



CHAPTER 2

Installing and Removing Power Components

This chapter provides instructions on how to install and remove the Cisco CRS Carrier Routing System 4-Slot Line Card Chassis power components.

This chapter presents the following topics:

- [About Installing and Removing the Power Components, page 2-1](#)
- [DC Power Systems on the Cisco CRS 4-Slot Router, page 2-7](#)
- [Installing a DC Power Shelf, page 2-14](#)
- [Removing a DC Power Shelf, page 2-20](#)
- [Installing an AC Power Shelf, page 2-24](#)
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- [Removing a Power Supply, page 2-30](#)

About Installing and Removing the Power Components

This section contains some general information about the power components.

- [Basic Chassis Power Recommendations, page 2-1](#)
- [Supplemental Unit Bonding and Grounding Guidelines, page 2-2](#)
- [AC Power Supply Cord Illustrations and Plug Types, page 2-4](#)
- [Powering the Chassis Up or Down, page 2-6](#)

Basic Chassis Power Recommendations

The Cisco CRS Carrier Routing System 4-Slot Line Card Chassis can be configured with either an AC-input power subsystem or a DC-input power subsystem. Site power requirements differ depending on the source voltage used. Follow these precautions and recommendations when planning power connections to the router:

- Check the power at your site before installation and periodically after installation to ensure that you are receiving clean power. Install a power conditioner, if necessary.
- Install proper grounding to avoid damage from lightning and power surges.

**Caution**

A Cisco router must be operated with all its power modules installed at all times for electromagnetic compatibility (EMC).

The Cisco CRS 4-slot line card chassis requires that at least the power shelves and their components be installed to operate properly. Two types of power shelves exist: an AC shelf and a DC shelf. An AC power shelf houses AC rectifiers, while a DC power shelf houses the DC power input module (PIM) and DC power input shelf (which encloses the DC power supplies). We recommend that you use only one type of power shelf in a chassis at a time.

**Warning**

This unit might have more than one power supply connection. All connections must be removed to de-energize the unit. Statement 1028

The Cisco CRS 4-slot line card chassis is shipped fully populated with a power shelf that contains four power supplies for power redundancy. See the appropriate installation section (see [“Installing a DC Power Shelf”](#) section on page 2-14 or [“Installing an AC Power Shelf”](#) section on page 2-24) for detailed installation information.

As viewed from the front (PLIM) side of the chassis, the left two power supplies feed output A, while the right two power supplies feed output B.

For 2N redundancy, the power input on rear (SFC) side of the chassis should be from two different branch sources, with the left two input connections to one branch source and the right two to the other branch source. With this configuration the router remains fully powered in case one branch source fails. In normal operation all power supplies should be installed.

Be sure to install the power shelf **before** installing the power supplies.

**Caution**

If you install a non-Cisco power supply in the chassis, upon its detection as a non-compliant power supply, the system will shut down. Using non-Cisco power supplies **MAY RESULT IN COMPLETE CHASSIS SHUTDOWN** due to insufficient power.

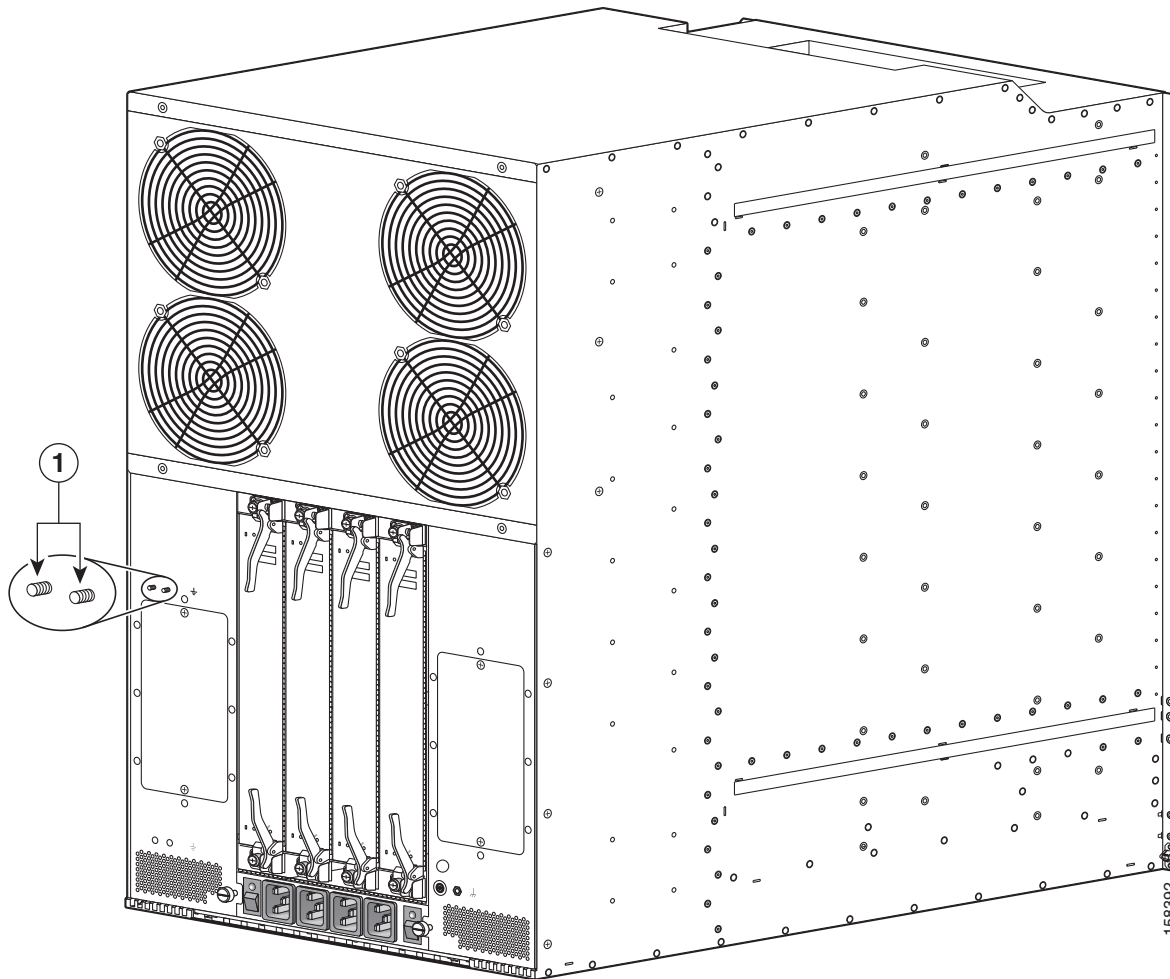
Supplemental Unit Bonding and Grounding Guidelines

Although the router chassis has a safety earth ground connection as part of the power cabling to the power shelf, the chassis includes an option that allows you to connect the central office ground system or interior equipment ground system to the supplemental bonding and grounding receptacles on the router chassis. Two ground studs are located on the rear (SFC) side of the chassis. (see [Figure 2-1](#)). This ground point is also called the *network equipment building system* (NEBS) bonding and grounding stud.

**Note**

These bonding and grounding receptacles satisfy the Telcordia® NEBS requirements for supplemental bonding and grounding connections. If you are not installing the router in a NEBS environment, you can choose to bypass these guidelines and rely on the safety earth ground connection for the power shelf.

Figure 2-1 NEBS Bonding and Grounding Points (Rear of Chassis)



1	NEBS bonding and grounding stud
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If you plan to connect the Cisco CRS 4-slot line card chassis system to a network equipment building system (NEBS)-compliant supplemental bonding and grounding system at the site, you must have the following:

- A minimum of one ground lug that has two M6 bolt holes with 0.625-inch (15.86-mm) spacing between them, and a wire receptacle large enough to accept a 6-AWG or larger multistrand copper wire. The lug is similar to the type used for the DC-input power supply leads. This ground lug is not available from Cisco Systems. This type of lug is available from electrical-connector vendors, such as Panduit.
- Two M6 nuts with locking washers (nickel-plated brass is ideal). This hardware is not available from Cisco Systems; they are available from any commercial hardware vendor.
- A commensurately rated ground 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.

**Note**

The DC return of this system should remain isolated from the system frame and chassis (DC-I: Isolated DC Return).

AC Power Supply Cord Illustrations and Plug Types

This section contains the AC power cord illustrations and a table of power plug types for the Cisco CRS Carrier Routing System 4-Slot Line Card Chassis for Australia (AU), European (EU), Italy (IT), United Kingdom (UK), United States (USA), and Japan.

Table 2-1 AC Power Supply Plug Types

Plug Type	Country
AU20S3	Australia— Figure 2-2
CEE 7/7	European— Figure 2-3
CEI 23-50	Italian— Figure 2-4
BS 1363	United Kingdom— Figure 2-5
NEMA L6-20	United States and Japan— Figure 2-6

