PureNetezza System for Operational Analytics

Planning for the system

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Note

Before using this information and the product it supports, read the information in "Safety notices" on page v and "Notices" on page 51, and read the information in the safety and environmental notices included with the system.

This edition applies to the IBM PureNetezza System for Operational Analytics and to all subsequent releases and modifications until otherwise indicated in new editions.

Contents

Safety notices

Safety notices may be printed throughout this guide:

- **DANGER** notices call attention to a situation that is potentially lethal or extremely hazardous to people.
- **CAUTION** notices call attention to a situation that is potentially hazardous to people because of some existing condition.
- **Attention** notices call attention to the possibility of damage to a program, device, system, or data.

World Trade safety information

Several countries require the safety information contained in product publications to be presented in their national languages. If this requirement applies to your country, safety information documentation is included in the publications package (such as in printed documentation, on DVD, or as part of the product) shipped with the product. The documentation contains the safety information in your national language with references to the U.S. English source. Before using a U.S. English publication to install, operate, or service this product, you must first become familiar with the related safety information documentation. You should also refer to the safety information documentation any time you do not clearly understand any safety information in the U.S. English publications.

Replacement or additional copies of safety information documentation can be obtained by calling the IBM Hotline at 1-800-300-8751.

German safety information

Das Produkt ist nicht für den Einsatz an Bildschirmarbeitsplätzen im Sinne § 2 der Bildschirmarbeitsverordnung geeignet.

Laser safety information

IBM® servers can use I/O cards or features that are fiber-optic based and that utilize lasers or LEDs.

Laser compliance

IBM servers may be installed inside or outside of an IT equipment rack.

DANGER

When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard:

- **Connect power to this unit only with the IBM provided power cord. Do not use the IBM provided power cord for any other product.**
- **Do not open or service any power supply assembly.**
- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords.**
- **Connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.**
- **Connect any equipment that will be attached to this product to properly wired outlets.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following procedures when installing, moving, or opening covers on this product or attached devices.**

  To Disconnect:

  1. **Turn off everything (unless instructed otherwise).**
  2. **Remove the power cords from the outlets.**
  3. **Remove the signal cables from the connectors.**
  4. **Remove all cables from the devices.**

  To Connect:

  1. **Turn off everything (unless instructed otherwise).**
  2. **Attach all cables to the devices.**
  3. **Attach the signal cables to the connectors.**
  4. **Attach the power cords to the outlets.**
  5. **Turn on the devices.**

  (D005)

DANGER

Observe the following precautions when working on or around your IT rack system:

- **Heavy equipment–personal injury or equipment damage might result if mishandled.**
- **Always lower the leveling pads on the rack cabinet.**
- **Always install stabilizer brackets on the rack cabinet.**
- **To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinet.**
- **Rack-mounted devices are not to be used as shelves or work spaces. Do not place objects on top of rack-mounted devices.**

- **Each rack cabinet might have more than one power cord. Be sure to disconnect all power cords in the rack cabinet when directed to disconnect power during servicing.**
- **Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.**
- **An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.**

CAUTION

- **Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.**
- **Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, front, or back of a unit used for air flow through the unit.**
- **Consideration should be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection. To provide the correct power connection to a rack, refer to the rating labels located on the equipment in the rack to determine the total power requirement of the supply circuit.**
- *(For sliding drawers.)* **Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack. Do not pull out more than one drawer at a time. The rack might become unstable if you pull out more than one drawer at a time.**
- *(For fixed drawers.)* **This drawer is a fixed drawer and must not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or completely out of the rack might cause the rack to become unstable or cause the drawer to fall out of the rack.**

(R001)

CAUTION:
Removing components from the upper positions in the rack cabinet improves rack stability during relocation. Follow these general guidelines whenever you relocate a populated rack cabinet within a room or building:

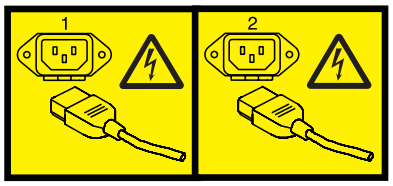
- **Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must observe the following precautions:**
  - **Remove all devices in the 32U position and above.**
  - **Ensure that the heaviest devices are installed in the bottom of the rack cabinet.**
  - **Ensure that there are no empty U-levels between devices installed in the rack cabinet below the 32U level.**
- **If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.**
- **Inspect the route that you plan to take to eliminate potential hazards.**
- **Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that comes with your rack cabinet for the weight of a loaded rack cabinet.**
- **Verify that all door openings are at least 760 x 230 mm (30 x 80 in.).**
- **Ensure that all devices, shelves, drawers, doors, and cables are secure.**
- **Ensure that the four leveling pads are raised to their highest position.**
- **Ensure that there is no stabilizer bracket installed on the rack cabinet during movement.**
- **Do not use a ramp inclined at more than 10 degrees.**
- **When the rack cabinet is in the new location, complete the following steps:**
  - **Lower the four leveling pads.**
  - **Install stabilizer brackets on the rack cabinet.**
  - **If you removed any devices from the rack cabinet, repopulate the rack cabinet from the lowest position to the highest position.**
- **If a long-distance relocation is required, restore the rack cabinet to the configuration of the rack cabinet as you received it. Pack the rack cabinet in the original packaging material, or equivalent. Also lower the leveling pads to raise the casters off of the pallet and bolt the rack cabinet to the pallet.**

(R002)

(L001)

(L002)

(L003)



or

All lasers are certified in the U.S. to conform to the requirements of DHHS 21 CFR Subchapter J for class 1 laser products. Outside the U.S., they are certified to be in compliance with IEC 60825 as a class 1 laser product. Consult the label on each part for laser certification numbers and approval information.

CAUTION:
This product might contain one or more of the following devices: CD-ROM drive, DVD-ROM drive, DVD-RAM drive, or laser module, which are Class 1 laser products. Note the following information:

- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**
- **Use of the controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

(C026)

CAUTION:
Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle. (C027)

CAUTION:
This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)

CAUTION:
Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following information: laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam. (C030)

CAUTION:
The battery contains lithium. To avoid possible explosion, do not burn or charge the battery.

Do Not:
- **___ Throw or immerse into water**
- **___ Heat to more than 100°C (212°F)**
- **___ Repair or disassemble**

Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C003)

Power and cabling information for NEBS (Network Equipment-Building System) GR-1089-CORE

The following comments apply to the IBM servers that have been designated as conforming to NEBS (Network Equipment-Building System) GR-1089-CORE:

The equipment is suitable for installation in the following:
- Network telecommunications facilities
- Locations where the NEC (National Electrical Code) applies

The intrabuilding ports of this equipment are suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding ports of this equipment *must not* be metallically connected to the interfaces that connect to the OSP (outside plant) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection to connect these interfaces metallically to OSP wiring.

Note: All Ethernet cables must be shielded and grounded at both ends.

The ac-powered system does not require the use of an external surge protection device (SPD).

The dc-powered system employs an isolated DC return (DC-I) design. The DC battery return terminal *shall not* be connected to the chassis or frame ground.

Site preparation and physical planning

These guidelines help you prepare your site for the delivery and installation of your system.

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 made on an existing site.

This section provides specific information about 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 utilities 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 needs to be recognized and included in the planning of the installation.

Access

Define an access route from your loading dock to your data processing area before delivery of your system.

A preliminary check of the building shows if adequate access for the normal delivery of supplies and systems 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 need to 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 needs to 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 needs to have a 1:12 relationship. For each inch of vertical height of the raised floor, 1 foot of ramp length needs to be provided. As an example, if the raised floor height is 12 inches, then the ramp length needs to be 12 feet. The ramps also need to be strong enough to support the weight of the system while it is being moved over the surface. The hallways and doors need to be wide enough and high enough to allow passage of the system, 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 system 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 systems 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 systems or relocating processors in the computer room. Ten mm (3/8 in.) plywood sheeting provides adequate protection. For some of the heavier high-end systems, it is recommended that you use tempered masonite or plyron. Plywood might be too soft for the heavier systems.

Delivery and subsequent transportation of the equipment

DANGER

Heavy 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 IBM 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 can transport the equipment. The IBM 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

Use these guidelines to minimize static electricity buildup in your data center.

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 system operating limits. Choose a control point that normally keeps the humidity between 35 percent and 60 percent. For more information, see *Air conditioning determination*.
- Providing a conductive path to the 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

further decreases static buildup and discharge. For safety, the floor covering and flooring system should provide a resistance of no less than 150 kilohm 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 compliance 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.

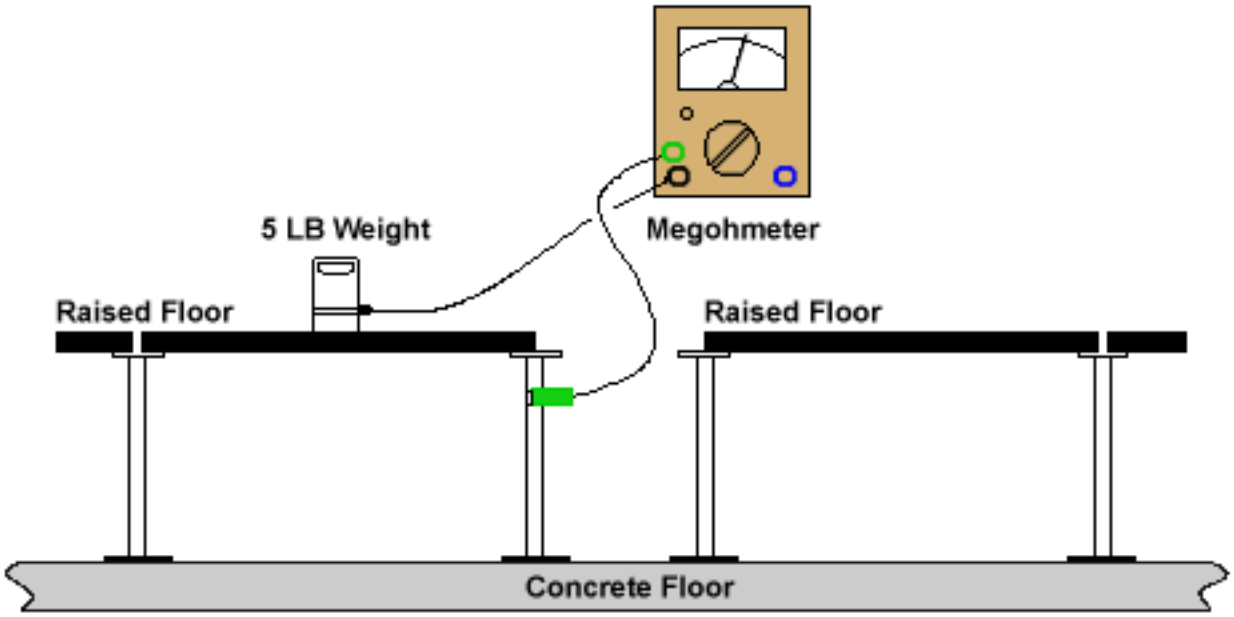


Figure 1. Typical test connection to measure floor conductivity

Space requirements

The floor area required for the equipment is determined by the specific systems 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. This additional space is also needed for the storage of tapes, forms, and other supplies. Additional space might be needed to access the system (for example, rack-door-opening clearance). Plan to store all combustible materials in properly designed and protected storage areas.

A computer room or area needs to be separated from adjacent areas to allow for air conditioning, fire protection, and security. The floor-to-ceiling height must be sufficient to allow system 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 - 2.9 m (8 ft 6 in.- 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

Calculate the floor loads for your system with these formulas.

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 system 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.

Floor Loading is: (machine weight + (15 lb/ft2 x 0.5 svc clear) + (10 lb/ft2 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.

Computer room layout

Effective computer room layout is dependent on several important factors.

The factors for effective computer room layout are as follows.

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 can be performed on that equipment, if it becomes 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 whether 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 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 workspace 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 system locations to make it easy for additional units to be added.

Other equipment

In addition to the information technology equipment that you are 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.

