ESCALA POWER5

Hardware Information

Physical site planning and preparation

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Physical site planning and preparation

This topic provides you with the general information you need to prepare your site for the delivery and installation of your server. This topic provides information regarding the following subjects:

Site selection, building and space considerations

- Site selection
- Access
- Static electricity and floor resistance
- Space requirements
- Floor construction and floor loading
- Raised floors
- Conductive contamination
- Computer room layout

Site environment, safety, and security

- Vibration and shock
- Lighting
- Acoustics
- Electromagnetic compatibility
- Computer room location
- Material and data storage protection
- Emergency planning for continuous operations

Electrical power and grounding

- General power information
- Power quality
- Voltage and frequency limits
- Power load
- Power source
- Dual power installations

Air conditioning

- Air conditioning determination
- General guidelines for data centers
- Temperature and humidity design criteria
- Temperature and humidity recording instruments
- Relocation and temporary storage
- Acclimation
- System air distribution

Planning for the installation of rear door heat exchangers

- Planning for the installation of rear door heat exchangers
- Heat exchanger specifications
- Water specifications for the secondary cooling loop
- Water delivery specifications for secondary loops
- Layout and mechanical installation
- Suggested sources for secondary loop components

Communications

- Planning for communications

Site selection

The selection of a site for information technology equipment is the first consideration in planning and preparing for the installation. Determine whether a new site is to be constructed or alterations are to be performed on an existing site. This section provides specific information on building location, structure, and space requirements for present and future needs.

Utilities

Power and communication facilities must be available in the quantities required for operation. If these are inadequate, contact the utility company to determine if additional services can be made available.

Exposure to hazards

Pollution, flooding, radio or radar interference, and hazards caused by nearby industries can cause problems to information technology equipment and recorded media. Any indication of exposure in these areas should be recognized and included in the planning of the installation.

Access

A preliminary check of the building will show if adequate access for the normal delivery of supplies and servers exists. A small alley, a narrow door opening, or limited access to the delivery area can become inhibitive to installation. The loading dock, passageways, and elevators should be able to accommodate heavy, oversized data processing support equipment such as air conditioning equipment.

Access route

Define an access route from the loading dock to the data processing area. A small alley (cannot accommodate delivery truck), a narrow door opening <914 mm (<36 in.), low height 2032 mm(<80 in.), or limited access to the delivery area can become inconvenient during the delivery process. If the heights of the truck bed and the dock surface do not match, the ramp angle should be such that the machine frame does not bottom out while taking it from the truck bed to the dock surface.

Within your site, ramps from hallways to computer-room floors should conform to the American Disabilities Acts (ADA). The ADA requirement states that the ramp should have a 1:12 relationship. For each inch of vertical height of the raised floor, one foot of ramp length should be provided. As an example, if the raised floor height is 12 inches, then the ramp length should be 12 feet. The ramps should also be strong enough to support the weight of the server while it is being moved over the surface. The hallways and doors should be wide enough and high enough to allow passage of the server, and ensure adequate turning radius in the hallway. The overhead clearance to pipes and ducts must be sufficient to allow movement of computer equipment, air conditioners, and electrical equipment. Most standard passenger elevators are rated for 1134 kg (2500 lb.). Selected information technology equipment, and some site infrastructure equipment such as air conditioning units might exceed 1134 kg (2500 lb.). Access to a freight elevator with a minimum rating of 1587 kg (3500 lb.) is recommended.

Review the access route from the loading dock to the computer room to prevent problems when moving the frames. Consider making a cardboard template to check the access route for height, width, and length interference. Employ qualified experts if special rigging is required to get the server from the loading dock to the computer room.

Because the dynamic loads of rolling frames are higher than the static loads of stationary frames, floor protection is required at delivery time. It is also important to consider the caster point loads. Some floors cannot withstand the force exerted by the casters of heavier systems. For example, caster point loads on some servers can be as high as 455 kg (1,000 lb.). This can penetrate, or otherwise damage, the surface of some floors.

It is also important to protect the raised floor from damage when moving servers or relocating processors in the computer room. Ten mm (3/8 in.) plywood sheeting provides adequate protection. For some of the heavier high-end servers, it is recommended that you use tempered masonite or plyron. Plywood might be too soft for the heavier servers.

Delivery and subsequent transportation of the equipment

DANGERHeavy equipment personal injury or equipment damage might result if mishandled. (D006)

You must prepare your environment to accept the new product based on the installation planning information provided, with assistance from an authorized service provider. In anticipation of the equipment delivery, prepare the final installation site in advance so that professional movers or riggers can transport the equipment to the final installation site within the computer room. If for some reason, this is not possible at the time of delivery, you must make arrangements to have professional movers or riggers return to finish the transportation at a later date. Only professional movers or riggers should transport the equipment. The authorized service provider can only perform minimal frame repositioning within the computer room, as needed, to perform required service actions. You are also responsible for using professional movers or riggers when you relocate or dispose of equipment.

Static electricity and floor resistance

Floor covering material can contribute to buildup of high static electrical charges as a result of the motion of people, carts, and furniture in contact with the floor material. Abrupt discharge of the static charges causes discomfort to personnel and might cause malfunction of electronic equipment.

Static buildup and discharge can be minimized by:

- Maintaining the relative humidity of the room within the server operating limits. Choose a control point that normally keeps the humidity between 35 percent and 60 percent. See the Air conditioning determination for further guidance.
- Providing a conductive path to ground from a metallic raised floor structure including the metal panels.
- Grounding the raised floor metallic support structure (stringer, pedestals) to building steel at several places within the room. The number of ground points is based on the size of the room. The larger the room, the more ground points are required.
- Ensuring the maximum resistance for the flooring system is 2×10^{10} ohms, measured between the floor surface and the building (or an applicable ground reference). Flooring material with a lower resistance will further decrease static buildup and discharge. For safety, the floor covering and flooring system should provide a resistance of no less than 150 kilohms when measured between any two points on the floor space 1 m (3 ft.) apart.
- Maintenance of antistatic floor coverings (carpet and tile) should be in agreement with the individual supplier's recommendations. Carpeted floor coverings must meet electrical conductivity requirements. Use only antistatic materials with low-propensity ratings.
- Using ESD-resistant furniture with conductive casters to prevent static buildup.

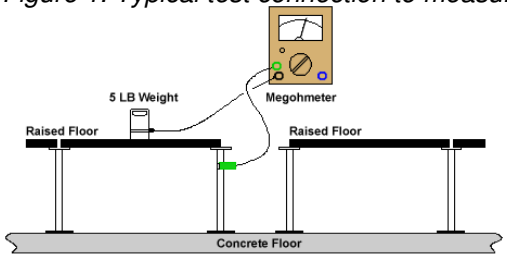
Measuring floor resistance

The following equipment is required for measuring floor resistance:

- A test instrument similar to an AEMC-1000 megohmmeter is required for measuring floor conductivity.

The following figure shows the typical test connection to measure floor conductivity.

Figure 1. Typical test connection to measure floor conductivity



Space requirements

The floor area required for the equipment is determined by the specific servers to be installed, the location of columns, floor loading capacity, and provisions for future expansion. See Floor construction and floor loading

to review floor loading and weight distribution for your system. When the amount of space is determined, allow for the addition of furniture, carts, and storage cabinets. Additional space, not necessarily in the computer area, is required for air conditioning, electrical, security systems, and fire protection equipment as well as for the storage of tapes, forms, and other supplies. Additional space might be needed to access the server (for example, rack-door-opening clearance). Plan to store all combustible materials in properly designed and protected storage areas.

A computer room or area should be separated from adjacent areas to allow for air conditioning, fire protection, and security. The floor-to-ceiling height must be sufficient to allow server top covers to open for service and should be adequate to allow air circulation from the data processing machine. Recommended heights are 2.6 m to 2.9 m (8 ft. 6 in. to 9 ft. 6 in.) from the building floor or (if used) from the raised floor to ceiling, but higher ceilings are acceptable. In new construction or remodeling, the computer room area should have a minimum door width of 914 mm (36 in.). Because many machine frames are close to 914 mm (36 in.) in width, the use of a 1067 mm (42 in.) door width would be preferable. The door height should be a minimum of 2032 mm (80 in.) of unobstructed height (no threshold plate).

Floor construction and floor loading

A floor loading assessment is the evaluation of the concrete subfloor, not the raised floor. The weight of the raised floor is considered in the floor loading formula.

The building floor must support the weight of the equipment to be installed. Although older devices might impose 345 kg/m^2 (75 lb./$ft.^2$) on the building floor, a typical server design imposes a load of no more than 340 kg/m^2 (70 lb./$ft.^2$). The following pounds-per-square-foot (lb./$ft.^2$) formula is used to calculate floor loading. For assistance with floor load evaluation, contact a structural engineer.

Machine weight + 15 lb./$ft.^2$ X (1/2 of the service clearance) + (10 lb./$ft.^2$ X total area)

Total Area

- The floor loading should not exceed 240 kg/m^2 (50 lb./$ft.^2$) with a partition allowance of 100 kg/m^2 (20 lb./$ft.^2$) for a total floor load rating of 340 kg/m^2 (70 lb./$ft.^2$).
- The raised-floor weight plus the cable weight adds 50 kg/m^2 (10 lb./$ft.^2$) uniformly across the total area used in calculations and is included in the 340 kg/m^2 (70 lb./$ft.^2$) floor loading. (The total area is defined as: machine area + 0.5 service clearance.)
- When the service clearance area is also used to distribute machine weight (weight distribution/service clearance), 75 kg/m^2 (15 lb./$ft.^2$) is considered for personnel and equipment traffic. The distribution weight is applied over 0.5 of the clearance up to a maximum of 760 mm (30 in.) as measured from the machine frame.

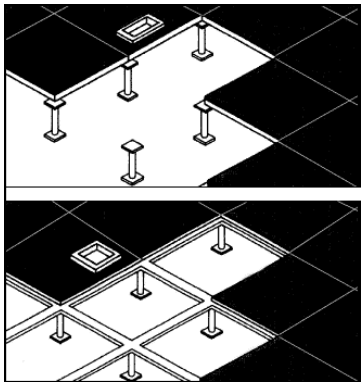
Raised floors

A raised floor accomplishes the following major objectives:

- Improves operational efficiency and allows greater flexibility in the arrangement of equipment
- Permits the space between the two floors to be used to supply cooling air to the equipment or area
- Allows for future layout change with minimum reconstruction cost
- Protects the interconnecting cables and power receptacles
- Prevents tripping hazards

A raised floor should be constructed of fire-resistant or noncombustible material. The two general floor types are shown in the following figure. The first figure is of a stringerless floor, and the second figure is a floor with stringers.

Figure 1. Raised floors types



Raised floor factors:

- No metal or highly-conductive material that might be at ground potential should be exposed to the walking surface when a metallic raised-floor structure is used. Such exposure is considered an electrical safety hazard.
- The raised-floor height should be between 155 mm (6 in.) and 750 mm (30 in.). For processors with multiple channels, a minimum raised-floor height of 305 mm (12 in.) is recommended. Clearance must be adequate to accommodate interconnecting cables, fiber cable raceways, power distribution, and any piping that is present under the floor. Experience has shown that higher raised-floor heights allow better air-conditioning balance in the room.
- Caster point loads on some servers can be as high as 455 kg (1,000 lb.) concentrated load anywhere on the panel with a 2 mm (0.080 in.) maximum deflection .
- When a raised-floor panel is cut for cable entry or air supply, an additional panel support (pedestal) might be required to restore the structural integrity of the panel to the above requirement.
- Use protective covering (such as plywood, tempered masonite, or plyron panels) to prevent damage to floor tiles, carpeting, and panels while equipment is being moved into or is relocated within the installation. When the equipment is moved, the dynamic load on the casters is significantly greater than when the equipment is stationary.
- Concrete subfloors require treatment to prevent the release of dust.
- Use noncombustible protective molding to eliminate sharp edges on all floor cutouts to prevent damage to cables and hoses and to prevent casters from rolling into the floor cutout.
- Pedestals must be firmly attached to the structural (concrete) floor using an adhesive.
- Cable cutout size information is determined by the volume of cables passing through the cutout. See the server's documentation for recommendations on the cable cutout size.

Signal reference ground

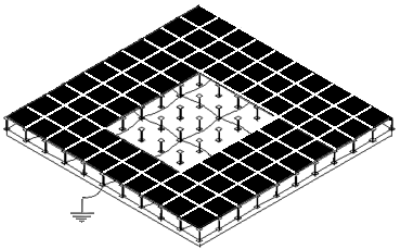
To minimize the effects of high-frequency (HF) interference and other undesired electrical signals (commonly referred to as electrical noise), a Signal Reference System (SRS) may be recommended. An SRS may be made up of a Signal Reference Ground or Grid (SRG), or a Signal Reference Plane (SRP). A Signal Reference Ground or Grid may also be known as a Zero Signal Reference Ground (ZSRG). Regardless of the name used, the intent is to provide an equal potential point of reference for equipment installed in a contiguous area for a wide range of frequencies. This is accomplished by installing a network of low impedance conductors throughout the information technology room.

Access (raised) flooring systems that utilize bolted stringer construction can be used to provide a simple SRG. Floor systems that have either no stringer or snap-in stringers do not provide for an effective SRG, and other methods for installing a SRG should be used.

For safety requirements, the SRG must be connected to earth ground. SRG practices recommend that all metallic objects that cross the SRG area are to be bonded (mechanically connected) to the SRG.

For more information on Signal Reference Grounds, contact your Installation Planning Representative.

Figure 2. Signal reference ground



Conductive contamination

Semiconductors and sensitive electronics used in current information technology equipment have allowed for the manufacture of very high density electronic circuitry. Although new technology allows for significant increases or capacity in a smaller physical space, it is susceptible to contamination, especially contamination particles that will conduct electricity. Since the early 1990s, it has been determined that data center environments may contain sources of conductive contamination. Contaminants include: carbon fibers, metallic debris such as aluminum, copper and steel filings from construction, and zinc whiskers from zinc-electroplated materials used in raised floor structures.

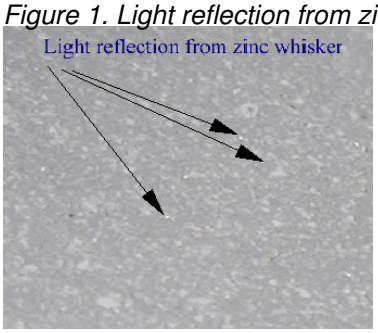
Although very small, and at times not easily seen without the visual aid of magnifying lenses, this type of contamination can have disastrous impact on equipment availability and reliability. Errors, component damage and equipment outages caused by conductive contamination can be difficult to diagnose. Failures may be at first attributed to other more common factors such as lightning events or electrical power quality or even just presumed to be defective parts.

Zinc whiskers

The most common conductive contamination in raised-floor data centers is what is known as zinc whiskers. It is the most common because it is frequently found on the underside of certain types of access floor tiles. Typically, the wood core style floor tile has a flat steel bottom. The steel may be coated with zinc either by a hot-dip-galvanize process or by zinc electroplate. The zinc electroplate steel exhibits a phenomena that appears as whisker-like growths on the surface. These small particles of approximately 1-2 mm (.04-.08 in.) in length can break away from the surface and get pulled into the cooling air stream. Eventually they might be ingested by the equipment air, settle on a circuit board and create a problem. If you suspect that you may have this type of problem, contact your seller.

The following figure shows light reflection from zinc whiskers.

Figure 1. Light reflection from zinc whiskers



Computer room layout

When planning your computer room, several important factors must be taken into consideration.

Service clearance and floor loading

Each piece of equipment that you plan to install has some minimum amount of space around it that is required to be kept clear so that service might be performed on that equipment, if it become necessary. Beyond keeping a clear area around the equipment, it is advisable that traffic patterns for work flow do not fall in

service clearance boundaries. Do not allow the service clearance areas to be used for temporary or permanent storage. Exact clearance dimensions are supplied with the individual product specifications.

Generally, floor loading areas fall inside the service clearance boundaries. Consult individual product planning documentation and your seller for specific information about the equipment that you are planning to install. If you have not yet done so, review floor loading, weight distribution, service clearance, and machine area.

Physical and logical priority

Some types of peripheral equipment might require physical or logical positioning in relation to the processor or other equipment that might dictate where that equipment must be placed on your floor. Consult individual product planning documentation and your seller to determine if equipment that you are planning to install must be specifically placed. Such equipment should be situated in your floor layout diagrams first, before other equipment that does not require precise positioning.

Restrictive cable lengths

As computing power increases, cable lengths might decrease to support improvements in processing speed. Consult product-specific planning documentation and your seller to determine where cable lengths will allow you to place each piece of equipment on your floor. Review cabling and connectivity, especially if you are using Integrated Cluster Bus (ICB) cables.

Practical work space and safety

Allow enough room around equipment for normal movement of work flow. Consider the placement of equipment in relation to entrances and exits, windows, columns, wall-mounted equipment, such as circuit breaker boxes and electrical outlets, safety equipment, fire extinguishers, storage areas, and furniture. Be especially careful to allow easy access to things like the emergency power-off controls, smoke detectors, sprinkler systems, and under-floor or in-ceiling fire extinguishing systems.

If possible, make plans now to allow for future additional equipment. Plan cable routing and server locations to make it easy for additional units to be added.

Other equipment

In addition to the information technology equipment that you will be installing, allow room for office furniture and equipment, power and air conditioning, storage for operating supplies, and miscellaneous considerations, such as a meeting area, vending machine location, or water fountains.

It is highly recommended that scale drawings of your proposed layout be prepared and reviewed by both your seller and all service providers to ensure that your floor layout is physically capable and practically useful. Following is a chart of standard symbols used to create floor layouts.

Figure 1. Standard symbols to create floor layouts

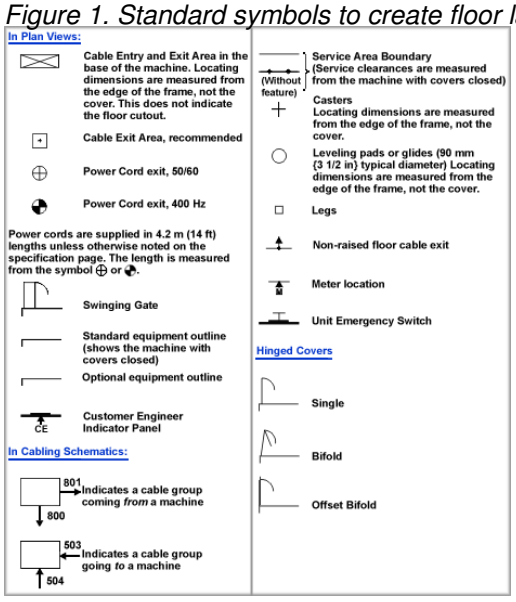
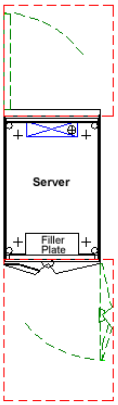


Figure 2. Sample plan view



Vibration and shock

It might be necessary to install the information technology equipment in an area subject to minor vibrations. The following information supplies vibration and shock limits for your equipment and some basic definitions concerning vibration. The vibration levels normally present in computer-room and industrial installations are well within the indicated levels.

However, mounting the equipment in racks, stackers, or similar equipment might increase the risks of vibration-related problems. It is important to consult the manufacturer of such equipment to ensure that vibration factors will not exceed the specifications provided in the following tables.

Some useful definitions of vibration include:

Acceleration: Normally measured in g multiples of the acceleration because of the force of gravity. If the frequency is also known for a sine wave, acceleration can be calculated from displacement. (g: The unit of acceleration caused by the force of gravity.)

Continuous: Vibrations present over an extended period and cause a sustained resonant response in the equipment.

Displacement: Magnitude of the wave shape; normally given in peak-to-peak displacement in English or metric units:

- Normally used to measure floor vibrations at low frequencies
- If the frequency is also known, it can be converted to displacement g for a sine wave.

Note: Many measuring instruments can convert displacement to g for either sinusoidal or complex wave shapes.

Peak: The maximum value of a sinusoidal or random vibration. This can be expressed as peak-to-peak in cases of sinusoidal vibration displacement.

Random: A complex vibration wave form varying in amplitude and frequency content.

rms (root mean square): The long-term average of the acceleration or amplitude values. Normally used as a measure of overall vibration for random vibration.

Shock: Intermittent inputs that occur and then decay to zero prior to a recurrence of the event. Typical examples are foot traffic, fork lifts in aisles, and external events such as railroad, highway traffic, or construction activities (including blasting).

Sinusoidal: Vibrations with the characteristic shape of the classical sine wave (for example, 60-Hz ac power).

Transient: Vibrations that are intermittent and do not cause a sustained resonant response in the equipment.

If you need to make any calculations or require information regarding the above definitions, consult a mechanical engineer, a vibration consulting engineer, or your seller.

The three classes of a vibration environment are shown in the following table.

Table 1. Vibration environment

Class	Vibration environment
V1	Floor-mounted machines in an office environment
V2	Table-top and wall-mounted machines
V3	Heavy industrial and mobile equipment

A summary of the vibration limits for each of the three classes is shown in the following table. A legend follows the table.

Note: Vibration levels at any discrete frequency should not exceed a level of 1/2 the g rms values for the class listed in the Vibration environment table.

Table 2. Operational vibration and shock limits

Class	g rms	g peak	Mils	Shock
V1 L	0.10	0.30	3.4	3 g at 3 ms
V1 H	0.05	0.15	1.7	3 g at 3 ms
V2	0.10	0.30	3.4	3 g at 3 ms
V3	0.27	0.80	9.4	application dependent

L: Light, weight less than 600 kg.

H: Heavy, weight equal to or greater than 600 kg.

g rms: Overall average g level over the 5 to 500 Hz frequency range.

g peak: Maximum real-time instantaneous peak value of the vibration time history wave form (excluding events defined as shocks).

Mils: Peak-to-peak displacement of a discrete frequency in the 5 to 17 Hz range. One mil equal .001 inch.

Shock: Amplitude and pulse width of a classical 1/2 sine shock pulse.

The values given in the Operational vibration and shock limit table are based on worst-case field data measured at customer installations for current and previously released products. The vibration and shock environment will not exceed these values except for abnormal cases involving earthquakes or direct impacts.

Earthquakes

Special frame-strengthening features or RPQs might be required in earthquake prone areas. Local codes might require the information technology equipment to be tied down to the concrete floor. If sufficient information on equipment tie down is not provided in the product's physical planning documentation, consult with your seller.

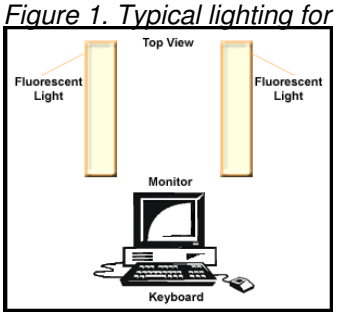
Lighting

Light sources in the equipment room and work station areas should have a general lighting level of 300 to 500 lumens/m^2 (lux) or 30 to 50 foot-candles. Proper lighting is required to normally operate the server and when service is required. When preparing the equipment room and work areas, consider painting the room a light color with a white ceiling to reflect (rather than absorb) light. To lessen any glare, windows should not be in an operator's field of vision or directly facing the display screen. Direct sunlight can cause light-sensing devices to malfunction and make observations of various signal lamps difficult.

To avoid eye fatigue, light sources should be compatible. Universal white fluorescent lamps are compatible with both incandescent lamps and daylight.

The following figure shows a suggested lighting layout for a workstation.

Figure 1. Typical lighting for a workstation



Provide and maintain emergency lighting, of sufficient intensity, to ensure a safe exit.

Acoustics

Acoustical noise emission data on products is provided for the benefit of installation planners and consultants to help predict acoustical noise levels in data centers and other installations of information technology and telecommunications equipment. Such noise declarations also allow you to compare noise levels of one product to another and to compare the levels to any applicable specifications. The format of the data provided conforms to ISO 9296: Acoustics - Declared Noise Emission Values of Computer and Business Equipment. The measurement procedures used to acquire the data conform to International Standard ISO 7779 and its American National Standard equivalent ANSI S12.10. The following terms are used to present acoustical data.

- $\mathbf{L_{WAd}}$ is the declared (upper limit) A-weighted sound power level for a random sample of machines.
- $\mathbf{L_{pAm}}$ is the mean value of the A-weighted sound pressure levels either at the operator position or at the bystander (1-meter) positions for a random sample of machines.
- $\mathbf{<L_{pA}>_m}$ is the mean value of the space-averaged sound-pressure-emission levels at the one-meter positions for a random sample of machines.

Acoustical treatment of data centers or other rooms, in which the equipment is installed, is recommended to achieve lower noise levels. Lower noise levels tend to enhance employee productivity and avoid mental fatigue, improve communications, reduce employee complaints, and generally improve employee comfort. Proper room design, including the use of acoustical treatment, might require the services of a specialist in acoustics.

The total noise level of an installation with information technology and telecommunications equipment is an accumulation of all the noise sources in the room. This level is affected by the physical arrangement of the products on the floor, the sound reflective (or absorptive) characteristics of the room surfaces, and the noise from other data center support equipment such as air conditioning units and backup power equipment. Noise levels might be reduced with proper spacing and orientation of the various noise-emitting equipment. Provide sufficient space around such machines: the farther apart they can be placed, the lower the overall room noise will be.

In smaller installations, such as small offices and general business areas, pay additional attention to the location of equipment relative to the work areas of the employees. At work areas, consider locating personal computers and computer workstations next to the desk rather than on top of it. Small servers should be

located as far away from personnel as possible. Locate nearby work areas away from the exhaust of computer equipment.

The use of absorptive materials can reduce the overall noise level in most installations. Effective and economical sound reduction can be achieved by using a sound-absorptive ceiling. The use of acoustically absorbing free-standing barriers can reduce the direct noise, increase room absorption and provide privacy. The use of absorptive material, such as carpeting on the floor, results in further reduction of the sound level in the room. Any carpeting used in a computer room must meet the electrical continuity requirements stated in Static electricity and floor resistance. To prevent computer room noise from reaching adjacent office areas, walls should be constructed from the structural floor to the structural ceiling. Also, ensure that doors and walls are properly sealed. Acoustical treatment of overhead ducts might further reduce noise transmitted to or from other rooms.

Many large systems products are offered with optional acoustical front and rear doors to help attenuate the noise of the product itself. Smaller products might also offer special acoustical packages. If noise exposure is a concern for the installation planners or employees, inquiries should be made to the seller on the availability of such product options.

Electromagnetic compatibility

Information technology equipment installation might occasionally be planned in an area that has a high electromagnetic-radiated field environment. This condition results when the information technology equipment is near a radio frequency source such as a radio-transmitting antenna (AM, FM, TV, or two-way radio), civilian and military radar, and certain industrial machines (rf induction heaters, rf arc welders, and insulation testers). If any of these sources are near the proposed site, a planning review might be appropriate to assess the environment and determine whether any special installation or product considerations are advisable to reduce interference. Consult your seller. Workstations located near devices like transformers or buried electrical conduits can experience jitter on the workstation display in the presence of strong magnetic fields.

Most products can tolerate low-frequency to very-high-frequency rf levels of 3 volts per meter. Field strengths greater than 3 volts per meter might cause operational or serviceability problems. Products have different tolerance levels to electromagnetic-radiated fields in different frequency ranges. Radar (frequency of 1300 MHz, and 2800 MHz) signals with field strengths of a maximum of 5 volts per meter are acceptable. If problems occur, reorientation of the server or selective shielding might be required.

Two-way radio or cellular telephone usage should be properly controlled in the computer room. To reduce the likelihood of a problem, the following recommendations should be considered when operating such equipment:

- Keep hand-held transmitters (for example, walkie-talkies, radio paging, and cellular telephones) a minimum of 1.5 m (5 ft.) from information technology equipment.
- Use only an operator-controlled transmitting device (no automatic transmissions). Develop specific rules, such as - Do not transmit within 1.5 m (5 ft.) of a fully covered operating server. If covers are open, do not transmit.
- Choose the minimum output power that will accomplish your communication needs.

Extremely low frequency (ELF) fields

With the exception of some video display cathode ray tubes (CRT), most information technology equipment is tolerant of extremely low frequency (ELF) electromagnetic fields. The video displays that use cathode ray tubes are more sensitive because they use electromagnetic fields to position the electron beam in normal operation. The extremely low frequency range covers frequencies between 0 and 300 Hz. It is also referred to as electrical power frequency because most world electrical power is generated at either 50 or 60 Hz.

Many products tolerate ELF electromagnetic fields in the following ranges:

- Cathode ray tube video display: 15-20 milligauss
- Liquid crystal display (LCD) : 10 Gauss
- Magnetic tape equipment: 20 Gauss
- Disk drive equipment : 20 Gauss
- Processors or Servers : 20 Gauss

Typical information technology centers exhibit an ambient electromagnetic field between 3-8 milligauss. Some equipment within a center may, under normal operation, produce fields in excess of 100 milligauss. Examples

of equipment that produces large magnetic fields include: power distribution units, electric motors, electrical transformers, laser printers and uninterruptible power systems. However, magnetic field density decreases rapidly with distance. If a CRT display is located near equipment that produces large electromagnetic fields, the display may exhibit distortion such as poor focus, change in image shape or slight motion in static display images. Moving the CRT away from the equipment may remedy the problem.

Computer room location

Before selecting a location for the computer, give attention to these requirements:

- The computer room should be in a noncombustible or fire-resistant building or room.
- The computer room should not be above, below, or adjacent to areas where hazardous materials or gases are stored, manufactured, or processed. If the computer must be located near such an area, take extra precautions to safeguard the area.
- If the computer room is below ground level, provide adequate drainage.

Safety consideration and fire prevention

Safety is a vital factor when planning computer installation. This consideration is reflected in the choice of the computer location, building materials used, fire prevention equipment, air conditioning and electrical systems, and personnel training.

If an inconsistency occurs between your server's recommendations and any local or national regulation, the more stringent of the recommendations or regulations should take precedence. The National Fire Protection Association standard, NFPA 75, provides guidelines for protection of information technology equipment. The customer is responsible for adherence to governmental regulations.

- Computer room walls should have a minimum of a 1-hour-fire-resistance rating and extend from the structural floor to the structural ceiling (slab-to-slab).
- In rooms used for critical operations, it is preferable to install processors in 1-hour-fire-rated rooms separate from the main computer room.
- If the computer room has one or more outside walls adjacent to a building that is susceptible to fire, consider taking the following precautionary actions:
    - Installing shatterproof windows in the computer room to improve the safety of personnel and equipment from flying debris and water damage. Usually, windows in the computer room are undesirable because of security concerns, and the negative effect they have on temperature control. They can cause excessive heating in the summer, and excessive cooling in the winter.
    - Installing sprinklers outside the windows to protect them with a blanket of water if a fire occurs in the adjacent area.
    - Sealing the windows with masonry.
- Where a false (or hung) ceiling or insulating material is to be added, ensure that it is noncombustible or fire-resistant material. All duct work should be noncombustible. If combustible material is used in the space between the structural ceiling and the false ceiling, appropriate protection should be provided.
- A raised floor that is installed over the structural floor should be constructed of noncombustible or fire-retardant materials. If the structural floor is of combustible material, it should be protected by water sprinklers on the ceiling of the room below.

Note: Before the information technology equipment is installed, the space between the raised and the structural floors should be cleared of debris. This space should also be checked periodically after installation to keep it free of accumulated dust, possible debris, and unused cables.

- The roof, ceiling, and floor above the computer room and the storage area for recorded media should be watertight. Liquid piping, roof drains, and other potential sources of liquid damage should be rerouted around the area.
- The space under the raised floor in the computer room should be provided with drainage to protect against flooding or trapped water.
- Waste material containers should be constructed of metal with a frame-suppressant lid.

Fire prevention equipment in a computer room

Fire prevention equipment in the computer room should be installed as an added safety measure. A fire suppression system is the responsibility of the customer. Your insurance underwriter, local fire marshall, and

local building inspector are all parties that should be consulted in selecting a fire suppression system that provides the correct level of coverage and protection. The seller designs and manufactures equipment to internal and external standards that require certain environments for reliable operation. Because the seller does not test any equipment for compatibility with fire suppression systems, the seller does not make compatibility claims of any kind nor does the seller provide recommendations on fire suppression systems.

- An early-warning fire detection system should be installed to protect the computer room and storage areas for recorded media. This system should activate both an audible and a visual alarm in the rooms and at a monitored central station.
- Portable carbon dioxide fire extinguishers, of suitable size and number, should be provided in the computer room for use on electrical equipment.
- Portable, pressurized-water extinguishers should be provided for combustible material such as paper.
- Extinguishers should be readily accessible to individuals in the area, and extinguisher locations should be marked so they are visible.
- Automatic sprinkler systems and gaseous total flooding systems are acceptable forms of fixed protection. For information on environmentally friendly gases for total flooding systems, consult NFPA 2001 titled Standard on Clean Agent Fire Extinguishing Systems.
- Special consideration should be used if you prefer a gaseous total flooding system. If a gaseous total flooding system is installed, include a time delay feature that allows investigation and evacuation from the covered area of the gaseous total flooding system. A cross-zoned detection system is suggested.
- The protected area must be evacuated whenever the gaseous total flooding system or its controls are being serviced. Additionally, a master Disarm switch, available for use by the system service personnel, is required. With the switch set in the off position, the detonators used to release the gaseous total flooding system must be made inoperative, even if the circuit fails elsewhere in the system. This switch must be placed in the off (manual) position before servicing begins to prevent possible accidental discharge of the gaseous total flooding system.
- Alternatives to ordinary wet pipe sprinkler systems might include dry pipe systems or preaction systems. Water flows into preaction systems only if triggered by smoke or heat detectors. The detection systems should be independent of gaseous total flooding system detection systems. The On-Off type of sprinkler head is not recommended because it is more prone to leakage.

To determine the proper fire protection required for the computer room, consult with your insurance underwriter and your local code authority.

Material and data storage protection

Special safety considerations are required when storing data or other material. Consider the following factors:

- Any data or material stored in the computer room, whether in the form of magnetic tapes, paper tapes, cards, or paper forms, should be limited to the minimum needed for safe, efficient operation and should be enclosed in metal cabinets or fire-resistant containers when not in use.
- For security purposes, and protection against fire, a separate room for material storage is strongly recommended. This room should be constructed of fire-resistant material (minimum 2-hour-fire-resistance rating). An approved fixed extinguishing system is recommended. Fixed extinguishing systems include automatic sprinklers and approved total flooding gaseous systems.

If continuity of operation is critical, plan a remote storage location for vital records if a disaster occurs. Key considerations in the choice of an off-site location for data storage are that the area is:

- Not subject to the same risk that might occur in the computer room.
- Suitable for long-term storage of hardcopy records and magnetic media files.

Air conditioning systems

In most installations, the computer area is controlled by a separate air conditioning system. Therefore, emergency power-off switches for the equipment and air conditioning should be placed in convenient locations, preferably near the console operator and next to the main exit doors. See National Fire Protection Association standard, NFPA 70 article 645, for information.

- When the regular building air conditioning system is used, with supplemental units in the computer area, the supplemental units would then be handled as stated above. The regular building air conditioning system should have an audible alarm to alert maintenance personnel of an emergency.
- Fire dampers should be located in all air ducts at fire walls.

- The air filters in the air conditioning system should contain noncombustible or self-extinguishing material.

Electrical systems

Provide a mainline disconnect control for the computer equipment at a remote location. The remote controls should be in a convenient location, preferably near the console operator and next to the main exit doors. They should be next to the power-off switch for the air conditioning system and should be properly marked. A light should be installed to indicate when power is on. The National Electric Code (NFPA 70) article 645 states that a single disconnecting means to control both the electronic equipment and the HVAC system is permitted.

- If continuity of operation is essential, a standby power source should be installed.
- It is advisable to install an automatic battery-operated lighting unit to illuminate an area if a power or lighting circuit failure occurs. This unit is wired to and controlled by the lighting circuit.
- Watertight connectors are recommended under raised floors because of the moisture exposures (water pipe leaks, high humidity levels) under raised floors.

Emergency planning for continuous operations

If a power outage occurs, continued operation depends on information stored on cards, tapes, or disks, and the equipment used to process the information being available immediately. Arrangements should be made for emergency use of other equipment and transportation of personnel, data, and supplies to a temporary location. Arrangements should also be made to ensure the continuous operation of environment equipment, such as air conditioning. Duplicate or master records and programming data should be maintained in a remote area, from which the necessary information can be taken to resume operation.

Precautions and personnel training

Further plans should include training of personnel to act in an emergency situation.

- Sound alarm signals for fire detection and for other abnormal conditions to familiarize personnel with the alarm.
- Monitor the computer room, air conditioning equipment room, and electrical and data storage room at all times.
- Inspect steam pipes and water pipes above the false ceiling to guard against possible damage due to accidental breakage, leakage, or condensation.
- Locate emergency exit doors in the computer area. The number of doors depends on the size and location of the area. Train personnel in emergency measures such as:
    - Shutting off all electrical power
    - Shutting off the air conditioning system
    - Shutting off the chilled water to the information technology equipment
    - Calling the fire company
    - Handling fire extinguishers in the approved manner
    - Operating a small-diameter fire hose
    - Evacuating records
    - Evacuating personnel
    - Administering first aid

Lightning protection for communication wiring

Be sure to install lightning protection devices to protect communication wiring and equipment from surges and transients induced into the communication wiring. In any area subject to lightning, surge suppressors should be installed at each end of every outdoor cable installation, whether installed above the ground (aerial) or buried below the ground.

Information about lightning surge suppressors for communication wiring and recommended methods for outdoor communication cables can be found in the information technology product's physical planning documentation.

General power information

Information Technology equipment requires a reliable electrical power source that is free from interference or disturbance. Electrical power companies generally supply power of sufficient quality. The Power quality,Voltage and frequency limits, Power load, and Power source topics provide the guidance and specifications needed to meet the requirements of the equipment. Qualified personnel must ensure that electrical power distribution system is safe and meets local and national codes. They must also ensure that the voltage measured at the power receptacle is within the specified tolerance for the equipment. In addition, a separate power feeder is required for items such as lighting and air conditioning. A properly installed electrical power system will help to provide for reliable operation of your equipment.

Other factors to consider when planning and installing the electrical system include a means of providing a low impedance conducting path to ground (path to earth) and lightning protection. Depending on the geographical location, special considerations may be required for lightning protection. Your electrical contractor should meet all local and national electrical code requirements. Building electrical power is normally derived from a three-phase power distribution system. General office areas are normally provided with single-phase power outlets, and data processing rooms are provided with three-phase power.

Some IT equipment and devices may require standard three-phase power; others may require single-phase power. The power requirements for each device are specified in the individual server specifications for that server. Nominal voltage, plugs, receptacles, and in some cases, conduit and back boxes are listed in the specific server specifications. Refer to the respective server specifications to determine the power requirements. Ensure that existing branch circuit outlets are the correct type and are properly grounded (see Grounding).

Server specifications

This topic provides the detailed physical and operational specifications for your server. This information can help you with the physical planning for the products you have ordered.

Click the appropriate models to view the specifications.

- Model ESCALA PL 245T/R
- Model 471/85
- Model ESCALA PL 250R-L
- Model ESCALA PL 250R-L+ or ESCALA PL 450R-VL+
- Model 112/85
- Model ESCALA PL 250T/R
- Model ESCALA PL 450T/R
- Model ESCALA PL 250R-VL or ESCALA PL 450R-XS
- Model ESCALA PL 850R/PL 1650R/R+
- Model ESCALA PL 1650R-L+
- Model 185/75
- Model ESCALA PL 3250R
- Model ESCALA PL 6450R
- Model ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- Model ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- Model 7/10
- Model 7/20

- 14T/00 rack
- 14T/42 and 0553 racks

Planning for model ESCALA PL 245T/R server and kstation specifications

Server specifications provide detailed information for your server or workstation, including dimensions, electrical, power, temperature, environment, and service clearances. You will also find links to more detailed information, such as compatible hardware and plug types.

Use the following specifications to plan for your server.

Table 1. Server or workstation specifications

Server or workstation specifications					
Plan views Rear view with connectors ASHRAE declarations					
Rack-mounted ESCALA PL 245T/R server					
Dimensions	Width	Depth	Height	**EIA units[1]**	Weight
Metric	429 mm	524 mm	218 mm	5	25 kg
English	16.9 in.	20.6 in.	8.6 in.		55 lb.
Stand-alone ESCALA PL 245T/R server					
Dimensions	Width	Depth	Height		Weight
Metric	216 mm 257 mm (including stabilizer foot)	496 mm (without rear cover 525 mm (with rear cover[8])	469 mm		25 kg
English	8.5 in. 10.1 in. (including stabilizer foot)	19.5 in. (without rear cover) 20.7 in. (with rear cover[8])	18.5 in.		55 lb.
Stand-alone kstation					
Dimensions	Width	Depth	Height		Weight
Metric	216 mm 257 mm (including stabilizer foot)	640 mm (with acoustical cover)	469 mm		25 kg
English	8.5 in. 10.1 in. (including stabilizer foot)	25.2 in. (with acoustical cover)	18.5 in.		55 lb.
Shipping dimensions	Width	Depth	Height	Weight	
Metric	625 mm	655 mm	485 mm	30 kg	
English	24.6 in.	25.8 in.	19.1 in.	67 lb.	
Shipping dimensions (China)	Width	Depth	Height	Weight	
Metric	625 mm	655 mm	599 mm	30 kg	
English	24.6 in.	25.8 in.	23.5 in.	67 lb.	
Feature code for drawer mounted in rack					
Electrical					
kVA (maximum)			0.474		
Rated voltage and frequency[5]			100 - 127/200 - 240 V ac at 50/60 plus or minus 0.5 Hz		
Thermal output (maximum)			1536 BTU/hr		

Maximum power consumption	530 W (1-way ESCALA PL 245T/R , 1-way 471/85, and 2-way 471/85) 750 W (2-way ESCALA PL 245T/R)
Power factor	0.95
Inrush current (maximum)	90 A
Leakage current (maximum)	1.6 mA
Phase	1
Compatible plug types	2, 4, 5, 6, 18, 19, 22, 23, 24, 25, 32, 57, 59, 62, 66, 69, 70, 73, 75, 76
Branch circuit breaker	20 A (maximum)
Power cord length	2.8 m (9 ft.) - except United States 1.8 m (6 ft.) - United States
Environment requirements	
Recommended operating temperature[2]	5 degrees to 35 degrees C (41 degrees to 95 degrees F)
Nonoperating temperature	5 degrees to 45 degrees C (41 degrees to 113 degrees F)
Shipping temperature	-40 degrees to 60 degrees C (-40 degrees to 140 degrees F)

	Operating	Nonoperating
Maximum dew point	28 degrees C (82.4 degrees F)	29 degrees C (84.2 degrees F)
Noncondensing humidity	8 to 80%	8 to 80%
Maximum altitude	3048 m (10 000 ft.)	3048 m (10 000 ft.)

Noise emissions[3, 4, 6, 7]

Product description	**Declared A-weighted sound power level, L_{WAd} (B)**		**Declared A-weighted sound pressure level, L_{pAm} (dB)**	
	Operating	Idling	Operating	Idling
471/85 1-way workstation with two 10 000 rpm hard disk drives, 2843 graphics card and 2 GB of memory (workstations have acoustical front and rear covers)	5.0[4]	4.7[4]	31[4]	28[4]
471/85 2-way workstation with two 10 000 rpm hard disk drives, 2843 graphics card and 4GB of memory (workstations have acoustical front and rear covers)	5.1[4]	4.9[4]	33[4]	31[4]
ESCALA PL 245T/R 1-way server tower	5.0[4]	4.7[4]	31[4]	28

with three 10 000 rpm hard disk drives, 2843 graphics card and 2 GB of memory and optional acoustical front and rear covers				
ESCALA PL 245T/R 2-way server tower with three 10 000 rpm hard disk drives, 2843 graphics card and 2 GB of memory and optional acoustical front and rear covers	5.5[4]	5.4[4]	37[4]	36[4]
ESCALA PL 245T/R 1-way server tower or rack-mounted server with three 10 000 rpm hard disk drives and 4 GB of memory	5.3 - 6.1[4]	5.0 - 6.1[4]	38[4]	35[4]
ESCALA PL 245T/R 2-way server tower or rack-mounted server with three 10 000 rpm hard disk drives and 4 GB of memory	5.7 - 6.1[4]	5.6 - 6.1[4]	42[4]	41[4]
Service clearances				
Clearances	Front	Back	Left or right	Top
Operating	762 mm (30 in.)	762 mm (30 in.)	N/A	N/A
Nonoperating	762 mm (30 in.)	762 mm (30 in.)	762 mm (30 in.)	762 mm (30 in.)
Seismic considerations				
Data communications				
Electromagnetic compatibility compliance: This server meets the following electromagnetic compatibility specifications: FCC (CFR 47, Part 15); VCCI; CISPR-22; 89/336/EEC; BSMI (A2/NZS 3548:1995); C-Tick; ICES/NMB-003; Korean EMI/EMC (MIC Notice 2000 94, Notice 2000 72); People's Republic of China Commodity Inspection Law				
Safety compliance: This server is designed and certified to meet the following safety standards: UL 60950; CAN/CSA C22.2 No. 60950 00; EN 60950; IEC 60950 including all National Differences				

Note:

1. See 0551, 0553, or 7014 rack configurations for typical configurations when the 0551, 0553, or 7014 rack is populated with various server models.
2. Class 3 product as defined in ASHRAE Thermal Guidelines for Data Processing Environments. The allowable operating range is 5 degrees to 35 degrees C (41 degrees to 95 degrees F). See Temperature and humidity design criteria topic for more information.
3. For a description of noise emission values, see Acoustics.

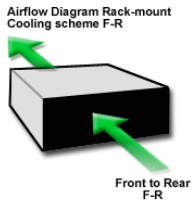
4. Estimated value
5. The power supplies automatically accept any voltage with the published, rated-voltage range. If dual power supplies are installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load.
6. When a tape drive is installed, using the acoustic cover feature will reduce the noise emissions when the tape drive is in use.
7. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.
8. An optional acoustical cover is available for the ESCALA PL 245T/R.

ASHRAE declarations

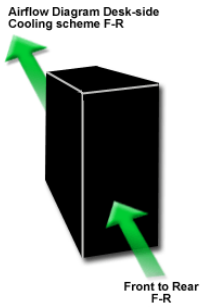
The following table and figures show the measurement reporting requirements as defined in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Thermal Guidelines for Data Processing Environments, which is available at http://tc99.ashraetcs.org .

Table 1. ASHRAE declarations

	Typical Heat Release	Airflow nominal		Airflow maximum at 35 degrees C (95 degrees F)		Weight	Overall system dimensions
Description	watts	cfm	m^3/hr	cfm	m^3/hr		
Minimum configuration	300	42	71	83	141	See ESCALA PL 245T/R	See ESCALA PL 245T/R
Maximum configuration	450	42	71	83	141	See ESCALA PL 245T/R	See ESCALA PL 245T/R
Typical configuration	375	42	71	83	141	See ESCALA PL 245T/R	See ESCALA PL 245T/R
ASHRAE Class	3						
Minimum configuration	1-way, 2.5 GHz processor, 2 GB memory, three hard disk drives, five PCI cards						
Maximum configuration	2-way, 2.5 GHz processor, 8 GB memory, three hard disk drives, six PCI cards						
Typical configuration	2-way, 2.5 GHz processor, 4 GB memory, three hard disk drives, four PCI cards						

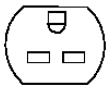


Airflow figure for server mounted in a rack



Airflow figure for desk-side server

Plug and receptacle type 76

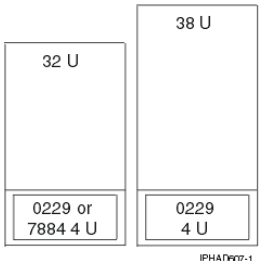
Plug	Receptacle	Countries/Regions
 Type 76 200 - 240 V 15A	 Type 76 200-240 V 15A	Taiwan
Cord Feature 6659 (A) 6663 (B)	Part Number 39M5254[1] - 2.7 m (9 ft.) (A) 39M5252[1] - 4.3 m (14 ft.) (B)	
Systems and expansion units (A) - ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, , 5095,		
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.		

7014 rack configurations

The 14T/00 provide a 1.8 meter rack (36 EIA units of total space). The 14T/42 or 0553 provides a 2.0 meter rack (42 EIA units of total space). The various configurations for the 7014 racks are:

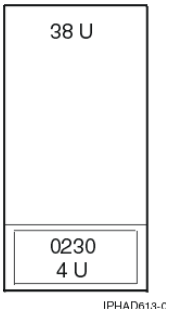
- 9406 feature code 7884, 9111 rack content specify code 0229 - 9406-520 and ESCALA PL 250T/R in rack
- 9113 rack content specify code 0230, 9406 rack content specify code 7886
- 9406-570 and ESCALA PL 850R/PL 1650R/R+ in rack, 9117 rack content specify codes 0231, 0232, 0241, 0242
- Feature code 0123 - 5074 lower expansion unit in rack; Feature code 0574 - 5074 equivalent
- Feature code 0694 - 5094 equivalent
- Feature code 0133 - Manufacturing install in rack (models 9406-800 and 9406-810); Feature code 0137 - Field install in rack (models 9406-800 and 9406-810)
- Feature code 0134 - Field install in rack (model 9406-825); Feature code 0138 - Field install in rack (model 9406-825)
- Feature code 0578 - PCI-X expansion unit in rack
- Feature code 0588 - PCI-X expansion unit in rack
- Feature code 0595 - PCI-X expansion unit in rack

9406 feature code 7884, 9111 rack content specify code 0229 - 9406-520 and ESCALA PL 250T/R in rack



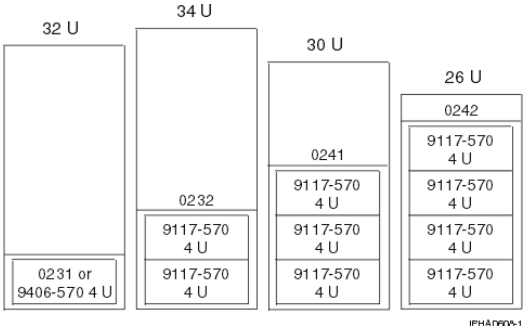
rack	0551[1], 0553[1], 7014[13]
Top rack, specify code	- -
Bottom rack, specify code	- -
Rack, specify code	7884, 0229
PDU support	0 to 4[2]
Power cords	7884, PDU[3]

9113 rack content, specify code 0230; 9406 rack content, specify code 7886



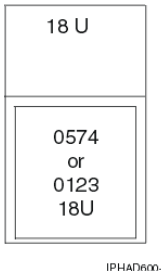
rack	7014[13]
Top rack, specify code	- -
Bottom rack, specify code	- -
Rack, specify code	0230 (ESCALA PL 450T/R), 7886 (9406-550)
PDU support	0 to 4[2]
Power cords	PDU[4]

9406-570 in rack, ESCALA PL 850R/PL 1650R/R+ rack content, specify codes 0231, 0232, 0241, 0242



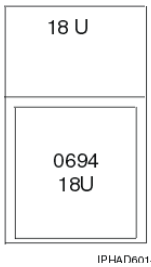
rack	0551[1], 0553[1], 7014[13]
Top rack, specify code	- -
Bottom rack, specify code	- -
Rack, specify code	0231, 0232, 0241, 0242
PDU support	0 to 4[2]
Power cords	PDU[4]

Feature code 0123 - 5074 lower expansion unit in rack; Feature code 0574 - 5074 equivalent



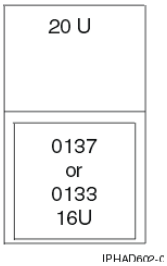
rack	0551[1], 0553[1]
Top rack, specify code	- -
Bottom rack, specify code	0123
Rack, specify code	0574
PDU support	0 to 4[2]
Power cords	0123, 0574, PDU[5]

Feature code 0694 - 5094 equivalent



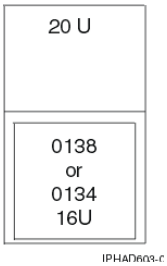
rack	0551[1], 0553[1]
Top rack, specify code	- -
Bottom rack, specify code	- -
Rack, specify code	0694
PDU support	0 to 4[2]
Power cords	0694, PDU[6]

Feature code 0133 - Manufacturing install in rack (models 9406-800 and 9406-810); Feature code 0137 - Field install in rack (models 9406-800 and 9406-810)



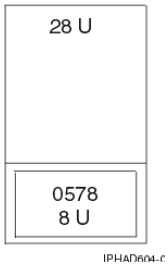
rack	0551[1], 0553[1]
Top rack, specify code	- -
Bottom rack, specify code	- -
Rack, specify code	0133[9], 0137[9]
PDU support	0 to 4[2]
Power cords	0133, 0137, PDU[4]

Feature code 0134 - Field install in rack (model 9406-825); Feature code 0138 - Field install in rack (model 9406-825)



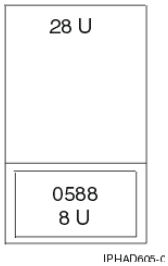
rack	0551[1], 0553[1]
Top rack, specify code	- -
Bottom rack, specify code	- -
Rack, specify code	0134[10], 0138[10]
PDU support	0 to 4[2]
Power cords	0134, 0138, PDU[4]

Feature code 0578 - PCI-X expansion unit in rack



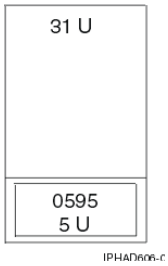
rack	0551[1], 0553[1]
Top rack, specify code	- -
Bottom rack, specify code	- -
Rack, specify code	0578
PDU support	0 to 4[2]
Power cords	PDU[8]

Feature code 0588 - PCI-X expansion unit in rack



rack	0551[1], 0553[1]
Top rack, specify code	- -
Bottom rack, specify code	- -
Rack, specify code	0588
PDU support	0 to 4[2]
Power cords	PDU[12]

Feature code 0595 - PCI-X expansion unit in rack



rack	0551[1], 0553[1]
Top rack, specify code	- -
Bottom rack, specify code	- -
Rack, specify code	0595
PDU support	0 to 4[2]
Power cords	0595, PDU[11]

Note:

1. 0551 is an empty 1.8 meter rack with 36 EIA units of total space. 0553 is a 2.0 meter rack with 42 EIA units of total space.
2. 0551 and 0553 feature codes 5160, 5161, 5163, and 7188. 7014 feature codes 7176, 7177, 7178, and 7188.
3. If units plug into a power distribution unit (PDU), power jumper cord feature code 6458, 6459, 6095, or 9911 is required. If redundant power supply (feature code 5158) is ordered, a second power jumper cord feature code is required.
4. If unit plugs into a PDU, two feature code 6458, 6459, 6095, or 9911 power jumper cords are required.
5. Feature code 0123 or 0574 do not plug into a PDU.
6. Feature code 0125 does not plug into a PDU.
7. Supported only on MES orders and includes a rack shelf with rail assembly, adapter plate, and cable-management-arm assembly.
8. 0578 comes with two rack power cords that plug into a PDU.
9. Field install in rack feature is used to mount a model 9406-270, 9406-800, or 9406-810 system unit (14 U) with attached expansion unit. This feature provides a rack shelf (2 U) with rail assembly, cable-management-arm assembly, adapter plate, and a pair of lift covers.
10. Field install in rack feature is used to mount a model 9406-825 system unit (14 U). This feature provides a rack shelf (2 U), cable-management-arm assembly, adapter plate, and a pair of lift covers.
11. If unit plugs into a PDU, feature code 1422 is required. If redundant power supply (feature code 5138) is ordered, a second feature code 1422 is required.
12. 0588 comes with two rack power cords that plug into a PDU.
13. 7014-T00 is a 1.8 meter rack with 36 EIA units of total space. 7014-T42 is a 2.0 meter rack with 42 EIA units of total space. The rack includes one PDU, feature code 9188, 9176, 9177, or 9178.

Planning for model ESCALA PL 250R-L, 7/10 (9123-710), and ESCALA PL 250R-L+ or ESCALA PL 450R-VL+ server specifications

This topic gives you a thorough understanding of your server specifications, including dimensions, electrical, power, temperature, environment, and service clearances. You will also find links to more detailed information, such as compatible hardware and plug types.

Use the following specifications to plan for your server.

Table 1. Server specifications

Server specifications
Plan views

Front and rear views with connectors					
Rack-mounted drawer					
Dimensions	Width	Depth	Height	**EIA units**[1]	Weight
Metric	437 mm	691 mm	88.9 mm	2	23 kg
English	17.20 in.	27.2 in.	3.5 in.		51 lb.
Rack-mounted drawer					
Shipping Dimensions	Width	Depth	Height	Weight	
Metric	635 mm	864 mm	457 mm	53 kg	
English	25 in.	34 in.	18 in.	117 lb.	
Rack-mounted drawer (China)					
Shipping Dimensions	Width	Depth	Height	Weight	
Metric	635 mm	864 mm	457 mm	53 kg	
English	25 in.	34 in.	18 in.	117 lb.	
Feature code for drawer mounted in rack Optional power distribution unit (PDU), 0551 rack, 14T/00, 14T/42 and 0553 racks					
Electrical					
kVA (maximum)			0.500 (ESCALA PL 250R-L 7/10) 0.658 (ESCALA PL 250R-L+ or ESCALA PL 450R-VL+ with 4-way, 1.5 GHz processor configuration)		
Rated voltage and frequency			100 - 127 or 200-240V ac at 50/60 plus or minus 0.5 Hz		
Thermal output (maximum)			1622 Btu/hr (ESCALA PL 250R-L 7/10) 2133 Btu/hr (ESCALA PL 250R-L+ or ESCALA PL 450R-VL+ with 4-way, 1.5 GHz processor configuration)		
Maximum power consumption			475 W (ESCALA PL 250R-L 7/10) 625 W (ESCALA PL 250R-L+ or ESCALA PL 450R-VL+ with 4-way, 1.5 GHz processor configuration)		
Power factor			0.95		
Inrush current (maximum)			75 A		
Leakage current (maximum)			1.2 mA		
Phase			1		
Compatible plug types			2, 4, 5, 6, 18, 19, 22, 23, 24, 25, 32, 59, Nema 6-15, 62, 66, 69, 70, 73		
Dual power feature code			7989 (quantity 2)		
Branch circuit breaker			20 A (maximum)		
Power cord length			2.8 m (9 ft.) - except United States 1.8 m (6 ft.) - United States		
Environment requirements					
Recommended operating temperature[2]			5 degrees to 35 degrees C (41 degrees to 95 degrees F)		
Nonoperating temperature			5 degrees to 45 degrees C (41 degrees to 113 degrees F)		
Shipping temperature			-40 degrees to 60 degrees C (-40 degrees to 140 degrees F)		
	Operating		Nonoperating		

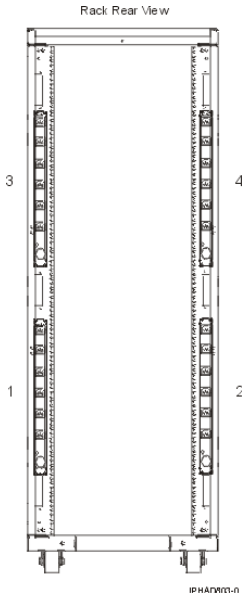
Maximum dew point	28 degrees C (82 degrees F)		29 degrees C (84.2 degrees F)	
Noncondensing humidity	8 to 80%		8 to 80%	
Maximum altitude	3048 m (10000 ft.)		3048 m (10000 ft.)	
Noise emissions[3]				
	Operating		Idle	
L_{WAd} (Category 2D, General business) rack drawer	6.2 bels[4]		6.2 bels[4]	
L_{pAm} (1-meter bystander)	44 dB[4]		44 dB[4]	
Service clearances				
Clearances	Front	Back	Left or right	Top
Operating	762 mm (30 in.)	762 mm (30 in.)	Not applicable	Not applicable
Nonoperating	762 mm (30 in.)	762 mm (30 in.)	762 mm (30 in.)	762 mm (30 in.)
Seismic considerations				
Data communications				
Electromagnetic compatibility compliance: This server meets the following electromagnetic compatibility specifications: FCC (CFR 47, Part 15); VCCI; CISPR-22; 89/336/EEC; BSMI (A2/NZS 3548:1995); C-Tick; ICES/NMB-003; Korean EMI/EMC (MIC Notice 2000 94, Notice 2000 72); People's Republic of China Commodity Inspection Law				
Safety compliance: This server is designed and certified to meet the following safety standards: UL 60950; CAN/CSA C22.2 No. 60950 00; EN 60950; IEC 60950 including all National Differences				

Note:

1. See 0551, 0553 or 7014 rack configurations for typical configurations when the 0551, 0553, or 7014 rack is populated with various server models.
2. Class 3 product as defined in ASHRAE Thermal Guidelines for Data Processing Environments. The allowable operating range is 5 degrees to 35 degrees C (41 degrees to 95 degrees F). See Temperature and humidity design criteria topic for more information.
3. For a description of noise emission values, see Acoustics.
4. Preliminary data.

