HP Industry Standard Servers

May 2003

Best Practice TC030501BP

HP Rack 9000 and 10000 Series installation and best practices

Table of contents

Abstract

This document discusses recommended practices when installing, transporting, and establishing a work environment for the HP Rack 9000 and Rack 10000 Series.

Symbols in text

The following symbols can be found in the text of this document.

WARNING: Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or loss of life.

CAUTION: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

Note: Text set off in this manner presents commentary, sidelights, or interesting points of information.

Products

HP offers a complete portfolio of racks, the 9000 and 10000 Series, with incredible strength and quality of design in the ideal size to meet your unique requirements. Use Rack Builder Online to configure ProLiant, StorageWorks, power, and networking equipment and options ensuring the perfect fit within each rack.

The 9000 and 10000 Series of racks and Rack Builder Online are described in the following sections.

HP 9000 series rack

HP sets the standard for performance and value in the Enterprise environment with the HP Rack 9000 Series of racks and rack options. This enterprise-class rack combines next-generation structural integrity, ease of use, and superior ventilation (65% open) to deliver industry-leading performance. HP 9000 Series racks provide customers with the power to sensibly maximize space utility while protecting and simplifying network management.

Ideal for on-site or pre-configured assembly of rack-mounted HP ProLiant and AlphaServer servers, rack-mounted workstations, and server storage products, the HP Rack 9000 Series complements and protects your investment in technology. The HP Rack 9000 Series is available in four sizes: 42U, 36U, and 22U racks are 600-mm wide; and the 9842 rack is 800-mm wide. The new HP Rack 9000 Series is designed to ensure outstanding performance and seamless integration to support all of your business needs.

Figure 1. 9000 Series Racks

All HP rack-mountable and floor-standing or "tower" products are designed to fit the industry-standard 19-inch (482.6-mm) wide Electronic Industry Association (EIA) rails. Tower-to-rack conversion kits are available to support tower units in the Rack 9000 Series.

Note: The 9842 rack is only available on a wooden pallet and has not been qualified for pre-configured rack shipment at this time.

Table 1. 9000 Series Rack Specifications

Model	U height	Width	Depth	Dynamic load	Static load	Shipping options	Color
9122	22U	600mm/ 23.62 in	900mm/ 35.43 in	450 lbs/ 204.12 kg	1045lbs/ 816.47 kg	pallet (-B21) shock pallet (-B22) crate (-B23)	opal
9136	36U	600mm/ 23.62 in	900mm/ 35.43 in	1400 lbs/ 635.03 kg	1800 lbs/ 816.47 kg	pallet (-B21) shock pallet (-B22) crate (-B23)	opal
9142	42U	600mm/ 23.62 in	900mm/ 35.43 in	1450 lbs/ 657.71 kg	1800 lbs/ 816.47 kg	pallet (-B21) shock pallet (-B22) crate (-B23)	opal
9842	42U	800mm/ 31.49 in	900mm/ 35.43 in	cannot ship with equipment installed	1100 lbs/ 498.95 kg	pallet (-B21)	opal

Product life span

The 9000 series racks will be discontinued in 2003 and will be replaced with the 10000 series racks. The discontinuation plan for the 9000 series racks is as follows:

- 9136 and 9842 were discontinued in April 2003
- 9122 will be discontinued in July 2003
- 9142 will be discontinued in September 2003

HP 10000 series rack

HP introduced a rack line with a similar industry award-winning design as the 9000 Series rack, but also incorporated many new features and enhancements in addition to a darker color. The 10000 series rack is 1 meter deep allowing more room for cable management and for accommodating deeper server and storage equipment. For additional cable management, large cable egresses have been cut into the roof of the rack, the removable access panel on the split rear door allows for cabling out the back and Velcro straps allow for clean bundling of cables.

Figure 2. 10000 Series Racks

This rack has a dynamic loading capacity up to 2000 lbs in the 10642. This means that when using a shock pallet, customers can ship up to 2000 lbs gross weight (including the weight of the rack).

Table 2. 10000 Series Rack Specifications

Model	U height	Width	Depth	Dynamic load (gross)	Static load	Shipping options	Color
10622	22U	600mm/ 23.62 in	1000mm / 39.37 in	1045 lbs/ 474.00 kg	1045 lbs/ 474.00 kg	pallet (-B21) shock pallet (-B22) crate (-B23)	graphite metallic
10636	36U	600mm/ 23.62 in	1000mm / 39.37 in	1520 lbs/ 689.46 kg	2000 lbs/ 907.18 kg	pallet (-B21) shock pallet (-B22) crate (-B23)	graphite metallic
10642	42U	600mm/ 23.62 in	1000mm / 39.37 in	2000 lbs/ 907.18 kg	2000 lbs/ 907.18 kg	pallet (-B21) shock pallet (-B22) crate (-B23)	graphite metallic
10647	47U	600mm/ 23.62 in	1000mm / 39.37 in	cannot ship with equipment installed *	2000 lbs/ 907.18 kg	pallet (-B21) crate (-B23)	graphite metallic
10842	42U	800mm/ 31.49 in	1000mm / 39.37 in	1000 lbs/ 453.59 kg	2000 lbs/ 907.18 kg	pallet (-B21) shock pallet (-B22)	graphite metallic
s10614	14U	600mm/ 23.62 in	1000mm / 39.37 in	500lbs/ 227.00 kg	600 lbs/ 270 kg	shock pallet (-B22)	graphite metallic

NOTE: Due to safety and stability concerns, the 10647 cannot ship with equipment installed.

9000/10000 rack options

HP delivers innovative racks that make it easy to centralize, protect, organize, and access your hardware for servicing and upgrading. The racks are flexible, secure, and designed to industry standards.

For a complete list of HP rack options and accessories, refer to the main rack page at www.hp.com/products/racks or to the main rack options page at www.hp.com/products/rackoptions.

For a list of ProLiant servers and options go to www.hp.com/servers/proliant.

For a list of HP power products such as UPS and PDU, refer to www.hp.com/products/ups.

For a complete list of HP server storage equipment, refer to www.hp.com/products/serverstorage.

To ensure a safe and compliant configuration and reduce the risk of damaging the equipment or voiding the warranty, the final integrator is responsible for installing all equipment in accordance with HP installation instructions and configuration guidelines. Failure to do so could produce a configuration that may not meet with regulatory compliance requirements and/or may violate the - environmental specifications (see www.hp.com/united-states/business/bizportal.html).

To facilitate compliance with industry standards, government regulations, and product specifications, HP offers the following rack and cabinet options for setup:

- Stabilizer kits
- Fan kits
- Extension kits (9136 and 9142 only)
- Top cable egress kits (9000 series only)
- Antistatic wrist strap kits
- Cable management kits
- Short rear doors (9000 series only)
- Split Rear Doors (9842 and 10000 series racks)
- Gasket Kit (303585-B21)

Stabilizer kits	Stabilizer kits are used with cabinets to keep them mechanically stable (front-to-back) when heavy, slide-mounted equipment is pulled out to its service position. HP offers these different stabilizers for different applications:

- Leveling feet (ship standard on the rack)
- Fixed stabilizer (600mm and 800mm)
- Deployable stabilizer
- Ballast

Note: The deployable stabilizer is required for any Alpha product and is only available through the high performance technical computing (hptc) solutions group at www.hp.com/techservers/buying/htbcontact.html.

