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## Preface

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This preface describes who should read the *Catalyst 6500 Series Switches Installation Guide*, how it is organized, and its document conventions.

## Audience

Only trained and qualified service personnel (as defined in IEC 60950 and AS/NZS3260) should install, replace, or service the equipment described in this publication.

## Organization

This publication is organized as follows:

Chapter	Title	Description
Chapter 1	<a href="#">Product Overview</a>	Describes and lists the hardware features and functionality of the Catalyst 6500 series switches. The chapter contains illustrations of the chassis and specifications tables for the chassis.
Chapter 2	<a href="#">Preparing for Installation</a>	Describes things you need to consider when preparing your site before installing the Catalyst 6500 series switch.
Chapter 3	<a href="#">Installing the Switch</a>	Describes how to install your Catalyst 6500 series switch. Procedures are provided for installing chassis in rack enclosures, freestanding with stability brackets installed, and freestanding with rubber feet installed.
Chapter 4	<a href="#">Removal and Replacement Procedures</a>	Provides procedures for removing and installing chassis components.
Appendix A	<a href="#">Power Supply Specifications</a>	Provides illustrations and specification tables for the available Catalyst 6500 series switch AC-input and DC-input power supplies. Illustrations and specifications tables are also provided for the supported AC power cords.

Chapter	Title	Description
Appendix B	<a href="#">Transceivers, Module Connectors, and Cable Specifications</a>	Gives brief descriptions of the different types of copper and optical transceiver modules, physical connectors, and the cables used with the Catalyst 6500 series switches.
Appendix C	<a href="#">Repacking the Switch</a>	Provides procedures to repack your Catalyst 6500 series switch if you need to return it to the factory.
Appendix D	<a href="#">Chassis and Module Power and Heat Values</a>	Provides listings of the power consumption and heat dissipation values for the Catalyst 6500 series switch chassis and modules.
Appendix E	<a href="#">Troubleshooting</a>	Provides troubleshooting guidelines for the initial hardware installation and suggests steps to help isolate and resolve problems.

## Conventions

This publication uses the following conventions:

Convention	Description
<b>boldface font</b>	Commands, command options, and keywords are in <b>boldface</b> .
<i>italic font</i>	Arguments for which you supply values are in <i>italics</i> .
[ ]	Elements in square brackets are optional.
{ x   y   z }	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.

Convention	Description
screen font	Terminal sessions and information the system displays are in <code>screen font</code> .
<b>boldface screen font</b>	Information you must enter is in <b>boldface screen font</b> .
<i>italic screen font</i>	Arguments for which you supply values are in <i>italic screen font</i> .
^	The symbol ^ represents the key labeled Control. For example, the key combination ^D in a screen display means hold down the Control key while you press the D key.
< >	Nonprinting characters, such as passwords, are in angle brackets.

Notes use the following conventions:



**Note**

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

Cautions use the following conventions:



**Caution**

Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Warnings use the following conventions:

## Statement 1071—Warning Definition



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

Waarschuwing

### BELANGRIJKE VEILIGHEIDSINSTRUCTIES

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Gebruik het nummer van de verklaring onderaan de waarschuwing als u een vertaling van de waarschuwing die bij het apparaat wordt geleverd, wilt raadplegen.

### BEWAAR DEZE INSTRUCTIES

Varoitus

### TÄRKEITÄ TURVALLISUUSOHJEITA

Tämä varoitusmerkki merkitsee vaaraa. Tilanne voi aiheuttaa ruumiillisia vammoja. Ennen kuin käsittelet laitteistoa, huomioi sähköpiirien käsittelemiseen liittyvät riskit ja tutustu onnettomuuksien yleisiin ehkäisytapoihin. Turvallisuusvaroitusten käännökset löytyvät laitteen mukana toimitettujen käännettyjen turvallisuusvaroitusten joukosta varoitusten lopussa näkyvien lausuntonumeroiden avulla.

### SÄILYTÄ NÄMÄ OHJEET

Attention

### IMPORTANTES INFORMATIONS DE SÉCURITÉ

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant entraîner des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers liés aux circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions des avertissements figurant dans les consignes de sécurité traduites qui accompagnent cet appareil, référez-vous au numéro de l'instruction situé à la fin de chaque avertissement.

### CONSERVEZ CES INFORMATIONS



**Warnung WICHTIGE SICHERHEITSHINWEISE**

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu Verletzungen führen kann. Machen Sie sich vor der Arbeit mit Geräten mit den Gefahren elektrischer Schaltungen und den üblichen Verfahren zur Vorbeugung vor Unfällen vertraut. Suchen Sie mit der am Ende jeder Warnung angegebenen Anweisungsnummer nach der jeweiligen Übersetzung in den übersetzten Sicherheitshinweisen, die zusammen mit diesem Gerät ausgeliefert wurden.

**BEWAHREN SIE DIESE HINWEISE GUT AUF.**

**Avvertenza IMPORTANTI ISTRUZIONI SULLA SICUREZZA**

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Utilizzare il numero di istruzione presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.

**CONSERVARE QUESTE ISTRUZIONI**

**Advarsel VIKTIGE SIKKERHETSINSTRUKSJONER**

Dette advarselssymbolet betyr fare. Du er i en situasjon som kan føre til skade på person. Før du begynner å arbeide med noe av utstyret, må du være oppmerksom på farene forbundet med elektriske kretser, og kjenne til standardprosedyrer for å forhindre ulykker. Bruk nummeret i slutten av hver advarsel for å finne oversettelsen i de oversatte sikkerhetsadvarslene som fulgte med denne enheten.

**TA VARE PÅ DISSE INSTRUKSJONENE**

**Aviso INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você está em uma situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha conhecimento dos perigos envolvidos no manuseio de circuitos elétricos e familiarize-se com as práticas habituais de prevenção de acidentes. Utilize o número da instrução fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.

**GUARDE ESTAS INSTRUÇÕES**

**¡Advertencia! INSTRUCCIONES IMPORTANTES DE SEGURIDAD**

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.

**GUARDE ESTAS INSTRUCCIONES**

**Varning! VIKTIGA SÄKERHETSANVISNINGAR**

Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanliga förfaranden för att förebygga olyckor. Använd det nummer som finns i slutet av varje varning för att hitta dess översättning i de översatta säkerhetsvarningar som medföljer denna anordning.

**SPARA DESSA ANVISNINGAR****Figyelem FONTOS BIZTONSÁGI ELOÍRÁSOK**

Ez a figyelmeztető jel veszélyre utal. Sérülésveszélyt rejtő helyzetben van. Mielőtt bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplő figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található; a fordítás az egyes figyelmeztetések végén látható szám alapján kereshető meg.

**ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!****Предупреждение ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

Этот символ предупреждения обозначает опасность. То есть имеет место ситуация, в которой следует опасаться телесных повреждений. Перед эксплуатацией оборудования выясните, каким опасностям может подвергаться пользователь при использовании электрических цепей, и ознакомьтесь с правилами техники безопасности для предотвращения возможных несчастных случаев. Воспользуйтесь номером заявления, приведенным в конце каждого предупреждения, чтобы найти его переведенный вариант в переводе предупреждений по безопасности, прилагаемом к данному устройству.

**СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ****警告 重要的安全性说明**

此警告符号代表危险。您正处于可能受到严重伤害的工作环境中。在您使用设备开始工作之前，必须充分意识到触电的危险，并熟练掌握防止事故发生的标准工作程序。请根据每项警告结尾提供的声明号码来找到此设备的安全性警告说明的翻译文本。

请保存这些安全性说明

**警告 安全上の重要な注意事項**

「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止策に留意してください。警告の各国語版は、各注意事項の番号を基に、装置に付属の「Translated Safety Warnings」を参照してください。

これらの注意事項を保管しておいてください。

**주의**    **중요 안전 지침**

이 경고 기호는 위험을 나타냅니다. 작업자가 신체 부상을 일으킬 수 있는 위험한 환경에 있습니다. 장비에 작업을 수행하기 전에 전기 회로와 관련된 위험을 숙지하고 표준 작업 관례를 숙지하여 사고를 방지하십시오. 각 경고의 마지막 부분에 있는 경고문 번호를 참조하여 이 장치와 함께 제공되는 번역된 안전 경고문에서 해당 번역문을 찾으십시오.

이 지시 사항을 보관하십시오.

**Aviso**    **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

**Este símbolo de aviso significa perigo. Você se encontra em uma situação em que há risco de lesões corporais. Antes de trabalhar com qualquer equipamento, esteja ciente dos riscos que envolvem os circuitos elétricos e familiarize-se com as práticas padrão de prevenção de acidentes. Use o número da declaração fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham o dispositivo.**

**GUARDE ESTAS INSTRUÇÕES****Advarsel**    **VIGTIGE SIKKERHEDSANVISNINGER**

**Dette advarselssymbol betyder fare. Du befinder dig i en situation med risiko for legemeskadedigelse. Før du begynder arbejde på udstyr, skal du være opmærksom på de involverede risici, der er ved elektriske kredsløb, og du skal sætte dig ind i standardprocedurer til undgåelse af ulykker. Brug erklæringsnummeret efter hver advarsel for at finde oversættelsen i de oversatte advarsler, der fulgte med denne enhed.**

**GEM DISSE ANVISNINGER****تحذير****إرشادات الأمان الهامة**

يوضح رمز التحذير هذا وجود خطر. وهذا يعني أنك متواجد في مكان قد ينتج عنه التعرض للإصابات. قبل بدء العمل، احذر مخاطر التعرض للصدمات الكهربائية وكن على علم بالإجراءات القياسية للحيولة دون وقوع أي حوادث. استخدم رقم البيان الموجود في آخر كل تحذير لتحديد مكان ترجمته داخل تحذيرات الأمان المترجمة التي تأتي مع الجهاز. قم بحفظ هذه الإرشادات

**Upozorenje**    **VAŽNE SIGURNOSNE NAPOMENE**

Ovaj simbol upozorenja predstavlja opasnost. Nalazite se u situaciji koja može prouzročiti tjelesne ozljede. Prije rada s bilo kojim uređajem, morate razumjeti opasnosti vezane uz električne sklopove, te biti upoznati sa standardnim načinima izbjegavanja nesreća. U prevedenim sigurnosnim upozorenjima, priloženima uz uređaj, možete prema broju koji se nalazi uz pojedino upozorenje pronaći i njegov prijevod.

**SAČUVAJTE OVE UPUTE**

**Upozornění DŮLEŽITÉ BEZPEČNOSTNÍ POKYNY**

**Tento upozorňující symbol označuje nebezpečí. Jste v situaci, která by mohla způsobit nebezpečí úrazu. Před prací na jakémkoliv vybavení si uvědomte nebezpečí související s elektrickými obvody a seznamte se se standardními opatřeními pro předcházení úrazům. Podle čísla na konci každého upozornění vyhledejte jeho překlad v přeložených bezpečnostních upozorněních, která jsou přiložena k zařízení.**

**USCHOVEJTE TYTO POKYNY****Προειδοποίηση ΣΗΜΑΝΤΙΚΕΣ ΟΔΗΓΙΕΣ ΑΣΦΑΛΕΙΑΣ**

Αυτό το προειδοποιητικό σύμβολο σημαίνει κίνδυνο. Βρίσκεστε σε κατάσταση που μπορεί να προκαλέσει τραυματισμό. Πριν εργαστείτε σε οποιοδήποτε εξοπλισμό, να έχετε υπόψη σας τους κινδύνους που σχετίζονται με τα ηλεκτρικά κυκλώματα και να έχετε εξοικειωθεί με τις συνήθειες πρακτικές για την αποφυγή ατυχημάτων. Χρησιμοποιήστε τον αριθμό δήλωσης που παρέχεται στο τέλος κάθε προειδοποίησης, για να εντοπίσετε τη μετάφρασή της στις μεταφρασμένες προειδοποιήσεις ασφαλείας που συνοδεύουν τη συσκευή.

**ΦΥΛΑΞΤΕ ΑΥΤΕΣ ΤΙΣ ΟΔΗΓΙΕΣ****אזהרה****הוראות בטיחות חשובות**

סימן אזהרה זה מסמל סכנה. אתה נמצא במצב העלול לגרום לפציעה. לפני שתעבוד עם ציוד כלשהו, עליך להיות מודע לסכנות הכרוכות במעגלים חשמליים ולהכיר את הנהלים המקובלים למניעת תאונות. השתמש במספר ההוראה המסופק בסופה של כל אזהרה כדי לאתר את התרגום באזהרות הבטיחות המתורגמות שמצורפות להתקן.

**שמור הוראות אלה****Opomena****ВАЖНИ БЕЗБЕДНОСНИ НАПАТСТВИЈА**

Симболот за предупредување значи опасност. Се наоѓате во ситуација што може да предизвика телесни повреди. Пред да работите со опремата, бидете свесни за ризикот што постои кај електричните кола и треба да ги познавате стандардните постапки за спречување на несреќни случаи. Искористете го бројот на изјавата што се наоѓа на крајот на секое предупредување за да го најдете неговиот период во преведените безбедносни предупредувања што се испорачани со уредот.

**ЧУВАЈТЕ ГИ ОБИЕ НАПАТСТВИЈА**

**Ostrzeżenie****WAŻNE INSTRUKCJE DOTYCZĄCE BEZPIECZEŃSTWA**

**Ten symbol ostrzeżenia oznacza niebezpieczeństwo. Zachodzi sytuacja, która może powodować obrażenia ciała. Przed przystąpieniem do prac przy urządzeniach należy zapoznać się z zagrożeniami związanymi z układami elektrycznymi oraz ze standardowymi środkami zapobiegania wypadkom. Na końcu każdego ostrzeżenia podano numer, na podstawie którego można odszukać tłumaczenie tego ostrzeżenia w dołączonym do urządzenia dokumencie z tłumaczeniami ostrzeżeń.**

**NINIEJSZE INSTRUKCJE NALEŻY ZACHOWAĆ**

**Upozornenie DÔLEŽITÉ BEZPEČNOSTNÉ POKYNY**

Tento varovný symbol označuje nebezpečenstvo. Nachádzate sa v situácii s nebezpečenstvom úrazu. Pred prácou na akomkoľvek vybavení si uvedomte nebezpečenstvo súvisiace s elektrickými obvodmi a oboznámte sa so štandardnými opatreniami na predchádzanie úrazom. Podľa čísla na konci každého upozornenia vyhladajte jeho preklad v preložených bezpečnostných upozorneniach, ktoré sú priložené k zariadeniu.

**USCHOVAJTE SI TENTO NÁVOD****Opozorilo**

**警告** 重要安全性指示  
此警告符號代表危險，表示可能造成人身傷害。使用任何設備前，請留心電路相關危險，並熟悉避免意外的標準作法。您可以使用每項警告後的聲明編號，查詢本裝置隨附之安全性警告譯文中的翻譯。請妥善保留此指示

## Related Documentation

For additional Catalyst 6500 series switch information, refer to these publications:

- *Regulatory Compliance and Safety Information for the Catalyst 6500 Series Switches*
- *Catalyst 6500 Series Switch Quick Software Configuration Guide*
- *Catalyst 6500 Series Switch Module Installation Guide*
- *Catalyst 6500 Series Switch Software Configuration Guide*
- *Catalyst 6500 Series Switch Command Reference*
- *Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide*
- *Catalyst 6500 Series Switch Cisco IOS Command Reference*
- *ATM Software Configuration and Command Reference—Catalyst 5000 Family and Catalyst 6000 Family Switches*
- *Catalyst 6500 Series Switch System Message Guide*
- For information about MIBs, refer to this URL:  
<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

# Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

<http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html>

Subscribe to the *What's New in Cisco Product Documentation* as a Really Simple Syndication (RSS) feed and set content to be delivered directly to your desktop using a reader application. The RSS feeds are a free service and Cisco currently supports RSS Version 2.0.



