

SGL® Altix® ICE
Site Planning Guide

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Site Preparation Overview

This document provides information that helps management and facilities personnel prepare for an SGI Altix ICE server installation. It includes general site planning concepts as well as specific site requirements that you may use as a guide during the site planning and preparation process.

SGI site planning representatives are available in the United States of America for site planning consultation; contact a site planning representative by telephone in the USA at +1 888 744 8638, extension 676-2820; at +1 715 726 2820; by fax at +1 715 726 2969; or by e-mail at *site@sgi.com*.

Contact your account manager to discuss your site planning, preparation, and installation plans and to obtain configuration information for any system.

Use the following steps as a planning guide for your system installation:

1. Identify the space, power, and environmental requirements for the system.
2. Select a location for the system and identify any necessary modifications.
3. Prepare the site according to the guidelines in this publication. You may use the site planning checklist in Chapter 6 on 59 of this document as a guide.

Warnings and Cautions

Read the following safety and warnings and cautions before you receive your SGI Altix ICE server.



Warning: The maximum weight of a single water-cooled SGI Altix ICE rack is:

- 2650 lb (1202 kg) when in shipping configuration
- 2569 lb (1165 kg) when cabled and operating

This system must be moved and installed by trained SGI personnel or authorized agents only. Make sure that the weight of the rack and pallet jack does not exceed the maximum safe floor load limits at your location. Failure to do so may result in property damage, serious injury, or death.



Warning: The maximum weight of an SGI Altix ICE rack is 2650 lb (1202 kg). This system must be moved and installed by trained SGI personnel or authorized agents to ensure that the rolling weight of the rack and the pallet jack does not exceed the maximum safe floor load limits at your location. Failure to do so may result in property damage, serious injury or death.



Warning: The maximum operating weight of a single water-cooled SGI Altix ICE rack while operating is 2569 lb. (1165 kg). Make sure that the weight of the entire system does not exceed the maximum safe floor load capacity at your location. Failure to do so may result in property damage, serious injury, or death.



Caution: To avoid an impact related injury, keep the water-cooled doors closed when working near (or beneath) the rear of the rack.



Caution: To reduce the likelihood of exposure to personal injury or property damage, SGI recommends that you use 27-in wide pallet jack to move the system racks or crates. Use the pallet jack to lift the rack only as far as needed to clear obstacles.

Pallet Jack Requirements

Two people are required to push or pull the rack, ideally a third to inspect and clear the path of any obstacles. When possible, use a pallet jack to move crates or racks, especially up/down ramps.

When a pallet jack is not available:

- Push rather than pull the system racks. It is easier and safer to push than to pull. You can use your body weight to assist when pushing.
- Keep close to the load and lock your arms. Try not to lean over and keep your back in its natural arches.
- Use both hands. Racks are easier to push and control using both hands.

About this Guide

This guide is intended for people who are responsible for physical site planning and preparation. By planning for your SGI Altix ICE system installation, you will have the opportunity to make adjustments to your site and order any additional facility equipment, thereby reducing the time required to install your system.

Obtaining Publications

To obtain SGI documentation, go to the SGI Technical Publications Library at <http://docs.sgi.com>.

Reader Comments

If you have comments about the technical accuracy, content, or organization of this document, please tell us. Be sure to include the title and document number of the manual\ with your comments. (Online, the document number is located in the front matter of the manual. In printed manuals, the document number is located on the front cover.)

You can contact us in any of the following ways:

- Send e-mail to site@sgi.com
- Contact your customer service representative and ask that an incident be filed in the SGI incident tracking system.
- Send mail to the following address:

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Chippewa Falls, WI 54729-0078
USA

Physical Location

This section addresses the issues that you need to consider when you select a physical location for a new system.

Selecting a Delivery Route



Warning: The maximum weight of a single water-cooled SGI Altix ICE rack is:

- 2650 lb (1202 kg) when in shipping configuration
- 2569 lb (1165 kg) when cabled and operating

This system must be moved and installed by trained SGI personnel or authorized agents only. Make sure that the weight of the rack and pallet jack does not exceed the maximum safe floor load limits at your location. Failure to do so may result in property damage, serious injury, or death.

To ensure that the system can be delivered to the planned location, answer the following questions before you plan a delivery route for the new system:

- Will the shipping crate fit through doorways and hallways and on elevators?

In addition to measuring the width of the hallways along the planned delivery route, measure corners where the system might get stuck, the width and height of doorways and elevators, and other areas that may cause problems. Table 5-1 lists the relevant system dimensions.

- **SGI recommends that you use a pallet jack to position the rack as close as possible to its final destination.** If the shipping crate cannot be transported to the final destination, can you unpack the system somewhere else?

Often it is possible to unpack the system in a hallway or on a loading dock, and then roll the system to its final destination.

- Is the floor strong enough to support the weight of the system?

Determine the weight of each rack and verify that the floor along the delivery route can safely support the weight. Refer to Table 5-1 for the maximum weight per system rack. Refer to “Floor Requirements” on page 10 for information about floor loading.

Note: It may be necessary to depopulate IRUs in the rack to reduce the weight of the system. You may also consider using floor plates to disperse the weight of the system during transport to its final location.

- Is the elevator capable of lifting the system?

If the intended delivery route includes an elevator, check its weight capacity and size against the system specifications listed in Table 5-1. The use of freight blankets can reduce damage to the elevator or the system.

- Are there any steep angles, bumps, changes in level, or thick carpeting along the delivery route?

Large systems are typically equipped with casters. However, the casters are designed to roll easily only on relatively smooth, level surfaces. Ramps, sliding door channels, rough flooring, and even thick carpeting may present difficulty. If in doubt, arrange for additional assistance. The maximum access incline should not exceed 10 degrees (height:length = 1:6).

- Did you ensure that the leveling pads are fully retracted?

Some systems have screw-in leveling pads. If you move the system with these feet extended, severe damage to the chassis can occur. These feet sometimes unscrew during shipment. Before you unpack or move a system, ensure that the leveling pads are fully retracted.

Unpacking



Warning: The maximum weight of the SGI Altix ICE rack in its shipping container is 2650 lb (1202 kg). This system must be moved and installed by trained SGI personnel or authorized agents only. Be sure that weight of the rack and the pallet jack does not exceed the maximum floor load limit at your location. Be sure that the rack remains on a level surface and that the rack weight remains evenly distributed across the four casters. Failure to do so may result in property damage, serious injury, or death.

Ensure that the temperature of the rack is acclimated to the installation environment and that the system crate is stable, and in an upright position.

1. Inspect Tilt Monitor Cards (2X) on adjacent package panels. A silver disk should appear in each “check” window (1).



Caution: Use eye protection when cutting the plastic bands on the shipping container. Cutting the bands under high tension may cause them to snap back and strike you in the face.

2. Carefully cut the three support bands, refer to Figure 1-1 (1).
3. Remove top corrugated cap, two corrugated sleeve panels and cushioned top pad surrounding the machine (2).
4. Remove the cover bag and bungee cushion from the rack (3).
5. Remove two M12 bolts (3/4in socket) holding base boards at both ends of machine (4).
6. Remove polyurethane plug pads (2X) located in base.
7. Remove five M12 bolts (3/4-in socket) securing side stabilizer assembly on both sides of machine (4).
8. Position a pallet jack under the rack and lift it until the shipping runners are clear of the floor.
9. Open front/rear door to gain access to end stabilizer bolts.
10. Carefully remove two M12 bolts (3/4-in socket) securing both end stabilizer assemblies to the machine (5).



Warning: Personal injury and system damage could result if the rack becomes unbalanced or gains too much momentum when rolled.

11. Use the pallet jack to lower the rack to the floor and use at least two people to roll the rack to the installation site (6).

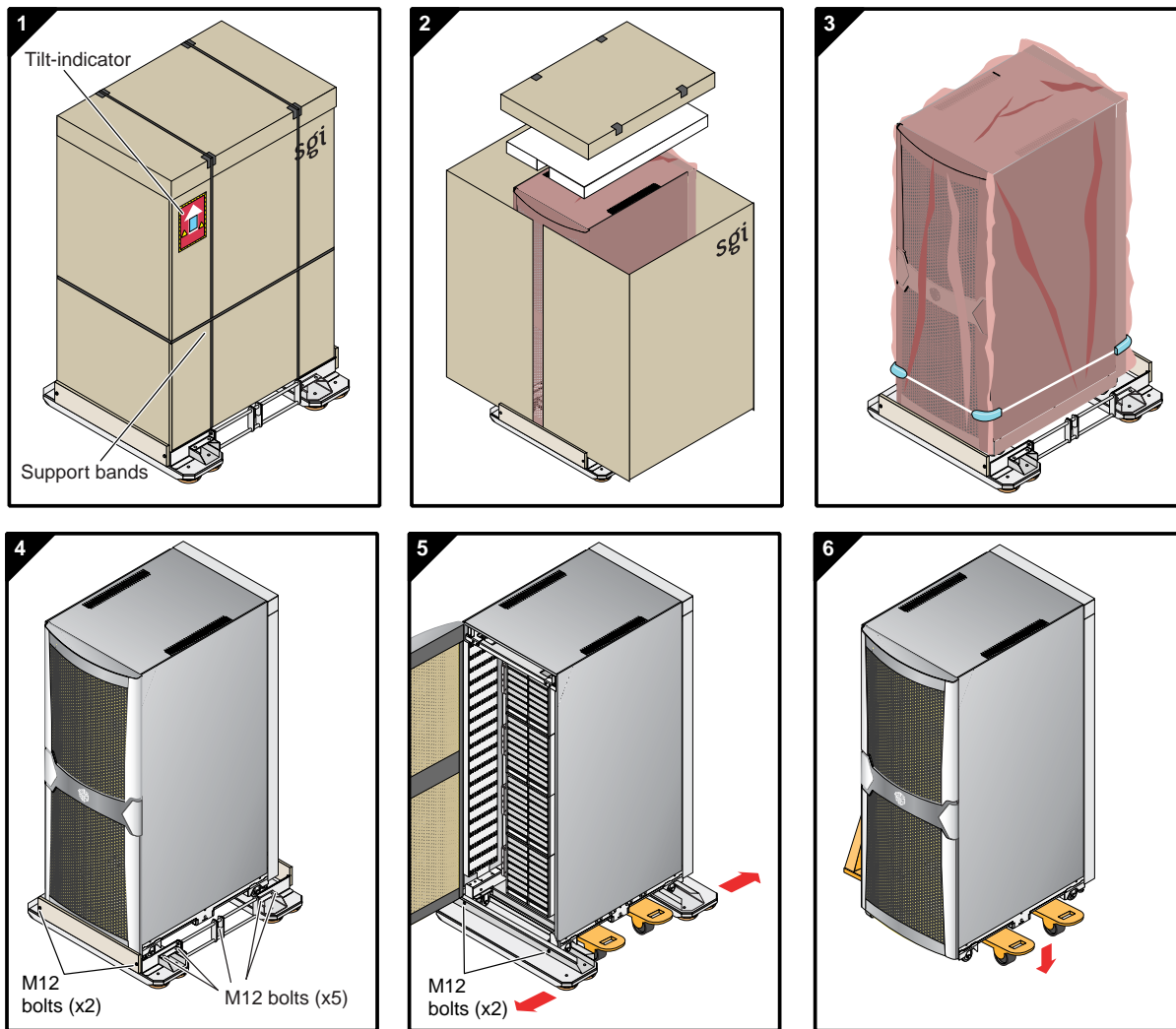


Figure 1-1 Unpacking the Rack

Selecting a Final Location

Consider the following issues when you select a final location for the system:

- Will the system fit in its intended location?
Carefully calculate the total system dimensions to ensure that it will fit in its intended final location.
- Does the intended system location provide adequate access space for maintenance?
- Even if the system will fit in its intended final location, you must have room to maintain it. Ensure that you have enough room to open the doors, remove boards, and accomplish other routine tasks. Table 5-1 lists the relevant system dimensions. Chapter 3, “Server Layouts” shows the typical computer room floor space requirements. As a general rule, SGI Altix ICE systems require 48-in of clearance from the front and rear of the rack. Side access to the rack is not required for service.
- Is the intended location subject to flooding, extremes of humidity or temperature, or any other factor that would make it inappropriate for sensitive electronic equipment?

The air temperature should not be too high and should not fluctuate dramatically, air should circulate freely and be relatively dust-free, and the system should not be exposed to any caustic or corrosive chemicals or vapors. Refer to Table 5-1 for computer room air temperature requirements.

- Will the system interfere with normal traffic through aisles, hallways, or entrance ways in the intended location?
- Will the intended location enable you to conveniently perform routine operations, such as loading and unloading media, attaching cables, and so on?
- Is the floor of the intended final location strong enough to support the weight of the system and any future expansions? Large systems should be installed in computer rooms with raised floors. Pay particular attention to floor loading and weight distribution in this case. Floor-loading specifications are typically calculated by averaging the total chassis weight that is distributed over the entire footprint of the chassis. Because the chassis sits on four casters or four leveling pads, the load at each of these four points is greater. Refer to “Floor Requirements” on page 10 for more information about floor loading.
- Does the intended location of the system allow for future expansion plans?
- Is there the potential for seismic activity in your area? Refer to “Seismic Tiedowns” in Chapter 3.

Floor Requirements

The total system weight on a facilities floor and the building structure must be considered. The computer room floor, as well as any floors along the delivery route, must be able to support the total weight of the computer system when installed as well as the weight of individual racks as they are moved into position.

Note: It may be necessary to depopulate IRUs in the rack to reduce the weight of the system. You may also consider using floor plates to disperse the weight of the system during transport to its final location.

Any floor system should be evaluated and verified by a structural engineer or appropriate floor consultant. They should use the manufacture's specifications to determine what floor loading characteristics the floor should have to support this computer equipment.

SGI recommends a bolted stringer understructure raised floor. Raise floor systems provide space to route power and signal cables as well as room for cooling water pipes if needed. The height of the raised floor should be at least 24-in (61 cm).

