Ranges and Environmental-Control Components

Attribute or Condition	Specification and Components
Acceptable external operating temperature/humidity ranges (no environmental shielding)	• -20–130ºF • 28–54ºC • 20–80% relative humidity
Internal/external pressure equalization	A vent in the side of the Sun MD container allows for pressure compensation. The vent is protected from particulate entry by an integral HEPA filter.
Humidity and condensation	The following components are included in a standard Sun MD to control excessive internal humidity: • External humidity sensors to warn against opening the unit if the external dew point is higher than the chilled water temperature • Standard dehumidifier to decrease humidity • Four floor drains with valves to protect against minimal back flow to remove small amounts of condensation
Leak management	The following components are included in a standard Sun MD for the unlikely event of a coolant leak: • Sensors located adjacent to each drain • Floor drains with valves to protect against minimal back flow
Fire suppression	The following components are included in a standard Sun MD: • Fire suppression system, which includes a Very Early Smoke Detection Apparatus (VESDA), two high-quality smoke detectors, and the Fire Control Panel (FCP), which monitors the VESDA system and controls the behavior of alarms and the release of a fire suppression clean agent
Shock and vibration	The following components are included in a standard Sun MD to limit the impact of transportation and movement on the heat exchangers: • Wire rope flexible isolators on the bottom of the equipment racks • Rubber shear mount isolators at the top of the heat exchangers that limit shock

Note – Work with the AHJ and licensed contractors to determine whether the provisions described in this section are sufficient for the conditions and environment in which you are installing a Sun MD unit.

When planning for the installation of a Sun MD, consider whether the installation site is likely to operate toward the bottom or top of the temperature or humidity range, and whether the standard environmental-control components will sufficiently resolve issues or conditions that are likely to occur at your site. If the unit is being installed in an area where environmental or natural events might test the limits of these ranges or might require additional environmental control, refer to "Environmental- and Weather-Related Considerations" on page 20 and "Planning for Natural Disasters" on page 22.

Environmental- and Weather-Related Considerations

The following sections describe some of the environmental- and weather-related issues to consider when preparing your site for a Sun MD.

Note – The following information *does not* imply that the Sun MD can be modified to function outside of the specifications described in the document. Customers are responsible for ensuring that their Sun MD operates within the stated specifications.

Special Considerations for Cold and Hot Environments

Determine whether the following considerations impact your site planning activities:

- In cold climates, it might be necessary to use a coolant additive such as propylene glycol in the chiller water. The dilution rate of the coolant will relate directly to the coldest outdoor temperature in which the Sun MD will be operating. Coolant should be used according to the chiller manufacturer or AHJ's standards.

Note – In very cold climates (below freezing), even a passive cooling system would make the temperature in the Sun MD too cold for many servers. In these cases, the water running through the Sun MD may need to be warmed. Work with your building contractor to identify requirements and options for protecting any pipes and fittings that are exposed between the chiller system and the Sun MD unit.

Caution – When using a glycol mix, follow the chiller manufacturer's usage requirements and AHJ or HAZMAT containment requirements.

- If the outdoor temperature might fall below -29ºC (-20ºF) or might rise above 54ºC (130ºF), install the Sun MD in a building or enclosure to ensure that the ambient temperature for the Sun MD is within its operating limits.
- If the Sun MD is being installed outdoors, construct a service vestibule to prevent incompatible weather from entering the Sun MD. This type of protection is required if the Sun MD must be serviced when any of the following conditions cannot be met:
  - Temperature 10 to 35ºC (50 to 95ºF)
  - Relative humidity: 20 to 80%
  - Dry weather
  - Absence of wind-borne dust and debris

Special Considerations for Low-Humidity Operation

The Sun MD maintains a controlled internal operating environment by managing both the temperature and the relative humidity (RH). The optimal operating range is between 45 and 55% RH.

In high-humidity environments, the Sun MD activates the dehumidification system which extracts moisture from the internal air. The Sun MD does not have the ability to add moisture to the air. In low-humidity environments, if the internal RH falls below 20%, an alarm condition is generated, and the Environmental Management System (EMS) will power off the Sun MD to protect the payload.

The doors of the Sun MD should remain closed in normal operations. The only air exchange between the inside and the outside environments is through a single vent, which is meant to equalize atmospheric pressure. In cold climates, air cannot hold as much moisture. If the Sun MD is operated in an environment where the external air is either very cold or very dry for an extended period of time, the internal humidity will begin to fall very slowly. If the external air is very dry for an extended period of time (weeks or months), there is a possibility that the internal environment can fall below 20% RH, triggering the low-humidity alarm condition.

To avoid a low-humidity alarm condition, avoid opening the doors to the Sun MD in an environment of extreme low humidity. If the Sun MD is to be operated in an environment where prolonged periods of low humidity are normal, consider placing the Sun MD within a structure where humidity is controlled.

Special Considerations for Areas Prone to Lightning or Power Surges

Consider the level of surge protection that is required at your site. The Sun MD system can contain an EMI power-line filter on each of its power inputs to protect equipment in the Sun MD from normal voltage fluctuations that occur in power sources. However, transient voltage surge suppression (TVSS) or lightning protection is optional.

If lightning or power surges occur frequently at the site where the Sun MD will be installed, work with a licensed contractor to determine what level of protection is needed.

Special Considerations for High Elevations

When preparing for installations in high elevations, refer to the altitude limitations for the payload you plan to install.

Planning for Natural Disasters

There are a number of issues related to planning for natural disasters to consider when preparing your site for a Sun MD. Such potentially disastrous events include floods, hurricanes, tornados, earthquakes, and fires. The following list describes some considerations you should address when planning for these events.

- **Floods.** The Sun MD container is weather and dust resistant, but it is not intended to withstand standing water. While the floor drains have valves that provide some protection against backflow, they will not prevent water from entering the Sun MD in the event of a flood. When deciding where to position a Sun MD unit, ensure that it is not in an area that is prone to flooding.
- **Tornados.** In areas that are prone to tornados or other high-wind conditions, consider installing permanent tie downs to ensure that the Sun MD container is securely fastened to the mooring site. Thru-bolts or other industrial-grade fasteners should be securely anchored and properly grounded electrically.

  In addition, ensure that any external components (for example, stand-alone chillers or generators) are properly secured.
- **Hurricanes and tsunamis.** In areas that are prone to hurricanes or tsunamis, consider the issues described for floods and tornados.
- **Earthquakes.** In areas that are prone to earthquakes, consider installing seismic isolators under the Sun MD to help reduce the impact of seismic activity on the container and the payload it contains. Consult with a local AHJ and civil engineering firm for proper requirements and construction.

- **External fire.** The Sun MD container is weather resistant, but it is not intended to be fire resistant. Clear brush and other combustible materials from the site where the Sun MD is to be installed and ensure that the defensible space is maintained.
- **Internal fire.** A standard Sun MD contains an internal fire detection and suppression system, but local building and fire codes will dictate whether additional fire control measures are required. If required, the electrical systems, motors, generators, UPS batteries, chillers, and any fuel storage containers will need to be customized to support the new mechanisms.

  In addition, connect the fire suppression system to the alarm systems and provide streamlined access control for emergency personnel. Check with the AHJ to ensure that you understand the requirements to install on-hand fire suppression equipment such as hand-held extinguishers at each critical area.

Providing Redundancy

Under most circumstances, redundancy should be provided for power, chilling, and networking connections to a Sun MD. This is especially true if the solution supported by the Sun MD is highly sensitive or has high-availability requirements. The methods you use to achieve redundancy must adhere to typical site and facility practices, as well as AHJ and local code requirements.

For more information about power redundancy, refer to "Maintaining Power While Switching From Primary to Backup Power" on page 31.

Providing Security for the Site and Container

Security measures should be designed to protect the Sun MD unit as well as any generators, chillers, fuel storage, electrical connections, and network connections. Security measures also need to account for life-safety protection.

