

Best practices for the HP Modular Cooling System

best practice



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Abstract

This document outlines recommended practices for facility planning and preparation for the HP Modular Cooling System (HP MCS) as used with the HP 10000 G2 Series Rack Model 10642 G2.

HP MCS Product overview

The HP MCS (Figure 1) cools the warm air that is generated by equipment installed in a 10642 G2 rack. The MCS unit is designed for high-density server and blade deployments. The horizontal air flow of the MCS unit distributes cooled air uniformly throughout the complete height of the enclosure (i.e., all devices receive adequate and evenly distributed cool air regardless of their mounting position within the enclosure).

Figure 1. HP 10642 G2 Rack with MCS



The HP MCS can be populated with the following HP products:

- HP ProLiant servers
- HP BladeSystem servers
- HP NonStop servers
- HP Integrity servers
- HP StorageWorks MSA, EVA and XP products
- HP rack mount power protection products
- HP rack mount switches
- HP rack mount monitors
- Third party IT equipment that conforms to 19" standard rack

The MCS unit cools and circulates air through the 10642 G2 rack as outlined in the following steps (Figure 2):

1. The rack-mounted components in the 10642 G2 rack receive cooled air from the MCS unit. The cooled air provides cooling for the components.
2. As the components warm the air, the warm air is expelled through the MCS heat exchangers located at the rear of the MCS unit.
3. Warmed air is channeled back into the MCS unit.
4. The air is cooled and then re-circulated to the front of the rack.

Figure 2. MCS cooling process

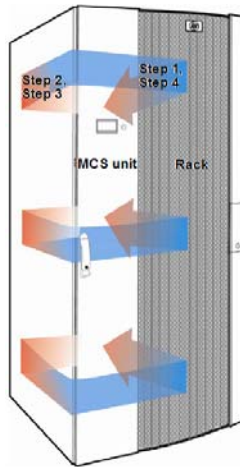


Table 1 lists the key features of the HP MCS.

Table 1. HP MCS key features

Feature	Description
Cooling Capacity of up to 35 kilowatts (kW)	Supports a maximum configuration of blade servers, which requires a power load of approximately 35 kW. The HP MCS provides 2,700 cubic-feet-per-minute (CFM) of cool air distributed along the full height of the rack.
Power Input Redundancy	Automatically detects power failure and switches to alternate source.
Environmental Control and Safety	Provides a full range of monitoring systems, including environmental control of the cooled air temperature being placed in front of the servers. The heat exchanger units features safety quick disconnect valves that prevent chilled water leakage during service.
Hot-swappable components	Fans and heat exchangers can be replaced while the unit is operating providing greater flexibility for servicing the HP MCS.
CTO	The MCS ships standard with a shock pallet that allows for factory integration of IT equipment of up to 2000 Lbs. It can also ship empty to a VAR for integration and then ship configured to the final destination.

Product components

Table 2 lists the key components of the HP MCS.

Table 2. HP MCS key components

Component	Description
Fan Module	A module containing one of the main, internal circulation fans. There are three hot-pluggable and online serviceable fan modules within the HP MCS.
Heat Exchanger Module	An air-to-water heat transfer device is designed for demanding data center environments and is the key component within the heat exchanger (hex) unit. There are three hot-pluggable and online serviceable hex units within each HP MCS.
Patch Panel	The patch panel provides for connection of the AC power and network interfaces.
Water Group	A module containing the magnetic valve, flow meter, check valve and condensate pump. There is one water group in each HP MCS.
Management Module	The Management Module provides users with web-based capabilities to set, monitor and control temperature and other parameters within the modular cooling unit, as well as displays the health of the unit.
Automatic Door Release Kit	An Automatic Door Release Kit is included as standard with every MCS. The kit ships in the accessories box and is to be field-installed. The Automatic Door Release Kit is designed to swing the MCS front and rear doors open in the case of a sudden increase in the temperature inside the MCS. The open doors will allow the IT equipment to cool using the air from the datacenter.

MCS Specifications

Table 3 lists HP MCS specification details.

Table 3. HP MCS specifications

Detail	HP MCS specification
Voltage	208–230 VAC +/- 10%, 50–60 Hz
Height (including the rack)	200.7 cm (79 in.)
Width (including the rack)	91.2 cm (35.9 in.) maximum
Depth (including the rack and rack handle)	127 cm (50 in.)
Weight (including the empty rack)	512.6 kg (1130 lbs.)
Weight (gross with packaging)	557.2 kg (1230 lbs.)
Effective cooling with 25 l/minimum water supply at 0° C, cold air at 25° C	35 kW
Rated current maximum	208 VAC–15 Amps
Cooling medium	Water
Minimum recommended water inlet temperature	7° C (45° F)
Permissible operating pressure (maximum)	100 pounds-per-square-inch (psi)

Table 4 provides dimensions and weights of a packed and unpacked MCS unit and rack that is not populated with rack-mounted components (i.e., an empty rack).