Table 1-1 lists some commonly used floor load terminology.

Table 1-1 Floor Load Terminology

Live Load	The load that the floor can safely support. Lbs/Sq Ft (KG/Sq m)
Concentrated Load	The load that a floor panel can support on one square inch at its weakest point, typically the center of the panel, without the panel deflecting more than a predetermined amount.
Ultimate Load	The maximum load per floor panel that the floor system can support without failure such as bending or braking.
Rolling Load	The load a floor panel can support without failure when a wheel or castor of a specified diameter and width is rolled across the panel.
Average Floor Load	Determined by dividing the total equipment weight by the area of the footprint of equipment expressed in Lbs/Sq Ft (KG/Sq M). Average floor loading is useful for determining floor loading at the building level, such as the area of solid floor or raised floor panels covered by the systems footprint.

Electrical Requirements

SGI Altix ICE server requires electrical resources beyond those that are normally provided in a typical office environment. The following sections describe those requirements in general. These sections, along with the data presented in subsequent sections, can help you determine the exact requirements for the new system. Table 1-2 lists the electrical service requirements.

Table 1-2 Electrical Service Requirements

Electrical Service	Requirement
Phase imbalance	5% maximum (line-to-line, line-to-neutral)
Voltage harmonics	5% maximum total, 3% largest
Voltage deviation from sine wave	+5% to -10%
Voltage modulation	3% maximum
Transient voltage surges	+5%
Transient voltage sags	-5%
Frequency tolerance	5%
Frequency rate of change	Less than 1.0 Hz during any 10-cycle period

Voltage Requirements

SGI Altix ICE servers ship with the option of either single-phase or three-phase input power. Refer to the section titled Table 5-1 for the voltage requirements of the rack. You must ensure that your account manager knows of your needs before the system is ordered.

Ensure that the required voltage is available and is within a reasonable distance of the intended location. If it is not, the site must be wired for the required voltage.

Power Requirements

Even one SGI Altix ICE server rack can require more power than is routinely available in an office environment (approximately 32 kVA). A room full of racks will almost certainly require specially installed electrical circuits. Refer to Table 5-1 for the power requirements of the rack.

Note: The wattages listed in this guide are the system maximums. While most systems may never draw the maximum rated wattage, SGI recommends that you install wiring that is capable of supporting the system's maximum potential wattage.

Power is measured in voltamperes (VA) and watts. Both measurements are important when you prepare to install wiring, power conditioning, and cooling.

A VA rating is a function of the voltage and amperage of a system. A watt rating is the VA rating multiplied by its power factor (refer to the section titled "Power Factor" on page 13). You can convert among amps, volts, VA, power factor, and watts by using the following formulas:

Single Phase	Three Phase
$VA = (\text{Amps} \cdot \text{Volts})$	$VA = (\text{Amps} \cdot \text{Volts} \cdot 1.73)$
$VA = \left(\frac{\text{Watts}}{\text{Power Factor}} \right)$	$VA = \left(\frac{\text{Watts}}{\text{Power Factor}} \right)$
$\text{Watts} = (VA \cdot \text{Power Factor})$	$\text{Watts} = (VA \cdot \text{Power Factor})$
$\text{Amps} = \left(\frac{\text{Watts}}{\text{Volts} \cdot \text{Power Factor}} \right)$	$\text{Amps} = \left(\frac{\text{Watts}}{\text{Volts} \cdot \text{Power Factor} \cdot 1.73} \right)$

Use this information and the information provided in Table 5-1 on page 52 to determine the site power requirements.

If, after you add up the power requirements of all the devices in the room, you find that the total is close to the limit that the existing wiring can support, you should install additional power circuits to support the systems.

Grounding Requirements

- Ensure that the ground has sufficiently low impedance in order to limit the voltage to ground and to facilitate the operation of protective devices in the electrical circuit.
- Ensure that all grounds entering the room are interconnected somewhere within the building to provide a common ground potential. This includes any separate power sources, lighting, convenience outlets, and other grounded objects such as building steel, plumbing, and ductwork. Refer to the *IEEE Emerald Book: IEEE Recommended Practices for Powering and Grounding Electronic Equipment* and the *National Electric Code (NEC)* for power, grounding, and life safety issues.



Caution: Any difference in ground potential greater than 250 millivolts between two racks can cause severe equipment damage.

- To maintain your entire SGI Altix ICE server at the same electrical potential, all multiple-rack systems must be bolted together. Refer to “Rack Tie Plates” in Chapter 3 for more information.

Power Factor

Power factor is a number between 0 and 1 that represents the ratio of the total power in watts to the total volt-ampere input. A system with a power factor of one (sometimes called “unity”) is making full use of the energy that it draws. A system with a power factor of 0.75 is effectively using only three-quarters of the energy that it draws.

SGI Altix ICE servers are power-factor corrected and thus have a power factor very close to 1. Some peripherals do not have this correction built in.



Caution: Ensure that you consider the power factor of the system when you select an uninterruptible power supply (UPS).

Inrush Current

Inrush current is the peak current that flows into a power supply as AC power is applied. The inrush current is usually much higher than the nominal current. This temporary increase is due to the charging of the input filter capacitors in the power supply and is limited only by the input impedance of the power supply and the wiring that supplies power to the system.

The inrush current often far exceeds the rating of the electrical outlet to which the system is connected. If the system is connected directly to “wall power” (that is, it is not on a UPS or a standby power system [SPS]), this is typically not a problem. The peak inrush current lasts for only a part of one AC cycle (less than 1/60 of a second). This is not long enough to damage wiring and, in most cases, will not trip a circuit breaker (depending on the delay curves of the circuit breaker).

It is very important that you consider the inrush current of the system when you select a UPS or SPS. Unlike power-company lines, these power-conditioning devices may not be able to supply the current that is required during power-on, even if they are sized appropriately for nominal current loads. For more information, refer to the following “Power-line Treatment” section.

It is possible for the inrush current drawn by a device to cause a slight drop in the line voltage. Although it is very brief, this drop can, in unusual situations, be enough to cause problems in other devices on the same line.

Inrush current is a characteristic of the power supplies in a system. The inrush current values apply whether the system is heavily or lightly loaded. Therefore, although a lightly loaded system may draw less power while it is running, it may still draw a very large inrush current.

SGI Altix ICE servers typically have low inrush characteristics.

Power-line Treatment

Power-line treatment may be required if the site has unstable power that results in problems such as fluctuating voltage, transients, surges and spikes, and noise. Common causes of unreliable power are old wiring; load-switching equipment, such as welding and plating devices; and variable-speed motors or motors that start and stop frequently.

A variety of devices are available to improve the quality of a power line, including:

- Line conditioners
- Line regulators
- Isolation transformers
- UPSs

Ask your SGI representative for more information about power solutions.

Total Harmonic Distortion

Table 4-1 lists total harmonic distortion (THD). Total harmonic distortion is a measure of the extent to which a waveform is distorted by harmonic content. This rating indicates how much the power supply in the system affects the quality of power delivered to other systems that are supplied by the same transformer.

Note: While the term *total harmonic distortion* can be applied to either voltage or current, all of the numbers listed in this guide apply to current.

Thermal Requirements

It is important that the SGI Altix ICE servers be maintained within their rated thermal range.

Refer to the section titled Table 5-1 on page 52 for the temperature ranges for each rack, both operating and nonoperating as well as the recommended operating ambient temperature. Typically, the upper limit of the temperature range is more likely to become a problem than the lower limit.

Heat Output

All of the systems that this guide describes have a maximum rated operating temperature. Exceeding this temperature greatly increases the rate of hardware failure and, in many cases, causes the system to shut itself down.

All of the power consumed by a computer system must exist as some form of energy. For air-cooled systems, this energy exists in the form of heat in the surrounding air. Every watt drawn by a system is eventually dissipated as heat. This heat tends to raise the temperature of the air in the room that houses the system. Therefore, some method is needed to keep the temperature within the required range. The typical method is to install additional process cooling capacity, or order a system with water-cooled doors (refer to “Water-cooled Racks” on page 46).

The maximum heat dissipation-to-air per rack is listed in Chapter 5, “Specifications”.

Air-conditioning Terminology

Air-conditioning capacity is generally measured in Btu/hr, tons, or kilocalories (kcal). A Btu, or British thermal unit, is the amount of energy needed to raise the temperature of one pound of water by one degree Fahrenheit at a constant pressure of one atmosphere. One ton of air conditioning removes 12,000 Btu of heat energy per hour.

The more systems that are installed in a given area, the larger the air-conditioning capacity that is required. It is important to calculate the total thermal load of the systems that you will be installing and determine whether the existing air-conditioning system can handle the additional load. If not, you must provide additional cooling capacity.

Calculating Thermal Load

You can calculate the thermal load as follows:

1. Add the wattages of all the items in the room.
2. Calculate Btu/hour by multiplying the total wattage by 3.41.
3. Calculate the kcal/hour by multiplying the total wattage by 3.23.
4. Calculate the tons of air-conditioning load by dividing Btu/hr by 12,000.
1 kBtu/hr = 1000 Btu/hr
12,000 Btu/hr = 1 ton of air-conditioning load

The calculations above yield results that represent the maximum thermal output of the equipment. These calculations and the heat-dissipation numbers that Table 5-1 on page 52 lists are based on maximum rated wattage.

The thermal figures quoted in this guide are likely to be worst-case figures.

Some sources quote a “typical” thermal output for a system, which may be significantly less than the numbers listed in this guide. Selecting an air-conditioning capacity that accommodates the “worst-case” thermal output, however, helps to minimize system problems later.

When you calculate the air-conditioning capacity that is required, be sure to include the heat load from computer equipment that is already installed at the site, noncomputer equipment that is already installed at the site, and the computer equipment that is being added. Also remember to include noncomputer equipment that is already installed or will be installed, and other factors such as solar gain, outside ambient air temperatures, and the number of people who work in the room.

Thermal Gradient

Table 5-1 on page 52 includes a maximum thermal gradient for each system. The thermal gradient is the rate at which the temperature changes, which is typically expressed in degrees per hour. Temperature changes that are more rapid than the given rate can damage some of the components in the system.

Unless otherwise indicated, the thermal gradients listed apply whether or not the system is operating.

Cooling In Mission-critical Installations

In mission-critical installations, it is important to consider what would happen if an air conditioner or chiller failed. Complete consideration of this topic is beyond the scope of this guide; however, consider the following questions:

- Should the site have multiple air-conditioning or chiller units, each capable of maintaining a safe temperature?
- If an air conditioner or chiller fails, how long can the systems run before they get too warm and must be shut off?
- Can the air conditioner or chiller be repaired before the systems get too warm?

Environmental Requirements

Electromagnetic interference (EMI), electrostatic discharge (ESD), vibration, and humidity can cause problems for computer systems.

Electromagnetic Interference

Electromagnetic interference (EMI) is caused by malfunctioning, incorrectly manufactured, or incorrectly installed devices that radiate electrical signals. Common sources of EMI include electronic, telephone, and communications equipment. EMI transmissions can be conducted or emitted.

Use properly shielded connectors and cables throughout the site.



Caution: Failure to use shielded cables where appropriate may violate FCC regulations and void the manufacturer's warranty.

Electrostatic Discharge

SGI designs and tests its products to ensure that they resist the effects of electrostatic discharge (ESD). However, it is still possible for ESD to cause problems that range from data errors and lockups to permanent component damage. To protect the systems from ESD, follow these precautions:

- Minimize the use of carpeting at computer locations (or consider special static-reducing carpet).
- Ensure that all electronic devices are properly grounded.
- Keep chassis doors and access panels closed while the system is operating.
- Fasten all screws, thumbnail-fasteners, and slide locks securely.
- Use a grounded static wrist strap whenever you work with the chassis or components.
- Use antistatic packing material for storage and transportation.
- Clear the site of all devices that create static electricity or provide possible sources of EMI.

Vibration

The SGI Altix ICE server is designed for typical computer room environments; it requires no special modifications or protection. If you plan to install a system at an industrial site, ensure that vibration does not exceed the limits in Table 5-1 on page 52.

Humidity

Table 5-1 on page 52 lists the maximum humidity levels for each rack, both operating and nonoperating. Exposure to humidity levels above the rated maximums and/or exposure to condensation can damage equipment.

Humidity Gradient

Table 5-1 on page 52 lists the maximum humidity gradient for the system. The humidity gradient is the rate at which the humidity changes, which is typically expressed in percent relative humidity per hour. Humidity changes that are more rapid than the given rate can damage some of the components in the system. Unless otherwise indicated, the humidity gradients that are listed apply whether or not the system is operating.

Ergonomic Requirements

When you select a physical location, pay attention to ergonomic considerations. The location of a system often restricts the location of the devices that attach to it, such as monitors, keyboards, and so on. Decisions that are made during the installation process can affect workers much later.

In addition to attached devices, consider other issues such as noise, temperature, air quality, and so on, some of which may be affected by the addition of the new system.

Acoustics

The acoustic measurement that Table 5-1 on page 52 lists is approximate. Acoustic values depend on many factors that are outside the control of the manufacturer. Room characteristics such as carpeting and wall coverings affect the noise levels at an installation. The acoustic measurement provided in this document is in dBa (decibels absolute) rather than dB (decibels). This is a measurement of weighted absolute noise power, and it includes frequency corrections.

If a site exceeds desirable noise levels, try these remedies:

- Reduce the quantity of flat reflective surfaces, such as glass, tile, or metal.
- Add sound-absorbing wall coverings, drapes, and ceiling tiles.
- Add sound baffles in critical locations (without blocking airflow).
- Modify the office space to separate the operators from the hardware.

Local Regulations

Before system installation, become familiar with any applicable local regulations. Because these vary dramatically by country and state, it is difficult for SGI to provide a complete list of such regulations. These regulations, however, might involve:

- Power
- Emissions
- Safety issues
- Ergonomic and health issues
- Telecommunications

If you have suggestions about obtaining the local regulations, please ask your SGI representative for assistance.

