Cisco CRS Routers 8-Slot Line Card Chassis Site Planning Guide

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Preface

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

The guide describes the power, cooling, and environmental specifications to consider before ordering and installing the chassis. It also describes each chassis, its components, site facilities requirements (such as floor space, weight requirements, receiving, and staging), and installation to help you plan the site where the system will be installed. The Cisco product IDs (PIDs) are listed in *System Product IDs* chapter.

Note The installation of a Cisco CRS 8-slot LCC may require space, floor loading, power, and cooling modifications to a facility. Therefore, you should plan the site well in advance of the delivery of the system.

Audience

This document is intended for those who must plan the facilities for the site where Cisco CRS 8-slot LCC is to be installed. It should be used with Cisco site planning coordinators and site inspections, well in advance of the delivery of the system.

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 Documentation

For complete planning, installation, and configuration information, see the following documents:

- *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis System Description*
- *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Unpacking, Moving, and Securing Guide*
- *Cisco CRS Carrier Routing System 8-Slot Line Card Chassis Installation Guide*
- *Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide*
- *Cisco CRS-1 Carrier Routing System to Cisco CRS-3 Carrier Routing System Migration Guide*
- *Regulatory Compliance and Safety Information for the Cisco CRS Carrier Routing System*

Changes to This Document

This table lists the technical changes made to this document since it was first created.

Table 1: Changes to This Document

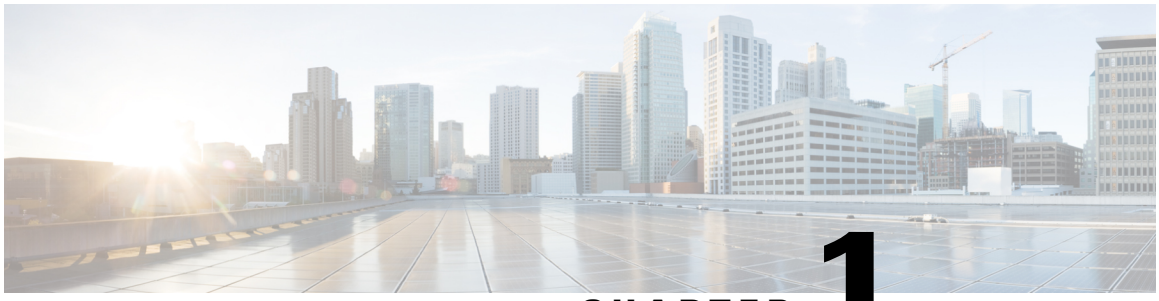
Date	Summary
January 2014	Added updates to support the Cisco CRS-X, which includes new line cards, switch fabric cards, and PLIMs.
April 2011	Added information about new CRS-8-PRP-6G and CRS-8-PRP-12G Performance Route Processor (PRP) cards. Technical updates and minor editorial changes were also made.
December 2010	Added information about new modular configuration AC and DC power systems. Added product IDs for the modular configuration power components.

Date	Summary
October 2010	Added information about new CRS-8-FC140/S switch fabric card, CRS-MSC-140G and FP-140G line cards; 4-port, 8-port, 14-port, and 20-port 10-GE XFP PLIMS; and 100-GE CFP PLIM. Minor editorial changes were also made.
February 2008	Minor editorial changes.
June 2007	Updated the two-pole DC power requirements.
June 2006	Updated the front and rear clearance values for installation, service, and airflow in Chapter 4, “Site Planning Considerations”.
April 2006	• Made various technical updates throughout the guide, especially in Chapter3, “Technical and Environmental Specifications”. • Updated document titles for the Cisco CRS 8-slot LCC documentation set. • Added SIP and SPA product IDs to Appendix B “Product IDs for the Cisco CRS 8-Slot Line Card Chassis.”
December 2005	Made changes to external packaging dimensions and added callout to Figure 2-4.
March 2005	• Updated the DC power section and added new information. • Added product IDs for the redundant route processor (RP) and RP memory options. • Updated the document to reflect that a set of horizontal shelf brackets is available as part of the installation kit (CRS-8-INSTALL-KT=).
December 2004	Initial release of this document.

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

Overview

This chapter provides an overview of Cisco Carrier Routing System (CRS) 8-slot Line Card Chassis (LCC), its main components, and provides a summary of the installation process. It contains the following sections:

Note You must plan the site before the scheduled delivery of the system because installation of a CRS 8-slot LCC may require space, floor loading, power, and cooling modifications to a facility.

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

Carrier Routing System (CRS) 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.

CRS 8-slot LCC is a half-height, rack-mounted 8-slot version of the 16-slot chassis. It is a highly scalable routing system that provides 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.

CRS 8-slot LCC can be installed in collocation 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 (up to 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 mid-plane that connects MSCs or FPs to their PLIMs and to switch fabric cards.

CRS 8-slot LCC has its own power and cooling sub-systems. Two types of power systems are available: fixed or modular configuration. Both power configurations use either AC or DC power.

CRS 8-slot LCC supports 40G, 140G, and 200G fabric cards, as follows:

- Cisco CRS-1 Carrier Routing System uses fabric cards designed for 40 G operation (CRS-8-FC/S or CRS-8-FC/M cards).
- Cisco CRS-3 Carrier Routing System uses fabric cards designed for 140G operation (CRS-8-FC140/S or CRS-8-FC140/M cards).
- Cisco CRS-X Carrier Routing System uses fabric cards designed for 200G operation (CRS-8-FC400/S cards in 200G mode).

A mixture of 40G, 140G, and 200G fabric cards is not supported except during migration.

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

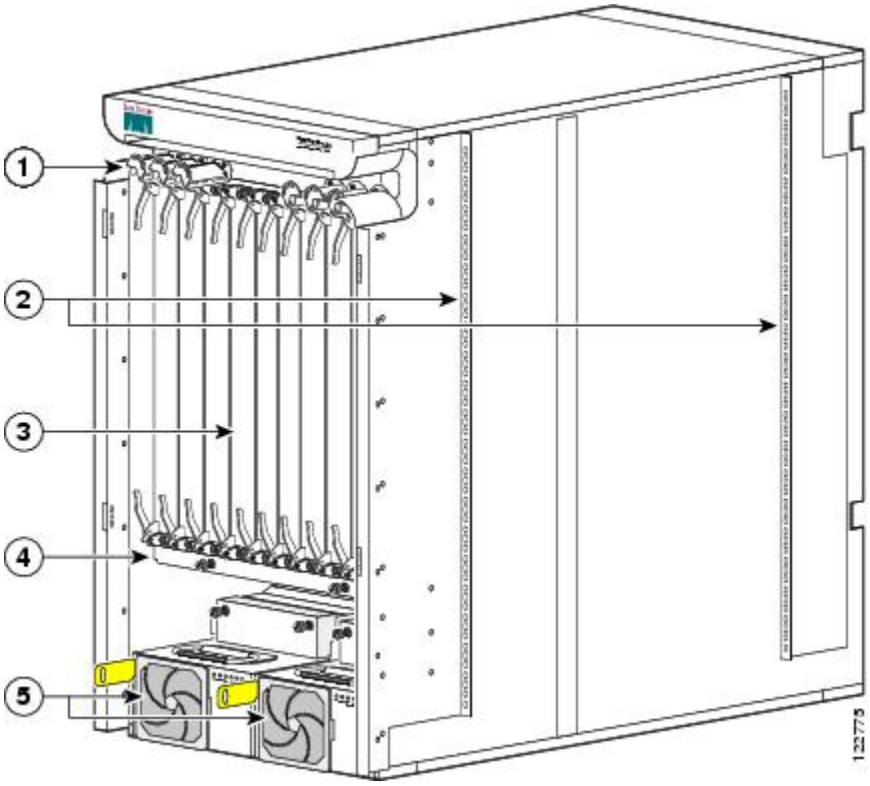
Cisco CRS 8-Slot Line Card Chassis

Cisco CRS 8-slot LCC is the main component of Cisco CRS. The chassis is a mechanical enclosure that contains a chassis mid-plane. The mid-plane holds the system Modular Services Cards (MSCs), Forwarding Processor (FP) cards, their associated Physical Layer Interface Modules (PLIM), and Switch Fabric Cards (SFCs). Cisco CRS 8-slot LCC contains its own power system; either fixed or modular configuration (see Chassis Power System, on page 13). The chassis is mounted on a 19-inch equipment rack (see Equipment Rack Considerations, on page 47).

This section describes the main components of Cisco CRS 8-slot LCC that are considered Field-Replaceable Units (FRUs), but where additional detail is useful, the section identifies sub-assemblies that are not field-replaceable.

The following figure shows the front view of Cisco CRS 8-slot LCC with a fixed configuration AC power system installed. The front view of a Cisco CRS 8-slot LCC with a fixed configuration DC power system installed is similar to this figure.

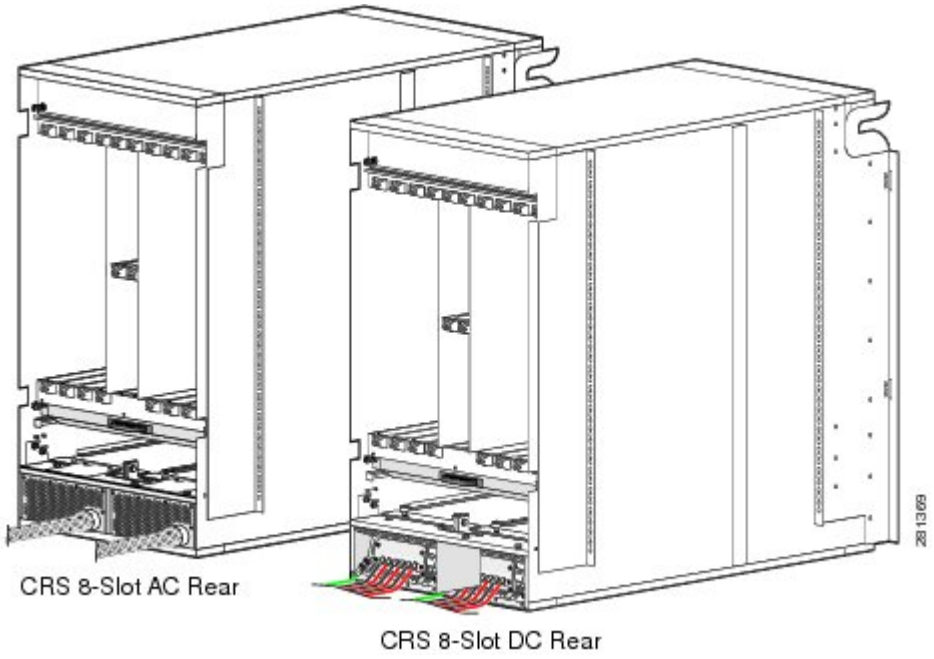
Figure 1: Front View of the 8-Slot Line Card Chassis—Fixed Configuration Power Shown



1	Cable management bracket	4	Air filter
2	Chassis vertical mounting brackets	5	Power system
3	PLIM and RP slots (RPs in middle 2 slots)		