# CHAPTER 1

## Product Overview

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**Revised: February 3, 2012**

This chapter describes the Catalyst 6500 series switches and contains these sections:

- [Catalyst 6503 Switch, page 1-2](#)
- [Catalyst 6503-E Switch, page 1-8](#)
- [Catalyst 6504-E Switch, page 1-13](#)
- [Catalyst 6506 Switch, page 1-18](#)
- [Catalyst 6506-E Switch, page 1-24](#)
- [Catalyst 6509 Switch, page 1-30](#)
- [Catalyst 6509-E Switch, page 1-36](#)
- [Catalyst 6509-NEB Switch, page 1-42](#)
- [Catalyst 6509-NEB-A Switch, page 1-49](#)
- [Catalyst 6509-V-E Switch, page 1-55](#)
- [Catalyst 6513 Switch, page 1-61](#)
- [Catalyst 6513-E Switch, page 1-67](#)



**Note**

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The Catalyst 6000 series switches (Catalyst 6006 switch and Catalyst 6009 switch) are described in a separate publication, the *Catalyst 6000 Series Switches Installation Guide*.

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**Note**

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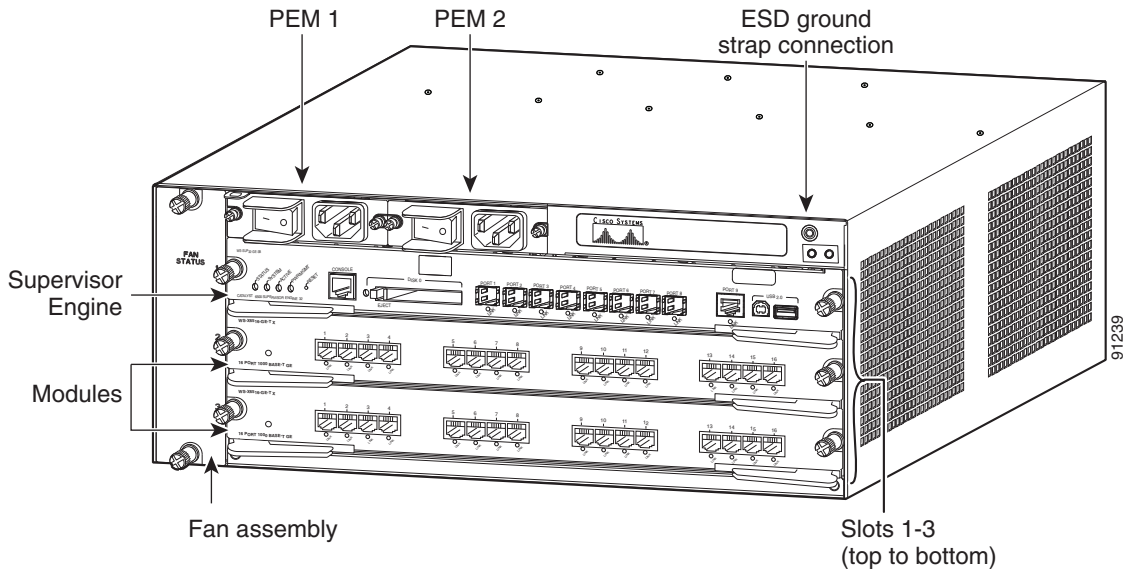
Throughout this publication, except where noted, the term *supervisor engine* is used to refer to Supervisor Engine 2, Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE.

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# Catalyst 6503 Switch

The Catalyst 6503 switch is a 3-slot horizontal chassis supporting redundant power supplies, redundant supervisor engines, and slots for up to two modules. The chassis is NEBS L3 compliant. [Figure 1-1](#) shows the front view of the chassis and [Figure 1-2](#) shows the rear view of the chassis.

**Figure 1-1 Catalyst 6503 Switch—Front View**



**Figure 1-2 Catalyst 6503 Switch—Rear View**

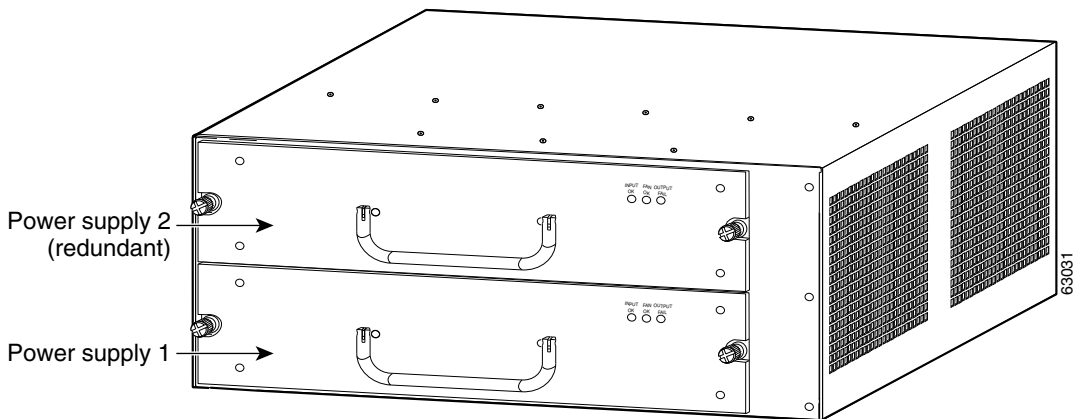




Table 1-1 lists the features of the Catalyst 6503 switch chassis.

**Table 1-1 Catalyst 6503 Switch Features**

Feature	Description
Chassis	<ul style="list-style-type: none"> <li>• Three horizontal slots. Slots are numbered from 1 (top) to 3 (bottom).</li> </ul>
Supervisor engine	<ul style="list-style-type: none"> <li>• Supports Supervisor Engine 2, Supervisor Engine 32, Supervisor Engine 32 PISA, and Supervisor Engine 720.</li> </ul> <p><b>Note</b> Refer to your software release notes for the minimum software release versions required to support the supervisor engines.</p> <ul style="list-style-type: none"> <li>• Supervisor engines can be installed in either slot 1 or slot 2.</li> </ul> <p><b>Note</b> Slots not occupied by supervisor engines can be used for modules. Check your software release notes for any restrictions on the type of module that can be installed.</p> <ul style="list-style-type: none"> <li>• Supervisor Engine 720 with 10-GB uplink ports (VS-S720-10G-3C and VS-S720-10G-3CXL) is not supported on the Catalyst 6503 switch chassis.</li> <li>• Supervisor Engine 32, Supervisor Engine 32 PISA, or a Supervisor Engine 720 requires that the optional high-speed fan tray (FAN-MOD-3HS) be installed in the chassis.</li> <li>• Supervisor Engine 720 has built-in switching fabric.</li> <li>• The uplink ports are fully functional on the redundant supervisor engine in standby mode.</li> </ul> <p><b>Note</b> In systems with redundant supervisor engines, both supervisor engines must be the same model and have the same daughter card configurations. Each supervisor engine must have the resources to run the switch on its own, which means that all supervisor engine resources are duplicated. Identical supervisor engine memory configurations are recommended, but are not required as long as the supervisor engine with the smaller memory configuration is sufficient to run the configured features of the switch. Additionally, each supervisor engine must have its own flash device and console port connections.</p>
Modules	<ul style="list-style-type: none"> <li>• Supports up to two Catalyst 6500 series modules.</li> <li>• Does not support the WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules.</li> <li>• Does not support the WS-X67xx modules.</li> <li>• Some Catalyst 6500 series modules may: <ul style="list-style-type: none"> <li>– Not be supported</li> <li>– Require that you install a Supervisor Engine 720</li> <li>– Have chassis slot restrictions</li> <li>– Require a specific software release level to operate</li> </ul> </li> </ul> <p><b>Note</b> Check your software release notes for specific information.</p>

Table 1-1 Catalyst 6503 Switch Features (continued)

Feature	Description
Backplane bandwidth	<ul style="list-style-type: none"> <li>• 32 GBps shared bus.</li> <li>• 720 GBps switch fabric.</li> </ul>
Clock and VTT modules	<ul style="list-style-type: none"> <li>• One replaceable clock module (CLK-7600=) provides clocking signals to the EOBC channel and the switching bus.</li> <li>• Nonreplaceable voltage termination (VTT) module provides reference voltage for bus signals.</li> </ul>
Fan tray	<ul style="list-style-type: none"> <li>• The chassis supports one hot-swappable fan tray. Two fan tray models are available: <ul style="list-style-type: none"> <li>– FAN-MOD-3 (Standard fan tray—170 CFM). Supports Supervisor Engine 1 and Supervisor Engine 2 only; does not support Supervisor Engine 32 or Supervisor Engine 720.</li> <li>– FAN-MOD-3HS (Optional high-speed fan tray—270 CFM). Required for Supervisor Engine 32 and Supervisor Engine 720. Supports Supervisor Engine 2.</li> </ul> </li> </ul> <p><b>Note</b> Both fan tray models contain four individual fans. The individual fans are not field replaceable; you must replace the fan tray in the event of a fan failure.</p> <p><b>Note</b> The WS-C6503-E-FAN tray is not supported in the Catalyst 6503 chassis.</p> <ul style="list-style-type: none"> <li>• Fan tray STATUS LED <ul style="list-style-type: none"> <li>– Red—One or more individual fans have failed.</li> <li>– Green—Fan tray is operating normally.</li> </ul> </li> </ul>

Table 1-1 Catalyst 6503 Switch Features (continued)

Feature	Description
Power Entry Module (PEM) <sup>1</sup>	<ul style="list-style-type: none"> <li>• A PEM is required for each installed power supply.               <ul style="list-style-type: none"> <li>– PEM-15A-AC (PEM for 950 W AC-input power supplies).</li> <li>– PEM-DC/3 (PEM for 950 W DC-input power supplies).</li> <li>– PEM-20A-AC+ (PEM for 1400 W AC-input power supplies).</li> </ul> </li> </ul>
Power supplies	<ul style="list-style-type: none"> <li>• Supports one or two power supplies. The following power supplies are supported:               <ul style="list-style-type: none"> <li>– PWR-950-AC (950 W AC-input power supply).</li> <li>– PWR-950-DC (950 W DC-input power supply).</li> <li>– PWR-1400-AC (1400 W AC-input power supply).</li> </ul> </li> <li>• Installed power supplies can be of different wattage ratings. Installed power supplies can be both AC-input, both DC-input, or one AC-input and one DC-input. Power supplies can be configured in either redundant or combined mode.</li> </ul> <p><b>Note</b> For Catalyst 6503 and Catalyst 6503-E chassis that are equipped with DC-input power supplies, the system (NEBS) ground serves as the primary safety ground and must be installed. The DC-input power supplies for these chassis do not have a separate ground.</p> <ul style="list-style-type: none"> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC. Source AC can be out of phase between multiple power supplies or multiple AC-power plugs on the same power supply because all AC power supply inputs are isolated.</li> <li>• Single power supplies are installed in the lower power supply bay. The second power supply is installed in the upper power supply bay.</li> </ul> <p><b>Note</b> For proper operation of the power supply OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

1. PEMs are required for Catalyst 6503 and Catalyst 6503-E switches only.

Table 1-2 lists the environmental and physical specifications of the Catalyst 6503 switch chassis.

**Table 1-2 Catalyst 6503 Switch Specifications**

Item	Specification
Environmental Temperature, operating  Temperature, nonoperating and storage  Thermal transition  Humidity (RH), ambient (noncondensing) operating  Altitude, operating	Certified for operation: 32° to 104°F (0° to 40°C) Designed and tested for operation: 32° to 131°F (0° to 55°C) <b>Note</b> The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 40°C (104°F) generating a minor alarm and at 55°C (131°F) generating a major alarm.  Chassis unpackaged: -4° to 149°F (-20° to 65°C) Chassis in protective shipping package: -40° to 158°F (-40° to 70°C)  0.5°C per minute (hot to cold) 0.33°C per minute (cold to hot)  Operating: 5% to 90% Nonoperating and storage: 5% to 95%  Certified for operation: 0 to 6500 ft (0 to 2000 m) Designed and tested for operation: -200 to 10,000 ft (-60 to 3000 m)
Shock and vibration	This switch complies with Network Equipment Building Systems (NEBS) (Zone 4 per GR-63-Core) in the following areas: <ul style="list-style-type: none"> <li>• Earthquake environment and criteria</li> <li>• Office vibration and criteria</li> <li>• Transportation vibration and criteria</li> </ul> <b>Shock</b> <ul style="list-style-type: none"> <li>• Operational—5 G 30 ms, half-sine (IEC 68-2-27)</li> <li>• Nonoperational—20 G, 7.5 ms, trapezoidal</li> </ul> <b>Vibration</b> Operational—3 Hz to 500 Hz, Power Spectral Density (PSD)—0.0005 G <sup>2</sup> /Hz at 10 Hz and 200 Hz. 5 dB/octave roll off at each end. 0.5 hours per axis (1.12 Grms).
Acoustic noise	64 to 76 dB. International Organization for Standardization (ISO) 7779: Bystander position operating to an ambient temperature of 86°F (30°C).

Table 1-2 Catalyst 6503 Switch Specifications (continued)

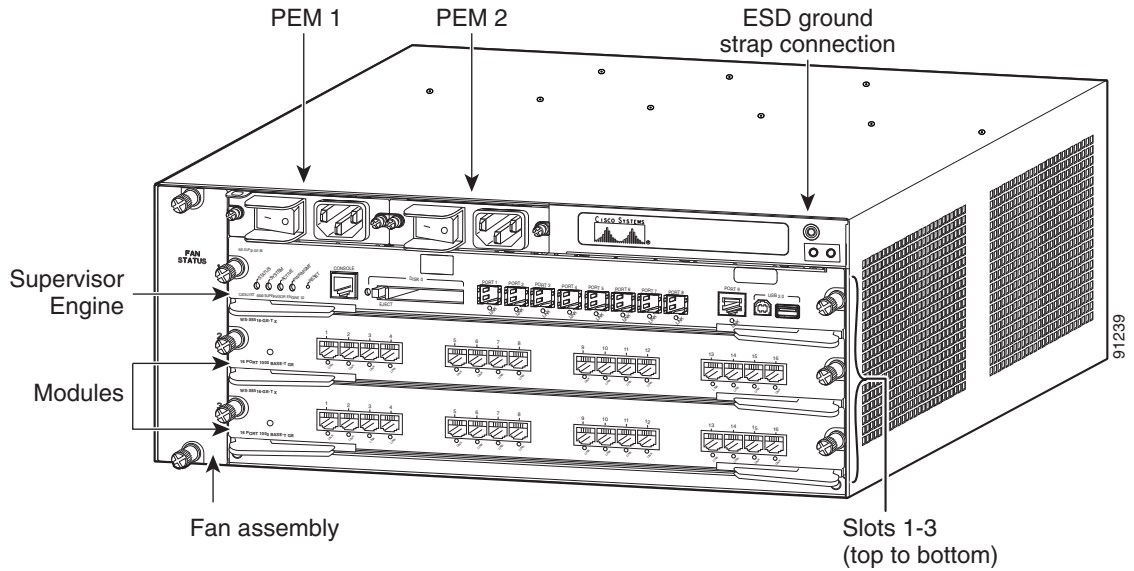
Item	Specification
Physical Characteristics Dimensions (H x W x D)  Weight	<ul style="list-style-type: none"> <li>• 7 x 17.37 x 21.75 in. (17.8 x 44.1 x 55.2 cm).</li> <li>• Chassis requires 4 RU<sup>1</sup>.</li> <li>• The Catalyst 6503 switch chassis is designed to install in standard 19-inch equipment racks that meet ANSI/EIA 310-D, IEC 60297, and ETS 300-119 standards.</li> <li>• Chassis only: 27 lb (12.25 kg).</li> <li>• Chassis fully configured with 1 supervisor engine, 2 modules, 2 AC-input PEMs, and 2 AC-input power supplies: 85.4 lb (38.7 kg).</li> </ul>
Airflow	<ul style="list-style-type: none"> <li>• FAN-MOD-3 (Standard fan tray)—170 CFM</li> <li>• FAN-MOD-3HS (Optional high-speed fan tray)—270 CFM</li> </ul> <p><b>Note</b> To maintain proper air circulation through the Catalyst switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis air exhaust. You should also allow a minimum separation of 12 inches (30.5 cm) between the hot air exhaust on one chassis and the air intake on another chassis. Failure to maintain adequate air space can cause the chassis to overheat and the system to fail. On Catalyst chassis in which the airflow is from front to back, the chassis may be placed side-by-side.</p>

1. RU = rack units

# Catalyst 6503-E Switch

The Catalyst 6503-E switch is an enhanced version of the Catalyst 6503 switch. The 3-slot horizontal chassis supports redundant power supplies, redundant supervisor engines, and slots for up to two modules. It also supports a greater power capacity per slot than the Catalyst 6503 switch chassis. The Catalyst 6503-E switch chassis is NEBS L3 compliant. [Figure 1-3](#) shows the front view of the chassis and [Figure 1-4](#) shows the rear view of the chassis.

