Site Planning Guide for Entry-Level Servers Version 1.3

Sun Enterprise™ 250 Server

Sun Fire™ 280R Server

Sun Fire V480 Server

Sun Fire V880 Server

Sun Fire V440 Server

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Preface

This guide is designed to assist Sun customers who have purchased Sun entry-level servers and who seek information about the proper way to house the servers in a data center. It provides information about the servers' environmental requirements, power consumption, cooling requirements, electrical specifications, and space requirements after the servers are mounted in Electronic Industries Association (EIA)-compliant cabinets or racks.

The Sun entry-level servers covered in this guide are:

- Sun Enterprise™ 250
- Sun Fire™ 280R
- Sun Fire V480
- Sun Fire V880
- Sun Fire V440

The material in this guide is correct as of the date of publication. For the most up-to-date information, refer to the Sun Microsystems web site for your product.

Other Resources

This manual is not intended as a comprehensive guide to facility design. Customers planning to construct a new data center should read the *Sun Microsystems Data Center Site Planning Guide* before reading this manual. Some of the material in this manual is summarized from the *Sun Microsystems Data Center Site Planning Guide.*

Another resource for data center design is *Enterprise Data Center Design and Methodology* by Rob Snevely. This is a Sun BluePrints™ book, published by Sun Microsystems Press, a Prentice Hall title. You can find information about this book and other BluePrints books at:

`http://www.sun.com/books/blueprints.series.html`

How This Book Is Organized

Chapter 1 describes site planning assistance that is available from Sun, site planning process and concepts, data center location, and route to the data center.

Chapter 2 explains environmental requirements of the data center, including temperature, humidity, cooling, and airflow.

Chapter 3 gives information about rackmounting the servers and how to locate rows of racks in the data center.

Chapter 4 discusses power and cooling issues relating to the servers, including power sources and heat output and cooling requirements.

Chapter 5 lists shipping, physical, configurations, electrical, environmental, rackmounting, and clearance for service specifications for the servers. It also provides specifications for Sun cabinets.

Chapter 6 provides a site planning checklist that you can use when planning your data center and preparing for system installations.

Metric and English Conventions

This guide provides measurements in both metric and English equivalents. To follow current industry usage, metric measurements are sometimes given first, followed by the English equivalent in parentheses. However, there are industry-acceptable exceptions to this usage. For example, racks are still referred to as “19-inch” racks rather than “48.26-cm” racks, and rack units (RU) are measured in inches. Use whichever unit of measurement best suits your needs.

Related Documentation

Application	Title	Part Number
Facility planning	*Sun Microsystems Data Center Site Planning Guide*	805-5863
	Enterprise Data Center Design and Methodology	See BluePrints URL
Rackmounting	*Sun Enterprise 250 Server Rackmounting Guide*	805-3611
	Sun Fire 280R Server Setup and Rackmounting Guide	806-4805
	Sun Fire V480 Server Setup and Rackmounting Guide	816-0902
	Sun Fire 880 Server Rackmounting Guide	806-6594
	Sun Fire V880 Server Rackmounting Guide for Sun Rack 900	817-2779
	Sun Fire V440 Server Installation Guide	816-7727
	Sun Fire V440 Server 2-Post Rackmounting Guide	817-0952

Application	Title	Part Number
Configuration	*Sun Enterprise 250 Server Owner's Guide*	805-5160
	Sun Fire 280R Server Owner's Guide	806-4806
	Sun Fire V480 Server Administration Guide	816-0904
	Sun Fire 880 Server Owner's Guide	806-6592
	Sun Fire V440 Server Administration Guide	816-7728
Sun cabinets	*Sun Rack 900*	See Sun Rack 900 URL
	Sun Rack 900 Installation Manual	816-6386
	Sun Rack 900 Service Manual	816-6387
	Sun StorEdge Expansion Cabinet Installation and Service Manual	805-3067
	Sun Fire Cabinet Installation and Reference Manual	806-2942
Web sites	Entry-level servers: `http://www.sun.com/servers/entry`	

	Site planning support:
	`http://www.sun.com/service/support/install/index.html`
	`http://www.sun.com/service/support/environment/`	

	Sun Rack 900: `http://www.sun.com/servers/rack`	
	Racks: `http://www.sun.com/servers/entry/rackmount`	
	Sun BluePrints documents: `http://www.sun.com/books/blueprints.series.html`	

Accessing Sun Documentation

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`http://www.sun.com/documentation`

Contacting Sun Technical Support

If you have technical questions about products that are not answered in this document, go to:

`http://www.sun.com/service/contacting`

Sun Welcomes Your Comments

Sun is interested in improving its documentation and welcomes your comments and suggestions. You can submit your comments by going to:

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

Site Planning Guide for Entry-Level Servers Version 1.3, part number 816-1613-13

CHAPTER 1

Site Preparation

This chapter provides an overview of the site planning process. It also describes some of the services that are available from Sun to help you plan and monitor your data center. This chapter offers basic information about issues relating to the data center location, system configurations, and the route to the data center.

This manual includes information only about these Sun servers:

- Sun Enterprise™ 250
- Sun Fire™ 280R
- Sun Fire V480
- Sun Fire V880
- Sun Fire V440

Go to this web site for more information about these servers:

`http://www.sun.com/servers/entry`

Site Planning Assistance From Sun

Sun takes a preemptive approach to maximizing system performance by providing services that can help you to properly evaluate your data center site, and install and configure your systems. With the appropriate Sun℠ Services agreement, you can choose the best services for your installation, which might include the following:

- Sun Enterprise Installation Services
- Sun Environmental Services

Sun Enterprise Installation Services

Using the Sun Enterprise Installation Services methodology, Sun technicians and engineers can help you to develop a stable data center site and equipment installations that provide the foundation for system reliability, availability, and serviceability. Sun Enterprise Installation Services are delivered in these phases:

- **Site audit** - (via telephone) Sun reviews your data center environmental and installation requirements.
- **Installation planning** - (via telephone) Sun and customer plan and document the installation schedule, resources, delivery dates, installation dates, and system setup requirements.
- **System installation specification** - Sun maps out the systems' installation requirements, confirms your installation acceptance criteria, and verifies that preinstallation tasks are complete.
- **Installation and configuration of Sun hardware and software** - Sun performs the following installation tasks:
  - Reviews the packing list
  - Installs all internal and external components
  - Sets SCSI devices for all drives
  - Powers up and tests all hardware components
  - Partitions the operating system disk(s) on defined defaults
  - Installs and configures the Solaris™ operating environment as an NFS file server
  - Installs all applicable software patches
  - Configures system hostname, IP address, NIS / NIS+ domain, and netmask, as applicable
  - Adds heterogeneous file systems support
  - Installs and configures CDE or NFS mount if remote
  - Sets up log host and system controller
  - Installs up to three unbundled software products
  - Sets up standard UNIX mail host and default routes
  - Configures as Domain Name Service client
- **Installation verification** - Sun performs level-0 backup of system disk(s) and mails installation data files to appropriate Sun aliases.
- **System turnover** - Sun and customer review the installation and associated documentation, and customer signs off that the installation is acceptable.

For more information about Sun Enterprise Installation Services, go to:

`http://www.sun.com/service/support/install/index.html`

Sun Environmental Services

To help you monitor, analyze, improve, and control environmental conditions in your data center, Sun provides Sun Environmental Services. By assessing your environment to finding potential causes of downtime, Sun can help you maintain the operating conditions in your data center so that your systems can perform optimally. Sun Environmental Services include the following:

- **Environmental System Inspection Services** - Provides you with a detailed evaluation of select Sun machines, outlining possible effects that the physical environment has on system availability. An environmental specialist will collect specific environmental, infrastructure, and planning information regarding your site to identify potential issues that could increase the threat of degraded performance. This service includes an inspection of the data processing area for temperature, humidity, airflow, cabling access to equipment, physical specifications, contamination, cleaning activities, and electrostatic discharge procedures. The result of the inspection is a report that outlines the data, provides recommendations for improvement or further inspection, and gives a summary of Sun data center best practices.
- **Environmental Assessment Services** - Provides a comprehensive evaluation of your data center environment. Unlike the Environmental System Inspection Services, which target specific Sun systems, the Environmental Assessment Services encompasses all systems, regardless of manufacturer, and the entire data center. By conducting detailed tests, making field observations, and interviewing site personnel, environmental experts focus on conditions that can impact the reliability of your systems, either by determining sources of existing problems or identifying potential susceptibilities before they impact hardware operations. An onsite environmental assessment measures and analyzes temperature, humidity, cleanliness, environmental monitoring and control equipment, hardware placement and configuration, contaminants, and equipment grounding. The results are compiled in a report that includes detailed recommendations for an improved data center environment and system performance.
- **Environmental Monitoring and Remediation Services** - Further environmental services might be recommended as a result of findings in your Assessment Services. Based on your needs, you can choose from a full complement of monitoring and remediation services to help eliminate existing and potential threats to system reliability and uptime.

For more information about Sun Environmental Services, go to:

`http://www.sun.com/service/support/environment/`

`http://www.sun.com/service/servicelist/`
(after opening your locale page, look under Support Services)

Site Planning Process

Customer facility managers, system administrators, and Sun account managers need to discuss site planning, preparation, and system installation before delivery of the systems. A common understanding of how the systems will be delivered, configured, installed, and maintained will help to create a suitable facility and successful installation of the servers and related equipment.

Use the following general steps as a guide to plan your installation. Use the more detailed Site Planning Checklist in Chapter 6 to verify that you have met all the site requirements outlined in this manual.