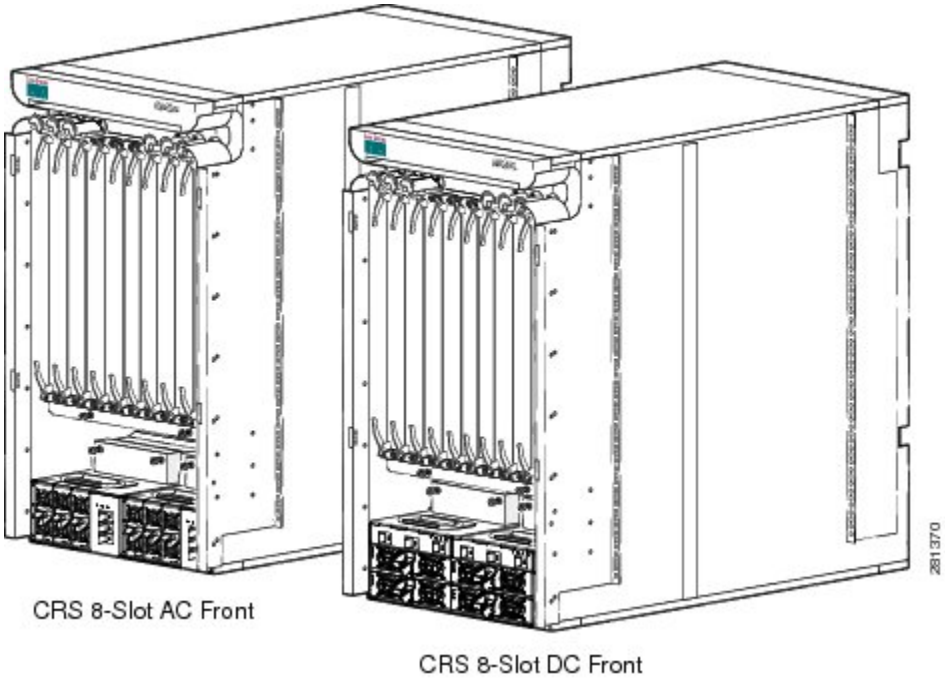
The following figure shows the rear view of a Cisco CRS 8-slot LCC with an AC and a DC fixed configuration power supply installed.

Figure 2: Rear View of Line Card Chassis—Fixed Configuration Power Shown



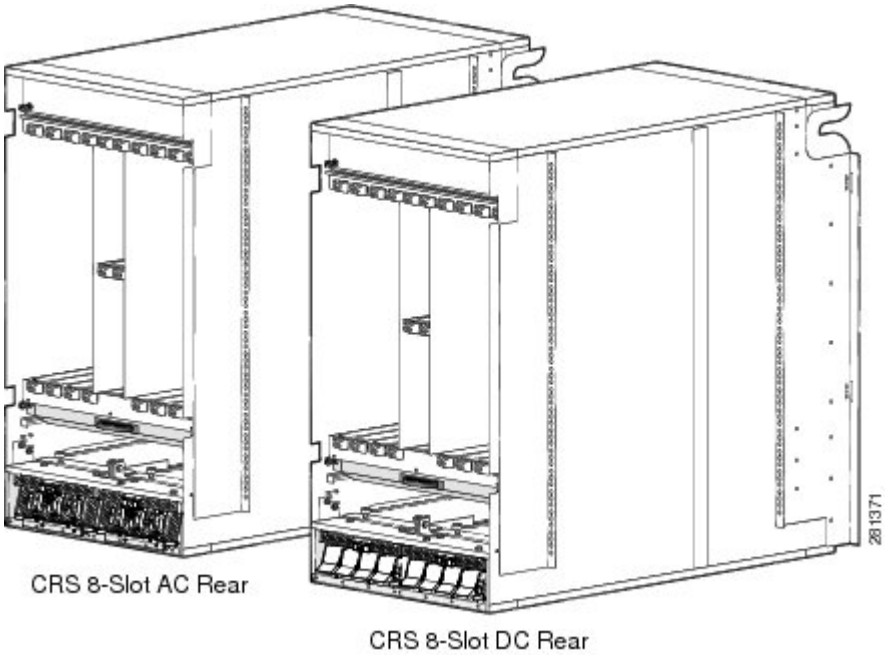
The following figure shows the front view of a Cisco CRS 8-slot LCC with an AC and a DC modular configuration power supply installed.

Figure 3: Front View of Line Card Chassis—Modular Configuration Power Shown



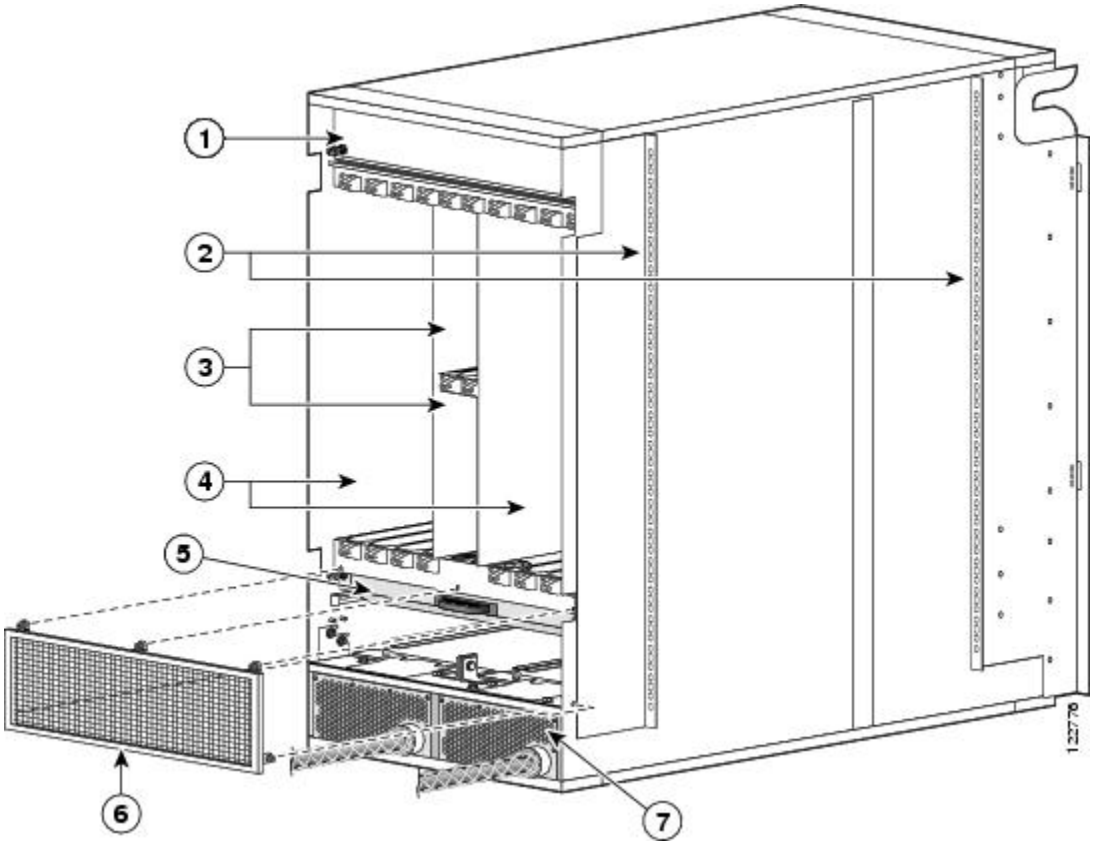
The following figure shows the rear view of a Cisco CRS 8-slot LCC with an AC and a DC modular configuration power supply installed.

Figure 4: Rear View of Line Card Chassis—Modular Configuration Shown



The following figure shows the rear view of a Cisco CRS 8-slot line card chassis with a fixed configuration AC power system installed.

Figure 5: Rear View of the 8-Slot Line Card Chassis—Fixed Configuration Power Shown



1	Upper fan tray (beneath cover)	5	Lower fan tray
2	Chassis vertical mounting brackets	6	Cooling air outlet screen
3	Switch fabric card (half-height) slots	7	Power distribution units (PDUs)
4	MSC slots		

Chassis Components

Cisco CRS 8-slot LCC 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 mid-plane. 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 packet-over-SONET (POS). Available with short-reach (SR) optics.
  - ◦ 4-port OC-192c/STM-64c POS/DPT. Available with long-reach (LR), intermediate-reach (IR), short-reach (SR), and very-short-reach (VSR) optics.
  - ◦ OC-48c/STM-16c 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 16- and 8-Slot LCC. Supports six normal-height SPAs or three double-height SPAs or any combination in between.

- Chassis mid-plane. The mid-plane 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. 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: fixed configuration power and modular configuration power. Both power configurations use either AC or DC power. The fixed configuration power solution contains two power distribution units (PDUs), with either one AC rectifier or one DC power entry modules (PEM) per PDU. Each DC PEM and AC rectifier contains a removable air filter, located on the back of the module. 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.

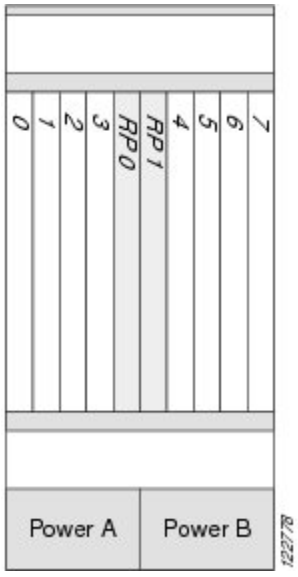
The PLIM side of the chassis is considered the front of the chassis, where user data cables attach to the PLIMs and cool air enters the chassis. The MSC side, which is where warm air is exhausted, is considered the rear of the chassis.

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.

Figure 6: Cisco CRS 8-Slot Line Card Chassis Slot Numbers—Front (PLIM) Side

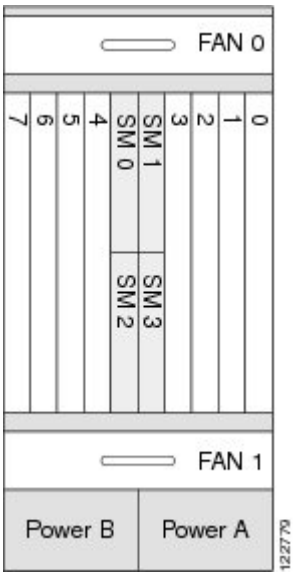


As shown, the front (PLIM) side of the chassis has the following card slots:

- 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 7: Cisco CRS 8-Slot Line Card Chassis 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.

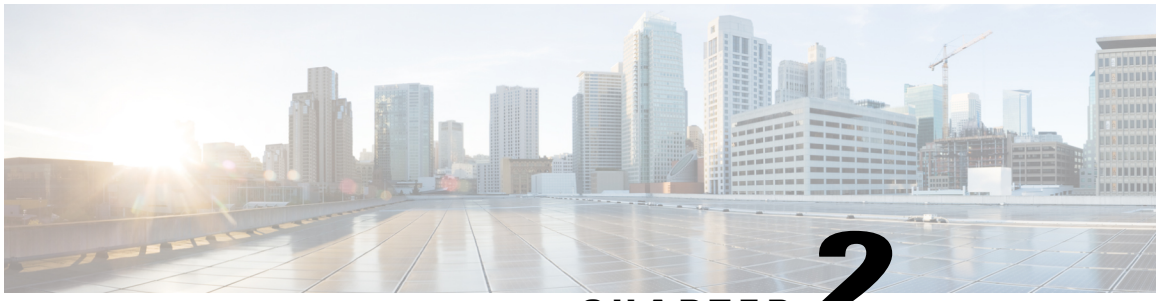
PLIM slot 0 is on the far left side of the chassis, looking at if from the front (PLIM) side. MSC slot 0 and PLIM slot 0 mate with each other through the midplane, and so do all other MSC and PLIM slots (0 through 7).

