Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router Site Planning Guide

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CONTENTS

Preface

This *site planning guide* describes how to plan and prepare your site facilities for the installation of a Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced router (also referred to in this document as the "Cisco CRS 8-slot LCC Enhanced router"). The guide provides a brief description of the chassis and its components, and basic site facilities requirements.

This guide describes all power, cooling, and environmental specifications to consider before ordering and installing the Cisco CRS 8-slot LCC Enhanced router. This guide also describes site facilities requirements, such as floor space, weight requirements, receiving and staging, and installation information to help you plan the site where the routing system will be installed.

Note The installation of a Cisco CRS 8-Slot Line Card Chassis Enhanced router may require space, floor loading, power, and cooling modifications to a facility; therefore, you should plan the site well in advance of the scheduled delivery of the system.

Audience

This guide is for customers who must plan the facilities for the site where the Cisco CRS 8-Slot Line Card Chassis Enhanced router is to be installed. It should be used with Cisco Systems site planning coordinators and site inspections, well in advance of the delivery of the routing system.

Document Organization

This guide contains the following chapters and appendixes:

- Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router Overview, on page 1 provides an overview of the routing system and its main components.
- Power and Cooling, on page 9 provides an overview of the chassis power and cooling systems, and describes the power and grounding requirements for the routing system.
- Technical and Environmental Specifications, on page 27 provides technical and environmental specifications.
- Site Planning Considerations, on page 39 describes the site facilities requirements to plan for before you receive and install the routing system.
- Preliminary Site Survey, on page 49 provides checklists for the site preparation process.
- Product IDs for the Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router, on page 53 provides information about how to order the Cisco CRS 8-Slot Line Card Chassis Enhanced router components.

Documentation Conventions

This document uses the following conventions:

Convention	Description
bold font	Commands and keywords and user-entered text appear in **bold** font.
Italic font	Document titles, new or emphasized terms, and arguments for which you supply values are in *italic* font.
[ ]	Elements in square brackets are optional.
{x | y | z}	Required alternative keywords are grouped in braces and separated by vertical bars.
[x | y | z]	Optional alternative keywords are grouped in brackets and separated by vertical bars.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
`courier` font	Terminal sessions and information the system displays appear in `courier` font.
	Indicates a variable for which you supply values, in context where italics cannot be used.
< >	Nonprinting characters such as passwords are in angle brackets.
[ ]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

Note *Means reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.

Tip *Means the following information will help you solve a problem*. The tips information might not be troubleshooting or even an action, but could be useful information, similar to a Timesaver.

Caution *Means reader be careful*. In this situation, you might perform an action that could result in equipment damage or loss of data.

Warning IMPORTANT SAFETY INSTRUCTIONS

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device.

SAVE THESE INSTRUCTIONS

Warning Statements using this symbol are provided for additional information and to comply with regulatory and customer requirements.

Related Cisco CRS Documentation

For a complete listing of Cisco CRS 8-Slot Line Card Chassis Enhanced router planning, installation, and configuration documents, see the following publications:

- Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router System Description
- Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router Installation Guide
- Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router Unpacking, Moving, and Securing Guide
- Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide
- Cisco Carrier Routing System Hardware Documentation Revision Roadmap
- Cisco CRS-1 Carrier Routing System to Cisco CRS-3 Carrier Routing System Migration Guide
- Cisco CRS Carrier Routing System Regulatory Compliance and Safety Information

See the Obtaining Documentation and Submitting a Service Request, on page viii for information on obtaining these and other publications.

Changes to This Document

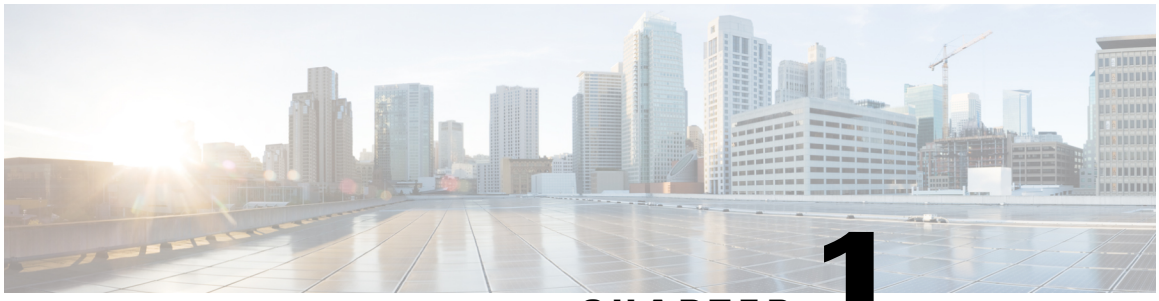
Table 1: Changes to This Document

Date	Change Summary
January 2014	Added updates to support the Cisco CRS-X, which includes new line cards, switch fabric cards, and PLIMs.
September 2013	Added updates to support new fan tray.
May 2012	Added corrections based on installation process changes.
January 2012	Initial release of this document. This document introduces the Cisco CRS 8-Slot Line Card Chassis Enhanced router. The Cisco CRS 8-Slot Line Card Chassis Enhanced router includes the following new features: • The mid plane on the Cisco CRS 8-Slot Line Card Chassis Enhanced router is redesigned to support 400G per slot. • The Cisco CRS 8-Slot Line Card Chassis Enhanced router has its own power and cooling subsystems. • A new power shelf with an upgraded 70 Amp circuit breaker has been introduced for the new Cisco CRS 8-Slot Line Card Chassis Enhanced router. • The Cisco CRS 8-Slot Line Card Chassis Enhanced router removes the zone circuit breaker and thus, eliminates the need to configure power-zoning.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see *What's New in Cisco Product Documentation*, at: http://www.cisco.com/c/en/us/td/docs/general/whatsnew/whatsnew.html.

Subscribe to *What's New in Cisco Product Documentation*, which lists all new and revised Cisco technical documentation as an RSS feed and delivers content directly to your desktop using a reader application. The RSS feeds are a free service.



CHAPTER 1

Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router Overview

This chapter describes the Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced router and its main components, and provides an overview of the installation process.

Note The installation of a Cisco CRS 8-Slot Line Card Chassis Enhanced router may require space, floor loading, power, and cooling modifications to a facility; therefore, you should plan the site well in advance of the scheduled delivery of the system.

The Cisco CRS Carrier Routing System replaces much of the equipment in service provider points of presence (POPs) today. The routing systems are built around a scalable, distributed three-stage switch fabric and a variety of line card (packet) interfaces. These packet interfaces are located on modular services cards (MSCs) or forwarding processors (FP) and their associated physical layer interface modules (PLIMs), which are effectively cross-connected to each other through the switch fabric.

The Cisco CRS 8-Slot Line Card Chassis Enhanced router is a half-height, rack-mounted 8-slot version of the 16-slot chassis. It is a highly scalable routing system that provides up to 6.4 terabits per second (Tbps) of routing capacity and supports up to 8 MSCs or FPs. (A terabit is 1 x 1012 bits or 1,000 Gigabits.) The chassis installs in a 19-inch equipment rack.

The Cisco CRS 8-Slot Line Card Chassis Enhanced router can be installed in colocation facilities, data centers, and many Tier II and Tier III locations. The routing system consists of a single rack-mounted chassis that contains the following system components:

- Modular services cards (MSCs) or forwarding processors (FP), also called line cards (up to eight)
- Physical layer interface modules, or PLIMs (eight, one for each MSC or FP)
- Route processor (RP) cards (up to two) or performance route processor (PRP) cards (up to two)
- Switch fabric cards (SFCs) (four required)
- A chassis midplane that connects MSCs or FPs to their PLIMs and to switch fabric cards

The Cisco CRS 8-Slot Line Card Chassis Enhanced router has its own power and cooling subsystems. The Cisco CRS 8-Slot Line Card Chassis Enhanced router can use either AC or DC power.

The mid plane on the Cisco CRS 8-Slot Line Card Chassis Enhanced router is redesigned to support 400G per slot.

The Cisco CRS 8-Slot Line Card Chassis Enhanced router supports 40G, 140G, and 400G fabric cards, as follows:

- The Cisco CRS-1 Carrier Routing System uses fabric cards designed for 40 G operation (CRS-16-FC/S or CRS-16-FC/M cards).
- The Cisco CRS-3 Carrier Routing System uses fabric cards designed for 140G operation (CRS-16-FC140/S or CRS-16-FC140/M cards).
- The Cisco CRS-X Carrier Routing Sytsem uses fabric cards designed for 400G operation (CRS-16-FC400/S cards).

A mixture of 40G, 140G, and 400G fabric cards is not supported except during migration.

Note Throughout this document, the generic term Cisco CRS Carrier Routing system refers to the Cisco CRS-1, Cisco CRS-3, and Cisco CRS-X Carrier Routing Systems, unless otherwise specified.

- The Cisco CRS 8-Slot Line Card Chassis Enhanced Router, page 2
- Overview of Site Planning Steps, page 7

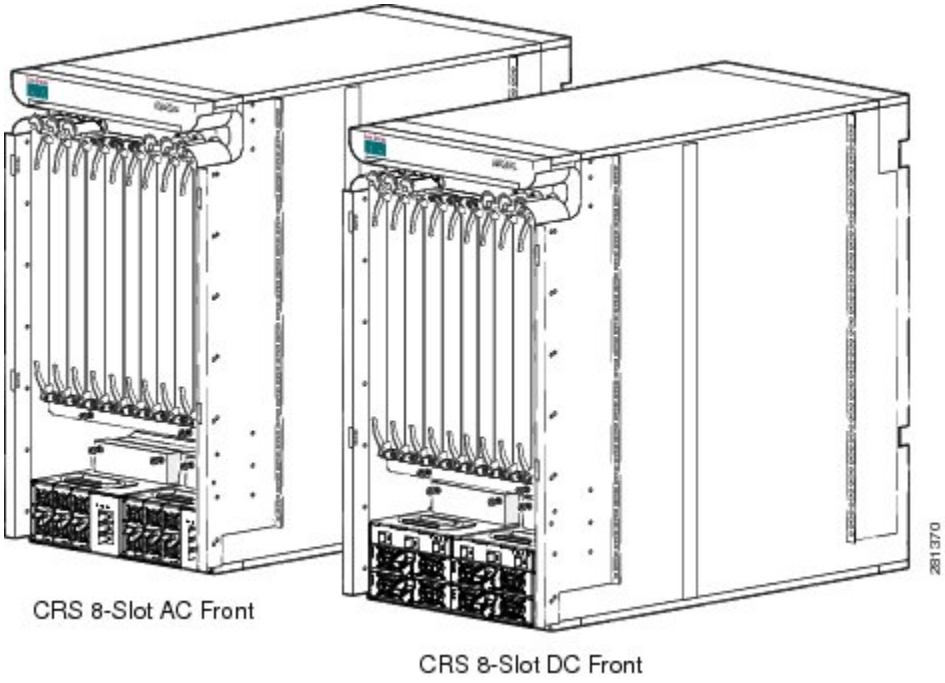
The Cisco CRS 8-Slot Line Card Chassis Enhanced Router

The Cisco CRS 8-Slot Line Card Chassis Enhanced router is the main component of the Cisco CRS Carrier Routing System. The chassis is a mechanical enclosure that contains a chassis midplane. The midplane holds the system modular services cards (MSCs) and forwarding processor (FP) cards, their associated physical layer interface modules (PLIMs), and switch fabric cards (SFCs). The Cisco CRS 8-Slot Line Card Chassis Enhanced router contains its own power system. See the Chassis Power System, on page 9 section for more information. The chassis is mounted in a 19-inch equipment rack.

This section describes the main components of the Cisco CRS 8-Slot Line Card Chassis Enhanced router. It primarily identifies the components that are considered field-replaceable units (FRUs), but where additional detail is useful, identifies subassemblies that are not field replaceable.