The equipment integrator will need to determine which ballast and stabilizer kits to use. If the cabinet is bolted to the floor or to adjacent cabinets with sufficient combined weight, a stabilizer kit may not be required.

For a discussion on each stabilizer kit, refer to the "Stability" section.

Fan kits	HP products are designed to provide airflow from the front of the rack to the rear. HP recommends that rack components only be installed on the front rails for many reasons including proper airflow. Fan kits may help meet additional thermal requirements of rack-mounted equipment and are used to keep the ambient temperature inside the cabinet within the specified operational limits of the equipment. Equipment that is exposed to excessive heat may not operate correctly and may experience abnormally high failure rates. Roof-mounted fan kits are supported in all 9000 and 10000 racks.
Extension kits (9136 and 9142 only)	Extension kits are used when additional room is required at the rear of the rack to satisfactorily house the computer equipment and associated cables. Cables and equipment can be damaged in use or in shipping if there is insufficient room in the cabinet. The Rack 9000 Series extension kit, mounted at the rear of the rack, provides roughly 3.5 inches (88.9 mm) of additional space. Extension kits are only available for the 600mm racks at this time. A list of available extension kits can be found at the main rack options product page at www.hp.com/products/rackoptions.
Top cable egress kits (9000 series only)	Top cable egress kits allow cables to be routed through the top of a cabinet yet prevent foreign objects from falling through the hole and damaging equipment below. Whether or not these kits are required is dependent upon how the cabinet will be qualified and used.
Antistatic wrist strap kits	Using the antistatic wrist strap keeps electrostatic discharge (ESD) from damaging equipment that is temporarily exposed when covers are removed for servicing. While not usually required to meet safety and regulatory standards, use of an antistatic wrist strap is standard operating procedure in the industry and will minimize component damage due to handling. (Spares Part Number 222948-001)

Cable management kits	Cable management kits provide an easy way to organize and route cables within HP racks. One cable management kit, the Cable Management D Ring Kit, consists of 10 D-shaped rings that are mounted at the back of the rack to allow for organization and management of cabling.
Short rear doors (9000 series only)	The short rear doors can be used to replace the full-size doors that are shipped with the 9000 Series rack. These doors provide about 7 inches (177.8 mm) of space at the bottom of the rack to allow cabling to be routed out of the rack while still maintaining the security of a locking door.
Split rear doors	The split rear doors ship standard on the 9842 and 10000 series racks and are an option for the 9142 racks (254045-B21). These doors allow for full access to rack mounted devices without blocking data center aisles. In addition, the split rear doors include a removable access panel for routing cables out of the racks.
Rack Builder Online	Rack Builder Online provides users with a powerful Web-based tool for configuring one or more racks with HP components. Using either the simple "Help Me Build It" guided interface or a "Build It Myself" mode for advanced users, you can create rack configurations using a complete and current database that includes all HP rack-mountable products.

Rack Builder Online provides users with a powerful Web-based tool for configuring one or more racks with HP components. Using either the simple "Help Me Build It" guided interface or a "Build It Myself" mode for advanced users, you can create rack configurations using a complete and current database that includes all HP rack-mountable products.

The two user modes provide flexibility and ease of use. The "Help Me Build It" mode interview process enables novice users to quickly begin creating rack configurations with questions that guide the user in selection of racks and components. The application calculates the selection of power products and adds accessories necessary for a functional configuration. In the "Build It Myself" mode, users with rack configuration experience have unlimited flexibility in building configurations with new and legacy HP components. If components are not available in the central product database, they can be user-defined, saved, and added to configurations using the "User-Defined Devices" function.

Users can easily drag-and-drop components from one rack to another to quickly customize a configuration. Validation messages provide detailed information specific to each combination of components, suggest missing pieces, and provide general information about the configuration.

Rack Builder Online also produces useful reports, such as a graphic representation of the rack layout and a detailed report on the specific part numbers, quantities of racks, and power management products required. These reports can be used to facilitate a speedy and efficient implementation of new installations.

Key features include:

- Centralized Web repository for saving configurations
- Instant access via the World Wide Web
- Online help for the application and product database
- Ability to edit, print, and save rack configurations on either your local drive or the HP server
- Graphic display of configurations with drag-and-drop functionality
- Improved power sizing algorithms

- Direct access to current product data as products are announced

- Complete database of new and legacy HP (Compaq) products

- Ability to create, save, and configure third-party rack components

- Two user modes: "Help Me Build It" and "Build It Myself"

Rack Builder Online can be accessed at www.hp.com.

Precautions

To reduce the risk of electric shock or damage to the equipment when installing, maintaining, or servicing Enterprise products, observe the following precautions.

Installation and maintenance

Some Enterprise products are capable of producing hazardous voltages and hazardous energy levels. The installation of internal options and routine maintenance and service of these products should be performed only by individuals who are knowledgeable with the procedures, precautions, and hazards associated with this type of equipment. Refer to the documentation included with each product to determine whether it belongs in this category.

Unless the equipment is installed in a restricted area, this equipment should be operated only with all enclosures in place and properly secured. Always refer to the equipment installation guide and observe all applicable warnings and precautions.

As a word of caution, a minimum clearance is required between the top of the rack and any fire protection sprinkler devices. Check your local building codes for details.

Products with casters

Products provided with casters should be moved with care. Sudden stops, excessive force, and uneven surfaces may cause the product to overturn. It is easier to move the rack with the back as the leading edge.

WARNING: To reduce the risk of personal injury or damage to the equipment, do not attempt to move large equipment racks by yourself. Obtain adequate assistance to stabilize the rack during movement or hire professional equipment riggers.

CAUTION: To reduce the risk of damage to the casters, make sure that the full weight of the rack rests on the leveling feet, and not on the casters. The casters are designed only as an aid in moving the rack into position. They are not designed to support the weight of the rack, and the casters may become damaged if relied on to support the rack.

Hot-pluggable power supplies

Observe the following guidelines when connecting and disconnecting power to the power supplies:

- Unplug the power cord before removing the power supply from the server.
- Install the power supply before connecting the power cord to the power supply.
- Do not overload the AC supply branch circuit that provides power to the rack. The total rack load should not exceed 80 percent of the branch circuit rating.

Rack-mountable products

Because the rack allows you to stack computer components vertically, you must take precautions to provide for rack stability and safety.

- Use the configuration you prepared with the Rack Builder Online utility as a guideline for installing the components.
- For safety and rack stability, load the heavier components first, and load the rack from the bottom up. When coupling racks, be sure to balance the weight load between the racks, placing the heaviest components at the bottom. For example, if you have several UPS units and several servers, do not put all of the UPS units into one rack—distribute them evenly in the bottom positions of each rack.
- Before working on the rack or extending a component on rails, be sure that the leveling feet (jacks) extend to the floor, the full weight of the rack rests on the feet, and the rack is level and stable. Also, install stabilizing brackets or extend deployable stabilizers on a single rack or bay multiple racks together before starting work.
- Extend only one component at a time. The rack may become unstable if more than one component is extended. If there is a deployable stabilizer installed, extend this part prior to sliding any component forward for access. When work is complete, replace the deployable stabilizer.
- Allow a minimum clearance of 30 inches (762 mm) at the back of the rack.
- Allow a minimum of 48" (1219.2 mm) clearance beyond the front of your rack to permit server installation and removal. This applies to both individual rack installations as well as when aligning rack rows so that the front doors are facing each other. See Figure 3.