Overview of Site Planning Steps

The 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
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 45 Tools Required for Installation, on page 46	
Consider equipment arrival, storage, and transport to the installation site.	Basic Site and Installation Planning, on page 45	
Make sure that the equipment rack meets the installation requirements.	Equipment Rack Specifications, on page 40 Equipment Rack Considerations, on page 47	
Consider the space where the routing system will be installed.	Aisle Spacing and Maintenance Access Floor Plan, on page 49	
Plan for power (fixed or modular configuration power, AC or DC).	Power and Cooling, on page 13 Line Card Chassis Specifications, on page 37	
Consider cooling and airflow requirements.	Chassis Airflow, on page 34 Facility Cooling Requirements, on page 35 Environmental Specifications, on page 44	
Consider cable management.	Cable Management, on page 51	
Consider Cisco installation services.	Cisco Installation Services, on page 53	



CHAPTER 2

Power and Cooling

This chapter describes Cisco CRS 8-Slot LCC 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. Cisco CRS 8-Slot LCC System Description provides detailed information about these components.

This chapter contains the following sections:

- Chassis Power System, page 13
- General Power and Grounding Requirements, page 15
- Bonding and Grounding Guidelines, page 15
- DC Power Systems, page 17
- AC Power Systems, page 24
- Chassis Airflow, page 34
- Facility Cooling Requirements, page 35

Chassis Power System

The 8-slot LCC can be either DC or AC powered. Each type of power system (DC or AC) provides power to chassis components. There are two options for power systems: the fixed configuration power system and the modular configuration power system.

- *Fixed configuration power system* consists of two power distribution units (PDUs) and either DC power entry modules (PEMs) or AC rectifiers. The AC version requires 3-phase AC-Delta or AC-Wye input power to the PDU. The PDU distributes facility power to the AC rectifier or DC PEM, which in turn provides processed power to the chassis. A removable air filter is located on the front of each DC PEM and AC rectifier. The fixed configuration power system includes SNMP MIBS and XML support.
- *Modular configuration power system* consists of two power shelves and either AC or DC power modules (PMs). However, unlike the fixed configuration power system, the AC version of the modular configuration 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. At the shelf level, the power system provides 2N redundancy; the PMs themselves provide load-share redundancy. The modular configuration power system also includes SNMP MIBs and XML support.

Note In a fixed configuration AC or DC power system, PDU refers to the power component that connects to the AC rectifier or DC PEM.

Note In a modular configuration AC power system, PDU refers to the *Cisco CRS 3-phase AC PDU* that converts 3-phase AC-Wye or AC-Delta input power to single-phase AC input power for the modular configuration AC power shelf. For further information, refer to Cisco CRS 3-Phase AC Power Distribution Unit Installation Guide.

Fixed configuration chassis input power requirements are as follows:

- DC-powered chassis requires up to a maximum of 8,000 watts (8.0 kW) of DC input power when the chassis is fully loaded.
- AC-powered chassis requires up to a maximum of 8,500 watts (8.5 kW) of AC input power when the chassis is fully loaded.

Modular configuration chassis input power requirements 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 modular configuration 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 Cisco CRS Carrier Routing System 8-Slot Line Card Chassis 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 DC Power Systems, on page 17 and AC Power Systems, on page 24 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:
- For fixed and modular configuration AC-powered systems, a grounding-type AC power outlet is required. In addition, AC-powered systems also require chassis grounding.
- For fixed configuration DC-powered systems, each DC PDU requires a connection to earth ground.
- Modular configuration DC-powered systems support chassis grounding only.
- When planning the power for the site, be sure to 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

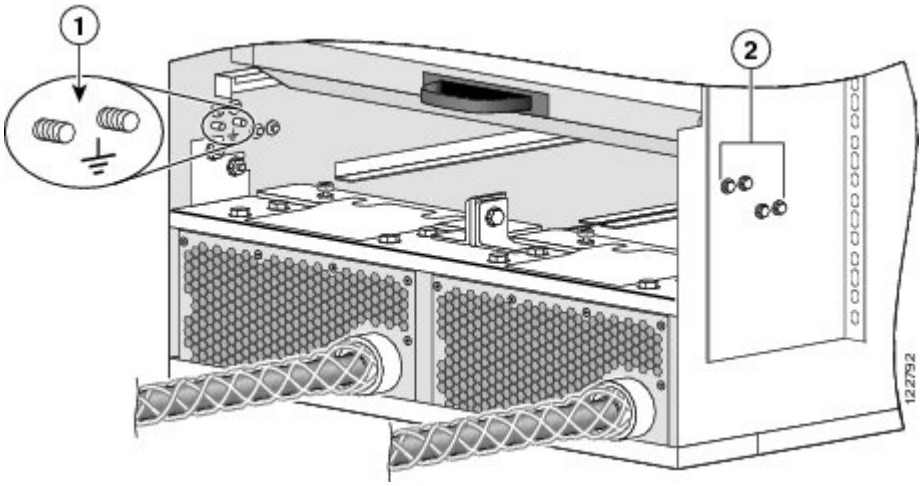
The router chassis has safety earth ground connections in conjunction with the power cabling to the fixed configuration PDUs.

Note Modular configuration power supports chassis grounding only.

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, when either a fixed or modular configuration power system is installed. 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 8: NEBS Bonding and Grounding Points (Rear of Chassis) - Fixed Configuration AC 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 grounding lug that has two M6 bolt holes with 0.625 inches (15.86 mm) spacing between them, and a wire receptacle large enough to accept a 6-AWG or larger multi-strand copper wire. The lug is similar to the straight type used for the DC-input power.
- Four M6 or equivalent hex-head nuts with integrated locking washers are shipped pre-installed on the inside of the chassis.
- Eight M6 or equivalent hex-head bolts with integrated locking washers are shipped pre-installed on the outside of the chassis.

Note The chassis ground wire connectors have a torque value of 30 in.-lb (3.39 N-m).

- Grounding wire. Although we recommend at least 6-AWG multi-strand copper wire, the actual wire diameter and length depend on your router location and site environment. This wire is not available from Cisco Systems; it is available from any commercial cable vendor. The wire should be sized according to local and national installation requirements.

Caution The DC Return of the Cisco CRS 8-slot chassis 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 Systems

The Cisco CRS 8-slot line card chassis can be configured with either a fixed or modular configuration DC-input power subsystem. The chassis power system provides the necessary power for chassis components. Site power requirements differ, depending on the source voltage used.

Each DC powered chassis contains either two fixed configuration PDUs or two modular configuration power shelves for 2N redundancy. A fixed configuration DC PDU connects to a DC PEM, while a modular configuration DC power shelf connects to up to four DC PMs.

Fixed Configuration DC Power Requirements

A fixed configuration DC-powered LCC contains two DC-input PDUs and two DC PEMs. Each DC PDU is connected to three DC power inputs and contains a single 7500-watt DC PEM that is field replaceable. Input DC power enters the PDU and is passed to the PEM, which provides power to the components in the chassis. Each PEM has its own circuit breaker.

In addition to the requirements described in the General Power and Grounding Requirements, on page 15, DC input power requirements are as follows:

- A DC-powered chassis requires up to a maximum of 8,000 watts (8.0 kW) of DC input power when the chassis is fully loaded.
- Each DC PDU requires three DC input feeds of –48/–60 VDC (nominal). The PDU accepts input DC power in the range –40.5 to –75 VDC.
- A DC-powered chassis requires access to the “A” and “B” power buses at the central office (CO). This dual connectivity provides 2N power redundancy in case a power source fails.
  - One PDU should be connected to three –48/–60 VDC inputs from the central office “A” power bus.
  - The other PDU should be connected to three –48/–60 VDC inputs from the “B” power bus.
- Required input current is as follows:

  - 56 amps at nominal input voltage (–48/–60 VDC).
  - 66 amps at low input voltage (–40.5 VDC).

- 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.
- A readily accessible two-pole disconnect device must be incorporated in the fixed wiring, unless it is possible to rely on the identification of the power return conductor that is earth-grounded in the DC power system.

Fixed Configuration DC Input Power and Ground Cables

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

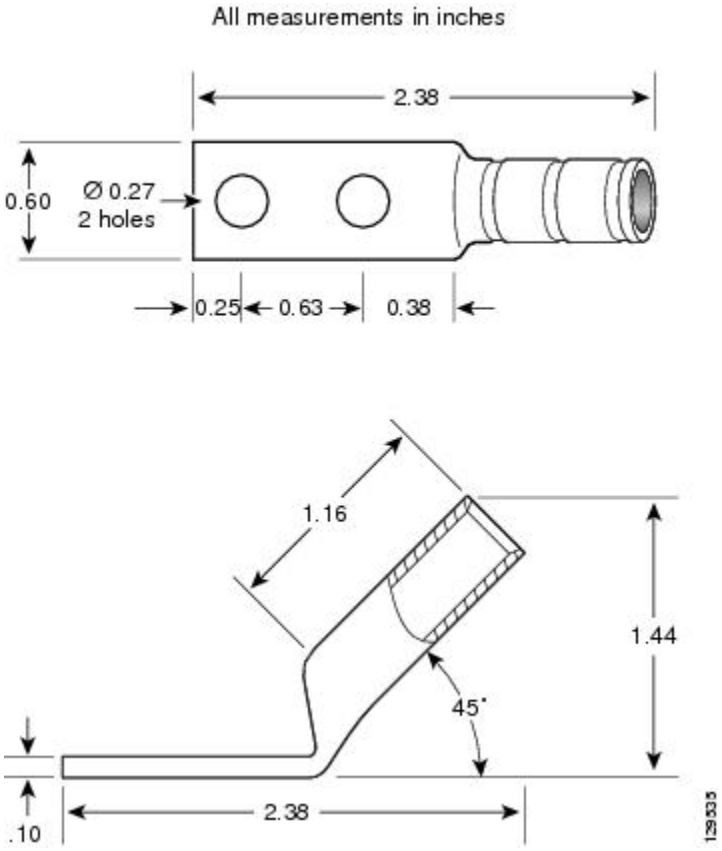
The requirements for the DC input power and ground connections are as follows:

- For DC input power cables, select the appropriate wire gauge based on the National Electrical Code (NEC) and local codes for 60-amp service at nominal DC input voltage (–48/–60 VDC). Three pairs of cable leads, source DC (–) and source DC return (+), are required for each PDU. These cables are available from any commercial cable vendor. All input power cables for the chassis should have the same wire gauge and cable lengths should match within 10 percent of deviation.