There are a number of methods for providing security at a site where Sun MD is installed. Carefully consider the security requirements of your site and the requirements to protect the solution supported by the Sun MD before the unit is delivered to your site.

Note – Sun neither requires nor endorses the security measures described in this section. This information is simply a compilation of customer experience from various Sun MD installation sites.

Physical Security

To prevent the removal or tampering of the Sun MD and ancillary equipment, implement any or all of the following security measures:

- Install a physical obstruction around the perimeter of the site. A security gate, perimeter wall, enclosure, or building are possible options depending on the level of security desired and remoteness of the installation. Ensure that you plan well enough in advance for the solution to be executed to support stated security requirements. Also ensure that the option you choose, if installed prior to the delivery of the Sun MD, will not hinder the delivery or installation of the Sun MD.
- Install anchors or corner block locks to secure the Sun MD container to the ground.
- Configure the Enterprise Management System software to trigger a security inspection in the event that network connections are lost, as this might indicate that the unit is being moved.
- Install padlocks on the unit's doors, and consider the use of a security monitoring system or service. Additional access control methods might include electronic key cards and video surveillance.
- Plan for installation and ongoing security around a Sun MD.

System Monitoring

The Sun MD provides an Environmental Management System (EMS) that enables data collection and reporting for the following events:

- Opening and closing of doors or data box
- Smoke detected
- Water detected on the floor
- Monitoring of the operation and discharge of the fire suppression system
- Chiller alarm received and communicated
- Chiller shutdown signal sent
- Overtemperature conditions
- High- and low-humidity conditions

The data that is collected can be analyzed by software on the EMS's Integrated Management Server (IMS) or can be sent to an enterprise management system such as Sun Management Center, Unicenter, Tivoli, or OpenView.

If you decide to add additional monitoring systems external to Sun MD, consider what type of system management software you will use, and assess whether it is compatible with Sun MD EMS. For more information about EMS, refer to the *Sun Modular Datacenter S20/D20 Overview* and the *Sun Modular Datacenter S20/D20 Administration Guide.*

CHAPTER 4

Power Considerations

The following sections provide overview information and describe the tasks involved in providing power to a Sun MD site:

Sun MD Power Overview

When deciding how to position the Sun MD container at your site, consider the location of the electrical feeder entrances. There is one entrance for power on the right side of the Sun MD (as shown in FIGURE 4-1), and one on the left.

Note – The power connection box in FIGURE 4-1 is shown with the EMI filter installed.

FIGURE 4-1 Exterior Power Connection Box

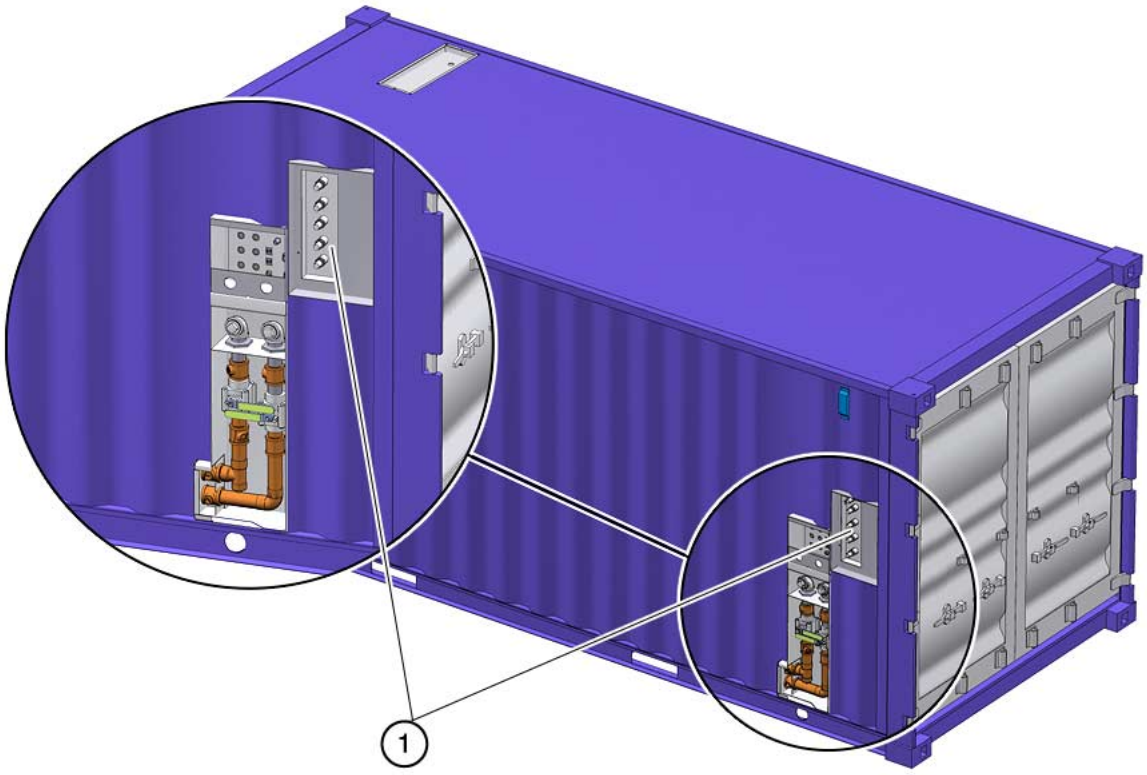


Figure Legend

1	Electrical feeder entrance

In addition to ensuring that the Sun MD power adheres to the specifications listed in TABLE 1-5 in "Power Options and Requirements" on page 7, answer the following questions when planning to provide power for a Sun MD:

- What are the power requirements of the Sun MD and the payload you plan to install in it?
- How will you provide power to the Sun MD? Will you use a commercial power utility, on-site generation facilities, a stand-alone generator, or some combination of these?
- How will you maintain power in the event of a failure?
- What level of lightning and transient voltage surge protection should be installed?

Note – To ensure that you allow enough time for design, AHJ reviews, and implementation, begin the tasks described in this chapter several months before the delivery of a Sun MD.

Sizing Power for a Sun Modular Datacenter and Payload

When sizing power for a Sun MD, begin by determining the power requirements for the Sun MD installation. This should include the power required to support Sun MD and the installed payload, as well as the power that might be required to support future Sun MD units and payload expansion.

The power requirements for a Sun MD will vary greatly depending on the country where the system is being installed and on the payload that will populate the Sun MD. Depending on the model, the Sun MD requires 110/190 to 127/220VAC 3-phase or 220/380 to 240/415VAC 3-phase 50 Hz/60 Hz electrical service.

Note – 110 to 127 VAC 1-phase power is distributed only for dedicated use such as lights and the dehumidifier. No general purpose single-phase outlets are available on either the low- or high-voltage power option.

Note – For specific power sizing for your installation and payload, work with your site evaluation team, Sun System Engineers or System Architects, and a licensed electrician.

After assessing the power requirements of the Sun MD and the expected payload, determine whether there is currently enough power at the site to satisfy the requirements. If enough power exists to support the requirements, you can begin making decisions about how to get power to the Sun MD unit. If enough power does not already exist, consider options for increasing the amount of available power.

Understanding Power Options and Configurations

This section describes two options that are commonly used in various configurations to satisfy power supply and redundancy needs at sites where Sun MD systems are installed.

Choosing Utility- or Generator-Supplied Power

Options for powering a Sun MD system and installed payload include commercial or on-site power utilities, on-site power generators, or a combination of these options.

Utility providers generate and distribute electricity from a facility that they own or operate. Utility power is generally supplied to a facility or campus, which can then be tapped and configured to supply power to Sun MD.

Power generators convert mechanical energy into electricity. Generators come in many different styles and sizes and can be powered by different fuel sources including natural gas, diesel, propane, or gasoline.