Figure 3. Rack Clearance Diagram

Minimum Recommended Front Rack Space

d1 = 32"– front most chassis feature to rear tip of attached inner slide member
d2 = 12"– front of rack to front tip of fully extended intermediate slide member
c1 = 1"– clearance to align/mate/unmate chassis slide members to intermediate slide members
c2 = 3"– clearance for movement between chassis front and adjacent rack front

Minimum recommended distance in front of rack for installing ProLiant chassis:
d3 = <u>48"</u> = d1 + d2+ c1 + c2

- Use caution when pressing the component rail release latches and sliding a component into the rack. The slide rails can pinch your fingers.

- Components must be qualified prior to consideration for shipment within racks; this means the unit has been successfully tested under common carrier simulations. Keep in mind, though, that HP recommends the use of padded van carriers to avoid some potential damaging handling scenarios mentioned in "modes of shipment" later in this section. The qualification process is an on-going effort to evaluate models as they are introduced. Prior to a successful qualification, a component should be shipped in its individual shipping container; shipment of an unqualified system in a rack, or any system without the proper shock pallet, will void the warranty.

Component placement and assembly guidelines

Apply the following rules when physically placing components in the HP Rack 9000 and 10000:

- **Weight**—Sort all components by weight, placing the heaviest components at the bottom of the rack.

- **Keyboard/video/mouse (KVM) switch box**—Mount the switchbox either behind the keyboard or within a sidewall cavity to provide a zero-U space solution.

- **Keyboard/integrated keyboard monitor**—When using any size rack, install the keyboard/integrated keyboard monitor at a level that is in the correct ergonomic position where your shoulders and neck are relaxed.

- **Monitor**—Ergonomic considerations should drive the placement of a monitor in the rack, whether it is a CRT or Flat-panel design. It is recommended to arrange the screen a minimum of 4U's above the keyboard tray. Most customers prefer placement of the video system high in the rack, especially in a full rack, to allow easier access to serviceability of other system components below it. If you are using a 22U rack, place the monitor on top of the rack frame.

  If you are using an optional rack-mountable flat panel monitor, select a position to accommodate the desired viewing height (a minimum of 4Us above the keyboard tray).

- **Balance**—When connecting racks, be sure to balance the weight load between the racks, placing the heaviest components at the bottom. For example, if you have several UPS units and several servers, do not put all of the UPS units into one rack—distribute them evenly in the bottom positions of each rack.

For further information regarding component placement, refer to the Important Safety Instructions that are shipped with the rack and the Safety and Comfort Guide - Precautions for Server and Network Products located at www.hp.com (search for safety and comfort guide).

Stability

Rack stability is of special concern when equipment is routinely installed, removed, or accessed within the rack. Stability is addressed through the use of leveling feet, fixed stabilizers, and deployable stabilizers or ballast.

Leveling feet (jacks)

Leveling feet are adjustable stabilizers that secure the cabinet at the installation site. The required leveling pads are shipped in the hardware kit.

Fixed stabilizer

This anti-tip stabilizer provides stability and support when equipment is installed, removed, or accessed within the rack. HP recommends that you use a stabilizer option kit, available in both a 600mm and 800mm version, with a stand-alone rack.

Deployable stabilizer

A retractable anti-tip stabilizer provides stability and support when equipment is installed, removed, or accessed within the rack.

Note: The deployable stabilizer is required for any Alpha product and is only available through HP Customs & Solutions at www.hp.com/techservers/buying/htbcontact.html.

Ballast kits

Ballast kits can be added to cabinets to increase side-to-side and/or front-to-back mechanical stability.

Lightly loaded 9000 and 10000 series cabinets may require ballast to keep them from tipping over when a force is applied to the side of the cabinet. Heavily loaded systems, depending on the particular configuration involved, usually do not require ballast.

To ensure rack stability, the minimum weight of the installed equipment should be 210 pounds (95 kg). Ballast kits should be added in the event a system has less than 210 pounds minimum weight.

For example, if you have only 50 pounds (23 kg) of equipment, you would add two ballast kits. Each kit contains two 40-pound (18 kg) ballast. Two ballast kits (a total of four ballast) equal 160 pounds (72 kg), bringing the total up to 210 pounds.

In addition, if any single piece of equipment weighs more than 100 pounds (46 kg), there must be at least 200 pounds (91 kg) of additional equipment installed to maintain stability when the piece of equipment is extended on its rails. Ballast kits should be added in the event the additional equipment is less than 200 pounds.

WARNING: To reduce the risk of personal injury or damage to the equipment, extend only one component at a time. The rack may become unstable if more than one component is extended.

Cable management

Due to the fluid nature of the rack environment, the cabling of systems has very few hard rules. HP recommends the following:

- Cabling is typically done as one of the last steps. This provides the proper visual references after all components are installed.

- Avoid dressing cabling tightly over sharp edges of railing or panels.

- Avoid pinching of cables between components.

- Avoid tight bend radii. Cables should never be bent tight enough to cause a crease in the sheathing. Fiber cables must not violate their minimum bend radius — no exceptions.

- Internal cab real estate is limited. When securing cables inside the cab, the bundle should be dressed in such a way as to avoid interference with installed components or cab side panels or rails.

- For components that must be movable while under power, ensure a full range of motion is possible without cable interference or disconnect. Cables dressed on management arms must be secured enough to prevent movement into interference or pinch areas, yet not so tight as to cause binding to the arm. Where possible, use all cable management arms included in component kits.

- As the configuration permits, dress power and data cables to allow as much separation as possible.

Facilities

To ensure proper operation of all components, HP recommends you consider the following installation guidelines:

- Thermal considerations

- Other considerations: Fire sprinkler heads require 18" of clearance (doorway height and width).

Thermal considerations

Slots and openings in the product are provided for ventilation and should never be blocked or covered, since these ensure reliable operation of the product and protect it from overheating. The perforated door assemblies are specifically designed for this requirement; for older series racks, such as the 7000 series, and any third-party racks with glass doors must have the door removed to support the newer high performance equipment. The product should not be placed in a built-up enclosure unless the enclosure has been specifically designed to accommodate the product, proper ventilation is provided for the product, and the manufacturer's instructions have been followed.

Any open "U" spaces in the front of a rack must have blanking panels installed to support the front-to-back airflow design needs. Some configurations such as those with extreme cable or server density may create a back pressure situation forcing heated exhaust air around the side of the server components and back into the inlet; if such conditions are suspected, contact your Service Provider for a gasket kit designed for this application.

Leave a minimum clearance of 48 inches (1219 mm) in the front of the rack, this applies to both individual rack installations as well as when aligning rack rows so that the front doors are facing each other. Allow 30 inches (762 mm) in the rear of the rack for servicing clearance needs. If multiple rows of rack mounted equipment are installed, the facility may take advantage of the front-to-back airflow by arranging racks front-to-front and back-to-back. Conditioned air registers may then be oriented along the "front" aisles and the return air registers in the "back" aisles. Such an arrangement will utilize the aisle space as air plenums and will increase the efficiency of the air conditioning. See Figure 22 on page 37.

