

**SGL® ICE X in D-racks  
Site Planning Guide**

007-5890-001

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# Contents

<b>1</b>	<b>Site Preparation Overview</b>	
	Warnings and Cautions . . . . .	2
	Pallet Jack Requirements . . . . .	3
	About this Guide. . . . .	3
	Obtaining Publications . . . . .	3
	Reader Comments . . . . .	4
	Physical Location . . . . .	5
	Selecting a Delivery Route . . . . .	5
	Selecting a Final Location . . . . .	7
	Floor Requirements . . . . .	8
	Electrical Requirements . . . . .	9
	Voltage Requirements . . . . .	9
	Power Requirements . . . . .	10
	Grounding Requirements . . . . .	11
	Power Factor . . . . .	12
	Inrush Current . . . . .	12
	Power-line Treatment . . . . .	13
	Total Harmonic Distortion . . . . .	13
	Thermal Requirements . . . . .	14
	Heat Output . . . . .	14
	Air-conditioning Terminology . . . . .	14
	Calculating Thermal Load . . . . .	15
	Water-cooled Rack Requirements . . . . .	16
	Cooling Water Requirements . . . . .	16
	Piping Requirements . . . . .	17

	Cooling Water Supply Requirements . . . . .	17
	Thermal Gradient . . . . .	18
	Cooling In Mission-critical Installations . . . . .	18
	Environmental Requirements . . . . .	19
	Electromagnetic Interference . . . . .	19
	Electrostatic Discharge . . . . .	19
	Vibration. . . . .	20
	Humidity. . . . .	20
	Humidity Gradient . . . . .	20
	Ergonomic Requirements . . . . .	21
	Acoustics . . . . .	21
	Local Regulations . . . . .	22
	Planning for the Future . . . . .	22
<b>2</b>	<b>Components</b>	
	Server Racks . . . . .	24
	Blade Enclosure Pair . . . . .	26
	Power Supplies . . . . .	28
	Cooling . . . . .	28
	I/O Expansion Racks . . . . .	29
	Trellis System . . . . .	30
<b>3</b>	<b>Specifications</b>	
	Shipping Container Specifications . . . . .	32
	Rack Dimensions. . . . .	34
	Rack Spacing . . . . .	38
	Rack Bonding Straps . . . . .	39
	System Specifications . . . . .	41
	Air-cooled Environmental Specifications . . . . .	44
	Water-cooled Environmental Specifications . . . . .	45
	Shock and Vibration . . . . .	46
<b>4</b>	<b>Layouts and Clearances</b>	
	General Recommendations . . . . .	47
	Air-cooled Rack Layout . . . . .	48

Water-cooled Rack Layout . . . . .	50
Service Clearance Requirements . . . . .	52
Seismic Tiedowns . . . . .	52
<b>5 Site Planning Checklist</b>	



# Figures

Figure 2-1	SGI ICE X System - Front View . . . . .	24
Figure 2-2	SGI ICE X Air-cooled and Water-Cooled Systems - Rear View. . . . .	25
Figure 2-3	Blade Enclosure Pair - Front . . . . .	26
Figure 2-4	Blade Enclosure Pair Component Numbering . . . . .	27
Figure 2-5	IRU Blowers - Rear . . . . .	28
Figure 2-6	I/O Expansion Rack . . . . .	29
Figure 2-7	SGI ICE X D-racks with Trellis System . . . . .	30
Figure 3-1	Wooden Crate Shipping Container Dimensions . . . . .	32
Figure 3-2	Cardboard Crate Shipping Container Dimensions . . . . .	33
Figure 3-3	SGI ICE X Compute Rack Dimensions (Air-cooled Rack) . . . . .	34
Figure 3-4	Rack Lift Opening in Shipping Configuration (Air-cooled SGI ICE X Compute Rack) . . . . .	35
Figure 3-5	SGI ICE X Compute Rack Dimensions (Water-cooled Rack) . . . . .	36
Figure 3-6	Rack Lift Opening in Shipping Configuration (Water-cooled SGI ICE X Compute Rack) . . . . .	37
Figure 3-7	Rack Spacing . . . . .	38
Figure 3-8	Rack Bonding Straps – Top of Rack . . . . .	39
Figure 3-9	Rack Bonding Strap – Bottom of Rack . . . . .	40
Figure 4-1	Single Air-cooled Rack Floor Layout (Shown on 24-in by 24-in Grid) . . . . .	48
Figure 4-2	Air-cooled Rack Floor Layout - Four Racks (Shown on 24-in by 24-in Grid) . . . . .	49
Figure 4-3	Single Water-cooled Rack Floor Layout (Shown on 24-in by 24-in Grid) . . . . .	50
Figure 4-4	Water-cooled Rack Floor Layout - Four Racks (Shown on 24-in by 24-in Grid) . . . . .	51
Figure 4-5	Service Clearance Requirements (Shown on 24-in by 24-in Grid) . . . . .	52
Figure 4-6	Seismic Tiedown Locations . . . . .	53



## Tables

Table 1-1	Floor Load Terminology . . . . .	8
Table 1-2	Electrical Service Requirements . . . . .	9
Table 1-3	Cooling Water Specifications (Example) . . . . .	16
Table 3-1	SIG ICE X System Specifications . . . . .	41
Table 3-2	Air-cooled System Environmental Requirements . . . . .	44
Table 3-3	Water-cooled System Environmental Requirements. . . . .	45
Table 5-1	Site Planning Checklist . . . . .	55
Table 5-2	Water-cooled Option Site Planning Checklist . . . . .	57



## Site Preparation Overview

This document provides information that helps management and facilities personnel prepare for an SGI ICE X server in D-rack(s) 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 +1 715 726 2820; by fax at +1 715 726 2969; or by e-mail at [site@sgi.com](mailto: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 5 on 55 of this document as a guide.

## Warnings and Cautions

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



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

- 2,532 lb (1,148 kg) when in shipping configuration
- 2,062 lb (935 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.

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**Warning:** The maximum weight of an SGI ICE X rack is 2,532 lb (1,148 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.

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**Warning:** The maximum operating weight of a single water-cooled SGI ICE X rack while operating is 2,062 lb. (935 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.

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

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**Caution:** To reduce the likelihood of exposure to personal injury or property damage, SGI recommends that you use a 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.

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## 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 ICE X 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 back cover.)

You can contact us in any of the following ways:

- Send e-mail to [site@sgi.com](mailto: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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890 Technology Way  
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



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

- 2,532 lb (1,148 kg) when in shipping configuration
- 2,062 lb (935 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.**

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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 3-1 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 3-1 for the maximum weight per system rack. Refer to “Floor Requirements” on page 8 for information about floor loading.

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**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.

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- 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 3-1. 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.

## 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 3-1 lists the relevant system dimensions. Chapter 4, “Layouts and Clearances” shows the typical computer room floor space requirements. As a general rule, SGI ICE X 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 3-1 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 8 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 4.

## 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.

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**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.

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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. Raised 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

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<b>Live Load</b>	<b>The load that the floor can safely support. Lbs/Sq Ft (KG/Sq m)</b>
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.

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## Electrical Requirements

An SGI ICE X 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 ICE X servers ship with three-phase input power. Refer to the section titled Table 3-1 on page 41 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

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 12). You can convert among amps, volts, VA, power factor, and watts by using the following formulas:

### Single Phase

$$\text{VA} = (\text{Amps} \cdot \text{Volts})$$

$$\text{VA} = \left( \frac{\text{Watts}}{\text{Power Factor}} \right)$$

$$\text{Watts} = (\text{VA} \cdot \text{Power Factor})$$

$$\text{Amps} = \left( \frac{\text{Watts}}{\text{Volts} \cdot \text{Power Factor}} \right)$$

### Three Phase

$$\text{VA} = (\text{Amps} \cdot \text{Volts} \cdot 1.73)$$

$$\text{VA} = \left( \frac{\text{Watts}}{\text{Power Factor}} \right)$$

$$\text{Watts} = (\text{VA} \cdot \text{Power Factor})$$

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

Even one SGI ICE X server rack can require more power than is routinely available in an office environment (approximately 34.58 kVA). A room full of racks will almost certainly require specially installed electrical circuits. Refer to Table 3-1 on page 41 for the power requirements of the rack. (The calculated power consumption for specific SGI ICE X rack configurations is available from your SGI site planning representative.)

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**Note:** To maintain a ground potential of less than 250 millivolts between interconnected SGI ICE X systems, SGI requires that all power circuits that supply power to an SGI ICE X 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.

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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 ICE X 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 3-1, please contact your account manager.

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**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.

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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.



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

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- To maintain your entire SGI ICE X server at the same electrical potential, all multiple-rack systems must be bolted together. Refer to “Rack Bonding Straps” on page 39 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-amperage 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 ICE X servers are power-factor corrected and thus have a power factor very close to 1. Some peripherals do not have this correction built in.



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**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 ICE X 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 3-1 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.

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**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.

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## Thermal Requirements

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

Refer to Table 3-1 on page 41 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 to order a system with water-cooled racks.

The maximum heat dissipation-to-air per rack is listed in Chapter 3, “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 3-1 on page 41 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.

## Water-cooled Rack Requirements

If water-cooled SGI D-racks will be used to provide proper cooling at your site, the following requirements must be met:

- “Cooling Water Requirements” on page 16
- “Piping Requirements” on page 17
- “Cooling Water Supply Requirements” on page 17

### 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). The actual heat rejection to water, water flow rate, and pressure drop values depend on the temperature of the water used.



**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.

### Example:

The following example values are based on 100% water at a supply temperature of 50 °F (10 °C). This example assumes that 95% of the heat load is rejected to water and 5% to the computer room air. Anticipated water-temperature increase across the coil is 23 °F (12.8 °C).

**Table 1-3** Cooling Water Specifications (Example)

	Heat Rejection to Water (based on a rack at 30.55 kW)		Water Flow Rate		Pressure Drop	
	kBTU/hour	Tons	gpm	m <sup>3</sup> /hour	psi	kPA
<b>Each Rack</b>	99	8.25	8 gpm	1.82	17	117

## 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 flexible hoses with female quick-disconnect couplings to connect the water-cooled coil 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 a condensate drain/pipe to provide connection to an SGI supplied 6 ft (1.8 m) long, 1/2 inch (12.7 mm) outside diameter, and 3/8 inch (9.5 mm) inside diameter flexible nylon drain hose from each rack.

You must supply one 1/2-inch push-to-connect type fitting [Parker P/N W68PL-8-8 or equivalent] connection point within 4 ft (1.2 m) of each associated rack floor cutout.