Each DC input power cable is terminated at the PDU by a cable lug. The cable lugs must be dual-hole, and have a 45-degree angle tongue. They must be able to fit over 1/4-inch terminal studs at 0.625-inch (15.88-mm) centers. For example, you could terminate a 2-AWG power cable with a cable lug, such as Panduit part number LCC2-14AWH-Q (Cisco part number 32-0677-01) or equivalent, as shown in this figure.

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

Figure 9: DC Input Power Cable Lug

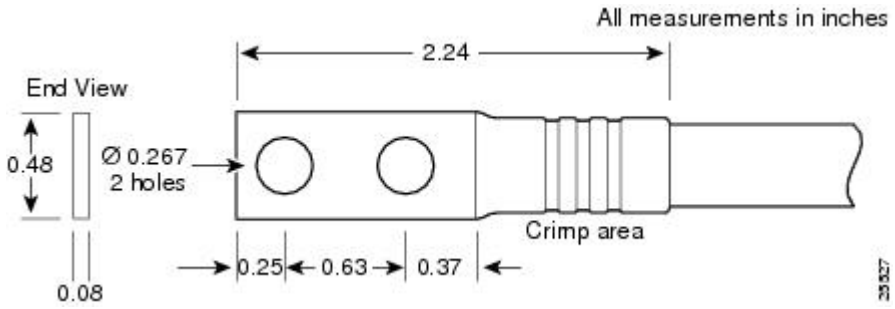


Note DC input power cables must be connected to the PDU terminal studs in the proper positive (+) and negative (–) polarity. In some cases, the DC cable leads are labeled, which is a relatively safe indication of the polarity. However, you must verify the polarity by measuring the voltage between the DC cable leads. When making the measurement, the positive (+) lead and the negative (–) lead must always match the (+) and (–) labels on the PDU.

- An earth ground cable is required for each fixed configuration DC PDU. We recommend that you use at least 6-AWG multistrand copper wire. This wire is not available from Cisco Systems; it is available from commercial cable vendors.

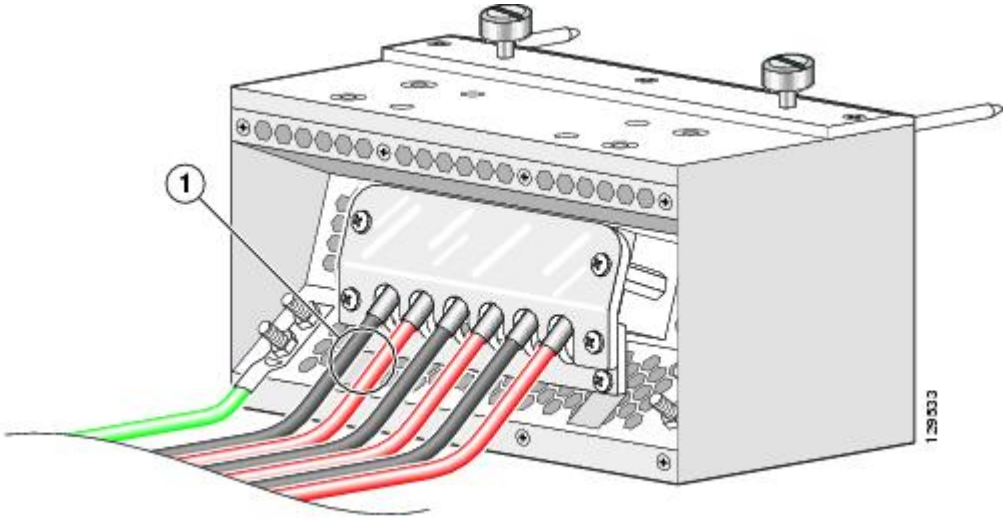
The ground wire cable lug should be dual-hole, as shown in the following figure, and able to fit over M6 terminal studs at 0.625-inch (15.88-mm) centers (for example, Panduit part number LCD6-14A-L or equivalent).

Figure 10: DC Earth Ground Cable Lug



This figure shows the DC input power cables connected to the DC PDU terminal studs.

Figure 11: Fixed Configuration DC PDU Power Cable Connections



1	Each set of cables (RTN and –48V/–60V) is a single VDC input.

Note When wiring the fixed configuration DC PDU, be sure to attach the ground wire first (shown above on the far left side of PDU). When removing the wiring, be sure to remove the ground wire last.

Note In the fixed configuration DC power system, power wires have a 20 in.-lb (2.26 N-m) torque value and ground wires have a 30 in.-lb (3.39 N-m) torque value. The PDU mounting screws have a 9 in.-lb (1.04 N-m) torque value.

The color coding of the DC input power cable leads depends on the color coding of the site DC power source. Typically, green or green and yellow indicates that the cable is a ground cable. Because there is no color code standard for the source DC wiring, you must ensure that the power cables are connected to the PDU terminal studs in the proper positive (+) and negative (–) polarity.

Caution Although reverse polarity should not damage the DC power system, you should correct a reverse polarity condition immediately.

Modular Configuration DC Power Requirements

A modular configuration DC-powered LCC contains two DC power shelves. Each modular configuration DC power shelf is connected to up to four DC power inputs and contains up to four DC PMs that are field replaceable.

In addition to the requirements described in the General Power and Grounding Requirements, on page 15, DC input power requirements are as follows:

- A DC-powered chassis requires up to a maximum of 9,500 watts of DC input power when the chassis is fully loaded.
- Each modular configuration DC power shelf requires up to four DC input feeds of either –48 VDC (nominal), 50 A or –60 VDC (nominal), 40 A. The power shelf accepts input DC power in the range –40 to –72 VDC.
- A DC-powered chassis requires access to the “A” and “B” power buses at the central office (CO). This dual connectivity provides 2N power redundancy in case a power source fails.
  - One power shelf should be connected to up to four –48/–60 VDC inputs from the central office “A” power bus, depending on the number of DC PMs installed.
  - The other power shelf should be connected to up to four –48/–60 VDC inputs from the “B” power bus, depending on the number of DC PMs installed.
- Required input current is as follows:
  - 50 amps at –48 VDC nominal input voltage.
  - 40 amps at –60 VDC nominal input voltage
  - 60 amps at low input voltage (–40 VDC).
- 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.

Modular Configuration DC Input Power Cables

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:

- For DC input power cables, select the appropriate wire gauge based on the National Electrical Code (NEC) and local codes for –48 VDC (nominal), 50 A DC input voltage, or –60 VDC (nominal), 40 A DC input voltage. Up to four pairs of cable leads, source DC (–) and source DC return (+), are required for each power shelf, depending on the number of DC PMs installed. These cables are available from any commercial cable vendor. All input power cables for the chassis should have the same wire gauge and cable lengths should match within 10 percent of deviation.
- Each DC input power cable is terminated at the power shelf by a cable lug. The power supply terminal block lug opening width is 0.625 inch (15.8 mm). The terminal posts are centered 0.625 inches (15.88 mm) apart and are M6-threaded. We recommend that you use an appropriately sized 180-degree angle (straight) industry standard dual-hole, standard barrel compression lug, as shown in the 180 Degree DC

Input Power Cable Lug figure, or an appropriately sized 45-degree angle industry standard 2-hole, standard barrel compression lug, as shown in the 45 Degree DC Input Power Cable Lug figure .

Figure 12: 180 Degree (Straight) DC Input Power Cable Lug

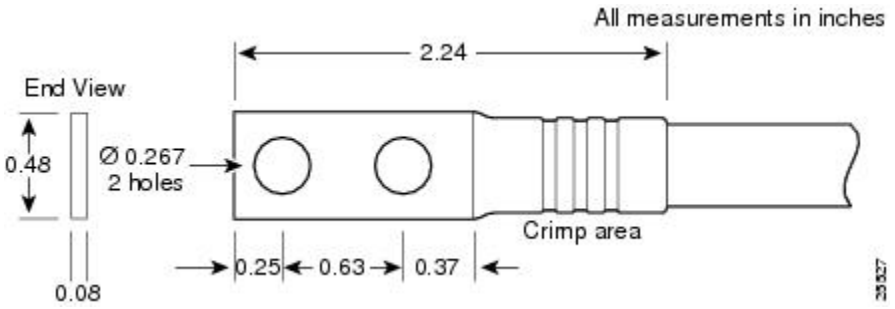
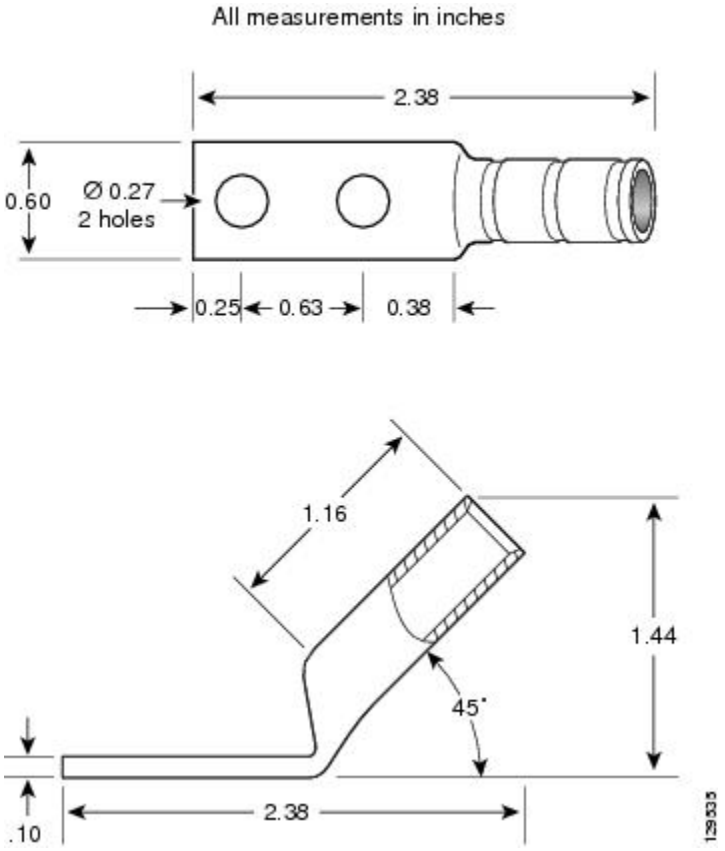


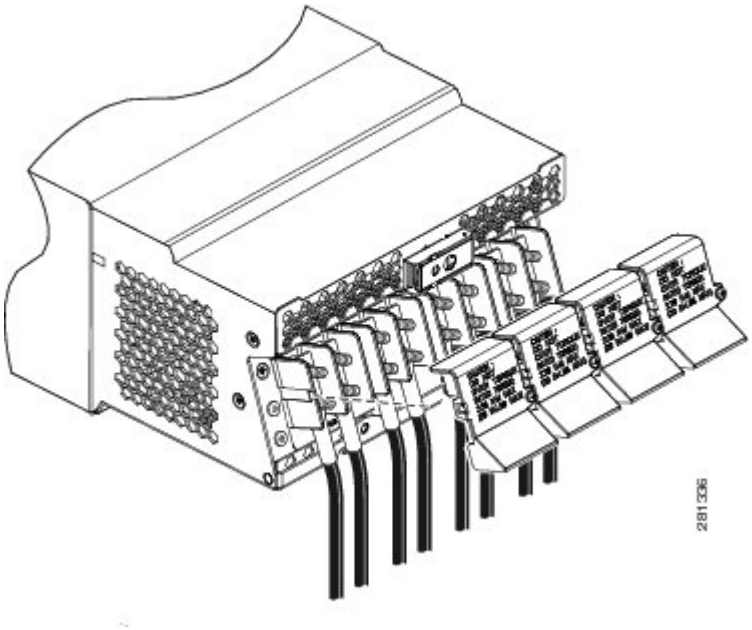
Figure 13: 45 Degree DC Input Power Cable Lug



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 modular configuration DC power shelf terminal studs.