For additional information on data center best practices, see the "Power and Cooling Trends in the Datacenter" white paper available online at ftp://ftp.compaq.com/pub/supportinformation/papers/tc030203tb_rev4_us.pdf.

Adhere to the following temperature and humidity guidelines.

Table 3. Temperature and Humidity

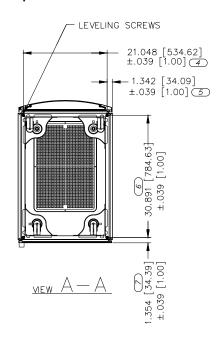| Type	Operating	Non-operating
temperature	10 to 35° C (50 to 90° F) at sea level	-22 to 140° F (-30 to 60° C)
humidity	10 to 90% non-condensing	5 to 90% non-condensing

Note: Altitude derating of 1° C per ever 300 meters above sea level to a maximum of 3,000 meters (1.8° F per every 1,000 feet up to a maximum of 10,000 feet). No direct sustained sunlight.

Floor loading

All buildings and raised computer room floors are engineered to provide a specific floor loading. When configuring a configuration, ensure that the floor loading specifications are followed. Failure to do so may result in physical injury or damage to the equipment and the facility.

Figure 4a. 9000 Series Rack Foot Print (600mm wide)

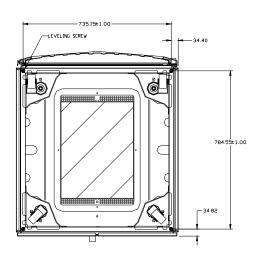**Figure 4b. 9000 Series Rack Foot Print (800mm wide)**

LEVELING SCREWS

21.048 [534.62]
±.039 [1.00] ④

1.342 [34.09]
±.039 [1.00] ⑤

⑥ 30.891 [784.63]
±.039 [1.00]

VIEW A—A

⑦ 1.354 [34.39]
±.039 [1.00]

735.15±1.00

LEVELING SCREW

34.40

784.55±1.00

34.82

Figure 5a. 10000 Series Rack Foot Print (600mm wide)

535.3

34.5

LEVELING SCREWS

885.3

34.5

Figure 5b. 10000 Series Rack Foot Print (800mm wide)

Power
The rack should be connected to a dedicated (unshared) branch circuit that is suitably rated for the continuous load of the rack. The total rack power load should not exceed 80 percent of the branch circuit rating.

Redundant
High-availability Information Technology equipment such as servers and storage devices can be configured with backup or redundant power sources and power supplies in either the 1+1 or N+1 configurations. In the 1+1 design, two power supplies can be provided where either power supply is capable of sustaining the associated equipment's power demand. In an N+1 design, there are typically three power supplies provided, requiring at least two to handle the equipment's power demand. If one fails, the other two remain on line with enough capacity to meet the power demand. It is important that the wiring and branch circuitry to each installation be suitably rated for the power demand of the connected equipment. Routing the power through separate branch circuits, breaker panels and PDUs is also recommended to provide additional redundancy.

Non-redundant
For equipment provided with a single source of power, all components should be connected to the same power distribution device (PDU or UPS). The power management device should be suitably rated for the connected load. If the total load exceeds the rating of the selected device, obtain a suitably rated device, or add a second device and divide the load equally between the power distribution devices.

High line voltage versus low line voltage

While the best setup for your data center application will be driven by your particular facility requirements, HP recommends that you install your rack-optimized equipment for operating at High Line voltage (200-240V AC).

All HP products that are optimized for rack mounting have wide range power supply inputs designed to operate at a voltage range of 100-240V. Here are a few of the benefits that support High Line operation of your installation:

- Power supplies run more efficiently and waste less power when operating at 200 to 240V, saving electrical power.

- Greater capacity in a single cabinet. For the same size circuit, almost twice the power can be delivered to a rack at high line versus low line. Example: A 115V 30A branch circuit can deliver 3450VA to a rack, while a 230V 30A branch can deliver 6900 VA to a rack.

- Some products require 200-240V input power to operate at their full rated capacity.

- Power supplies run cooler at higher input voltages and therefore will last longer and improve overall availability because they run cooler; they produce less waste heat contributing to lower cooling costs.

- Keeping input currents lower allows the use of smaller, more standardized power connections.

Grounding and Earth leakage current

For proper operation and safety, the equipment must be properly grounded. In the United States, install the equipment in accordance with NFPA 70-1999 (National Electric Code) Article 250 as well as any local and regional building codes. In Canada, install the equipment in accordance with Canadian Standards Association, CSA C22.1, and Canadian Electrical Code. In all other countries, install the equipment according to any regional or national electrical wiring codes such as the International Electrotechnical Commission (IEC) 364 parts 1 through 7. Furthermore, ensure that all power distribution devices used in the installation—such as branch wiring and receptacles—are Listed or Certified grounding-type devices.

Because of the high ground-leakage currents associated with multiple servers connected to the same power source, a reliable grounded (earthed) connection is essential. HP recommends the use of a power distribution unit (PDU) that is either permanently wired to the building's branch circuit or is provided with a non-detachable cord that is wired to an industrial style plug. NEMA locking-style plugs or those complying with IEC 60309 are considered suitable for this purpose. HP does not recommend using common power outlet strips for this equipment.

Observe the following limits when connecting the product to AC power distribution devices:

- For UPS products and PDUs that have permanently attached AC power cords or are directly wired to the building power, the total combined leakage current should not exceed 5 percent of the total input current required for the connected products.

- For UPS products and PDUs that have detachable AC power cords, the total combined leakage current should not exceed 3.5 mA per PDU or UPS.

Qualified shipping

All 42U, 36U, and 22U 600 mm wide racks can be shipped in three shipping configurations (-B21, -B22, -B23). The 10647 rack is available as a standard pallet and crate. The 10842 is available as a standard pallet and shock pallet. The S10614 is available only on the shock pallet. The 9842 is available as a standard pallet only.

Standard pallet (-B21)

The -B21 rack 9000 and 10000 ships on a standard wooden pallet with plastic shrink-wrap around the rack. This rack is ordered with the understanding that the component installation will occur on the customer site. This pallet and rack configuration does not support any component-shipping configuration.

Note: All wood components of these pallets have been properly treated to comply with the pest-free certifications required by foreign countries.

Shock pallet (-B22)

The -B22 version of the 9000 or 10000 series rack ships on a shock pallet. The shock pallet is designed to allow the rack to be shipped fully loaded and configured with equipment installed in the rack. The shock pallet ensures that the rack is capable of handling the weight of installed equipment during shipment without damaging the rack or the precision components within. Each of the packing and unpacking procedures takes less than one-half hour and requires at least two people to complete.

The shock pallet is required when shipping any 9000 or 10000 series rack loaded with equipment. For your convenience, these racks can be ordered with the shock pallet and all required packaging materials.

Note: The 9000 and 10000 series racks use different shock pallets.

To move your data center or relocate pre-configured racks, a spares kit is available to support your efforts. Contact your local HP reseller for information on spares kits.

The rack 9842 has not been qualified to ship on a shock pallet. The 10647 rack is not available on a shock pallet due to safety and stability concerns.

Note: All wood components of these pallets have been properly treated to comply with the pest-free certifications required by foreign countries.