## Cooling Water Supply Requirements

The water-cooled coils 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 60 °F (15.6 °C), each water-cooled rack could require up to 12 gpm (2.72m<sup>3</sup>/hr). SGI will provide rates based on you specific configuration. The corresponding cooling water pressure drop for the (coil + hoses + mated quick-disconnect fittings) shall be less than 30 psig (207 kPa). These flow and pressure drop values are based on analytical modeling of expected coil performance.

## Thermal Gradient

Table 3-1 on page 41 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.



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

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### 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 ICE X 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 3-1 on page 41.

## Humidity

Table 3-1 on page 41 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 3-1 on page 41 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 3-1 on page 41 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 ICE X system is an integrated compute environment that can scale to thousands of Intel processor cores, terabytes (TBs) of memory, and petabytes (PBs) of storage.

The standard cooling method for SGI ICE X systems in D-rack(s) is blower-driven air cooling. Each blower enclosure has six blowers that are mounted at the rear of the rack (up to a total of 24 blowers per rack).

Optional supplemental water cooling is available for cases where conventional computer room air cooling is not adequate. Water-cooled coils are mounted to the rear of the rack. Hot air is exhausted through each cooling coil, which transfers the heat from the air prior to entering the computer room. Refer to Table 3-1 on page 41 for the water-cooled option facilities requirements.

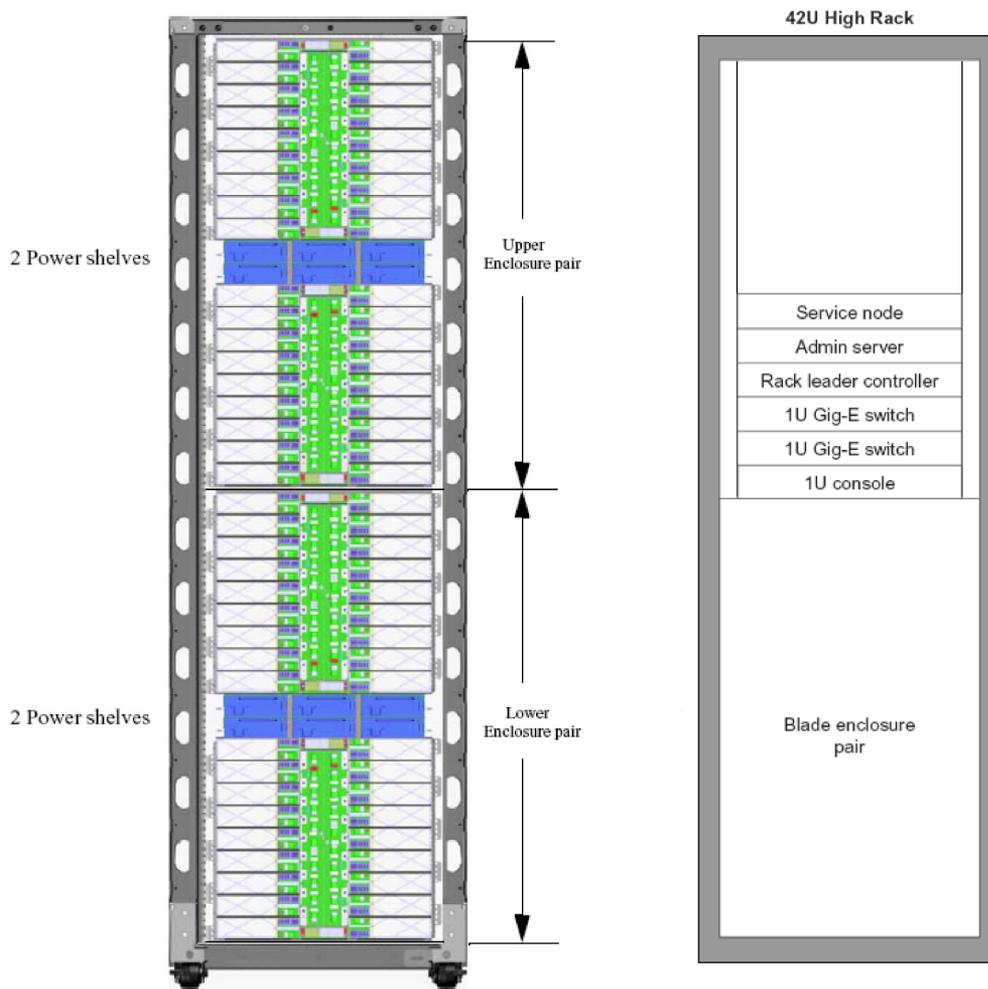
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**Note:** Contact *site@sgi.com* for specific power and cooling specifications for your system configuration to determine if your facility will require the water-cooled option.

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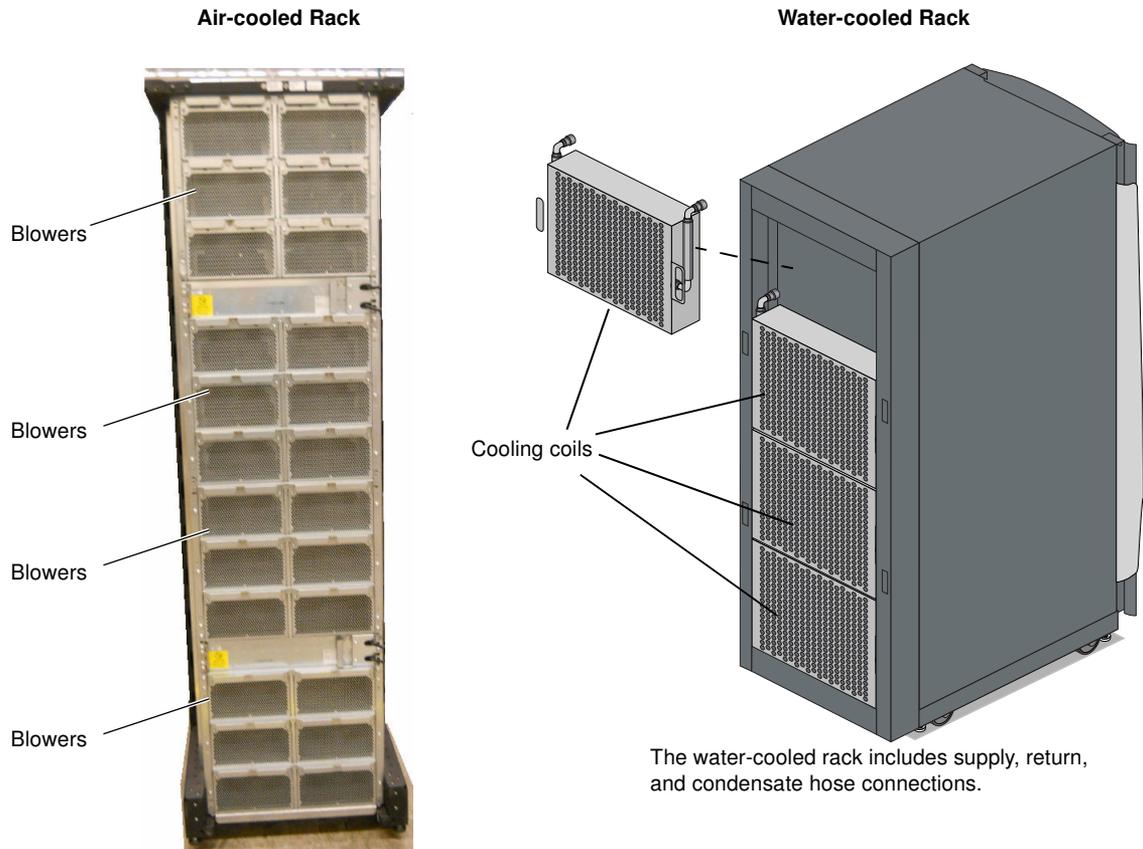
## Server Racks

Each SGI ICE X server rack contains up to two blade enclosure pairs and two power distribution units (PDUs). Racks with only one blade enclosure pair can also include a console, support nodes, and switches (refer to Figure 2-1).



**Figure 2-1** SGI ICE X System - Front View

The racks can be air cooled or water cooled (refer to Figure 2-2). The water-cooled configuration circulates facility chilled-water through cooling coils mounted to the rear of the rack. Exhaust air from components in the rack cools as it passes through the coils, which lowers the temperature of the air returned to the computer room. The water running through the coils carries away up to 95 percent of the heat generated by the components in the rack.



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

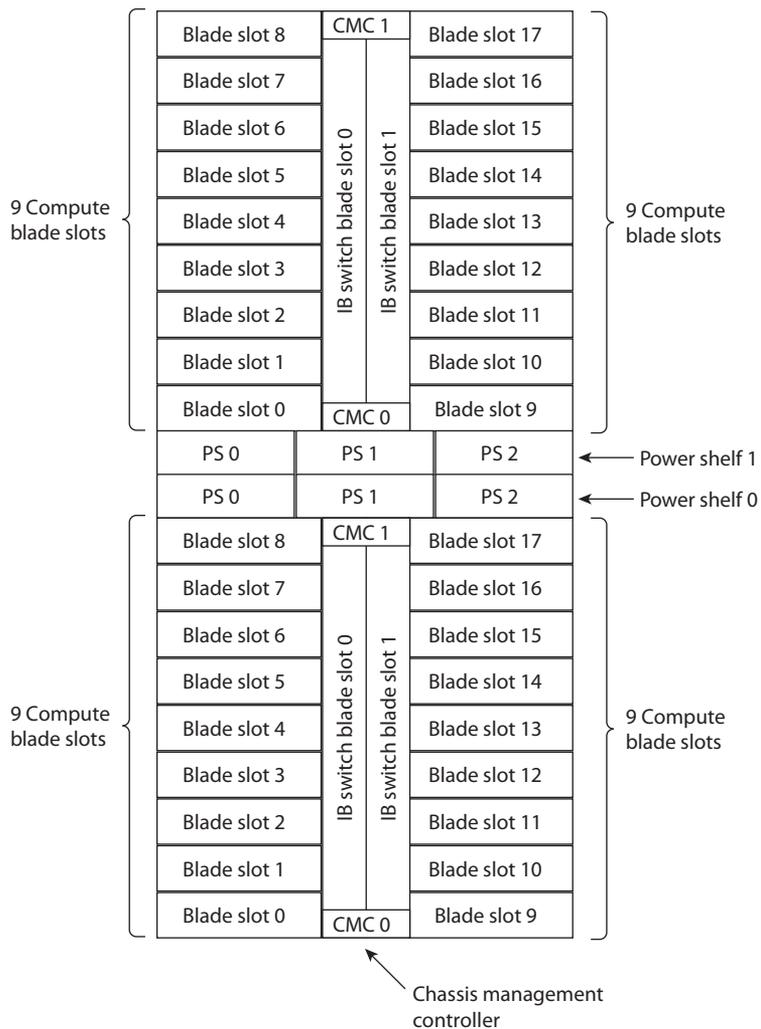
## Blade Enclosure Pair

The basic building block is the blade enclosure pair. A blade enclosure pair provides power, cooling, system control, and the network fabric for up to 36 compute blades (refer to Figure 2-1). Each compute blade supports two four-core, six-core, or eight-core Xeon processor sockets and 16 fully-buffered DDR3 memory DIMMs. One or two blade enclosure pairs reside in a 42U high rack



**Figure 2-3** Blade Enclosure Pair - Front

Figure 2-4 shows the numbering for components in each blade enclosure pair.