**Figure 1-3 Catalyst 6503-E Switch—Front View**



**Figure 1-4 Catalyst 6503-E Switch—Rear View**

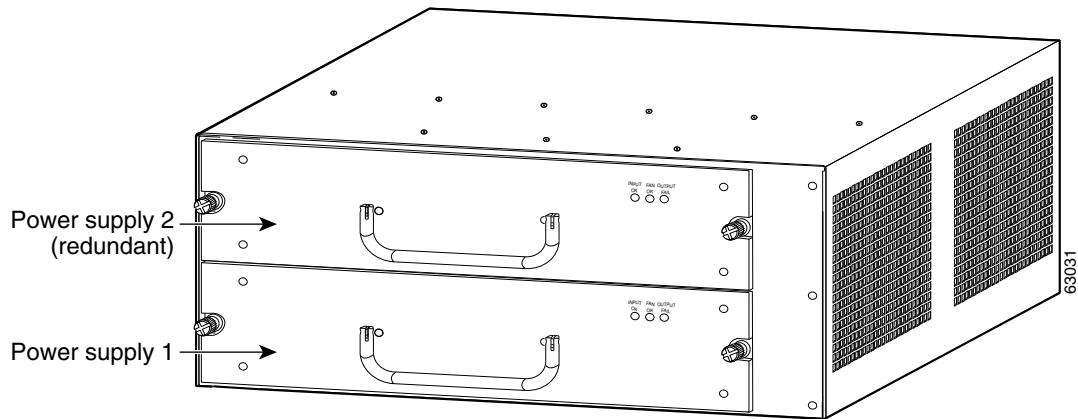


Table 1-3 lists the features of the Catalyst 6503-E switch chassis.

**Table 1-3 Catalyst 6503-E Switch Features**

Feature	Description
Chassis	<ul style="list-style-type: none"> <li>• Three horizontal slots. Slots are numbered from 1 (top) to 3 (bottom).</li> </ul>
Supervisor engine	<ul style="list-style-type: none"> <li>• Supports Supervisor Engine 2, Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T.</li> </ul> <p><b>Note</b> Refer to your software release notes for the minimum software release versions required to support the supervisor engines.</p> <ul style="list-style-type: none"> <li>• Supervisor engines can be installed in either slot 1 or slot 2.</li> </ul> <p><b>Note</b> Slots not occupied by supervisor engines can be used for modules. Check your software release notes for any restrictions on the type of module that can be installed.</p> <ul style="list-style-type: none"> <li>• Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T have a built-in switching fabric. Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2) are not supported.</li> <li>• Supervisor Engine 32 and Supervisor Engine 32 PISA do not support the Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2).</li> <li>• The uplink ports are fully functional on the redundant supervisor engine when it is in standby mode.</li> </ul> <p><b>Note</b> In systems with redundant supervisor engines, both supervisor engines must be the same model and have the same daughter card configurations. Each supervisor engine must have the resources to run the switch on its own, which means that all supervisor engine resources are duplicated. Identical supervisor engine memory configurations are recommended, but are not required as long as the supervisor engine with the smaller memory configuration is sufficient to run the configured features of the switch. Additionally, each supervisor engine must have its own flash device and console port connections.</p>
Modules	<ul style="list-style-type: none"> <li>• Supports up to two Catalyst 6500 series modules.</li> <li>• Does not support the WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules.</li> <li>• Some Catalyst 6500 series modules may: <ul style="list-style-type: none"> <li>– Not be supported</li> <li>– Require that you install a certain supervisor engine</li> <li>– Have chassis slot restrictions</li> <li>– Require a specific software release level to operate</li> </ul> </li> </ul> <p><b>Note</b> Check your software release notes for specific information on module support and restrictions.</p>

Table 1-3 Catalyst 6503-E Switch Features (continued)

Feature	Description
Backplane bandwidth	<ul style="list-style-type: none"> <li>• 32 GBps shared bus.</li> <li>• 720 GBps switch fabric.</li> </ul>
Clock and VTT module	<ul style="list-style-type: none"> <li>• One replaceable clock module (CLK-7600=) provides clocking signals to the EOBC channel and the switching bus.</li> <li>• Nonreplaceable voltage termination (VTT) module provides reference voltage for bus signals.</li> </ul>
Fan tray	<ul style="list-style-type: none"> <li>• The chassis supports one hot-swappable fan tray. One fan tray model is available: <ul style="list-style-type: none"> <li>– WS-C6503-E-FAN—282 CFM</li> </ul> </li> </ul> <p><b>Note</b> The fan tray contains four individual fans. The individual fans are not field replaceable; you must replace the fan tray in the event of a fan failure.</p> <ul style="list-style-type: none"> <li>• Fan tray STATUS LED <ul style="list-style-type: none"> <li>– Red—One or more individual fans have failed.</li> <li>– Green—Fan tray is operating normally.</li> </ul> </li> </ul>
Power Entry Module (PEM) <sup>1</sup>	<ul style="list-style-type: none"> <li>• A PEM is required for each installed power supply. <ul style="list-style-type: none"> <li>– PEM-15A-AC (PEM for 950 W AC-input power supplies).</li> <li>– PEM-DC/3 (PEM for 950 W DC-input power supplies).</li> <li>– PEM-20A-AC+ (PEM for 1400 W AC-input power supplies).</li> </ul> </li> </ul>



**Table 1-3 Catalyst 6503-E Switch Features (continued)**

Feature	Description
Power supplies	<ul style="list-style-type: none"> <li>• Supports one or two power supplies. The following power supplies are supported: <ul style="list-style-type: none"> <li>– PWR-950-AC (950 W AC-input power supply).</li> <li>– PWR-950-DC (950 W DC-input power supply).</li> <li>– PWR-1400-AC (1400 W AC-input power supply).</li> </ul> </li> <li>• Installed power supplies can be of different wattage ratings. Installed power supplies can be both AC-input, both DC-input, or one AC-input and one DC-input. Power supplies can be configured in either redundant or combined mode.</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC. Source AC can be out of phase between multiple power supplies or multiple AC-power plugs on the same power supply because all AC power supply inputs are isolated.</li> <li>• Single power supplies are installed in the lower power supply bay. The second power supply is installed in the upper power supply bay.</li> <li>• Supervisor Engine 2T requires a 1400 W power supply to operate.</li> </ul> <p><b>Note</b> For proper operation of the power supply OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

1. PEMs are required for Catalyst 6503 and Catalyst 6503-E switches only.

Table 1-4 lists the environmental and physical specifications of the Catalyst 6503-E switch chassis.

**Table 1-4 Catalyst 6503-E Switch Specifications**

Item	Specification
Environmental	
Temperature, operating	<p>Certified for operation: 32° to 104°F (0° to 40°C)</p> <p>Designed and tested for operation: 32° to 131°F (0° to 55°C)</p> <p><b>Note</b> The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 104°F (40°C) generating a minor alarm and at 131°F (55°C) generating a major alarm.</p>
Temperature, nonoperating and storage	<p>Chassis unpackaged: –4° to 149°F (–20° to 65°C)</p> <p>Chassis in protective shipping package: –40° to 158°F (–40° to 70°C)</p>
Thermal transition	<p>0.5°C per minute (hot to cold)</p> <p>0.33°C per minute (cold to hot)</p>
Humidity (RH), ambient (noncondensing) operating	5% to 90%

Table 1-4 Catalyst 6503-E Switch Specifications (continued)

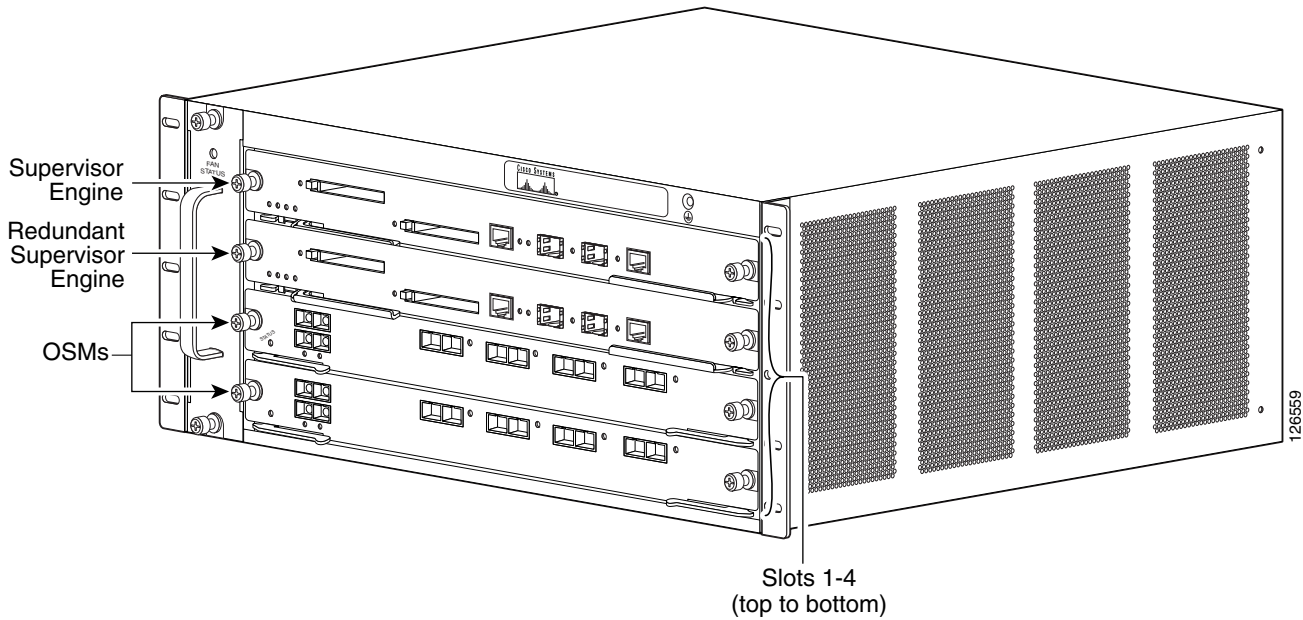
Item	Specification
Humidity (RH), ambient (noncondensing) nonoperating and storage Altitude, operating	5% to 95%  Certified for operation: 0 to 6500 ft Designed and tested for operation: -200 to 10000 ft (-60 to 3000 m)
Shock and vibration	This switch complies with Network Equipment Building Systems (NEBS) (Zone 4 per GR-63-Core) in the following areas: <ul style="list-style-type: none"> <li>• Earthquake environment and criteria</li> <li>• Office vibration and criteria</li> <li>• Transportation vibration and criteria</li> </ul> <p><b>Shock</b></p> <ul style="list-style-type: none"> <li>• Operational—5 G 30 ms, half-sine (IEC 68-2-27)</li> <li>• Nonoperational—20 G, 7.5 ms, trapezoidal</li> </ul> <p><b>Vibration</b></p> <p>Operational—3 Hz to 500 Hz, Power Spectral Density (PSD)—0.0005 G<sup>2</sup>/Hz at 10 Hz and 200 Hz. 5 dB/octave roll off at each end. 0.5 hours per axis (1.12 Grms).</p>
Acoustic noise	64 to 76 dB. International Organization for Standardization (ISO) 7779: Bystander position operating to an ambient temperature of 86°F (30°C).
Physical characteristics	
Dimensions (H x W x D)	<ul style="list-style-type: none"> <li>• 7 x 17.37 x 21.75 in. (17.8 x 44.1 x 55.2 cm).</li> <li>• Chassis requires 4 RU<sup>1</sup>.</li> <li>• The Catalyst 6503-E switch chassis is designed to install in standard 19-inch equipment racks that meet ANSI/EIA 310-D, IEC 60297, and ETS 300-119 standards.</li> </ul>
Weight	<ul style="list-style-type: none"> <li>• Chassis only: 33 lb (15 kg).</li> <li>• Chassis fully configured with 1 supervisor engine, 2 modules, 2 AC-input PEMs, and 2 AC-input power supplies: 85.4 lb (38.7 kg).</li> </ul>
Airflow	<ul style="list-style-type: none"> <li>• WS-C6503-E-FAN—282 CFM</li> </ul> <p><b>Note</b> To maintain proper air circulation through the Catalyst switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis air exhaust. You should also allow a minimum separation of 12 inches (30.5 cm) between the hot air exhaust on one chassis and the air intake on another chassis. Failure to maintain adequate air space can cause the chassis to overheat and the system to fail. On Catalyst chassis in which the airflow is from front to back, the chassis may be placed side-by-side.</p>

1. RU = rack units

# Catalyst 6504-E Switch

The Catalyst 6504-E switch is a 4-slot horizontal chassis that supports redundant power supplies, redundant supervisor engines, and slots for up to three modules. The Catalyst 6504-E switch chassis is NEBS L3 compliant. [Figure 1-5](#) shows the front view of the chassis and [Figure 1-6](#) shows the rear view of the chassis.

**Figure 1-5 Catalyst 6504-E Switch—Front View**



**Figure 1-6 Catalyst 6504-E Switch—Rear View**

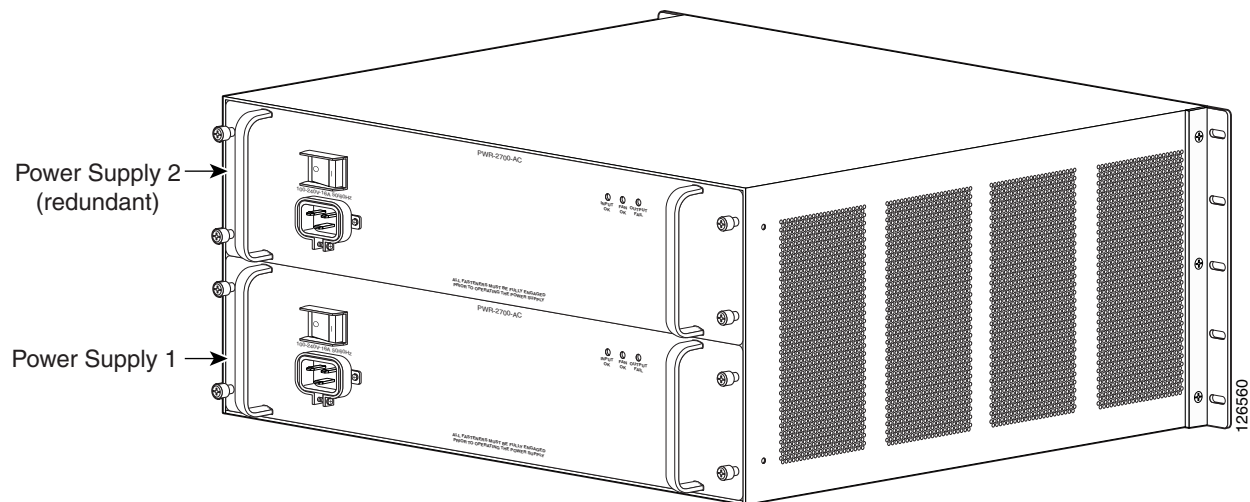


Table 1-5 lists the features of the Catalyst 6504-E switch chassis.