Crated pallet (-B23)

When the -B23 version of the rack 9000 and 10000 is ordered, it ships enclosed in a wooden crate. This configuration provides more protection for the empty rack for use in airfreight and other rugged transportation modes.

The 9842 and 10842 are not available in a crated pack.

Configured rack shipments

This section describes the procedures and materials required to enable shipments of configured HP 9000 and 10000 Series racks.

Table 4. Shipment Procedures and Materials

Model	U height	Width	Depth	Shipping options	Shipping dimensions	Shipping weight
9122	22U	600mm/ 23.62 in	900mm/ 35.43 in	pallet (-B21) shock pallet (-B22) crate (-B23)	52.25 x 48 x 32 in/1,327.15 x 1,219.2 x 812.8 mm	225 lbs/ 102.13 kg
9136	36U	600mm/ 23.62 in	900mm/ 35.43 in	pallet (-B21) shock pallet (-B22) crate (-B23)	75.25 x 48 x 32 in/1,911.35 x 1,219.2 x 812.8 mm	234 lbs/ 106 kg
9142	42U	600mm/ 23.62 in	900mm/ 35.43 in	pallet (-B21) shock pallet (-B22) crate (-B23)	86.22 x 48 x 32 in/2,190 x 1,219.2 x 812.8 mm	325lbs/ 147.52 kg
9842*	42U	800mm/ 31.49 in	900mm/ 35.43 in	pallet (-B21)	86.22 x 48 x 38.8 in/2,190 x 1,219.2 x 985.52 mm	440 lbs/ 200 kg
10622	22U	600mm/ 23.62 in	1000mm/ 39.37 in	pallet (-B21) shock pallet (-B22) crate (-B23)	52.25 x 48x 32 in/1,327.15 x 1,219.2 x 812.8 mm	225 lbs/ 102.13 kg
10636	36U	600mm/ 23.62 in	1000mm/ 39.37 in	pallet (-B21) shock pallet (-B22) crate (-B23)	75.25 x 48 x 32 in/1,911 x 1,219.2 x 812.8 mm	272 lbs/ 123 kg
10642	42U	600mm/ 23.62 in	1000mm/ 39.37 in	pallet (-B21) shock pallet (-B22) crate (-B23)	86.22 x 48 x 32 in /2,190 x 1,219.2x 812.8 mm	284 lbs/ 129 kg
10647*	47U	600mm/ 23.62 in	1000mm/ 39.37 in	pallet (-B21) crate (-B23)	95.37 x 48 x 32 in /2,425 x 1,219.2 x 812.8 mm	296 lbs/ 134 kg
10842	42U	800mm/ 31.49 in	1000mm/ 39.37 in	pallet (-B21) shock (-B22)	86.22 x 48 x 43.5 in/2,190 x 1,219.2 x 1,104.9 mm	335 lbs/ 151.95 kg
s10614	14U	600mm/ 23.62 in	1000mm/ 39.37 in	shock (-B22)	44 x 35 x 30.5 in/1,117.6 x 889 x 774.7 mm	200 lbs/ 90.91 kg

NOTES:

* The 9842 and 10647 racks cannot ship with equipment installed.

Qualification of rack components

A component is a term used in this document to mean a physical device intended to be mounted in the rack. Examples of components include, but are not limited to:

- Slide- or rail-mounted devices such as server or storage units
- Shelved devices such as keyboards and displays
- Side-mounted "zero-U" PDUs
- Fan kits that mount to the rack roof

Components must be qualified prior to consideration for shipment within racks; this means the unit has been successfully tested under common carrier simulations. Keep in mind, though, that HP recommends the use of padded van carriers to avoid some potential damage handling scenarios mentioned in the "Modes of shipment" section. The qualification process is an on-going effort to evaluate models as they are introduced.

Prior to a successful qualification, a component should be shipped in its individual shipping container; shipment of an unqualified system in a rack or any system without the proper shock pallet will void the warranty.

Packaging materials

This section discusses the best practices for shipping qualified components in a rack 9000 and 10000 on a shock pallet.
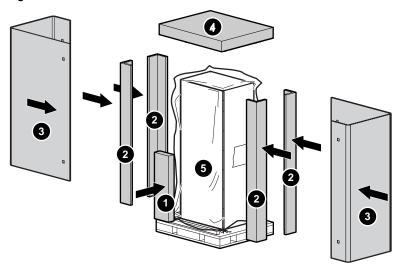
- Qualified components
- Requirements for mounting

Standard –B22 shock pallet configuration

Refer to the Bill of Materials for shipment of the various racks, sorted by rack height.

Figure 6 shows the normal packaging material that is shipped with the empty rack as it arrives at the customer configuration site.

Figure 6. HP Rack on Shock Pallet

Items shown in figure above:
1. Ramps are placed vertically on the side of the rack during shipment, typically held in place with the stretch wrap.
2. Corner posts
3. Corrugated sheets
4. Cap
5. Antistatic bag
6. Stretch wrap (not shown)
7. Banding (not shown)
8. Corruclips
9. IATA labels
10. –B22 Shock Pallet

Note: HP manufacturing sites are required to order items 1, 3, 4, 6, 7, and 8 separately.

Preparation for shipment

All racks require some preparation for shipment, regardless if qualified components are used. These requirements are listed under "general considerations (all shipments)." A qualified component has been tested for common carrier shipment conditions, often with the aid of specific hardware. This hardware, if required, is included in the accessories shipped with the product. If a component is being shipped that has not been qualified, additional preparation may be required. See the section "special considerations."

Site survey

To determine if a configured rack is suitable for shipment, be sure to examine the receiving facility site conditions. Circumstances requiring special handling of the rack, such as inadequate door height clearance or having to move the rack in a horizontal orientation, may justify a decision to install components after the moving process.

The specialized, air-ride, padded-van carriers usually has the ability to perform site surveys. Among other elements, the site survey should determine:

- What are the hours the facility is open for deliveries?

- Does the facility have a dock? Can a 48-foot trailer access it?

- Are appointments required?

- Is movement across rough surfaces likely?

- What are the clearances (width and height) for freight elevators, doorways, or other obstacles?

Additional discussion of these considerations may be found in the "Mode of receiving and delivery" section.

General considerations (all shipments)

Before beginning these procedures, make sure you understand and follow these precautions.

> **WARNING:** To reduce the risk of personal injury or damage to the equipment, be sure to remove all non-rack-mounted monitors and other non-rack-mounted equipment. This category includes all components not mechanically fastened to the rack structure.

The following are the minimum requirements for qualifying components for shipment in a HP Rack 9000 and 10000 mounted on a shock pallet:

- Use a torque wrench to tighten all front panel mounting hardware and rail/slide connections to 20 in-lb (2.2594 N-m). Use provided mounting hardware to secure any spring-loaded slide assemblies to the mounting rails.

- Use the shipping hardware or additional clamping or hold-down brackets provided with each component. This hardware is typically found in the accessory box. The Server Immobilization Bolt (SIB) is a large red thumbscrew and is easily installed from the rear of the rack.

- Dress and secure all data and power cables. Cables and cable management arms should be tie-wrapped to prevent movement of cables that may place a load on connector assemblies or that may cause fraying due to friction. Wire-formed cable management clamps are provided with each rack for this purpose. Some components provide sheet metal cable management extensions or spring loaded cable retention reels that should be utilized in all cases. Firmly close front and rear doors.