**Figure 2-4** Blade Enclosure Pair Component Numbering

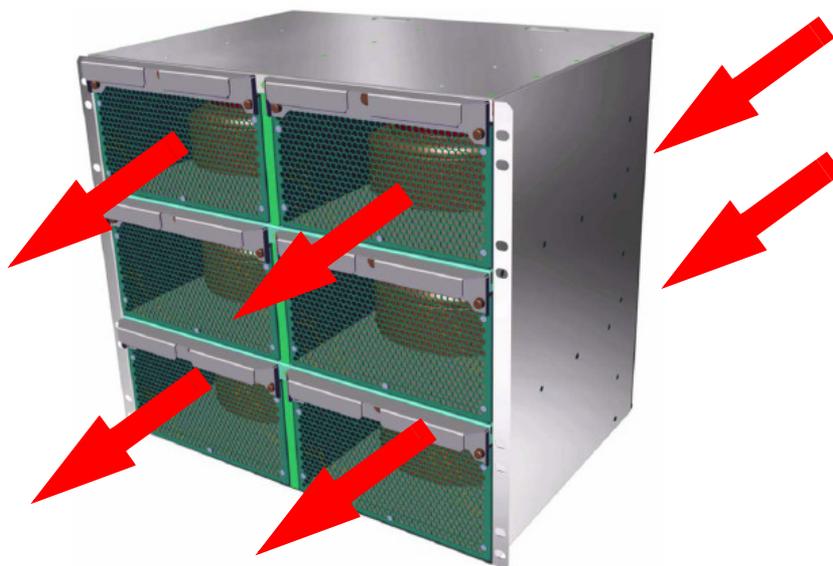
## Power Supplies

The blade enclosure pair uses power supplies with two different voltage levels:

- Up to six hot-swappable 3037W 12V power supplies are located between the two blade enclosures in a rack to provide power to the compute blades.
- Two hot-swappable 3037W 48V power supplies that are located in the fan power box at the rear of the system provide power to the blowers in the rear of the rack.

## Cooling

A blower enclosure containing six blowers is installed behind each blade enclosure to bring air into the front of the rack and exhaust it out the rear (refer to Figure 2-5). This provides up to 24 blowers per rack. Optional water-cooled coils can be added to the rear of the rack if the computer room environment requires additional cooling capacity (refer to Figure 2-2).



**Figure 2-5** IRU Blowers - Rear

## I/O Expansion Racks

I/O expansion racks are typically used to hold the system console, support nodes, switches, and storage, as shown in Figure 2-6.

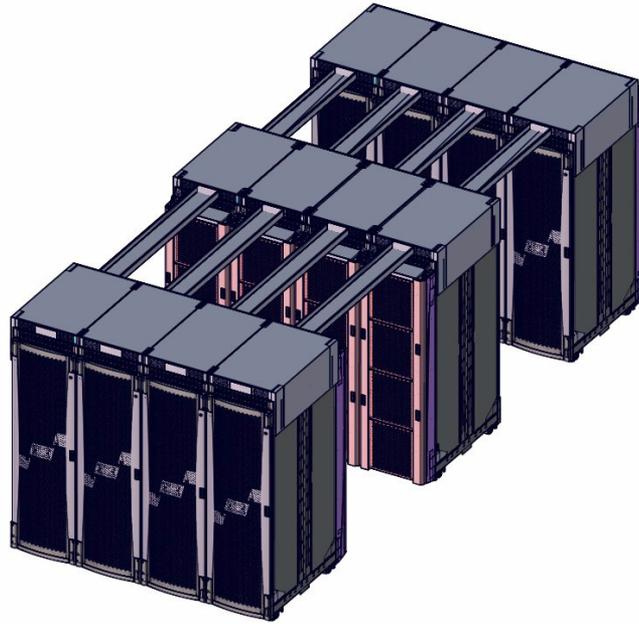
I/O expansion racks use the same racks (SGI D-racks) as compute racks.



**Figure 2-6** I/O Expansion Rack

## Trellis System

System configurations that span multiple rows use a trellis system to route cables between the rows; refer to Figure 2-7.



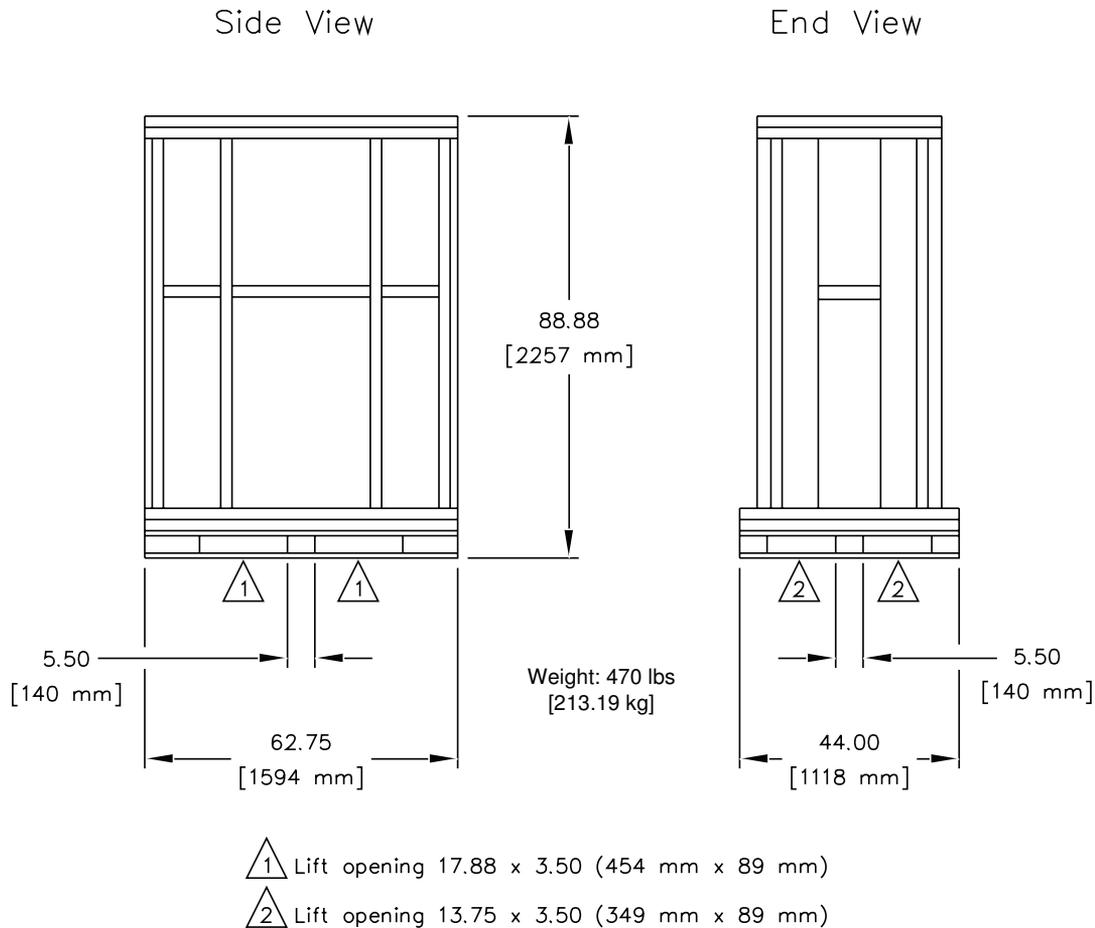
**Figure 2-7** SGI ICE X D-racks with Trellis System

## **Specifications**

This section provides a summary of the mechanical, electrical, and environmental specifications for SGI ICE X systems.

## Shipping Container Specifications

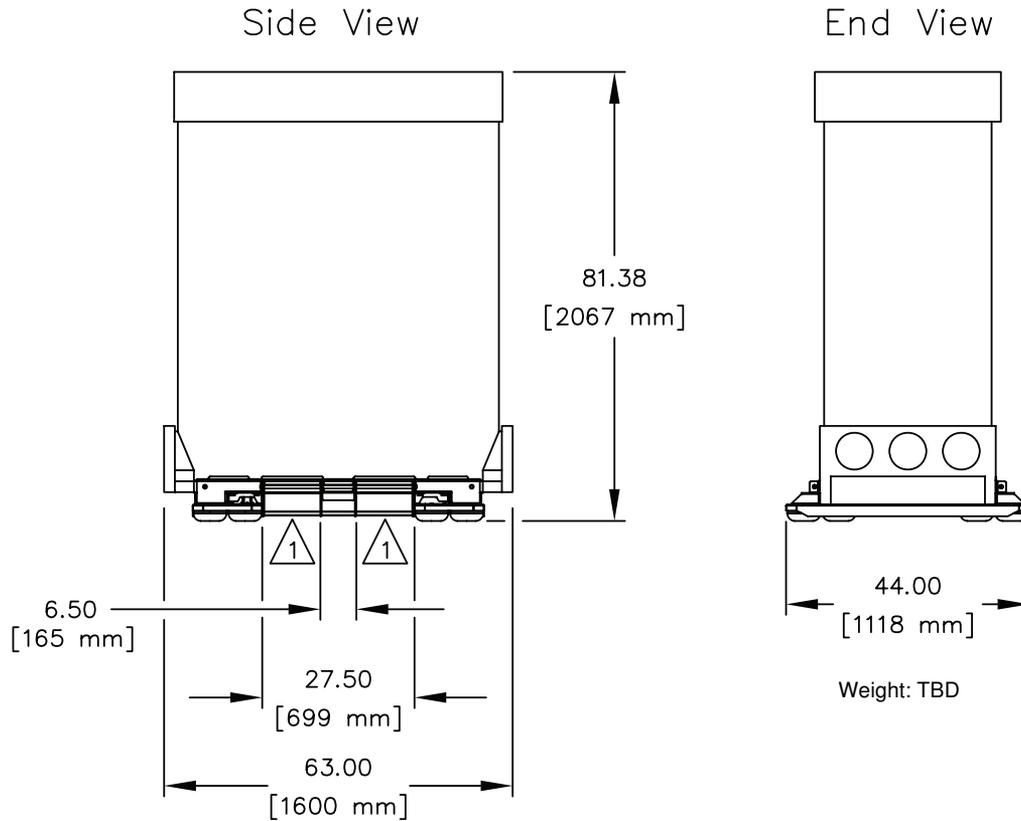
Figure 3-1 and Figure 3-2 show and Table 3-1 lists the shipping container dimensions and specifications.