Planning for the Future

Even if the existing infrastructure can handle the immediate site needs, consider the future plans. It is much easier to provide enough space, power, air-conditioning capacity, chilled water capacity and other resources in advance, rather than to add them later.

Components

An SGI Altix ICE system is an integrated compute environment that can scale to thousands of processor cores, terabytes (TBs) of memory, and petabytes (PBs) of storage. A single 42U rack supports a maximum of 512 processor cores (when configured with quad-core Intel® Xeon® processors) and 2TB of memory (refer to Figure 2-1 and Figure 2-2).

The standard cooling method for the SGI Altix ICE systems is blower-driven air cooling. Each individual rack unit (IRU) contains eight blowers that are mounted at the rear of the rack.

Optional supplemental water cooling is available. Water-cooled coils are supplied for each IRU in the rack. Hot air is exhausted through each IRU cooling coil which transfers the heat from the air prior to entering the computer room.

System configuration sizes greater than or equal to 256 processor sockets may require the use of this cooling option. Refer to Table 5-1 on page 52 for the water-cooled option facilities requirements.

Note: Contact site@sgi.com for specific power and cooling specifications for your system configuration to determine if your facility will require the water-cooled option.

Server Racks

Each Altix ICE server rack contains 4 individual rack units (IRUs), power distribution units (PDUs) and optional service nodes (refer to Figure 2-1 and Figure 2-2). The racks can be either air-cooled or water cooled. Chilled water running through the hinged door coils carries away up to 95 percent of the heat generated by an SGI Altix ICE system (refer to Figure 2-2).

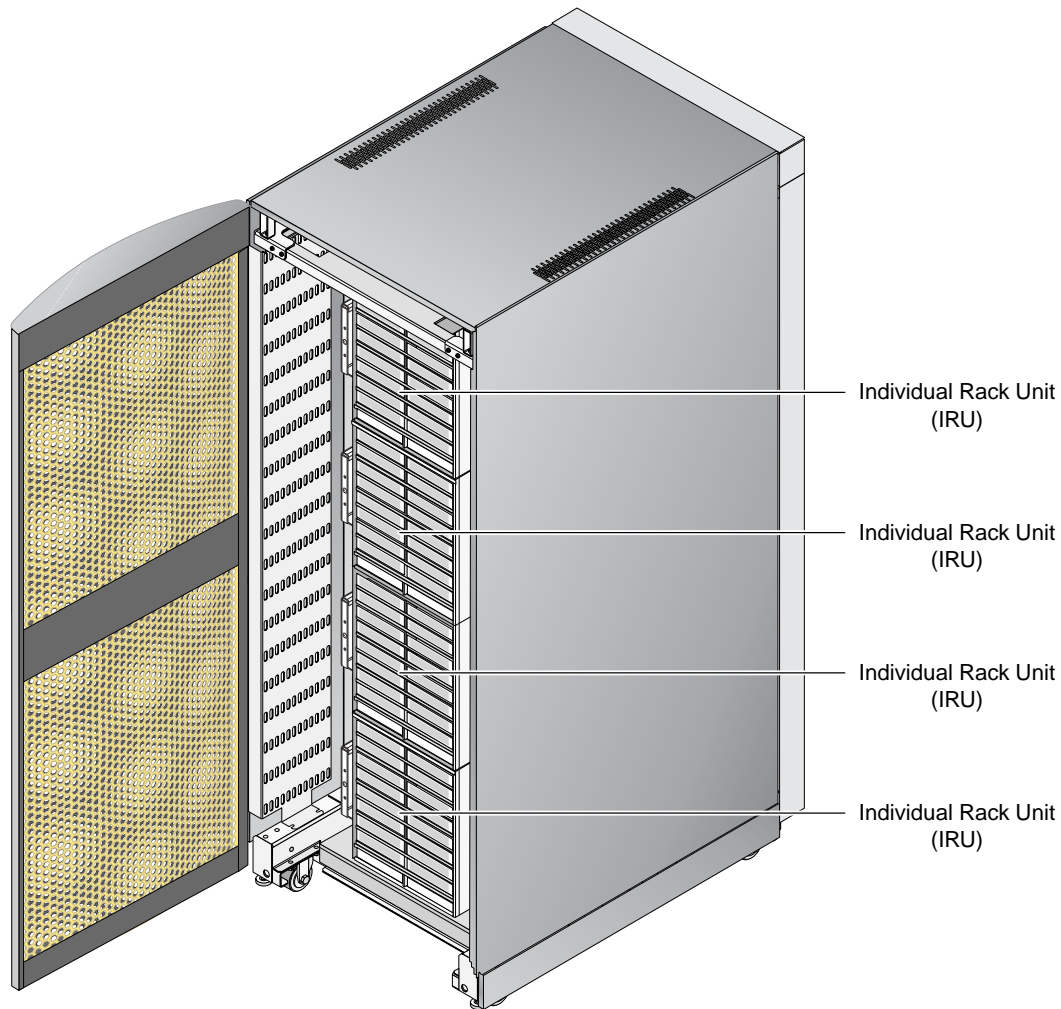


Figure 2-1 SGI Altix ICE System - Front View

The water-cooled subsystem includes four hinged door coils (refer to Figure 2-2) that circulate facility chilled-water through a cooling coil in each door. Exhaust air from a system cools as it passes through the coils which lowers the temperature of the air returned to the computer room.

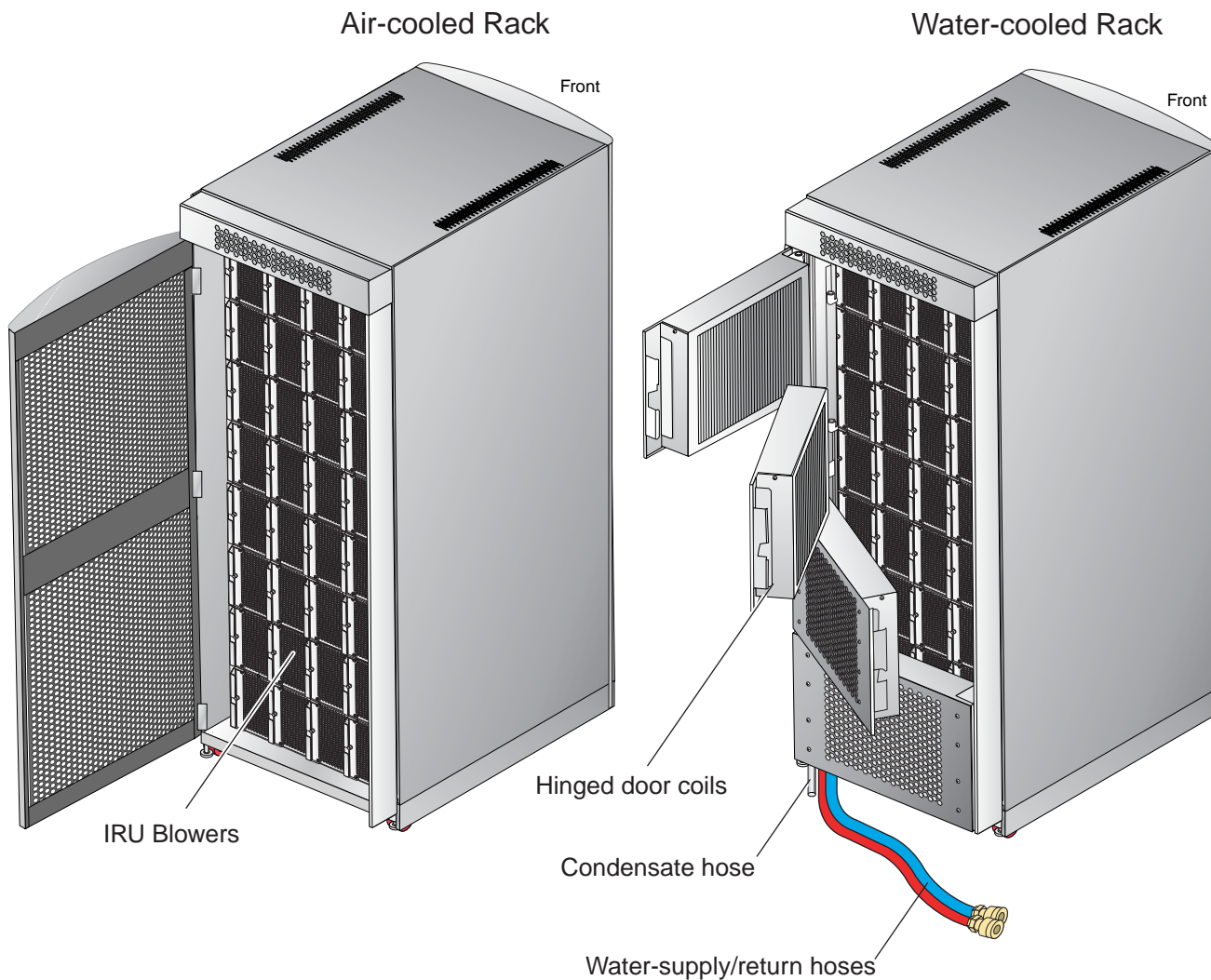


Figure 2-2 SGI Altix ICE Air-cooled and Water-Cooled Systems - Rear View

Individual Rack Unit

The basic building block is the individual rack unit (IRU). The IRU provides power, cooling, system control, and the network fabric for 16 compute blades. Each compute blade supports two either dual-core or quad-core Xeon processor sockets and eight fully-buffered, DDR2 memory DIMMs. Four IRUs reside in a 42U high rack (refer to Figure 2-1).

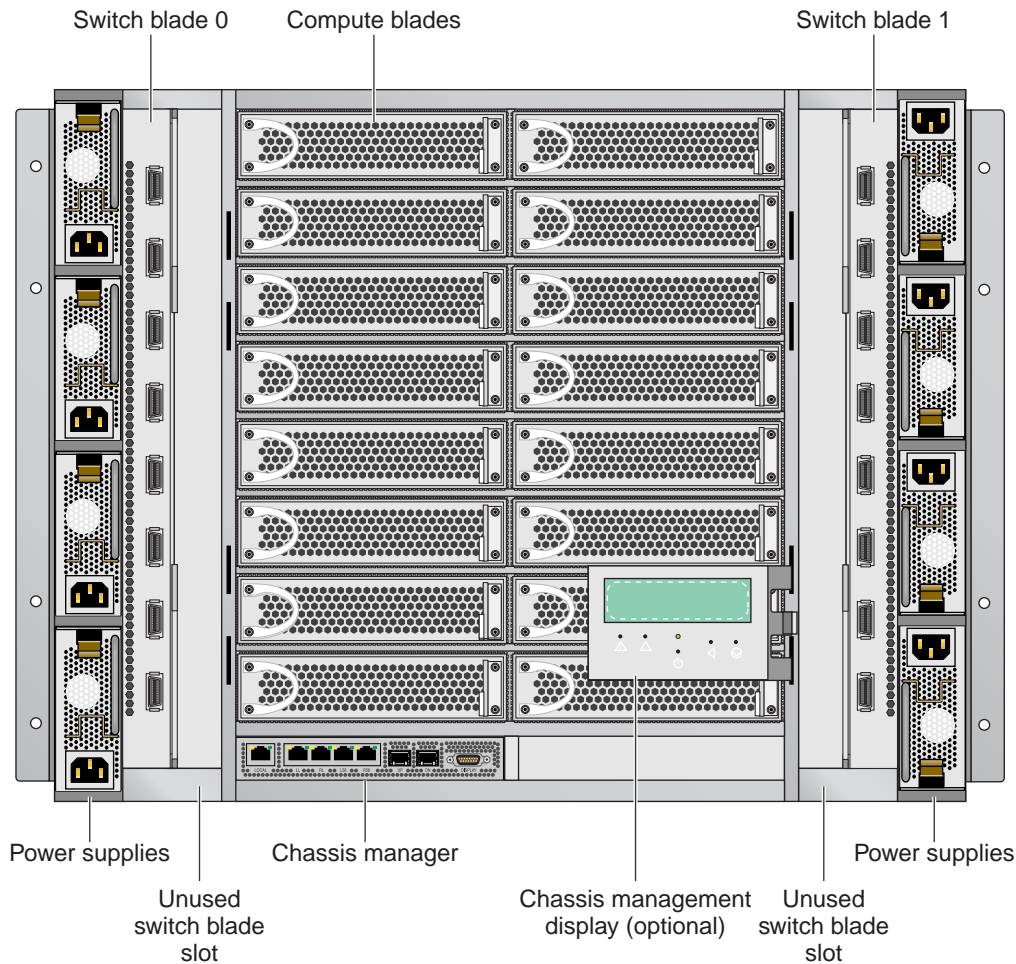


Figure 2-3 IRU Components - Front

Power Supplies

The IRU contains eight hot-swap 1625 watt power supplies located on the right and left sides of the IRU chassis (refer to Figure 2-3). The power supplies are numbered 0 through 7, PS-0 is the power supply located at the bottom left of the IRU and PS-7 is the power supply located at the top right side of the chassis.

Cooling

Eight blowers move air from the front of the IRU and exhaust it out the rear (refer to Figure 2-4). Optional water-cooled coils can be added to the rear door if the computer room environment requires additional cooling capacity (refer to Figure 2-2).