Table 4. HP MCS and Server Cabinet Dimensions and Weights

Detail	Unpackaged rack with pre-installed MCS unit	Packaged rack with pre-installed MCS unit
Height	78.7 in. (1999 mm)	88.5 in. (2248 mm)
Width	35.8 in. (909 mm)	48 in. (1220 mm)
Depth	50 in. (1270 mm)	70 in. (1778 mm)
Weight	1190 lbs.* (540 Kg)	1370 lbs.** (621.4 kg)

*Weight of the fully assembled MCS and rack before any components are installed in the rack.

**The packaged weight of the MCS, along with all packaging materials such as cartons and skid.

Additional Resources

Additional resources are available as follows:

- For a complete list of HP rack options and accessories, go 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/products/proliant.
- For a list of HP power products such as UPS and PDU, go to www.hp.com/products/ups.
- For a complete list of HP server storage equipment, go to www.hp.com/products/serverstorage.
- For a list of the HP MCS documentation, including the HP Modular Cooling System Site Preparation Guide, go to <http://h20000.www2.hp.com/bizsupport/TechSupport/DocumentIndex.jsp?contentType=SupportManual&lang=en&cc=us&docIndexId=179111&taskId=101&prodTypeId=329290&prodSeriesId=1155256>.

Certification and regulatory compliance

For information on the HP MCS certification and regulatory compliance, refer to either of the following documents:

- Quickspecs, available at http://h18004.www1.hp.com/products/servers/proliantstorage/racks/mcs/index.html?jumpid=reg_R1002_USEN
- HP Modular Cooling System User Guide, available at <http://h20000.www2.hp.com/bizsupport/TechSupport/DocumentIndex.jsp?contentType=SupportManual&lang=en&cc=us&docIndexId=179111&taskId=101&prodTypeId=329290&prodSeriesId=1155256>

Integration services and software

Several resources are available for planning HP MCS configurations.

HP UPS Sizing Tool

The UPS Sizing tool is an online tool that collects information on power consumption requirements and then provides the correct UPS product for those requirements.

Additional resources

For additional information on the UPS Sizing tool, refer to <http://www.upssizer.com/selector.asp>.

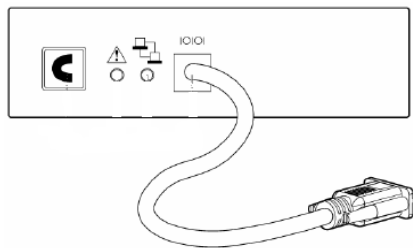
MCS documentation CD

The Documentation CD shipped with the MCS and provides documentation for installing and optimizing the MCS.

HP Modular Cooling System Management Module

The MCS management module (Figure 3) is located inside of the MCS front door. The management module can be accessed remotely through a web interface, and can be used to analyze, query, and manage various measurements in the MCS unit. If a parameter is out of the specified threshold, either a warning or alarm message displays on the operator display and on the web interface.

Figure 3. MCS management module



MCS deployment considerations

The following sections describe components and options available for the MCS that may be necessary to achieve safety, regulatory compliance, or functionality requirements.

Levels of HP MCS security

Either of the following conditions may be necessary for compliance with certain safety certifications:

- The HP MCS must be located in a restricted access area that is only accessible to trained personnel.
- Or-
- The HP MCS must be configured with lockable hardware.

HP MCS front doors, rear doors, and side panels support this locking requirement. Rear split doors are standard on the MCS.

HP MCS Front Doors

The MCS front door ships standard with every MCS unit. The MCS includes a front door with a polycarbonate insert, which prevents chilled air from being re-circulated into the data center.

HP MCS Rear Doors

The MCS ships with solid rear doors as the standard configuration.

HP Side Panel Kit

Side panels ship as the standard configuration. Side panels aid in providing proper front to rear airflow and a first level of security.

Important:

The MCS unit is not bayable and for proper air flow, the side panels should not be removed from a MCS unit.

Stabilization for seismic activity

HP MCS installations in geographical areas where there is a risk of seismic activity require special considerations for stabilization of the HP MCS.

Important:

The HP MCS is not a Zone 4 or OSHPOD solution.

An equipment integrator will need to determine the requirements for which, if any, ballast and stabilizer kits are required. If the HP MCS is bolted to the floor or to an adjacent HP MCS that has sufficient combined weight, additional stabilization products may not be required.

Space and cable management requirements

Important:

Roof-mounted fan kits should not be used in the HP MCS. The roof-mounted fans are not compatible with the HP MCS air flow requirements.

Extension kits

Cables and equipment can be damaged in use or in shipping if there is insufficient room in the HP MCS. Extensions can be used when additional room is required at the rear of the HP MCS to provide adequate room for equipment and associated cables. The extension kit provides approximately 6.0 inches (155 mm) of additional space at the rear of the HP MCS.

Cable management kits

Due to the dynamic nature of the HP MCS environment, the cabling of systems has very few hard rules. Cable management kits provide an easy way to organize and route cables within the HP MCS. Several kits are available as options to assist with cabling requirements.

Additional information on cable management kits is available at: www.hp.com/products/rackoptions.