When choosing a power source for a Sun MD system, consider the following questions:

- Will the option you select provide enough power to support the current design, as well as the power requirements of possible future expansion?
- What option best supports the reliability and availability requirements of the solution that is supported by Sun MD?
- For utility-supplied power, will the distance between the power source and the Sun MD unit pose any challenges (for example, protecting power cables)?
- For generator-supplied power, will supplying, storing, and disposing of fuel create challenges?

Understanding How Power Is Distributed in Sun MD

The Sun MD power distribution panel comprises a set of circuit breakers that protect the power source from overload and direct the power to all electrical components inside the Sun MD, including all payload and infrastructure cabinets and overhead lighting.

Two power distribution panels are available for equipment within the Sun MD system, a primary (Panel A) and a secondary (Panel B). Feeder wiring from the feeder distribution panel should be wired into the Sun MD as required by the AHJ. If only a single power source is available, consider connecting it to Panel A and to Panel B to provide multiple electrical feeds to the payload components.

Maintaining Power While Switching From Primary to Backup Power

If the solution that will be supported by the Sun MD provides power redundancy through a secondary power source, consider connecting the secondary source directly to one of the Sun MD electrical feeder entrances. This is especially worthwhile in cases where the secondary source is always live (such as utility electric service from a different power grid). Otherwise, consider using an automatic transfer switch (ATS) to connect the primary and secondary power sources to the electrical feeder entrance on the Sun MD.

Because the switch to the backup power source is not instantaneous, consider also installing an uninterruptible power supply (UPS) between the source of power and the load it is protecting. When a power failure or abnormality occurs, the UPS will switch from the normal source of power to its own power source in a manner imperceptible to the operating payload. As a result, the load does not experience any interruption in its power feed.

Note – If the customer decides to install an ATS and UPS, it should be installed by a licensed electrician as prescribed by the appropriate local electrical codes.

Grounding the Data Center

When planning for the installation of an electrical service, establish a common central electrical ground for the Sun MD and other related electrical equipment (Sun MD, chiller and related equipment, and power subpanels).

The ground you select must adhere to local code and safety guidelines, and you must follow the local AHJ permitting process to ensure that the choice is properly permitted. Before installation day, ensure that you understand all code, safety, and AHJ requirements.

CHAPTER 5

Water Supply Requirements

Sun MD uses a unique cooling system with heat exchangers between each rack of equipment. A suitable source of water to flow through the heat exchangers must be available for any Sun MD installation to ensure that proper internal temperatures are maintained.

During the site planning phase of a Sun MD project, consider the following issues as they relate to the decisions you make about providing water to the Sun MD system:

Water Supply Overview

For convenience of installation, there are two sets of water supply and return fittings located on opposite sides of the Sun MD unit. When deciding how to position the Sun MD container, consider the location of these connections and to which side the supply and return plumbing must be connected.

FIGURE 5-1 shows the location of the water ports on both sides of the Sun MD container.

FIGURE 5-1 Exterior Connections to Water Return and Supply

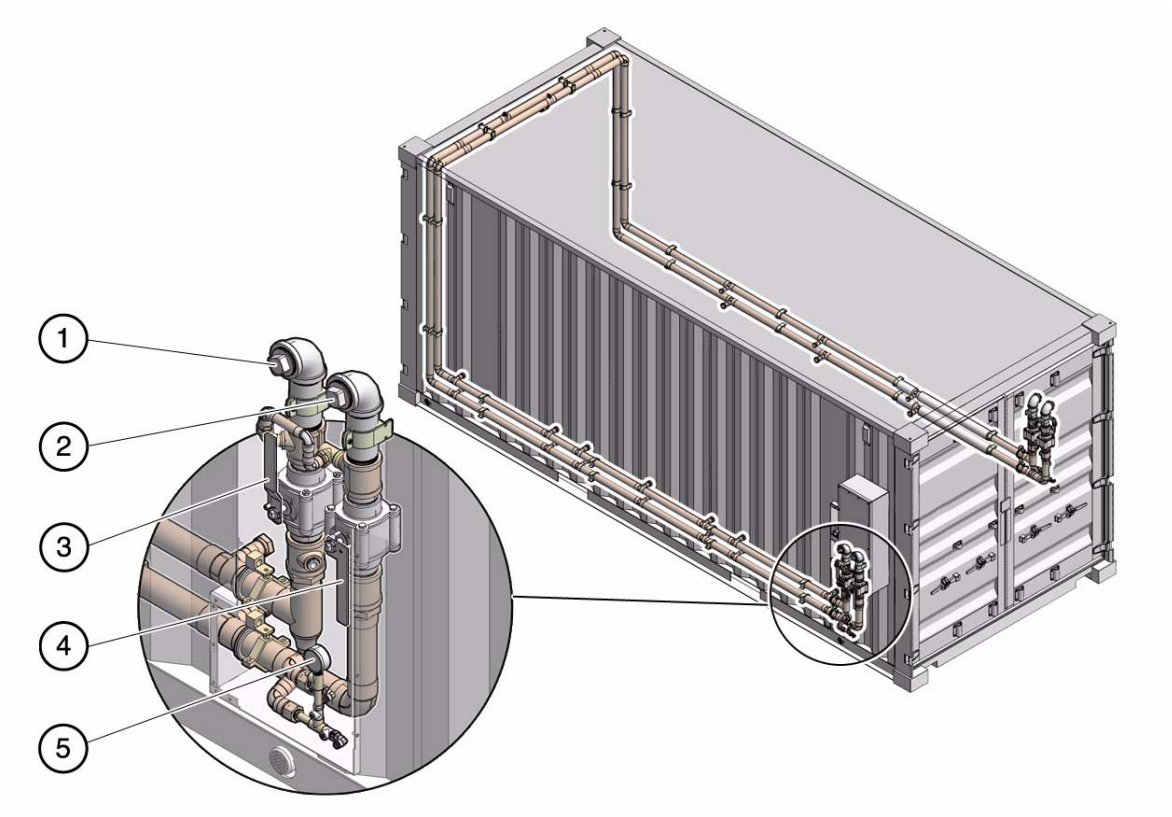


Figure Legend

1	Water return connection
2	Water supply connection
3	Water return valve
4	Water supply valve
5	Pressure gauge

Note – The supply valve is located on the side that is closest to the doors. On the right side of the container, as shown in the callouts for FIGURE 5-1, the return valve is on the left and the supply valve is on the right. However, on the left side of the container, the return valve is on the right and the supply valve is on the left.

Example Temperature and Flow Rate Requirements for Water Supplied to a Sun MD

The water supplied to a Sun MD must adhere to the specifications listed in TABLE 1-6 in "Water Supply Requirements" on page 8. These specifications are designed to ensure that the internal temperature of the Sun MD remains within the acceptable operating range of 10–35ºC (50–95ºF).