Figure 2-2 CAB-CRS4AC-AU

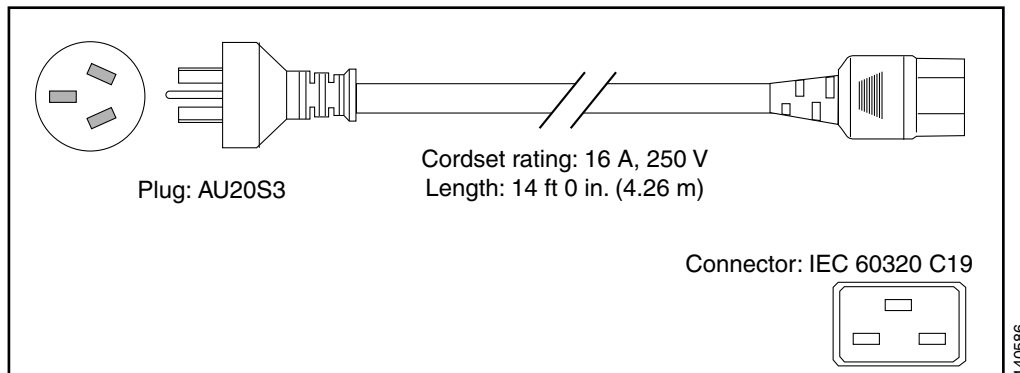


Figure 2-3 CAB-CRS4AC-EU

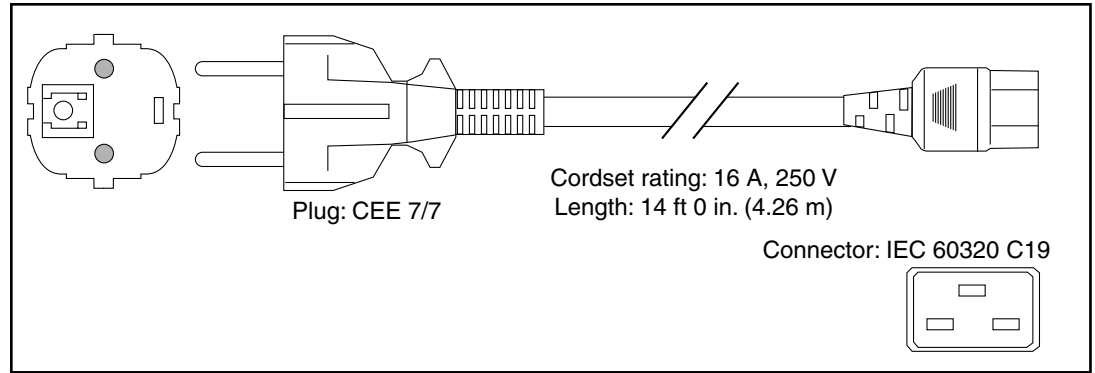


Figure 2-4 CAB-CRS4AC-IT

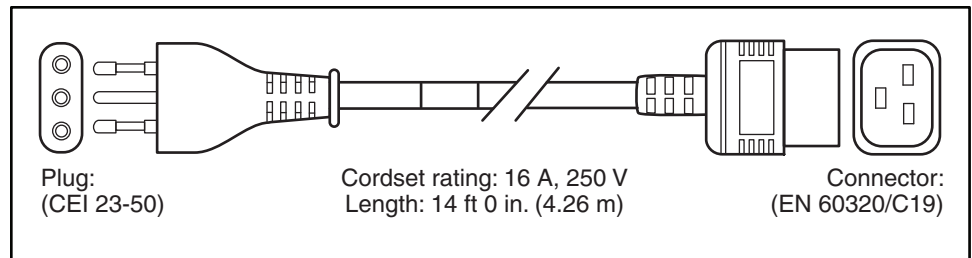


Figure 2-5 CAB-CRS4AC-UK

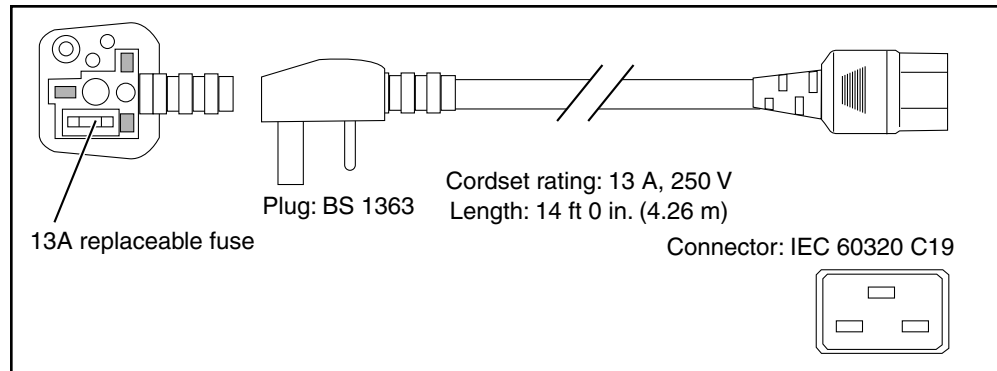
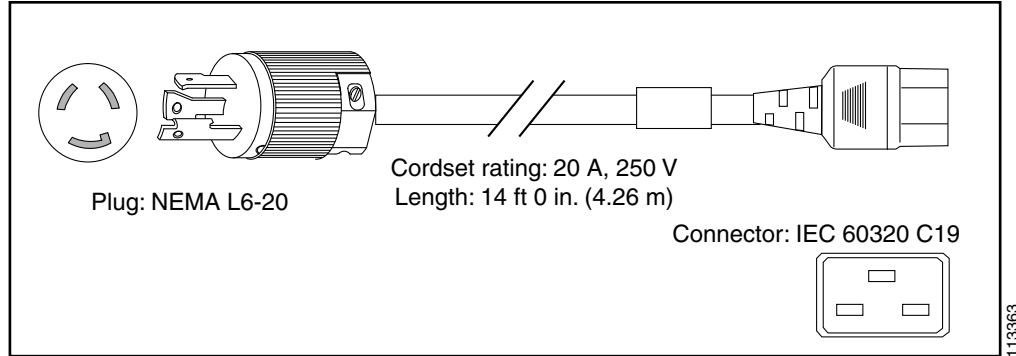


Figure 2-6 CAB-CRS4AC-US and Japan



Powering the Chassis Up or Down

The chassis does not have a single enable switch that powers the entire chassis and all its components up and down. (These switches are called enable switches because they enable the power supplies to produce output voltage and power). Most components on the chassis, such as the power supplies, MSCs, FPs, PLIMs, and fan trays can be removed or installed in the chassis while it is running.

Before you can power the chassis up, you must complete the following tasks:

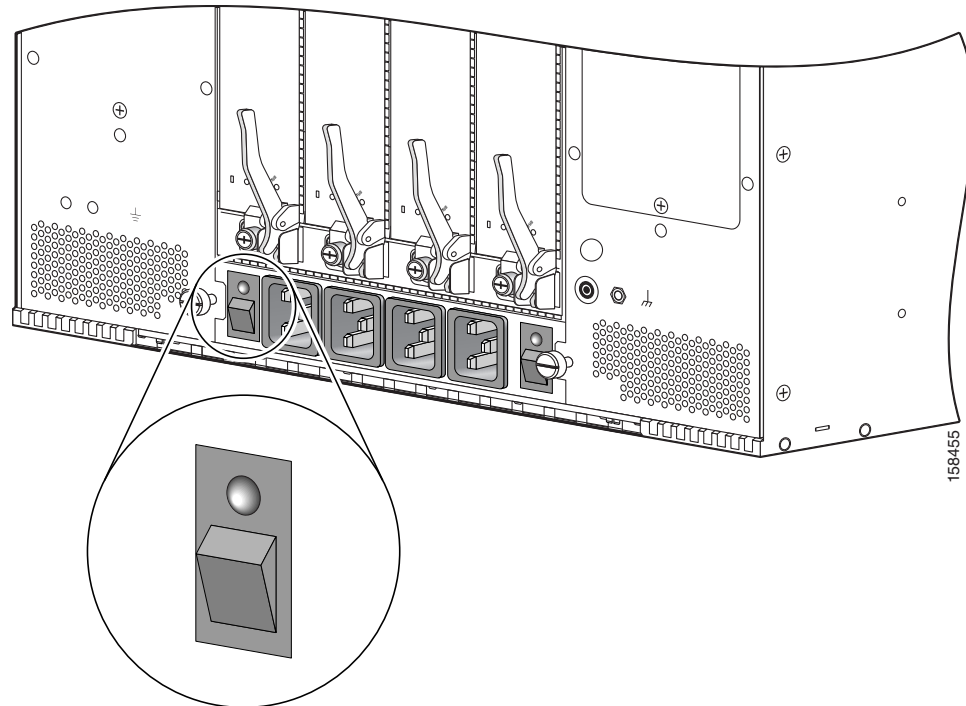
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- Step 1** Install the appropriate power shelf for your system (see the “[Installing a DC Power Shelf](#)” section on page 2-14 or the “[Installing an AC Power Shelf](#)” section on page 2-24).
 - Step 2** Install the power supplies (see the “[Installing a Power Supply](#)” section on page 2-28).
 - Step 3** Install the route processor (RP) card (see the “[Installing an RP or PRP Card](#)” section on page 4-26).
 - Step 4** Install the input power cables to the input power connectors on the rear of the chassis, and the other end (plug side) to the AC or DC power source.
 - Step 5** Activate your power source.
 - Step 6** Turn the two power shelf enable switches on the rear (SFC) side of the power shelf (see [Figure 2-7](#)) to the ON position.



Note

The two enable switches on the rear (SFC) side of the AC power shelf ([Figure 2-7](#)) put the chassis in standby mode; in other words, they only power down the -54VDC output from the power supplies.

Figure 2-7 AC Power Enable Switches



For an illustration of the DC power enable switches, see [Figure 2-19](#).



Note

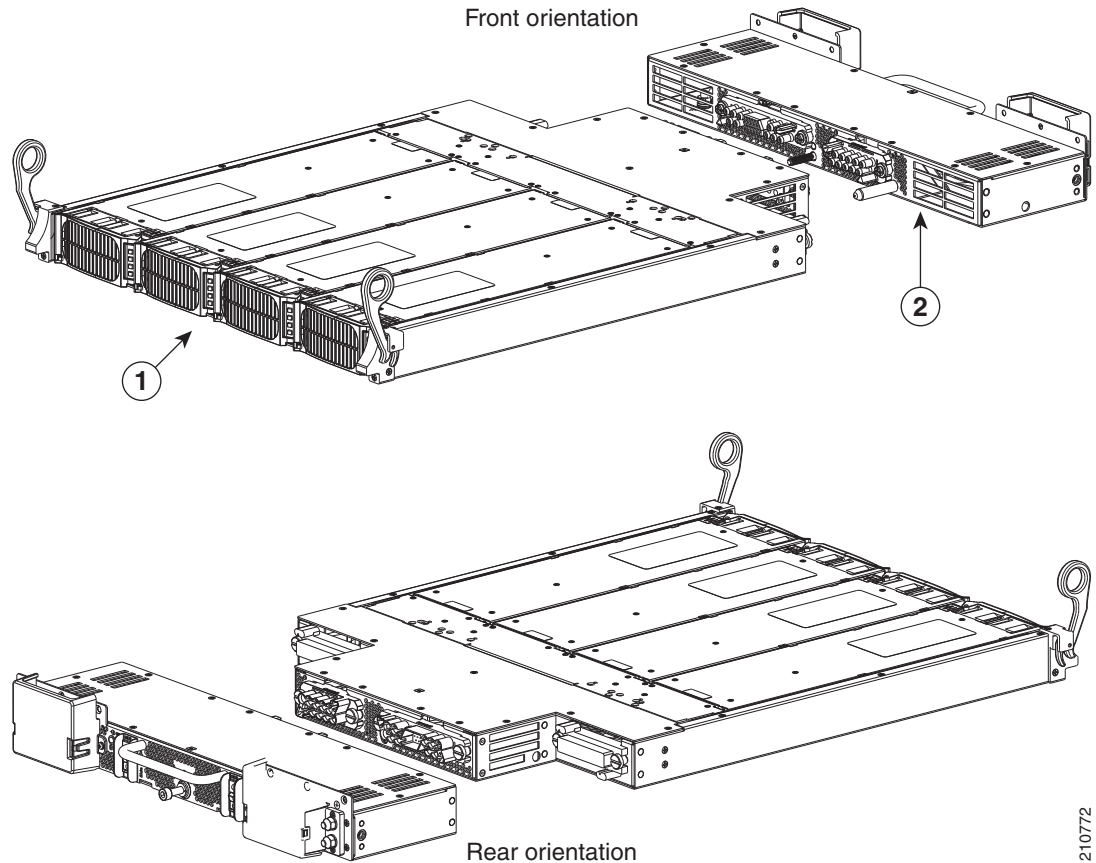
All power cords must be unplugged from wall power to fully remove power from the chassis.