HP general guidelines for cable management are as follows:

- Rack Rear Extension kit (AF058A) is available to provide additional cabling space. The Rack Rear extension kit will not affect the cooling capabilities of the MCS.
- For good visual reference, do not install cabling until all equipment has been installed in the HP MCS.
- 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.
- When securing cables inside the HP MCS, the bundle should be dressed in such a way as to avoid interference with installed components or HP MCS side panels or rails.
- When possible, use all cable management arms included in component kits.
- For components that must be movable while Powered On, 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.
- Separate power and signal cables as much as possible. For example, dress all signal cables on the Left side of the HP MCS and all power cables on the Right side of the HP MCS.
- Ensure that cabling does not impede the airflow to the rack-mountable servers or increase the internal HP MCS temperature beyond the specified maximum rating.
- Route all cables away from fans.

A list of available extension kits can be found at the main rack options product page at www.hp.com/products/rackoptions.

Thermal requirements

Equipment that is exposed to excessive heat may not operate correctly and may experience abnormally high failure rates. The air flows from the front to the rear of the HP MCS. HP recommends that components only be installed on the front rails for proper airflow.

Automatic door opening mechanism

An Automatic Door Release Kit is included standard with every HP MCS. The kit ships in the accessories box and is to be field-installed. The Automatic Door Release Kit is designed to swing the HP MCS front and rear doors open in the case of a sudden increase in the temperature inside the HP MCS. The open doors will allow the IT equipment to cool using the air from the datacenter.

Insulation Considerations

Flex-Hose exiting the MCS may be insulated to reduce condensation. The insulation should cover the hose snugly with no gaps, with enough thickness as appropriate.

Additional resources

- For information on options available for the 10000 Series Rack, refer to the Rack Options Catalogue at <http://h18004.www1.hp.com/products/servers/proliantstorage/racks/10000series/documentation.html>.
- For information on deployment and configuration of multiple servers in a single rack, refer to the white paper on high-density deployment on the HP 10000 Series Rack support and documentation section at <http://h18004.www1.hp.com/products/servers/proliantstorage/racks/10000series/documentation.html>.
- For information on the HP Modular Cooling System refer to the HP Modular Cooling System Site Preparation Guide and white papers available at <http://h20000.www2.hp.com/bizsupport/TechSupport/Home.jsp?lang=en&cc=us&prodTypeId=329290&prodSeriesId=1155256>.
- For a list of the HP MCS documentation including the HP Modular Cooling System Site Preparation Guide, go to <http://h20000.www2.hp.com/bizsupport/TechSupport/DocumentIndex.jsp?contentType=SupportManual&lang=en&cc=us&docIndexId=179111&taskId=101&prodTypeId=329290&prodSeriesId=1155256>.

HP MCS assembly guidelines

Table 5 lists guidelines to follow when physically placing components in an HP MCS.

Table 5. HP MCS assembly guidelines

Component	Guideline
Weight	Sort all components by weight, placing the heaviest components at the bottom of the HP MCS.
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	Mount the keyboard or 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 HP MCS, whether it is a CRT or Flat-panel design. It is recommended to arrange the screen or rack-mountable flat panel monitor, a minimum of 4U's above the keyboard tray. Most customers prefer placement of the video system high in the HP MCS, especially in a full HP MCS, to allow easier access to serviceability of other system components below it.

Additional resources

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

HP MCS Installation and maintenance precautions

To reduce the risk of electric shock or damage to the equipment when installing, maintaining, or servicing Enterprise products, observe the general precautions listed in Table 6.

Table 6. HP MCS installation and maintenance precautions

Precaution	Description
Follow manufacturer instructions	Always refer to the individual equipment installation instructions for any special considerations when installing equipment in an HP MCS.
Be aware of power voltages and use trained personnel	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.
Secure all equipment	Unless the equipment is installed in a restricted access area, HP MCS 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.
Provide overhead clearance for fire sprinkler devices	A minimum clearance is required between the top of the HP MCS and any fire protection sprinkler devices. Check your local building codes for details.

HP MCS side service access

The HP MCS does not provide full accessibility for servicing a rack-mountable component from the side of the HP MCS unit; therefore, side serviceability may be limited for certain rack-mountable components.

Moving an HP MCS on its casters

An HP MCS should be moved on its casters with care. Sudden stops, excessive force, and uneven surfaces may cause the product to overturn. The HP MCS has casters which are fixed in the front and swivel in the rear. Therefore, it is recommended and also easier to move the HP MCS with the back as the leading edge. Roll the HP MCS with fixed casters first. When rolling the HP MCS, make sure to push firmly on the doorframe and not the door mesh.

Important:

An HP MCS must be disconnected from water and power sources before being moved.

Warning:

To reduce the risk of personal injury or damage to the equipment, do not attempt to move large equipment alone. Obtain adequate assistance to stabilize the HP MCS 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 HP MCS rests on the leveling feet, and not on the casters. The casters are designed only as an aid in moving the HP MCS 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 HP MCS.