Power distribution unit and power cord options for 7014 rack

The following figure shows the four vertical PDU locations in a rack.



Power distribution units (PDUs) are required with 7014 racks. If a PDU is not defaulted or ordered, a power cord is provided with each individual rack-mounted drawer for connection to a country-specific utility mains receptacle or uninterruptible power supply. See the individual rack-mounted drawer specifications for the appropriate power cords. The following PDU is available for the 7014 racks:

9188 or 7188 universal PDU

The following power cords are supported on the 9188 or 7188:

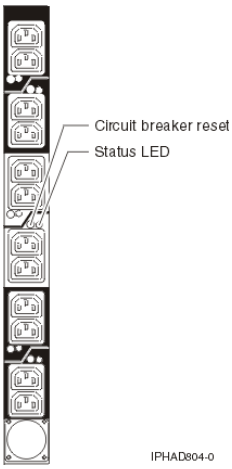
- 6489 - 4.3 m (14 ft.) 3-phase IEC309 3P+N+G 32 A plug (PDU rated 24 A per phase)
- 6491 - 4.3 m (14 ft.) 1-phase IEC309 P+N+G 63 A plug (PDU rated 48 A)
- 6492 - 4.3 m (14 ft.) 1-phase IEC309 2P+G 60 A plug (PDU rated 48 A)
- 6653 - 4.3 m (14 ft.) 3-phase IEC 309 3P+N+G 16 A plug (PDU rated 16 A per phase)
- 6654 - 4.3 m (14 ft.) 1-phase NEMA L6-30 plug (PDU rated 24 A)
- 6655 - 4.3 m (14 ft.) 1-phase Russell Stoll 3750DP plug (PDU rated 24 A)
- 6656 - 4.3 m (14 ft.) 1-phase IEC 309 P+N+G 32A plug (PDU rated 24 A)
- 6657 - 4.3 m (14 ft.) 1-phase PDL 250 V ac; 30 A plug (PDU rated 24 A)
- 6658 - 4.3 m (14 ft.) 1-phase 250 V ac, 30 A Korean plug (PDU rated 24 A)

The amperage rating of the PDU is either 16 A, 24 A, or 48 A depending on the power cord.

Note: All power cords are 4.3 m (14 ft.). For installation in Chicago, only 2.8 m (6 ft.) of the 4.3 m (14 ft.) power cord can extend beyond the perimeter of the rack frame. If more than 2.8 m (6 ft.) can exit the rack, retain any additional cordage within the rack frame via Velcro ties in the cable management space until 2.8 (6 ft.) or less exits the rack.

The PDU has twelve customer-usable IEC 320-C13 outlets rated at 200-240 V ac. There are six groups of two outlets fed by six circuit breakers. Each outlet is rated up to 10 A, but each group of two outlets is fed from one 20 A circuit breaker. The following IEC 320-C13 to IEC 320-C14 power cords are available to supply from the PDU outlet to the rack-mounted device:

- 1422 - 3.0 m (10 ft.)
- 6458 - 4.3 m (14 ft.)
- 6459 - 3.7 m (12 ft.)
- 6095 - 3.0 m - 4.3 m (10 ft. - 14 ft.)
- 9911 - 4.3 m (14 ft.)



To calculate the power loading requirements and proper loading sequence for the 7188 and 9188 PDU, see Power load calculating for 7188 or 9188 power distribution units.

The following three PDUs are available for the 7014 rack only:

9176 or 7176 single phase PDU

The following power cords are supported on the 9176 or 7176:

- 6442, 9800, or 9824 - 200 V ac; 4.3 m (14 ft.) locking line cord (L6-30P)
- 6443 or 9801 - 200 V ac; 4.3 m (14 ft.) watertight line cord (3750DP)
- 6444 or 9822 - 200 V ac; 4.3 m (14 ft.) PDL 250 V ac; 30 A plug
- 6447 or 9826 - 200 V ac; 4.3 m (14 ft.) PDL 250 V ac; 30 A plug Right Angle
- 6448 or 9835 - 200 V ac; 4.3 m (14 ft.) 250 V ac, 30 A Korean plug
- 6449 or 9986 - 200 V ac; 1.8 m (6 ft.) locking line cord (L6-30P) Chicago
- 6450 or 9987 - 200 V ac; 1.8 m (6 ft.) watertight line cord (3750DP) Chicago

9177 or 7177 single phase PDU

The following power cord is supported on the 9177 or 7177:

- 6445 or 9823 - 200 V ac; 4.3 m (14 ft.) (IEC 309, 3-pin, 32 A; plug type 46)

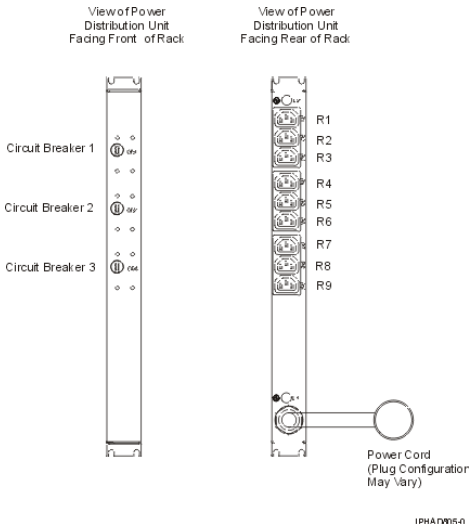
9178 or 7178 three phase wye PDU

The following power cord is supported on the 9178 or 7178:

- 400 V ac; 4.3 m (14 ft.) (IEC 309, 5-pin, 16 A; plug type 46)

The PDUs have nine customer-usable IEC 320-C13 outlets rated at 200-240 V ac. There are three groups of three outlets fed by three circuit breakers. Each outlet is rated up to 10 A, but each group of three outlets is fed from one 15 A circuit breaker. The following IEC 320-C13 to IEC 320-C14 power cords are available to supply from the PDU outlet to the rack-mounted device:

- 6095 - 3.0 m 4.3 m (10 ft. 14 ft.)
- 9911 - 4.3 m (14 ft.)



If a PDU is ordered, the following three PDUs are available for the 0551 and 0553 rack only:

5160 single phase PDU

The following power cords are supported on the 5160:

- 1426 - 200 V ac; 4.3 m (14 ft.) locking power cord (L6-30P)
- 1427 - 200 V ac; 4.3 m (14 ft.) watertight power cord (3750DP)
- 1446 - 200 V ac; 4.3 m (14 ft.) 30 A Korean (250 V ac, 30 A Korean plug)
- 1447 - 200 V ac; 4.3 m (14 ft.) 30 A AU (PDL 250 V ac; 30 A plug)
- 1448 - 200 V ac; 4.3 m (14 ft.) 30 A NZ (PDL 250 V ac; 30 A plug)

5161 single phase PDU

The following power cord is supported on the 5161:

- 1449 - 200 V ac; 4.3 m (14 ft.) (IEC 309, 3-pin, 32 A; plug type 46)

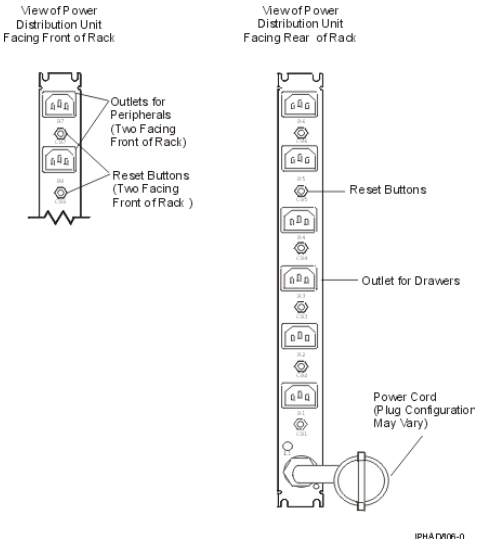
5163 three phase wye PDU

The following power cord is supported on the 5163:

- 1477 - 400 V ac; 4.3 m (14 ft.) (IEC 309, 5-pin, 16 A; plug type 46)

The PDUs have six customer-usable IEC 320-C13 outlets rated at 200-240 V ac. Each outlet is rated 8 A and is protected by a circuit breaker. The following IEC 320-C13 to IEC 320-C14 power cords are available to supply from the PDU outlet to the rack-mounted device:

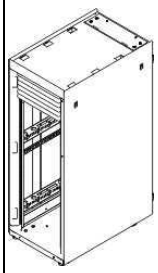
- 1422 - 3.0 m (10 ft.)
- 6458 - 4.3 m (14 ft.)
- 6459 - 3.7 m (12 ft.)



See 7014 rack configurations for typical configurations and PDUs when the 7014 rack is populated with various server models.

0551 rack

This topic provides the detailed specifications for the 0551 rack. For information on installing the racks, see Installing the 7014-T00, 7014-T42, 0551, and 0553 racks. For information on installing additional rack features, such as rack doors, heat exchanger doors, security kits, earthquake kits, multiple rack attachment kits, status beacons, and latch brackets, see Installing rack features.

Specifications for the 0551 rack			
Pictured is the 0551 rack The 0551 provides an empty 1.8 m rack (36 EIA units of total space). See the plug types for specific information on the power distribution units.			
Dimensions	Width	Depth	Height
Metric	650 mm	1020 mm	1800 mm
English	25.5 in.	40.0 in.	71.0 in.
Maximum configuration weight	The weight of the empty rack is 244 kg (535 lb.). Click the appropriate link to see the weight for what is installed. , , 9406-570 and ESCALA PL 850R/PL 1650R/R+,, 7884		
Electrical			
Click the appropriate link to see the electrical characteristics for what is installed. , ,			

9406-570 and ESCALA PL 850R/PL 1650R/R+,, , 7884			
Plug types and power distribution unit.	Power distribution unit (PDU) option. , , 9406-570 and ESCALA PL 850R/PL 1650R/R+,, 7884		
High Speed Link (HSL) cable requirements			
Temperature requirements			
Operating	10 degrees to 38 degrees C (50 degrees to 100.4 degrees)		
Nonoperating	1 degrees to 60 degrees C (33.8 degrees to 140 degrees F)		
Environment requirements	Operating	Nonoperating	
Noncondensing humidity	8 to 80%	8 to 80%	
Wet bulb temperature	22.8 degrees C (73 degrees F)	27 degrees C (80.6 degrees F)	
Maximum altitude	3048 m (10000 ft.)		
Noise emissions[4]	Rack noise levels are a function of the number and type of drawers installed. See server or hardware specifications for specific requirements		
Service clearances			
Front	Back	Sides[2]	Top[2]
762 mm	762 mm	762 mm	762 mm
30 in.	30 in.	30 in.	30 in.

Notes:

1. The 1.8 meter rack has 10 EIA units of space remaining. This space will be filled with a 5 EIA filler panel, a 3 EIA filler panel, and two of the 1 EIA filler panels. Because the rack does not have power distribution, the model 830 requires a power cord of sufficient length to reach the receptacle. The power cord for model 830 must be used to determine the appropriate receptacle.
2. Side and top clearances are optional during operation.
3. Acoustic doors are available for the racks. Feature code 6248 is available for the 0551 and 14T/00 racks. Feature code 6249 is available for the 0553 and 14T/42 racks. The overall sound reduction is approximately 6 dB. The doors add 381 mm (15 in.) to the depth of the racks.
4. For a description of noise emission values, see Acoustics.

See 0551 or 7014 rack configurations for typical configurations when the 0551 or 7014 rack is populated with various server models.

Caster and leveler locations

The following diagram provides the caster and leveler locations for the 14T/00, 14T/42, 0551, and 0553 racks.

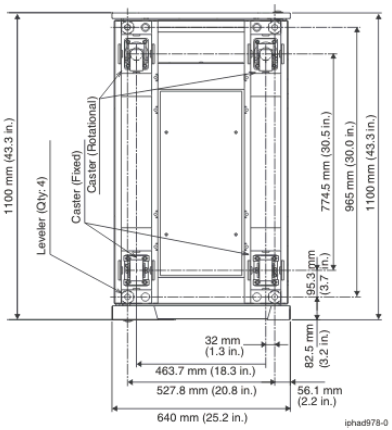


Figure 1. Caster and leveler locations

Plug and receptacle type 73

Plug	Receptacle	Countries/Regions
	Type 73 250V 15A	Brazil
Cord Feature	Part Number	
1394 (D)	74P4393 and 39M5240[1] - 2.7 m (9 ft.) (A)	
6495 (A) (C)	25R2584 and 39M5240[1] - 2.7 m (9 ft.) (A) (C)	
6499 (D) (B)	25R2585 and 39M5241[1] - 4.3 m (14 ft.) (B) (D)	
Systems and expansion units (A) - Model ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, , (B) - 11D/10, 11D/11 expansion units, , 57/86, 57/87, D24, T24 (C) - 10C/R3, 10C/04, , (D) - Model 11D/20, 5095		
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.		

Planning for model ESCALA PL 250T/R, 112/85, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+ server specifications

This topic gives you a thorough understanding of the model ESCALA PL 250T/R, 112/85, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+ server specifications, including dimensions, electrical, power, temperature, environment, and service clearances. You will also find links to more detailed information, such as compatible hardware and plug types.

Use the following specifications to plan for your server.

Table 1. Specifications for model ESCALA PL 250T/R, 112/85, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+

Specifications for model ESCALA PL 250T/R, 112/85, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+ [5]					
Plan views Top down view Front and rear view with connectors ASHRAE declarations					
Rack-mounted drawer					
Dimensions	Width	Depth	Height	**EIA units**[1]	Weight
Metric	437 mm	584 mm	178 mm	4	43 kg
English	17.20 in.	23 in.	7 in.		95 lb.
Desk-side server					
Dimensions	Width	Depth	Height		Weight
Metric	201 mm	630 mm (without rear cover 706 mm (with 6587 rear cover)	533 mm		43 kg
English	7.9 in.	23 in. (without rear cover) 27.8 in. (with 6587 rear cover)	21 in.		95 lb.
Rack-mounted drawer					
Shipping Dimensions	Width	Depth	Height	Weight	
Metric	630 mm	933 mm	584 mm	53 kg	
English	24.80 in.	36.75 in.	23 in.	117 lb.	
Rack-mounted drawer (China)					
Shipping Dimensions	Width	Depth	Height	Weight	
Metric	679 mm	978 mm	610 mm	53 kg	
English	26.75 in.	38.50 in.	24 in.	117 lb.	
Desk-side server					
Shipping Dimensions	Width	Depth	Height		Weight
Metric	584 mm	880 mm	813 mm		50 kg

English	23 in.	34.65 in.	32 in.	110 lb.
Desk-side server (China)				
Shipping Dimensions	Width	Depth	Height	Weight
Metric	616 mm	904 mm	832 mm	63 kg
English	24.25 in.	35.60 in.	32.75 in.	138 lb.

Feature code for drawer mounted in rack Optional power distribution unit (PDU), 0551 rack, 14T/00, 14T/42 and 0553 racks	7884 (9406-520 and 9405-520) 0229 (ESCALA PL 250T/R)
Electrical	
kVA (maximum)	0.632
Rated voltage and frequency[6]	100 - 127/200 - 240V ac at 50/60 plus or minus 0.5 Hz
Thermal output (maximum)	2046 Btu/hr
Maximum power consumption	600 W
Power factor	0.95
Inrush current (maximum)	88 A
Leakage current (maximum)	1.2 mA
Phase	1
Compatible plug types	2, 4, 5, 6, 10, 18, 19, 22, 23, 24, 25, 32, 34, 62, 64, 66, 69, 70, 75, 76
Dual power feature code	5158
Branch circuit breaker	20 A (maximum)
Power cord length	2.8 m (9 ft.) - except United States 1.8 m (6 ft.) - United States
Environment requirements	
Recommended operating temperature[2]	5 degrees to 35 degrees C (41 degrees to 95 degrees F)
Nonoperating temperature	5 degrees to 45 degrees C (41 degrees to 113 degrees F)
Shipping temperature	-40 degrees to 60 degrees C (-40 degrees to 140 degrees F)

	Operating[4]	Nonoperating
Maximum dew point	28 degrees C (82.4 degrees F)	29 degrees C (84.2 degrees F)
Noncondensing humidity	8 to 80%	8 to 80%
Maximum altitude	3048 m (10000 ft.)	3048 m (10000 ft.)

Noise emissions[3, 8, 9]

Product description	**Declared A-weighted sound power level, L_{Wad} (B)**		**Declared A-weighted sound pressure level, L_{pAm} (dB)**	
	Operating	Idle	Operating	Idle
112/85 workstation	5.1	5.0	33	31
ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, , ESCALA PL 250T/R, and desk side server with two power	5.7	5.6	40	39

supplies, eight hard drives and acoustic package				
ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, , ESCALA PL 250T/R, and desk side server with two power supplies and eight hard drives	6.1	5.9	44	41
ESCALA PL 250T/R rack-mounted server	6.0	5.8	43	41
Service clearances				
Clearances	Front	Back	Left or right	Top
Operating	762 mm (30 in.)	762 mm (30 in.)	N/A	N/A
Nonoperating	762 mm (30 in.)	762 mm (30 in.)	762 mm (30 in.)	762 mm (30 in.)
Seismic considerations				
Data communications				
Electromagnetic compatibility compliance: This server meets the following electromagnetic compatibility specifications: FCC (CFR 47, Part 15); VCCI; CISPR-22; 89/336/EEC; BSMI (A2/NZS 3548:1995); C-Tick; ICES/NMB-003; Korean EMI/EMC (MIC Notice 2000 94, Notice 2000 72); People's Republic of China Commodity Inspection Law				
Safety compliance: This server is designed and certified to meet the following safety standards: UL 60950; CAN/CSA C22.2 No. 60950 00; EN 60950; IEC 60950 including all National Differences				

Note:

1. See 0551, 0553, or 7014 rack configurations for typical configurations when the 0551, 0553, or 7014 rack is populated with various server models.
2. Class 3 product as defined in ASHRAE Thermal Guidelines for Data Processing Environments. The allowable operating range is 5 degrees to 35 degrees C (41 degrees to 95 degrees F). See Temperature and humidity design criteria topic for more information.
3. For a description of noise emission values, see Acoustics.
4. All Model ESCALA PL 250T/R disk bays should be filled when the unit is shippedwith either disk drives or slot fillers, but if a disk is removed, the seller recommends that disk drive slots be refilled with either another disk drive or a disk slot filler. Filling the disk drive slot will help ensure proper air flow for cooling and help maintain optimal EMI compliance. Ordering feature 6598 results in four additional disk slot fillers being shipped.
5. The power supplies automatically accept any voltage with the published rated voltage range. If dual power supplies are installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load.
6. The model 112/85[8], is only available as a desk-side model.
7. When a tape drive is installed, using the acoustic cover feature will reduce the noise emissions when the tape drive is in use.
8. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.

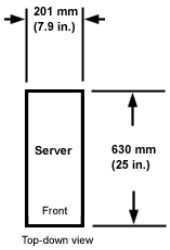
Special Hardware Management Console considerations

When the ESCALA PL 250T/R, 112/85, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+ servers are connected to a Hardware Management Console, the console must be provided within the same room and within 8 m (26 ft.) of the server. For additional considerations, see Planning for consoles, interfaces, and terminals for your service environment.

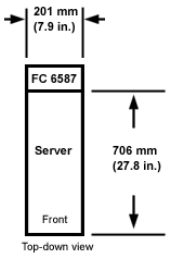
Plan view for model 9406-520 and ESCALA PL 250T/R

Note: A flat, supportive surface is optimal for placement of the of the ESCALA PL 250T/R desk-side servers. This allows the front cover to be properly supported.

The following figure shows dimensional planning information for the desk-side model ESCALA PL 250T/R.



Model ESCALA PL 250T/R plan view



The feature code 6587 is a decorative rear cover that has sound-deadening capability. This cover is for servers that do not have external I/O attached to a high speed link (HSL) loop. The cover cannot be used if HSL cables are attached to the server.

ASHRAE declarations

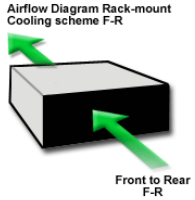
The following table and figures show the measurement reporting requirements as defined in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Thermal Guidelines for Data Processing Environments, which is available at http://tc99.ashraetcs.org .

Table 1. ASHRAE declarations

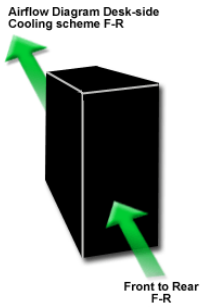
	Typical Heat Release[2]	Airflow nominal[1]		Airflow maximum[1] at 35 degrees C (95 degrees F)		Weight	Overall system dimensions
Description	watts	cfm	m^3/hr	cfm	m^3/hr		
Configuration 1	420	26	44	40	68	See ESCALA PL 250T/R	See ESCALA PL 250T/R
Configuration 2	450	26	44	40	68	See ESCALA PL 250T/R	See ESCALA PL 250T/R
Configuration 3	500	30	51	45	76	See ESCALA PL 250T/R	See ESCALA PL 250T/R
Configuration 4	485	30	51	45	76	See ESCALA PL 250T/R	See ESCALA PL 250T/R
Configuration 5	550	30	51	45	76	See ESCALA PL 250T/R	See ESCALA PL 250T/R
ASHRAE Class	3						
Configuration 1	1-way, 1.5 GHz processor, 16 GB memory, eight hard disk drives, six PCI cards, tape, DVD						
Configuration 2	1-way, 1.65 GHz processor, 16 GB memory, eight hard disk drives, four PCI cards, tape, DVD						
Configuration 3	2-way, 1.65 GHz processor, 32 GB memory, eight hard disk drives, five PCI cards, tape, DVD						
Configuration 4	1-way, 1.9 GHz processor, 16 GB memory, eight hard disk drives, three PCI cards, tape, two DVDs						
Configuration 5	2-way, 1.9 GHz processor, 32GB memory, eight hard disk drives, five PCI cards, tape, DVD						

Note:

1. Airflow for the typical and minimum configurations do not include redundant power supply, feature code 5158.
2. The product safety rating label contains the following information:
   - 100-127/200-240 Vac
   - 10/5 A | 1.0 kVa
   - 50/60 Hz | 1-phase



Airflow figure for server mounted in a rack



Airflow figure for desk-side server

Planning for model ESCALA PL 450T/R, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+ server specifications

This topic gives you a thorough understanding of the model ESCALA PL 450T/R, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+ server specifications, including dimensions, electrical, power, temperature, environment, and service clearances. You will also find links to more detailed information, such as compatible hardware and plug types.

Model ESCALA PL 450T/R, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+ server specifications

Use the following specifications to plan for your server.

Note: The following specifications are approximate and do not represent measured data. They are provided for informational purposes only.

Specifications for model ESCALA PL 450T/R, 7/20 , and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+					
Plan views Top down view Front and rear views with connectors ASHRAE declarations					
Rack-mounted drawer					
Dimensions	Width	Depth	Height	**EIA Units[3]**	Weight
Metric	437 mm	731 mm	178 mm	4	44.7 kg
English	17.2 in.	28.8 in.	7.0 in.		98.5 lb.
Desk-side server					
Dimensions	Width	Depth	Height	Weight	
Metric	201 mm	779 mm	533 mm	62 kg	
English	7.9 in.	30.7 in.	21.0 in.	137 lb.	
Rack-mounted drawer					
Shipping Dimensions	Width	Depth	Height	Weight	
Metric	648 mm	991 mm	704 mm	80 kg	

English	25.5 in.	39 in.	27.7 in.	175 lb.
Rack-mounted drawer (China)				
Shipping Dimensions	Width	Depth	Height	Weight
Metric	640 mm	965 mm	692 mm	80 kg
English	25.2 in.	38 in.	27.25 in.	1.75 lb.
Desk-side server[4]				
Shipping Dimensions	Width	Depth	Height	Weight
Metric	648 mm	991 mm	704 mm	80 kg
English	25.5 in.	39 in.	27.7 in.	175 lb.
Desk-side server (China)[4]				
Shipping Dimensions	Width	Depth	Height	Weight
Metric	640 mm	965 mm	692 mm	80 kg
English	25.2 in.	38 in.	27.25 in.	175 lb.

Feature code for drawer mounted in rack Power distribution Unit (PDU), 0551, 14T/00 , 14T/42 and 0553 racks	0230 (ESCALA PL 450T/R)
Electrical	
kVA (maximum)	1.158
Rated voltage, rated amps, and frequency[6]	135/507/20 1-2 way 100-127 V ac (12 A) to 200-240 V ac (10 A) at 50 to 60 plus or minus 0.5 Hz 1-4 way and 3-4 way 200-240 V ac (10 A) at 50 to 60 plus or minus 0.5 Hz
	ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+ 1-2 way 100-127 V ac (12 A) to 200-240 V ac (10 A) at 50 to 60 plus or minus 0.5 Hz 1-8 way and 3-8 way 200-240 V ac (10 A) at 50 to 60 plus or minus 0.5 Hz
Thermal output (maximum)	3754 Btu/hr
Maximum power consumption	1100 W
Power factor	0.95
Inrush current (maximum)	85 A
Leakage current (maximum)	1.5 mA
Phase	1
Compatible plug types	2, 4, 5, 6, 10, 18, 19, 22, 23, 24, 25, 32, 34, 59, 62, 64, 66, 69, 70, 73
Dual power feature code	Included
Branch circuit breaker	20 A (maximum)
Power cord length	2.8 m (9 ft.) - except United States 1.8 m (6 ft.) - United States
Environment requirements	

Recommended operating temperature[2]			5 degrees to 35 degrees C (41 degrees to 95 degrees F)	
Nonoperating temperature			5 degrees to 45 degrees C (41 degrees to 113 degrees F)	
Shipping temperature			-40 degrees to 60 degrees C (-40 degrees to degrees 140 F)	
	Operating[5]		Nonoperating	
Maximum dew point	28 degrees C (82.4 degrees F)		29 degrees C (84.2 degrees F)	
Noncondensing humidity	8 to 80%		8 to 80%	
Maximum altitude	3048 m (10000 ft.)		3048 m (10000 ft.)	
Noise emissions[1, 10]				
Product description	**Declared A-weighted sound power level, L_{Wad} (B)**		**Declared A-weighted sound pressure level, L_{pAm} (dB)**	
	Operating	Idle	Operating	Idle
Desk-side models: ESCALA PL 450T/R, 7/20 with two hard drives and non-redundant power	6.0	5.9	42	41
Rack-mounted models: ESCALA PL 450T/R, 7/20 with two hard drives and non-redundant power	6.1	6.0	44	43
Rack-mounted models: ESCALA PL 450T/R, 7/20 with eight hard drives and redundant power	6.3	6.2	45	45
Rack-mounted model: ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+ with eight hard drives and redundant power	6.8[9]	6.6[9]		
Service clearances				
Clearances	Front	Back	Left/right	Top
Operating	762 mm (30 in.)	762 mm (30 in.)	N/A	N/A
Nonoperating	762 mm (30 in.)	762 mm (30 in.)	762 mm (30 in.)	762 mm (30 in.)
Seismic considerations				
Data communications				

Electromagnetic compatibility compliance: This server meets the following electromagnetic compatibility specifications: FCC (CFR 47, Part 15); VCCI; CISPR-22; 89/336/EEC; BSMI (A2/NZS 3548:1995); C-Tick; ICES/NMB-003; Korean EMI/EMC (MIC Notice 2000 94, Notice 2000 72); People's Republic of China Commodity Inspection Law
Safety compliance: This server is designed and certified to meet the following safety standards: UL 60950; CAN/CSA C22.2 No. 60950 00; EN 60950; IEC 60950 including all National Differences

Note:

1. For a description of noise emission values, see Acoustics.
2. Class 3 product as defined in ASHRAE Thermal Guidelines for Data Processing Environments. The allowable operating range is 5 degrees to 35 degrees C (41 degrees to 95 degrees F). See Temperature and humidity design criteria topic for more information.
3. See 0551, 0553, or 7014 rack configurations for typical configurations when the 0551, 0553, or 7014 rack is populated with various server models.
4. Desk-side server is shipped on its side
5. All Model ESCALA PL 450T/R disk bays should be filled when the unit is shippedwith either disk drives or slot fillers, but if a disk is removed, the seller recommends that disk drive slots be refilled with either another disk drive or a disk slot filler. Filling the disk drive slot will help ensure proper air flow for cooling and help maintain optimal EMI compliance. Ordering feature 6598 results in four additional disk slot fillers being shipped.
6. The power supplies automatically accept any voltage with the published rated voltage range for a defined processor configuration. If dual power supplies are installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load.
7. Configured with two disk drives and non-redundant power system.
8. Configured with eight disk drives and redundant power system.
9. Estimated value.
10. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.

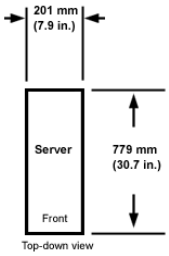
Special Hardware Management Console considerations

When the ESCALA PL 450T/R, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+ servers are connected to a Hardware Management Console, the console must be provided within the same room and within 8 m (26 ft.) of the server. For additional considerations, see Planning for consoles, interfaces, and terminals for your service environment.

Plan view for model ESCALA PL 450T/R

Note: A flat, supportive surface is optimal for placement of the ESCALA PL 450T/R desk-side servers. This allows the front cover to be properly supported.

The following figure shows dimensional planning information for the desk-side model ESCALA PL 450T/R.



Model ESCALA PL 450T/R plan view

ASHRAE declarations

The following table and figures show the measurement reporting requirements as defined in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Thermal Guidelines for Data Processing Environments, which is available at http://tc99.ashraetcs.org .

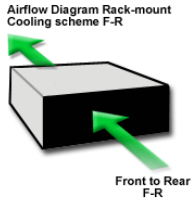
Table 1. ASHRAE declarations

	Typical Heat Release[2]	Airflow nominal[1]		Airflow maximum[1] at 35 degrees C (95 degrees F)		Weight	Overall system dimensions
Description	watts	cfm	m^3/hr	cfm	m^3/hr		
Configuration 1	500	28	48	45	76	See ESCALA PL 450T/R, 7/20, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+	See ESCALA PL 450T/R, 7/20, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
Configuration 2	575	32	60	50	85	See ESCALA PL 450T/R, 7/20, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+	See ESCALA PL 450T/R, 7/20, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
Configuration 3	800	32	60	50	85	See ESCALA PL 450T/R, 7/20, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+	See ESCALA PL 450T/R, 7/20, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
Configuration 4	650	32	60	50	85	See ESCALA PL 450T/R, 7/20, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+	See ESCALA PL 450T/R, 7/20, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
Configuration 5	865	32	60	50	85	See ESCALA PL 450T/R, 7/20, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+	See ESCALA PL 450T/R, 7/20, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
Configuration 6	925	32	60	50	85	See ESCALA PL 450T/R, 7/20, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+	See ESCALA PL 450T/R, 7/20, and ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
ASHRAE Class	3						
	1-way, 1.65 GHz processor, 32 GB memory, eight hard disk drives, five PCI cards, tape, DVD						

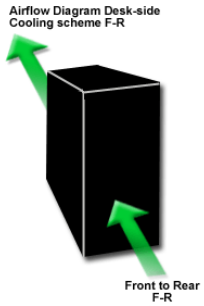
Configuration 1	
Configuration 2	2-way, 1.65 GHz processor, 32 GB memory, eight hard disk drives, four PCI cards, tape, DVD
Configuration 3	4-way, 1.65 GHz processor, 48 GB memory, eight hard disk drives, four PCI cards, tape, DVD
Configuration 4	2-way, 1.9 GHz processor, 32 GB memory, eight hard disk drives, five PCI cards, tape, DVD
Configuration 5	4-way, 1.9 GHz processor, 48 GB memory, eight hard disk drives, five PCI cards, tape, DVD
Configuration 6	8-way, 1.5 GHz processor, 4 GB memory, eight hard disk drives, five PCI cards, tape, 2 DVDs

Note:

1. Airflow for the typical and minimum configurations.
2. The product safety rating label contains the following information:
   - 100-127/200-240 Vac
   - 10/10 A | 1.0/2.0 kVa
   - 50/60 Hz | 1-phase



Airflow figure for server mounted in a rack



Airflow figure for desk-side server

Planning for model ESCALA PL 250R-VL or ESCALA PL 450R-XS server specifications

This topic gives you a thorough understanding of your server specifications, including dimensions, electrical, power, temperature, environment, and service clearances. You will also find links to more detailed information, such as compatible hardware and plug types.

Use the following specifications to plan for your server.

Server specifications					
Plan views Rear view with connectors					
Rack-mounted drawer					
Dimensions	Width	Depth	Height	**EIA Units**[3]	Weight
Metric	440 mm	710 mm	43 mm	1	17 kg
English	17.3 in.	28.0 in.	1.7 in.		37 lb.
Rack-mounted drawer					
Shipping dimensions	Width	Depth	Height	Weight	
Metric	635 mm	851 mm	330 mm	20 kg	
English	25.0 in.	33.5 in.	13.0 in.	43 lb.	
Rack-mounted drawer (China)					
Shipping dimensions	Width	Depth	Height	Weight	
Metric	610 mm	1016 mm	445 mm	27 kg	
English	24.0 in.	40 in.	17.5 in.	60 lb.	
Feature code for drawer mounted in rack Power distribution Unit (PDU), 0551, 14T/00 , 14T/42 and 0553 racks			0259		
Electrical					
kVA (maximum)			0.421		
Rated voltage, rated amps, and frequency[4]		ESCALA PL 250R-VL or ESCALA PL 450R-XS	100-127 V ac (12 A) to 200-240 V ac (10 A) at 50 to 60 plus or minus 0.5 Hz		
Thermal output (maximum)			1365 Btu/hr		
Maximum power consumption			400 W		
Power factor			0.95		
Inrush current (maximum)			75 A		
Leakage current (maximum)			1.2 mA		
Phase			1		
Compatible plug types			2, 4, 5, 6, 18, 19, 22, 23, 24, 25, 32, 57, 59, 62 , 66, 69, 70, 73, 75, 76		
Dual power feature code			7958 (quantity 2)		
Branch circuit breaker			20 A (maximum)		
Power cord length			2.8 m (9 ft.) - except United States 1.8 m (6 ft.) - United States		
Environment requirements					
Recommended operating temperature[2]			5 degrees to 35 degrees C (41 degrees to 95 degrees F)		
Nonoperating temperature			5 degrees to 45 degrees C (41 degrees to 113 degrees F)		
Shipping temperature			-40 degrees to 60 degrees C (-40 degrees to degrees 140 F)		
	Operating		Nonoperating		
Maximum dew point	28 degrees C (82.4 degrees F)		29 degrees C (84.2 degrees F)		
Noncondensing humidity	8 to 80%		8 to 80%		

Maximum altitude	3048 m (10000 ft.)		3048 m (10000 ft.)	
Noise emissions[1, 5]				
Product description	**Declared A-weighted sound power level, L_{Wad} (B)**		**Declared A-weighted sound pressure level, L_{pAm} (dB)**	
	Operating	Idle	Operating	Idle
ESCALA PL 250R-VL or ESCALA PL 450R-XS with two hard drives and two power supplies	6.8	6.8	52	52
ESCALA PL 250R-VL or ESCALA PL 450R-XS with acoustic door (feature code 6248 or 6249) with two hard drives and two power supplies	6.2	6.2	44	44
Service clearances				
Clearances	Front	Back	Left/right	Top
Operating	762 mm (30 in.)	762 mm (30 in.)	N/A	N/A
Nonoperating	762 mm (30 in.)	762 mm (30 in.)	762 mm (30 in.)	762 mm (30 in.)
Seismic considerations				
Data communications				
Electromagnetic compatibility compliance: This server meets the following electromagnetic compatibility specifications: FCC (CFR 47, Part 15); VCCI; CISPR-22; 89/336/EEC; BSMI (A2/NZS 3548:1995); C-Tick; ICES/NMB-003; Korean EMI/EMC (MIC Notice 2000 94, Notice 2000 72); People's Republic of China Commodity Inspection Law				
Safety compliance: This server is designed and certified to meet the following safety standards: UL 60950; CAN/CSA C22.2 No. 60950 00; EN 60950; IEC 60950 including all National Differences				

Note:

1. For a description of noise emission values, see Acoustics.
2. Class 3 product as defined in ASHRAE Thermal Guidelines for Data Processing Environments. The allowable operating range is 5 degrees to 35 degrees C (41 degrees to 95 degrees F). See Temperature and humidity design criteria topic for more information.
3. See 0551, 0553, or 7014 rack configurations for typical configurations when the 0551, 0553, or 7014 rack is populated with various server models.
4. The power supplies automatically accept any voltage with the published rated voltage range for a defined processor configuration. If dual power supplies are installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load.
5. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.

Planning for model ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+ server specifications

This topic gives you a thorough understanding of your server specifications, including dimensions, electrical, power, temperature, environment, and service clearances. You will also find links to more detailed information, such as compatible hardware and plug types.

Use the following specifications to plan for your server.

Table 1. Server specifications

Server specifications					
Plan views Top down view Front and rear views with connectors ASHRAE declarations					
Dimensions	Width	Depth	Height	**EIA units**[1]	Weight
Metric	483 mm	790 mm	174.1 mm	4	63.6 kg
English	19 in.	31.1 in.	6.85 in.		140 lb.
Rack-mounted drawer					
Shipping Dimensions	Width	Depth	Height	Weight	
Metric	648 mm	991 mm	704 mm	80 kg	
English	25.5 in.	39 in.	27.7 in.	175 lb.	
Rack-mounted drawer (China)					
Shipping Dimensions	Width	Depth	Height	Weight	
Metric	640 mm	965 mm	692 mm	80 kg	
English	25.2 in.	38 in.	27.25 in.	1.75 lb.	
Drawer mounted in 0551 rack, 14T/00 , 14T/42 and 0553 racks, Power distribution unit (PDU)			0231 (ESCALA PL 850R/PL 1650R/R+, 4-way), 0232 (ESCALA PL 850R/PL 1650R/R+, 8-way), 0241 (ESCALA PL 850R/PL 1650R/R+, 12-way), 0242 (ESCALA PL 850R/PL 1650R/R+, 16-way) 0260 (ESCALA PL 1650R-L+, 8-way) 0261 (ESCALA PL 1650R-L+, 16-way)		
Electrical					
kVA (maximum)			1.368		
Rated voltage and frequency[6]			200-240V ac at 50/60 plus or minus 0.5 Hz		
Thermal output (maximum)[9]			4437 Btu/hr		
Maximum power consumption[4, 7]			1300 W		
Power factor			0.95		
Inrush current (maximum)			88 A		

Leakage current (maximum)			3 mA	
Phase			1	
Compatible plug types			2, 5, 6, 10, 18, 19, 22, 23, 24, 25, 32, 34, 62, 64, 66, 69	
Dual power feature code			Included	
Branch circuit breaker			20 A maximum	
Power cord length			2.7 m (9 ft.) Europe; 1.8 m (6 ft.) U.S.; 1.8 m (6 ft.) and 4.3 m (14 ft.) for U.S. cords with plug type 5	
Environment requirements				
Recommended operating temperature			5 degrees to 35 degrees C (41 degrees to 95 degrees F)	
Nonoperating temperature			5 degrees to 40 degrees C (41 degrees to 104 degrees F)	
Shipping temperature			-40 degrees to 60 degrees C (-40 degrees to 140 degrees F)	
	Operating		Nonoperating	
Wet bulb temperature	23 degrees C (73.4 degrees F)		27 degrees C (80.6 degrees F)	
Noncondensing humidity	8 to 80%		8 to 80% (5 to 100% shipping)	
Maximum altitude	3048 m (10000 ft.)		3048 m (10000 ft.)	
Noise emissions[2, 8]				
Product description	**Declared A-weighted sound power level, L_{Wad} (B)**		**Declared A-weighted sound pressure level, L_{pAm} (dB)**	
	Operating	Idle	Operating	Idle
ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+, 1.65 GHz, 4-way configuration with four hard drives and two power supplies	6.8	6.8	51	51
ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+, 1.65 GHz, 4-way configuration with four hard drives and two power supplies and acoustic doors (feature code 6248 or 6249)	6.2[3]	6.2[3]	46[3]	46[3]
ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+, 1.9 GHz, 4-way configuration with four hard	7.1[3]	7.1[3]	53[3]	53[3]

drives and two power supplies				
ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+, 1.9 GHz, 4-way configuration with four hard drives and two power supplies and acoustic doors (feature code 6248 or 6249)	6.5[3]	6.5[3]	47[3]	47[3]
Service clearances				
Clearances	Front	Back	Left or right	Top
Operating	762 mm (30 in.)	762 mm (30 in.)	N/A	N/A
Nonoperating	762 mm (30 in.)	762 mm (30 in.)	762 mm (30 in.)	762 mm (30 in.)
Seismic considerations:				
Data communications:				
Electromagnetic compatibility compliance: FCC Part 15, ICES-003				
Safety compliance: IEC 60950; UL 60950; CSA 60950				

Note:

1. See 0551, 0553, or 7014 rack configurations for typical configurations when the 0551, 0553, or 7014 rack is populated with various server models.
2. For a description of noise emission values, see Acoustics.
3. Estimated value
4. Maximum power consumption is specified for each ESCALA PL 850R/PL 1650R/R+ 4-way drawer. The 8-way, 12-way, and 16-way configurations are based on the use of multiple 4-way drawers (for example, an 8-way configuration consists of two 4-way drawers, a 12-way configuration consists of three 4-way drawers, and a 16-way configuration consists of four 4-way drawers).
5. All Model ESCALA PL 850R/PL 1650R/R+ disk bays should be filled when the unit is shippedwith either disk drives or slot fillers, but if a disk is removed, the seller recommends that disk drive slots be refilled with either another disk drive or a disk slot filler. Filling the disk drive slot will help ensure proper air flow for cooling and help maintain optimal EMI compliance. Ordering feature 6598 results in four additional disk slot fillers being shipped.
6. The power supplies automatically accept any voltage with the published, rated-voltage range. If dual power supplies are installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load.
7. Maximum power consumption is specified for each ESCALA PL 1650R-L+ 8-way drawer. The 8-way and 16-way configurations are based on the use of multiple 8-way drawers (for example, a 16-way configuration consists of two 8-way drawers).
8. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.
9. Thermal output value is for each 4-way drawer configuration.

Special Hardware Management Console considerations

When the server is connected to a Hardware Management Console, the console must be provided within the same room and within 8 m (26 ft.) of the server. For additional considerations, see Planning for consoles,

interfaces, and terminals for your service environment.

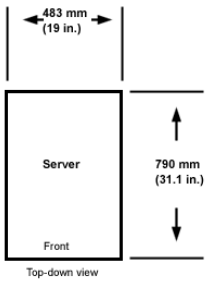
Delivery and subsequent transportation of the equipment

DANGERHeavy equipment personal injury or equipment damage might result if mishandled. (D006)

You must prepare your environment to accept the new product based on the installation planning information provided, with assistance from an authorized service provider. In anticipation of the equipment delivery, prepare the final installation site in advance so that professional movers or riggers can transport the equipment to the final installation site within the computer room. If for some reason, this is not possible at the time of delivery, you must make arrangements to have professional movers or riggers return to finish the transportation at a later date. Only professional movers or riggers should transport the equipment. The authorized service provider can only perform minimal frame repositioning within the computer room, as needed, to perform required service actions. You are also responsible for using professional movers or riggers when you relocate or dispose of equipment.

Plan view for model ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+

The following figure shows dimensional planning information for the model ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+.



Model ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+ plan view (rack-mount)

ASHRAE declarations

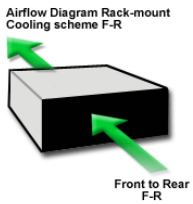
The following table and figures show the measurement-reporting requirements as defined in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Thermal Guidelines for Data Processing Environments, which is available at http://tc99.ashraetcs.org .

Table 1. ASHRAE declarations

	Typical Heat Release[2]	Airflow nominal[1]		Airflow maximum[1] at 35 degrees C (95 degrees F)		Weight	Overall system dimensions
Description	watts	cfm	m^3/hr	cfm	m^3/hr		
Configuration 1	750	90	153	140	238	See ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+	See ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+
Configuration 2	950	90	153	140	238	See ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+	See ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+
Configuration 3	910	90	153	140	238	See ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+	See ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+
Configuration 4	1000	90	153	140	238	See ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+	See ESCALA PL 850R/PL 1650R/R+, and ESCALA PL 1650R-L+
ASHRAE Class	3						
Configuration 1	4-way, 1.65 GHz processor, 48 GB memory, six hard disk drives, six PCI cards, DVD						
Configuration 2	4-way, 1.9 GHz processor, 12 GB memory, six hard disk drives, five PCI cards, two DVDs						
Configuration 3	8-way, 1.5 GHz processor, 4 GB memory, six hard disk drives, two PCI cards, DVD						
Configuration 4	4-way, 2.2 GHz processor, 32 GB memory, six hard disk drives, four PCI cards, DVD						

Note:

1. Airflow for the typical and minimum configurations.
2. The product safety rating label contains the following information:
   - 200-240 Vac
   - 10 A | 2.0 kVa
   - 50/60 Hz | 1-phase



Airflow figure for server mounted in a rack

Plug and receptacle type 69

Plug	Receptacle	Countries/Regions
	 Type 69 200-240 V 10 A	*International Electrotechnical Commission* ***IS6538*** India
Cord Feature	Part Number	
6494 (A) (when ordered with server)	74P4424 and 39M5226[1] - 2.7 m (9 ft.) (A)	
6451 (B)	74P4422 and 39M5224[1] - 4.3 m (14 ft.)(B)	
Systems and expansion units (A) - Models ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, ,		
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.		

Planning for model 185/75 server specifications

This topic gives you a thorough understanding of the model 185/75 server specifications, including dimensions, electrical, power, temperature, environment, and service clearances. You will also find links to more detailed information, such as compatible hardware and plug types.

The model 185/75 refers to the complete system. The system consists of multiple components, as summarized in the following table.

Table 1. Model 185/75 components

Model	Description	Minimum per system	Maximum per system
FC5793	42 EIA unit, 24-inch rack (54-inch deep)	1	1
FC7945	Slimline door set for FC5793 rack (front and rear)	1[1]	1[1]
FC7947	Acoustic door set for FC5793 rack (front and rear)	1[1]	1[1]
185/75 (FC7836)[3]	8-way, 1.9 GHz processor	1	12
185/75 (FC7657)[3]	16-way, 1.5 GHz processor	1	12
185/75 (FC7675)[3]	8-way, 2.2 GHz processor	1	12
185/75 (FC7676)[3]	16-way, 1.9 GHz processor	1	12

Various	Hardware Management Console (HMC)[2]	1	2
7045-SW4	HPS switch	0	2
FC57/91 and FC57/94	I/O drawer	0	5
FC6200 or FC6201	Optional integrated battery backup	0	6

Note:

1. Either slimline doors or acoustical doors are selected during the order process. Slimline doors do not meet the acoustic limits for Category 1A or 1B.
2. For the model 185/75, a Hardware Management Console must be provided within the same room and within 8 m (26 ft.) of the server.
3. The maximum number of processors per system is the total number of FC7836, FC7657, FC7675, and FC7676 that can be combined to a maximum of 12.

Table 2. Specifications for model 185/75

Specifications for model 185/75				
Plan views Top down view Rear view with connectors ASHRAE declarations (heat load data for various configurations)				
Dimensions and weight[1]				
Physical Characteristic	Slimline doors[2]		Acoustical doors[2]	
Height	2025 mm (79.7 in.)		2025 mm (79.7 in.)	
Width	785 mm (30.9 in.)		785 mm (30.9 in.)	
Depth	1529 mm (60.2 in.)		1885 mm (74.2 in.)	
Weight - maximum configuration (with 1.9 GHz processor)				
	With integrated battery backup and slimline doors	Without integrated battery backup with slimline doors	With integrated battery backup and with acoustical doors	Without integrated battery backup and with acoustical doors
Single frame	1569 kg (3460 lb.)	1439 kg (3173 lb.)	1578 kg (3479 lb.)	1448 kg (3192 lb.)
Shipping dimensions and weight				
Height	2311 mm (91 in.)			
Width	940 mm (37 in.)			
Depth	1613 mm (63.5 in.)			
Weight	Varies by configuration			
Electrical and thermal characteristics (3-phase)				
Rated voltage and frequency (3 phase)		200 to 240 V ac at 50 to 60 Hz	380 to 415 V ac at 50 to 60 Hz	480 V ac at 50 to 60 Hz
Rated current, power cord with 48A plug, FC 8688 or 8689 (amps per phase)		48	--	--
Rated current, all other power cords (amps, per phase)		60	32	24

Maximum power		41.6 kW		
Power factor, typical		0.99	0.97	0.93
Inrush current (maximum)[3]		163 A		
Thermal output		142 kBtu/hr	142 kBtu/hr	142 kBtu/hr
Dual power feature code			Standard[7]	
Branch circuit breaker and cord information			See Breaker rating and cord information	
Power cord length			4.2 m (14 ft.) - all locations (except Chicago) 1.8 m (6 ft.) - United States (Chicago)	
Environment specifications (based on an altitude of 1295 m (4250 ft.)				
Recommended operating temperature[8]			10 degrees to 32 degrees C (50 degrees to 89.6 degrees F)	
Nonoperating temperature			10 degrees to 43 degrees C (50 degrees to 109.4 degrees F)	
Storage temperature			1 degree to 60 degrees C (33.8 degrees to 140 degrees F)	
Shipping temperature			-40 degrees to 60 degrees C (-40 degrees to 140 degrees F)	
	Operating	Nonoperating	**Storage[4]**	**Shipping[4]**
Maximum wet bulb	23 degrees C (73.4 degrees F)	27 degrees C (80.6 degrees F)	29 degrees C (84.2 degrees F)	29 degrees C (84.2 degrees F)
Noncondensing relative humidity	8 to 80 %	8 to 80 %	5 to 80 %	5 to 100 %
Maximum altitude				

Declared acoustical noise emissions[7]				
Product configuration	**Declared A-Weighted Sound Power Level, L_{WAd} (Bels)[5, 6]**		**Declared A-Weighted Sound Pressure Level, LpAM (dB)[5, 6] (bystander, 1 m)**	
	Operating	Idle	Operating	Idle
Small configuration: Two processors, bulk power, and one I/O drawer; nominal conditions, slimline door set	8.2	8.2	65	65
Small configuration: Two processors, bulk power, and one I/O drawer; nominal conditions, acoustical door set	7.6	7.6	59	59

Typical configuration: six processors, bulk power, and one I/O drawer; nominal conditions, slimline door set	8.6[7]	8.6[7]	69	69
Typical configuration: six processors, bulk power, and one I/O drawer; nominal conditions, acoustical door set	8.0	8.0	63	63
Maximum configuration: 12 processors, bulk power, and two I/O drawers; nominal conditions, slimline door set	8.9[7]	8.9[7]	71[7]	71[7]
Maximum configuration: 12 processors, bulk power, and two I/O drawers; nominal conditions, acoustical door set	8.2	8.2	65	65
Service clearances				
For a graphical representation of service clearances, see Service clearances				
Data communications				
Electromagnetic compatibility compliance: This server meets the following electromagnetic compatibility specifications: FCC (CFR 47, Part 15); VCCI; CISPR-22; 89/336/EEC; BSMI (A2/NZS 3548:1995); C-Tick; ICES/NMB-003; Korean EMI/EMC (MIC Notice 2000 94, Notice 2000 72); People's Republic of China Commodity Inspection Law				
Safety compliance: This server is designed and certified to meet the following safety standards: UL 60950-1; CAN/CSA C22.2 No. 60950-1; EN 60950-1; IEC 60950-1 including all national differences				

Note:

1. For configuration weights, see Approximate system weights by configuration
2. Doors are not installed during product shipment to the customer.
3. Inrush currents occur only at initial application of power (short duration for charging capacitors). No inrush currents occur during the normal power off-on cycle.
4. When an approved vapor bag and desiccant packets are used to protect the system, the storage specifications are valid for 6 months and the shipping specifications are valid for 1 month. Otherwise, storage and shipping specifications are valid for two weeks each.
5. L_{WAd} is the upper-limit A-weighted sound level; LpAM is the mean A-weighted sound pressure measured at the 1-meter bystander postions; 1 B = 10 dB.
6. All measurements made in conformance with ISO 7779 and declared in conformance with 9296.

7. Attention: Your server installation may be subject to government regulations (such as those prescribed by OSHA or European Community Directives that cover noise level exposure in the workplace. The model 185/75 is available with an optional acoustical door feature that can reduce the likelihood of exceeding noise level exposure limits for densely populated racks. The actual sound pressure levels in your installation will depend on a variety of factors, including the number of racks in the installation; the size, materials, and configuration of the room where the racks are installed; the noise levels from other equipment; the room ambient temperature, and employees' location in relation to the equipment. It is recommended that a qualified person, such as an industrial hygienist or acoustical consultant, be consulted to determine whether the sound pressure levels to which employees may be exposed exceed regulatory limits.
8. The upper limit of the dry bulb temperature must be derated 1 degree C (1.8 degrees F) per 219 m (719 ft.) above 1295 m (4250 ft.). Maximum altitude is 3048 m (10000 ft.).

To effectively plan for the model 185/75, you will need to view the following topics and incorporate them into your server planning, as appropriate.

- Breaker rating and cord information
- Power cord features
- Doors and covers
- Plan views
- Raised-floor requirements and preparation
- Cut and place floor panels
- Secure the rack
- Position the rack
- Install the frame tie-down kit
- Attach the rack to a concrete (nonraised) floor
- Attach the rack to a short- or long-raised floor
- Considerations for multiple system installations
- Service clearances
- Total system power consumption
- Cooling requirements
- Moving the system to the installation site
- Phase imbalance and BPR configuration
- Balancing power panel loads
- Power cord configurations
- Dual power installation
- Approximate system weights by configuration
- Weight distribution
- Unit emergency power off
- Computer room emergency power off (EPO)
- Machine holdup times

Plan views

The following figure shows dimensional planning information for single-frame systems.

Figure 1. Plan view for single-frame systems with acoustical doors

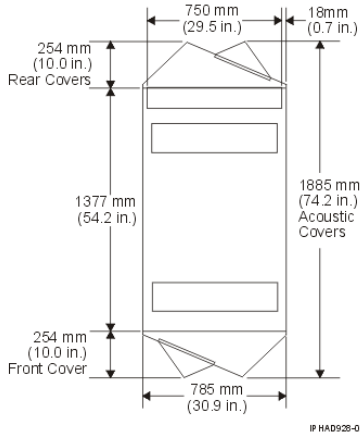
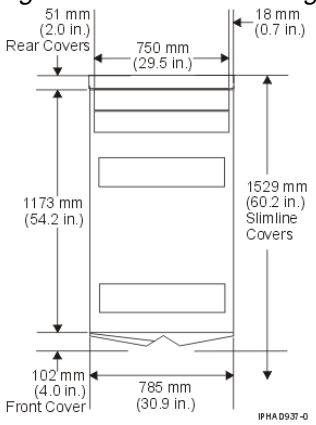
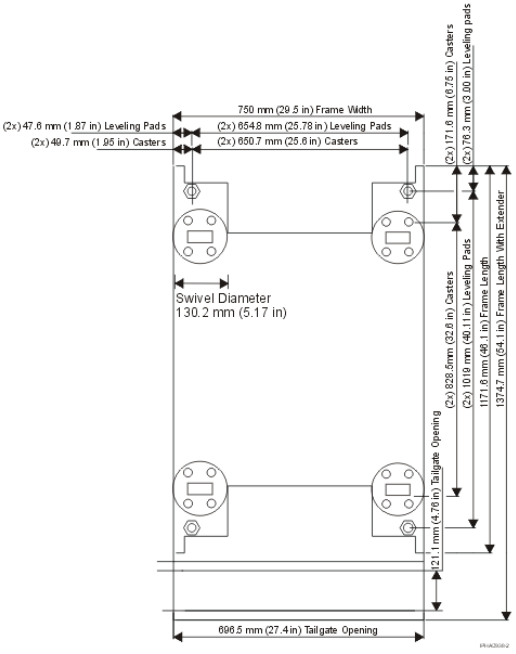


Figure 2. Plan view for single frame systems with slimline doors



Attention: When moving the rack, note the caster swivel diameters shown in the following figure. Each caster swivels in an approximate 130 mm (5.1 inch) diameter.

Figure 3. Leveling foot and frame dimensions



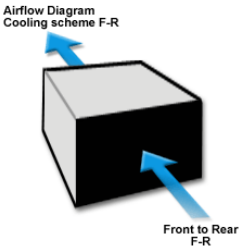
ASHRAE declarations

The following table and figures show the measurement reporting requirements as defined in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Thermal Guidelines for Data Processing Environments, which is available at http://tc99.ashraetcs.org .

Table 1. ASHRAE declarations

	Typical Heat Release	Airflow nominal[1]		Airflow maximum[1] at 35 degrees C (95 degrees F)		Weight	Overall system dimensions
Description	kW	cfm	m^3/hr	cfm	m^3/hr		
Minimum configuration	3.7	485	824	725	1232	See 185/75	See 185/75
Maximum configuration	41.6	2960	3029	4300	7306	See 185/75	See 185/75
Typical configuration	22.2	1610	2735	2350	3993	See 185/75	See 185/75
ASHRAE Class	3						
Minimum configuration	One processor drawer						
Maximum configuration	12 processor drawers and two I/O drawers						
Typical configuration	6 processor drawers and 2 I/O drawers						

Figure 1. Airflow figure for server mounted in a rack



Breaker rating and cord information

The following table illustrates the power cord options for the three-phase model 185/75 with their geographic, breaker rating, and cord information.

Table 1. Breaker rating and cord information

Three-phase supply voltage (50/60 Hz)	200-240 V	380-415 V	480 V
Recommended customer-circuit-breaker rating[1]	60 A (60-A plug) or 80 A (100-A plug)	40 A	30 A
Cord information	1.8 m (6 ft.) and 4.3 m (14 ft.) 6 AWG power cord (60-A plug), or 1.8 m (6 ft.) and 4.3 m (14 ft.) 6 AWG power cord (100-A Plug)	14 foot, 8 AWG power cord, (electrician installed)	6 and 14 foot, 8AWG power cord
Recommended receptacle	IEC309, 60 A, type 460R9W (not provided) or IEC309, 100 A, type 4100R9W (not provided)	Not specified, electrician installed	IEC309, 30 A, type 430R7W (not provided)

Note:

1. The exact circuit breaker ratings may not be available in all countries. Where the specified circuit breaker ratings are not acceptable, use the nearest available rating. Always consult local electrical codes.
2. When possible, use metal backbox with power cords using IEC-309 plugs.

Service clearances

The minimum service clearance for systems with slimline doors is shown in the following figures.

Figure 1. Service clearances f/75 single frame systems with slimline doors

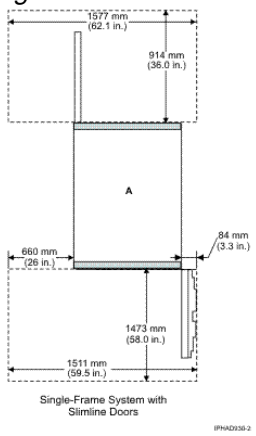
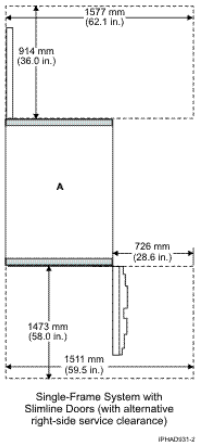


Figure 2. Service clearances f/75 single frame systems with slimline doors (with alternative right-side service clearance)



The minimum service clearance for systems with acoustical doors is shown in the following figures.