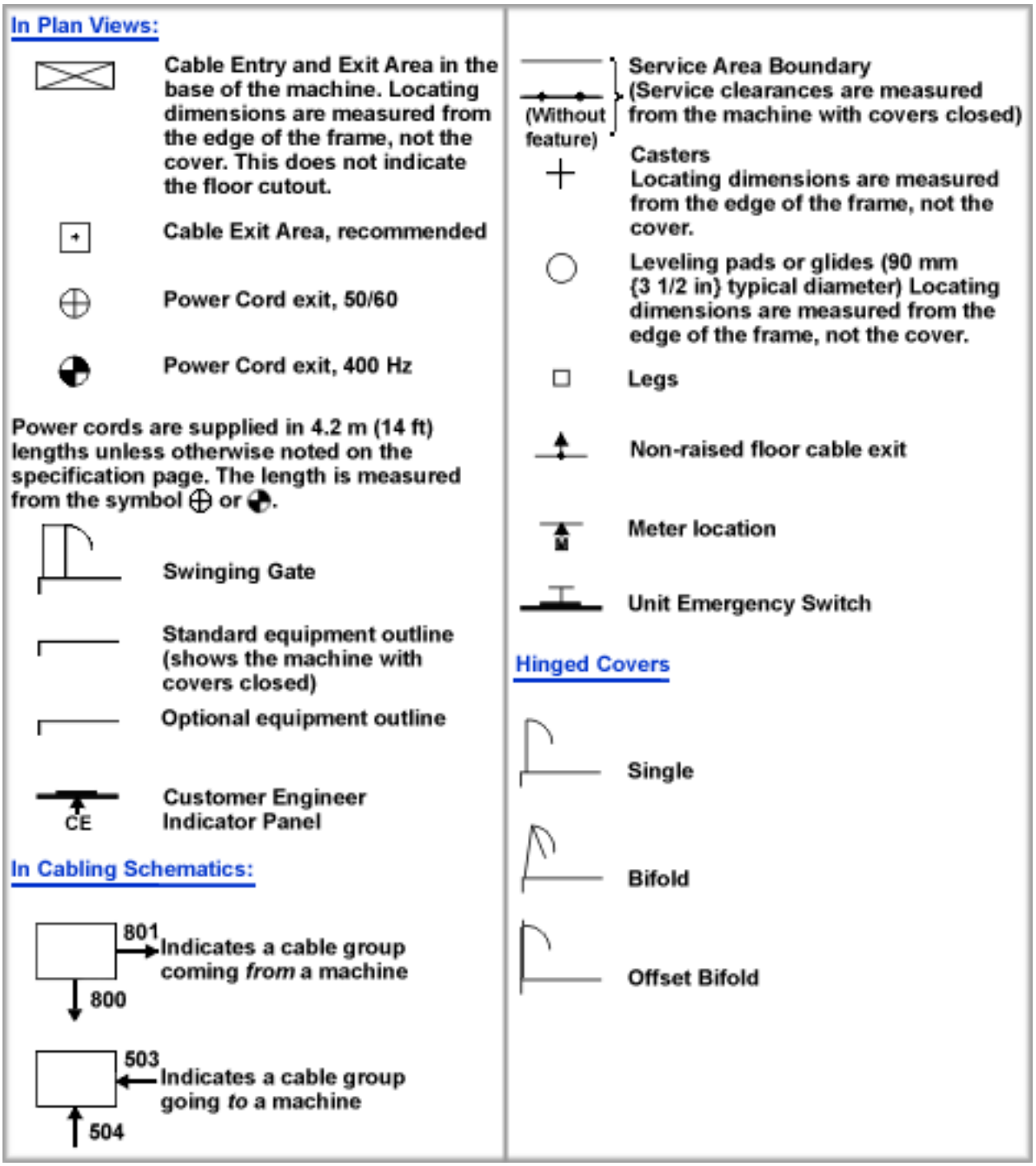


Figure 2. Standard symbols to create floor layouts

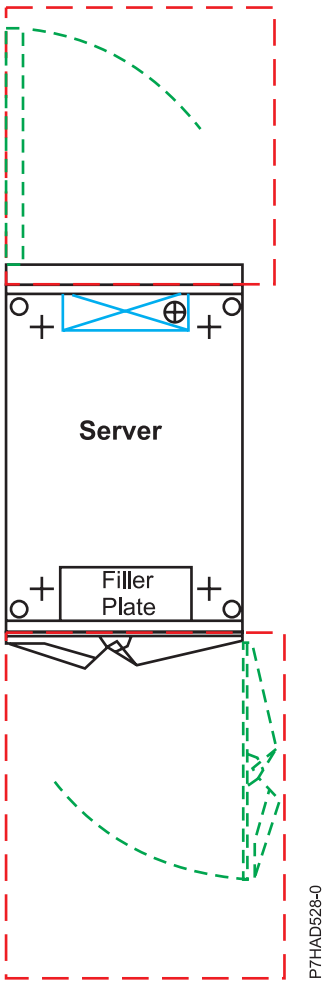


Figure 3. Sample plan view

Vibration and shock

Use this information to plan for possible vibration and shock in your data center.

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 on 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 do not exceed the specifications provided in the following tables.

Some useful definitions of vibration follow:

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 that varies 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 before 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 that relates to these 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 Operational vibration and shock limits 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

Table 2. Operational vibration and shock limits (continued)

Class	g rms	g peak	Mils	Shock
V3	0.27	0.80	9.4	application dependent

L Light with weight less than 600 kg

H Heavy with weight equal to or greater than 600 kg

g rms Overall average g level over the 5 - 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 - 17 Hz range. One mil equals 0.001 inch

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

The values given in the Operational vibration and shock limits 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 that involves earthquakes or direct impacts. Your seller can contact the IBM Standards Authority for Vibration and Shock in case of specific technical questions.

Earthquakes

Special frame-strengthening features 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 about equipment tie down is not provided in the physical planning documentation of your product, consult with your seller.

Acoustics

Acoustic noise emission data helps you to assess noise levels for your data processing equipment.

Acoustic noise emission data on IBM 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 help 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. In addition to the individual product noise declarations that appear in the IBM product-specific documents, an index of links to most of IBM product noise declarations is available online at Acoustical Noise Declarations for Selected IBM Products.

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.
- $\mathbf{\langle L_{pA} \rangle_m}$ is the mean value of the space-averaged sound-pressure-emission levels at the 1-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. Good 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 adequate 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.

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 systems 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.

Electromagnetic compatibility

Use this information to plan for system installation in an environment that has a high electomagnetic-radiated field.

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-core 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 system or selective shielding might be required.

Two-core radio or cellular telephone usage need to be properly controlled in the computer room. To reduce the likelihood of a problem, the following recommendations need to 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 system. If covers are open, do not transmit.
- Choose the minimum output power that accomplishes your communication needs.

Extremely low frequency (ELF) fields

Except for 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 in the range of 0 - 300 Hz. It is also referred to as electrical power frequency because most world electrical power is generated at either 50 or 60 Hz.

IBM 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 systems: 20 Gauss

Typical information technology centers exhibit an ambient electromagnetic field of 3 - 8 milligauss. Some equipment within a center might, under normal operation, produce fields in excess of 100 milligauss. Examples of equipment that produce 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 might exhibit distortion such as poor focus, change in image shape or slight motion in static display images. Moving the CRT away from the equipment might remedy the problem.

Computer room location

Computer room location is affected by several factors.

Before selecting a location for the computer, give attention to these guidelines:
- The computer room should be in a noncombustible or fire-resistant building or room.
- The computer room should not be above, below, or next 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 system 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 next 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. IBM designs and manufactures equipment to internal and external standards that require certain environments for reliable operation. Because IBM does not test any equipment for compatibility with fire suppression systems, IBM does not make compatibility claims of any kind nor does IBM 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. Dry chemical extinguishers should not be used in the data center.
- 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 about 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 correct 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 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 the 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 previously stated. The regular building air conditioning system should have an audible alarm to alert maintenance personnel of an emergency.
- Fire dampers should be 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.

General power information

Reliable electrical power is required for the proper functioning of your data processing equipment.

IBM 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 helps to provide for reliable operation of your IBM 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 might be required for lightning protection. Your electrical contractor needs to 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 IBM IT equipment and devices might require standard three-phase power; others might require single-phase power. The power requirements for each device are specified in the individual system specifications for that system. Nominal voltage, plugs, receptacles, and in some cases, conduits and back boxes are listed in the specific system specifications. See the respective system specifications to determine the power requirements. Ensure that existing branch circuit outlets are the correct type and are properly grounded.

Power quality

The quality of electrical power significantly impacts the performance of sensitive electronic equipment. These guidelines ensure that quality electrical power is provided to your data center.

IBM equipment 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 many parts of the world. 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 adopted the National Electric Code or 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 might be required. Typically, additional ground connections are recommended when there is a concern for high frequency or radio frequency (RF) interference, which might impact electronic circuits. These additional ground requirements can be found with the installation documentation for specific equipment. Additional ground requirements can 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

IBM equipment, unless double insulated, has power cords that contain 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 IBM equipment are identified in the equipment documentation and should match the equipment power plug. In some cases, there can be options for different manufacturer equivalent receptacles. IBM equipment plugs should not be changed or altered to match existing connectors or receptacles. To do so might create a safety hazard and void product warranty. The connectors or receptacles for IBM 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 cannot 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 - 100 ampere circuits.

All grounds that enter the room need to 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.

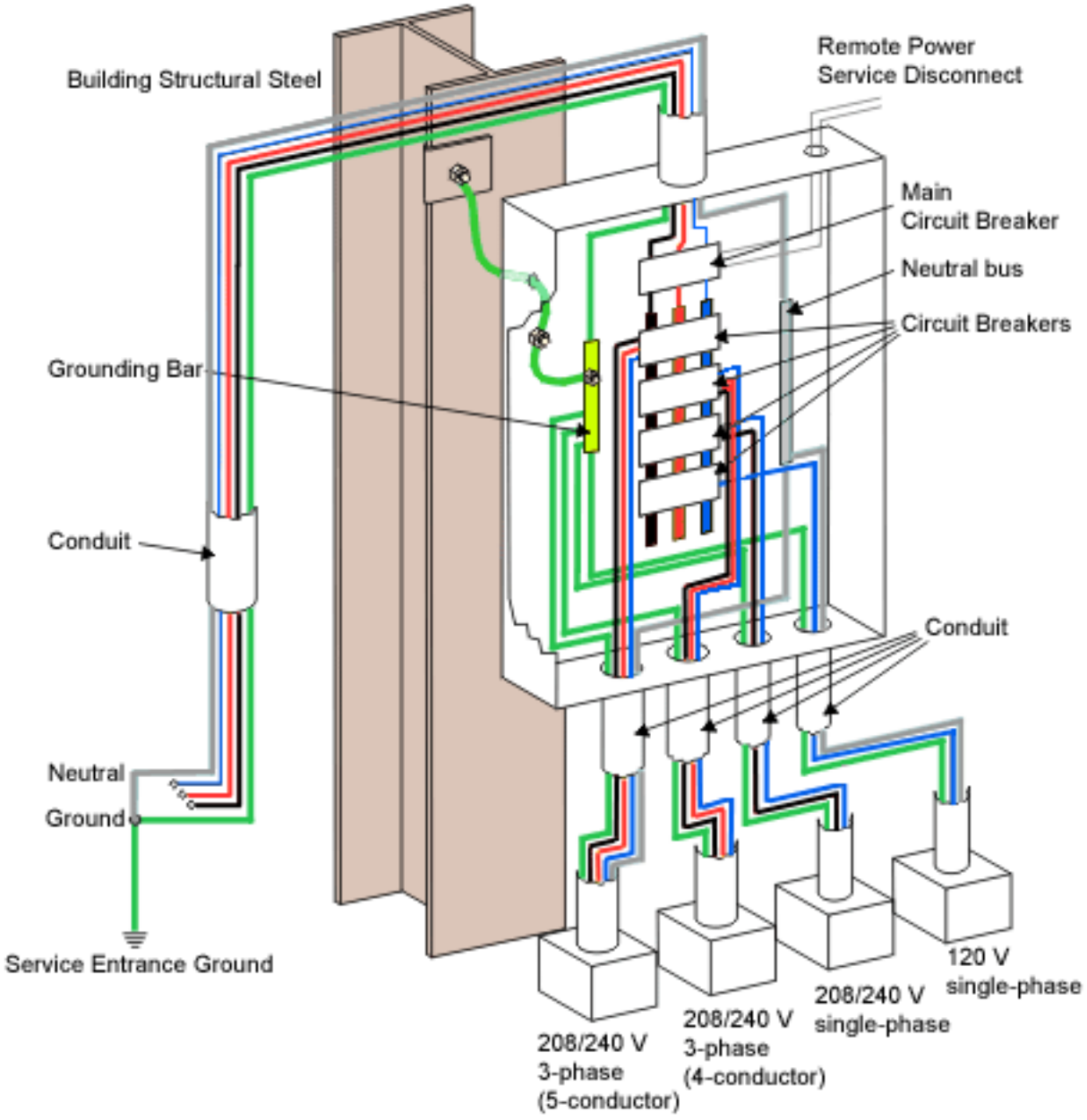


Figure 4. Transient grounding plate

Transient grounding

To minimize the effects of high-frequency electrical noise, the branch circuit power panel that services the equipment should be mounted in contact with bare building steel or connected to it by a short length of cable. If this configuration 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.