Connecting and disconnecting power to hot-pluggable power supplies

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

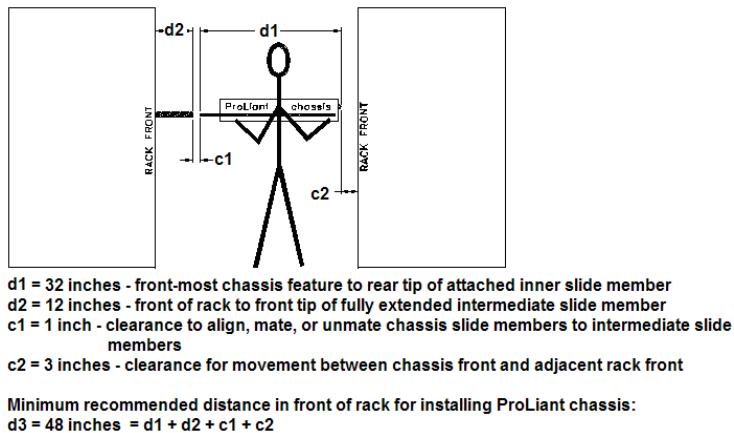
- Unplug the power cord before removing the power supply from the server.
- Install the power supply before connecting the power cord to the power supply.
- Do not overload the AC supply branch circuit that provides power to the HP MCS. The total HP MCS load should not exceed 80 percent of the branch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

Rack-mountable components

Because computer components are stacked vertically in an HP MCS, adhere to the following precautions to ensure HP MCS stability:

- Load heavier components first and load the HP MCS from the bottom up.
- Allow a minimum clearance of 30 in. (762 mm) at the back of the HP MCS.
- Allow a minimum of 48 in. (1219.2 mm) clearance beyond the front of the HP MCS to permit server installation and removal. This applies to both individual HP MCS installations as well as when aligning HP MCSs in rows so that the front doors are facing each other. See Figure 4.
- Use caution when pressing the component rail release latches and sliding a component into the HP MCS. The slide rails can pinch your fingers and cables.

Figure 4. HP MCS clearance (Minimum recommended front HP MCS space)



Warning:

To reduce the risk of personal injury or damage to the equipment, be sure that the HP MCS is stabilized as follows:

- The leveling feet are extended to the floor.
- The full weight of the HP MCS rests on the leveling feet.
- Extend only one component at a time or the HP MCS may become unstable.

Aligning the HP MCS with HP 10000 Series racks

The HP MCS can be installed next to an existing or new row of HP 10000 Series racks. Based on the facility design requirements, the cabinets can be arranged in a flush-front (Figure 5) or flush-rear (Figure 6) configuration.

Figure 5. HP MCS arranged in a flush-front configuration with a row of 10000 Series racks (top view)

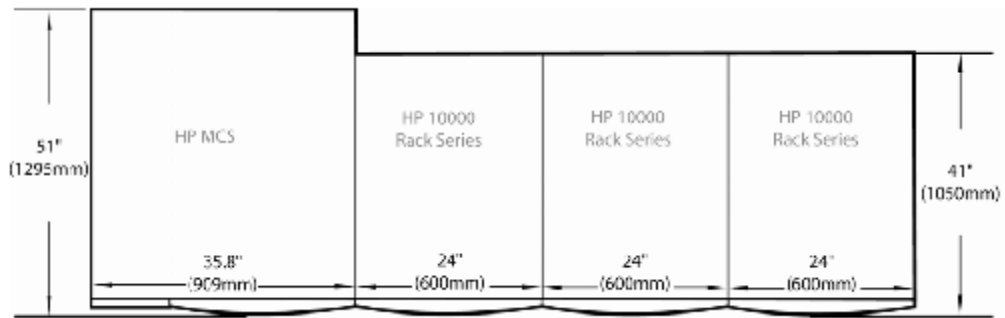
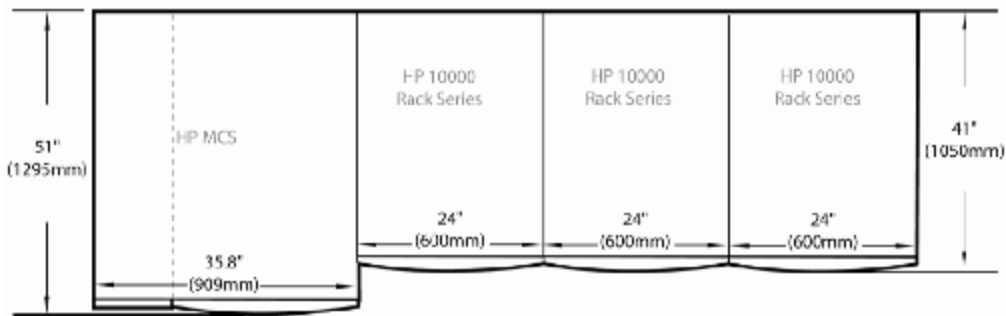


Figure 6. HP MCS arranged in a flush-rear configuration with a row of 10000 Series racks (top view)



Data Center planning and considerations

Environmental considerations

The data center must meet certain environmental conditions for the HP MCS implementation. The HP MCS should be configured and arranged in a data center to ensure proper air flow. The HP MCS should be installed in a protective environment that is not exposed to the elements.