Specific allowable water temperatures can only be determined by considering the maximum payload installed and the maximum flow rate of water to the system. The example payloads presented in this section assume the following specifications:

- A flow rate not to exceed 65 gal. (246 L) per minute, depending on payload
- A supply temperature no lower than 18ºC (64ºF) and no higher than 22ºC (72ºF), depending on payload

The data presented in the following sections illustrates the relationships between flow rates, temperatures, power loads, and rack payloads. This data was derived from psychometric charts:

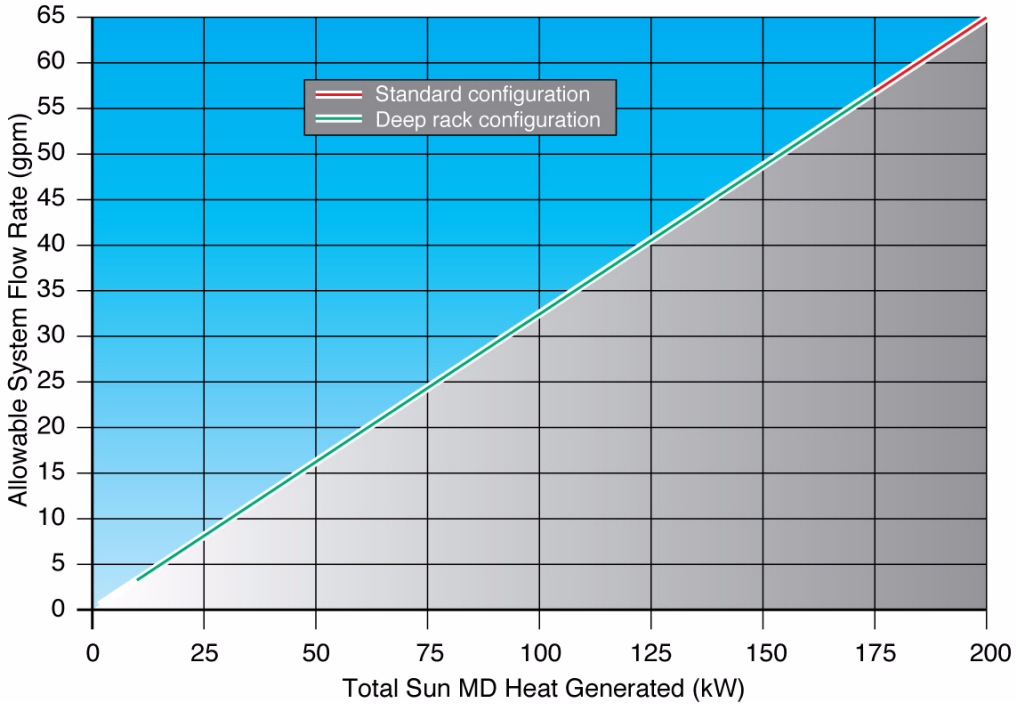
- "Adjusting Minimum Water Flow Rates to Accommodate Specific Heat Rates" on page 36
- "Adjusting Minimum Water Flow Rates to Accommodate the Power Requirements of Specific Payloads" on page 37
- "Understanding the Impact of Payload and Flow Rates on Water Temperatures" on page 38
- "Sustaining Recommended Operating Temperatures for Specific Payloads" on page 39
- "Determining the Maximum Operating Temperature of Water for Specific Payloads" on page 40

Adjusting Minimum Water Flow Rates to Accommodate Specific Heat Rates

FIGURE 5-2 maps the minimum allowable system flow rate in relation to the total heat generated by the system and by solar loading. As the amount of heat increases, the minimum allowable flow rate for coolant also must increase. In the following chart, the zone above the plotted line represents the rates at which water can acceptably flow into the system. Note that 65 gpm is the maximum water flow rate for standard configurations, and 57 gpm is the maximum water flow rate for deep rack configurations.

Note – The results in the following graph were generated on a system for which water was supplied at approximately 22ºC.

FIGURE 5-2 Minimum Scalable Water Flow Rates as Impacted by Total Overall Heat

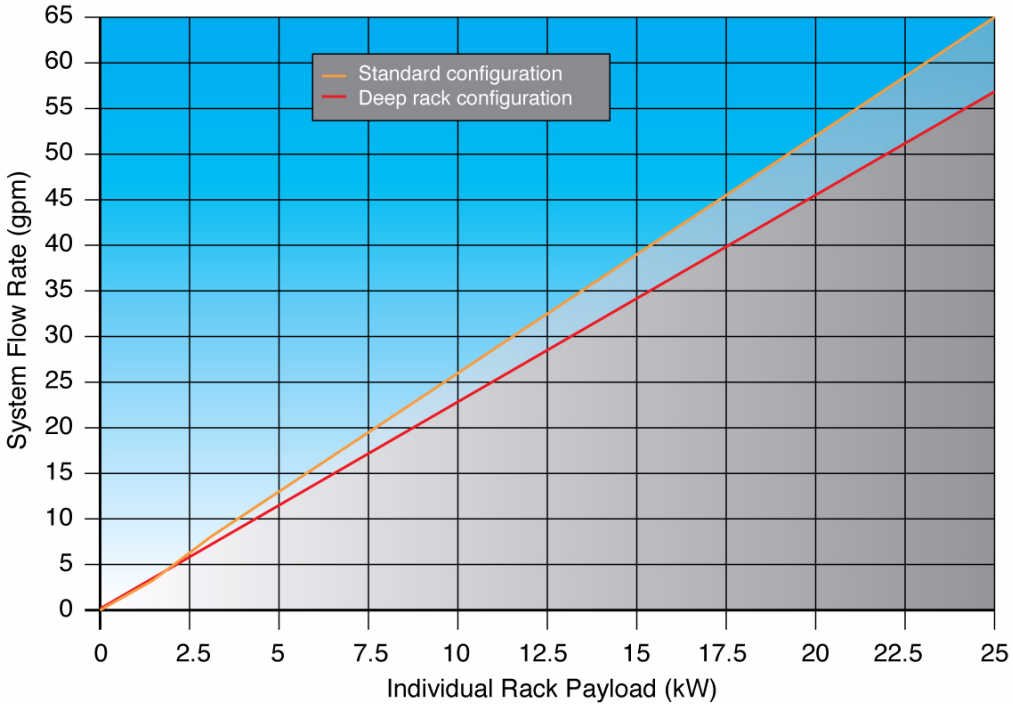


Adjusting Minimum Water Flow Rates to Accommodate the Power Requirements of Specific Payloads

FIGURE 5-3 maps the minimum allowable flow rate in relation to the individual rack payload. As the power required to support a given payload increases, the minimum allowable flow rate for coolant also must increase. In the following chart, the zone above the plotted line represents the rates at which water can acceptably flow to the system.

Note – The results in the following graph were generated on a system for which water was supplied at approximately 22ºC.

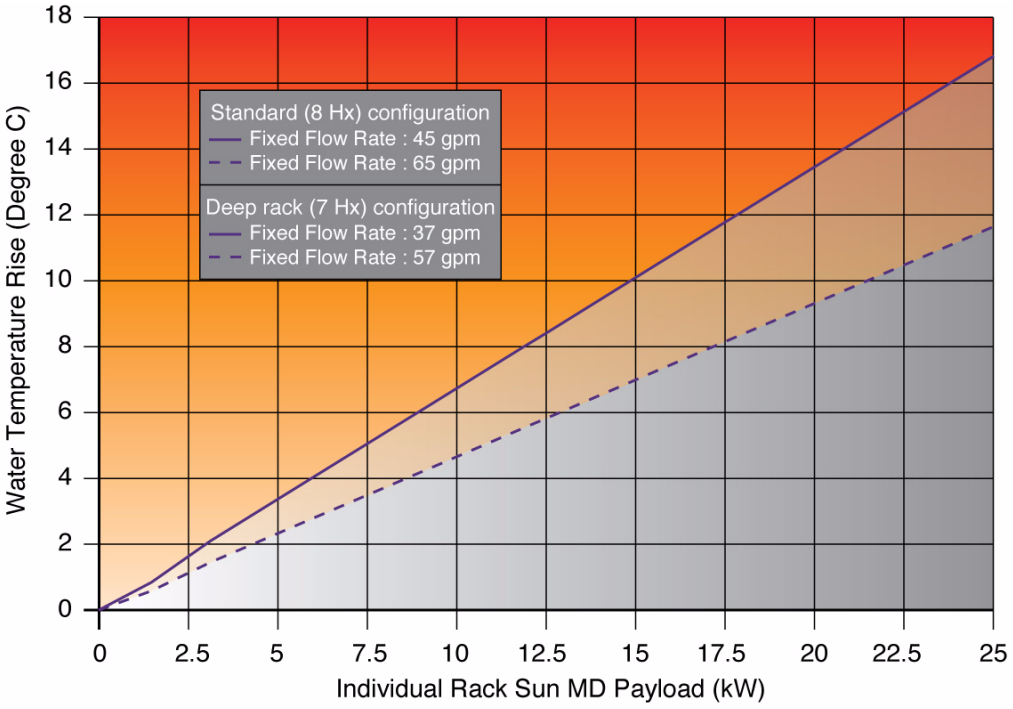
FIGURE 5-3 Minimum Scalable Water Flow Rates as Impacted by the Rack Payload



Understanding the Impact of Payload and Flow Rates on Water Temperatures

FIGURE 5-4 maps the increase in water temperature at two fixed flow rates in relation to the individual rack payload. As the power required to support a given payload increases, the coolant temperature is also expected to rise. Temperatures will be higher and will rise at a faster rate using a fixed flow rate of 45 gpm (standard configuration) or 37 gpm (deep-rack configuration) than they will using a flow rate of 65 gpm (standard configuration) or 57 gpm (deep-rack configuration).