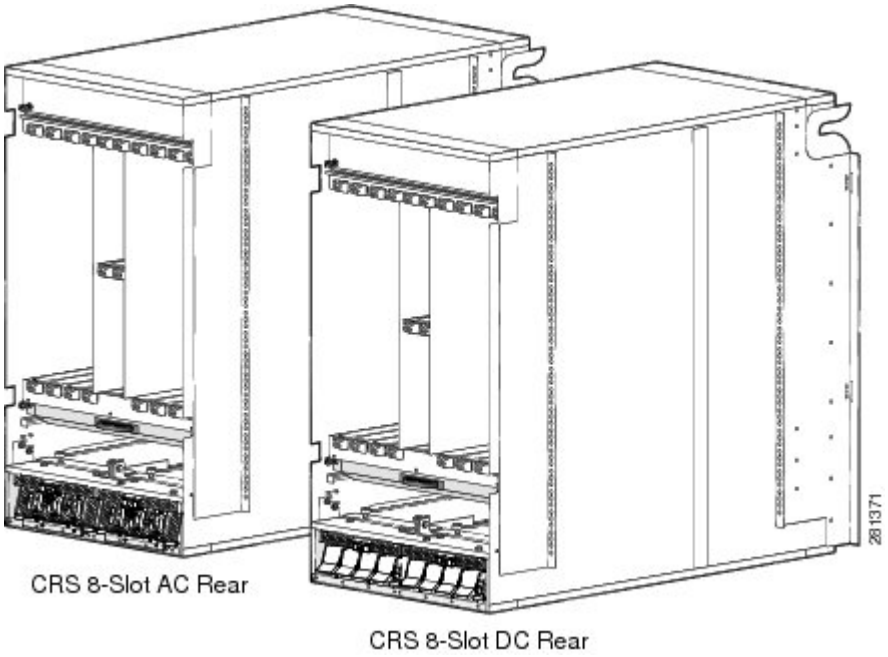
The following figure shows the front view of a Cisco CRS 8-Slot Line Card Chassis Enhanced router with an AC and a DC modular configuration power supply installed.

Figure 1: Front View of the Cisco CRS 8-Slot Line Card Chassis Enhanced Router—Modular Configuration Power Shown



The following figure shows the rear view of a Cisco CRS 8-Slot Line Card Chassis Enhanced router with an AC and a DC modular configuration power supply installed.

Figure 2: Rear View of the Cisco CRS 8-Slot Line Card Chassis Enhanced Router—Modular Configuration Shown



Chassis Components

The Cisco CRS 8-Slot Line Card Chassis Enhanced router contains the following components:

- As many as eight modular services cards (MSCs) or forwarding processor (FP) cards (both types are also called line cards), and eight physical layer interface modules (PLIMs). The MSC or FP and PLIM are an associated pair of cards that mate through the chassis midplane. The MSC or FP provides the forwarding engine for Layer 3 routing of user data, and the PLIM provides the physical interface and connectors for the user data.

Each MSC or FP can be associated with several different PLIMs, which provide different interface speeds and technologies. Some of the available PLIMs are:

Note For a complete list of available PLIMs, consult your Cisco sales representative or visit: http://www.cisco.com

-
  - 1-port OC-768c/STM-256c or STS-768 packet-over-SONET (POS). Available with short-reach (SR) optics.
  - 4-port OC-192c/STM-64c or STS-192 POS/DPT. Available with long-reach (LR), intermediate-reach (IR), short-reach (SR), and very-short-reach (VSR) optics.

- OC-48c/STM-16c or STS-48 POS/DPT, configurable with 1 to 16 ports. Available with long-reach (LR) and short-reach (SR) optics. This PLIM supports pluggable optics.
- 10-Gigabit Ethernet PLIMs (available with a variety of optics, including LR). These PLIMs support pluggable XENPAK and XFP optics, and can be configured with up to 20 ports, depending on the PLIM.
- 100-Gigabit Ethernet PLIM. This single-port PLIM supports a pluggable CFP optics module.
- Cisco CRS SPA Interface Processor-800. Occupies one PLIM slot on the Cisco CRS 8-Slot Line Card Chassis Enhanced router. Supports six normal-height SPAs or three double-height SPAs or any combination in between.

- Chassis midplane. The midplane connects MSCs to their associated PLIMs and allows an MSC to be removed from the chassis without having to disconnect the cables that are attached to the associated PLIM. The midplane distributes power, connects the MSCs to the switch fabric cards, and provides control plane interconnections. The midplane is not field replaceable by the customer.
- One or two route processor cards (RPs). The RPs provide the intelligence of the system by functioning as the LCC system controller and providing route processing. Only one RP is required for system operation. For redundant operation, you can order a second, redundant RP as an option (CRS-8-RP/R). When two RPs are used, only one RP is active at a time. The second RP acts as a "standby" RP, serving as a backup if the active RP fails.

The RP also monitors system alarms and controls the system fans. LEDS on the front panel indicate active alarm conditions.

A Performance Route Processor (PRP) is also available for the Cisco CRS 8-Slot Line Card Chassis Enhanced router. Two PRPs perform the same functions as two RPs, but provide enhanced performance for both route processing and system controller functionality.

Note A chassis may not be populated with a mix of RP and PRP cards. Both route processor cards should be of the same type (RP or PRP).

- Upper and lower fan trays. The fans pull cool air through the chassis. A removable air filter is located below the PLIM card cage at the front of the chassis. Each fan tray contains four fans.
- Four half-height switch fabric cards (SFCs). These cards provide the three-stage Benes switch fabric (S1/S2/S3) for the routing system. The switch fabric performs the cross-connect function of the routing system, connecting every MSC (and its associated PLIM) with every other MSC (and its associated PLIM) in the system.

The switch fabric receives user data from one MSC (or FP) and PLIM pair and performs the switching necessary to route the data to the appropriate egress MSC (or FP) and PLIM pair. The switch fabric is divided into eight planes that evenly distribute the traffic across the switch fabric. Each switch fabric card implements two planes of the switch fabric.

- A power system that provides redundant power to the chassis. Two types of power systems are available: either AC or DC power. The modular configuration power solution contains two power shelves with either up to four DC power modules (PMs) or up to three AC PMs per power shelf.

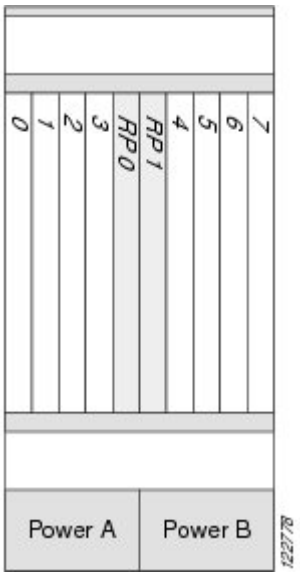
The PLIM side of the chassis is considered the front of the chassis, where user data cables attach to the PLIMs and cool air enters the chassis. The MSC side, which is where warm air is exhausted, is considered the rear of the chassis.

Chassis Slot Numbers

This section identifies the location and slot numbers for major cards and modules (primarily the field-replaceable units) that plug into the chassis.

The following figure shows the slot numbers on the front (PLIM) side of the Cisco CRS 8-Slot Line Card Chassis Enhanced router.

Figure 3: Cisco CRS 8-Slot Line Card Chassis Enhanced Router Slot Numbers—Front (PLIM) Side

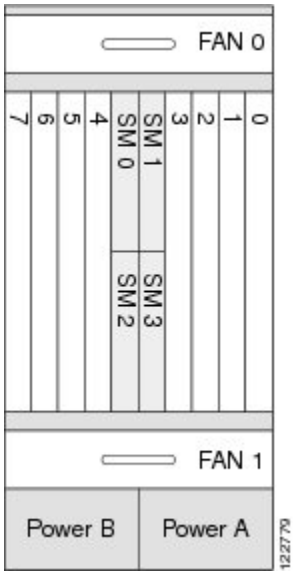


As shown, the front (PLIM) side of the chassis has the following card slots:

- Eight PLIM slots (left to right: 0, 1, 2, 3...4, 5, 6, 7)
- Two route processor card slots (RP0 and RP1)

The following figure shows the slot numbers on the rear (MSC) of the chassis.

Figure 4: Cisco CRS 8-Slot Line Card Chassis Enhanced Router Slot Numbers—Rear (MSC) Side



The rear (MSC) side of the chassis has the following card slots:

- Eight MSC slots (left to right: 7, 6, 5, 4...3, 2, 1, 0)
- Four half-height switch fabric card slots (SM0, SM1, SM2, and SM3)

The MSC slot numbers are reversed from the PLIM slot numbers on the other side of the chassis. Because an MSC mates with its associated PLIM through the midplane, MSC slot 0 is on the far right side of the chassis looking at it from the rear (MSC) side.

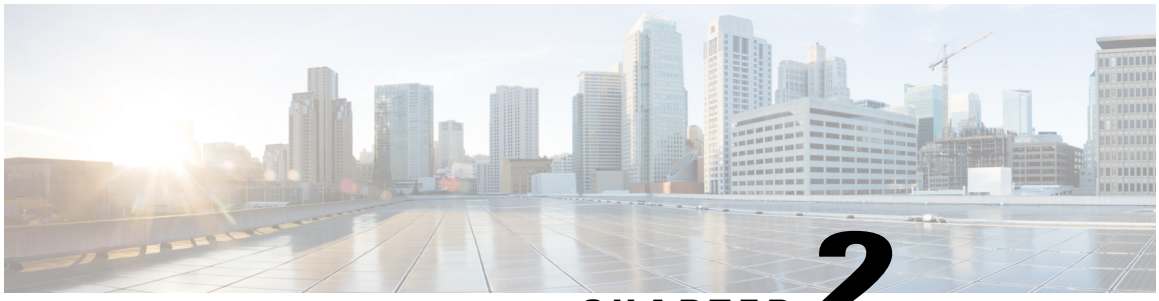
PLIM slot 0 is on the far left side of the chassis, looking at if from the front (PLIM) side. MSC slot 0 and PLIM slot 0 mate with each other through the midplane, and so do all other MSC and PLIM slots (0 through 7).

Overview of Site Planning Steps

The following table lists the sequence of tasks to perform as you plan the installation of the routing system. Use the table as a checklist for all aspects of the installation. For information about a particular task, see the appropriate section of this site planning guide. After completing the checklist, you should consult your Cisco installation coordinator for a site-readiness inspection

Table 2: Site Planning Checklist

Site Planning Steps	See	Check
1. Determine where to install the routing system and make sure that you have the appropriate installation and configuration tools.	Basic Site and Installation Planning, on page 39 section Tools Required for Installation, on page 40 section	
2. Consider equipment arrival, storage, and transport to the installation site.	Basic Site and Installation Planning, on page 39 section	
3. Make sure that the equipment rack meets the installation requirements.	Equipment Rack Specifications, on page 33 section Equipment Rack Considerations, on page 41 section	
4. Consider the space where the routing system will be installed.	Aisle Spacing and Maintenance Access Floor Plan, on page 43 section	
5. Plan for power (AC or DC).	Power and Cooling, on page 9 section Line Card Chassis Specifications, on page 27 section	
6. Consider cooling and airflow requirements.	Chassis Airflow, on page 23 section Facility Cooling Requirements, on page 24 section Environmental Specifications, on page 37 section	
7. Consider cable management.	Cable Management, on page 45 section	
8. Consider Cisco installation services.	Cisco Installation Services, on page 47 section	



CHAPTER 2

Power and Cooling

This chapter describes the Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced router power and cooling systems. It also provides the power, grounding, and cooling requirements for the installation site to help you plan the site facilities for the system. The Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router System Description provides detailed information about these components.

This chapter contains the following sections:

Chassis Power System

The chassis power system provides power to chassis components and is made up of two power shelves that contain power modules. Each power shelf is connected to a separate and independent power source. Input power enters the power shelves and is processed by the power modules before being distributed to the components in the chassis. At the shelf level, the power system provides 2N redundancy; the PMs themselves provide load-share redundancy.

The Cisco CRS 8-Slot Line Card Chassis Enhanced router can be either DC or AC powered. The AC power system requires single-phase AC input power to power the shelves. If you have 3-phase AC-Delta or AC-Wye at your equipment, a *Cisco CRS 3-Phase AC PDU* will be required to convert 3-phase AC input power to single-phase AC input power for the power shelf.

Note In an AC power system, PDU refers to the *Cisco CRS 3-phase AC PDU* which is required to convert 3-phase AC-Wye or AC-Delta input power to single-phase AC input power for the AC power shelf. For further information, refer to Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide .

Maximum input power requirements for the Cisco CRS 8-Slot Line Card Chassis Enhanced router are as follows:

- DC-powered chassis requires up to a maximum of 9,500 watts (9.5 kW) of DC input power when the chassis is fully loaded.
- AC-powered chassis requires up to a maximum of 9,800 watts (9.8 kW) of AC input power when the chassis is fully loaded.

Note If you have a *Cisco CRS 3-phase AC PDU* installed, three AC PMs are required to be installed in each AC power shelf to maintain a balanced 3-phase power load.