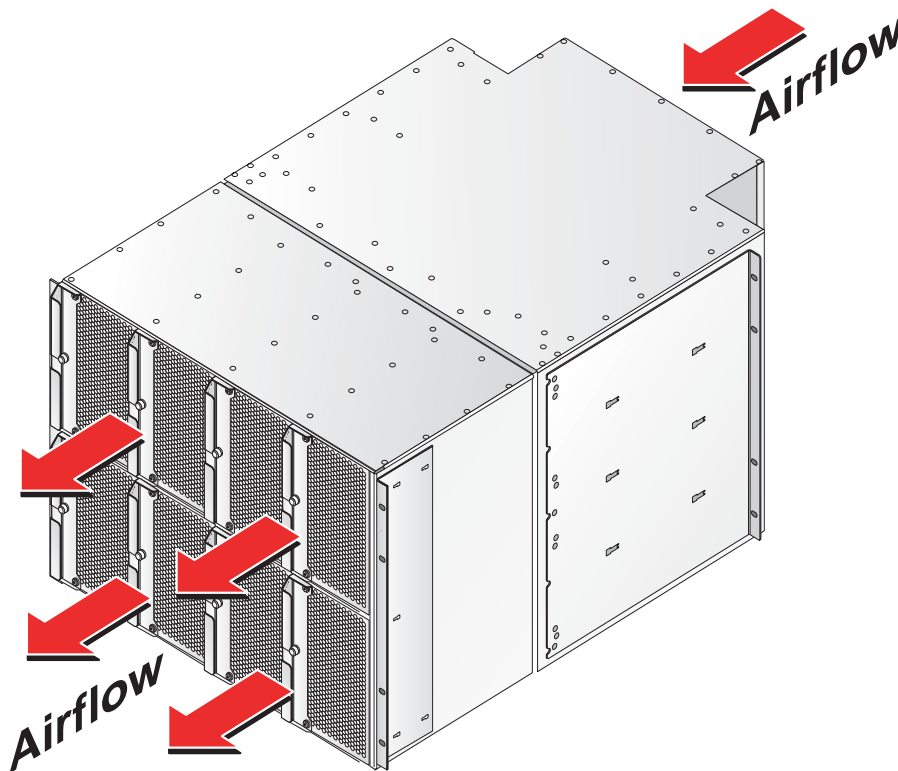


Figure 2-4 IRU Blowers - Rear

I/O Expansion Racks

SGI Altix ICE expansion racks can contain a wide variety of computer equipment and are typically air cooled. The SGI InfiniteStorage CUBE system (refer to Figure 2-5 and Figure 2-6) is the storage system used for disk storage on SGI Altix ICE systems.

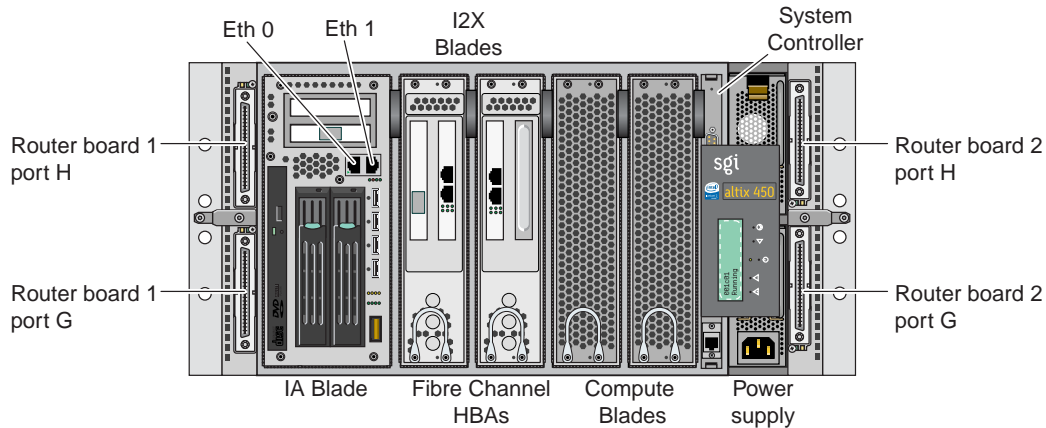


Figure 2-5 SGI Altix 450 Data Manager IRU - Front View

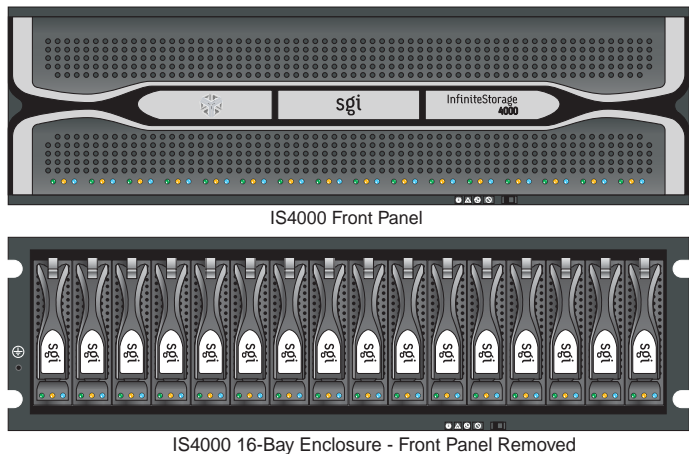


Figure 2-6 SGI InfiniteStorage CUBE Disk Enclosure

The storage system consists of an SGI Altix 450 server as the NAS data manager and SGI InfiniteStorage 4000 disk subsystems connected via Fibre Channel (FC) network. The SGI Altix 450 data manager connects to the SGI Altix ICE network topology via two 4x SDR IB InfiniBand ports. The SGI InfiniteStorage CUBE system uses a 16-bay disk enclosure (refer to Figure 2-6). The disk enclosure is a high-bandwidth RAID FC storage system.

The 5U high data manager IRU provides power, cooling, system control, and a connection to the network fabric for each blade inserted into the IRU. The basic components of the IRU are as follows:

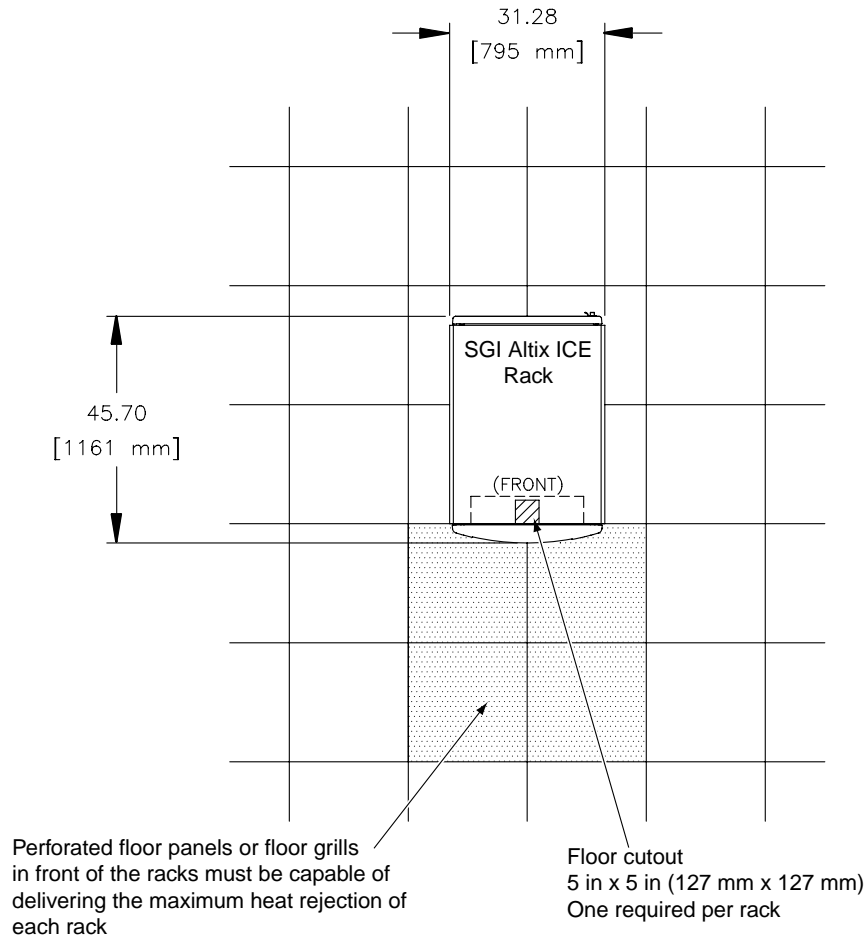
- SGI Altix 450 IRU (5 blade slots)
- Two 1325 watt power supplies
- Two single-router modules
- One system controller
- One Blower pack (3 individual blower fan assemblies)
- IA Blade for base I/O operations
 - Two SATA2 disk drives configured as JBOD
 - CD-ROM drive
 - Ethernet and USB ports
 - Two low-profile PCI slots

The SGI Altix 450 data manager connects to the SGI Altix ICE network topology via two 4x SDR IB InfiniBand ports. Storage nodes within the SGI Altix ICE system handle the I/O traffic between the server and storage system. A dedicated IB network topology is used for storage I/O operations.

Server Layouts

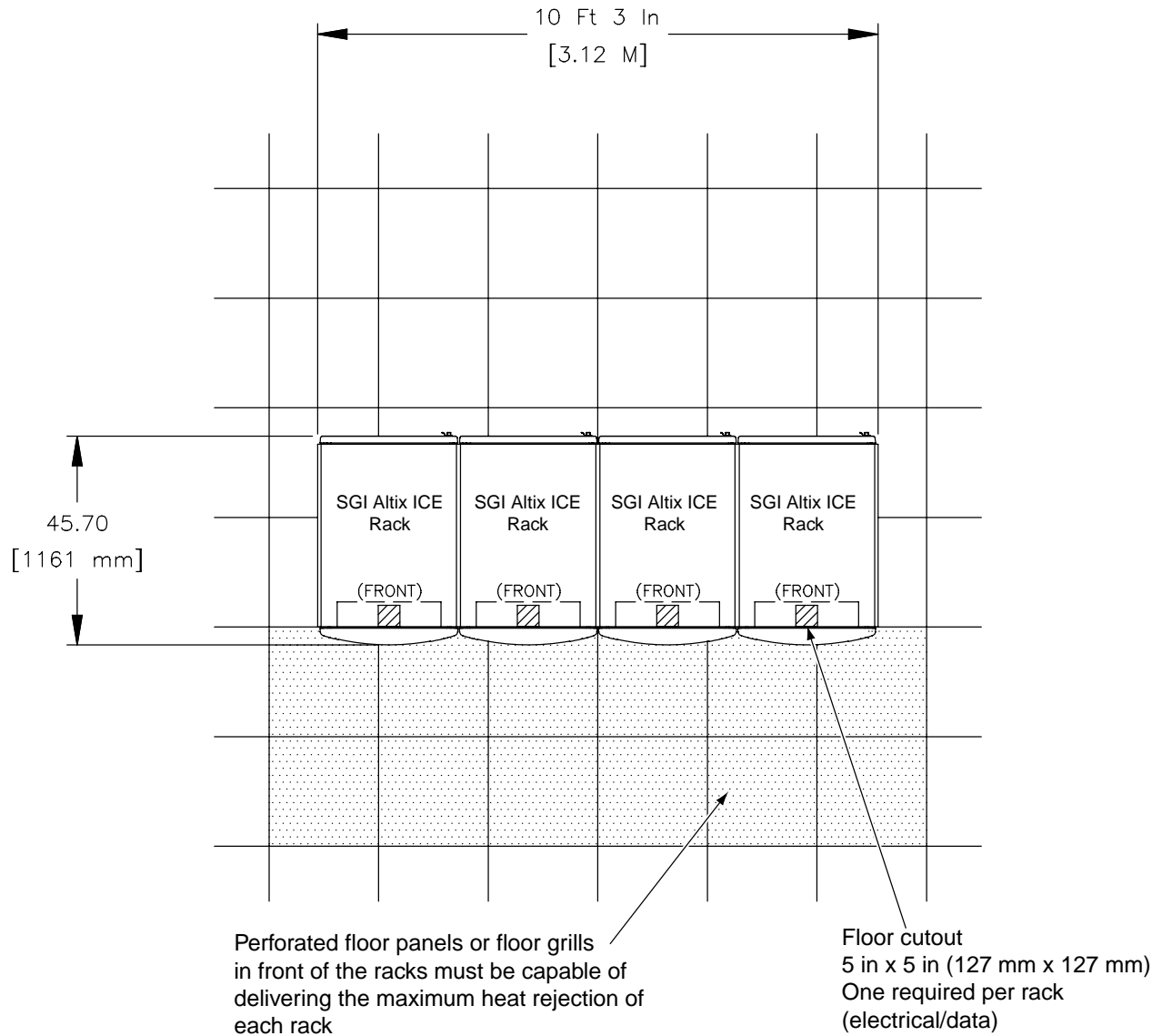
The following illustrations show the overall dimensions and required service clearances for typical air-cooled and water-cooled SGI Altix ICE system configurations. If necessary, contact SGI site planning for site planning consultation at +1 888 744 8638, extension 676-2820; at +1 715 726 2820; by fax at +1 715 726 2969; or by e-mail at site@sgi.com.