**Table 1-5 Catalyst 6504-E Switch Features**

Feature	Description
Chassis	<ul style="list-style-type: none"> <li>Four horizontal slots. Slots are numbered from 1 (top) to 4 (bottom).</li> </ul>
Supervisor engine	<ul style="list-style-type: none"> <li>Supports Supervisor Engine 2, Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE.</li> </ul> <p><b>Note</b> Refer to your software release notes for the minimum software release versions required to support the supervisor engines.</p> <ul style="list-style-type: none"> <li>Supervisor engines are installed in slot 1 and slot 2.</li> </ul> <p><b>Note</b> Slots not occupied by supervisor engines can be used for modules. Check your software release notes for any restrictions on the type of module that can be installed.</p> <ul style="list-style-type: none"> <li>Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T have a built-in switching fabric. Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2) are not supported.</li> <li>Supervisor Engine 32 and Supervisor Engine 32 PISA do not support the Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2).</li> <li>The uplink ports are fully functional on the redundant supervisor engine when it is in standby mode.</li> </ul> <p><b>Note</b> In systems with redundant supervisor engines, both supervisor engines must be the same model and have the same daughter card configurations. Each supervisor engine must have the resources to run the switch on its own, which means that all supervisor engine resources are duplicated. Identical supervisor engine memory configurations are recommended, but are not required as long as the supervisor engine with the smaller memory configuration is sufficient to run the configured features of the switch. Additionally, each supervisor engine must have its own flash device and console port connections.</p>
Modules	<ul style="list-style-type: none"> <li>Supports up to three Catalyst 6500 series modules.</li> <li>Does not support the WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules.</li> <li>Some Catalyst 6500 series modules may:             <ul style="list-style-type: none"> <li>Not be supported or have slot restrictions</li> <li>Require that you install a Supervisor Engine 720</li> <li>Require a specific software release level to operate</li> </ul> </li> </ul> <p><b>Note</b> Check your software release notes for specific information.</p>
Backplane bandwidth	<ul style="list-style-type: none"> <li>32 GBps shared bus.</li> <li>720 GBps switch fabric.</li> </ul>

Table 1-5 Catalyst 6504-E Switch Features (continued)

Feature	Description
Clock and VTT module	<ul style="list-style-type: none"> <li>• One replaceable clock module (CLK-7600=) provides clocking signals to the EOBC channel and the switching bus.</li> <li>• Nonreplaceable voltage termination (VTT) module provides reference voltage for bus signals.</li> </ul>
Fan tray	<ul style="list-style-type: none"> <li>• The chassis supports one hot-swappable fan tray. One fan tray model is available: <ul style="list-style-type: none"> <li>– FAN-MOD-4HS—300 CFM</li> </ul> </li> </ul> <p><b>Note</b> The fan tray contains eight individual fans. The individual fans are not field replaceable; you must replace the fan tray in the event of a fan failure.</p> <ul style="list-style-type: none"> <li>• Fan tray STATUS LED <ul style="list-style-type: none"> <li>– Red—One or more individual fans have failed.</li> <li>– Green—Fan tray is operating normally.</li> </ul> </li> </ul>
Power supplies	<ul style="list-style-type: none"> <li>• Supports one or two power supplies. The following power supplies are supported: <ul style="list-style-type: none"> <li>– PWR-2700-AC/4 (2700 W AC-input power supply).</li> <li>– PWR-2700-DC/4 (2700 W DC-input power supply).</li> </ul> </li> <li>• Installed power supplies can be both AC-input, both DC-input, or one AC-input and one DC-input. Power supplies can be configured in either redundant or combined mode.</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC. Source AC can be out of phase between multiple power supplies or multiple AC-power plugs on the same power supply because all AC power supply inputs are isolated.</li> <li>• Single power supplies are installed in the lower power supply bay. The second power supply is installed in the upper power supply bay.</li> </ul> <p><b>Note</b> For proper operation of the power supply OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

Table 1-6 lists the environmental and physical specifications of the Catalyst 6504-E switch chassis.

**Table 1-6 Catalyst 6504-E Switch Specifications**

Item	Specification
Environmental Temperature, operating  Temperature, nonoperating and storage  Thermal transition	Certified for operation: 32° to 104°F (0° to 40°C) Designed and tested for operation: 32° to 131°F (0° to 55°C) <b>Note</b> The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 104°F (40°C) generating a minor alarm and at 131°F (55°C) generating a major alarm.  Chassis unpackaged: -4° to 149°F (-20° to 65°C) Chassis in protective shipping package: -40° to 158°F (-40° to 70°C)  0.5°C per minute (hot to cold) 0.33°C per minute (cold to hot)
Humidity (RH), ambient (noncondensing) operating  Humidity (RH), ambient (noncondensing) nonoperating and storage  Altitude, operating	5% to 90%  5% to 95%  Certified for operation: 0 to 6500 ft (0 to 2000 m) Designed and tested for: -200 to 10,000 ft (-60 to 3000 m)
Shock and vibration	This switch complies with Network Equipment Building Systems (NEBS) (Zone 4 per GR-63-Core) in the following areas: <ul style="list-style-type: none"> <li>• Earthquake environment and criteria</li> <li>• Office vibration and criteria</li> <li>• Transportation vibration and criteria</li> </ul> <b>Shock</b> <ul style="list-style-type: none"> <li>• Operational—5 G 30 ms, half-sine (IEC 68-2-27)</li> <li>• Nonoperational—20 G, 7.5 ms, trapezoidal</li> </ul> <b>Vibration</b> Operational—3 Hz to 500 Hz. Power Spectral Density (PSD)—0.0005 G <sup>2</sup> /Hz at 10 Hz and 200 Hz. 5 dB/octave roll off at each end. 0.5 hours per axis (1.12 Grms).

**Table 1-6 Catalyst 6504-E Switch Specifications (continued)**

Item	Specification
Acoustic noise	64 to 76 dB. International Organization for Standardization (ISO) 7779: Bystander position operating to an ambient temperature of 86°F (30°C).
Physical characteristics	<ul style="list-style-type: none"> <li>• 8.75 x 17.5 x 21.75 in. (22.225 x 44.45 x 55.245 cm).</li> <li>• Chassis requires 5 RU<sup>1</sup>.</li> <li>• The Catalyst 6504-E switch chassis is designed to install in standard 19-inch equipment racks that meet ANSI/EIA 310-D, IEC 60297, and ETS 300-119 standards.</li> </ul>
Dimensions (H x W x D)	
Weight	<ul style="list-style-type: none"> <li>• Chassis only: 27 lb (12.25 kg).</li> <li>• Chassis fully configured with 2 supervisor engines, 2 modules, and 2 AC-input power supplies: 97 lb (43.99 kg).</li> </ul>
Airflow	<ul style="list-style-type: none"> <li>• FAN-MOD-4HS—300 CFM</li> </ul> <p><b>Note</b> To maintain proper air circulation through the Catalyst switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis air exhaust. You should also allow a minimum separation of 12 inches (30.5 cm) between the hot air exhaust on one chassis and the air intake on another chassis. Failure to maintain adequate air space can cause the chassis to overheat and the system to fail. On Catalyst chassis in which the airflow is from front to back, the chassis may be placed side-by-side.</p>

1. RU = rack units

# Catalyst 6506 Switch

The Catalyst 6506 switch is a 6-slot horizontal chassis supporting redundant power supplies, redundant supervisor engines, and slots for up to five modules. The chassis is NEBS L3 compliant. [Figure 1-7](#) shows a front view of the Catalyst 6506 switch chassis.

**Figure 1-7 Catalyst 6506 Switch**

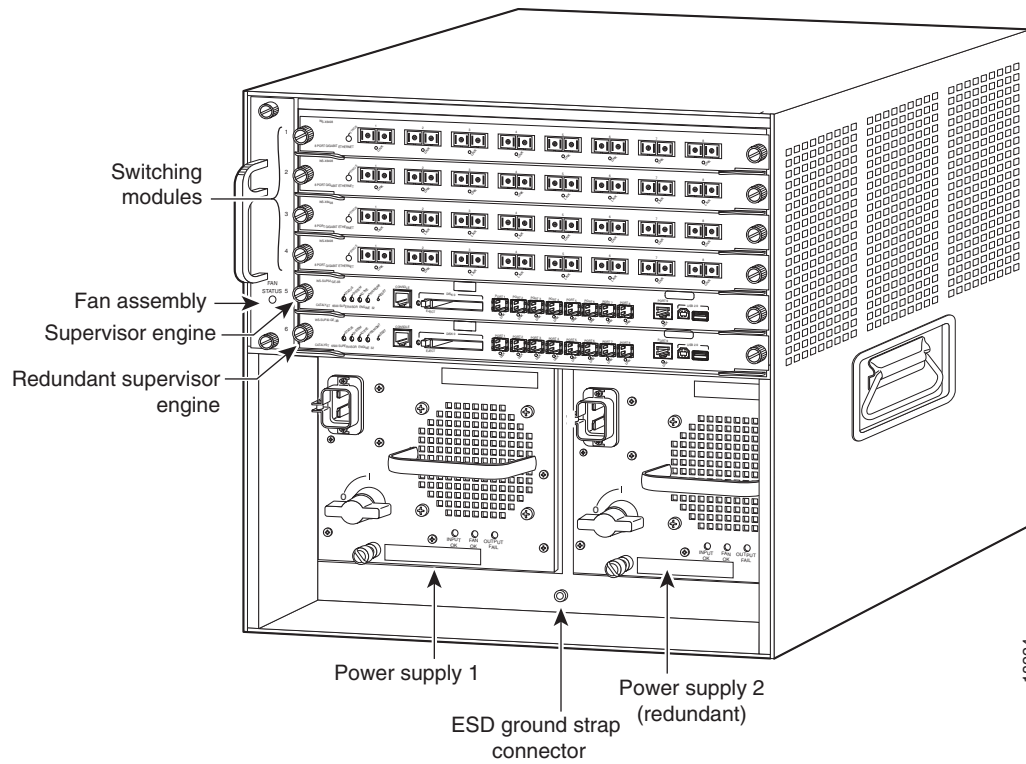




Table 1-7 lists the features of the Catalyst 6506 switch chassis.

**Table 1-7 Catalyst 6506 Switch Features**

Feature	Descriptions
Chassis	<ul style="list-style-type: none"> <li>• Six horizontal slots. Slots are numbered from 1 (top) to 6 (bottom).</li> </ul>
Supervisor engines	<ul style="list-style-type: none"> <li>• Supports Supervisor Engine 2, Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE.</li> </ul> <p><b>Note</b> Refer to your software release notes for the minimum software release versions required to support the supervisor engines.</p> <ul style="list-style-type: none"> <li>– Supervisor Engine 2 must be installed in slot 1 or slot 2.</li> <li>– Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE must be installed in slot 5 or slot 6.</li> </ul> <p><b>Note</b> Slots not occupied by supervisor engines can be used for modules. Check your software release notes for any restrictions on the type of module that can be installed.</p> <ul style="list-style-type: none"> <li>• Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE all require the high-speed fan tray (WS-C6K-6SLOT-FAN2) be installed in the chassis. You must also install a 2500 W or higher capacity power supply in the chassis to power the high-speed fan tray.</li> </ul> <p><b>Note</b> The 2500 W power supply, when supporting the high-speed fan tray, can be powered from either 120 VAC or 220 VAC.</p> <ul style="list-style-type: none"> <li>• Supervisor Engine 720 and Supervisor Engine 720-10GE have a built-in switching fabric. Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2) are not supported by Supervisor Engine 720 and Supervisor Engine 720-10GE.</li> <li>• Supervisor Engine 32 and Supervisor Engine 32 PISA do not support the Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2).</li> <li>• The uplink ports are fully functional on the redundant supervisor engine in standby mode.</li> </ul> <p><b>Note</b> In systems with redundant supervisor engines, both supervisor engines must be the same model and have the same daughter card configurations. Each supervisor engine must have the resources to run the switch on its own, which means that all supervisor engine resources are duplicated. Identical supervisor engine memory configurations are recommended, but are not required as long as the supervisor engine with the smaller memory configuration is sufficient to run the configured features of the switch. Additionally, each supervisor engine must have its own flash device and console port connections.</p>

Table 1-7 Catalyst 6506 Switch Features (continued)

Feature	Descriptions
Modules	<ul style="list-style-type: none"> <li>• Supports up to five Catalyst 6500 series modules.</li> <li>• WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules must be installed in slot 5 or slot 6.</li> </ul> <p><b>Note</b> Mixing WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules in the Catalyst 6506 chassis is allowed.</p> <ul style="list-style-type: none"> <li>• Some Catalyst 6500 series modules may:               <ul style="list-style-type: none"> <li>– Not be supported</li> <li>– Require that you install a Supervisor Engine 720</li> <li>– Have chassis slot restrictions</li> <li>– Require a specific software release level to operate</li> </ul> </li> </ul> <p><b>Note</b> Check your software release notes for specific information on module support and restrictions.</p>
Backplane bandwidth	<ul style="list-style-type: none"> <li>• 32 GBps shared bus.</li> <li>• 256 GBps switch fabric.</li> <li>• 720 GBps switch fabric.</li> </ul>
Clock and VTT modules	<ul style="list-style-type: none"> <li>• Two replaceable clock modules (WS-C6K-CL=) provide clocking signals to the EOBC channel and the switching bus.</li> <li>• Three replaceable voltage termination (VTT) modules (WS-C6K-VTT=) provide reference voltage for bus signals.</li> </ul>
Fan tray	<ul style="list-style-type: none"> <li>• The chassis supports one hot-swappable fan tray. Two fan tray models are available:               <ul style="list-style-type: none"> <li>– WS-C6K-6SLOT-FAN (Standard fan tray—227 CFM). Supports Supervisor Engine 1 and Supervisor Engine 2 only; does not support Supervisor Engine 32 or Supervisor Engine 720.</li> <li>– WS-C6K-6SLOT-FAN2 (Optional high-speed fan tray—420 CFM. Required for Supervisor Engine 32 and Supervisor Engine 720. Supports Supervisor Engine 1 and Supervisor Engine 2.</li> </ul> </li> </ul> <p><b>Note</b> You must install a 2500 W or higher capacity power supply in the chassis to power the high-speed fan tray. The 2500 W power supply can be powered from either 120 VAC or 220 VAC.</p> <p><b>Note</b> The fan trays contains six individual fans. The individual fans are not field replaceable; you must replace the fan tray in the event of a fan failure.</p> <ul style="list-style-type: none"> <li>• Fan tray STATUS LED               <ul style="list-style-type: none"> <li>– Red—One or more individual fans have failed.</li> <li>– Green—Fan tray is operating normally.</li> </ul> </li> </ul>

Table 1-7 Catalyst 6506 Switch Features (continued)

Feature	Descriptions
Power supply	<ul style="list-style-type: none"> <li>• Supports one or two power supplies. The following power supplies are supported:               <ul style="list-style-type: none"> <li>– WS-CAC-1000W (1000 W AC-input power supply).</li> <li>– WS-CAC-1300W (1300 W AC-input power supply).</li> <li>– WS-CDC-1300W (1300 W DC-input power supply).</li> <li>– WS-CAC-2500W (2500 W AC-input power supply).</li> <li>– WS-CDC-2500W (2500 W DC-input power supply).</li> <li>– WS-CAC-3000W (3000 W AC-input power supply).</li> <li>– WS-CAC-4000W-US (4000 W AC-input power supply).</li> <li>– WS-CAC-4000W-INT (4000 W AC-input power supply).</li> <li>– PWR-4000-DC (4000 W DC-input power supply).</li> <li>– WS-CAC-6000W (6000 W AC-input power supply).</li> <li>– PWR-6000-DC (6000 W DC-input power supply).</li> <li>– WS-CAC-8700W (8700 W AC-input power supply).</li> </ul> </li> </ul> <p><b>Note</b> The 6000 W AC-input and DC-input power supplies, and the 8700 W AC-input power supply are limited to 4000 W maximum output when installed in the Catalyst 6506 chassis.</p> <ul style="list-style-type: none"> <li>• Installed power supplies can be of different wattage ratings. Installed power supplies can also be both AC-input, both DC-input, or one AC-input and one DC-input. Power supplies can be configured in either redundant or combined mode.</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC. Source AC can be out of phase between multiple power supplies or multiple AC-power plugs on the same power supply because all AC power supply inputs are isolated.</li> <li>• Single power supplies are installed in the left power supply bay. The second power supply is installed in the right power supply bay.</li> <li>• You must install a 2500 W or higher capacity power supply when using the Supervisor Engine 32 or the Supervisor Engine 720 and the high-speed fan tray.</li> </ul> <p><b>Note</b> For proper operation of the power supply OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

Table 1-8 lists the environmental and physical specifications of the Catalyst 6506 switch chassis.