FIGURE 5-4 Increase in Water Temperature at Different Rates of Flow for Specific Rack Payloads



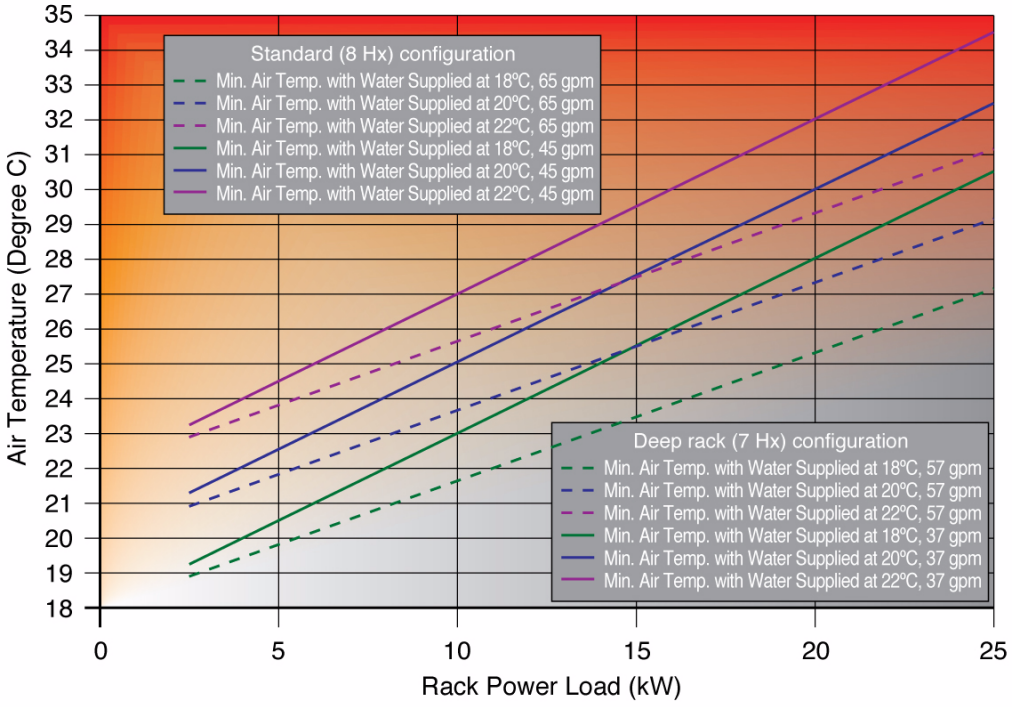
Note – In a standard configuration, 45–65 gpm is the recommended operating range for water flowing into the Sun MD. In a deep-rack configuration, 37–57 gpm is the recommended operating range.

Sustaining Recommended Operating Temperatures for Specific Payloads

FIGURE 5-5 maps the recommended water temperatures and system flow rates required to ensure that the internal air temperature of the Sun MD remains within the recommended operating range of 18-35ºC. Increases to the inlet water temperature or to the power requirements of the payload will cause the operating air temperature to increase. Increasing the flow rate of water through the system can help lower the operating air temperature.

Of the data mapped in FIGURE 5-5, supplying water at 18ºC and 65 gpm (standard configuration) or 18ºC and 57 gpm (deep-rack configuration) results in an estimated air temperature for all payload levels that is on the low to middle end of the acceptable range (dashed line on the bottom of the chart). Supplying water at 22ºC and 45 gpm (standard configuration) or 22ºC and 37 gpm (deep-rack configuration) for payloads of 10kW and higher results in an estimated air temperature that is on the higher end of the acceptable range (solid line on the top of the chart).

FIGURE 5-5 Payload-Specific Water Temperatures and Flow Rates Required to Sustain Operating Air Temperature of 18-35ºC



Determining the Maximum Operating Temperature of Water for Specific Payloads

FIGURE 5-6 (standard configuration) and FIGURE 5-7 (deep-rack configuration) map the maximum allowed temperatures and flow rates for water supplied to the Sun MD. These are not-to-exceed values for maintaining an internal temperature of 35ºC, but they are *not* recommended for normal operation.

Caution – Do *not* use the values shown in FIGURE 5-6 as a baseline for normal operation. Doing so may impact reliability and reduce the margin for failure.

FIGURE 5-6 Standard Configuration (8 Heat Exchangers) With an Internal Temperature of 35ºC (*Not Recommended for Normal Operation*)—Maximum Supply Water Temperature and System Flow Rates

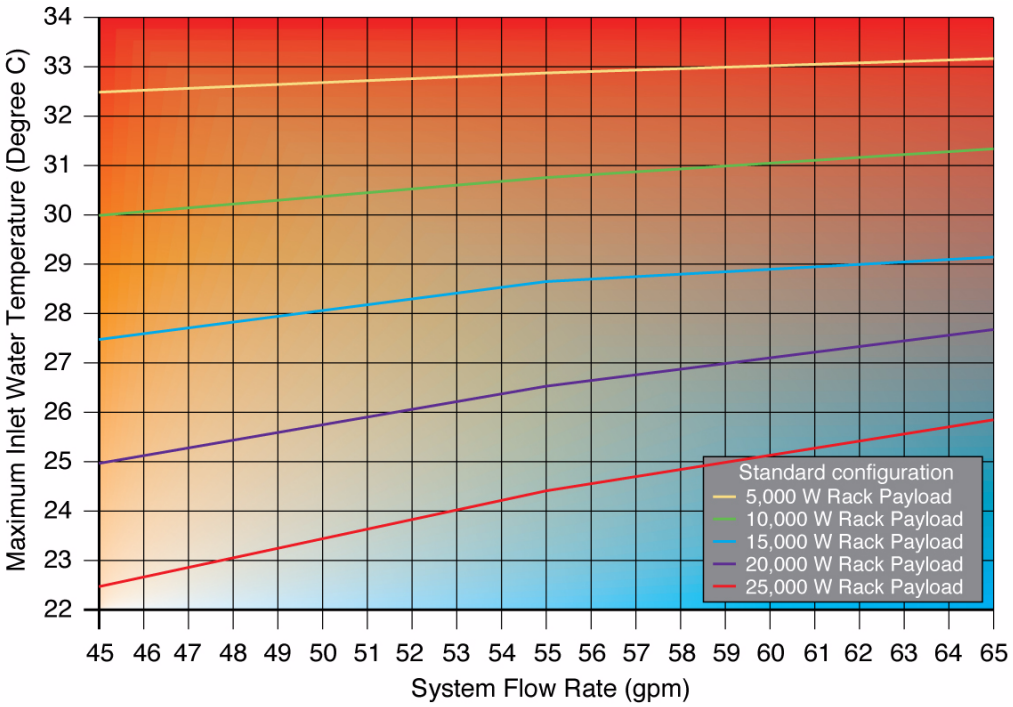
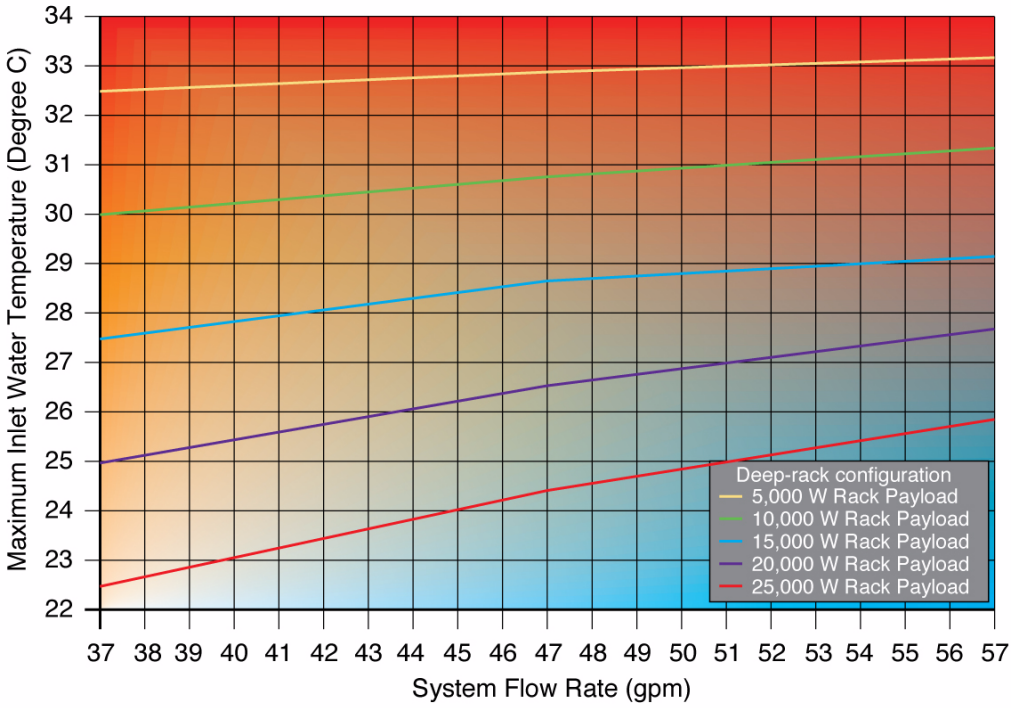