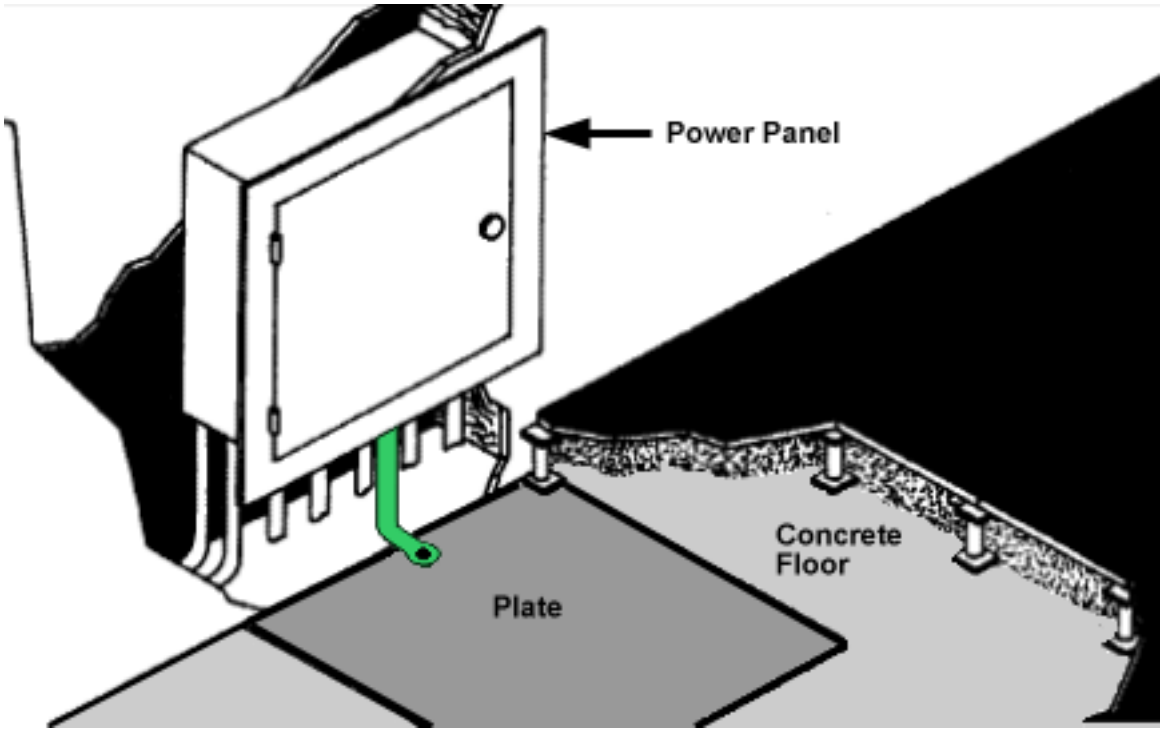


Figure 5. Transient grounding plate

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 consistent 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 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.

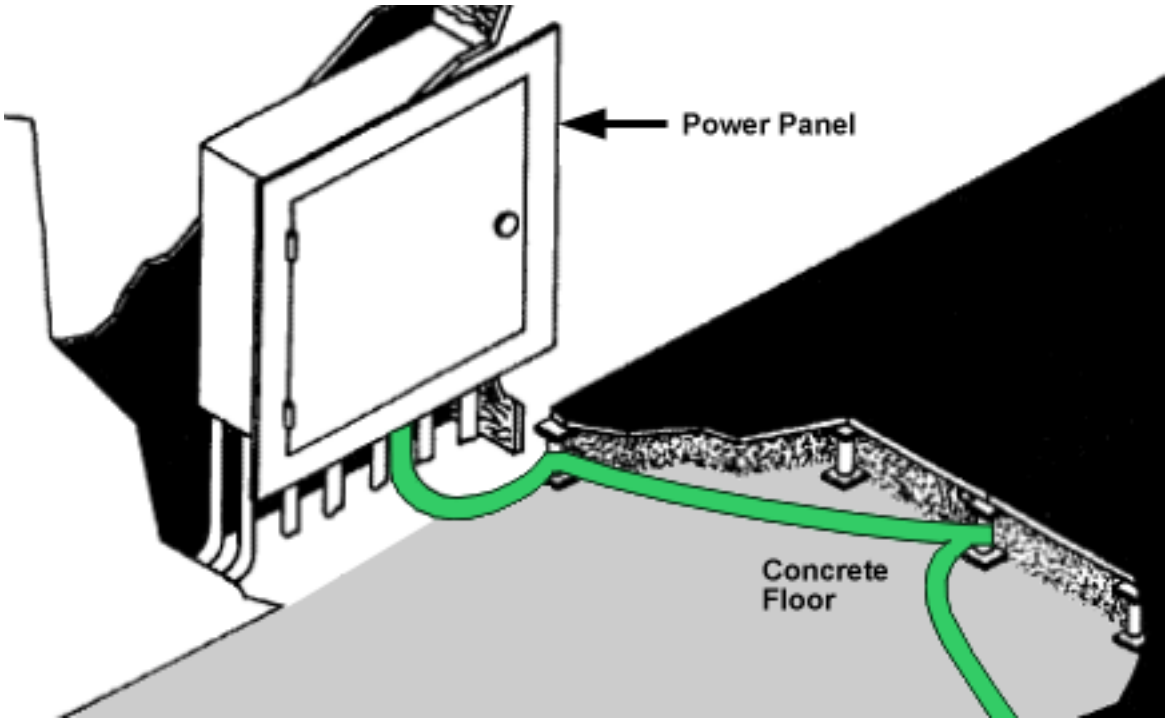


Figure 6. Transient grounding through the raised floor support structure

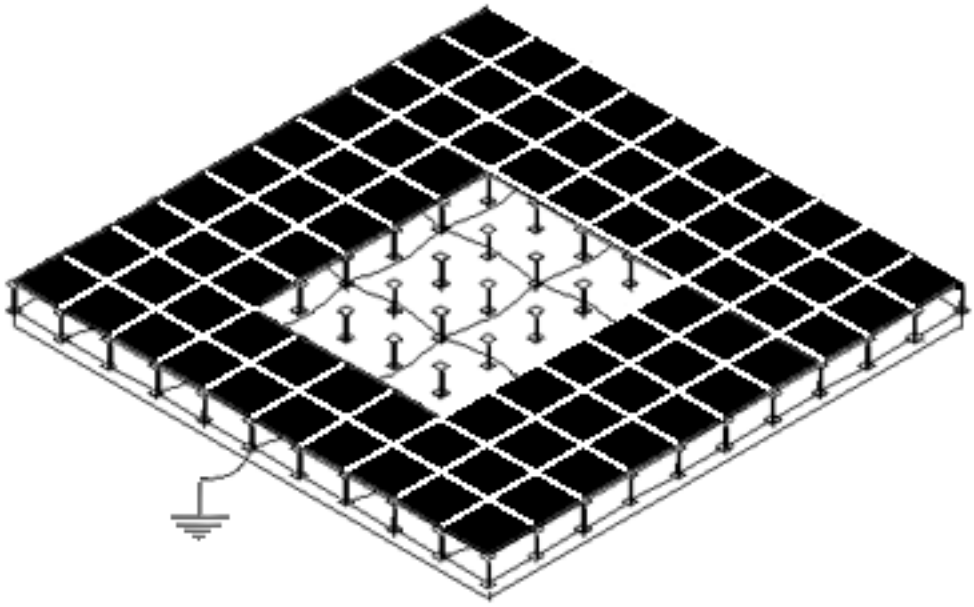


Figure 7. Signal reference grid

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 if 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.

Voltage and frequency limits

Voltage and frequency limits must be maintained to ensure proper functioning of your system.

The phase-to-phase steady-state voltage must be maintained within plus six 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 systems might require special considerations and might have more or less restrictive specifications. See the individual system 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 previously specified.

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 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 an IBM 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 considers power factor and phase relationships. In addition, it considers waveform distortions caused by the load and inrush requirements. Additional capacity needs to be planned for future expansion. Contact your seller for information about how to obtain a System Power Profile.

Primary power problem areas

Your system 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 contained in this topic.

Failures caused by the power source are basically of three types:

- Power line disturbances, such as short duration dips in voltage and 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 various industrial, medical, communication, or other equipment:
  - Within the computing facilities
  - Next to the computing facilities
  - In the vicinity of the distribution lines of power company

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 system directly from your power source.

If the transient-producing devices are 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 need to 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

These guidelines help to ensure that your data center has a quality power source.

The primary power source is normally a wye-type or delta-type, three-phase service that comes 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 provides 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 panel feeders

Ensure that the feeder wires to the branch-circuit distribution panel (shown in *Power quality*) are large enough to handle the total system power load. It is recommended that these feeders do not service 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 needs to 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 system, it is recommended that the grounding conductor of the branch circuit is 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 need to be within 0.9 m (3 ft) of the system that they supply power to. If the branch circuits are contained in a metallic conduit, either rigid or nonrigid, the conduit system needs to be grounded. This grounding 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 system 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 needs to 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 that serves 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 *Emergency planning for continuous operations*.

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 systems to be used for any purpose other than normal servicing.

Dual-power installation configurations

These dual-power installation configurations provide fully redundant power features for your system.

Some IBM Systems models are designed with a fully redundant power system. The possible power installation configurations are:

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.

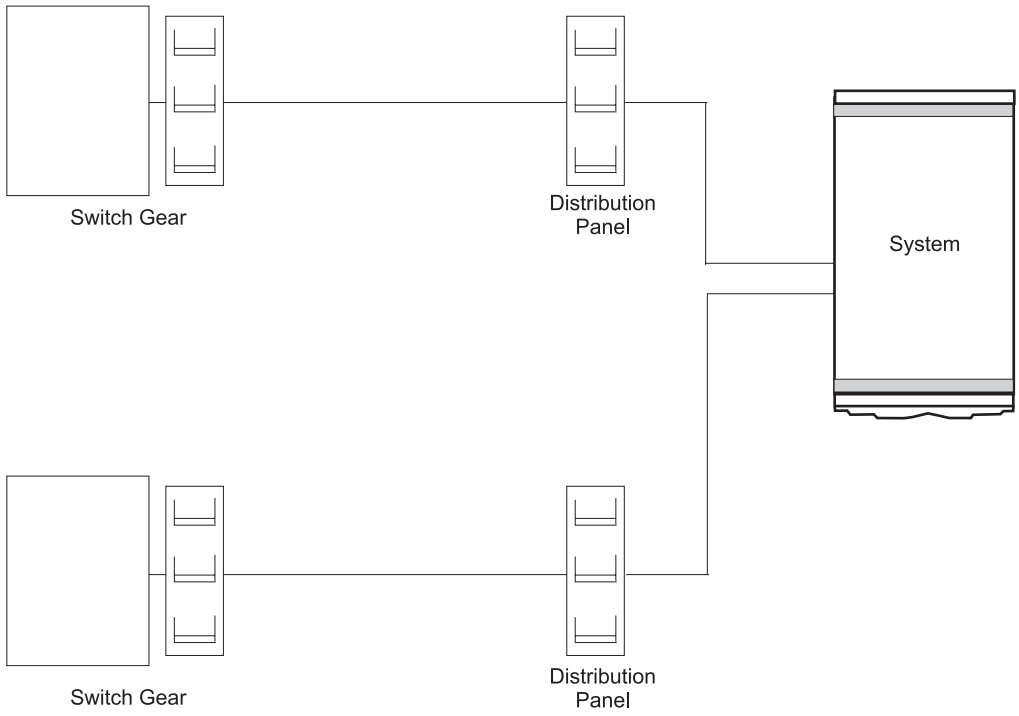


Figure 8. Dual power installation - Redundant distribution panel and switch

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 are able to achieve this level of redundancy.