**Table 1-8 Catalyst 6506 Switch Specifications**

Item	Specification
Environmental Temperature, operating  Temperature, nonoperating and storage  Thermal transition  Humidity (RH), ambient (noncondensing) operating  Humidity (RH), ambient (noncondensing) nonoperating and storage  Altitude, operating	Certified for operation: 32° to 104°F (0° to 40°C) Designed and tested for operation: 32° to 130°F (0° to 55°C) <b>Note</b> The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 104°F (40°C) generating a minor alarm and at 131°F (55°C) generating a major alarm.  Chassis unpackaged: -4° to 149°F (-20° to 65°C) Chassis in protective shipping package: -40° to 158°F (-40° to 70°C)  0.5°C per minute (hot to cold) 0.33°C per minute (cold to hot)  5% to 90%  5% to 95%  Certified for operation: 0 to 6500 ft (0 to 2000 m) Designed and tested for operation: -200 to 10,000 ft (-60 to 3000 m)
Shock and vibration	This switch complies with Network Equipment Building Systems (NEBS) (Zone 4 per GR-63-Core) in the following areas: <ul style="list-style-type: none"> <li>• Earthquake environment and criteria</li> <li>• Office vibration and criteria</li> <li>• Transportation vibration and criteria</li> </ul> <b>Shock</b> <ul style="list-style-type: none"> <li>• Operational—5 G 30 ms, half-sine (IEC 68-2-27)</li> <li>• Nonoperational—20 G, 7.5 ms, trapezoidal</li> </ul> <b>Vibration</b> Operational—3 Hz to 500 Hz. Power Spectral Density (PSD)—0.0005 G <sup>2</sup> /Hz at 10 Hz and 200 Hz. 5 dB/octave roll off at each end. 0.5 hours per axis (1.12 Grms).
Acoustic noise	53 to 61 dB. International Organization for Standardization (ISO) 7779: Bystander position operating to an ambient temperature of 86°F (30°C).

Table 1-8 Catalyst 6506 Switch Specifications (continued)

Item	Specification
Physical characteristics Dimensions (H x W x D)         Weight	<ul style="list-style-type: none"> <li>• 20.1 x 17.2 x 18.2 in. (51.1 x 43.7 x 46.0 cm).</li> <li>• Chassis depth including cable guide is 21.64 in. (55.0 cm).</li> <li>• Chassis requires 12 RU.</li> <li>• The Catalyst 6506 switch chassis is designed to install in standard 19-inch equipment racks that meet ANSI/EIA 310-D, IEC 60297, and ETS 300-119 standards.</li> <li>• Chassis only: 45 lb (20.4 kg).</li> <li>• Chassis fully configured with 1 supervisor engine, 5 switching modules, and 2 power supplies: 156.6 lb (71.0 kg).</li> </ul>
Airflow	WS-C6K-6SLOT-FAN (Standard fan tray)—227 CFM. WS-C6K-6SLOT-FAN2 (Optional high-speed fan tray)—420 CFM.  <b>Note</b> To maintain proper air circulation through the Catalyst switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis air exhaust. You should also allow a minimum separation of 12 inches (30.5 cm) between the hot air exhaust on one chassis and the air intake on another chassis. Failure to maintain adequate air space can cause the chassis to overheat and the system to fail. On Catalyst chassis in which the airflow is from front to back, the chassis may be placed side-by-side.

# Catalyst 6506-E Switch

The Catalyst 6506-E switch is an enhanced version of the Catalyst 6506 switch. The 6-slot horizontal chassis supports redundant power supplies, redundant supervisor engines, and slots for up to five modules. It also supports a greater power capacity per slot than the Catalyst 6506 switch chassis. The Catalyst 6506-E switch chassis is NEBS L3 compliant. Figure 1-8 shows a front view of the Catalyst 6506-E switch.

**Figure 1-8 Catalyst 6506-E Switch**

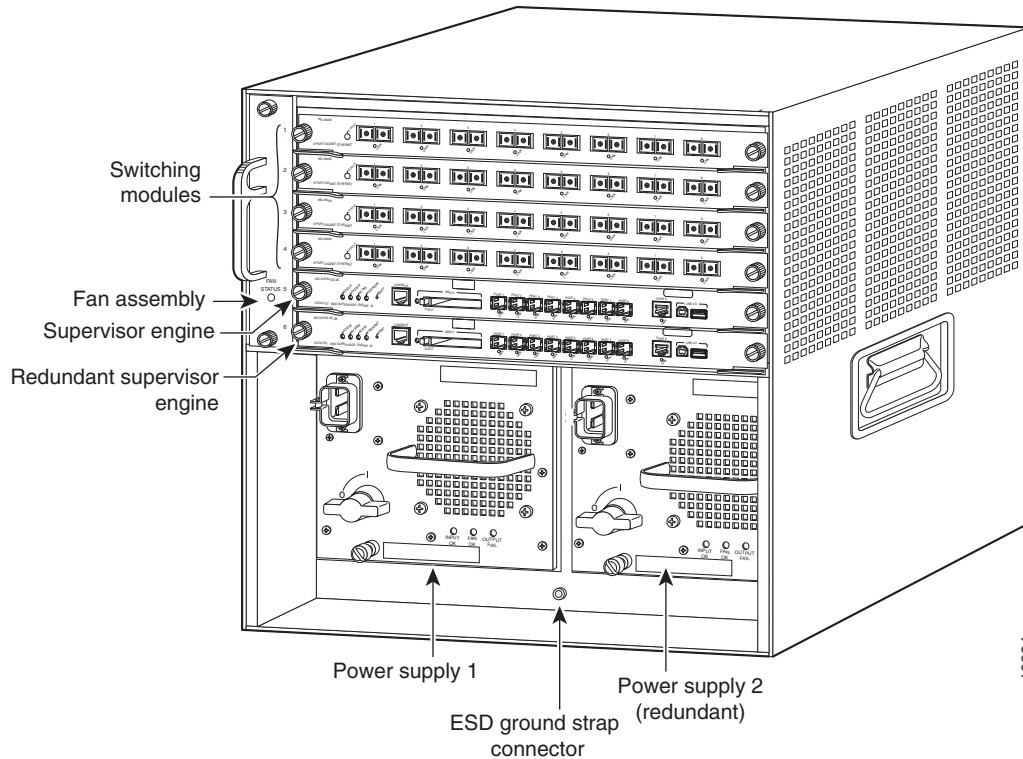


Table 1-9 lists the features of the Catalyst 6506-E switch chassis.

**Table 1-9 Catalyst 6506-E Switch Features**

Feature	Descriptions
Chassis	<ul style="list-style-type: none"> <li>• Six horizontal slots. Slots are numbered from 1 (top) to 6 (bottom).</li> </ul>
Supervisor engines	<ul style="list-style-type: none"> <li>• Supports Supervisor Engine 2, Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T.</li> </ul> <p><b>Note</b> Refer to your software release notes for the minimum software release versions required to support the supervisor engines.</p> <ul style="list-style-type: none"> <li>– Supervisor Engine 2 must be installed in slot 1 and slot 2.</li> <li>– Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T must be installed in slot 5 and slot 6.</li> </ul> <p><b>Note</b> Slots not occupied by supervisor engines can be used for modules. Check your software release notes for any restrictions on the type of module that can be installed.</p> <ul style="list-style-type: none"> <li>• Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T have a built-in switching fabric. Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2) are not supported.</li> <li>• Supervisor Engine 32 and Supervisor Engine 32 PISA do not support the Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2).</li> <li>• The uplink ports are fully functional on the redundant supervisor engine in standby mode.</li> </ul> <p><b>Note</b> In systems with redundant supervisor engines, both supervisor engines must be the same model and have the same daughter card configurations. Each supervisor engine must have the resources to run the switch on its own, which means that all supervisor engine resources are duplicated. Identical supervisor engine memory configurations are recommended, but are not required as long as the supervisor engine with the smaller memory configuration is sufficient to run the configured features of the switch. Additionally, each supervisor engine must have its own flash device and console port connections.</p>

Table 1-9 Catalyst 6506-E Switch Features (continued)

Feature	Descriptions
Modules	<ul style="list-style-type: none"> <li>• Supports up to five Catalyst 6500 series modules.</li> <li>• WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules must be installed in slot 5 or slot 6.</li> </ul> <p><b>Note</b> Mixing WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules in the Catalyst 6506-E chassis is allowed.</p> <ul style="list-style-type: none"> <li>• Some Catalyst 6500 series modules may: <ul style="list-style-type: none"> <li>– Not be supported</li> <li>– Require that you install a Supervisor Engine 720</li> <li>– Have chassis slot restrictions</li> <li>– Require a specific software release level to operate</li> </ul> </li> </ul> <p><b>Note</b> Check your software release notes for specific information on module support and restrictions.</p>
Backplane bandwidth	<ul style="list-style-type: none"> <li>• 32 GBps shared bus.</li> <li>• 256 GBps switch fabric.</li> <li>• 720 GBps switch fabric.</li> </ul>
Clock and VTT modules	<ul style="list-style-type: none"> <li>• Two replaceable clock modules (CLK-7600=) provide clocking signals to the EOBC channel and the switching bus.</li> <li>• Three replaceable voltage termination (VTT) modules (WS-C6K-VTT-E=) provide reference voltage for bus signals.</li> </ul>
Fan tray	<ul style="list-style-type: none"> <li>• The chassis supports one hot-swappable fan tray. One fan tray model is available: <ul style="list-style-type: none"> <li>– WS-C6506-E-FAN—564 CFM</li> </ul> </li> </ul> <p><b>Note</b> You must install a 2500 W or higher capacity power supply in the chassis to power the fan tray. The 2500 W power supply can be powered from either 120 VAC or 220 VAC.</p> <p><b>Note</b> The fan tray contains six individual fans. The individual fans are not field replaceable; you must replace the fan tray in the event of a fan failure.</p> <ul style="list-style-type: none"> <li>• Fan tray STATUS LED <ul style="list-style-type: none"> <li>– Red—One or more individual fans have failed.</li> <li>– Green—Fan tray is operating normally.</li> </ul> </li> </ul>



Table 1-9 Catalyst 6506-E Switch Features (continued)

Feature	Descriptions
Power supply	<ul style="list-style-type: none"> <li>• Supports one or two power supplies. The following power supplies are supported:               <ul style="list-style-type: none"> <li>– WS-CAC-2500W (2500 W AC-input power supply).</li> <li>– WS-CDC-2500W (2500 W DC-input power supply).</li> <li>– WS-CAC-3000W (3000 W AC-input power supply).</li> <li>– WS-CAC-4000W-US (4000 W AC-input power supply).</li> <li>– WS-CAC-4000W-INT (4000 W AC-input power supply).</li> <li>– PWR-4000-DC (4000 W DC-input power supply).</li> <li>– WS-CAC-6000W (6000 W AC-input power supply).</li> <li>– PWR-6000-DC (6000 W DC-input power supply).</li> <li>– WS-CAC-8700W-E (8700 W AC-input power supply).</li> </ul> </li> <li>• Installed power supplies can be of different wattage ratings. Installed power supplies can also be both AC-input, both DC-input, or one AC-input and one DC-input. Power supplies can be configured in either redundant or combined mode.</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC. Source AC can be out of phase between multiple power supplies or multiple AC-power plugs on the same power supply because all AC power supply inputs are isolated.</li> <li>• Single power supplies are installed in the left power supply bay. The second power supply is installed in the right power supply bay.</li> <li>• Supervisor Engine 2T requires a 3000 W or greater power supply to operate.</li> </ul> <p><b>Note</b> For proper operation of the power supply OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

Table 1-10 lists the environmental and physical specifications of the Catalyst 6506-E switch chassis.

**Table 1-10 Catalyst 6506-E Switch Specifications**

Item	Specification
Environmental Temperature, operating  Temperature, nonoperating and storage  Thermal transition  Humidity (RH), ambient (noncondensing) operating  Humidity (RH), ambient (noncondensing) nonoperating and storage  Altitude, operating	Certified for operation: 32° to 104°F (0° to 40°C) Designed and tested for operation: 32° to 131°F (0° to 55°C) <b>Note</b> The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 104°F (40°C) generating a minor alarm and at 131°F (55°C) generating a major alarm.  Chassis unpackaged: -4° to 149°F (-20° to 65°C) Chassis in protective shipping package: -40° to 158°F (-40° to 70°C)  0.5°C per minute (hot to cold) 0.33°C per minute (cold to hot)  5% to 90%  5% to 95%  Certified for operation: 0 to 6500 ft (0 to 2000 m) Designed and tested for operation: -200 to 10,000 ft (-60 to 3000 m)
Shock and vibration	This switch complies with Network Equipment Building Systems (NEBS) (Zone 4 per GR-63-Core) in the following areas: <ul style="list-style-type: none"> <li>• Earthquake environment and criteria</li> <li>• Office vibration and criteria</li> <li>• Transportation vibration and criteria</li> </ul> <b>Shock</b> <ul style="list-style-type: none"> <li>• Operational—5 G 30 ms, half-sine (IEC 68-2-27)</li> <li>• Nonoperational—20 G, 7.5 ms, trapezoidal</li> </ul> <b>Vibration</b> Operational—3 Hz to 500 Hz. Power Spectral Density (PSD)—0.0005 G <sup>2</sup> /Hz at 10 Hz and 200 Hz. 5 dB/octave roll off at each end. 0.5 hours per axis (1.12 Grms).
Acoustic noise	53 to 61 dB. International Organization for Standardization (ISO) 7779: Bystander position operating to an ambient temperature of 86°F (30°C).

Table 1-10 Catalyst 6506-E Switch Specifications (continued)

Item	Specification
Physical characteristics Dimensions (H x W x D)         Weight	<ul style="list-style-type: none"> <li>• 19.2 x 17.5 x 18.2 in. (48.8 x 44.5 x 46.0 cm).</li> <li>• Chassis depth including cable guide is 21.64 in. (55.0 cm).</li> <li>• Chassis requires 12 RU.</li> <li>• The Catalyst 6506-E switch chassis is designed to install in standard 19-inch equipment racks that meet ANSI/EIA 310-D, IEC 60297, and ETS 300-119 standards.</li> </ul> Chassis only: 50 lb (22.7 kg). Chassis fully configured with 1 supervisor engine, 5 switching modules, and 2 power supplies: 159 lb (72.3 kg).
Airflow	WS-C6506-E-FAN—564 CFM.  <b>Note</b> We recommend that you maintain a minimum air space of 6 inches (16 cm) between walls and the chassis air vents and a minimum horizontal separation of 12 inches (30.5 cm) between two chassis to prevent overheating.