Note These power requirements are for a fully loaded chassis with eight PLIMs. A chassis with six or seven PLIMs uses slightly less power. However, it is a good idea to allocate this much power for each chassis to ensure that enough power is available for future system expansion.

See the Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router System Description for detailed information about how each power system operates and distributes power to components in the chassis.

General Power and Grounding Requirements

This section describes the power and grounding requirements you must consider when planning the site facilities for the routing system. In addition, see the DC Power System, on page 12 section or the AC Power Systems, on page 16 section for additional information about the power requirements for your chassis type.

Note A qualified electrician should review the information in these sections to ensure that the installation site meets these requirements. For larger system configurations, consult a facilities electrical expert to understand the load that the routing system may put on the facility power plant.

General power and grounding requirements are:

- Installation of the routing system must follow national and local electrical codes:
  - In the United States: United States National Fire Protection Association (NFPA) 70 and United States National Electrical Code (NEC).
  - In Canada: Canadian Electrical Code, part I, CSA C22.1.
  - In other countries: International Electrotechnical Commission (IEC) 60364, parts 1 through 7.
- Two separate and independent AC or DC power sources are needed to provide 2N redundancy for system power. Each power source requires its own circuit breaker.
- Each power source must provide clean power to the site. If necessary, install a power conditioner.
- The site must provide short-circuit (over-current) protection for devices.
- Proper grounding is required at the site to ensure that equipment is not damaged by lightning and power surges. In addition:

- Chassis grounding is required for AC and DC-powered systems.
- For AC-powered systems, a grounding-type AC power outlet is required.

- Site power planning must include the power requirements for any external terminals and test equipment you will use with your system.

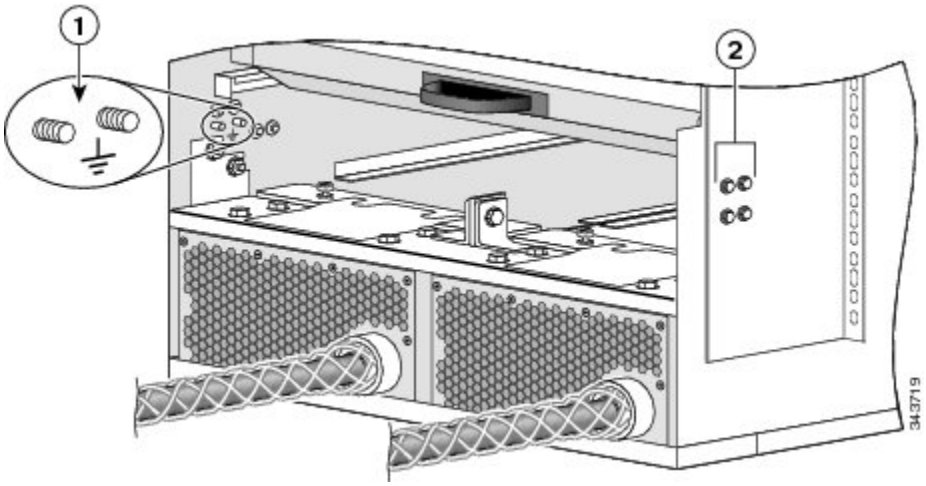
Note Be sure to review the safety warnings in *Regulatory Compliance and Safety Information for the Cisco CRS Carrier Routing System* before attempting to install the routing system.

Bonding and Grounding Guidelines

The chassis allows you to connect the central office ground system or interior equipment ground system to the bonding and grounding receptacles on the router chassis. Six chassis grounding points are provided at the rear (MSC) side of the chassis, as shown in the following figure. Each side of the chassis has one pair of threaded ground studs located on the inside of the chassis and two pairs of grounding receptacles located on the outside of the chassis. These ground points are also called the network equipment building system (NEBS) bonding and grounding points.

Note These bonding and grounding receptacles satisfy the Telcordia NEBS requirements for bonding and grounding connections.

Figure 5: NEBS Bonding and Grounding Points (Rear of Chassis)—DC Power Shown

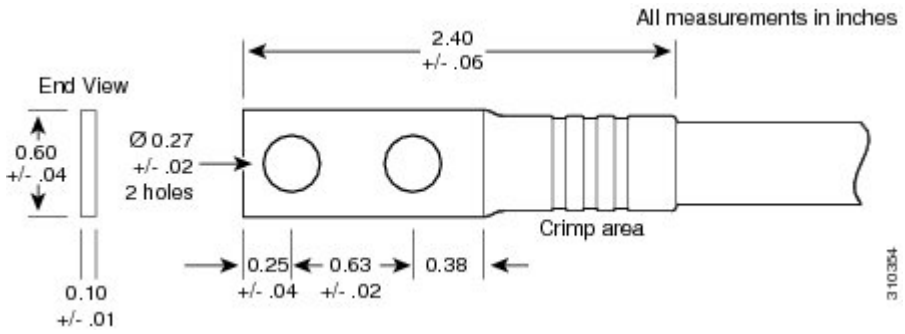


1	NEBS bonding and grounding points (inside chassis)
2	NEBS bonding and grounding points (outside chassis)

To connect the chassis to a NEBS-compliant bonding and grounding system at your site, you must have the following:

- One straight (180 degree) grounding lug that has two M6 bolt holes with 0.63 inches (1.60 cm) of spacing center to center between them and a 6-AWG or larger multistrand copper wire. See the following figure.

Figure 6: Straight (180-Degree) Chassis Ground Lug



- Four M6 hex-head nuts with integrated locking washers are shipped pre-installed on the inside of the chassis.
- Eight M6 hex-head bolts with integrated locking washers are shipped pre-installed on the outside of the chassis.
- Cisco recommends at least 6 AWG multistrand copper cable. This cable is not available from Cisco Systems; it is available from any commercial cable vendor. The cable should be sized according to local and national installation requirements.

Caution The DC Return of the Cisco CRS 8-Slot Line Card Chassis Enhanced router should remain isolated from the system frame and chassis (DC-I: Isolated DC Return).

For additional information about NEBS, see Cisco CRS Carrier Routing System Regulatory Compliance and Safety Information .

DC Power System

Each DC powered chassis contains two power shelves for 2N redundancy. The power shelves contain the input power connectors. Each shelf can contain up to four DC PMs. The power shelves and DC PMs are field replaceable.

DC Power Requirements

Observe the following guidelines for DC-powered shelves. In addition, be sure to review the requirements described in the Bonding and Grounding Guidelines, on page 11 section.

- A DC-powered chassis requires up to a maximum of 9,500 watts of DC input power when the chassis is fully loaded.

- Two separate and independent power sources are required for N+N redundancy, each providing nominal –48/-60 VDC, 60 A service (four inputs per shelf). The system will operate with power to only one shelf but will not have N+N redundancy.
- All power connection wiring must conform to the rules and regulations in the National Electrical Code (NEC) and any local codes. In addition, make sure that the wiring conforms to any internal requirements at the installation site.
- Each DC power source must comply with the safety extra-low voltage (SELV) requirements in UL 60950-1, CSA-C22.2 No. 60950-1, EN60950-1, AS/NZS 60950, and IEC60950-1.
- A DC-powered system should be installed in a restricted access area in accordance with the National Electric Code, ANSI/NFPA 70.
- All components in the area where DC input power is accessible must be properly insulated.
- If it is not possible to rely on the identification of the earthed conductor in the DC mains supply, whereby the equipment is not provided with a two-pole disconnect device, then a two-pole disconnect device is to be provided external to the equipment.

The following table lists the DC input current and voltage specifications.

Table 3: DC Input Current and Voltage Information

Nominal input voltage	–48 VDC North America–60 VDC European Community(range: –40 VDC to –72 VDC)
Input line current	50 A maximum at –48 VDC40 A maximum at –60 VDC60 A maximum at -40 VDC

DC Power Shelf Wiring

Each power shelf contains four pairs of double-stud terminals (RTN, –48V/–60V) for connecting DC input power. To provide 2N power redundancy, one power shelf should be connected to the central office “A” power bus and the other power shelf should be connected to the “B” power bus.

The requirements for the DC input power connections are as follows:

- Each power shelf requires up to four pairs of distribution cables, DC (–48) and RTN (+).
- Paired battery and RTN cables should have the same cable lengths and should run together for equalization.
- Use the appropriate wire gauge for –48/-60 VDC, 60 A service. We recommend that you use a commensurately rated, high-strand-count copper cable. This cable is not available from Cisco Systems; it is available from any commercial vendor.

Caution A certified electrician must select the appropriate DC input power cable based on standard electrical practices, such as derating factors, wiring type, operating temperatures, and so on. The electrician must verify that the cable complies with the National Electrical Code (NEC) and local codes and any guidelines in effect at the installation site. At minimum, DC input power cables must be 6-AWG or heavier and rated for 90°C (194°F) temperature or higher.

- Each DC input power cable is terminated at the power shelf by a cable lug. The power supply terminal block lug opening width is 0.63 inch (1.60 cm). The cable lug must be dual hole and able to fit over M6 terminal studs at 0.63-inch (1.60 cm) centers. We recommend that you use an appropriately sized 180-degree angle (straight) industry standard dual-hole, standard barrel compression lug, as shown in Figure 7: 180 Degree (Straight) DC Input Power Cable Lug, or an appropriately sized 45-degree angle

industry standard 2-hole, standard barrel compression lug, as shown in Figure 8: 45 Degree DC Input Power Cable Lug.

Figure 7: 180 Degree (Straight) DC Input Power Cable Lug

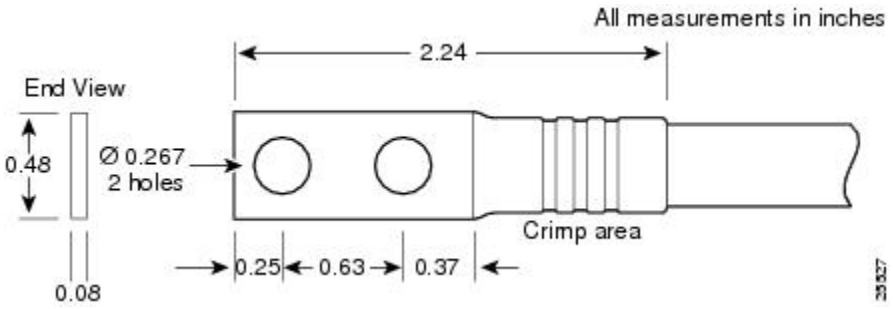
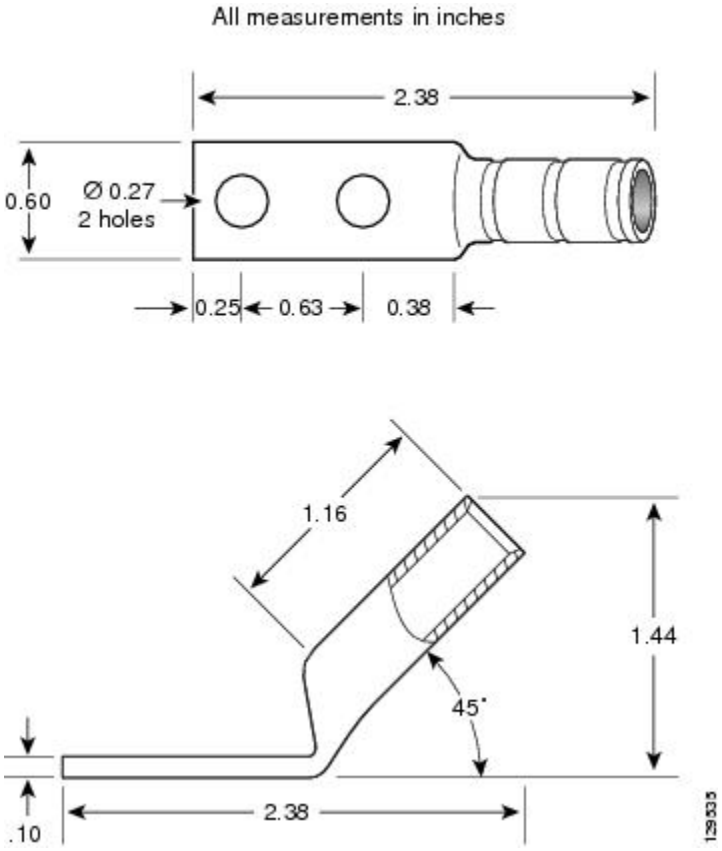


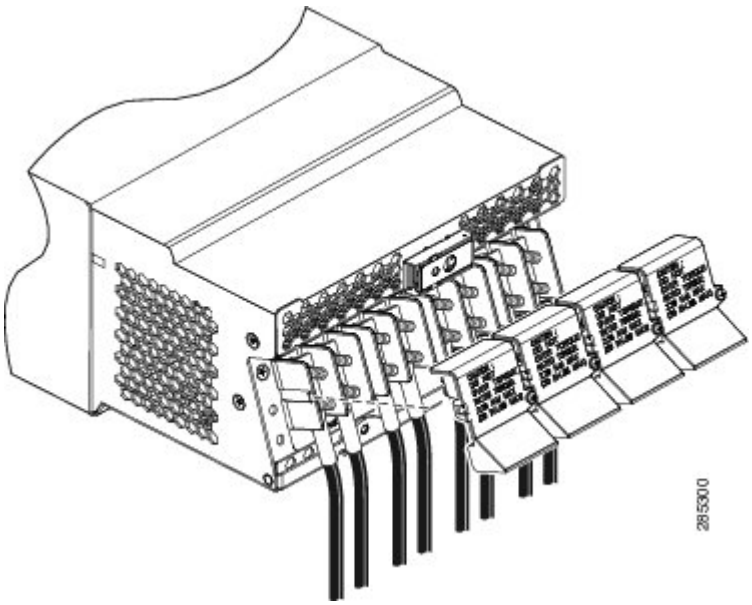
Figure 8: 45 Degree DC Input Power Cable Lug



Note Use local electrical codes for clearance requirements when using power lugs to ensure safe operation.

