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HPE Adaptive Rack Cooling System Site Preparation Guide

Abstract

This document provides site preparation guidance for the HPE Adaptive Rack Cooling System.

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Contents

Overview

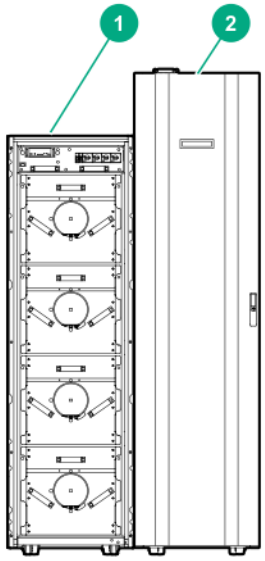
Product overview

The HPE Adaptive Rack Cooling System is a supplemental cooling system for data centers. It is a liquid-to-air heat exchanger and fan system that removes heat generated by rack-installed IT equipment. The HPE Adaptive Rack Cooling System is connected to adjoining racks with baying brackets and front and rear extensions, creating a cold aisle and hot aisle air plenum. Hot air from the IT exhaust is pulled through the HPE Adaptive Rack Cooling System, cooled with the heat exchanger that is connected to facility water, and the cooled air is then returned to the inlet of the servers. The HPE Adaptive Rack Cooling System is offered in four configurations using either HPE ARCS 42U 600x1600mm Racks or HPE ARCS 48U 600x1600mm Racks.

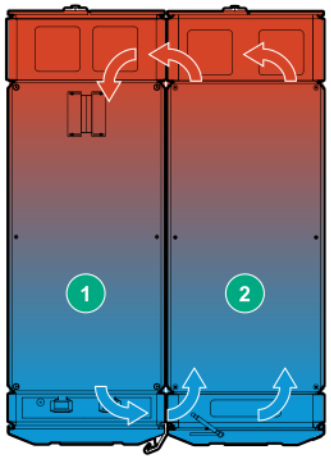
NOTE: The HPE Adaptive Rack Cooling System supports both HPE ARCS 42U and 48U 600x1600mm Racks. For the following front elevation views, the HPE ARCS 48U 600x1600mm Rack is shown. The HPE Adaptive Rack Cooling System is shown without doors for better viewing of components.

The thermal airflow illustrations show a top view of the HPE Adaptive Rack Cooling System and HPE ARCS 42U/48U 600x1600mm Racks.

HPE Adaptive Rack Cooling System + one HPE ARCS 42U/48U 600x1600 Rack

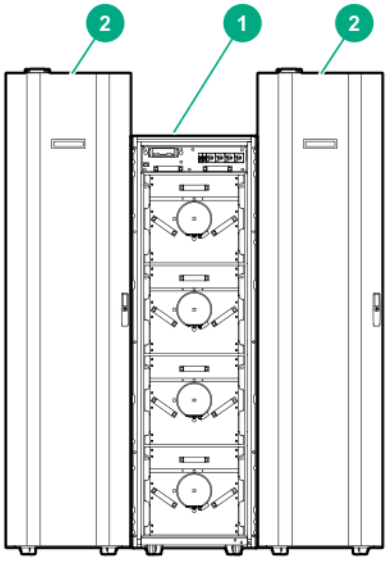


Airflow for HPE Adaptive Rack Cooling System (single-rack configuration)

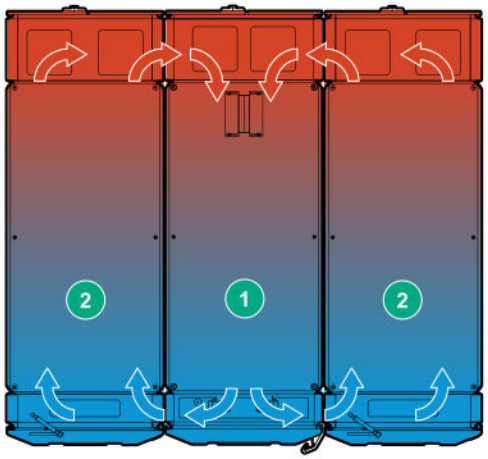


Item	Description
1	HPE Adaptive Rack Cooling System
2	HPE ARCS 48U 600x1600mm Rack

HPE Adaptive Rack Cooling System + two HPE ARCS 42U/48U 600x1600 Racks

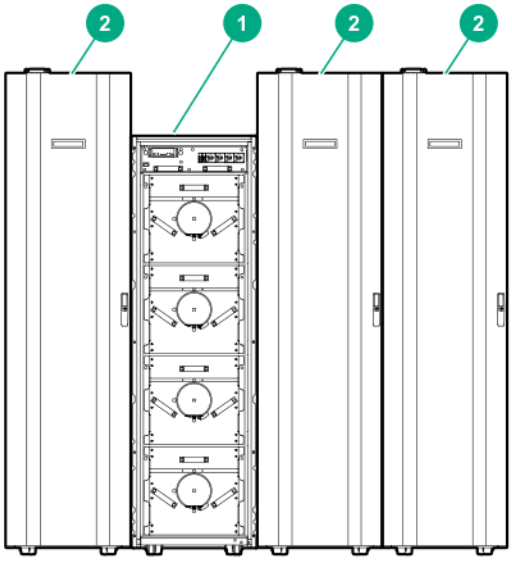


Air flow for HPE Adaptive Rack Cooling System (dual-rack configuration)

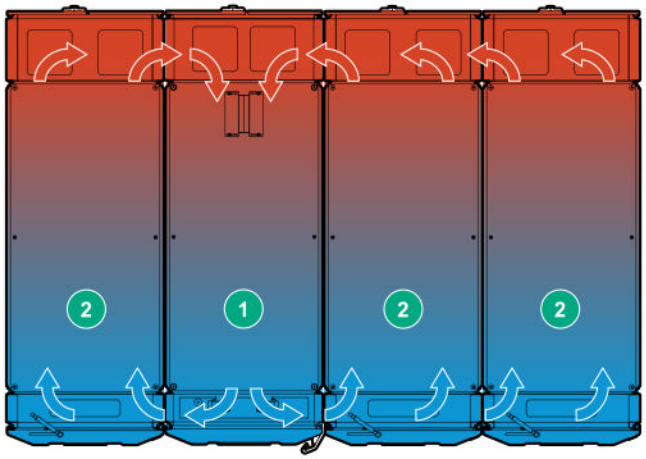


Item	Description
1	HPE Adaptive Rack Cooling System
2	HPE ARCS 48U 600x1600mm Rack

HPE Adaptive Rack Cooling System + three HPE ARCS 42U/48U 600x1600mm Racks

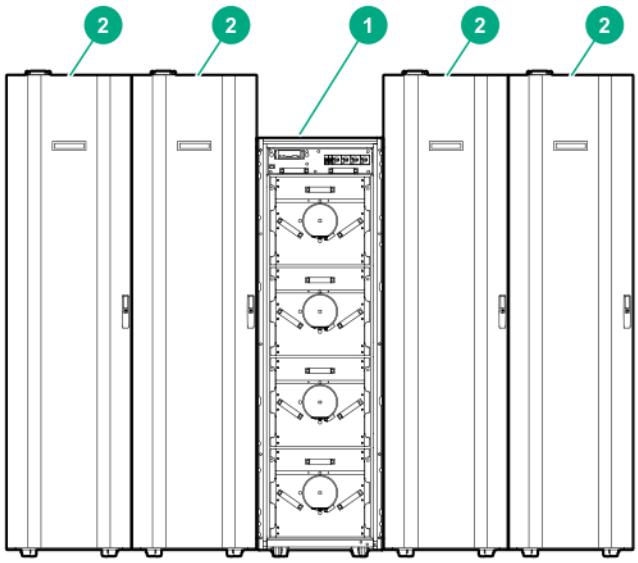


Air flow for HPE Adaptive Rack Cooling System (three-rack configuration)

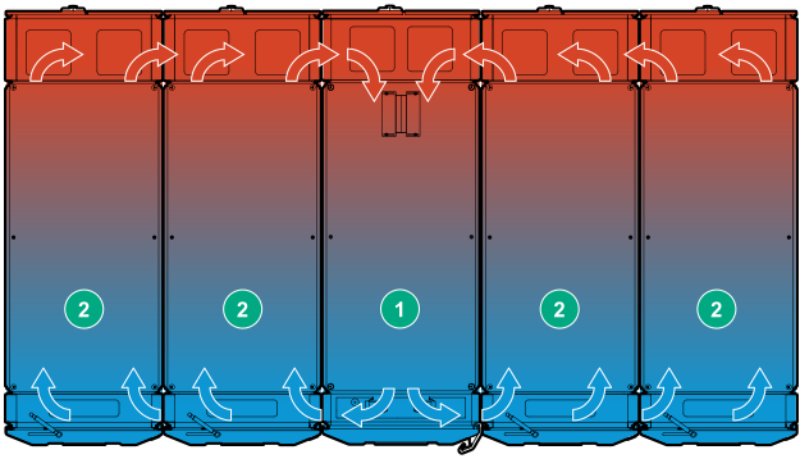


Item	Description
1	HPE Adaptive Rack Cooling System
2	HPE ARCS 48U 600x1600mm Rack

HPE Adaptive Rack Cooling System + four HPE ARCS 42U/48U 600x1600mm Racks



Air flow for HPE Adaptive Rack Cooling System (four-rack configuration)



Item	Description
1	HPE Adaptive Rack Cooling System
2	HPE ARCS 48U 600x1600mm Rack

The airflow of the HPE Adaptive Rack Cooling System fully supports the industry standard front-to-back cooling—cold air pulled into the front of the server and warm air expelled out the rear of the unit. All devices receive adequate and evenly distributed cool air regardless of the mounting position within the rack. The HPE Adaptive Rack Cooling System distributes precisely cooled and targeted air flow evenly across the front of the IT equipment. The HPE Adaptive Rack Cooling System and rack extensions channel warmed air from the rear of the IT equipment into the side-mounted or center-mounted HPE Adaptive Rack Cooling System cooling unit. From there, it is cooled and recirculated to the front of the equipment stack.

A 6U facade comes in the HPE ARCS 48U Air Rack Installation Kit, and you can place it on top of the HPE Adaptive Rack Cooling System to make the HPE Adaptive Rack Cooling System the same height as the HPE ARCS 48U 600x1600mm Racks. The following illustration shows a single-unit configuration with the 6U facade in place on the HPE Adaptive Rack Cooling System and the HPE Adaptive Rack Cooling System doors in place.

Item	Description
1	HPE Adaptive Rack Cooling System with 6U facade
2	HPE ARCS 48U 600x1600mm Rack

Key components

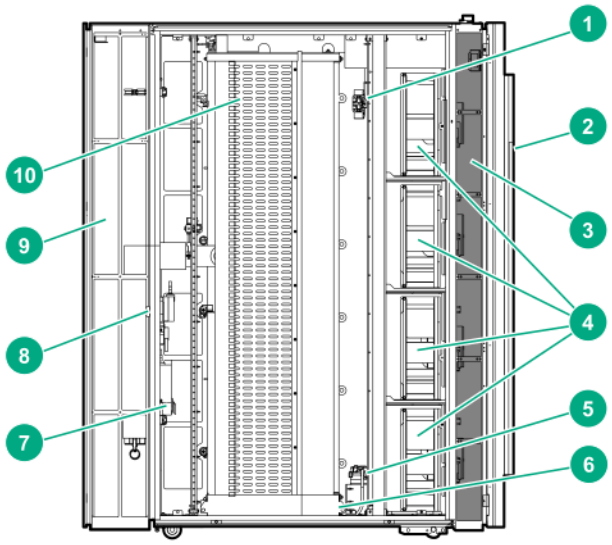
The HPE Adaptive Rack Cooling System uses the following key components to provide cooling performance. Some of these components are optional for the HPE Adaptive Rack Cooling System. For more information, see **HPE Adaptive Rack Cooling System components**.

- **Heat Exchanger Module (HEX)—**A liquid-to-air heat transfer device which transfers IT heat load to facility water.
- **Display—**Provides general cooling unit status and allows operational set point adjustments to be made.
- **Management module—**Provides users with web-based capabilities to set, monitor, and control temperature within the HPE Adaptive Rack Cooling System, and displays the health of the unit.
- **Fan controller—**Operates the fans according to air differential pressure or return temperature.
- **Air bleeder valve—**Manually actuated air venting valve used during initial coolant fill to release air contained in the HPE Adaptive Rack Cooling System.
- **Water controller—**Senses condensation, leaks, water temperatures, flow rate, and the status of the water valve. It then sends this data to the management module.
- **AC input/network connection—**Provides primary and secondary AC input connections and a network management interface.
- **AC transfer switch—**Provides dual-AC power with a fail-over feature for redundancy
- **Fans—**Provide circulation of cooled air through the computer equipment rack.
- **Water group—**Includes the water valve, flow meter, and temperature sensors.

  A condensation pump with overflow and condensation lines connects to the water group.
- **HPE ARCS 42U/48U 600X1600mm Racks with front and rear extensions (for air flow)—**The 42U and 48U racks include front and rear extensions to create an air flow plenum for supply and return air from the HPE Adaptive Rack Cooling System.
- **Door opening kits—**If the high temperature alarm level of the HPE Adaptive Rack Cooling System is exceeded, the Automatic Door Opening kit and HPE ARCS Auto Door Release Kit enable the HPE ARCS 42U/48U 600X1600mm Rack doors to open.