- Systems that are installed on raised-floor panels require a floor cutouts below each rack to accommodate the entrance of data and power cables or water cooling.
- SGI recommends placing two perforated floor panels in front of each SGI Altix ICE server rack for an additional supply of cooling air.
- If your system is using the water-cooled door option, ensure that the water shut-off valves are located in an area that is easily accessible by service personnel (refer to Figure 3-3 and Figure 3-4).
- In areas that are prone to earthquakes, secure each SGI Altix ICE system to the computer room subfloor. Four M12 threaded weld nuts are located on the underside of each rack frame for attachment to customer-supplied hold-down devices (refer to Figure 3-9).
- Each rack in the system should be secured as shown in Figure 3-10 and Figure 3-11 for increased stability and proper grounding.
- Single Air-cooled Rack Floor Layout, on page 32
- Four Air-cooled Racks Floor Layout, on page 33
- Single Water-cooled Rack Floor Layout, on page 34
- Four Water-cooled Racks Floor Layout, on page 35
- Eight Water-cooled Racks and I/O Expansion Rack Floor Layout, on page 36
- Twelve Air-cooled Racks with Trellis Hardware Example, on page 37
- Sixteen Water-cooled Racks and I/O Expansion Rack Floor Layout, on page 38
- Service Clearance Requirements, on page 39
- Seismic Tiedown Locations, on page 40
- Rack Tie Plate Attachment Locations – Top, on page 41
- Rack Tie Plate Attachment Locations – Bottom, on page 42



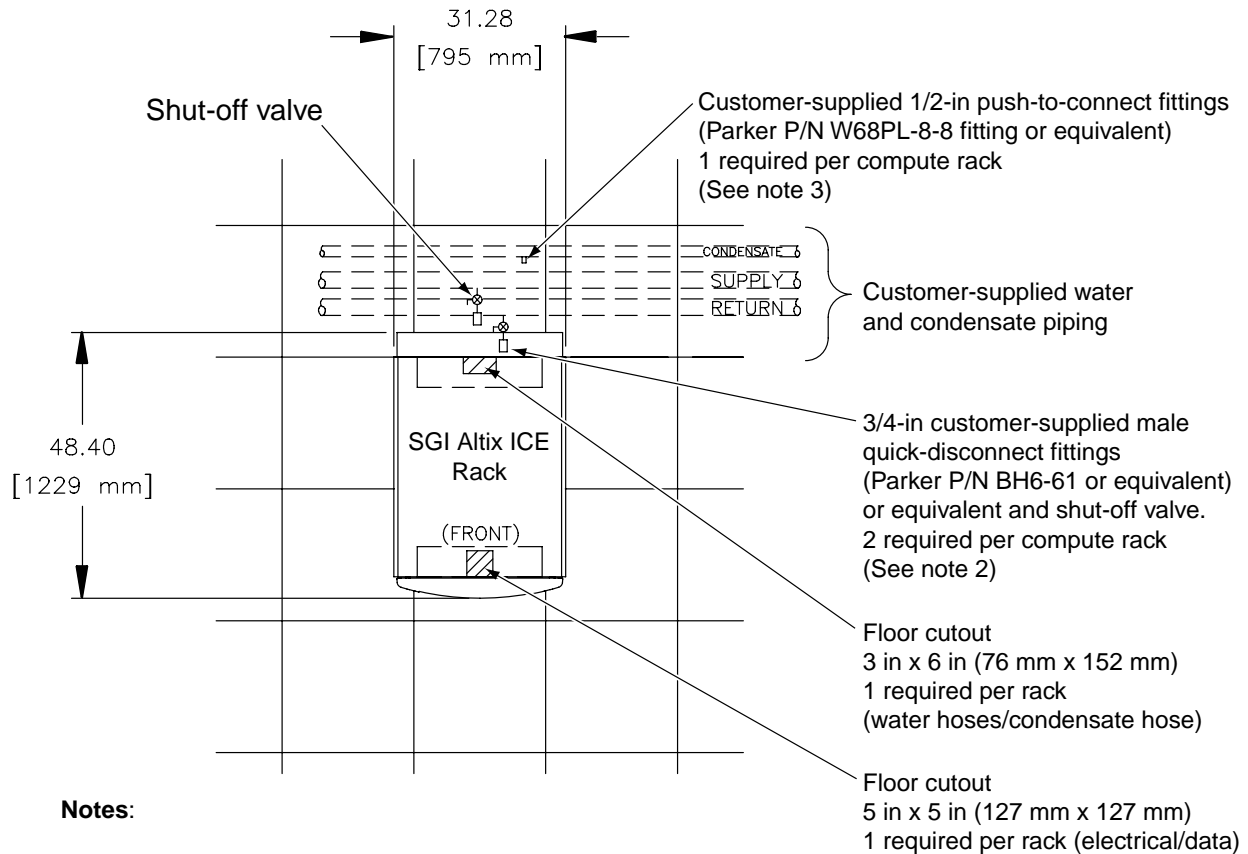
Note: Equipment shown on 24 inch floor tile
Approximate area of 10 square feet (0.9 square meters) without access
Approximate area of 30 square feet (2.8 square meters) with access

Figure 3-1 Single Air-cooled Rack Floor Layout



Note: Equipment shown on 24 inch floor tile
 Approximate area of 39 square feet (3.6 square meters) without access
 Approximate area of 116 square feet (10.8 square meters) with access

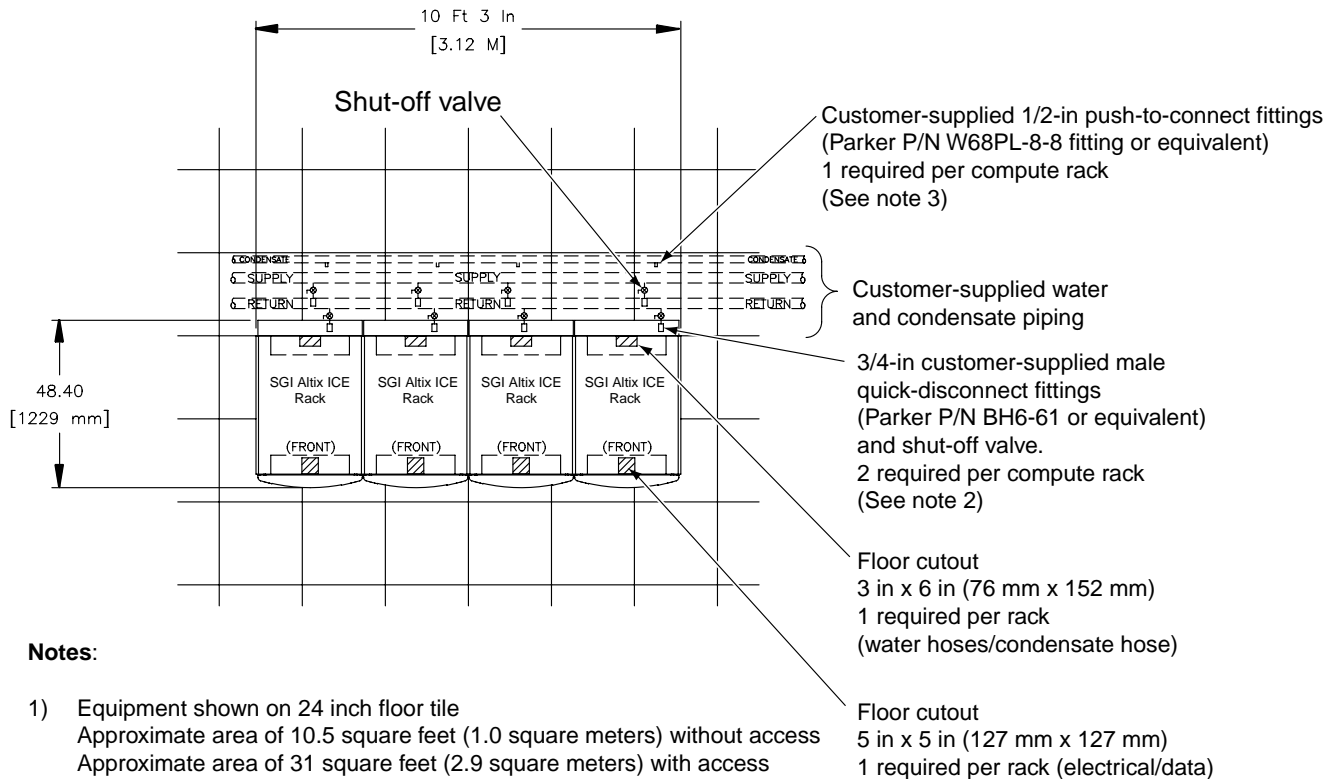
Figure 3-2 Four Air-cooled Racks Floor Layout



Notes:

- 1) Equipment shown on 24 inch floor tile
 Approximate area of 10.5 square feet (1.0 square meters) without access
 Approximate area of 31 square feet (2.9 square meters) with access
- 2) Customer supplied male quick-disconnect fittings to be located within 4 ft (1.2 m) of associated rack floor cutout. SGI provides two 10-ft (3 m) water hoses with female quick-disconnect fittings to make this connection.
- 3) Customer-supplied push-to-connect fittings to be located within 4 ft (1.2 m) of associated rack floor cutout. SGI provides one 6 ft (1.8 M), 1/2-in (12.7-mm) O.D., 3/8-in (9.5 mm) I.D. flexible nylon condensate hose for each rack. Customer to provide one Parker P/N W68PL-8-8 1/2-in male NPTF push-to-connect fitting or equivalent per rack to make this connection.

Figure 3-3 Single Water-cooled Rack Floor Layout



- 1) Equipment shown on 24 inch floor tile
Approximate area of 10.5 square feet (1.0 square meters) without access
Approximate area of 31 square feet (2.9 square meters) with access
- 2) Customer supplied male quick-disconnect fittings to be located within 4 ft (1.2 m) of associated rack foot cutout. SGI provides two 10-ft (3 m) water hoses with female quick-disconnect fittings to make this connection.
- 3) Customer-supplied push-to-connect fittings to be located within 4 ft (1.2 m) of associated rack floor cutout. SGI provides one 6 ft (1.8 M), 1/2-in (12.7-mm) O.D., 3/8-in (9.5 mm) I.D. flexible nylon condensate hose for each rack. Customer to provide one Parker P/N W68PL-8-8 1/2-in male NPTF push-to-connect fitting or equivalent per rack to make this connection.