Figure 3. Service clearances f/75 single-frame systems with acoustical doors

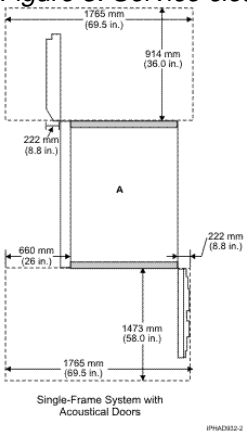
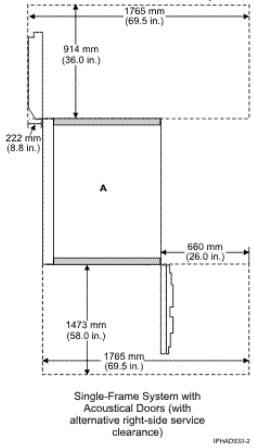
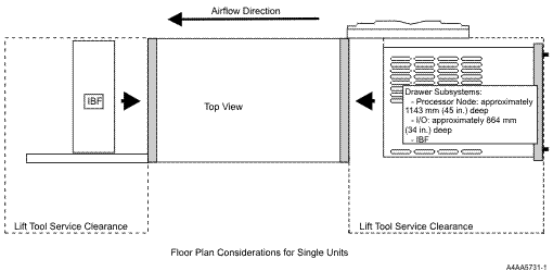


Figure 4. Service clearances f/75 single-frame systems with acoustical doors (with alternative right-side service clearance)



Front service access is necessary on the model 185/75 to accommodate a lift tool for the servicing of large drawers (the processor books and I/O drawers). Front and rear service access is necessary to accommodate the lift tool for servicing of the optional integrated battery backup.

Figure 5. Floor plan considerations for single units



Approximate system weights by configuration

If the system that you order weighs more than 1134 kg (2500 lb.) when it is shipped from the factory, a weight-distribution plate will be provided for the system. This plate is used to minimize the point loading from casters and leveling pads.

Table 1. Approximate system weights with acoustical covers and with integrated battery backup kg (lb.)[3]

Number of processor drawers	Drawers (I/O and switches)						
	0	1	2	3	4	5	6
1	620 (1367)	725 (1599)	824 (1817)[1]	923 (2035)[2]			
2	677 (1493)	894 (1972)	1111 (2450)	1210 (2668)[1]	1309 (2886)[2]		
3	958 (2112)	1063 (2344)	1169 (2576)	1274 (2808)	1373 (3026)1	1472 (3244)[2]	
4	1015 (2238)	1121 (2470)	1226 (2702)	1331 (2934)	1436 (3167)	1535 (3385)[1]	Not supported
5	1072 (2364)	1178 (2596)	1283 (2828)	1388 (3061)	1493 (3293)		
6	1130 (2490)	1235 (2723)	1340 (2955)	1445 (3187)	1551 (3419)		
7	1187 (2617)	1292 (2849)	1397 (3081)	1503 (3313)			
8	1244 (2743)	1349 (2975)	1455 (3207)	1560 (3439)			
9	1301 (2869)	1406 (3101)	1512 (3333)				
10	1358 (2995)	1464 (3227)	1569 (3459)				
11	1416 (3121)	1521 (3353)					
12	1473 (3247)	1578 (3479)					

Note:

1. This configuration is only valid when populated with one 7045-SW4 switch drawer.
2. This configuration is only valid when populated with two 7045-SW4 switch drawers.
3. For systems with slimline doors subtract 9 kg (19 lb.).

Table 2. Approximate system weights with acoustical covers and without integrated battery backup kg (lb.)[1]

Number of processor drawers	Drawers (I/O and switches)						
	0	1	2	3	4	5	6
1	531 (1168)	636 (1400)	735 (1618)[1]	835 (1836)[2]			

2	587 (1294)	714 (1574)	841 (1853)	939 (2071)[1]	1038 (2289)[2]		
3	687 (1515)	793 (1747)	898 (1979)	1003 (2211)	1102 (2429)[1]	1201 (2647)[2]	
4	744 (1641)	850 (1873)	955 (2105)	1060 (2337)	1166 (2570)	1265 (2788)[1]	1364 (3006)[3]
5	802 (1767)	907 (1999)	1012 (2231)	1117 (2464)	1223 (2696)	1328 (2928)	
6	859 (1893)	964 (2126)	1069 (2358)	1175 (2590)	1280 (2822)	1385 (3054)	
7	916 (2020)	1021 (2252)	1127 (2484)	1232 (2716)	1337 (2948)	1430 (3152)	
8	973 (2146)	1078 (2378)	1184 (2610)	1289 (2842)	1394 (3074)		
9	1030 (2272)	1136 (2504)	1241 (2736)	1346 (2968)	1439 (3172)		
10	1088 (2398)	1193 (2630)	1298 (2862)	1403 (3094)			
11	1145 (2524)	1250 (2756)	1355 (2988)	1448 (3192)			
12	1202 (2650)	1307(2882)	1412 (3114)				

Note:

1. This configuration is only valid when populated with one 7045-SW4 switch drawer.
2. This configuration is only valid when populated with two 7045-SW4 switch drawers.
3. For systems with slimline doors subtract 9 kg (19 lb.).

Power cord features

The following three-phase power cord features are available for the three-phase model 185/75:

Table 1. Power cord features

Supply type	Nominal voltage range (V ac)	Voltage tolerance (V ac)	Frequency range (Hz)
Two 3-phase power cords	200-480	180-509	47-63
Feature code	Description	Voltage (V ac)	Plug
8697	Power cord, 8 AWG, 4.3 m (14 ft.)	480	IEC309 30 A plug
8698	Power cord, 8 AWG, 1.8 m (6 ft.)	480	IEC309 30 A plug
8688	Power cord, 6 AWG/Type W, 4.3 m (14 ft.)	200-240	IEC309 60 A plug
8689	Power cord, 6 AWG/Type W, 1.8 m (6 ft.)	200-240	IEC309 60 A plug
8686	Power cord, 6 AWG, 4.3 m (14 ft.)	200-240	IEC309 100 A plug
8687	Power cord, 6 AWG, 1.8 m (6 ft.)	200-240	IEC309 100 A plug
8694[1]	Power cord, 6 AWG/Type W, 4.3 m (14 ft.)	200-240	No plug
8677[1]	Power cord, 8 AWG, 4.3 m (14 ft.)	380-415	No plug

Note:

1. These power cords are shipped without a plug or receptacle. An electrician may be required to install the plug and receptacle to meet applicable country or region electrical codes.

Doors and covers

Doors and covers are an integral part of the system and are required for product safety and electromagnetic compatibility compliance. The following rear door options are available for the model 185/75:

- Enhanced acoustical cover option

  This feature provides a low-noise option for customers or sites with stringent acoustical requirements and where a minimal system footprint is not critical. The acoustical cover option consists of special front and rear doors that are approximately 250 mm (10 in.) deep and contain acoustical treatment that lowers the noise level of the machine by approximately 7 dB (0.7 B) compared to the slimline doors. This reduction in noise emission levels means that the noise level of a single model system with slimline covers is about the same as the noise level of five model systems with acoustical covers.
- Slimline cover option

  This feature provides a smaller-footprint and lower-cost option for customers or sites where space is more critical than acoustical noise levels. The slimline cover option consists of a front door, which is approximately 100 mm (4 in.) deep, and a rear door, which is approximately 50 mm (2 in.) deep. No acoustical treatment is available for this option.
- Rear door heat exchanger option

  The rear door heat exchanger is a water-cooled device that mounts on the rear of the 19-inch and 24-inch racks to cool the air that is heated and exhausted by devices inside the rack. A supply hose delivers chilled, conditioned water to the heat exchanger. A return hose delivers warmed water back to the water pump or chiller. Each rear door heat exchanger can remove up to 50 000 Btu (or approximately 15 000 watts) of heat from your data center. For detailed information on preparing your data center for using the rear door heat exchanger, see Planning for the installation of rear door heat exchangers. For detailed information about installing a heat exchanger on your rack, see Installing the rear door heat exchanger.

For declared levels of acoustical noise emissions, refer to Acoustical noise emissions.

Raised-floor requirements and preparation

A raised-floor is strongly recommended for the model its associated rack to ensure optimal performance for system cooling, cable management, and to comply with electromagnetic compatibility requirements. Raised-floor cutouts should be protected by electrically nonconductive molding, appropriately sized, with edges treated to prevent cable damage and to prevent casters from rolling into the floor cutouts.

Cut and place floor panels

This section provides recommendations for making the necessary openings in the raised floor for installing the model 185/75.

The x-y alphanumeric grid positions are used to identify relative positions of cutout floor panels that may be cut in advance.

1. Measure the panel size of the raised floor.
2. Verify the floor panel size. The floor panel size illustrated is 600 mm (23.6 in.) and 610 mm (24 in.) panels.
3. Ensure adequate floor space is available to place the frames over the floor panels exactly as shown in the figure. Use the plan view, if necessary. Consider all obstructions above and below the floor.
4. Identify the panels needed, and list the total quantity of each panel required for the installation.
5. Cut the required quantity of panels. When cutting the panels, you must adjust the size of the cut for the thickness of the edge molding you are using. The dimensions shown in the figures are finished dimensions. For ease of installation, number each panel as it is cut, as shown in the following figure.

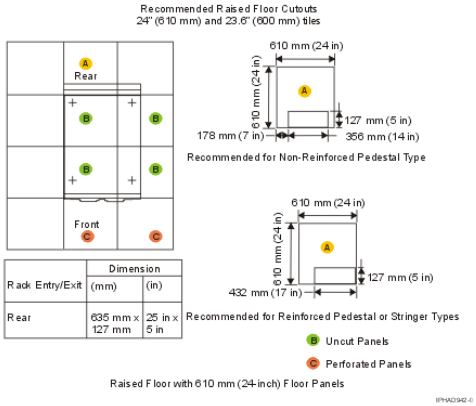
   Note: Depending on the panel type, additional panel support (pedestals) may be required to restore structural integrity of the panel. Consult the panel manufacturer to ensure that the panel can sustain a concentrated load of 525 kg (1160 lb). For multiple frame installation, it is possible that two casters will produce loads as high as 1050 kg (2320 lb)..

6. Use the raised floor figure below to install the panels in the proper positions.

   Note:

   a. This floor-tile arrangement is recommended so that the casters or leveling pads are placed on separate floor tiles to minimize the weight on a single floor tile. Furthermore, tiles bearing the weight (having casters or leveling pads on the tiles) should be uncut to retain the strength of the floor tile.
   b. The following figure is intended only to show relative positions and accurate dimensions of floor cutouts. The figure is not intended to be a machine template and is not drawn to scale.

Figure 1. Raised floor with 610 mm (24 in.) floor panels



Secure the rack

Securing the rack is an optional procedure. See Vibration and shock for more information.

The following can be ordered by the customer as additional rack-securing options for the model 185/75.

- RPQ 8A1183 for attaching the rack-mounting plates to the concrete floor (nonraised floor)
- RPQ 8A1185 to attach the rack to a concrete floor when server is on a raised floor 228.6 mm to 330.2 mm (9 in. to 13 in. depth)
- RPQ 8A1186 to attach the rack to a concrete floor when server is on a raised floor 304.8 mm to 558.8 mm (12 in. to 22 in. depth)

Before the service representative can perform the tie-down procedure, you must complete the floor preparation described in Cut and place floor panels and the procedures described in Attach the rack to a concrete (nonraised) floor or Attach the rack to a short- or long-raised floor.

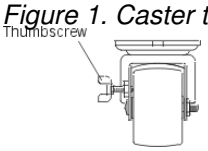
Position the rack

To unpack and position the rack, do the following:

Note: See Moving the system to the installation site before attempting to position the rack.

1. Remove all packing and tape from the rack.
2. Place the last floor covering exactly adjacent and in the front of the final installation location.
3. Position the rack according to the customer floor plan.
4. Lock each caster wheel by tightening the thumbscrew on the caster.

Figure 1. Caster thumbscrew



5. While moving the system to its final installed location and during relocation, it may be necessary to lay down floor covering, such as Lexan sheets, to prevent floor panel damage.

Install the frame tie-down kit

The following procedures describe how to install a frame tie-down kit and floor tie-down hardware to secure a rack to a concrete floor beneath a 228.6 mm to 330.2 mm (9 in. to 13 in. depth) or a 304.8 mm to 558.8 mm (12 in. to 22 in. depth) raised-floor environment or to a nonraised floor.

- Position the rack
- Attach the rack to a concrete (nonraised) floor
- Attach the rack to a short- or long-raised floor

Attach the rack to a concrete (nonraised) floor

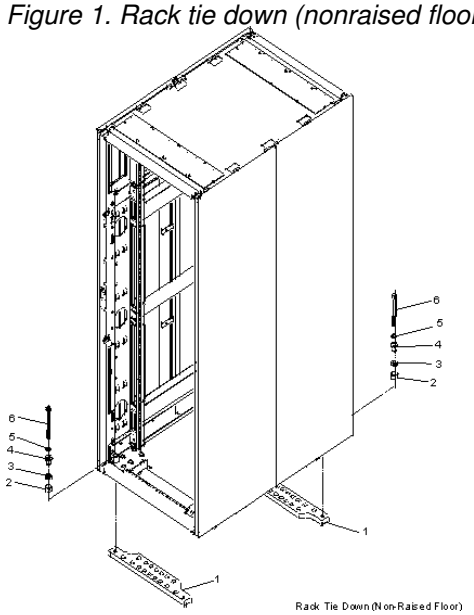
Use this procedure to attach the rack to a concrete (nonraised) floor.

Attention: It is the customer's responsibility to ensure the following steps are completed before the service representative performs the tie-down procedure.

Note: The customer should obtain the service of a qualified structural engineer to determine appropriate anchoring of the mounting plates. A minimum of five anchor bolts for each mounting plate must be used to secure the plates to the concrete floor. Because some of the drilled holes may be aligned with concrete reinforcement rods below the surface of the concrete floor, additional holes must be drilled. Each mounting plate must have at least five usable holes, two that are on the right-hand sides and the other two are on opposite ends, and one hole at the center. The mounting plates should be able to withstand 1134 kg (2500 lb.) pulling force on each end.

1. Be sure the rack is in the correct location. To ensure that the holes are in the correct location, the diagonal distance of the center of the holes should be 1211.2 mm (47.7 in.). The distance between the center holes to the center of the next holes should be 654.8 mm (25.8 in.) (the side-to-side distance) and 1019 mm (40.1 in.) (the front-to-back distance).

Figure 1. Rack tie down (nonraised floor)



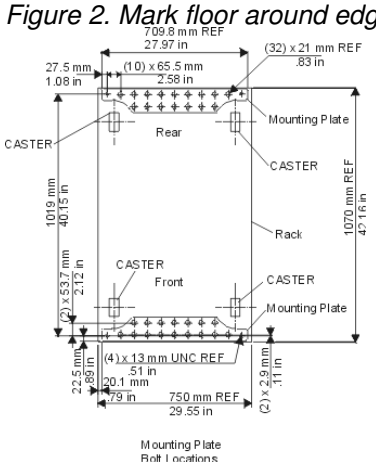
2. Place the mounting plates (item 1 in Figure 1), front and rear, in the approximate mounting position under the system rack.
3. To align the mounting plates to the system rack, do the following:
    a. Place the four rack-mounting bolts (item 6 in Figure 1) through the plate assembly holes at the bottom of the rack. Install the bushings and washers (item 4 and 5 in Figure 1) to ensure bolt positioning.

Note: The plastic bushing is intended to provide electrical insulation between the frame and the ground. When such insulation is not required, the plastic bushing does not need to be installed.

b. Position the mounting plates (item 1 in Figure 1) under the four rack-mounting bolts (item 6 in Figure 1) so that the mounting bolts are centered directly over the tapped holes.
c. Turn the rack-mounting bolts (item 6 in Figure 1) three or four rotations into the tapped holes.

4. Mark the floor around the edge of the mounting plates, as shown in the following figure.

Figure 2. Mark floor around edge of mounting plates



5. Remove the mounting bolts from the threaded holes.
6. Move the rack away from the mounting plates.
7. Mark the floor at the center of each hole in the mounting plate (including tapped holes).
8. Remove the mounting plates from the marked locations.
9. At the marked location of the tapped mounting holes, drill two holes approximately 19 mm (.75 in.) to allow clearance for the ends of the two rack-mounting bolts. The ends of the rack-mounting bolts may protrude past the thickness of the mounting plate. Drill one hole in each group of anchor bolt location marks as indicated on the marked floor.
10. Using at least five heavy duty concrete anchoring bolts for each mounting plate, mount the mounting plates to the concrete floor.

Attach the rack to a short- or long-raised floor

Attention: The frame tie downs are intended to secure a frame weighing less than 1429 kg (3150 lb.). These tie downs are designed to secure the frame on a raised floor installation. It is the customer's responsibility to ensure the following steps are completed before the service representative performs the tie-down procedure.

Use the following to determine your next step:

1. If the rack is being attached to a short depth raised floor environment 228.6 mm to 330.2 mm (9 in. to 13 in. depth) install the Raised Floor Tie Down Kit (Part number 16R1102) described in the following table.

Table 1. Raised Floor Tie Down Kit (Part number 16R1102)

228.6 mm to 330.2 mm (9 in. to 13 in.) Raised Floor Tie Down Kit (Part number 16R1102)			
Item	Part Number	Quantity	Description
1	44P3438	1	Wrench
2	44P2996	2	Stabilizer bar
3	44P2999	4	Turnbuckle Assembly

2. If the rack is being attached to a deep raised floor environment 304.8 mm to 558.8 mm (12 in. to 22 in. depth) install the Raised Floor Tie Down Kit (Part number 16R1103) described in the following table.
   Table 2. Raised Floor Tie Down Kit (Part number 16R1103)

304.8 mm to 558.8 mm (12 in. to 22 in.) Raised Floor Tie Down Kit (Part number 16R1103)			
Item	Part Number	Quantity	Description
1	44P3438	1	Wrench
2	44P2996	2	Stabilizer bar
3	44P3000	4	Turnbuckle Assembly

It is the customer's responsibility to ensure the following steps are completed before the service representative performs the tie-down procedure.

Note: To accommodate a floor with a depth of more than 558.8 mm (22 in.), a steel beam or a steel channel adapter for mounting the subfloor eyebolts is required. The customer must supply the floor eyebolts.

Consider the following when preparing the floor for tie-down:

- The hardware is designed to support a frame weighing no more than 1578.5 kg (3480 lb.).
- The estimated maximum concentrated load on one caster for a 1578.5 kg (3480 lb.)-system is 526.2 kg (1160 lb.). For a multiple system installation, it is possible that one floor tile will bear a total concentrated load of 1052.3 kg (2320 lb.).

To install the eyebolts, do the following:

1. Obtain the service of a qualified structural engineer to determine appropriate installation of the eyebolts.
2. Consider the following before installing the eyebolts:
   - Floor eyebolts must be securely anchored to the concrete floor.
   - For a single frame installation, four 1/2-in. diameter by 13-inch subfloor eyebolts should be secured to the subfloor.
   - The minimum height of the center of the internal diameter is 2.54 mm (1 in.) above the concrete floor surface.
   - The maximum height is 63.5 mm (2.5 in.) above the concrete floor surface. Higher than 63.5 mm (2.5 in.) can cause excessive lateral deflection to the tie-down hardware.
   - The eyebolt's internal diameter should be 1-3/16 inch, and each eyebolt should be able to withstand 1224.7 kg (2700 lb). The customer should obtain the service of a qualified consultant or structural engineer to determine the appropriate anchoring method for these eyebolts and to ensure that the raised floor and the building can support the floor-loading specifications.
   - To ensure that the holes are in the correct location, the diagonal distance of the center of the holes should be 1211.2 mm (47.7 in.). The distance between the center holes to the center of the next holes should be 654.8 mm (25.8 in.) (the side to side distance) and 1019 mm (40.1 in.) (the front to back distance)
3. Verify that the four eyebolts are positioned to match the dimensions is given in the following figures.

Figure 1. Eyebolt positioning for 610 mm (24 in.) floor tile layout

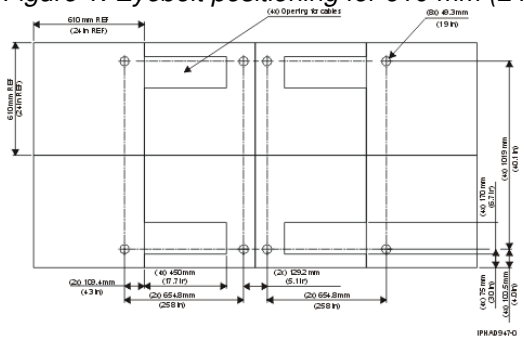


Figure 2. Eyebolt positioning for 600 mm (23.6 in.) floor tile layout

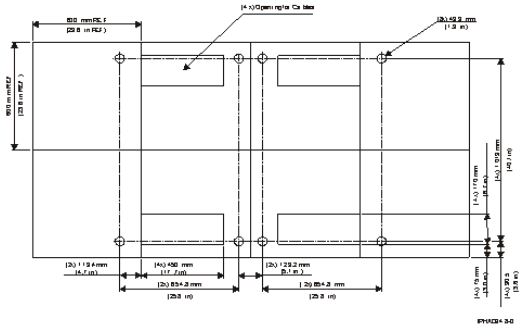
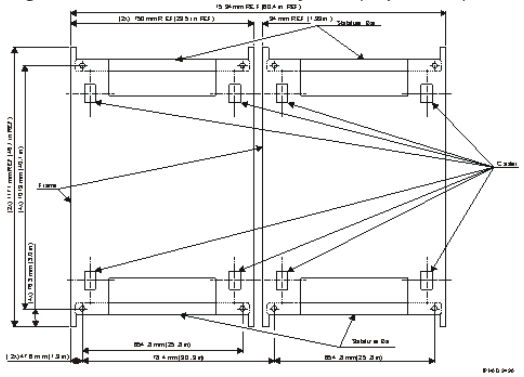


Figure 3. Stabilizer bar layout (top view)



4. Install the eyebolts to the floor.

Figure 4. Turnbuckle assembly frame tie down hardware for 228.6 mm to 330.2 mm (9 in. to 13 in.) raised floor (Part number 44P2999)

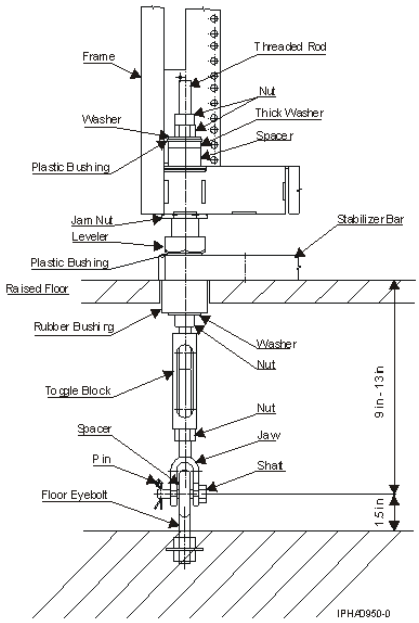


Figure 5. Turnbuckle assembly frame tie down hardware for 228.6 mm to 330.2 mm (9 in. to 13 in.) raised floor (Part number 44P2999)

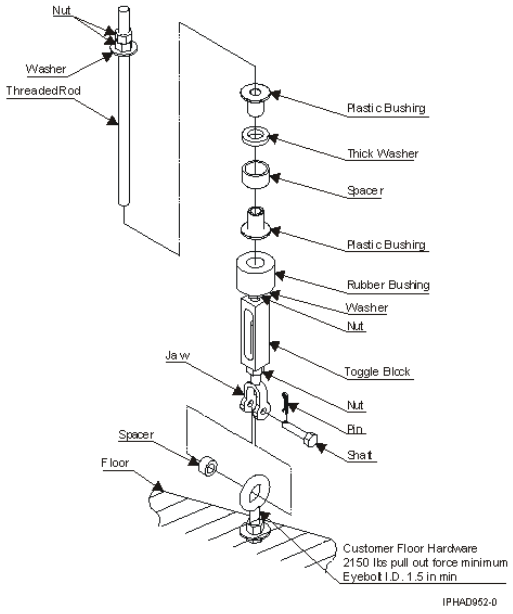


Figure 6. Turnbuckle assembly frame tie down hardware for 304.8 mm to 558.8 mm (12 in. to 22 in.) raised floor (Part number 44P3000)

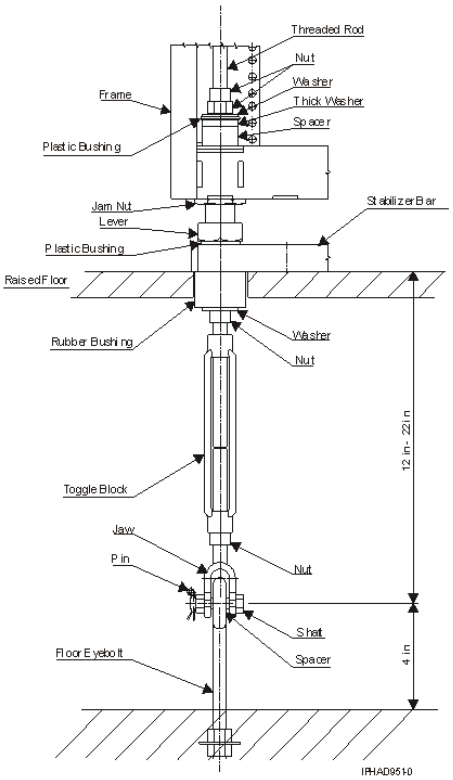
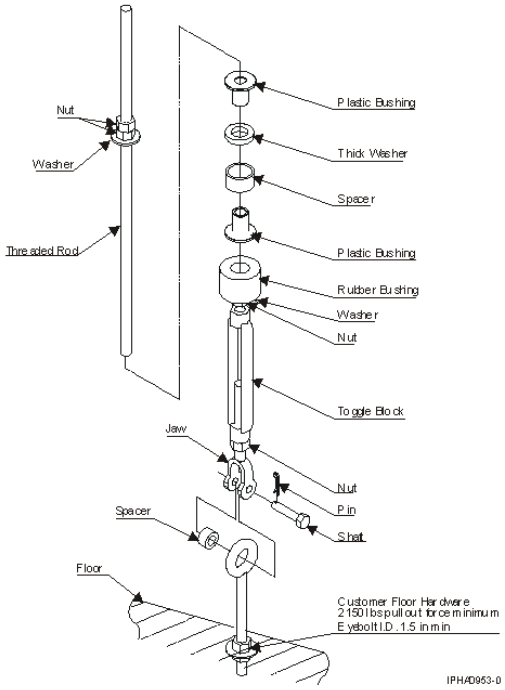


Figure 7. Turnbuckle assembly frame tie down hardware for 304.8 mm to 558.8 mm (12 in. to 22 in.) raised floor (Part number 44P3000)



Considerations for multiple system installations

In a mutiple-frame installation, it is possible that a floor tile with cable cutouts (refer to Cut and place floor panels) will bear two concentrated static loads up to 526 kg (1160 lb.) per caster and leveler. Thus, the total

concentrated load can be as high as 1052 kg (2320 lb.). Contact the floor tile manufacturer or consult a structural engineer to ensure that the raised floor assembly can support this load.

When you are integrating a model 185/75 into an existing multiple-system environment, or when adding additional systems to an installed 185/75, consider the following factors:

- Minimum aisle width

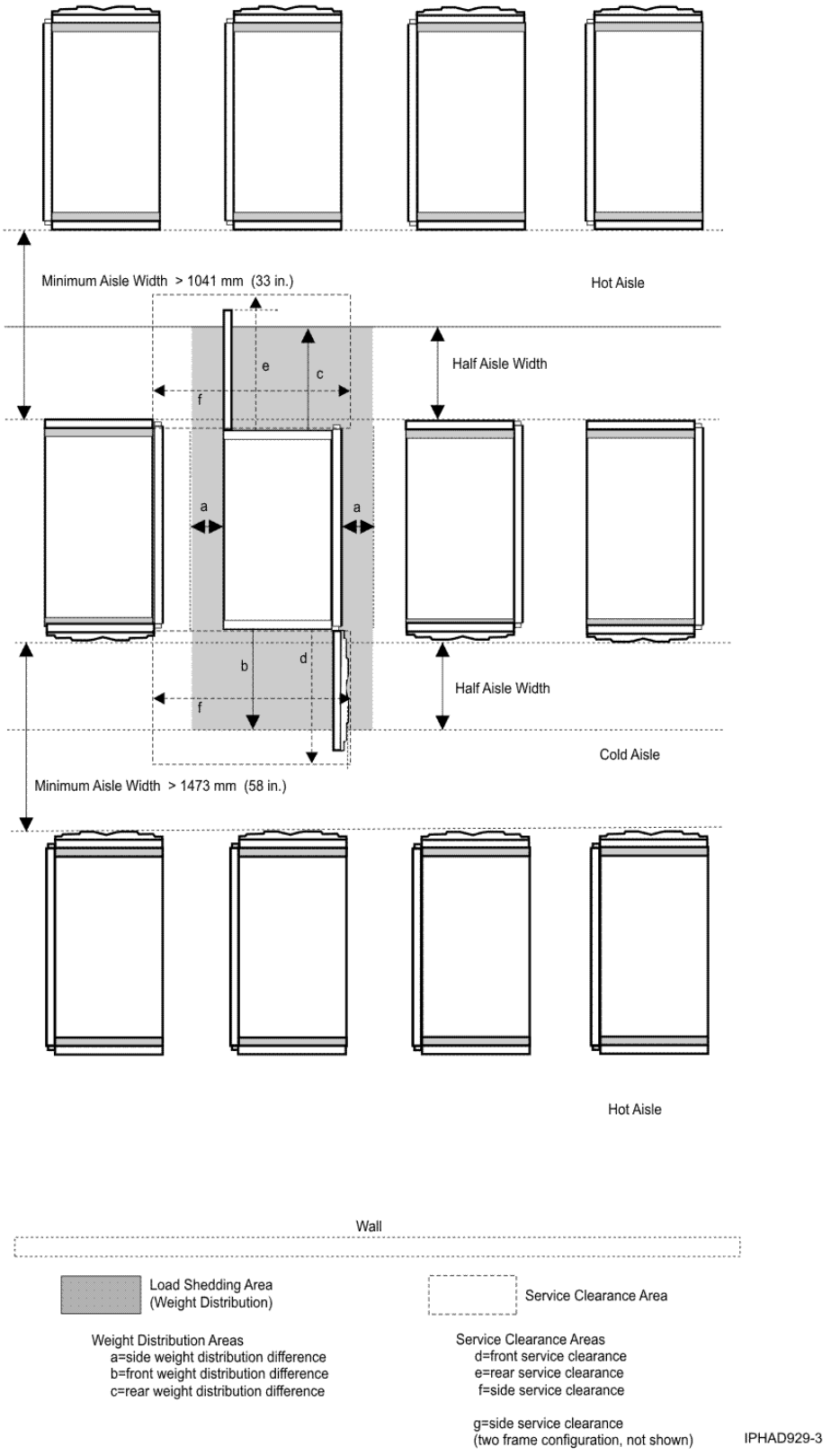
  For multiple rows of systems containing one or more 185/75 models, the minimum aisle width in the front of the system is 1473 mm (58 in.) and 914 mm (36 in.) in the rear of the system to allow room to perform service operations. The front and rear service clearances should be at least 1473 mm (58 in.) and 914 mm (36 in.), respectively. Service clearances are measured from the edges of the frame (with doors open) to the nearest obstacle.
- Thermal interactions

  Systems should be faced front-to-front and rear-to-rear to create "cool" and "hot" aisles to maintain effective system thermal conditions, as shown in the following figure.

  Cool aisles need to be of sufficient width to support the airflow requirements of the installed systems as indicated in Cooling requirements. The airflow per tile will be dependent on the underfloor pressure and perforations in the tile. A typical underfloor pressure of 0.025 in. of water will supply 300-400 cfm through a 25 percent open 2 ft. by 2 ft. floor tile.

Figure 1. Proposed floor layout for multiple systems

Proposed Floor Layout for Multiple Systems



Wall

Load Shedding Area
(Weight Distribution)

Service Clearance Area

Weight Distribution Areas
a=side weight distribution difference
b=front weight distribution difference
c=rear weight distribution difference

Service Clearance Areas
d=front service clearance
e=rear service clearance
f=side service clearance

g=side service clearance
(two frame configuration, not shown)

IPHAD929-3

Total system power consumption

The following table contains the maximum power requirements for the model 185/75.

Table 1. System power requirements for 1.9 GHz processor systems (185/75 only) - (kW)

Processor drawers Total number of FC7836, FC7657, FC7675 and FC7676)[8, 9]	I/O drawers and switch drawers						
	0	1	2	3	4	5	6
1	3.7[4]	4.9[4]	5.9[1,4]	7.0[2, 4]			
2	6.9[4]	8.1[4]	9.2[4]	10.3[1,4]	11.4[2, 4]		
3	10.2[4]	11.3[4]	12.4[4]	13.6[4]	14.7[1, 4]	15.8[2, 4]	
4	13.5[4]	14.6[4]	15.6[4]	16.8[4]	17.9[4]	19.0[1, 5]	22.3[1, 5]
5	16.7[4]	17.8[4]	18.9[5]	20.0[5]	21.2[5]	22.3[3, 5]	
6	19.9[5]	21.1[5]	22.2[5]	23.3[6]	24.4[6]	25.5[3, 6]	
7	23.2[6]	24.3[6]	25.4[6]	26.5[6]	27.6[3, 6]	28.8[3, 6]	
8	26.4[6]	27.6[6]	28.7[6]	29.8[6]	30.9[3, 6]		
9	29.7[6]	30.8[6]	31.9[7]	33.0[7]	34.1[3, 7]		
10	32.9[7]	34.0[7]	35.2[7]	36.3[7]			
11	36.2[7]	37.3[7]	38.4[3, 7]	39.5[7]			
12	39.4[7]	40.5[7]	41.6[3, 7]				

The following notes apply to the preceding table.

Note:

1. This configuration is valid only when populated with one 7045-SW4 switch drawer.
2. This configuration is valid only when populated with two 7045-SW4 switch drawers.
3. Not supported with integrated battery backup.
4. Power cord and bulk power jumper rules for this configuration:

60 A cord allowed	60 A cord redundant	Other cords redundant	Bulk power jumper provided
Yes	Yes	Yes	No

5. Power cord and bulk power jumper rules for this configuration:

60 A cord allowed	60 A cord redundant	Other cords redundant	Bulk power jumper provided
Yes	No	Yes	Only provided with 60 A power cords

6. Power cord and bulk power jumper rules for this configuration:

60 A cord allowed	60 A cord redundant	Other cords redundant	Bulk power jumper provided

Yes	No	No	Yes

7. Power cord and bulk power jumper rules for this configuration:

60 A cord allowed	60 A cord redundant	Other cords redundant	Bulk power jumper provided
No	Not applicable	No	Yes

8. The maximum number of processors per system is the total number of FC7836 plus FC7657 that can be combined to a maximum of 12.
9. For each FC7657, FC7675, and FC7676 installed, subtract 0.2 kW from the total system power specified in this table.

Maximum configurations are based on 64 memory cards per processor, two disk drives and four PCI adapter cards. To determine the typical power consumption for a specific configuration, subtract the following typical power values.

Component	Typical power value (W)
Disk drives	20
PCI adapter card	20
Memory book	10

Cooling requirements

The model 185/75 requires air for cooling. As shown in Figure 1, rows of model 185/75, and systems must face front-to-front. The use of a raised floor is recommended to provide air through perforated floor panels placed in rows between the fronts of systems (the cold aisles shown in Figure 1).

The following table provides system cooling requirements based on system configuration. The letter designations in the table correspond to the letter designations shown in Cooling requirements graph.

Table 1. System cooling requirements for 1.9 GHz processor systems (185/75 only)

Number of processor drawers FC7836 plus FC7657[4]	Number of I/O drawers and switch drawers						
	0	1	2	3	4	5	6
1	A	B	B_1	C_2			
2	C	C	D	D_1	D[2]		
3	D	D	E	E	F[1]	F[2]	
4	E	F	F	G	G	G[1]	I[2]
5	G	G	G	H	H	I[3]	
6	H	H	I	I	J	J[3]	
7	I	J	J	J	K[3]	K[3]	
8	K	K	K	L	L[3]		
9	L	L	M	M[3]	M[3]		
10	M	M	N	N[3]			

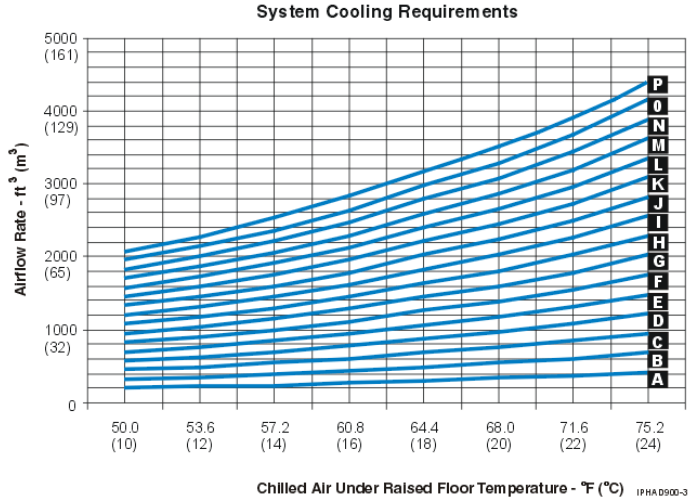
11	N	O	O[3]	P[3]			
12	P	P	P[3]				

Note:

1. This configuration is valid only when populated with one 7045-SW4 switch drawer.
2. This configuration is valid only when populated with two 7045-SW4 switch drawers.
3. Not supported with integrated battery backup.
4. The maximum number of processors per system is the total number of FC7836 plus FC7657 processor drawers that can be combined to a maximum of 12.

Cooling requirements graph

Figure 1. Cooling requirements graph



Moving the system to the installation site

Prior to moving the system to the installation site, you should:

- Determine the path that must be taken to move the system from the delivery location to the installation site.
- You should verify that the height of all doorways, elevators, and so on are sufficient to allow moving the system to the installation site.
- Verify that the weight limitations of elevators, ramps, floors, floor tiles, and so on are sufficient to allow moving the system to the installation site. If the height or weight of the system can cause a problem when the system is moved to the installation site, you should contact your local site planning, marketing, or sales representative.

For more detailed information, see Access.

If needed, a height reduction feature 7960 may be ordered. This feature allows for the system frame and the expansion frame to be shipped in two pieces and assembled at your location. With this feature, the top section of the system frame (including the power subsystem) is removed. The height of the system frame with the upper section removed is reduced by .35 m (14 in.) to approximately 1.64 m (65 in.). For planning purposes, the weight of the rack top frame and components are shown in the following table.

Table 1. Weight of rack top frame and components

Item	Weight[1]
Rack top frame and crate	210.5 kg (463 lb.)
Rack top frame with power (4 bulk power regulators, 4 bulk power distributors, and 2 bulk power assemblies)[2]	149.5 kg (329 lb.)
Bulk power regulator	13.6 kg (30 lb.)
Bulk power distributor	6.4 kg (14 lb.)
Bulk power assembly	18 kg (40 lb.)
Rack top frame without rails	30 kg (66 lb.)
Rack top frame with rails	33 kg (73 lb.)
Side cover[3]	22.7 kg (50 lb.)
Front acoustic door	17.9 kg (39.4 lb.)
Rear acoustic door	17.2 kg (37.9 lb.)
Front slimline door	17.2 kg (38 lb.)
Rear slimline door	9.1 kg (20 lb.)

Note:

1. Maximum total weight can be up to 255 kg (ESCALA PL 1650R-L+ lb.)
2. Can be shipped with up to six bulk power regulators and six bulk power distributors.
3. Each side cover consists of two panels.

Delivery and subsequent transportation of the equipment

DANGERHeavy equipment personal injury or equipment damage might result if mishandled. (D006)

You must prepare your environment to accept the new product based on the installation planning information provided, with assistance from an authorized service provider. In anticipation of the equipment delivery, prepare the final installation site in advance so that professional movers or riggers can transport the equipment to the final installation site within the computer room. If for some reason, this is not possible at the time of delivery, you must make arrangements to have professional movers or riggers return to finish the transportation at a later date. Only professional movers or riggers should transport the equipment. The authorized service provider can only perform minimal frame repositioning within the computer room, as needed, to perform required service actions. You are also responsible for using professional movers or riggers when you relocate or dispose of equipment.

Phase imbalance and BPR configuration

Depending on the number of bulk power regulators (BPRs) in your system, phase imbalance can occur in line currents. All systems are provided with two bulk power assemblies (BPAs), with separate power cords. Phase currents will be divided between two power cords in normal operation. The following table illustrates phase imbalance as a function of BPR configuration. For information about power consumption, see Total system power consumption.

Table 1. Phase imbalance and BPR configuration

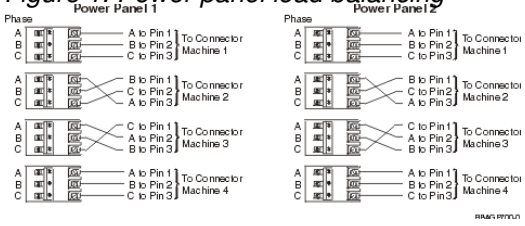
Number of BPRs per BPA	Phase A line current	Phase B line current	Phase C line current
1	Power / Vline	Power / Vline	0
2	0.5 Power / Vline	0.866 Power / Vline	0.5 Power / Vline
3	0.577 Power / Vline	0.577 Power / Vline	0.577 Power / Vline
Note: Power is calculated from Total system power consumption. Vline is line-to-line nominal input voltage. Since total system power is divided between two power cords, divide the power number by two.			

Balancing power panel loads

When three-phase power is used, and depending on the system configuration, the phase currents can be fully balanced or unbalanced. System configurations with three BPRs per BPA have balanced power panel loads, while configurations with only one or two have unbalanced loads. With two BPRs per BPA, two of the three phases will draw an equal amount of current, and will be, nominally, 57.8 percent of the current on the third phase. With one BPR per BPA, two of three phases will carry an equal amount of current, with no current drawn on the third phase. The following figure is an example of feeding several loads of this type from two power panels in a way that balances the load among the three phases.

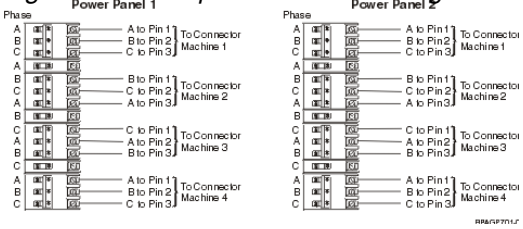
Note: Use of ground fault interrupt (GFI) circuit breakers is not recommended for this system because GFI circuit breakers are earth leakage current sensing circuit breakers and this system is a high earth leakage current product.

Figure 1. Power panel load balancing



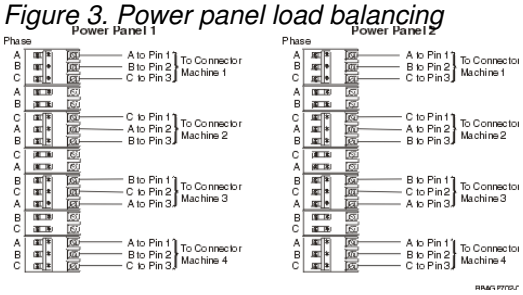
The method illustrated in the preceding figure requires that the connection from the three poles of each breaker to the three phase pins of a connector be varied. Some electricians may prefer to maintain a consistent wiring sequence from the breakers to the connectors. The following figure shows a way to balance the load without changing the wiring on the output of any breakers. The three-pole breakers are alternated with single-pole breakers, so that the three-pole breakers do not all begin on Phase A.

Figure 2. Power panel load balancing



The following figure shows another way of distributing the unbalanced load evenly. In this case, the three-pole breakers are alternated with two-pole breakers.

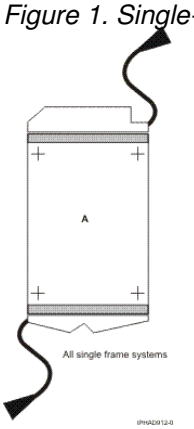
Figure 3. Power panel load balancing



Power cord configurations

The power cords exit the system from different points of the frame as indicated in the following figure. For raised-floor applications, it is recommended that both cords be routed to the rear of the frame and through the same floor-tile cutout. For more information about raised-floor applications, refer to Cut and place floor panels and Figure 1.

Figure 1. Single-frame system power cord configuration



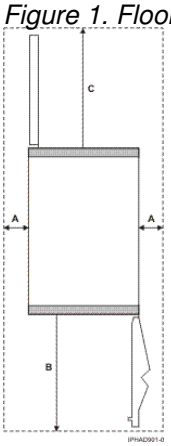
Dual power installation

The model 185/75 is designed with dual power cords with a fully redundant power system, except on some larger configurations. Table 1 and Table 3 provide details for the configurations that have fully-redundant power and those that do not. To take full advantage of the redundancy and reliability that is built into the system, the system must be powered from two different power distribution panels. The possible power installation configurations are described in Dual power installations.

Weight distribution

The following figure shows the floor loading dimensions for the model 185/75. Use this figure in conjunction with the floor loading tables to determine the floor loading for various configurations.

Figure 1. Floor loading dimensions



The following table shows the values used for calculating floor loading for the model 185/75. Weights include covers, width and depth are indicated without covers.

Table 1. Floor loading for system with 12 processors, 2 I/O drawers, and without integrated battery backup

Floor loading for system with 12 processors, 2 I/O drawers, and without integrated battery backup							
a (sides)		b (front)		c (back)		1 frame	
mm	in.	mm	in.	mm	in.	lb./ft^2	kg/m^2
25	1.0	254	10.0	254	10.0	206.6	1008.7
25	1.0	508	20.0	508	20.0	168.0	820.4
25	1.0	762	30.0	762	30.0	143.0	698.1
254	10.0	254	10.0	254	10.0	140.6	686.3
254	10.0	508	20.0	508	20.0	116.0	566.5
254	10.0	762	30.0	762	30.0	100.1	488.7
508	20.0	254	10.0	254	10.0	107.3	523.9
508	20.0	508	20.0	508	20.0	89.8	438.6
508	20.0	762	30.0	762	30.0	78.5	383.2
762	30.0	254	10.0	254	10.0	88.9	434.1

762	30.0	508	20.0	508	20.0	75.3	367.9
762	30.0	762	30.0	762	30.0	66.5	324.8

Note:

1. Floor calculations should not be based on a weight shed area beyond 30 in. from each side of the system.
2. All floor calculations are intended for a raised-floor environment.
3. Contact your supplier or structural engineer for further assistance with calculating floor load.

Table 2. Floor loading for system with 12 processors, 1 I/O drawer, and with integrated battery backup

Floor loading for system with 12 processors, 1 I/O drawer, and with integrated battery backup							
a (sides)		b (front)		c (back)		1 frame	
mm	in.	mm	in.	mm	in.	lb./ft^2	kg/m^2
25	1.0	254	10.0	254	10.0	229.1	1118.5
25	1.0	508	20.0	508	20.0	185.7	906.9
25	1.0	762	30.0	762	30.0	157.6	769.5
254	10.0	254	10.0	254	10.0	154.9	756.2
254	10.0	508	20.0	508	20.0	127.3	621.5
254	10.0	762	30.0	762	30.0	109.4	534.1
508	20.0	254	10.0	254	10.0	117.5	573.7
508	20.0	508	20.0	508	20.0	97.9	477.8
508	20.0	762	30.0	762	30.0	85.1	415.5
762	30.0	254	10.0	254	10.0	96.8	472.8
762	30.0	508	20.0	508	20.0	81.6	398.3
762	30.0	762	30.0	762	30.0	71.7	349.9

Note:

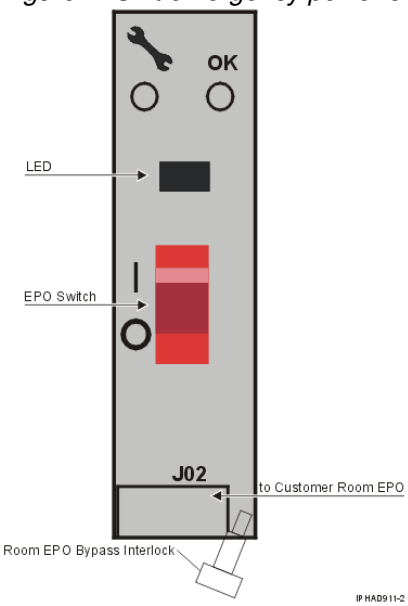
1. Floor calculations should not be based on a weight shed area beyond 30 in. from each side of the system.
2. All floor calculations are intended for a raised-floor environment.
3. Contact your supplier or structural engineer for further assistance with calculating floor load.

Floor loading for the system is illustrated in the Proposed Floor Layout for Multiple Systems in Considerations for multiple system installations.

Unit emergency power off

The server has a unit emergency power off (UEPO) switch on the front of the first frame (A Frame). Refer to the following figure, which shows a simplified UEPO panel.

Figure 1. Unit emergency power off figure



When the switch is reset, the utility power is confined to the system power compartment. All volatile data will be lost.

It is possible to attach the computer room emergency power off (EPO) system to the system UEPO. When this is done, resetting the computer room EPO disconnects all power from the power cords and the internal battery backup unit, if it is provided. All volatile data will be lost in this case also.

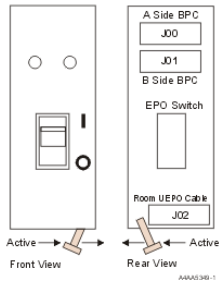
If the room EPO is not connected to the UEPO, resetting the computer room EPO removes ac power from the system. If the interlock bypass feature is used, the system remains powered for a short time based on system configuration.

Computer room emergency power off (EPO)

When the integrated battery backup is installed and the room EPO is reset, the batteries engage and the computer continues to run. It is possible to attach the computer room EPO system to the machine EPO. When this is done, resetting the room EPO disconnects all power from the power cords and the internal battery backup unit. In this event, all volatile data will be lost.

To incorporate the integrated battery backup into the room Emergency Power Off systems (EPO), a cable must connect to the back of the system EPO panel. The following figures illustrate how this connection is made.

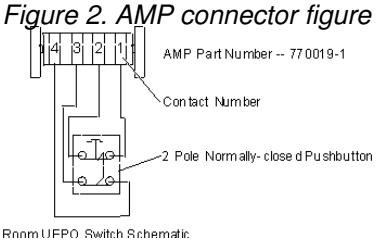
Figure 1. Computer room emergency power off figure



The preceding figure illustrates the back of the machine UEPO panel with the room EPO cable plugging into the machine. Notice the switch actuator. After it is moved to make the cable connection possible, the room EPO cable must be installed for the machine to power on.

In the following figure, AMP connector 770019-1 is needed to connect to the system EPO panel. For room EPO cables using wire sizes #20 AWG to #24 AWG, use AMP pins (part number 770010-4). This connection should not exceed 5 Ohms, which is approximately 61 m (200 ft.) of #24 AWG.

Figure 2. AMP connector figure



Machine holdup times

The following tables illustrate typical machine holdup times (time versus load) for fresh and aged batteries.

- All times are listed in minutes
- Machine load is listed in total ac input power (power for both power cords combined)
- A fresh battery is defined as 2.5 years old or less.
- An aged battery is defined as 6.5 years.

Note: Battery capacity decreases gradually as the battery ages (from fresh-battery value to aged-battery value). The system diagnoses a failed-battery condition if the capacity decreases below the aged-battery value.

Table 1. Typical machine-holdup time versus load for fresh battery

Typical machine-holdup time versus load for fresh battery														
Machine load	**3.3 kW**		**6.67 kW**		**10 kW**		**13.33 kW**		**16.67 kW**		**20 kW**		**21.67 kW**	
Integrated battery backup configuration	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**
1 BPR	7.0	21.0	2.1	7.0										

2 BPR	21.0	50.0	7.0	21.0	4.0	11.0	2.1	7.0						
3 BPR	32.0	68.0	12.0	32.0	7.0	21.0	4.9	12.0	3.2	9.5	2.1	7.0	1.7	6.5
N=Nonredundant, R=Redundant														

Table 2. Typical machine-holdup time versus load for aged battery

Typical machine-holdup time versus load for aged battery														
Machine load	**3.3 kW**		**6.67 kW**		**10 kW**		**13.33 kW**		**16.67 kW**		**20 kW**		**21.67 kW**	
Integrated battery backup configuration	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**
1 BPR	4.2	12.6	1.3	4.2										
2 BPR	12.6	30.0	4.2	12.6	2.4	6.6	1.3	4.2						
3 BPR	19.2	41.0	7.2	19.2	4.2	12.6	2.9	7.2	1.9	5.7	1.3	4.2	1.0	3.9
N=Nonredundant, R=Redundant														

Table 3. Bulk power regulator rules[6]

Bulk power regulator (BPR) per bulk power assembly (BPA) rules							
Number of processor drawers	Number of I/O drawers and switch drawers						
	0	1	2	3	4	5	6
1	1[2]	1[2]	1[2]	1[2]	Not applicable[1]	Not applicable[1]	Not applicable
2	1[2]	2[2]	2[2]	2[2]	2[2]	Not applicable[1]	Not applicable
3	2[2]	2[2]	2[2]	3[2]	3[2]	3[2]	Not applicable
4	3[2]	3[2]	3[2]	3[2]	3[2]	3[3]	3[3]
5	3[2]	3[2]	3[3]	3[3]	3[3]	3[3]	Not applicable
6	3[3]	3[3]	3[3]	3[4]	3[4]	3[4]	Not applicable
7	3[4]	3[4]	3[4]	3[4]	3[4]	3[4]	Not applicable
8	3[4]	3[4]	3[4]	3[4]	3[4]	Not applicable	Not applicable
9	3[4]	3[4]	3[5]	3[5]	3[5]	Not applicable	Not applicable
10	3[5]	3[5]	3[5]	3[5]	Not applicable	Not applicable	Not applicable
11	3[5]	3[5]	3[5]	3[5]	Not applicable	Not applicable	Not applicable
12	3[5]	3[5]	3[5]	Not applicable	Not applicable	Not applicable	Not applicable
13	3[3]	3[3]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14	3[3]	3[3]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

The following notes apply to the preceding table.

Note:

1. Maximum of two 7045-SW4 switches in rack and one 5791 or 5794 per processor drawer.
2. Power cord and bulk power jumper rules for this configuration:

60 A cord allowed	**60 A cord redundant**	**Other cords redundant**	**Bulk power jumper provided**

Yes	Yes	Yes	No

3. Power cord and bulk power jumper rules for this configuration:

60 A cord allowed	60 A cord redundant	Other cords redundant	Bulk power jumper provided
Yes	No	Yes	Yes - for 60 A cords No - for other cords

4. Power cord and bulk power jumper rules for this configuration:

60 A cord allowed	60 A cord redundant	Other cords redundant	Bulk power jumper provided
Yes	No	No	Yes

5. Power cord and bulk power jumper rules for this configuration:

60 A cord allowed	60 A cord redundant	Other cords redundant	Bulk power jumper provided
No	Not applicable	No	Yes

Planning for model ESCALA PL 3250R, ESCALA PL 6450R server specifications

This topic gives you a thorough understanding of the model ESCALA PL 3250R, ESCALA PL 6450R server specifications, including dimensions, electrical, power, temperature, environment, and service clearances. You will also find links to more detailed information, such as compatible hardware and plug types.

The server model ESCALA PL 3250R and ESCALA PL 6450R consist of multiple components, as summarized in the following table.

Table 1. Model ESCALA PL 3250R, ESCALA PL 6450R components

Model	Description	Minimum per system	Maximum per system
FC6251	Slimline door set for primary rack (front and rear) See Doors and covers.	1	1
FC6252	Acoustic door set for primary rack (front and rear) See Doors and covers.	1	1
FC8691	Optional expansion frame (Based on number of I/O and switch drawers installed.)	0	1
FC6253	Slimline door set for 8691 (front and rear)	0	1
FC6254	Acoustical door set for 8691 (front and rear)	0	1
ESCALA PL 6450R (FC8970)	16-way, 2.1 GHz processor book	1[10]	4
	16-way, 2.3 GHz processor book	1[10]	4

ESCALA PL 6450R (FC8968)			
ESCALA PL 3250R (FC8967)	16-way, 2.1 GHz processor book	1[10]	2
9406-595 (FC8966)	16-way, 1.9 GHz processor book	1[10]	4
9406-595 (FC8981)	16-way, 1.65 GHz processor book	1[10]	4
ESCALA PL 3250R (FC7891)	16-way, 1.9 GHz processor book	1[10]	2
ESCALA PL 6450R (FC7913)	16-way, 1.9 GHz processor book	1[10]	4
ESCALA PL 6450R (FC8969)	16-way, 1.9 GHz processor book		
ESCALA PL 6450R (FC7988)	16-way, 1.65 GHz processor book	1[10]	4
FC57/92	Optional base rack. See Planning for 57/92 base rack.		
Various	Hardware Management Console (HMC)[6]	0[4]	2[4]
7040-61D 57/91 57/94	Optional I/O drawer (20 PCI cards max., 16 disk drives maximum)	0 (9406) 1 (9119)	8-way or 16-way: 6 drawers maximum[1] 32-way: 12 drawers maximum[2] 48-way and 64-way: 4 drawers maximum[3] 9406-595[9]
FC6200 or FC6201	Optional integrated battery backup feature	0	6
FC3757	Service Shelf Tool Kit[8]	1	1
	Base PCI-X Expansion tower (9406-595 only)	1	1

Note:

1. For the ESCALA PL 3250R and ESCALA PL 6450R, the 16-way processor configuration supports up to 6 I/O drawers.
2. For the ESCALA PL 3250R and ESCALA PL 6450R, the 32-way processor configurations support up to 12 I/O drawers.
3. For the ESCALA PL 3250R and ESCALA PL 6450R, the 48-way and 64-way processor configurations support a maximum of 12 I/O drawers, which require a FC57/92 frame.
4. An HMC can connect to multiple systems (therefore, an HMC may not need to be ordered), or up to two HMCs can connect to the system for redundancy.
5. For the ESCALA PL 3250R and ESCALA PL 6450R, the The 32-way, 48-way, and 64-way processor configurations are based on the combining of multiple 16-way processors. The 8-way processor configuration is a 16-way with eight processors available for upgrade on demand.
6. For the model ESCALA PL 3250R and ESCALA PL 6450R, a Hardware Management Console must be provided within the same room and within 8 m (26 ft.) of the server.
7. The 32-way processor configuration of the ESCALA PL 3250R supports a maximum of eight I/O drawers.
8. The FC3757 Service Shelf Tool Kit contains six separate tool kits that are required for the installation and maintenance of the ESCALA PL 3250R, ESCALA PL 6450R and 9406-595 processor books and memory cards. Each kit weighs

   40 lb. Without this feature, installation and maintenance may be delayed. At least one FC3757 is required on site where one or more model ESCALA PL 3250R or ESCALA PL 6450R are located.
9. A number 4643 indicates that a 406/1D I/O drawer is installed in the 24-inch primary rack of a model 9406-595. One to four 4643s may be installed. Only AIX and Linux operating system supported I/O features may be installed in the 406/1D. Other I/O towers or drawers may be attached via HSL/RIO

loops.
10. Minimum per system is based on one processor with this feature code. Processor feature codes cannot be mixed.