HPE Adaptive Rack Cooling System components

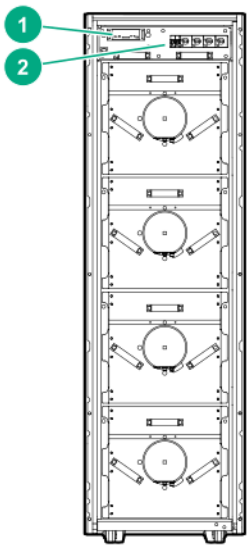
Unit Side View



Item	Reference
1	Humidity sensor
2	Touchscreen display
3	Front air plenum
4	Fan units (4)
5	Condensation pump
6	Leak sensors
7	Isolation valves
8	Control valve
9	Rear air plenum
10	Heat exchanger unit

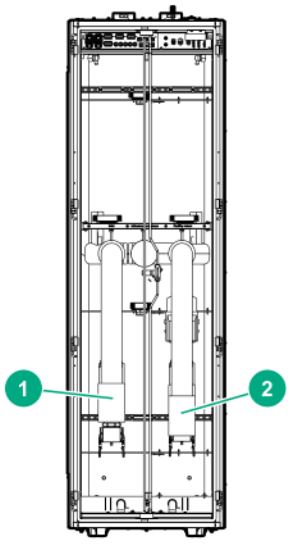
Unit Front View

NOTE: The HPE Adaptive Rack Cooling System is shown without doors for better viewing of components.



Item	Reference
1	CMC (management module)
2	Transfer switch

Unit Rear View



Item	Reference
1	Water supply
2	Water return

Physical specifications

Item	Specification
Maximum height	200.7 cm (79 in)
Maximum width	60 cm (23.6 in) maximum
Maximum depth (including the rack and rack handle)	166 cm (65.3 in) (Depth includes front and rear extensions)
Maximum shipping height (on skid)	228.5 cm (90.0 in)
Maximum shipping width (on skid)	122.0 cm (48.0 in)
Maximum shipping depth (on skid)	182.9 cm (72.0 in)
Net weight	645 kg (1,423 lb)
Shipping Weight (gross with packaging)	732 kg (1,614 lb)

Electrical specifications

Item	Specification
Input voltage range	380-480V, 3ph Wye (3P+N+Gnd)
Effective cooling	150 Kw at 270 lpm (71 US gal/min) [1]
Rated current maximum	380Y/220V: 17.5A 400Y/230V: 16.7A 415Y/240V: 16.0A 480Y/277V: 13.8A
Steady state current with maximum fans	380Y/220V: 13.0A 400Y/230V: 12.4A 415Y/240V: 11.9A 480Y/277V: 10.3A
Cooling medium	Air and facility water/glycol
Permissible operating pressure max	8 bar (116 psi)

Table Continued

Item	Specification
Maximum operating noise level (with IT rack doors open)	101 dBa
Power cords	IEC 60309 32/30A 220/415V 6h/IP44 (Quantity 2) Maximum branch circuit size: 32A NEMA L22-20P 277/480V 4P/5W (Quantity 2) Maximum branch circuit size: 20A

[1] For more information, see **Determining heat load capacities**.

Facility planning for implementation

Facility planning overview

The HPE Adaptive Rack Cooling System offers an incremental data center cooling solution, capable of cooling up to 150 kW of heat.

In planning water supply and design, consider short- and long-term needs for cooling. Immediate supply needs must meet the specifications and target cooling requirements based on the parameters defined in this Site Preparation Guide. In anticipation of future heat loads, installing additional facility water piping and connections might be advantageous. As cooling, rack space, and equipment density requirements increase, you can add HPE Adaptive Rack Cooling Systems to the facility cooling system.

To route water lines to the HPE Adaptive Rack Cooling System, use one of the following methods:

- Through an opening in the raised floor
- Through the top of the HPE Adaptive Rack Cooling System

For more information on routing the water lines, see **HPE Water Hook-Up Kit**.

For installation service for the HPE Adaptive Rack Cooling System, use order number HA113A1.

For site evaluations and technical consulting for your site, see the Hewlett Packard Enterprise Services website (https://www.hpe.com/us/en/services/data-center-facilities-services.html).

The implementation of the HPE Adaptive Rack Cooling System aligns with Data Center Best Practices. For more information, see optimizing data centers for high-density computing, which can be found on the Hewlett Packard Enterprise website (https://www.hpe.com/us/en/servers.html).

This section discusses key issues for site preparedness, including:

- Space considerations for delivery, operation, and service, and other space-related considerations such as floor loading
- Electrical considerations
- Coolant considerations
- Other considerations

A complete site preparation checklist is provided in **Appendix A: Forms and checklists**.

Space and positioning considerations

The HPE Adaptive Rack Cooling System is a row-based cooling unit. It incorporates extensions in the front and rear and requires facility cooling connections in the rear of the unit to enable operation. Allow adequate space around the unit to maneuver it into place in the data center, paying attention to floor tile locations and facility connections. Be sure to also allow adequate space for future unit servicing.

Delivery space requirements

Be sure that the facility has adequate space to receive and remove the HPE Adaptive Rack Cooling System from the shipping pallet. Consider the following when unloading the racks:

- Forklifts must enter and transport the shipping pallet from the side.
- Delivery plans might include the possible removal of walls or doors.

Dimension requirements

Dimension requirements	HPE Adaptive Rack Cooling System	HPE ARCS 42U 600X1600mm Rack	HPE ARCS 48U 600X1600mm Rack
Total length allowed to safely remove the HPE Adaptive Rack Cooling System from the shipping pallet down the provided ramps	Approximately 6.55 m (21.5 ft)	Approximately 6.55 m (21.5 ft)	Approximately 6.55 m (21.5 ft)
Packaged dimensions of the HPE Adaptive Rack Cooling System (including shock pallet and cartons)	2,250 mm (88.58 inches) height x 1,000 mm (39.37 inches) width x 1,845 mm (72.64 inches) depth	2,250 mm (88.58 inches) height x 1,000 mm (39.37 inches) width x 1,845 mm (72.64 inches) depth	2,545 mm (100.20 inches) height x 1,000 mm (39.37 inches) width x 1,845 mm (72.64 inches) depth

Maneuvering space requirements

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

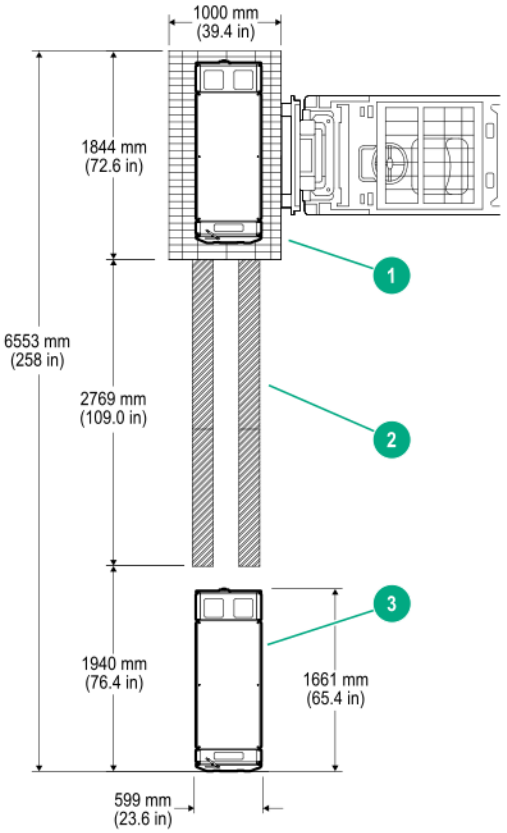
WARNING: To reduce the risk of personal injury or damage to the equipment, use extreme care when moving racks with casters. Sudden stops, excessive force, and uneven surfaces can cause the product to overturn.

When maneuvering the HPE Adaptive Rack Cooling System, use the following guidelines:

- Move racks that have casters with care. Sudden stops, excessive force, and uneven surfaces might cause the product to overturn.
- The racks have casters that are fixed to the front and swivel in the back.
- For long and straight distances, roll the HPE Adaptive Rack Cooling System with the front fixed casters leading. For better maneuverability, lead with the rear swiveling casters.
- When rolling the HPE Adaptive Rack Cooling System, do not push on the doors.
- Be sure that the rooms and doors are large enough to accommodate the movement of the HPE Adaptive Rack Cooling System cabinet into the data center.
- When transporting the HPE Adaptive Rack Cooling System to a different building floor, be sure that the elevators have adequate load capacity, floor space, and door clearance to accommodate the rack. The HPE Adaptive Rack Cooling System pallet can only be moved with forklifts from the side, which has a length of 1,845 mm (72.64 inches).
- When transporting the HPE Adaptive Rack Cooling System within a building, ensure that doorway thresholds are adequate to hold the rack.

The following figure shows the maneuvering space required when unloading the HPE Adaptive Rack Cooling System or HPE ARCS 42U/48U 600X1600mm Rack from a pallet. When planning to maneuver the unit, use the delivery forms provided in **Appendix A: Forms and checklists**.

CAUTION: Hewlett Packard Enterprise recommends a ramp angle of no greater than 5° to move the HPE Adaptive Rack Cooling System up or down elevations. Typical data center ramps have a 5º angle (1 to 12 pitches).



Item	Reference
1	HPE Adaptive Rack Cooling System rack shock pallet
2	Four-piece ramp
3	HPE Adaptive Rack Cooling System rack

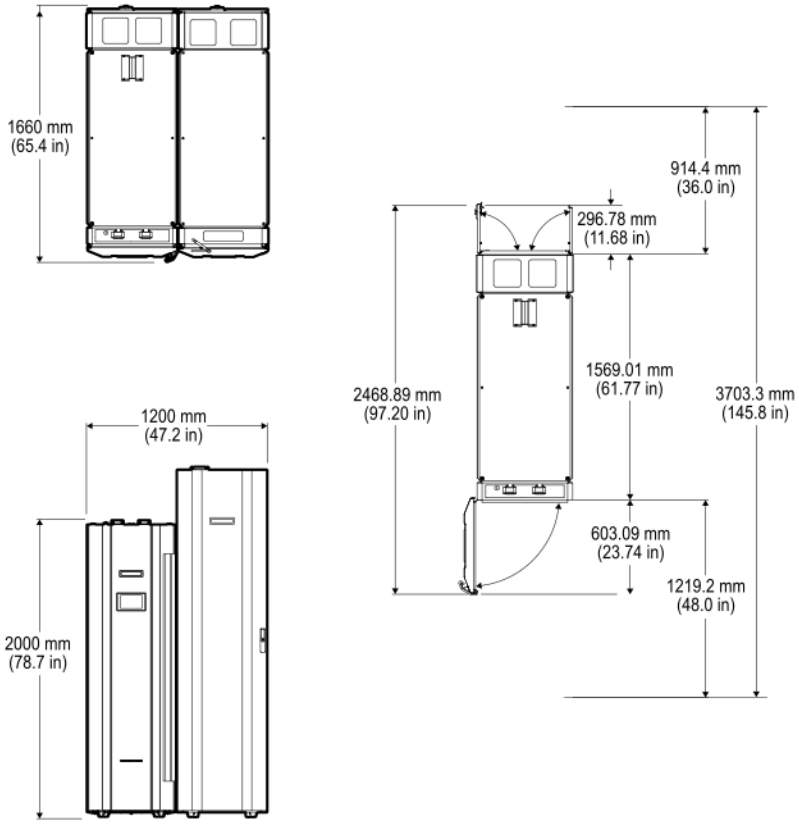
Operational space requirements

To provide space for internal airflow and housing of the cooling unit components, the HPE Adaptive Rack Cooling System is deeper than conventional racks.

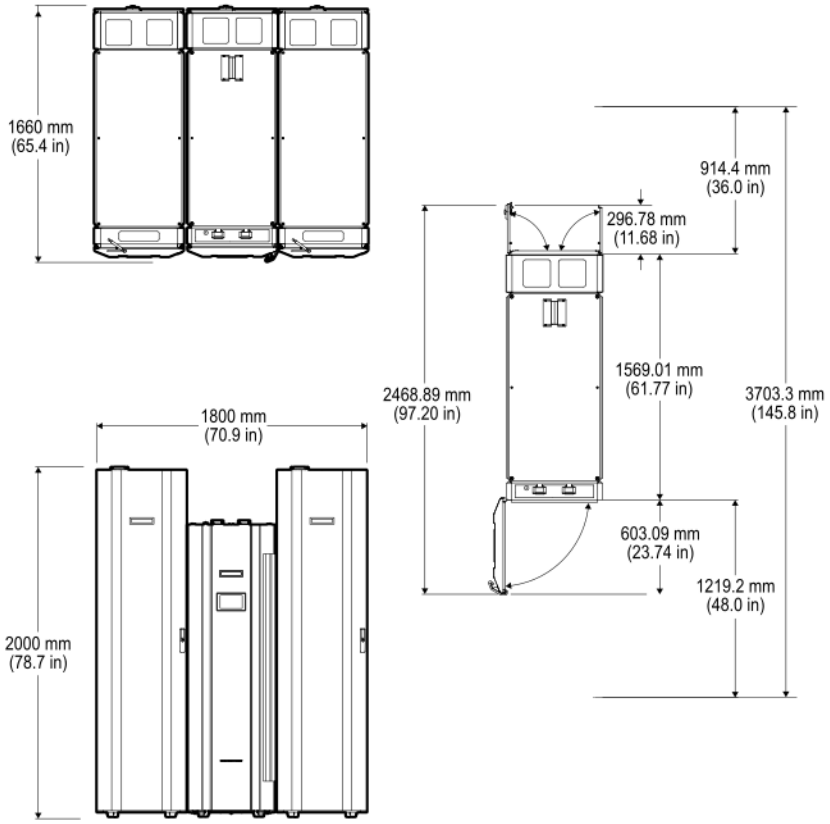
Hewlett Packard Enterprise recommends the minimum access space for the HPE Adaptive Rack Cooling System is 1,219 mm (4 ft) in the front and 914 mm (3 ft) in the rear, as shown in the following figures.

- The total height for the HPE ARCS 42U 600X1600mm Rack is 2,000 mm (78.74 inches).
- The total height for the HPE ARCS 48U 600X1600mm Rack is 2,295 mm (90.35 inches).