Note:

The shipping container consists of a wooden pallet with removable wooden sides and top. An end panel serves as a ramp for unloading the rack.

**Figure 3-1** Wooden Crate Shipping Container Dimensions



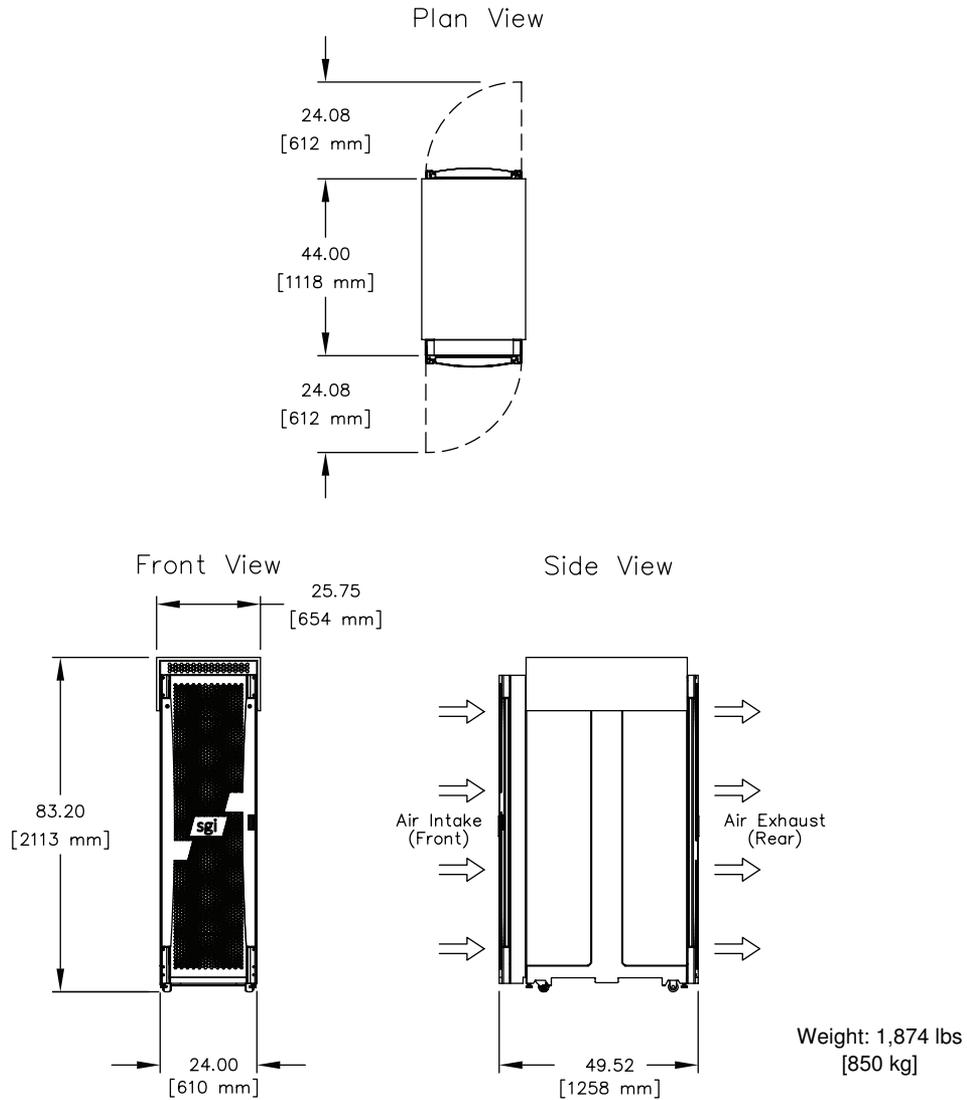
△ 1 ForkLift Openings 3.31 x 10.13 (84 mm x 257 mm)

**Figure 3-2** Cardboard Crate Shipping Container Dimensions

**Note:** Cardboard crates are sometimes used to ship small single-rack, air-cooled systems.

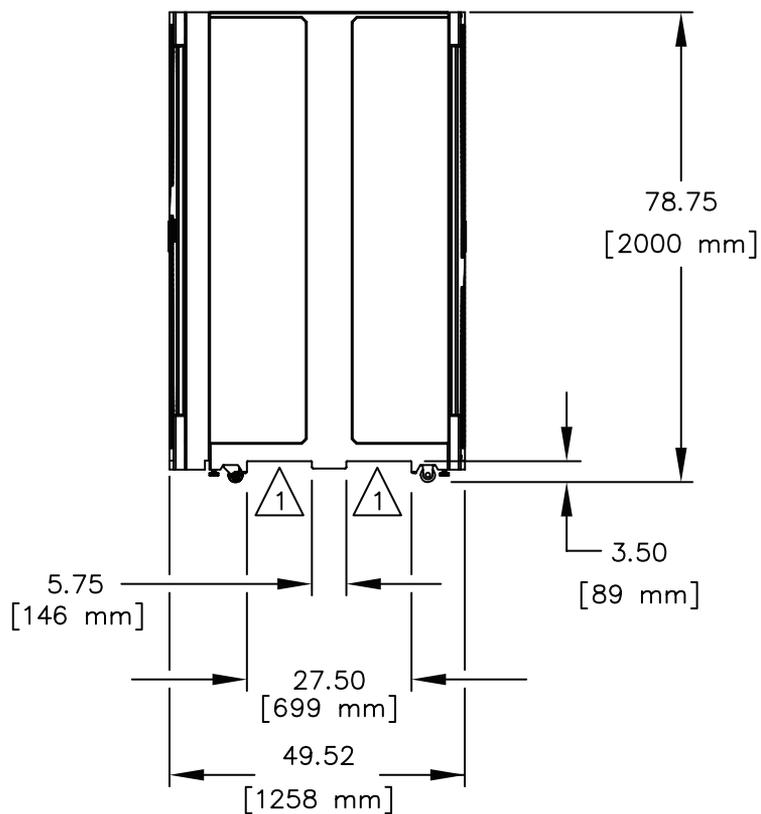
## Rack Dimensions

Figure 3-3 and Figure 3-4 show the SGI ICE X server rack dimensions and rack lift opening dimensions for air-cooled racks.



**Figure 3-3** SGI ICE X Compute Rack Dimensions (Air-cooled Rack)

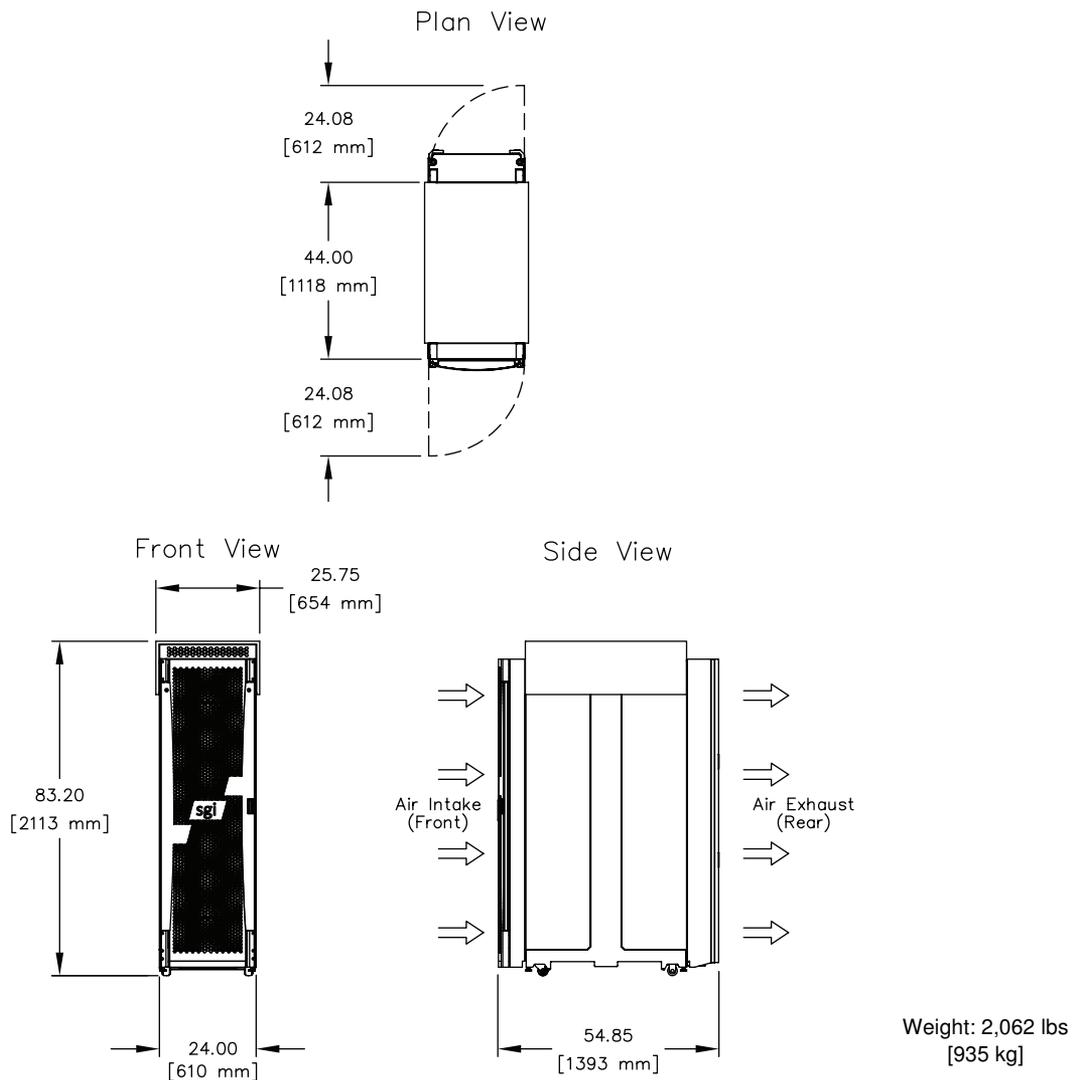
## Side View



△ 1 Lift opening 3.50 x 10.88 (89 mm x 276 mm)