DC Power Systems on the Cisco CRS 4-Slot Router

The Cisco CRS 4-slot line card chassis DC power shelf consists of two major components, as shown in [Figure 2-8](#):

- DC power input shelf (Cisco product number: CRS-4-DC-INPUT)
[Figure 2-8](#) shows the power supplies installed in the DC power input shelf.
- DC power input module (PIM) (Cisco product number: CRS-4-DC-PIM)

Figure 2-8 DC Power Shelf: DC Power Input Shelf and DC Power Input Module (PIM)



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1	DC power input shelf	2	Power input module (PIM)
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When installing the DC power shelf, these two components are mated to create the complete DC power shelf (see the [“Installing a DC Power Shelf”](#) section on page 2-14 for details).

The Cisco CRS 4-slot line card chassis DC power system provides 4,000 watts to power the chassis. (To provide power redundancy, up to 8,000 watts are available.) Each DC-powered chassis contains four DC power supplies for 2N redundancy. The power input module (PIM) provides the input power connections. Note that each power connection has two cables: –48 VDC and return. The power input module (PIM), DC power input shelf, and the power supplies are field replaceable.

The Cisco CRS 4-slot line card chassis requires a total of four dedicated pairs of 60-A DC input power connections, one pair for each of the power supplies, to provide redundant DC power to the Cisco CRS 4-slot line card chassis midplane.

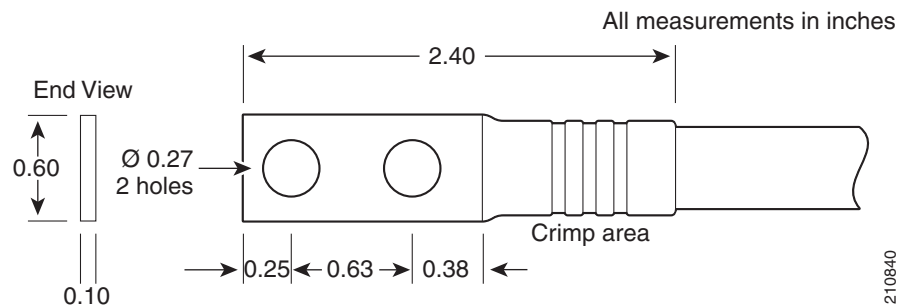
For full 2N redundancy, we recommend that you have two independent –48 VDC power sources to provide power to the Cisco CRS 4-slot line card chassis. Connect the two 60-A DC inputs on the left to one wiring block, and the two 60-A DC inputs on the right to the other wiring block.

DC Power Shelf Guidelines

At sites where the Cisco CRS 4-slot line card chassis is equipped with a DC power input shelf and power supplies, observe the following guidelines:

- All power connection wiring should follow the rules and regulations in the National Electrical Code (NEC) and any local codes.
- Each DC-input power entry module connection is rated at 60 A maximum. A dedicated, commensurately rated DC power source is required for each power supply connection.
- Each power supply requires one –48 VDC input, or four inputs for each power shelf (in which each input consists of a pair of positive and negative wires), and one power-shelf grounding wire.
- For DC power cables, we recommend that you use commensurately rated, high-strand-count copper wire cable. Each DC power supply requires one –48 VDC input, which means that there are two wires for each power supply, or eight total wires (four pairs) for each power shelf, plus the grounding wire. The length of the wires depends on the router's location. These wires are not available from Cisco Systems; they are available from any commercial vendor.
- DC power cables must be terminated by cable lugs at the power-shelf end. The lugs should be dual hole and able to fit over M6 terminal studs at 0.625-in (15.88-mm) centers (for example, Panduit part number LCD2-14A-Q or equivalent) (see [Figure 2-9](#)).

Figure 2-9 DC Power Cable Lug



Color Coding of the Source DC Power Cable

The color coding of the source DC 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 no color code standard exists for the source DC wiring, you must ensure that the power cables are connected to the DC-input power shelf terminal studs in the proper positive (+) polarity and negative (–) polarity.

DC Cable Polarity Labels


Sometimes, the source DC cable leads might have a positive (+) or a negative (–) label. This label is a relatively safe indication of the polarity, but 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 power shelf.



Caution

The DC-input power supplies contain circuitry to prevent damage due to reverse polarity, but you should correct a reverse-polarity condition immediately.

Table 2-2 DC Input Current and Voltage Information

Nominal input voltage	Supports –48 VDC and –60 VDC systems (range: –40 to –72 VDC)
	 Note The <i>turn-on</i> voltage of the DC power supplies is –43.5 +/- 0.5 VDC. When a power supply is powered on, it continues to operate down to an input voltage of –40 VDC.
Input line current	50 A maximum at –48 VDC 40 A maximum at –60 VDC
Inrush current	60 A peak at –75 VDC (maximum for 1 ms)

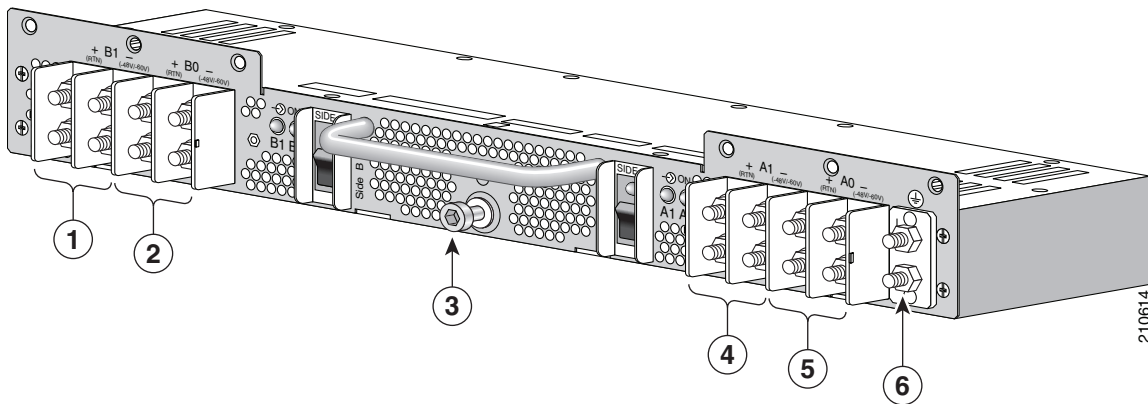
**Note**

When wiring the DC power shelf, be sure to attach the ground wire first. When removing the wiring, be sure to remove the ground wire last. The ground wire must be attached with a torque value of 30 in.-lb. The power cables should also be attached with a torque value of 30 in.-lb.

Wiring Block on the PIM

Each wiring block on the power input module (PIM) contains four sets of terminals, two positive and two negative (see [Figure 2-10](#)). Each wiring block is covered by a plastic block cover that snaps onto the wiring block and is secured by a screw to a torque value of 50 in.-lb.

You must remove the block cover before you work with the wires.

Figure 2-10 Power Input Module (PIM)

1	Power supply B1 wiring block	4	Power supply A1 wiring block
2	Power supply B0 wiring block	5	Power supply A0 wiring block
3	Power shelf coupling screw	6	Ground lug nuts

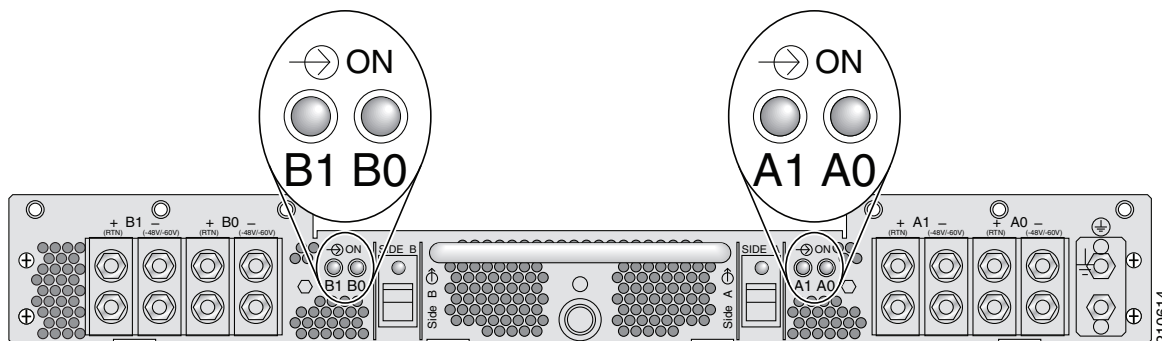
Input-Power-Present LEDs

The DC power Input-Power-Present LEDs provide a visual indication to service personnel that there is voltage present across the input terminal's connections (see [Figure 2-11](#)). The LED provides a warning to the service person that there is power present.


Note

Power should be disconnected before servicing the input power connections. Always check for hazardous voltage with a multimeter device before servicing the router.

Figure 2-11 Input-Power-Present LEDs



The input-power-present LED starts to light up when the input voltage reaches 20 VDC; the LED gets brighter as voltage increases. The input-power-present LED is fully lit when the input voltage reaches 38 VDC.


Note

If an input-power-present LED is not lit, check for: 1) the presence of voltage, and 2) the polarity of the corresponding wiring block.