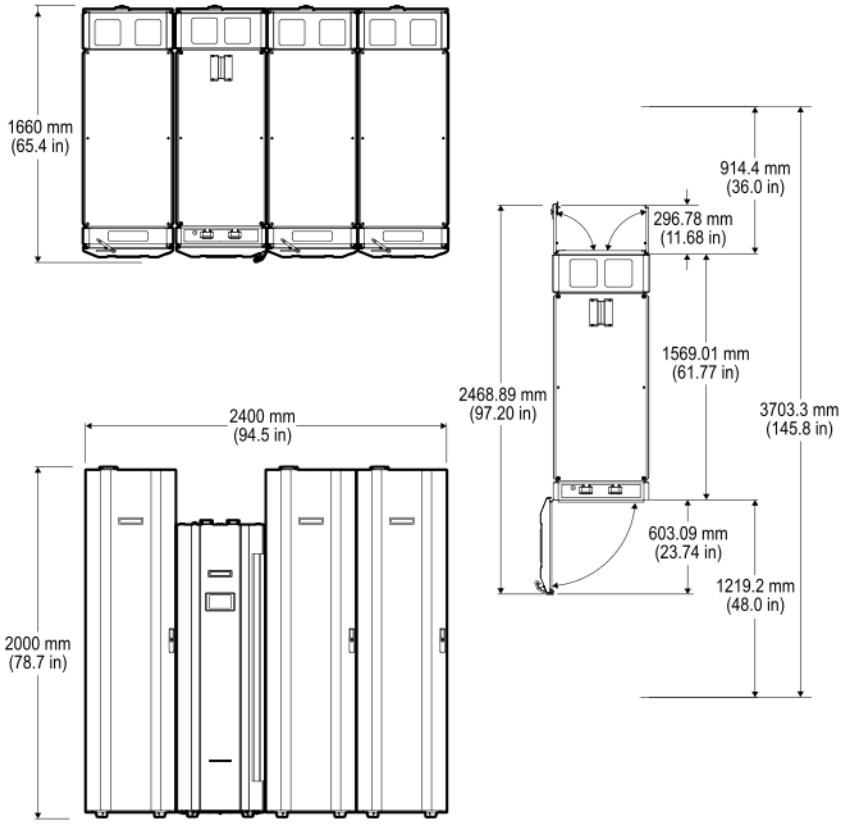
Single-rack configuration



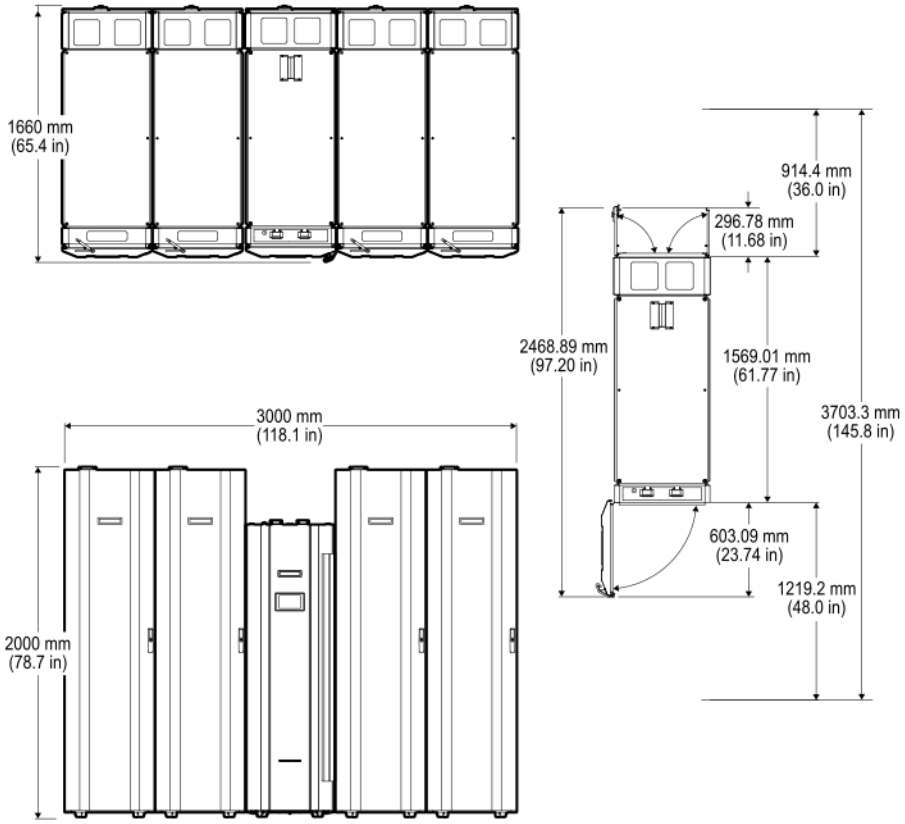
Dual-rack configuration



Three-rack configuration



Four-rack configuration

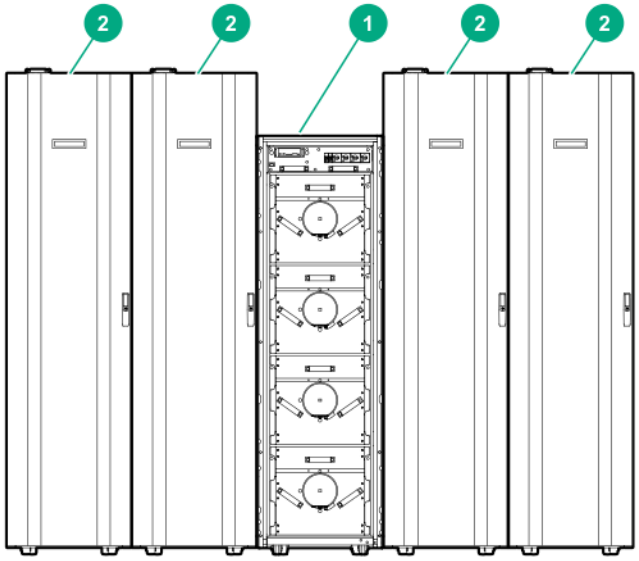


System positioning

The HPE Adaptive Rack Cooling System can be installed next to an existing or new row of HPE ARCS 42U or 48U 600X1600mm Racks.

NOTE: The following illustration shows the HPE ARCS 48U 600X1600mm Rack. The HPE Adaptive Rack Cooling System is shown without doors for better viewing of components.

Configuration example



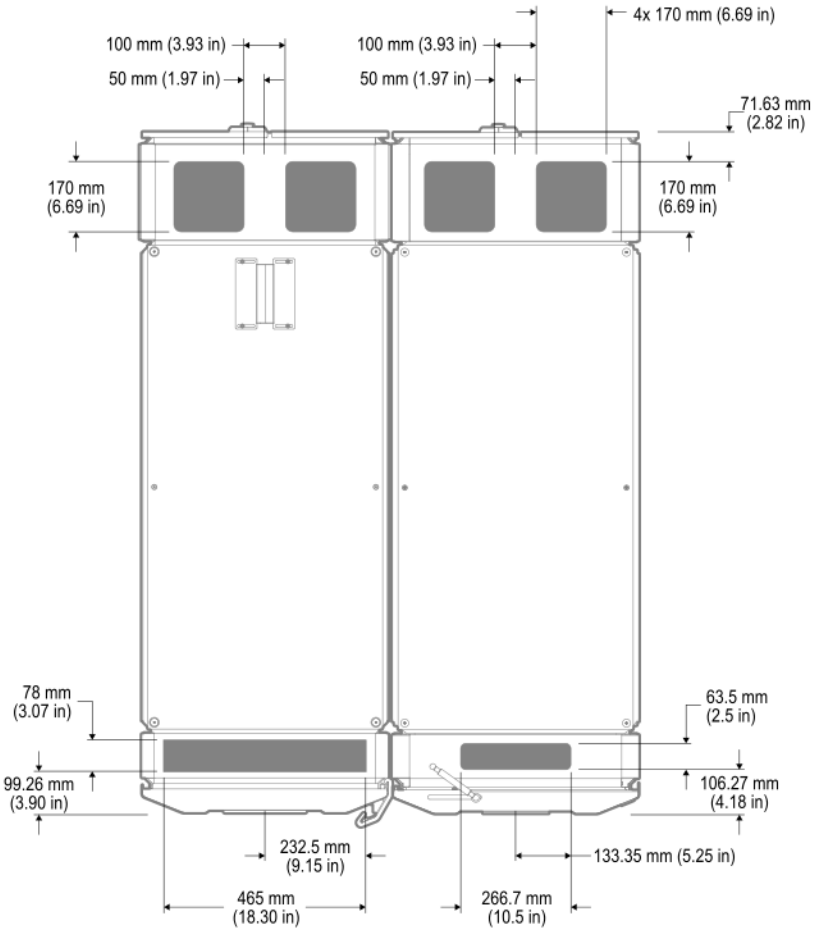
Item	Description
1	HPE Adaptive Rack Cooling System
2	HPE ARCS 42U or 48U 600X1600mm Rack

When arranging the HPE Adaptive Rack Cooling System next to an HPE ARCS 42U or 48U 600X1600mm Rack, and depending on the configuration, be aware of the potential for slight rear door swing interference. Equipment might require the removal of a door during installation to allow for unimpeded access.

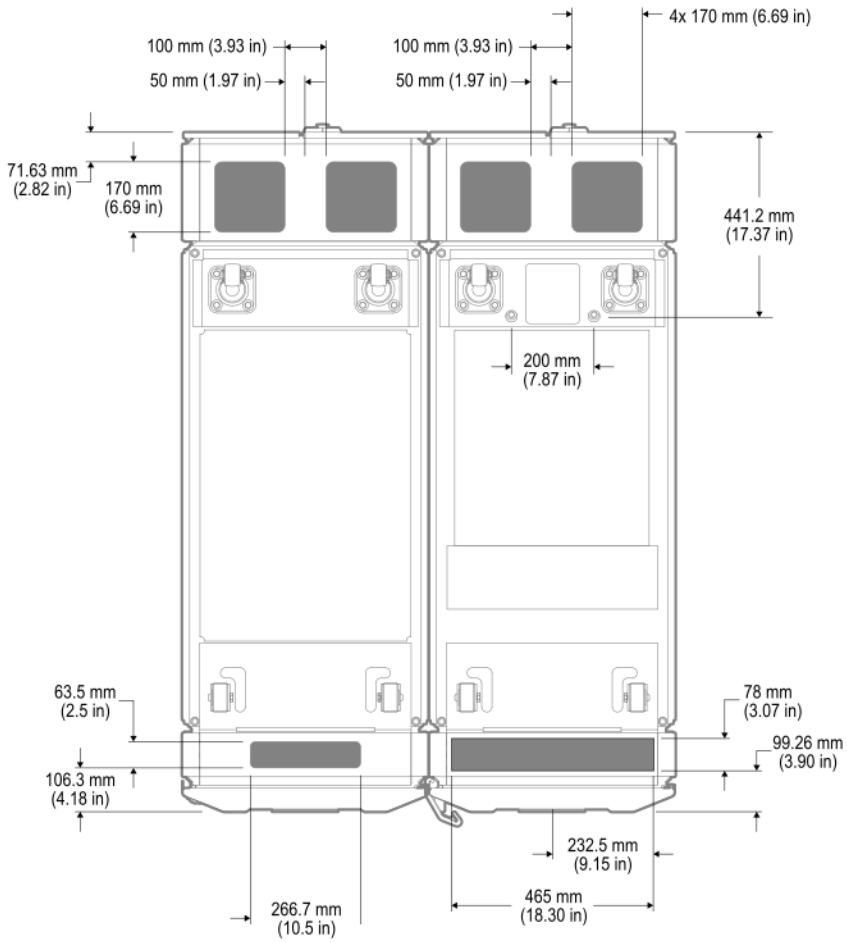
Cable openings

The HPE Adaptive Rack Cooling System has several usable cable openings on the front and rear rack extensions. The following figures show the size and position of the cable openings at the top and bottom of the HPE Adaptive Rack Cooling System and adjacent HPE ARCS 42U/48U 600X1600mm Rack.

Top view


4x 170 mm (6.69 in)
100 mm (3.93 in)
100 mm (3.93 in)
50 mm (1.97 in)
50 mm (1.97 in)
71.63 mm
(2.82 in)
170 mm
(6.69 in)
170 mm
(6.69 in)
78 mm
(3.07 in)
63.5 mm
(2.5 in)
99.26 mm
(3.90 in)
106.27 mm
(4.18 in)
232.5 mm
(9.15 in)
133.35 mm (5.25 in)
465 mm
(18.30 in)
266.7 mm
(10.5 in)

Bottom view



Cabinet leveling feet

CAUTION: Hewlett Packard Enterprise recommends that you support the rack by its leveling feet after installation. Check with your floor provider before installing racks to ensure that floor capacity meets rack static load rating. Hewlett Packard Enterprise is not responsible for damage due to floor overloading.

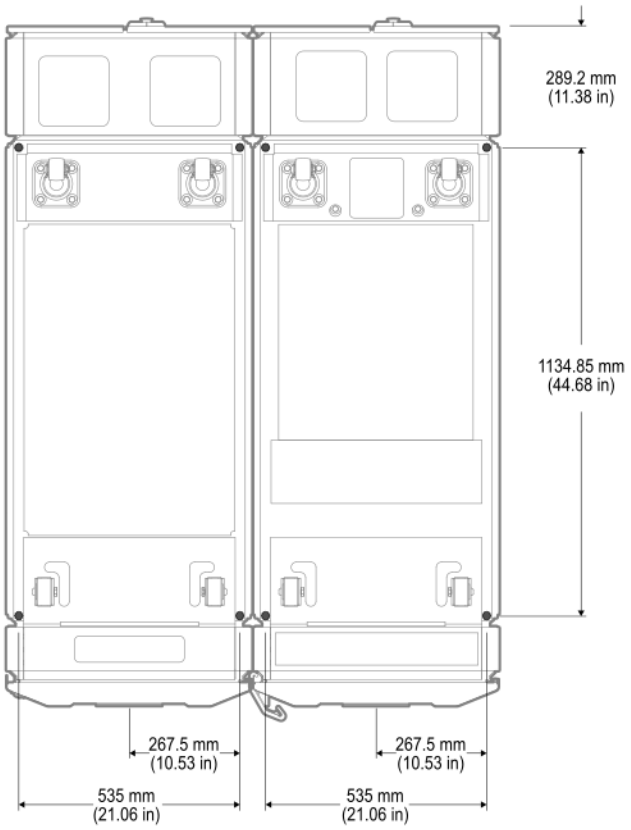
The HPE Adaptive Rack Cooling System and HPE ARCS 42U/48U 600X1600mm Rack include leveling feet and do not require fastening to the floor. To avoid personnel and equipment damage when loading the equipment, ensure that the rack remains stable during operation and servicing.