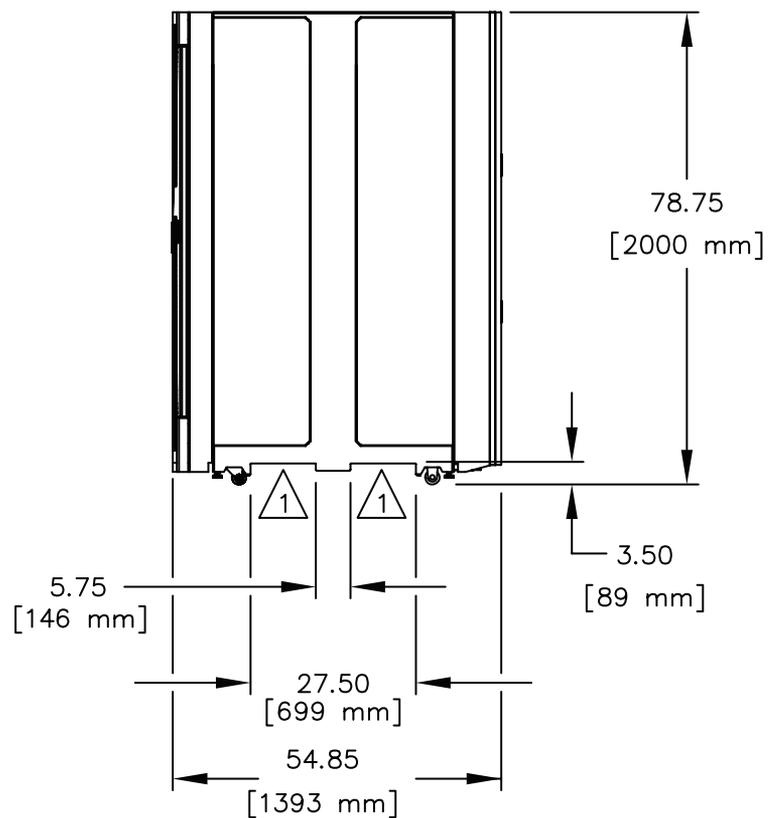
**Figure 3-4** Rack Lift Opening in Shipping Configuration (Air-cooled SGI ICE X Compute Rack)

Figure 3-5 and Figure 3-6 show the SGI ICE X server rack dimensions and rack lift opening dimensions for water-cooled racks.



**Figure 3-5** SGI ICE X Compute Rack Dimensions (Water-cooled Rack)

## Side View

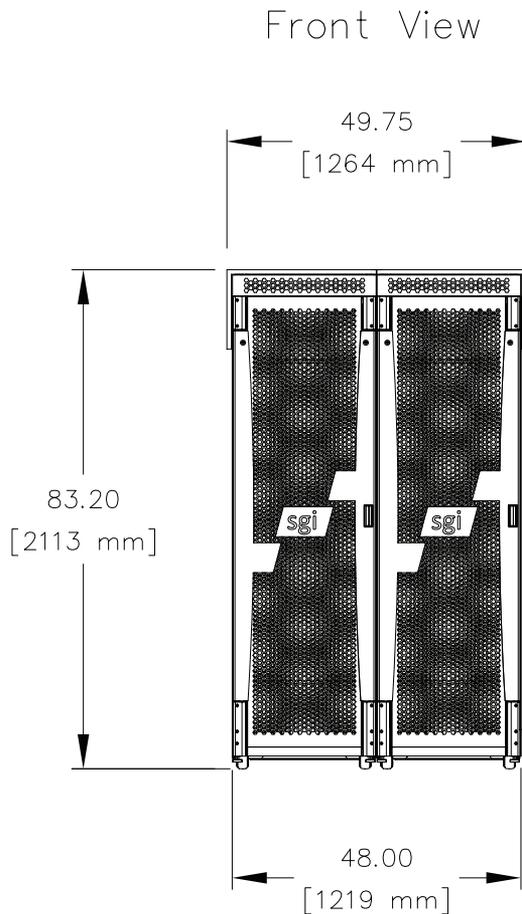


△ 1 Lift opening 3.50 x 10.88 (89 mm x 276 mm)

**Figure 3-6** Rack Lift Opening in Shipping Configuration (Water-cooled SGI ICE X Compute Rack)

## Rack Spacing

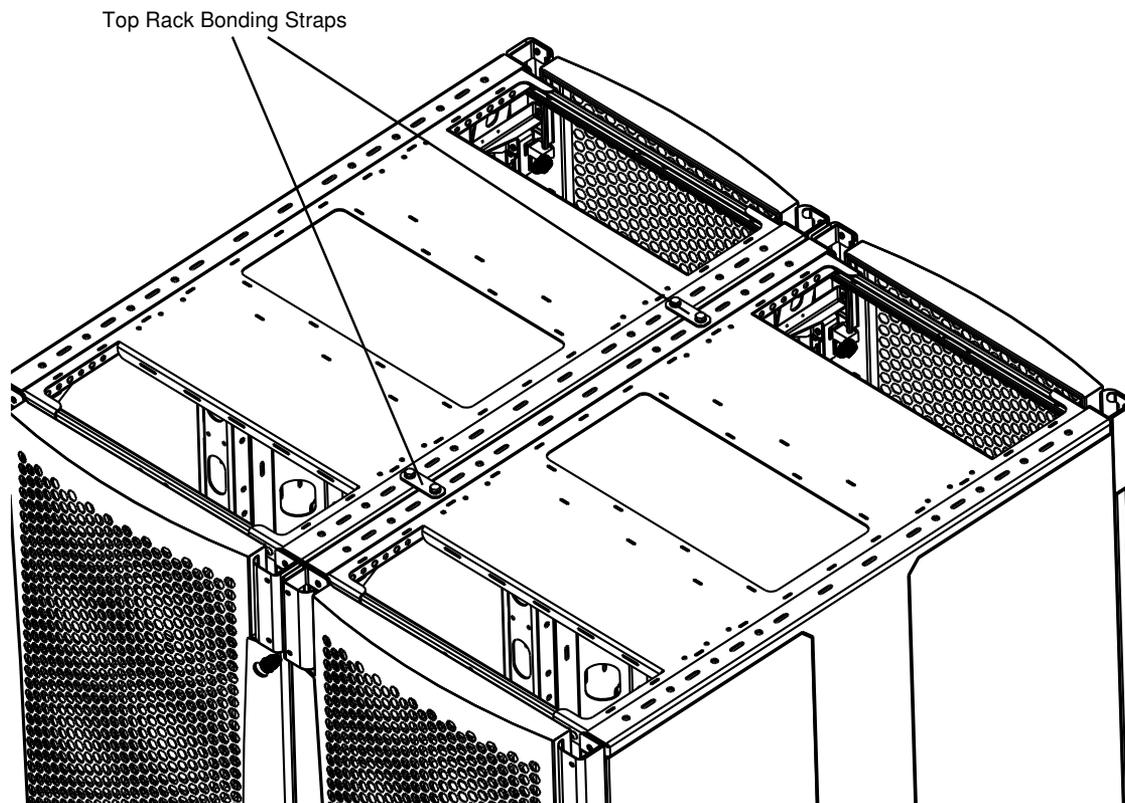
SGI ICE X systems in D-racks are placed side-by-side without additional space between them, as shown in Figure 3-7. Racks are secured using rack bonding straps (refer to “Rack Bonding Straps” on page 39).



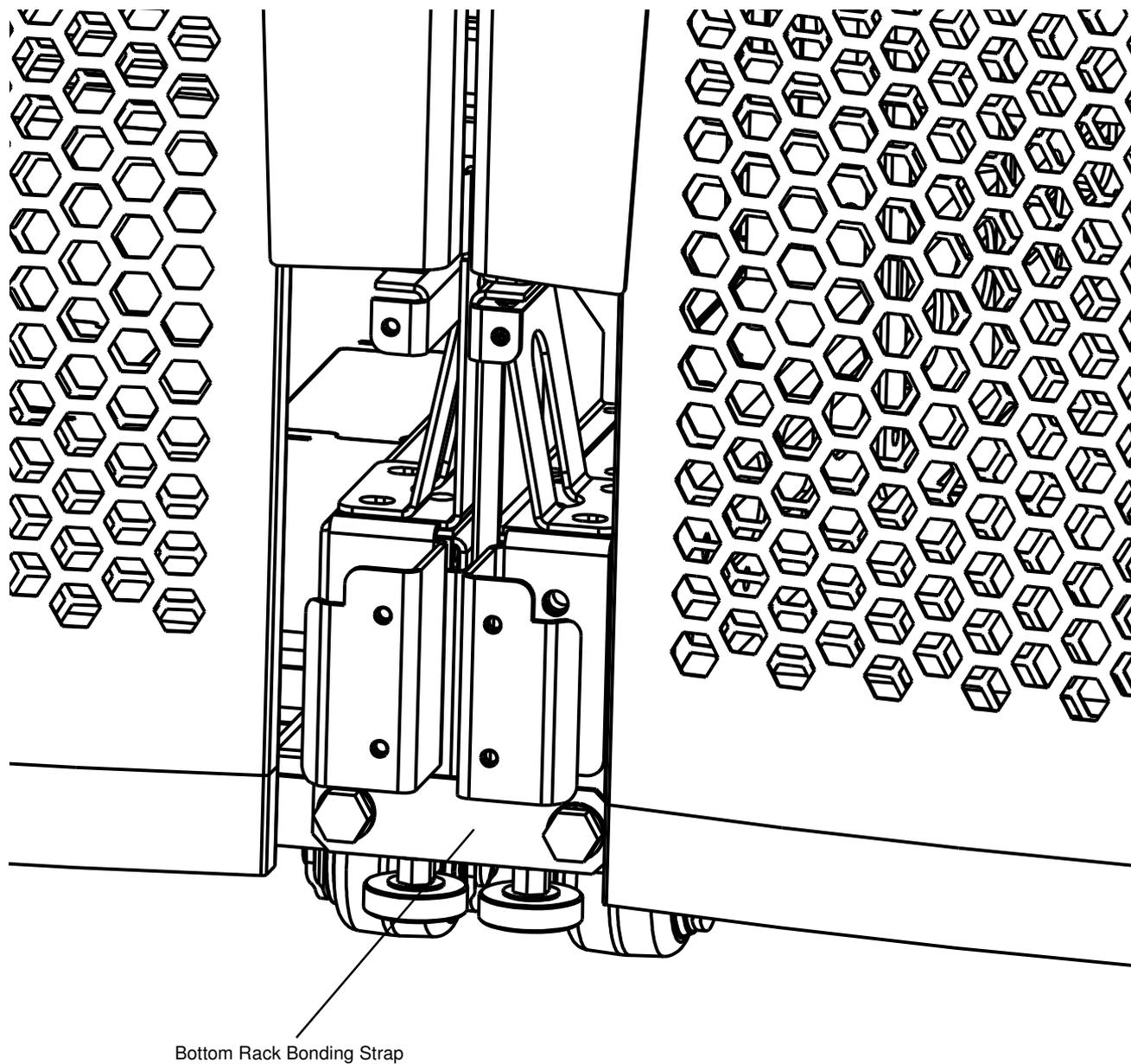
**Figure 3-7** Rack Spacing

## Rack Bonding Straps

Top and bottom rack bonding straps are used between racks to secure the racks together for increased stability and proper grounding. (Refer to Figure 3-8 and Figure 3-9.)