DC Power Wire Characteristics

For signal degradation to be averted, a conductor must be large enough to prevent its impedance from creating a voltage drop equal to 2 percent of the reference voltage. Also, the gauge of the earth conductor must be equal to or larger than that of the -48 VDC (or -48 VDC return) conductor. This latter requirement is for safety. Full fault redundancy is achieved by having conductors of equal size for the protective earth ground and the -48 VDC return of the switch.

For site preparation, proper wire size and insulation must be selected. For a planned power distribution, calculation must be done prior to distribution to meet the proper voltage drop and temperature rise.

For wire gauges that prevent unacceptable voltage drops over different lengths of copper wire, see [Table 2-3](#). For the resistance of 1000 feet of copper wire for each gauge of wire, see [Table 2-4](#). These references are for planning purposes and might be further subject to local laws and practices.

[Table 2-3](#) provides the gauges of wire needed for wire lengths and DC power currents. The units of measurement are in American wire gauge (AWG).

**Note**

Table 2-3 and Table 2-4 are for reference; we recommend using at least 50 A of DC current and 6-gauge wire.

Table 2-3 *Wire Gauge for Current Loads Over Copper Wire Lengths*

DC Current (Amps)	25 Feet	50 Feet	75 Feet	100 Feet	150 Feet	200 Feet	400 Feet
5 A	18 AWG	14 AWG	14 AWG	12 AWG	10 AWG	8 AWG	6 AWG
10 A	14 AWG	12 AWG	10 AWG	8 AWG	8 AWG	6 AWG	2 AWG
15 A	14 AWG	10 AWG	8 AWG	8 AWG	6 AWG	4 AWG	2 AWG
20 A	12 AWG	8 AWG	8 AWG	6 AWG	4 AWG	2 AWG	0 AWG
25 A	12 AWG	8 AWG	6 AWG	4 AWG	4 AWG	2 AWG	0 AWG
30 A	10 AWG	8 AWG	6 AWG	4 AWG	2 AWG	2 AWG	00 AWG
35 A	10 AWG	6 AWG	4 AWG	2 AWG	2 AWG	1 AWG	000 AWG
40 A	8 AWG	6 AWG	2 AWG	2 AWG	2 AWG	0 AWG	000 AWG
45 A	8 AWG	6 AWG	4 AWG	2 AWG	1 AWG	0 AWG	0000 AWG
50 A	8 AWG	4 AWG	4 AWG	2 AWG	1 AWG	00 AWG	N/A
55 A	8 AWG	4 AWG	2 AWG	2 AWG	0 AWG	00 AWG	N/A
60 A	8 AWG	4 AWG	2 AWG	2 AWG	0 AWG	00 AWG	N/A
65 A	6 AWG	4 AWG	2 AWG	1 AWG	0 AWG	000 AWG	N/A
70 A	6 AWG	4 AWG	2 AWG	1 AWG	00 AWG	000 AWG	N/A
75 A	6 AWG	4 AWG	2 AWG	1 AWG	00 AWG	000 AWG	N/A
100 A	4 AWG	2 AWG	1 AWG	00 AWG	000 AWG	N/A	N/A

Table 2-4 provides the correlation between wire gauge and the resistance (in Ohms for each 1000 feet of wire) for copper wire.

Table 2-4 Resistance for Each Gauge of Copper Wire

Wire Gauge (AWG)	Ohms for Each 1000 Feet of Wire
0000 AWG	0.0489
000 AWG	0.0617
00 AWG	0.0778
0 AWG	0.098
1 AWG	0.1237
2 AWG	0.156
3 AWG	0.1967
4 AWG	0.248
5 AWG	0.3128
6 AWG	0.3944
7 AWG	0.4971
8 AWG	0.6268
9 AWG	0.7908
10 AWG	0.9968
11 AWG	1.257
12 AWG	1.5849
13 AWG	1.9987
14 AWG	2.5206
15 AWG	3.1778
16 AWG	4.0075
17 AWG	5.0526
18 AWG	6.3728
19 AWG	8.0351
20 AWG	10.1327
21 AWG	12.7782
22 AWG	16.1059

Installing a DC Power Shelf

This section describes how to install a DC power shelf in the Cisco CRS 4-slot line card chassis.

The DC power shelf encloses four power supplies and the power distribution connections and wiring. The DC power input shelf is installed in the front of the chassis; the power input module (PIM) is installed in the rear of the chassis.

We recommend that you have two separate, redundant –48 VDC power battery sources to provide power to the Cisco CRS 4-slot line card chassis. Connect the two input pair 60-A DC inputs on the left to one –48 VDC power source, and the input pair 60-A DC inputs on the right to the other –48 VDC power source.

Sequence of Tasks

The sequence of tasks required to install the DC power shelf is:

1. Remove the rear power access panels.
2. Install the DC power input module (PIM).
3. Install the DC power input shelf.
4. Mate and secure the power input module to the DC power input shelf.
5. Connect the grounding cable and the power input cables.
6. Install the DC power supplies.

Prerequisites

Power down the Cisco CRS 4-slot line card chassis.



Tip

We recommend that you do this procedure with the line card chassis mounted in a rack with sufficient space for bottom and side access to the screws.

Required Tools and Equipment

You need the following tools and parts to perform this task:

- ESD-preventive wrist strap
- Medium flat-blade screwdriver
- Number 1 Phillips screwdriver
- Number 2 Phillips screwdriver
- 5-mm Allen wrench
- 10-mm hex socket wrench
- DC power input shelf (Cisco product number: CRS-4-DC-INPUT)
- DC power input module (PIM) (Cisco product number: CRS-4-DC-PIM)
- DC power supplies (Cisco product number: CRS-4-DC-SUPPLY)

**Note**

This procedure assumes that the Cisco CRS 4-slot line card chassis is already mounted in a rack with sufficient room to access the sides and the bottom of the chassis.

Steps

To install the DC power shelf, follow these steps:

- Step 1** Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.
- Step 2** If the AC power shelf is currently installed, remove it from the front of the chassis. (For details, see the “[Removing an AC Power Shelf](#)” section on page 2-26.)

Removing the Rear Power Access Panels

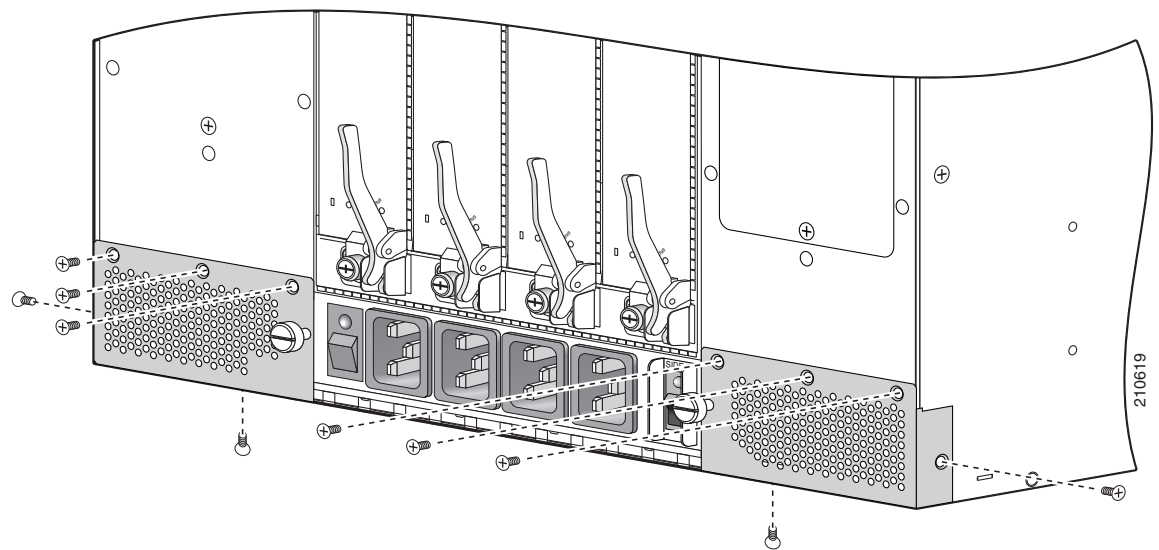
Before you can install the power input module, you must remove the rear power access panels.

- Step 3** From the rear of the chassis, use a medium Phillips screwdriver to remove the rear power access panels (located on the bottom right and bottom left rear of the chassis). Remove the screws shown in [Figure 2-12](#).

**Tip**

One screw on each side is located under the chassis (as shown in [Figure 2-12](#)). To access this screw safely, the chassis must be in a rack with adequate space below the chassis.

Figure 2-12 Removing the Rear Power Access Panels



- Step 4** Unscrew the coupling screw from each panel with a medium flat-blade screwdriver. Set aside the access panels and their screws.

**Note**

You will need these screws later when you install the power input module (PIM).

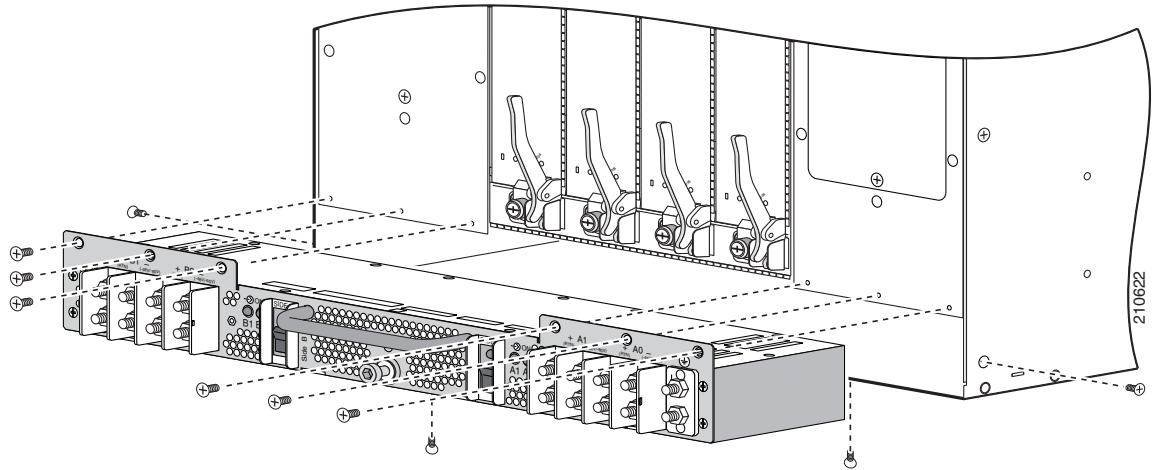
Installing the DC Power Input Module

- Step 5** From the rear of the chassis, insert the DC power input module (PIM) into the open power bay (see [Figure 2-13](#)).