The following figures show the locations of the cabinet leveling feet. Be sure that there is adequate floor and remaining understructure support to handle the load-bearing leveling feet, taking any floor cutouts into account. After positioning the HPE Adaptive Rack Cooling System in the proper location in the data center, extend the leveling feet to transfer the weight of the rack to the feet.

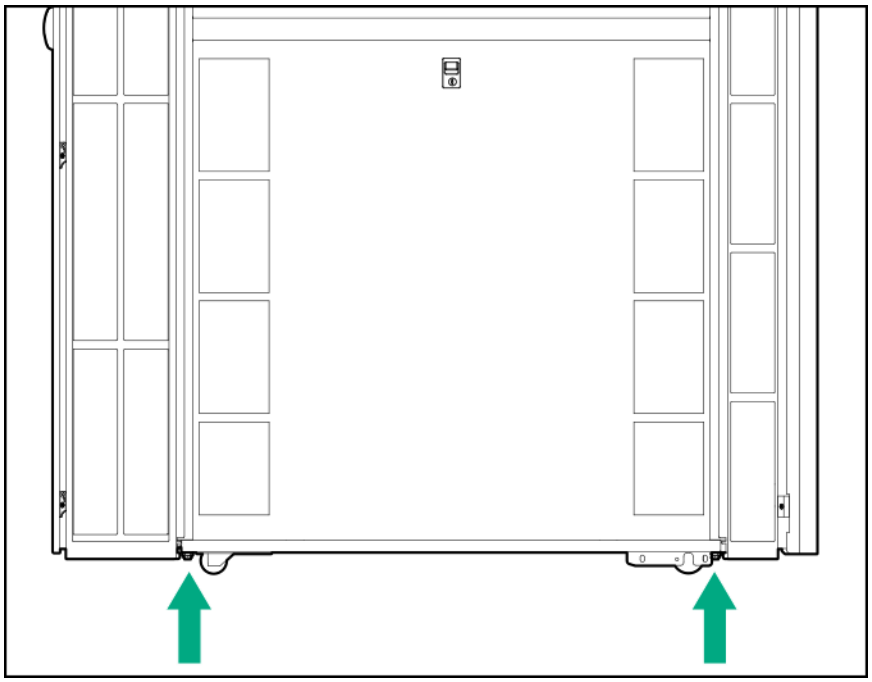
The leveling feet help to ensure weight distribution and help transfer the load to the support structure under the floor.

Cabinet leveling feet locations

Bottom view



Side view



Floor loading considerations

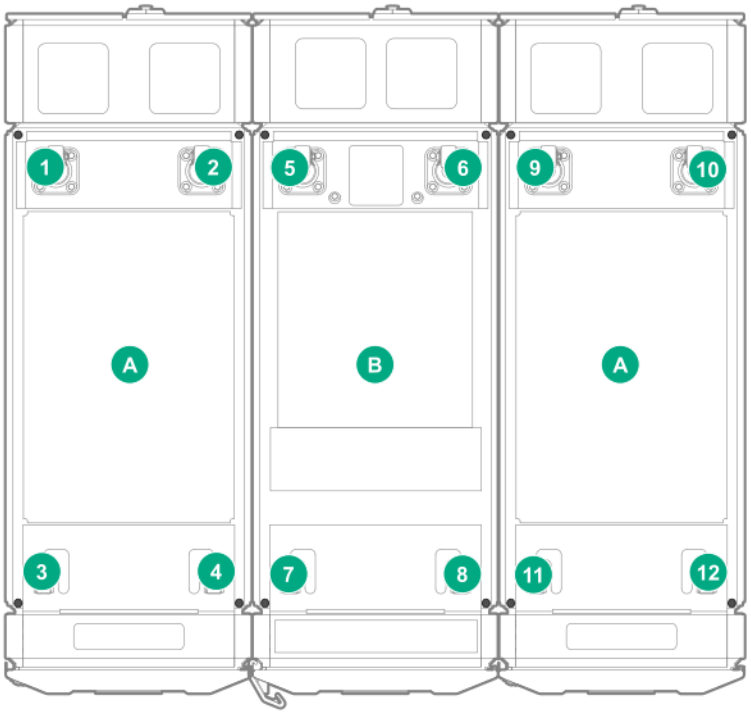
Raised floor loading is a function of the manufacturer load specification and the positioning of the equipment relative to the raised floor grid. When positioning the HPE Adaptive Rack Cooling System unit and HPE ARCS 42U/48U 600X1600mm Racks, consider the following guidelines:

- Some raised floor systems do not have grid stringers between floor stands. The lateral support for the floor stands depends on adjacent panels being in place. To avoid compromising this type of floor system when gaining under-floor access, remove only one floor panel at a time.
- Larger floor grids (bigger panels) might be rated for lighter loads.
- The HPE ARCS 42U/48U 600X1600mm Rack supports approximately 1,361 kg (3,000 lb) of IT equipment, plus the rack weight, on the leveling feet and feet pads.

The HPE Adaptive Rack Cooling System and HPE ARCS 42U/48U 600X1600mm Rack have not been certified for seismic environments.

The following figure shows load distribution on the leveling feet, assuming the load is centered in the rack. The HPE ARCS 42U/48U 600X1600mm Rack weight assumes 3,000 lb of IT equipment and 400 lb of empty rack weight.

Dual-rack configuration



Item	Description
A	HPE ARCS 42U/48U 600X1600mm Rack
B	HPE Adaptive Rack Cooling System

Item	Weight
1	385.5 kg (850 lb)
2	385.5 kg (850 lb)
3	385.5 kg (850 lb)

Table Continued

Item	Weight
4	385.5 kg (850 lb)
5	161 kg (355 lb)
6	161 kg (355 lb)
7	161 kg (355 lb)
8	161 kg (355 lb)
9	385.5 kg (850 lb)
10	385.5 kg (850 lb)
11	385.5 kg (850 lb)
12	385.5 kg (850 lb)

Common floor loading terms

Term	Description
Design load	The load rating of an individual floor panel, expressed in kg or lb
Uniform load	The average load rating of the floor panel, expressed in kg/m² (lb/ft²)
Concentrated load	The load that a floor panel can support on a 25 x 25 mm² (1 x 1 inches²) area at the weakest point (typically the center of the panel) without the surface of the panel deflecting more than a predetermined amount
Rolling load	The load a floor panel can support (without failure) when a wheel of specified diameter and width is rolled across the panel

Electrical considerations

The electrical practices and suggestions in this guide are based on North American practices. For regions and areas outside North America, local electrical codes take precedence. An example would be the recommendation that the protective ground conductor is green with yellow stripes—this requirement is a North American directive and does not override the local code requirements for a region or areas outside North America.

⚠ **WARNING:** To avoid personal injury and damage to the equipment, be sure that an emergency power shut off switch is in place and is easily accessible.

The HPE Adaptive Rack Cooling System provides a NEMA L22-20P 4P/5W AC input connection in North America and an IEC 60309 32/30A 220/415V 6h/IP44 power connector for international use. It ships with one set of two power cords for connecting to redundant AC power buses, when available. Only one power cord is necessary for operation. To improve system availability by protecting against power source failures, connect the second cord to a redundant AC power bus. Doing so can also protect against accidentally tripped circuit breakers.

For more information, see **Connecting to facility A/C power**.

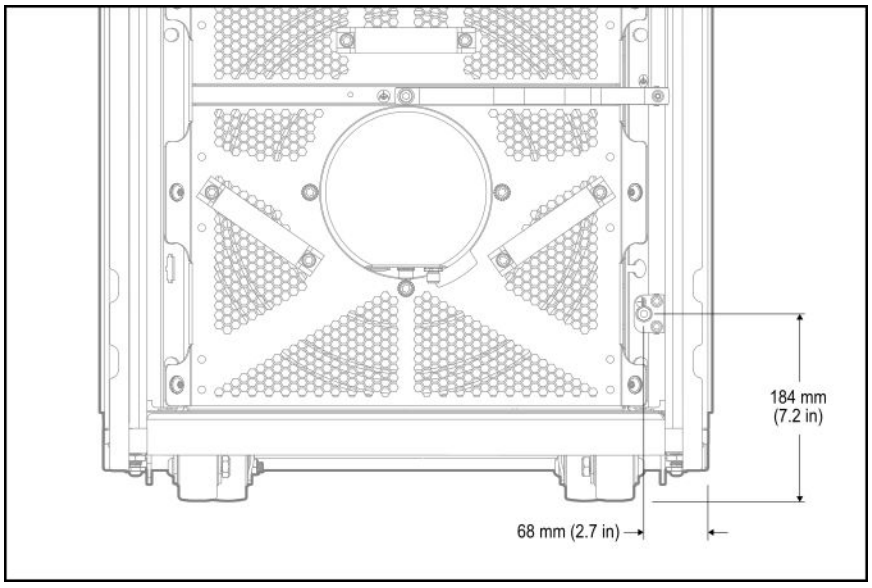
System grounding

Hewlett Packard Enterprise server systems require two methods of grounding: power distribution grounding for safety and high-frequency signal grounding for equipment performance. Power distribution grounding involves the main building electrical service entrance, electrical conduit, facility power panels, and equipment cabinets (including the HPE Adaptive Rack Cooling System and server cabinets). Ground this equipment using green or yellow insulated wire conductors according to the applicable electrical codes. High-frequency grounding consists of using ground return conductors for intra- and intercabinet signal interconnects as well as chassis and cabinet grounding.

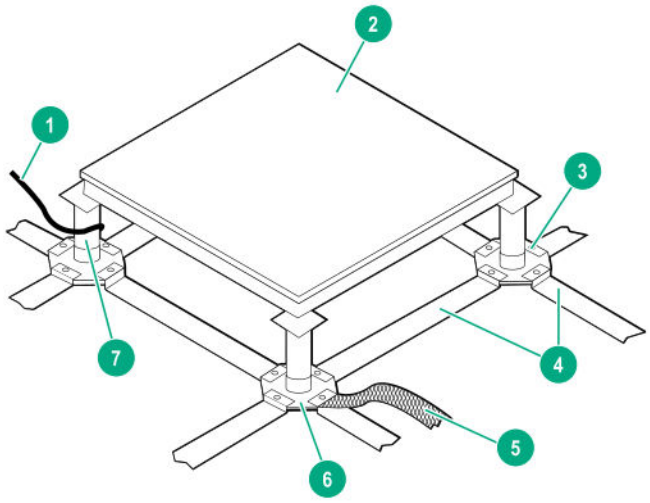
For HPE Adaptive Rack Cooling System and server systems installed on a raised floor, electrically ground the floor assembly to form a complete ground grid. An optimum raised-floor grounding solution is shown in the following figure.

Each floor panel needs at least one supporting pedestal grounded to the facility power panel and another pedestal grounded to an equipment cabinet. This broadband solution provides excellent grounding for improved safety and performance.

Central ground stud location inside the HPE Adaptive Rack Cooling System



Raised floor grounding



Item	Description
1	Ground wire to power panel
2	Floor panel
3	Hex bolt
4	Grounding grid element
5	Grounding braid to computer equipment
6	Band and pedestal
7	Grounding clamp

Voltage fluctuations and outages

To obtain the best possible performance of power distribution systems for Hewlett Packard Enterprise equipment, observe the following guidelines:

- **Dedicated power source—**Isolates the power distribution system from other circuits in the facility
- **Missing-phase and low-voltage detectors—**Automatically shuts down equipment when a severe power disruption occurs.
- **Online UPS—**Maintains constant input voltage for devices. Consider using if outages of one-half cycle or more are common. For each situation, consult a qualified contractor or consultant.

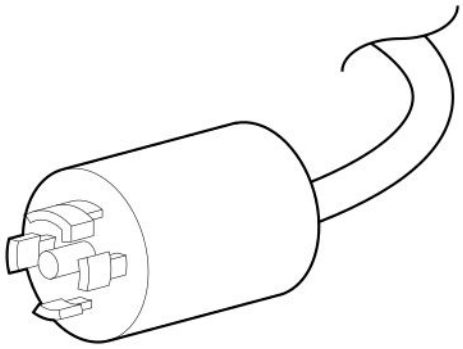
You can protect the HPE Adaptive Rack Cooling System from the sources of many electrical disturbances by using:

- An isolated power distribution system
- Power conditioning equipment
- Protection to reduce high-frequency electrical energy radiation
- Surge protective devices on power cables to protect equipment against electrical storms

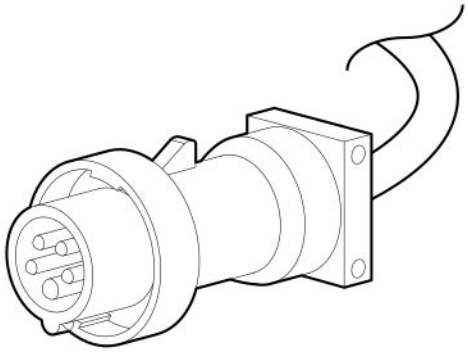
Connecting to facility A/C power

The HPE Adaptive Rack Cooling System accepts AC power through two Walther COQ04 power receptacles at the top rear patch panel. The optional Power Cord kit ships with one of each AC power cord set for connecting to redundant AC power buses. The NEMA L22-20P power cord uses a NEMA L22-20P male plug for connecting to a facility AC feed connector common to North America and Japan. The IEC 60309 power cord uses an IEC 60309 male plug for connecting to a facility AC feed connector.