Figure 14: Modular Configuration DC Power Shelf Power Cable Connections



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

Note An earth ground cable is not required for the modular configuration DC power shelf.

AC Power Systems

The Cisco CRS 8-slot line card chassis can be configured with either a fixed or modular configuration AC-input power subsystem. The chassis power system provides the necessary power for chassis components. Site power requirements differ, depending on the source voltage used.

Each AC powered chassis contains two fixed configuration AC PDUs or two modular configuration AC power shelves for 2N redundancy. A fixed configuration AC PDU connects to an AC rectifier, while a modular configuration AC power shelf can contain up to three AC PMs.

Fixed Configuration AC Power Requirements

A fixed configuration AC-powered LCC contains two AC power distribution units (PDUs) and two AC rectifier modules. Each AC PDU is connected to an input AC power source and holds a single 7500-watt AC rectifier. Input AC power enters the PDU and is passed to the rectifier. Here, the input AC power is converted

into the 54.5 VDC used to power components in the chassis. Each AC rectifier is field replaceable and has its own circuit breaker.

Two versions of the AC PDU are available to accommodate AC input power in either the Delta or Wye configuration. Each PDU has a different Cisco part number, and ships with an AC power cord that is 14 feet (4.3 m) long.

In addition to the requirements in the General Power and Grounding Requirements, on page 15, AC input power requirements are as follows:

- An AC-powered chassis (Wye or Delta) requires up to a maximum of 8,500 watts of AC input power when the chassis is fully loaded.
- 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 AC 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: 30 A. The PDU is rated for 24-amp service, and accepts AC input of 30 A.
  - Delta power cord has a 4-pin NEMA L15-30P plug (3 wire + protective earthing [3W+PE]). The power cord is rated for 250 VAC, 30 A, and plugs into a similarly rated NEMA L15-30R locking-type receptacle.
- 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 14-amp service, and accepts AC input of 16 A (International) or 20 A (North America).
  - Wye power cord has a 5-pin IEC 60309 plug (3 wire + neutral + protective earthing conductor (ground wire) [3W+N+PE]). The cord is rated for 400 VAC, 16 or 20 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.

The following figures show the plugs for the AC Delta and Wye power cords.

Figure 15: AC Delta Power Cord Plug

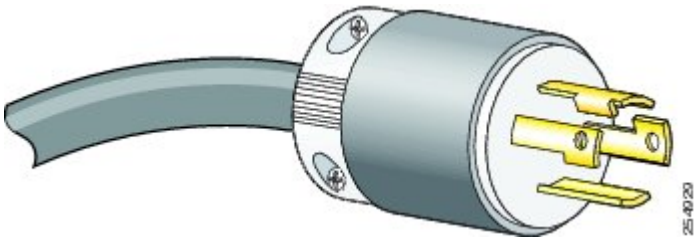


Figure 16: AC Wye Power Cord Plug

For detailed AC power specifications, see Line Card Chassis Specifications, on page 37. The following section describes the 3-phase wiring for AC Delta and Wye configurations.

Fixed Configuration AC PDU Wiring

This section contains a brief description of the 3-phase wiring for AC Delta and Wye configurations that facilities electricians should understand.

AC Delta and AC Wye are both basically 200 to 240 VAC input power:

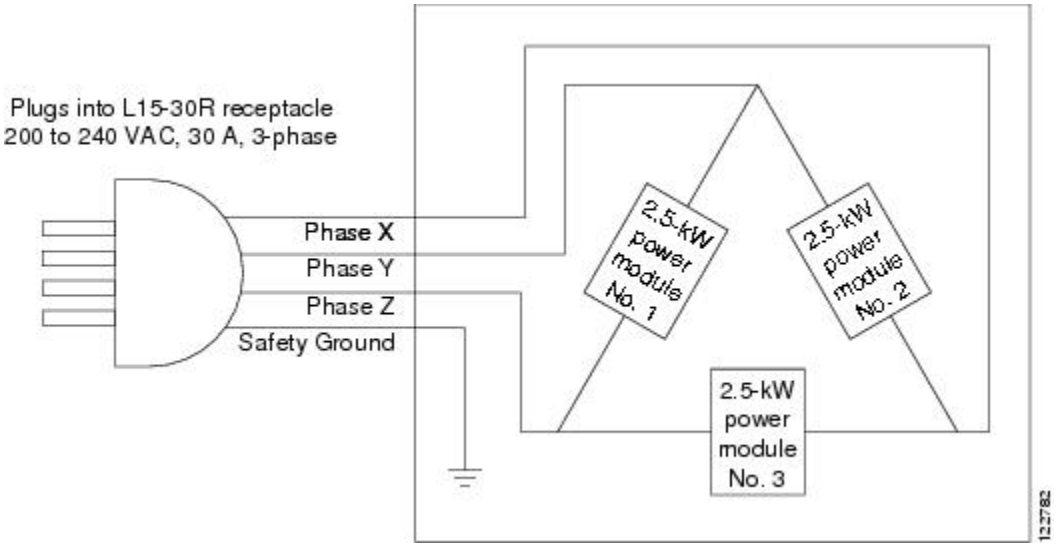
- AC Delta 3-phase wiring is typically used in the United States, Japan, and other countries where the phase-to-neutral voltage is approximately 120 VAC and 208 VAC phase to phase.
- AC Wye 3-phase wiring is typically used in Europe and countries where each phase-to-neutral voltage is approximately 220 VAC.

AC Delta 3-Phase Wiring

The figure shows a PDU wired for AC Delta 3-phase power. As shown, input AC power is routed to three internal 2.5-kW power modules in the rectifier, where it is converted into DC power (nominal 54.5 VDC, 46 ADC) and routed to the three load zones of the chassis.

The AC Delta PDU is shipped with a 14-foot (4.3-m) AC power cord with a 4-pin L15-30P plug.

Figure 17: AC Delta PDU Wiring

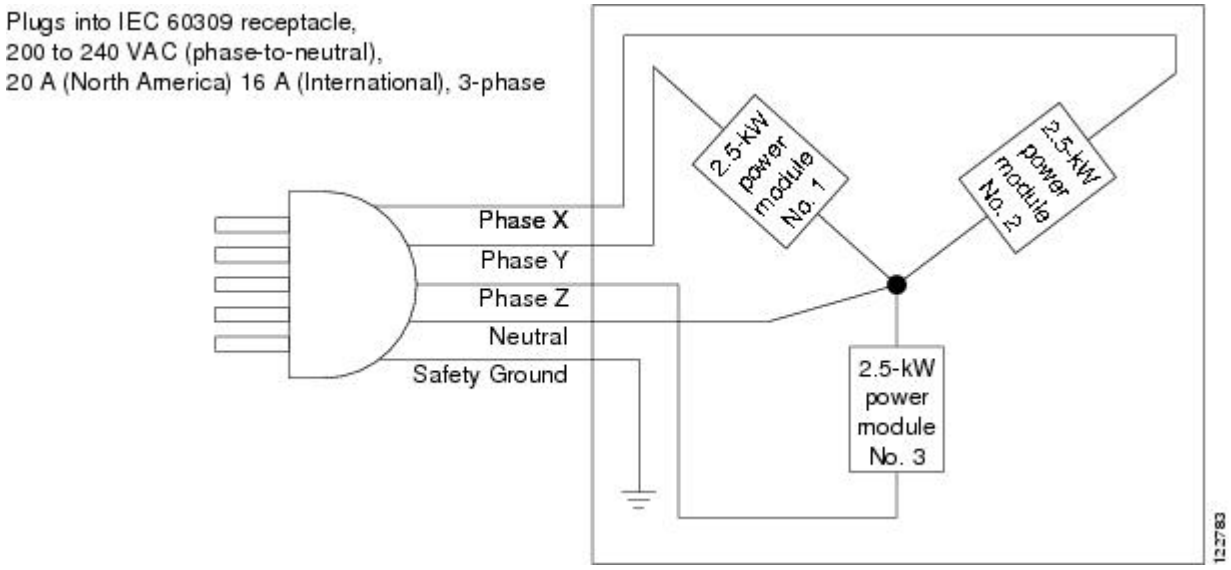


AC Wye 3-Phase Wiring

This figure shows a PDU wired for AC Wye 3-phase power. As shown, input AC power is routed to three internal 2.5-kW power modules in the rectifier, where it is converted into DC power (nominal 54.5 VDC, 46 ADC) and routed to the three load zones of the chassis.

The AC Wye PDU is shipped with a 14-foot (4.3-m) AC power cord. The power cord has a 5-pin IEC 60309 plug that is rated for 16 A (International) and 20 A (North America). It plugs into an IEC 60309 receptacle (16 or 20 A).

Figure 18: AC Wye PDU Wiring



Modular Configuration AC Power Requirements

A modular configuration AC-powered LCC contains two AC power shelves and up to three AC PMs per power shelf.

In addition to the requirements in the General Power and Grounding Requirements, on page 15 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, 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.
- 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, depending on how many AC PMs are installed in the shelf.

- Unlike the fixed configuration AC power system, which requires 3-phase AC Delta or AC Wye input power, the modular configuration AC power system requires single-phase AC input power. 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 modular configuration AC power shelf to maintain a balanced 3-phase power load.

For detailed modular configuration AC power specifications, see the Line Card Chassis Specifications, on page 37.

Modular Configuration AC Power Shelf Wiring

The modular configuration AC power shelf is shipped with AC power cords. Each modular configuration AC power shelf accepts up to three power cords. Each AC power cord has a different plug type, depending on locale. AC power cords are available for the following locales:

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

The table lists the single-phase AC-input cord power options and Cisco product numbers for the Cisco CRS 8-slot LCC with a modular configuration AC power shelf installed. Every locale listed in the table have power cord illustrations as show below.