**Figure 3-8** Rack Bonding Straps – Top of Rack



**Figure 3-9** Rack Bonding Strap – Bottom of Rack

# System Specifications

**Table 3-1** SGI ICE X System Specifications

Characteristic	Specification	
	Air-cooled Configuration	Water-cooled Configuration
<b>Mechanical Requirements</b>		
Maximum rack dimensions:		
Height	83.20 in (2,089 mm) <sup>a</sup>	83.20 in (2,089 mm) <sup>a</sup>
Width	25.75 in (654 mm)	25.75 in (654 mm)
Depth	49.52 in (1,258 mm)	54.85 in (1,393 mm)
Maximum shipping dimensions:		
Wooden shipping container:		
Height	88.88 in (2,258 mm)	88.88 in (2,257 mm)
Width	44.00 in (1,118 mm)	44.00 in (1,118 mm)
Depth	62.75 in (1,594 mm)	62.75 in (1,594 mm)
Weight	470 lbs (213.19 kg)	470 lbs (213.19 kg)
Cardboard shipping container:		
Height	81.38 in (2,067 mm)	Water-cooled configurations are not shipped in cardboard shipping containers.
Width	44.00 in (1,118 mm)	
Depth	66.00 in (1,600 mm)	
Weight	TBD	
Weight (maximum while operating):		
Compute rack	1,874 lbs (850 kg)	2,062 lbs (935 kg)
Shipping weight (maximum):		
Compute rack	2,344 lbs (1,063 kg)	2,532 lbs (1,148 kg)
Access requirements:		
Front	48.00 in (1,219 mm)	48.00 in (1,219 mm)
Rear	48.00 in (1,219 mm)	48.00 in (1,219 mm)
Top	18.00 in (457 mm)	18.00 in (457 mm)
Side	None	None

**Table 3-1** SGI ICE X System Specifications (continued)

Characteristic	Specification	
	Air-cooled Configuration	Water-cooled Configuration
<b>Mechanical Requirements (cont.)</b>		
Vibration:		
Non-operational (sine sweep)	3-200-3 Hz, 0.5g @ 1octave/min (vertical orientation)	3-200-3 Hz, 0.5g @ 1octave/min (vertical orientation)
Operational (sine sweep)	5-500-5 Hz, 0.25g @ 1octave/min (vertical orientation)	5-500-5 Hz, 0.25g @ 1octave/min (vertical orientation)
<b>Electrical Requirements</b>		
Three-phase options:		
208 VAC or 400 VAC	180 to 264 VAC (North America/Japan) 312 to 440 VAC (International)	180 to 264 VAC (North America/Japan) 312 to 440 VAC (International)
480 VAC	456 to 504 VAC (North America/Japan) N/A (International)	456 to 504 VAC (North America/Japan) N/A (International)
Frequency:	47 - 63 Hz	47 - 63 Hz
Power requirements, fully configured rack	34.58 kVA (33.89 kW) (maximum) 29.41 kVA (30.01 kW) (typical <sup>b</sup> )	34.58 kVA (33.89 kW) (maximum) 30.53 kVA (29.92 kW) (typical <sup>b</sup> )
Hold-up time	16 ms	16 ms
Power cable	8 ft (2.4 m) pluggable drop cords	8 ft (2.4 m) pluggable drop cords
Power receptacles:		
Compute rack (three-phase options): 208 VAC or 400 VAC	Two IEC60309, 60 A (North America/Japan) Two IEC60309, 32 A (International)	Two IEC60309, 60 A (North America/Japan) Two IEC60309, 32 A (International)
480 VAC	One IEC60309, 60 A (North America/Japan) N/A (International)	One IEC60309, 60 A (North America/Japan) N/A (International)
Wall breaker size:		
Three-phase (North America/Japan)	60 A	60 A
Three-phase (Europe)	32 A	32 A
Total harmonic distortion (THD)	Less than 10% at full load	Less than 10% at full load

**Table 3-1** SGI ICE X System Specifications **(continued)**

Characteristic	Specification	
	Air-cooled Configuration	Water-cooled Configuration
<b>Environmental Requirements</b>		
Non-operating environment:		
Temperature	-40 to 140 °F (-40 to +60 °C)	-40 to 140 °F (-40 to +60 °C)
Humidity	8% to 95% non-condensing	8% to 95% non-condensing
Altitude	40,000 ft. (12,192 m) max.	40,000 ft. (12,192 m) max.
Operating environment:	Refer to Table 3-2 for the air-cooled rack environmental requirements.	Refer to Table 3-3 for the water-cooled rack environmental requirements.
Acoustical noise level (maximum)	TBD	TBD
Heat dissipation to air (maximum)	115.63 kBTU/hr (9.64 tons) (maximum)	10% of total power load (maximum)
Compute rack	100.35 kBTU/hr (8.36 tons) (typical <sup>b</sup> )	5% of total power load (typical <sup>b</sup> )
Cooling requirement (Ambient air or water-cooled)	Refer to “Air-cooled Environmental Specifications” on page 44.	Refer to “Water-cooled Environmental Specifications” on page 45.
Airflow (intake, front; exhaust, rear)	4,800 CFM (2.26 m <sup>3</sup> /hr) (maximum) 3,200 CFM (1.51 m <sup>3</sup> /hr) (typical <sup>b</sup> )	4,000 CFM (1.88 m <sup>3</sup> /hr) (maximum) 2,400 CFM (1.13 m <sup>3</sup> /hr) (typical <sup>b</sup> )

a. The height can be reduced to 79.75 in (2,000 mm) for shipping purposes.

b. Typical power/cooling is based on a system running the Linpack benchmark with 144 130W processors, 4,608GB memory (using 8GB DIMMs), and four standard switch blades.

## Air-cooled Environmental Specifications

Table 3-2 lists the maximum operating environmental specifications for an air-cooled SGI ICE X server.

**Table 3-2** Air-cooled System Environmental Requirements

Characteristic	Specification
<b>Maximum Environmental Requirements</b>	
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)
<b>Optimal Environmental Requirements</b>	
Humidity	45% to 55% non-condensing 45% (optimum) Rate of change must not exceed 10% relative humidity/hour
Operating environment:	
Air temperature	64 to 81 °F (17.8 to 27.2 °C) 72 °F (22.2 °C) (optimum)

## 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 3-2. Table 3-2 lists the maximum operating environmental specifications for an water-cooled SGI ICE X server and the optimal specifications.

**Table 3-3** Water-cooled System Environmental Requirements

Characteristic	Specification
<b>Maximum Environmental Requirements</b>	
Humidity	20% to 80% 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 °C/hour)
<b>Optimal Environmental Requirements</b>	
Humidity	42 °F (5.5 °C) dewpoint to 60% relative humidity and 59 °F (15 °C) dewpoint, non-condensing <sup>a</sup> 45% (optimum) Rate of change must not exceed 10% relative humidity/hour
Operating environment:	
Air temperature	64 to 81 °F (17.8 to 27.2 °C) 72 °F (22.2 °C) (optimum)

a. Based on the ASHRAE® TC 9.9 2011 thermal guidelines

## Shock and Vibration

The vibration specifications for a functional 42U rack system with one blade enclosure pair 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

## Layouts and Clearances

The following illustrations show the overall dimensions and required service clearances for air-cooled and water-cooled SGI ICE X system configurations:

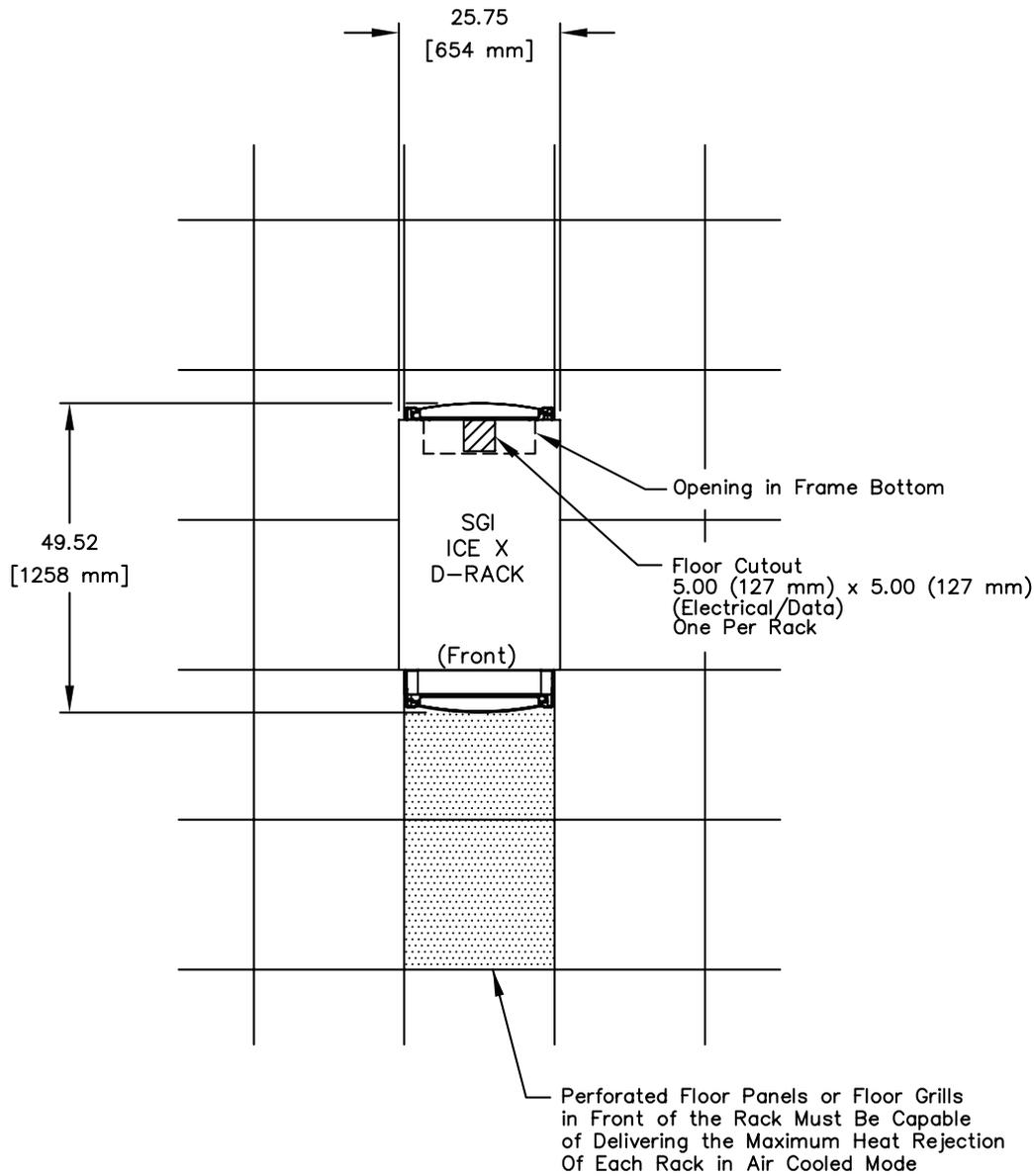
- Single Air-cooled Rack Floor Layout (Shown on 24-in by 24-in Grid), on page 48
- Air-cooled Rack Floor Layout - Four Racks (Shown on 24-in by 24-in Grid), on page 49
- Single Water-cooled Rack Floor Layout (Shown on 24-in by 24-in Grid), on page 50
- Water-cooled Rack Floor Layout - Four Racks (Shown on 24-in by 24-in Grid), on page 51
- Service Clearance Requirements (Shown on 24-in by 24-in Grid), on page 52
- Seismic Tiedown Locations, on page 53