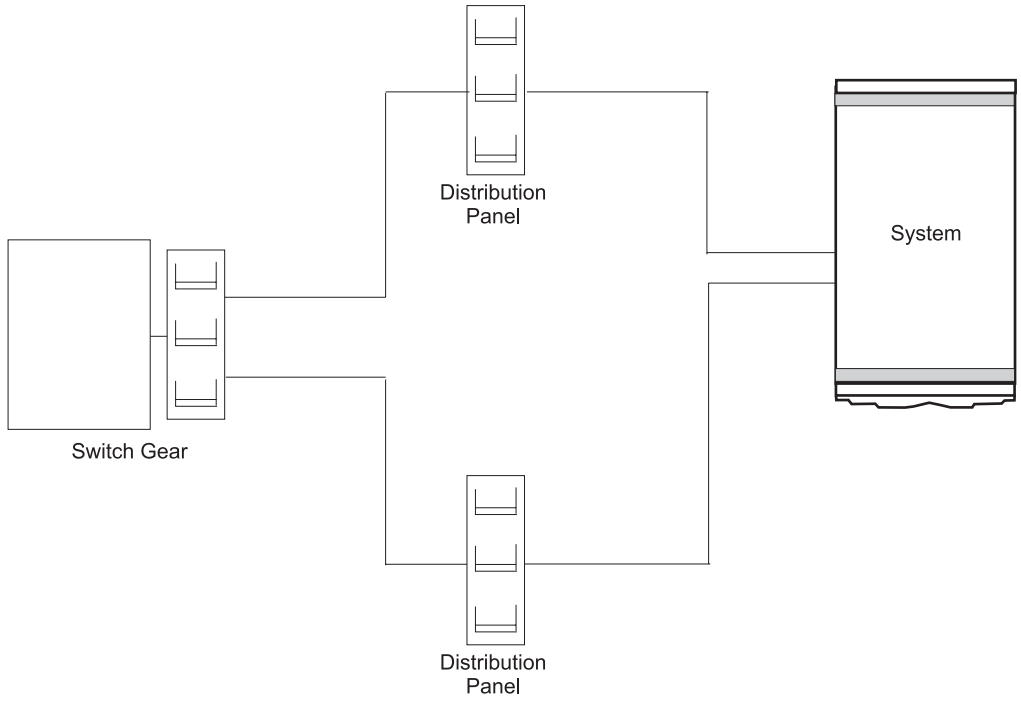


Figure 9. Dual power installation - Redundant distribution panel

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.

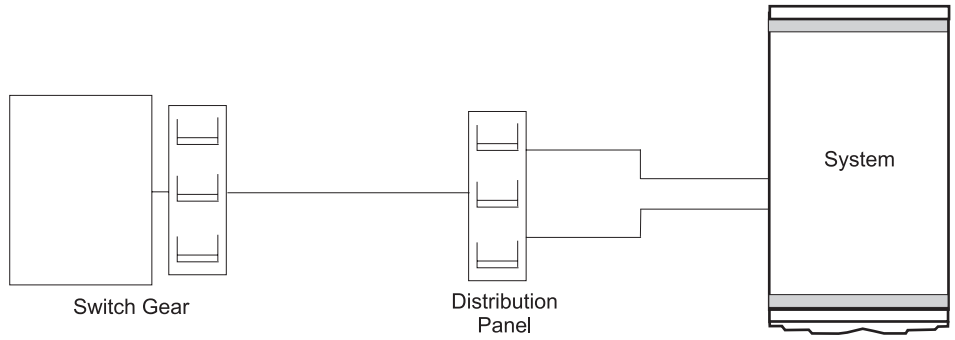


Figure 10. Single distribution panel - Dual circuit breakers

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

Use these general guidelines to set up your data center.

See 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.

System and storage considerations

Most IBM systems and storage products are designed to pull chilled air through the front of the system 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 IBM environmental specifications. See the environmental requirements in the system 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 system, be sure not to exceed, if specified, the maximum allowed time for having the cover removed while the unit is running. After your work is completed, be sure to reinstall all fans, heat sinks, air baffles, and other devices per IBM documentation.

Manufacturers, including IBM, 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 regarding heat load, including considerations for future growth, is required.

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 - 24 inches in

height, room ceiling heights of 8 - 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 was 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 already installed. There are several ways to conduct this assessment, but the most common is to review the heat load and cooling in logical sections defined by I-beams, airflow blockages, or CRAC unit locations.

Equipment layout and air delivery paths

The hot-aisle, cold-aisle arrangement that is explained in the ASHRAE publication, *Thermal Guidelines for Data Processing Environments*, dated January 2004, should be used. In Figure 11, racks within the data center are arranged such that there are cold aisles and hot aisles. The cold aisle consists of perforated floor tiles that separate 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 to exhaust from the rear of the racks to return to the CRAC units; thus, minimizing hot exhaust air from the rack to circulate 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.

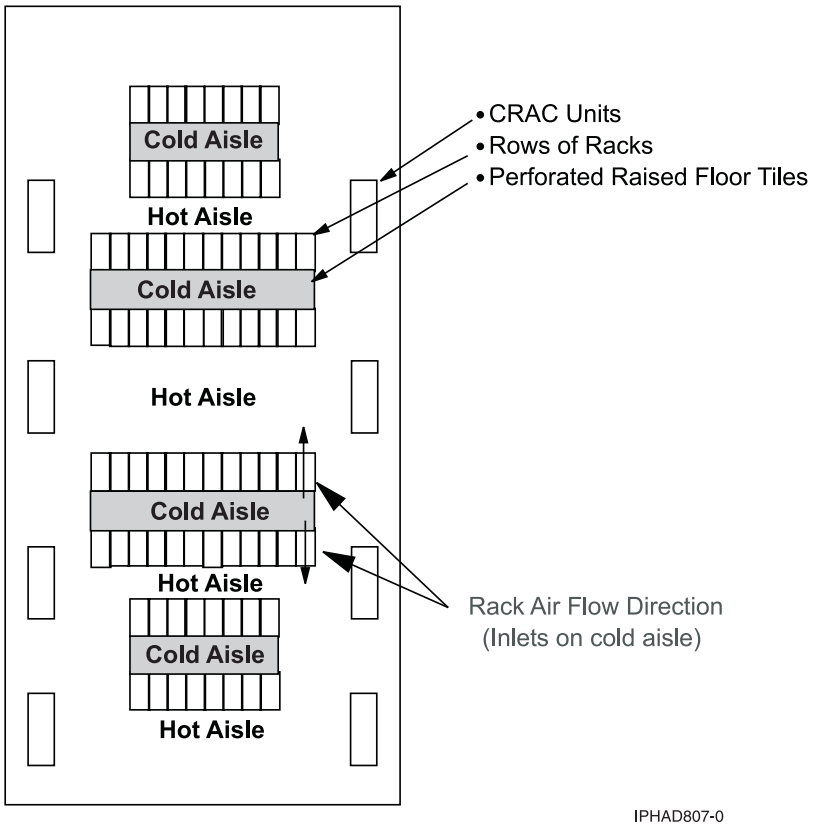


Figure 11. Hot aisle and cold aisle arrangement

The key to heat load management of the data center is to provide inlet air temperatures to the rack that meet the specifications set by the manufacturer. Because the chilled air that exhausts from the perforated tiles in the cold aisle might not satisfy the total chilled airflow required by the rack, additional flow can be from other areas of the raised floor and might not be chilled. See Figure 12. In many cases, the airflow drawn into the top of the rack, after the bottom of the rack is 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 airflow 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.

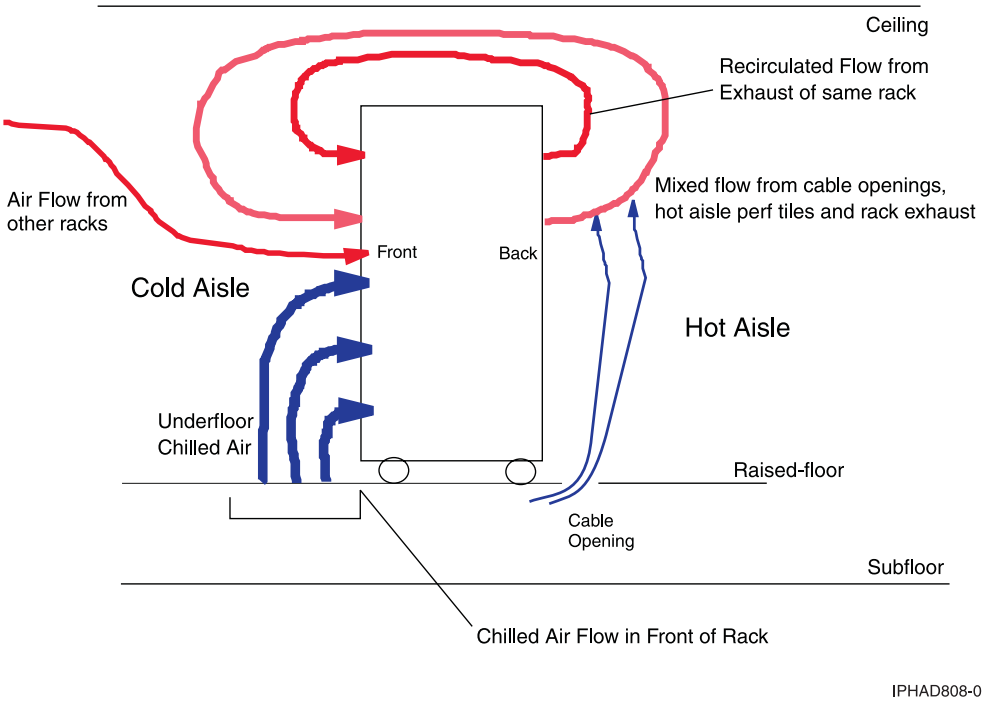


Figure 12. Possible rack airflow patterns

For a data center that might not have the best chilled-air-flow distribution, Figure 13 on page 27 gives guidance in providing adequate chilled airflow given a specific heat load. The chart takes into account worst-case locations in a data center and is the requirements to meet the maximum temperature specifications required by most IBM high-end equipment. Altitude corrections are noted on the chart.

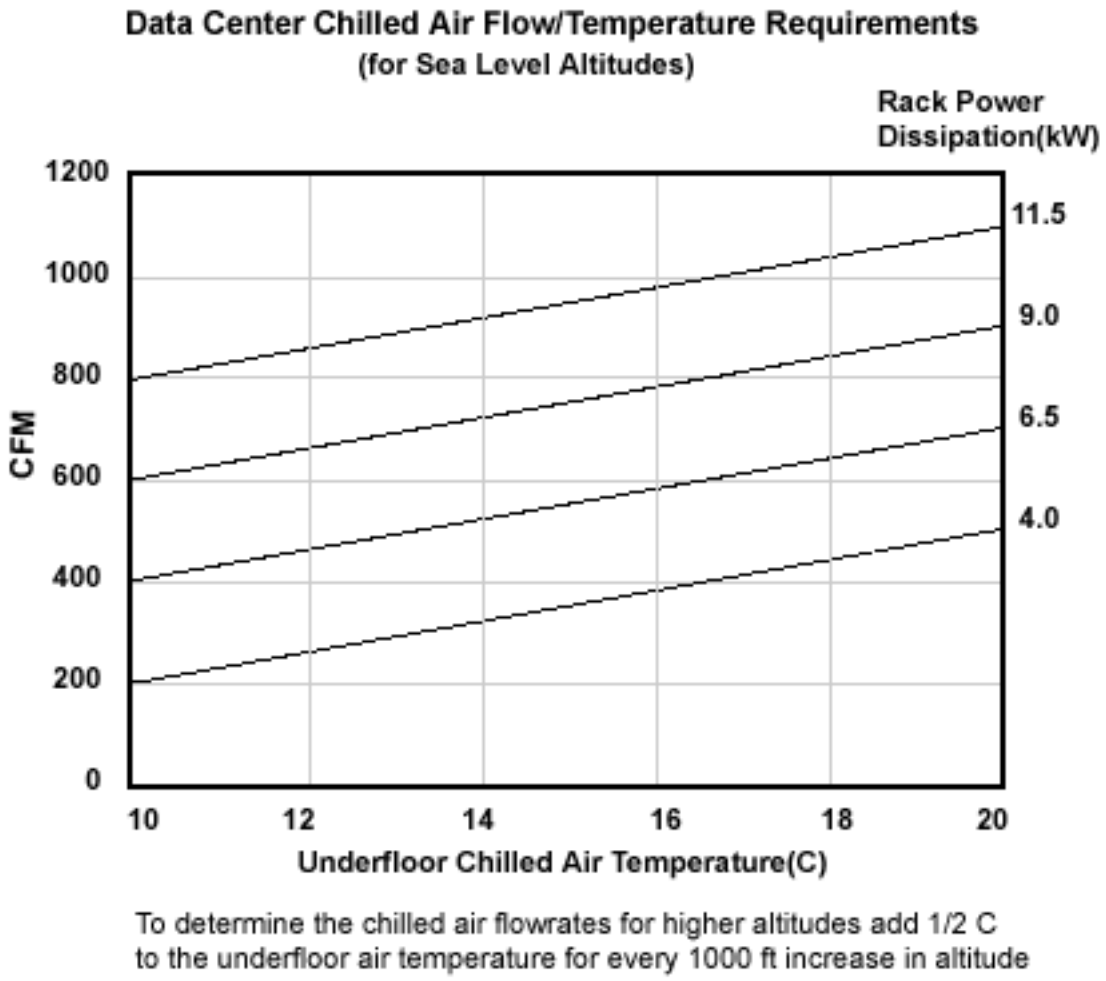


Figure 13. High-end equipment chilled airflow and temperature requirements

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 cause 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 system or storage deployment:

- Provide ample cooling for maximum heat load requirements across the entire data center.
- Provide an average amount of cooling across the data center with the capability to increase cooling in limited, local areas.