Table 2. Specifications for model ESCALA PL 3250R, ESCALA PL 6450R

Specifications for model ESCALA PL 3250R, ESCALA PL 6450R[14]				
Plan views Top down view ASHRAE declarations (heat load data for various configurations)				
Dimensions and weight[8]				
Physical characteristic	**Slimline doors[1]**		**Acoustical doors[1]**	
	1 Frame	2 Frames	1 Frame	2 Frames
Height	2025 mm (79.7 in.)	2025 mm (79.7 in.)	2025 mm (79.7 in.)	2025 mm (79.7 in.)
Width	785 mm (30.9 in.)	1575 mm (62.0 in.)	785 mm (30.9 in.)	1575 mm (62.0 in.)
Depth	1326 mm (52.2 in.)	1326 mm (52.2 in.)	1681 mm (66.2 in.)	1681 mm (66.2 in.)
Weight[10] - model ESCALA PL 6450R and 9406-595maximum configuration				
	With integrated battery backup and slimline doors[13]	Without integrated battery backup with slimline doors	**With integrated battery backup and with acoustical doors[13]**	Without integrated battery backup and with acoustical doors
Single frame	1419 kg (3128 lb.)	1358 kg (2995 lb.)	1427 (3147 lb.)	1367 kg (3014 lb.)
Double frame[12]	2441 kg (5381 lb.)	2381 kg (5249 lb.)	2458 (5420 lb.)	2398 (5287 lb.)
Weight[10] - model ESCALA PL 3250R maximum configuration				
	With integrated battery backup and with slimline doors[13]	Without integrated battery backup and with slimline doors	**With integrated battery backup and with acoustical doors[13]**	Without integrated battery backup and with acoustical doors
Single frame	1419 kg (3128 lb.)	1358 kg (2995 lb.)	1427 kg (3147 lb.)	1367 kg (3014 lb.)
Double frame[12]	2230 kg (4917 lb.)	1960 kg (4321 lb.)	2248 kg (4956 lb.)	1977 kg (4359 lb.)
Shipping dimensions and weight[9]				
Height	2311 mm (91 in.)			
Width	940 mm (37 in.)			
Depth	1511 mm (59.5 in.)			
Weight	Varies by configuration			
Electrical and thermal characteristics (3-phase) - ESCALA PL 3250R, ESCALA PL 6450R - for additional information, see Total system power consumption				

Rated voltage and frequency (3 phase)	200 to 240 V ac at 50 to 60 Hz	380 to 415 V ac at 50 to 60 Hz	480 V ac at 50 to 60 Hz
Rated current, power cord with 100 A plug FC 8686 or 8687 (amps per phase)	60	32	24
Rated current, power cord with 60 A plug, FC 8688 or 8689 (amps per phase)	48		
Rated current, all other power cords (amps per phase)	60	32	24
Maximum power (1.9 GHz processor)	22.7 kW		
Maximum power (1.65 GHz processor)	20.3 kW		
Power factor, typical	0.99	0.97	0.93
Inrush current (maximum)[3]	163 A		
Thermal output (maximum for 1.9 GHz processor)	77.5 kBtu/hr	77.5 kBtu/hr	77.5 kBtu/hr
Thermal output (maximum for 1.65 GHz processor)	69.3 kBtu/hr	69.3 kBtu/hr	69.3 kBtu/hr
Phase	ESCALA PL 6450R, ESCALA PL 3250R	3	
Dual power feature code		Standard[7]	
Branch circuit breaker and cord information		See Breaker rating and cord information	
Power cord length		4.2 m (14 ft.) - all locations (except Chicago) 1.8 m (6 ft.) - United States (Chicago)	
Environment specifications			
Recommended operating temperature[5] (16-way, 32-way)		10 degrees to 32 degrees C (50 degrees to 89.6 degrees F)	
Recommended operating temperature[5] (48-way and 64-way)		10 degrees to 28 degrees C (50 degrees to 82.4 degrees F)	
Nonoperating temperature (All models)		10 degrees to 43 degrees C (50 degrees to 109.4 degrees F)	
Storage temperature (All models)		1 degree to 60 degrees C (33.8 degrees to 140 degrees F)	
Shipping temperature (All models)		-40 degrees to 60 degrees C (-40 degrees to 140 degrees F)	

	Operating	Nonoperating	**Storage[4]**	**Shipping[4]**
Maximum wet bulb	23 degrees C (73.4 degrees F)	23 degrees C (73.4 degrees F)	27 degrees C (80.6 degrees F)	29 degrees C (84.2 degrees F)
Noncondensing relative humidity	8 to 80 %	8 to 80 %	5 to 80 %	5 to 100 %
Maximum altitude	8-way, 16-way, 32-way - 3048 m (10000 ft.) 48-way, 64-way - 2133 m (7000 ft.)			

Acoustical noise emissions[6, 15]

Product configuration	**L_{WAd} (Bels)[6]**		**L_{pAM} (dB)[6] (bystander, 1 m)**	
	Operating	Idle	Operating	Idle
Typical configuration with two processors,	7.6	7.6	59	59

two I/O drawers, and bulk power unit; acoustical door set				
Typical configuration with two processors, two I/O drawers, and bulk power unit; slimline door set	8.3	8.3	65	65
Maximum configuration with four processors, four I/O drawers, and bulk power unit; acoustical door set	7.9	7.9	61	61
Maximum configuration with four processors, four I/O drawers, and bulk power unit; slimline door set	8.6[11]	8.6[11]	68[11]	68[11]
Service clearances				
For a graphical representation of service clearances, see Service clearances				
Seismic considerations: See Secure the rack				
Data communications				
Electromagnetic compatibility compliance: This server meets the following electromagnetic compatibility specifications: FCC (CFR 47, Part 15); VCCI; CISPR-22; 89/336/EEC; BSMI (A2/NZS 3548:1995); C-Tick; ICES/NMB-003; Korean EMI/EMC (MIC Notice 2000 94, Notice 2000 72); People's Republic of China Commodity Inspection Law				
Safety compliance: This server is designed and certified to meet the following safety standards: UL 60950-1; CAN/CSA C22.2 No. 60950-1; EN 60950-1; IEC 60950-1 including all national differences				

Note:

1. Doors are not installed during product shipment to the customer.
2. Refer to Approximate system weights by configuration for the approximate weight of your system configuration.
3. Inrush currents occur only at initial application of power (short duration for charging capacitors). No inrush currents occur during the normal power off-on cycle.
4. When an approved vapor bag and desiccant packets are used to protect the system, the storage specifications are valid for 6 months and the shipping specifications are valid for 1 month. Otherwise, storage and shipping specifications are valid for two weeks each.
5. For the 8-way, 16-way, and 32-way processor configurations, the upper limit of the dry bulb temperature must be derated 1 degree C (1.8 degrees F) per 219 m (719 ft.) above 1295 m (4250 ft.). Maximum altitude is 3048 m (10000 ft.). For the 48-way and 64-way configurations, the upper limit of the dry bulb temperature must be derated 1 degree C (1.8 degrees F) per 210 m (688 ft.) above 1295 m (4250 ft.). Maximum altitude is 2133 m (7000 ft.).
6. L_{WAd} is the upper-limit A-weighted sound level; LpAM is the mean A-weighted sound pressure measured at the 1-meter bystander postions; 1 B = 10 dB.
7. Dual power and power cords are standard on the Model ESCALA PL 3250R, 9406-595, and ESCALA PL 6450R. For maximum availability, each of the power cords should be fed from

independent power grids.
8. For specific configuration weights, see Approximate system weights by configuration. The feature code 7960 (Compact Handling Option) allows the processor or expansion frame to pass through doors that are less than 2.0 m (79.5 in.). The top 8U section of the frame, including the power subsystem, is removed at the factory and shipped separately for installation at the customer location. The height of the rack with the upper section removed is approximately 1.65 m (65 in.).
9. Shipping dimensions are indicated for each frame. Each frame is shipped separately.
10. See Approximate system weights by configuration for detailed information on weights based on configuration.
11. Attention: Your server installation may be subject to government regulations (such as those prescribed by OSHA or European Community Directives that cover noise level exposure in the workplace. The model ESCALA PL 3250R, ESCALA PL 6450R 9406-595 is available with an optional acoustical door feature that can reduce the likelihood of exceeding noise level exposure limits for densely populated racks. The actual sound pressure levels in your installation will depend on a variety of factors, including the number of racks in the installation; the size, materials, and configuration of the room where the racks are installed; the noise levels from other equipment; the room ambient temperature, and employees' location in relation to the equipment. It is recommended that a qualified person, such as an industrial hygienist, be consulted to determine whether the sound pressure levels to which employees may be exposed exceed regulatory limits.
12. The cabling requirements of the model ESCALA PL 6450R limit the distance between the server frame and a separately powered I/O frame. See Special considerations for model ESCALA PL 6450R cabling for details.
13. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.

To effectively plan for the model ESCALA PL 3250R, ESCALA PL 6450R, the following topics are also provided.

- Breaker rating and cord information
- Power cord features
- Doors and covers
- Plan views
- Raised-floor requirements and preparation
- Cut and place floor panels
- Secure the rack
- Position the rack
- Install the frame tie-down kit
- Attach the rack to a concrete (nonraised) floor
- Attach the rack to a short- or long-raised floor
- Considerations for multiple system installations
- Service clearances
- Total system power consumption
- Cooling requirements
- Moving the system to the installation site
- Phase imbalance and BPR configuration
- Balancing power panel loads
- Power cord configurations
- Dual power installation
- Approximate system weights by configuration
- Weight distribution
- Unit emergency power off
- Computer room emergency power off (EPO)
- Machine holdup times

Doors and covers

Doors and covers are an integral part of the system and are *required* for product safety and electromagnetic compatibility compliance. The following rear door options are available for your server:

- Enhanced acoustical cover option

This feature provides a low-noise option for customers or sites with stringent acoustical requirements and where a minimal system footprint is not critical. The acoustical cover option consists of a special front and rear doors that are approximately 250 mm (10 in.) deep and contain acoustical treatment that lowers the noise level of the machine by approximately 7 dB (0.7 B) compared to the slimline doors. This reduction in noise emission levels means that the noise level of a single model system with slimline covers is about the same as the noise level of five model systems with acoustical covers.

- Slimline cover option

  This feature provides a smaller-footprint and lower-cost option for customers or sites where space is more critical than acoustical noise levels. The slimline cover option consists of a front door, which is approximately 100 mm (4 in.) deep, and a rear door, which is approximately 50 mm (2 in.) deep. No acoustical treatment is available for this option.
- Rear Door Heat Exchanger for 14T/42 option

  The Heat Exchanger is a water-cooled device that mounts on the rear of the 19-inch and 24-inch racks to cool the air that is heated and exhausted by devices inside the rack. A supply hose delivers chilled, conditioned water to the Heat Exchanger. A return hose delivers warmed water back to the water pump or chiller. Each Heat Exchanger can remove up to 50 000 Btu (or approximately 15 000 watts) of heat from your data center. For detailed information on preparing your data center for using the Heat Exchanger, see Planning for the installation of rear door heat exchangers. For detailed information about installing a Heat Exchanger on your rack, see Installing the rear door heat exchanger.

Note: For declared levels of acoustical noise emissions, refer to Acoustical noise emissions.

Planning for 57/92 base rack

This topic gives you a thorough understanding of the 57/92 rack specifications, including dimensions, electrical, power, temperature, environment, and service clearances. You will also find links to more detailed information, such as compatible hardware and plug types.

The 57/92 base rack is an optional second base frame with its own separate connection to AC power that is designed for use with the model ESCALA PL 3250R and ESCALA PL 6450R. A complete set of planning information is provided to address the resulting system.

The 57/92 consists of multiple components, as summarized in the following table.

Table 1. 57/92 base rack components

Model	Description	Minimum per system	Maximum per system
FC6251	Slimline door set for primary rack (front and rear) See Doors and covers.	1	2
FC6252	Acoustic door set for primary rack (front and rear) See Doors and covers.	1	2
FC8691	Optional expansion frame (16-way and 32-way only)	0	1
Various	Hardware Management Console (HMC)[3]	0[1]	2[1]
7040-61D (ESCALA PL 3250R and ESCALA PL 6450R), 57/91 and 57/94	Optional I/O drawer (20 PCI cards max., 16 disk drives max.)	0	12[2]

FC6200 or FC6201	Optional integrated battery backup feature	0	6

Note:

1. A Hardware Management Console can connect to multiple systems (therefore, a Hardware Management Console may not need to be ordered), or up to two HMCs can connect to the system for redundancy.
2. A maximum of 12 I/O drawers can be connected to a single ESCALA PL 3250R or ESCALA PL 6450R frame. Typically, I/O drawers are populated in the server frame first, which reduces the maximum number of drawers available in the 57/92 frame.
3. For the 57/92 base rack, a Hardware Management Console must be provided within the same room and within 8 m (26 ft.) of the server.

Table 2. Specifications for 57/92 base rack

Specifications for 57/92 base rack				
Plan views Top down views ASHRAE declarations (heat load data for various configurations)				
Dimensions and weight				
Physical Characteristic	Slimline doors		Acoustical doors	
	1 Frame	2 Frames	1 Frame	2 Frames
Height	2025 mm (79.7 in.)	2025 mm (79.7 in.)	2025 mm (79.7 in.)	2025 mm (79.7 in.)
Width	785 mm (30.9 in.)	1575 mm (62.0 in.)	785 mm (30.9 in.)	1575 mm (62.0 in.)
Depth	1326 mm (52.2 in.)	1326 mm (52.2 in.)	1681 mm (66.2 in.)	1681 mm (66.2 in.)
Weight - Maximum Configuration[4]	1264 kg (2786 lb.)	2659 kg (5863 lb.)	1273 kg (2806 lb.)	2677 kg (5901 lb.)
Shipping dimensions and weight				
Height	2311 mm (91 in.)			
Width	940 mm (37 in.)			
Depth	1511 mm (59.5 in.)			
Weight	Varies by configuration			
Electrical and thermal characteristics (3-phase)				
Rated voltage and frequency (3 phase)		200 to 240 V ac at 50 to 60 Hz	380 to 415 V ac at 50 to 60 Hz	480 V ac at 50 to 60 Hz
Rated current, power cord with 100 A plug FC 8686 or 8687 (amps per phase)		60	32	24
Rated current, power cord with 60 A plug, FC 8688 or 8689 (amps per phase)		48		
Rated current, all other power cords (amps per phase)			32	24
Maximum power		21.4 kW	21.4 kW	21.4 kW
Power factor, typical		0.99	0.97	0.93
Inrush current (maximum)[3]		163 A		
Thermal output		73 kBtu/hr	73 kBtu/hr	73 kBtu/hr

Dual power feature code	Standard
Branch circuit breaker and cord information	See Breaker rating and cord information
Power cord length	4.2 m (14 ft.) - all locations (except Chicago) 1.8 m (6 ft.) - United States (Chicago)
Environment specifications	
Recommended operating temperature	10 degrees to 32 degrees C (50 degrees to 89.6 degrees F)
Nonoperating temperature (All models)	10 degrees to 43 degrees C (50 degrees to 109.4 degrees F)
Storage temperature (All models)	1 degree to 60 degrees C (33.8 degrees to 140 degrees F)
Shipping temperature (All models)	-40 degrees to 60 degrees C (-40 degrees to 140 degrees F)

	Operating	Nonoperating	**Storage[3]**	**Shipping[3]**
Maximum wet bulb	23 degrees C (73.4 degrees F)	27 degrees C (80.6 degrees F)	29 degrees C (84.2 degrees F)	29 degrees C (84.2 degrees F)
Noncondensing relative humidity	8 to 80 %	8 to 80 %	5 to 80 %	5 to 100 %
Maximum altitude[3]	3048 m (10000 ft.)			

Acoustical noise emissions[1, 5, 6]				
Product Configuration	**L_{WAd} (Bels) [5]**		**LpAM (dB)[5] (bystander, 1 m)**	
	Operating	Idle	Operating	Idle
Single, typical I/O drawer in rack, nominal conditions, slimline door set	7.5	7.5	60	60
Single, typical I/O drawer in rack, nominal conditions, acoustical door set	6.8	6.8	53	53
Single, typical I/O drawer in rack plus bulk power unit, nominal conditions, slimline door set	7.8	7.8	62	62
Single, typical I/O drawer in rack plus bulk power unit, nominal conditions, acoustical door set	7.1	7.1	55	55

Service clearances
For a graphical representation of service clearances, see Service clearances
Seismic considerations: See Secure the rack
Data communications
Electromagnetic compatibility compliance: This server meets the following electromagnetic compatibility specifications: FCC (CFR 47, Part 15); VCCI; CISPR-22; 89/336/EEC; BSMI (A2/NZS 3548:1995); C-Tick; ICES/NMB-003; Korean EMI/EMC (MIC Notice 2000 94, Notice 2000 72); People's Republic of China Commodity Inspection Law
Safety compliance: This server is designed and certified to meet the following safety standards: UL 60950-1; CAN/CSA C22.2 No. 60950-1; EN 60950-1; IEC 60950-1 including all national differences

Note:

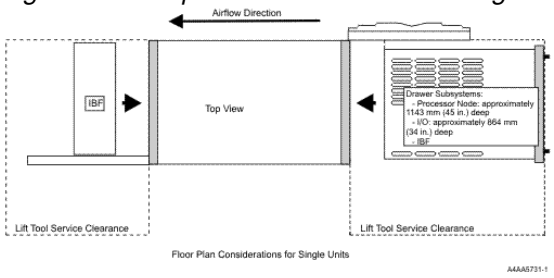
1. Noise levels are only reported for the base machine type.
2. Inrush currents occur only at initial application of power (short duration for charging capacitors). No inrush occurs during normal power off-on cycle.
3. The upper limit of the dry bulb temperature must be derated 1 degree C (1.8 degrees F) per 219 m (719 ft.) above 1295 m (4250 ft.). Maximum altitude is 3048 m (10000 ft.).
4. For specific configuration weights, see Approximate system weights by configuration
5. L_{WAd} is the upper-limit A-weighted sound level; LpAM is the mean A-weighted sound pressure measured at the 1-meter bystander postions; 1 B = 10 dB.
6. All measurements made in conformance with ISO 7779 and declared in conformance with 9296.

To effectively plan for the 57/92, information on the following topics is also provided:

- Breaker rating and cord information
- Power cord features
- Doors and covers
- Plan views
- Raised-floor requirements and preparation
- Cut and place floor panels
- Secure the rack
- Position the rack
- Install the frame tie-down kit
- Attach the rack to a concrete (nonraised) floor
- Attach the rack to a short- or long-raised floor
- Considerations for multiple system installations
- Service clearances
- Total system power consumption
- Cooling requirements
- Moving the system to the installation site
- Phase imbalance and BPR configuration
- Balancing power panel loads
- Power cord configuration
- Dual power installation
- Approximate system weights by configuration
- Weight distribution
- Unit emergency power off
- Computer room emergency power off (EPO)
- Machine holdup times

Front-service access is necessary on the 57/92 to accommodate a lift tool for the servicing of large drawers (I/O drawers). Front and rear service access is necessary to accommodate the lift tool for servicing of the optional integrated battery backup.

Figure 1. Floor plan considerations for single units



Doors and covers

Covers are an integral part of the 57/92 and are *required* for product safety and electromagnetic compatibility compliance. The following rear door options are available for the 57/92:

- Enhanced acoustical cover option

  This feature provides a low-noise option for customers or sites with stringent acoustical requirements and where a minimal system footprint is not critical. The acoustical cover option consists of a special front and rear doors which are approximately 250 mm (10 in.) deep and contain acoustical treatment that lowers the noise level of the machine by approximately 7 dB (0.7 B) compared to the slimline doors. This reduction in noise emission levels means that the noise level of a single 57/92 with slimline covers is about the same as the noise level of five model 57/92 systems with acoustical covers.
- Slimline cover option

  This feature provides a smaller-footprint and lower-cost option for customers or sites where space is more critical than acoustical noise levels. The slimline cover option consists of a front door, which is approximately 100 mm (4 in) deep, and a rear door, which is approximately 50 mm (2 in) deep. No acoustical treatment is available for this option.

Note: For declared levels of acoustical noise emissions, refer to Table 2.

Plan views

The following figure shows dimensional planning information for systems with acoustical doors.

Figure 1. Plan view for single-frame systems with slimline doors and acoustical doors

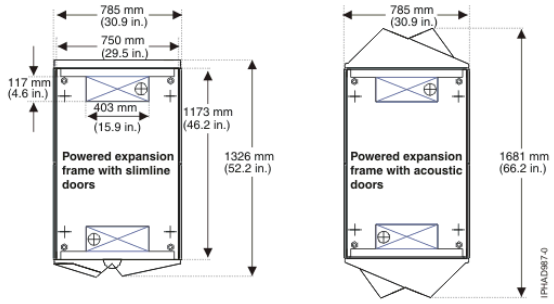
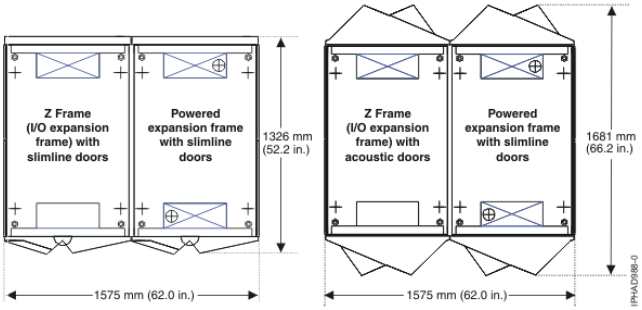
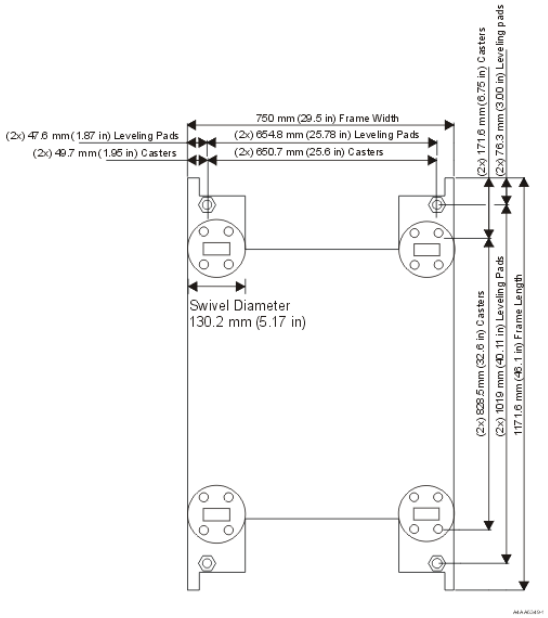


Figure 2. Plan view for double-frame systems with slimline doors and acoustical doors



Attention: When moving the rack, note the caster swivel diameters shown in the following figure. Each caster swivels in an approximate 130 mm (5.1 inch) diameter.

Figure 3. Leveling foot and frame dimensions



ASHRAE declarations

The following table and figures show the measurement reporting requirements as defined in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Thermal Guidelines for Data Processing Environments, which is available at http://tc99.ashraetcs.org .

Table 1. ASHRAE declarations

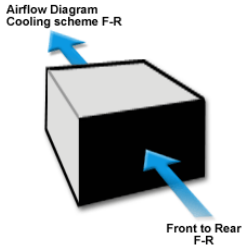
	Typical Heat Release	Airflow nominal[1]		Airflow maximum[1] at 35 degrees C (95 degrees F)		Weight	Overall system dimensions
Description	watts	cfm	m^3/hr	cfm	m^3/hr		

Minimum configuration	1500	410	697	580	985	See 57/92	See 57/92
Maximum configuration	14400	2060	2990	2560	373876	See 57/92	See 57/92
Typical configuration	6200	1010	1716	1300	2209	See 57/92	See 57/92
ASHRAE Class	3						
Minimum configuration	One I/O drawer						
Maximum configuration	12 I/O drawers						
Typical configuration	5 I/O drawers						

Note:

1. Airflow for the typical and minimum configurations do not include redundant power supply, feature code 5158.

Figure 1. Airflow figure for server mounted in a rack



Breaker rating and cord information

The following table provides the recommended circuit breaker ratings.

Table 1. Breaker rating and cord information

Voltage (Phase to phase)	200-240 V	200-240 V	380-415 V	480 V
Circuit breaker rating	60 A (60 A plug) or 80 A (100 A plug)	63 A (No plug)	30 A	32 A

Note:

1. The exact circuit breaker ratings may not be available in all countries. Where the specified circuit breaker ratings are not acceptable, use the nearest available rating. These recommendations are based on a maximum configuration running in "n-mode."
2. The supplier strongly recommends the use of a metal backbox with power cords using IEC-309 plugs.

Service clearances

The minimum service clearance for systems with slimline doors is shown in the following figure.

Figure 1. Service clearances for system with slimline doors

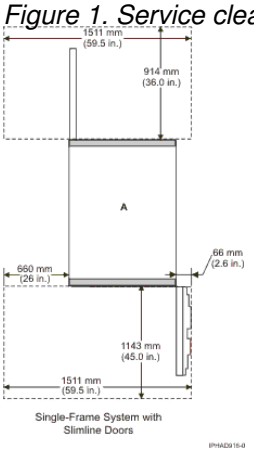


Figure 2. Service clearances for single-frame systems with slimline doors (with alternative right-side service clearance)

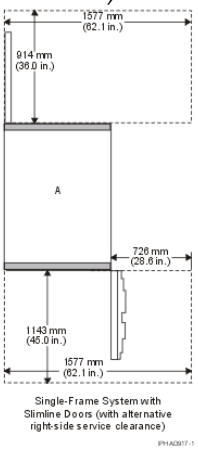
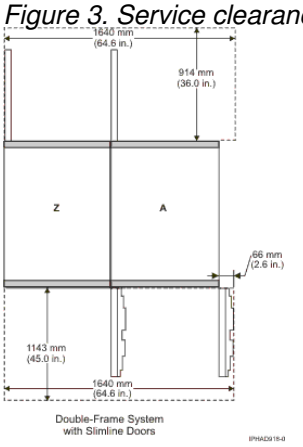


Figure 3. Service clearances for double-frame systems with slimline doors



The minimum service clearance for systems with acoustical doors is shown in the following figure.

Figure 4. Service clearances for single-frame system with acoustical doors

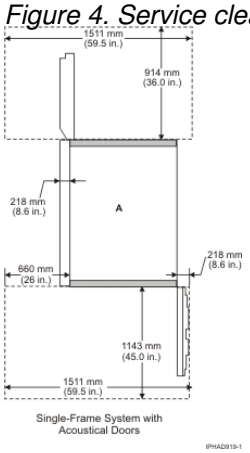


Figure 5. Service clearances for single-frame system with acoustical doors (with alternative right side service clearance)

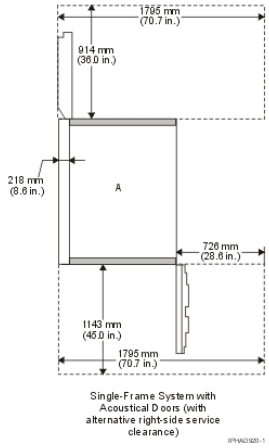
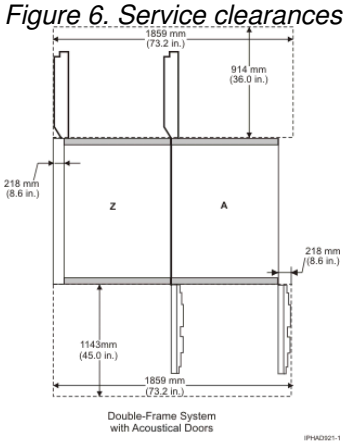


Figure 6. Service clearances for double-frame system with acoustical doors



Refer to the figure in Raised-floor requirements and preparation for service clearances shown in a raised-floor installation.

Approximate system weights by configuration

Table 1. Approximate system weight by configuration without integrated battery backup and with acoustic doors

Number of I/O drawers	System weight - kg (lb.)	A-frame weight - kg (lb.)
1	549 (1211)	549 (1211)
2	649 (1431)	649 (1431)
3	749 (1651)	749 (1651)
4	852 (1878)	852 (1878)
5	952 (2098)	952 (2098)
6	1051 (2318)	1051 (2318)
7	1173 (2586)	1173 (2586)
8	1273 (2806)	1273 (2806)
9	1680 (3704)	1254 (2765)
10	1780 (3924)	1255 (2767)
11	1880 (4144)	1256 (2769)
12	1980 (4364)	1257 (2771)

Note:

1. I/O drawers are populated based on the number of processor books in the server frame.

Table 2. Approximate system weight by configuration with integrated battery backup and with acoustic doors

Number of I/O drawers	System weight - kg (lb.)	A-frame weight - kg (lb.)
1	640 (1410)	640 (1410)
2	739 (1630)	739 (1630)
3	839 (1850)	839 (1850)
4	942 (2077)	942 (2077)
5	1042 (2297)	1042 (2297)
6	1142 (2517)	1142 (2517)
7	1658 (3655)	1143 (2519)
8	1758 (3875)	1144 (2521)
9	1861 (4102)	1148 (2530)
10	1960 (4322)	1149 (2534)
11	2060 (4542)	1149 (2534)
12	2159 (4760)	1149 (2534)

Note:

1. I/O drawers are populated based on the number of processor books in the server frame.

Table 3. Approximate system weight by configuration without integrated battery backup and with slimline doors

Number of I/O drawers	System weight - kg (lb.)	A-frame weight - kg (lb.)
1	541 (1192)	541 (1192)
2	641 (1412)	641 (1412)
3	740 (1632)	740 (1632)
4	843 (1859)	843 (1859)
5	943 (2079)	943 (2079)
6	1043 (2299)	1043 (2299)
7	1164 (2567)	1164 (2567)
8	1264 (2787)	1264 (2787)
9	1672 (3685)	1246 (2746)
10	1771 (3905)	1247 (2750)
11	1871 (4125)	1247 (2750)
12	1971 (4345)	1248 (2752)

Note:

1. I/O drawers are populated based on the number of processor books in the server frame.

Table 4. Approximate system weight by configuration with integrated battery backup and with slimline doors

Number of I/O drawers	System weight - kg (lb.)	A-frame weight - kg (lb.)
1	631 (1391)	631 (1391)
2	731 (1611)	731 (1611)
3	831 (1831)	831 (1831)
4	934 (2058)	934 (2058)
5	1033 (2278)	1033 (2278)
6	1133 (2498)	1133 (2498)
7	1649 (3636)	1134 (2500)
8	1749 (3856)	1135 (2502)
9	1842 (4083)	1139 (2511)
10	1952 (4303)	1141 (2515)
11	2052 (4523)	1141 (2515)
12	2151 (4741)	1141 (2515)

Note:

1. I/O drawers are populated based on the number of processor books in the server frame.

Power cord features

The following three-phase power cord features are available for the 57/92:

Table 1. Power cord features

Supply type	Nominal voltage range (V ac)	Voltage tolerance (V ac)	Frequency range (Hz)	
Two redundant three-phase power cords	200-480	180-509	47-63	
Feature code	Description	Voltage (V ac)	Plug	Customer receptacle (not provided)
8697	Power cord, 8 AWG, 4.3 m (14 ft.)	480	IEC309 30 A plug	IEC309 Type 430R7W
8698	Power cord, 8 AWG, 1.8 m (6 ft.)			
8688	Power cord, 6 AWG, 4.3 m (14 ft.)	200-240	IEC309 60 A plug	IEC309 Type 460R9W
8689	Power cord, 6 AWG, 1.8 m (6 ft.)			
8686	Power cord, 6 AWG, 4.3 m (14 ft.)	200-240	IEC309 100 A plug	IEC309 Type 4100R9W
8687	Power cord, 6 AWG, 1.8 m (6 ft.)			
8694[1]	Power cord, 6 AWG, 4.3 m (14 ft.)	200-240	Not provided	
8677[1]	Power cord, 8 AWG, 4.3 m (14 ft.)	380-415		

Note:

1. These power cords are shipped without a plug or receptacle. An electrician may be required to install the plug and receptacle to meet applicable country or region electrical codes.

Raised-floor requirements and preparation

A raised-floor is required for the 57/92 to ensure optimal performance and to comply with electromagnetic compatibility requirements. It will also provide optimum system cooling and cable management. Raised-floor cutouts should be protected by electrically nonconductive molding, appropriately sized, with edges treated to prevent cable damage and to prevent casters from rolling into the floor cutouts.

Cut and place floor panels

This section provides recommendations for making the necessary openings in the raised floor for installing the 57/92.

The x-y alphanumeric grid positions are used to identify relative positions of cutout floor panels that may be cut in advance.

1. Measure the panel size of the raised floor.
2. Verify the floor panel size. The floor panel size illustrated is 600 mm (23.6 in.) and 610 mm (24 in.) panels.
3. Ensure adequate floor space is available to place the frames over the floor panels exactly as shown in the figure. For front-to-back and side-to-side clearances, refer to Considerations for multiple system installations. Use the plan view, if necessary. Consider all obstructions above and below the floor.
4. Identify the panels needed, and list the total quantity of each panel required for the installation.
5. Cut the required quantity of panels. When cutting the panels, you must adjust the size of the cut for the thickness of the edge molding you are using. The dimensions shown in the figures are finished dimensions. For ease of installation, number each panel as it is cut, as shown in the following figure.

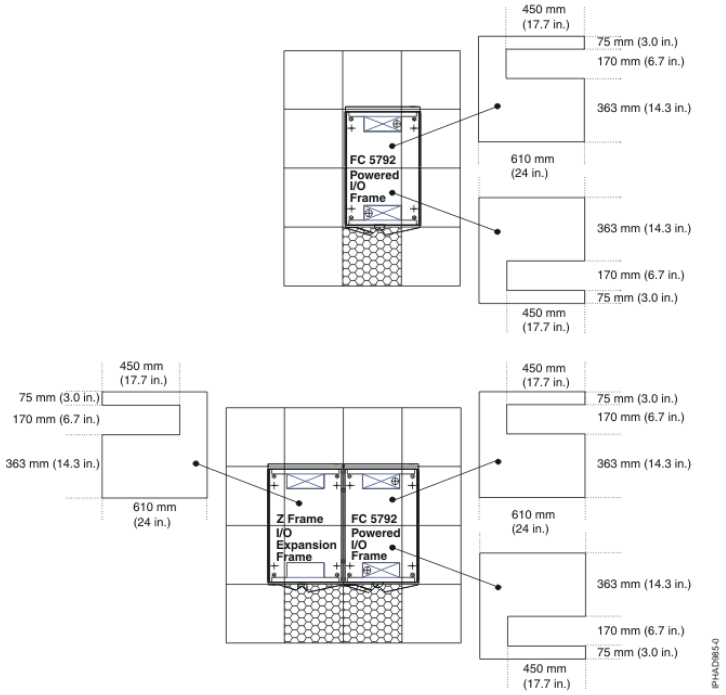
   Note: Depending on the panel type, additional panel support (pedestals) may be required to restore structural integrity of the panel. Consult the panel manufacturer to ensure that the panel can sustain a concentrated load of 476 kg (1050 lb). For multiple frame installation, it is possible that two casters will produce loads as high as 953 kg (2100 lb).

6. Use Figure 1 to install the panels in the proper positions.

   Note:

   a. This floor-tile arrangement is recommended so that the castors or leveling pads are placed on separate floor tiles to minimize the weight on a single floor tile. Furthermore, we recommend that the tiles bearing the weight (having castors or leveling pads on the tiles) should be uncut to retain the strength of the floor tile.
   b. The following figure is intended only to show relative positions and accurate dimensions of floor cutouts. The figure is not intended to be a machine template and is not drawn to scale.

Figure 1. Raised floor with 610 mm (24 in.) floor panels figure



Note: This figure shows a dual frame configuration. If your installation uses a single frame configuration, use the dimensions associated with the primary frame.

Secure the rack

Note: Securing the rack is an optional procedure. See Vibration and shock for more information.

The following can be ordered by the customer as additional rack-securing options for the 57/92.

- RPQ 8A1183 for attaching the rack-mounting plates to the concrete floor (nonraised floor)
- RPQ 8A1185 to attach the rack to a concrete floor when server is on a raised floor 228.6 mm to 330.2 mm (9 in. to 13 in. depth)
- RPQ 8A1186 to attach the rack to a concrete floor when server is on a raised floor 304.8 mm to 558.8 mm (12 in. to 22 in. depth)

Before the service representative can perform the tie-down procedure you must complete the floor preparation described in Cut and place floor panels and the procedures described in Attach the rack to a concrete (nonraised) floor or Attach the rack to a short- or long-raised floor.

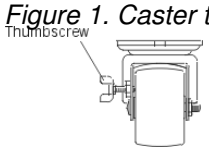
Position the rack

To unpack and position the rack, do the following:

Note: See Moving the system to the installation site before attempting to position the rack.

1. Remove all packing and tape from the rack.
2. Place the last floor covering exactly adjacent and in the front of the final installation location.
3. Position the rack according to the customer floor plan.
4. Lock each caster wheel by tightening the thumbscrew on the caster.

Figure 1. Caster thumbscrew



5. While moving the system to its final installed location and during relocation, it may be necessary to lay down floor covering, such as Lexan sheets, to prevent floor panel damage.

Install the frame tie-down kit

The following procedures describe how to install a frame tie down kit and floor tie down hardware to secure an rack to a concrete floor beneath a 228.6 mm to 330.2 mm (9 in. to 13 in. depth) or a 304.8 mm to 558.8 mm (12 in. to 22 in. depth) raised-floor environment or to a nonraised floor.

- Position the rack
- Attach the rack to a concrete (nonraised) floor
- Attach the rack to a short- or long-raised floor

Attach the rack to a concrete (nonraised) floor

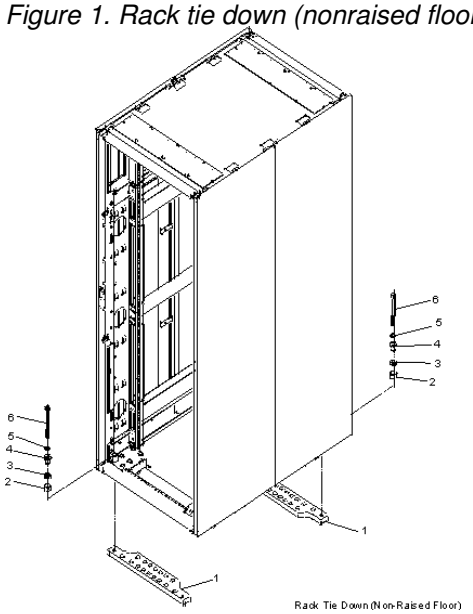
Use this procedure to attach the rack to a concrete (nonraised) floor. It is the customer's responsibility to ensure the following steps are completed before the service representative performs the tie-down procedure.

Note: The customer should obtain the service of a qualified structural engineer to determine appropriate anchoring of the mounting plates. A minimum of three anchor bolts for each mounting plate must be used to secure the plates to the concrete floor. Because some of the drilled holes may be aligned with concrete reinforcement rods below the surface of the concrete floor, additional holes must be drilled. Each mounting plate must have at least three usable holes, two that are on opposite sides and opposite ends of each other, and one hole at the center. The mounting plates should be able to withstand 1134 kg (2500 lb.) of pulling force on each end.

1. Be sure the rack is in the correct location. To ensure that the holes are in the correct location, the diagonal distance of the center of the holes should be 1211.2 mm (47.7 in.). The distance between the center holes to the center of the next holes should be 654.8 mm (25.8 in.) (the side-to-side

distance) and 1019 mm (40.1 in.) (the front-to-back distance).

Figure 1. Rack tie down (nonraised floor)

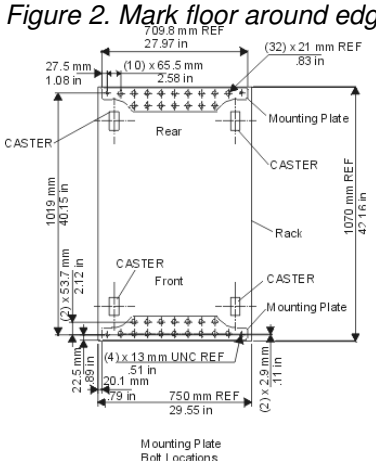


2. Place the mounting plates (item 1 in Figure 1), front and back, in the approximate mounting position under the system rack.
3. To align the mounting plates to the system rack, do the following:
    a. Place the four rack-mounting bolts (item 6 in Figure 1) through the plate assembly holes at the bottom of the rack. Install the bushings and washers (item 4 and 5 in Figure 1) to ensure bolt positioning.

    Note: The plastic bushing is intended to provide electrical insulation between the frame and the ground. When such insulation is not required, the plastic bushing does not need to be installed.

    b. Position the mounting plates (item 1 in Figure 1) under the four rack-mounting bolts (item 6 in Figure 1) so that the mounting bolts are centered directly over the tapped holes.
    c. Turn the rack-mounting bolts (item 6 in Figure 1) three or four rotations into the tapped holes.
4. Mark the floor around the edge of the mounting plates, as shown in the following figure.

Figure 2. Mark floor around edge of mounting plates



5. Remove the mounting bolts from the threaded holes.
6. Move the rack away from the mounting plates.
7. Mark the floor at the center of each hole in the mounting plate (including tapped holes).
8. Remove the mounting plates from the marked locations.

9. At the marked location of the tapped mounting holes, drill two holes approximately 19 mm (.75 in.) to allow clearance for the ends of the two rack-mounting bolts. The ends of the rack-mounting bolts may protrude past the thickness of the mounting plate. Drill one hole in each group of anchor bolt location marks as indicated on the marked floor.
10. Using at least five heavy duty concrete anchoring bolts for each mounting plate, mount the mounting plates to the concrete floor.

Attach the rack to a short- or long-raised floor

Attention: The frame tie downs are intended to secure a frame weighing less than 1429 kg (3150 lb.). These tie downs are designed to secure the frame on a raised floor installation.

Use the following to determine your next step:

1. If the rack is being attached to a short depth raised floor environment 228.6 mm to 330.2 mm (9 in. to 13 in. depth) install the Raised Floor Tie Down Kit (Part number 16R1102) described in the following table.

   Table 1. Raised Floor Tie Down Kit (Part number 16R1102)

228.6 mm to 330.2 mm (9 in. to 13 in.) Raised Floor Tie Down Kit (Part number 16R1102)			
Item	Part Number	Quantity	Description
1	44P3438	1	Wrench
2	44P2996	2	Stabilizer bar
3	44P2999	4	Turnbuckle Assembly

2. If the rack is being attached to a deep raised floor environment 304.8 mm to 558.8 mm (12 in. to 22 in. depth) install the Raised Floor Tie Down Kit (Part number 16R1103) described in the following table.
   Table 2. Raised Floor Tie Down Kit (Part number 16R1103)

304.8 mm to 558.8 mm (12 in. to 22 in.) Raised Floor Tie Down Kit (Part number 16R1103)			
Item	Part Number	Quantity	Description
1	44P3438	1	Wrench
2	44P2996	2	Stabilizer bar
3	44P3000	4	Turnbuckle Assembly

It is the customer's responsibility to ensure the following steps are completed before the service representative performs the tie-down procedure.

Note: To accommodate a floor with a depth of more than 558.8 mm (22 in.), a steel beam or a steel channel adapter for mounting the subfloor eyebolts are required. The customer must supply the floor eyebolts.

Consider the following when preparing the floor for tie-down:

- The hardware is designed to support a frame weighing no more than 1578.5 kg (3480 lb.).
- The estimated maximum concentrated load on one caster for a 1578.5 kg (3480 lb.)-system is 526.2 kg (1160 lb.). For a multiple system installation, it is possible that one floor tile will bear a total concentrated load of 1052.3 kg (2320 lb.).

To install the eyebolts, do the following:

1. Obtain the service of a qualified structural engineer to determine appropriate installation of the eyebolts.
2. Consider the following before installing the eyebolts:
    - Floor eyebolts must be securely anchored to the concrete floor.
    - For a single frame installation, four 1/2-in. diameter by 13-inch subfloor eyebolts should be secured to the subfloor.
    - The minimum height of the center of the internal diameter is 2.54 mm (1 in.) above the concrete floor surface.
    - The maximum height is 63.5 mm (2.5 in.) above the concrete floor surface. A height greater than 63.5 mm (2.5 in.) can cause excessive lateral deflection to the tie-down hardware.
    - The eyebolt's internal diameter should be 1-3/16 inch, and each eyebolt should be able to withstand 1224.7 kg (2700 lb). The customer should obtain the service of a qualified consultant or structural engineer to determine the appropriate anchoring method for these eyebolts and to ensure that the raised floor can support the floor-loading specifications.
    - To ensure that the holes are in the correct location, the diagonal distance of the center of the holes should be 1211.2 mm (47.7 in.). The distance between the center holes to the center of the next holes should be 654.8 mm (25.8 in.) (the side to side distance) and 1019 mm (40.1 in.) (the front to back distance)
3. Verify that the four eyebolts are positioned to match the dimensions is given in the following figures.

Figure 1. Eyebolt positioning for 610 mm (24 in.) floor tile layout

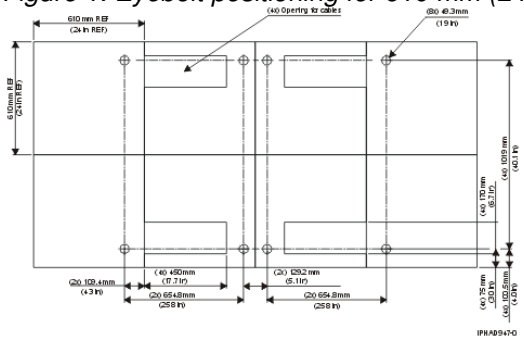


Figure 2. Eyebolt positioning for 600 mm (23.6 in.) floor tile layout

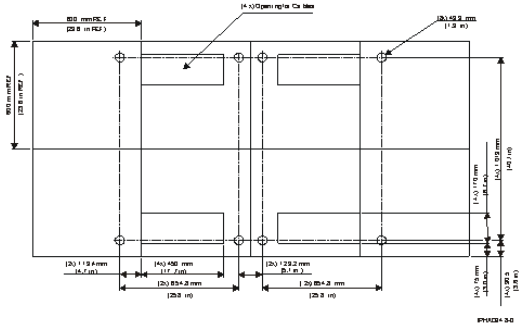
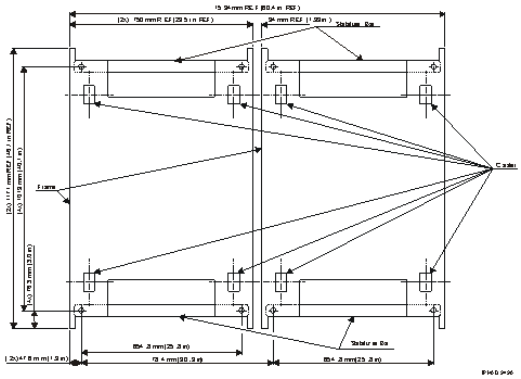


Figure 3. Stabilizer bar layout (top view)



4. Install the eyebolts to the floor.

Figure 4. Turnbuckle assembly frame tie down hardware for 228.6 mm to 330.2 mm (9 in. to 13 in.) raised floor (Part number 44P2999)

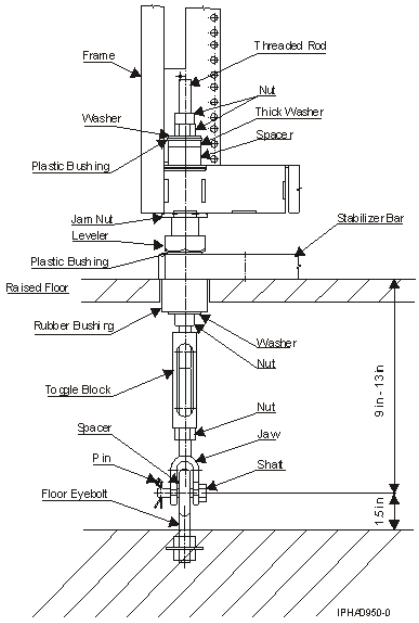


Figure 5. Turnbuckle assembly frame tie down hardware for 228.6 mm to 330.2 mm (9 in. to 13 in.) raised floor (Part number 44P2999)

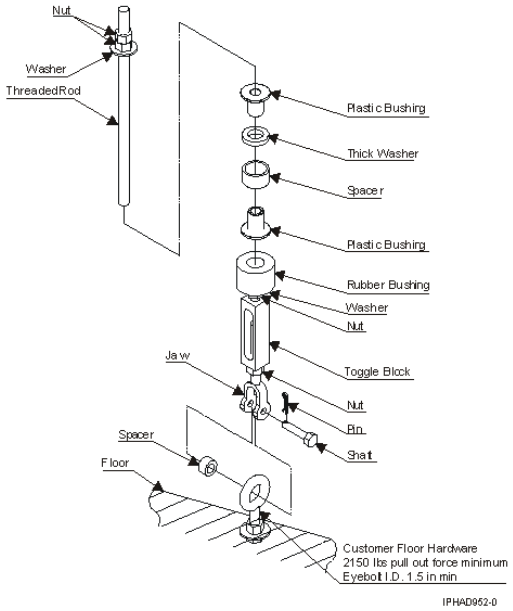


Figure 6. Turnbuckle assembly frame tie down hardware for 304.8 mm to 558.8 mm (12 in. to 22 in.) raised floor (Part number 44P3000)

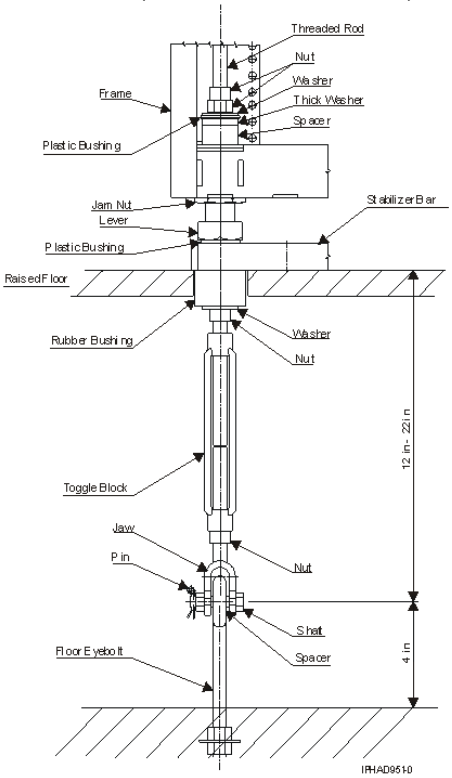
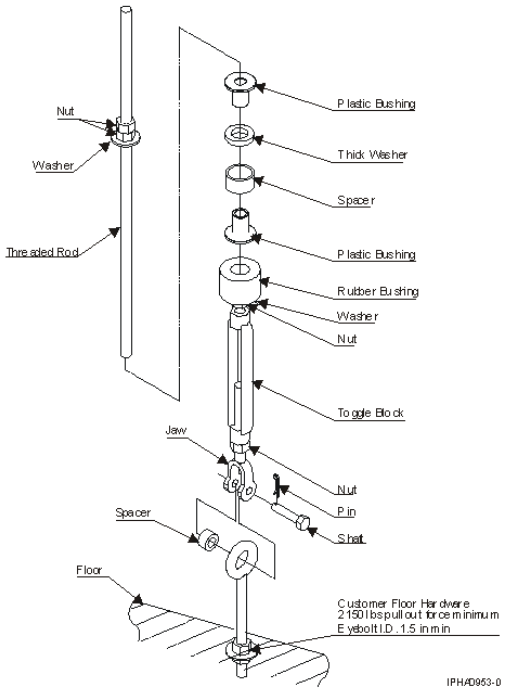


Figure 7. Turnbuckle assembly frame tie down hardware for 304.8 mm to 558.8 mm (12 in. to 22 in.) raised floor (Part number 44P3000)



Considerations for multiple system installations

When you are integrating a 57/92 with a model ESCALA PL 3250R and other products in your data center, consider the following factors:

- Minimum aisle width

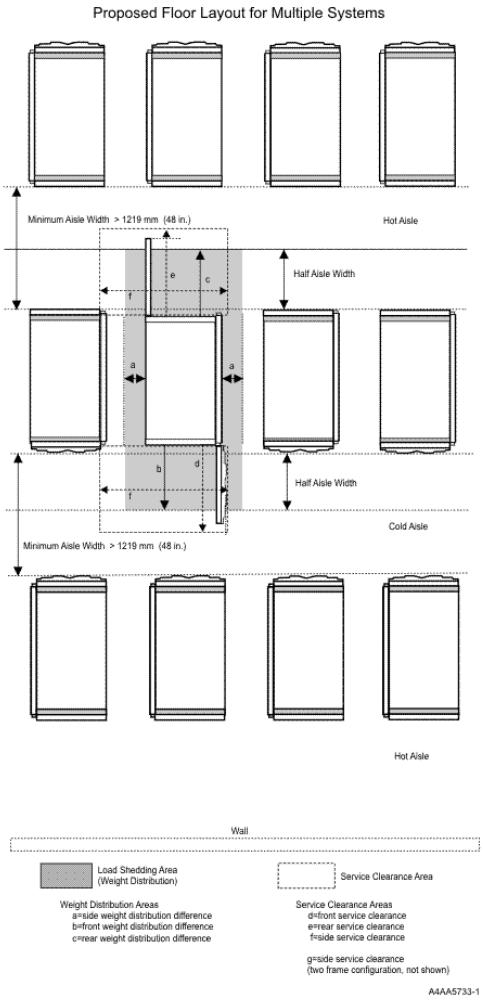
  The minimum aisle width in the front of the system is 1041 mm (41 in.) to allow room to perform service operations. The minimum aisle width in the rear of the system is 914 mm (36 in.) to allow room to perform service operations. The front and rear service clearances should be at least 1143 mm (45 in.) and 914 mm (36 in.), respectively. Service clearances are measured from the edges of the frame with frame extenders to the nearest obstacle.
- Thermal interactions

  Systems should be faced front-to-front and rear-to-rear to create "cool" and "hot" aisles to maintain effective system thermal conditions, as shown in the following figure.

  Cool aisles need to be of sufficient width to support the airflow requirements of the installed systems as indicated in Cooling requirements. The airflow per tile will be dependent on the under floor pressure and perforations in the tile. A typical under floor pressure of 0.025 in. of water will supply 300-400 cfm through a 25 percent open 0.61 mm by 0.61 m (2 ft. by 2 ft.) floor tile.
- Floor tile requirements

  In a multiframe installation, it is possible that a floor tile with cable cutouts (refer to Cut and place floor panels) will bear two concentrated static loads up to 408 kg (900 lb.) per caster or leveler. Thus, the total concentrated load can be as high as 816 kg (1800 lb.). Contact the floor tile manufacturer or consult a structural engineer to ensure that the raised floor assembly can support this load.

Figure 1. Proposed floor layout for multiple systems



Total system power consumption

The following table provides input power ranges based on system configuration.

Table 1. Total system power consumption

Configuration - number of I/O drawers and switches	AC power (kW)
1	1.5
2	2.7
3	3.7
4	5.0
5	6.2
6	7.4
7	8.5
8	9.7
9	10.9

10	12.0
11	13.2
12	14.4

Note:

1. Configurations are based in 16 disk drives per I/O drawer and 20 PCI cards per I/O drawer. To determine the typical power consumption for a specific configuration, subtract the following typical power values for each unpopulated disk drive or PCI card:
   - Each PCI card - 20 W
   - Each disk drive - 20 W

Cooling requirements

The 57/92 requires air for cooling. As shown in Figure 1, rows of 57/92 systems must face front-to-front. The use of a raised floor is recommended to provide air through perforated floor panels placed in rows between the fronts of systems (the cold aisles shown in Figure 1).

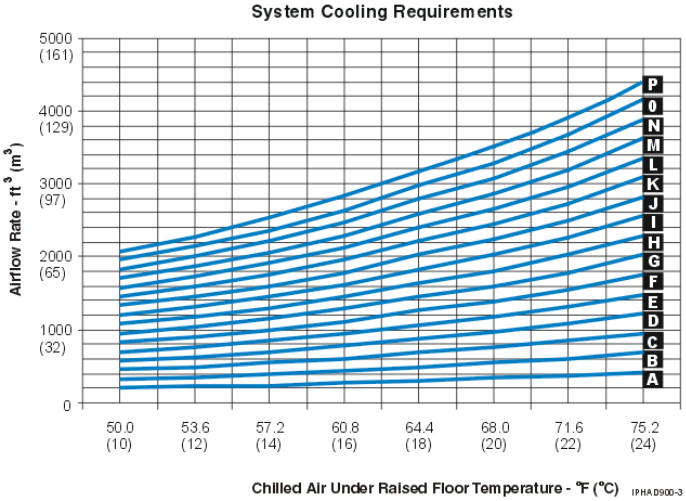
The following table provides system cooling requirements based on system configuration. The letter designations in the table correspond to the letter designations in the graph shown in Cooling requirements graph.

Table 1. Cooling system requirements based on system configuration

Configuration -number of I/O drawers and switches	AC power (kW)
1	A
2	A
3	A
4	B
5	B
6	C
7	C
8	D
9	D
10	E
11	E
12	F

Cooling requirements graph

Figure 1. Cooling requirements



Moving the system to the installation site

You should determine the path that must be taken to move the system from the delivery location to the installation site. You should verify that the height of all doorways, elevators, and so on are sufficient to allow moving the system to the installation site. You should also verify that the weight limitations of elevators, ramps, floors, floor tiles, and so on, are sufficient to allow moving the system to the installation site. If the height or weight of the system can cause a problem when the system is moved to the installation site, you should contact your local site planning or marketing representative. For more detailed information, see Access.

Delivery and subsequent transportation of the equipment

DANGERHeavy equipment personal injury or equipment damage might result if mishandled. (D006)

You must prepare your environment to accept the new product based on the installation planning information provided, with assistance from an authorized service provider. In anticipation of the equipment delivery, prepare the final installation site in advance so that professional movers or riggers can transport the equipment to the final installation site within the computer room. If for some reason, this is not possible at the time of delivery, you must make arrangements to have professional movers or riggers return to finish the transportation at a later date. Only professional movers or riggers should transport the equipment. The authorized service provider can only perform minimal frame repositioning within the computer room, as needed, to perform required service actions. You are also responsible for using professional movers or riggers when you relocate or dispose of equipment.

Phase imbalance and BPR configuration

Depending on the number of Bulk Power Regulators (BPRs) in your system, phase imbalance can occur in line currents. All systems are provided with two bulk power assemblies (BPAs), with separate power cords. Phase currents will be divided between two power cords in normal operation. The following table illustrates phase imbalance as a function of BPR configuration. For information about power consumption, see Total system power consumption.

Table 1. Phase imbalance and BPR configuration

Number of BPRs per BPA	Phase A Line Current	Phase B Line Current	Phase C Line Current
1	Power / Vline	Power / Vline	0
2	0.5 Power / Vline	0.866 Power / Vline	0.5 Power / Vline
3	0.577 Power / Vline	0.577 Power / Vline	0.577 Power / Vline

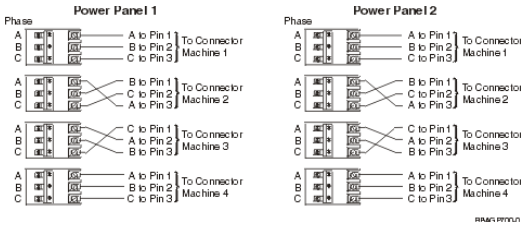
Note: Power is calculated from Total system power consumption. Vline is line-to-line nominal input voltage. Since total system power is divided between two power cords, divide the power number by two.

Balancing power panel loads

When three-phase power is used, and depending on the system configuration, the phase currents can be fully balanced or unbalanced. System configurations with three BPRs per BPA have balanced power panel loads, while configurations with only one or two have unbalanced loads. With two BPRs per BPA, two of the three phases will draw an equal amount of current, and will be, nominally, 57.8 percent of the current on the third phase. With one BPR per BPA, two of three phases will carry an equal amount of current, with no current drawn on the third phase. The following figure is an example of feeding several loads of this type from two power panels in a way that balances the load among the three phases.

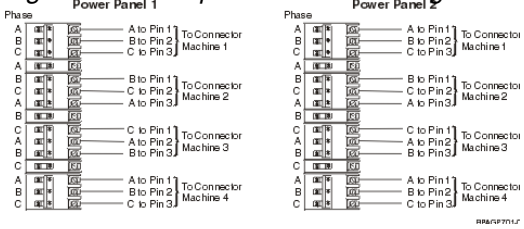
Note: Use of ground-fault-interrupt (GFI) circuit breakers is not recommended for this system because GFI circuit breakers are earth-leakage-current sensing circuit breakers and this system is a high earth-leakage-current product.