If necessary, contact SGI site planning for site planning consultation by telephone at +1 715 726 2820, by fax at +1 715 726 2969, or by e-mail at [site@sgi.com](mailto:site@sgi.com).

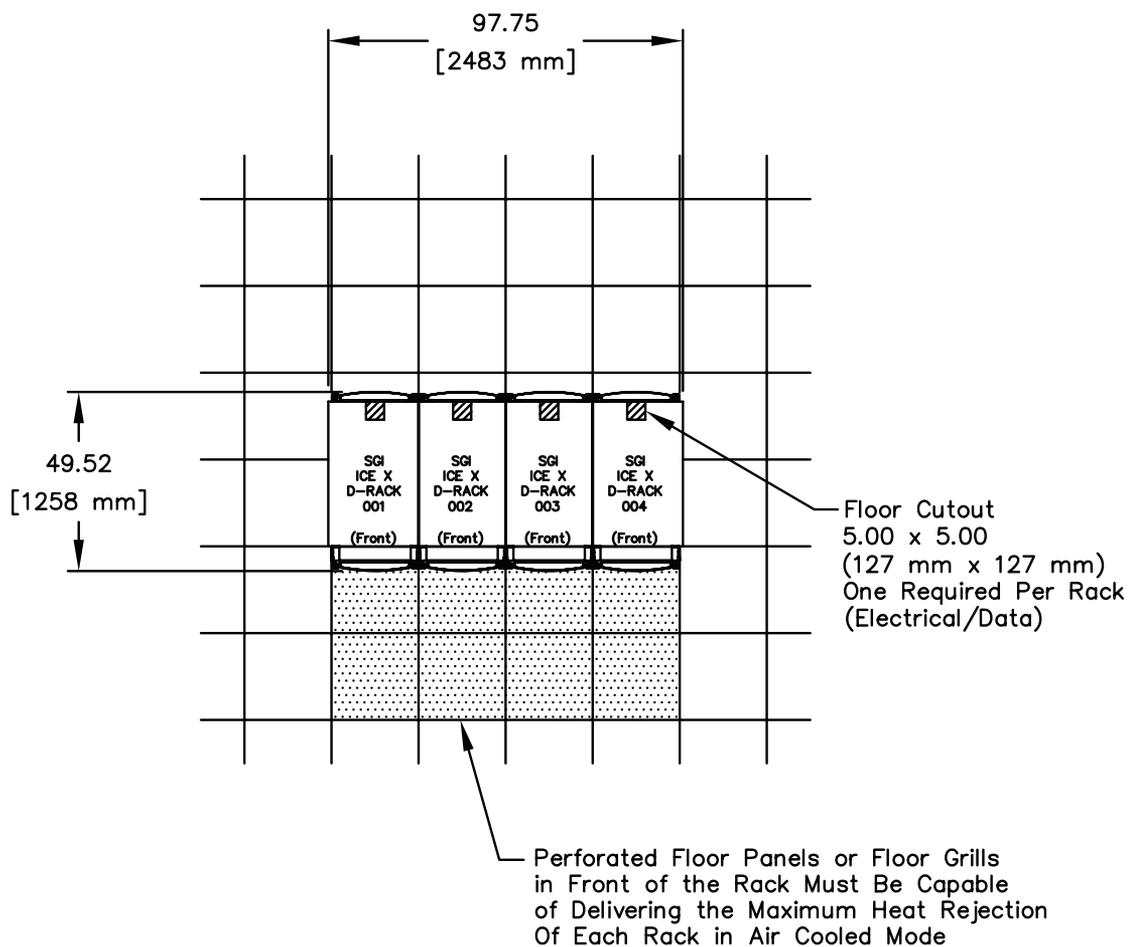
### General Recommendations

- Systems that are installed on raised-floor panels require 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 ICE X server rack for an additional supply of cooling air.
- If your system is using the water-cooled option, ensure that the water shut-off valves are located in an area that is easily accessible by service personnel.
- In areas that are prone to earthquakes, secure each SGI ICE X 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 4-6).
- Each rack in the system should be secured with rack bonding straps as shown in Figure 3-8 on page 39 and Figure 3-9 on page 40 for increased stability and proper grounding.