# Catalyst 6509 Switch

The Catalyst 6509 switch is a 9-slot horizontal chassis supporting redundant power supplies, redundant supervisor engines, and slots for up to eight modules. The chassis is NEBS L3 compliant. [Figure 1-9](#) shows a front view of the Catalyst 6509 switch chassis.

**Figure 1-9 Catalyst 6509 Switch**

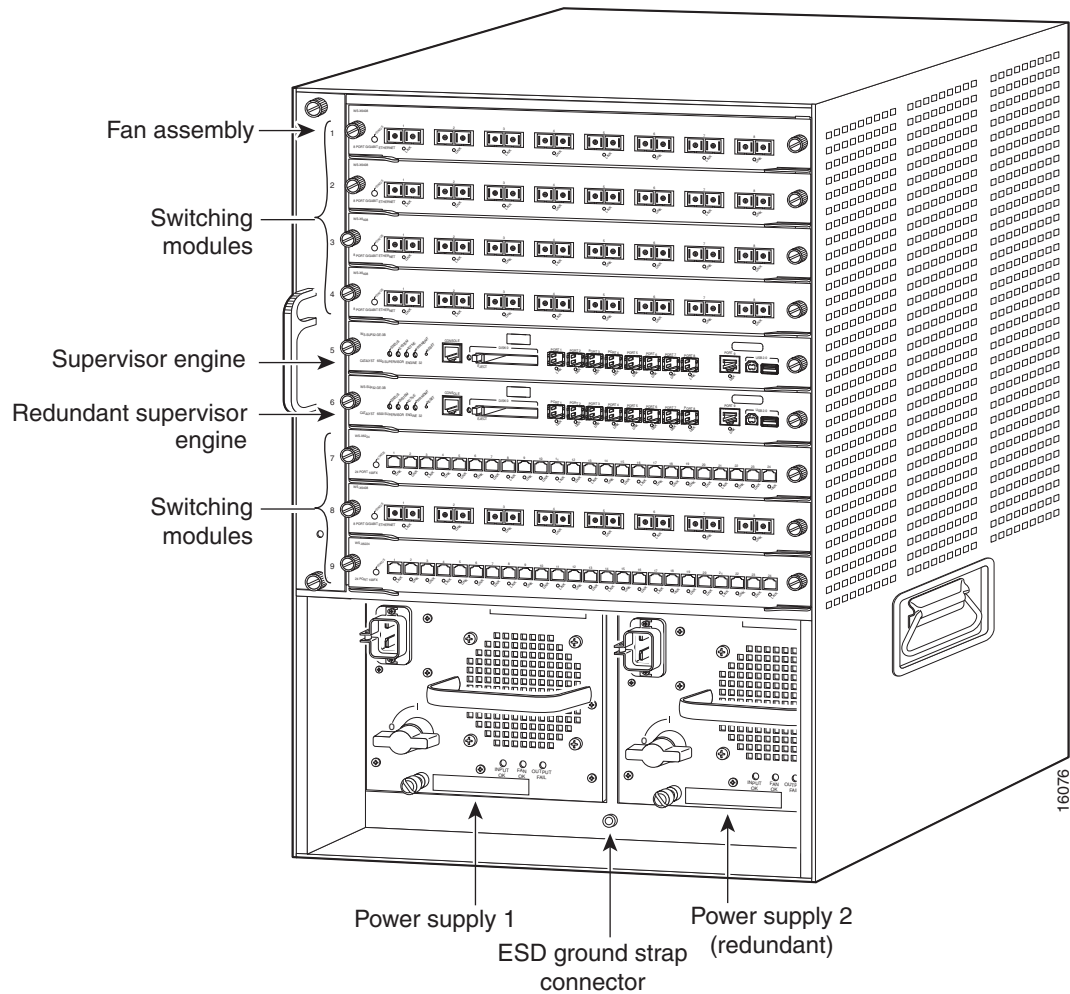


Table 1-11 lists the features of the Catalyst 6509 switch chassis.

**Table 1-11 Catalyst 6509 Switch Features**

Feature	Description
Chassis	<ul style="list-style-type: none"> <li>• Nine horizontal slots. Slots are numbered from 1 (top) to 9 (bottom).</li> </ul>
Supervisor engines	<ul style="list-style-type: none"> <li>• Supports Supervisor Engine 2, Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE.</li> </ul> <p><b>Note</b> Refer to your software release notes for the minimum software release versions required to support the supervisor engines.</p> <ul style="list-style-type: none"> <li>– Supervisor Engine 2 must be installed in slot 1 and slot 2.</li> <li>– Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE must be installed in slot 5 and slot 6.</li> </ul> <p><b>Note</b> Slots not occupied by supervisor engines can be used for modules. Check your software release notes for any restrictions on the type of module that can be installed.</p> <ul style="list-style-type: none"> <li>• Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE require that the high-speed fan tray be installed in the chassis. You must also install a 2500 W or higher capacity power supply in the chassis to power the high-speed fan tray.</li> </ul> <p><b>Note</b> The 2500 W power supply, when supporting the high-speed fan tray, can be powered from either 120 VAC or 220 VAC.</p> <ul style="list-style-type: none"> <li>• Supervisor Engine 720 and Supervisor Engine 720-10GE have a built-in switching fabric. Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2) are not supported by Supervisor Engine 720 and Supervisor Engine 720-10GE.</li> <li>• Supervisor Engine 32 and Supervisor Engine 32 PISA do not support the Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2).</li> <li>• The uplink ports are fully functional on all redundant supervisor engine models when they are in standby mode.</li> </ul> <p><b>Note</b> In systems with redundant supervisor engines, both supervisor engines must be the same model and have the same daughter card configurations. Each supervisor engine must have the resources to run the switch on its own, which means that all supervisor engine resources are duplicated. Identical supervisor engine memory configurations are recommended, but are not required as long as the supervisor engine with the smaller memory configuration is sufficient to run the configured features of the switch. Additionally, each supervisor engine must have its own flash device and console port connections.</p>

Table 1-11 Catalyst 6509 Switch Features (continued)

Feature	Description
Modules	<ul style="list-style-type: none"> <li>• Supports up to eight Catalyst 6500 series modules.</li> <li>• WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules must be installed in slot 5 or slot 6.</li> </ul> <p><b>Note</b> Mixing WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules in the Catalyst 6509 chassis is allowed.</p> <ul style="list-style-type: none"> <li>• Some Catalyst 6500 series modules may:               <ul style="list-style-type: none"> <li>– Not be supported</li> <li>– Require that you install a Supervisor Engine 720</li> <li>– Have chassis slot restrictions</li> <li>– Require a specific software release level to operate</li> </ul> </li> </ul> <p><b>Note</b> Check your software release notes for specific information on modules supported and restrictions.</p>
Backplane bandwidth	<ul style="list-style-type: none"> <li>• 32 GBps shared bus.</li> <li>• 256 GBps switch fabric.</li> <li>• 720 GBps switch fabric.</li> </ul>
Clock and VTT modules	<ul style="list-style-type: none"> <li>• Two replaceable clock modules (WS-C6K-CL=) provide clocking signals to the EOBC channel and the switching bus.</li> <li>• Three replaceable voltage termination (VTT) modules (WS-C6K-VTT=) provide reference voltage for bus signals.</li> </ul>
Fan tray	<ul style="list-style-type: none"> <li>• The chassis supports one hot-swappable fan tray. Two fan tray models are available:               <ul style="list-style-type: none"> <li>– WS-C6K-9SLOT-FAN (Standard fan tray—340 CFM). Supports Supervisor Engine 1 and Supervisor Engine 2 only; does not support Supervisor Engine 32 or Supervisor Engine 720.</li> <li>– WS-C6K-9SLOT-FAN2 (Optional high-speed fan tray—630 CFM). Required for Supervisor Engine 32 and Supervisor Engine 720. Supports Supervisor Engine 1 and Supervisor Engine 2.</li> </ul> </li> </ul> <p><b>Note</b> You must install a 2500 W or higher capacity power supply in the chassis to power the high-speed fan tray. The 2500 W power supply can be powered from either 120 VAC or 220 VAC.</p> <p><b>Note</b> The fan tray contains nine individual fans. The individual fans are not field replaceable; you must replace the fan tray in the event of a fan failure.</p> <ul style="list-style-type: none"> <li>• Fan tray STATUS LED               <ul style="list-style-type: none"> <li>– Red—One or more individual fans have failed.</li> <li>– Green—Fan tray is operating normally.</li> </ul> </li> </ul>

Table 1-11 Catalyst 6509 Switch Features (continued)

Feature	Description
Power supply	<ul style="list-style-type: none"> <li>• Supports one or two power supplies. The following power supply models are supported: <ul style="list-style-type: none"> <li>– WS-CAC-1000W (1000 W AC-input power supply).</li> <li>– WS-CAC-1300W (1300 W AC-input power supply).</li> <li>– WS-CDC-1300W (1300 W DC-input power supply).</li> <li>– WS-CAC-2500W (2500 W AC-input power supply).</li> <li>– WS-CDC-2500W (2500 W DC-input power supply).</li> <li>– WS-CAC-3000W (3000 W AC-input power supply).</li> <li>– WS-CAC-4000W-US (4000 W AC-input power supply).</li> <li>– WS-CAC-4000W-INT (4000 W AC-input power supply).</li> <li>– PWR-4000-DC (4000 W DC-input power supply).</li> <li>– WS-CAC-6000W (6000 W AC-input power supply).</li> <li>– PWR-6000-DC (6000 W DC-input power supply).</li> <li>– WS-CAC-8700W-E (8700 W AC-input power supply).</li> </ul> </li> </ul> <p><b>Note</b> The 6000 W AC-input and DC-input power supplies and the 8700 W AC-input power supply are limited to 4000 W maximum output when installed in the Catalyst 6509 chassis.</p> <ul style="list-style-type: none"> <li>• Installed power supplies can be of different wattage ratings. Installed power supplies can also be both AC-input, both DC-input, or one AC-input and one DC-input. Power supplies can be configured in either redundant or combined mode.</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC. Source AC can be out of phase between multiple power supplies or multiple AC-power plugs on the same power supply because all AC power supply inputs are isolated.</li> <li>• Single power supplies are installed in the left power supply bay. The second (redundant) power supply is installed in the right power supply bay.</li> <li>• You must install a 2500 W or higher capacity power supply when using the Supervisor Engine 32 or the Supervisor Engine 720 and the high-speed fan tray.</li> </ul> <p><b>Note</b> For proper operation of the power supply OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

Table 1-12 lists the environmental and physical specifications of the Catalyst 6509 switch chassis.

**Table 1-12 Catalyst 6509 Switch Specifications**

Item	Specification
Environmental Temperature, operating  Temperature, nonoperating and storage  Thermal transition  Humidity (RH), ambient (noncondensing) operating  Humidity (RH), ambient (noncondensing) nonoperating and storage  Altitude, operating	Certified for operation: 32° to 104°F (0° to 40°C) Designed and tested for operation: 32° to 131°F (0° to 55°C) <b>Note</b> The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 104°F (40°C) generating a minor alarm and at 131°F (55°C) generating a major alarm.  Chassis unpackaged: -4° to 149°F (-20° to 65°C) Chassis in protective shipping package: -40° to 158°F (-40° to 70°C)  0.5°C per minute (hot to cold) 0.33°C per minute (cold to hot)  5% to 90%  5% to 95%  Certified for operation: 0 to 6500 ft (0 to 2000 m) Designed and tested for operation: -200 to 10,000 ft (-60 to 3000 m)
Shock and vibration	This switch complies with Network Equipment Building Systems (NEBS) (Zone 4 per GR-63-Core) in the following areas: <ul style="list-style-type: none"> <li>• Earthquake environment and criteria</li> <li>• Office vibration and criteria</li> <li>• Transportation vibration and criteria</li> </ul> <b>Shock</b> <ul style="list-style-type: none"> <li>• Operational—5 G 30 ms, half-sine (IEC 68-2-27)</li> <li>• Nonoperational—20 G, 7.5 ms, trapezoidal</li> </ul> <b>Vibration</b> Operational—3 Hz to 500 Hz. Power Spectral Density (PSD)—0.0005 G <sup>2</sup> /Hz at 10 Hz and 200 Hz. 5 dB/octave roll off at each end. 0.5 hours per axis (1.12 Grms).
Acoustic noise	53.6 to 68 dB. International Organization for Standardization (ISO) 7779: Bystander position operating to an ambient temperature of 86°F (30°C).



Table 1-12 Catalyst 6509 Switch Specifications (continued)

Item	Specification
Physical characteristics Dimensions (H x W x D)  Weight	<ul style="list-style-type: none"> <li>• 25.3 x 17.2 x 18.2 in. (64.0 x 43.7 x 46.0 cm).</li> <li>• Chassis depth including cable guide is 21.64 in. (55.0 cm).</li> <li>• Chassis requires 15 RU<sup>1</sup>.</li> <li>• The Catalyst 6509 switch chassis is designed to install in standard 19-inch equipment racks that meet ANSI/EIA 310-D, IEC 60297, and ETS 300-119 standards.</li> </ul> Chassis only: 55 lb (24.9 kg). Chassis fully configured with 1 supervisor engine, 8 switching modules, and 2 power supplies: 194.5 lb (88.2 kg).
Airflow	WS-C6K-9SLOT-FAN (Standard fan tray)—340 CFM WS-C6K-9SLOT-FAN2 (Optional high-speed fan tray)—630 CFM  <b>Note</b> To maintain proper air circulation through the Catalyst switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis air exhaust. You should also allow a minimum separation of 12 inches (30.5 cm) between the hot air exhaust on one chassis and the air intake on another chassis. Failure to maintain adequate air space can cause the chassis to overheat and the system to fail. On Catalyst chassis in which the airflow is from front to back, the chassis may be placed side-by-side.

1. RU = rack units

# Catalyst 6509-E Switch

The Catalyst 6509-E switch is an enhanced version of the Catalyst 6509 switch. The 9-slot horizontal chassis supports redundant power supplies, redundant supervisor engines, and slots for up to eight modules. It also supports a greater power capacity per slot than the Catalyst 6509 switch chassis. The Catalyst 6509-E switch chassis is NEBS L3 compliant. Figure 1-10 shows the Catalyst 6509-E switch.