The following figure shows the DC input power cables connected to the DC power shelf terminal studs.

Figure 9: DC Power Shelf Power Cable Connections



Note In the DC power system, the power wire connectors have a torque value of 20 in-lb (2.26 N-m).

AC Power Systems

The chassis power system provides the necessary power for chassis components. Site power requirements differ, depending on the input source voltage available, i.e. single-phase AC, AC Delta or AC Wye.

Each AC powered chassis contains two AC power shelves for 2N redundancy. The power shelves contain the input power connectors. Each AC power shelf can contain up to three AC PMs. The power shelves and AC PMs are field replaceable.

AC Power Requirements

In addition to the requirements in the Bonding and Grounding Guidelines, on page 11 section, AC input power requirements are as follows:

- An AC-powered chassis requires up to a maximum of 9,800 watts of AC input power when the chassis is fully loaded.
- Two separate and independent AC power sources are required for N+N redundancy, one for each power shelf. Each power shelf should be connected to a different power source to provide 2N power redundancy in case a power source fails. The system will operate with power to only one shelf but will not have N+N redundancy.

- Each AC power source must provide single-phase AC power, and have its own circuit breaker.
- The AC power receptacles used to plug in the chassis must be the grounding type. The grounding conductors that connect to the receptacles should connect to protective earth ground at the service equipment.
- AC single-phase input:
  - Single-phase, 200 to 240 VAC nominal, 50 to 60 Hz, 16 A International and 20 A North America.
  - Each AC power shelf contains three IEC-320-C22 receptacles which can accept up to three IEC-320-C21 connector female plugs.
- If you have 3-phase AC Delta or AC Wye at your equipment, a *Cisco CRS 3-phase AC PDU* will be required to convert 3-phase AC input power to single-phase AC input power for the power shelf. For further information, refer to *Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide* .

Note If you have a *Cisco CRS 3-phase AC PDU* installed, three AC PMs are required to be installed in each AC power shelf to maintain a balanced 3-phase power load.

For detailed AC power specifications, see the Line Card Chassis Specifications, on page 27 section.

AC Power Shelf Wiring

The AC power shelf is shipped with AC power cords when the AC PDU is not ordered. Each AC power shelf accepts up to three power cords. Each AC power cord is 4.25 m in length and different plug types (pre-attached) are available, depending on the locale. AC power cords are available for the following locales:

- North America
- Europe
- United Kingdom
- Italy
- Australia

The following table lists the single-phase AC-input cord power options and Cisco product numbers for the Cisco CRS 8-Slot Line Card Chassis Enhanced router with AC power shelves installed. The table also references power cord illustrations.

Table 4: AC-Input Power Cord Options

Locale	Cisco Product Number	Plug Rating	Reference Illustration
North America	CRS-AC-CAB-NA(=)	20 A/250 VAC	Figure 10: North America—AC-Input Power Cord
Europe	CRS-AC-CAB-EU(=)	16 A/250 VAC	Figure 11: Europe—AC-Input Power Cord

Locale	Cisco Product Number	Plug Rating	Reference Illustration
United Kingdom	CRS-AC-CAB-UK(=)	13 A/250 VAC	Figure 12: United Kingdom— AC-Input Power Cord
Italy	CRS-AC-CAB-IT(=)	16 A/250 VAC	Figure 13: Italy—AC-Input Power Cord
Australia	CRS-AC-CAB-AU(=)	15 A/250 VAC	Figure 14: Australia—AC-Input Power Cord

Figure 10: North America—AC-Input Power Cord

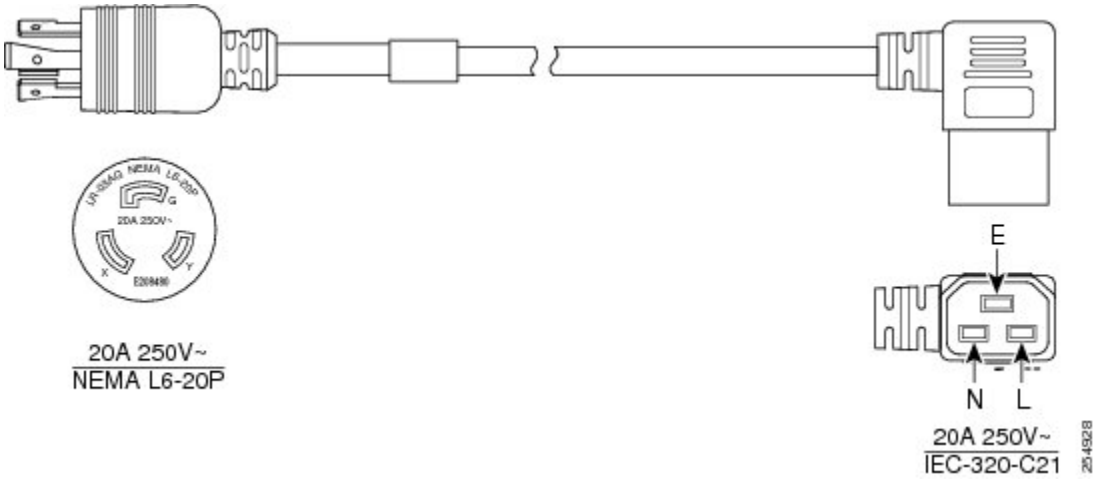


Figure 11: Europe—AC-Input Power Cord

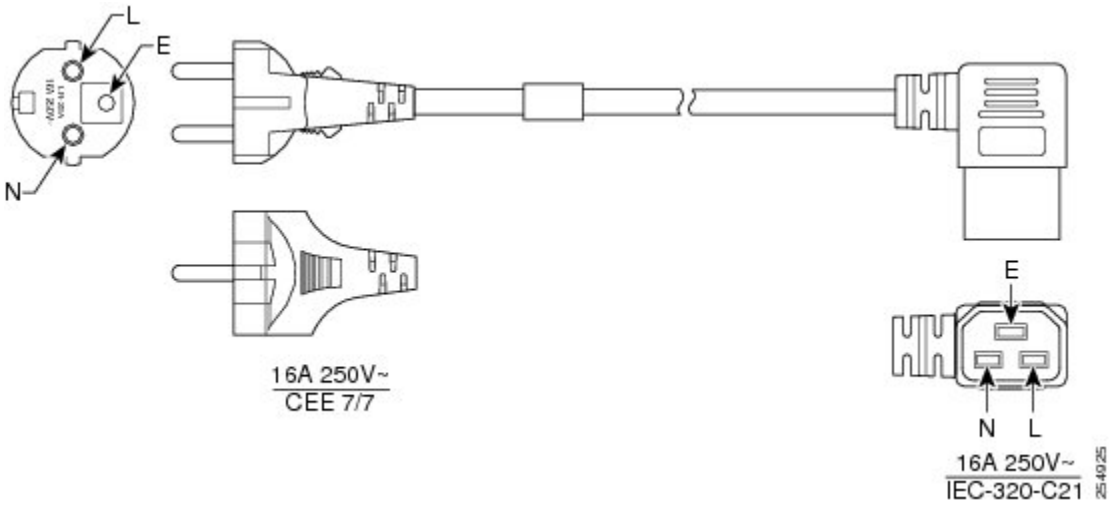
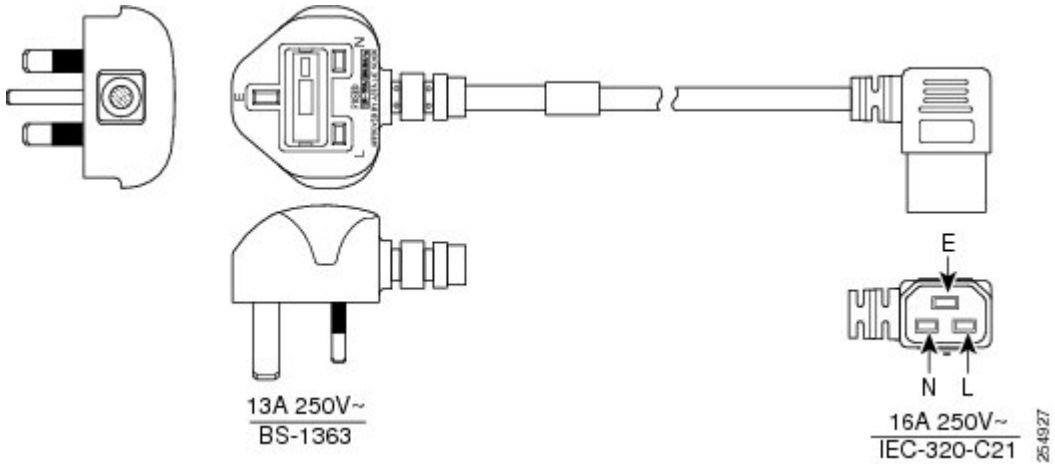


Figure 12: United Kingdom— AC-Input Power Cord


E
N
L
13A 250V~
BS-1363
E
N L
16A 250V~
IEC-320-C21
254927

Note The BS-1363 standard rates cord sets up to a maximum of 13 A, 250 VAC for the C-21 plug. Therefore, the building circuit breaker must be 13 A maximum. Installation of the Cisco CRS 8-slot line card chassis must follow national and local electrical codes.