FIGURE 5-7 Deep-Rack Configuration (7 Heat Exchangers) With an Internal Temperature of 35ºC (*Not Recommended for Normal Operation*)—Maximum Supply Water Temperature and System Flow Rates



Note – Work with a licensed HVAC contractor to determine the temperature at which water should be supplied to the Sun MD to maintain a nominal internal air temperature of 22.5ºC which is the middle of the acceptable 10-35ºC operating range.

Choosing a Water Source

The water source you choose for the Sun MD must adhere to the specifications listed in TABLE 1-6 in "Water Supply Requirements" on page 8.

Options for providing water to a Sun MD system and the installed payload include using excess capacity from an existing cold water source at the site or providing water with a stand-alone chiller.

If the Sun MD is installed at a facility with sufficient excess water capacity, consider the following questions when deciding whether to use that capacity:

- Do the existing chilled water specifications (supply temperatures, flow rates, and operating pressure) and capacity satisfy the requirements of Sun MD? If not, consider working with a professional mechanical contractor to create a solution that will mitigate the differences.
- Does the facility configuration comply with the Uniform Plumbing Code (UPC) in your area, to which the Sun MD must comply? If not, consider upgrading the facility to be in compliance with the UPC.
- What are the related plumbing costs, risks of leaks and broken plumbing, and the ability to isolate the system for service? If it is not cost-effective to make the changes needed for compliance or to mitigate the differences in water supply requirements, consider using a dedicated stand-alone chiller for the Sun MD.

Preparing the Site and Power Source for a Stand-Alone Chiller

If you use a stand-alone chiller with a Sun MD, ensure that it is installed on a level surface. In addition, ensure that sufficient power will be run to the chiller. It is good practice to route power through the site electrical distribution panel to enable all electricity to be controlled from a central location.

During the site planning phase of a Sun MD project, consider how to route the chilled water supply and the warm water return plumbing. Also consider whether these pipes need to be insulated, heated, or secured.

Understanding Water Treatment Options

Chiller manufacturers might specify that additives for the chiller such as corrosion inhibitors, rust inhibitors, algaecides, or fungicides be added to the water. Work with the contractor who supplies the chiller for recommendations that are appropriate to your particular installation.

CHAPTER 6

Cabling and Networking Requirements

Consider how the following issues impact the networking requirements of the Sun MD unit to be installed at your site:

Understanding Cabling and Networking Requirements

On the Sun MD unit, networking cables are run to two data boxes, one on either side of the unit. There can be up to eight network connection ports in each data box, combining RJ-45 and LC connection ports. Refer to "Network Specifications" on page 9 for information about the supported configurations.

If your configuration will require more than eight connections on one side of the Sun MD, you can order a panel for the data box that accommodates bulk cable routing. This optional plate has two large-diameter conduits with environmental seals that permit 18 cables (9 per conduit) to be routed directly into the container and terminated on a switch or panel inside the Sun MD.

Network cables are routed into the data box through two 1.5-inch nipples, which are located just below the door of the data box, as shown in FIGURE 6-1.

FIGURE 6-1 Networking Panel

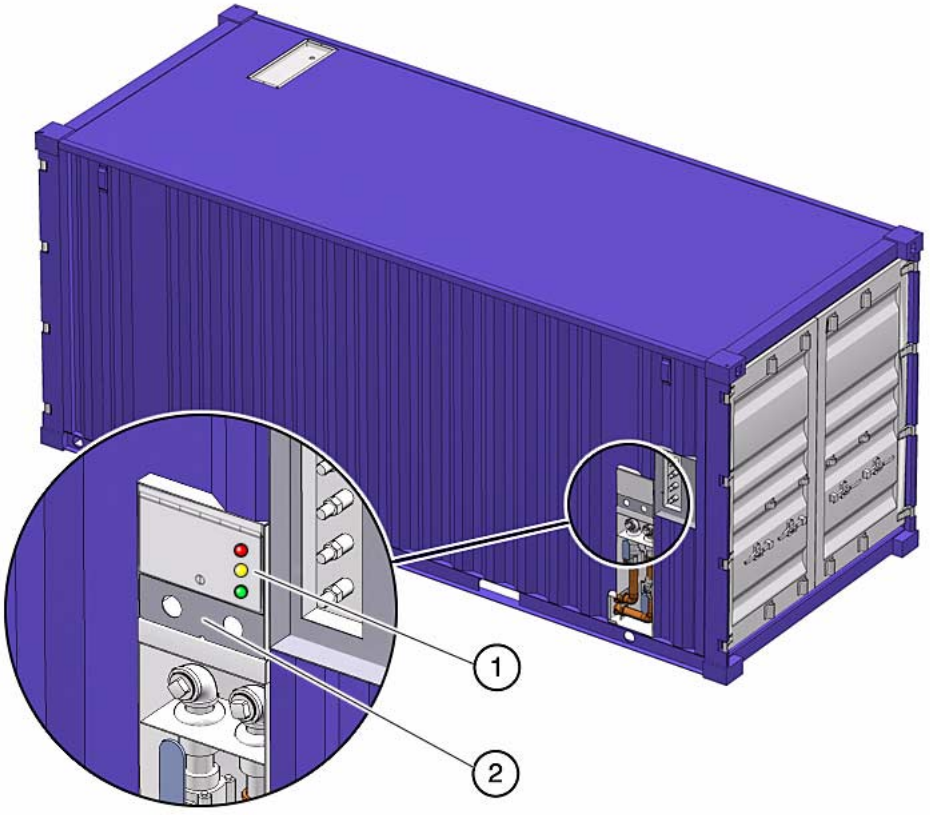


Figure Legend

1	Data box door with LED lights
2	1.5-in. network cable feeder entrances

When deciding how to route cables from the data source to the Sun MD data box, consider how to best protect them from traffic and tampering. In addition, plan to protect the cables from their source to the Sun MD data box by installing them through conduit.