Note The PIM weighs 6.5 lb (2.9 kg).

Figure 2-13 Inserting the DC Power Input Module (PIM)



- Step 6** Reinsert the No. 2 Phillips screws taken from the rear power access panels into their respective holes: one on each side, three in front, and one underneath the chassis.

Installing the DC Power Input Shelf**Caution**

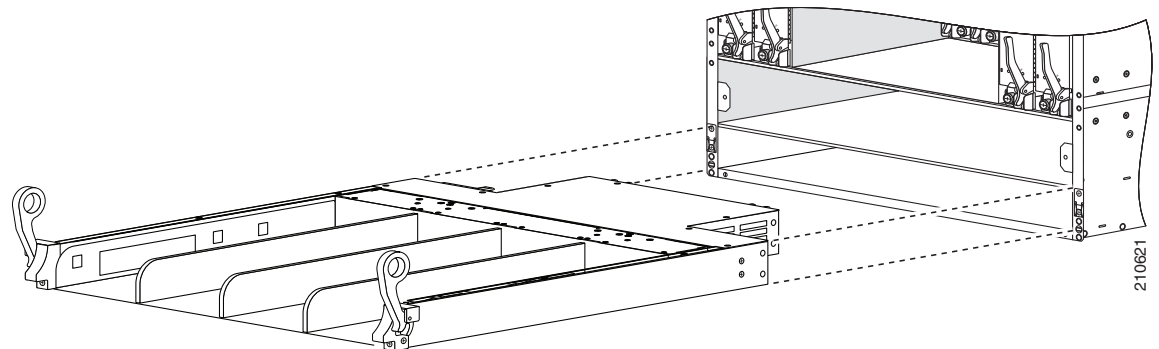
The DC power input shelf can only be inserted into the chassis when all power is removed from the chassis.

- Step 7** Go to the front of the chassis. To install the DC power input shelf, follow these steps:
- To prepare the chassis for installing the DC power input shelf, remove the inlet grille from the bottom of the chassis (for the procedure, see the [“Removing the Inlet Grille”](#) section on page 5-3).
 - Holding the DC power input shelf underneath with one hand and steadying it with the other, lift the DC power input shelf up and slide it part way into the power shelf slot on the front (PLIM) side of the chassis. Be sure to center the DC power input shelf in the slot when you slide it in (see [Figure 2-14](#)).

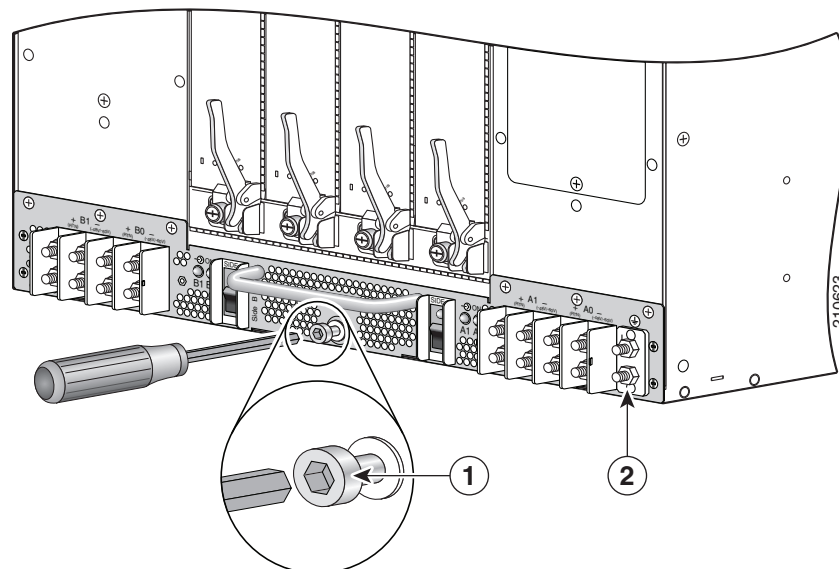
**Caution**

An empty DC power input shelf weighs about 15.5 lb (7 kg). To prevent injury when lifting the shelf, keep your back straight and lift with your legs, not your back. Avoid sudden twists or lateral moves.

- Slide the DC power input shelf fully into the chassis. Be sure that the lever handles are aligned with the lever handle catches on the chassis casing.
- To lock the power input shelf into position, lift the lever handles up.

Figure 2-14 Inserting the DC Power Input Shelf**Securing the PIM to the DC Power Input Shelf**

- Step 8** Go to the rear of the chassis. To mate the PIM to the DC power input shelf, push the PIM firmly but carefully into the power input shelf.
- Step 9** To secure the input power module connections to the power input shelf, use a 5-mm Allen wrench to tighten the power shelf coupling screw into the DC power input shelf (see [Figure 2-15](#)).

Figure 2-15 Power Shelf Coupling Screw

1	Power shelf coupling screw	2	Ground lug nuts
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Connecting the Grounding Cable and Power Input Cables

- Step 10** On the PIM, use a 10-mm hex socket wrench to connect the grounding cable (see item 2 in [Figure 2-15](#)).



Note When wiring the power shelf, be sure to attach the ground wire first. When removing the wiring, be sure to remove the ground wire last. The ground wire must be attached with a torque value of 30 in-lb.

- Step 11** On the PIM, use a 10-mm hex socket wrench to hook up the DC input power cables. Connect the four 60 A DC cables (two cables per input) on the left to one wiring block, and the four 60A DC cables on the right to the other wiring block (see [Figure 2-16](#)).

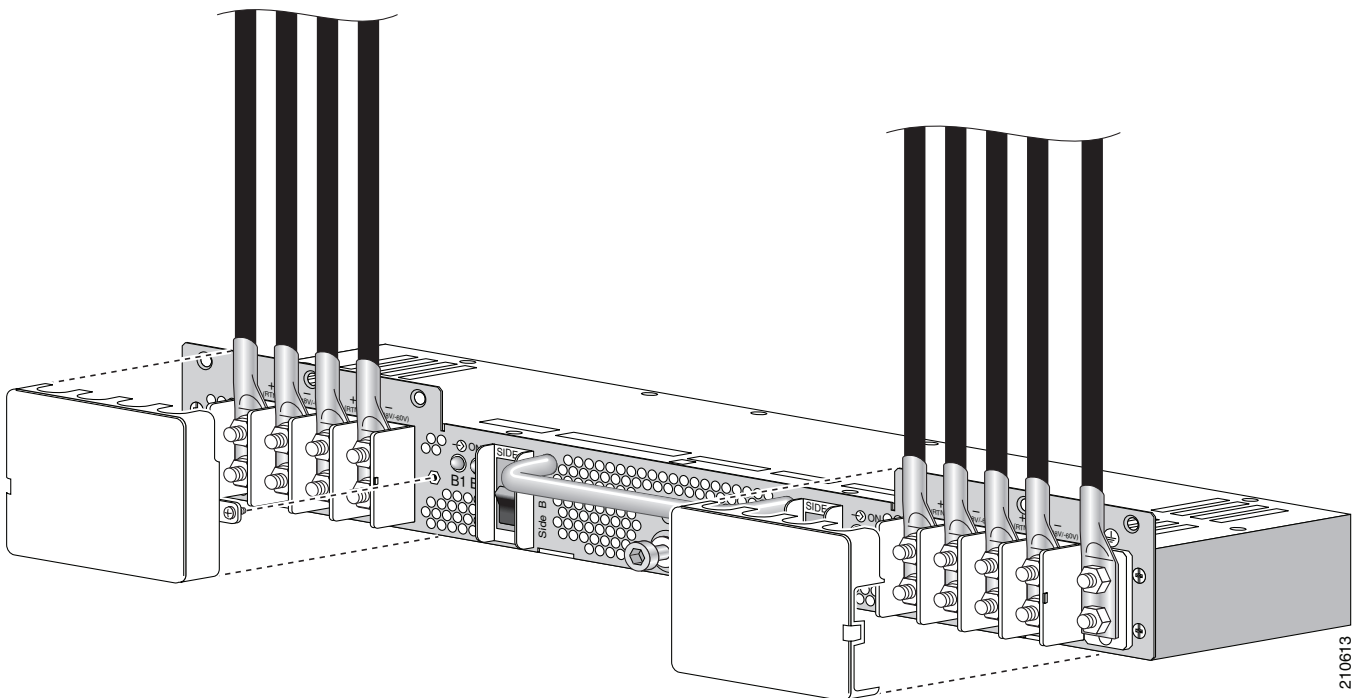


Note The DC input power cables should also be attached with a torque value of 30 in-lb.

Color Coding of the Source DC Power Cable. The color coding of the source DC power cable leads depends on the color coding of the site's DC power source. Typically, green or green and yellow indicates that the cable is a ground cable. Because no color code standard exists for the source DC wiring, you must ensure that the power cables are connected to the DC-input power shelf terminal studs in the proper positive (+) polarity and negative (-) polarity.

DC Cable Polarity Labels. Sometimes, the source DC cable leads might have a positive (+) or a negative (-) label. This label is a relatively safe indication of the polarity, but 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 power shelf.

Figure 2-16 DC Power Shelf Cable Cabling



- Step 12** Reattach both wiring block covers (see [Figure 2-16](#)).
- a. Snap the cover over the wiring block so that it snaps closed.
 - b. Use a number 1 Phillips screwdriver to tighten the capture screw.



Note The wiring block covers can be oriented to route the wire cabling from the top or the bottom of the covers.