1. Determine which systems you plan to install and how you want to configure them.
2. Select the cabinets and racks that you will use.
3. Determine the location and physical space requirements of the systems, cabinets, and racks.
4. Determine the amount of power required by the systems and any other equipment installed in each cabinet or rack.
5. Determine the amount of cooling required by the systems and any other equipment installed in each cabinet or rack.
6. Ensure that the data center can support the electrical and environmental requirements of the systems.
7. Obtain the power and networking cables required by the systems, cabinets, and racks.
8. Obtain all the required hardware not provided with the systems or racks.
9. Verify that the route from the unloading dock to the computer room is sufficient to allow moving systems, racks, and related equipment.
10. Complete the Site Planning Checklist found in Chapter 6.

Data Center Location

Whether a dedicated facility or part of a multipurpose building, the location of the data center needs special consideration. The raised floor space, air conditioning, power supply equipment and generators, and related support equipment must be positioned within the data center in a way that best meets the demands of the servers and other mission-critical equipment.

When determining the location of the data center, consider the following issues:

- **Contaminants** - Isolate the data center from activities that could contaminate the environment. Ensure that the air intake for the data center is clean. Maintain airborne dusts, gasses, and vapors within defined limits for data center environments to minimize their impact on the systems.
- **Access** - Ensure that there is adequate access to the data center from the loading dock, freight elevator, or other equipment entrances.
- **Security** - Provide secure points of entry to the data center so that only the proper personnel have access to the equipment.
- **Raised flooring** - Design the raised flooring to consolidate cabinets and racks and to maximize access to support equipment and cables.
- **Room temperature and humidity** - Ensure that the data center has the required air conditioning equipment to adequately cool the systems. The data center should provide a stable ambient temperature and relative humidity that fall within the system operating specifications and that provide operator comfort.
- **Airflow** - Consider the intake and exhaust airflow of the systems in the data center. Ensure that the airflow in the room does not compromise the cooling of equipment in the room.
- **Aisle space** - Provide adequate room at the front and back of the cabinets and racks to allow unobstructed servicing of the systems and clear passage for personnel.
- **Expansion room** - Design the data center in a way that can accommodate future equipment expansion. Include resources that can provide additional power, environmental support, and floor usage.

When designing the data center, create a floor plan illustration that shows the location of all computing and environmental support equipment, including:

- Placement of Sun equipment
- Rack orientation
- Placement of air conditioning units
- Placement of perforated floor tiles
- Service areas
- Data center access doors

System Configurations

The first step in the installation process is to determine the hardware configuration for each server you plan to install. You can obtain advice about your system configuration from your Sun account manager or Sun authorized sales representative. You can obtain system documentation before receiving your system by downloading product information and manuals from the Web. See “Accessing Sun Documentation” on page xv. Alternatively, you can consult the documentation provided with your systems for information about supported configurations.

In some facilities there will be many different configurations of the same server model; in others, multiple configurations of different server models. Each server should be accounted for separately because each server requires a specific amount of power and a specific amount of cooling. Future server upgrades and other modifications will be easier if you keep a written record of each server’s configuration.

It may be prudent to plan your facility using data for maximally configured systems. There are several ways in which maximum system configuration data is useful.

- Facility managers can use this data to quickly calculate the most demanding set of conditions for weight, power, and air conditioning load. This data is helpful for planning purposes early in a facility construction cycle.
- Many customers buy servers configured for present needs but realize that future demands will require server upgrades. Since the specifics of such upgrades are often difficult to predict, some customers elect to make facility planning decisions based on maximum configuration data from the start. One benefit of this approach is that it minimizes subsequent facility disruptions.
- Maximum configuration data can also help you when you select racks and cabinets and determine how to route electrical circuits.
- Maximum configuration data helps you to plan for auxiliary power or backup power, and to plan for power grid independence if continued uptime is required.

It is important for data center designers not to use the systems’ nameplate power ratings when calculating existing power consumption and heat load. The *nameplate ratings* indicate the servers’ hardware limits for maximum power draw that the systems can support. This information is useful if you add future components that significantly affect power specifications. Instead, for current data center planning, rely on maximum *system configuration* data, which you can obtain from your Sun account manager or Sun authorized sales representative.

TABLE 5-3 provides some of the components of base system configurations. There are many more standard and optional components associated with these configurations. Therefore, the system components comprising the three levels of base configurations will vary depending on the components that you choose for your server. TABLE 5-4 provides electrical specifications for the systems.

Route to the Data Center

Most cabinets and racks ship in their own containers on a pallet. Make sure that the facility loading dock and unloading equipment can accommodate the height and weight of the cabinets, racks, and servers while in their shipping packages. See TABLE 5-1 for shipping specifications for the servers and TABLE 5-11 for shipping specifications for three Sun cabinets.

Inspect all shipping cartons for evidence of physical damage. If a shipping carton is damaged, request that the carrier's agent be present when you open the carton. Save the original shipping containers and packing materials in case you need to store or ship the system.

When you plan your route to the data center, make sure that the boxed cabinets, racks, and servers can fit through doors and hallways, and on elevators. Also make sure that the route floor and elevators can support the weight of the cabinets, racks, and servers. The route to the data center should have minimal ramps, minimal sharp angles, few bumps, and no stairs.

Do not unpack the servers or racks in the data center. Dirt and dust from the packing materials can contaminate the data center environment.

CHAPTER 2

Environmental Requirements

Computer system reliability is dependent upon a stable environment. The design of the environmental control system for your data center must ensure that each system can operate reliably while remaining within the range of its operating specifications.

Accurate and comprehensive monitoring of environmental support equipment and in-room conditions is extremely important in a sensitive data center environment. The monitoring system should have historical trend capabilities. Analyzing historical trend information is instrumental when determining seasonal changes or other contributing influences. Also, the environmental control system should have critical alarm capabilities. The system must be able to notify the appropriate personnel when conditions move outside of the systems' established operating specifications.

Operating Specifications

TABLE 5-5, TABLE 5-6, TABLE 5-7, and TABLE 5-8 list the environmental specifications for the servers described in this guide. These specifications might seem broad for data center equipment. However, the operating ranges apply to the absolute hardware limits and the extreme ranges should not be considered guidelines for normal, continuous operation. While the servers can operate in diverse locations and within a wide range of environmental conditions, stringent control over temperature, humidity, and airflow is necessary for *optimal* system performance and reliability.

Temperature

An ambient temperature range of 21 to 23 ºC (70 to 74 ºF) is optimal for system reliability and operator comfort. While most computer equipment can operate within a rather broad range, a temperature level near 22 ºC (72 ºF) is desirable because it is easier to maintain a safe associated relative humidity level at this temperature. Further, this recommended temperature provides an operational buffer in case the environmental support systems are down.

Note that the operating temperature range for the servers is either 5 to 40 ºC (41 to 104 ºF) or 5 to 35 ºC (41 to 95 ºF). These temperatures apply to the air taken in by each server *at the point where the air enters the server,* and not necessarily the temperature of the air in the aisles. To check the temperature of the air entering the servers, measure the temperature at 2 inches (5 cm) from the front of the equipment.

It is also important to verify that the temperatures midway vertically and across the aisles are within the servers' operating temperature ranges. These measurements are necessary because temperatures in the data center are different depending on where in the room the measurements are taken. The heat load in the data center can vary depending on the density of heat-producing equipment located within the room. Aisle temperatures can give you a first-level alert to conditions in the data center.

When measuring aisle temperature, place multiple temperature sensors within the data center. It is usually sufficient to place one sensor for every 30 feet (9 m) of aisle space. Avoid placing sensors in areas that are exposed to drafts or other uncontrolled airflow.

Also measure the rate of temperature changes within a 60-minute period. Conditions should not be allowed to change by more that 5.5 ºC (10 ºF) or 10% relative humidity during a 60-minute period. If you detect fluctuations, measure conditions over a 24-hour period and compare results against historical data to analyze trends. Make sure that the sensors provide a detailed and representative temperature profile of the room. By continuously monitoring aisle temperatures, you can guard against changes that could affect the optimal temperature range of the systems' intake air.

Also avoid cooling *short cycles,* which can occur if perforated tiles or grilled tiles are placed between the air conditioners and the nearest heat-producing equipment. If tiles are layed out in that way, cold air returns to the air conditioner without circulating through the equipment. The air conditioner might register that temperatures in the room are cooler than is actually the case. The air conditioner might cycle out of its cooling mode while temperatures in the room still call for cooler air.

Acclimatization

When determining how long you must allow a system to acclimatize after delivery to the data center, and before power can be applied to the system without causing damage, you should compare the temperature and humidity of the environment in which the system had been stored to the conditions in the data center. Equipment damage can occur if the *rate* of temperature or humidity change is too great. The maximum positive or negative temperature gradient that is recommended for multilayered boards is approximately 2 ºC (4 ºF) per hour. The same consideration applies to humidity; it is best to have a slow rate of change.

If it is necessary to compensate for significant temperature or humidity differences between the systems and the data center, place the systems, in their shipping containers, in a location that has a similar temperature and humidity environment as the data center. Wait at least 24 hours before removing the systems from their shipping containers to prevent thermal shock and condensation.

Humidity

Relative humidity (RH) is the amount of moisture in a given sample of air at a given temperature in relation to the maximum amount of moisture that a sample could contain at the same temperature. A volume of air at a given temperature can hold a certain amount of moisture. Because air is a gas, it expands as it is heated. As air gets warmer, its volume increases and the amount of moisture it can hold increases, thus causing its relative humidity to decrease.

Ambient relative humidity levels between 45% and 50% are most suitable for safe server operations. This optimal range also provides the greatest operating time buffer in the event of an environmental control system failure.

Data center equipment is particularly sensitive to high humidity levels. When relative humidity levels are too high, water condensation can occur, which can lead to hardware corrosion problems.

Further, maintaining a relative humidity level between 45% and 50% helps avoid system damage or temporary malfunctions caused by intermittent interference from electrostatic discharge (ESD), which occurs when relative humidity is too low. Electrostatic discharge is easily generated and less easily dissipated in areas where the relative humidity is below 35%, and becomes critical when relative humidity drops below 30%.