Figure 1. Power panel load balancing



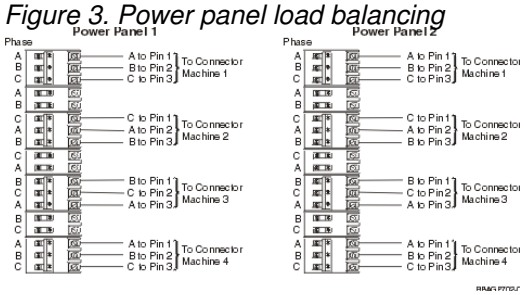
The method illustrated in the preceding figure requires that the connection from the three poles of each breaker to the three phase pins of a connector be varied. Some electricians may prefer to maintain a consistent wiring sequence from the breakers to the connectors. The following figure shows a way to balance the load without changing the wiring on the output of any breakers. The three-pole breakers are alternated with single-pole breakers, so that the three-pole breakers do not all begin on Phase A.

Figure 2. Power panel load balancing



The following figure shows another way of distributing the unbalanced load evenly. In this case, the three-pole breakers are alternated with two-pole breakers.

Figure 3. Power panel load balancing



Power cord configuration

The power cords exit the system from different points of the frame as indicated in the following figure. For raised-floor applications, it is recommended that both cords be routed to the rear of the frame and through the same floor-tile cutout.

Figure 1. Single-frame system power cord configuration

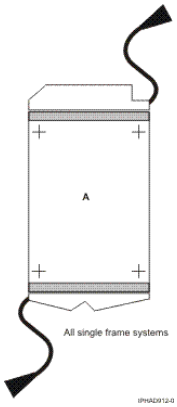
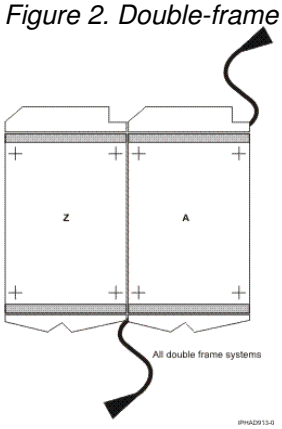


Figure 2. Double-frame system power cord configuration



Dual power installation

Some 57/92 configurations are designed with a fully redundant power system. These systems have two power cords attached to two power input ports which, in turn, power a fully redundant power distribution system within the system. To take full advantage of the redundancy/reliability that is built into the computer system, the system must be powered from two distribution panels.

Weight distribution

The following table shows the values used for calculating floor loading for the 57/92. The weights specified include covers, while the width and depth are indicated without covers.

Table 1. Floor loading for system with 8 I/O drawers and without integrated battery backup

Floor loading for system with 8 I/O drawers and without integrated battery backup							
a (sides)		b (front)		c (back)		1 frame	
mm	in.	mm	in.	mm	in.	lb./ft^2	kg/m^2

25	1.0	254	10.0	254	10.0	208.9	1020.2
25	1.0	508	20.0	508	20.0	166.3	811.8
25	1.0	762	30.0	762	30.0	139.7	681.9
254	10.0	254	10.0	254	10.0	142.1	693.6
254	10.0	508	20.0	508	20.0	114.9	ESCALA PL 1650R-L+.0
254	10.0	762	30.0	762	30.0	98.0	478.3
508	20.0	254	10.0	254	10.0	108.4	529.1
508	20.0	508	20.0	508	20.0	89.0	434.7
508	20.0	762	30.0	762	30.0	77.0	375.8
762	30.0	254	10.0	254	10.0	89.7	438.2
762	30.0	508	20.0	508	20.0	74.7	364.8
762	30.0	762	30.0	762	30.0	65.4	319.1

Note:

1. Service clearance is independent from weight distribution distance and must be at least 1143 mm (45 in.) for the front of the frame and 914 mm (36 in.) for the rear of the frame (measured from the base frame).
2. Weight distribution area should not be overlapped.
3. Floor loading weight distribution distances should not exceed 762 mm (30 in.) in any direction when measured from the base frame.

Table 2. Floor loading for systems with 6 I/O drawers and with integrated battery backup

Floor loading for systems with 6 I/O drawers and with integrated battery backup							
a (sides)		b (front)		c (back)		1 frame	
mm	in.	mm	in.	mm	in.	lb./ft^2	kg/m^2
25	1.0	254	10.0	254	10.0	189.0	922.9
25	1.0	508	20.0	508	20.0	151.0	737.1
25	1.0	762	30.0	762	30.0	127.2	621.2
254	10.0	254	10.0	254	10.0	129.4	631.7
254	10.0	508	20.0	508	20.0	105.2	513.4
254	10.0	762	30.0	762	30.0	90.1	439.7
508	20.0	254	10.0	254	10.0	99.3	485.0
508	20.0	508	20.0	508	20.0	82.1	400.8
508	20.0	762	30.0	762	30.0	71.3	348.3
762	30.0	254	10.0	254	10.0	82.7	403.9
762	30.0	508	20.0	508	20.0	69.3	338.5
762	30.0	762	30.0	762	30.0	61.0	297.8

Note:

1. Service clearance is independent from weight distribution distance and must be at least 1143 mm (45 in.) for the front of the frame and 914 mm (36 in.) for the rear of the frame (measured from the base

frame).
2. Weight distribution area should not be overlapped.
3. Floor loading weight distribution distances should not exceed 762 mm (30 in.) in any direction when measured from the base frame.

Table 3. Floor loading for system with 12 I/O drawers and without integrated battery backup

Floor loading for system with 12 I/O drawers and without integrated battery backup							
a (sides)		b (front)		c (back)		2 frames	
mm	in.	mm	in.	mm	in.	lb./ft^2	kg/m^2
25	1.0	254	10.0	254	10.0	167.5	817.7
25	1.0	508	20.0	508	20.0	134.4	656.3
25	1.0	762	30.0	762	30.0	113.8	555.7
254	10.0	254	10.0	254	10.0	135.5	661.6
254	10.0	508	20.0	508	20.0	109.9	536.4
254	10.0	762	30.0	762	30.0	93.9	458.4
508	20.0	254	10.0	254	10.0	113.4	553.9
508	20.0	508	20.0	508	20.0	92.9	453.7
508	20.0	762	30.0	762	30.0	80.1	391.3
762	30.0	254	10.0	254	10.0	98.7	482.1
762	30.0	508	20.0	508	20.0	81.6	398.5
762	30.0	762	30.0	762	30.0	71.0	346.5

Note:

1. Service clearance is independent from weight distribution distance and must be at least 1143 mm (45 in.) for the front of the frame and 914 mm (36 in.) for the rear of the frame (measured from the base frame).
2. Weight distribution area should not be overlapped.
3. Floor loading weight distribution distances should not exceed 762 mm (30 in.) in any direction when measured from the base frame.

Table 4. Floor loading for system with 12 I/O drawers and with integrated battery backup

Floor loading for system with 12 I/O drawers and with integrated battery backup							
a (sides)		b (front)		c (back)		2 frames	
mm	in.	mm	in.	mm	in.	lb./ft^2	kg/m^2
25	1.0	254	10.0	254	10.0	181.3	885.3
25	1.0	508	20.0	508	20.0	145.1	708.3

25	1.0	762	30.0	762	30.0	122.4	597.9
254	10.0	254	10.0	254	10.0	146.2	714.0
254	10.0	508	20.0	508	20.0	118.1	576.7
254	10.0	762	30.0	762	30.0	100.6	491.1
508	20.0	254	10.0	254	10.0	122.0	ESCALA PL 6450R.9
508	20.0	508	20.0	508	20.0	99.5	485.9
508	20.0	762	30.0	762	30.0	85.5	417.4
762	30.0	254	10.0	254	10.0	105.9	517.0
762	30.0	508	20.0	508	20.0	87.1	425.4
762	30.0	762	30.0	762	30.0	75.4	368.3

Note:

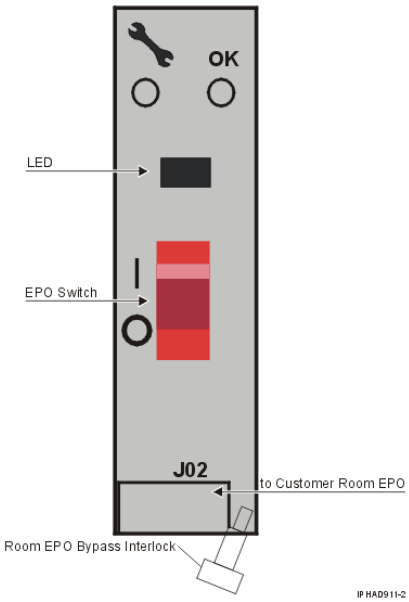
1. Service clearance is independent from weight distribution distance and must be at least 1143 mm (45 in.) for the front of the frame and 914 mm (36 in.) for the rear of the frame (measured from the base frame).
2. Weight distribution area should not be overlapped.
3. Floor loading weight distribution distances should not exceed 762 mm (30 in.) in any direction when measured from the base frame.

Floor loading for the system is illustrated in the Proposed Floor Layout for Multiple Systems in Considerations for multiple system installations.

Unit emergency power off

The server has a unit emergency power off (UEPO) switch on the front of the first frame (A Frame). Refer to the following figure, which shows a simplified UEPO panel.

Figure 1. Unit emergency power off



When the switch is reset, the utility power is confined to the system power compartment. All volatile data will be lost.

It is possible to attach the computer room emergency power off (EPO) system to the system UEPO. When this is done, resetting the computer room EPO disconnects all power from the power cords and the internal battery backup unit, if it is provided. All volatile data will be lost in this case also.

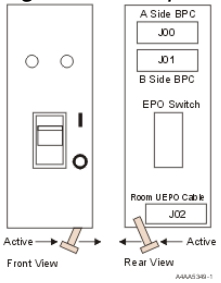
If the room EPO is not connected to the UEPO, resetting the computer room EPO removes ac power from the system. If the interlock bypass feature is used, the system remains powered for a short time based on system configuration.

Computer room emergency power off (EPO)

When the integrated battery backup is installed and the room EPO is reset, the batteries will engage and the computer will continue to run. It is possible to attach the computer room EPO system to the machine EPO. When this is done, resetting the room EPO will disconnect all power from the power cords and the internal battery backup unit. In this event all volatile data will be lost.

To incorporate the integrated battery backup into the room Emergency Power Off systems (EPO), a cable must be made to connect to the back of the system EPO panel. The following figures illustrate how this connection is made.

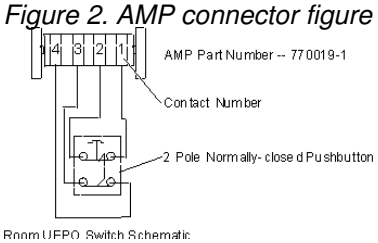
Figure 1. Computer room emergency power off



The preceding figure illustrates the back of the machine UEPO panel with the room EPO cable plugging into the machine. Notice the switch actuator. After it is moved to make the cable connection possible, the room EPO cable must be installed for the machine to power on.

In the following figure, an AMP connector 770019-1 is needed to connect to the system EPO panel. For room EPO cables using wire sizes #20 AWG to #24 AWG, use AMP pins (part number 770010-4). This connection should not exceed 5 Ohms, which is approximately 200 ft.(61 m) of #24 AWG.

Figure 2. AMP connector figure



Machine holdup times

The following tables illustrate typical machine holdup times (time versus load) for fresh and aged batteries.

- All times are listed in minutes
- Machine load is listed in total ac input power (power for both power cords combined)
- A fresh battery is defined as 2.5 years old or less.
- An aged battery is defined as 6.5 years.

Note: Battery capacity decreases gradually as the battery ages (from fresh-battery value to aged-battery value). The system diagnoses a failed-battery condition if the capacity decreases below the aged-battery value.

Table 1. Typical machine-holdup time versus load for fresh battery

Typical machine holdup time vs. load for fresh battery														
Machine load	**3.3 kW**		**6.67 kW**		**10 kW**		**13.33 kW**		**16.67 kW**		**20 kW**		**21.67 kW**	
Integrated battery backup configuration	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**
1 BPR	7.0	21.0	2.1	7.0										
2 BPR	21.0	50.0	7.0	21.0	4.0	11.0	2.1	7.0						
3 BPR	32.0	68.0	12.0	32.0	7.0	21.0	4.9	12.0	3.2	9.5	2.1	7.0	1.7	6.5
N=Non-redundant, R=Redundant														

Table 2. Typical machine-holdup time versus load for aged battery

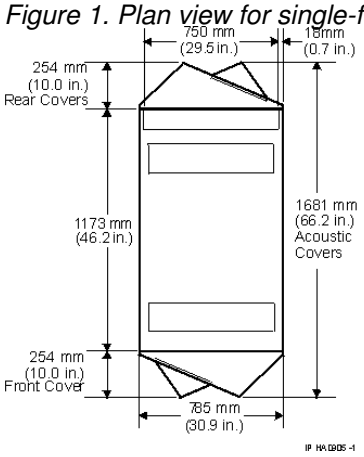
Typical machine holdup time vs. load for aged battery														
Machine load	**3.3 kW**		**6.67 kW**		**10 kW**		**13.33 kW**		**16.67 kW**		**20 kW**		**21.67 kW**	
Integrated battery backup configuration	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**

1 BPR	4.2	12.6	1.3	4.2										
2 BPR	12.6	30.0	4.2	12.6	2.4	6.6	1.3	4.2						
3 BPR	19.2	41.0	7.2	19.2	4.2	12.6	2.9	7.2	1.9	5.7	1.3	4.2	1.0	3.9
N=Non-redundant, R=Redundant														

Plan views

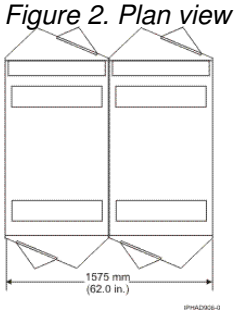
The following figure shows dimensional planning information for single-frame systems.

Figure 1. Plan view for single-frame systems with acoustical doors



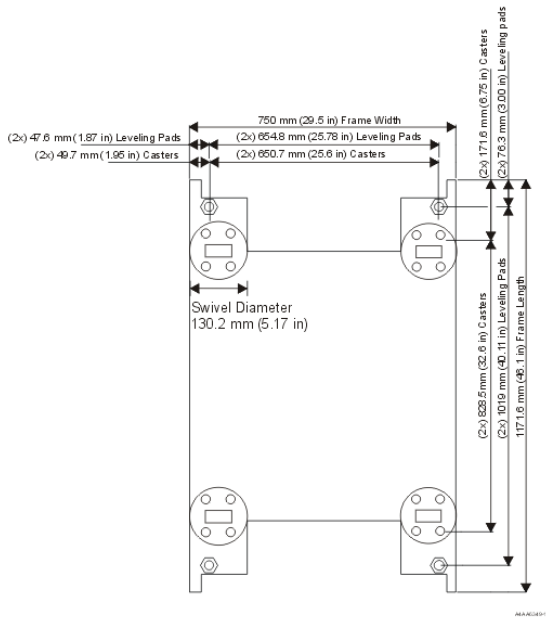
The following figure shows dimensional planning information for double-frame systems.

Figure 2. Plan view for double-frame systems with acoustical doors



Attention: When moving the rack, note the caster swivel diameters shown in the following figure. Each caster swivels in an approximate 130 mm (5.1 inch) diameter.

Figure 3. Leveling foot and frame dimensions



ASHRAE declarations

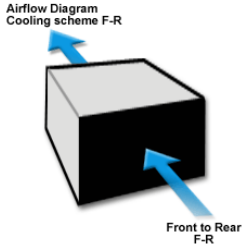
The following table and figures show the measurement reporting requirements as defined in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Thermal Guidelines for Data Processing Environments, which is available at http://tc99.ashraetcs.org

Table 1. ASHRAE declarations

	Typical Heat Release	Airflow nominal[1]		Airflow maximum[1] at 35 degrees C (95 degrees F)		Weight	Overall system dimensions
Description	kW	cfm	m^3/hr	cfm	m^3/hr		
Minimum configuration	6.1	635	1080	915	1556	See ESCALA PL 3250R, ESCALA PL 6450R	See ESCALA PL 3250R, ESCALA PL 6450R
Maximum configuration	22.7	1760	2992	2460	4182	See ESCALA PL 3250R, ESCALA PL 6450R	See ESCALA PL 3250R, ESCALA PL 6450R
Typical configuration	13.0	1310	2227	1790	3043	See ESCALA PL 3250R, ESCALA PL 6450R	See ESCALA PL 3250R, ESCALA PL 6450R
ASHRAE Class	3						
Minimum configuration	16-way with a single I/O drawer						
Maximum configuration	64-way with 4 I/O drawers						
	32-way with 4 I/O drawers						

Typical configuration	

Figure 1. Airflow figure for server mounted in a rack



Total system power consumption

The following table contains the maximum power requirements for the model ESCALA PL 3250R, ESCALA PL 6450R.

Table 1. System power requirements for 1.9 GHz, 2.1 GHz, or 2.3 GHz processor systems (ESCALA PL 6450R only) - (kW)

I/O drawers and switches	Processor books			
	1	2	3	4
0	6.1	11.1	15.2	19.2
1	7.0	12.1	16.1	20.1
2	8.0	13.0	17.0	21.0
3	8.9	13.9	17.9	21.9[1]
4	9.8	14.8	18.9	22.7[1]
5	10.7	15.7		
6	11.6	16.6		
7		17.5		
8		18.5		
9		19.4		
10		20.3		
11		21.2[1]		
12		22.1[1]		

Note:

1. 100 A power cord is required unless a 57/92 optional base rack is ordered and the noted drawers are installed in the 57/92 rack. See Planning for 57/92 base rack.

Table 2. System power requirements for 1.65 GHz processor systems (ESCALA PL 3250R, and ESCALA PL 6450R - (kW)

I/O drawers and switches	Processor books			
	1	2	3	4
0	5.1	9.3	12.5	15.7
1	6.1	10.2	13.5	16.6
2	7.0	11.2	14.4	17.6
3	7.9	12.1	15.3	
4	8.8	13.0	16.2	
5	9.8	13.9		
6	10.7	14.8		
7		15.8		
8		16.7		
9		17.6		
10		18.5		
11				
12				

Maximum configurations are based on 16 memory cards per processor book, 16 disk drives per I/O drawer. 20 PCI cards per I/O drawer and 16 switch cards per HPS switch. To determine the typical power consumption for a specific configuration, subtract the following typical power values.

Table 3. Typical power values

Component	Typical power value (W)
Disk drives	20
I/O PCI card	20
Memory book	100
Switch card	30

Breaker rating and cord information

The following table illustrates the power cord options for the three-phase Model ESCALA PL 3250R, ESCALA PL 6450R with their geographic, breaker rating, and cord information.

Table 1. Breaker rating and cord information

3-phase supply voltage (50/60 Hz)	200-240 V	200-240 V	380-415 V	480 V
Recommended customer-circuit-breaker rating (see Note below)	60 A (60-A plug)or80 A (100-A plug)	63 A (no plug)	32 A (no plug)	30 A(30A plug)
Cord information	1.8 m (6 ft.) and 4.3 m (14 ft.) 6 AWG power cord (60-A plug), or 1.8 m (6 ft.)	14 foot, 6 AWG power cord, (electrician	14 foot, 8 AWG power cord, (electrician	6 and 14 foot, 8AWG

	and 4.3 m (14 ft.) 6 AWG power cord (100-A Plug)	installed)	installed)	power cord (30A plug)
Recommended receptacle	IEC309, 60 A, type 460R9W (not provided) or IEC309, 100A, type 4100R9W (not provided)	Not specified, electrician installed	Not specified, electrician installed	IEC309, 30 A, type 430R7W (not provided)

Note:

1. The exact circuit breaker ratings may not be available in all countries. Where the specified circuit breaker ratings are not acceptable, use the nearest available rating. Use of a time delayed circuit breaker is recommended. Use of a GFI circuit breaker is not recommended.
2. When possible, use metal backbox with power cords using IEC-309 plugs.

Service clearances

The minimum service clearance for systems with slimline doors is shown in the following figures.

Figure 1. Service clearances for single frame systems with slimline doors

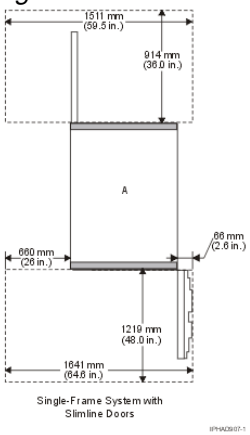


Figure 2. Service clearances for single frame systems with slimline doors (with alternative right-side service clearance)

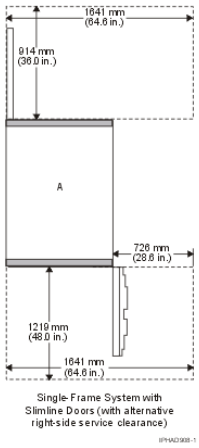
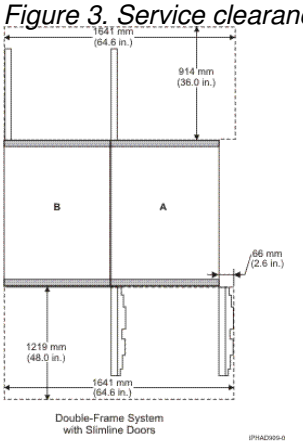


Figure 3. Service clearances for double-frame systems with slimline doors



The minimum service clearance for systems with acoustical doors is shown in the following figures.

Figure 4. Service clearances for single-frame systems with acoustical doors

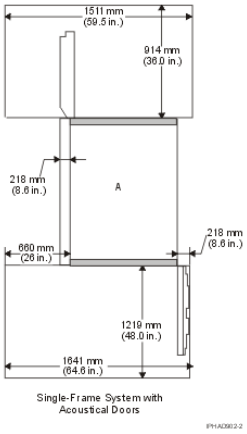


Figure 5. Service clearances for single-frame systems with acoustical doors (with alternative right-side service clearance)

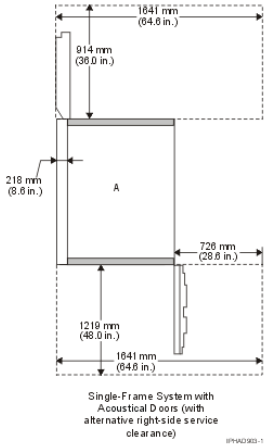
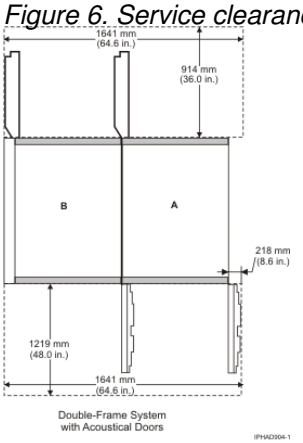


Figure 6. Service clearances for double-frame systems with acoustical doors



Refer to the figure in Raised-floor requirements and preparation for service clearances shown in a raised-floor installation.

Secure the rack

Note: Securing the rack is an optional procedure. See Vibration and shock for more information.

The following can be ordered by the customer as additional rack-securing options for the model ESCALA PL 3250R, ESCALA PL 6450R.

- RPQ 8A1183 for attaching the rack-mounting plates to the concrete floor (nonraised floor)
- RPQ 8A1185 to attach the rack to a concrete floor when on a raised floor 241 mm to 298.5 mm (9.5 in. to 11.75 in. high)
- RPQ 8A1186 to attach the rack to a concrete floor when on a raised floor 298.5 mm to 406.4 mm (11.75 in. to 16 in. high)

Before the service representative can perform the tie-down procedure you must complete the floor preparation described in Cut and place floor panels and the procedures described in Attach the rack to a concrete (nonraised) floor or Attach the rack to a short- or long-raised floor.

Approximate system weights by configuration

If the system that you order has a frame that weighs more than 1134 kg (2500 lb.) when it is shipped from the factory, a weight-distribution plate will be provided for the system. This plate is used to minimize the point loading from casters and leveling pads.

Table 1. Approximate system weights with acoustical covers and with integrated battery backup kg (lb.)[1, 2]

I/O drawers and switches with redundant integrated battery backup (non-redundant available)	Processor books			
	1	2	3	4
0	809 (1784)	1075 (2370)	1246 (2747)	1223 (2697)
1	908 (2002)	1092 (2408)	1263 (2785)	1322 (2915)
2	1125 (2480)	1309 (2887)	1368 (3017)	1427 (3147)
3	1534 (3382)	1719 (3789)		
4	1639 (3614)	1824 (4021)		
5	1744 (3846)	1929 (4253)		
6	1853 (4085)	2037 (4492)		
7		2143 (4724)		
8		2248 (4956)		
9		2353 (5188)		
10		2458 (5420)		
11				
12				

Note:

1. A primary rack with one or two processor books and either greater than four I/O drawers or greater than two I/O drawers and two integrated battery backup units requires a FC8691. A primary frame with three or four processor books and either greater than four I/O drawers or greater than two I/O drawers and two integrated battery backup units requires a FC5792.
2. The ESCALA PL 3250R with two processor books supports a maximum of eight I/O drawers.

Table 2. Approximate system weights with acoustical covers and without integrated battery backup kg (lb.)[1, 2, 3]

I/O drawers and switches without integrated battery backup	Processor books			
	1	2	3	4

0	719 (1585)	895 (1972)	975 (2150)	952 (2100)
1	818 (1803)	912 (2010)	992 (2188)	1051 (2318)
2	944 (2082)	1039 (2290)	1098 (2420)	1157 (2550)
3	1050 (2315)	1158 (2522)	1203 (2652)	1262 (2782)
4	1155 (2547)	1249 (2754)	1308 (2884)	1367 (3014)
5	1564 (3448)	1658 (3656)		
6	1669 (3680)	1764 (3888)		
7		1869 (4120)		
8		1977 (4359)		
9		2082 (4591)		
10		2188 (4823)		
11		2293 (5055)		
12		2398 (5287)		

Note:

1. A primary rack with one or two processor books and either greater than four I/O drawers or greater than two I/O drawers and two integrated battery backup units requires a FC8691. A primary frame with three or four processor books and either greater than four I/O drawers or greater than two I/O drawers and two integrated battery backup units requires a FC5792.
2. The ESCALA PL 3250R with two processor books supports a maximum of eight I/O drawers.

Table 3. Approximate system weights with slimline covers and with integrated battery backup kg (lb.)[1, 2]

I/O drawers and switches with redundant integrated battery backup (non-redundant available)	Processor books			
	1	2	3	4
0	801 (1765)	985 (2371)	1156 (2748)	1215 (2678)
1	900 (1983)	1084 (2389)	1255 (2766)	1314 (2896)
2	1116 (2461)	1301 (2868)	1360 (2998)	1419 (3128)
3	1517 (3344)	1619 (3750)		
4	1622 (3576)	1806 (3982)		
5	1727 (3808)	1911 (4214)		
6	1836 (4047)	2020 (4453)		
7		2125 (4685)		
8		2230 (4917)		
9		2335 (5149)		

10		2441 (5381)		
11				
12				

Note:

1. A primary rack with one or two processor books and either greater than four I/O drawers or greater than two I/O drawers and two integrated battery backup units requires a FC8691. A primary frame with three or four processor books and either greater than four I/O drawers or greater than two I/O drawers and two integrated battery backup units requires a FC5792.
2. The ESCALA PL 3250R with two processor books supports a maximum of eight I/O drawers.

Table 4. Approximate system weights with slimline covers and without integrated battery backup kg (lb.)[1, 2, 3]

I/O drawers and switches without integrated battery backup	Processor books			
	1	2	3	4
0	710 (1566)	886 (1953)	967 (2131)	944 (2081)
1	809 (1784)	903 (1991)	984 (2169)	1043 (2299)
2	936 (2063)	1030 (2271)	1089 (2401)	1148 (2531)
3	1041 (2295)	1135 (2503)	1194 (2633)	1253 (2763)
4	1146 (2527)	1241 (2735)	1299 (2865)	1358 (2995)
5	1547 (3410)	1641 (3618)		
6	1652 (3642)	1746 (3850)		
7		1852 (4082)		
8		1960 (4321)		
9		2065 (4553)		
10		2170 (4785)		
11		2276 (5017)		
12		2381 (5249)		

Note:

1. A primary rack with one or two processor books and either greater than four I/O drawers or greater than two I/O drawers and two integrated battery backup units requires a FC8691. A primary frame with three or four processor books and either greater than four I/O drawers or greater than two I/O drawers and two integrated battery backup units requires a FC5792.
2. The ESCALA PL 3250R with two processor books supports a maximum of eight I/O drawers.

Special considerations for model ESCALA PL 6450R cabling

The 8 m (26 ft.) RIO-G cable is a limiting factor in determining the distance between the server frame and a separately powered I/O frame. The RIO-G cables are the communication cables that connect the server to the I/O drawers. Up to 2 m (6.5 ft.) of the cable length is needed to exit the server frame. An additional 2 m (6.5 ft.) may be required to connect the I/O drawer in the I/O frame, depending on the position of the drawer in the frame. The additional cable length to go horizontally between the two frames is approximately 1 m (3.2 ft.) even with the frames touching. This leaves approximately 3 m (9.8 ft.) to use under a raised floor or to space the server frame and I/O frame further apart.

Power cord features

The following three-phase power cord features are available for the three-phase model ESCALA PL 3250R, 195/95:

Table 1. Power cord features

Supply type	Nominal voltage range (V ac)	Voltage tolerance (V ac)	Frequency range (Hz)
Two redundant three-phase power cords	200-480	180-509	47-63
Feature code	Description	Voltage (V ac)	Plug
8697	Power cord, 8 AWG, 4.3 m (14 ft.)	480	IEC309 30 A plug
8698	Power cord, 8 AWG, 1.8 m (6 ft.)	480	IEC309 30 A plug
8688	Power cord, 6 AWG, 4.3 m (14 ft.)	200-240	IEC309 60 A plug
8689	Power cord, 6 AWG, 1.8 m (6 ft.)	200-240	IEC309 60 A plug
8686	Power cord, 6 AWG, 4.3 m (14 ft.)	200-240	IEC309 100 A plug
8687	Power cord, 6 AWG, 1.8 m (6 ft.)	200-240	IEC309 100 A plug
8694[1]	Power cord, 6 AWG, 4.3 m (14 ft.)	200-240	no plug
8677[1]	Power cord, 8 AWG, 4.3 m (14 ft.)	380-415	no plug

Note:

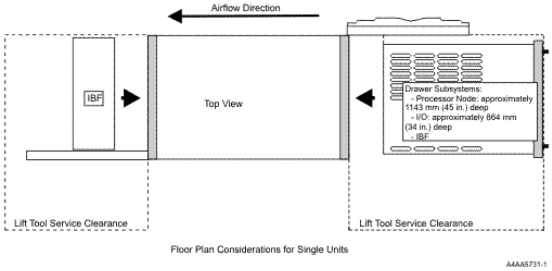
1. These power cords are shipped without a plug or receptacle. An electrician may be required to install the plug and receptacle to meet applicable country or region electrical codes.

Raised-floor requirements and preparation

A raised floor is required for the model ESCALA PL 6450R and its associated racks to ensure optimal performance and to comply with electromagnetic compatibility requirements. A raised floor is not required for the model ESCALA PL 3250R, but it is recommended for optimum system cooling and cable management. Raised-floor cutouts should be protected by electrically nonconductive molding, appropriately sized, with edges treated to prevent cable damage and to prevent casters from rolling into the floor cutouts.

Front-service access is necessary on the model ESCALA PL 3250R and ESCALA PL 6450R to accommodate a lift tool for the servicing of large drawers (the processor books and I/O drawers). Front and rear service access is necessary to accommodate the lift tool for servicing of the optional integrated battery backup.

Figure 1. Floor plan considerations for single units



Cut and place floor panels

This section provides guidelines for making the necessary openings in the raised floor for installing your server.

The x-y alphanumeric grid positions are used to identify relative positions of cutout floor panels that may be cut in advance.

1. Measure the panel size of the raised floor.
2. Verify the floor panel size. The floor panel size illustrated is 600 mm (23.6 in.) and 610 mm (24 in.) panels.
3. Ensure adequate floor space is available to place the frames over the floor panels exactly as shown in the figure. For front-to-back and side-to-side clearances, refer to Considerations for multiple system installations. Use the plan view, if necessary. Consider all obstructions above and below the floor.
4. Identify the panels needed, and list the total quantity of each panel required for the installation.
5. Cut the required quantity of panels. When cutting the panels, you must adjust the size of the cut for the thickness of the edge molding you are using. The dimensions shown in the figures are finished dimensions. For ease of installation, number each panel as it is cut, as shown in the following figure.

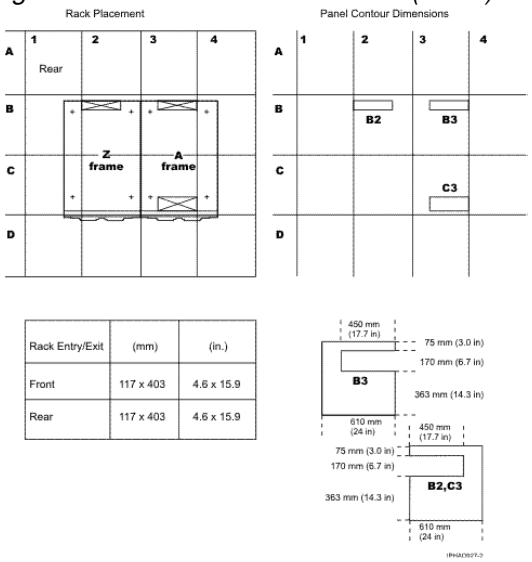
   Note: Depending on the panel type, additional panel support (pedestals) may be required to restore structural integrity of the panel. Consult the panel manufacturer to ensure that the panel can sustain a concentrated load of 476 kg (1050 lb). For multiple frame installation, it is possible that two casters will produce loads as high as 953 kg (2100 lb).

6. Use Figure 1 to install the panels in the proper positions.

   Note:

a. This floor-tile arrangement is recommended so that the castors or leveling pads are placed on separate floor tiles to minimize the weight on a single floor tile. Furthermore, we recommend that tiles bearing the weight (having castors or leveling pads on the tiles) be uncut to retain the strength of the floor tile.
b. The following figure is intended only to show relative positions and accurate dimensions of floor cutouts. The figure is not intended to be a machine template and is not drawn to scale.

Figure 1. Raised floor with 610 mm (24 in.) floor panels figure



Rack Entry/Exit	(mm)	(in.)
Front	117 x 403	4.6 x 15.9
Rear	117 x 403	4.6 x 15.9

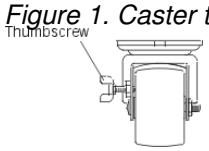
Position the rack

To unpack and position the rack, do the following:

Note: Before attempting to position the rack, see Moving the system to the installation site.

1. Remove all packing and tape from the rack.
2. Place the last floor covering exactly adjacent and in the front of the final installation location.
3. Position the rack according to the customer floor plan.
4. Lock each caster wheel by tightening the thumbscrew on the caster.

Figure 1. Caster thumbscrew



5. While moving the system to its final installed location and during relocation, it may be necessary to lay down floor covering, such as Lexan sheets, to prevent floor panel damage.

Install the frame tie-down kit

The following procedures describe how to install a frame tie down kit and floor tie down hardware to secure a rack to a concrete floor beneath a 228.6 mm to 330.2 mm (9 in. to 13 in. depth) or a 304.8 mm to 558.8 mm (12 in. to 22 in. depth) raised-floor environment or to a nonraised floor.

- Position the rack
- Attach the rack to a concrete (nonraised) floor
- Attach the rack to a short- or long-raised floor

Attach the rack to a concrete (nonraised) floor

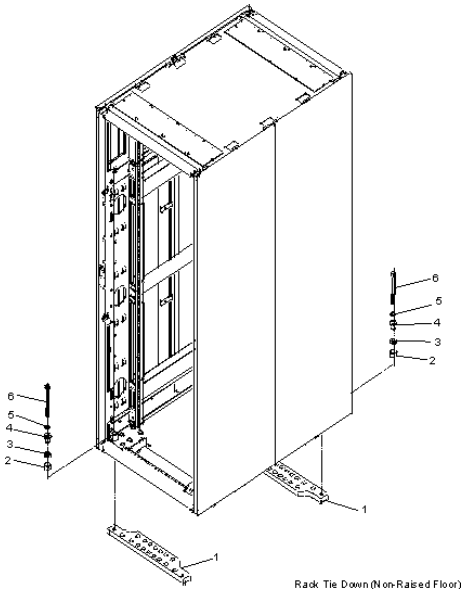
Use this procedure to attach the rack to a concrete (nonraised) floor.

Attention: It is the customer's responsibility to ensure the following steps are completed before the service representative performs the tie-down procedure.

Note: The customer should obtain the service of a qualified structural engineer to determine appropriate anchoring of the mounting plates. A minimum of five anchor bolts for each mounting plate must be used to secure the plates to the concrete floor. Because some of the drilled holes may be aligned with concrete reinforcement rods below the surface of the concrete floor, additional holes must be drilled. Each mounting plate must have at least five usable holes, two that are on the right-hand sides and the other two are on opposite ends, and one hole at the center. The mounting plates should be able to withstand 1134 kg (2500 lb.) pulling force on each end.

1. Be sure the rack is in the correct location. To ensure that the holes are in the correct location, the diagonal distance of the center of the holes should be 1211.2 mm (47.7 in.). The distance between the center holes to the center of the next holes should be 654.8 mm (25.8 in.) (the side-to-side distance) and 1019 mm (40.1 in.) (the front-to-back distance).

   Figure 1. Rack tie down (nonraised floor)

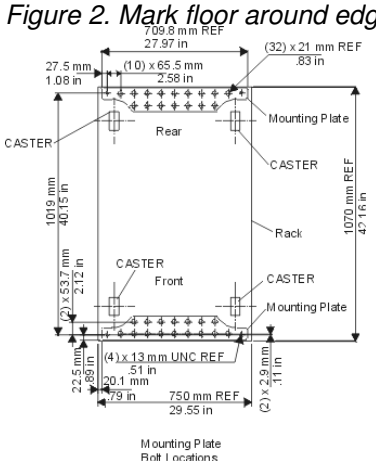


2. Place the mounting plates (item 1 in Figure 1), front and rear, in the approximate mounting position under the system rack.
3. To align the mounting plates to the system rack, do the following:
    a. Place the four rack-mounting bolts (item 6 in Figure 1) through the plate assembly holes at the bottom of the rack. Install the bushings and washers (item 4 and 5 in Figure 1) to ensure bolt positioning.

    Note: The plastic bushing is intended to provide electrical insulation between the frame and the ground. When such insulation is not required, the plastic bushing does not need to be installed.

    b. Position the mounting plates (item 1 in Figure 1) under the four rack-mounting bolts (item 6 in Figure 1) so that the mounting bolts are centered directly over the tapped holes.
    c. Turn the rack-mounting bolts (item 6 in Figure 1) three or four rotations into the tapped holes.
4. Mark the floor around the edge of the mounting plates, as shown in the following figure:

Figure 2. Mark floor around edge of mounting plates



5. Remove the mounting bolts from the threaded holes.
6. Move the rack away from the mounting plates.
7. Mark the floor at the center of each hole in the mounting plate (including tapped holes).
8. Remove the mounting plates from the marked locations.
9. At the marked location of the tapped mounting holes, drill two holes approximately 19 mm (.75 in.) to allow clearance for the ends of the two rack-mounting bolts. The ends of the rack-mounting bolts may protrude past the thickness of the mounting plate. Drill one hole in each group of anchor bolt location marks as indicated on the marked floor.
10. Using at least five heavy duty concrete anchoring bolts for each mounting plate, mount the mounting plates to the concrete floor.

Attach the rack to a short- or long-raised floor

Attention: The frame tie downs are intended to secure a frame weighing less than 1429 kg (3150 lb.). These tie downs are designed to secure the frame on a raised floor installation.

Use the following to determine your next step:

1. If the rack is being attached to a short depth raised floor environment 228.6 mm to 330.2 mm (9 in. to 13 in. depth) install the Raised Floor Tie Down Kit (Part number 16R1102) described in the following table.

   Table 1. Raised Floor Tie Down Kit (Part number 16R1102)

9" - 13" Raised Floor Tie Down Kit (Part number 16R1102)			
Item	Part Number	Quantity	Description
1	44P3438	1	Wrench
2	44P2996	2	Stabilizer bar
3	44P2999	4	Turnbuckle Assembly

2. If the rack is being attached to a deep raised floor environment 304.8 mm to 558.8 mm (12 in. to 22 in. depth) install the Raised Floor Tie Down Kit (Part number 16R1103) described in the following table.
   Table 2. Raised Floor Tie Down Kit (Part number 16R1103)

Raised Floor Tie Down Kit (Part number 16R1103)			
Item	Part Number	Quantity	Description
1	44P3438	1	Wrench
2	44P2996	2	Stabilizer bar
3	44P3000	4	Turnbuckle Assembly

It is the customer's responsibility to ensure the following steps are completed before the service representative performs the tie-down procedure.

Note: To accommodate a floor with a depth of more than 558.8 mm (22 in.), a steel beam or a steel channel adapter for mounting the subfloor eyebolts are required. The customer must supply the floor eyebolts.

Consider the following when preparing the floor for tie-down:

- The hardware is designed to support a frame weighing no more than 1429 kg (3150 lb.).
- The estimated maximum concentrated load on one caster for a 1429 kg (3150 lb.)-system is 476.3 kg (1050 lb.). For a multiple system installation, it is possible that one floor tile will bear a total concentrated load of 952.5 kg (2100 lb.).

To install the eyebolts, do the following:

1. Obtain the service of a qualified structural engineer to determine appropriate installation of the eyebolts.
2. Consider the following before installing the eyebolts:
    - Floor eyebolts must be securely anchored to the concrete floor.
    - For a single frame installation, four 1/2-in. diameter by 13-inch subfloor eyebolts should be secured to the subfloor.
    - The minimum height of the center of the internal diameter is 2.54 mm (1 in.) above the concrete floor surface.
    - The maximum is height 63.5 mm (2.5 in.) above the concrete floor surface. Higher than 2.5 inches can cause excessive lateral deflection to the tie-down hardware.
    - The eyebolt's internal diameter should be 1-3/16 inch, and each eyebolt should be able to withstand 1224.7 kg (2700 lb). The customer should obtain the service of a qualified consultant or structural engineer to determine the appropriate anchoring method for these eyebolts and to ensure that the raised floor and the building can support the floor-loading specifications.
    - To ensure that the holes are in the correct location, the diagonal distance of the center of the holes should be 1211.2 mm (47.7 in.). The distance between the center holes to the center of the next holes should be 654.8 mm (25.8 in.) (the side to side distance) and 1019 mm (40.1 in.) (the front to back distance)
3. Verify that the four eyebolts are positioned to match the dimensions is given in the following figures.

Figure 1. Eyebolt positioning for 610 mm (24 in.) floor tile layout

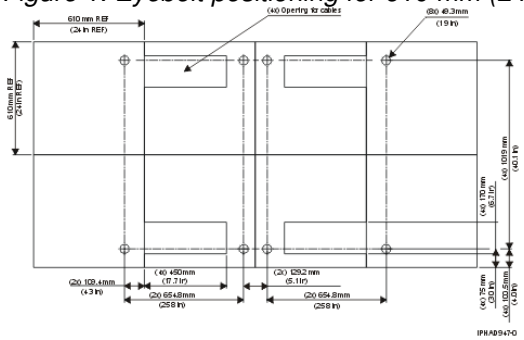


Figure 2. Eyebolt positioning for 600 mm (23.6 in.) floor tile layout

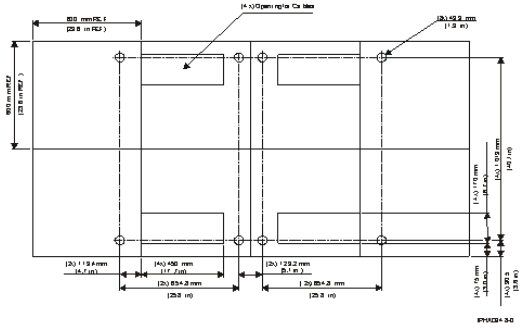
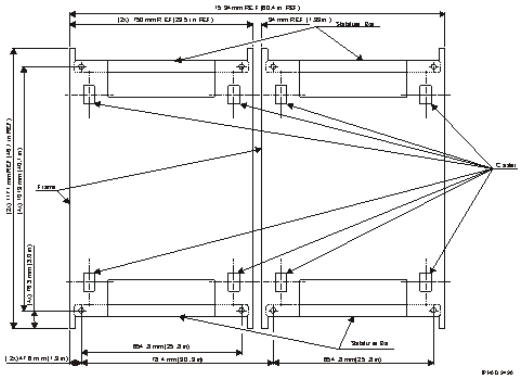


Figure 3. Stabilizer bar layout (top view)



4. Install the eyebolts to the floor. The service representative can now install the frame.

Figure 4. Turnbuckle assembly frame tie down hardware for 228.6 mm to 330.2 mm (9 in. to 13 in.) raised floor (Part number 44P2999)

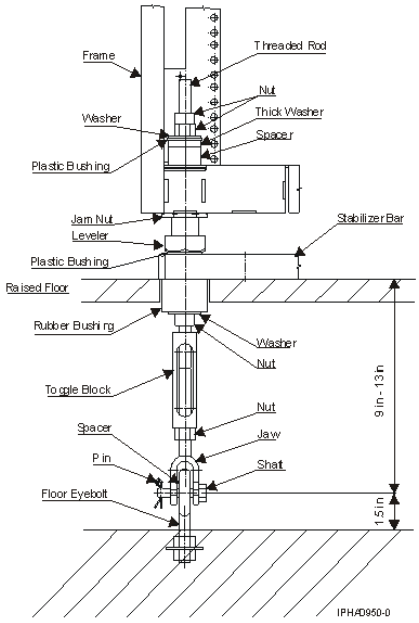


Figure 5. Turnbuckle assembly frame tie down hardware for 228.6 mm to 330.2 mm (9 in. to 13 in.) raised floor (Part number 44P2999)

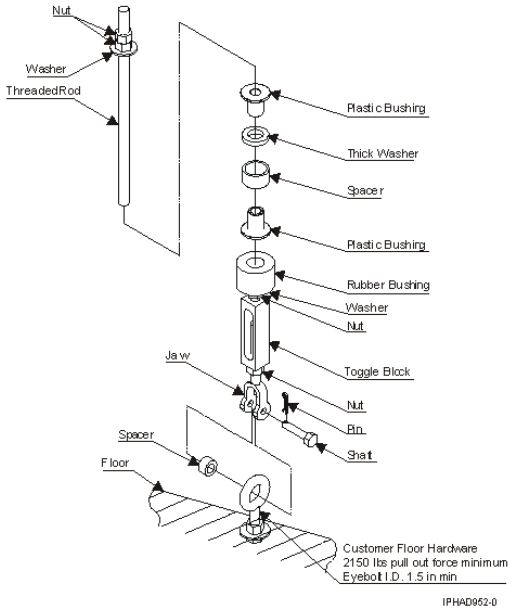


Figure 6. Turnbuckle assembly frame tie down hardware for 304.8 mm to 558.8 mm (12 in. to 22 in.) raised floor (Part number 44P3000)

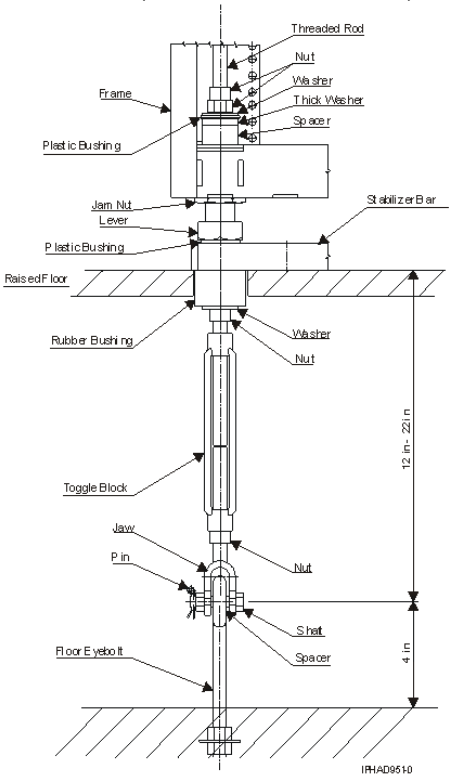
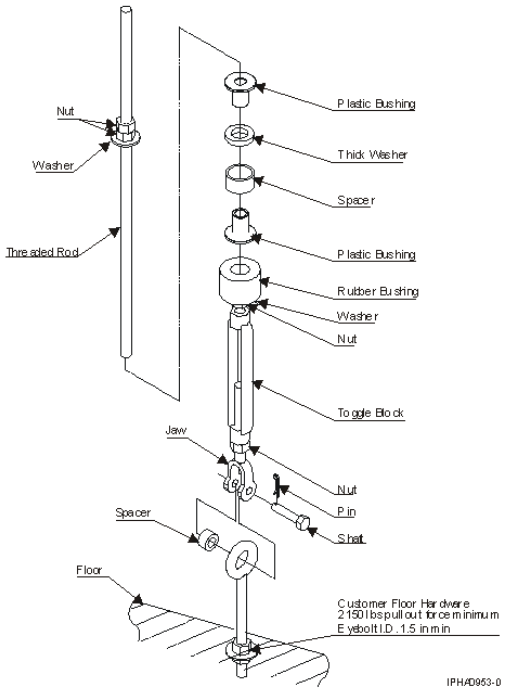


Figure 7. Turnbuckle assembly frame tie down hardware for 304.8 mm to 558.8 mm (12 in. to 22 in.) raised floor (Part number 44P3000)



Considerations for multiple system installations

In a multi-frame installation, it is possible that a floor tile with cable cutouts (refer to Cut and place floor panels) will bear two concentrated static loads up to 476 kg (1050 lb.) per caster and leveler. Thus, the total concentrated load can be as high as 953 kg (2100 lb.). Contact the floor tile manufacturer or consult a structural engineer to ensure that the raised floor assembly can support this load.

When you are integrating a model ESCALA PL 3250R, ESCALA PL 6450R into an existing multiple-system environment, or when adding additional systems to an installed ESCALA PL 3250R, ESCALA PL 6450R, consider the following factors:

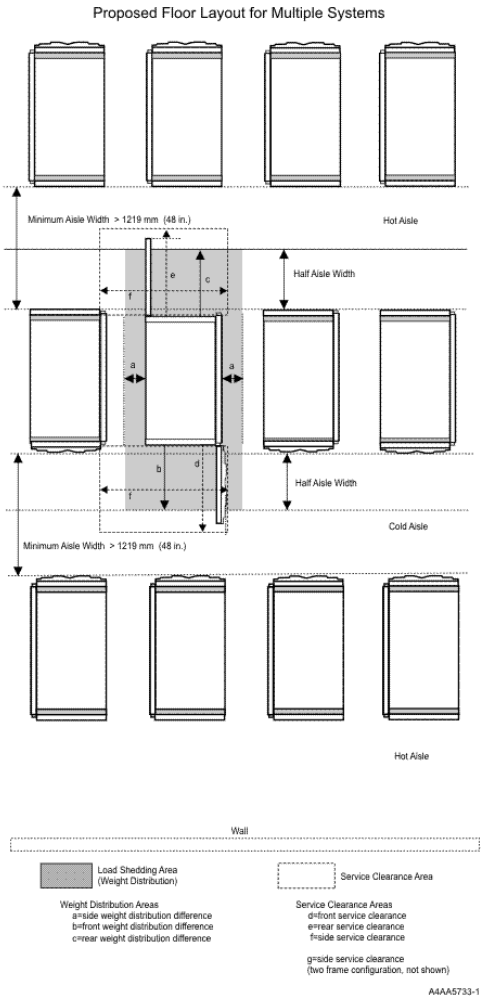
- Minimum aisle width

  For multiple rows of systems containing one or more model ESCALA PL 3250R, or ESCALA PL 6450R, the minimum aisle width in the front of the system is 1219 mm (48 in.) and 914 mm (36 in.) in the rear of the system to allow room to perform service operations. The front and rear service clearances should be at least 1219 mm (48 in.) and 914 mm (36 in.), respectively. Service clearances are measured from the edges of the frame (with doors open) to the nearest obstacle.
- Thermal interactions

  Systems should be faced front-to-front and rear-to-rear to create "cool" and "hot" aisles to maintain effective system thermal conditions, as shown in the following figure.

  Cool aisles need to be of sufficient width to support the airflow requirements of the installed systems as indicated in Cooling requirements. The airflow per tile will be dependent on the underfloor pressure and perforations in the tile. A typical underfloor pressure of 0.025 in. of water will supply 300-400 cfm through a 25 percent open 2 ft. by 2 ft. floor tile.

Figure 1. Proposed floor layout for multiple systems



Cooling requirements

The model ESCALA PL 3250R, ESCALA PL 6450R require air for cooling. As shown in Figure 1, rows of model ESCALA PL 3250R, ESCALA PL 6450R systems must face front-to-front. The use of a raised floor is recommended to provide air through perforated floor panels placed in rows between the fronts of systems (the cold aisles shown in Figure 1).

The following table provides system cooling requirements based on system configuration. The letter designations in the table correspond to the letter designations in the graph shown in Cooling requirements graph.

Table 1. System cooling requirements for 1.9 GHz, 2.1 GHz, or 2.3 GHz processor systems (ESCALA PL 6450R only)

Number of I/O drawers	Number of processor books			
	1	2	3	4
0	B	D	F	H
1	C	E	F	H
2	C	E	G	H

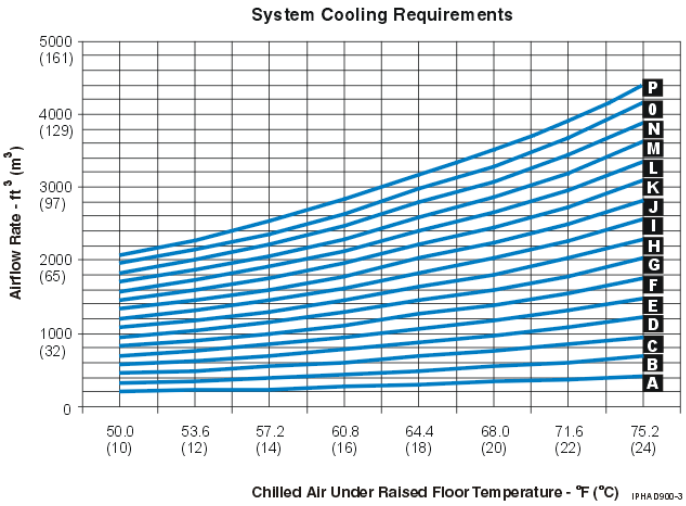
3	C	E	G	I
4	D	F	G	I
5	D	F		
6	E	G		
7		G		
8		G		
9		H		
10		H		
11		H		
12		I		

Table 2. System cooling requirements for 1.65 GHz processor systems (ESCALA PL 3250R, and ESCALA PL 6450R)

Number of I/O drawers	**Number of processor books**			
	1	**2**	**3**	**4**
0	B	D	E	F
1	B	D	E	G
2	C	D	F	G
3	C	E	F	G
4	C	E	F	H
5	D	E		
6	D	F		
7		F		
8		G		
9		G		
10		G		
11		H		
12		H		

Cooling requirements graph

Figure 1. Cooling requirements graph



Moving the system to the installation site

Prior to moving the system to the installation site, you should:

- Determine the path that must be taken to move the system from the delivery location to the installation site.
- You should verify that the height of all doorways, elevators, and so on are sufficient to allow moving the system to the installation site.
- Verify that the weight limitations of elevators, ramps, floors, floor tiles, and so on are sufficient to allow moving the system to the installation site. If the height or weight of the system can cause a problem when the system is moved to the installation site, you should contact your local site planning, marketing, or sales representative.

For more detailed information, see Access.

If needed, a height reduction feature (0126 for and models, and 7960 for servers and servers) may be ordered. This feature allows for the system frame (both , models,servers, and servers) and the expansion frame (servers and servers only) to be shipped in two pieces and assembled at your location. With this feature, the top section of the system frame (including the power subsystem) is removed. The height of the system frame with the upper section removed is reduced by .35 m (14 in.) to approximately 1.64 m (65 in.). For planning purposes, the weight of the rack top frame and components are shown in the following table.

Table 1. Weight of rack top frame and components

Item	Weight[1]
Rack top frame and crate	210.5 kg (463 lb.)
Rack top frame with power (4 bulk power regulators, 4 bulk power distributors, and 2 bulk power assemblies)[2]	149.5 kg (329 lb.)
Bulk power regulator	13.6 kg (30 lb.)
Bulk power distributor	6.4 kg (14 lb.)
Bulk power assembly	18 kg (40 lb.)
Rack top frame without rails	30 kg (66 lb.)
Rack top frame with rails	33 kg (73 lb.)
Side cover[3]	22.7 kg (50 lb.)
Front acoustic door	17.9 kg (39.4 lb.)
Rear acoustic door	17.2 kg (37.9 lb.)

Front slimline door	17.2 kg (38 lb.)
Rear slimline door	9.1 kg (20 lb.)

Note:

1. Maximum total weight can be up to 255 kg (ESCALA PL 1650R-L+ lb.)
2. Can be shipped with up to six bulk power regulators and six bulk power distributors.
3. Each side cover consists of two panels.

Delivery and subsequent transportation of the equipment

DANGERHeavy equipment personal injury or equipment damage might result if mishandled. (D006)

You must prepare your environment to accept the new product based on the installation planning information provided, with assistance from an authorized service provider. In anticipation of the equipment delivery, prepare the final installation site in advance so that professional movers or riggers can transport the equipment to the final installation site within the computer room. If for some reason, this is not possible at the time of delivery, you must make arrangements to have professional movers or riggers return to finish the transportation at a later date. Only professional movers or riggers should transport the equipment. The authorized service provider can only perform minimal frame repositioning within the computer room, as needed, to perform required service actions. You are also responsible for using professional movers or riggers when you relocate or dispose of equipment.

Phase imbalance and BPR configuration

Depending on the number of Bulk Power Regulators (BPRs) in your system, phase imbalance can occur in line currents. All systems are provided with two bulk power assemblies (BPAs), with separate power cords. Phase currents will be divided between two power cords in normal operation. The following table illustrates phase imbalance as a function of BPR configuration. For information about power consumption, see Total system power consumption.

Table 1. Phase imbalance and BPR configuration

Number of BPRs per BPA	Phase A Line Current	Phase B Line Current	Phase C Line Current
1	Power / Vline	Power / Vline	0
2	0.5 Power / Vline	0.866 Power / Vline	0.5 Power / Vline
3	0.577 Power / Vline	0.577 Power / Vline	0.577 Power / Vline

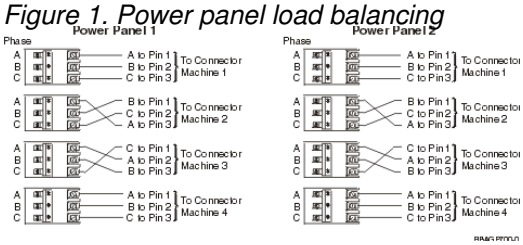
Note: Power is calculated from Total system power consumption. Vline is line-to-line nominal input voltage. Since total system power is divided between two power cords, divide the power number by two.

Balancing power panel loads

When three-phase power is used, and depending on the system configuration, the phase currents can be fully balanced or unbalanced. System configurations with three BPRs per BPA have balanced power panel loads, while configurations with only one or two have unbalanced loads. With two BPRs per BPA, two of the three phases will draw an equal amount of current, and will be, nominally, 57.8 percent of the current on the third phase. With one BPR per BPA, two of three phases will carry an equal amount of current, with no current drawn on the third phase. The following figure is an example of feeding several loads of this type from two power panels in a way that balances the load among the three phases.