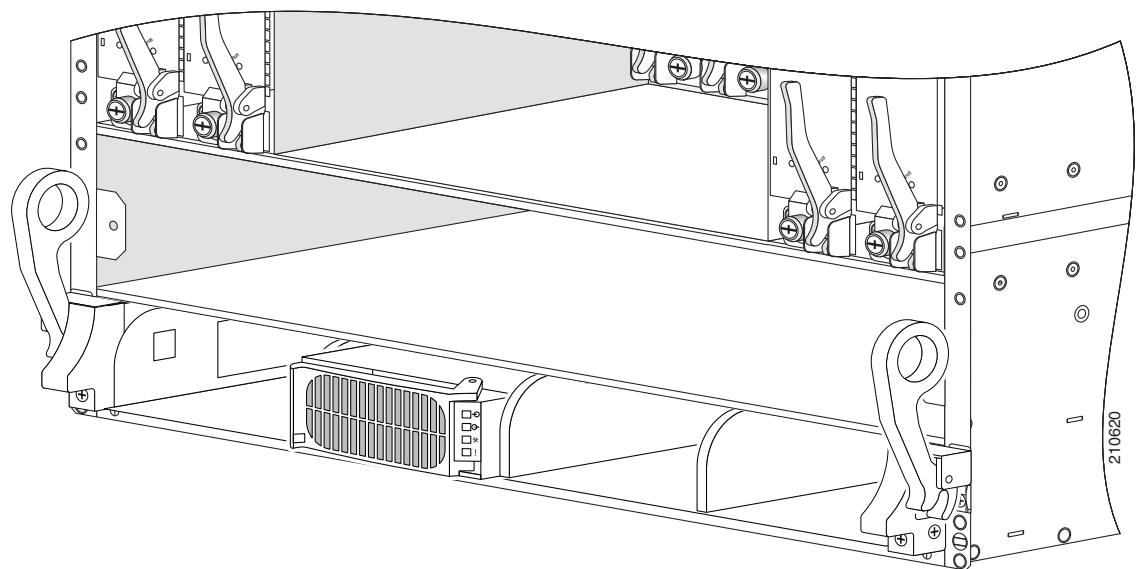
Installing the DC Power Supplies

Step 13 Go to the front of the chassis. Install the four DC power supplies into the power input shelf (see [Figure 2-17](#)). For details, see the “[Installing a Power Supply](#)” section on page 2-28.



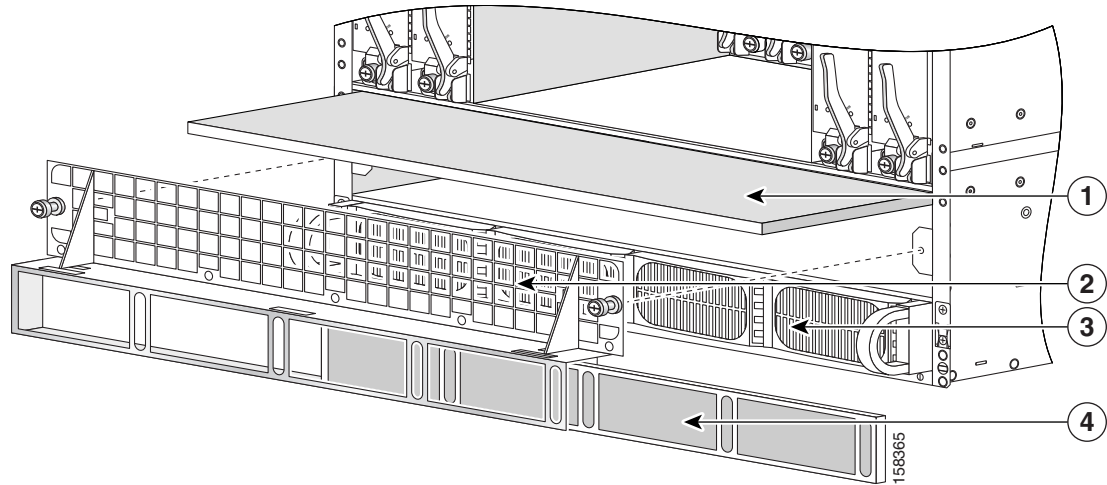
Note Each DC power supply weighs 4.5 lb (2 kg).

Figure 2-17 *Installing DC Power Supplies*



Step 14 Install the air filter (see [Figure 2-18](#)). For the procedure, see the “[Installing the Chassis Air Filter](#)” section on page 3-7.

Figure 2-18 Chassis Air Filter



1	Chassis air filter	3	Power tray and power supplies
2	Air intake grille	4	Power tray air filter

Step 15 Install the inlet grille. See the “[Installing the Inlet Grille](#)” section on page 5-1.

Removing a DC Power Shelf

This section describes how to remove a DC power shelf from the Cisco CRS 4-slot line card chassis. The DC power shelf is comprised of both the *DC power input shelf* and the *DC power input module (PIM)*. The DC power shelf encloses four power supplies and the power distribution connections and wiring blocks.

The DC power input shelf is in the front of the chassis; the power input module (PIM) is in the rear of the chassis.

Sequence of Tasks

The sequence of tasks required to remove the DC power shelf is as follows:

1. Bring down all power to the chassis.
2. Disconnect the input power cables.
3. Disconnect the grounding cable.
4. Remove the air intake (inlet) grille.
5. Remove all DC power supplies.
6. Remove the DC power input shelf.
7. Remove the DC power input module (PIM).

Prerequisites

Power down the Cisco CRS 4-slot line card chassis (as described in the steps below).

Required Tools and Equipment

You need the following tools and parts to perform this task:

- ESD-preventive wrist strap
- Medium flat-blade screwdriver
- Number 1 Phillips screwdriver
- Number 2 Phillips screwdriver
- 5-mm Allen wrench
- 10-mm hex socket wrench

**Note**

This procedure assumes that the Cisco CRS 4-slot line card chassis is already mounted in a rack with sufficient room to access the sides and the bottom of the chassis.

Steps

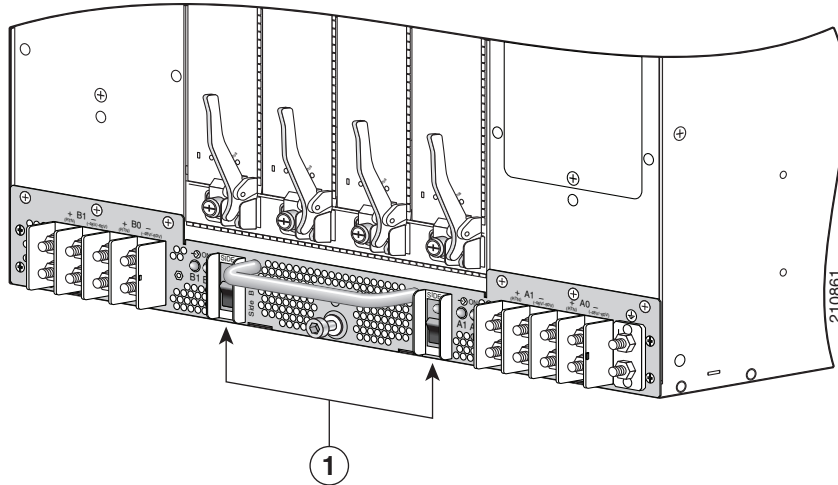
To remove the DC power shelf, follow these steps:

- Step 1** Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

Bring Down All Power to the Chassis

- Step 2** Power down the chassis:
- a. Go to the rear of the chassis. On the PIM, set both power shelf enable switches to OFF (see [Figure 2-19](#)). Now the system's boards and fans have no power.
 - b. Unplug the DC power supplies.
 - c. Disconnect input power from the customer source.

Figure 2-19 DC Power Shelf Enable Switches



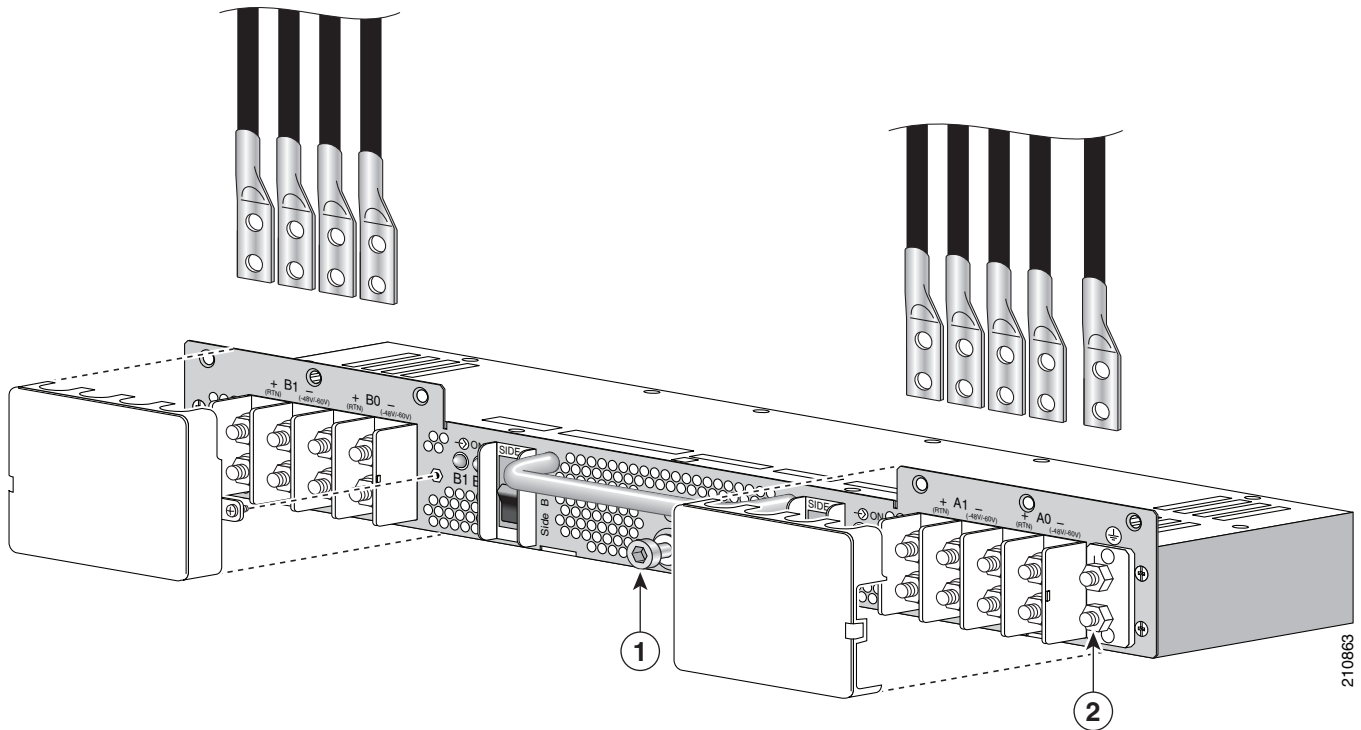
1	DC power shelf enable switches
---	--------------------------------

- Step 3** Remove both wiring block covers (see [Figure 2-20](#)).
- a. Use a number 1 Phillips screwdriver to loosen the capture screw.
 - b. Snap off the cover over the wiring block.