Though the 20% to 80% RH operating specifications for the servers are wide, conditions should be maintained near the optimal relative humidity levels. Extremes within the 20% to 80% RH range can lead to unacceptable conditions. For instance, if very high temperatures are maintained with very high humidity levels, condensation can occur, which can cause corrosive equipment damage. If very low temperatures are maintained with very low humidity levels, even a slight rise in temperature can lead to unacceptably low relative humidity levels.

Cooling and Airflow

Data centers have different cooling and airflow capacities, often depending on when the data center was built and the requirements it was designed to meet. When designing a data center, you should consider the facility's heating, ventilation, and air conditioning (HVAC) capacity so that equipment in fully populated cabinets and racks can be adequately cooled.

Typically, a cabinet footprint requires 12 square feet (1.115 sq. m). However, cooling measurements are calculated using the gross square footage required by the cabinets or racks, which is not just the area where cabinets or racks are located. The measurement includes aisles and areas where power distribution, ventilation, and other facility equipment is located. Gross square footage is estimated to be 20 square feet (1.858 sq. m) per cabinet or rack.

For example, a data center may provide 100 watts per square foot of cooling capacity using air conditioners. Based on 100 watts per square foot and 20 square feet (1.858 sq. m) per cabinet, each cabinet is allowed a cooling capacity of 2000 watts (100 watts x 20 sq. ft.) or 2 kW. Remember, 2 kW per cabinet in a data center is only an example. Some cabinets may require 3 kW or more of cooling capacity. See "Heat Output and Cooling" on page 34 for more information about cooling requirements.

It is also important to consider the intake and discharge airflow required to cool the systems. All of the servers described in this guide draw in ambient air for cooling from the front and discharge heated exhaust air to the rear. Ensure that the air conditioning equipment can adequately move air down the aisles so that heated air does not flow over the cabinets and racks to the front of the systems.

Measure airflow speed in different zones of the floor to determine whether the existing airflow pressure is sufficient to provide the necessary conditioned air to the systems. Take measurements every 13 to 16 feet (4 to 5 m). Measurements taken at lesser distances might not be able to detect a significant pressure difference. The recommended airflow speed ranges between 10 to 13 feet (3 to 4 m) per second.

This airflow speed will facilitate an adequate change of conditioned air down the aisles. While a typical office environment might require only two air changes per hour, the high-density heat load in the data center can require as many as 30 air changes per hour. If airflow pressure is inadequate, the conditioned air will heat up before it reaches the areas in need of cooling.

See “Airflow” on page 34 for more information about the servers’ airflow requirements. See “Cabinet Location” on page 25 for information about how to locate cabinets and racks in the data center to ensure proper airflow for the servers.

Vibration and Shock

Make sure that your installation adequately protects equipment from excessive vibration and shock. When installing systems of different types in the same cabinet or rack, be sure that the overall vibration and shock characteristics do not exceed those of the system with the lowest vibration and shock specifications. For example, if you are installing two different types of systems in the same cabinet, and one system can tolerate 4 g peak shock, and the other system can tolerate 10 g peak shock, make sure that vibration of your cabinet does not exceed 4 g peak shock. TABLE 5-7 and TABLE 5-8 describe vibration and shock specifications for the systems covered in this guide.

Contaminants

The impact of contaminants on sensitive electronic equipment is well known, but the most harmful contaminants are often overlooked because they are so small. Most particles smaller than 10 microns are not visible to the naked eye. Yet it is these particles that are most likely to migrate to areas where they can do damage.

Some sources of contaminants include the following:

- **Personnel activity** - Human movement within the computer room is probably the single greatest source of contamination in an otherwise clean room. The opening and closing of drawers or hardware panels or any metal-on-metal activity can produce metal filings. Simply walking across the floor can agitate settled contaminants making them airborne and potentially harmful.
- **Hardware movement** - Hardware installation or reconfiguration involves a great deal of onfloor and subfloor activity, and settled contaminants can be disturbed, forcing them to become airborne.

- **Stored items** - Storage and handling of unused equipment or supplies are also a source of contamination. Cardboard boxes or wooded skids shed fibers when moved or handled.
- **Cleaning activity** - Many chemicals used in office cleaning solutions can damage electronic equipment. Gases from these products or direct contact with the hardware can cause component failure. Solutions that can damage hardware include chlorine-based products, phosphate-based products, bleach-enriched products, petrolchemical-based products, and floor strippers or reconditionsers.

CHAPTER 3

Rackmounting the Systems

The Electronic Industries Association (EIA) establishes standards for cabinets and racks intended for use with computers and other electronic equipment. All of the servers discussed in this guide are designed for rackmounting in cabinets or racks that comply with the EIA 310D standard.

Cabinet and Rack Terminology

The terms *cabinet* and *rack* are sometimes used interchangeably, which is incorrect. Computer cabinets are fitted with doors and side panels, which may or may not be removable, and are available in a very wide variety of sizes and colors. Most cabinets provide connections for electrical power. Some cabinets provide fans and baffles designed to move cooling air in a specified direction and often, at a specified rate. Others provide electromagnetic interference (EMI) and radio frequency interference (RFI) shielding to meet standards established by various regulatory agencies.

Cabinets enclose a rack, which is a frame that provides a means for mounting electronic equipment. Racks can also stand alone and do not require the doors, panels, and other integrated equipment that comes with cabinets. Racks come in different types. One type consists of two vertical rails, which are not enclosed by cabinet doors and panels. Another, and more common type, consists of four vertical rails, which may or may not be enclosed by cabinet doors and panels.

You can mount the Sun Fire V480 server and the Sun Fire V440 server in either a 4-post rack or a 2-post rack, using optional two-post rackmounting kits. The racks used for mounting the other servers covered in this guide consist of four vertical mounting rails. The servers are attached to mounting hardware, and the mounting hardware is secured to the rack's front and back vertical rails. FIGURE 3-1 shows Sun servers mounted in a cabinet and rack.

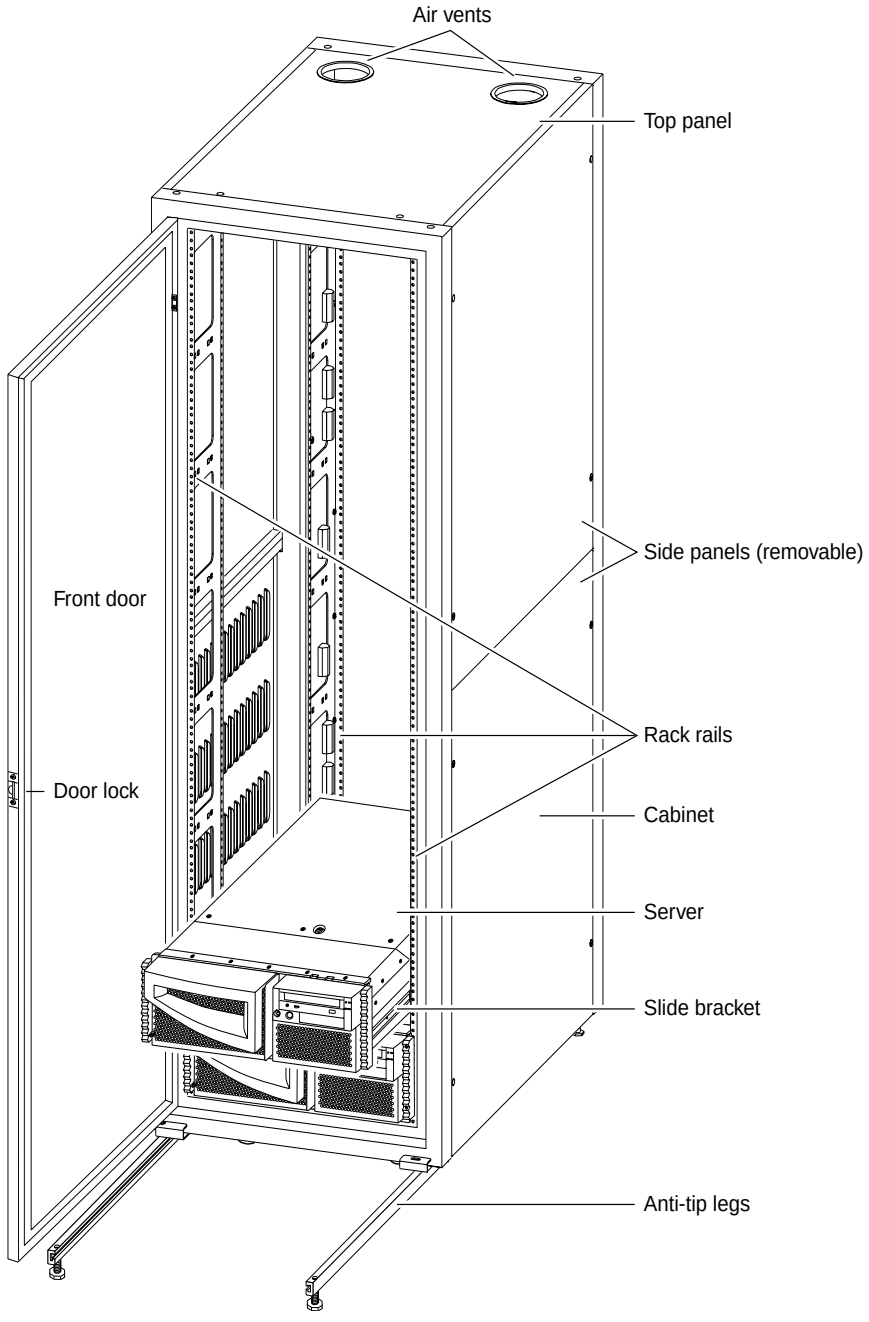


FIGURE 3-1 Systems Mounted in a Cabinet and Rack

Cabinet and Rack Manufacturers

Cabinets and racks are available from Sun Microsystems and other companies. Your system may require a rackmount kit to enable installation into certain cabinets or racks. Contact your Sun account manager or Sun authorized sales representative for details.