Figure 13: Italy—AC-Input Power Cord

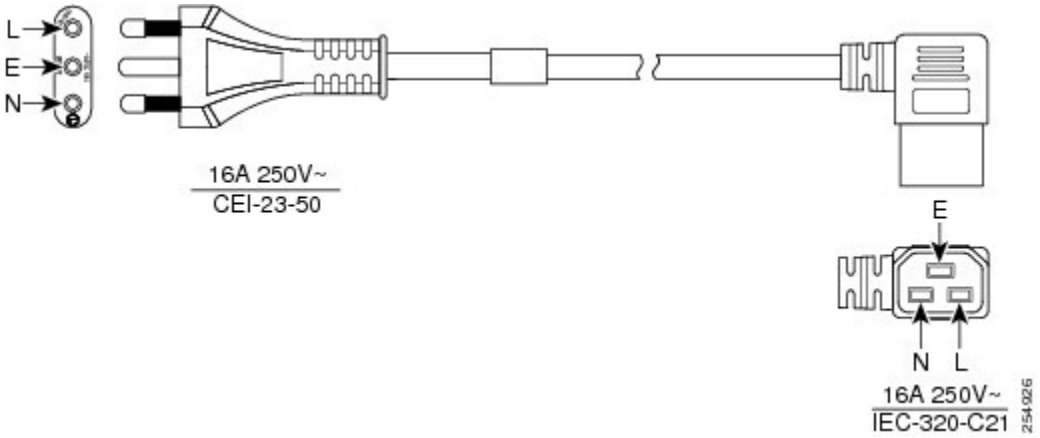
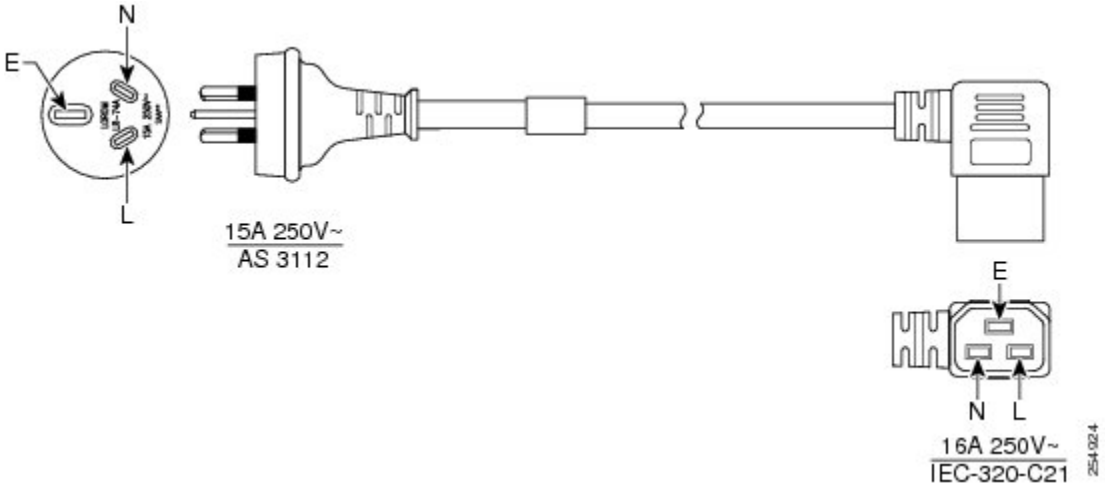


Figure 14: Australia—AC-Input Power Cord



Note The AS 3112 standard rates cord sets up to a maximum of 15 A, 250 VAC for the C-21 plug. Therefore the building circuit breaker must be 15 A maximum. Installation of the Cisco CRS 8-slot line card chassis must follow national and local electrical codes.

Converting 3-Phase AC to Single-Phase AC

If you have 3-phase AC Delta or AC Wye input power at your equipment, a *Cisco CRS 3-phase AC PDU* will be required to convert 3-phase AC Delta or AC Wye input power to single-phase AC input power that connects directly to the rear of the AC power shelf. The Cisco CRS PDU includes either an AC Delta or AC Wye power interface, and has power input and power output cords entering and exiting the box.

There are two versions of the Cisco CRS 3-Phase AC PDU available for the Cisco CRS8-Slot Line Card Chassis Enhanced router:

- CRS-8-PDU-Delta—Redundant 3-phase to single-phase Delta PDU for Cisco CRS 8-Slot Line Card Chassis Enhanced router, 2 input/6 output
- CRS-8-PDU-Wye—Redundant 3-phase to single-phase Wye PDU for Cisco CRS 8-Slot Line Card Chassis Enhanced router, 2 input/6 output

In addition to the requirements in the General Power and Grounding Requirements, on page 10 section, AC input power requirements are as follows:

- Two separate and independent AC power sources are required, one for each PDU. Each PDU should be connected to a different power source to provide 2N power redundancy in case a power source fails.
- Each AC power source must provide 3-phase VAC power, and have its own circuit breaker.
- AC Delta input:
  - 3-phase, 200 to 240 VAC (phase-to-phase), 50 to 60 Hz.
  - Input current: 27.7 A.
  - Each PDU has one Delta input power cord with a 4-pin IEC 60309 plug (3 wire + protective earthing [3W+PE]). The power cord is rated for 250 VAC, 60 A, and plugs into a similarly rated IEC 60309 receptacle.
  - Each PDU has three single phase output cords preattached, each with a 90 degree IEC-320-C21 plug that plugs into a IEC-320-C22 inlet on the rear of the AC power shelf.
- AC Wye input:
  - 3-phase, 200 to 240 VAC (phase-to-neutral), 50 to 60 Hz.
  - Input current: 16 A (International) or 20 A (North America). The PDU is rated for 16-amp service.
  - Each PDU has one Wye power cord with a 5-pin IEC 60309 plug (3 wire + neutral + protective earthing conductor (ground wire) [3W+N+PE]). The cord is rated for 415 VAC, 16 A, and plugs into a similarly rated IEC 60309 receptacle.

- Grounding-type AC power outlet is required. The PDUs are shipped with AC power cords that have a grounding-type plug. As a safety feature, the plugs fit only a grounding-type AC power outlet.

Figure 15: AC Delta Power Cord Plug

Figure 16: AC Wye Power Cord Plug

For detailed Cisco CRS Power Distribution Unit AC power specifications, see the Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide.

Chassis Airflow

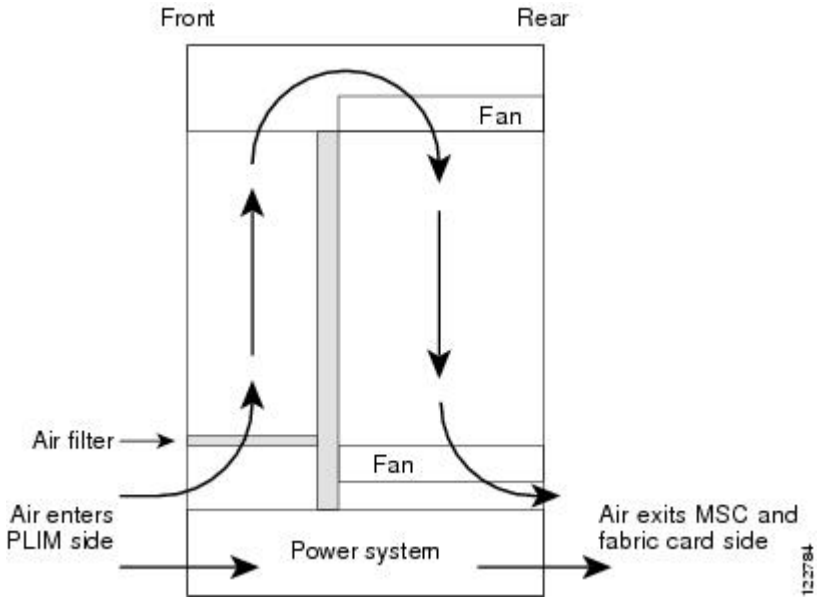
The Cisco CRS 8-Slot Line Card Chassis Enhanced router has two fan trays, with four fans each, that cool the chassis card cages. Cool air flows in at the bottom front of the chassis and flows through the chassis card cages and through the fans in the fan trays before being exhausted through the bottom rear of the chassis, as shown in the following figure.

A replaceable air filter is located on the front of the chassis below the PLIM card cage. How often you should replace the air filters depends on the facility environment.

In a dirty environment, or when you start getting frequent temperature alarms, you should always check the intake grills for debris, and then check the air filters to see if they need to be replaced.

Note We recommend that you check the air filters once a month. Replace a filter when you notice a significant amount of dust.

Figure 17: Airflow Through the Cisco CRS 8-Slot Line Card Chassis Enhanced Router



The Cisco CRS 8-Slot Line Card Chassis Enhanced router airflow volumes are as follows:

- Chassis airflow: Up to 1000 cubic feet (28, 317liters) per minute
- Power system airflow: Up to 240 cubic feet (6800 liters) per minute

Facility Cooling Requirements

The Cisco CRS 8-Slot Line Card Chassis Enhanced router dissipates considerable power that generates much heat. In large configurations, additional air cooling is required to maintain correct operating temperatures. The room air must be cooled by external cooling units that are installed as part of the routing system.

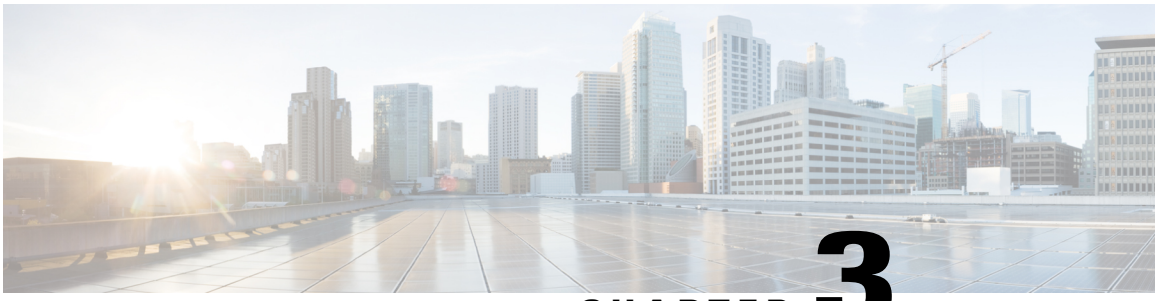
Heat dissipation and external cooling requirements for the Cisco CRS 8-Slot Line Card Chassis Enhanced router are as follows:

- Heat dissipation: 32,570 BTUs per hour
- External cooling requirements: 2.3 tons

To ensure that the site provides the proper air circulation for the system:

- Make certain that the site is as dust free as possible. Dusty environments can clog the air filter or power supply intake vents, reducing the cooling airflow through the system.

- Allow sufficient airflow by maintaining a minimum of 6 inches (15.2 cm) of clearance at both the inlet and exhaust openings on the chassis. If airflow is blocked or restricted, or if inlet air is too warm, an over-temperature condition can occur. Under extreme conditions, the environmental monitoring system shuts down the power to protect the routing system components.



CHAPTER 3

Technical and Environmental Specifications

This chapter summarizes the technical and environmental specifications for the Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced router. It includes the following sections:

Line Card Chassis Specifications

The following table lists the system specifications for the Cisco CRS 8-Slot Line Card Chassis Enhanced router with a modular configuration power system installed.

Table 5: Cisco CRS 8-Slot Line Card Chassis Enhanced Router Component and Power Specifications—Modular Configuration Power

Description	Value
Supported Cards and Modules	

Description	Value
	8 modular services cards (MSCs) or forwarding processor (FP) cards (line cards) 8 physical layer interface modules (PLIMs), one for each MSC or FP 4 switch fabric cards (SFCs) 2 route processors (RP) cards or performance route processor (PRP) cards 1 distributed route processor (DRP) 2 fan trays (with four fans per fan tray)

Description	Value
	1 air filter
Power Shelves	2 AC or 2 DC power shelves (cannot mix AC and DC power shelves in the chassis)
DC power shelf	Accepts up to 4 DC PMs
AC power shelf	Accepts up to 3 AC PMs
Maximum Power Consumption (total input power)	**Note** Proper grounding is also required at the site to ensure that equipment is not damaged by lightning or power surges.
Maximum DC	9.5 kW (assuming 88% efficiency)

Description	Value
Maximum AC	9.8 kW (assuming 92% efficiency)
Power Redundancy (2N)	
DC	Up to four "A" battery plant feeds required for one power shelf, and up to four "B" battery plant feeds required for the other power shelf.
AC (Delta or Wye 3-phase)	Up to three "A" AC single-phase power sources and up to three "B" AC single-phase power sources required.
DC Input	

Description	Value
Nominal input voltage	–48 VDC North America–60 VDC International range (–40 to –72 VDC)
Input current	50 A max at –48 VDC40 A max at –60 VDC60 A at –40 VDC (low voltage extreme)
AC Input, single-phase	
Input voltage	Single-phase 200 to 240 VAC (nominal range 180 to 264 VAC)
Line frequency	50 to 60 Hz (nominal range 47 to 63 Hz)
Input current	16 A International20 A North America

Equipment Rack Specifications

Cisco Systems has tested the Cisco CRS 8-Slot Line Card Chassis Enhanced router to Cisco internal mechanical design verification testing and electrical design verification testing in a four-post seismic rated (zone 4) rack. Use this information for planning only. Consult your Cisco account representative for additional details.

If you plan to install the chassis in your own four-post rack, make sure that the rack meets the specifications summarized in the following table.