Option 1 is 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 can 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 airflow 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, 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 might be created where room air is sucked downward into the raised floor, opposite of the wanted result of upward chilled air delivery.

The volumetric flow capabilities of floor tiles with various percent-open ratings are shown in Figure 14.

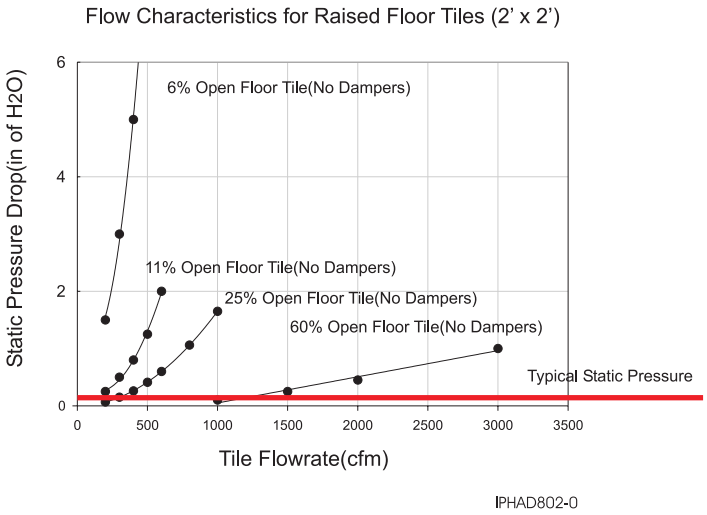


Figure 14. Volumetric flow capabilities of various raised floor tiles

Floor tiles in typical data centers deliver 100 - 300 cfm. By optimizing the flow that uses some of the guidelines presented in this document, it might 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 delivering chilled air directly to the equipment in the data center space need to be 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 helps to maximize under-floor static pressure, ensure optimal airflow to the cold aisles where it is needed, and eliminate short-circuiting of unused air to the CRAC unit returns.

Environmental design criteria

Use these environmental design criteria to ensure that your data center environment provides optimal conditions for your server operation.

The following environmental specifications are based on an altitude 1800 m (5906 ft above sea level). Some systems have more restrictive requirements on temperature, moisture, and altitude. For more information, see the individual system specifications.

Airborne particulates (including metal flakes or particles) and reactive gases that act alone or in combination with other environmental factors, such as humidity or temperature, might pose a risk to the system. Risks that are posed by the presence of excessive particulate levels or concentrations of harmful gases include damage that might cause the server to malfunction or cease functioning altogether. The environmental specifications present limits for particulates and gases that are intended to avoid such damage. The limits must not be viewed or used as definitive limits because numerous other factors, such as temperature or moisture content of the air, can influence the impact of particulates or environmental corrosives and gaseous contaminant transfer. In the absence of specific limits that is shown in the environmental specifications, you must implement practices that maintain particulate or gas levels that are consistent with the protection of human health and safety. If IBM determines that the levels of particulates or gases in your environment damaged the system, IBM might limit or restrict the provision of repair or replacement of servers or parts on the implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 3. Operating environment[1, 5]

Environmental characteristics	Properties
Temperature	18°C (64.4°F) – 27°C (80.6°F)[4]
Low-end moisture	5.5°C (41.9°F) dew point
High-end moisture	60% relative humidity or 15°C (59°F) dew point
Gaseous contamination	Severity level G1 as per ANSI/ISA 71.04-1985[2], which states that the reactivity rate of copper coupons shall be fewer than 300 Angstroms per month (Å/month, ≈ 0.0039 µg/cm2-hour weight gain).[6] In addition, the reactivity rate of silver coupons shall be less than 300Å/month (≈ 0.0035 µg/cm^2-hour weight gain).[7] The reactive monitoring of gaseous corrosivity must be conducted approximately 5 cm (2 in.) in front of the rack on the air inlet side at one-quarter and three-quarter frame height off the floor or where the air velocity is much higher.
Particulate contamination	Data centers must meet the cleanliness level of ISO 14644-1 class 8. For data centers without air-side economizer, the ISO 14644-1 class 8 cleanliness might be met by choosing one of the following filtration methods: • The room air might be continuously filtered with MERV 8 filters. • Air entering a data center might be filtered with MERV 11 or preferably MERV 13 filters. For data centers with air-side economizers, the choice of filters to achieve ISO class 8 cleanliness depends on the specific conditions present at that data center. The deliquescent relative humidity of the particulate contamination should be more than 60% RH.[3] Data centers must be free of zinc whiskers.[8]

Table 3. Operating environment[1, 5] (continued)

Environmental characteristics	Properties

1. The class 1 and class 2 temperature and moisture limits, which are measured at the IT equipment air inlet, are from ASHRAE Thermal Guidelines for Data Processing Environments, second edition (2009). Maximum recommended ambient temperature reduces 1°C (1.8°F) for every 300 m (984 ft) over 1800 m (5906 ft). The ASHRAE class 1 allowable ranges are 15°C – 32°C, 20% – 80% relative humidity, and the class 2 allowable ranges are 10°C – 35°C, 20% – 80% relative humidity. For extended periods of time, IT manufacturers recommend that data center operators maintain the recommended environment for maximum reliability. The allowable environment is where IT manufacturers test their equipment operation to verify that the equipment operates. This is not a statement of reliability, but one of functional IT equipment.
2. ANSI/ISA-S71.04. 1985. *Environmental conditions for process measurement and control systems: Airborne contaminants*, Instrument Society of America, Research Triangle Park, NC, 1985.
3. The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.
4. For ambient temperatures that exceed 25°C (77°F), the acoustical noise levels of the system might increase as the speed of the air-moving devices increases.
5. The IT equipment acclimation period is 1 hour per 20°C (68°F) of temperature change from the shipping environment to the operating environment.
6. The derivation of the equivalence between the rate of copper corrosion growth in the thickness of the corrosion product in Å/month and the rate of weight gain assumes that Cu_2S and Cu_2O grow in equal proportions.
7. The derivation of the equivalence between the rate of silver corrosion growth in the thickness of the corrosion product in Å/month and the rate of weight gain assumes that Ag_2S is the only corrosion product.
8. Surface debris is randomly collected from 10 areas of the data center on a 1.5 cm diameter disk of sticky electrically conductive tape on a metal stub. If examination of the sticky tape in a scanning electron microscope reveals no zinc whiskers, the data center is considered free of zinc whiskers.

Table 4. Nonoperating environment[2]

Environmental characteristics	Properties
Temperature	5°C (41°F) – 45°C (113°F)
Relative humidity	8% – 80%
Dew point	Less than 27°C (81°F)
Gaseous contamination	Severity level G1 as per ANSI/ISA 71.04-1985[1], which states that the reactivity rate of copper coupons shall be fewer than 300 Angstroms per month (Å/month, ≈ 0.0039 µg/cm^2-hour weight gain).[3] In addition, the reactivity rate of silver coupons shall be less than 300Å/month (≈ 0.0035 µg/cm^2-hour weight gain).[4] The reactive monitoring of gaseous corrosivity should be conducted approximately 2 in. (5 cm) in front of the rack on the air inlet side at one-quarter and three-quarter frame height off the floor or where the air velocity is much higher.

1. ANSI/ISA-S71.04. 1985. *Environmental conditions for process measurement and control systems: Airborne contaminants*, Instrument Society of America, Research Triangle Park, NC, 1985.
2. The IT equipment acclimation period is 1 hour per 20°C (68°F) of temperature change from the shipping environment to the operating environment.
3. The derivation of the equivalence between the rate of copper corrosion growth in the thickness of the corrosion product in Å/month and the rate of weight gain assumes that Cu_2S and Cu_2O grow in equal proportions.
4. The derivation of the equivalence between the rate of silver corrosion growth in the thickness of the corrosion product in Å/month and the rate of weight gain assumes that Ag_2S is the only corrosion product.

Table 5. Shipping and storage environment

Environmental characteristics	Shipping environment properties	Storage environment properties
Temperature	-40°C to 60°C (-40°F to 140°F)	1°C – 60°C (33.8°F - 140°F)

Table 5. Shipping and storage environment (continued)

Environmental characteristics	Shipping environment properties	Storage environment properties
Relative humidity	5% – 100% (no condensation)	5% – 80% (no condensation)
Wet bulb	Less than 29°C (84.2°F)	Less than 29°C (84.2°F)
Shipping package	IBM-approved Vapor barrier bag with desiccant	IBM-approved Vapor barrier bag with desiccant

Notes:

Solid-state drives (SSD) have the following restrictive limits for data retention:

- Do not exceed 60°C (140°F).
- Do not store at 60°C (140°F) or more for over 30 days when new.
- Do not store at 37.8°C (100°F) or more for over 180 days when new.
- Do not store at 60°C (140°F) or more for over 6 days when relocating (cumulative time at the specified temperature).
- Do not store at 37.8°C (100°F) or more for over 90 days when relocating.

Ensure that you back up your data first, if applicable, before shipping.

Air quality

Many systems are installed in environments other than the typical data center, business office, or clean industrial location. These environments might exhibit various temperatures, relative humidity, and levels of airborne particles or corrosive gases. IBM systems are designed to work within the environmental specifications that are shown in the previous tables unless otherwise noted on an individual system specification.

An environment is considered unacceptable when the temperature, relative humidity, corrosive gases, or solid particles in the air exceed specific limits that are set by IBM. Equipment that operates in environments that are classified as unacceptable might be subject to degraded performance and permanent damage if the equipment is not designed for such environments.

Contaminants

Systems are being installed in increasingly diversified industries. Some of these industries, as a by-product of their processes, cause the atmosphere to contain measurable quantities of gases and solid particles that are potentially harmful to electronic equipment. Urban areas that are highly industrialized might have levels of gases and solid particles that cause an unacceptable environment exposure to exist throughout an entire area.

IBM is concerned with two classes of atmospheric contaminants: solid particles and gases. Solid particles in the air are referred to as *particulates*. Water vapor can combine with these tiny, solid particles and form compounds. Such matter is said to be hygroscopic. It can be harmful, depending on the particulate composition. Gases can form harmful acids or bases when combined with water. Because of the ability to absorb moisture, the relative humidity and temperature are significant factors in an unacceptable environment.

High concentrations of gases, such as sulfur dioxide, nitrogen dioxide, ozone, and acidic gaseous chlorine, which are associated with industrial processes, are known to cause corrosion and failure of electronic components. 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 that produces the particles might be some distance away.

Industries that are engaged in processing petroleum, chemicals, primary metals, food, mining, and paper have a higher probability of encountering an unacceptable environment. However, contamination can be a result of construction, cleaning, or other activities that can occur anywhere.

A visual inspection is the first step in determining the likelihood of contamination. Some indicators of an unacceptable environment might include corrosion of metal, such as door handles and hinges. Often, the presence of contaminants can be determined by odor as in the case of chlorine or sulfur, which have a distinctive smell. Observe whether a heavy layer of dust settles on surfaces, especially in the primary metals industry. This dust is often conductive and can create electrical arcing or short circuits if drawn into electronic equipment.

To determine adherence to IBM requirements for gases and particulates, laboratory techniques are necessary. Testing for gases and particulates involves special equipment and procedures. Contact your IBM installation planning representative for guidance.

If the environment is contaminated, IBM can also provide guidance on remediation, prevention, and control. Recommended solutions might include, but are not limited to, room pressurization, tighter relative humidity control, filtration, maintenance, and monitoring.

System specifications

System specifications provide detailed information for your system, including dimensions, electrical, power, temperature, environmental requirements, and noise emissions.

Select the appropriate models to view the specifications for your system.

Model 8279-A01 rack specifications

Rack specifications provide detailed information for IBM 8279-A01 foundation racks including dimensions, electrical data, power, temperature, environmental requirements, and noise emissions.