Ensure that the data center meets the environmental guidelines outlined in the HP Modular Cooling System Site Preparation Guide, available at:

<http://h20000.www2.hp.com/bizsupport/TechSupport/DocumentIndex.jsp?contentType=SupportManual&lang=en&cc=us&docIndexId=179111&taskId=101&prodTypeId=329290&prodSeriesId=1155256>.

Slots, openings and perforations in the HP MCS (especially in doors) provide ventilation, reliable operation, and prevent overheating and, therefore, should never be blocked or covered. To provide proper front-to-back air flow, any open "U" space in the front of the HP MCS must be covered with a HP 10000 Series Universal Filler Panel.

Caution:

Failure to cover open U spaces with blanking panels may result in improper cooling that can lead to thermal damage.

Refer to the HP Modular Cooling System Site Preparation Guide for temperature and humidity guidelines. For the HP Modular Cooling System Site Preparation Guide, go to <http://h20000.www2.hp.com/bizsupport/TechSupport/DocumentIndex.jsp?contentType=SupportManual&lang=en&cc=us&docIndexId=179111&taskId=101&prodTypeId=329290&prodSeriesId=1155256>.

Note:

Altitude derating of 1° Celsius for every 300 meters above sea level to a maximum of 3,000 meters (1.8° Fahrenheit per every 1,000 feet up to a maximum of 10,000 feet). No direct sustained sunlight.

Power considerations

Power is best managed within the HP MCS by the use of a power distribution unit (PDU). Depending on the configuration, it may be necessary or desirable to use multiple PDUs to connect all devices inside the HP MCS.

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

If a PDU is not used, each piece of equipment within the HP MCS should be connected to a dedicated branch circuit.

Power redundancy

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 of the following configurations:

- **1+1 design:** Two power supplies can be provided where either power supply is capable of sustaining the associated equipment's power demand.
- **N+1 design:** Typically three power supplies are 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 distribution device should be suitably rated for the connected load. If the total load exceeds the rating of the power distribution device, obtain a suitably rated device or add a second power distribution device and divide the load equally between the devices.

High line voltage versus low line voltage

HP recommends that rack-optimized equipment is installed for operating at high line voltage (200-240V AC).

Note:

The HP MCS can only be operated using high line voltage; however, rack-mounted components can be operated using either high line or low line voltage.

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.

Benefits that support high line voltage operation of an installation are as follows:

- Power supplies run more efficiently and waste less power when operating at 200-240V, thus saving electrical power.
- Greater power capacity in a single HP MCS. For the same size circuit, almost twice the power can be delivered to an HP MCS at high line versus low line. For example, a 115V 30A branch circuit can deliver 3450VA to an HP MCS, while a 230V 30A branch can deliver 6900 VA to an HP MCS.
- 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. Also, 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, HP MCS components must be properly grounded in accordance with any local and regional building codes. Furthermore, make sure that all power distribution devices used in the installation, such as branch wiring and receptacles, are Listed or Certified grounding-type devices.

The HP MCS is grounded. Ensure that the rack-mounted components are grounded as follows:

- 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.

Additional resources

A power calculator is available at the following link:

[http://h30099.www3.hp.com/configurator/calc/Power Calculator Catalog.xls](http://h30099.www3.hp.com/configurator/calc/Power%20Calculator%20Catalog.xls).

Also available is a ProLiant Rack/Site Installation Utility for purposes of reviewing the server loading to determine the number of power supplies for the power supplies to be redundant and approximate the electrical and heating load per server for facilities planning. Please see the following:

[http://h30099.www3.hp.com/configurator/calc/Site Preparation Utility.xls](http://h30099.www3.hp.com/configurator/calc/Site%20Preparation%20Utility.xls).

There is also a quick reference power cord matrix available at the following:

<ftp://ftp.compaq.com/pub/products/servers/proliantstorage/power-protection/powercordmatrix.pdf>.

Equipment clearance and floor loading

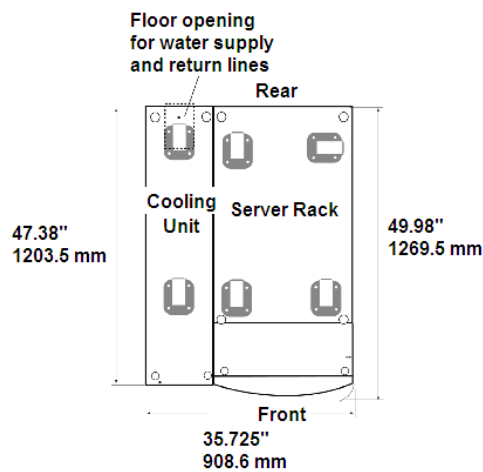
A minimum clearance of 48 inches in front of a configured HP MCS and 30 inches to the rear of a configured rack is recommended. All buildings and raised computer room floors are engineered to provide a specific floor loading.

Warning:

When configuring a solution, make sure 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 7 illustrate the foot print of an HP MCS.