Assessing Data Provider Options and Limitations

When planning for the networking requirements of a Sun MD, consider whether the unit's placement will impact the accessibility of network-supplied data coming from an adjacent facility. Also consider whether there are requirements to support wireless network connectivity.

Glossary

A

AHJ Authority Having Jurisdiction. The agency that regulates fire codes, building codes, and electrical codes within a specific physical locality, such as a city, state, or country.

air plenum A separate space that is provided for air circulation in heating, ventilation, and air conditioning (HVAC).

aisle 1 The aisle on the left side of the Sun MD that contains racks 1 through 4 and associated heat exchangers. Air flows from the front to the rear of the Sun MD by traveling through aisle 1.

aisle 2 The aisle on the right side of the Sun MD that contains racks 5 through 8 and associated heat exchangers. Air flows from the rear to the front of the Sun MD by traveling through the heat exchangers located in aisle 2.

aisle door The doors at each end of the Sun MD service aisle: the front aisle door and rear aisle door.

alarm module The alarm module monitors the Sun MD temperature, emergency power off (EPO) events, inputs from security sensors, data panels, and data box tamper signals. The alarm module directly controls the EPO actuation circuitry. This module is mounted in the infrastructure rack.

A or amp ampere. A measurement of electrical current in a circuit.

ATS automatic transfer switch. An ATS allows switching from a primary power source to a secondary or tertiary power source.

availability The percentage of a specified period of time for which a service, system, or system component satisfactorily performs its intended function.

B

back See *rear*.

back door See *rear door*.

baseline A measurement, calculation, or location that is used as a basis for comparison; a measurable characterization that is used as a basis to establish the current state.

C

cable tray A ladder-type tray that is located over the service aisle and that holds the overhead cabling.

CDF cumulative distribution function. In reliability engineering, the area under the PDF curve representing the probability that a randomly selected unit from a population will fail by some time.

CDU Cabinet power distribution unit. The power strips in the Sun MD racks. See also *PDU*.

chiller A cooling system that removes heat from one element and deposits it into another.

CLI command-line interface. A textual input communication to a computer by way of a command prompt.

conduit A protective tube or duct for enclosing electrical wiring or cabling.

container vents See *vents*.

continuous availability The ability of a service, system, or system component to satisfactorily perform its intended function without planned or unplanned interruption during a specified period of time.

corner blocks The external blocks on all eight corners of the Sun MD container that are used for attaching, lifting, or securing devices.

D

daisy chain A wiring scheme in which device A is wired to device B, device B is wired to device C, and so on. The last device is normally wired to a resistor or terminator. All devices can receive identical signals, or each device in the chain can modify one or more signals before passing them on. For example, the fan control boxes can be daisy-chained together in the Sun MD.

data box The data box houses the data panels. There are two data boxes on the Sun MD; one on the left and one on the right side of the unit.

data panel The panels inside the data box where private network and alarm system cabling is brought into the unit.

The data panel also contains the status LEDs, chiller port, chiller alarm, temperature and humidity sensors, and data box door sensor.

data redundancy The duplication of data objects as a failure mode mitigation and recovery strategy.

dehumidifier An appliance that reduces the amount of water vapor in the air. The dehumidifier in the Sun MD is located in the infrastructure rack.

drain Four drains, one in each corner of the container, are provided to remove moisture from the floor of the Sun MD. Drain outlets are located in the sides of the container's base frame. The front left drain allows water from the dehumidifier to exit the unit.

E

EMI electromagnetic interference. The disruption of operation of an electronic device when it is in the vicinity of an electromagnetic field in the radio frequency spectrum that is caused by another electronic device.

EMS Environmental Management System. The system that monitors environmental conditions and events that occur in the Sun MD. The EMS includes the sensor module, fan control module, alarm module, and all of the associated components that provide control of the system.

EPO emergency power off. The capability to immediately remove power from a system all at once. In the Sun MD, an emergency power off can be triggered by the EMS or the alarm module based on condition sensed within the Sun MD. The Sun MD EPO can also be triggered manually. The manually operated EPO buttons are located to the front-left and rear-right of the service aisle.

event An occurrence that happens somewhere in an overall system. Events carry meaning and definition.

Events are a particular type of message that can be passed between systems.

While events are descriptive, they do not directly produce an action. The EMS is responsible for assigning actions that occur as the result of an event in the Sun MD.

F

fan control module The mechanism that is mounted above each heat exchanger to power and control the fans on the heat exchanger assembly. The fan control module receives input from the temperature sensors that are located on the heat exchangers. The Sun MD contains a total of eight fan control modules.

fire control panel A circuit board that monitors signals from the VESDA sampling points and smoke detectors to determine when to change the status LEDs, trigger audible and visual alarms, and release the clean agent gas. The FCP also monitors the signal sent by the EMS to prevent the release of the clean agent gas.

The FCP is located just inside the rear door on the left side (to the right when entering through the rear door) of the Sun MD.

front The end of the Sun MD that contains the infrastructure rack.

front door The front, outermost doors to the Sun MD.

front plenum The space between the front doors and the front service aisle door where environmentally controlled air flows from aisle 2 to aisle 1.

front service aisle door The door located inside the front door that provides access to the service aisle.

FRU field-replaceable unit. A hardware component that can replaced or repaired at the point of deployment.

G

generator A machine that changes mechanical energy into electricity.

grid Any interconnected set of nodes such as the electric power network or a communications network.

H

heat exchanger A component hat cools or heats air as it circulates through the Sun MD. Heat exchangers are provided between each rack of equipment. Each heat exchanger includes five pairs of fans, five temperature sensors, and five cooling cores. A Sun MD has a total of eight heat exchangers: three in aisle 1 and five in aisle 2.

home position The position of a rack when it is located between the heat exchangers and is bolted to the floor with the securing pin in place.

I

IMS Integrated Management Server. The server that ships installed in rack 1 of the Sun MD and is preloaded with system monitoring and management software. The IMS is the repository of all data collected by the EMS (including power consumption and environmental status) and provides external access to that data through a web server.

infrastructure cable tray Vertical trays on the front, right, and left sides of the infrastructure rack that maintain the cabling to the infrastructure rack.

infrastructure rack Rack 1 in the Sun MD, which contains customer-supplied networking equipment, a dehumidifier, the sensor module, and the alarm module. Rack 1 is located on the left and in the front of the Sun MD, and is the first rack in aisle 1.

inherent availability The percentage of a specified period of time for which a system or service is satisfactorily performing its intended function under ideal conditions.

inherent reliability The probability that a system or system component will remain failure-free during a specified time interval under ideal conditions.

ISO International Standards Organization.

L

latency The time delay experienced when performing a specified unit of work.

left The left side of the Sun MD when faced from the front of the unit; this is where racks 1–4 are located.

leveling legs Commercially available container leveling legs that are used to level all four corners of the Sun MD.

leveling shims Metal plates or stock shims of varying thickness that can be used to level all four corners of the Sun MD.

light timer Two timer mechanisms, one located at the front left side and one at the rear-right side of the Sun MD, that control how long the lights remain turned on inside the unit. The timer can be set for a maximum of two hours.

LOM Lights Out Manager. Software that enables system administrators to remotely monitor and manage systems and other network equipment, regardless of whether the primary machine is powered on.

N

NEMA National Electrical Manufacturers Association. An organization that has established environmental ratings for electrical equipment enclosures.

NPT National Pipe Thread. A United States standard for tapered threads used to join pipe and fittings.

O

operational availability The percentage of a specified period of time for which a service, system, or system component is satisfactorily performing its intended function under stated conditions.

operational redundancy A system or subsystem architecture in which multiple components that are operating in parallel manage specific failure modes as part of the normal operation of the system (for example, failure-mode recovery time at, or approaching, zero).

operational reliability The probability that a system or system component will remain failure-free during a specified time interval under stated conditions.