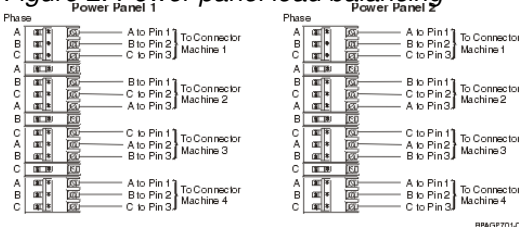
Note: Use of ground-fault-interrupt (GFI) circuit breakers is not recommended for this system because GFI circuit breakers are earth-leakage-current sensing circuit breakers and this system is a high earth-leakage-current product.

Figure 1. Power panel load balancing



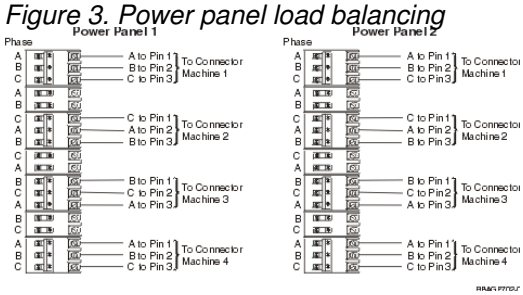
The method illustrated in the preceding figure requires that the connection from the three poles of each breaker to the three phase pins of a connector be varied. Some electricians may prefer to maintain a consistent wiring sequence from the breakers to the connectors. The following figure shows a way to balance the load without changing the wiring on the output of any breakers. The three-pole breakers are alternated with single-pole breakers, so that the three-pole breakers do not all begin on Phase A.

Figure 2. Power panel load balancing



The following figure shows another way of distributing the unbalanced load evenly. In this case, the three-pole breakers are alternated with two-pole breakers.

Figure 3. Power panel load balancing



Power cord configurations

The power cords exit the system from different points of the frame as indicated in the following figure. For raised-floor applications, it is recommended that both cords be routed to the rear of the frame and through the same floor-tile cutout. For more information about raised-floor applications, refer to Cut and place floor panels and Figure 1.

Figure 1. Single-frame system power cord configuration

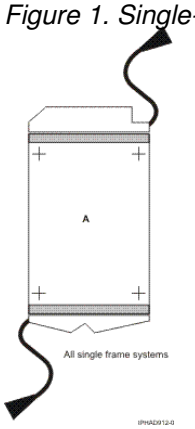
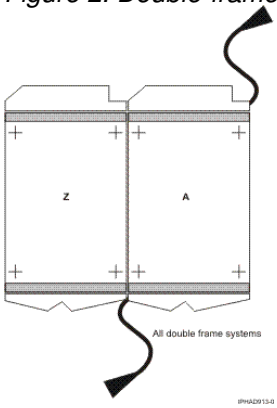


Figure 2. Double-frame system power cord configuration



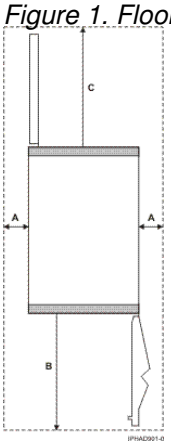
Dual power installation

The model ESCALA PL 3250R, ESCALA PL 6450R configurations are designed with a fully redundant power system. These systems have two power cords attached to two power input ports which, in turn, power a fully redundant power distribution system within the system. To take full advantage of the redundancy and reliability that is built into the computer system, the system must be powered from two distribution panels. The possible power installation configurations are described in Dual power installations.

Weight distribution

The following figure shows the floor loading dimensions for the model ESCALA PL 3250R, 9406-595, and ESCALA PL 6450R. Use this figure in conjunction with the floor loading tables to determine the floor loading for various configurations.

Figure 1. Floor loading dimensions



The following table shows the values used for calculating floor loading for the model ESCALA PL 3250R, 9406-595, and ESCALA PL 6450R. Weights include covers, width and depth are indicated without covers.

Table 1. Floor loading for system with 2 processor books, 12 drawers, and without integrated battery backup

Floor loading for system with 2 processor books, 12 drawers, and without integrated battery backup							
a (sides)		b (front)		c (back)		2 frames	
mm	in.	mm	in.	mm	in.	lb./ft^2	kg/m^2
25	1.0	254	10.0	254	10.0	198.6	969.6
25	1.0	508	20.0	508	20.0	158.3	772.9
25	1.0	762	30.0	762	30.0	133.2	650.4
254	10.0	254	10.0	254	10.0	159.8	780.3
254	10.0	508	20.0	508	20.0	128.5	627.6
254	10.0	762	30.0	762	30.0	109.0	532.4
508	20.0	254	10.0	254	10.0	133.0	649.4
508	20.0	508	20.0	508	20.0	108.0	527.1
508	20.0	762	30.0	762	30.0	92.3	450.8

762	30.0	254	10.0	254	10.0	115.1	562.0
762	30.0	508	20.0	508	20.0	94.2	459.9
762	30.0	762	30.0	762	30.0	81.2	396.3

Table 2. Floor loading for systems with 4 processor books, 4 drawers, and without integrated battery backup

Floor loading for systems with 4 processor books, 4 drawers, and without integrated battery backup							
a (sides)		b (front)		c (back)		2 frames	
mm	in.	mm	in.	mm	in.	lb./ft^2	kg/m^2
25	1.0	254	10.0	254	10.0	223.3	1090.5
25	1.0	508	20.0	508	20.0	177.3	865.8
25	1.0	762	30.0	762	30.0	148.6	725.7
254	10.0	254	10.0	254	10.0	151.2	738.3
254	10.0	508	20.0	508	20.0	121.9	ESCALA PL 6450R.3
254	10.0	762	30.0	762	30.0	103.7	506.2
508	20.0	254	10.0	254	10.0	114.9	ESCALA PL 1650R-L+.0
508	20.0	508	20.0	508	20.0	94.0	459.1
508	20.0	762	30.0	762	30.0	81.0	395.7
762	30.0	254	10.0	254	10.0	94.8	462.9
762	30.0	508	20.0	508	20.0	78.6	383.8
762	30.0	762	30.0	762	30.0	68.5	334.5

Table 3. Floor loading for system with 2 processor books, 10 drawers, and with integrated battery backup

Floor loading for system with 2 processor books, 10 drawers, and with integrated battery backup							
a (sides)		b (front)		c (back)		2 frames	
mm	in.	mm	in.	mm	in.	lb./ft^2	kg/m^2
25	1.0	254	10.0	254	10.0	203.2	992.1
25	1.0	508	20.0	508	20.0	161.9	790.3
25	1.0	762	30.0	762	30.0	136.1	664.4
254	10.0	254	10.0	254	10.0	163.4	797.8
254	10.0	508	20.0	508	20.0	131.3	641.0
254	10.0	762	30.0	762	30.0	111.3	543.3
508	20.0	254	10.0	254	10.0	135.9	663.5
508	20.0	508	20.0	508	20.0	110.2	537.9
508	20.0	762	30.0	762	30.0	94.1	459.6
762	30.0	254	10.0	254	10.0	117.5	573.7
762	30.0	508	20.0	508	20.0	96.0	468.9
762	30.0	762	30.0	762	30.0	82.7	403.6

Table 4. Floor loading for system with 4 processor books, 2 drawers, and with integrated battery backup

Floor loading for system with 4 processor books, 2 drawers, and with integrated battery

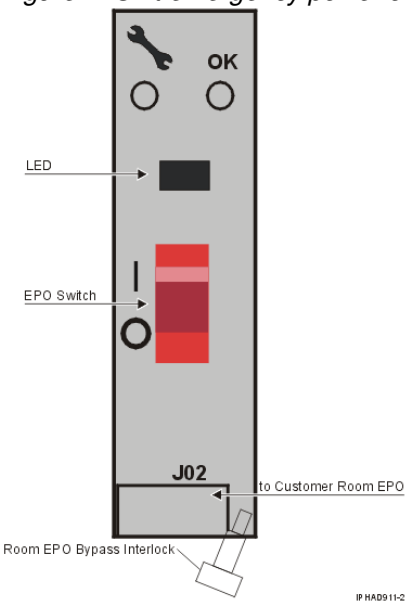
backup							
a (sides)		b (front)		c (back)		2 frames	
mm	in.	mm	in.	mm	in.	lb./ft^2	kg/m^2
25	1.0	254	10.0	254	10.0	232.5	1135.3
25	1.0	508	20.0	508	20.0	184.4	900.2
25	1.0	762	30.0	762	30.0	154.4	753.6
254	10.0	254	10.0	254	10.0	157.1	766.8
254	10.0	508	20.0	508	20.0	126.4	617.2
254	10.0	762	30.0	762	30.0	107.3	524.0
508	20.0	254	10.0	254	10.0	119.1	581.3
508	20.0	508	20.0	508	20.0	97.2	474.7
508	20.0	762	30.0	762	30.0	83.6	408.3
762	30.0	254	10.0	254	10.0	98.0	478.7
762	30.0	508	20.0	508	20.0	81.1	395.9
762	30.0	762	30.0	762	30.0	70.5	344.3

Floor loading for the system is illustrated in the Proposed Floor Layout for Multiple Systems in Considerations for multiple system installations.

Unit emergency power off

The server has a unit emergency power off (UEPO) switch on the front of the first frame (A Frame). Refer to the following figure, which shows a simplified UEPO panel.

Figure 1. Unit emergency power off figure



When the switch is reset, the utility power is confined to the system power compartment. All volatile data will be lost.

It is possible to attach the computer room emergency power off (EPO) system to the system UEPO. When this is done, resetting the computer room EPO disconnects all power from the power cords and the internal battery backup unit, if it is provided. All volatile data will be lost in this case also.

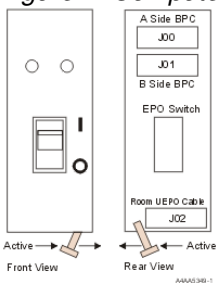
If the room EPO is not connected to the UEPO, resetting the computer room EPO removes ac power from the system. If the interlock bypass feature is used, the system remains powered for a short time based on system configuration.

Computer room emergency power off (EPO)

When the integrated battery backup is installed and the room EPO is reset, the batteries engage and the computer continues to run. It is possible to attach the computer room EPO system to the machine EPO. When this is done, resetting the room EPO disconnects all power from the power cords and the internal battery backup unit. In this event, all volatile data will be lost.

To incorporate the integrated battery backup into the room Emergency Power Off systems (EPO), a cable must connect to the back of the system EPO panel. The following figures illustrate how this connection is made.

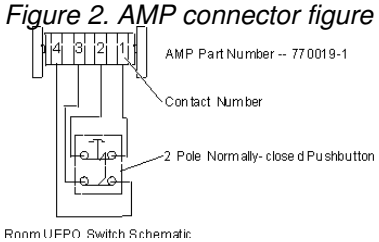
Figure 1. Computer room emergency power off figure



The preceding figure illustrates the back of the machine UEPO panel with the room EPO cable plugging into the machine. Notice the switch actuator. After it is moved to make the cable connection possible, the room EPO cable must be installed for the machine to power on.

In the following figure, an AMP connector 770019-1 is needed to connect to the system EPO panel. For room EPO cables using wire sizes #20 AWG to #24 AWG, use AMP pins (part number 770010-4). This connection should not exceed 5 Ohms, which is approximately 61 m (200 ft.) of #24 AWG.

Figure 2. AMP connector figure



Machine holdup times

The following tables illustrate typical machine holdup times (time versus load) for fresh and aged batteries.

- All times are listed in minutes
- Machine load is listed in total ac input power (power for both power cords combined)

- A fresh battery is defined as 2.5 years old or less.
- An aged battery is defined as 6.5 years.

Note: Battery capacity decreases gradually as the battery ages (from fresh-battery value to aged-battery value). The system diagnoses a failed-battery condition if the capacity decreases below the aged-battery value.

Table 1. Typical machine holdup time versus load for fresh battery

Typical machine holdup time versus load for fresh battery														
Machine load	**3.33 kW**		**6.67 kW**		**10 kW**		**13.33 kW**		**16.67 kW**		**20 kW**		**21.67 kW**	
Integrated battery backup configuration	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**
1 BPR	7.0	21.0	2.1	7.0										
2 BPR	21.0	50.0	7.0	21.0	4.0	11.0	2.1	7.0						
3 BPR	32.0	68.0	12.0	32.0	7.0	21.0	4.9	12.0	3.2	9.5	2.1	7.0	1.7	6.5
N=Non-redundant, R=Redundant														

Table 2. Typical machine holdup time versus load for aged battery

Typical machine holdup time versus load for aged battery														
Machine load	**3.3 kW**		**6.67 kW**		**10 kW**		**13.33 kW**		**16.67 kW**		**20 kW**		**21.67 kW**	
Integrated battery backup configuration	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**	**N**	**R**
1 BPR	4.2	12.6	1.3	4.2										
2 BPR	12.6	30.0	4.2	12.6	2.4	6.6	1.3	4.2						
3 BPR	19.2	41.0	7.2	19.2	4.2	12.6	2.9	7.2	1.9	5.7	1.3	4.2	1.0	3.9
N=Non-redundant, R=Redundant														

Model 14T/00 rack

Specifications for 14T/00 rack	
Dimensions	
Height	1804 mm (71.0 in.)
Capacity	36 usable EIA units
Height with PDP - DC only	1926 mm (75.8 in.)
Width without side panels	

	623 mm (24.5 in.)
Width with side panels	644 mm (25.4 in)
Depth with rear door only	1042 mm (41.0 in.)
Depth with rear door and front door	1098 mm (43.3 in.)
Depth with sculptured style front door	1147 mm (45.2 in.)
Weight	
Base rack (empty)	244 kg (535 lb.)
Full rack[1]	816 kg (1795 lb.) See 14T/00, 14T/42 and 0553 rack weight distribution and floor loading
Electrical[2]	(sum specified values for drawers or enclosures in rack)
DC rack voltage (nominal)	-48 V dc
Power source loading maximum in kVa[3]	See power cord options for an 0551 rack for details
Voltage range (V dc)	-40 to -60
AC rack	683 Btu/hr
Power source loading maximum in kVa (per PDB)[4]	135 W
Voltage range (V ac)	200 to 240
Frequency (Hz)	50 or 60
Temperature requirements	See server or hardware specifications for specific requirements
Humidity requirements	See server or hardware specifications for specific requirements
Noise emissions[6]	Rack noise levels are a function of the number and type of drawers installed. See server or hardware specifications for specific requirements
Install or air flow	

	Rack airflow requirements are a function of the number and type of drawers installed (see Note 5). Refer to the individual drawer specifications.

Service clearances		
Front	Back	Sides
915 mm (36 in.)	915 mm (36 in.)	915 mm (36 in.)

Note:

1. Configuration dependent, base rack weight plus the weight of the drawers mounted in the rack. The rack can support up to a maximum weight of 35 lb. per EIA unit.
2. The total rack power should be derived from the sum of the power used by the drawers in the rack.
3. The power distribution panel (PDP) on the DC-powered rack can hold up to eighteen (nine per power source) 48-volt, 20- to 50-amp circuit breakers (configuration dependent). Each power source supports up to 8.4 kVa.
4. Each ac power distribution bus (PDB) can supply 4.8 kVa. A rack can have up to four PDBs as required by the drawers mounted in the rack.
5. All rack installations require careful site and facilities planning designed to both address the cumulative drawer heat output and provide the airflow volume rates necessary to comply with drawer temperature requirements.
6. Acoustic doors are available for the racks. Feature code 6248 is available for the 0551 and 14T/00 racks. Feature code 6249 is available for the 0553 and 14T/42 racks. The overall sound reduction is approximately 6 dB. The doors add 381 mm (15 in.) to the depth of the racks.

Hardware specification sheets

Select the appropriate category for a list of available hardware specification sheets.

Tip: Print the specification tables for all of your equipment. You will need this information several times during the planning process.

- Expansion units and migration towers
- Racks
- Hardware management consoles
- Uninterruptible power supply
- Power distribution unit and power cord options for 7014 racks

Specifications for expansion units and migration towers

Select a model to view its specifications.

Expansion units and migration towers

- 7031-D24 and 7031-T24 expansion unit
- 11D/11 expansion unit
- 11D/20 expansion unit

D24, T24 expansion units

Specifications for the D24, T24 expansion units			
Dimensions for rack-mounted expansion unit	Width	Depth	Height
Metric	447 mm	660 mm	171 mm
English	17.5 in.	26 in.	6.75 in.
Dimensions for desk-side expansion unit with stabilizer foot and decorative covers	Width	Depth	Height
Metric	305 mm	655 mm	508 mm
English	12.0 in.	26.0 in.	20.0 in.
Maximum configuration weight (rack-mounted)		54 kg (120 lb.)	
Maximum configuration weight (desk-side)		66 kg (145 lb.)	
Electrical			
kVA (maximum)		0.740	
Rated voltage and frequency		100-127 V ac at 50-60 plus or minus 3 Hz and 12 A 200-240 V ac at 50-60 plus or minus 3 Hz and 6.2 A Machine rating with two redundant power cords	
Thermal output (maximum)		4232 Btu/hr	
Power requirements (maximum)		700 W	
Power factor		0.95	
Inrush current		55 A per power cord	

Leakage current (maximum)		3.10 mA	
Phase		1	
Plug type (Canada and U.S.)		2, 4, 5, 6, 10 (for 57/86 and 57/87 only), 18, 19, 22, 23, 24, 25, 32, 34 (for 57/86 and 57/87 only), 57, 59, 62, 66, 69, 70, 73, 75, 76	
Power cord length		1.8 m (6 ft.) (U.S. only) or 4.3 m (14 ft.)	
Temperature requirements			
Operating		10 degrees to 38 degrees C (50 degrees to 100.4 degrees F)[3]	
Nonoperating		-40 degrees to 60 degrees C (-40 degrees to 140 degrees F)	
Environmental requirements		Operating	Nonoperating
Noncondensing humidity		20 to 80% (allowable) 40 to 55% (recommended)	8 to 80% (including condensing)
Wet bulb temperature		21 degrees C (69.8 degrees F)	27 degrees C (80.6 degrees F)
Maximum altitude		2134 m (7000 ft.) above sea level	
Noise emissions[1, 4]		Operating	Idle
Single 57/86 or D24 drawer in standard 19-inch rack with 24 hard drives, nominal environmental conditions, and no front or rear doors on rack.	L_{WAd}	6.6 bels	6.5 bels
	L_{pAm} (1-meter bystander)	49 dB	49 dB
57/87 or T24 tower with 24 hard drives, and nominal environmental conditions.	L_{WAd}	6.6 bels	6.5 bels
	L_{pAm} (1-meter bystander)	47 dB	47 dB
Service clearances			
Service clearances for rack-mounted expansion unit			
Front	Back	**Sides[2]**	**Top[2]**
914 mm	914 mm	914 mm	
36 in.	36 in.	36 in.	
Service clearances for desk-side expansion unit			
Front	Back	Sides	Top
368.3 mm	381 mm		
14.5 in.	15 in.		

Notes:

1. For a description of noise emission values, see Acoustics.
2. Side and top clearances are optional during operation.
3. The maximum 38 degree C (100.4 degree F) temperature must be derated 1 degree C (1.8 degrees F) per 137 m (450 ft.) above 1295 m (4250 ft.). Maximum altitude is 2134 m (7000 ft.).
4. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.

11D/11 expansion unit

Specifications for 11D/11 expansion unit			
Dimensions	Height	Width	Depth
Metric	168 mm	221 mm	711 mm
English	6.6 in.	8.7 in.	28.0 in.
		11D/11	Two 11D/11 with drawer enclosure
Maximum configuration weight		16.8 kg (37 lb.)	39.1 kg (86 lb.)
Electrical			
kVA		0.21[1]	0.42[1]
Rated voltage and frequency		200-240 V ac at 50-60 plus or minus 0.5 Hz	200-240 V ac at 50-60 plus or minus 0.5 Hz
Thermal output (maximum)		683 Btu/hr[1]	1366 Btu/hr[1]
Power requirements (maximum)		200 W[1]	400 W[1]
Power factor		0.95[1]	
Inrush current per 11D/11		71 A[1]	
Leakage current (maximum)		3 mA[1]	
Phase		1	
Plug type (Canada and U.S.)		5, 10, 34	
Power cord length (U.S. only)		1.8 m (6 ft.) 2.7 m (9 ft.)	
Temperature requirements			
Operating		10 degrees to 38 degrees C (50 degrees to 100.4 degrees F)	
Nonoperating		1 degree to 60 degrees C (33.8 degrees to 140 degrees F)	
Environment requirements		Operating	Nonoperating
Noncondensing humidity		8% to 80%	8% to 80%
Wet bulb temperature		23 degrees C (73.4 degrees F)	27 degrees C (80.6 degrees F)
Maximum altitude		3048 m (10000 ft.)	
Noise emissions (one 11D/11 unit) [1]		Operating	Idle
L_{WAd}		5.6 bels	5.6 bels
$<L_{pA}>_m$		40 dB	40 dB
Service clearances			
Front	Back	Sides	Top
915 mm	915 mm	915 mm	915 mm
36 in.	36 in.	36 in.	36 in.

Note:

1. For a description of noise emission values, see Acoustics.

For information about floor loading, please contact your service or Installation Planning representative. Because the thickness of the covers are negligible, the height, width, and depth of the overall dimensions may be used in floor loading calculations.

11D/20 expansion unit

Specifications for 11D/20 expansion unit				
Dimensions	Height	Width	Depth	
Metric	178 mm	445 mm	610 mm	
English	7.0 in.	17.5 in.	24.0 in.	
Maximum configuration weight	45.9 kg (101 lb.)			
Electrical	11D/20			
kVA	0.358			
Rated voltage and frequency	100-240 V ac at 50-60 Hz, V dc not supported			
Thermal output (typical)	775 Btu/hr			
Thermal output (maximum)	1161 Btu/hr			
Power requirements (typical)	227 W			
Power requirements (maximum)	340 W			
Power factor	0.95			
Inrush current per 11D/20[2]	60 A			
Temperature requirements[3]				
Operating	5 degrees to 35 degrees C (41 to 95 degrees F)			
Nonoperating	1 degrees to 60 degrees C (33.8 to 140 degrees F)			
Storage	1 degrees to 60 degrees C (33.8 to 140 degrees F)			
Environment requirements	Operating	Nonoperating	Storage	
Noncondensing humidity	8% to 80%	8% to 80%	5% to 80 %	
Wet bulb temperature[4]	23 degrees C (73.4 degrees F)	27 degrees C (80.6 degrees F)	29 degrees C (84.2 degrees F)	
Maximum altitude[3, 4]	3048 m (10000 ft.)			
Noise emissions [1]	Operating	Idle		
L_{WAd}	6.2 bels	6.1 bels		
$<L_{pA}>_m$	44 dB	43 dB		
Service clearances**				
Front	Back	Sides		
915 mm	915 mm	915 mm		
36 in.	36 in.	36 in.		

Note:

1. For a description of noise emission values, see Acoustics.

2. Inrush currents occur only at initial application of power, no inrush occurs during normal power off-on cycle.
3. The upper limit of the dry bulb temperature must be derated 1 degree C per 137 m (450 ft.) above 915 m (3000 ft.).
4. The upper limit of the wet bulb temperature must be derated 1 degree C per 274 m (900 ft.) above 305 m (1000 ft.).

Rack specifications

This topic provides specifications for the following racks.

- 05/54 rack
- 05/55 rack
- 57/92 expansion rack
- 14S/11 rack
- 14S/25 rack
- 14T/00 rack
- 14T/42 rack

Model 14S/11 rack

This topic provides the detailed specifications for the 14S/11 racks. For information on installing the racks, see Installing the 14S/11 racks. For information on installing additional rack features, such as rack doors, heat exchanger doors, security kits, earthquake kits, multiple rack attachment kits, status beacons, and latch brackets, see Installing rack features.

Specifications for 14S/11 rack	
Dimensions	
Height	611 mm (24 in.)
Capacity	11 usable EIA units
Height with PDP - DC only	Not applicable
Width without side panels	Not applicable
Width with side panels	518 mm (20.4 in.)
Depth without doors	820 mm (32.3 in.)
Depth with front door	873 mm (34.4 in.)
Depth with sculptured style front door	Not applicable
Weight	
Base rack (empty)	36 kg (80 lb.)

Full rack[1]	218 kg (481 lb.)
Electrical[3]	(sum specified values for drawers or enclosures in rack)
DC rack voltage (nominal)	Not applicable
Power source loading maximum in kVa	Not applicable
Voltage range (V dc)	Not applicable
AC rack	See server or hardware specifications for specific requirements
Power source loading maximum in kVa (per PDU)	See server or hardware specifications for specific requirements
Voltage range (V ac)	See server or hardware specifications for specific requirements
Frequency (Hz)	50 or 60
Temperature requirements	See server or hardware specifications for specific requirements
Humidity requirements	See server or hardware specifications for specific requirements
Noise emissions	Rack noise levels are a function of the number and type of drawers installed. See server or hardware specifications for specific requirements
Install or air flow	Rack airflow requirements are a function of the number and type of drawers installed (see Note 5). Refer to the individual drawer specifications.

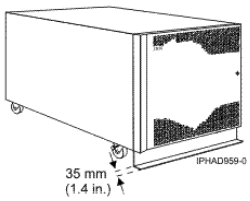
Service clearances[2]

Front	Back	Sides
915 mm (36 in.)	254 mm (10 in.)	71 mm (2.8 in.)

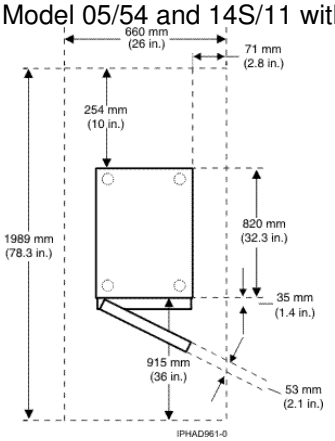
Note:

1. Configuration dependent, base rack weight plus the weight of the drawers mounted in the rack. The rack can support up to a maximum weight of 15.9 kg (35 lb.) per EIA unit.
2. Recommended minimum vertical service clearance from floor is 2439 mm (8 ft.).
3. The 7188 power distribution unit used with this rack is mounted horizontally and requires one EIA unit of space.

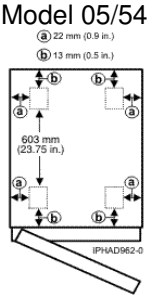
Model 14S/11 rack operational clearances



Model 05/54 and 14S/11 with stabilizer bar



Model 05/54 and 14S/11 plan view



Model 05/54 and 14S/11 caster locations

Model 14S/25 rack

This topic provides the detailed specifications for the 14S/25 racks. For information on installing the racks, see Installing the 14S/25 racks. For information on installing additional rack features, such as rack doors, heat exchanger doors, security kits, earthquake kits, multiple rack attachment kits, status beacons, and latch brackets, see Installing rack features.

Specifications for 14S/25 rack	
Dimensions	
Height	1240 mm (49 in.)
Capacity	25 usable EIA units
Height with PDP - DC only	Not applicable
Width without side panels	590 mm (23.2 in.)
Width with side panels	610 mm (24 in)
Depth with back door only	996 mm (39.2 in.)
Depth with back door and front door	1000 mm (39.4 in.)
Depth with sculptured style front door	Not applicable
Weight	
Base rack (empty)	98 kg (217 lb.)
Full rack[1]	665 kg (1467 lb.)
Electrical[3]	(sum specified values for drawers or enclosures in rack)
DC rack voltage (nominal)	Not applicable
Power source loading maximum in kVa	Not applicable
Voltage range (V dc)	Not applicable
AC rack	See server or hardware specifications for specific requirements
Power source loading maximum in kVa (per PDU)	See server or hardware specifications for specific requirements
Voltage range (V ac)	See server or hardware specifications for specific requirements
Frequency (Hz)	50 or 60
Temperature requirements	See server or hardware

	specifications for specific requirements
Humidity requirements	See server or hardware specifications for specific requirements
Noise emissions	Rack noise levels are a function of the number and type of drawers installed. See server or hardware specifications for specific requirements
Install or air flow	Rack airflow requirements are a function of the number and type of drawers installed (see Note 5). Refer to the individual drawer specifications.

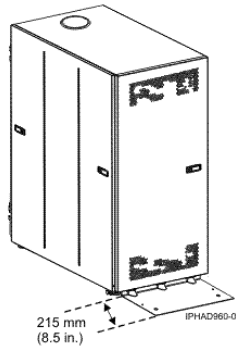
Service clearances[2]

Front	Back	Sides
915 mm (36 in.)	760 mm (30 in.)	915 mm (36 in.)

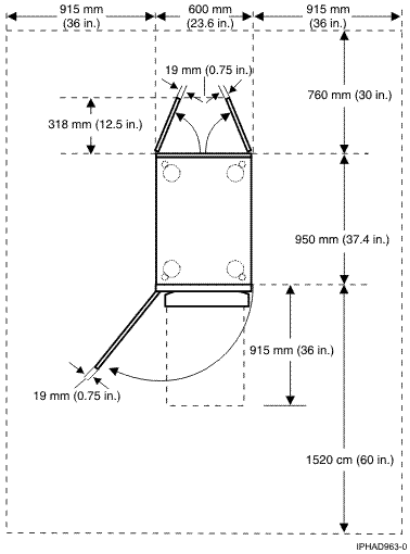
Note:

1. Configuration dependent, base rack weight plus the weight of the drawers mounted in the rack. The rack can support up to a maximum weight of 22.7 kg (50 lb.) per EIA unit.
2. Recommended minimum vertical service clearance from floor is 2439 mm (8 ft.).
3. The 7188 power distribution unit used with this rack is mounted horizontally and requires one EIA unit of space.

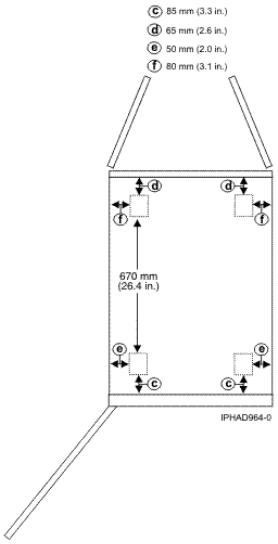
Model 14S/25 rack operational clearances



Model 05/55 and 14S/25 with stabilizer foot



Model 05/55 and 14S/25 plan view



Model 05/55 and 14S/25 caster locations

Hardware management console specifications

This topic provides specifications for the following Hardware Management Consoles (HMCs).

- 10C/03 desktop Hardware Management Console
- 10C/04 desktop Hardware Management Console
- 10C/05 desktop Hardware Management Console

- 10C/R2 rack-mounted Hardware Management Console
- 10C/R3 rack-mounted Hardware Management Console

10C/03 desktop Hardware Management Console specifications

The Hardware Management Console (HMC) controls managed systems, including the management of logical partitions and the use of Power On Demand. Using service applications, the HMC communicates with managed systems to detect, consolidate, and send information for analysis. The HMC provides service technicians with diagnostic information for systems that can operate in a multiple-partitioned environment.

Use the following specifications to plan for your HMC.

Dimensions				
	Width	Depth	Height	Weight
Metric	425 mm	425 mm	140 mm	12.0 kg
English	16.7 in.	16.7 in.	5.5 in.	26.5 lb.
Electrical				
Power source loading			0.11 kVa to 0.35 kVa	
Input voltage			100 V ac to 127 V ac 200 V ac to 240 V ac	
Frequency (hertz)			50 Hz to 60 Hz	
Thermal output (minimum)			375 Btu/hr. (110 watts)	
Thermal output (maximum)			1195 Btu/hr. (350 watts)	
Maximum altitude			3048 m (10000 ft.)	
Air temperature requirements				
Operating			Nonoperating	
10 to 35 degrees C (50 to 95 degrees F) at altitude 0 to 914 m (2999 ft.)			10 to 43 degrees C (50 to 109.4 degrees F)	
Humidity requirements				
	Operating		Nonoperating	
Noncondensing humidity	8 to 80%		8 to 80%	
Noise emissions[1]				
	Operating		Nonoperating	
L_{WAd}	6.5 bels		6.5 bels	
[1] See Acoustics for definitions of noise emissions positions.				

10C/04 desktop Hardware Management Console specifications

The Hardware Management Console (HMC) controls managed systems, including the management of logical partitions and use of Power On Demand. Using service applications, the HMC communicates with managed systems to detect, consolidate, and send information for analysis. The HMC provides service technicians with

diagnostic information for systems that can operate in a multiple-partitioned environment.

Use the following specifications to plan for your HMC.

Dimensions					
	Width	Depth	Height	Weight (minimum configuration as shipped)	Weight (maximum configuration)
Metric	442 mm	401 mm	146 mm	11.0 kg	14.0 kg
English	17.4 in.	15.8 in.	5.7 in.	24 lb.	31 lb.

Electrical[1]	
Power source loading	0.09 kVa to 0.32 kVa
Input voltage	90 V ac to 100 V ac (low range)
	137 V ac to 265 V ac (high range)
Frequency (hertz)	47 Hz to 53 Hz (low range)
	57 Hz to 63 Hz (high range)
Thermal output (minimum)	256 Btu/hr. (75 watts)
Thermal output (maximum)	1058 Btu/hr. (310 watts)
Maximum altitude	2134 m (7000 ft.)

Air temperature requirements	
Operating	Nonoperating
10 to 35 degrees C (50 to 95 degrees F) at altitude 0 to 2134 m (7000 ft.) 10 to 32 degrees C (50 to 89.6 degrees F) at altitude 914 m (2999 ft.) to 2133 m (6998 ft.)	10 to 43 degrees C (50 to 109.4 degrees F)

Humidity requirements		
	Operating	Nonoperating
Noncondensing humidity	8 to 80%	8 to 80%

Noise emissions[2]		
	Operating	Nonoperating
L_{WAd}	4.4 bels	4.3 bels
L_{pAm} (1-meter bystander position)	31 dB	29 dB
L_{pAm} (.5-meter operator postion)	35 dB	33 dB

Note:

1. Power consumption and heat output vary depending on the number and type of optional features installed and the power management optional features in use.
2. These levels were measured in controlled acoustical environments according to the procedures specified by the American National Standards Institute (ANSI) S12.10 and ISO 7779 and are reported in accordance with IS) 9296. Actual sound-pressure levels in a given location might exceed the average values stated because of room reflections and other nearby noise sources. The declared sound-power levels indicate an upper limit, below which a large number of computers will operate.

desktop Hardware Management Console specifications

The Hardware Management Console (HMC) controls managed systems, including the management of logical partitions and use of Power On Demand. Using service applications, the HMC communicates with managed systems to detect, consolidate, and send information for analysis. The HMC provides service technicians with diagnostic information for systems that can operate in a multiple-partitioned environment.

Use the following specifications to plan for your HMC.

Dimensions					
	Width	**Depth**	**Height**	**Weight (minimum configuration as shipped)**	**Weight (maximum configuration)**
Metric	438 mm	540 mm	216 mm	16.3 kg	20.8 kg
English	17.25 in.	21.25 in.	8.5 in.	36 lb.	45.8 lb.

Electrical[1]	
Power source loading	0.106 kVa to 0.352 kVa
Input voltage	100 - 127 V ac (low range)
	200 - 240 V ac (high range)
Frequency (hertz)	47 Hz to 53 Hz (low range)
	57 Hz to 63 Hz (high range)
Thermal output (minimum)	361 Btu/hr. (106 watts)
Thermal output (maximum)	1201 Btu/hr. (352 watts)
Maximum altitude	2134 m (7000 ft.)

Air temperature requirements	
Operating	Nonoperating and shipping
10 to 35 degrees C (50 to 95 degrees F)	0 to 60 degrees C (-32 to 140 degrees F)

Humidity requirements		
	Operating	Nonoperating
Noncondensing humidity	8 to 80%	8 to 80%

Noise emissions[2]				
Product description	**Declared A-weighted sound power level, L_{WAd} (bels)**		**Declared A-weighted sound pressure level, L_{pAm} (dB)**	
	Operating	Nonoperating	Operating	Nonoperating
One hard disk drive configuration	5.2	4.8	37	33

Note:

1. Power consumption and heat output vary depending on the number and type of optional features installed and the power management optional features in use.
2. These levels were measured in controlled acoustical environments according to the procedures specified by the American National Standards Institute (ANSI) S12.10 and ISO 7779 and are reported in accordance with IS) 9296. Actual sound-pressure levels in a given location might exceed the average values stated because of room reflections and other nearby noise sources. The declared sound-power levels indicate an upper limit, below which a large number of computers will operate.

10C/R2 rack-mounted Hardware Management Console specifications

The Hardware Management Console (HMC) controls managed systems, including the management of logical partitions and use of Power On Demand. Using service applications, the HMC communicates with managed systems to detect, consolidate, and send information for analysis. The HMC provides service technicians with diagnostic information for systems that can operate in a multiple-partitioned environment.

This HMC mounts in a 19-inch system rack. The 0551 rack is recommended. This rack operates with a voltage range of 200 V ac to 240 V ac. For additional information about this rack, see 0551 rack.

Use the following specifications to plan for your HMC.

Dimensions				
	Width	Depth	Height	Weight
Metric	440 mm	660 mm	43 mm	12.7 kg
English	17.3 in.	25.98 in.	1.69 in.	28.4 lb.
Electrical				
Power source loading			0.11 kVa to 0.35 kVa	
Input voltage			100 V ac to 127 V ac 200 V ac to 240 V ac	
Frequency (hertz)			50 Hz to 60 Hz	
Thermal output (minimum)			375 Btu/hr. (110 watts)	
Thermal output (maximum)			1195 Btu/hr. (350 watts)	
Maximum altitude			3048 m (10000 ft.)	
Air temperature requirements				
Operating		Nonoperating		
10 to 35 degrees C (50 to 95 degrees F) at altitude 0 to 914 m (2999 ft.) 10 to 32 degrees C (50 to 89.6 degrees F) at altitude 914 m (2999 ft.) to 2133 m (6998 ft.)		10 to 43 degrees C (50 to 109.4 degrees F)		
Humidity requirements				
	Operating		Nonoperating	
Noncondensing humidity	8 to 80%		8 to 80%	
Noise Emissions[1]				
	Operating		Nonoperating	
L_{WAd}	6.5 bels		6.5 bels	
[1] Note: See Acoustics for definitions of noise emissions positions.				

10C/R3 rack-mounted Hardware Management Console specifications

The Hardware Management Console (HMC) controls managed systems, including the management of logical partitions and use of Power On Demand. Using service applications, the HMC communicates with managed systems to detect, consolidate, and send information for analysis. The HMC provides service technicians with

diagnostic information for systems that can operate in a multiple-partitioned environment.

This HMC mounts in a 19-inch system rack. The 0551 rack is recommended. This rack operates with a voltage range of 200 V ac to 240 V ac. For additional information about this rack, see 0551 rack.

Use the following specifications to plan for your HMC.

Dimensions					
	Width	Depth	Height	Weight (minimum configuration)	Weight (maximum configuration)
Metric	440 mm	686 mm	43 mm	12.7 kg	15.6 kg
English	17.32 in.	27.0 in.	1.69 in.	28 lb.	35 lb.

Electrical[1]	
Power source loading	0.172 kVa to 0.550 kVa
Input voltage	100 V ac to 127 V ac (low range)
	200 V ac to 240 V ac (high range)
Frequency (hertz)	50 Hz to 60 Hz
Thermal output (minimum)	587 Btu/hr. (172 watts)
Thermal output (maximum)	1878 Btu/hr. (ESCALA PL 450T/R watts)
Maximum altitude	2133 m (6998 ft.)

Air temperature requirements	
Operating	Nonoperating
10 to 35 degrees C (50 to 95 degrees F) at altitude 0 to 2133 m (6998 ft.)	10 to 43 degrees C (50 to 109.4 degrees F)

Humidity requirements		
	Operating	Nonoperating
Noncondensing humidity	8 to 80%	8 to 80%

Noise emissions[2]		
	Operating	Nonoperating
L_{WAd}	6.9 bels	6.9 bels

Note:

1. Power consumption and heat output vary depending on the number and type of optional features installed and the power management optional features in use.
2. These levels were measured in controlled acoustical environments according to the procedures specified by the American National Standards Institute (ANSI) S12.10 and ISO 7779 and are reported in accordance with IS) 9296. Actual sound-pressure levels in a given location might exceed the average values stated because of room reflections and other nearby noise sources. The declared sound-power levels indicate an upper limit, below which a large number of computers will operate.

Uninterruptible power supply

To meet the power protection needs of servers, the seller has uninterruptible power supplies availableas type 9910.

The 9910 uninterruptible power supply solutions are compatible with the power requirements for these servers and have passed rigorous testing procedures. The uninterruptible power supplies are intended to provide a single source for purchase and protection of servers. All 9910 uninterruptible power supplies include a premium warranty package that is designed to enhance the potential for return on investment over the uninterruptible power supplies available on the market today.

Type 9910 uninterruptible power supply solutions are available from the following suppliers:

- Powerware
- APC
- MGE

Figure 1. Model ESCALA PL 250T/R rear view with cable install location

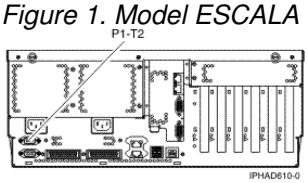


Figure 2. Model ESCALA PL 450T/R rear view with connection port

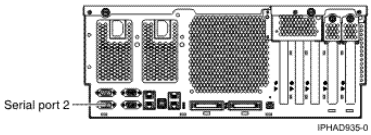


Figure 3. Model ESCALA PL 850R/PL 1650R/R+ rear view with connection port

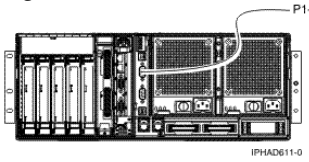
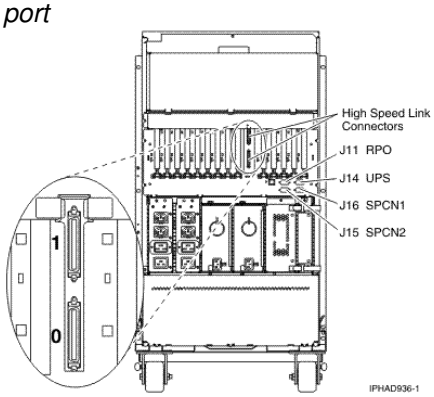


Figure 4. Model ESCALA PL 6450R and 91/94 base PCI-X expansion tower rear view with J14 connection port



Note: The 8-way, 12-way, and 16-way processor configurations for the model ESCALA PL 850R/PL 1650R/R+ consists of several 4-way processors connected together. The uninterruptible power supply converter cable must be connected to the 4-way drawer that has the operator's panel on the front of the unit.

For the 91/94, the 1827 convertor cable is not needed. Plug the uninterruptible power supply communications cable provided by the uninterruptible power supply supplier into the J14 port.

Model 14T/42 and 0553 rack

This topic provides the detailed specifications for the 14T/42 and 0553 racks. For information on installing the racks, see Installing the 7014-T00, 7014-T42, 0551, and 0553 racks. For information on installing additional rack features, such as rack doors, heat exchanger doors, security kits, earthquake kits, multiple rack attachment kits, status beacons, and latch brackets, see Installing rack features.

Note: Before installing rear door heat exchangers on your 14T/42 rack, see Planning for the installation of rear door heat exchangers.

Specifications for 14T/42[3] and 0553 rack	
Dimensions	
Height	2015 mm (79.3 in.)
Capacity	42 usable EIA units
Height with PDP - DC only	Not applicable
Width without side panels	623 mm (24.5 in.)
Width with side panels	644 mm (25.4 in)
Depth with back door only	1042 mm (41.0 in.)
Depth with back door and front door	1098 mm (43.3 in.)
Depth with sculptured style front door	1147 mm (45.2 in.)
Weight	
Base rack (empty)	261 kg (575 lb.)
Full rack[1]	930 kg (2045 lb.) See 14T/00, 14T/42 and 0553 rack weight distribution and floor loading
Electrical[2]	(sum specified values for

	drawers or enclosures in rack)
DC rack voltage (nominal)	-48 V dc
Power source loading maximum in kVa[3]	See power cord options for the 7014, 0551, and 0553 racks for details
Voltage range (V dc)	-40 to -60
AC rack	683 Btu/hr
Power source loading maximum in kVa (per PDB)[4]	135 W
Voltage range (V ac)	200 to 240
Frequency (Hz)	50 or 60
Temperature requirements	See server or hardware specifications for specific requirements
Humidity requirements	See server or hardware specifications for specific requirements
Noise emissions[4]	Rack noise levels are a function of the number and type of drawers installed. See server or hardware specifications for specific requirements
Install or air flow	Rack airflow requirements are a function of the number and type of drawers installed (see Note 5). Refer to the individual drawer specifications.

Service clearances[2]

Front	Back	Sides
915 mm (36 in.)	915 mm (36 in.)	915 mm (36 in.)

Note:

1. Configuration dependent, base rack weight plus the weight of the drawers mounted in the rack. The rack can support up to a maximum weight of 35 lb. per EIA unit.
2. Recommended minimum vertical service clearance from floor is 2439 mm (8 ft.)

3. When installing a model ESCALA PL 850R/PL 1650R/R+ or 9406-570 in a 14T/42 rack, there are restrictions to what height the rack installation can begin so that SMP and FSP flex assemblies are accommodated. The installation configurations are as follows:
    - 16-way configurations (16U) start installation between EIA 1 through EIA 21
    - 12-way configurations (12U) start installation between EIA 1 though EIA 25
    - 8-way configurations (8U) start installation between EIA 1 through EIA 29
    - 4-way configurations (4U) start installation between EIA 1 through EIA 37, EIA 37 through 39 (does not use SMP or SMP flex assemblies)

   Associated I/O platforms can be mounted in the upper locations of the rack.
4. Acoustic doors are available for the racks. Feature code 6248 is available for the 0551 and 14T/00 racks. Feature code 6249 is available for the 0553 and 14T/42 racks. The overall sound reduction is approximately 6 dB. The doors add 381 mm (15 in.) to the depth of the racks.
5. All rack installations require careful site and facilities planning designed to address both the cumulative drawer heat output and provide the airflow volume rates necessary to comply with drawer temperature requirements.

Caster and leveler locations

The following diagram provides the caster and leveler locations for the 14T/00, 14T/42, 0551, and 0553 racks.

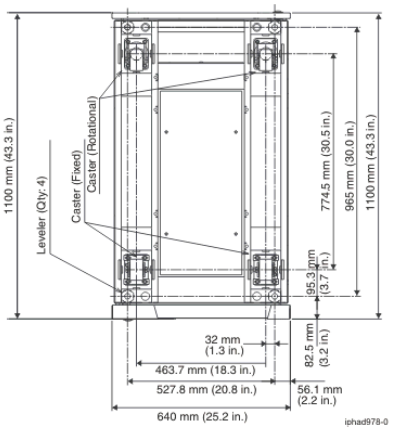


Figure 1. Caster and leveler locations

Power quality

The quality of electrical power can make a big difference in the performance of any sensitive electronic equipment. Most equipment is very robust and can tolerate some power disturbances or transients. However, large disturbances can cause equipment power failures or errors. Transients can come into the site on the power utility company lines but are often caused by electrical equipment installed in the building. For example, transients can be produced by welders, cranes, motors, induction heaters, elevators, copy machines, and other office equipment. The best way to prevent problems caused by power disturbances is to have transient-producing equipment on a separate power service than the one that supplies power to your information technology equipment.

Ground or earth

When used in reference to electrical power systems, Ground is a conducting connection between an electrical circuit and the earth or some conducting body that serves in place of the earth. The term ground is the most common name used, however it is also referred to as earth or terra in several international geographies. In this topic, these terms and other local language equivalents are interchangeable.

Ground is a critical component of an electrical power distribution system. A properly installed ground system allows for safe operation of equipment that is connected to the electrical power source under normal and electrical or equipment fault conditions. The life safety function of ground and grounding methods is addressed by the appropriate local and national electrical wiring codes. In the United States, this code is known as the National Electric Code or publication 70 of the National Fire Protection Association. Many countries have adopted the National Electric Code or have developed an equivalent code.

The National Electric Code and its equivalents have a primary objective to provide safe operation of electrical power distribution systems and electrical equipment installations. Compliance with these codes does not guarantee efficient operation of equipment connected to the power distribution systems. When sensitive electronic equipment is connected, there are often times when additional ground connections may be required. Typically, additional ground connections are recommended when there is a concern for high frequency or radio frequency (RF) interference, which may impact electronic circuits. These additional ground requirements will be found with the installation documentation for specific equipment. Additional ground requirements may also be recommendations from engineering or data center evaluations, reviews or surveys. Local or national codes allow for these additional grounds to be installed.

Grounding

Most equipment, unless double insulated, has power cords containing an insulated grounding conductor (color-coded green or green with yellow stripe) that connects the frame of the equipment to the ground terminal at the power receptacle. The power receptacles for equipment are identified in the equipment documentation and should match the equipment power plug. In some cases, there may be options for different manufacturer equivalent receptacles. The equipment plugs should not be changed or altered to match existing connectors or receptacles. To do so may create a safety hazard and void product warranty. The connectors or receptacles for the equipment should be installed to a branch circuit with an equipment grounding conductor, connected to the grounding bus bar in the branch-circuit distribution panel. The grounding bus bar in the panel should then be connected back to the service entrance or suitable building ground by an equipment grounding conductor.

Information technology equipment must be properly grounded. It is recommended that an insulated green wire ground, the same size as the phase wire, be installed between the branch circuit panel and the receptacle.

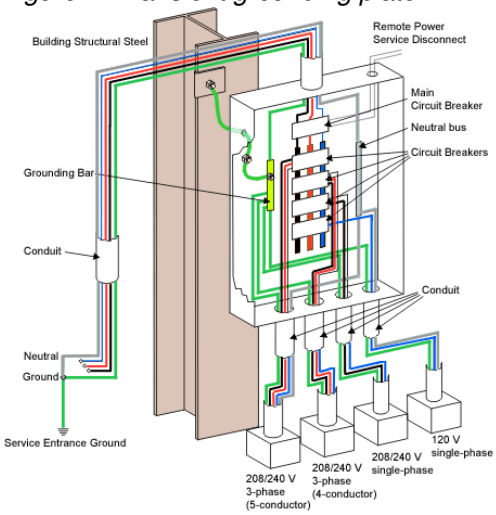
For personnel safety, the ground must have sufficiently low impedance to limit the voltage to ground and to facilitate the operation of protective devices in the circuit. For example, the ground path shall not exceed 1 ohm for 120-volt, 20-ampere branch circuit devices.

The ground path impedance limit is 0.5 ohms for 120 volt branch circuits protected by 30 ampere circuit breakers. The limit is 0.1 ohms for 120 volt 60 to 100 ampere circuits.

All grounds entering the room should be interconnected somewhere within the building to provide a common ground potential. This includes any separate power sources, lighting and convenience outlets, and other grounded objects, such as building steel, plumbing, and duct work.

The equipment grounding conductor must be electrically attached to both the enclosure of the computer power center and the connector grounding terminal. Conduit must not be used as the only grounding means, and it must be connected in parallel with any grounding conductors it contains.

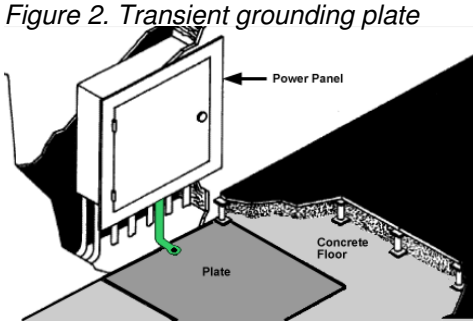
Figure 1. Transient grounding plate



Transient grounding

To minimize the effects of high-frequency electrical noise, the branch circuit power panel servicing the equipment should be mounted in contact with bare building steel or connected to it by a short length of cable. If this is not possible, a metal area of at least 1 m^2 (10 $ft.^2$) in contact with masonry can be used. The plate should be connected to the green-conductor common.

Figure 2. Transient grounding plate



The preferred connection is with a braided strap. If a braided strap is not available, the connection should consist of no. 12 AWG (3.3 mm or 0.0051 in.) or larger conductor and should not be more than 1.5 m (5 ft.) long. To minimize this length, the preferred connection of this braided strap or conductor is to the nearest portion of the enclosure on the panel, if the enclosure is electrically continuous from the green-conductor common point to this point of connection.

The raised-floor-supporting substructure can be used as a substitute for the transient plate if the structure has a consistently low-impedance path. If the raised floor has stringers or other subframing that makes electrical connection between the pedestals, the floor itself can be used for the signal reference plane. Some raised floors are stringerless and the floor tiles lock into isolated pedestals by gravity alone. If there is no reliable electrical connection between the pedestals, a signal reference grid (see figure) can be constructed by connecting the pedestals together with conductors. A minimal grid would interconnect every other pedestal in the immediate area of the power panel and extend at least 3 m (10 ft.) in all directions.

Figure 3. Transient grounding using the raised floor support structure

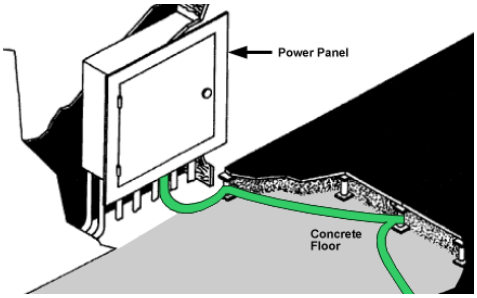
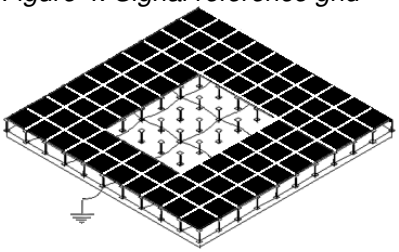


Figure 4. Signal reference grid



Stranded bare or insulated conductor of at least no. 8 AWG (8 mm or 0.0124 in.) copper is required. This conductor provides a low-impedance path and is strong enough to make physical damage unlikely. Any connection method is acceptable as long as it provides a reliable electrical and mechanical connection.

A customer's self-contained, separately-derived power system (computer power centers, transformers, motor generators), installed on a raised floor, has the same requirements.

Power specifications

Your server is normally furnished with power-supply provision to meet the 50- or 60-Hz voltage standards shown in the following tables, respectively.

Table 1. 50-Hz standard voltages

	50-Hz nominal voltages					
Single phase	100	110	200	220	230	240
Three phase	200	220	380	400	415	

Table 2. 60-Hz standard voltages

	60-Hz nominal voltages								
Single phase	100	110	120	127	200	208	220	240	277
Three phase	200	208	220	240	480				

Voltage and frequency limits

The phase-to-phase steady-state voltage must be maintained within plus 6 percent to minus 10 percent of the normal rated voltage, measured at the receptacle when the system is operating. A voltage surge or sag condition must not exceed plus 15 percent or minus 18 percent of the nominal voltage and must return to within a steady-state tolerance of plus 6 percent or minus 10 percent of normal rated voltage within 0.5 second.

Some servers might require special considerations and might have more or less restrictive specifications. See the individual server specifications for actual requirements. Because of the possibility of brownouts (planned voltage reduction by the utility company) or other marginal voltage conditions, installing a voltage monitor might be advisable.

The phase frequency must be maintained at 50 or 60 Hz + 0.5 Hz.

The value of any of the three phase-to-phase equipment voltages in the three-phase system must not differ by more than 2.5 percent from the arithmetic average of the three voltages. All three line-to-line voltages must be within the limits specified above.

The maximum total harmonic content of the power system voltage waveforms on the equipment feeder must not exceed 5 percent with the equipment operating.

Power load

A preliminary sizing for the total power load can be obtained by adding the total power requirements for all devices to be connected. For a more precise analysis of power distribution system requirements, you can request a System Power Profile Program printout from your seller. The System Power Profile Program, controlled and operated by the service office installation planning representative, provides a vector analysis rather than an arithmetic summation of total power. The vector analysis takes into consideration power factor and phase relationships. In addition, it considers waveform distortions caused by the load and inrush requirements. Additional capacity should be planned for future expansion. Contact you service office installation planning representative for information on how to obtain a System Power Profile.

Primary power problem areas

Your server is designed to operate on the normal power supplied by most electrical utility companies. However, possible computer malfunctions can be caused by outside (radiated or conducted) transient electrical noise signals being superimposed on the power line to the computer. To guard against this interference, power distribution design should comply with the specifications discussed in this topic.

Failures caused by the power source are basically of three types:

- Power line disturbances, such as, short duration dips in voltage as well as prolonged outages. If the frequency of such power failures is not acceptable for your operation, installing standby or buffered power might be necessary.
- Transient electrical noise superimposed on power lines might be caused by a variety of industrial, medical, communication, or other equipment:
    - Within the computing facilities
    - Adjacent to the computing facilities
    - In the vicinity of the power company's distribution lines
        - Switching large electrical loads can cause problems, even though the source is on a different branch circuit. If you suspect such a condition, it might be advisable to provide a separate, dedicated feeder or transformer for your server directly from your power source.

If the transient-producing devices have been eliminated from the feeder and the computer room power panel and power line disturbances are still present, it might be necessary for you to install isolation equipment (for example, transformers, motor generators, or other power conditioning equipment).

Lightning protection

Installing lightning protection devices is recommended on the computer power source when:

- The primary power is supplied by an overhead power service.
- The utility company installs lightning protectors on the primary power source.
- The area is subject to electrical storms or an equivalent type of power surge.

Lightning protection for communication wiring

Be sure to install lightning protection devices to protect communication wiring and equipment from surges and transients induced into the communication wiring. In any area subject to lightning, surge suppressors should be installed at each end of every outdoor cable installation, whether installed above the ground (aerial) or

buried below the ground.

Information about lightning surge suppressors for communication wiring systems and recommended installation methods for outdoor communication cables can be found in the manuals for the specific type of data processing system that is being considered.

Power source

The primary power source is normally a wye-type or delta-type, three-phase service coming from a service entrance or a separately derived source with appropriate overcurrent protection and suitable ground (service entrance or building ground). A three-phase, five-wire power distribution system should be provided for flexibility in your data processing installation. However, depending on the type of equipment installed, a single-phase distribution system might be sufficient. The five wire system enables you to provide power for three-phase line-to-line, single phase line-to-line, and single phase line-to-Neutral. The five wires consist of three phase conductors, one neutral conductor, and one insulated equipment grounding conductor (green, or green with yellow trace).

Conduit must not be used as the only grounding means.

Power plugs and receptacles are illustrated in the plugs and receptacles topic.

Power panel feeders

Ensure that the feeder wires to the branch-circuit distribution panel (shown in Grounding) are large enough to handle the total server power load. It is recommended that these feeders service no other loads.

Branch circuits

The computer branch circuit panel should be in an unobstructed, well-lighted area in the computer room.

The individual branch circuits on the panel should be protected by suitable circuit breakers properly rated according to manufacturer specifications and applicable codes. Each circuit breaker should be labeled to identify the branch circuit it is controlling. The receptacle should also be labeled.

Where a branch circuit and receptacle are installed to service your server, it is recommended that the grounding conductor of the branch circuit be insulated and equal in size to the phase conductors. The grounding conductor is an insulated, dedicated-equipment-grounding conductor, not the neutral.

Branch circuit receptacles installed under a raised floor should be within 0.9 m (3 ft.) of the server that they supply power to. If the branch circuits are contained in a metallic conduit, either rigid or nonrigid, the conduit system should be grounded. This is accomplished by bonding the conduit to the power distribution panel, which in turn, is tied to the building or transformer ground.

Power cords are supplied in 4.3 m (14 ft.) lengths unless otherwise noted in the server specifications. The length is measured from the exit symbol on the plan views. Some power plugs furnished by your seller are watertight, and should be located under the computer room raised floor.

Phase rotation

The three-phase power receptacles for some equipment, such as printers, must be wired for correct phase rotation. When looking at the face of the receptacle and counting clockwise from the ground pin, the sequence is phase 1, phase 2, and phase 3.

Emergency power control

A disconnecting means should be provided to disconnect the power from all electronic equipment in the computer room. This disconnecting means should be controlled from locations readily accessible to the operator at the principal exit doors. A similar disconnecting means to disconnect the air conditioning system serving this area should be available. Consult the local and national codes to determine the requirements for your installation. National Electric Code (NFPA 70) article 645 provides the requirements for this room EPO.

See also Precautions and Personnel Training.