Figure 7. HP MCS foot print



Front door clearance

HP MCS units can be set side-by-side (Figure 8). The HP MCS door clearance is illustrated in Figure 9.

Figure 8. HP MCS installed side-by-side

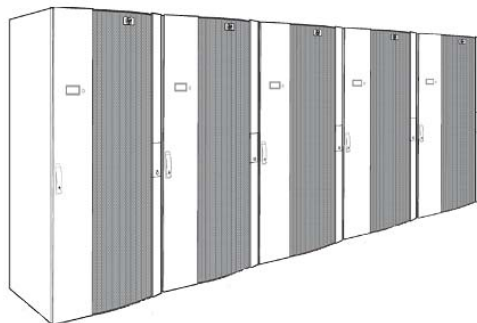
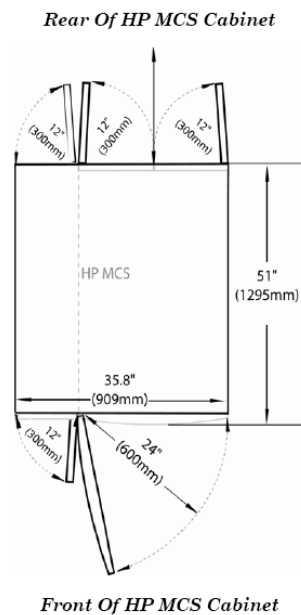


Figure 9 illustrate the door clearance for the HP MCS.

Figure 9. HP MCS door clearance



Note:

There is a potential for front or rear door swing interference when arranging the HP MCS immediately next to an HP 10000 Series rack. It may be necessary for the removal of a rack door for full, unimpeded access to the adjacent rack.

Qualified shipping

The HP MCS ships pre-installed to a 10000 G2 Series rack. The MCS is CTO-capable for up to 2000 Lbs and ships standard with a shock pallet. The MCS can be used to factory-integrate IT equipment at Factory Express or other configuration services.

Standard shipping pallet

The HP MCS ships on a special wooden shock pallet with plastic shrink-wrap around the HP MCS. Component installation may occur at the customer site, at a VAR or integrator, or at HP Factory Express.

Note:

Wooden components of the pallets have been properly treated to comply with the pest-free certifications required by foreign countries.

HP MCS shipping specifications

Table 7 list the HP MCS shipping specifications

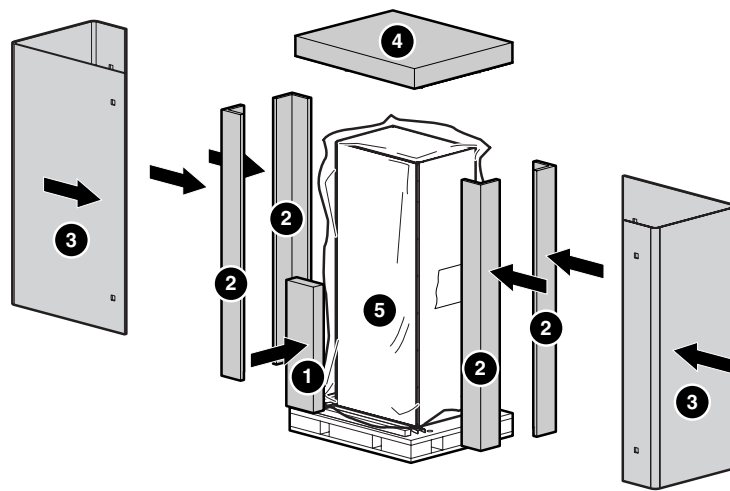
Table 7. HP MCS shipping specifications

Shipping dimensions (on skid)			Shipping weight	Static load capacity
Height	Width	Depth		
88.5 in. (2248 mm)	48 in. (1220 mm)	70 in. (1778 mm)	1370 lbs. (621.4 kg)	20000 lbs. (908 kg)

HP MCS packing materials

Figure 10 shows the typical packaging material shipped with the empty HP MCS upon arriving at the customer configuration site.

Figure 10. HP MCS on shipping pallet



Items shown:

1. Ramps
(ramps are placed vertically on the side of the HP MCS during shipment, typically held in place with the stretch wrap.)
2. Corner posts
3. Corrugated sheets
4. Cap
5. Antistatic bag

Items not shown:

- Stretch wrap
- Banding
- Corroclips
- IATA labels
- CTO shock pallet

Site preparation for receiving the HP MCS

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

The specialized, air-ride, padded-van carriers usually have the ability to perform site surveys.