Table 6: Cisco CRS 8-Slot Line Card Chassis Enhanced Router and Equipment Rack Specifications

Cisco CRS 8-Slot Line Card Chassis Enhanced Router Specifications	
Chassis Dimensions	
Height	38.5 in. (97.8 cm)
Width	17.5 in. (44.5 cm) 18.9 in. (48.0 cm) mounting rail flange, outside to outside
Depth	36.6 in. (93.0 cm) without cosmetics40.5 in. (102.9 cm) with full cosmetics
Chassis Weight	
Chassis shipping weight	418.3 lb. (189.7 kg) chassis with shipping crate and pallet330.8 lb. (138 kg) chassis with fans, PDUs, and blanks (as shipped)
Chassis with all cards and power modules, no cosmetics	600 lb. (272.2 kg)
Chassis, fully loaded with line cards and full cosmetics	650 lb. (294.8 kg)
Equipment Rack Specifications	
Rack Dimensions	
Height	Available aperture in rack for two chassis in a single rack: • 78.6 in. (199.6 cm)
Width	Vertical posts: • 19.5 in. (49.5 cm) inside-to-inside minimum • 23.6 in. (60.0 cm) outside-to-outside maximum

Cisco CRS 8-Slot Line Card Chassis Enhanced Router Specifications	
Depth	Exterior of four-post rack: • Optimal: 27 in. (68.6 cm), for best access to mounting hardware • Optional: 30, 36, or 42 in. (76.2, 91.4, or 106.7 cm) and other standard depths allowed, allow less space for cable management
Load (weight) rating	The rack must support the following weights and specifications: • 650 lb. (294.8 kg) single chassis with full cosmetics • 1300 lb. (589.7 kg) two chassis, each with full cosmetics • 95 lb. (43.0 kg) or more for each chassis for cabling • Additional weight of other components in rack **Note** ANSI specification T1.336 (2003), which defines static load and safety margins, recommends that racks be designed to support at least two times the anticipated load. **Note** See ANSI specification T1.329 (2002) for dynamic load requirements and earthquake resistance specifications.
Chassis and rack footprint(floor contact area)	5.9 sq. ft. (0.55 sq. m), 23.6 in. rack width by 36 in. chassis depth (60 cm rack width by 91.4 cm chassis depth)
Maximum floor loading	600 lb/4.5 sq. ft. = 133 lb/sq. ft. (without cosmetics)272.2 kg/4134.2 sq. cm = 0.07 kg/sq. cm 650 lb/4.9 sq. ft. = 132.7 lb/sq. ft. (with cosmetics)294.8 kg/4580.1 sq. cm = 0.06 kg/sq. cm **Note** Be sure to include the weight of the rack when you consider floor loading requirements. The above numbers do not include rack weight.
Rack Anchoring	

Cisco CRS 8-Slot Line Card Chassis Enhanced Router Specifications	
General considerations	• The rack must be bolted to the floor. For more information, see the *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router Unpacking, Moving, and Securing Guide.* • Consider floor and overhead anchoring requirements for the site, and size and load capacity of anchors and floor structure. • Make sure that floor mounting bolts are accessible, especially if annual retorquing of bolts is required.
Floor mounting holes	• Outrigger L-brackets: Depends on chosen rack • Internal frame holes: Depends on chosen rack
Chassis Clearances	
Two chassis in a single rack	0.5-in. (1.27 cm) between chassis for horizontal shelf brackets
Front and rear of chassis	40.4-in. (102.6 cm) for chassis installation36-in. (91.4 cm) for service access and airflow
Inlet and exhaust openings on chassis and power modules	6-in. (15.2 cm)
Top of chassis	No overhead clearance for a single chassis. Two chassis in a rack requires 0.5-inch (1.27 cm) between chassis for mounting rails.
Mounting Rails and Hardware	
Rail openings (aperture)	• 17.75 in. (45.1 cm), side to side • 22.8 in. (57.9 cm), front to back (adjustable or fixed)

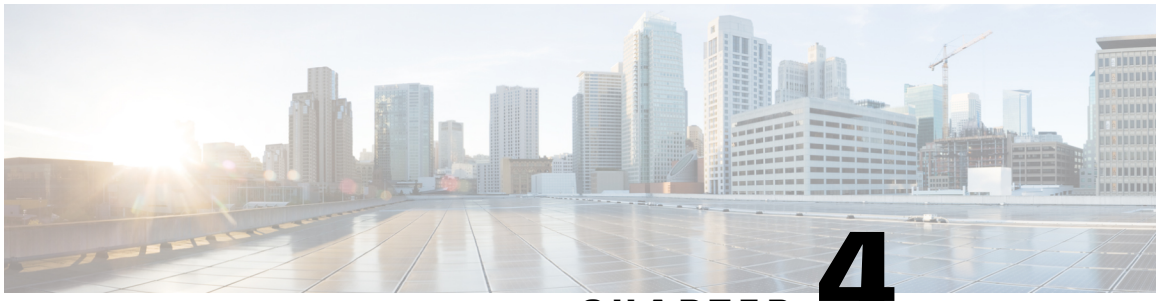
Cisco CRS 8-Slot Line Card Chassis Enhanced Router Specifications	
Horizontal mounting rails	The equipment rack should contain horizontal mounting rails to place the chassis on. The mounting rails, which must be able to hold at least 650 lb (294.8 kg), support the weight of the chassis. • A set of brackets is included in the chassis installation kit, which is available as an option (CRS-8-INSTALL-KT=). Install these brackets and place the chassis on them. For details, see the *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router Unpacking, Moving, and Securing Guide.* **Note** In addition to supporting the chassis, the mounting rails are also designed to space adjustable rack rails at 22.8-inches (front to back) for chassis installation.
Mounting holes	EIA standard mounting-hole spacing: • 18.25-inches to 18.31-inches (46.36 to 46.51 cm), center-to-center horizontal spacing • 0.5 + 0.625 + 0.625-inches (1.27 + 1.59 + 1.59 cm),vertical-hole-spacing pattern; repeats on 1.75-inch (4.45 cm) pitch ETSI racks have mounting rails with EIA standard spacing.
Mounting screws	• 48 screws for each chassis, 12 screws in each of 4 vertical rails, installed in holes with tick marks • Number 10-32 x 5/8 in. long socket head cap screws (sixty screws provided with the chassis) **Note** If you plan to use mounting screws other than the ones shipped with the chassis, you can use 10-32, 10-24, 12-24, or M5 screws. (M6 and 1/4-20 screws do not fit.)
Compliance	Make sure that the rack complies with all appropriate standards for your geographical area—for example, NEBS Seismic Zone 4 (GR-63-CORE, Sections 4.4.1 and 4.4.2).
Additional Rack Considerations	
Interface cables	When choosing a rack, consider cabling needs (chassis front). Allow at least 95 lb (43.1 kg) weight for each chassis for cables.

Environmental Specifications

The following table lists the environmental specifications for the Cisco CRS 8-Slot Line Card Chassis Enhanced router.

Table 7: Cisco CRS 8-Slot Line Card Chassis Enhanced Router Environmental Specifications

Description	Value
Temperature	Operating, nominal: 41° to 104°F (5° to 40°C)Operating, short-term: 23° to 122°F (–5° to 50°C)Nonoperating: –40° to 158°F (–40° to 70°C)
Humidity	Operating: 5 to 85% noncondensingNonoperating: 5 to 90% noncondensing, short-term operation
Altitude	1 to 5906 ft (0.305 m to 1800 m) at 122°F (50°C), short-termUp to 13,123 ft (4000 m) at 104°F (40°C) or below
Heat dissipation	32,570 BTU per hour (modular configuration DC) **Note** Heat dissipation from the DC power system based on maximum output power capacity at 88% efficiency. Depending on the hardware deployed at your site, your system may not consume or be capable of consuming the maximum power supplied by the power system.
External cooling requirements	2.3 tons
Chassis airflow	Up to 900 cubic feet (25,485 liters) per minute
Power system airflow	Up to 240 cubic feet (6800 liters) per minute
Sound power level (modular configuration power)	77 dB—80°F (27°C) or lower (fan speed 3700 RPM)89 dB—104°F (40°C) or higher (fan speed 6500 RPM)
Shock and vibration	Designed and tested to meet the NEBS shock and vibration standards defined in GR-63-CORE (Issue 2, April 2002).



CHAPTER 4

Site Planning Considerations

This chapter describes the general considerations to address while planning for the installation of the Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced router. It does not repeat the specifications in Technical and Environmental Specifications, on page 27, but you should keep those specifications in mind as you plan for your system.

This chapter includes the following sections:

Basic Site and Installation Planning

As you plan for basic site and installation requirements, consider the following:

- Does the installation site have adequate power for the routing system?
- Can the routing system be positioned close to the AC or DC power source, and are the power receptacles easy to reach?
- Does the site have appropriate equipment racks with space available in which to install the system? Are additional equipment racks required? See the Equipment Rack Specifications, on page 33 section for information about rack requirements.
- Is there a scissor lift or similar lifting device available to lift the chassis into the equipment rack?

In addition, make sure that the installation site meets the following access requirements:

- At least 48 inches (122 cm) of clearance exists between rows of equipment racks. This space is needed to access components in the chassis. Additional clearance may be necessary for installation.
- Enough room exists for the system console terminal, and that the console cable is long enough to reach the routing system from the terminal.
- Fan tray exhaust vents are not blocked, and airflow at the bottom of the chassis is not blocked.

When planning the site, you should think about potential expansion of the system. Consider the following:

- Equipment rack space for additional chassis
- Power and cooling requirements for additional chassis
- Cable management for routing system cables

Tools Required for Installation

The following tools are required to install the Cisco CRS 8-Slot Line Card Chassis Enhanced router:

- Safety hand truck, pallet jack, or forklift to move the equipment to the installation site. Make sure that the device is capable of preventing the router from tipping. For example, you could use a safety hand truck with retractable safety leg wheels and a security strap, such as the Stevens Appliance Truck Company “Escort,” Model STEV SRT-M-66 (distributed by McMaster-Carr as Model 2654T6) or an equivalent safety hand truck.
- Scissor lift or similar lifting device to position the chassis in the rack and hold the chassis in place while you bolt it to the rack.
- Electric screwdriver or cordless drill (optional, but helpful)
- 5/32-inch insert bit that fits a 1/4-inch drive extension (preferably magnetic, and one that fits in a cordless drill)
- 1/4-inch drive socket
- 1/4-inch drive extension and 1/4-inch drive flexible extension, length of 6 inches (15.24 cm)
- Number 1, Number 2, and Number 3 Phillips screwdrivers
- 7-mm wrench or 7-mm nut driver or socket (if unavailable, use 9/32-inch standard tools)
- 8-mm wrench
- 10-mm wrench
- Crescent wrench
- 5/16-inch socket wrench
- M6 hex socket screwdriver
- Large and small socket wrenches
- Allen wrench
- Large, medium, and small flat-blade screwdrivers

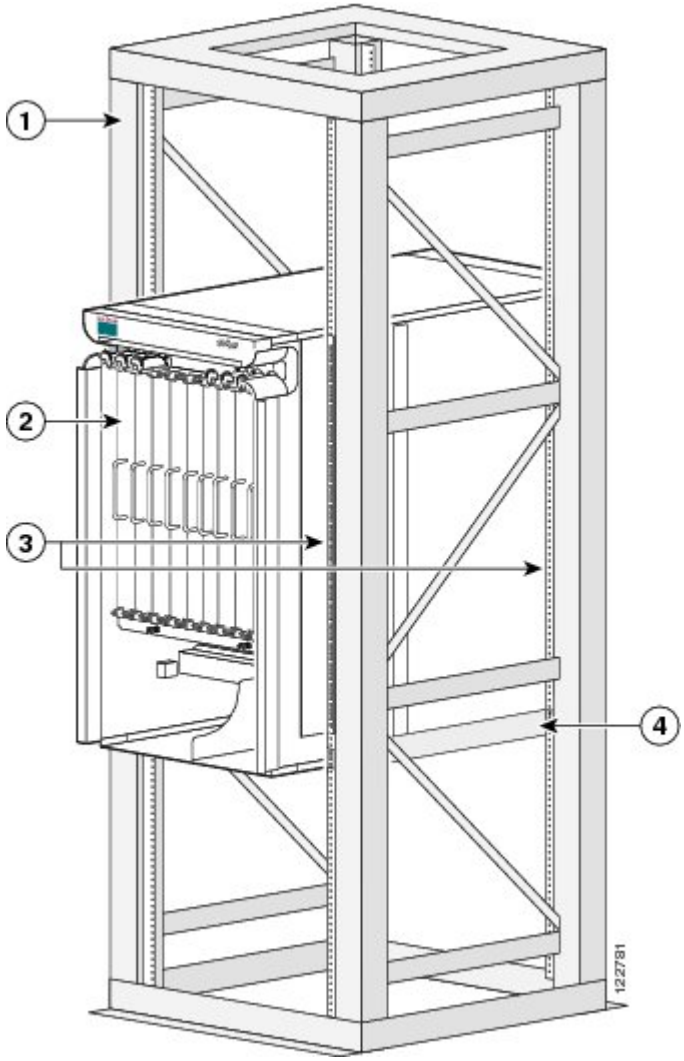
- Torque wrench with 10-mm 6 pt. socket and rated accuracy at 30 in.-lb (3.39 N-m)
- Torque wrench with 10-mm 6 pt. socket and rated accuracy at 20 in.-lb (2.26 N-m)
- Torque screwdriver with number 1 Phillips bit and rated accuracy at 5.5 in-lb (0.62 N-m)
- ESD-preventive wrist strap
- Antistatic mat
- Scissors
- Tape measure (optional)

Equipment Rack Considerations

A fully loaded Cisco CRS 8-Slot Line Card Chassis Enhanced router weighs 650 lb (294.8 kg). The chassis is mounted in a four-post rack, as shown in the following figure.