NEMA L22-20P connector



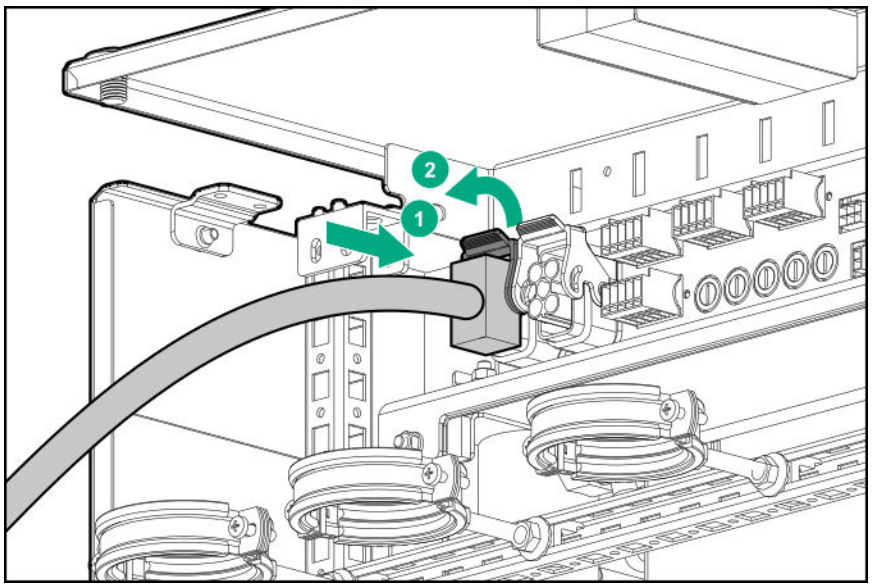
IEC 60309 power connector



At least one power cord must be used for HPE Adaptive Rack Cooling System operation. To improve system availability, connect the second cord to a redundant AC power bus. When the redundant power is connected, the HPE Adaptive Rack Cooling System transfer switch provides switchover to the active power bus when there is a power source failure or tripped circuit breaker.

The HPE Adaptive Rack Cooling System power cords are approximately 4.5 m (14.8 ft) long. The power connections are inside of the top of the HPE ARCS 42U/48U 600X1600mm Rack as shown in the following figures.

When using only a single source for power, the AC power cord is connected to the left receptacle (#1). When redundant AC power is available, the redundant AC power cord is connected to the right receptacle (#2).



Coolant source planning

The HPE Adaptive Rack Cooling System connects to facility supply and return water to provide cooling to the adjacent HPE ARCS 42U/48U 600X1600mm Racks. For proper operation, it is important to ensure that facility design can support the HPE Adaptive Rack Cooling System coolant temperature and flow requirements. Following are some important cooling performance points to understand:

- The overall HPE Adaptive Rack Cooling System capacity is dependent on the facility supply water temperature and desired IT inlet temperature. For more information, see **Determining heat load capacities**.
- The performance capacities and curves shown in this guide are based on the water fluid properties. The addition of glycol to the facility loop will decrease HPE Adaptive Rack Cooling System cooling performance.
- The HPE Adaptive Rack Cooling System uses a two-way modulating valve for temperature control. Facility flow rates through the HPE Adaptive Rack Cooling System can vary from no flow to full flow, depending on current IT workload and temperature set point.

Facility piping considerations

When planning for the HPE Adaptive Rack Cooling System, consider the following facility design points:

- Facility pipe diameter and flow capacity must support HPE Adaptive Rack Cooling System flow rate and differential pressure requirements.
- Material compatibility within piping system to minimize the potential for electrochemical corrosion.
- Insulation of piping to minimize risk of condensation and reduce incidental heating of supplied water.
- Availability of a floor drain or reclamation system to capture system condensation.
- Structural securing of piping to support weight of distribution network filled with water.
- Facility water quality and HPE Adaptive Rack Cooling System water quality requirements.
- Availability and access to a data center leak detection system to monitor the infrastructure system for leaks.

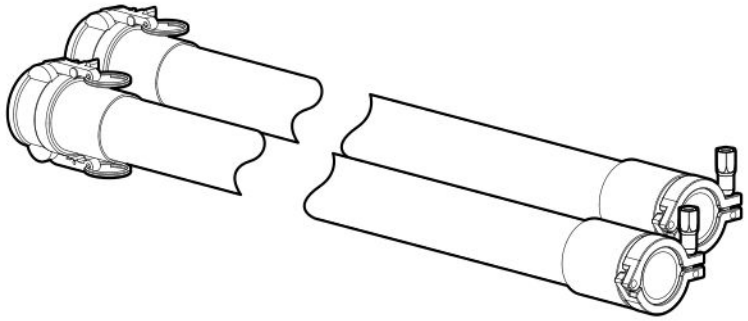
HPE Water Hook-Up Kit

Hewlett Packard Enterprise recommends using the HPE Adaptive Rack Cooling SystemWater Hook-Up Kit (part number P00675-B21) to connect the HPE Adaptive Rack Cooling System to a facility water supply. Each kit includes two hose assemblies with 2-inch sanitary flange connections that are required for connecting the facility supply and return lines to the main inlet and outlet connections of an HPE Adaptive Rack Cooling System. One Water Hook-Up Kit is required for each HPE Adaptive Rack Cooling System.

NOTE: To properly connect the Water Hook-Up Kit, the facility plumbing connection must be a 2-inch flange fitting.

HPE Adaptive Rack Cooling System Water Hook-Up Option Kit contents

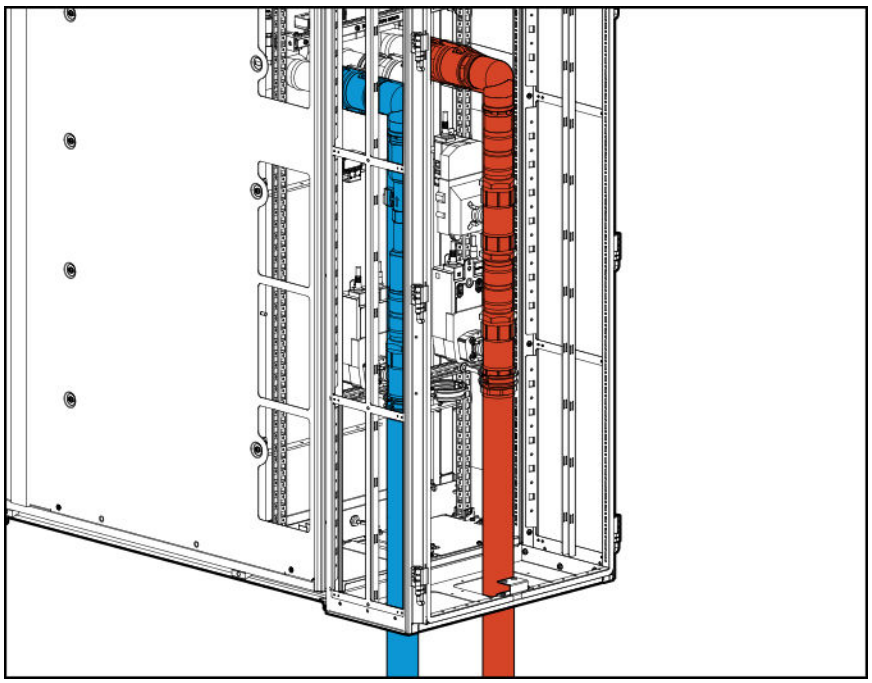
NOTE: The illustration is not drawn to scale. The actual length of the hoses is approximately 1.83 m (6 ft).



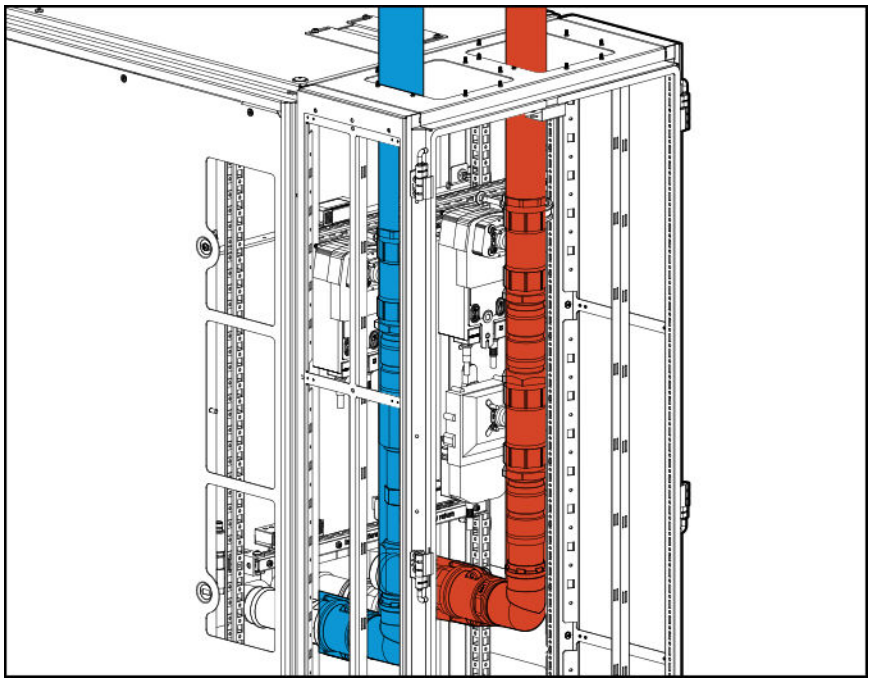
Coolant line hookup options for the HPE Adaptive Rack Cooling System

The facility connection fittings are inside the HPE Adaptive Rack Cooling System, approximately 381 mm (15 in) above the floor on the rear side. You can also route the main coolant hoses up through openings in the top of the cabinet and above the unit. In the following illustrations, the left (blue) hose designates the facility water supplied to the HPE Adaptive Rack Cooling System and the right (red) hose designates the return water exiting the HPE Adaptive Rack Cooling System.

Coolant line hookup through raised floor cutouts



Coolant line hookup above the unit

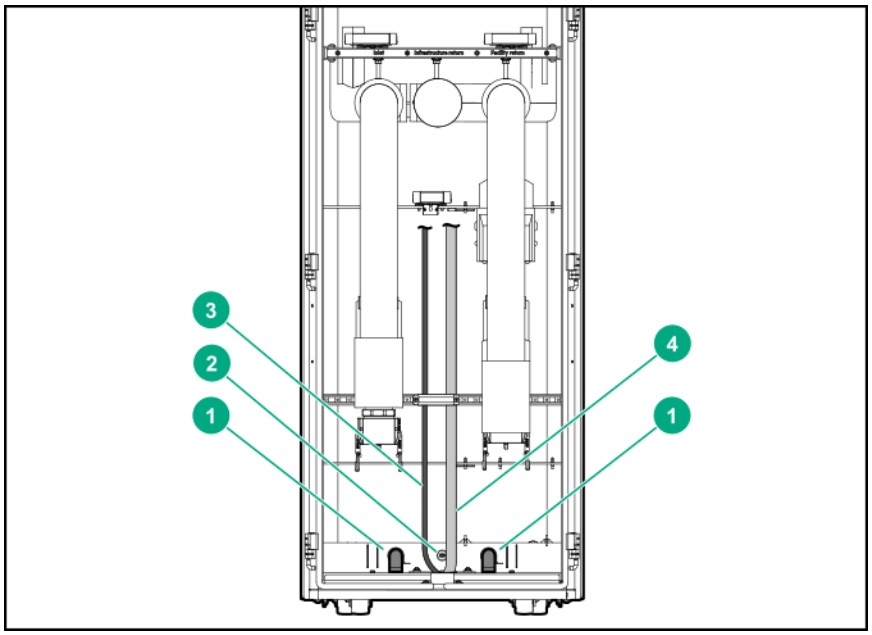


The Water Hook-up Kit contains approximately 1.83 m (6 ft) of flexible hose with terminated fittings on each end. The length that is available outside the HPE Adaptive Rack Cooling System depends on the preferred type of connection.

Available hose lengths outside the HPE Adaptive Rack Cooling System by connection type

Connection type	Approximate length supply and return hoses
Bottom	152 cm (60 inches)
Top	168 cm (66 inches)

The following figure shows the location of the two overflow drains in the rear of the cooling unit. Each drain is a 15-mm ID tube. There is also a 15-mm ID gravity drain tube and a 0.275-in ID/0.375-in OD condensate pump drain tube. Both tubes are 1.83 m (6 feet) long. The preferred method of routing for all hoses is downward at an angle of at least 3º (pitch of 0.6 inch per 12 inches), without loops, and away from the HPE Adaptive Rack Cooling System cabinet. All hoses must be routed to a floor drain or reclamation system. The two overflow hoses are located in the HPE Adaptive Rack Cooling System Accessory Kit.



Item	Description
1	Overflow drains
2	Overflow sensor
3	Condensate pump drain hose
4	Gravity drain hose

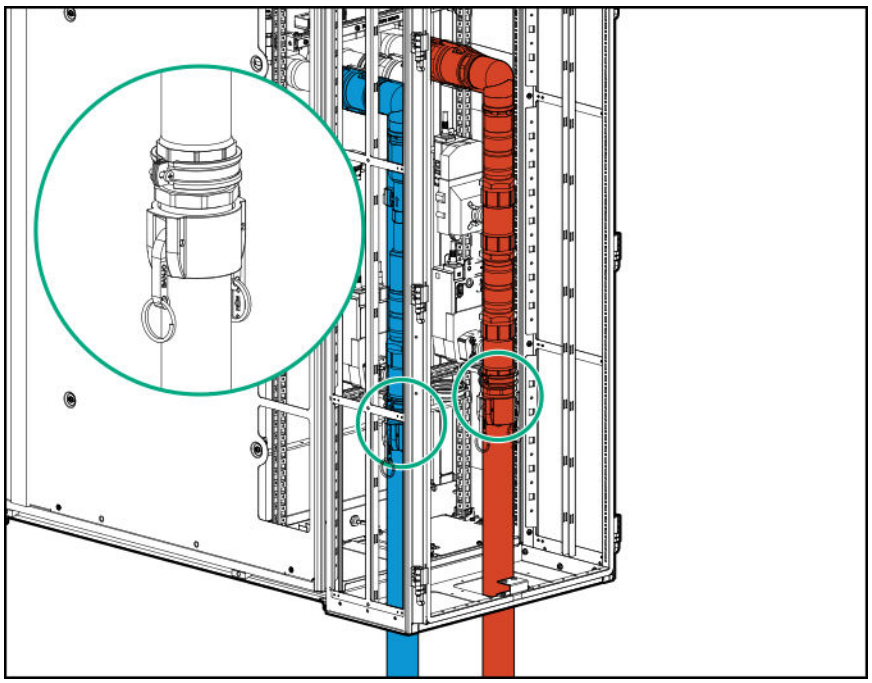
Flexible attachment hoses allow for deflection in any direction for equipment that is mounted on dynamic platforms, or for slight relocation of cabinets. Installation service for this HPE Adaptive Rack Cooling System is order number HA113A1.