Sun Cabinets and Racks

Sun Microsystems offers EIA 310D-compliant cabinets for mounting the servers. Sun cabinets are designed and tested with some configurations of Sun equipment. Any limitations on mixing Sun products in the cabinets are also known and documented. Contact your Sun account manager or Sun authorized sales representative for details about which servers are qualified for a specific cabinet.

One of the newer cabinets from Sun is the Sun Rack 900. This cabinet is designed to hold both servers and storage products. This flexibility can help you to better utilize floor space and to reduce administrative costs because you can mount a greater variety of products in the Sun Rack 900 than was previously possible with other cabinets.

The Sun Rack 900 provides you with options for power, front door, filler panels, cables, and so forth, which enable you to configure the cabinet to fit your needs. The optional power distribution system (PDS) consists of two independently powered sequencers. Each power sequencer consists of two power outlet strips, each with 24 outlets, providing 48 outlets to systems. The PDS does not use any rack units (RU) of available product space when installed in the Sun Rack 900.

The Sun Rack 900 can be populated with products while on the shipping pallet and sent to you as an integrated system solution. For information about products qualified by Sun to rackmount in the Sun Rack 900, go to:

`http://www.sun.com/servers/rack/approved.html`

For further information about the Sun Rack 900, go to:

`http://www.sun.com/servers/rack`

Another Sun cabinet is the Sun StorEdge Expansion Cabinet. See the *Sun StorEdge Expansion Cabinet Installation and Service Manual* for information about this enclosure. A third cabinet is the Sun Fire Cabinet. See the *Sun Fire Cabinet Installation and Reference Guide* for information.

TABLE 5-11, TABLE 5-12, and TABLE 5-13 contain specifications for the three cabinets.

Third-Party Cabinets and Racks

While Sun makes no representations about the products of other companies, it is clear that other companies offer cabinets and racks valued by some Sun customers. For information about some of these third-party cabinets and racks, go to:

`http://www.sun.com/servers/entry/rackmount`

Cabinet, Rack, and Server Dimensions

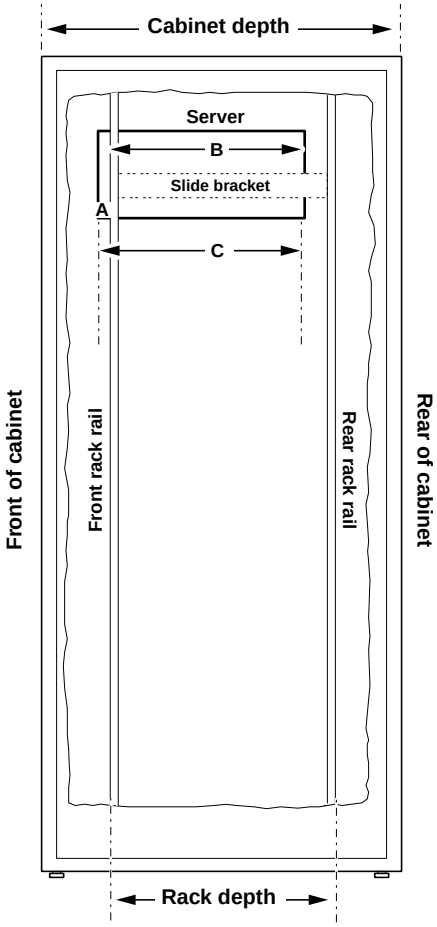
Because the terms *rack* and *cabinet* are sometimes used interchangeably, much confusion exists about the proper way to measure cabinets and the proper way to measure racks. Cabinets are traditionally referred to by their external dimensions. Most newer cabinets have depths of 32 or 36 inches (81.28 or 91.44 cm). In most cases, the rack depth is 4 to 6 inches (10.6 to 15.25 cm) less than the external cabinet depth.

To measure the rack depth, measure the horizontal distance from the forward-most part of the front rail to the rear-most point of the rear rail. TABLE 5-10 provides the depths of the servers, the rackmounting depth ranges for the servers when using Sun rackmounting equipment, and the recommended cabinet depths.

Third-party cabinet manufacturers typically recommend 34-inch (86.36-cm) or greater cabinets for use with servers that have an average depth of 28 inches (71.12 cm), and 39-inch (99.06-cm) or greater cabinets for use with servers that have an average depth of 33 inches (83.82 cm). The approximate 6-inch (15.24-cm) space at the back between the server and back cabinet door allows for cable management, airflow, and service access.

Rack widths are specified in the EIA 310D standard. Available widths include 19 inches (48.26 cm), 23 inches (58.42 cm), 24 inches (60.96 cm), and 30 inches (76.2 cm). All servers covered by this guide are designed for mounting in 19-inch (48.26-cm) wide racks that comply with the EIA 310D standard. However, you can rackmount some of the servers in racks of other widths using adapter hardware. Contact your Sun account manager or Sun authorized sales representative for further information.

FIGURE 3-2 illustrates the proper way to measure cabinet, rack, and server depths.



A = Depth of the server in front of the front rack rail
B = Depth of server from the forward-most part of the front rack rail to the rear-most part of the server
C = Total depth of server

FIGURE 3-2 Measuring Cabinet, Rack, and Server Depths

Rack Units

Be certain that there is sufficient vertical mounting height for the servers and other equipment you plan to mount in the rack. The vertical mounting space in EIA 310D-compliant racks is defined in rack units (RU). One RU is equal to 1.75 inches (4.45 cm). The number and type of systems you can mount in a rack is determined by the number of RU the systems require, as well as the amount of power available to the systems.

The rack rail holes on a standard rack are arranged in sets of three holes, spaced vertically 5/8, 5/8, and 1/2 of an inch apart. FIGURE 3-3 shows some of the features, the dimensions, and rack unit spacing of an EIA 310D-compliant cabinet and rack.

TABLE 5-9 gives the number of RU that each system requires.

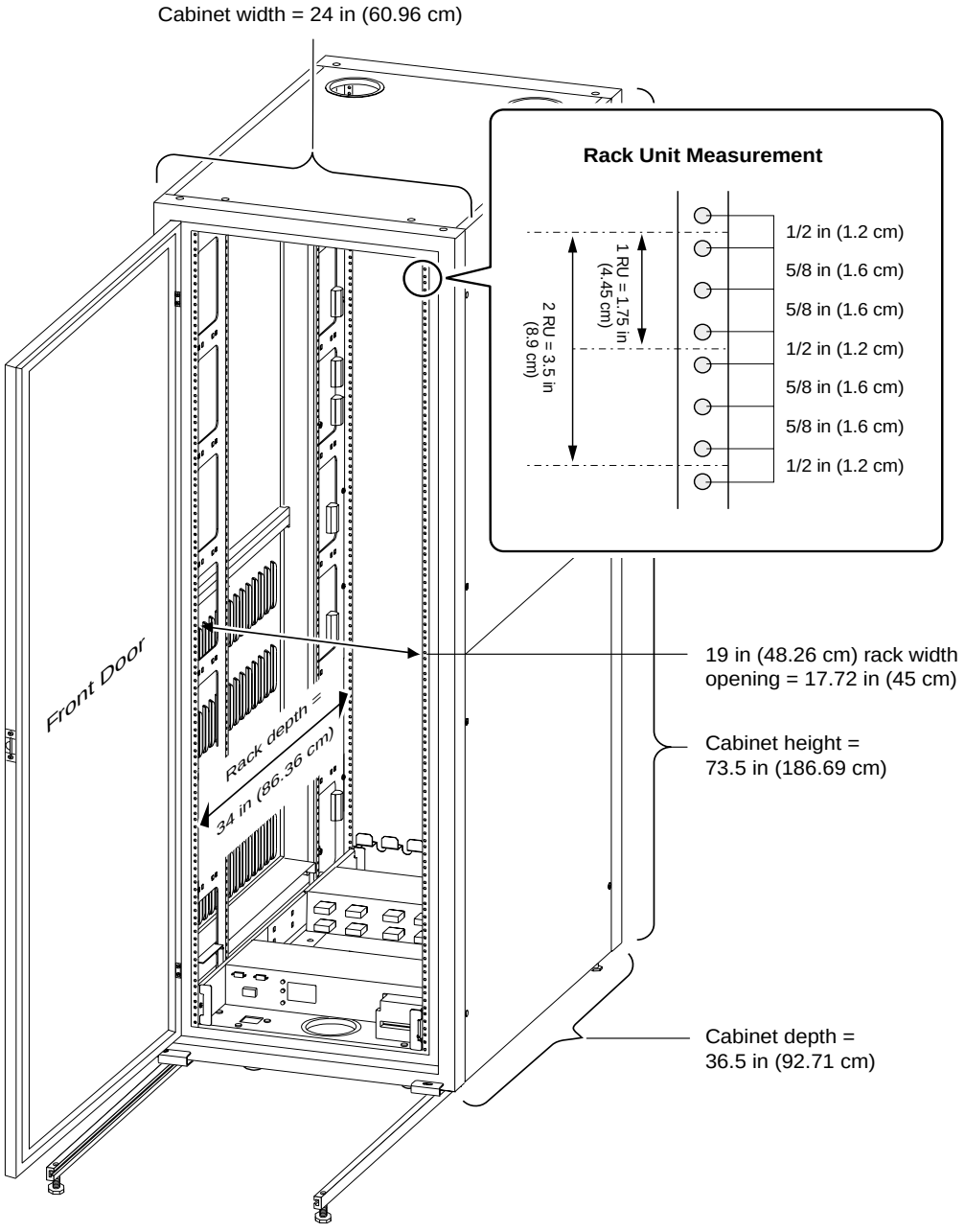


FIGURE 3-3 EIA 310D-Compliant Cabinet and Rack

Other Cabinet and Rack Features

Cabinet Doors and Panels

Determine which cabinet doors and panels you will need to properly mount equipment at your site. The Sun servers discussed in this guide come with lockable doors or panels. Most cabinets, however, are available with locking doors, which provide an additional measure of security. Some cabinets have rear doors and some have side panels. Typically, if several cabinets are located in a row, side panels are only attached to the two end units.