## Air-cooled Rack Layout

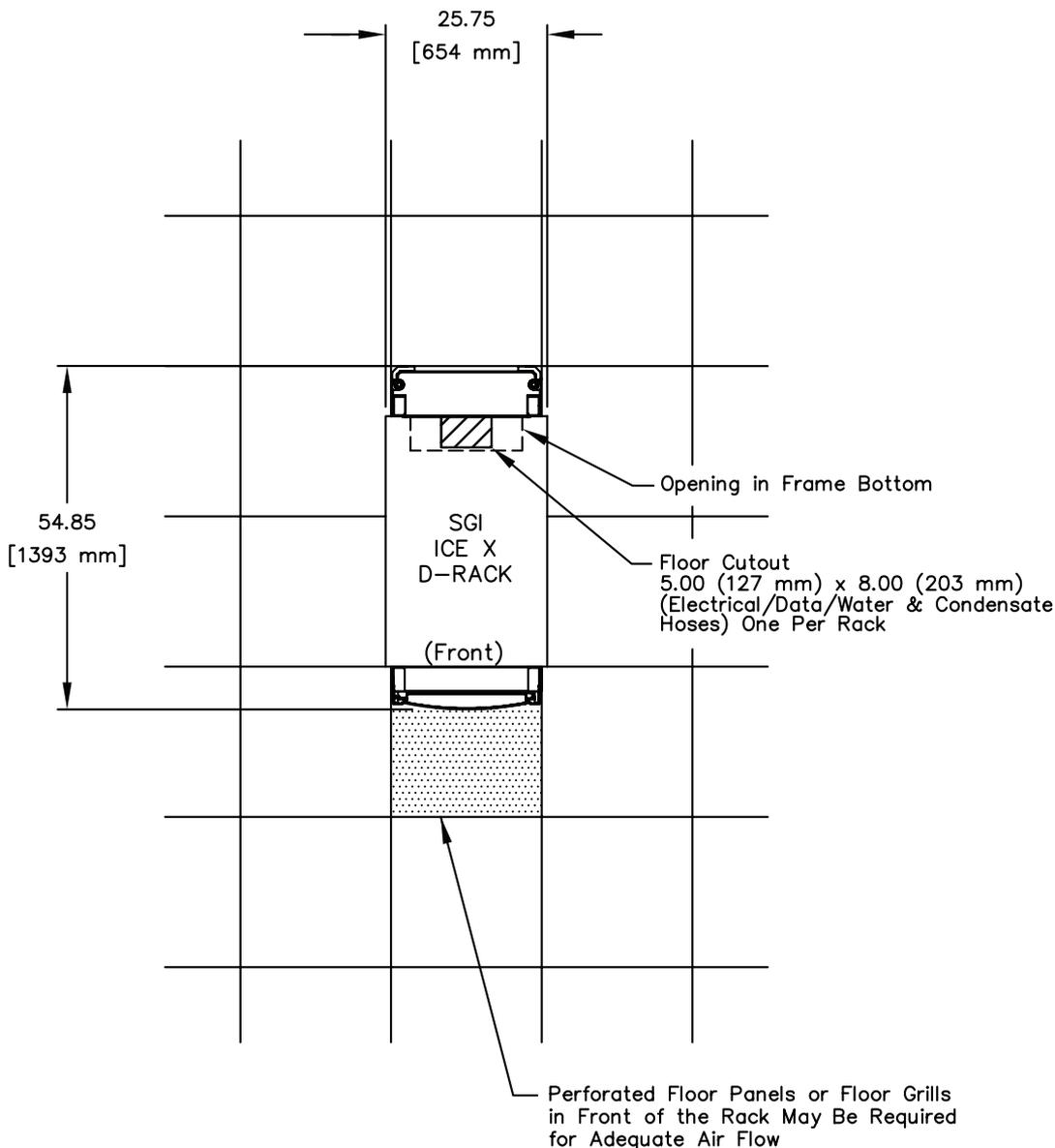


**Figure 4-1** Single Air-cooled Rack Floor Layout (Shown on 24-in by 24-in Grid)

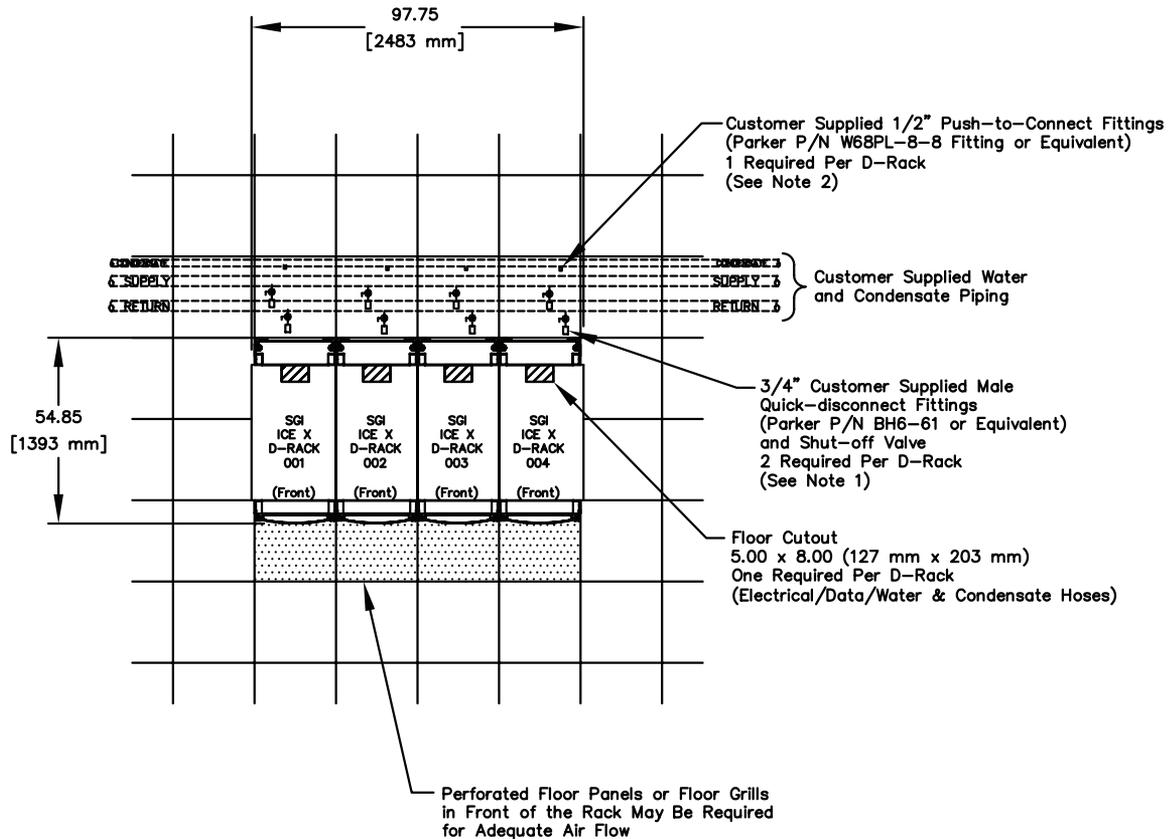


**Figure 4-2** Air-cooled Rack Floor Layout - Four Racks (Shown on 24-in by 24-in Grid)

### Water-cooled Rack Layout



**Figure 4-3** Single Water-cooled Rack Floor Layout (Shown on 24-in by 24-in Grid)



## Notes:

- 1) Customer Must Supply Two Male Quick-Disconnect Nipples Listed Below per D-Rack to be Located Within 4 Ft (1.2 M) of Each Associated D-Rack Floor Cutout. SGI Provides Two 13 Ft (3.9 M) Long, 3/4 Inch Flexible Rubber Water Hoses with Equivalent Female Quick-Disconnect Couplings to Make this Connection.

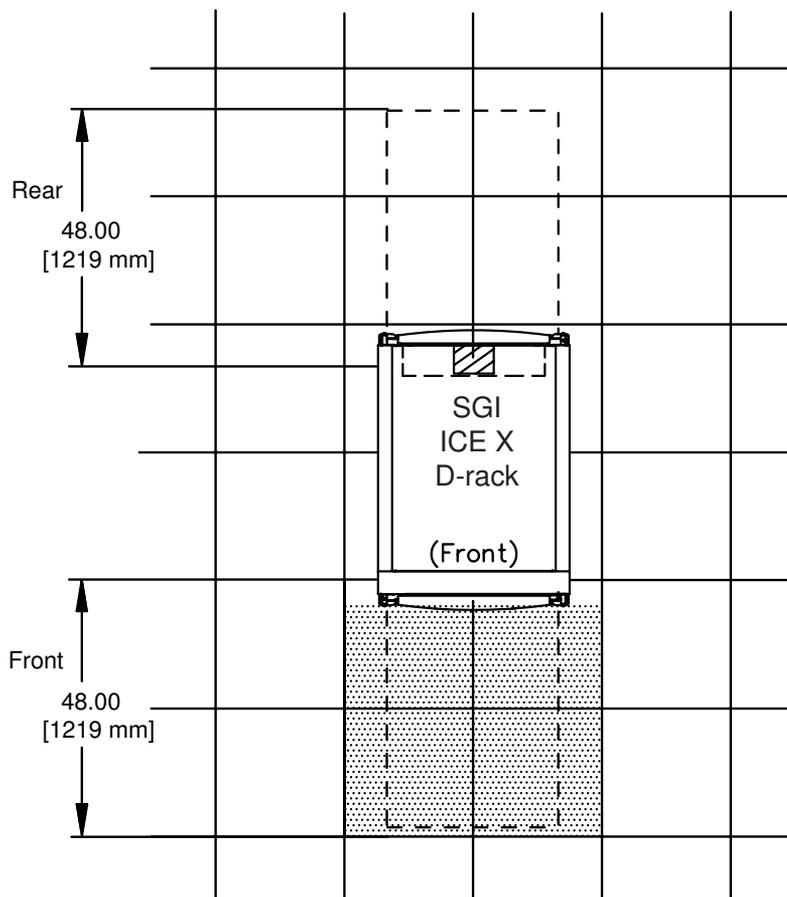
Customer Provided Equivalent Male Quick-Disconnect Nipples:

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

- 2) Customer Supplied Push-to-Connect Fittings to be Located Within 4 FT (1.2 M) of Associated D-Rack Floor Cutout. SGI Provides One 6 FT (1.8 M) Long, 1/2" (12.7mm) O.D., 3/8" (9.5mm) I.D. Flexible Nylon Condensate Hose for Each D-Rack. Customer to Provide One Parker P/N W68PL-8-8, 1/2" Male NPTF Push-to-Connect Fitting or Equivalent per D-Rack to Make this Connection.

**Figure 4-4** Water-cooled Rack Floor Layout - Four Racks (Shown on 24-in by 24-in Grid)

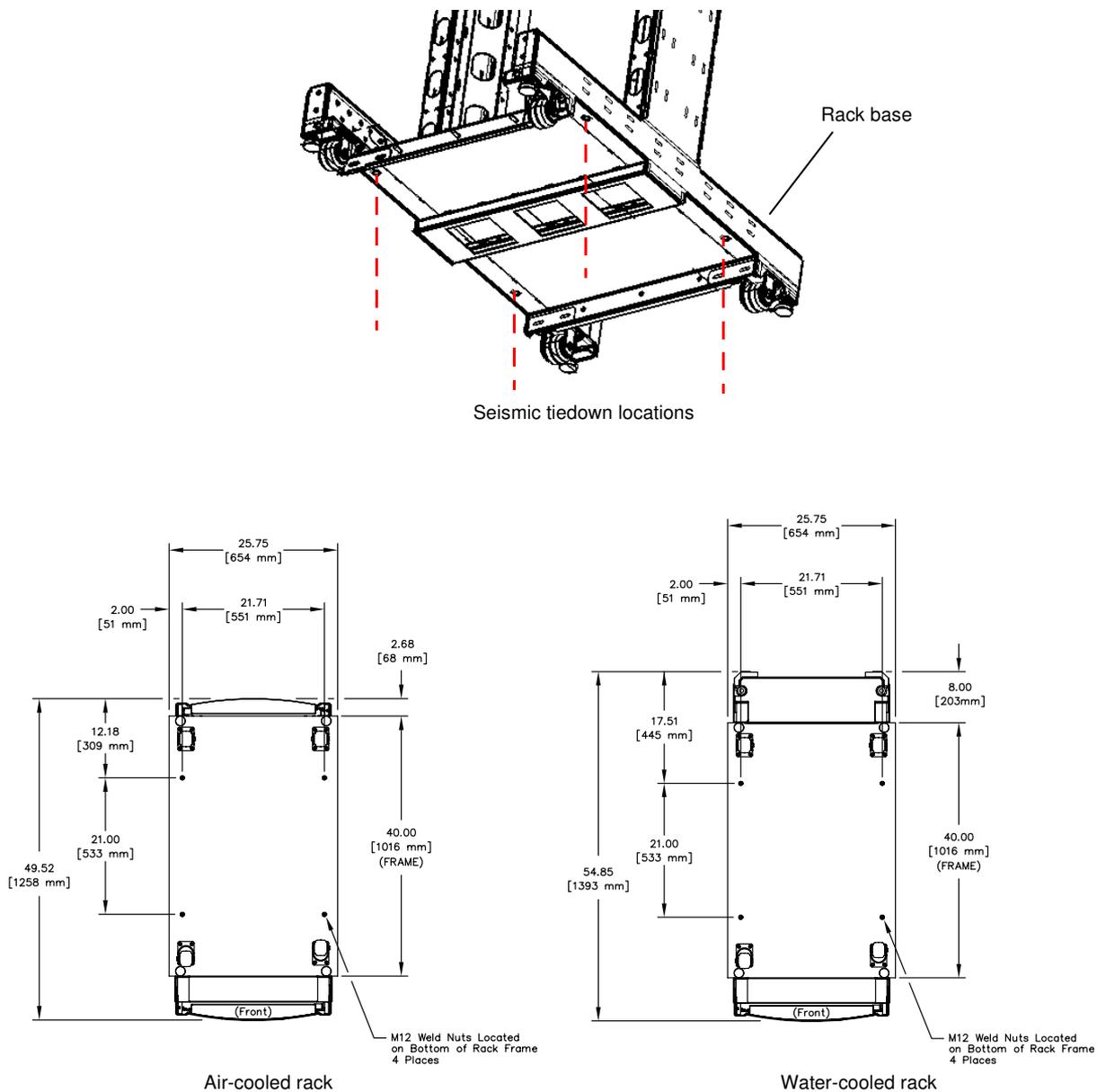
## Service Clearance Requirements



**Figure 4-5** Service Clearance Requirements (Shown on 24-in by 24-in Grid)

## Seismic Tiedowns

In areas that are prone to earthquakes, you should secure each SGI ICE X 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 4-6.



**Figure 4-6** Seismic Tiedown Locations



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## Site Planning Checklist

Table 5-1 and Table 5-2 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 5-1** 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?	

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**Table 5-1** 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 3-1 on page 41?	
		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?	
		<a href="http://www.hpctraining.com">http://www.hpctraining.com</a> hpctraining@sgi.com	

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**Table 5-2** Water-cooled Option Site Planning Checklist

<b>Yes</b>	<b>No</b>	<b>Planning Issue</b>	<b>Comments</b>
		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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