To ensure safe installation and operation of the routing system, you must install the chassis in a four-post equipment rack that meets the specifications described in the Equipment Rack Specifications, on page 33 section.

Figure 18: 8-Slot LIne Card Chassis Mounted in an Equipment Rack



1	Equipment rack	3	Vertical mounting brackets
2	8-slot line card chassis	4	Horizontal mounting brackets

Warning The chassis should be mounted on a rack that is permanently affixed to the building. Statement 1049

Note We recommend that you use a scissor lift or similar lifting device to position the chassis in the rack and to hold the chassis in place while you bolt it to the rack. *A forklift is not recommended for this purpose* .

As you plan the installation of the chassis into the equipment rack, consider the following:

- Make sure that the floor mounting bolts on the equipment rack are accessible, especially if annual retorquing of bolts is required.
- For chassis installation, you must have access to the vertical mounting rails at each corner of the equipment rack.
- Consider whether the area around the rack is large enough to accommodate the scissor lift (or similar lifting device) and installation personnel.
- A minimum of 48 mounting screws (10-32 x 5/8 in. socket head cap screws are provided with the chassis) are needed to secure the chassis to the rack. To secure the chassis to the rack, install twelve screws on each of the four vertical mounting brackets.

Note If you plan to use mounting screws other than the ones shipped with the chassis, you can use 10-32, 10-24, 12-24, or M5 screws. (M6 and 1/4-20 screws do not fit.)

- The rack should have horizontal shelf brackets to place the chassis on. The brackets must be able to support at least 650 lb. (294.8 kg). If the rack does not have horizontal mounting rails, a set of rails is included in the installation kit, which is available as an option (CRS-8-INSTALL-KT=).

Caution Standard rack-mounting screws are not strong enough to secure the chassis to the equipment rack. Use only those mounting screws that are shipped with the chassis or those listed in the Equipment Rack Specifications, on page 33 section.

For complete instructions on mounting and securing the chassis to a rack, see the *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router Unpacking, Moving, and Securing Guide* .

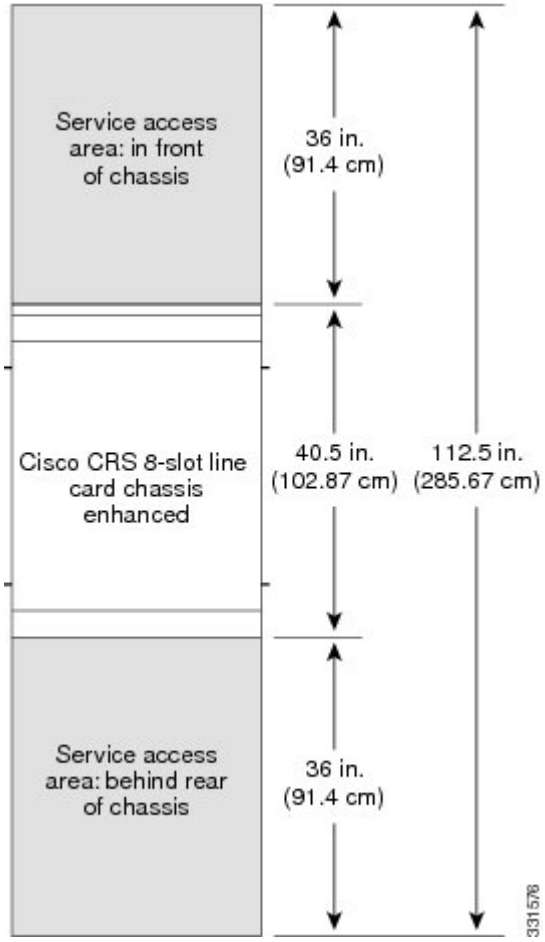
Aisle Spacing and Maintenance Access Floor Plan

The floor plan for the Cisco CRS must include enough space to install the Cisco CRS 8-Slot Line Card Chassis Enhanced router in the equipment rack and allow sufficient airflow for the system. The floor plan must also provide enough room to access chassis components for maintenance (for example, to remove fan trays, power modules, cables, and air filters).

The following figure shows a top view of the Cisco CRS 8-Slot Line Card Chassis Enhanced router footprint required for installation.

Note For chassis installation, make sure that enough room exists in front of the chassis to accommodate installation personnel and the scissor lift (or similar lifting device) used to hold the chassis in the rack while it is bolted in.

Figure 19: Typical Cisco CRS 8-Slot Line Card Chassis Enhanced Router Floor Plan



Dimensions of the Cisco CRS 8-Slot Line Card Chassis Enhanced Router

The dimensions for the Cisco CRS 8-Slot Line Card Chassis Enhanced router are:

- Chassis depth (including front grille and optional front cover): 40.5 in. (102.9 cm)
- Chassis height: 38.5 in. (97.8 cm)
- Chassis width: 17.5 in. (44.5 cm).

Front and Rear Clearances

The site requires the following front and rear clearances for chassis installation and maintenance access:

- To install the chassis in the equipment rack: approximately 40 inches (101.6cm)
- To service components and allow system airflow (both in front of and behind the chassis): 36 inches (91.4 cm)

Note Maintain at least 6 inches (15.2 cm) of clearance at both the inlet and exhaust openings on the chassis and on the power modules to allow sufficient airflow.

Power and Cooling Requirements

See Power and Cooling, on page 9 for information about the power and cooling systems on the Cisco CRS 8-Slot Line Card Chassis Enhanced router and for information about the power and cooling requirements at the installation site.

System Console

A system console is required to configure the routing system for operation. As you plan your site facilities, make sure that the site has enough room for a system console and the console cable is long enough to reach the routing system.

Note The console port does not support modem control or hardware flow control. The port requires a straight-through EIA/TIA-232 cable.

Cable Management

As the size of the routing system increases, the cabling required for the chassis increases. For example, a fully loaded Cisco CRS 8-Slot Line Card Chassis Enhanced router has more cables connected to it than a partially loaded chassis. The cabling runs must be carefully planned. The basic configurations for various routing systems should be arranged to minimize the complexity and length of the cable runs. Precut and terminated cables are considered part of the basic configuration.

- CONSOLE or AUX RJ-45 RS-232 serial ports on the route processor cards for terminal connections
- Ethernet ports on the route processor cards for connecting network management equipment
- Modular service cards (MSCs) and physical layer interface modules (PLIMs) for data connections

The cable-management bracket is for organizing these interface cables to keep the front of the chassis clear and to eliminate sharp bends in the cables.

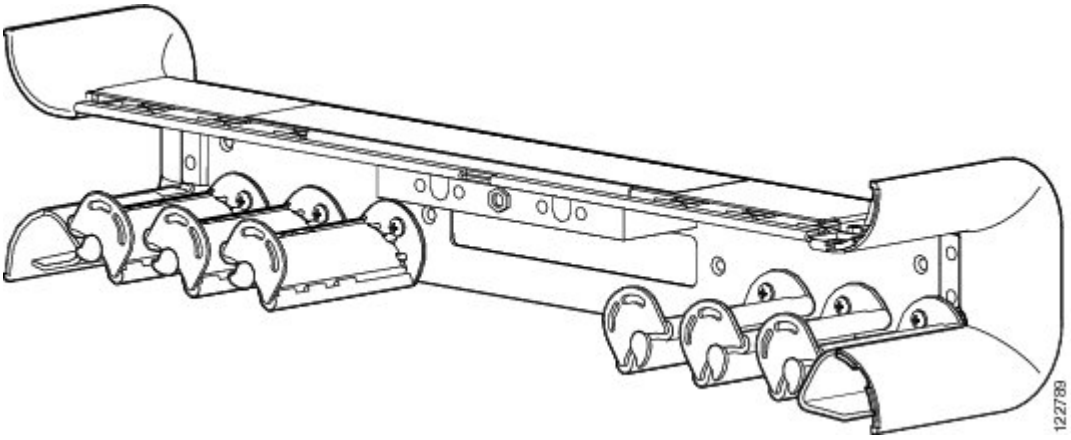
Caution Excessive bending can damage interface cables.

The cable-management bracket has a special telescoping feature that allows the bracket to be extended when the chassis is upgraded with higher-density cards. This extension feature also helps in installing the cables in the chassis.

Note When the telescoping feature is in use the front cover on the chassis cannot be installed.

The following figure shows the chassis cable-management bracket.

Figure 20: Cable Management Bracket (Front of Chassis Only)



Route Processor Cables

As you consider system cabling, see the following table to determine the types of cables required to connect to ports on the route processor (RP).

Table 8: Route Processor Cables

RP Port	Required Cable Type
Ethernet management	STP cable (Category 5 or better). Required for enhanced immunity to external electromagnetic disturbance levels of 10 V/m and 10 Vrms. **Note** STP = shielded twisted-pair
Alarm	Shielded cable. Required for EMC compliance.

PLIM Interface Cables

You must provide the PLIM interface cables. Because the type and number of interfaces can vary, plan these cable runs prior to the installation. When planning the cable runs, consider the following:

- Number and type of interface connections (OC-48/STM-16 or STS-48, OC-192/STM-64 or STS-192, OC-768/STM-256 or STS-768, 10-Gigabit Ethernet, and 100-Gigabit Ethernet)
- Termination at the other end of the cables (such as patch panel or optical transport equipment)
- Proper length and termination of cables

Custom Cables

The installation site may require custom cables designed for the facilities. We can assist you in planning custom cables.

Noise Control

A routing system can generate large amounts of fan noise. The Cisco CRS 8-Slot Line Card Chassis Enhanced router has some built-in noise reduction, such as fan speed control. If the routing system is installed in an environment where excessive noise could be harmful to personnel, some other noise reduction options could be attempted. Passive noise reduction could include the installation of foam panels to insulate the surrounding area from the noise.

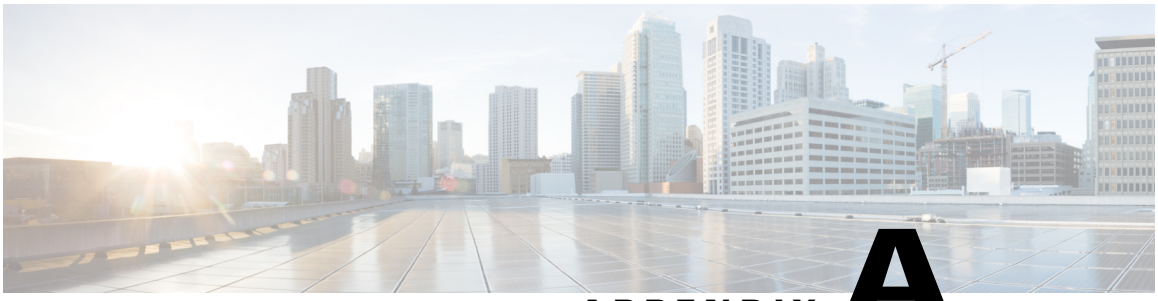
Additional noise-reduction measures have to be designed on an individual site basis.

Cisco Installation Services

Cisco or a Cisco partner can provide a complete installation, from planning to power up. For information about Cisco or Cisco partner installation services, consult Cisco Customer Advocacy.

System Testing, Certification, and Warranties

After the routing system has been installed, it must be tested and certified. Consult Cisco Customer Advocacy for information about testing, certification, and warranties.



APPENDIX A

Preliminary Site Survey

This appendix contains a sample preliminary site survey that you should complete before planning a detailed site survey. This preliminary survey ensures that the basic system requirements have been completed or are underway before detailed site plans are completed.