All of the servers described in this guide draw in ambient air for cooling from the front and discharge heated exhaust air to the rear. Make sure that any front or back cabinet doors are at least 63% open to allow adequate airflow. This can be accomplished by removing the doors, or by ensuring that the doors have a perforated pattern that provides at least 63% open area. In addition, maintain a minimum 3.8-cm (1.5-inch) clearance between the systems and any front or back cabinet doors.

Static Load Capacity

Calculate the weight of the servers and other equipment you plan to mount in a given cabinet or rack. Then, be sure that this weight falls within the static load capacity of the enclosure. The weight of a given cabinet or rack includes the weight of all servers and other equipment installed in it, plus the weight of the cabinet or rack itself. The approximate weights of systems covered in this manual are provided in TABLE 5-2. The static load capacities of the Sun Rack 900, Sun StorEdge Expansion Cabinet, and Sun Fire Cabinet are listed in TABLE 5-12.

It is important to determine whether the strength of the data center floor is sufficient to support the weight of all the cabinets and racks that you will install, after they are fully populated with systems and other equipment. Consult a qualified structural engineer to evaluate the locations of the cabinets and racks in the data center.

EMI and RFI Requirements

All Sun entry-level servers comply with all electromagnetic interference (EMI) and radio frequency interference (RFI) shielding requirements for a computer room environment. The servers do not rely on the cabinet for EMI or RFI shielding. Other equipment that you include in the cabinet might depend on the cabinet for proper EMI or RFI shielding. The Sun cabinets achieve this by retaining EMI and RFI within the cabinet. It is a best practice to house devices that radiate EMI or RFI in cabinets that are separate from the server cabinets.

The servers comply with the following U.S. Federal Communications Commission (FCC) Part 15 Rules for Class A or Class B operation. Class A operation describes equipment operated in a commercial environment; Class B operation describes equipment operated in a residential environment.

- Sun Enterprise 250 - Class B
- Sun Fire 280R - Class A
- Sun Fire V480 - Class A
- Sun Fire V880 - Class A
- Sun Fire V440 - Class A

Power Sequencers

Power sequencers are devices that provide sequential power to the available outlets on the sequencer. When power is available, not every outlet may be powered on at the same time. For instance, if the sequencer has 10 outlets, outlet 1 may be powered on, then one second (arbitrary number) later, outlet 2 is powered on, and then another second later outlet 3 is powered on.

The Sun cabinets come with two power sequencers, which enable AC input fault tolerance when each sequencer is connected to a different power source. In this way, the sequencers can provide some power redundancy for the servers. In addition, the power sequencers provide a limited amount of power conditioning. See TABLE 5-13 for the power sequencer specifications.

Be sure that there is a sufficient number of power outlets within reach of the power cords for each server and for the cabinet's power cords. See TABLE 5-2 for the lengths of the power cords for the servers.

Do not use extension cords or plug-in power strips in your installation.

See Chapter 4 for further information about the power requirements of the servers.

Stabilization

Each cabinet or rack must be bolted securely to the floor or be equipped with extendable anti-tip legs in order to keep it from tipping forward when a server or other equipment is extended out the front of the rack. For added stability, extend only one system out of the rack at a time. Always install systems in the rack from the bottom up to help stabilize the cabinet.

Fire Containment

A fire in the data center can cause catastrophic damage to the equipment and the building structure. Take the following precautions to minimize the risk of a fire:

- **Avoid unnecessary storage** - Do not store combustible materials in the data center. Remove packing materials and other unnecessary materials as soon as possible.
- **Check the electrical system insulation periodically** - Breakdowns in insulation and the resultant short circuiting can lead to intense heat that can melt materials or cause a fire.
- **Check heat recoils on the air conditioners periodically** - If left unused for a long time, these recoils can collect layers of dust that can ignite when the unit is turned on.
- **Inspect the data center perimeter** - Look for any openings that could expose the data center to hazardous areas.
- **Install an automatic fire detection system** - Use a fire detection system that is sensitive to smoke and other products of combustion rather than solely temperature in the room. Also install manual fire alert stations and provide fire extinguishers throughout the data center.
- **Create detailed disaster response plans** - Train personnel in how to respond in the event of a fire.

The cabinet or rack must meet Underwriters Laboratories, Inc. and TUV Rheinland of N.A. requirements for fire containment. See the server documentation for specific requirements.

Location and Space Requirements

There are several matters to consider when planning the location of rackmounted systems in a data center. Typically, service access to the rackmounted systems is from the front and cable management from the rear. For future planning, consider whether the location and space provisions of your equipment provide a reasonable amount of room for expansion.

Cabinet Location

When planning the floor space utilization of your facility, be aware that a typical cabinet occupies 12 square feet (1.115 sq. m) of floor space, which corresponds to three tiles, each tile measuring 2 x 2 feet (0.61 x 0.61 m). When room for aisles, power distribution equipment, air conditioners, and other facility equipment is included, floor space utilization may equal 20 square feet (1.858 sq. m), or five tiles, per cabinet.

When possible, form rows of racks or cabinets perpendicular to air conditioners. This formation facilitates airflow down the aisles to the air conditioner return ducts. Heated air should have an unobstructed path back to the air conditioner return ducts. Heated air must not be forced to travel over the cabinets to get to the air conditioner return ducts. Doing so could heat the air in the cool aisles.

Because of the front-to-back airflow of the systems, the ideal placement of the cabinets and racks have the systems installed front to front and back to back. This configuration eliminates direct transfer of hot exhaust from one system into the intake air of another system. Locate air distribution tiles so that conditioned air can be delivered effectively to the intake of each cabinet.

Aisle Clearances

In order to allow for installation, removal, or maintenance of a server or other equipment, a clear service area must be maintained in front and back of the cabinet or rack. At a minimum, this area should extend 3 feet (0.9 m) forward from the front of the cabinet or rack (4 feet / 1.2 m for a rackmounted Sun Fire V880 server) and 3 feet on either side of the server when it is fully extended from the rack. You should also keep at least a 3-foot clearance at the rear of the cabinet or rack to allow for service and maintenance.

There are no side clearance requirements for the cabinets or racks because the air intake for the servers is from the front and the exhaust is to the rear. If cabinets are located closely side by side, leave at least 1.5 feet (0.46 m) between every five cabinets for access to the rear of the cabinets or to another aisle. If the cabinets or racks have side panels and you believe that at some time you may need to remove them, then position the cabinets or racks with at least 2 feet (0.6 m) of space on either side.

FIGURE 3-4 shows the preferred location, clearance, and access requirements of the rackmounted Sun systems in a data center. The figure also shows the recommended locations of the heat, ventilation, and air conditioning (HVAC) equipment.

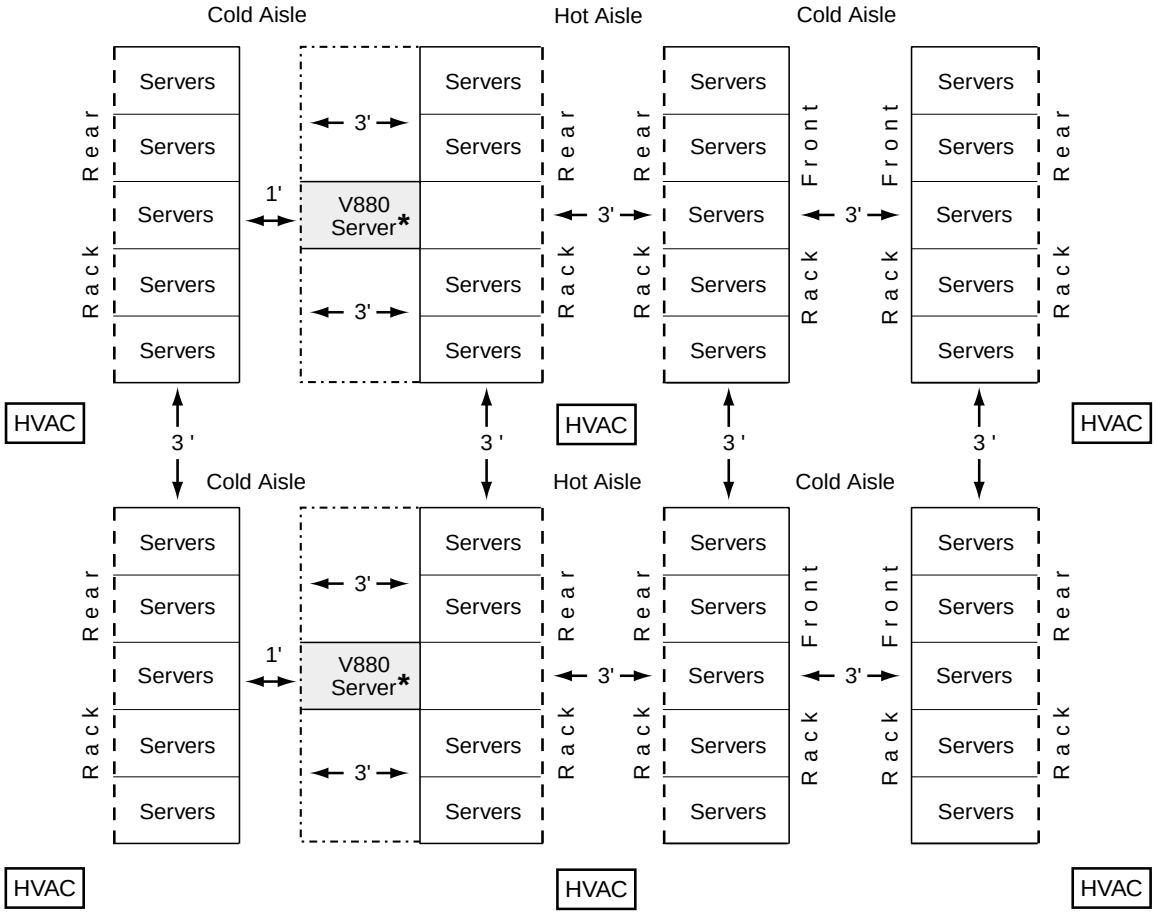


FIGURE 3-4 Cabinet and Rack Minimum Space Requirements

Tools Required for Rackmounting the Systems

You will need some of the following tools to rackmount the systems:

- Phillips No. 1, No. 2, and No. 3 screwdrivers
- Flat-blade No. 1 and No. 2 screwdrivers
- Allen and adjustable wrenches
- Needlenose pliers
- Spirit level
- Electrostatic discharge (ESD) wrist strap
- ESD mat
- GL-8 Genie Lift (recommended for larger systems)

Rackmounting Guidelines

Follow these guidelines when rackmounting a server:

- Consult the appropriate rackmounting documentation before attempting to install any server into a rack.
- Before attempting to install a server into a rack, fully extend the anti-tip legs or bolt the cabinet to the floor.
- Two persons are needed to install these servers into a rack:
  - Sun Enterprise 250
  - Sun Fire 280R
  - Sun Fire V480
  - Sun Fire V440
- Four persons (or a suitable lift) are needed to install the Sun Fire V880 server into a rack.
- Remove some of the components of the larger servers to make the lift easier.
- Install the heaviest servers and storage devices in the lowest position in the rack.
- Install the remaining servers from the lowest system upward into the rack.
- Make sure that the floor can support the weight of people performing the lift, plus the weight of the server, the rack, and any other nearby equipment.

CHAPTER 4

System Power and Cooling Requirements

This chapter provides information about important power issues relating to your servers. Your server documentation provides more detailed power information.

The design of your electrical power system must ensure that adequate, high-quality power is provided to each server and all peripherals at all times. Power system failures can result in system shutdown and possible loss of data. Further, computer equipment that is subject to repeated power interruptions or fluctuations experiences a higher component failure rate than equipment that has a stable power source.

It is important to use dedicated AC breaker panels for all power circuits that supply power to your systems. The power system should be designed to provide sufficient redundancy and to avoid all single points of failure.

Power Requirements

Each system, when properly configured and installed, must receive sufficient incoming AC power to supply all installed components. The effects of power disturbances on sensitive electronic equipment can include data errors, system halts, memory or program loss, or equipment damage. In addition, the power infrastructure must be designed to maintain system uptime even during disruption of the main power source. The following sections describe these requirements in more detail.

Power Sources

It is important to secure multiple sources of power when possible. Ideally, multiple utility feeds should be provided from different substations or power grids. This setup provides power redundancy and backup.

The systems provide AC input fault tolerance via redundant power supplies. Therefore, it is prudent to attach to each primary power supply a common power cord from one power grid that can supply power to all systems, and to attach another power cord from a different power grid to the redundant supplies. If a primary power grid goes offline, a backup power grid will provide power to the redundant supplies to keep the systems operating. See “Power Supplies” on page 32 for information about power supply redundancy.

UPS and Backup Generator

Using an online uninterruptible power supply (UPS) and a backup power generator provides a good strategy for obtaining an uninterruptible source of power. The online UPS filters, conditions, and regulates the power. It protects the systems from fluctuating voltages, surges and spikes, and noise that may be on the power line.

The battery backup for the UPS should be capable of maintaining the critical load of the data center for a minimum of 15 minutes during a power failure. This is typically sufficient time to allow for the transfer of power to an alternate feed or to the power generator.

The backup power generator should be able to carry the load of both the computer equipment and the supporting heat, ventilation, and air conditioning (HVAC) equipment in the data center.

Grounding

Grounding design must address both the electrical service and the installed equipment. A properly designed grounding system should have as low an impedance as is practically achievable for proper operation of electronic devices as well as for safety. It is important to use a continuous, dedicated ground for the entire power system to avoid a ground differential between various grounds.

Grounding design in the United States should comply with Article 250 of the U.S. National Electrical Code unless superseded by local codes. For international operation, consult the country or local electrical codes. Make sure that all electronic equipment is grounded. Use an antistatic wrist strap when working inside a chassis.

All properly installed Sun systems are grounded through the power cable. However, there are reasons for installing an additional mechanism to equalize potential. Problematic or deficient conduits can negatively affect another system, especially with respect to the possibility of spreading voltages. Additional grounding points help to avoid leakage current, which prevent system malfunctions. Therefore, additional cables are used to connect Sun systems and cabinets to the data center's potential equalization rail. Enlist the aid of a qualified electrician to install grounding cables.

Emergency Power Control

A primary power switch that can disconnect all electronic equipment in the data center is recommended by NFPA 70 and NFPA 75 (National Fire Protection Association specifications) at each point of entry to the data center. The primary switch should disconnect power to all computer systems and related electronic equipment, HVAC equipment, UPS, and batteries. Multiple disconnects for separate parts of the power systems are also acceptable, but in both cases, the switches must be unobstructed and clearly marked.

Power Constraints

All servers covered by this guide are shipped with a sufficient number of power supplies to provide all power needed by all Sun supported configurations of the servers.

Note – Sun does not test many third-party products that are compatible with Sun servers. Therefore, Sun makes no representations about those products or about the power requirements for products not supplied by Sun.

Power constraints can occur in two areas:

- Total AC power consumption
- Current limit of the AC power outlet

To maintain a safe facility, you must ensure that the AC current draw does not exceed the maximum current limit for your power outlet. In the United States and Canada, the maximum is 80% of the outlet's total capacity, which is 12 amps for 15-amp circuits and 16 amps for 20-amp circuits, and so forth. For areas outside of the United States and Canada, contact local agencies for information about local electrical codes.

Power Supplies

Each server covered by this guide is shipped by Sun with one or more power supplies, which are sufficient to support the maximum configuration of the server.

The systems provide “N+1” power supply redundancy to maintain system uptime. An N+1 redundant power supply configuration does not add to the power capacity of the systems. “N” represents the number of power supplies needed to power a fully configured system. The “1” means that there is one additional power supply in the system to handle the load if a supply fails. When the system is operating normally, all of the power supplies are turned on, even the redundant supplies.

The redundancy configurations of the systems are as follows:

- **1+1**, One supply needed to power the system and one backup supply
  - 250 server
  - 280R server
  - V480 server
  - V440 server
- **2+1**, Two supplies needed to power the system and one backup supply
  - V880 server

In a 1+1 configuration (that is, two power supplies are installed, each capable of providing enough power for the entire system), both supplies are turned on and are delivering power. Each supply delivers 50% of the power needed by the system. If one supply fails, the supply that is still online will deliver 100% of the power needed to keep the system running.

In a 2+1 configuration (that is, three power supplies are installed, with two power supplies delivering enough power for the entire system), all three power supplies are turned on and are delivering power. Each supply delivers 33% of the power needed by the system. If one supply fails, the supplies that are still online will each provide 50% of the power needed to keep the system running.

The servers have built-in protection against exceeding the output capacity of the power supply configuration. Be sure to consult the server documentation to learn how the servers will react during a power overload.

Most power supplies cannot support the maximum values on all outputs at the same time because that would exceed the total power supply output capacity. The load must be distributed among the outputs in a way that does not exceed their maximum values or the total output capacity of the power supply.

PCI Bus Power

The PCI bus in each server is designed to provide 15 watts of power multiplied by the number of PCI slots in the PCI chassis. Thus, a four-slot PCI chassis has a total of 60 watts of power available. These 60 watts can be used in any manner that conforms to the PCI standard. A single PCI slot can support a card that requires up to 25 watts. Here are some examples of how you might populate a four-slot PCI chassis:

- **Example 1** - You install four 15-watt cards. These four 15-watt cards would use up all of the 60 watts of available power in the PCI chassis. They would also occupy all four of the available PCI slots.
- **Example 2** - You install two 22-watt cards plus one 15-watt card. This combination of cards would use 59 watts of the 60 watts available. However, this card combination only uses three of the four available PCI slots. In all probability, you would have to leave the fourth slot empty in this example, unless you could find a PCI card that required only 1 watt.

Input Power

Often, a cabinet has a primary and a secondary power strip rated at 20 amps and 120 VAC. The maximum amperage per power strip is governed by national and state codes. The U.S. National Electrical Code states that the current draw should not exceed 80% of the outlet's total capacity. For example, on a 20-amp circuit, only 16 amps should be used. Unless additional circuits are provided to some taller cabinets, power constraints can limit the number of servers you can install. For international operation, consult the country or local electrical codes.

Your server configurations may not draw the maximum power listed in TABLE 5-4. However, if you design the wiring of your data center for maximum system configurations, you will minimize disruption to your electrical infrastructure as your system configurations grow. Contact your Sun account manager or Sun authorized sales representative to obtain information about components that comprise the maximum system configurations. TABLE 5-3 presents a sample of components within minimum, typical, and maximum base configurations of the servers.

Heat Output and Cooling

Servers and related equipment generate a considerable amount of heat in a relatively small area. This is because every watt of power used by a system is dissipated into the air as heat. The amount of heat output per server varies, depending on the system configuration.

The heat load in a data center is seldom distributed uniformly and the areas generating the most heat can change frequently. Further, data centers are full of equipment that is highly sensitive to temperature and humidity fluctuations. See TABLE 5-5 for the servers' temperature and humidity specifications. Also see "Temperature" on page 10 for information about how to measure the temperature of the air taken in by each server at the point where the air enters the server and how to measure the room aisle temperature.