Dimensions

Table 6. Dimensions[1]

Width	Depth	Height	EIA units	Weight[2]
644 mm (25.4 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	42 EIA units	562 kg (1236 lb)

1. The rack is equivalent to a 7014-T42 rack with PureSystems™ doors that add approximately 284.5 mm (11.2 in.) to the depth (front and rear doors). For more information about the 7014 rack, see Model 7014-T42, 7014-B42, and 0553.
2. Additional data racks have the following weights: 8279-AD1 = 492 kg (1081 lb), 8279-AD2 = 648 kg (1426 lb), and 8279-AD3 = 805 kg (1771 lb). The data rack (second rack and beyond) has an additional 47.6 kg (105 lbs) welded to the bottom of the rack (nonremovable) for stabilization during shipping. This additional weight is not included in the data in Table 6.

Electrical

Table 7. Electrical

Electrical characteristics	Properties
Maximum kVA	6.5 kVA
Voltage[1,2]	200 - 240 V ac
Frequency	47 - 63 Hz
Maximum thermal output	14160 BTU/hr
Maximum power consumption[3]	6200 W
Phase	1

1. The input voltage is based on the power distribution unit (PDU) power cord. For more information, see “Power distribution unit and power cord specifications” on page 48.
2. All drawers mounted in the rack are rated 200 - 240 V ac. The power supplies automatically accept any voltage within the rated voltage range. With dual power supplies installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load.
3. When you plan the electrical system, it is important to use maximum values to account for internal or environmental conditions that result in power consumption that increases beyond typical values. However, when you plan for heat load, you can use the typical value of 4780 W.

Environment requirements

Table 8. Environment requirements

Environment	Recommended operating	Allowable operating	Nonoperating
ASHRAE class		A2	
Airflow direction[1]		Front-to-back	
Temperature[2]	18°C - 27°C (64°F - 80°F)	10°C - 35°C (50°F - 95°F)	5°C - 45°C (41°F - 113°F)
Humidity range	5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point	20% - 80% RH	8% - 80% RH
Maximum rate of change		5°C/20 hrs	
Maximum dew point		21°C (70°F)	27°C (80°F)
Maximum operating altitude		3050 m (10000 ft)	
Shipping temperature			-40°C - 60°C (-40°F - 140°F)
Shipping relative humidity			5% - 100%

1. Nominal cubic feet per minute (CFM) is approximately 2030. Maximum CFM is approximately 4025.
2. Derate maximum allowable dry-bulb temperature 1°C/175 m above 950 m.

Electromagnetic compatibility compliance

The electromagnetic compatibility compliance is: CISPR 22; CISPR 24; FCC, CFR 47, Part 15 (US); VCCI (Japan); Directive 2004/108/EC (EEA); ICES-003, Issue 4 (Canada); ACMA radio communications standard (Australia, New Zealand); CNS 13438 (Taiwan); Radio Waves Act, MIC Rule No. 210 (Korea); Commodity Inspection Law (China); TCVN 7189 (Vietnam); MoCI (Saudi Arabia); SI 961 (Israel); GOST R 51318.22, 51318.24 (Russia).

Product safety compliance

The product safety compliance is: IEC 60950-1; UL 60950-1; CSA 60950-1.

Delivery and subsequent transportation of the equipment

DANGER

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

You must prepare your environment, with assistance from an authorized service provider, to accept the new product based on the installation planning information provided. 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 can 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.

Model 8279-A02 rack specifications

Rack specifications provide detailed information for IBM 8279-A02 racks including dimensions, electrical data, power, temperature, environmental requirements, and noise emissions.

Dimensions

This model consists of one 8279-A01 foundation rack and one 8279-AD1 data rack that is bundled together.

Table 9. Dimensions[1]

Models	Width	Depth	Height	EIA units	Weight[2]
Model 8279-A01	644 mm (25.4 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	42 EIA units	562 kg (1236 lb)
Model 8279-AD1	644 mm (25.4 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	42 EIA units	492 kg (1081 lb)
Model 8279-A02 (8279-A01 + 8279-AD1)	1288 mm (50.8 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	84 EIA units	1054 kg (2317 lb)

1. The rack is equivalent to a 7014-T42 rack with PureSystems doors that add approximately 284.5 mm (11.2 in.) to the depth (front and rear doors). For more information about the 7014 rack, see Model 7014-T42, 7014-B42, and 0553.
2. Additional data racks have the following weights: 8279-AD1 = 492 kg (1081 lb), 8279-AD2 = 648 kg (1426 lb), and 8279-AD3 = 805 kg (1771 lb). The data rack (second rack and beyond) has an additional 47.6 kg (105 lbs) welded to the bottom of the rack (nonremovable) for stabilization during shipping. This additional weight is not included in the data in Table 9.

Electrical

Table 10. Electrical

Electrical characteristics	Properties
Maximum kVA	6.5 kVA (8279-A01)
	4.9 kVA (8279-AD1)
	11.4 kVA (8279-A02 (8279-A01 + 8279-AD1))
Voltage[1,2]	200 - 240 V ac (all models)
Frequency	47 - 63 Hz (all models)
Maximum thermal output	14160 Btu/hr (8279-A01)
	11601 Btu/hr (8279-AD1)
	25761 Btu/hr (8279-A02 (8279-A01 + 8279-AD1))
Maximum power consumption[3]	6200 W (8279-A01)
	4600 W (8279-AD1)
	10800 W (8279-A02 (8279-A01 + 8279-AD1))
Phase	1 (all models)

Table 10. Electrical (continued)

Electrical characteristics	Properties
1. The input voltage is based on the power distribution unit (PDU) power cord. For more information, see "Power distribution unit and power cord specifications" on page 48. 2. All drawers mounted in the rack are rated 200 - 240 V ac. The power supplies automatically accept any voltage within the rated voltage range. With dual power supplies installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load. 3. When you plan the electrical system, it is important to use maximum values to account for internal or environmental conditions that result in power consumption that increases beyond typical values. However, when you plan for heat load, you can use the typical value of 4780 W for model 8279-A01 and 3460 W for model 8279-AD1. For model 8279-A02 (8279-A01 + 8279-AD1), you can use the combined typical value of 8240 W.	

Environment requirements

Table 11. Environment requirements

Environment	Recommended operating	Allowable operating	Nonoperating
ASHRAE class		A2	
Airflow direction[1]		Front-to-back	
Temperature[2]	18°C - 27°C (64°F - 80°F)	10°C - 35°C (50°F - 95°F)	5°C - 45°C (41°F - 113°F)
Humidity range	5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point	20% - 80% RH	8% - 80% RH
Maximum rate of change		5°C/20 hrs	
Maximum dew point		21°C (70°F)	27°C (80°F)
Maximum operating altitude		3050 m (10000 ft)	
Shipping temperature			-40°C - 60°C (-40°F - 140°F)
Shipping relative humidity			5% - 100%

1. Nominal cubic feet per minute (CFM) is approximately 2030. Maximum CFM is approximately 4025.
2. Derate maximum allowable dry-bulb temperature 1°C/175 m above 950 m.

Electromagnetic compatibility compliance

The electromagnetic compatibility compliance is: CISPR 22; CISPR 24; FCC, CFR 47, Part 15 (US); VCCI (Japan); Directive 2004/108/EC (EEA); ICES-003, Issue 4 (Canada); ACMA radio communications standard (Australia, New Zealand); CNS 13438 (Taiwan); Radio Waves Act, MIC Rule No. 210 (Korea); Commodity Inspection Law (China); TCVN 7189 (Vietnam); MoCI (Saudi Arabia); SI 961 (Israel); GOST R 51318.22, 51318.24 (Russia).

Product safety compliance

The product safety compliance is: IEC 60950-1; UL 60950-1; CSA 60950-1.

Delivery and subsequent transportation of the equipment

DANGER

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

You must prepare your environment, with assistance from an authorized service provider, to accept the new product based on the installation planning information provided. 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 can 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.

Model 8279-A03 rack specifications

Rack specifications provide detailed information for IBM 8279-A03 racks including dimensions, electrical data, power, temperature, environmental requirements, and noise emissions.

Dimensions

This model consists of one 8279-A01 foundation rack and one 8279-AD2 data rack that is bundled together.

Table 12. Dimensions[1]

Models	Width	Depth	Height	EIA units	Weight[2]
Model 8279-A01	644 mm (25.4 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	42 EIA units	562 kg (1236 lb)
Model 8279-AD2	644 mm (25.4 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	42 EIA units	648 kg (1426 lb)
Model 8279-A03 (8279-A01 + 8279-AD2)	1288 mm (50.8 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	84 EIA units	1210 kg (2662 lb)

1. The rack is equivalent to a 7014-T42 rack with PureSystems doors that add approximately 284.5 mm (11.2 in.) to the depth (front and rear doors). For more information about the 7014 rack, see Model 7014-T42, 7014-B42, and 0553.
2. Additional data racks have the following weights: 8279-AD1 = 492 kg (1081 lb), 8279-AD2 = 648 kg (1426 lb), and 8279-AD3 = 805 kg (1771 lb). The data rack (second rack and beyond) has an additional 47.6 kg (105 lbs) welded to the bottom of the rack (nonremovable) for stabilization during shipping. This additional weight is not included in the data in Table 12.

Electrical

Table 13. Electrical

Electrical characteristics	Properties
Maximum kVA	6.5 kVA (8279-A01)
	7.9 kVA (8279-AD2)
	14.4 kVA (8279-A03 (8279-A01 + 8279-AD2))
Voltage[1,2]	200 - 240 V ac (all models)
Frequency	47 - 63 Hz (all models)

Table 13. Electrical (continued)

Electrical characteristics	Properties
Maximum thermal output	14160 Btu/hr (8279-A01)
	19534 Btu/hr (8279-AD2)
	33694 Btu/hr (8279-A03 (8279-A01 + 8279-AD2))
Maximum power consumption[3]	6200 W (8279-A01)
	7600 W (8279-AD2)
	13800 W (8279-A03 (8279-A01 + 8279-AD2))
Phase	1 (all models)

1. The input voltage is based on the power distribution unit (PDU) power cord. For more information, see "Power distribution unit and power cord specifications" on page 48.
2. All drawers mounted in the rack are rated 200 - 240 V ac. The power supplies automatically accept any voltage within the rated voltage range. With dual power supplies installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load.
3. When you plan the electrical system, it is important to use maximum values to account for internal or environmental conditions that result in power consumption that increases beyond typical values. However, when you plan for heat load, you can use the typical value of 4780 W for model 8279-A01 and 6100 W for model 8279-AD2. For model 8279-A03 (8279-A01 + 8279-AD2), you can use the combined typical value of 10880 W.

Environment requirements

Table 14. Environment requirements

Environment	Recommended operating	Allowable operating	Nonoperating
ASHRAE class		A2	
Airflow direction[1]		Front-to-back	
Temperature[2]	18°C - 27°C (64°F - 80°F)	10°C - 35°C (50°F - 95°F)	5°C - 45°C (41°F - 113°F)
Humidity range	5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point	20% - 80% RH	8% - 80% RH
Maximum rate of change		5°C/20 hrs	
Maximum dew point		21°C (70°F)	27°C (80°F)
Maximum operating altitude		3050 m (10000 ft)	
Shipping temperature			-40°C - 60°C (-40°F - 140°F)
Shipping relative humidity			5% - 100%

1. Nominal cubic feet per minute (CFM) is approximately 2030. Maximum CFM is approximately 4025.
2. Derate maximum allowable dry-bulb temperature 1°C/175 m above 950 m.

Electromagnetic compatibility compliance

The electromagnetic compatibility compliance is: CISPR 22; CISPR 24; FCC, CFR 47, Part 15 (US); VCCI (Japan); Directive 2004/108/EC (EEA); ICES-003, Issue 4 (Canada); ACMA radio communications standard (Australia, New Zealand); CNS 13438 (Taiwan); Radio Waves Act, MIC Rule No. 210 (Korea); Commodity Inspection Law (China); TCVN 7189 (Vietnam); MoCI (Saudi Arabia); SI 961 (Israel); GOST R 51318.22, 51318.24 (Russia).

Product safety compliance

The product safety compliance is: IEC 60950-1; UL 60950-1; CSA 60950-1.

Delivery and subsequent transportation of the equipment

DANGER

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Model 8279-A04 rack specifications

Rack specifications provide detailed information for IBM 8279-A04 racks including dimensions, electrical data, power, temperature, environmental requirements, and noise emissions.

Dimensions

This model consists of one 8279-A01 foundation rack and one 8279-AD3 data rack that is bundled together.