- Reuse any packaging materials that were initially provided with the rack.

- Check to ensure the rack mounting brackets are properly secured to the pallet. The bracket should be at an angle to the pallet deck (see Figure 12) and should not be loose. Ensure that the bolt securing the bracket to the pallet is torqued to 150 in-lb (16.9 N-m).

- All racks should be secured in the trailer/truck to prevent the rack from potentially falling on its side during vehicle turns.

Note: Since most common carriers are not accustomed nor equipped to perform this function, this detail is particularly important, even if the configuration is common carrier qualified.

Special considerations

Additional requirements for nonqualified components for shipment in a HP Rack 9000 and 10000 that is mounted on a shock pallet are listed below:

- Replace any wing nuts with hex- or square-head nuts and appropriate locking hardware.

- Inspect the rack for unsupported mechanical structures. Look for cantilevered chassis with little or no rear support or large chassis with rails mounted to the extreme top or bottom of the chassis. Be especially attentive to any free movement of the component while mounted in the rack. In some cases, it may be beneficial to use supplemental packaging materials to brace these components. The white foam from the shipping containers of the components works well in these situations. The ProLiant BL e-Class and BL p-Class Enclosures have been qualified and are supported in a shipping environment when the appropriate shipping brackets are installed and shock pallets are used. While these enclosures are supported, the blade servers and power supplies are not supported and must be removed prior to shipping.

- The BL p-Class and BL e-Class server and power enclosures are supported in this shipping environment when they are installed with proper brackets and transported on shock pallets.

- The R3000XR and R1500 UPS systems have been qualified to ship with the batteries installed provided the rear support brackets are used. For the R3000XR, these are U-shaped brackets. For the R1500, use the provided locking brackets that tab into slots at the rear of the system. In both cases these brackets arrive in the option kits and are to be installed per the instructions included in the shipping box. All other UPS systems should have the batteries removed and shipped separately. See Table 7 for packaging details and part numbers. In circumstances where the UPS front bezel is no longer screw-supported on one side, secure the bezel to the UPS chassis with tape (non-residue preferred) or ship the bezel separately.

- Do not ship backup media in either tape drives or in tape library units. With the exception of the TL890 and TL891, rack-mounted tape libraries are not approved to shipped in a configured rack.

- Use double-sided tape to secure the keyboard to the keyboard drawer, or ship the keyboard separately.

- Some shipping regulations require specific identification of the batteries enclosed with the package. For example, the US Department of Transportation requires a pack enclosing a UPS battery be marked to indicate a spill proof lead acid battery was enclosed. For CTO Rack shipments destined for the EU, specific markings of all battery systems are required, including the real-time clock batteries found in each server.

To comply with these requirements, HP provides a family of decals that may be applied to the shipping carton; these are listed in Table 6. Markings are pre-printed on the cartons for the Return Kit Spares packaging found in Table 7.

WARNING: When reinstalling the battery, a spark may be observed when reconnecting the spade terminals. Be sure to hold the connectors by the insulated housing. To prevent rotation of mounting rails, ensure that the front panel mounting screws are in place when reinstalling the battery.

Modes of shipment

HP recommends that you ship all configured racks through a service offering specialized, air-ride, padded-van carriers. These carriers, such as North American Van Lines and United Van Lines, etc., differentiate themselves by providing operators who are specifically trained for inside deliveries and special handling situations involving electronic equipment; for example, they will routinely carry the strapping needed to secure the rack to the side of the trailer. They are also trained to conduct site surveys, if required.

Guidelines for selecting a specialized, air-ride, padded-van carriers include the following considerations:

- A dedicated truck shipment can be set up with no transfer points where the equipment is unloaded/reloaded enroute to its destination.

- These carriers are accustomed to special handling arrangements and will provide any necessary materials.

- The rack assembly is secured within the truck.

- Specialized, air-ride, padded-van carriers are required for shipment of any rack with at least one component that has not been qualified.

Airfreight

Because the rack cannot be safely tipped or placed on its side during transit or storage, air cargo doors must have height sufficient for the rack to be loaded and removed without tipping. Consult your freight forwarder for available aircraft configurations that satisfy your particular rack height.

Mode of receiving
and delivery

Knowledge of the receiving site is an important planning consideration, as special equipment or arrangements may have to be made. Think about the following issues:

- Inquire whether the receiver has a shipping dock with adequate height for a truck to load and unload the equipment. Without a dock, specialized equipment such as bobtail trucks and forklifts may be required. If the rack is to be rolled across a parking area, panels of plywood or Formica are recommended to minimize the vibration induced into the rack.

- Be aware that the 42U rack is 85 inches (2159 mm) high on the pallet and exceeds standard 7-foot doorways so the rack will have to be de-palletized for passage through the standard 7-foot doorframe.

- The 47U racks cannot be moved with equipment installed due to safety and stability concerns.

- Use the shock pallet to ship the rack with equipment installed. Pallet jacks are recommended when moving the rack inside a building structure. The pallet jack should enter the shock pallet from the front side as indicated by the pack artwork (Additionally, the front side has the long section of foam on the right side).

- Consider that alternative handling schemes may be required in areas with elevated floor structures with inadequate ramp systems (for example, lifting the rack with eyebolts in the top frame for floors with an incline greater than 15 degrees). For products with casters, when negotiating any ramp, keep the front of the rack pointed uphill to minimize the possibility of the rack tipping.

WARNING: To reduce the risk of personal injury or damage to the equipment, do not attempt to move large equipment racks by yourself. Obtain adequate assistance to stabilize the rack during movement, or hire professional equipment riggers.

IATA labeling

Typical HP products that are classified as Magnetized Material are those with arc-welded frames that contain a large mass of ferrous metal. For example, most racks or cabinets will usually test in the low to mid-range of the regulatory limits and be classified as Magnetized Material. In the past, high-end (floor standing) disk drives were regulated due to the large motors they contained; however, as the size of the drives has been reduced, so has the size of the motors. Disk drives alone are no longer regulated, but may be loaded into a rack system that is.

Magnetized Material are regulated as Dangerous Goods under Class 9, "Miscellaneous Dangerous Goods," and have been assigned the United Nations identification number, UN2807. These goods are only regulated when transported by air due to their potential for interference with aircraft instrumentation. Shipments must be properly marked, labeled and documented to be legally accepted by an air carrier for transport.

For more specific details of how and why this requirement process is managed, please refer to the following URL: www.iata.com.

In all cases of air shipments, a Shipper Declaration is required (see Figure 7). This sample is an internal HP document. If access is needed, please ask your local HP service representative to contact the Rack Program management organization within HP.

Figure 7. Sample Shipper Declaration

The "place and date" of shipment must be entered by the shipper (the "person" who offers the freight to the carrier). The shipper must offer a minimum of two signed copies (our internal standard is four) of the completed Shipper's Declarations for Dangerous Goods to the carrier, usually along with the Air Waybill.

A copy may be taped on the side of the box, but this is not required. There are currently no provisions in the regulations for them to be electronically transmitted.

Should a shipment be rejected for any reason, a Dangerous Goods Checklist should be provided which indicates the specific reason for the rejection.