Proper cooling and related ventilation of a server within a cabinet is affected by many variables, including the cabinet and door construction, cabinet size, and thermal dissipation of any other components within the cabinet. Therefore, it is the responsibility of the data center manager to ensure that the cabinet's ventilation system is sufficient for all the equipment mounted in the cabinet.

Note – Do not use the servers' nameplate power ratings when calculating the servers' heat release. The purpose of the nameplate power ratings is solely to indicate the servers' hardware limits for maximum power draw.

Airflow

The flow of air through the servers is essential to the proper cooling of the servers. Even though the data center air may be at a safe and steady temperature at one location, the temperature of the air entering each server is critical. Problems sometimes arise for these reasons:

- One server is positioned so that its hot exhaust air is directed into the intake air of another server, thus preheating the intake air of the second server.
- Servers are sometimes mounted in cabinets that restrict airflow excessively. This might occur because the cabinets have solid front or rear doors, inadequate plenums, or they might have cooling fans that work against the fans in the servers themselves.
- A server might be mounted in a cabinet above a device that generates a great amount of heat.

All of the servers described in this guide draw in ambient air for cooling from the front and discharge heated exhaust air to the rear. The servers require that the front and back cabinet doors to be at least 63% open for adequate airflow. This can be accomplished by removing the doors, or by ensuring that the doors have a perforated pattern that provides at least 63% open area. In addition, maintain a minimum of 1.5-inch (3.8-cm) clearance between the systems and front and back doors of a cabinet.

The servers are equipped with fans that route cool air throughout the chassis. As long as the necessary air conditioning is provided in the data center to dissipate the heat load, and sufficient space and door openings are provided at the front and back of the servers, the fans will enable the rackmounted servers to work within the temperature specifications for systems in operation. See TABLE 5-5 for temperature specifications.

See “Location and Space Requirements” on page 25 for information about recommended placement of cabinets and racks to optimize proper airflow for the systems.

Units of Measurement

A standard unit for measuring the heat generated within (or removed from) a computer room is the British Thermal Unit (Btu). The heat produced by electronic devices such as servers is usually expressed as the number of Btu generated in an hour (Btu / hr).

Watts is also a term used to express heat output and cooling. One watt is equal to 3.412 Btu / hr. For example, if you use 100 watts of power, you generate 341.2 Btu / hr.

Air conditioning capacity is also measured in Btu / hr or watts. Large air conditioning systems are rated in tons. One ton of air conditioning is a unit of cooling equal to 12,000 Btu / hr (3517 watts).

Measuring Heat Output and Cooling

TABLE 5-4 lists the minimum, typical, and maximum heat output and cooling requirements for base configurations of the servers. These specification are the *measured power* ratings, which are calculated for the base server configurations as defined by Sun. Use the nameplate ratings only as a references to the servers’ hardware limits that could accommodate future components and not to calculate the servers’ current power and cooling requirements.

In addition to the heat load generated by the servers, some cabinets include fans, power sequencers, and other devices that generate heat. Be sure to obtain the heat output values of these devices from your cabinet supplier. Also, when calculating data center cooling requirements, be sure to include heat dissipation for all equipment in the room.

To determine the heat output and cooling requirements of the rackmounted servers, add the Btu or watts for each server in the rack. For example, if one server is putting out 1000 Btu / hr (293 watts) and another one is putting out 2000 Btu / hr (586 watts), the total heat generated is 3000 Btu / hr (879 watts). The air conditioning equipment then should be properly sized to cool at least 3000 Btu / hr (879 watts) to accommodate these two systems. If you only have wattage measurements and want to obtain the equivalent Btu rating, multiply the total wattage by 3.41 to obtain the Btu / hr. To calculate tons of air conditioning, multiply the total wattage by 0.000285.

See “Cooling and Airflow” on page 12 for an example of how to estimate cooling requirements based on the square footage used by the cabinets and racks in the data center.

CHAPTER 5

System Specifications

This chapter includes shipping, physical, configuration, electrical, environmental, rackmounting, and cabinet specifications for the following Sun systems:

- Sun Enterprise 250
- Sun Fire 280R
- Sun Fire V480
- Sun Fire V880
- Sun Fire V440

Shipping Crate Specifications

TABLE 5-1 Shipping Crate Specifications for Sun Systems[1]

	250	280R	V480	V880	V440
Height	35.75 in 90.80 cm	17.25 in 43.80 cm	23.13 in 58.74 cm	43.69 in 110.97 cm	21.13 in 53.65 cm
Width	18 in 45.72 cm	23.63 in 60.02 cm	24 in 60.96 cm	25 in 63.50 cm	24 in 60.96 cm
Depth	34 in 86.36 cm	37 in 93.98 cm	31.50 in 80.01 cm	37.50 in 95.25 cm	32.25 in 81.91cm
Weight	130 lb 58.97 kg	100 lb 45.37kg	150 lb 68.04 kg	320 lb 145 kg	120 lb 54.45 kg
On Pallet	No	No	Yes	Yes	Yes

1. Dimensions and weights are estimates based on fully configured systems, and are dependent on specific system configurations.

Physical Specifications

TABLE 5-2 Physical Specifications for Sun Systems

	250	280R	V480	V880	V440
Height	18.1 in 46.0 cm	6.95 in 17.65 cm	8.75 in 22.23 cm	28.1 in 71.4 cm	6.85 in 17.40 cm
Width	10.3 in 26.2 cm	17.25 in 43.81 cm	17.5 in 44.6 cm	18.9 in (tower) 48.0 cm (tower) 17.25 in (rack) 43.81 cm (rack)	17.48 in 44.40 cm
Depth[1]	28.8 in73.2 cm	27.25 in 69.21 cm	24 in 61 cm	32.9 in 83.6 cm	25 in 63.5 cm
Weight[2]	118 lb 53 kg	73 lb 33 kg	97 lb 44 kg	288 lb 131 kg	82 lb 37 kg
Power Cord Length	8.2 ft 2.5 m	6.56 ft 1.99 m	8.2 ft 2.5 m	8.2 ft[3] 2.5 m	8.2 ft 2.5 m

1. The depth given does not include any I/O or power connectors, or any cable management features.
2. Weights are estimates based on fully configured systems, and are dependent on specific system configurations.
3. Three 2.75-m (9-ft) cords are provided in the Sun Fire V880 rackmounting kit (Sun part number x9628A), which extend the original 2.5-m (8.2-ft) power cord lengths to 5.25 m (17.2 ft).

Base System Configurations

TABLE 5-3 Base Configurations for Sun Systems[1]

	Minimum	Typical	Maximum
250	1 400-MHz CPU 512-Mbyte memory 1 36-Gbyte drive 1 DVD drive 1 PCI card	2 400-MHz CPUs 1-Gbyte memory 2 36-Gbyte drives 1 DVD drive 2 PCI cards	2 400-MHZ CPUs 2-Gbyte memory 6 36-Gbyte drives 1 DVD drive 4 PCI cards
280R	1 1.2-GHz CPU 1-Gbyte memory 1 73-Gbyte drive 1 DVD drive 1 PCI card	2 1.2-GHzCPUs 2-Gbyte memory 2 73-Gbyte drives 1 DVD 2 PCI cards	2 1.2-GHz CPUs 8-Gbyte memory 2 73-Gbyte drives 1 DVD 4 PCI cards
V480	2 1.05-GHz CPUs 4-Gbyte memory 2 36-Gbyte drives 1 DVD drive 1 PCI card	4 1.05-GHz CPUs 8-Gbyte memory 2 36-Gbyte drives 1 DVD drive 3 PCI cards	4 1.05-GHz CPUs 16-Gbyte memory 2 36-Gbyte drives 1 DVD drive 6 PCI cards
V880	2 1.05-GHz CPUs 4-Gbyte memory 6 73-Gbyte drives 1 DVD drive 1 PCI card	4 1.05-GHz CPUs 8-Gbyte memory 6 73-Gbyte drives 1 DVD drive 5 PCI cards	8 1.05-GHz CPUs 32-Gbyte memory 12 73-Gbyte drives 1 DVD drive 9 PCI cards
V440	2 1.062-GHz CPUs 4-Gbyte memory 4 36-Gbyte drives 1 DVD drive 1 PCI card	4 1.062-GHz CPUs 8-Gbyte memory 4 36-Gbyte drives 1 DVD drive 3 PCI cards	4 1.28-GHz CPUs 16-Gbyte memory 4 36-Gbyte drives 1 DVD drive 6 PCI cards

1. These are examples of *possible* base system configurations and do not represent all configurations available. There are many other components that are included within the systems that help to qualify them as minimum, typical, and maximum configurations. For complete system configuration information, see your Sun account manager or Sun authorized sales representative.

Electrical Specifications

TABLE 5-4 Electrical Specifications for Sun Systems

	250	280R	V480	V880	V440
Nominal Frequencies	50 or 60 Hz	50 or 60 Hz	50 or 60 Hz	50 or 60 Hz	50 or 60 Hz
Nominal Voltage Range	100 to 240 VAC auto ranging	100 to 240 VAC auto ranging	100 to 240 VAC auto ranging	100 to 240 VAC auto ranging	100 to 240 VAC auto ranging
AC Operating Range	90 to 264 Vrms 47 to 63 Hz	90 to 264 Vrms 47 to 63 Hz	90 to 264 Vrms 47 to 63 Hz	90 to 264 Vrms 47 to 63 Hz	90 to 264 Vrms 47 to 63 Hz
Max Current AC RMS[1]	3.1A @ 120 VAC	7.5A @ 120 VAC	10.0A @ 120 VAC	12.0A @ 120 VAC	7.7A @ 120 VAC
	1.6A @ 240 VAC	3.7A @ 240 VAC	5.0A @ 240 VAC	6.0A @ 240 VAC	3.65A @ 240 VAC
AC Power Consumption[2]					
Min	133W	305W	617W	1050W	360W
Typ	224W	418W	1023W	1440W	570W
Max	358W	750W	1100W	2115W	650W
Nameplate	600W	890W	1440W	2880W	925W
Heat Dissipation and Cooling[3]					
Min	454 Btu / hr	1041Btu / hr	2106 Btu / hr	3584Btu / hr	1229 Btu / hr
Typ	765 Btu / hr	1427 Btu / hr	3491 Btu / hr	4778 Btu / hr	1945 Btu / hr
Max	1222 Btu / hr	2560 Btu / hr	3754 Btu / hr	7218 Btu / hr	2218 Btu / hr
Nameplate	2048 Btu / hr	3038 Btu / hr	4915 Btu / hr	9829 Btu / hr	3157 Btu / hr

1. For the 250, 280R, V480, and V440 systems, the specifications refer to total input current required for a single AC inlet when operating with a single power supply. The second power supply is the redundant element. For the V880 system, the specifications refer to total input current for two AC inlets as two power supplies are required to operate the system. The third V880 power supply is the redundant element.
2. These specifications are calculated using the base system configurations listed in TABLE 5-3.
3. These specifications are calculated using the base system configurations listed in TABLE 5-3.