Piping approaches

Hewlett Packard Enterprise recommends that you locate the HPE Adaptive Rack Cooling System facility connection point behind the HPE Adaptive Rack Cooling System when facility plumbing is routed under the floor. The connections must be easily accessible by removing a floor tile and located within reach of the Water Hook-up Kit.

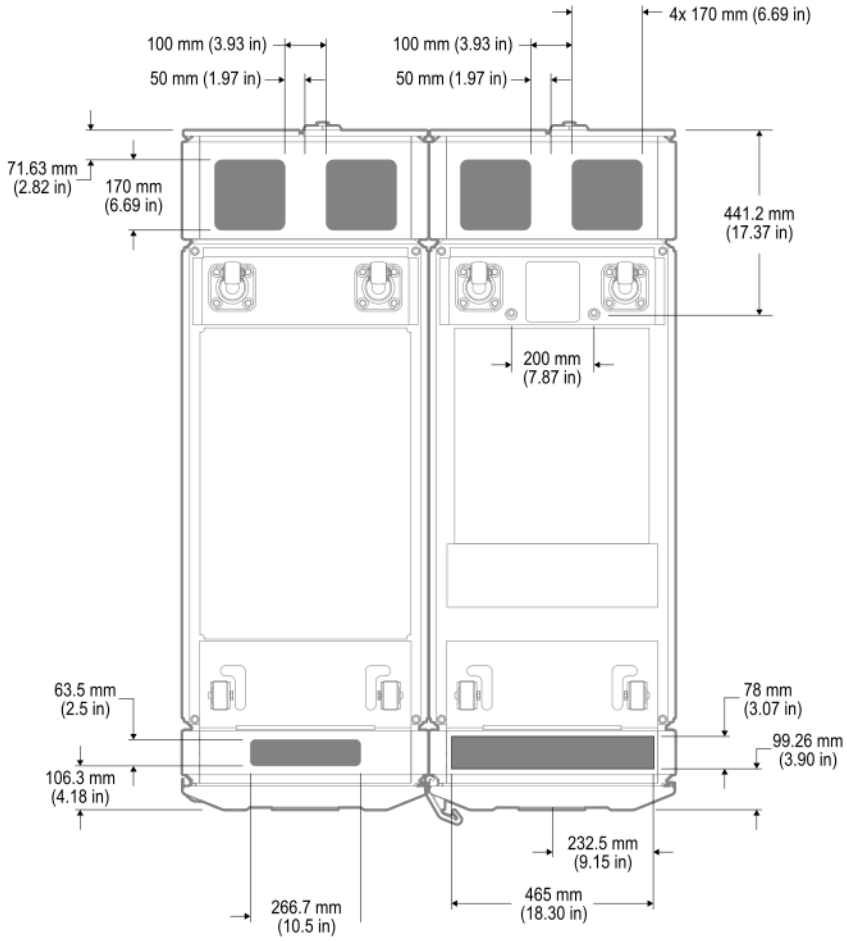
The HPE Adaptive Rack Cooling System plumbing can approach the unit from the front, but the layout must allow for accessibility of piping components and hose attachment points.

The following figure shows the rear of the HPE Adaptive Rack Cooling System with hose attachments.



Raised floor cutouts for the HPE Adaptive Rack Cooling System

When installed on a raised floor, the HPE Adaptive Rack Cooling System and HPE ARCS 42U/48U 600X1600mm Racks support either top or bottom feed of facility water, power, and data connections. When using bottom feed, the following illustration shows the rack opening sizes and locations relative to the centerline of the rack. Use this illustration for planning floor cutouts. The HPE Adaptive Rack Cooling System requires both openings at the rear of the rack to be used for the facility water connections. One hose passes through each opening.



Typical HPE Adaptive Rack Cooling System plumbing installation guidelines

- Installation service for the HPE Adaptive Rack Cooling System is order number HA113A1.
- To ensure that they are free of debris, flush HPE Adaptive Rack Cooling System supply lines prior to connecting them to the HPE Adaptive Rack Cooling System.
- To prevent condensation, HPE Adaptive Rack Cooling System supply and return piping might need to be insulated, depending on facility site conditions and coolant temperature.
- HPE Adaptive Rack Cooling System condensate and overflow hoses do not require insulation.
- To allow for isolation and disconnection, Hewlett Packard Enterprise recommends installing a manual isolation valve on the facility supply and return between the HPE Adaptive Rack Cooling System Hook-Up Kit and the facility piping.

Coolant requirements

General thermal requirements

The following table lists the coolant requirements that the facility must meet to support an HPE Adaptive Rack Cooling System installation. In addition to the requirements listed, the coolant must meet the requirements prescribed in the **Acceptable water quality specifications** section.

Parameter	Value
Minimum	7°C (45°F)
Maximum	32°C (89.6°F)
Chilled water flow rate (maximum)	270 lpm (71.3 gpm)
Inlet/outlet water connections to HPE Adaptive Rack Cooling System [1]	50.80 mm (2.00 inch) sanitary flange
Inlet/outlet hose connections to facility	50.80 mm (2.00 inch) 150-lb flanged connection
Gravity and overflow drain (hose barb connections)	1.83 m (6 feet) length, 15 mm (0.625 inch) inner diameter
Condensate discharge tubing (push-to-connect fittings)	1.83 m (6 feet) length, 9.53 mm (0.375 inch) outer diameter
Water pressure differential at maximum flow	1.03 bar (15 psid)
Cooling capacity [2]	150 kW maximum (Performance is dependent on water temperature and air temperature set point)

[1] For more information, see **Facility piping considerations**.

[2] For more information, see **Determining heat load capacities**.

To estimate the required facility flow rate and total facility load, perform the following steps:

1. Determine the maximum server heat load capacity.
2. Determine the desired server intake temperature and estimated air flow requirements when operating. For more information, see the Rack Cooling Loop Sizing Chart in **Cooling loop sizing**.
3. Consult the building cooling system administration, and obtain the maximum coolant temperature.
4. Find the required facility flow rate. For more information, see **Determining heat load capacities**.

Cooling loop sizing

Sizing the cooling loops is accomplished based on the cooling requirements of each populated/planned HPE ARCS 42U/48U 600x1600mm Rack. To obtain the total heat the HPE Adaptive Rack Cooling System will remove, add the amount of heat, in watts, that must be removed from each component in the server rack. You can copy the following table for documenting individual cabinet calculations. Calculations must include the equipment installed today and additional equipment planned for installation over the design life of the system.

Table 1: Rack Cooling Loop Sizing Chart

Installed Component	Quantity	Maximum Watts Generated	Maximum CFM Required	Maximum Watts Total	Maximum CFM Total
Component 1:					
Component 2:					
Component 3:					
Component 4:					
Component 5:					
Component 6:					
Component 7:					
Component 8:					
Component 9:					
Component 10:					
Total for Cabinet:					

After you calculate the total expected required heat load, use the charts in **Determining heat load capacities** to determine required water flow and pressure based on potential facility water temperatures. Measure the required facility pressure differential at the facility connection point between the facility supply water inlet to the HPE Adaptive Rack Cooling System and the facility water return. All water system equipment, materials, and installation must comply with any applicable construction codes and LAHJ.

Determining heat load capacities

The total airflow required by the equipment installed in each server rack must be compared with the total available supply from the HPE Adaptive Rack Cooling System. The fans in the HPE Adaptive Rack Cooling System are speed-controlled to reduce the airflow when the maximum cooling capacity is not demanded from the HPE Adaptive Rack Cooling System.

Table 2: HPE Adaptive Rack Cooling System maximum capacity chart

Thermal capacity	10,000 CFM @ N (4 fans)	7,500 CFM @ N + 1 (3 fans)
Example operating points	150kW @ full flow (270 lpm), 14°C facility water, 25°C server supply air (30°C IT dT)	110kW @ full flow (270 lpm), 17°C facility water, 25°C server supply air (30°C IT dT)

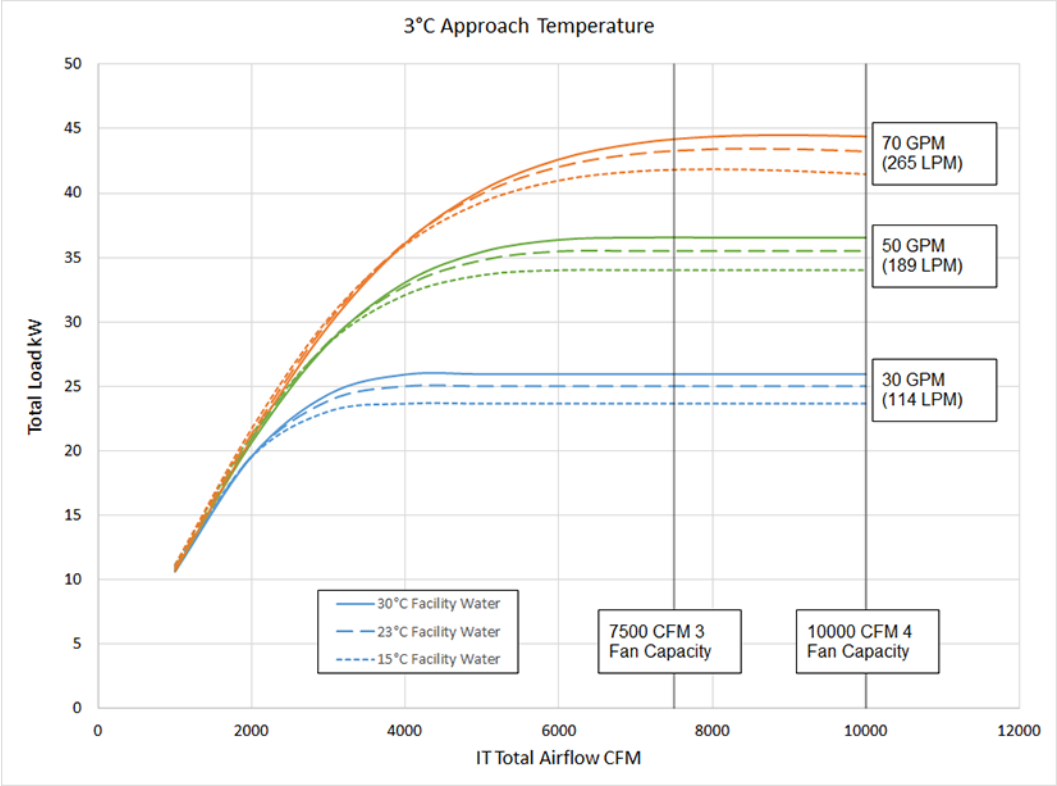
HPE Adaptive Rack Cooling System with HPE ARCS 42U/48U 600X1600mm Rack capacity/airflow is pooled and does not have to be evenly split between racks. For example, the HPE Adaptive Rack Cooling System with four fans provides a total of 10,000 CFM. One rack can use 5,000 CFM and two others can use 2,500 CFM each.

The following charts offer a guideline for determining the approximate amount of heat that can be removed from the HPE Adaptive Rack Cooling System. The different charts show an HPE Adaptive Rack Cooling System approach temperature, defined as the difference between server supply air temperature and facility supply water temperature, and the approximate HPE Adaptive Rack Cooling System capacity based on facility water flow rate. The dashed lines correspond with different water temperatures, and allowable server airflow range is listed on the X axis. These charts assume that the facility coolant is

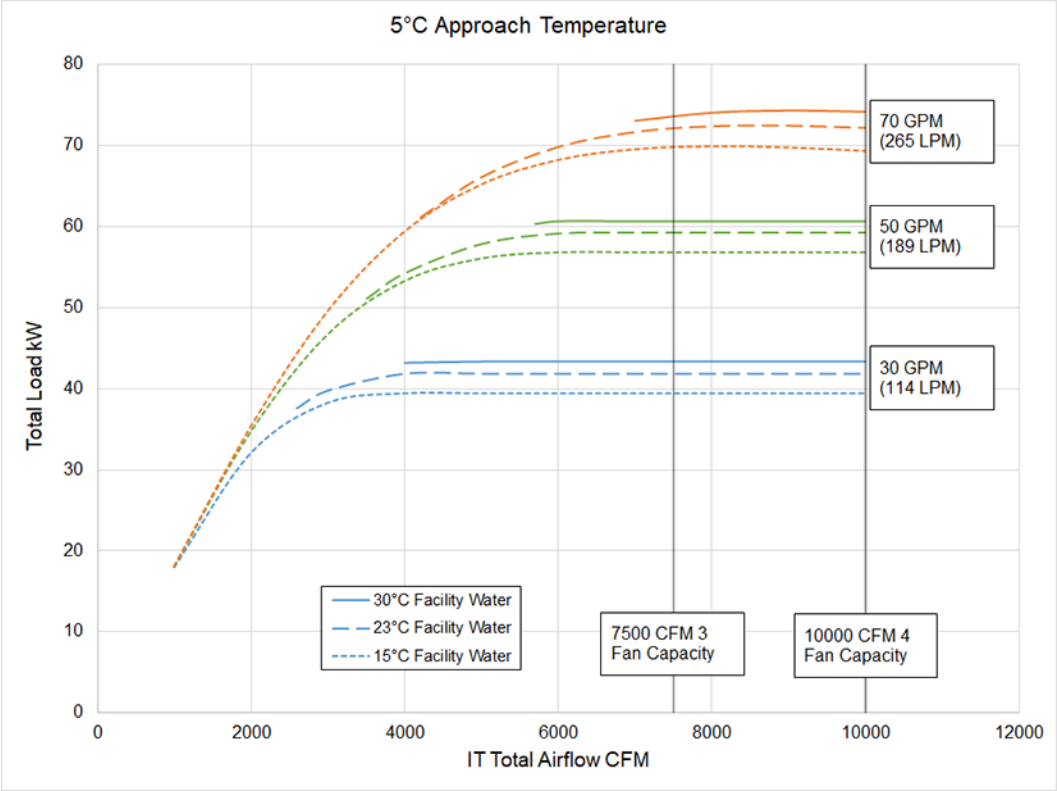
water and altitude is sea level. Acceptable airflow rates are based on a 55°C maximum return air temperature.