Disconnect the Input Power Cables and Grounding Cable

- Step 4** Use a 10-mm hex socket wrench to disconnect the DC input power cables. Disconnect the four 60 A DC cables (two cables per input) on the left from one wiring block, and the four 60 A DC cables on the right from the other wiring block (see [Figure 2-20](#)).
- Step 5** Use a 10-mm hex socket wrench to disconnect the grounding cable (see [Figure 2-20](#)).

Figure 2-20 Removing Wiring Block Covers and DC Input Power Cables



1	Power shelf coupling screw	2	Grounding lug nuts
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- Step 6** With a 5-mm Allen wrench, loosen the power shelf coupling screw (see item 1 in [Figure 2-20](#)). This will allow you to remove the DC power input shelf from the chassis (as described below).
- Step 7** Go to the front of the chassis. Remove the inlet grille. For the procedure, see the “[Removing the Inlet Grille](#)” section on page 5-3.
- Step 8** Remove the four DC power supplies. For the procedure, see the “[Removing a Power Supply](#)” section on page 2-30.

Remove the DC Power Input Shelf

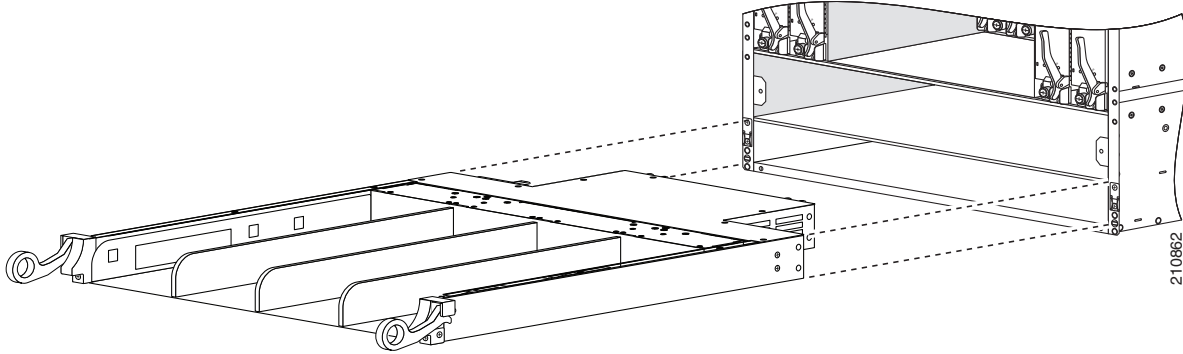
- Step 9** While still in the front of the chassis, you can now remove the DC power input shelf. To remove the DC power input shelf, follow these steps:



Caution An empty DC power input shelf weighs about 15.5 lb (7 kg). To prevent injury when lifting the shelf, keep your back straight and lift with your legs, not your back. Avoid sudden twists or lateral moves.

- a. To unlock the power input shelf, pull the lever handles down (see [Figure 2-21](#)).
- b. Holding the DC power input shelf underneath with one hand and steadying it with the other, lift the DC power input shelf up and slide it part way out of the power shelf slot.
- c. Slide the DC power input shelf fully out of the chassis. Set the power input shelf carefully aside.

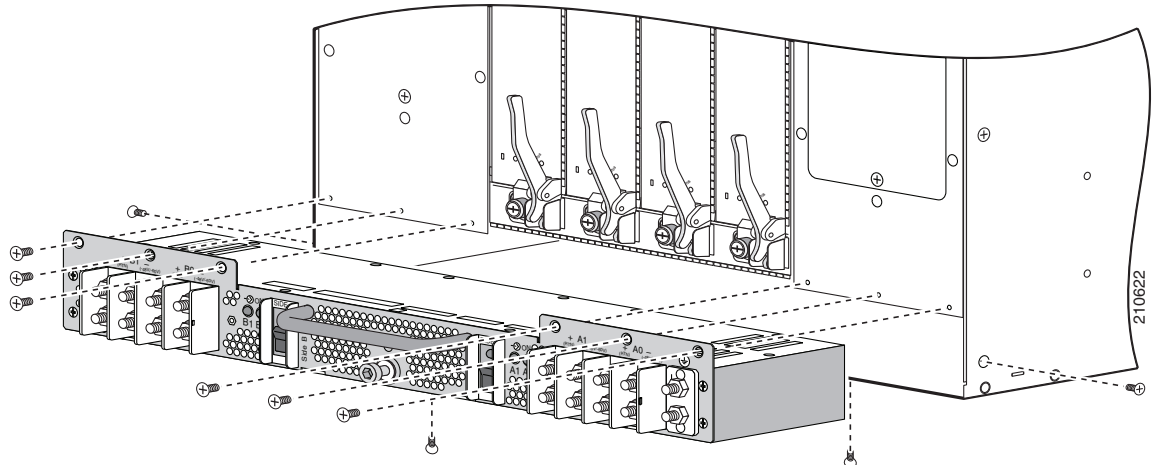
Figure 2-21 Removing the DC Power Input Shelf



Remove the DC Power Input Module (PIM)

- Step 10** Go to the rear of the chassis. Remove the DC power input module (PIM).
- With a Number 2 Phillips screwdriver, remove the first set of eight screws—six screws in the front of the chassis, two on the outside right and left sides of the chassis (see [Figure 2-22](#)).
 - Remove the additional two screws underneath the chassis (one on the left side, one on the right side) (see [Figure 2-22](#)).
 - With one hand gripping the handle and one hand underneath the module, carefully remove the PIM from the chassis, then set it aside.

Figure 2-22 Removing the DC Power Input Module (PIM)



Installing an AC Power Shelf

This section describes how to install an AC power shelf in the Cisco CRS 4-slot line card chassis. The power shelf encloses four power supplies and the power distribution connections and wiring. The AC power shelf is installed in the front (PLIM) side of the chassis.

The AC-powered chassis contains a single AC power shelf containing four AC power supplies. Each AC power supply converts input AC power to the -54 VDC used by the Cisco CRS 4-slot line card chassis.

The AC power shelf is configured for single-phase AC power supply wiring (two wires + ground), and is safety-rated at 110 to 240 VAC nominal, 50 to 60 Hz (4x) 11A.

For additional power details, see *Cisco CRS Carrier Routing System 4-Slot Line Card Chassis System Description*, or in this document, see [Appendix A, “Cisco CRS 4-Slot Line Card Chassis System Specifications.”](#)

For complete information on regulatory compliance and safety, see *Cisco CRS Carrier Routing System Regulatory Compliance and Safety Information*.

Prerequisites

Remove the air intake grille from the bottom of the chassis.

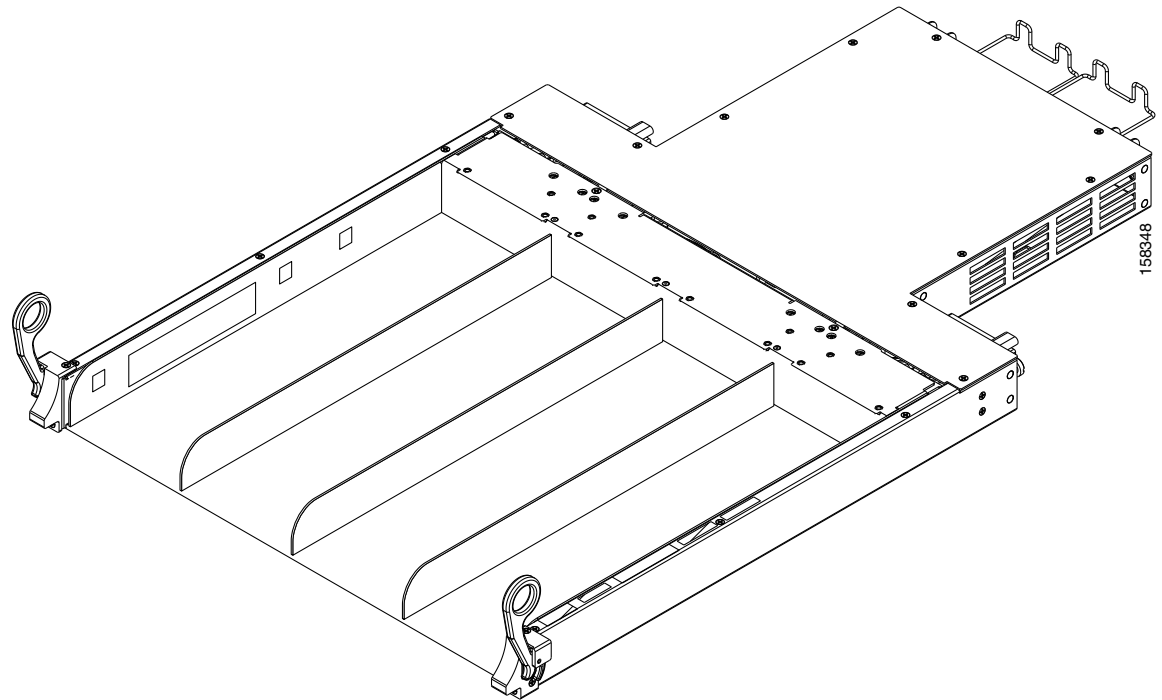
Required Tools and Equipment

You need the following tools and parts to perform this task:

- ESD-preventive wrist strap
- Medium flat-blade screwdriver
- AC Power shelf (Cisco product number: CRS-4-AC-SHELF)

[Figure 2-23](#) shows the AC power shelf.

Figure 2-23 AC Power Shelf



Steps

To install an AC power shelf, use [Figure 2-23](#) as a reference and follow these steps:

-
- Step 1** Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.
- Step 2** Remove the air intake grille from the bottom of the chassis.
- Step 3** Holding the AC power shelf underneath with one hand and steadying it with the other, lift the shelf up and slide it partway into the power shelf slot on the front (PLIM) side of the chassis. Be sure to center the shelf in the slot when you slide it in.