Table 3: Modular Configuration AC-Input Power Cord Options

Locale	Cisco Product Number	Plug Rating
North America	CRS-AC-CAB-NA(=)	20 A/250 VAC
Europe	CRS-AC-CAB-EU(=)	16 A/250 VAC
United Kingdom	CRS-AC-CAB-UK(=)	13 A/250 VAC
Italy	CRS-AC-CAB-IT(=)	16 A/250 VAC
Australia	CRS-AC-CAB-AU(=)	15 A/250 VAC

Figure 19: North America—Modular Configuration AC-Input Power Cord

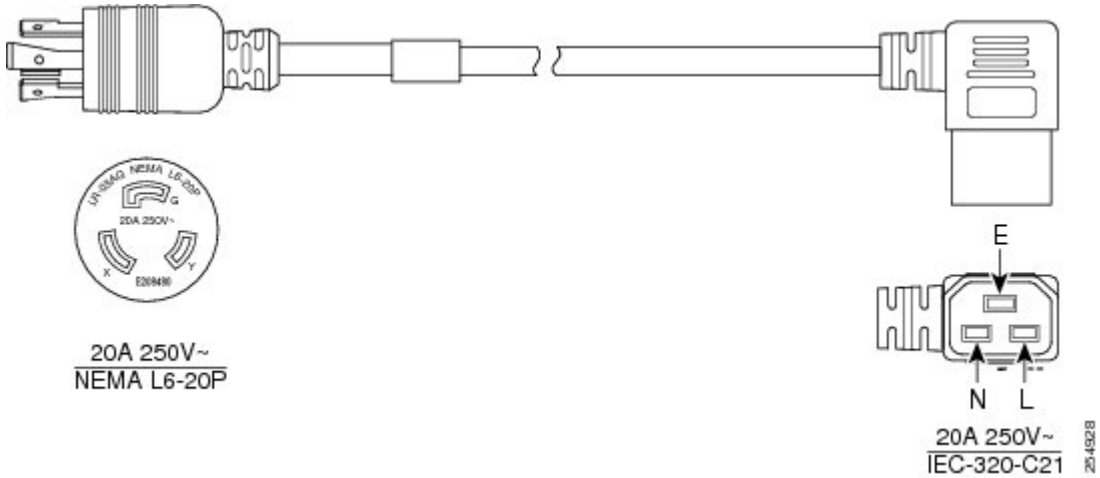


Figure 20: Europe—Modular Configuration AC-Input Power Cord

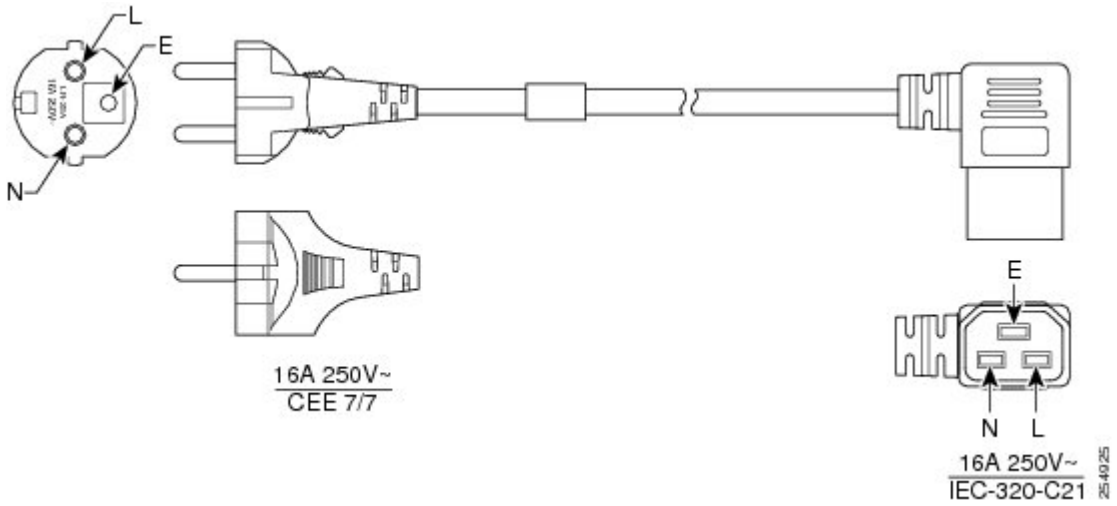
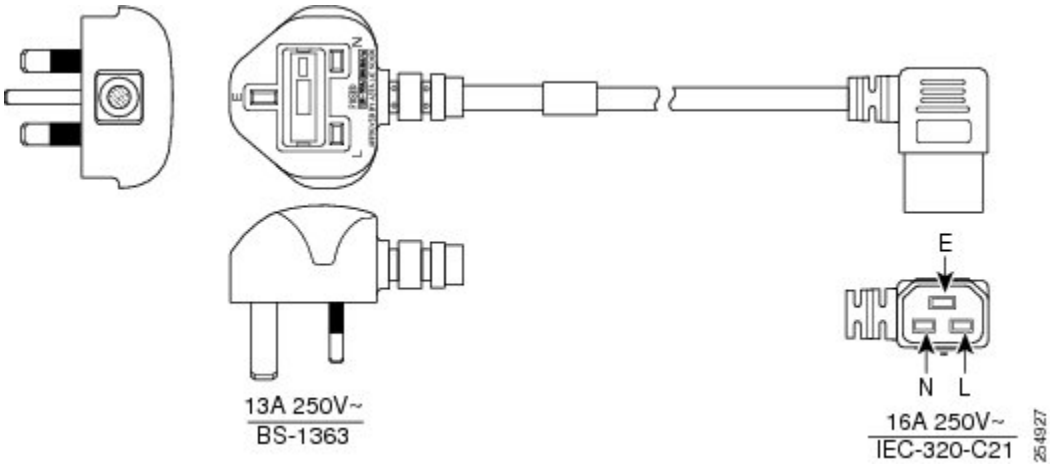


Figure 21: United Kingdom—Modular Configuration AC-Input Power Cord


E
N L
13A 250V~
BS-1363
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 22: Italy—Modular Configuration AC-Input Power Cord

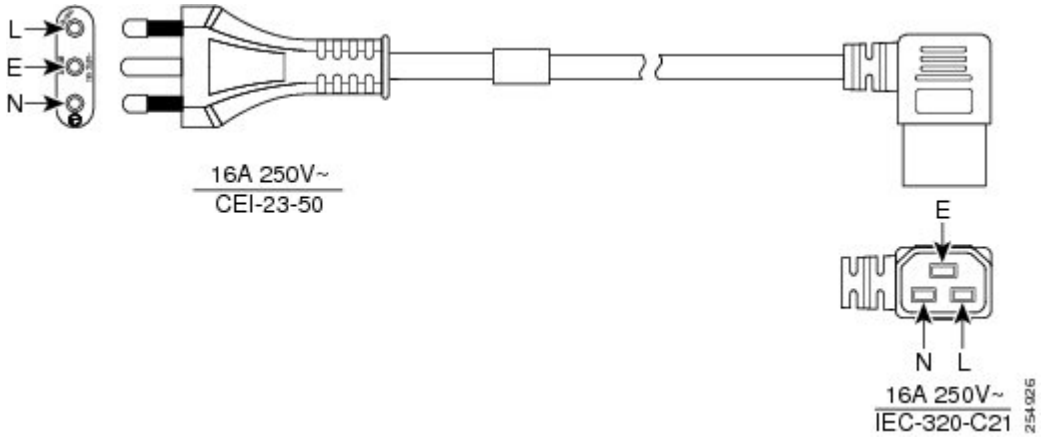
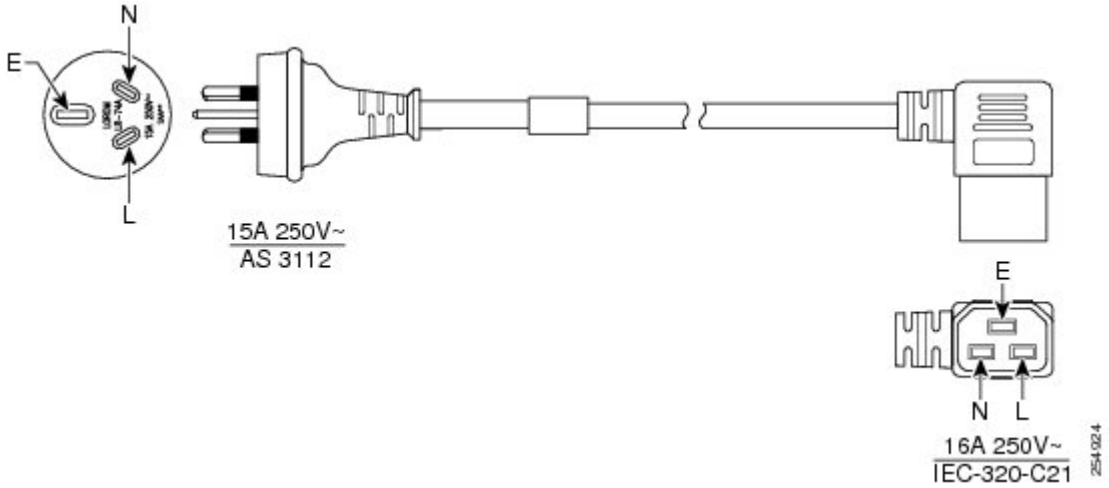


Figure 23: Australia—Modular Configuration AC-Input Power Cord



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 modular configuration 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.

In addition to the requirements in the General Power and Grounding Requirements, on page 15, 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.
  - Delta input power cord has 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 single PDU has three single phase output cords, each with a 90 degree IEC-320-C21 plug that plugs into a IEC-320-C22 inlet on the rear of the modular configuration 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.
  - Wye power cord has 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.

The following figures show the plugs for the power cords on the AC Delta and Wye PDUs.

Figure 24: AC Delta Power Cord Plug

Figure 25: 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 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 figure below.

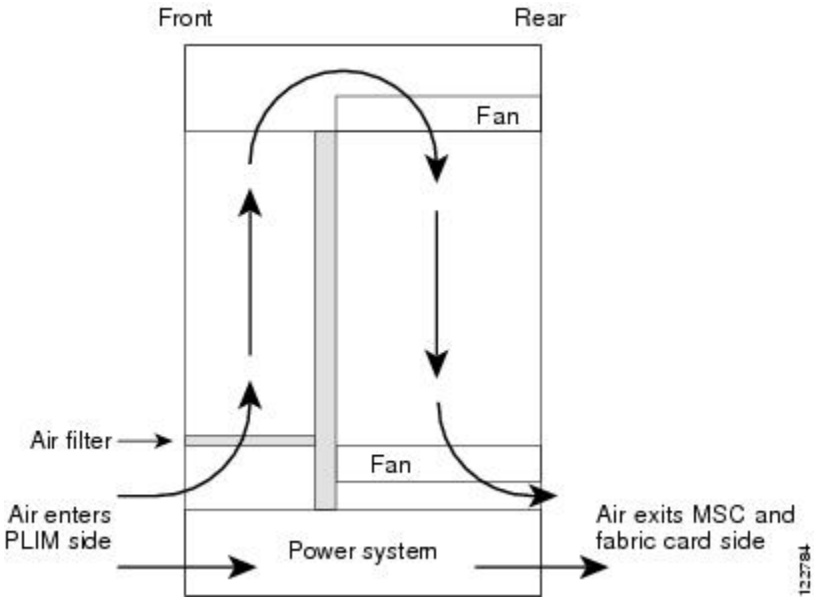
In addition, each fixed configuration AC or DC power module at the bottom of the chassis has self-contained fans that pull in cool air from the front of the chassis and exhaust warm air out the rear.

A replaceable air filter is located on the front of the chassis below the PLIM card cage. Each fixed configuration power module also has a replaceable air filter that attaches to the module at the front side of the chassis. 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 26: Airflow Through the 8-Slot Line Card Chassis



The 8-slot LCC airflow volumes are as follows:

- Chassis airflow: Up to 900 cubic feet (25,485 liters) per minute
- Power system airflow: Up to 240 cubic feet (6800 liters) per minute

Facility Cooling Requirements

The 8-slot line card chassis 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.