Figure 3-4 Four Water-cooled Racks Floor Layout

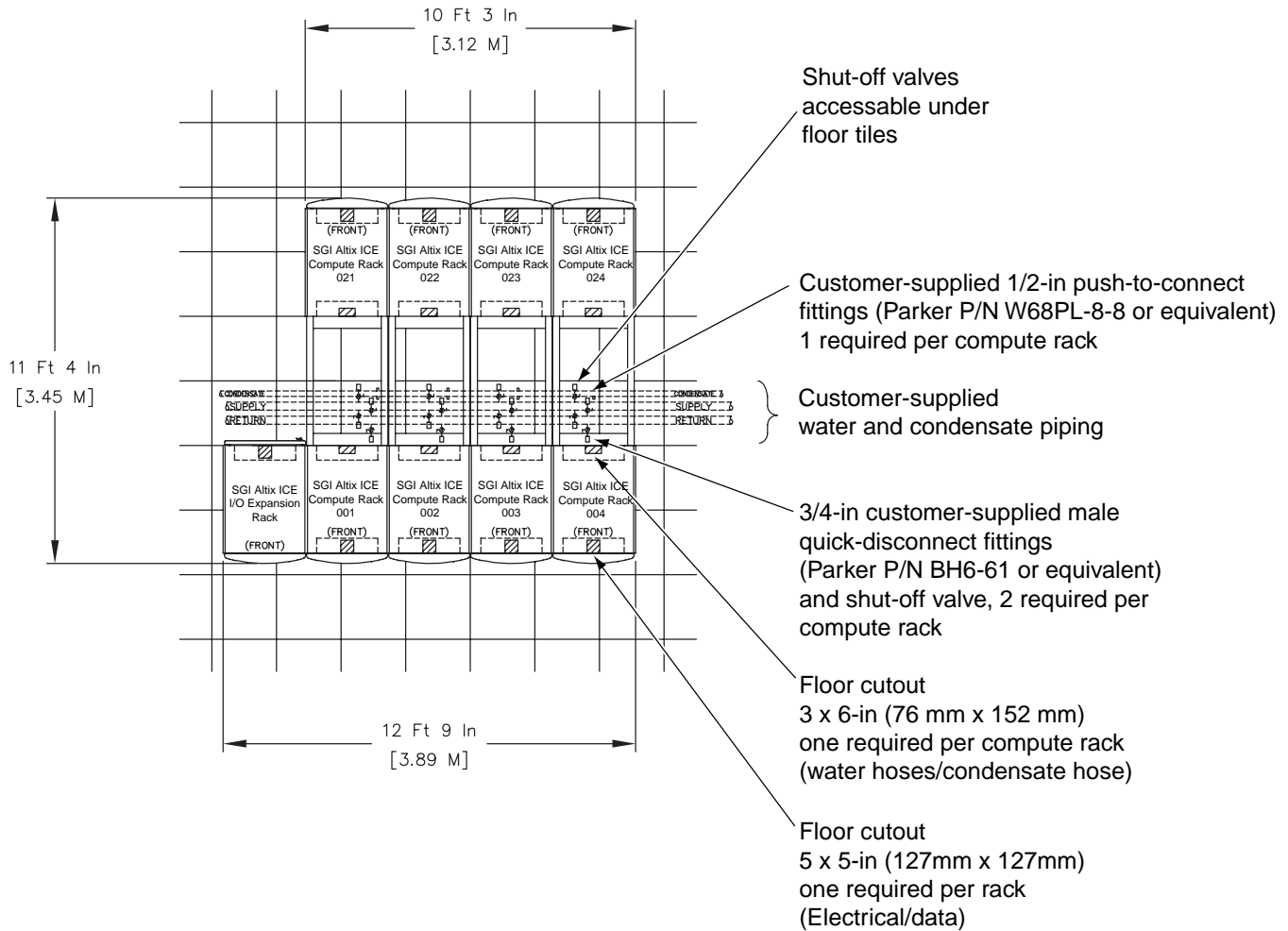


Figure 3-5 Eight Water-cooled Racks and I/O Expansion Rack Floor Layout

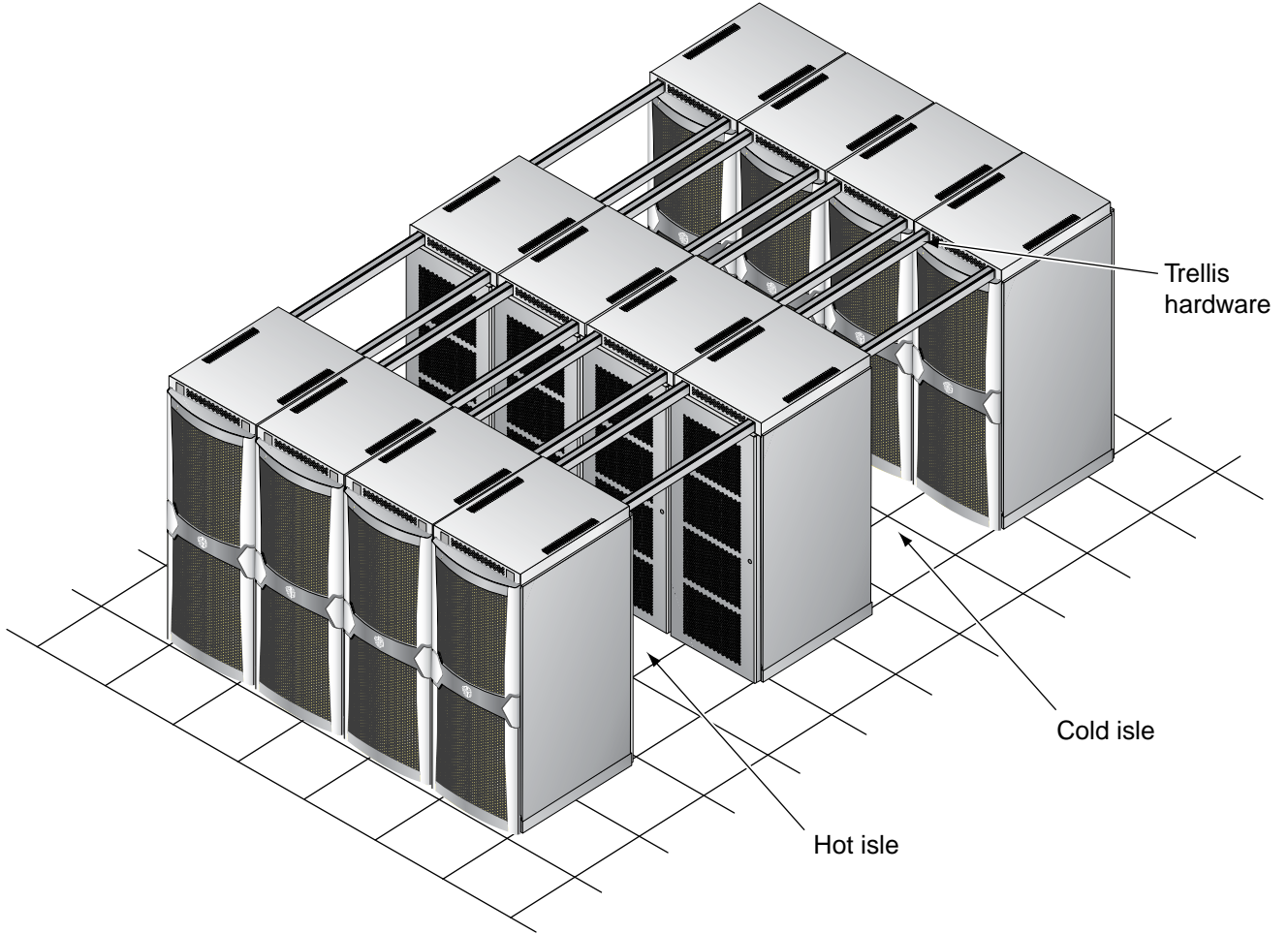


Figure 3-6 Twelve Air-cooled Racks with Trellis Hardware Example

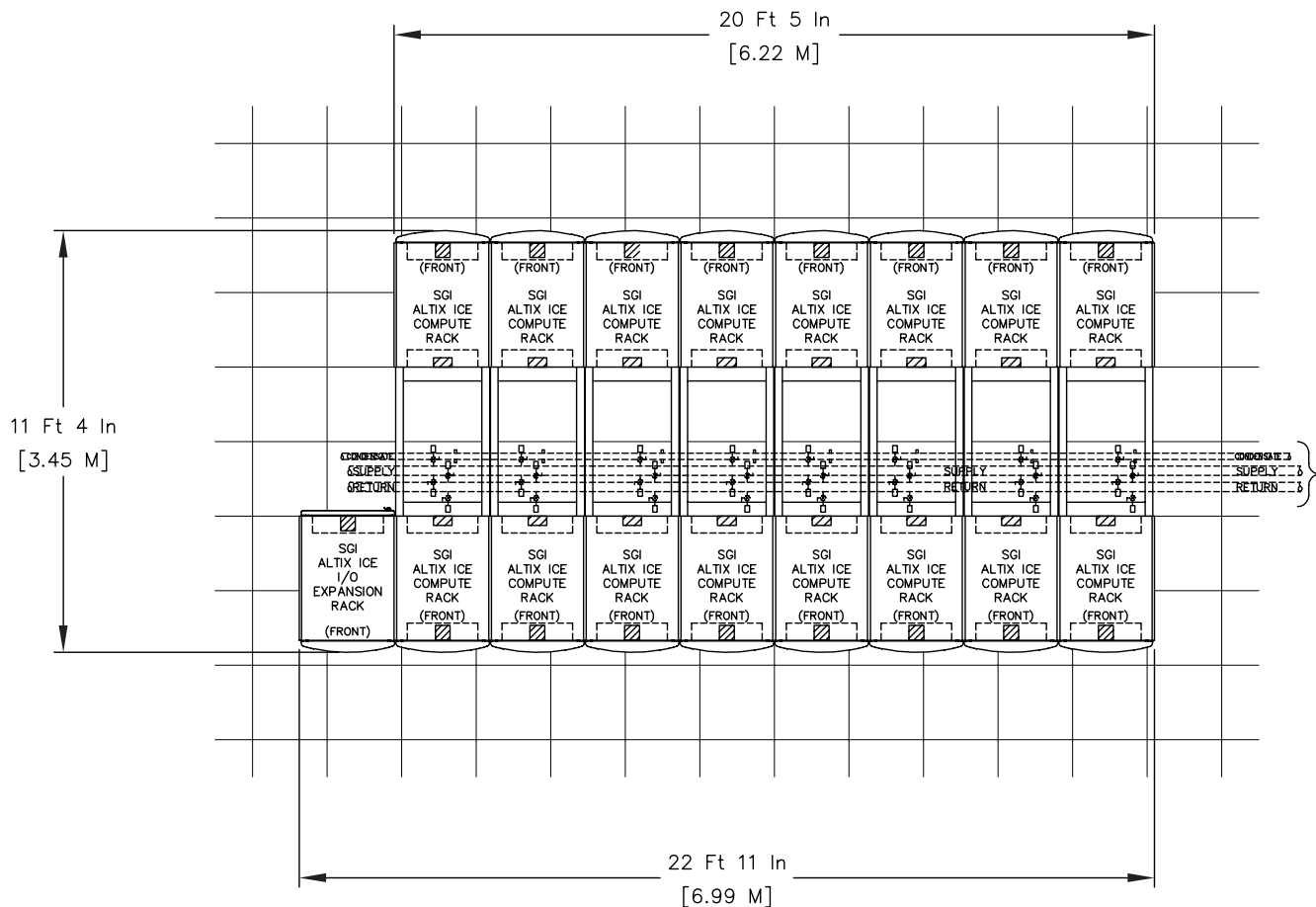


Figure 3-7 Sixteen Water-cooled Racks and I/O Expansion Rack Floor Layout

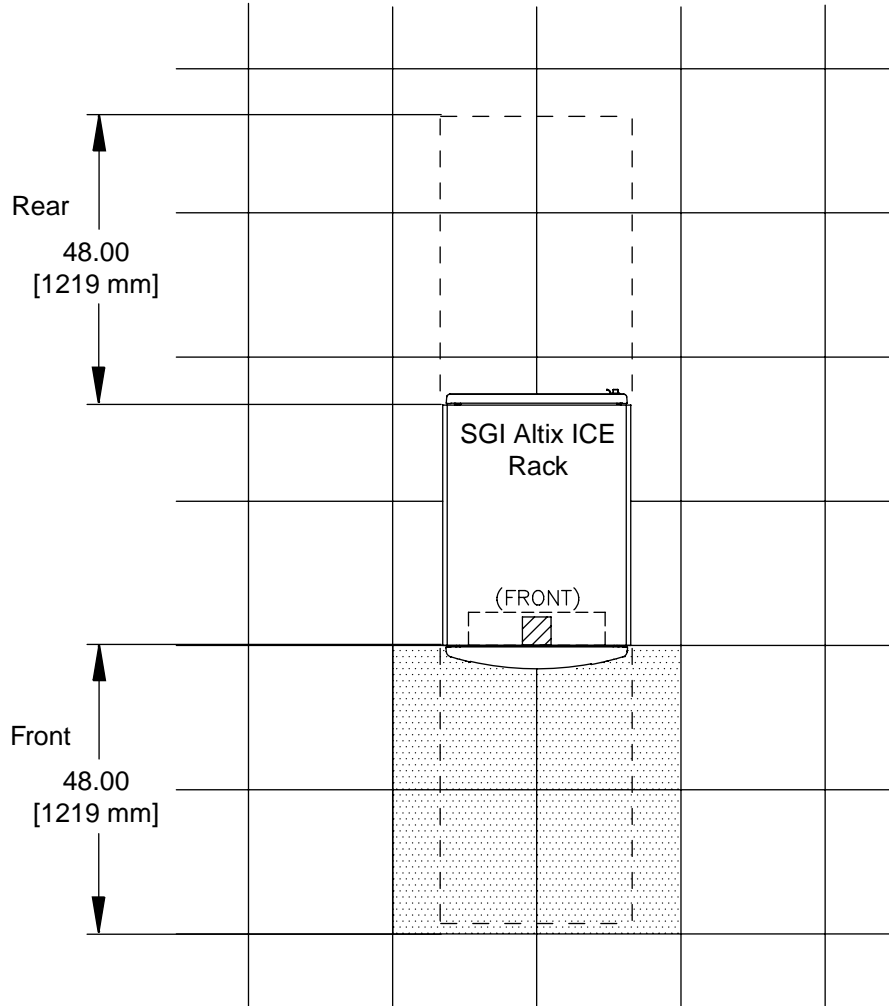


Figure 3-8 Service Clearance Requirements

Seismic Tiedowns

In areas that are prone to earthquakes, you should secure each SGI Altix ICE system to the computer room subfloor. Four M12 threaded weld nuts are located on the underside of each cabinet frame for attachment to customer-supplied hold-down devices. The attachment points are shown in Figure 3-9.

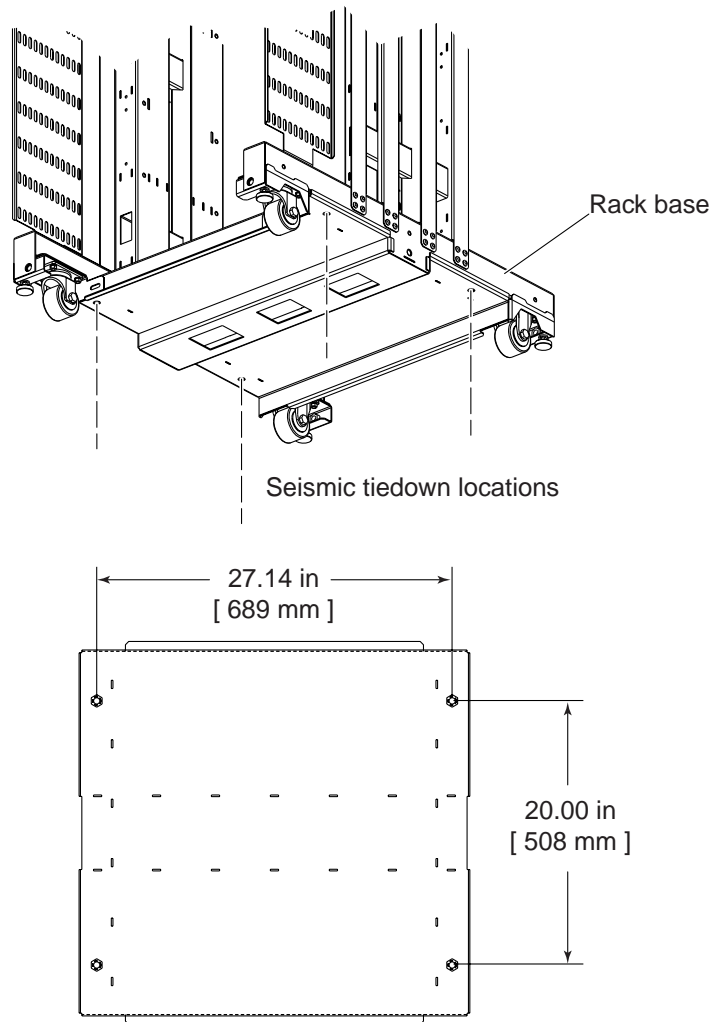


Figure 3-9 Seismic Tiedown Locations

Rack Tie Plates

Top and bottom tie plates are used to secure the racks together. The attachment points are shown in Figure 3-10.