Environmental Specifications

TABLE 5-5 Environmental Specifications for Sun Systems in Operation

	250 V480 V880	280R V440
Temperature[1]		
Allowable	41 to 95 °F 5 to 35 °C	41 to 104 °F 5 to 40 °C
Recommended	70 to 74 °F 21 to 23 °C	70 to 74 °F 21 to 23 °C
Relative Humidity (RH) Noncondensing		
Allowable	20% to 80% 27 °C max wet bulb	20% to 80% 27 °C max wet bulb
Recommended	45% to 50%	45% to 50%
Altitude	0 to 10,000 ft 0 to 3000 m	0 to 10,000 ft 0 to 3000 m

1. The front and back doors of the cabinet must be at least 63% open for adequate airflow.

TABLE 5-6 Acoustic Specifications for Sun Systems in Operation

	Acoustics Rating
250	6.5 bels
280R	6.9 bels
V480	6.7 bels
V880	6.7 bels
V440	6.2 bels

TABLE 5-7 Vibration Specifications for Sun Systems in Operation

	Maximum Vibration Rating[1]
250	0.2 g peak (swept sine) 0.0002 g^2 / Hz (random); vertical axis only (castered configuration); vertical and horizontal axis (foot glide configuration)
280R	0.0002 g^2 / Hz (random), flat from Z-axis only
V480	0.0001 g^2 / Hz (random), flat from Z-axis only
V880	Deskside: 0.0002 g^2 / Hz (random) Rackmounted: 0.00015 g^2 / Hz (random)
V440	0.0001 g^2 / Hz (random)

1. Measured at 5 to 500 Hz for swept sine.

TABLE 5-8 Shock Specifications for Sun Systems in Operation

	Maximum Shock Rating[1]
250	4 g peak
280R	3 g peak
V480	10 g peak
V880	Deskside: 4 g peak Rackmounted: 3 g peak
V440	3 g peak

1. Measured at 11 milliseconds half-sine pulse.

Rackmounting Specifications

TABLE 5-9 Rack Units Required by Sun Systems

	RU Required per System for Mounting
250	6
280R	4
V480	5
V880	17
V440	4

TABLE 5-10 Typical Rack and Cabinet Depths Used by Sun Systems

	System Depth[1]	Rackmounting Depth Range[3]	Cabinet Depth
250	27.1 in[2] 68.8 cm	27.5 to 35.5 in 69.85 to 90.17 cm	34 in or greater 86 cm or greater
280R	27.25 in 69.21 cm	29.5 to 35.5 in 75.95 to 90.17 cm	34 in or greater 86 cm or greater
V480	24.0 in 61.0 cm	23 to 34.5 in 58.42 to 87.63	28 in or greater 71.12 or greater
V880	32.90 in 83.60 cm	34 to 36 in 86.36 to 91.44 cm	39 in or greater 99 cm or greater
V440	24.0 in 61.0 cm	23 to 34.5 in 58.42 to 87.63	28 in or greater 71.12 or greater

1. The depth given does not include any I/O or power connectors, or any cable management features
2. Depth is 28.8 in (73.2 cm) including the power supply handle.
3. The rack depth range is for systems using Sun rackmounting equipment. (Rackmounting hardware is designed to fit a range of different cabinet depths.)

Sun Cabinet Physical Specifications

TABLE 5-11 Physical Specifications for Crated Cabinets

	Sun StorEdge Expansion Cabinet	Sun Fire Cabinet	Sun Rack 900
Height	80 in 203 cm	80 in 203 cm	80 in 203 cm
Width	42 in 107 cm	43 in 109 cm	43 in 109 cm
Depth	47 in 120cm	47 in 120 cm	48 in 122 cm
Weight	524 lb 238 kg	558 lb 253 kg	530 lb 240 kg

TABLE 5-12 Physical Specifications for Cabinets in Operation

	Sun StorEdge Expansion Cabinet	Sun Fire Cabinet	Sun Rack 900
Height	73.5 in 186.7 cm	75 in 191 cm	73.75 in 187 cm
Width	24 in 61 cm	24 in 61 cm	23.6 in 60 cm
Nominal Rack Opening	17.72 in 45 cm	17.72 in 45 cm	17.72 in 45 cm
Depth	36 in 91 cm	36 in 91 cm	35.4 in 90 cm
Weight[1]	350 lb 159 kg	325 lb 147 kg	400 lb 181 kg
Static Load Capacity[2]	1300 lb 589 kg	1200 lb[3] 544 kg	1600 lb 726 kg
Usable Rack Units	36	32	38

1. This specification is the weight of the cabinet and two power sequencers only. The total weight of the cabinet also includes the systems and other equipment it houses.
2. This capacity is for a fully configured cabinet.
3. The Sun Fire Cabinet has been tested to 1200 lb, though its total static load capacity is higher.

TABLE 5-13 Cabinet Power Sequencer Specifications

	Sun StorEdge Expansion Cabinet	Sun Fire Cabinet	Sun Rack 900
AC Voltage Rating	200 to 240 VAC	200 to 240 VAC	200 to 240 VAC
Frequency Range	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz
Max Current	24A @ 240 VAC	24A @ 240 VAC	32A @ 240 VAC
Max Power Capacity[1]	5.7 kW	5.7 kW	7.6 kW
Required Power Receptacles	2-NEMA L6-30R (U.S.)	NEMA L6-30R (U.S.)	4-NEMA L6-20R (U.S.)
	2-IEC309 32A (International)	IEC309 32A (International)	4-IEC309 16A (International)

1. This is the theoretical maximum power capacity of the cabinet. This number should *not* be used to calculate power and cooling requirements for your installation. Use the combined power consumption figures of the equipment installed in the cabinet instead. See TABLE 5-4.

TABLE 5-14 Clearance Specifications for Servicing the Rackmounted Sun Systems[1]

	250, 280R, V480 V440	V880
Front	36 in 91.44 cm	48 in 121.92 cm
Rear	36 in 91.44 cm	36 in 91.44 cm
Right	36 in 91.44 cm	36 in 91.44 cm
Left	36 in 91.44 cm	36 in 91.44 cm
Top	36 in 91.44 cm	36 in 91.44 cm

1. These specifications refer to systems that are fully extended from the rack.

CHAPTER 6

Site Planning Checklist

TABLE 6-1 organizes the site planning tasks into a checklist that you can use during the site planning process.

TABLE 6-1 Site Planning Checklist

Requirement	Completed	Task
Configuration	Yes__No__	Have you determined the hardware configuration for each system?
	Yes__No__	Have you determined the type and number of cabinets and racks you need?
	Yes__No__	Have you determined how you will populate each rack?
	Yes__No__	Have you determined which external peripherals, such as terminals, monitors, keyboards, SCSI devices, and so forth, the systems require?
Environmental	Yes__No__	Does the data center environment meet the system specifications for temperature and humidity?
	Yes__No__	Have you determined the thermal load, heat dissipation, and air conditioning requirements of all equipment in the data center?
	Yes__No__	Can you maintain the data center environment when certain failures occur, such as power failure, air conditioning unit failure, or humidity control unit failure?
	Yes__No__	Is fire suppression and alarm equipment installed?
Power	Yes__No__	Have you determined the maximum power requirements of the systems?
	Yes__No__	Have you considered using an alternate source of power for grid independence and backup power for the local sub-station?
	Yes__No__	Do you have sufficient power receptacles for each system and its peripherals?
	Yes__No__	Are the power receptacles within reach of the racks?
	Yes__No__	Have you installed and labeled the circuit breakers?

TABLE 6-1 Site Planning Checklist *(Continued)*

Requirement	Completed	Task
Physical	Yes__No__	Does the facility's loading dock meet standard common carrier truck requirements? If not, have you made other arrangements for unloading the racks and systems, such as providing a fork lift?
	Yes__No__	Are pallet jacks or carts available to move the systems and racks from the loading dock to the computer room?
	Yes__No__	Will the equipment fit through the access route and into the computer room?
	Yes__No__	Have you calculated the weight of each rack with all the equipment installed within it?
	Yes__No__	Is the data center floor able to support the weight of the systems and racks?
	Yes__No__	Have you established where you will locate each rack on the data center floor?
	Yes__No__	Are the systems and racks positioned so that the heated exhaust air of one system does not enter the air inlet of another system?
	Yes__No__	Is there sufficient room around the racks for system access and maintenance?
Miscellaneous	Yes__No__	Are there sufficient number of people available to unload, unpack, and install the systems into the racks?
	Yes__No__	Have system administrators and service technicians enrolled in appropriate training courses to upgrade their skills, as necessary?
	Yes__No__	Have you acquired all the hardware needed to set up the systems and racks?
	Yes__No__	Do you have the documents required to install the systems into the racks?