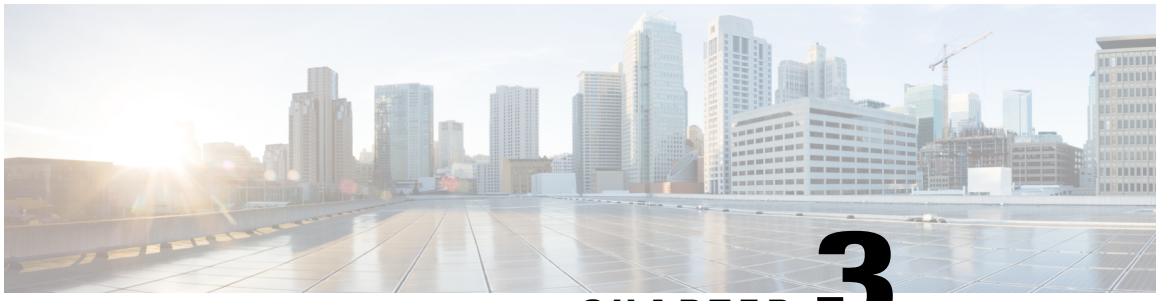
>Heat dissipation and external cooling requirements for the 8-slot line card chassis are as follows:

- Heat dissipation (fixed configuration): 28,720 BTUs per hour
- Heat dissipation (modular configuration): 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 and the fixed configuration power modules. 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 8-Slot LCC.

Line Card Chassis Specifications

This table lists the system specifications for the Cisco CRS 8-slot LCC with a fixed configuration power system installed.

Table 4: 8-Slot Line Card Chassis Component and Power Specifications—Fixed Configuration Power

Description	Value
Supported Cards and Modules	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) card (no dedicated slot; installs in open MSC slot) 2 fan trays (with four fans per fan tray) 1 air filter
Power Distribution Units	2 AC (Wye or Delta) or 2 DC power distribution units (PDUs) (cannot mix AC and DC PDUs in the chassis)
DC PDU	Supports 1 DC power entry module (PEM)

Description	Value
AC PDU	Supports 1 AC rectifier module
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	8.0 kW (assuming 94% efficiency)
Maximum AC	8.5 kW (Delta or Wye 3-phase) (assuming 88% efficiency)
Power Redundancy (2N)	
DC	Three “A” battery plant feeds required for one PDU, and three “B” battery plant feeds required for the other PDU.
AC (Delta or Wye 3-phase)	Two independent Delta or Wye 3-phase power sources required, one for each PDU.
DC Input	
Nominal input voltage	–48 VDC North America–54 VDC Telco (RBOC)–60 VDC International(range –40.5 to –75 VDC)
Input current	56 A at –48/–60 VDC (nominal voltage)66 A at –40.5 VDC (low voltage extreme)
AC Input, Delta 3-phase	3W + PE (3 wire + protective earthing conductor ground wire)
Input voltage	3-phase 200 to 240 VAC, phase-to-phase (nominal)(range 170 to 264 VAC, phase-to-phase)
Line frequency	50 to 60 Hz(range 47 to 63 Hz)
Input current(PDU rated for 24 A)	30 A
AC Input, Wye 3-phase	3W + N + PE (3 wire + neutral + protective earthing conductor ground wire)
Input voltage	3-phase 200 to 240 VAC, phase-to-neutral (nominal)(range 170 to 264 VAC, phase-to-neutral) (range 295 to 457 VAC, phase-to-phase)
Line frequency	50 to 60 Hz (nominal)(range 47 to 63 Hz)
Input current (PDU rated for 14 A)	16 A International 20 A North America

This table lists the system specifications for the Cisco CRS 8-slot LCC with a modular configuration power system installed.

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

Description	Value
Supported Cards and Modules	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) 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)
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	
Nominal input voltage	–48 VDC North America–60 VDC International(range –40 to –72 VDC)

Description	Value
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 LCC 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: 8-Slot Line Card Chassis and Equipment Rack Specifications

8-Slot Line Card Chassis 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 (front cover, front grille, and so on)	650 lb. (294.8 kg)

8-Slot Line Card Chassis Specifications	
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
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
Equipment Rack Specifications (continued)	
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 length (60 cm rack width by 91.4 cm chassis length)

8-Slot Line Card Chassis Specifications	
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	
General considerations	• The rack must be bolted to the floor. For more information, see the *Cisco CRS Carrier Routing System Line Card Chassis 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	

8-Slot Line Card Chassis Specifications	
Rail openings (aperture)	• 17.75 in. (45.1 cm), side to side • 22.8 in. (57.9 cm), front to back (adjustable or fixed)
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 *Cisco CRS Carrier Routing System Line Card Chassis 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).

8-Slot Line Card Chassis Specifications	
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

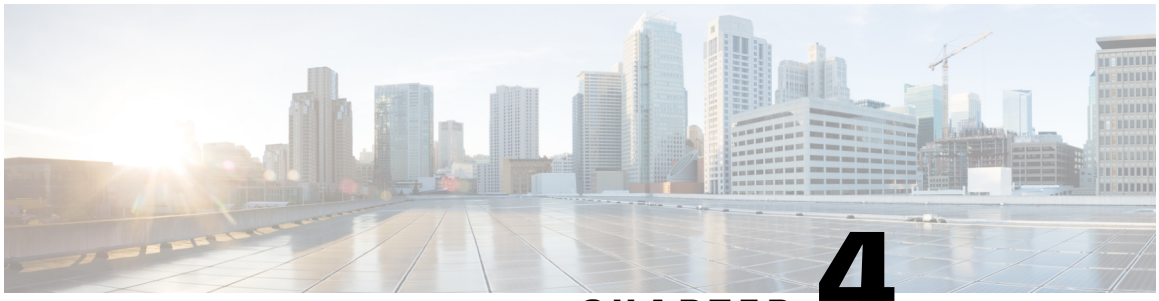
This table lists the environmental specifications for the Cisco CRS 8-slot LCC.

Table 7: 8-Slot Line Card Chassis 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	28,720 BTU per hour (fixed configuration DC)[1] 32,570 BTU per hour (modular configuration DC)[2]
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 (fixed configuration power)	81 dB—80°F (27°C) or lower (fan speed 4000 RPM, nominal)92 dB—104°F (40°C) or higher (fan speed 6500 RPM)
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).

1 Heat dissipation from the DC power system based on maximum output power capacity at 94% efficiency.

2 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.



CHAPTER 4

Site Planning Considerations

This chapter describes the general considerations to address while planning for the installation of the Cisco CRS 8-Slot LCC. It does not repeat the specifications in Technical and Environmental Specifications, on page 37 but you should keep those specifications in mind as you plan for your system.

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 Equipment Rack Specifications, on page 40 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 LCC:

- 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)

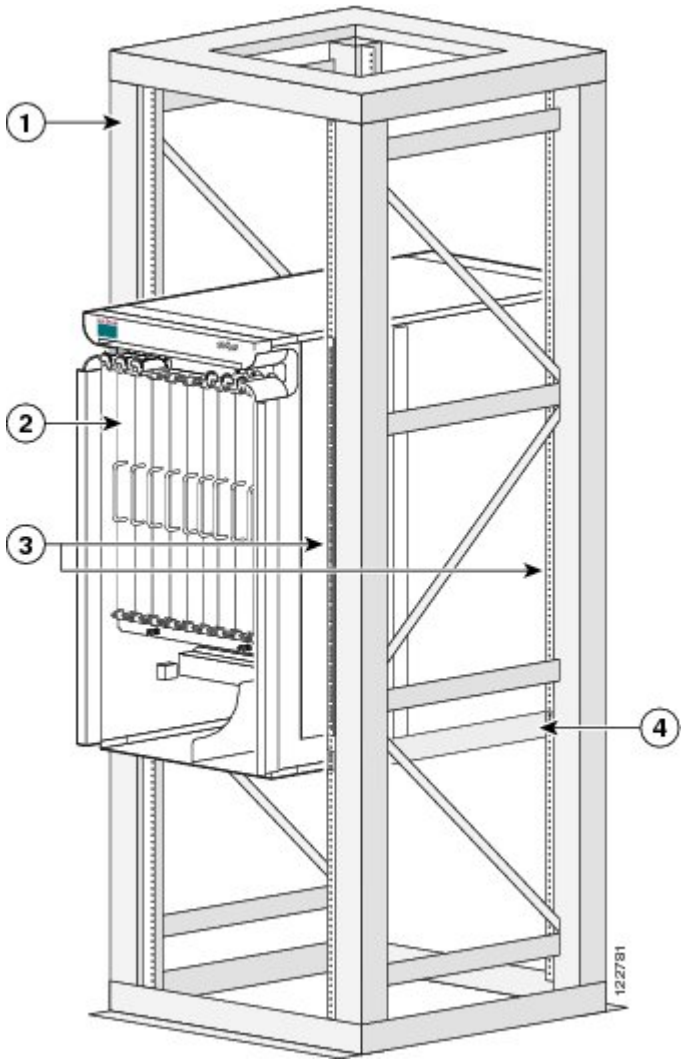
- Torque wrench with 10-mm 6 pt. socket and rated accuracy at 20 in.-lb (2.26 N-m)
- Torque screwdriver with number 1 Phillips bit and rated accuracy at 5.5 in-lb (0.62 N-m)
- ESD-preventive wrist strap
- Antistatic mat
- Scissors
- Tape measure (optional)

Equipment Rack Considerations

A fully loaded Cisco CRS 8-slot LCC 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 40.

Figure 27: 8-Slot LIne Card Chassis Mounted in an Equipment Rack



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

Danger 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, you install 12 screws in each of the four corners of the rack.

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 40.

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

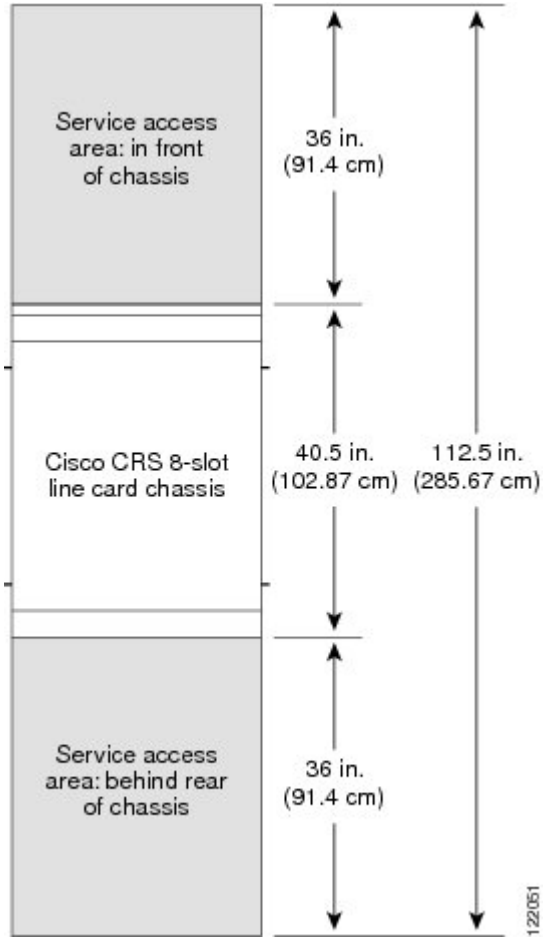
Aisle Spacing and Maintenance Access Floor Plan

The floor plan for the Cisco CRS must include enough space to install the 8-slot line card chassis 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).