The term “water” in the following charts refers to the coolant described in **Acceptable water quality specifications**.

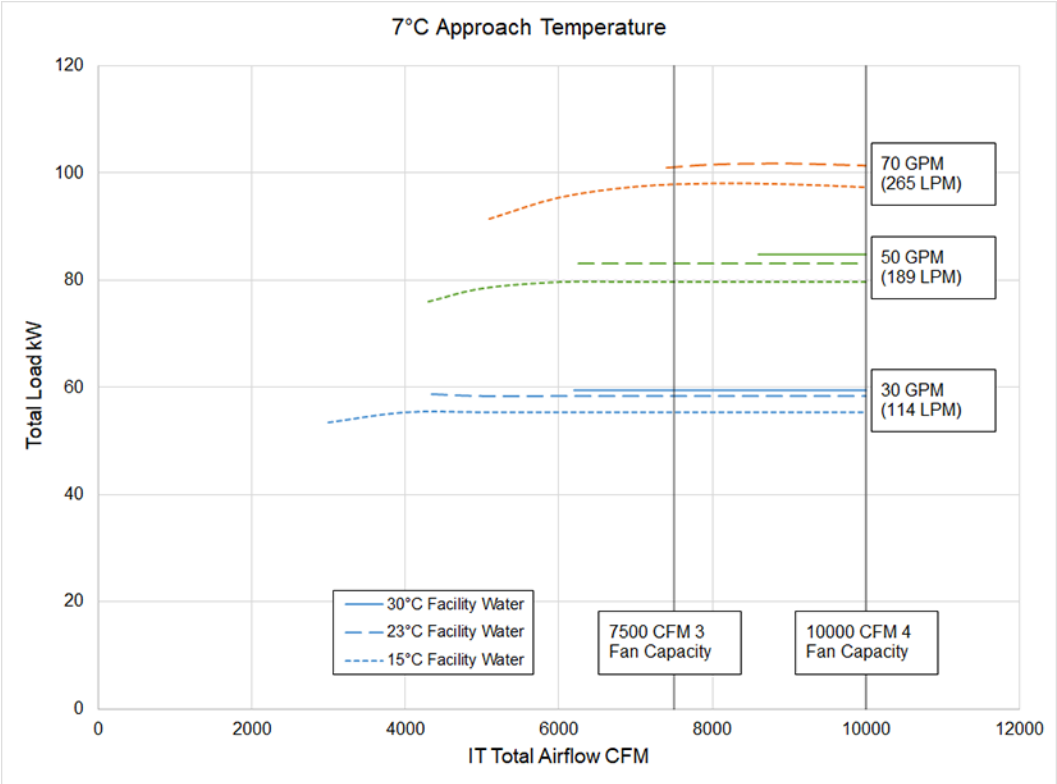
HPE Adaptive Rack Cooling System coolant flow requirements with 3°C approach temperature



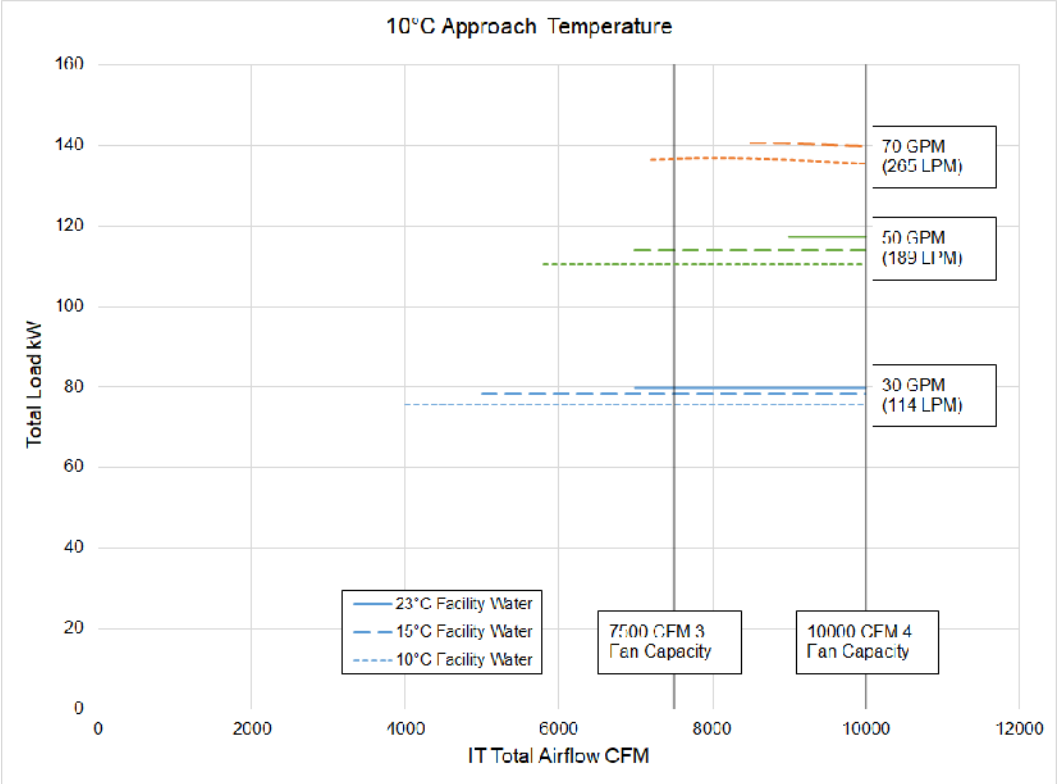
HPE Adaptive Rack Cooling System coolant flow requirements with 5°C approach temperature



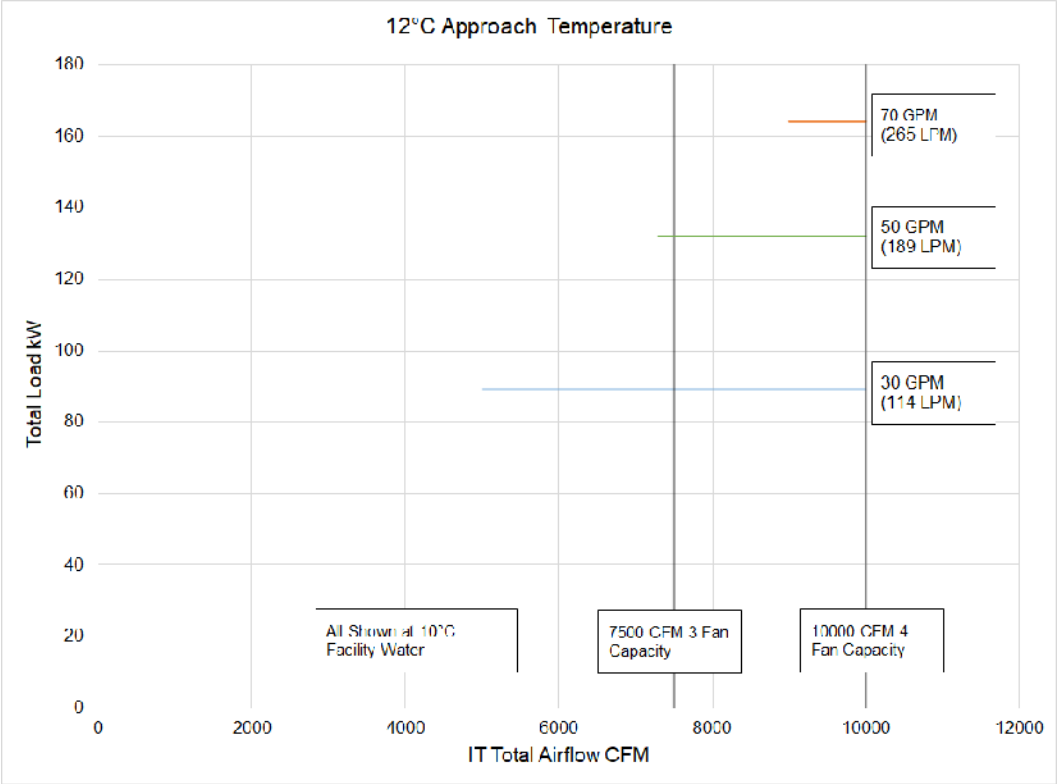
HPE Adaptive Rack Cooling System coolant flow requirements with 7°C approach temperature



HPE Adaptive Rack Cooling System coolant flow requirements with 10°C approach temperature

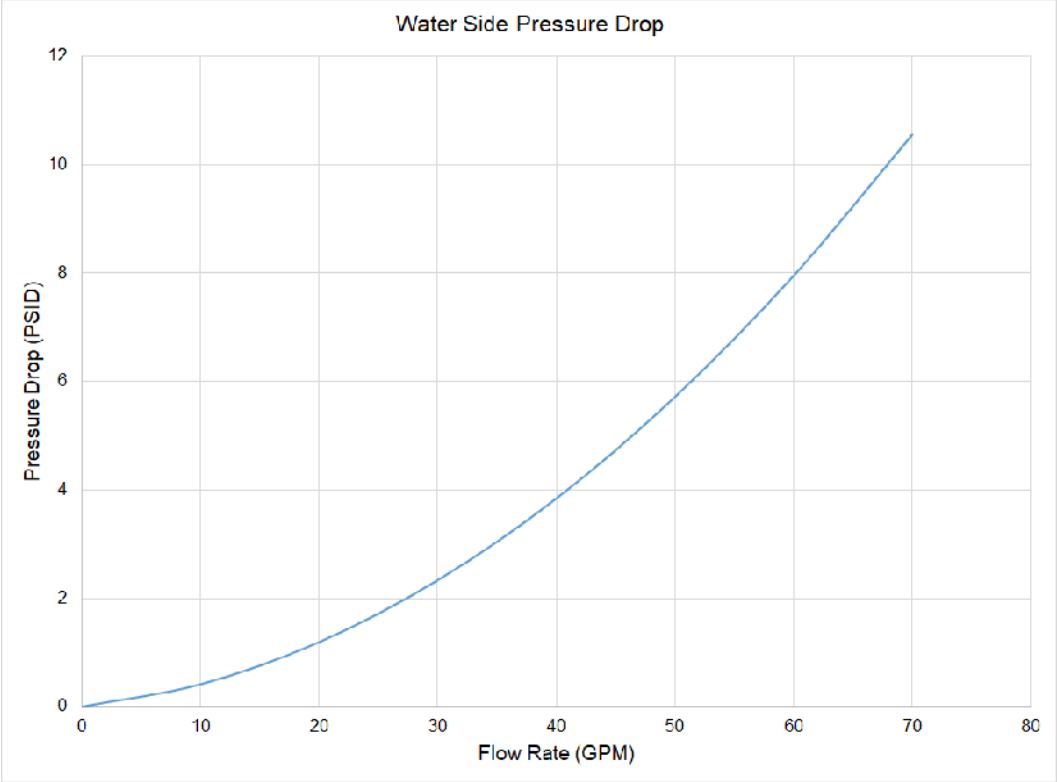


HPE Adaptive Rack Cooling System coolant flow requirements with 12°C approach temperature



HPE Adaptive Rack Cooling System facility pressure drop

A minimum water pressure difference of 1.03 bar (15 psi) between facility supply and return is required. The following figure gives the pressure difference with a fully opened control valve. During operation, the control valve adjusts facility water flow rate to maintain the supply air temperature set point. The provided facility pressure differential must be higher than the maximum pressure loss with a fully opened control valve.



Acceptable water quality specifications

The HPE Adaptive Rack Cooling System requires facility water to meet the conditions listed in the following table for continuous quality of performance. Hewlett Packard Enterprise recommends using a #30 mesh filter for water supplied to the HPE Adaptive Rack Cooling System.

The following values are water quality ranges required for continuous quality of performance.

Parameter	Range
pH	7-9
Specific conductance at 25ºC (77ºF)	<2500 µmhos
Sulfur (SO_4), total	<100 ppm
Chloride (Cl)	<50 ppm
Sulfide (S)	<10 ppm
Hardness ($CaCO_3$), total	<200 ppm
Iron (Fe), total	<3.0 ppm
Manganese (Mn), total	<0.1 ppm

Table Continued

Bacteria	<1000 CFUs/ml
Residue on evaporation	<500 ppm
Turbidity	20
Corrosion inhibitor	Recommended

CAUTION: Water that is out of spec might cause decreased cooling capacity or disruption in service. The water flowing into the HPE Adaptive Rack Cooling System must meet the guidelines stated in this guide. Damage caused by contaminated water is not covered by the HPE Adaptive Rack Cooling System warranty.

If your water is out of range, consult a water quality expert.

Hewlett Packard Enterprise recommends using particulate filtration on the dedicated water supply system connected to the HPE Adaptive Rack Cooling System.