Caution An empty AC power shelf weighs about 7.0 lb (3.2 kg). To prevent injury when lifting the shelf, keep your back straight and lift with your legs, not your back. Avoid sudden twists or lateral moves.

- Step 4** Slide the AC power shelf fully into the chassis. Be sure that the lever handles are aligned with the lever handle catches on the chassis casing.



Caution When inserting the power shelf, carefully guide the shelf in to prevent the power switch from hitting the edge of the power shelf opening. If possible, have a second person guide the power shelf from the rear of the unit.

- Step 5** Lift the lever handles up to lock the tray into position.
- Step 6** Use the flat-blade screwdriver to turn the two captive screws that connect the rear of the chassis to the power shelf, and tighten them fully.



Caution Be sure to attach the plugs carefully; incorrectly attached plugs can damage the chassis.

What to Do Next

After performing this task, install the power supplies (see the [“Installing a Power Supply”](#) section on [page 2-28](#)), and replace any chassis cosmetic cover plates.

Removing an AC Power Shelf

This section describes how to remove an AC power shelf from the Cisco CRS 4-slot line card chassis. The AC power shelf encloses four power supplies and the power distribution connections and wiring. The AC power shelf is installed in the front (PLIM) side of the chassis. For more details on the power systems see the [“About Installing and Removing the Power Components”](#) section on [page 2-1](#). For complete information on regulatory compliance and safety, see *Cisco CRS Carrier Routing System Regulatory Compliance and Safety Information*.

**Caution**

Prior to removing the AC power shelf, to reduce the risk of damage, ensure that the rear panel fasteners are disengaged, the input power cables are disconnected, and the air intake (inlet) grille is removed.

See [Figure 2-23](#) for an illustration of the AC power shelf.

Prerequisites

Before performing this task, you must first remove the air intake grille from the bottom of the chassis, power down the chassis (see the “[AC Power Supply Cord Illustrations and Plug Types](#)” section on [page 2-4](#)), and detach the power cords.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap
- Medium flat-blade screwdriver

Steps

To remove an AC power shelf, follow these steps:

- Step 1** Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.
- Step 2** Remove all four power supplies from the shelf you are removing. (See the “[Removing a Power Supply](#)” section on [page 2-30](#).)
- Step 3** Remove the power cables from the power from the four power inlets.
- Step 4** While facing the rear (SFC) side of the chassis, use the screwdriver to loosen the two captive screws that connect the rear of the chassis to the power shelf by turning them counterclockwise.
- Step 5** Pull the lever handles down with both hands and slide the AC power shelf partway from the slot in the chassis.

**Caution**

An empty AC power shelf weighs about 7.0 lb (3.2 kg). To prevent injury when lifting the shelf, keep your back straight and lift with your legs, not your back. Avoid sudden twists or lateral moves.

- Step 6** Placing one hand underneath the AC power shelf and pulling on it and steadying it with the other hand, slide the shelf completely from the chassis. (If attached, be sure to thread the power cable through the chassis carefully.)
- Step 7** Set the AC power shelf carefully aside.

What to Do Next

After performing this task, you may install a replacement power shelf (see the “[Installing an AC Power Shelf](#)” section on page 2-24), install the power supplies (see the “[Installing a Power Supply](#)” section on page 2-28), and replace any front chassis cosmetic covers.

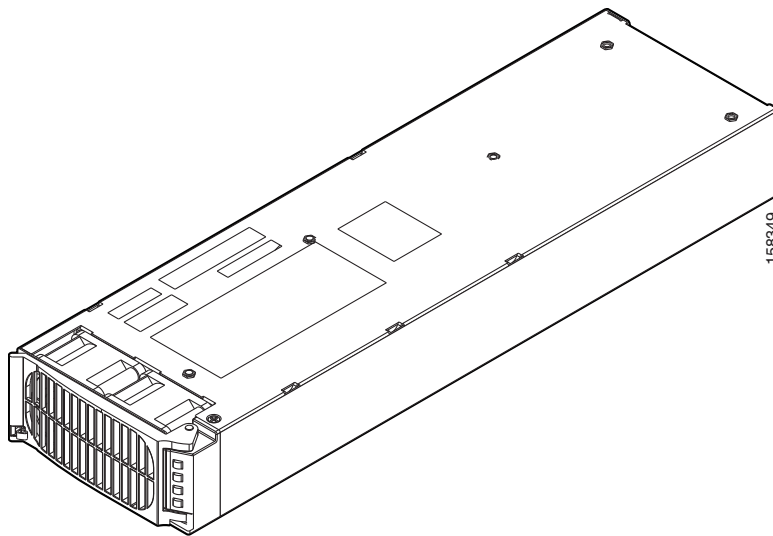
Installing a Power Supply

This section describes how to install an AC or DC power supply in the Cisco CRS 4-slot power shelf. The AC power supply converts facility AC power into the DC power necessary to power the cards and modules in the chassis. Each AC and DC power supply has its own pair of cooling fans, which draws air through the power supply.

For complete information on regulatory compliance and safety, see *Cisco CRS Carrier Routing System Regulatory Compliance and Safety Information*.

[Figure 2-24](#) shows a power supply.

Figure 2-24 Power Supply



Prerequisites

Before performing this task, make sure that the power shelf has been installed (see the “[Installing an AC Power Shelf](#)” section on page 2-24 or the “[Installing a DC Power Shelf](#)” section on page 2-14); remove any cosmetic covers.

Required Tools and Equipment

You need the following tools and part to perform this task:

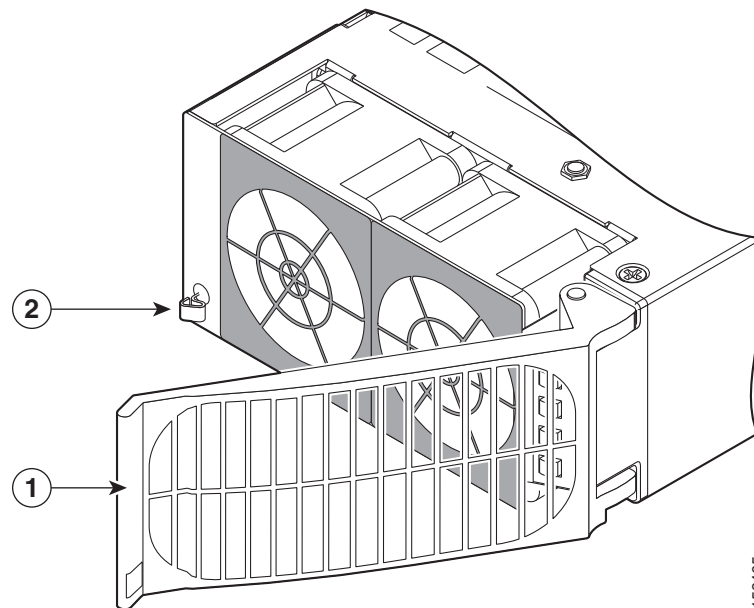
- ESD-preventive wrist strap
- Power supply

Steps

To install a power supply, follow these steps:

- Step 1** Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.
- Step 2** Using two hands to support and guide the power supply, slide it partway into the power tray on the front (PLIM) side of the chassis.
- Step 3** Make sure that the power supply door grille is in the open position (see [Figure 2-25](#)).

Figure 2-25 Power Supply Door Grille in Open Position



1	Power supply door grille
----------	--------------------------

2	Power supply door latch
----------	-------------------------

- Step 4** Slide the power supply into the power shelf until the connector on the back of the module meets the connector on the backplane of the AC or DC power shelf.



Caution A power supply weighs about 4.5 lb (2 kg). You should use two hands when handling a module.

- Step 5** Close the power supply door grille to seat the power supply fully against the AC or DC power shelf. Make sure that the power supply door grille latch clicks into place.



Tip The power supply door can be latched while it is still outside of the power shelf; if that occurs, the power supply will not function according to specification. To ensure proper functionality, the power supply door must be latched *only* after the power supply is fully engaged into the AC power shelf.

**Caution**

To prevent damage to the AC or DC power shelf-to-power supply connections, do not use excessive force when seating a power supply to its power shelf.

What to Do Next

After performing this task, you may connect the power shelf to the power source (see the [“About Installing and Removing the Power Components”](#) section on page 2-1, replace any front cosmetic covers, and power up the chassis (see the [“AC Power Supply Cord Illustrations and Plug Types”](#) section on page 2-4).

Removing a Power Supply

This section describes how to remove a power supply in the Cisco CRS 4-slot line card chassis. The power supplies can be an AC or DC power supplies (however, mixed types are not permitted). The AC power supply converts facility AC power into the DC power necessary to power the cards and modules in the chassis. Each AC power supply has its own pair of cooling fans, which draws air through the power supply.

For complete information on regulatory compliance and safety, see *Cisco CRS Carrier Routing System Regulatory Compliance and Safety Information*.

See [Figure 2-24](#) for an illustration of a power supply.

Prerequisites

Before operating the power shelf ejectors and removing the power shelf, take the following precautions:

- For an AC power shelf, ensure that the rear panel fasteners are disengaged.
- For a DC power shelf, unlock the power input shelf by pulling the lever handles down.
- Disconnect the input power cables.
- Remove the air intake (inlet) grille.

Required Tools and Equipment

You need the following tools to perform this task:

- ESD-preventive wrist strap

Steps

To remove a power supply, follow these steps:

-
- Step 1** Attach the ESD-preventive wrist strap to your wrist and connect its leash to one of the ESD connection sockets on the front (PLIM) side of the chassis or a bare metal surface on the chassis.

- Step 2** To unseat the power supply from the power shelf connector, unlatch the power supply door grille latch and open it completely. See [Figure 2-25](#) for an illustration of the power supply grille and door latch.



Note The power supply fans may continue to turn at high speed for a few seconds after they are unseated from the power shelf.

- Step 3** Grasp the power supply door grille and gently pull the power supply halfway from the bay.



Caution Take care when handling a power supply that has recently been in use; it can be hot to the touch.



Caution A power supply weighs about 4.6 lb (2.1 kg). You should use two hands when handling a power supply.

- Step 4** Use your free hand to support the power supply while you slide the power supply completely from the bay, then set the power supply safely aside.

What to Do Next

After performing this task, you may install a new power supply, if needed (see the [“Installing a Power Supply”](#) section on page 2-28), and replace any front cosmetic covers.