Among other elements, the site survey should address the following in general terms:

- What are the hours the facility is open for deliveries? Can delivery be done during the day during normal business hours?
- Are appointments required?
- Does the receiving dock require union labor? Is there a site contact?
- Are there any security or building access issues? Is there a site contact?
- Does the facility have a dock? Is the delivery dock a standard raised dock? Can a 48-foot trailer gain access? Are there any restrictions on the size, length, width or height, of the truck permitted?
- On what floor in building will the equipment be installed? This information is in consideration of height and width clearances along the way: doors, light fixtures, cable trays, sprinkler heads, elevators, etc.
- What are the door height clearances (width and height) for freight elevators, doorways, or other obstacles?
- If equipment is not going on the first floor, is there an elevator? If yes, what is the weight capacity of the elevator?
- Is the path from the loading dock to the computer room robust enough to support the weight of the configured HP MCS?
- Is there a delivery/unpacking/staging area? Does the customer allow cardboard boxes and/or other packing material in the computer room? Does the customer have a detrash requirement, for example is complete trash removal one or two days after install required?
- Is there a raised floor or are there any thresholds of concern? If there is a raised floor, how deep? Is there a ramp? What sort of equipment maneuvering is required to gain access? Are there special equipment needs, for example, will any stair walkers, lifters, cranes, ramps, steel plates or floor covers be required to place the equipment in the computer room?
- Will the HP MCS be removed from the pallet at a location other than the final installation location?
- Is movement across rough surfaces likely?
- Refer to the HP Modular Cooling System Site Preparation guide at www.hp.com/go/mcs for complete information on deploying the HP MCS.

Door Height Clearances

HP does not advocate tipping loaded the HP MCS to navigate height restricted doorways. The HP recommended procedure is to first depopulate the HP MCS and then tip the HP MCS to pass the restricted doorway. Once the HP MCS is positioned in its final location, it can be repopulated. This will ensure that HP MCS stability is maintained by not tipping a heavily loaded HP MCS.

Depopulating the HP MCS also ensures that the integrity of the components in the HP MCS are not compromised by tipping.

Note:

An empty HP MCS can be tipped if necessary to clear a doorway.

If you have restricted height doorways, you have several alternatives for purchasing HP factory racked solutions that can accommodate the height of the doorways without the need to depopulate the HP MCS.

If you have restricted doorways:

- You can order racked solutions in an appropriate sized HP MCS that can be accommodated by the doorways. Choose the rack size that best meets your datacenter needs while at the same time being able to pass all doorways on the path to the HP MCS final location.
- An HP MCS that is unable to pass fully loaded through the doorway, options include:
 - Ordering an empty HP MCS and purchasing installation services from HP Services.
 - For BCS midrange servers with included installation services, you can order an empty HP MCS and order the server with the field installation option.
- With included site preparation service, the best way to locate the system to its final location is recommended.

Airfreight

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

International Air Transport Association 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 HP MCSs 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 an HP MCS 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 11). 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 11. Sample shipping declaration

SHIPPER'S DECLARATION FOR DANGEROUS GOODS							
Shipper				Air Waybill No.			
				Page 1 of 1 pages			
				Shipper's Reference Number (optional)			
Consignee				S/O#			
				S/O Consists of			
				Box #			
Two completed and signed copies of this Declaration must be handed to the operator				WARNING			
TRANSPORT DETAILS							
This shipment is within the limitations prescribed for:				Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.			
(delete non-applicable)							
PASSENGER		CARGO					
AND CARGO		AIRCRAFT					
AIRCRAFT		ONLY					
Airport of Departure				Shipment type: (delete non-applicable)			
Airport of Destination				NON-RADIOACTIVE RADIOACTIVE			
NATURE AND QUANTITY OF DANGEROUS GOODS							
Dangerous Goods Identification							
Proper Shipping Name	Class or Divi- sion	UN or ID No.	Pack- ing Group	Subsidiary Risk	Quantity and type of packing	Packing Inst.	Authorization
Magnetized Material	9	UN 2807			1 fiberboard box x 5 Kg	902	
Additional Handling Information							
ICAO EMERGENCY PHONE NUMBER (650) 852-8462							
U.S. ERG # 171							
I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.				Name/Title of Signatory		type name	
				Place and Date		type title	
				Signature		type city, state	
				(see warning above)		type date	

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 HP MCS 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 HP MCS.

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 HP MCS is to be rolled across a parking area, panels of plywood or Formica are recommended to minimize the vibration induced into the HP MCS.
- Be aware that the HP MCS is 85.5 in. (2170 mm) high on the skid and exceeds standard 7-foot doorways so the HP MCS will have to be de-palletized for passage through the standard 7-foot doorframe.
- Be aware that a fully configured MCS may weigh up to 3130 lbs. Check weight limits along the route from the dock to the datacenter, including ramps, elevators, and raised floors.
- Consider that alternative handling schemes may be required in areas with elevated floor structures with inadequate ramp systems. For products with casters, when negotiating any ramp, keep the front of the HP MCS pointed uphill to minimize the possibility of the HP MCS tipping.
- Lifting the HP MCS with eyebolts is not recommended. The HP MCS should remain on the pallet until it has been moved as close to the final deployment location as possible.