**Figure 1-10 Catalyst 6509-E Switch**

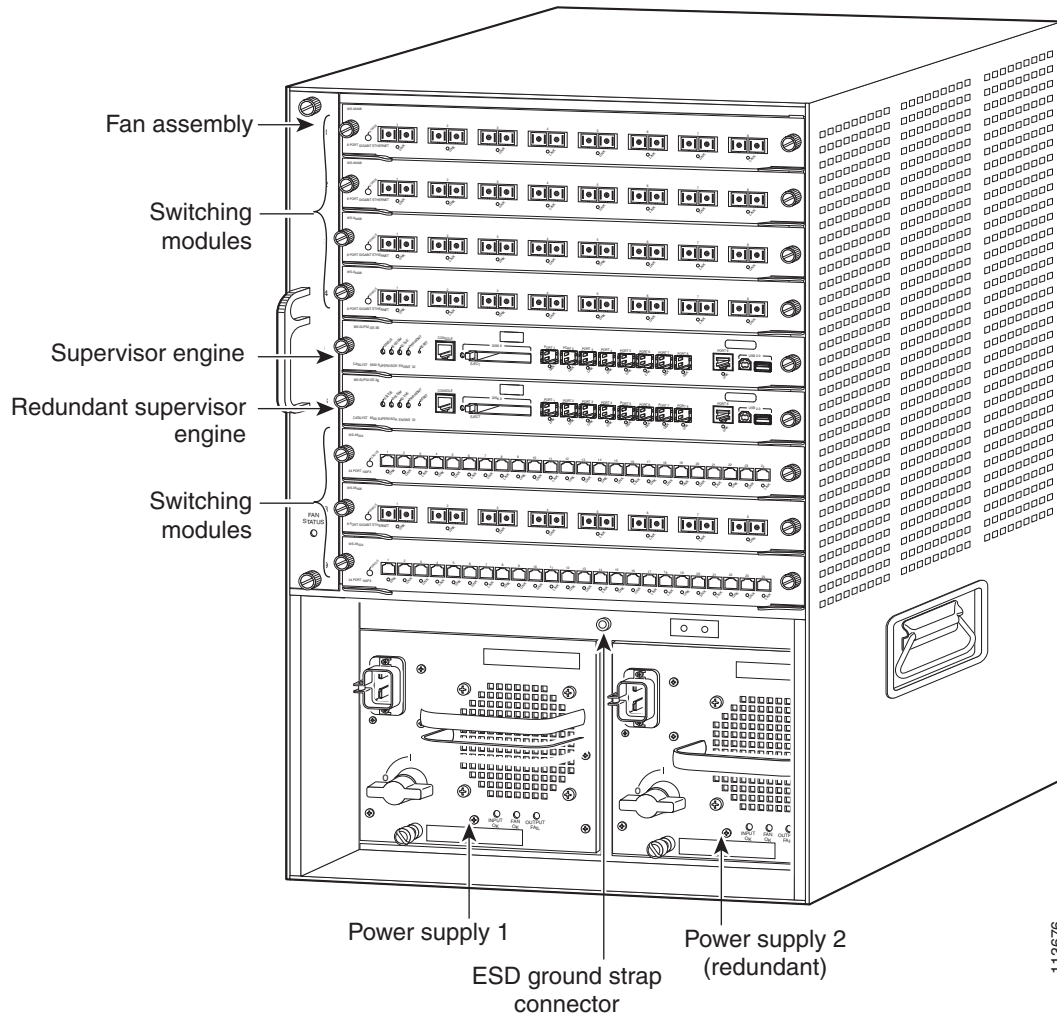


Table 1-13 lists the features of the Catalyst 6509-E switch chassis.

**Table 1-13 Catalyst 6509-E Switch Features**

Feature	Description
Chassis	<ul style="list-style-type: none"> <li>• Nine horizontal slots. Slots are numbered from (1) top to (9) bottom.</li> </ul>
Supervisor engines	<ul style="list-style-type: none"> <li>• Supports Supervisor Engine 2, Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T.</li> </ul> <p><b>Note</b> Refer to your software release notes for the minimum software release versions required to support the supervisor engines.</p> <ul style="list-style-type: none"> <li>– Supervisor Engine 2 must be installed in slot 1 and slot 2.</li> <li>– Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T must be installed in slot 5 and slot 6.</li> </ul> <p><b>Note</b> Slots not occupied by supervisor engines can be used for modules. Check your software release notes for any restrictions on the type of module that can be installed.</p> <ul style="list-style-type: none"> <li>• Supervisor Engine 720 and Supervisor Engine 720-10GE , and Supervisor Engine 2T have a built-in switching fabric. Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2) are not supported.</li> <li>• Supervisor Engine 32 and Supervisor Engine 32 PISA do not support the Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2).</li> <li>• The uplink ports are fully functional on all redundant supervisor engine models when they are in standby mode.</li> </ul> <p><b>Note</b> In systems with redundant supervisor engines, both supervisor engines must be the same model and have the same daughter card configurations. Each supervisor engine must have the resources to run the switch on its own, which means that all supervisor engine resources are duplicated. Identical supervisor engine memory configurations are recommended, but are not required as long as the supervisor engine with the smaller memory configuration is sufficient to run the configured features of the switch. Additionally, each supervisor engine must have its own flash device and console port connections.</p>

Table 1-13 Catalyst 6509-E Switch Features (continued)

Feature	Description
Modules	<ul style="list-style-type: none"> <li>• Supports up to eight Catalyst 6500 series modules.</li> <li>• WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules must be installed in slot 5 or slot 6.</li> </ul> <p><b>Note</b> Mixing WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules in the Catalyst 6509-E chassis is allowed.</p> <ul style="list-style-type: none"> <li>• Some Catalyst 6500 series modules may: <ul style="list-style-type: none"> <li>– Not be supported</li> <li>– Require that you install a Supervisor Engine 720</li> <li>– Have chassis slot restrictions</li> <li>– Require a specific software release level to operate</li> </ul> </li> </ul> <p><b>Note</b> Check your software release notes for specific information on module supported and restrictions.</p>
Backplane bandwidth	<ul style="list-style-type: none"> <li>• 32 GBps shared bus.</li> <li>• 256 GBps switch fabric.</li> <li>• 720 GBps switch fabric.</li> </ul>
Clock and VTT modules	<ul style="list-style-type: none"> <li>• Two replaceable clock modules (CLK-7600=) provide clocking signals to the EOBC channel and the switching bus.</li> <li>• Three replaceable voltage termination (VTT) modules (WS-C6K-VTT-E=) provide reference voltage for bus signals.</li> </ul>
Fan tray	<ul style="list-style-type: none"> <li>• The chassis supports one hot-swappable fan tray. One fan tray model is available: <ul style="list-style-type: none"> <li>– WS-C6509-E-FAN—846 CFM</li> </ul> </li> </ul> <p><b>Note</b> You must install a 2500 W or higher capacity power supply in the chassis to power the high-speed fan tray. The 2500 W power supply can be powered from either 120 VAC or 220 VAC.</p> <p><b>Note</b> The fan tray contains nine individual fans. The individual fans are not field replaceable; you must replace the fan tray in the event of a fan failure.</p> <ul style="list-style-type: none"> <li>• Fan tray STATUS LED <ul style="list-style-type: none"> <li>– Red—One or more individual fans have failed.</li> <li>– Green—Fan tray is operating normally.</li> </ul> </li> </ul>

Table 1-13 Catalyst 6509-E Switch Features (continued)

Feature	Description
Power supply	<ul style="list-style-type: none"> <li>• Supports one or two power supplies. The following models are supported:               <ul style="list-style-type: none"> <li>– WS-CAC-2500W (2500 W AC-input power supply).</li> <li>– WS-CDC-2500W (2500 W DC-input power supply).</li> <li>– WS-CAC-3000W (3000 W AC-input power supply).</li> <li>– WS-CAC-4000W-US (4000 W AC-input power supply).</li> <li>– WS-CAC-4000W-INT (4000 W AC-input power supply).</li> <li>– PWR-4000-DC (4000 W DC-input power supply).</li> <li>– WS-CAC-6000W (6000 W AC-input power supply).</li> <li>– PWR-6000-DC (6000 W DC-input power supply).</li> <li>– WS-CAC-8700W-E (8700 W AC-input power supply).</li> </ul> </li> <li>• Installed power supplies can be of different wattage ratings. Installed power supplies can also be both AC-input, both DC-input, or one AC-input and one DC-input. Power supplies can be configured in either redundant or combined mode.</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC. Source AC can be out of phase between multiple power supplies or multiple AC-power plugs on the same power supply because all AC power supply inputs are isolated.</li> <li>• Supervisor Engine 2T requires a 3000 W or greater power supply to operate.</li> </ul> <p><b>Note</b> For proper operation of the power supply OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

Table 1-14 lists the environmental and physical specifications of the Catalyst 6509-E switch chassis.

**Table 1-14 Catalyst 6509-E Switch Specifications**

Item	Specification
Environmental Temperature, operating  Temperature, nonoperating and storage  Thermal transition  Humidity (RH), ambient (noncondensing) operating  Humidity (RH), ambient (noncondensing) nonoperating and storage  Altitude, operating	Certified for operation: 32° to 104°F (0° to 40°C) Designed and tested for operation: 32° to 131°F (0° to 55°C) <b>Note</b> The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 104°F (40°C) generating a minor alarm and at 131°F (55°C) generating a major alarm.  Chassis unpackaged: -4° to 149°F (-20° to 65°C) Chassis in protective shipping package: -40° to 158°F (-40° to 70°C)  0.5°C per minute (hot to cold) 0.33°C per minute (cold to hot)  5% to 90%  5% to 95%  Certified for operation: 0 to 6500 ft (0 to 2000 m) Designed and tested for operation: -200 to 10,000 ft (-60 to 3000 m)
Shock and vibration	This switch complies with Network Equipment Building Systems (NEBS) (Zone 4 per GR-63-Core) in the following areas: <ul style="list-style-type: none"> <li>• Earthquake environment and criteria</li> <li>• Office vibration and criteria</li> <li>• Transportation vibration and criteria</li> </ul> <b>Shock</b> <ul style="list-style-type: none"> <li>• Operational—5 G 30 ms, half-sine (IEC 68-2-27)</li> <li>• Nonoperational—20 G, 7.5 ms, trapezoidal</li> </ul> <b>Vibration</b> Operational—3 Hz to 500 Hz. Power Spectral Density (PSD)—0.0005 G <sup>2</sup> /Hz at 10 Hz and 200 Hz. 5 dB/octave roll off at each end. 0.5 hours per axis (1.12 Grms).
Acoustic noise	67 dB. International Organization for Standardization (ISO) 7779: Bystander position operating to an ambient temperature of 86°F (30°C).

**Table 1-14 Catalyst 6509-E Switch Specifications (continued)**

Item	Specification
Physical characteristics Dimensions (H x W x D)         Weight	<ul style="list-style-type: none"> <li>• 24.5 x 17.5 x 18.2 in. (62.2 x 44.5 x 46.0 cm).</li> <li>• Chassis depth including cable guide is 21.64 in. (55.0 cm).</li> <li>• Chassis requires 15 RU<sup>1</sup>.</li> <li>• The Catalyst 6509-E switch chassis is designed to install in standard 19-inch equipment racks that meet ANSI/EIA 310-D, IEC 60297, and ETS 300-119 standards.</li> </ul> Chassis only: 60 lb (27.3 kg). Chassis fully configured with 1 supervisor engine, 8 switching modules, and 2 power supplies: 190 lb (86.4 kg).
Airflow	WS-C6509-E-FAN—846 CFM  <b>Note</b> To maintain proper air circulation through the Catalyst switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis air exhaust. You should also allow a minimum separation of 12 inches (30.5 cm) between the hot air exhaust on one chassis and the air intake on another chassis. Failure to maintain adequate air space can cause the chassis to overheat and the system to fail. On Catalyst chassis in which the airflow is from front to back, the chassis may be placed side-by-side.

1. RU = rack units

# Catalyst 6509-NEB Switch

The Catalyst 6509-NEB switch is a 9-slot vertical chassis supporting redundant power supplies, redundant supervisor engines, and slots for up to eight modules. The chassis is NEBS L3 compliant. [Figure 1-11](#) shows the Catalyst 6509-NEB switch chassis.

**Figure 1-11 Catalyst 6509-NEB Switch**

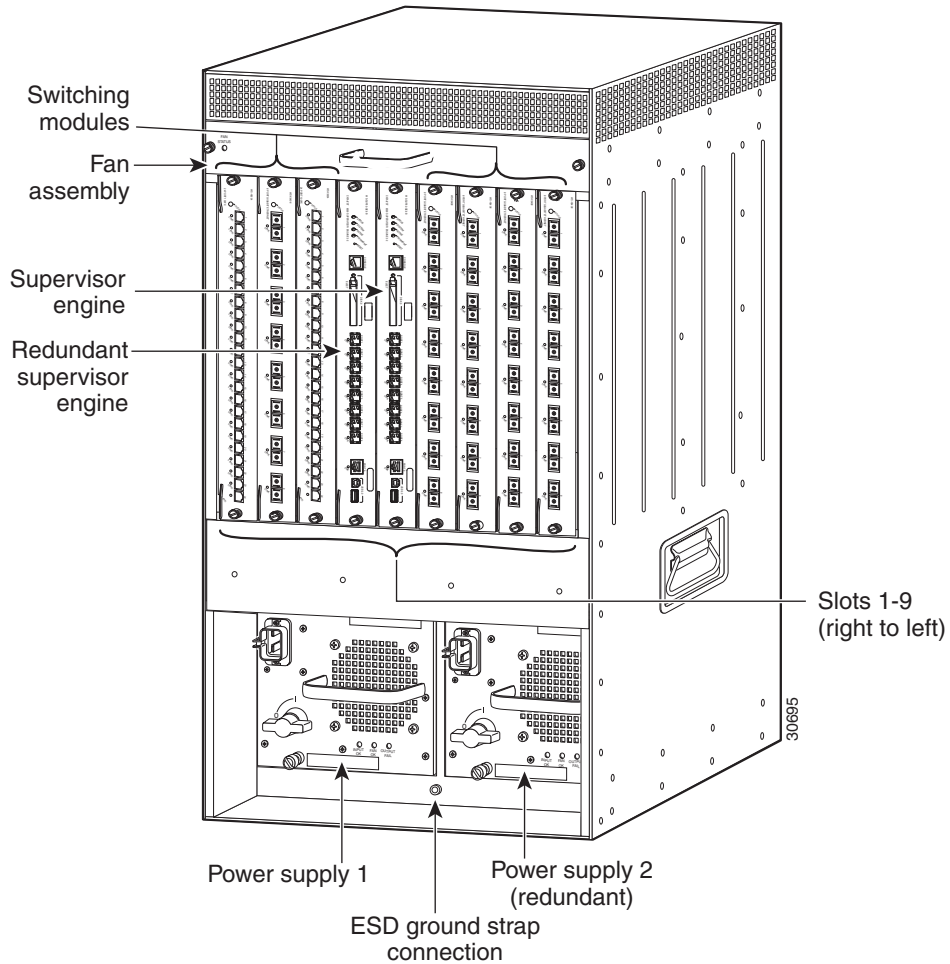




Table 1-15 lists the features of the Catalyst 6509-NEB switch chassis.