Convenience outlets

A suitable number of convenience outlets should be installed in the computer room and the Service Representative area for use by building maintenance personnel and service representatives. Convenience outlets should be on the lighting or other building circuits, not on the computer power panel or feeder. Under no circumstances are the service convenience outlets on your servers to be used for any purpose other than normal servicing.

Determine power cord, plug, and receptacle type

To determine what power cord, plug, and receptacle type your server or system requires, you need three pieces of information:

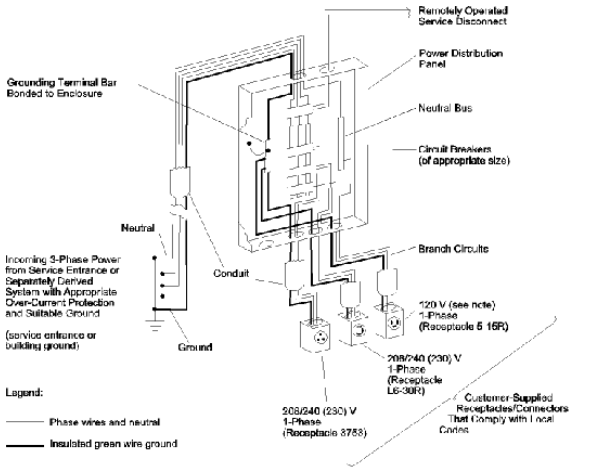
- The Country or Region in which your server or system will reside
- Your server or system Model
- The Voltage and amperage of your power supply

With this information, you can determine your type through these tables:

- Power cords, plugs, and receptacles: By model
- Power cords, plugs, and receptacles: By voltage and amperage
- Power cord features
- Power load calculating for 7188 and 9188 power distribution units

Tip: Print the Plug and receptacle type table for your server or system and give it to your electrician. The table contains information needed to install the proper receptacle for your system expansion unit.

The server or system and all of the expansion units and attached equipment will require an isolated power supply. This means, it must have its own circuit. It is highly recommended that an uninterruptible power supply be used to help protect both the server and its data.



Note: 1. The receptacles must match the plug types ordered on your data processing equipment

2. For loads requiring a neutral, attach computer/data processing equipment only

Plug and receptacle types: By model

Select your model to find its plug and receptacle type and power cord features.

- Model ESCALA PL 245T/R

- Model 471/85
- Model ESCALA PL 250R-L
- Model 112/85
- Model ESCALA PL 250T/R
- Model ESCALA PL 450T/R
- Model ESCALA PL 250R-VL or ESCALA PL 450R-XS
- Model ESCALA PL 1650R-L+
- Model ESCALA PL 850R/PL 1650R/R+
- Model 185/75
- Model ESCALA PL 3250R, ESCALA PL 6450R
- Model ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- Model ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+

Plug and receptacle types: Model ESCALA PL 245T/R

Voltage and amperage	Plug and receptacle type
250 V, 10 A	Type 2, Type 6, Type 19, Type 24, Type 25, Type 32, Type 62
100-127 V, 10 A	Type 75
100-127 V, 15 A	Type 4, Type 70
100-127 V, 12 A	Type 59
250 V, 15 A	Type 5
250 V, 16 A	Type 18, Type 22, Type 25, Type 32
250 V, 13 A	Type 23
200-240 V, 10 A	Type 66, Type 69, Type 73, Type 76
200-240 V, 12 A	Type 57

To determine the plug and receptacle type your model will need, follow these steps:

1. In the preceding table, find the Voltage and Amperage of your power supply.

   The Plug and receptacle type that is listed in the same row as your voltage and amperage supports your model.
2. Click on the plug and receptacle Type to view information about that type.

If more than one plug appears in your row:

1. Click one of the plug and receptacle types.
2. In the Plug and Receptacles table, look for your country or region (the country or region where your model will reside) in the Countries or regions column (on the right side of the table).
3. Repeat steps 1 and 2 until you find your country or region in the Plug and Receptacle table.

   The plug and receptacle type that lists your country or region is the type for which you need to plan.

Note: If your country or region is not listed or, for some reason, you still cannot determine your plug and receptacle type, contact your marketing representative.

Plug and receptacle type 6

Plug	Plug	Countries/Regions
 Type 6 250V 10A		*International Electrotechnical Commission* ***IEC 83-A5*** Australia, Fiji, New Zealand, Papua New Guinea, Western Samoa, Kiribati, Nauru
Cord Feature 6479 (T) 6680 (T) 6468 and 6681(U)	Part Number 13F9940 and 39M5102[1] - 2.7 m (9 ft.) (T) 13F9938 and 39M5100[1] - 4.3 m (14 ft.) (T) (U)	
Cord Rating 2.4 kVA cord (T)		
Systems and expansion units (T) - Models ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, ,		

Note:

1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.

Plug and receptacle type 24

Plug	Receptacle	Countries/Regions
 Type 24 250V 10A		**Schweizerischer Elecktrotechnischer Verein* ***SEV 24507*** Liechtenstein, Switzerland
Cord Feature	Part Number	Cord Rating

6476 (T) 6465 (U)	14F0051 and 39M5158[1] - 2.7 m (9 ft.) **(T)** 14F0049 and 39M5156[1] - 4.3 m (14 ft.) (U)	2.4 kVA cord (T)
Systems and expansion units (T) - Models ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, ,		
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.		

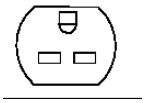
Plug and receptacle type 62

Plug  Type 62 250V 10A	Plug 	Countries/Regions *International Electrotechnical Commission 320 C13* ***CCC certified GB 1053*** People's Republic of China
Cord Feature 6452(U) 6493 (T)	Part Number 02K0546 and 39M5206[1] - 2.7 m (9 ft.) (T) 02K0544 and 39M5204[1] - 4.3 m (14 ft.)(U)	
Cord Rating 2.4 kVA cord (K) (T)		
Systems and expansion units (T) - Models ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, ,		
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.		

Plug and receptacle type 59

Plug	Receptacle	Countries/Regions
 Type 59 125V 20A	Type 59 250V 15A	***JIS C-8303-1983*** Japan
Cord Feature	Part Number	
6670 (C)	34G0222 and 39M5198[1] - 1.8 m (6 ft.) (B) (C)	
6660 (C)	34G0224 and 39M5200[1] - 4.3 m (14 ft.) (B) (C)	
Cord Rating 1.2 kVA cord (A) (B)		
Systems and expansion units (B) - Expansion units 5070, 5072, 5080, 5082 (C) - Model 7/10, ESCALA PL 250R-L, , 57/86, 57/87, D24, T24, ESCALA PL 250R-VL or ESCALA PL 450R-XS, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, 10C/04,		
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.		

Plug and receptacle type 5

Plug	Receptacle	Countries/Regions
 Type 5 250V 15A		*National Electrical Manufacturers Association* ***NEMA WD-1: 6-15P*** Anguilla, Antigua, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Bonaire, Canada, Caicos Islands, Cayman Islands, Costa Rica, Curacao, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Haiti, Honduras, Jamaica, Montserrat, Netherland

		Antilles, Nicaragua, Panama, Peru, Philippines, Puerto Rico, Saudi Arabia, St. Marten, Taiwan, Thailand, Tobago, Tortola, Turks Island, United States, Venezuela, Virgin Islands
Cord Feature 6469 (T) (K) 6487 (T) 6455(W)	Part Number 1838576 and 39M5094[1] - 1.8 m (6 ft.) (T) 1838573 and 39M5096[1] - 4.3 m (14 ft.) (T) 6952287 and 39M5093[1] - 4.3 m (14 ft.) (T) (W)	
Cord Rating 2.4 kVA cord (T)		
Systems and expansion units **(T)** - ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, ,		
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.		

Plug and receptacle types: Model ESCALA PL 250R-L

Voltage and amperage	Plug and receptacle type
250 V, 10 A	Type 2, Type 6, Type 19, Type 24, Type 25, Type 32, Type 62
100-127 V, 15 A	Type 4, Type 70
100-127 V, 12 A	Type 59
250 V, 15 A	Type 5
250 V, 16 A	Type 18, Type 22, Type 25, Type 32
250 V, 13 A	Type 23
200-240 V, 10 A	Type 66, Type 69, Type 73

To determine the plug and receptacle type your model will need, follow these steps:

1. In the preceding table, find the Voltage and Amperage of your power supply.

   The Plug and receptacle type that is listed in the same row as your voltage and amperage supports your model.
2. Click on the plug and receptacle Type to view information about that type.

If more than one plug appears in your row:

1. Click one of the plug and receptacle types.

2. In the Plug and Receptacles table, look for your country or region (the country or region where your model will reside) in the Countries or regions column (on the right side of the table).
3. Repeat steps 1 and 2 until you find your country or region in the Plug and Receptacle table.

   The plug and receptacle type that lists your country or region is the type for which you need to plan.

Note: If your country or region is not listed or, for some reason, you still cannot determine your plug and receptacle type, contact your marketing representative.

Plug and receptacle types: Model ESCALA PL 250T/R, ESCALA PL 450T/R 7/20, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+

Voltage and amperage	Plug and receptacle type
250 V, 10 A	Type 2, Type 6, Type 19, Type 24, Type 25, Type 32, Type 34, Type 62
100-127 V, 15 A	Type 4, Type 70
250 V, 15 A	Type 5, Type 10, Type 34, Type 64
250 V, 16 A	Type 18, Type 22, Type 25, Type 32
250 V, 13 A	Type 23
200-240 V, 10 A	Type 66, Type 69

To determine the plug and receptacle type your model will need, follow these steps:

1. In the table above, find the Voltage and Amperage of your power supply.

   The Plug and receptacle type listed in the same row as your voltage and amperage supports your model.
2. Click on the plug and receptacle Type to view information about that type.

If more than one plug appears in your row:

1. Click one of the plug and receptacle types.
2. In the Plug and Receptacles table, look for your Country or Region (the Country or Region where your model will reside) in the Countries or regions column (on the right side of the table).
3. Repeat steps 1 and 2 until you find your Country or Region in the Plug and Receptacle table.

   The plug and receptacle type that lists your Country or Region is the type for which you need to plan.

Note: If your Country or Region is not listed or, for some reason, you still cannot determine your plug and receptacle type, contact your seller.

Plug and receptacle types: Model ESCALA PL 250R-VL or ESCALA PL 450R-XS

Voltage and amperage	Plug and receptacle type
250 V, 10 A	Type 2, Type 6, Type 19, Type 24, Type 25, Type 32, Type 62
100-127 V, 15 A	Type 4, Type 70
100-127 V, 10 A	Type 75
100-127 V, 12 A	Type 59
250 V, 15 A	Type 5
250 V, 16 A	Type 18, Type 22, Type 32
250 V, 13 A	Type 23
200-240 V, 10 A	Type 66, Type 69, Type 73, Type 76
200-240 V, 12 A	Type 57

To determine the plug and receptacle type your model will need, follow these steps:

1. In the table above, find the Voltage and amperage of your power supply.

   The Plug and receptacle type listed in the same row as your voltage and amperage supports your model.
2. Click on the plug and receptacle Type to view information about that type.

If more than one plug appears in your row:

1. Click one of the plug and receptacle types.
2. In the Plug and Receptacles table, look for your Country or Region (the Country or Region where your model will reside) in the Countries or regions column (on the right side of the table).
3. Repeat steps 1 and 2 until you find your Country or Region in the Plug and Receptacle table.

   The plug and receptacle type that lists your Country or Region is the type for which you need to plan.

Note: If your Country or Region is not listed or, for some reason, you still cannot determine your plug and receptacle type, contact your seller.

Plug and receptacle types: Model ESCALA PL 1650R-L+

Voltage and amperage	Plug and receptacle type
250 V, 10 A	Type 2, Type 6, Type 19, Type 24, Type 25, Type 32, Type 62
250 V, 15 A	Type 5, Type 10
250 V, 16 A	Type 18, Type 22, Type 25, Type 32
250 V, 13 A	Type 23
200-240 V, 10 A	Type 66, Type 69, Type 73, Type 76
200-240 V, 12 A	Type 57

To determine the plug and receptacle type your model will need, follow these steps:

1. In the preceding table, find the Voltage and Amperage of your power supply.

   The Plug and receptacle type that is listed in the same row as your voltage and amperage supports your model.
2. Click on the plug and receptacle Type to view information about that type.

If more than one plug appears in your row:

1. Click one of the plug and receptacle types.
2. In the Plug and Receptacles table, look for your country or region (the country or region where your model will reside) in the Countries or regions column (on the right side of the table).
3. Repeat steps 1 and 2 until you find your country or region in the Plug and Receptacle table.

   The plug and receptacle type that lists your country or region is the type for which you need to plan.

Note: If your country or region is not listed or, for some reason, you still cannot determine your plug and receptacle type, contact your marketing representative.

Plug and receptacle types: Model ESCALA PL 850R/PL 1650R/R+

Voltage and amperage	Plug and receptacle type
250 V, 10 A	Type 2, Type 6, Type 19, Type 24, Type 25, Type 32, Type 34, Type 62
250 V, 15 A	Type 5, Type 10, Type 34, Type 64
250 V, 16 A	Type 18, Type 22, Type 25, Type 32
250 V, 13 A	Type 23
200-240 V, 10 A	Type 66, Type 69

To determine the plug and receptacle type your model will need, follow these steps:

1. In the table above, find the Voltage and amperage of your power supply.

   The Plug and receptacle type listed in the same row as your voltage and amperage supports your model.
2. Click on the plug and receptacle Type to view information about that type.

If more than one plug appears in your row:

1. Click one of the plug and receptacle types.
2. In the Plug and Receptacles table, look for your Country or Region (the Country or Region where your model will reside) in the Countries or regions column (on the right side of the table).
3. Repeat steps 1 and 2 until you find your Country or Region in the Plug and Receptacle table.

   The plug and receptacle type that lists your Country or Region is the type for which you need to plan.

Note: If your Country or Region is not listed or, for some reason, you still cannot determine your plug and receptacle type, contact your seller.

Plug and receptacle types: Model 185/75

For a detailed description of the plug and receptacles used with the Model 185/75, see 185/75 power cord features.

Plug and receptacle types: Model ESCALA PL 3250R, ESCALA PL 6450R

For a detailed description of the plug and receptacles used with Models ESCALA PL 3250R, ESCALA PL 6450R, see ESCALA PL 3250R, ESCALA PL 6450R power cord features.

Power cords: Plugs and receptacles

Note: When you select a plug and receptacle type, you will see a ***Plug and receptacle type*** table. Look for your Country or Region (where your system or server will reside) in the ***Countries or regions*** section (right side of table) and your model type in the ***Systems and expansion units*** section (bottom of table). You will find the plug type that supports your system or server in the table that lists both your model and your Country or Region.

Voltage and amperage	Plug and receptacle type
100 - 127 V 10 A	Type 75
100 - 127 V 10A/15A	Type 70
100 - 127V 15A	Type 4 ,
200 - 240 V 10A	Type 2, Type 66, Type 68, Type 69
200 - 240 V 15A	Type 64
200 - 240V 10A	Type 6, Type 19, Type 24, Type 62, Type 76
200 - 240 V 12 A	Type 57
200 - 240 V 10A/15A	Type 34, Type 73
200 - 240 V 10A/16A	Type 25, Type 32
200 - 240 V 10A/13A	Type 23
200 - 240 V 15A	Type 5, , Type 10, , Type 74, Type 76
200 - 240 10A/16A	Type 18, Type 22, ,

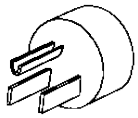
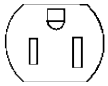
Plug and receptacle type 75

Plug	Receptacle	Countries/Regions
	Type 75 100 - 127 V 10A	NEMA 5-15P Taiwan

		
Cord Feature 6651 (A)	Part Number 39M5247 - 2.7 m (9 ft.) (A) 39M5246 - 1.8 m (6 ft.) (A)	
Systems and expansion units (A) - ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, , 5095		
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.		

Plug and receptacle Type 70

Table 1.

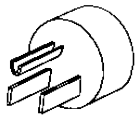
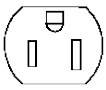
Plug	Receptacle	Countries/Regions
 Type 70 100-127V 15A		*National Electrical Manufacturers Association* ***iNMETRO NBR 6147*** Brazil
Cord Feature 6471(T)	Part Number 49P2110 and 39M5233[1] - 2.7 m (9 ft.) (T)	
Cord Rating 1.6 kVA Cord (T)		
Systems and expansion units (T) - Models ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04,		

Note:

1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.

Plug and receptacle type 4

Table 1.

Plug	Receptacle	Countries/Regions
 Type 4 100-127V 15A		*National Electrical Manufacturers Association* ***NEMA WD-1: 5-15P*** Anguilla, Antigua, Aruba, Bahamas, Barbados, Belize, Bermuda, Bonaire, Bolivia, Caicos Islands, Canada, Canary Islands, Cayman Islands, Colombia, Costa Rica, Curacao, Dominican Republic, El Salvador, Ecuador, Guam, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Montserrat, Netherland Antilles, Nevis, Nicaragua, Panama, Peru, Philippines, Puerto Rico, Saudi Arabia, St. Kitts, St. Martin, Taiwan, Tobago, Tortola BVI, Trinidad, Turk Islands, United States, Venezuela, Virgin Islands, Yemen
Cord Feature	Part Number	
6470 and 6460 (T) (K) (B) (U)	86G7648 and 39M5080[1] - 1.8 m (6 ft.) (T) 87G3880 and 39M5082[1] - 4.3 m (14 ft.) (T) 6952301 and 39M5080[1] - 1.8 m (6 ft.)	
Systems and expansion units (T) - Models ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, and , 7/20		

Note:

1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.

Plug and receptacle type 64

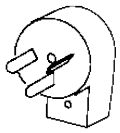
Plug	Receptacle	Countries/Regions
	 Type 64 250V 15A	*International Electrotechnical Commission* ***iNMETRO***
Cord Feature	Part Number	
6495 (L)	74P4393 and 39M5240[1] - 2.7 m (9 ft.) **(L)**	
Cord Rating		
3.8 kVA cord (L)		
Systems and expansion units		
(L) - Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+		
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.		

Plug and receptacle type 57

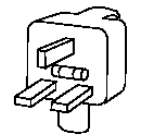
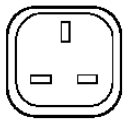
Plug	Receptacle	Countries/Regions
 Type 57 200 - 240 V 12 A	Type 57 200 - 240 V 12 A	***NEMA 6-15*** Japan
Cord Feature	Part Number	
6687 (A) (B)	25R2576 and 39M5185[1] - 1.8 m (6 ft.) (A) (B)	
6669 (A) (B)	25R2578 and 39M5187[1] - 4.3 m (14 ft.) (A) (B)	
6456 (A) (B)	25R2573 and 39M5173[1] - 1.8 m (6 ft.) (A) (B)	
6691 (C)	25R2582 and 39M5335[1] - 4.3 m (14 ft.) (A) (B)	
	25R2580 and 39M5333[1] - 1.8 m (6 ft.) (A) (B)	

	25R2581 and 39M5334[1] - 2.7 m (9 ft.) (A) (B) 25R2577 and 39M5198[1] - 2.7 m (9 ft.) (A) (B) 25R2578 and 39K5235[1] - 4.3 m (14 ft.) (C)
Systems and expansion units (A) - ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, ,	
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.	

Plug and receptacle type 32

Plug	Receptacle	Countries/Regions
 Type 32 250V 10A/16A		*Standards Institution of Israel* ***SII 32-1971*** Israel
Cord Feature	Part Number	Cord Rating
6475 (T) 6464(U)	14F0087 and 39M5172[1] - 2.7 m (9 ft.) **(T)** 14F0088 and 39M5173[1] - 4.3 m (14 ft.) (T) 14F0085 and 39M5170[1] - 4.3 m (14 ft.)(U)	2.4 kVA cord (B) (G) (H) (K) (T)
Systems and expansion units (T) - Models ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, ,		
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.		

Plug and receptacle type 23

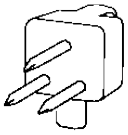
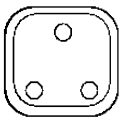
Plug	Receptacle	Countries/Regions
 Type 23 250V 13A		*British Standards Institution* ***BS 1363A*** Abu Dhabi, Bahrain, Botswana, Brunei, Channel Islands, Cyprus, Dominica, Gambia, Ghana, Grenada, Grenadines, Guyana, Iraq, Ireland, Hong Kong S.A.R. of the PRC, Jordan, Kenya, Kuwait, Liberia, Malawi, Malaysia, Malta, Myanmar, Nevis, Nigeria, Oman, Qatar, Sabah, Seychelles, Sierra Leone, Singapore, St. Lucia, St. Kitts, St. Vincent, Sudan, Tanzania, Trinidad and Tobago, United Arab Emirates, United Kingdom, Yemen, Zambia
Cord Feature	Part Number	
6474 (T)	14F0033 and 39M5151[1] - 2.7 m (9 ft.) **(T)**	
6463 (U)	14F0034 and 39M5152[1] - 4.3 m (14 ft.) (T)	
	14F0031 and 39M5149[1] - 4.3 m (14 ft.)(U)	
Systems and expansion units (T) - Models ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, ,		
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.		

Plug and receptacle type 10

Plug	Receptacle	Countries/Regions
		*National Electrical Manufacturers Association NEMA WD-5: L6-15P* Canada, Colombia, Japan, Mexico, United States, Uruguay Note: Plug Type 10 supports models 9910-080 in Colombia and Mexico. Plug Type 10 is not available in Canada and the United States for these

 Type 10 250V 15A Locking	NEMA L6-15R	models.
Cord Feature 6497(J) (M)	Part Number 86G7878 and 39M5115[1] (10 A only) - 1.8 m (6 ft.) (M)	
Systems and expansion units (M) - Models ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04,		
Note: 1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.		

Plug and receptacle type 22

Plug  Type 22 250V 16A	Receptacle 	Countries/Regions *South African Bureau of Standards* ***SABS 164 BS 546*** Bangladesh, Pakistan, South Africa, Sri Lanka, LeSotho, Maceo, Maldives, Namibia, Nepal, Samoa, South Africa, Swaziland, Uganda
Cord Feature 6477 (T) 6466 (U) Migration (K)	Part Number 14F0015 and 39M5144[1] - 2.7 m (9 ft.) (T) 14F0013 and 39M5142[1] - 4.3 m (14 ft.)(U)	
Systems and expansion units (T) - Models ESCALA PL 250T/R, ESCALA PL 450T/R, ESCALA PL 850R/PL 1650R/R+, ESCALA PL 250R-VL or ESCALA PL 450R-XS, 57/86 , 57/87 , D24, T24, ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+, ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+, ESCALA PL 245T/R, 471/85, ESCALA PL 1650R-L+, ESCALA PL 250R-L+ or ESCALA PL 450R-VL+, ESCALA PL 250R-L, 10C/R3, 10C/04, ,		
Note:		

1. This part meets the European Union Directive 2002/95/EC on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.

Power cord features

When ordering power cords (also known as power cables), use power cord options to specify features like length and general plug type.

You can use some of the option numbers in conjunction with each other. For example, 9182 specifies a 4.3 m (14 ft.) cord, and 9183 specifies a locking power cord.

The following lists the power cords and a *general* description of the power cord. Select the option number for a full description, including requirements.

Note: Some features are not available in all Countries or Regions, for all systems, or with all other options. Select the option number and check the full descriptions of the power cord for these prohibitions.

Feature or option code	Voltage	Amperage	Length	System connector	Plug	Comments
6451	200-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	IS 6538	
6452	200-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	GB 1053 (CCC Cert)	
6453	200-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	IRAM 2073	
6454	200-240 V ac	16 A	4.3 m (14 ft.)	IEC320-C13	KSC 8305	
6455	200-240 V ac	15 A	4.3 m (14 ft.)	IEC320-C13		
6456	200-240 V ac	12 A	4.3 m (14 ft.)	IEC320-C13	NEMA 6-15	
6458	100-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	IEC320-14	Inside the rack, this cord connects a drawer to the PDU for power
6459	200-240 V ac	10 A	3.66 m (12 ft.)	IEC320-C13	IEC320-C14	Inside the rack, this cord connects a drawer to the PDU for power
6460	120-127 V ac	12 A	4.3 m (14 ft.)	IEC320-C13	NEMA 5-15 non-locking wall plug	This cord connects a deskside or rack drawer to its power source

6461	200-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	CEE 7 VII	
6462	200-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	DK2-5e	
6463	200-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	BS1364A	
6464	200-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	SII 32-1971	
6465	200-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	SEV 24507	
6466	200-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	SABS 1661	
6467	200-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	CEI 23-16	
6468	200-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	AS3112-1964, NZS 198	
6469	200-240 V ac	12 A (15 A derated)	4.3 m (14 ft.)	IEC320-C13		
6470	100-127 V ac	12 A	1.8 m (6 ft.)	IEC320-C13	NEMA 5-15 non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6471	100-127 V ac	15 A	2.7 m (9 ft.)	IEC320-C13	INMETRO NBR 6147 (NEMA 5-15) non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6472	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	Schucko non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6473	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	CEE Danish non-locking plug	This cord connects a deskside or rack drawer to its power source
6474	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	BS1364A non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6475	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	SII 32 non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6476	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	SEV 24507 non-locking wall plug	This cord connects a deskside or rack drawer to its power source

6477	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	SABS 164 non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6478	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	CEI 23-16 non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6479	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	AS3112	This cord connects a deskside or rack drawer to its power source
6487	200-240 V ac	12 A	1.8 m (6 ft.)	IEC320-13	NEMA 6-15 non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6488	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-13	IRAM 2073 non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6489	380-415 V ac	24 A, 3-phase	4.3 m (14 ft.)	UTG0247 (32A)	IEC309 (32 A, 3P+N+G) non-locking wall plug	This cord connect the 7188 or 9188 PDU to the wall for power
6491	200-240 V ac	63 A, 1-phase	4.3 m (14 ft.)	UTG0247	IEC309 (63 A, P+N+G) non-locking wall plug	This cord connect the 7188 or 9188 PDU to the wall for power
6492	200-240 V ac	48 A, 1-phase	4.3 m (14 ft.)	UTG0247	IEC309 (60 A, 2P+G) non-locking wall plug	This cord connect the 7188 or 9188 PDU to the wall for power
6493	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	GB53 non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6494	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	IS6538 non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6495	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	IEC60083-A5 non-locking wall plug	This cord connects a deskside or

						rack drawer to its power source
6496	200-240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	KETI non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6497	200-240 V ac	12 A	1.8 m (6 ft.)	IEC320-13	NEMA L6-15 locking wall plug	This cord connects a deskside or rack drawer to its power source
6498	200-240 V ac	12 A	1.8 m (6 ft.)	IEC320-C13	RS37204-2 water-resistant	This cord connects a deskside or rack drawer to its power source
6499	200-240 V ac	15 A	4.3 m (14 ft.)	IEC320-C19		
6651	100 - 127 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	NEMA 5-15P non-locking wall plug	
6653	380-415 V ac	16 A, 3-phase	4.3 m (14 ft.)	UTG0247	IEC309 (16 A, 3P+N+G) non-locking wall plug	This cord connect the 7188 or 9188 PDU to the wall for power
6654	200-240 V ac	24 A, 1-phase	4.3 m (14 ft.)	UTG0247	NEMA L6-30P locking wall plug	This cord connect the 7188 or 9188 PDU to the wall for power
6655	200-240 V ac	24 A	4.3 m (14 ft.)	UTG0247	Water-resistant	This cord connect the 7188 or 9188 PDU to the wall for power
6656	200-240 V ac	32 A	4.3 m (14 ft.)	UTG0247	IEC309 (32 A, P+N+G) non-locking wall plug	This cord connect the 7188 or 9188 PDU to the wall for power
6657	200-240 V ac	24 A	4.3 m (14 ft.)	UTG0247	Plug type PDL non-locking wall plug	This cord connect the 7188 or 9188 PDU to the wall for power
6658	200-240 V ac	24 A	4.3 m (14 ft.)	UTG0247	Plug type KP non-locking wall plug	This cord connect the 7188 or 9188 PDU to the wall for power
6659		10 A		IEC320-C13	NEMA 6-15P	

	200 - 240 V ac		2.7 m (9 ft.)			
6660	120-127 V ac	15 A	4.3 m (14 ft.)	IEC320-C13	NEMA 5-15 non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6663	200-240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13 right angle	NEMA 6-15P	
6669	200-240 V ac	12 A (15 A derated)	4.3 m (14 ft.)	IEC320-C13		
6670	100-127 V ac	15 A	1.8 m (6 ft.)	IEC320-C13	NEMA 5-15 non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6671	100-240 V ac	10 A (HV), 12 A (LV)	2.7 m (9 ft.)	IEC320-C13	IEC320-C14 wall plug	
6672	100-240 V ac	10 A (HV), 12 A (LV)	1.5 m (5 ft.)	IEC320-C13	IEC320-C14 wall plug	
6680	200 - 240 V ac	10 A	2.7 m (9 ft.)	IEC320-C13	AS3112-1964, NZS 198	
6681	200 - 240 V ac	10 A	4.3 m (14 ft.)	IEC320-C13	AS3112-1964, NZS 198	
6687	200-240 V ac	15 A	1.8 m (6 ft.)	IEC320-13	NEMA 6-15 non-locking wall plug	This cord connects a deskside or rack drawer to its power source
6690	200-240 V ac	16 A	4.3 m (14 ft.)	IEC320-C19		
6691	200-240 V ac	15 A	4.3 m (14 ft.)	IEC320-C19	NEMA 6-15P Denan	

Power cord 6451 description

This option is the 200 - 240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and IS 6538 wall plug for:

- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit

Power cord 6452 description

This option is the 200 - 240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and GB 1053 (CCC Cert) wall plug for:

- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit

Power cord 6453 description

This option is the 200 - 240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and IRAM 2073 wall plug for:

- 11D/10
- 11D/11

Power cord 6454 description

This option is the 200 - 240 V ac, 16 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and KSC 8305 wall plug for:

- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit

Power cord 6455 description

This option is the 200-240 V ac, 15 A, 4.3 m (14 ft.) power cord with an IEC320-C13 machine input connector for:

- 11D/11
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit

Power cord 6456 description

This option is the 200-240 V ac, 12 A, 4.3 m (14 ft.) power cord with an IEC320-C13 machine input connector for:

- 11D/11

Power cord 6458 description

This option is the 100-240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and an IEC 320-14 plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6459 description

This option is the 200-240 V ac, 10 A, 3.66 m (12 ft.) power cord with an IEC 320-C13 machine input connector and an IEC 320-14 plug for:

- 57/90, 7311-11D/10, 11D/11 expansion units

Power cord 6460 description

This option is the 120-127 V ac, 12 A, 4.3m (14 ft.) power cord with an IEC 320-C13 machine input connector and an NEMA 5-15 plug for:

- Models ESCALA PL 250T/R, and ESCALA PL 450T/R
- 57/86, 57/87, D24,31T/24
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85

Power cord 6461 description

This option is the 200 - 240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and CEE 7 VII wall plug for:

- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit

Power cord 6462 description

This option is the 200 - 240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and DK2-5e wall plug for:

- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit

Power cord 6463 description

This option is the 200 - 240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and BS1364A wall plug for:

- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit

Power cord 6464 description

This option is the 200 - 240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and SII 32-1971 wall plug for:

- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit

Power cord 6465 description

This option is the 200 - 240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and SEV 24507 wall plug for:

- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit

Power cord 6466 description

This option is the 200 - 240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and SABS 1661 wall plug for:

- 11D/10
- 11D/11
- 57/90

Power cord 6467 description

This option is the 200 - 240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and CEI23-16 wall plug for:

- 11D/10
- 11D/11
- 57/90

Power cord 6468 description

This option is the 200 - 240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and AS3112-1964, NZS 198 wall plug for:

- 11D/10, 11D/11

Power cord 6469 description

This option is the 200-240 V ac, 12 A (15 A derated), 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit

- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6470 description

This option is the 100-127 V ac, 12 A, 1.8 m (6 ft.) power cord with an IEC 320-C13 machine input connector and NEMA 5-15 wall plug for:

- Models 9406-520, ESCALA PL 250T/R, 9406-550, and ESCALA PL 450T/R
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85

Power cord 6471 description

This option is the 100-127 V ac, 15 A, 2.7 m (9 ft.) power cord with an IEC320-C13 system connector and an iNMETRO NBR 6147 non-locking wall plug for:

- Models 9406-520, ESCALA PL 250T/R, 9406-550, ESCALA PL 450T/R, 9406-570, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+

- ESCALA PL 245T/R
- 471/85

Power cord 6472 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and Schuko plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6473 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and a CEE wall plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6474 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and a BS 1364 A plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit

- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6475 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and an SII-32 plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6476 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320 C13 machine input connector and an SEV24507 wall plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6477 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and an SABS164 plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6478 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and a CEI23-16 plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6479 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and an AS3112 plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6487 description

This option is the 200-240 V ac, 12 A, 1.8 m (6 ft.) power cord with an IEC 320-C13 machine input connector and NEMA 6-15 wall plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6488 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC320-C13 system connector and an IRAM 2079 wall plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6489 description

This option is the 380-415 V ac, 24 A, 3-phase, 24 A, 4.3 m (14 ft.) power cord with a UTG0247 (32A) system connector and an IEC309 (32 A, 3P+N+G) non-locking wall plug for:

- FC 7188 and 9188

Power cord 6491 description

This option is the 200-240 V ac, 63 A, 1-phase, 4.3 m (14 ft.) power cord with a UTG0247 system connector and an IEC309 (63 A, P+N+G) non-locking wall plug for:

- FC 7188 and 9188

Power cord 6492 description

This option is the 200-240 V ac, 48 A, 1-phase, 4.3 m (14 ft.) power cord with a UTG0247 system connector and an IEC309 (60 A, 2P+G) non-locking wall plug for:

- FC 7188 and 9188

Power cord 6493 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and a GB 53 plug:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6494 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and a IS 6538 plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6495 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and an IEC 60083-AS plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6496 description

This option is the 200-240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector with a KETI wall plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R

- 471/85
- ESCALA PL 1650R-L+

Power cord 6497 description

This option is the 200-240 V ac, 12 A, 1.8 m (6 ft.) power cord with a twist-lock and an IEC 320-C13 machine input connector and a NEMA L6-15 locking wall plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 1650R-L+

Power cord 6498 description

This option is the 200-240 V ac, 12 A, 1.8 m (6 ft.) water-resistant power cord with an IEC320-C13 machine input connector and RS37204-2 water-resistant plug for:

- Models ESCALA PL 250T/R, ESCALA PL 450T/R, and ESCALA PL 850R/PL 1650R/R+
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+

Power cord 6499 description

This option is the 200-240 V ac, 15 A, 4.3 m (14 ft.)non-locking power cord with an IEC320-C19 machine input connector for:

- 11D/10, 11D/11
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit

Power cord 6651 description

This option is the 100-127 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and NEMA 5-15P wall plug for:

- ESCALA PL 450T/R
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85

Power cord 6653 description

This option is the 380-415 V ac, 16 A, 3-phase, 4.3 m (14 ft.) power cord with a UTG2047 system connector and an IEC309 (16 A, 3P+N+G) non-locking wall plug.

Power cord 6654 description

This option is the 200-240 V ac, 24 A, 1-phase, 4.3 m (14 ft.) power cord with a UTG2047 system connector and a NEMA L6-30P locking wall plug.

Power cord 6655 description

This option is the 200-240 V ac, 24 A, 4.3 m (14 ft.) power cord with a UTG2047 system connector and a water-resistant wall plug.

Power cord 6656 description

This option is the 200-240 V ac, 32 A, 4.3 m (14 ft.) power cord with a UTG2047 system connector and an IEC309 (32 A, P+N+G) non-locking wall plug.

Power cord 6657 description

This option is the 200-240 V ac, 24 A, 4.3 m (14 ft.) power cord with a UTG2047 system connector and an plug type PDL non-locking wall plug.

Power cord 6658 description

This option is the 200-240 V ac, 24 A, 4.3 m (14 ft.) power cord with a UTG2047 system connector and a plug type KP non-locking wall plug.

Power cord 6659 description

This option is the 200 - 240 V ac, 10 A, 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and NEMA 6-15P wall plug for:

- ESCALA PL 250R-L
- ESCALA PL 250T/R
- ESCALA PL 450T/R
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- ESCALA PL 850R/PL 1650R/R+
- 7/10
- 7/20
- D24
- T24
- 11D/20
- 50/95
- 57/86
- 57/87
- 10C/R3
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6660 description

This option is the 120-127 V ac, 15 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and an NEMA 5-15 plug for:

- Model 7/20
- 57/86 expansion unit

- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85

Power cord 6663 description

This option is the 200-240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 right-angle machine input connector

Power cord 6669 description

This option is the 200-240 V ac, 12 A (15 A derated), 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector for:

- 7/20
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6670 description

This option is the 100-127 V ac, 15 A, 1.8 m (6 ft.) power cord with an IEC 320-C13 machine input connector and NEMA 5-15 wall plug for:

- 7/20
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85

Power cord 6671 description

This option is the 100 - 240 V ac, 10 A (HV), 12 A (LV), 2.7 m (9 ft.) power cord with an IEC 320-C13 machine input connector and IEC 320-C14 wall plug for:

- 14S/25 rack
- 05/55 rack
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+

Power cord 6672 description

This option is the 100 - 240 V ac, 10 A (HV), 12 A (LV), 1.5 m (5 ft.) power cord with an IEC 320-C13 machine input connector and IEC 320-C14 wall plug for:

- 14S/11 rack
- 14S/25 rack
- 05/54 rack
- 05/55 rack
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+

Power cord 6680 description

This option is the 200 - 240 V ac, 10 A, 2.7m (9 ft.) power cord with an IEC 320-C13 machine input connector and AS3112-1964 and NZS 198 wall plug for:

- ESCALA PL 250R-L
- ESCALA PL 250T/R
- ESCALA PL 450T/R
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- ESCALA PL 850R/PL 1650R/R+
- 9406-520
- 9406-550
- 9406-570
- 57/86
- 57/87
- 05/95
- 10C/R3
- 10C/04
- 57/86 expansion unit
- 57/87 expansion unit
- D24 expansion unit
- T24 expansion unit
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R

- 471/85
- ESCALA PL 1650R-L+

Power cord 6681 description

This option is the 200 - 240 V ac, 10 A, 4.3 m (14 ft.) power cord with an IEC 320-C13 machine input connector and AS3112-1964 and NZS 198 wall plug for:

- 11D/10
- 11D/11

Power cord 6687 description

This option is the 200-240 V ac, 15 A, 1.8 m (6 ft.) power cord with an IEC 320-C13 machine input connector and NEMA 6-15 wall plug for:

- 7/20
- ESCALA PL 250R-VL or ESCALA PL 450R-XS
- 112/85
- ESCALA PL 250T/R+ or ESCALA PL 450T/R-L+
- ESCALA PL 450T/R+ or ESCALA PL 850T/R-L+
- ESCALA PL 245T/R
- 471/85
- ESCALA PL 1650R-L+

Power cord 6690 description

This option is the 200-240 V ac, 16 A, 4.3 m (14 ft.) power cord with an IEC 320-C19 machine input connector for:

- 11D/10, 11D/11 expansion units

Power cord 6691 description

This option is the 200-240 V ac, 15 A, 4.3 m (14 ft.) power cord with an IEC 320-C19 machine input connector and NEMA 6-15P wall plug for:

- Expansion units 5074, 5079, 5094, 5294, 8079, 8093, 8094, 9079, 9094, 9194

Power load calculating for 7188 or 9188 power distribution units

This topic provides the power loading requirements and proper loading sequence for the 7188 or 9188 power distribution unit.

Rack-mounted 7188 or 9188 power distribution unit

The 7188 or 9188 rack-mounted power distribution unit (PDU) contains 12 IEC 320-C13 outlets connected to six 20 A circuit breakers (two outlets per circuit breaker). The PDU employs an inlet current that allows a variety of power cord options that are listed in the following chart. Based on the power cord that is used, the PDU can supply from 4.8 kVa to 19.2 kVa.

Table 1. Power cord options

Feature code	Power cord description	KVa available
6489	Power cord, PDU to wall, 4.3 m (14 ft.), 3-phase, UTG0247, IEC309 32 A 3P+N+G plug	21.0
6491	Power cord, PDU to wall, 4.3 m (14 ft.), 200 - 240 V ac, UTG0247, IEC309 63 A P+N+G plug	9.6
6492	Power cord, PDU to wall, 4.3 m (14 ft.), 200 - 240 V ac, UTG0247, IEC309 60 A 2P+G plug	9.6
6653	Power cord, PDU to wall, 4.3 m (14 ft.), 3-phase, UTG0247, IEC309 16A 3P+N+G plug	9.6
6654	Power cord, PDU to wall, 4.3 m (14 ft.), 200 - 240 V ac, UTG0247, Plug type 12 plug	4.8
6655	Power cord, PDU to wall, 4.3 m (14 ft.), 200 - 240 V ac, UTG0247, Plug type 40 plug	4.8
6656	Power cord, PDU to wall, 4.3 m (14 ft.), 200 - 240 V ac, UTG0247, IEC309 32 A P+N+G plug	4.8
6657	Power cord, PDU to wall, 4.3 m (14 ft.), 200 - 240 V ac, UTG0247, Plug type PDL plug	4.8
6658	Power cord, PDU to wall, 4.3 m (14 ft.), 200 - 240 V ac, UTG0247, Plug type KP plug	4.8

Loading requirements

The power loading of the 7188 or 9188 PDU must follow these rules:

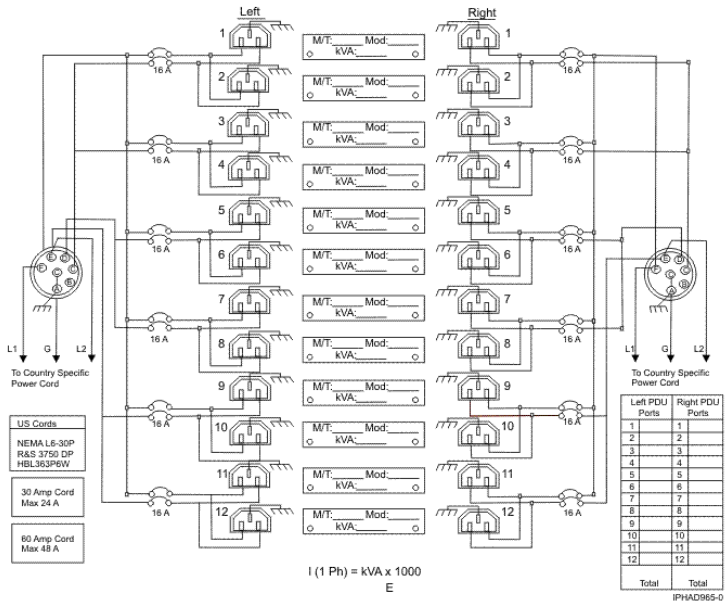
1. Total power load connected to the PDU must be limited to below the kVa listed in the table.
2. Total power load connected to any one circuit breaker must be limited to 16 A (derating of circuit breaker).
3. Total power load connected to any one IEC320-C13 outlet must be limited to 10 A.

Note: The load on the PDU when a dual line configuration is used will only be half the total load of the system. When calculating the power load on the PDU, you must include the total power load of each drawer even if the load is distributed over two PDUs.

Proper loading sequence

1. Collect power requirements for all units that will be connected to the 7188 or 9188 PDU. See Server specifications for specific power requirements.
2. Sort list by total power required from highest power draw to lowest power draw.
3. Connect highest power drawer to outlet 1 on circuit breaker 1.
4. Connect next highest power drawer to outlet 3 on circuit breaker 2.
5. Connect next highest power drawer to outlet 5 on circuit breaker 3.
6. Connect next highest power drawer to outlet 7 on circuit breaker 4.
7. Connect next highest power drawer to outlet 9 on circuit breaker 5.
8. Connect next highest power drawer to outlet 11 on circuit breaker 6.
9. Connect next highest power drawer to outlet 12 on circuit breaker 6.
10. Connect next highest power drawer to outlet 10 on circuit breaker 5.
11. Connect next highest power drawer to outlet 8 on circuit breaker 4.
12. Connect next highest power drawer to outlet 6 on circuit breaker 3.
13. Connect next highest power drawer to outlet 4 on circuit breaker 2.
14. Connect next highest power drawer to outlet 2 on circuit breaker 1.

Following these rules will allow the load to be distributed more evenly across the six PDU circuit breakers. Ensure that your total power load is below the maximum listed in the table and that each circuit breaker is not loaded above 15 A.



PDU load sequence schematic

Dual-power installation configurations

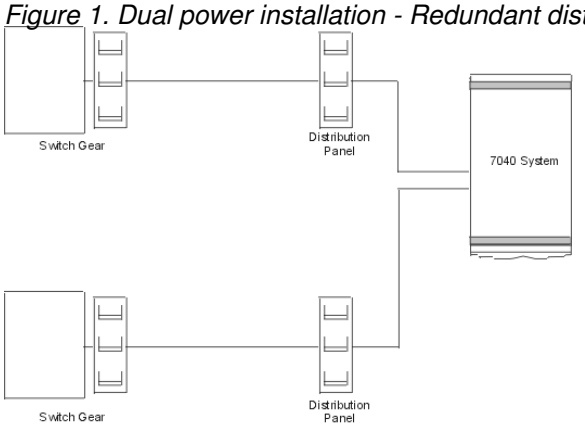
Some server models are designed with a fully redundant power system. The possible power installation configurations are:

- Dual power installation - Redundant distribution panel and switch
- Dual power installation - Redundant distribution panel
- Single distribution panel - Dual circuit breakers

Dual-power installation - Redundant distribution panel and switch

This configuration requires that the system receives power from two separate power distribution panels. Each distribution panel receives power from a separate piece of building switch gear. This level of redundancy is not available in most facilities.

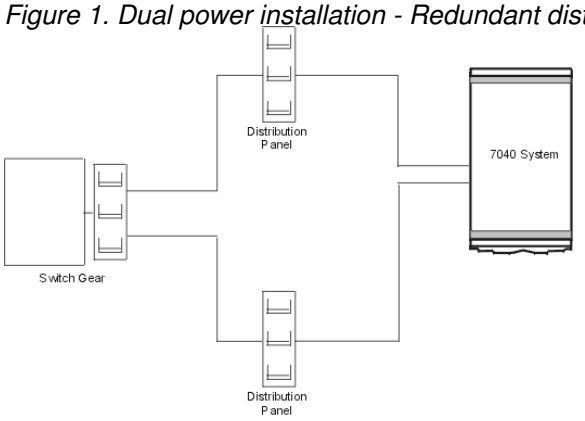
Figure 1. Dual power installation - Redundant distribution panel and switch



Dual-power installation - Redundant distribution panel

This configuration requires that the system receives power from two separate power distribution panels. The two distribution panels receive power from the same piece of building switch gear. Most facilities should be able to achieve this level of redundancy.

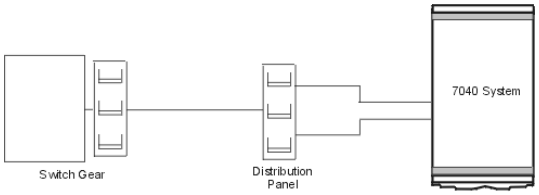
Figure 1. Dual power installation - Redundant distribution panel



Single distribution panel - Dual circuit breakers

This configuration requires that the system receives power from two separate circuit breakers in a single power panel. This configuration does not make full use of the redundancy provided by the processor. It is, however, acceptable if a second power distribution panel is not available.

Figure 1. Single distribution panel - Dual circuit breakers



Air conditioning determination

The air conditioning system must provide year-round temperature and humidity control as a result of the heat dissipated during equipment operation. Heat dissipation ratings are given in the server specifications for each server. Air conditioning units should not be powered from the computer power panel because of the high starting current drawn by their compressor units. The feeder line for the air conditioning system and the computer room power should not be in the same conduit.

Consider the following factors when determining the air conditioning capacity necessary for installation:

- Information technology equipment heat dissipation
- Number of personnel
- Lighting requirements
- Amount of fresh air introduced
- Possible reheating of circulated air
- Heat conduction through outer walls and windows
- Ceiling height
- Area of floors
- Number and placement of door openings
- Number and height of partitions

Most servers are air-cooled by internal blowers. A separate air conditioning system is recommended for data processing installation. A separate system might be required for small systems or individual servers intended for operation when the building air conditioning system is not adequate or is not operational. Server heat dissipation loads are given on the server specifications for each server. See the environmental requirements in the server specifications for your server.

General guidelines for data centers

Refer to the latest ASHRAE publication, "Thermal Guidelines for Data Processing Environments", dated January, 2004. This document can be purchased online at ashrae.org. A dedicated section outlines a detailed procedure for assessing the overall cooling health of the data center and optimizing for maximum cooling.

Server and storage considerations

Most servers and storage products are designed to pull chilled air through the front of the server and exhaust hot air out of the back. The most important requirement is to ensure that the inlet air temperature to the front of the equipment does not exceed environmental specifications. See the environmental requirements in the server specifications or hardware specification sheets. Make sure that the air inlet and exit areas are not blocked by paper, cables, or other obstructions. When upgrading or repairing your server, be sure not to exceed, if specified, the maximum allowed time for having the cover removed with the unit running. After your work is completed, be sure to reinstall all fans, heat sinks, air baffles, and other devices per your documentation.

Manufacturers are reporting heat loads in a format suggested by the ASHRAE publication, "Thermal Guidelines for Data Processing Environments", dated January, 2004. Although this data is meant to be used to for heat load balancing, care is required when using the data to balance cooling supply and demand as many applications are transient and do not dissipate constant rates of heat. A thorough understanding of how the equipment and application behave with regard to heat load, including considerations for future growth, is required.

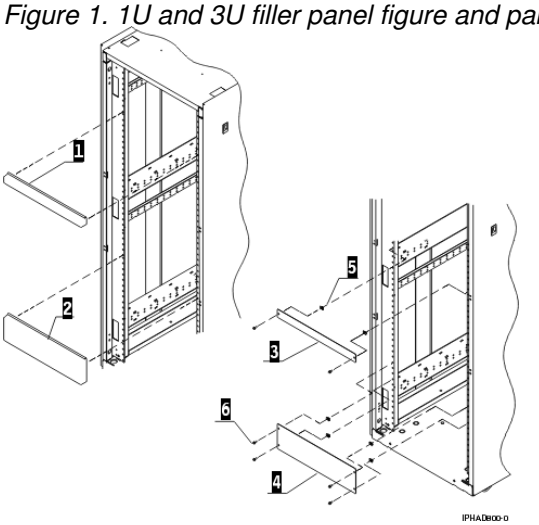
Rack or cabinet considerations

Note: Racks are used throughout this section to also mean cabinets, frames, and any other commonly used term to identify the unit that houses rack-mounted equipment.

The 19-inch racks are designed to allow maximum air flow through the equipment installed in the rack. Chilled air is pulled through the front and exhausted through the rear by the fans in the rack-mounted equipment. Most racks come with a perforated rear door and an optional front door that is perforated. Some racks have optional acoustical treatment to reduce the noise emissions from the rack. If other racks are used, solid doors or doors with significant amounts of decorative glass are not recommended as these will not allow sufficient air to flow into and out of the rack.

Recirculation of hot air exiting the back of the rack into the front of the rack must be eliminated. There are two actions that can be taken to prevent air recirculation. First, filler or blanking panels must fill all unoccupied rack space that is not occupied by equipment shipped in rack. 1U and 3U filler panels are used to block air recirculation within the rack. If you do not have filler panels installed in your rack, these are available from your seller.

Figure 1. 1U and 3U filler panel figure and part numbers



Index number	FRU part number	Units per assembly	Description
1	97H9754	As needed	1U Filler snap (black)
	62X3443	As needed	1U Filler snap (white)
2	97H9755	As needed	3U Filler snap (black)
	62X3444	As needed	3U Filler snap (white)
3	12J4072	As needed	1U Filler snap (black)
4	12J4073	As needed	3U Filler snap (black)
5	74F1823	2 per Item 3	M5 Nut clip
	74F1823	4 per Item 4	M5 Nut clip
6	1624779	2 per Item 3	M5 X 14 Hex flange
	1624779	4 per Item 4	M5 X 14 Hex flange

Second, allow proper operating clearance around all racks. See the clearance requirements in the server specifications or hardware specification sheets. The floor layout should not allow the hot air exhaust from the back of one rack to enter the front air inlet of another rack.

Finally, proper cable management is another important element of maximizing the air flow through the rack. Cables must be routed and tied down in such a way that they do not impede the movement of air into or out of the rack. Such impedance could significantly reduce the volumetric flow of air through the equipment.

Use a fan-assisted rack or cabinet with caution. Depending upon how much equipment is installed in the cabinet, the air movers in the cabinet may limit the amount of flow to less than what is required by the equipment.

Room considerations

Data centers designed and built in the last 10 years are typically capable of cooling up to 3KW of heat load per cabinet. These designs often involve raised floor air distribution plenums 18 to 24 inches in height, room ceiling heights of 8 to 9 feet, and Computer Room Air Conditioning (CRAC) units distributed around the perimeter of the room. IT equipment occupies roughly 30-35% of the total data center space. The remaining space is white space (for example, access aisles, service clearances), power distribution units (PDUs), and CRAC units. Until recently, little attention has been given to heat load assessments, equipment layout and air delivery paths, heat load distribution, and floor tile placement and openings.

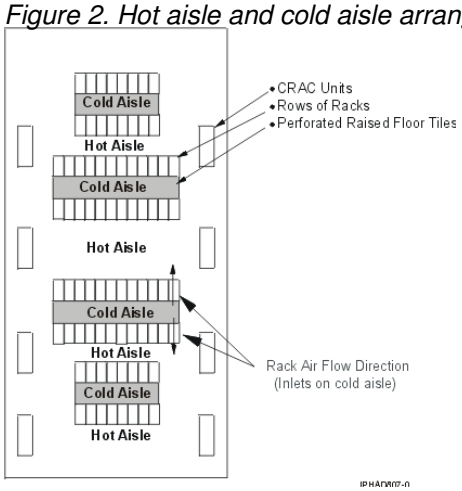
Assessing the total heat load of your installation

A total heat load assessment should be conducted to determine your overall environment balance point. The purpose of the assessment is to see if you have enough sensible cooling, including redundancy, to handle the heat load that you plan to install or have installed. There are several ways to perform this assessment, but the most common is to review the heat load and cooling in logical sections defined by I-beams, air flow blockages, or CRAC unit locations.

Equipment layout and air delivery paths

The seller recommends the hot-aisle, cold-aisle arrangement that is explained in the ASHRAE publication, "Thermal Guidelines for Data Processing Environments", dated January, 2004. In the following figure, racks within the data center are arranged such that there are cold aisles and hot aisles. The cold aisle consists of perforated floor tiles separating two rows of racks. The chilled air from the perforated floor tiles is exhausted from the tiles and is drawn into the fronts of the racks. The inlets of each rack (front of each rack) face the cold aisle. This arrangement allows the hot air exhausting the rear of the racks to return to the CRAC units; thus, minimizing hot exhaust air from the rack circulating back into the inlets of the racks. CRAC units are placed at the end of the hot aisles to facilitate the return of the hot air to the CRAC unit and maximize static pressure to the cold aisle.

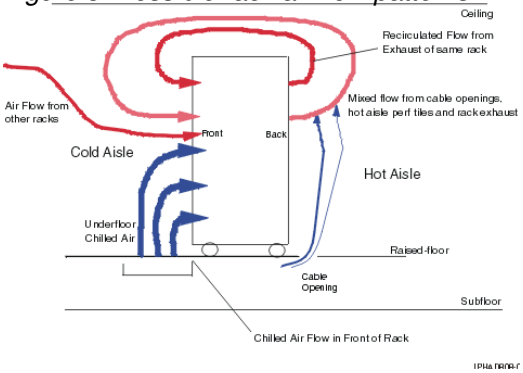
Figure 2. Hot aisle and cold aisle arrangement



The key to heat load management of the data center is to provide inlet air temperatures to the rack that meet the manufacturer's specifications. Because the chilled air exhausting from the perforated tiles in the cold aisle may not satisfy the total chilled air flow required by the rack, additional flow will be drawn from other areas of the raised floor and may not be chilled. See the following figure. In many cases, the air flow drawn into the top of the rack, after the bottom of the rack has been satisfied, will be a mixture of hot air from the rear of the

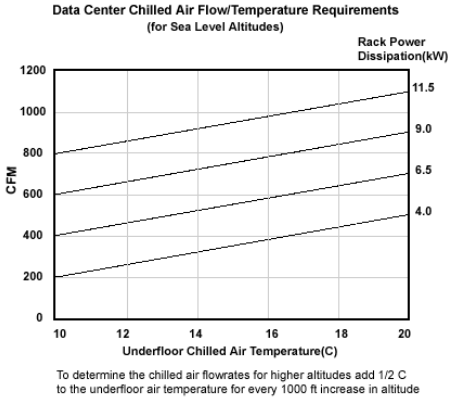
system and air from other areas. For those racks that are at the ends of a row, the hot air flow that exhausts from the rear of the rack and migrate to the front around the sides of the rack. These flow patterns have been observed in actual data centers and in flow modeling.

Figure 3. Possible rack air flow patterns



For a data center that may not have the best chilled-air-flow distribution, the following figure gives guidance in providing adequate chilled air flow given a specific heat load. The chart takes into account worst-case locations in a data center and are the requirements to meet the maximum temperature specifications required by most high-end equipment. Altitude corrections are noted on the bottom portion of the chart.

Figure 4. High-end equipment chilled air flow and temperature requirements



The most common methods for delivering supply air to the racks can be found in System air distribution.

Heat load distribution

Increased performance capabilities and the accompanying heat load demands have caused data centers to have hot spots in the vicinity of heat loads that exceed 3KW. Facility owners are discovering that it is becoming increasingly difficult to plan cooling schemes for large-scale deployments of high-heat-load equipment. Essentially, two different approaches can be undertaken for a large-scale, high-end server or storage deployment:

1. Provide ample cooling for maximum heat load requirements across the entire data center.
2. Provide an average amount of cooling across the data center with the capability to increase cooling in limited, local areas.

Option 1 is very expensive and more conducive to new construction. For option 2, a number of things can be done to optimize cooling in existing data centers and possibly raise the cooling capability in limited sections.

One recommendation is to place floor tiles with high percent-open and flow ratings in front of the high-end racks. Another recommendation is to provide special means for removing hot exhaust air from the backs of the high-end racks immediately, before it has a chance to migrate back to the air intakes on racks in other parts of the room. This could be accomplished by installing special baffling or direct ducting back to the air returns on the CRAC units. Careful engineering is required to ensure that any recommendation does not have an adverse effect on the dynamics of the underfloor static pressure and air flow distribution.

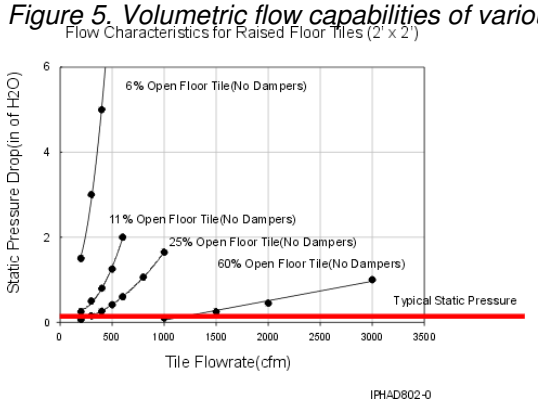
In centers where floor space is not an issue, it would be most practical to design the entire raised floor to a constant level of cooling and depopulate racks or observe a greater distance between racks in order to meet the per-cabinet capability of the floor.

Floor tile placement and openings

Perforated tiles should be placed exclusively in the cold aisles, aligned with the intakes of the equipment. No perforated tiles should be placed in the hot aisles, no matter how uncomfortably hot. Hot aisles are, by design, supposed to be hot. Placement of open tiles in the hot aisle artificially decreases the return air temperature to the CRAC units, thereby reducing their efficiency and available capacity. This phenomenon contributes to hot spot problems in the data center. Perforated tiles should not be placed in too close proximity to the CRAC units. In areas under the raised floor where air velocities exceed about 530 feet-per-minute, usually within about six tiles of the unit discharges, a Venturi effect may be created where room air will be sucked downward into the raised floor, opposite of the desired result of upward chilled air delivery.