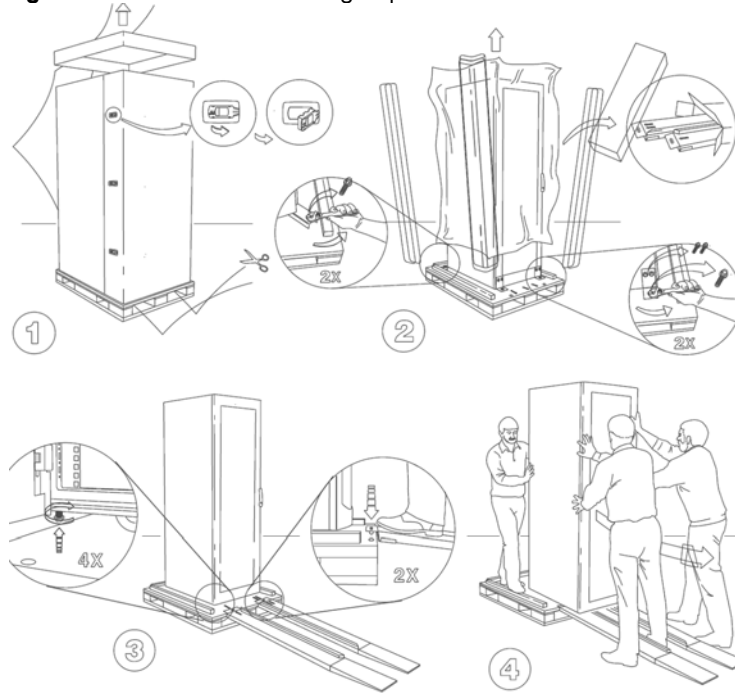
Warning:

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

Dismounting the HP MCS from the shipping pallet

To dismount the HP MCS, reverse the process for assembling the shock pallet. Figure 12 illustrates the dismounting process for the HP MCS.

Figure 12. HP MCS dismounting steps



Installation service

In the United States, HP can arrange to have your HP MCS 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 <http://h71028.www7.hp.com/enterprise/cache/284965-0-0-225-121.html>.

Spares kits

Contact your local reseller for information on spares kits.

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
- 8/16-in (or 12mm) open-ended wrench or socket
- Stretch wrap
- Banding
- HP MCS hex water connection wrench

Appendix a: glossary

Table 8 lists technical terms and associated description.

Table 8. Definition of technical terms

Term	Definition
Chassis	Rack-mountable configuration of a server or a storage component.
Dedicated circuit branch	A dedicated electrical circuit between a source and distribution point.
Dynamic loading capacity	A dynamic environment is one where the HP MCS is shipped on a shock pallet with equipment installed or rolling HP MCSs with equipment installed to new locations within the data center.
Electronic Industries Association (EIA)	An American association of electronic manufacturers that sets standards, disseminates information, provides industry-government liaison, and public relations.
Electromagnetic interference (EMI)	Disturbances of equipment operation caused by electromagnetic fields from other sources.
Electrostatic discharge (ESD)	The flow of current across two devices that have unintentionally accumulated differences in electrical potential.
EOL (End of Life)	A term used for signifying discontinuation of products.
fixed stabilizer	An anti-tip stabilizer providing stability and support when equipment is installed, removed, or accessed within the HP MCS.
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.
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.
static loading capacity	A static environment is one where the HP MCS is positioned into place and the leveling feet are extended prior to equipment being installed.
U	A standard unit of measure for designating the height in computer enclosures and HP MCS cabinets. One U equals 1.75 inches (44.5 mm). Measurements typically go from the bottom of the HP MCS up. For example, a 4U chassis is 7 inches (177.8 mm) high. A 42U 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: torque values

Table 9 provides torque values for specific components.

Table 9. Torque values (specific)

Component	Torque (in-lb)	Torque (N-m)
All M6 rack hardware	20 in-lb	2.26 N-m
Pallet bracket hold-down bolts	150 in-lb	16.95 N-m
All Phillips-head screws	20 in-lb	2.26 N-m
All M5-M6 slotted-torx head screws	20 in-lb (minimum) / 60 in-lb (maximum)	2.26 N-m (minimum) / 6.78 N-m (maximum)

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

The torque values listed in Tables 10 and 11 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 10 Torque values (standard hardware)

Measurement	Torque (in-lb)	Torque (N-m)
#4	6 in-lb	0.678 N-m
#6	10 in-lb	1.13 N-m
#8	19 in-lb	2.15 N-m
#10	27 in-lb	3.05 N-m
1/4-20	66 in-lb	7.46 N-m
3/8-16	240 in-lb	27.11 N-m
1/2-13	585 in-lb	66.09 N-m

Table 11. Torque values (metric hardware)

Measurement	Torque (in-lb)	Torque (N-m)
M3	7.6 in-lb	0.86 N-m
M4	17 in-lb	1.92 N-m
M5	36 in-lb	4.07 N-m
M5.5 self tap	40 in-lb	4.52 N-m
M6	60 in-lb	6.78 N-m
M8	147 in-lb	16.61 N-m
M10	292 in-lb	32.99 N-m
M12	509 in-lb	57.50 N-m

For more information

HP contact phone numbers are as follows:

- Buy Direct: Small & Medium Business: 800-888-9909
- Buy Direct Large Enterprise Business: 800-282-6672
- Post-sales: 1-800-652-6672

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

For more information on HP 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.

Call to action

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