Table 15. Dimensions[1]

Models	Width	Depth	Height	EIA units	Weight[2]
Model 8279-A01	644 mm (25.4 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	42 EIA units	562 kg (1236 lb)
Model 8279-AD3	644 mm (25.4 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	42 EIA units	805 kg (1771 lb)
Model 8279-A04 (8279-A01 + 8279-AD3)	1288 mm (50.8 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	84 EIA units	1367 kg (3007 lb)

1. The rack is equivalent to a 7014-T42 rack with PureSystems doors that add approximately 284.5 mm (11.2 in.) to the depth (front and rear doors). For more information about the 7014 rack, see Model 7014-T42, 7014-B42, and 0553.
2. Additional data racks have the following weights: 8279-AD1 = 492 kg (1081 lb), 8279-AD2 = 648 kg (1426 lb), and 8279-AD3 = 805 kg (1771 lb). The data rack (second rack and beyond) has an additional 47.6 kg (105 lbs) welded to the bottom of the rack (nonremovable) for stabilization during shipping. This additional weight is not included in the data in Table 15.

Electrical

Table 16. Electrical

Electrical characteristics	Properties
Maximum kVA	6.5 kVA (8279-A01)
	11.0 kVA (8279-AD3)
	17.5 kVA (8279-A04 (8279-A01 + 8279-AD3))
Voltage[1,2]	200 - 240 V ac (all models)
Frequency	47 - 63 Hz (all models)
Maximum thermal output	14160 Btu/hr (8279-A01)
	27467 Btu/hr (8279-AD3)
	41627 Btu/hr (8279-A04 (8279-A01 + 8279-AD3))
Maximum power consumption[3]	6200 W (8279-A01)
	10500 W (8279-AD3)
	16700 W (8279-A04 (8279-A01 + 8279-AD3))
Phase	1 (all models)

1. The input voltage is based on the power distribution unit (PDU) power cord. For more information, see "Power distribution unit and power cord specifications" on page 48.
2. All drawers mounted in the rack are rated 200 - 240 V ac. The power supplies automatically accept any voltage within the rated voltage range. With dual power supplies installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load.
3. When you plan the electrical system, it is important to use maximum values to account for internal or environmental conditions that result in power consumption that increases beyond typical values. However, when you plan for heat load, you can use the typical value of 4780 W for model 8279-A01 and 9310 W for model 8279-AD3. For model 8279-A04 (8279-A01 + 8279-AD3), you can use the combined typical value of 14090 W.

Environment requirements

Table 17. Environment requirements

Environment	Recommended operating	Allowable operating	Nonoperating
ASHRAE class		A2	
Airflow direction[1]		Front-to-back	
Temperature[2]	18°C - 27°C (64°F - 80°F)	10°C - 35°C (50°F - 95°F)	5°C - 45°C (41°F - 113°F)
Humidity range	5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point	20% - 80% RH	8% - 80% RH
Maximum rate of change		5°C/20 hrs	
Maximum dew point		21°C (70°F)	27°C (80°F)
Maximum operating altitude		3050 m (10000 ft)	
Shipping temperature			-40°C - 60°C (-40°F - 140°F)
Shipping relative humidity			5% - 100%

1. Nominal cubic feet per minute (CFM) is approximately 2030. Maximum CFM is approximately 4025.
2. Derate maximum allowable dry-bulb temperature 1°C/175 m above 950 m.

Electromagnetic compatibility compliance

The electromagnetic compatibility compliance is: CISPR 22; CISPR 24; FCC, CFR 47, Part 15 (US); VCCI (Japan); Directive 2004/108/EC (EEA); ICES-003, Issue 4 (Canada); ACMA radio communications standard (Australia, New Zealand); CNS 13438 (Taiwan); Radio Waves Act, MIC Rule No. 210 (Korea); Commodity Inspection Law (China); TCVN 7189 (Vietnam); MoCI (Saudi Arabia); SI 961 (Israel); GOST R 51318.22, 51318.24 (Russia).

Product safety compliance

The product safety compliance is: IEC 60950-1; UL 60950-1; CSA 60950-1.

Delivery and subsequent transportation of the equipment

DANGER

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Model 8279-A05 rack specifications

Rack specifications provide detailed information for IBM 8279-A05 racks including dimensions, electrical data, power, temperature, environmental requirements, and noise emissions.

Dimensions

This model consists of one 8279-A05 foundation rack and one 8279-AD3 data rack that is bundled together.

Table 18. Dimensions[1]

Models	Width	Depth	Height	EIA units	Weight[2]
Model 8279-A05	644 mm (25.4 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	42 EIA units	593 kg (1304 lb)
Model 8279-AD3	644 mm (25.4 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	42 EIA units	805 kg (1771 lb)
Model 8279-A05 (8279-A05 + 8279-AD3)	1288 mm (50.8 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	84 EIA units	1398 kg (3075 lb)

1. The rack is equivalent to a 7014-T42 rack with PureSystems doors that add approximately 284.5 mm (11.2 in.) to the depth (front and rear doors). For more information about the 7014 rack, see Model 7014-T42, 7014-B42, and 0553.
2. Additional data racks have the following weights: 8279-AD1 = 492 kg (1081 lb), 8279-AD2 = 648 kg (1426 lb), and 8279-AD3 = 805 kg (1771 lb). The data rack (second rack and beyond) has an additional 47.6 kg (105 lbs) welded to the bottom of the rack (nonremovable) for stabilization during shipping. This additional weight is not included in the data in Table 18.

Electrical

Table 19. Electrical

Electrical characteristics	Properties
Maximum kVA	7.6 kVA (8279-A05)
	11.0 kVA (8279-AD3)
	18.6 kVA (8279-A05 (8279-A05 + 8279-AD3))
Voltage[1,2]	200 - 240 V ac (all models)
Frequency	47 - 63 Hz (all models)
Maximum thermal output	16855 Btu/hr (8279-A05)
	27467 Btu/hr (8279-AD3)
	44322 Btu/hr (8279-A05 (8279-A05 + 8279-AD3))
Maximum power consumption[3]	7200 W (8279-A05)
	10500 W (8279-AD3)
	17700 W (8279-A05 (8279-A05 + 8279-AD3))
Phase	1 (all models)

1. The input voltage is based on the power distribution unit (PDU) power cord. For more information, see "Power distribution unit and power cord specifications" on page 48.
2. All drawers mounted in the rack are rated 200 - 240 V ac. The power supplies automatically accept any voltage within the rated voltage range. With dual power supplies installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load.
3. When you plan the electrical system, it is important to use maximum values to account for internal or environmental conditions that result in power consumption that increases beyond typical values. However, when you plan for heat load, you can use the typical value of 5570 W for model 8279-A05 and 9310 W for model 8279-AD3. For model 8279-A05 (8279-A05 + 8279-AD3), you can use the combined typical value of 14880 W.

Environment requirements

Table 20. Environment requirements

Environment	Recommended operating	Allowable operating	Nonoperating
ASHRAE class		A2	
Airflow direction[1]		Front-to-back	
Temperature[2]	18°C - 27°C (64°F - 80°F)	10°C - 35°C (50°F - 95°F)	5°C - 45°C (41°F - 113°F)
Humidity range	5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point	20% - 80% RH	8% - 80% RH
Maximum rate of change		5°C/20 hrs	
Maximum dew point		21°C (70°F)	27°C (80°F)
Maximum operating altitude		3050 m (10000 ft)	
Shipping temperature			-40°C - 60°C (-40°F - 140°F)
Shipping relative humidity			5% - 100%

1. Nominal cubic feet per minute (CFM) is approximately 2030. Maximum CFM is approximately 4025.
2. Derate maximum allowable dry-bulb temperature 1°C/175 m above 950 m.

Electromagnetic compatibility compliance

The electromagnetic compatibility compliance is: CISPR 22; CISPR 24; FCC, CFR 47, Part 15 (US); VCCI (Japan); Directive 2004/108/EC (EEA); ICES-003, Issue 4 (Canada); ACMA radio communications standard (Australia, New Zealand); CNS 13438 (Taiwan); Radio Waves Act, MIC Rule No. 210 (Korea); Commodity Inspection Law (China); TCVN 7189 (Vietnam); MoCI (Saudi Arabia); SI 961 (Israel); GOST R 51318.22, 51318.24 (Russia).

Product safety compliance

The product safety compliance is: IEC 60950-1; UL 60950-1; CSA 60950-1.

Delivery and subsequent transportation of the equipment

DANGER

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Model 8279-AD1 rack specifications

Rack specifications provide detailed information for IBM 8279-AD1 data racks including dimensions, electrical data, power, temperature, environmental requirements, and noise emissions.

Dimensions

Table 21. Dimensions[1,2]

Width	Depth	Height	EIA units	Weight
644 mm (25.4 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	42 EIA units	492 kg (1081 lb)

1. The rack is equivalent to a 7014-T42 rack with PureSystems doors that add approximately 284.5 mm (11.2 in.) to the depth (front and rear doors). For more information about the 7014 rack, see Model 7014-T42, 7014-B42, and 0553.
2. Data rack (second rack and beyond) has an additional 47.6 kg (105 lbs) welded to the bottom of the rack (nonremovable) for stabilization during shipping. This additional weight is not included in the data in Table 21.

Electrical

Table 22. Electrical

Electrical characteristics	Properties
Maximum kVA	4.9 kVA
Voltage[1,2]	200 - 240 V ac
Frequency	47 - 63 Hz
Maximum thermal output	11601 BTU/hr

Table 22. Electrical (continued)

Electrical characteristics	Properties
Maximum power consumption[3]	4600 W
Phase	1

1. The input voltage is based on the power distribution unit (PDU) power cord. For more information, see "Power distribution unit and power cord specifications" on page 48.
2. All drawers mounted in the rack are rated 200 - 240 V ac. The power supplies automatically accept any voltage within the rated voltage range. With dual power supplies installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load.
3. When you plan the electrical system, it is important to use maximum values to account for internal or environmental conditions that result in power consumption that increases beyond typical values. However, when you plan for heat load, you can use the typical value of 3460 W.

Environment requirements

Table 23. Environment requirements

Environment	Recommended operating	Allowable operating	Nonoperating
ASHRAE class		A2	
Airflow direction[1]		Front-to-back	
Temperature[2]	18°C - 27°C (64°F - 80°F)	10°C - 35°C (50°F - 95°F)	5°C - 45°C (41°F - 113°F)
Humidity range	5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point	20% - 80% RH	8% - 80% RH
Maximum rate of change		5°C/20 hrs	
Maximum dew point		21°C (70°F)	27°C (80°F)
Maximum operating altitude		3050 m (10000 ft)	
Shipping temperature			-40°C - 60°C (-40°F - 140°F)
Shipping relative humidity			5% - 100%

1. Nominal cubic feet per minute (CFM) is approximately 2030. Maximum CFM is approximately 4025.
2. Derate maximum allowable dry-bulb temperature 1°C/175 m above 950 m.

Electromagnetic compatibility compliance

The electromagnetic compatibility compliance is: CISPR 22; CISPR 24; FCC, CFR 47, Part 15 (US); VCCI (Japan); Directive 2004/108/EC (EEA); ICES-003, Issue 4 (Canada); ACMA radio communications standard (Australia, New Zealand); CNS 13438 (Taiwan); Radio Waves Act, MIC Rule No. 210 (Korea); Commodity Inspection Law (China); TCVN 7189 (Vietnam); MoCI (Saudi Arabia); SI 961 (Israel); GOST R 51318.22, 51318.24 (Russia).

Product safety compliance

The product safety compliance is: IEC 60950-1; UL 60950-1; CSA 60950-1.

Delivery and subsequent transportation of the equipment

DANGER

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Model 8279-AD2 rack specifications

Rack specifications provide detailed information for IBM 8279-AD2 data racks including dimensions, electrical data, power, temperature, environmental requirements, and noise emissions.

Dimensions

Table 24. Dimensions[1,2]

Width	Depth	Height	EIA units	Weight
644 mm (25.4 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	42 EIA units	648 kg (1426 lb)

1. The rack is equivalent to a 7014-T42 rack with PureSystems doors that add approximately 284.5 mm (11.2 in.) to the depth (front and rear doors). For more information about the 7014 rack, see Model 7014-T42, 7014-B42, and 0553.
2. Data rack (second rack and beyond) has an additional 47.6 kg (105 lbs) welded to the bottom of the rack (nonremovable) for stabilization during shipping. This additional weight is not included in the data in Table 24.

Electrical

Table 25. Electrical

Electrical characteristics	Properties
Maximum kVA	7.9 kVA
Voltage[1,2]	200 - 240 V ac
Frequency	47 - 63 Hz
Maximum thermal output	19534 BTU/hr
Maximum power consumption[3]	7600 W
Phase	1

1. The input voltage is based on the power distribution unit (PDU) power cord. For more information, see “Power distribution unit and power cord specifications” on page 48.
2. All drawers mounted in the rack are rated 200 - 240 V ac. The power supplies automatically accept any voltage within the rated voltage range. With dual power supplies installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load.
3. When you plan the electrical system, it is important to use maximum values to account for internal or environmental conditions that result in power consumption that increases beyond typical values. However, when you plan for heat load, you can use the typical value of 6100 W.