This figure shows a top view of the Cisco CRS 8-slot LCC 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 28: Typical Cisco CRS 8-Slot Line Card Chassis Floor Plan



Dimensions of the 8-Slot Line Card Chassis

The dimensions for the Cisco CRS 8-slot LCC 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 13 for information about the power and cooling systems on the 8-slot chassis 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 8-slot line card chassis 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.

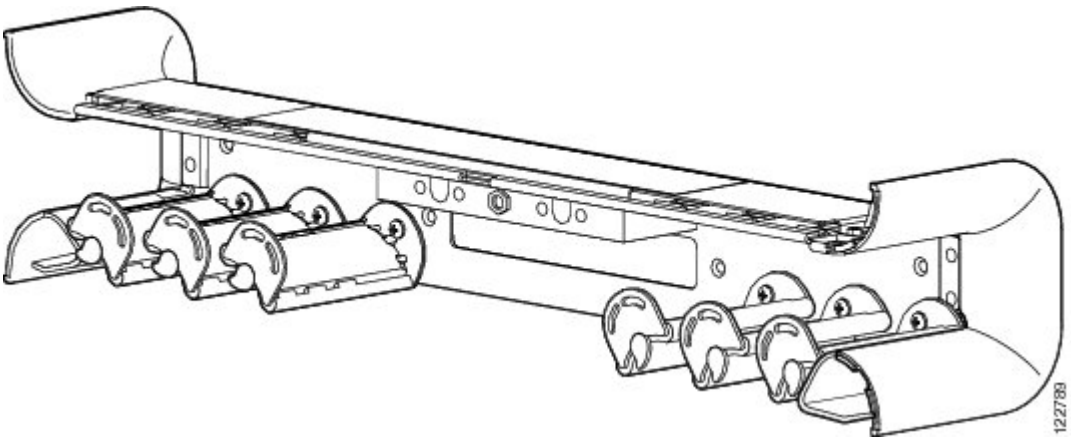
Caution Excessive bending can damage interface cables.

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 Do not install the front cover on the chassis when the telescoping feature is in use.

This figure shows the chassis cable-management bracket.

Figure 29: 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[3] cable (Category 5 or better). Required for enhanced immunity to external electromagnetic disturbance levels of 10 V/m and 10 Vrms.
Alarm	Shielded cable. Required for EMC compliance.

3 STP = shielded twisted-pair

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, OC-192/STM-64, OC-768/STM-256, 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 8-slot LCC 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.

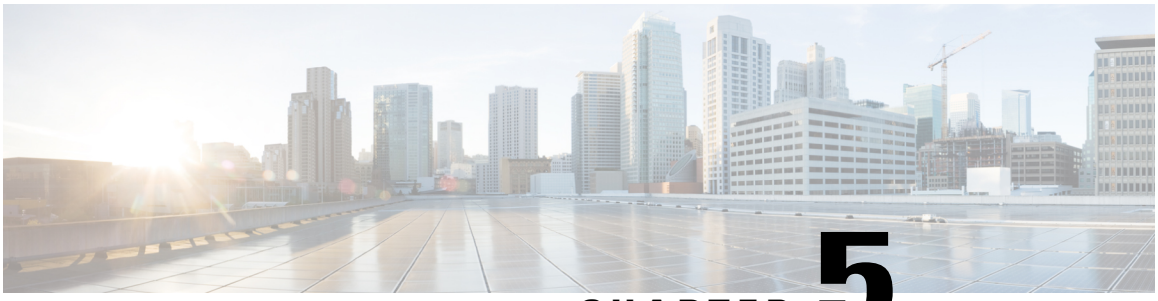
Additional noise-reduction measures have to be designed on an individual site basis.

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.



CHAPTER 5

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

This 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:	

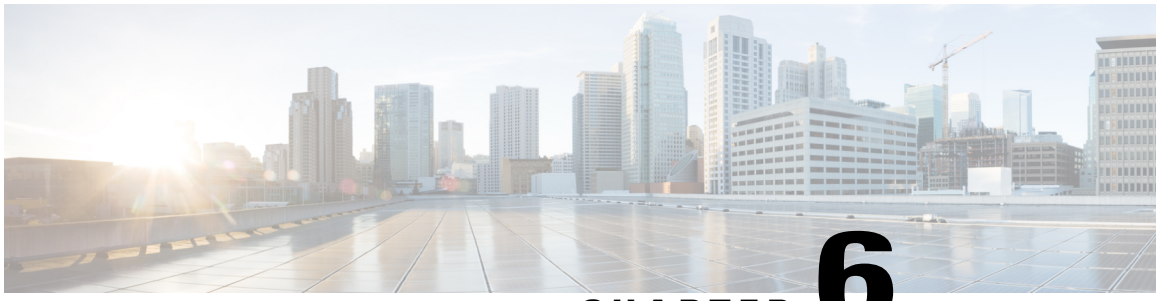
Preliminary Site Survey	
Special instructions:	
Hours and days of operation:	
Site Survey Contacts	
Primary Contact	
Name:	
Title:	
Phone number:	
Mobile phone number:	
Fax number:	
Pager number:	
E-mail address:	
Secondary Contact	
Name:	
Title:	
Phone number:	
Mobile phone number:	
Fax number:	
Pager number:	
E-mail address:	
Delivery and Installation Constraints	
Is there a loading dock available to unload the equipment at this site?	

Preliminary Site Survey	
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?	
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?	
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.	

Preliminary Site Survey		
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		
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?		

Preliminary Site Survey		
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? What length of fiber jumper is required to complete the installation?		
What type of fiber connector is used at the site?		
If attenuation is required, will attenuators be provided? If not, who will pay for the attenuators?		

Preliminary Site Survey



CHAPTER 6

Product IDs for the Cisco CRS 8-Slot Line Card Chassis

This appendix provides information about the product IDs for components of the Cisco CRS 8-Slot LCC. It contains the following tables:

These 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 http://www.cisco.com/cgi-bin/front.x/pricing (CCO login required), and enter a search term such as "CRS" to view a list of components.

Cisco CRS 8-Slot Line Card Chassis Component Product IDs

This table lists the product IDs for components in the Cisco CRS 8-slot LCC.

Table 10: 8-Slot Routing System Component Product IDs

Component	Product ID	Description
CRS 8-slot routing system	CRS-8/S	Cisco CRS 8-slot routing system
CRS 8-slot line card chassis	CRS-8-LCC(=)	Cisco CRS 8-slot line card chassis (spare chassis)
Fan tray	CRS-8-LCC-FAN-TR(=)	Cisco CRS 8-slot fan tray and fans (spare)(2 required for each chassis)
Air filter	CRS-8-LCC-FILTER(=)	Line card chassis filter pack (spare)

Component	Product ID	Description
Inlet grille	CRS-8-FRNT-GRILL(=) CRS-8-PW-GRILL(=)	Line card chassis inlet air grille—fixed configuration power Line card chassis inlet air grille—modular configuration power
Installation kit	CRS-8-INSTALL-KT(=)	Line card chassis installation kit(includes a set of horizontal shelf brackets, mounting screws, and other items)
Fixed Configuration Power Components		
Power module filter	CRS-8-PWR-FILTER(=)	Filters (five per pack) for AC rectifier and DC PEM
AC Delta power components		
AC Delta PDU	CRS-8-LCC-PDU-ACD(=)	Cisco CRS AC Delta power distribution unit(two required for each chassis)
AC rectifier module	CRS-8-AC-RECT(=)	Cisco CRS AC rectifier module(two required for each chassis, one for each PDU)
AC Wye power components		
AC Wye PDU	CRS-8-LCC-PDU-ACW(=)	Cisco CRS AC Wye power distribution unit(two required for each chassis)
AC rectifier module	CRS-8-AC-RECT(=)	Cisco CRS AC rectifier module(two required for each chassis, one for each PDU)
DC power components		
DC PDU	CRS-8-LCC-PDU-DC(=)	Cisco CRS DC power distribution unit(two required for each chassis)
DC PEM	CRS-8-DC-PEM(=)	Cisco CRS DC PEM[4](two required for each chassis, one for each PDU)
Modular Configuration Power Components		
AC power components, single-phase		
AC power shelf	CRS-8-PSH-AC(=)	Cisco CRS single-phase AC power shelf(two required for each chassis)

Component	Product ID	Description
AC PM	CRS-PM-AC(=)	Cisco CRS AC PM[5](up to three required for each power shelf)
DC power components		
DC power shelf	CRS-8-PSH-DC(=)	Cisco CRS DC power shelf (two required for each chassis)
DC PM	CRS-PM-DC(=)	Cisco CRS DC PM(up to four required for each power shelf)
Switch fabric cards		
Switch fabric cards	CRS-8-FC/S(=) CRS-8-FC140/S(=) CRS-8-FC400/S (=) (200G mode)	Cisco CRS switch fabric card (half-height)(four required for each chassis)
Switch fabric blank	CRS-8-FC-BLANK(=)	Blank card carrier for each switch fabric slot (used during shipment, must be replaced by a switch fabric card)
Switch fabric handle	CRS-8-FC-HANDLE(=)	Handle for carrying card (spare)
Route processor card		
Route processor (RP)[6]	CRS-8-RP(=)	Cisco CRS RP card(one required for each chassis; for redundant operation, you also need CRS-8-RP/R=)
Route processor, redundant	CRS-8-RP/R(=)	Optional route processor for redundant RP operation(one required for each chassis, along with CRS-8-RP=)
Route processor memory	CRS-MEM-2G(=)CRS-MEM-4G(=)	RP memory module, 2 gigabytes RP memory module, 4 gigabytes
Route processor blank	CRS-8-RP-BLANK(=)	Blank card carrier for each route processor slot(used during shipment, must be replaced by a route processor card)
Performance route processor (PRP)[7]	CRS-8-PRP-6G(=) CRS-8-PRP-12G(=)	Cisco CRS performance route processor card
Route processor handle	CRS-8-RP-HANDLE(=)	Handle for carrying card (spare)

4 PEM = power entry module
5 PM = power module

6 RP = route processor
7 PRP = performance route processor

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

The following tables list the product IDs for the modular services cards (MSCs) and physical layer interface modules (PLIMs) available for the Cisco CRS 8-slot LCC.

Table 11: MSC Component Product IDs

Component	Product ID	Description
MSC[8] FP card	CRS-MSC-B(=), CRS-MSC-140G(=), CRS-MSC-X (200G) FP40FP-140CRS-FP-X (200G)	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)

8 Refer to the product data sheet for ordering details.

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

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)

Component	Product ID	Description
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)
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.

Component	Product ID	Description
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 16- and 8-Slot LCC. 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 Multi-rate POS SPA	SPA-8XOC12-POS	—
8-Port Gigabit Ethernet SPA	SPA-8X1GE	—