P

payload Any electronic equipment including, but not limited to, compute nodes, servers, storage devices, routers, switches, communications, and other computer-type equipment that is located in the racks inside a Sun MD.

PDF probability density function. In reliability engineering, a frequency distribution denoting the fraction of failures for a given population within some interval of time (a lifetime distribution model).

PDU power distribution unit. The stand-alone devices that control the distribution of power to CDUs. There are two power options available for the racks: two PDUs (low-power option) or four PDUs (high-power option). The infrastructure rack always has two PDUs. See also *CDU*.

platform The hardware and hardware-specific software components of a system.

power strip A device that has a strip of sockets that protects the devices plugged into it from surges in power.

pressure release valve A device that controls or limits the amount of pressure allowed to accumulate within a closed system.

PSI pounds per square inch. The unit of measure for pressure.

public networks Commercially available network infrastructure (the Internet).

R

rack A metal frame that is used to hold hardware equipment in a shelf-like configuration by stacking the components vertically. The Sun MD has eight racks.

rack dolly A tool that is used to remove a rack and position it for service inside a Sun MD.

rack wrench A bent-handle service wrench with an alignment point on one end and a ratcheting socket wrench on the other end. The point is typically used to assist in aligning the rack prior to bolting it down. The socket/ratchet is used for loosening and tightening the bolts that secure the rack to the container while it's in the home position.

rear The end of the Sun MD where the two electrical panels and the fire suppression system are located.

rear door The first set of doors on the rear side of the Sun MD.

rear plenum The space between the rear service aisle door and the rear plenum door where environmentally controlled air flows from aisle 1 to aisle 2.

rear plenum door The door behind the two external doors in the rear of the Sun MD. This door and its surrounding wall form an air plenum through which environmentally controlled air flows from aisle 1 on the left side of the Sun MD to aisle 2 on the right side of the Sun MD.

rear service aisle door The door that is located inside the rear plenum door and provides access to the service aisle.

reliability The probability that a service, a system, or a system component will continue to satisfactorily perform its intended function at a specified point in time. The concept of reliability is classically derived from life distribution models described by the probability density function (PDF) and cumulative distribution function (CDF).

response time A measure of latency relative to the expected rate of execution.

right The right side of the Sun MD when faced from the front of the unit; this is where racks 5–8 (standard configuration) or racks 5–7 (deep-rack configuration) are located.

RJ-45 Registered Jack-45. An eight-wire connector commonly used to connect computers to local area networks (LANs), especially Ethernets.

RTU remote terminal unit. An embedded microprocessor system located inside the sensor module that is receives input from sensors throughout the Sun MD. The RTU sends control information throughout the Sun MD in response to sensor stimuli.

RS-232 Recommended Standard 232. A standard interface for connecting serial devices. This port should be used only by trained service personnel.

RS-485 Recommended Standard 485. An OSI model physical layer electrical specification of a two-wire, half-duplex, multipoint serial connection. This port should be used only by trained service personnel.

RU rack unit. A measurement inside the equipment rack. Each RU is 1.75 inches (44.45 mm). Rack units in the Sun MD are numbered from the bottom of the rack to the top of the rack.

S

scalability A measure of the ability to comply with stated service policies relative to changes in workload for a service, system, or system component.

securing pin The top mounting system for each rack consists of a pin used to help secure racks in place. The pin secures the top of the rack to a bracket mounted on the Unistrut that is above the racks.

sensor and control array The network of sensors and their controls that are in the Sun MD.

sensor module A control box mounted in the infrastructure rack that contains the Linux-based RTU. See also *RTU*.

service aisle The center walkway inside the Sun MD that is used as a service area.

service apron The space outside the Sun MD that is used to access the system and to transport hardware into and out of it.

service position The position of the payload rack when it is located in the service aisle.

shock mounts Helical springs that are mounted on skids, to which the equipment racks are mounted to absorb the shock when the Sun MD is moved.

skids The mounting plates for the shock mounts, which are located under the racks.

SLA Service Level Agreement. A contract between parties that includes both technical and legal components defining the specific service level objectives to be maintained, how they will be measured, and the penalties to the service provider for failing to maintain those levels.

slice The airflow through the racks is divided into five horizontal planes. Each plane is separated into five segments that correspond to each slice. Each segment includes two fans and a cooling core. The fans blow air through the cooling core to cool the air before it is consumed by the next rack. The slices are numbered from 1–5 starting near the floor.

SLO Service Level Objective. A measurable statement of need that expresses the desired performance and behavior for an application or service.

SLS Service Level Specification. A detailed technical description of the operational design parameters for an application or service.

smoke alarm A device that provides sensor input to the EMS and sounds an audible alarm when it senses the presence of smoke. The smoke alarm in the Sun MD is completely independent of the fire suppression system.

smoke detector Two smoke detectors are provided to report the presence of smoke in the Sun MD directly to the FCP.

SNMP Simple Network Management Protocol. A standard for gathering statistical data about network traffic and the behavior of network components. SNMP uses management information bases (MIBs), which define what information is available from any manageable network device.

SOP standard operating procedure. A set of instructions that define a standardized procedure.

SPOF single point of failure. The failure of an entire system that occurs when a single part of any system fails.

SSH Secure Shell. A client/server-based service and protocol designed to replace `rlogin`, TELNET, and `rsh` unencrypted communications with encrypted communications and protocol tunneling between two untrusted hosts over an insecure network (for example, the Internet).

SSL Secure Sockets Layer. A cryptographic protocol that provides secure communications over the Internet.

standby redundancy A system, subsystem, or component with one or more identical backups that remain in an "off" state until needed (for example, when the system is not experiencing mechanical, thermal, or electrical stress), but becomes active after some switchover time during failure mode recovery.

system A collection of hardware, software, people, or processes that are organized and operated to fulfill a business or mission objective.

system component A specific hardware, software, people, or process element of a system.

T

TEU twenty-foot equivalent unit. The size of the ISO shipping container used to build a Sun MD.

TLS Transport Layer Security. A cryptographic protocol that provides secure communications over the Internet and is intended as a replacement for SSL.

transformer A device that transfers electric energy from one alternating-current circuit to one or more other circuits, either increasing (stepping up) or reducing (stepping down) the voltage.

TVSS transient voltage surge suppression. A lightning protection box that can be added in line with the power feed to the Sun MD. A separate TVSS is needed for each power input to the Sun MD.

U

UPS uninterruptible power supply. A device that maintains a continuous supply of electric power to connected equipment by supplying power from a separate source when utility power is unavailable.

utility A company that generates, transmits, or distributes communication services, electricity, water, or gas from facilities that it owns or operates.

V

VAC volts of alternating current. A measure of force behind an electrical current.

vents The Sun MD container has four vents; both of the vents on the right side of the container, and the rear vent on the left side of the container, are sealed. The front vent on the left side is left open to aide in atmospheric pressure equalization. The open vent has a HEPA filter.

VESDA Very Early Smoke Detection Apparatus. A system that samples the air inside the Sun MD on a continuous basis and can detect fire at the precombustion stage. This type of system aspirates the smoke from various locations into a tube where the smoke is analyzed electro-optically by a line of sight transmitter-receiver set.

VLAN virtual local area network. A collection of devices that can communicate on the same broadcast domain. VLANs can be based on a physical port, layer-2 mac-address, or layer-3 protocol.

W

water connectors The supply and return fittings for bringing water into and out of the Sun MD. There are two sets of connectors; one on the left side and one on the right side of the container. These pairs of connectors are not redundant, they are strictly for hookup convenience.

water I/O boxes The boxes located on the left side and right side of the Sun MD that contain the water connectors. These boxes are referred to as the left water I/O box and the right water I/O box.

watts Multiplying amps times volts equals the total measurement of power or watts.

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