Think of a Shipper's Declaration as a quality check for the shipper. For example, when taking an airplane trip as a passenger and checking in at the airline front desk, you would be asked, "Did you pack your bags and have your bags been with you at all times?" The airlines, just like shippers want the declaration that everything is in order from the last person who touched the product. If the rack had been built out for CTO and then put on a plane, the documents would come from the factory or the group building out the rack.

Installation instructions

To install a HP Rack 9000 and 10000 cabinet into a shock pallet:

1. Unpack and attach the ramp rails to the pallet.

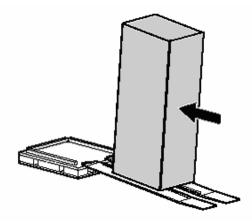   **Figure 8. Attaching Rack Rails**

    Note: If components have been removed for shipping, care should be taken to ensure that the rack is stable prior to rack installation onto the shock pallet. Place the remaining components in the lower portion of the rack to ensure that the rack is not top-heavy or unstable during shipment.

2. Roll the rack up the ramps (with fixed casters up the ramp first) and place the rack on the pallet. When rolling the rack up the ramp, make sure to push firmly on the doorframe and not the door mesh. See Figure 9.

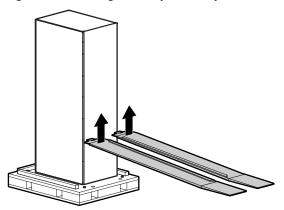   **Note:** Raise the leveling feet up into the rack to allow ease of movement over the ramp and pallet.

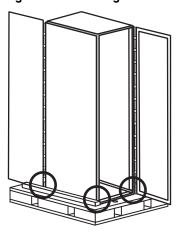**Figure 9. Placing the Rack on the Pallet**

3. Remove the ramps from the pallet and repack the ramps in the original box.
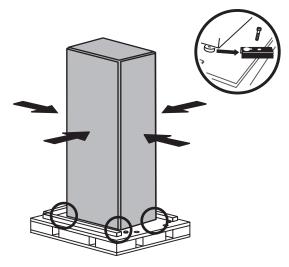
Figure 10. Removing the Ramp Assembly

4. Place a metal shipping bracket and load spreader plate under each leveling foot. Extend all four leveling feet until they just short of touching the top surface of the brackets. The leveling feet should be between 0.88 inch (22.352 mm) and 1 inch (25.4 mm) from the pallet deck. Place the shipping bracket onto the leveling feet through the keyhole in the bracket.
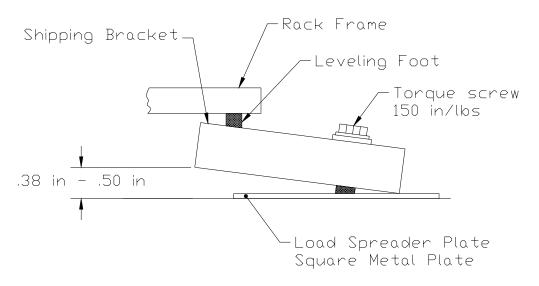
Figure 11. Positioning Rack onto Pallet

5. Center the rack on the pallet, and position the hold-down brackets with bolts and lock washers and load spreader plate into the threaded holes in the pallet deck (see Figure 12). Additionally, refer to Figure 13 for more details.

Figure 12. Positioning the Hold-down Brackets

6. Tighten the bolts in the four hold-down brackets to 150 in-lb (16.9455 N-m) to secure the hold-down brackets to the pallet. Use a 9/16-in (14 mm) open-end wrench. The hold-down brackets should be angled up off the pallet deck holding the leveling feet in tension. See Figure 13.

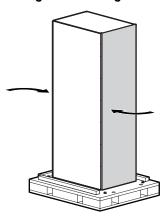**Figure 13. Tightening the Hold-down Brackets**

Note: Before securing the cabinet to the pallet, be sure the shipping brackets are located on the load spreader plates and the leveling foot is between 0.88 inch and 1.00 inch. Once installation is properly completed, the space between the high end of the bracket and the pallet should be between 0.38 inches (9.652 mm) and 0.50 inches (12.7 mm).

> **Note:** Before locking the rack doors, all servers and other equipment should be installed in the rack. Only equipment certified to ship in the rack 9000 and 10000 should be installed at this time. Equipment not yet certified to ship in the rack 9000 and 10000 should be installed on-site at the final destination to prevent damage to equipment while the rack is in transit.
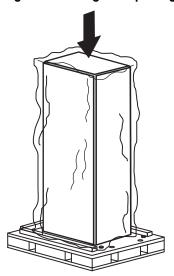
7. Close and lock both doors.

Figure 14. Closing the Rack Doors

8. Place the plastic bag over the rack and tape the keys to the front of the bag.
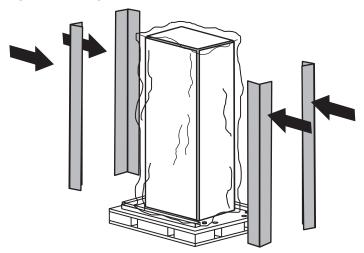
Figure 15. Placing the Paper Bag over the Rack

9. Place the four corner posts on each corner of the rack. Make sure that the corner posts are properly positioned around the door handles to prevent damage.
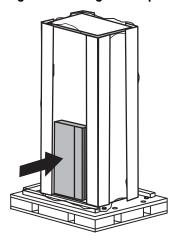
Note: It is helpful to tape or stretch-wrap the corner posts in place.
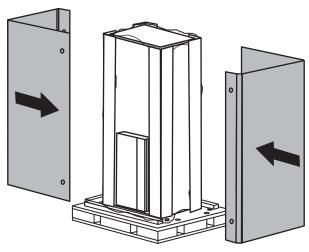
Figure 16. Placing the Four Corner Posts

10. Place the ramp box against the sidewall of the rack between the corner posts on either side of the rack. Then, stretch-wrap the corner posts and the box containing the ramp assembly to the rack.

Figure 17. Placing the Ramp Box against the Sidewall

11. Place the two corrugated sides around the rack.
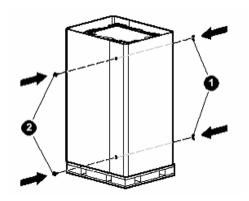
Figure 18. Placing the Two Corrugated Sides

12. See Figure 19.

For racks with plastic fasteners: Secure the corrugated sides with the appropriate fasteners. Insert an outside plastic fastener into the upper and lower hole of each corrugated panel. Fold the plastic fastener over and snap the parts in place, using appropriate pressure in place to secure the panels together.
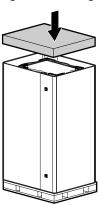
For racks with metal fasteners: ❶ Insert an outside metal tri-wall fastener into the upper and lower hole of each corrugated panel. ❷ Secure with an inside metal tri-wall fastener, using an 11-mm wrench.

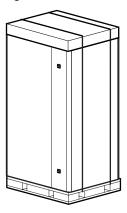**Figure 19. Securing the Two Corrugated Sides**

13. Place the corrugated cap on the top of the assembly.

Figure 20. Placing the Box Cap

14. Secure the corrugated cap and corrugated sides to the pallet using two applications of banding running from front to back.

Figure 21. Installed Shock Pallet

Installation is complete.

Installation service

In the United States, HP can arrange to have your rack installed by qualified service providers. This installation service covers the entire hardware installation sequence, from unpacking the components to routing cabling and running a test of the system.