The volumetric flow capabilities of floor tiles with various percent-open ratings are shown in figure 5.

Figure 5. Volumetric flow capabilities of various raised floor tiles



Floor tiles in typical data centers deliver between 100 and 300 cfm. By optimizing the flow utilizing some of the guidelines set forth in this document, it may be possible to realize flows as high as 500 cfm. Flow rates as high as 700-800 cfm per tile are possible with tiles with the highest percent-open rating. Floor tiles must be aligned in the cold aisles with the intake locations on the equipment.

Openings in the raised-floor that are not there for the purpose of delivering chilled air directly to the equipment in the data center space should be completely sealed with brush assemblies or other cable opening material (for example, foam sheeting, fire pillows). Other openings that must be sealed are holes in data center perimeter walls, underfloor, and ceiling. Sealing all openings will help maximize under-floor static pressure, ensure optimal air flow to the cold aisles where it is needed, and eliminate short-circuiting of unused air to the CRAC unit returns.

Temperature and humidity design criteria

The information technology equipment can tolerate a considerable range of temperature and humidity, as described in the server specifications for each server. Generally, the air conditioning system should be designed for 22 degrees C (71.6 degrees F) and 45 percent relative humidity at altitudes up to 2150 m (7000 ft.). This design point provides for the largest buffer in terms of available system time. If the air conditioning system fails or malfunctions, the computer will be able to operate until it reaches its specified limits. This buffer provides additional time for air conditioning repairs before the computer must be shut down. The design point has also been proven to be a generally acceptable personal comfort level.

The design points for temperature and relative humidity might differ in certain geographical areas.

Air conditioning control instruments that respond to + or - 1 degree C (+ or - 2 degrees F) temperature and + or - 5 percent relative humidity should be installed.

Computer room cooling is basically a sensible (as opposed to a latent) cooling operation. (Sensible heat is defined as the transfer of thermal energy to or from a substance resulting in a change in temperature: Latent heat is the thermal energy absorbed or evolved in a process other than change of temperature.)

Substantial deviations from the recommended design point in either direction, if maintained for long periods (that is, for hours), will expose the system to malfunction from external conditions. For example, high relative humidity levels might cause improper feeding of paper, operator discomfort, and condensation on windows and walls when outside temperatures fall below room dew point.

Low relative humidity levels alone will not cause static discharge. However, in combination with many types of floor construction, floor coverings, and furniture, static charges that are generated by movement of people, carts, furniture, and paper will be more readily stored on one or more of the objects. These charges might be high enough to be objectionable to operating personnel, if discharged by contact with another person or object. If discharged to or near information technology equipment or other electronic equipment, these charges can cause intermittent interference. In most areas, it will be necessary to add moisture to the room air to meet the design criteria.

Because temperature or relative humidity deviations for only a few hours will cause the floors, desks, furniture, cards, tapes, and paper to reach a condition that will readily permit the retention of a charge, it is recommended that the air conditioning system be automatically controlled and provided with a high or low alarm or a continuous recording device with the appropriate limits marked.

Server operating limits

Some individual servers might require special consideration and have more or less restrictive requirements. See your server specifications for specific environmental limits.

The typical server operating environment is shown in the following table. The server nonoperating limits are shown in the following *Nonoperating Server Limits* table.

Table 1. Typical server operating environment

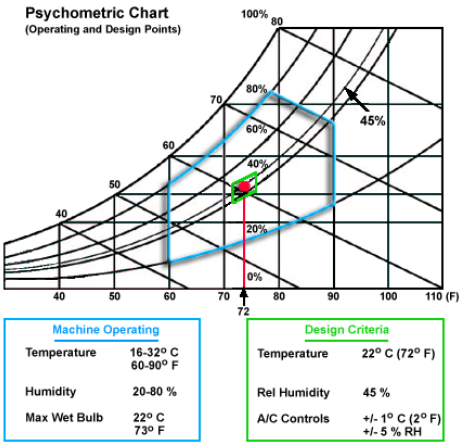
	Computer room limits	Office space air conditioned	Office space not air conditioned
Temperature	16 to 32 degrees C (60.8 to 89.6 degrees F)	16 to 32 degrees C (60.8 to 89.6degrees F)	10.0 to 40.6 degrees C (50 to 105.08 degrees F)
Relative humidity	20 to 80 percent	8 to 80 percent	8 to 80 percent
Maximum wet bulb	23 degrees C (73.4 degrees F)	23 degrees C (73.4 degrees F)	27.0 degrees C (80.6 degrees F)

The design criteria is shown is the following table.

Table 2. Design criteria

	Design criteria
Temperature	22 degrees C (71.6 degrees F)
Relative humidity	45 percent
Maximum wet bulb	23 degrees C (73.4 degrees F)

Figure 1. Recommended design



The recommended design is shown in the figure above.

Note: The air entering the server must be at the conditions for operation before power is turned on. Under no circumstances may the server's input air, room air, or humidity exceed the upper limit of the operating conditions. This is the maximum operating temperature limit and should not be considered a design condition. Also, the relative humidity of the air entering the server should not be greater than 80 percent. This specification is an absolute maximum. The optimum condition is where the room is at the design criteria of 22 degrees C (71.6 degrees F) and 45 percent humidity.

Air temperature in a duct or an underflow air supply should be kept above the room dew point temperature to prevent condensation within or on the servers. When it is necessary to add moisture to the system for control of low relative humidity, one of the following methods should be used:

- Steam grid or jets
- Evaporation pan or pane
- Steam cup
- Water atomizers

Water treatment might be necessary in areas with high mineral content to avoid contamination of the air.

Note: In localities where the outside temperature drops below freezing, condensation will form on single, glazed window panes. Also, if outside temperatures are considerably below freezing, the outside walls of the building should be waterproofed or vapor sealed on the inside or, in time, structural damage will occur in the outside walls.

Server nonoperating limits

When the facilities are shut down, the nonoperating environmental specifications must be followed to prevent damage to the server and to ensure reliable operation when power is restored.

Table 3. Nonoperating server limits

	Server nonoperating limits
Temperature	10 to 43 degrees C (50 to 109.4 degrees F)
Relative humidity	8 to 80 percent
Maximum wet bulb	27 degrees C (80.6 degrees F)

Temperature and humidity recording instruments

It is recommended that temperature and humidity recording instruments be installed to provide a continuous record of the environmental conditions.

Direct-reading instruments with 7-day charts are suggested to monitor the ambient room conditions. Any under-floor air conditioning supply should also be monitored.

Monitoring provides the ability to:

- Assure the air conditioning system is continuously performing as designed.
- Determine whether a mandatory drying-out period is necessary when the humidity limitations are exceeded. The duration of the drying-out period is determined by the extent and duration of excess humidity.
- Determine whether a mandatory warm-up period is necessary when the building temperature has dropped below server operating specifications during off-shift hours.

A visual or audible signal should be incorporated with the recording instrument to alert personnel that ambient conditions are approaching the maximum limitations.

Relocation and temporary storage

Shipment or storage conditions that exceed the specified limits can cause permanent damage. Care should be taken to ensure that a server is not stored with chemicals that can cause corrosion damage.

When a server is removed in preparation for shipment or storage, use the packaging bill of material. This might include a protective package, including blocks, braces, and preparation instructions, designed uniquely for each server. Some large processors are designed for operation in a controlled temperature and relative humidity range, and require the environment be kept within this range even when they are in a storage area or in transit. See the individual server specifications for operating environment limits. Shipment of large processors should be in an environmentally controlled van with appropriate strapping and padding to avoid any transit damage.

Table 1. Typical shipping environment

	Shipping environment
Temperature	-40 to 60 degrees C (-40 to 140 degrees F)
Relative humidity	5 to 100 percent (no condensation)
Maximum wet bulb	1 to 27 degrees C (33.8 to 80.6 degrees F)

If shipping a large processor in a nonenvironmentally controlled van, contact your seller for packing and unpacking instructions.

Table 2. Typical storage environment

	Storage environment
Temperature	1 to 60 degrees C (33.8 to 140 degrees F)
Relative humidity	5 to 80 percent
Maximum wet bulb	1 to 29 degrees C (33.8 to 84.2 degrees F)

Acclimation

When server and storage equipment is shipped in a climate where the outside temperature is below the dew point of an indoor location, there is a possibility that water condensation will form on the cooler surfaces inside the equipment when brought into a warmer indoor environment. If condensation occurs, sufficient time must be allowed for the equipment to reach equilibrium with the warmer indoor temperature before removing the shipping bag, if used. Leave the system in the shipping bag, if used, for up to 48 hours, or until there is no visible signs of condensation, to let it acclimate to the indoor environment.

System air distribution

Careful attention should be given to the method of air distribution to eliminate areas of excessive air motion and hot spots.

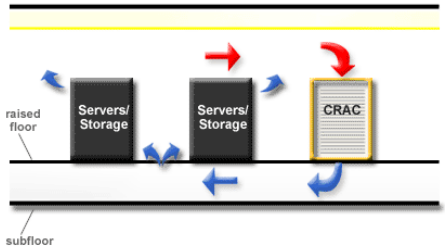
Regardless of the type of system, it should use predominantly recirculated air with a set minimum of fresh air for personnel. This helps eliminate the introduction of dust, reduces the latent load, and allows the system to carry on a sensible cooling operation. The various methods of air distribution and computer room air conditioning (CRAC) are shown in the following figures.

In general you should ensure that the design supply and return air temperatures are within the manufacturer's specifications for CRAC units.

Underfloor air distribution

In underfloor air distribution, the space between the regular building floor and the raised floor is used as a means to supply air for equipment cooling (see the following figure). Concrete subfloors might require treatment to prevent the release of dust. Air is discharged into the room through perforated panel floor registers. The air is returned directly to the air conditioning system or by means of a ceiling return system. Remove obsolete cabling (as required in the United States National Electrical Code) and seal all raised-floor openings that are not specifically intended to supply cool air to equipment intakes.

Figure 1. Underfloor air distribution



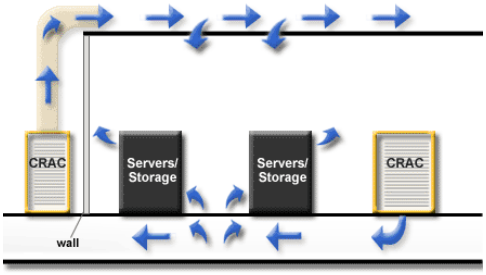
A higher return air temperature can be tolerated in underfloor air distribution without affecting the design conditions of the overall room. The underfloor design takes into consideration a heat transfer factor through the raised metal floor and also provides some reheated air to control the relative humidity before it enters the room.

A temperature control system would consist of the same controls as described for the single duct system. In addition, the system must have controls for air temperature in the under floor supply system to prevent under floor temperatures from getting below the room dew point. Air entering the server through the cable holes must be within operating limits. (See Server operating limits).

Combination overhead and under floor system

For a combination overhead and under floor air circulation design, the primary air conditioning unit is inside the room and the secondary air conditioning unit is outside the room. See following figure.

Figure 2. Combination overhead and underfloor air conditioning system



An air handler, with separate controls, supplies conditioned and filtered air to the area under the raised floor. The air is discharged into the room through floor panels or registers. This air absorbs the heat generated by the server and is discharged from the top or rear of the servers into the room. The relative humidity of the air supplied to the information technology equipment should be below 80 percent and the temperature should be controlled to prevent condensation on or within the servers. It might be necessary to provide for a reheating system to operate with the cooling unit to control relative humidity.

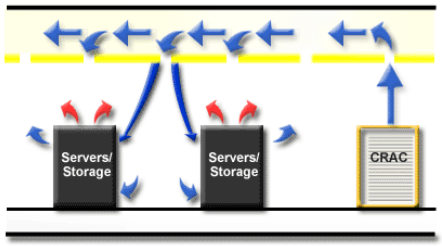
The second air handling system supplies air directly to the room through a separate supply system and should be large enough to absorb the remaining heat load in the computer room. It should maintain room temperature and relative humidity as specified and give continuous air conditioning and ventilation.

Overhead air circulation

In overhead air circulation, the entire heat load of the room or area, including the heat generated by the information technology equipment, is absorbed by the air supplied to the computer room and the area diffuser system or by a pressurized ceiling supply.

The air returned to the air conditioning system is from either ceiling return registers above the heat-producing servers, or from a fixed pattern of return registers both in the ceiling and on the walls of the room. The following figure shows an overhead air circulation system.

Figure 3. Overhead air distribution system



To maximize the cooling capability of such an arrangement, it is imperative to align the supply discharges with the cold aisles and the return grilles with the hot aisles. The supply discharges should force air directly down into the cold aisles and not use diffusers that distribute air laterally. Such diffusion can cause cool air to migrate undesirably into the return air path prior to having the opportunity to transfer heat from the equipment.

A temperature control system should consist of temperature and humidity controls. These controls should be placed in a representative location within the machine room. The temperature and humidity recorder (described in the Temperature and humidity design criteria topic) should be mounted next to the controls to monitor conditions.

Air filtration

A high efficiency filter should be installed to filter all air supplied to the computer room. Because mechanical and electrostatic air cleaners operate on different principles, a different rating is specified for each type. Ratings are determined by using the test methods outlined in the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard No. 52-76 (or national equivalent). Special air filtration is necessary where installations are exposed to corrosive gases, salt air, or unusual dirt or dust conditions.

Mechanical air filters must be rated at a minimum initial atmospheric dust-spot efficiency of 40 percent.

Electrostatic air filters are designed to operate at 85 to 90 percent efficiency at a given face velocity. The filter must be operated in accordance with the manufacturer's recommendation to prevent bypass and ozone

buildup, which can be detrimental to certain servers.

Air quality

If you are installing your system in a typical business office or clean industrial location, you probably do not have to worry about the quality of the surrounding air. However, if your site is unusually dirty or has a chemical odor, you should be concerned. Dirt and corrosive gases can cause corrosion and possible equipment damage.

High concentrations of gases such as sulfur dioxide, nitrogen dioxide, ozone, and acidic gaseous chlorine associated with industrial processes are known to cause corrosion and failure of electronic components. If you have any reason to suspect the presence of a corrosive gas (for example, the presence of an odor), determine what contaminant is in the air and whether it is in high enough concentrations to be harmful to your system. In addition to gases, some industrial processes produce particulate contamination. These particles can settle (in the form of dust) in surrounding areas even though the process producing the particles might be some distance away.

Testing for gases and particulate in the air involves special equipment and procedures. Your seller can provide guidance.

Planning for the installation of rear door heat exchangers

This topic provides information for preparing your location to facilitate the use of the Rear Door Heat Exchanger for 7014-T42.

The rear door heat exchanger is a water-cooled device that mounts on the rear of 19-inch EIA-rail and 24-inch EIA-rail Enterprise racks to cool the air that is heated and exhausted by devices inside the rack. A supply hose delivers chilled, conditioned water to the heat exchanger. A return hose delivers warmed water back to the water pump or chiller. This is referred to as a secondary cooling loop. The primary cooling loop supplies the building chilled water to secondary cooling loops, air conditioning units, and so on. The hoses for the secondary cooling loop are not included with the rear door heat exchanger kit. The rack on which you install this cooling feature can be on a raised floor or a non-raised floor. Each rear door heat exchanger can remove up to 50 000 Btu/hr (or approximately 15 000 watts) of heat from your data center.

Suggestions for sources of hoses, water treatment and cooling distribution units for supplying conditioned water are provided under Suggested sources for secondary loop components.

The following topics provide the detailed planning specifications for the rear door heat exchanger environment.

- Rear door heat exchanger specifications
- Water specifications for the secondary cooling loop
- Water delivery specifications for secondary loops
- Layout and mechanical installation

Planning considerations overview

High-level planning considerations for the rear door heat exchanger are as follows.

1. Provide chilled, conditioned water to the heat exchangers that meets the specifications outlined in Water specifications for the secondary cooling loop.
2. Procure and install the water supply system that is suitable for your data center. Details are provided in Water delivery specifications for secondary loops
3. Provide floor tile cutouts on raised floors, or protective coverings to avoid trip hazards on non-raised floors as part of hose management.

Heat exchanger specifications

The following are the specifications for the rear door heat exchanger.

Table 1. Operating specifications for 19-inch EIA-rail rear door heat exchanger

Door size • Depth: 142.6 mm (5.6 in.) • Height: 1945.4 mm (76.6 in.) • Width: 639 mm (25.2 in.) **Exchanger size** • Depth: 67 mm (2.6 in.) • Height: 1791.3 mm (70.5 in.) • Width: 438.6 mm (17.3 in.) **Door assembly weight** • Empty: 29.9 kg (66 lb.) • Filled: 35.6 kg (78.5 lb.) **Door heat removal capacity** • Lab tests indicate 50 to 60 percent of total rack heat output can be removed by the door • Up to 15 kW (50 000 Btu/hr) heat removal possible	**Air movement** • Provided by servers and other devices in the rack **Air source for servers** • Room air for front of rack. Air exhausts servers, moves through rear door heat exchanger and exits into the room (open loop) **Air temperature drop** • The temperature drop can be up to 25 degrees C (45 degrees F) between the air exiting the rack devices and the air exiting the heat exchanger on high heat load products. **Air impedance** • Air pressure drop across the rear door heat exchanger is equivalent to the acoustic 19-inch rear door	**Water source** • User-supplied, compliant with specifications in this topic. **Water pressure** • Normal operation: 137.93 kPa (20 psi) • Maximum: 689.66 kPa (100 psi) • Pressure drop across heat exchanger: approximately 48 kPa (7 psi) **Water volume** • Exchanger: 2.8 liters (0.75 gallons) • Exchanger plus supply and return hoses to the pump unit: Maximum of approximately 15.1 liters (4.0 gallons) excluding pump unit piping and reservoir **Water temperature** • If no dew point control is available from the secondary loop cooling distribution unit, 18 degrees C +/- 1 degree C (64.4 degrees F +/- 1.8 degrees F) must be maintained. • Lower temperature water is allowed as long as the water supply is monitored and adjusted to remain above room dew point (where rear door heat exchanger is located). **Required water flow rate** (as measured at the supply entrance to the heat exchanger) • Minimum: 22.7 liters per minute (6 gallons per minute)

		• Maximum: 37.9 liters per minute (10 gallons per minute)

Table 2. Operating specifications for 24-inch EIA-rail rear door heat exchanger

Door size • Depth: 142.6 mm (5.6 in.) • Height: 1945.4 mm (76.6 in.) • Width: 771.8 mm (34.4 in.) **Exchanger size** • Depth: 67 mm (2.6 in.) • Height: 1791.3 mm (70.5 in.) • Width: 574.6 mm (22.6 in.) **Door assembly weight** • Empty: 31.7 kg (70 lb.) • Filled: 39.9 kg (88.2 lb.) **Door heat removal capacity** • Lab tests indicate 10 percent improvement over the 19-inch version of the door. • Up to 17 kW (58 000 Btu/hr) heat removal possible	**Air movement** • Provided by servers and other devices in the rack **Air source for servers** • Room air for front of rack. Air exhausts servers, moves through rear door heat exchanger and exits into the room (open loop) **Air temperature drop** • The temperature drop can be up to 25 degrees C (45 degrees F) between the air exiting the rack devices and the air exiting the heat exchanger on high heat load products. **Air impedance** • Air pressure drop across the rear door heat exchanger is equivalent to the acoustic 24-inch rear door	**Water source** • User-supplied, compliant with specifications in this topic. • 3/4-inch couplings on floor • Minimum 3/4-inch inside diameter hose required **Water pressure** • Normal operation: 137.93 kPa (20 psi) • Maximum: 689.66 kPa (100 psi) • Pressure drop across heat exchanger: approximately 48 kPa (7 psi) **Water volume** • Exchanger: 5.3 liters (1.4 gallons) • Exchanger plus supply and return hoses to the pump unit: Maximum of approximately 15.1 liters (4.0 gallons) excluding pump unit piping and reservoir **Water temperature** • If no dew point control is available from the secondary loop cooling distribution unit, 18 degrees C +/- 1 degree C (64.4 degrees F +/- 1.8 degrees F) must be maintained. • Lower temperature water is allowed as long as the water supply is monitored and adjusted to remain above room dew point (where rear door heat exchanger is located).

		Required water flow rate (as measured at the supply entrance to the heat exchanger) • Minimum: 22.7 liters per minute (6 gallons per minute) • Maximum: 37.9 liters per minute (10 gallons per minute)

Rear door heat exchanger option kit

The rear door heat exchanger feature kit consists of the components listed below and shown in the following figures.

- Door assembly
- Hinge kit
- Air-purge tool

Figure 1. Components of the heat exchanger kit for 19-inch EIA-rail racks

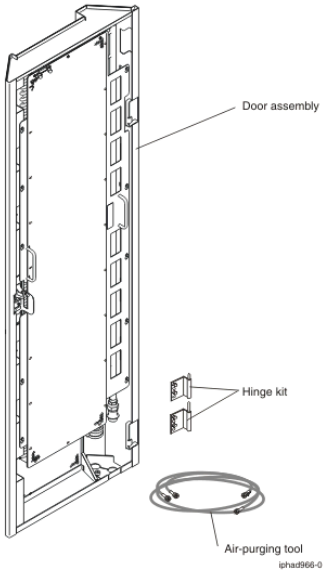
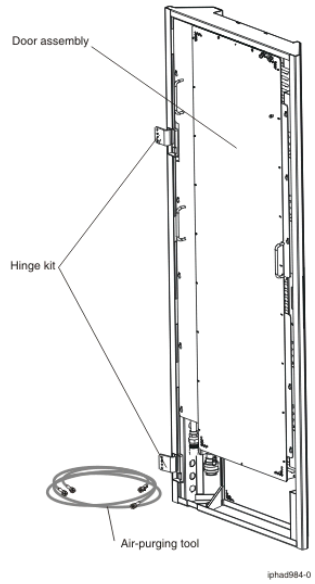


Figure 2. Components of the heat exchanger kit for 24-inch EIA-rail racks



Water specifications for the secondary cooling loop

It is important that the water being supplied to the heat exchanger meet the requirements described in this topic; otherwise, system failures might occur over time, as a result of:

- Leaks due to corrosion and pitting of the metal components of the heat exchanger or the water supply system
- Buildup of scale deposits inside the heat exchanger, which can cause the following problems:
  - A reduction of the heat exchanger s ability to cool the air that is exhausted from the rack.
  - Failure of mechanical hardware, such as a hose quick-connect adapter.
- Organic contamination, such as bacteria, fungi, or algae. This contamination can cause the same problems as described for scale deposits.

Water control and conditioning for the secondary cooling loop

The water used to fill, refill, and supply the heat exchanger must be particle-free deionized water or particle-free distilled water with appropriate controls for avoiding the following issues.

- Metal corrosion
- Bacterial fouling
- Scaling

Because of typical water temperatures (described in Water delivery specifications for secondary loops), the water may not be able to originate from the primary, building, chilled-water system. Conditioned water for the rear door heat exchanger should be supplied as part of a secondary, closed-loop system.

Important: Use of glycol solutions is not recommended because they can adversely affect the cooling performance of the heat exchanger.

Materials for secondary loops

This topic describes the materials for use in supply lines, connectors, manifolds, pumps, hoses, and any other hardware that makes up the closed-loop water-supply system at your location.

- Copper
- Brass with less than 30 percent zinc content
- Stainless steel 303, 304, or 316
- Ethylene Propylene Diene Monomer (EPDM) rubber peroxide cured, non-metal oxide

Materials to avoid in secondary loops

Do not use any of the following materials in any part of your water supply system.

- Oxidizing biocides, such as, chlorine, bromine, and chlorine dioxide
- Aluminum
- Brass with greater than 30 percent zinc
- Irons (non-stainless steel)

Water supply requirements for secondary loops

This topic describes specific characteristics of the system that supplies the chilled conditioned water to the heat exchanger.

Temperature

The heat exchanger, its supply hose and return hoses are not insulated and do not have features designed to address the creation and collection water from condensate. Avoid any condition that could cause condensation. The temperature of the water inside the supply hose, return hose, and the heat exchanger must be kept above the dew point of the location where the heat exchanger is being used.

Attention: Typical primary chilled water is too cold for use in this application because building chilled water can be as cold as 4 - 6 degrees C (39 to 43 degrees F).

Important: If the system supplying the cooling water does not have the ability to measure the room dew point and automatically adjust the water temperature accordingly, the minimum water temperature that must be maintained is 18 degrees C plus or minus 1 degree C(64.4 degrees F plus or minus 1.8 degrees F). This is consistent with the ASHRAE Class 1 Environmental Specification that requires a maximum dew point of 17 degrees C (62.6 degrees F). Refer to the ASHRAE document entitled *Thermal Guidelines for Data Processing Environments*. Information on obtaining this document is found at www.ashrae.org. Search on document id ASHRAE TC 9.9.

Pressure

The water pressure in the secondary loop must be less than the maximum 689.66 kPa (100 pounds per square inch). Somewhere in the water circuit, a pressure relief valve, set to this maximum value, is required for safety reasons. Normal operating pressure at the rear door heat exchanger should be 137.93 kPa (20 psi) or less.

Flow rate

The flow rate of the water in the system must be in the range of 23 - 38 liters per minute (6 - 10 gallons per minute).

Pressure drop versus flow rate for heat exchangers (including quick-connect couplings) is defined as approximately 48 kPa (7 psi) at 30 liters per minute (8 gallons per minute). Adjustable flow valves are recommended for installation on all supply lines of the water circuit, to enable compliance, to this flow specification.

Water volume limits

The heat exchangers hold between 2.8 liters (0.75 gallons) and 5.3 liters (1.4 gallons). Fifteen meters (50 ft.) of 19 mm (0.75 in.) supply and return hoses hold approximately 9.4 liters (2.5 gallons). To minimize exposure to flooding in the event of leaks, the entire product cooling system (heat exchanger, supply hose and return hose) excluding any reservoir tank should have a maximum 15.1 liters (4 gallons) of water. This is a cautionary statement not a functional requirement. Also consider using leak detection methods on the secondary loop that supplies water to the heat exchanger.

Air exposure

The secondary cooling loop is a closed loop, with no continuous exposure to room air. After you fill the loop, remove all air from the loop. Air bleed valves are provided at the top of each heat exchanger manifold for purging all air from the system.

Water delivery specifications for secondary loops

This topic describes the various hardware components that make up the delivery system secondary loop that provides the chilled, conditioned water to the rear door heat exchanger. The delivery system includes pipes, hoses and the required connection hardware to attach to the heat exchanger. Hose management on raised or non-raised floor environments is also described.

The rear door heat exchanger can remove 50-60 percent of the heat load from an individual rack when water is supplied to at 18 degrees C (64 degrees F) and the door is running under optimum conditions. For sizing purposes, consider a rack that produces a heat load of X watts. The heat exchanger can remove 0.5X watts before the heated air enters the room.

The primary cooling loop is considered to be the low temperature building chilled-water supply or a modular chiller unit. The primary loop must not be used as a direct source of coolant for the rear door heat exchanger for two main reasons. First, below-dew-point water will cause air moisture to form on the door heat exchanger as it operates (condensation will drip and gather under the rack). Second, if proper leak detection is not established (for example, monitored leak tape, hose-in-trough with leak sensors and automatic shut-off valves) and a leak in the door, hoses or manifolds occurs, the constant, large supply of primary loop water could result in large amounts of water leaking into the data center. Water provided in a controlled and monitored secondary, closed loop, would limit the amount of water available in a leak situation, and prevent condensation from forming.

Procurement and the installation of the components needed to create the secondary cooling loop system are required for this design and are your responsibility. For suggestions on where to procure hoses and cooling distribution units, see Flexible hose suppliers and Cooling distribution unit suppliers. The main purpose of this topic is to provide examples of typical methods for secondary loop set-up and operating characteristics that are needed to provide an adequate, safe supply of water to the rear door heat exchanger. Key components recommended for the water supply and return liness are:

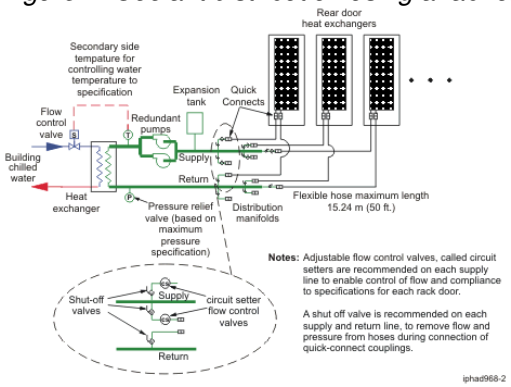
- couplings to match those provided on the rear door heat exchanger
- flexible hoses
- thermal feedback to a flow valve that will adjust and control supply water temperature
- pressure relief valve
- shutoff valves for each line running to a door
- adjustable flow valves for each supply line to a door.

The actual number of rear door heat exchangers connected to a secondary loop depends on the capacity of the secondary loop to transfer heat to the primary loop. For example, if the secondary loop can remove 100 kW of heat load and you have multiple 25 kW racks, you could have 12.5 kW per rack (assuming 50 percent

door heat removal) going into the water loop, and attach eight doors per secondary loop.

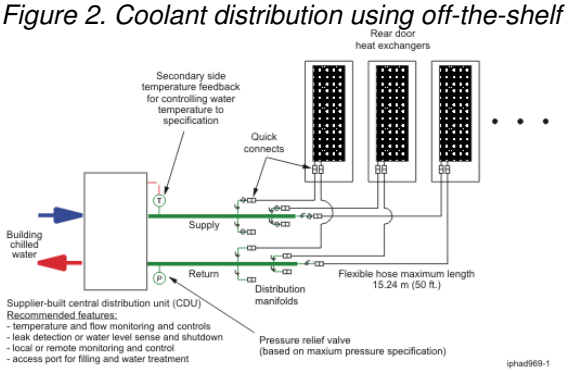
The following figure shows an example of a facilities fabricated solution. The actual number of rear door heat exchangers connected to a secondary loop depends on the capacity of the cooling distribution unit that is running the secondary loop.

Figure 1. Coolant distribution using a fabricated facilities solution



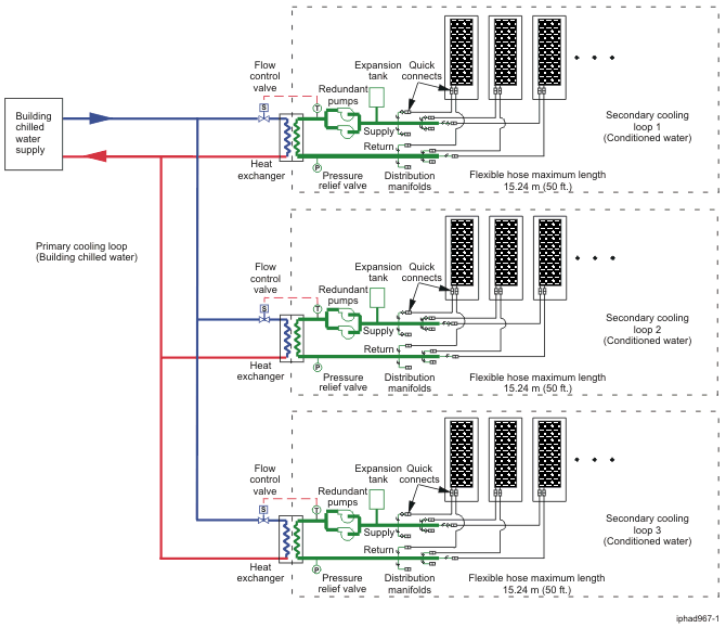
The following figure shows an example of an off-the-shelf modular cooling distribution unit. The actual number of rear door heat exchangers connected to a secondary loop depends on the capacity of the cooling distribution unit that is running the secondary loop.

Figure 2. Coolant distribution using off-the-shelf supplier solutions



The following figure shows a typical cooling solution and defines the components of the primary cooling loop and the components of the secondary cooling loop.

Figure 3. Primary and secondary cooling loops



Manifolds and piping

Manifolds that accept large-diameter feed pipes from a pump unit are the preferred method for splitting the flow of water to smaller diameter pipes or hoses that are routed to individual rear door heat exchangers. Manifolds must be constructed of materials compatible with the pump unit and related piping. See Materials for secondary loops. The manifolds must provide enough connection points to allow a matching number of supply and return lines to be attached and the manifolds must match the capacity rating of the pumps and heat exchanger (between the secondary cooling loop and building chilled-water source). Anchor or restrain all manifolds to provide the required support to avoid movement when quick-connect couplings are plugged to the manifolds and when valves are opened or closed.

Example manifold supply pipe sizes

- Use a 50.8 mm (2 in.) supply pipe to provide the correct flow to six (100 kW CDU) 19 mm (0.75 in.) supply hoses.
- Use a 63.5 mm (2.50 in.) supply pipe to provide the correct flow to eight (120 kW CDU) 19 mm (0.75 in.) supply hoses.
- Use an 88.9 mm (3.50 in.) supply pipe to provide the correct flow to twenty (300 kW CDU) 19 mm (0.75 in.) supply hoses.

Shutoff valves are suggested for each supply and return line that exits the manifold to allow stopping the flow of water in individual lines of multiple circuit loops. This provides a way of servicing or replacing an individual heat exchanger without affecting the operation of other heat exchangers in the loop.

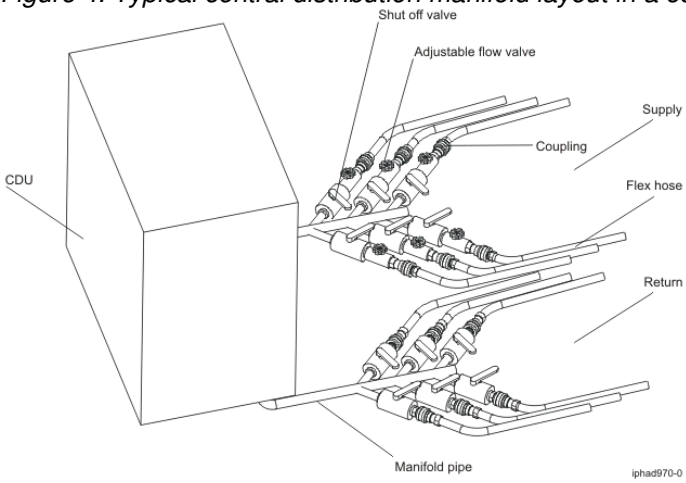
Adjustable flow valves (called circuit setters) are also suggested for each supply line that exits a supply manifold so changes can be made to the flow to each individual rack, in the event that door heat exchangers are added or removed from the secondary loop (this method keeps water flow within specification to each door heat exchanger).

Temperature and flow metering (monitoring) are suggested in secondary loops, to provide assurance that water specifications are being met and that the optimum heat removal is taking place.

Anchor or restrain all manifolds and pipes to provide the required support, and to avoid movement when quick-connect couplings are being attached to the manifolds.

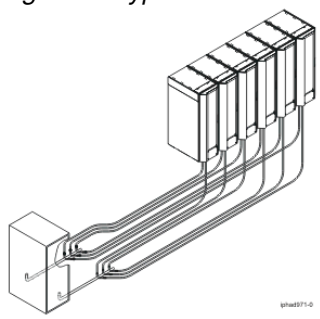
The following figure shows an example of a typical central manifold layout that supplies water to multiple heat exchangers.

Figure 4. Typical central distribution manifold layout in a central location



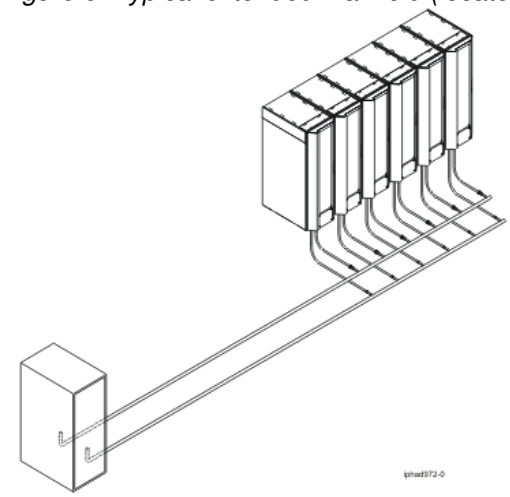
The following figure shows another layout for multiple water circuits.

Figure 5. Typical central manifold (located at a central location for multiple water circuits)



The following figure shows an extended manifold layout.

Figure 6. Typical extended manifold (located along aisles between racks)



Flexible hoses and connections to manifolds and heat exchangers

Pipes and hose configurations can vary and are determined by analyzing the needs of your facilities, or a site preparation representative can provide this analysis.

Flexible hoses are needed to supply and return water between your hard plumbing (manifolds and cooling distribution units) and the rear door heat exchanger, (allowing needed movement when opening and closing the rack rear door).

Hoses are available that provide water with acceptable pressure-drop characteristics and that help prevent depletion of some corrosion inhibitors. These hoses must be made of Ethylene Propylene Diene Monomer (EPDM) rubber - peroxide cured, non-metal oxide material and will have Parker Fluid quick-connect couplings at each end. These couplings are defined below and are compatible with the heat exchanger couplings. Hose lengths from 3 to 15 m (10 ft. to 50 ft.), in increments of 3 m (10 ft.) are available. Hoses longer than 15 m (50 ft.) may create unacceptable pressure loss in the secondary circuit and reduce the water flow, and thus reduce the heat removal capabilities of the heat exchanger.

For a suggested supplier of these hoses, see Flexible hose suppliers. Use solid piping or tubing that has a minimum inner diameter of 19 mm (0.75 in.) and the least number of joints possible between a manifold and a heat exchanger in each secondary loop.

Quick-connect couplings are used to attach the hoses or fixed pipes to the distribution manifolds and the rear door heat exchangers. Hose couplings that attach to the heat exchanger must have the following characteristics.

- The couplings should be constructed of passivated 300-L series stainless steel or brass couplings with less than 30 percent zinc content. The coupling size is 19 mm (0.75 in.).
- The supply hose must have a Parker (male) quick-coupling nipple part number SH6-63-W, or equivalent. The return hose must have a Parker (female) quick-conect couplings part number SH6-62-W, or equivalent.
- At the opposite (manifold) end of the hoses, it is suggested that similar quick-connect couplings be used. However, if other types are desired, it is also suggested that positive locking mechanisms be used to prevent loss of water when the hoses are disconnected. The connections must minimize water spill and air inclusion into the system when they are disconnected.

Note: When creating supply and return loops, it is recommended to avoid placement of electrical connections directly below water connections. These would be areas prone to water drips or splash when working with the water loop. Water dripping or splashing onto electrical connections can cause electrical problems or an unsafe environment.

Layout and mechanical installation

This topic provides an overview of the installation steps. The topics described are:

- Rear door heat exchanger installation overview
- Planning for rear door heat exchangers in a raised-floor environment
- Planning for rear door heat exchangers in a non-raised floor environment

It also provides examples of typical layouts for water circuits. For detailed information about installing a heat exchanger, see Installing the rear door heat exchanger.

Rear door heat exchanger installation overview

Installing the rear door heat exchanger consists of the following major tasks:

1. Preparing your facility to provide water to the rack per the required specifications.

2. Removing the existing rack rear door, and installing new hinge assemblies, and installing new latch plate.
3. Attaching the heat exchanger door assembly to the rack.
4. Routing flexible hoses, leaving enough length at the rack end to easily make connections to the heat exchanger.
5. Connecting the water-supply and water-return hose that runs from the cooling distribution unit or distribution manifold to the heat exchanger.
6. Filling the heat exchanger with water.
7. Adjusting and inspecting the hoses to ensure there are no kinks in the hoses and that the hoses are not lying against any sharp edges.
8. Adjusting the door latch assembly to ensure the door fits flatly to the rack and that all gaskets seal to the rack.

Note: For safety reasons, trained service personnel (or qualified professionals) must perform the installation of the rear door heat exchanger.

Heat exchanger filling and draining overview

The following steps describes the requirements for draining and filling a heat exchanger.

1. Filling a heat exchanger with water includes using the air purge tool supplied with the heat exchanger to purge any air from the heat exchanger manifolds.

   Note: Attachment and detachment of air purge tool should be done with the tool valve open to reduce water pressure at the air bleed valves and reduce water that might escape at the valves during attaching or detaching.

   Containers must be available for capturing water. The container must hold a minimum of 2 L (0.5 gal) capacity for purging air and a minimum 6 L (1.6 gal) capacity for draining a heat exchanger.
2. Draining a heat exchanger is required before the door containing the heat exchanger can be removed from the rack, or before a rack with a heat exchanger installed can be moved. The air purge tool can be connected to the drain port on the bottom of the heat exchanger to drain the water.
3. Use absorbent materials, such as cloth, under the work area to capture any water that might spill when filling or draining a heat exchanger.

Raised floor and non-raised floor environments

Planning for installation of your rear door heat exchangers is dependent on whether your data center has a raised floor or a non-raised floor.

The following topics describe the requirements for raised floor and non-raised floor environments.

- Raised floor environment
- Non-raised floor environment

Planning for rear door heat exchangers in a raised floor environment

On a raised floor, hoses are routed under the floor tiles and are brought up from beneath the rack through special tile cut outs. The hoses attach to the quick-connect couplings on the bottom of the heat exchanger.

Note: In the following examples, figures show optimal placement and size of openings for hose exit. In some products, installation planning documents recommend other hole locations (for example, heavy racks may not have openings allowed in tiles that casters are resting on). Specific product requirements should be followed over those provided in this topic. Recommendations for openings in reinforced pedestal or stringer type tiles versus non-reinforced pedestal tiles should also be followed. Existing tile cutouts for electrical or other cables can be used (or expanded) for the hoses, if enough opening space is available to allow easy movement of both hoses when the door is opened and closed. In general, hoses should exit the tiles at locations that will not put high forces on the hoses, or cause rubbing that will abrade the hose surface and lead to premature hose failure (leaks).

Raised floor hose requirements and management

In a typical example, each heat exchanger requires a special cut 0.6 m by 0.6 m (2 ft. by 2 ft.) floor tile below it and in front of the rack. A portion of the tile is cut away and correctly covered to protect against sharp edges. The corner opening is placed directly under the hinge side of the rack rear door. The opening size of the cut is 152.4 mm wide and 190.5 mm long +/- 12.7 mm (6.0 in. wide and 7.5 in. long +/- 0.5 in.) in the direction parallel to the door. The following figures provide examples of hose management methods.

Figure 1. Raised floor hose management example 1; tile cut out size and position for 19-inch EIA-rail racks.

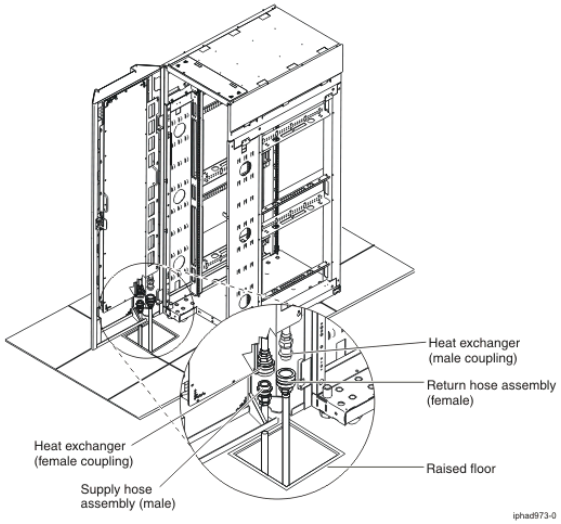


Figure 2. Raised floor hose management example 1; tile cut out size and position for 24-inch EIA-rail racks.

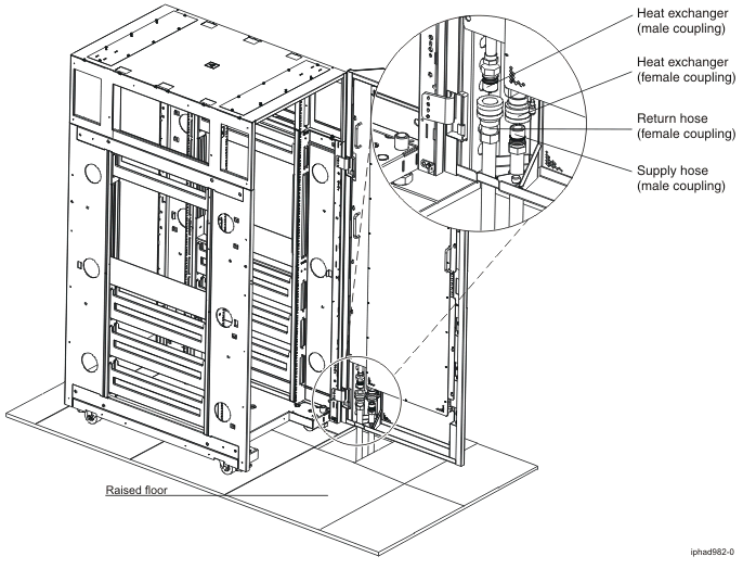


Figure 3. Raised floor hose management example 1; Tile cut out definition and location for 19-inch EIA-rail racks

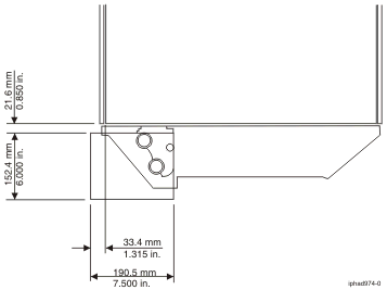
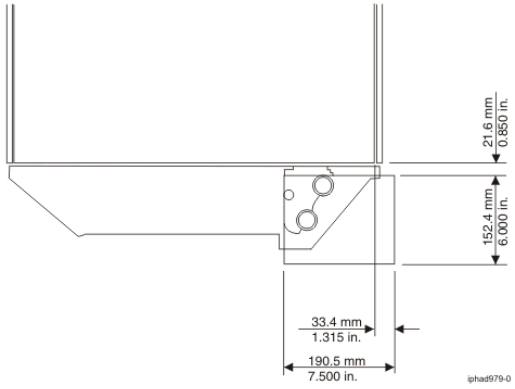


Figure 4. Raised floor hose management example 1; Tile cut out definition and location for 24-inch EIA-rail racks



In another example, for racks being installed at the same time a heat exchanger is being installed, and in cases where installation planning allows floor tile cutouts under the rack, each heat exchanger still requires a special cut 0.6 m by 0.6 m (2 ft. by 2 ft.) floor tile. However, the floor tile will be positioned completely within the footprint of the rack. A modified cable opening or independent hose cut out is used. Flexible hoses that contain a right-angle elbow are used to route the hoses under the rack in a large loop to allow hose movement when the door is opened and closed. The following figures show how to route hoses under the rack with enough hose length to allow the hose to move freely as the door is opened and closed.

Figure 5. Raised floor and non-raised floor hose management example 2; loop under the 19-inch EIA-rail rack with door closed

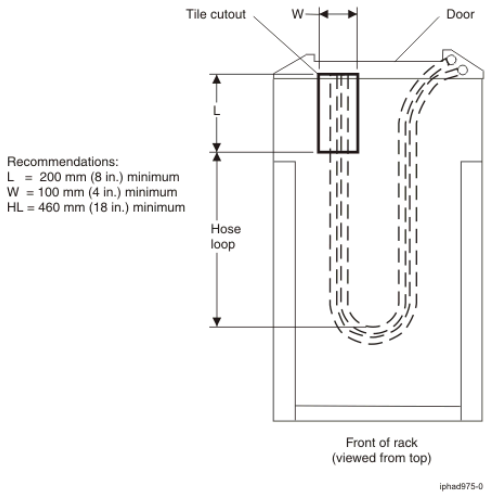


Figure 6. Raised floor and non-raised floor hose management example 2; loop under the 24-inch EIA-rail rack with door closed

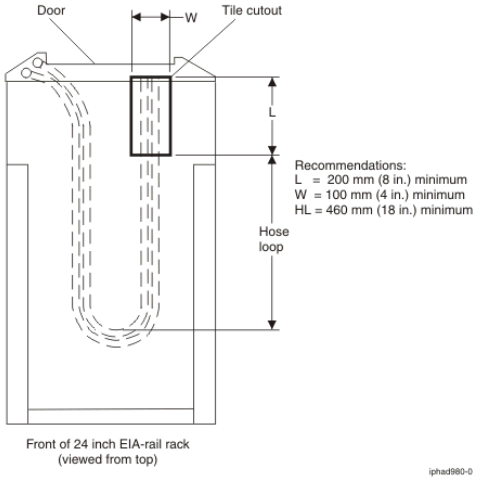


Figure 7. Raised floor and non-raised floor hose management example 2; loop under the 19-inch EIA-rail rack with door open

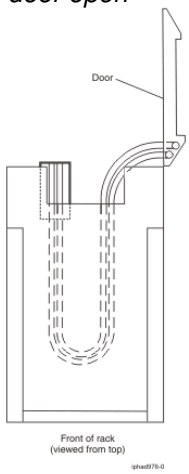
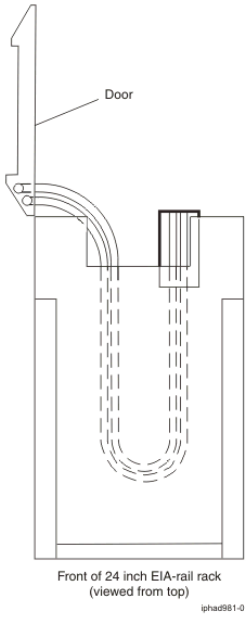


Figure 8. Raised floor and non-raised floor hose management example 2; loop under the 24-inch EIA-rail rack with door open



Lay hoses side-by-side as they run between the heat exchanger and the supply and return manifolds, and allow the hoses to freely move. Leave enough slack in the hoses below the rear door so that minimum forces are exerted on the door when the hoses are attached and operating. When routing hoses, avoid sharp bends that cause hose kinks, and avoid hose contact with sharp edges.

Planning for rear door heat exchangers in a non-raised floor environment

In data centers without a raised floor, straight hose assemblies cannot make the sharp bend to exit between the floor and the rack door without kinking the hose.

Non-raised floor hose requirements and management

Hose assemblies with right-angle metal elbows are needed. This allows the hoses to be routed along the floor, make the 90 degree turn upwards within the gap between the bottom of the heat exchanger door and the floor surface, and then connect to the heat exchanger couplings. This is shown in the following figures.

Figure 1. Non-raised floor hose requirements for 19-inch EIA-rail rack

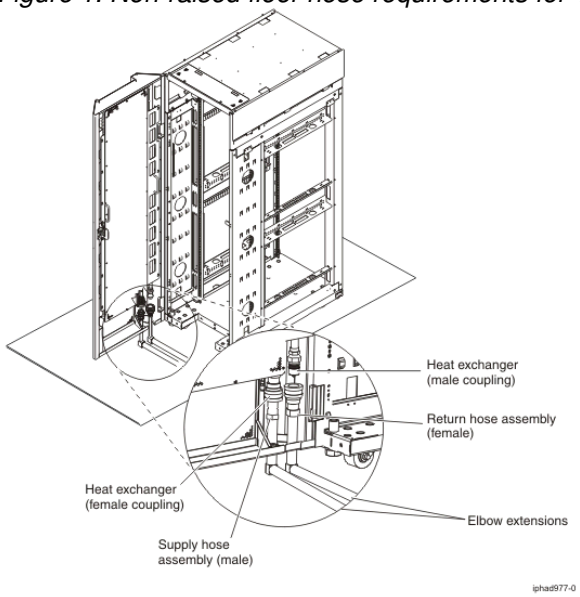
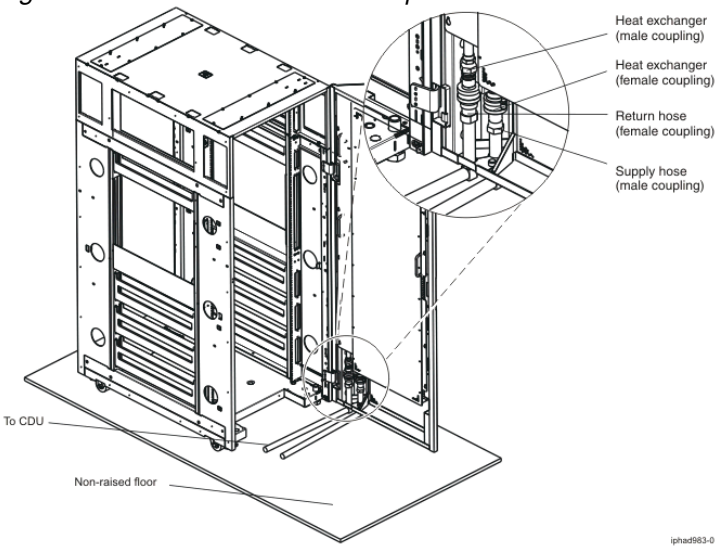


Figure 2. Non-raised floor hose requirements 24-inch EIA-rail rack



Hoses exiting the heat exchanger can be routed in a manner similar to that of power cables in a non-raised floor data center. For example, place the hoses side-by-side and allow them to move freely as they approach the rack (within approximately 3 m (10 ft.) of the rack). When the door is opened, it is acceptable for the hoses to move slightly and rotate in parallel at the coupling interface inside the door. As the door is closed, the hoses rotate back to their original positions.

Note: When opening or closing the door, some manipulation of the hose along the floor might be necessary to prevent unwanted forces on the door and to make it easier to open and close the door.

Another method for non-raised floor hose routing is described using Figures 10 and 11 (without the hoses exiting a tile cutout). Hose exiting the heat exchanger turns and loops under the rack. In that method, the hose can then exit from under the rack at any place and in any direction that is convenient in your data center.

In either of these examples, hose coverings or protective devices are not provided by the seller. Routing and protection of the hose assemblies exterior to the rack is your responsibility.

Suggested sources for secondary loop components

This topic provides lists of suggested suppliers that can provide cooling distribution solutions, and sources for either flexible hose assemblies, or for providing water treatment that meets the suggested water quality requirements.

- Cooling distribution unit suppliers
- Flexible hose suppliers
- Water treatment suppliers

Cooling distribution unit suppliers

The following table provides a list of possible suppliers for cooling distribution units.

Table 1. Suggested sources of cooling distribution units

North America		
Vendor	**Unit capacity**	**Contact information**
Lytron Corporation	Coolant distribution unit - 100 kW nominal capacity	www.lytron.com Lytron Corporation Sales (U.S.) (781) 933-7300
North America, Europe, Middle East, Africa, Asia Pacific		
Liebert Corporation	Coolant distribution unit - 100 kW nominal capacity	www.liebert.com Select **Contacts** and search for a local office and telephone number.
Affinity, Lydall Industrial Thermal Solutions Inc	Coolant distribution units • 60 kW nominal capacity • 100 kW nominal capacity • 120 kW nominal capacity • 300 kW nominal capacity	www.affinitychillers.com email: affinity_sales@lydall.com (603) 539-1420
Knurr Inc	Coolant distribution unit - 75 Kw nominal capacity	www.knurr.com U.S. (514) 865-9454
Europe, Middle East, Africa, Asia Pacific		
Knurr Inc	Coolant distribution unit - 75 kW nominal capacity	www.knurr.com +49 619-291-0455
Eaton-Williams Group, Ltd.	Coolant distribution unit - 100 kW nominal capacity	www.eation-williams.com +44 (0)1732 866055

Flexible hose suppliers

The following table provides a possible source of flexible hose assemblies that are fabricated from approved materials. These assemblies have the required quick-connect couplings and are offered in various lengths, providing choices in the type of hook-up and routing of hoses in your secondary loops.

Table 1. Suggested source for flexible hose supplier

North America, Europe, Middle East, Africa, Asia Pacific		
Dff Corporation	Flexible hose assemblies with required quick-connect couplings. Available in these lengths. • 3 m (10 ft.) • 6 m (20 ft.) • 9 m (30 ft.) • 12 m (40 ft.) • 15 m (50 ft.) Hoses can be straight for raised floor applications, or hoses can use a 90 degree elbow at one end for either non-raised floor applications or raised floor applications.	59 Abrams Drive Agawam, MA U.S., 01001 (413) 786-8880 www.dffcorp.com

Water treatment supplier

The following table provides a list of possible water treatment suppliers.

Table 1. Suggested source of water treatment supplier

North America, Europe, Middle East, Africa, Asia Pacific	
Nalco Company Chemical kits are available for treating the water in secondary cooling loops. Treatment can typically consist of anti-corrosion coatings and biocides. Obtain details for the contents of these chemical kits from the supplier.	www.nalco.com **North America: U.S.** 1601 W. Diehl Road Naperville, Illinois 60563-1198 **North America: Latin America** Av. Das Nocoes Unidas 17.891 6 Andar 04795-100 Sao Paulo, SP Brazil **Europe:** Ir.G.Tjalmaweg 1 2342 BV Oegstgeest The Netherlands **Asia Pacific:** 2 International Business Park #02-20 The Strategy Tower 2 Singapore 609930 **Wordwide contact:** U.S. (480) 213-8915

Planning for communications

Your installation will probably require a variety of communication equipment to support the computer installation. Telephone lines, fax lines, and the remote support facility (RSF) are just some of the types of communications that you will need to have installed. You will have to refer to specific product planning documentation for each type of communication equipment that you are going to install. The main tasks to prepare for communication equipment are:

1. Get an exact list of the communication features that your company ordered:
    a. First, make copies of the communication-feature planning list.
    b. Next, find out the specific communication features on order from your company's copy of the purchase agreement.
    c. Finally, check the types of communication features and enter the quantities of feature cards and cables on the communication-feature planning list. This list is your record of

communication features to help in your planning and coordinating tasks.

2. Prepare a communication-feature planning list:
   - Use a separate planning list for each communication feature. On the list, connect the device and modem blocks with lines to indicate the feature's arrangement in the network. Indicate whether the network is switched or nonswitched. The network-diagram part of the list is for typical networks. If enough space is not available on the planning list, use additional lists or separate sheets of paper to draw the network.
   - Finally, check or fill in the remaining part of the communication-feature planning list. You might not be able to answer some items, such as the modem model, until you meet with the local communication company representative.
3. Meet with the local communication company representative to order needed equipment and to discuss service:
   - Define the equipment and wiring to be provided by the communication company.
   - Determine the power outlets needed for communication company equipment.
   - Place an order for the needed services.
   - Schedule the installation work the communication company will do before the arrival of your server.
   - Install a telephone for the service representative, if recommended.
   - Define the options when you order a handset with a switched line.
4. Meet with the modem vendor to discuss the following items:
   - Options such as switched or leased line, line speed, auto answer, and clocking must be known.
   - Who will install and who will service the original equipment manufacturer's (OEM) modem.
   - What modems will require couplers, jacks, and plugs.
   - Match the coupler and the modem.
   - The telephone company must be notified of the Federal Communications Commission (FCC) registration number and ringer equivalence number.
   - Modems that require power outlets.
5. Coordinate the installation of your equipment with remote locations to be sure the proper equipment is installed on time at both locations. Be sure the equipment at your location is compatible with the equipment at the remote location. Pay particular attention to these items:
   - The communicating devices must use the same type of communication features.
   - The devices must operate at the same speed (bits per second).
   - The modems must be compatible.
   - The couplers must match the modem.
   - The modem strapping (jumpers) must be the same at both ends of the line.
   - Properly coordinating remote locations can prevent problems such as mismatched communication equipment. A copy of the completed communication feature planning list should be sent to the remote locations before the equipment is installed.
6. Determine and establish wiring practices for privately owned lines:
   - Do not route your communication lines parallel with power lines. Power transients can cause electrical noise in your communication lines. Noise can also be caused by electric motors, radios, and radar equipment.
   - Use shielded outdoor-type cable where communication lines exit a building.
   - Install shunt-type lightning protection on all exterior communication lines, whether they are buried or overhead.
   - Ground the shields of overhead communication lines where cables enter or exit junction boxes or at other points where the shield is broken. For buried lines, ground the shield at each building exit or entry.
   - Shield continuity must not be broken where the ground conductor connects to the shield. Cable that includes a drain conductor is easier to install when multiple grounding is needed.

See the applicable national and local safety standards for communication regulations and requirements.

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