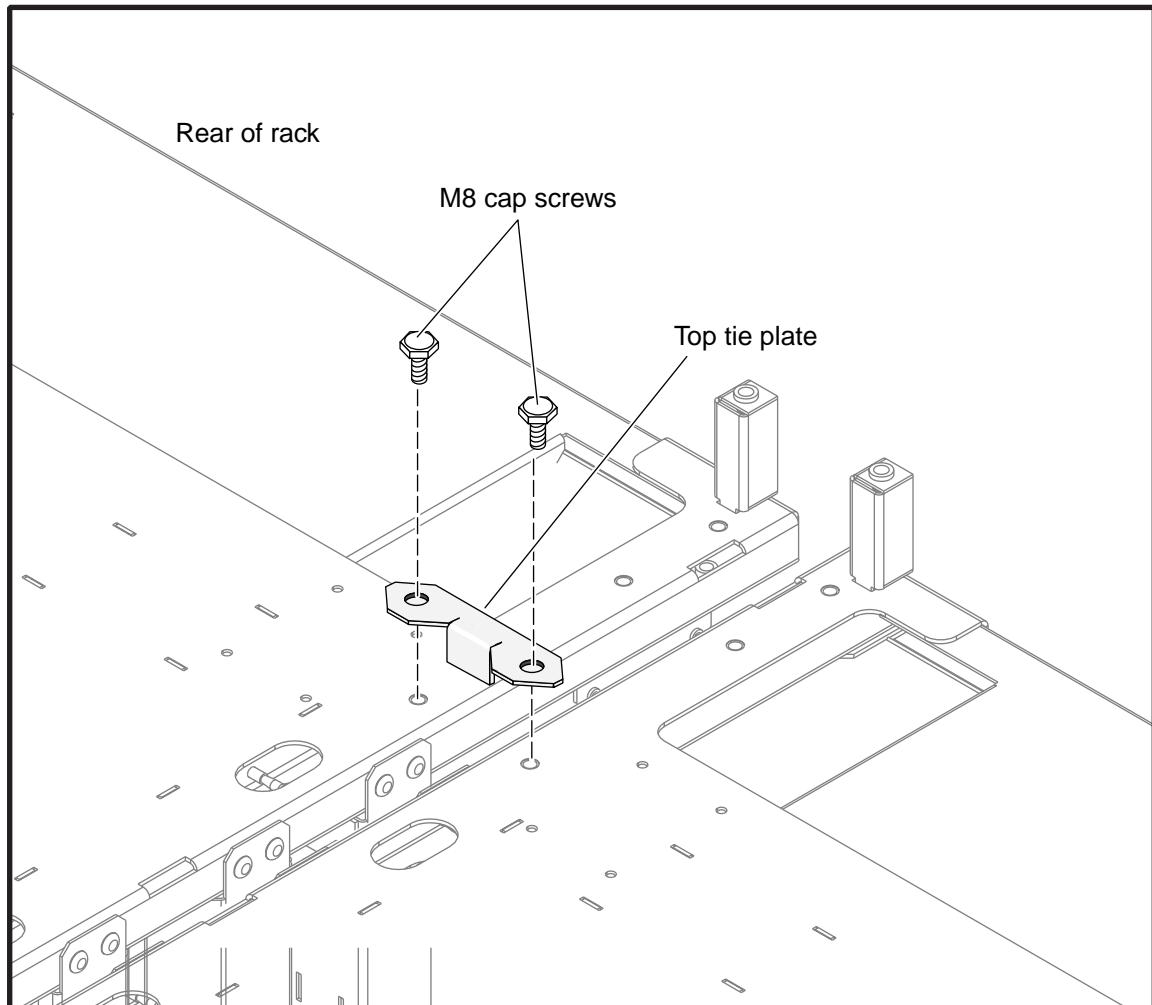


Figure 3-10 Rack Tie Plate Attachment Locations – Top

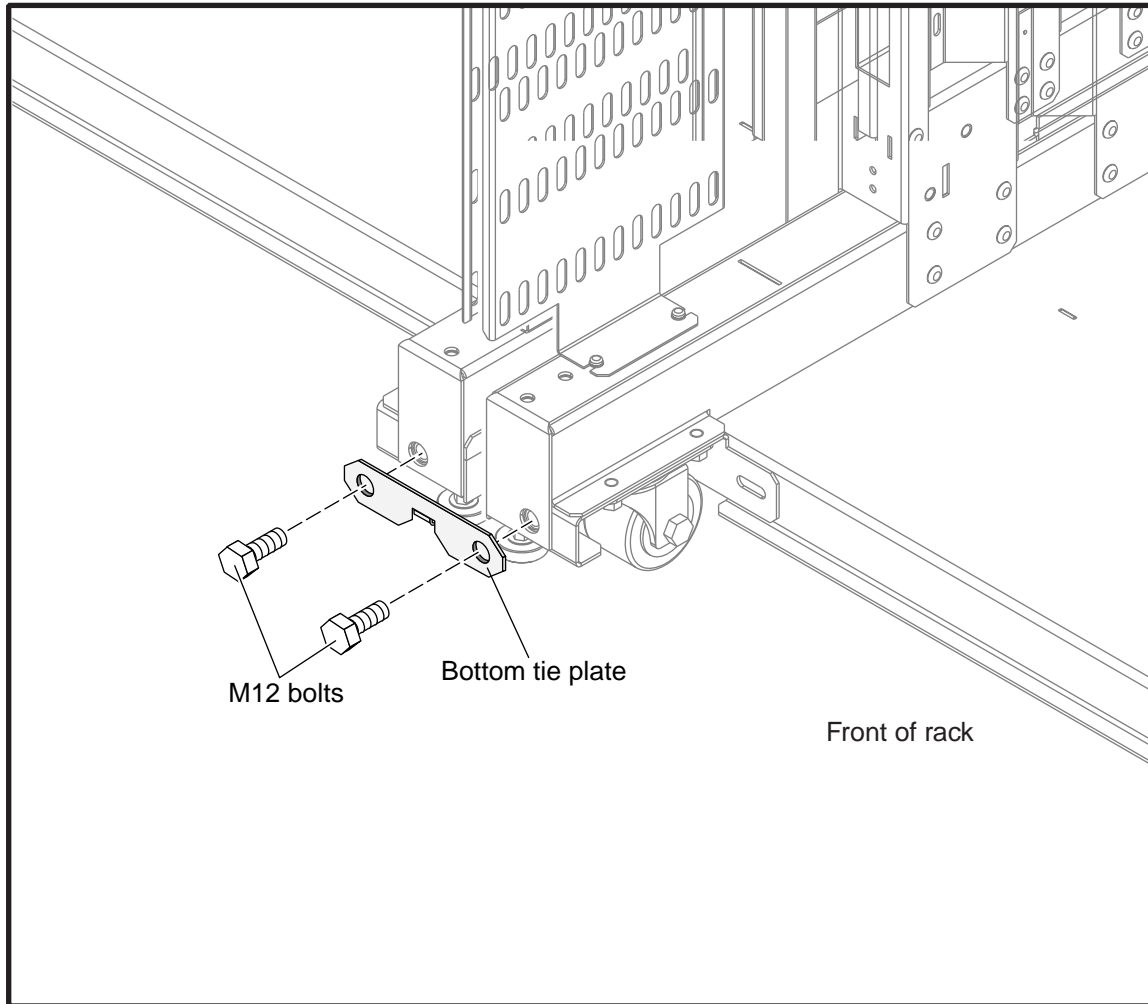


Figure 3-11 Rack Tie Plate Attachment Locations – Bottom

Power and Cooling Considerations

Power Requirements

Table 4-1 lists the electrical specifications for the SGI Altix ICE server.

Note: Table 4-1 lists the maximum numbers; other configurations might require significantly less power.

The calculated power consumption for specific SGI Altix ICE rack configurations is available from your SGI site planning representative.

Note: To maintain a ground potential of less than 250 millivolts between interconnected Altix ICE systems, SGI requires that all power circuits that supply power to an Altix ICE system originate from the same distribution panel if possible. If not, they must originate from the same source (transformer). Electrical work and installations must comply with all applicable local, state, and national electrical codes.

SGI makes every effort to minimize the effects of power failures and interruptions to the system hardware. Studies indicate that computer systems that are subjected to repeated power interruptions and fluctuations experience higher component failure rates than systems with stable power sources.

SGI encourages you to install a stable power source, such as an uninterruptible power system (UPS), to minimize component failures. Each SGI Altix ICE system and each piece of support equipment requires its own customer-supplied receptacles. If you have difficulty obtaining the correct receptacles as listed in Table 4-1, please contact your account manager.

Table 4-1 Electrical Specifications for the SGI Altix ICE Server

Electrical Service	Specifications
Input Voltage:	
Single-phase option	180 to 254 VAC
Three-phase options	180 to 254 VAC (North America/Japan) or 312 to 440 VAC (International)
Maximum Power Consumption:	
Per rack	35 kVA, 34.29 kW
Hold-up Time	
	20 milliseconds
Total Harmonic Distortion (THD)	
	Less than 10% THD-RMS at full load
Power Cable	
	10 ft. (3 m) pluggable drop cords
Power receptacles:	
Compute rack (single-phase option)	North America/Japan: (Maximum 8) 180-264 VAC, 30 A, NEMA L6-30R International: (Maximum 8) 180-264 VAC, 3-wire, 32 A, NEMA IEC60309
Compute rack (three-phase option)	North America/Japan: (2) Three-phase, 180-264 VAC, 60 A, 4-wire, IEC60309 International: (2) Three-phase, 312-457 VAC, 32 A, 5-wire, IEC6039

In addition to the equipment that Table 4-1 lists, your system configuration might also include optional equipment such as switches or storage. Please plan your facility electrical and air-conditioning requirements accordingly. If you have a system configuration that requires specific power specifications, contact a site planning representative by e-mail at site@sgi.com.

Cooling Requirements

Air-cooled Racks

Table 4-2 lists the maximum operating environmental specifications for an air-cooled SGI Altix ICE server.

Table 4-2 Air-cooled System Environmental Requirements

Characteristic	Specification
Maximum Environmental Requirements	
Humidity	10% to 90% non-condensing Rate of change must not exceed 10% relative humidity/hour
Operating environment:	
Air temperature (0 to 5,000 ft.)	41 to 95 °F (5 to 35 °C)
Air temperature (5,000 ft. to 10,000 ft.)	41 to 86 °F (5 to 30 °C)
Optimal Environmental Requirements	
Humidity	40% to 55% non-condensing Rate of change must not exceed 10% relative humidity/hour
Operating environment:	
Air temperature	68 to 77 °F (20 to 25 °C)

Water-cooled Racks

Table 4-2 lists the maximum operating environmental specifications for an water-cooled SGI Altix ICE server.

Table 4-3 Water-cooled System Environmental Requirements

Characteristic	Specification
Maximum Environmental Requirements	
Humidity	40% to 55% non-condensing Rate of change must not exceed 10% relative humidity/hour
Operating environment:	
Air temperature (0 to 5,000 ft.)	41 to 95 °F (5 to 35 °C)
Air temperature (5,000 ft. to 10,000 ft.)	41 to 86 °F (5 to 30 °C)
	Mean sea-level temperature rate of change must not exceed 18 °F/hour (10 °/hour)
Optimal Environmental Requirements	
Humidity	40% to 55% non-condensing Rate of change must not exceed 10% relative humidity/hour
Operating environment:	
Air temperature	68 to 77 °F (20 to 25 °C)

Cooling Water Requirements

Each water-cooled rack requires a customer-supplied source of clean cooling water. The system will operate on cooling water supply temperatures from 45 °F (7 °C) to 60 °F (15.5 °C).

Note: SGI recommends a cooling water temperature of 55 °F (12.8 °C).

The heat rejection to water, water flow rate, and pressure drop values are listed in Table 4-4. These values are based on 100% water at a supply temperature of 55 °F (12.8 °C). Anticipated water-temperature increase across the coil is 17 °F (8 °C).



Caution: Water flow and pressure drop values will differ for treated water (antifreeze, corrosion inhibitors, etc.) depending on the percentage (maximum 30% by volume) of treatment in the solution. Water flow and pressure drop values will also differ with the temperature and pressure of the water supply. Water pressure must be limited to 100 psig (690 kPA) maximum.

Table 4-4 Maximum Cooling Water Specifications

	Heat Rejection to Water (based on 34.64 kW)		Water Flow Rate		Pressure Drop	
	kBTU/hour	Tons	gpm	m ³ /hour	psi	kPA
Each Rack	111	9.26	11 gpm	2.34	30	207

Piping Requirements

Water piping must be installed under the raised floor within 4 ft. (1.2 m) of the rear of each compute rack. SGI supplies 10-ft. (3-m) flexible hoses with female quick-disconnect couplings to connect the water-cooled rack to the facility piping connectors. Each water-cooled rack requires one supply and one return pipe connection. It is the customer's responsibility to supply one of the following types of male quick-disconnect nipples:

- Parker - Part Number BH6-61
- Aeroquip - Part number FD45-1086-12-12
- Hansen - Part number B6-K31

SGI also recommends that you:

- Place isolation valves (ball-valves or butterfly valves) near the quick-disconnect nipples
- Insulate the chilled-water supply and chilled-water return piping under the raised-floor to minimize condensation
- Install condensate drain piping under the raised-floor within 4 ft (1.2 m) of the rear of each compute rack. SGI supplies (1) flexible nylon condensate drain hose per compute rack. It is the customer's responsibility to provide a hose barb of the proper size on the facilities drain piping for this hose.

Cooling Water Supply Requirements

The water-cooled subsystem can be supplied with water ranging in temperature from 45 to 60 °F (7.2 to 15.6 °C); however, water temperatures cooler than 60 °F (15.6 °C) could cause condensate to form on the hoses and manifolds.

The customer may treat the cooling water with glycol or corrosion inhibitors up to a maximum of 30%. Water pressure must be limited to 100 psig (690 kPa) maximum.

Based on pure cooling water supplied at 55 °F (12.8 °C), each water-cooled coil requires a maximum of 11 gpm (3 m³/hr). The corresponding cooling water pressure drop for the (coil + hoses + mated quick-disconnect fittings) shall be less than 30 psig (207 kPa).

Specifications

This section provides a summary of the mechanical, electrical, and environmental specifications.

Note: The water-cooled and air-cooled systems have slightly different environmental specifications. Refer to Table 5-2 for air-cooled rack environmental specifications. Refer to Table 5-3 for water-cooled rack environmental specifications.

Shipping Container Specifications

Figure 5-1 shows and Table 5-1 lists the shipping container dimensions and specifications.