Installation can also be provided directly by HP authorized service providers.

If you need a pre-certified solution, contact the high performance technical computing (hptc) solutions group at www.hp.com/techservers/buying/htbcontact.html.

Spares kits

Contact your local reseller for information on spares kits.

Shock pallet

Table 5 lists the items and quantities required for assembly of the HP Shock Pallet Spares Kit.

Table 5. HP Shock Pallet Spares Kit Contents

Item	9000 Series	10000 Series
Sheet, Corrugated Covers	2	2
Fastener, Corrugated	4	0
Assembly, Fastener	4	0
Pallet, Cushioned	1	1
Corrugated Cap	1	1
Ramp Assembly	1	1
Bracket, Hold Down	4	4
Screw, Machine	4	4
Washer, Flat	4	4
Washer, Helical Split	4	4
Static Bag	1	1
Corner Posts	4	4
Clip, Plastic, Box	0	6
Pallet, Hold Down LD SPDR Plate	0	4

This kit may contain extra pieces of hardware for your convenience.

Additional tools and equipment

- 11/16-in (or 17-mm) open-end wrench
- 9/16-in (or 14-mm) open-end wrench or socket
- 7/16-in (or 11-mm) open-end wrench or socket
- Stretch wrap
- Banding

Battery decals and boxes

HP provides a family of decals that may be applied to the shipping carton; these are listed in Table 6.

Table 6. Power Products: Decals

Part number	Decal description
247933-001	Label, Battery Disposal Warning, Cadmium
247933-002	Label, Battery Disposal Warning, Mercury
247933-003	Label, Battery Disposal Warning, Lead Acid
247933-004	Label, Battery Disposal Warning, Other
244014-001	Label, Battery Statement (Non-spill able)

When shipping a battery outside the UPS, use the packaging provided in the Return Kit Spare. Table 7 lists spare batteries for power products.

Table 7. Power Products: Spare Batteries

Unit	Battery spare (battery and packaging)	Return kit spare (packaging only)
R3000	295462-001	242006-001
R6000	401863-001	241965-001
R1500	240789-001	242007-001
R1500 ERM	240790-001	242008-001
R3000 XR	204503-001	234400-001
R3000 XR ERM	204503-001	234400-001
R12000	228288-001	228293-001 UPS 228294-001 Battery

Rack option kits

HP offers a variety of rack options. For complete information, see the HP Rack Options website at www.hp.com/products/rackoptions.

Appendix a: glossary

In this glossary, industry technologies are listed alphabetically with detailed descriptions for each entry.

B

ballast

A metal block that can be mounted in the sides of the rack to provide additional weight and protection against tipping.

C

chassis

Rack-mountable configuration of a server or a storage component.

D

dedicated circuit branch	A dedicated electrical circuit between a source and distribution point.
dynamic loading capacity	A dynamic environment is one where the rack is shipped on a shock pallet with equipment installed or rolling racks with equipment installed to new locations within the data center.

E

EOL (End of Life)	A term used for signifying discontinuation of products.

F

fixed stabilizer	An anti-tip stabilizer providing stability and support when equipment is installed, removed, or accessed within the rack. It is recommended that you use a stabilizer option kit with a stand-alone rack.

K

keyboard/video/mouse (KVM) switch	A switch that allows a single keyboard, video display monitor, and mouse to be switched to any of a number of computers.

P

PDU	Power Distribution Unit.
PNP (Plug-and-Play)	A standard that gives computer users the ability to plug a device into a computer and have the computer recognize that the device is connected.

S

static loading capacity	A static environment is one where the rack is positioned into placed and the leveling feet are extended prior to equipment being installed.

U

U	A standard unit of measure for designating the height in computer enclosures and rack cabinets. One U equals 1.75 inches (44.5 mm). Measurements typically go from the bottom of the rack up.
	For example, a 4U chassis is 7 inches (177.8 mm) high. A 42U rack cabinet has 73.5 inches (1866.9 mm) of usable mounting space.
UPS (uninterruptible power supply)	A device that allows a computer to continue running for at least a short time after the primary power source is lost.

Appendix b: general specifications

The following table provides torque values for specific rack components.

Table 8. Torque Values (Specific)

Component	Torque (in-lb)	Torque (N-m)
All M6 rack hardware	20 in-lb	2.2594 N-m
Pallet bracket hold-down bolts	150 in-lb	16.9455 N-m

In addition to any specific torque value given in this document, the following tables provide torque values that can be used to prevent over-torquing a fastener.

The following torque values assume SAE (Society of Automotive Engineers) grade 2 hardware or ISO (International Standards Organization) 898 property classes less than 8.8 hardware (for example, 4.6, 4.8, 5.6). Steel hardware for both male and female threads is assumed. For ISO 8.8 or 12.9 and SAE Grade 5 or 8, torque should be determined by the application.
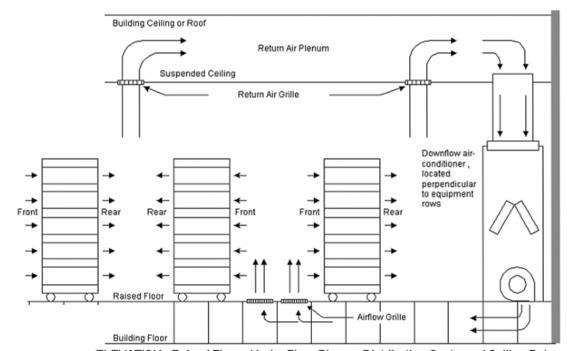
Table 9. Torque Values (Standard Hardware)

Measurement	Torque (in-lb)	Torque (N-m)
#4	6 in-lb	0.67782 N-m
#6	10 in-lb	1.1297 N-m
#8	19 in-lb	2.14643 N-m
#10	27 in-lb	3.05019 N-m
1/4-20	66 in-lb	7.45602 N-m
3/8-16	240 in-lb	27.1128 N-m
1/2-13	585 in-lb	66.08745 N-m

Table 10. Torque Values (Metric Hardware)

Measurement	Torque (in-lb)	Torque (N-m)
M3	7.6 in-lb	0.858572 N-m
M4	17 in-lb	1.92049 N-m
M5	36 in-lb	4.06692 N-m
M5.5 self tap	40 in-lb	4.5188 N-m
M6	60 in-lb	6.7782 N-m
M8	147 in-lb	16.60659 N-m
M10	292 in-lb	32.98724 N-m
M12	509 in-lb	57.50173 N-m

Figure 22. Airflow Diagram

ELEVATION: Raised Floor - Under Floor Plenum Distribution System w/ Ceiling Return

For more information

Product information: 1-800-345-1518

Pre-sales: 1-800-282-6672

Post-sales: 1-800-652-6672

Business partner sales consulting: 1-800-888-5874

For more information on ProLiant servers, visit www.hp.com/servers/proliant.

For more information on HP 9000 and 10000 series racks and options, visit www.hp.com/products/racks.

Learn more about optional rack features at www.hp.com/products/rackoptions.

Learn more about ProLiant server power protection and management at www.hp.com/products/ups.

Feedback

Please direct comments regarding this communication to the ISS Technology Communications Group at this Internet address: TechCom@HP.com

05/2003

Document Number TC030501BP