Additional water precautions

Take the following actions during the installation of the HPE Adaptive Rack Cooling System:

- Be sure that all foreign matter and particulates are flushed from the system prior to installing the water kits for the HPE Adaptive Rack Cooling System.
- Evaluate the short- and long-term system requirements against available cooling system capacity.
- Be sure that your facility water loop is properly designed for liquid cooling systems and separate from the sanitary water systems such as bathroom, sink, or drinking water within your building.
- Be sure that facility managers understand that additional load is being added to the facility water supply. Adding heat load might affect other components that are cooled by the facility cooling plant.

CAUTION: The water supply system feeding the HPE Adaptive Rack Cooling System must be able to withstand operation with rapid and frequent changes in flow requirements, including long periods with zero water flow through the HPE Adaptive Rack Cooling System.

Plumbing materials to avoid

Hewlett Packard Enterprise recommends avoiding the following materials in a closed water system.

- Oxidizing biocides
- Aluminum components
- Brass components with high levels of zinc

Environmental considerations

Parameter	Value
Room temperature: Recommended minimum/maximum	10°C (50°F)/50°C (122°F)
Humidity: Recommended range	8% to 90% relative humidity, non-condensing
Air quality	Standard Hewlett Packard Enterprise requirements

The temperatures stated are for an elevation of -76.2 m (-250 ft) to 3,048 m (10,000 ft) above sea level.

Control system

The HPE Adaptive Rack Cooling System includes a control system that constantly monitors the air temperatures, water temperatures, and flow rate. The management module attempts to maintain the air temperature at the target set point. If the set point temperature cannot be maintained, the management module generates an alarm and notifies facility management systems, as configured.

You can remotely monitor the HPE Adaptive Rack Cooling System using HTTP, or you can connect the HPE Adaptive Rack Cooling System to a BMS through the Modbus TCP protocol or SNMP.

Before installing and running active components

CAUTION: If the HPE Adaptive Rack Cooling System runs in manual mode for too long without an adequate heat load generated by servers or other devices, excess condensation could form within the cabinet or system.

Before starting up any active components mounted in the HPE ARCS 42U 600X1600mm Rack or HPE ARCS 48U 600X1600mm Rack, perform the following actions:

- Be sure that the facility water source is available prior to the start-up of an HPE Adaptive Rack Cooling System.
- The HPE Adaptive Rack Cooling System must be operational and running before turning on the servers and closing the front and rear cabinet doors.

For more information on the installation of the HPE Adaptive Rack Cooling System, see the *HPE Adaptive Rack Cooling System Installation Guide*.

Websites

General websites

Hewlett Packard Enterprise Information Library

www.hpe.com/info/EIL

Single Point of Connectivity Knowledge (SPOCK) Storage compatibility matrix

www.hpe.com/storage/spock

Storage white papers and analyst reports

www.hpe.com/storage/whitepapers

For additional websites, see **Support and other resources**.

Support and other resources

Accessing Hewlett Packard Enterprise Support

- For live assistance, go to the Contact Hewlett Packard Enterprise Worldwide website:

  http://www.hpe.com/assistance

- To access documentation and support services, go to the Hewlett Packard Enterprise Support Center website:

  http://www.hpe.com/support/hpesc

Information to collect

- Technical support registration number (if applicable)
- Product name, model or version, and serial number
- Operating system name and version
- Firmware version
- Error messages
- Product-specific reports and logs
- Add-on products or components
- Third-party products or components

Accessing updates

- Some software products provide a mechanism for accessing software updates through the product interface. Review your product documentation to identify the recommended software update method.
- To download product updates:

  Hewlett Packard Enterprise Support Center

  www.hpe.com/support/hpesc

  Hewlett Packard Enterprise Support Center: Software downloads

  www.hpe.com/support/downloads

  Software Depot

  www.hpe.com/support/softwaredepot

- To subscribe to eNewsletters and alerts:

  www.hpe.com/support/e-updates

- To view and update your entitlements, and to link your contracts and warranties with your profile, go to the Hewlett Packard Enterprise Support Center **More Information on Access to Support Materials** page:

  www.hpe.com/support/AccessToSupportMaterials

IMPORTANT: Access to some updates might require product entitlement when accessed through the Hewlett Packard Enterprise Support Center. You must have an HPE Passport set up with relevant entitlements.

Customer self repair

Hewlett Packard Enterprise customer self repair (CSR) programs allow you to repair your product. If a CSR part needs to be replaced, it will be shipped directly to you so that you can install it at your convenience. Some parts do not qualify for CSR. Your Hewlett Packard Enterprise authorized service provider will determine whether a repair can be accomplished by CSR.

For more information about CSR, contact your local service provider or go to the CSR website:

http://www.hpe.com/support/selfrepair

Remote support

Remote support is available with supported devices as part of your warranty or contractual support agreement. It provides intelligent event diagnosis, and automatic, secure submission of hardware event notifications to Hewlett Packard Enterprise, which will initiate a fast and accurate resolution based on your product's service level. Hewlett Packard Enterprise strongly recommends that you register your device for remote support.

If your product includes additional remote support details, use search to locate that information.

Remote support and Proactive Care information

HPE Get Connected

www.hpe.com/services/getconnected

HPE Proactive Care services

www.hpe.com/services/proactivecare

HPE Proactive Care service: Supported products list

www.hpe.com/services/proactivecaresupportedproducts

HPE Proactive Care advanced service: Supported products list

www.hpe.com/services/proactivecareadvancedsupportedproducts

Proactive Care customer information

Proactive Care central

www.hpe.com/services/proactivecarecentral

Proactive Care service activation

www.hpe.com/services/proactivecarecentralgetstarted

Warranty information

To view the warranty information for your product, see the links provided below:

HPE ProLiant and IA-32 Servers and Options

www.hpe.com/support/ProLiantServers-Warranties

HPE Enterprise and Cloudline Servers

www.hpe.com/support/EnterpriseServers-Warranties

HPE Storage Products

www.hpe.com/support/Storage-Warranties

HPE Networking Products

www.hpe.com/support/Networking-Warranties

Regulatory information

To view the regulatory information for your product, view the *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products*, available at the Hewlett Packard Enterprise Support Center:

www.hpe.com/support/Safety-Compliance-EnterpriseProducts

Additional regulatory information

Hewlett Packard Enterprise is committed to providing our customers with information about the chemical substances in our products as needed to comply with legal requirements such as REACH (Regulation EC No 1907/2006 of the European Parliament and the Council). A chemical information report for this product can be found at:

www.hpe.com/info/reach

For Hewlett Packard Enterprise product environmental and safety information and compliance data, including RoHS and REACH, see:

www.hpe.com/info/ecodata

For Hewlett Packard Enterprise environmental information, including company programs, product recycling, and energy efficiency, see:

www.hpe.com/info/environment

Documentation feedback

Hewlett Packard Enterprise is committed to providing documentation that meets your needs. To help us improve the documentation, send any errors, suggestions, or comments to Documentation Feedback (**docsfeedback@hpe.com**). When submitting your feedback, include the document title, part number, edition, and publication date located on the front cover of the document. For online help content, include the product name, product version, help edition, and publication date located on the legal notices page.

Appendix A: Forms and checklists

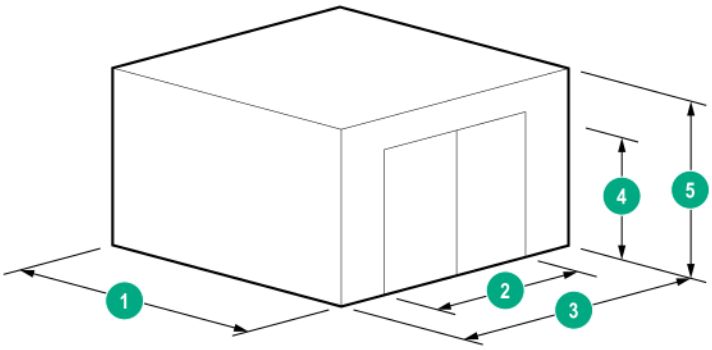
Delivery survey form

WARNING: To prevent possible serious personal injury or damage to equipment, do not move the HPE Adaptive Rack Cooling System up or down stairs.

The delivery survey form lists delivery or installation requirements. If any of the items on the list apply, enter the appropriate information in the areas provided on the form. Enter special instructions or recommendations on a special instructions or recommendations form. The following list gives examples of special instructions or issues:

- Packaging restrictions at the facility, such as size and weight limitations
- Special delivery procedures
- Special equipment required for installation, such as tracking or hoists
- What time the facility is available for installation, after the equipment is unloaded
- Special security requirements applicable to the facility, such as security clearance

Complete the following information if an elevator is required to move equipment:



Item	Dimension	Measurement
1	Interior depth	
2	Door width	
3	Interior width	
4	Door height	
5	Interior height	
6	Elevator weight capacity	

Pre-installation checklists

Site preparation checklist

The following tables are site preparation checklists. These checklists can be used at any point in the site preparation process, for example:

- An initial walk-through with Hewlett Packard Enterprise services representative to decide what preparations the site needs to adjust to support the product
- A pre-delivery or installation walk-through to ensure the site is ready for installation and deployment

For each item, check "yes" or "no" in the appropriate column.

The requirements listed in the checklists can vary based on region or facility; therefore, it is important to note that if the answer is "no," a comment or explanation is needed to help Hewlett Packard Enterprise assess the situation. An alternative solution might be required. A "no" does not automatically indicate the solution cannot work, just that additional information is needed.

Facility considerations

Item	Area/condition	Yes	No	Comment/date
1	Is there adequate clearance from the loading area to the installation site to accommodate rack dimensions, including the pallet, if applicable?			
2	Is there a completed floor plan, including a detailed location of the HPE Adaptive Rack Cooling System relative to the floor tile breaks and supports?			
3	Is there adequate space for maintenance needs? Recommended clearances are minimum 1,219 mm (48 inches) in front, minimum 914 mm (36 inches) in the rear.			
4	Is access to the site or computer room restricted?			
5	Is the computer room structurally complete? What is the expected date of completion?			
6	Is a raised floor installed and in good condition?			
7	In a raised floor system, has the customer conducted a floor loading analysis to ensure that the floor can adequately support the fully loaded rack and HPE Adaptive Rack Cooling System?*			
8	Are there channels or cutouts for cable routing?			
9	Is a network line available?			
10	Are floor tiles in good condition and properly braced?			
11	Is there a leak detector for the facility water system (external to the HPE Adaptive Rack Cooling System)?			

Table Continued

Item	Area/condition	Yes	No	Comment/date
12	Are Masonite boards available for floor protection during rack movement over carpets and thresholds?			
13	Is there a plan for trash removal? • Do shipping materials get trashed or recycled? • Who is responsible for handling trash removal? • Where does trash get taken? (Location for trash dumpster?)			

*Hewlett Packard Enterprise is not responsible for ensuring the strength of the floor can sustain the weight of the loaded HPE Adaptive Rack Cooling System. Verify that the customer is aware of the weight requirements for all components, including installation equipment such as the Gantry lift, and has approved the expected floor loading.

Power and lighting considerations

Item	Area/condition	Yes	No	Comment/date
1	Are there AC outlets available for servicing needs (for example, for laptop)?			
2	Does the input voltage correspond to HPE Adaptive Rack Cooling System specifications?			
3	Is wye power available?			
4	Is dual source power used? If so, identify types and evaluate grounding.			
5	Does the input frequency correspond to equipment specifications?			
6	Is power conditioning equipment installed?			
7	Is there a dedicated branch circuit for equipment?			
8	Is there a dedicated branch circuit less than 22.86 m (75 ft) away?			
9	Are the input circuit breakers sized to protect their respective receptacles for equipment loads?			

Safety considerations

Item	Area/condition	Yes	No	Comment/date
1	Is there an emergency power shutoff switch?			
2	Is there a telephone available for emergency purposes?			

Table Continued

Item	Area/condition	Yes	No	Comment/date
3	Is there a fire protection system in the computer room?			
4	Does facility water supply have leak detection and handling implemented?			
5	If installing ARPO, does the HPE Adaptive Rack Cooling System power supply have adequate shut off capability? For more information, see the *HPE HPE Adaptive Rack Cooling System User Guide*.			

Cooling considerations

Item	Area/condition	Yes	No	Comment/date
1	Can the room temperature be maintained between the recommended range of 10°C and 50°C (50°F and 122°F)?			
2	Can the humidity level be maintained at the recommended range of 8% to 90%, non-condensing?			
3	Are air conditioning filters installed and clean?			

Water preparation considerations

Item	Area/condition	Yes	No	Comment/date
1	Has a sample of the primary facility water or fluid been tested for acceptable quality for use in the HPE Adaptive Rack Cooling System?			
2	If the water quality is unacceptable, have adequate treatment measures been put in place to meet the water quality standards?			
3	Have the water temperature and flow been evaluated?			
4	Has piping of an appropriate diameter, material, and pressure tolerance been installed to reach the back of each HPE Adaptive Rack Cooling System?			
5	Is there a provision for fluid collected from the condensation and overflow hoses at each HPE Adaptive Rack Cooling System?			

Appendix B: Conversion factors and formulas

Conversion factors and formulas

The conversion factors provided in this appendix are intended to ease data calculation for systems that do not provide information in the format requested in this site preparation guide. The following list includes the conversion factors used in this document, as well as additional conversion factors that might be helpful in determining those factors required for site planning.

Conversion factors for refrigeration

- 1 watt = 0.86 kcal/hour
- 1 watt = 3.412 British thermal unit (BTU)/hour
- 1 ton = 200 BTU/minute
- 1 ton = 12,000 BTU/hour
- 1 ton = 3,517.2 W

Metric equivalents

- 1 centimeter = 0.3937 inches
- 1 meter = 3.28 feet
- 1 meter = 1.09 yards
- 1 inch = 2.54 centimeters
- 1 foot = 0.305 meters
- 1 cubic foot/minute = 1.7 cubic meters/hour

kVa conversions

- Three-phase kilovolt-amperes (kVA) = V x A x √3/1,000
- Single-phase kVA = V x A/1,000

Formulas

- kVA = [Voltage x Current (amps)]/1,000
- Watts = VA x power factor
- BTU = Watts x 3.41