Environment requirements

Table 26. Environment requirements

Environment	Recommended operating	Allowable operating	Nonoperating
ASHRAE class		A2	
Airflow direction[1]		Front-to-back	
Temperature[2]	18°C - 27°C (64°F - 80°F)	10°C - 35°C (50°F - 95°F)	5°C - 45°C (41°F - 113°F)
Humidity range	5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point	20% - 80% RH	8% - 80% RH
Maximum rate of change		5°C/20 hrs	
Maximum dew point		21°C (70°F)	27°C (80°F)
Maximum operating altitude		3050 m (10000 ft)	
Shipping temperature			-40°C - 60°C (-40°F - 140°F)
Shipping relative humidity			5% - 100%

1. Nominal cubic feet per minute (CFM) is approximately 2030. Maximum CFM is approximately 4025.
2. Derate maximum allowable dry-bulb temperature 1°C/175 m above 950 m.

Electromagnetic compatibility compliance

The electromagnetic compatibility compliance is: CISPR 22; CISPR 24; FCC, CFR 47, Part 15 (US); VCCI (Japan); Directive 2004/108/EC (EEA); ICES-003, Issue 4 (Canada); ACMA radio communications standard (Australia, New Zealand); CNS 13438 (Taiwan); Radio Waves Act, MIC Rule No. 210 (Korea); Commodity Inspection Law (China); TCVN 7189 (Vietnam); MoCI (Saudi Arabia); SI 961 (Israel); GOST R 51318.22, 51318.24 (Russia).

Product safety compliance

The product safety compliance is: IEC 60950-1; UL 60950-1; CSA 60950-1.

Delivery and subsequent transportation of the equipment

DANGER

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Model 8279-AD3 rack specifications

Rack specifications provide detailed information for IBM 8279-AD3 data racks including dimensions, electrical data, power, temperature, environmental requirements, and noise emissions.

Dimensions

Table 27. Dimensions[1,2]

Width	Depth	Height	EIA units	Weight
644 mm (25.4 in.)	1181 mm (46.5 in.)	2015 mm (79.3 in.)	42 EIA units	805 kg (1771 lb)

1. The rack is equivalent to a 7014-T42 rack with PureSystems doors that add approximately 284.5 mm (11.2 in.) to the depth (front and rear doors). For more information about the 7014 rack, see Model 7014-T42, 7014-B42, and 0553.
2. Data rack (second rack and beyond) has an additional 47.6 kg (105 lbs) welded to the bottom of the rack (nonremovable) for stabilization during shipping. This additional weight is not included in the data in Table 27.

Electrical

Table 28. Electrical

Electrical characteristics	Properties
Maximum kVA	11.0 kVA
Voltage[1,2]	200 - 240 V ac
Frequency	47 - 63 Hz
Maximum thermal output	27467 BTU/hr
Maximum power consumption[3]	10500 W
Phase	1

1. The input voltage is based on the power distribution unit (PDU) power cord. For more information, see “Power distribution unit and power cord specifications” on page 48.
2. All drawers mounted in the rack are rated 200 - 240 V ac. The power supplies automatically accept any voltage within the rated voltage range. With dual power supplies installed and operating, the power supplies draw approximately equal current from the utility (mains) and provide approximately equal current to the load.
3. When you plan the electrical system, it is important to use maximum values to account for internal or environmental conditions that result in power consumption that increases beyond typical values. However, when you plan for heat load, you can use the typical value of 9310 W.

Environment requirements

Table 29. Environment requirements

Environment	Recommended operating	Allowable operating	Nonoperating
ASHRAE class		A3	
Airflow direction[1]		Front-to-back	
Temperature[2]	18°C - 27°C (64°F - 80°F)	5°C - 40°C (41°F - 104°F)	5°C - 45°C (41°F - 113°F)
Humidity range	5.5°C (42°F) dew point (DP) to 60% relative humidity (RH) and 15°C (59°F) dew point	-12.0°C (10.4°F) DP and 8% - 85% RH	8% - 85% RH
Maximum dew point		24°C (75°F)	27°C (80°F)
Maximum operating altitude		3050 m (10000 ft)	

Table 29. Environment requirements (continued)

Environment	Recommended operating	Allowable operating	Nonoperating
Shipping temperature			-40°C - 60°C (-40°F - 140°F)
Shipping relative humidity			5% - 100%

1. Nominal cubic feet per minute (CFM) is approximately 2030. Maximum CFM is approximately 4025.
2. Derate maximum allowable dry-bulb temperature 1°C/175 m above 950 m.

Electromagnetic compatibility compliance

The electromagnetic compatibility compliance is: CISPR 22; CISPR 24; FCC, CFR 47, Part 15 (US); VCCI (Japan); Directive 2004/108/EC (EEA); ICES-003, Issue 4 (Canada); ACMA radio communications standard (Australia, New Zealand); CNS 13438 (Taiwan); Radio Waves Act, MIC Rule No. 210 (Korea); Commodity Inspection Law (China); TCVN 7189 (Vietnam); MoCI (Saudi Arabia); SI 961 (Israel); GOST R 51318.22, 51318.24 (Russia).

Product safety compliance

The product safety compliance is: IEC 60950-1; UL 60950-1; CSA 60950-1.

Delivery and subsequent transportation of the equipment

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Power distribution unit and power cord specifications

Learn about the power distribution unit (PDU) and power cord specifications and configurations for your system.

Power distribution unit

All racks ship with four PDUs.

Table 30. PDU rating

Electrical characteristics	Properties	
Voltage	200 - 240 V ac	200 - 240 V ac
Amps	24	48
kVA	4.8	9.6
Frequency	50 or 60 Hz	50 or 60 Hz
Phase	1	1

Power cord configurations

The power cord supplied with each system is determined by IBM and can vary based on the country of the installation. Power cord configurations are as follows:

- Model 8279-A01, 8279-A02, 8279-A03, and 8279-A04 foundation racks support power cord options 6654, 6655, 6656, 6657, and 6658.
- Model 8279-AD1[1], 8279-AD2, and 8279-AD3 data racks support power cord options 6491 and 6492[2].

1. For model 8279-AD1, only two power cords are included and required for powering the system.
2. For customers in India, power cord option 6656 is provided.

For more information, see Power distribution unit and power cord options for 7014, 0551, 0553, and 0555 rack.

Notices

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Electronic emission notices

When attaching a monitor to the equipment, you must use the designated monitor cable and any interference suppression devices supplied with the monitor.

Class A Notices

The following Class A statements apply to the IBM servers that contain the POWER7® processor and its features unless designated as electromagnetic compatibility (EMC) Class B in the feature information.

Federal Communications Commission (FCC) statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this

equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Compliance Statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

European Community Compliance Statement

This product is in conformity with the protection requirements of EU Council Directive 2004/108/EC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

European Community contact:
IBM Deutschland GmbH
Technical Regulations, Department M372
IBM-Allee 1, 71139 Ehningen, Germany
Tele: +49 7032 15 2941
email: lugi@de.ibm.com

Warning: This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

VCCI Statement - Japan

この装置は、クラスA 情報技術装置です。この装置を家庭環境で使用すると電波妨害
を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求され
ることがあります。 VCCI－A

The following is a summary of the VCCI Japanese statement in the box above:

This is a Class A product based on the standard of the VCCI Council. If this equipment is used in a domestic environment, radio interference may occur, in which case, the user may be required to take corrective actions.

Japanese Electronics and Information Technology Industries Association (JEITA) Confirmed Harmonics Guideline (products less than or equal to 20 A per phase)

高調波ガイドライン適合品

Japanese Electronics and Information Technology Industries Association (JEITA) Confirmed Harmonics Guideline with Modifications (products greater than 20 A per phase)

高調波ガイドライン準用品

Electromagnetic Interference (EMI) Statement - People's Republic of China

声　明

此为A级产品，在生活环境中，
该产品可能会造成无线电干扰。
在这种情况下，可能需要用户对其
干扰采取切实可行的措施。

Declaration: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may need to perform practical action.

Electromagnetic Interference (EMI) Statement - Taiwan

警告使用者：
這是甲類的資訊產品，在
居住的環境中使用時，可
能會造成射頻干擾，在這
種情況下，使用者會被要
求採取某些適當的對策。

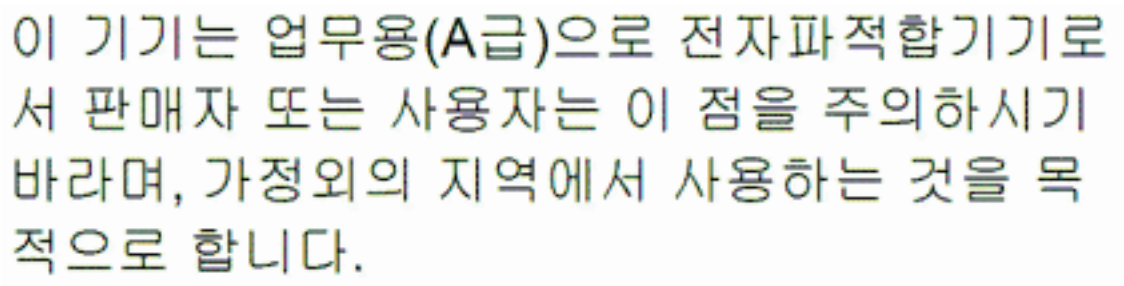
The following is a summary of the EMI Taiwan statement above.

Warning: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user will be required to take adequate measures.

IBM Taiwan Contact Information:

台灣IBM 產品服務聯絡方式：
台灣國際商業機器股份有限公司
台北市松仁路7號3樓
電話：0800-016-888

Electromagnetic Interference (EMI) Statement - Korea



Germany Compliance Statement

Deutschsprachiger EU Hinweis: Hinweis für Geräte der Klasse A EU-Richtlinie zur Elektromagnetischen Verträglichkeit

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2004/108/EG zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022 Klasse A ein.

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EN 55022 Klasse A Geräte müssen mit folgendem Warnhinweis versehen werden:
"Warnung: Dieses ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funk-Störungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen zu ergreifen und dafür aufzukommen."

Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten

Dieses Produkt entspricht dem “Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)“. Dies ist die Umsetzung der EU-Richtlinie 2004/108/EG in der Bundesrepublik Deutschland.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC EG Richtlinie 2004/108/EG) für Geräte der Klasse A

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:
International Business Machines Corp.
New Orchard Road
Armonk, New York 10504
Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:
IBM Deutschland GmbH
Technical Regulations, Abteilung M372
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 7032 15 2941
email: lugi@de.ibm.com

Generelle Informationen:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 Klasse A.

Electromagnetic Interference (EMI) Statement - Russia

ВНИМАНИЕ! Настоящее изделие относится к классу А.
В жилых помещениях оно может создавать
радиопомехи, для снижения которых необходимы
дополнительные меры

Class B Notices

The following Class B statements apply to features designated as electromagnetic compatibility (EMC) Class B in the feature installation information.

Federal Communications Commission (FCC) statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM-authorized dealer or service representative for help.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Proper cables and connectors are available from IBM-authorized dealers. IBM is not responsible for

any radio or television interference caused by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Compliance Statement

This Class B digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

European Community Compliance Statement

This product is in conformity with the protection requirements of EU Council Directive 2004/108/EC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class B Information Technology Equipment according to European Standard EN 55022. The limits for Class B equipment were derived for typical residential environments to provide reasonable protection against interference with licensed communication equipment.

European Community contact:
IBM Deutschland GmbH
Technical Regulations, Department M372
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email: lugi@de.ibm.com

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取扱説明書に従って正しい取り扱いをして下さい。 VCCI－B

Japanese Electronics and Information Technology Industries Association (JEITA) Confirmed Harmonics Guideline (products less than or equal to 20 A per phase)

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高調波ガイドライン準用品

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台灣國際商業機器股份有限公司
台北市松仁路7號3樓
電話：0800-016-888

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Germany Compliance Statement

Deutschsprachiger EU Hinweis: Hinweis für Geräte der Klasse B EU-Richtlinie zur Elektromagnetischen Verträglichkeit

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2004/108/EG zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022 Klasse B ein.

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Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten

Dieses Produkt entspricht dem “Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)“. Dies ist die Umsetzung der EU-Richtlinie 2004/108/EG in der Bundesrepublik Deutschland.

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC EG Richtlinie 2004/108/EG) für Geräte der Klasse B

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:
International Business Machines Corp.
New Orchard Road
Armonk, New York 10504
Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:
IBM Deutschland GmbH
Technical Regulations, Abteilung M372
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 7032 15 2941
email: lugi@de.ibm.com

Generelle Informationen:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 Klasse B.

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