Preliminary Site Survey

The following table shows a sample preliminary site survey form.

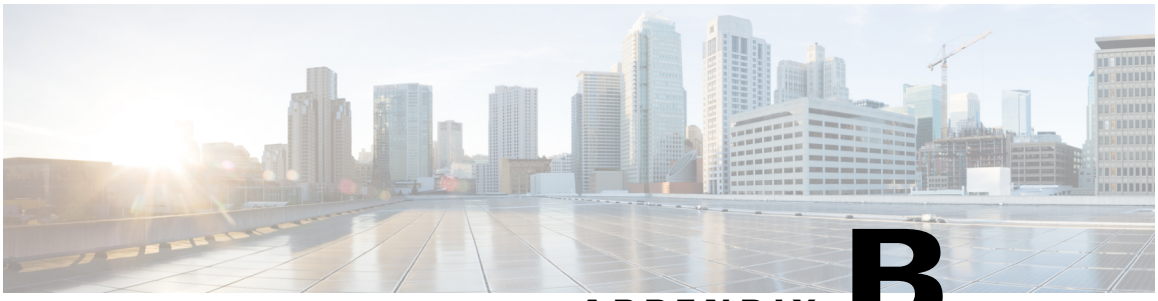
Table 9: Sample Preliminary Site Survey

Preliminary Site Survey	
Order Information	
Sales order number:	
Estimated shipping date:	
Site ready date:	
Installation date:	
Site Location and Address	
Company name:	
Site address:	
Shipping address:	
Building or computer room access:	
Special instructions:	

Preliminary Site Survey	
Hours and days of operation:	
Site Survey Contacts	
Primary Contact	
Name:	
Title:	
Phone number:	
Mobile phone number:	
Fax number:	
Pager number:	
E-mail address:	
Secondary Contact	
Name:	
Title:	
Phone number:	
Mobile phone number:	
Fax number:	
Pager number:	
E-mail address:	
Delivery and Installation Constraints	
Is there a loading dock available to unload the equipment at this site?	
Is the path to the installation area unobstructed? If not, can special arrangements be made to get the equipment to the installation area? Describe them.	
On what floor is the installation?	

Preliminary Site Survey	
If it is on a floor other than the ground floor, is there a freight elevator available? Note if the equipment will have to be brought up a flight of stairs.	
Is there someone on site during working hours to accept delivery of the materials? If not, list the times this person would be available.	
Floor Mounting	
How many line card chassis will be installed? Is there floor space available for all of the chassis?	
Does the floor meet the routing system floor-loading requirements?	
Make a sketch of the area where the chassis is to be installed and note the chassis location.	
Power	
Is AC or DC power available for the chassis? Is there a connection point on the panel for the chassis?	
Is there a fuse access panel (FAP) available for the equipment? Provide a connection point on the fuse access panel for each chassis.	
Will a fuse access panel be installed in time for the routing system installation? Provide a date when the FAP will be installed.	
Is the FAP in the same room as the chassis?	
Is there an AC power outlet (220 V or 110 V) located within 10 feet of each chassis for PCs and test equipment?	
Is there proper grounding for the equipment? If not, when will the grounding be available? Provide a connection point for the grounding.	
Are there any restrictions when the equipment can be powered on or when electrical work can be done? If so, describe them.	
Are there special requirements for power or power cables (for example, a different wire gauge, and so on)? If so, describe them.	
Air Conditioning	

Preliminary Site Survey	
Does the site have the air conditioning capacity to handle the routing system? If not, note what will be done to rectify the lack of adequate cooling.	
Describe the air conditioning at the site.	
Supported Data Interfaces	
Will the routing system be connected to OC-3/STM-1 POS circuits? How many ports?	
Will the routing system be connected to OC-48/STM-16 POS or DPT circuits? How many ports?	
Will the routing system be connected to OC-192/STM-64 POS or RPR XFP circuits? How many ports?	
Will the routing system be connected to OC-768/STM-256 POS circuits? How many ports?	
Will the routing system be connected to Gigabit Ethernet (GE) or 10-GE circuits? How many ports?	
Will the routing system be connected to 100-GE circuits? How many ports?	
Cable Plant	
Have the cables been pulled for all data interfaces? If not, list the outstanding cabling that needs to be installed and the scheduled completion dates.	
Are there connection points on the fiber distribution panel for all optical cables connecting to the routing system?	
Will fiber jumpers be provided? If not, measure and record the length of fiber jumper required to complete the installation, and place the order.	
What type of fiber connector is used at the site?	
If attenuation is required, will attenuators be provided? If not, who will provide the attenuators?	



APPENDIX B

Product IDs for the Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced Router

This appendix provides information about the product IDs for components of the Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Enhanced router.

The tables list the components that make up the routing system, their product IDs (the part numbers to use to order the components), and descriptions.

Note Although this appendix provides product IDs for routing system components, the Cisco online ordering and pricing tool has the most up-to-date information on the routing system and product IDs. You can access the ordering tool at the following URL (CCO login required), and enter a search term such as "CRS" to view a list of components: http://www.cisco.com/cgi-bin/front.x/pricing

Cisco CRS 8-Slot Line Card Chassis Enhanced Router Component Product IDs

The following table lists the product IDs for components in the Cisco CRS 8-Slot Line Card Chassis Enhanced router.

Table 10: 8-Slot Routing System Component Product IDs

Component	Product ID	Description
CRS 8-slot routing system	CRS-8S	Cisco CRS 8-slot routing system
Cisco CRS 8-Slot Line Card Chassis Enhanced router	CRS-8-LCC/E	Cisco CRS 8-Slot Line Card Chassis Enhanced router (spare chassis)
Fan tray	CRS-8-FTA CRS-8-FTA2	Cisco CRS 8-slot fan tray and fans (spare) 2 required for each chassis)
Air filter	CRS-8-FLTR	Line card chassis filter pack (spare)
Inlet grille	CRS-8-GRILL CRS-8-GRILL=	Line card chassis inlet air [illegible] power

Component	Product ID	Description
Installation kit	CRS-8-LCC-INSTL=	Line card chassis installation kit (includes a set of horizontal shelf brackets, mounting screws, and other items)
Modular Configuration Power Components		
AC power components, single-phase		
AC power shelf	CRS-8-LCC-ACPWR=	Cisco CRS 8-Slot Line Card Chassis Enhanced router single-phase AC power shelf (two required for each chassis)

Component	Product ID	Description
AC PM	[illegible]	Cisco CRS 8-Slot Line Card Chassis Enhanced router AC PM (up to three required for each power shelf) **Note** PM = power module
DC power components		
DC power shelf	[illegible]	Cisco CRS 8-Slot Line Card Chassis Enhanced router DC power shelf (two required for each chassis)

Component	Product ID	Description
DC PM	[illegible]	Cisco CRS 8-Slot Line Card Chassis Enhanced router DC PM (up to four required for each power shelf)
Switch fabric cards		
Switch fabric cards	[illegible] (=) (400G)	Cisco CRS 8-Slot Line Card Chassis Enhanced router switch fabric card [illegible] required for each chassis)

Component	Product ID	Description
Switch fabric blank	CRS-8-SFBLNK=	Blank card carrier for each switch fabric slot (used during shipment, must be replaced by a switch fabric card)
Switch fabric handle	CRS-8-SFHNDL=	Handle for carrying card (spare)
Route processor card		
Route processor (RP) **Note** RP = route processor	CRS-8-RP=	Cisco CRS 8-Slot Line Card Chassis Enhanced router RP card (one required for each chassis, for redundant operation, you also need CRS-8-RP=)

Component	Product ID	Description
Route processor, redundant	[illegible]	Optional route processor for redundant RP configuration required for each Cisco CRS 8-Slot Line Card Chassis Enhanced router, along with [illegible]
Route processor memory	[illegible]	RP memory module; 2 gigabytes RP memory module; 4 gigabytes

Component	Product ID	Description
Route processor blank	[illegible]	Blank card carrier for each route processor slot (used during shipment, must be replaced by a route processor card)
Performance route processor (PRP) **Note**	[illegible]	Cisco CRS 8-Slot Line Card Chassis Enhanced performance route processor card PRP card performance route processor
Route processor handle	[illegible]	Handle for carrying card (spare)

Optional MSC, FP, PLIM, SIP, and SPA Product IDs

The following table list the product IDs for the modular services cards (MSCs) available for the Cisco CRS 8-Slot Line Card Chassis Enhanced router.

Table 11: MSC Component Product IDs

Component	Product ID	Description
MSC **Note** Refer to the product data sheet for ordering details. FP card	CRS-MSC-B(=) CRS-MSC-140G(=) CRS-MSC-X (400G) FP40FP-140CRS-FP-X (400G)	Cisco CRS Layer 3 modular service card (every MSC must have an associated PLIM) Cisco CRS Layer 3 forwarding processor(every FP must have an associated PLIM)
MSC impedance carrier	CRS-MSC-IMPEDANCE(=)	Blank card carrier for each empty MSC slot (required for EMI compliance and cooling)

Note For a complete list of PLIM product IDs, see the *Cisco CRS Carrier Routing System Ethernet Physical Layer Interface Module Installation Note*.

The following table list the physical layer interface modules (PLIMs) available for the Cisco CRS 8-Slot Line Card Chassis Enhanced router.

Table 12: PLIM Component Product IDs

Component	Product ID	Description
1xOC-768 PLIM	1OC768-POS-SR(=)	1-port OC-768c/STM-256c PLIM, with short-reach optics (POS)
4xOC-192 PLIM	4OC192-POS/DPT-LR(=)	4-port OC-192c/STM-64c PLIM, with long-reach optics (POS or DPT)
	4OC192-POS/DPT-IR(=)	4-port OC-192c/STM-64c PLIM, with intermediate-reach optics (POS or DPT)
	4OC192-POS/DPT-SR(=)	4-port OC-192c/STM-64c PLIM, withshort-reach optics (POS or DPT)
	4OC192-POS/DPT-VS(=)	4-port OC-192c/STM-64c PLIM, with very-short-reach optics (POS or DPT)

Component	Product ID	Description
16xOC-48 PLIM	16OC48-POS/DPT(=) POM-OC48-LR2-LC-C(=) POM-OC48-SR-LC-C(=)	OC-48c/STM-16c PLIM, uses small form-factor pluggable (SFP) modules (POS or DPT) The PLIM uses 1 to 16 single-mode, long- and short-reach optic modules (mixing allowed): • Long-reach optics (POM-OC48-LR2-LC-C=) • Short-reach optics (POM-OC48-SR-LC-C=)
8x10-GE XENPAK PLIM	8-10GBE(=) CRS-XENPAK10GB-LR(=)	10-GE PLIM, uses XENPAK optic modules. The PLIM uses 1 to 8 single-mode, long-reachoptic modules: Long-reach optics (CRS-XENPAK10GB-LR=)
8x10-GE and 4x10-GE XFP PLIMs	8-10GBE-WL-XFP(=) 4-10GBE-WL-XFP(=)	10-GE PLIM, uses XFP optic modules. These PLIMs use 1 to 8 (or 1 to 4) single-mode, XFP optic modules.
20x10-GE and 14x10-GE XFP PLIMs	20X10GBE-WL-XFP 14X10GBE-WL-XFP	10-GE PLIM, uses XFP optic modules. These PLIMs use 1 to 20 (or 1 to 14) single-mode, XFP optic modules.
1x100-GE CFP PLIM	1X100GBE(=)	100-GE PLIM, uses one CFP optic module.
PLIM impedance carrier	CRS-INT-IMPEDANCE(=)	Blank card carrier for each empty PLIM slot (required for EMI compliance and cooling)

Note For a complete list of SIP and SPA product IDs, see the *Cisco CRS SIP and SPA Hardware Installation Guide* .

Table 13: SIP and SPA Component Product IDs

Component	Product ID	Description
Cisco CRS SPA Interface Processor-800	CRS1-SIP-800	Occupies one PLIM slot on the Cisco CRS 8-Slot Line Card Chassis Enhanced router. Supports six normal-height SPAs or three double-height SPAs or any combination in between.
1-Port OC-192c/ STM- 64 POS/RPR XFP SPA	SPA-OC192POS-XFP	—
4-Port OC-3c/STM-1 POS SPA	SPA-4XOC3-POS	—
8-Port OC-12c/STM-4 Multirate POS SPA	SPA-8XOC12-POS	—
8-Port Gigabit Ethernet SPA	SPA-8X1GE	—