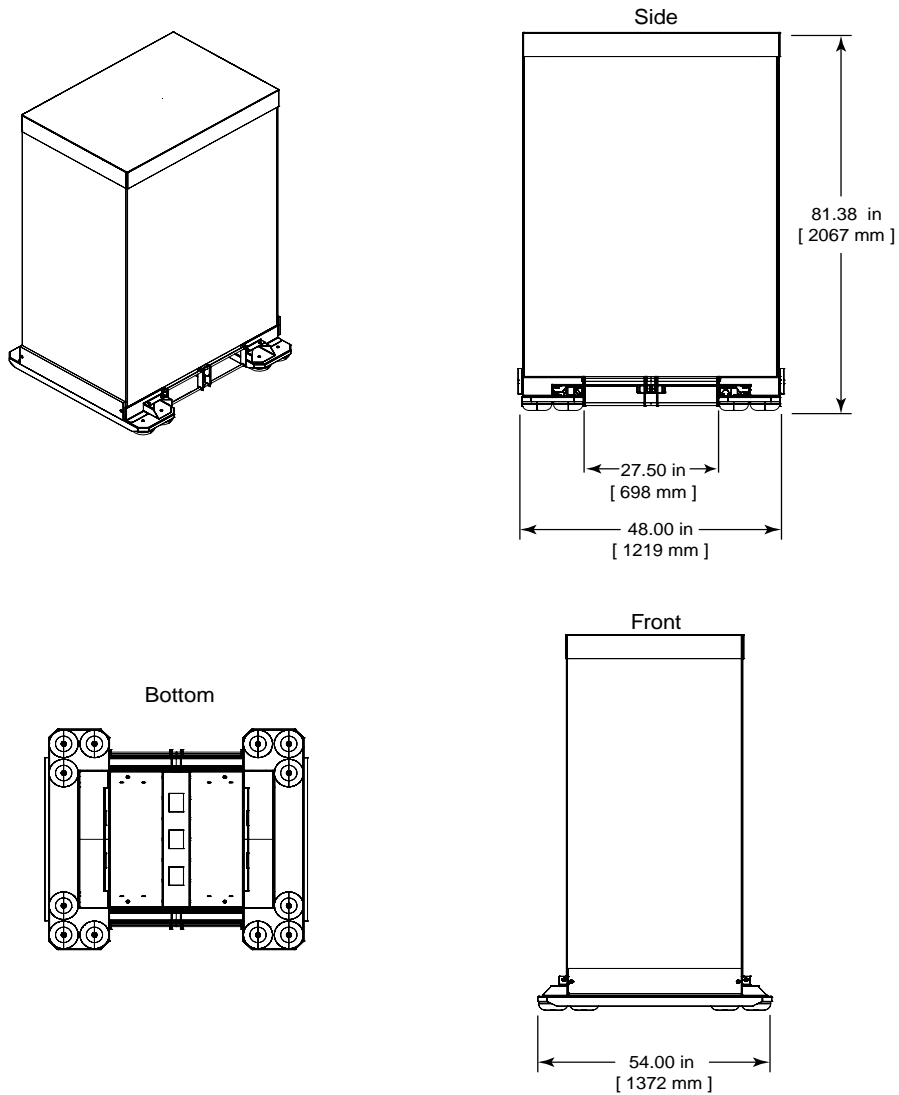


Figure 5-1 Shipping Container Dimensions

Rack Dimensions

Figure 5-2 shows the SGI Altix ICE server rack dimensions.

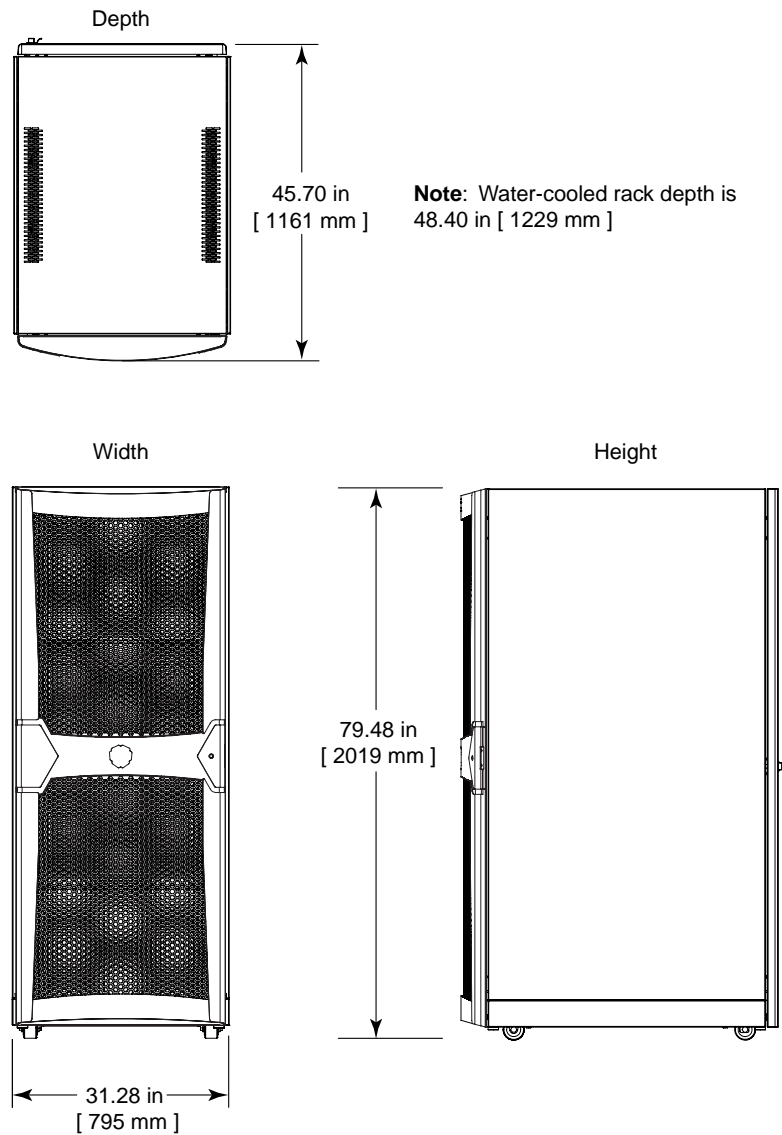


Figure 5-2 SGI Altix ICE Compute Rack Dimensions

Table 5-1 SGI Altix ICE System Specifications

Characteristic	Specification
Mechanical Requirements	
Maximum rack dimensions:	
Height	79.48 in (2019 mm)
Width	31.28 in (795 mm)
Depth	48.40 in (1229 mm)
Maximum shipping dimensions:	
Height	81.38 in (2067 mm)
Width	48.00 in (1219 mm)
Depth	54.00 in (1372 mm)
Rack Depth	
Air-cooled	45.70 in (1161 mm)
Water-cooled	48.40 in (1229 mm)
Weight (maximum while operating):	
Compute rack	2569 lb (1165 kg)
Shipping weight (maximum):	
Compute rack	2650 lb (1202 kg)
Access requirements:	
Front	48.00 in (1219 mm)
Rear	48.00 in (1219 mm)
Side	None

Table 5-1 SGI Altix ICE System Specifications **(continued)**

Characteristic	Specification
Electrical Requirements	
Voltage:	North America/Japan:
Nominal	200-240 VAC
Tolerance	180-254 VAC
	International:
Nominal	230 VAC
Tolerance	180-254 VAC
Frequency:	North America/Japan:
Nominal	60 Hz
Tolerance	47/63 Hz
	International
Nominal	50 Hz
Tolerance	47-63 Hz
Phases	Single-phase or optional three-phase
Power requirements, fully configured rack (maximum)	35 kVA, 34.29 kW
Hold-up time	20 ms
Power cable	10 ft. (3 m) pluggable drop cords
Power receptacles:	
Compute rack (single-phase option)	North America/Japan: (Maximum 8) 180-264 VAC, 30 A, NEMA L6-30R International: (Maximum 8) 180-264 VAC, 3-wire, 32 A, NEMA IEC60309
Compute rack (three-phase option)	North America/Japan: (2) Three-phase, 180-264 VAC, 60 A, 4-wire, IEC60309 International: (2) Three-phase, 312-457 VAC, 32 A, 5-wire, IEC6039

Table 5-1 SGI Altix ICE System Specifications **(continued)**

Characteristic	Specification
Wall breaker size:	
Single-phase (North America/Japan)	Multiple 30 A
Single-phase (Europe)	32 A
Three-phase (North America/Japan)	60 A
Three-phase (Europe)	32 A
Environmental Requirements	
Non-operating environment:	
Temperature	-40 to 140 °F (-40 to +60 °C)
Humidity	10% to 95% non-condensing
Altitude	40,000 ft. max.
Operating environment:	
	Refer to Table 5-2 for the air-cooled rack environmental requirements.
	Refer to Table 5-3 for the water-cooled rack environmental requirements.
Acoustical noise level (maximum)	Less than 80 dBa
Heat dissipation to air (maximum) Compute rack	118.19 kBTU/hr (based on 34.64 kVA)
Cooling requirement	Ambient air or water-cooled
	Refer to "Air-cooled Environmental Specifications" on page 55.
	Refer to "Water-cooled Environmental Specifications" on page 56.
Airflow (intake, front; exhaust, rear)	Air cooled: 2800 CFM typical per rack Water cooled: 2400 CFM, typical per rack

Air-cooled Environmental Specifications

Table 5-2 lists the maximum operating environmental specifications for an air-cooled SGI Altix ICE server.

Table 5-2 Air-cooled System Environmental Requirements

Characteristic	Specification
Maximum Environmental Requirements	
Humidity	10% to 90% non-condensing Rate of change must not exceed 10% relative humidity/hour
Operating environment:	
Air temperature (0 to 5,000 ft.)	41 to 95 °F (5 to 35 °C)
Air temperature (5,000 ft. to 10,000 ft.)	41 to 86 °F (5 to 30 °C)
Optimal Environmental Requirements	
Humidity	40% to 55% non-condensing Rate of change must not exceed 10% relative humidity/hour
Operating environment:	
Air temperature	68 to 77 °F (20 to 25 °C)

Water-cooled Environmental Specifications

To help minimize condensation on the coil during normal operation it is recommended to maintain the ambient air in the computer room within the limits in Table 5-2. Table 5-2 lists the maximum operating environmental specifications for an water-cooled SGI Altix ICE server and the optimal specifications.

Table 5-3 Water-cooled System Environmental Requirements

Characteristic	Specification
Maximum Environmental Requirements	
Humidity	40% to 55% non-condensing Rate of change must not exceed 10% relative humidity/hour
Operating environment:	
Air temperature (0 to 5,000 ft.)	41 to 95 °F (5 to 35 °C)
Air temperature (5,000 ft. to 10,000 ft.)	41 to 86 °F (5 to 30 °C)
	Mean sea-level temperature rate of change must not exceed 18 °F/hour (10 °/hour)
Optimal Environmental Requirements	
Humidity	40% to 55% non-condensing Rate of change must not exceed 10% relative humidity/hour
Operating environment:	
Air temperature	68 to 77 °F (20 to 25 °C)

Shock and Vibration

The vibration specifications for a functional 42U rack system with one chassis IRU are:

- Operational vibration
 - Sine Sweep 5-500-5 Hz, 0.25g @ 1 oct/min
 - Dwells at 4 lowest resonant frequencies at 0.25g for 15 minutes each
 - Random vibration at 0.10gRMS for 15 minutes
 - Vertical orientation
- Non-operational vibration
 - Sine sweep 3-200-3 Hz, 0.5g @ 1 oct/min
 - Dwells at 4 lowest resonant frequencies at 0.5g for 15 minutes each
 - Random vibration at 1.15gRMS for 15 minutes
 - Vertical orientation

The vibration specifications for a functional IRU are:

- Operational vibration
 - Sine sweep 5-500-5 Hz, 0.25g at 1 oct/min
 - Dwells at 4 lowest resonant frequencies at 0.25g for 15 minutes each
 - Random vibration at 0.67gRMS for 15 minutes
 - In both vertical and side orientations
- Non-operational vibration
 - Sine sweep 3-200-3 Hz, 0.5g at 1 oct/min
 - Dwells at 4 lowest resonant frequencies at 0.5g for 15 minutes each
 - Random vibration at 1.15gRMS for 15 minutes
 - In both vertical and side orientations

Site Planning Checklist

Table 6-1 and Table 6-2 provide a site planning checklist that you can use as an organizational tool during the site planning and preparation process. During the planning process, you might discover additional preparation issues at your site that this checklist does not address. To discuss your site plans and to resolve any issues, contact an SGI site planning representative by one of the methods listed in the summary of this document.

Table 6-1 Site Planning Checklist

Yes	No	Planning Issue	Comments
		Have you determined the system configuration? Configuration:_____	
		Have you determined the installation date? Date:_____	
		What is the total number of system cabinets?	
		Have you established the system location?	
		Does the equipment floor layout meet the equipment maintenance access requirements?	
		Is the equipment positioned so that the exhaust air of one heat-ejecting device does not enter the air inlet of another?	
		Have you identified an access route to the final system location?	
		Does the access route meet the access requirements for the system?	
		Does the access route meet the floor-loading requirements for the system?	
		Have you made provisions to cover irregular or engraved floor patterns along the access route to reduce vibration of the system while moving it?	

Table 6-1 Site Planning Checklist

Yes	No	Planning Issue	Comments
		Does your loading dock meet standard freight-carrier truck requirements? If not, have you allocated a forklift for delivery? Contact your site planning representative if you have concerns about your loading dock.	
		Is a pallet jack available on-site to move the system in its shipping container to the final system location?	
		Do the pallet-jack fork dimensions meet the requirements for the shipping container?	
		Are the elevator and elevator door dimensions adequate?	
		Is the elevator weight capacity adequate?	
		Does each ramp in the access route have an incline that is less than 10 degrees?	
		Did you order the power receptacles for your system?	
		Are the circuit breakers for all cabinets properly installed and labeled?	
		Are all power receptacles properly installed and labeled?	
		Are the floor cutouts properly positioned and free of sharp edges?	
		Are the recommended perforated floor panels properly positioned?	
		Is the computer room floor strong enough to support the weight of the system?	
		Can the computer room environment be properly maintained within the specifications listed in Table 5-1 on page 52?	
		Are telephone lines installed if you plan to implement remote support for your system?	
		Have you trained system administrators or enrolled operators in the necessary training courses? Customer Ed North America: (800) 361-2621 Customer Ed Europe, the Middle East, and Africa: +44 (118) 912-7725	

Table 6-2 Water-cooled Option Site Planning Checklist

Yes	No	Planning Issue	Comments
		Do you have an adequate chilled-water supply?	
		Are the required plumbing and pipe fixtures installed?	
		Have floor cutouts been provided for the cooling water and condensate hose?	

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