**Table 1-15 Catalyst 6509-NEB Switch Features**

Feature	Features
Chassis	<ul style="list-style-type: none"> <li>• Nine vertical slots. Slots are numbered from 1 (right) to 9 (left).</li> </ul>
Supervisor engines	<ul style="list-style-type: none"> <li>• Supports Supervisor Engine 2, Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE.</li> </ul> <p><b>Note</b> Refer to your software release notes for the minimum software release versions required to support the supervisor engines.</p> <ul style="list-style-type: none"> <li>– Supervisor Engine 2 must be installed in slot 1 or slot 2.</li> <li>– Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE. must be installed in slot 5 or slot 6.</li> </ul> <p><b>Note</b> Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE are supported if the WS-6509-NEB-UPGRD kit is installed.</p> <p><b>Note</b> Slots not occupied by supervisor engines can be used for modules. Check your software release notes for any restrictions on the type of module that can be installed.</p> <ul style="list-style-type: none"> <li>• Supervisor Engine 720 and Supervisor Engine 720-10GE have a built-in switching fabric. Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2) are not supported by Supervisor Engine 720. You cannot install the Switch Fabric Modules and the Supervisor Engine 720 or the Supervisor Engine 720-10GE in the same chassis.</li> <li>• Supervisor Engine 32 and Supervisor Engine 32 PISA do not support the Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2). You cannot install the Switch Fabric Modules and the Supervisor Engine 32 or the Supervisor Engine 32 PISA in the same chassis.</li> <li>• The uplink ports are fully functional on all redundant supervisor engine models when they are in standby mode.</li> </ul> <p><b>Note</b> In systems with redundant supervisor engines, both supervisor engines must be the same model and have the same daughter card configurations. Each supervisor engine must have the resources to run the switch on its own, which means that all supervisor engine resources are duplicated. Identical supervisor engine memory configurations are recommended, but are not required as long as the supervisor engine with the smaller memory configuration is sufficient to run the configured features of the switch. Additionally, each supervisor engine must have its own flash device and console port connections.</p>

Table 1-15 Catalyst 6509-NEB Switch Features (continued)

Feature	Features
Modules	<ul style="list-style-type: none"> <li>• Supports up to eight Catalyst 6500 series modules.</li> <li>• WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules must be installed in slot 5 or slot 6.</li> </ul> <p><b>Note</b> Mixing WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules in the Catalyst 6509-NEB chassis is allowed.</p> <ul style="list-style-type: none"> <li>• Some Catalyst 6500 series modules may:               <ul style="list-style-type: none"> <li>– Not be supported</li> <li>– Require that you install a Supervisor Engine 720</li> <li>– Have chassis slot restrictions</li> <li>– Require a specific software release level to operate</li> </ul> </li> </ul> <p><b>Note</b> Check your software release notes for specific information.</p>
Backplane bandwidth	<ul style="list-style-type: none"> <li>• 32 GBps shared bus.</li> <li>• 256 GBps switch fabric.</li> <li>• 720 GBps switch fabric.</li> </ul>
Clock and VTT modules	<ul style="list-style-type: none"> <li>• Two replaceable clock modules (WS-C6K-CL=) provide clocking signals to the EOBC channel and the switching bus.</li> <li>• Three replaceable voltage termination (VTT) modules (WS-C6K-VTT=) provide reference voltage for bus signals.</li> </ul>

Table 1-15 Catalyst 6509-NEB Switch Features (continued)

Feature	Features
Fan tray	<ul style="list-style-type: none"> <li>• The chassis supports one hot-swappable fan tray. Two fan tray models are available:               <ul style="list-style-type: none"> <li>– WS-C6509-NEB-FAN (Standard fan tray—294 CFM). Supports Supervisor Engine 1 and Supervisor Engine 2 only; does not support Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, or Supervisor Engine 720-10GE.</li> <li>– WS-6509-NEB-UPGRD<sup>1</sup>—630 CFM (The high-speed fan tray (WS-C6509-NEB-FAN2) is a part of the upgrade kit). This kit must be installed if you are installing a Supervisor Engine 32 or a Supervisor Engine 720 in the Catalyst 6509-NEB switch. The kit contains a high-speed fan tray, back panel, and power harness. If you are operating the chassis from an AC source, you will also need to order a 3000 W AC-input power supply which has a front panel DC power connector. The upgrade kit fan tray receives 42 VDC power from this front panel DC power connector through a power harness also provided in the upgrade kit. If you are operating the chassis from a DC source, you can power the system with either the 2500 W or 4000 W DC-input power supplies and power the upgrade fan tray from the site source DC.</li> </ul> </li> </ul> <p><b>Note</b> Both fan tray models contain nine individual fans. The individual fans are not field replaceable; you must replace the fan tray in the event of a fan failure.</p> <ul style="list-style-type: none"> <li>• Fan tray STATUS LED               <ul style="list-style-type: none"> <li>– Red—One or more individual fans have failed.</li> <li>– Green—Fan tray is operating normally.</li> </ul> </li> </ul>

Table 1-15 Catalyst 6509-NEB Switch Features (continued)

Feature	Features
Power supply	<ul style="list-style-type: none"> <li>• Supports one or two power supplies. The following models are supported:               <ul style="list-style-type: none"> <li>– WS-CAC-2500W (2500 W AC-input power supply).</li> <li>– WS-CDC-2500W (2500 W DC-input power supply).</li> <li>– WS-CAC-3000W (3000 W AC-input power supply).</li> <li>– WS-CAC-4000W-US (4000 W AC-input power supply).</li> <li>– WS-CAC-4000W-INT (4000 W AC-input power supply).</li> <li>– PWR-4000-DC (4000 W DC-input power supply).</li> <li>– WS-CAC-6000W (6000 W AC-input power supply).</li> <li>– PWR-6000-DC (6000 W DC-input power supply).</li> <li>– WS-CAC-8700W-E (8700 W AC-input power supply).</li> </ul> </li> </ul> <p><b>Note</b> The 6000 W AC-input and DC-input power supplies and the 8700 W AC-input power supply are limited to 4000 W maximum output when installed in the Catalyst 6509-NEB chassis.</p> <ul style="list-style-type: none"> <li>• Installed power supplies can be of different wattage ratings. Installed power supplies can also be both AC-input, both DC-input, or one AC-input and one DC-input. Power supplies can be configured in either redundant or combined mode.</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC. Source AC can be out of phase between multiple power supplies or multiple AC-power plugs on the same power supply because all AC power supply inputs are isolated.</li> <li>• Single power supplies are installed in the left power supply bay. The second power supply is installed in the right power supply bay.</li> </ul> <p><b>Note</b> For proper operation of the power supply OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

1. Refer to the *Catalyst 6509-NEB Switch and Cisco OSR-7609 Router Upgrade Note* for kit installation instructions.

Table 1-16 lists the environmental and physical specifications of the Catalyst 6509-NEB switch chassis.

**Table 1-16 Catalyst 6509-NEB Switch Specifications**

Item	Specification
Environmental Temperature, operating  Temperature, nonoperating and storage  Thermal transition  Humidity (RH), ambient (noncondensing) operating  Humidity (RH), ambient (noncondensing) nonoperating and storage  Altitude, operating	Certified for operation: 32° to 104°F (0° to 40°C) Designed and tested for operation: 32° to 131°F (0° to 55°C) <b>Note</b> The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 104°F (40°C) generating a minor alarm and at 131°F (55°C) generating a major alarm.  Chassis unpackaged: -4° to 149°F (-20° to 65°C) Chassis in protective shipping package: -40° to 158°F (-40° to 70°C)  0.5°C per minute (hot to cold) 0.33°C per minute (cold to hot)  5% to 90%  5% to 95%  Certified for operation: 0 to 6500 ft (0 to 2000 m) Designed and tested for operation: -200 to 10,000 ft (-60 to 3000 m)
Shock and vibration	This switch complies with Network Equipment Building Systems (NEBS) (Zone 4 per GR-63-Core) in the following areas: <ul style="list-style-type: none"> <li>• Earthquake environment and criteria</li> <li>• Office vibration and criteria</li> <li>• Transportation vibration and criteria</li> </ul> <b>Shock</b> <ul style="list-style-type: none"> <li>• Operational—5 G 30 ms, half-sine (IEC 68-2-27)</li> <li>• Nonoperational—20 G, 7.5 ms, trapezoidal</li> </ul> <b>Vibration</b> Operational—3 Hz to 500 Hz. Power Spectral Density (PSD)—0.0005 G <sup>2</sup> /Hz at 10 Hz and 200 Hz. 5 dB/octave roll off at each end. 0.5 hours per axis (1.12 Grms).
Acoustic noise	56.4 to 75 dB. International Organization for Standardization (ISO) 7779: Bystander position operating to an ambient temperature of 86°F (30°C).

Table 1-16 Catalyst 6509-NEB Switch Specifications (continued)

Item	Specification
Physical characteristics Dimensions (H x W x D)  Weight	<ul style="list-style-type: none"> <li>• 33.3 x 17.2 x 18.1 in. (84.6 x 43.7 x 46.0 cm).</li> <li>• Chassis requires 20 RU<sup>1</sup>.</li> <li>• The Catalyst 6509-NEB switch chassis is designed to install in standard 19-inch equipment racks that meet ANSI/EIA 310-D, IEC 60297, and ETS 300-119 standards.</li> </ul> Chassis only: 55 lb (24.9 kg). Chassis fully configured with 1 supervisor engine, 8 switching modules, and 2 power supplies: 135 lb (61.2 kg).
Airflow	<ul style="list-style-type: none"> <li>• WS-C6509-NEB-FAN (Standard fan tray)—294 CFM</li> <li>• Optional high-speed fan tray<sup>2</sup>—630 CFM</li> </ul> <p><b>Note</b> To maintain proper air circulation through the Catalyst switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis air exhaust. You should also allow a minimum separation of 12 inches (30.5 cm) between the hot air exhaust on one chassis and the air intake on another chassis. Failure to maintain adequate air space can cause the chassis to overheat and the system to fail. On Catalyst chassis in which the airflow is from front to back, the chassis may be placed side-by-side.</p>

1. RU = rack units.

2. Part of the WS-6509-NEB-UPGRD kit.

# Catalyst 6509-NEB-A Switch

The Catalyst 6509-NEB-A switch is an enhanced version of the Catalyst 6509-NEB switch. The 9-slot vertical chassis supports redundant power supplies, redundant supervisor engines, and slots for up to eight modules. It also supports the Supervisor Engine 720 without any upgrades to the chassis. The Catalyst 6509-NEB-A switch chassis is NEBS L3 compliant. [Figure 1-12](#) shows a front view of the Catalyst 6509-NEB-A switch chassis.

**Figure 1-12 Catalyst 6509-NEB-A Switch Chassis**

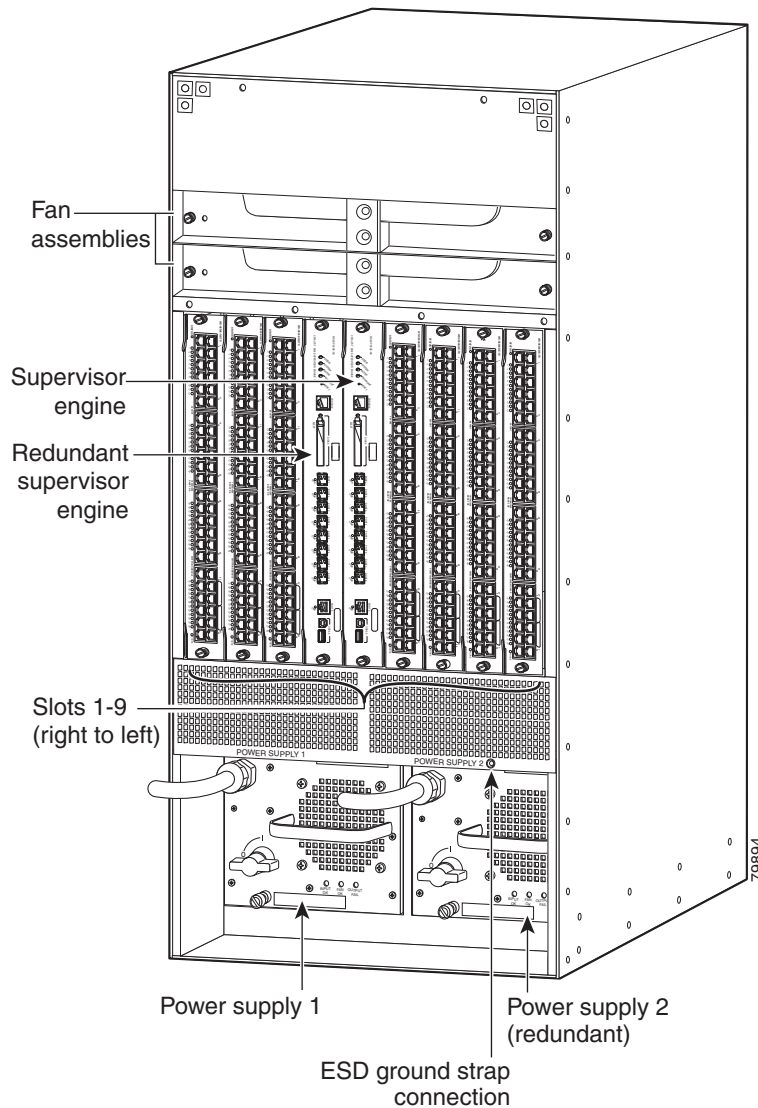


Table 1-17 lists the features of the Catalyst 6509-NEB-A switch chassis.

**Table 1-17 Catalyst 6509-NEB-A Switch Features**

Feature	Description
Chassis	<ul style="list-style-type: none"> <li>• Nine vertical slots. Slots are numbered from 1 (right) to 9 (left).</li> </ul>
Supervisor engines	<ul style="list-style-type: none"> <li>• Supports Supervisor Engine 2, Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE.</li> </ul> <p><b>Note</b> Refer to your software release notes for the minimum software release versions required to support the supervisor engines.</p> <ul style="list-style-type: none"> <li>– Supervisor Engine 2 must be installed in slot 1 and slot 2.</li> <li>– Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE must be installed in slot 5 and slot 6.</li> </ul> <p><b>Note</b> Slots not occupied by supervisor engines can be used for modules. Check your software release notes for any restrictions on the type of module that can be installed.</p> <ul style="list-style-type: none"> <li>• Supervisor Engine 720 and Supervisor Engine 720-10GE have a built-in switching fabric. Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2) are not supported by Supervisor Engine 720 and Supervisor Engine 720-10GE. You cannot install the Switch Fabric Modules and the Supervisor Engine 720 or the Supervisor Engine 720-10GE in the same chassis.</li> <li>• Supervisor Engine 32 and Supervisor Engine 32 PISA do not support the Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2). You cannot install the Switch Fabric Modules and the Supervisor Engine 32 or the Supervisor Engine 32 PISA in the same chassis.</li> <li>• The uplink ports are fully functional on all redundant supervisor engine models when they are in standby mode.</li> </ul> <p><b>Note</b> In systems with redundant supervisor engines, both supervisor engines must be the same model and have the same daughter card configurations. Each supervisor engine must have the resources to run the switch on its own, which means that all supervisor engine resources are duplicated. Identical supervisor engine memory configurations are recommended, but are not required as long as the supervisor engine with the smaller memory configuration is sufficient to run the configured features of the switch. Additionally, each supervisor engine must have its own flash device and console port connections.</p>



Table 1-17 Catalyst 6509-NEB-A Switch Features (continued)

Feature	Description
Modules	<ul style="list-style-type: none"> <li>• Supports up to eight Catalyst 6500 series modules.</li> <li>• WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules must be installed in slot 5 or slot 6.</li> </ul> <p><b>Note</b> Mixing WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules in the Catalyst 6509-NEB-A chassis is allowed.</p> <ul style="list-style-type: none"> <li>• Some Catalyst 6500 series modules may: <ul style="list-style-type: none"> <li>– Not be supported</li> <li>– Require that you install a Supervisor Engine 720</li> <li>– Have chassis slot restrictions</li> <li>– Require a specific software release level to operate</li> </ul> </li> </ul> <p><b>Note</b> Check your software release notes for specific information.</p>
Backplane bandwidth	<ul style="list-style-type: none"> <li>• 32 GBps shared bus.</li> <li>• 256 GBps switch fabric.</li> <li>• 720 GBps switch fabric.</li> </ul>
Clock and VTT modules	<ul style="list-style-type: none"> <li>• Two replaceable clock modules (CLK-7600=) provide clocking signals to the EOBC channel and the switching bus.</li> <li>• Three replaceable voltage termination (VTT) modules (WS-C6K-VTT=) provide reference voltage for bus signals.</li> </ul>
Fan tray	<ul style="list-style-type: none"> <li>• The chassis supports two hot-swappable fan trays. With one fan tray installed, the chassis supports operating temperatures up to 104°F (40°C). With both fan trays installed, the chassis supports operating temperatures up to 131°F (55°C). One fan tray model is available: <ul style="list-style-type: none"> <li>– FAN-MOD-09 (High-speed fan tray—760 CFM). Supports Supervisor Engine 2, Supervisor Engine 32, and Supervisor Engine 720.</li> </ul> </li> </ul> <p><b>Note</b> Each fan tray contains four individual fans. The individual fans are not field replaceable; you must replace the fan tray in the event of a fan failure.</p> <ul style="list-style-type: none"> <li>• Fan tray STATUS LED <ul style="list-style-type: none"> <li>– Red—One or more individual fans have failed.</li> <li>– Green—Fan tray is operating normally.</li> </ul> </li> </ul>

Table 1-17 Catalyst 6509-NEB-A Switch Features (continued)

Feature	Description
Power supply	<ul style="list-style-type: none"> <li>• Supports one or two power supplies. The following models are supported:               <ul style="list-style-type: none"> <li>– WS-CAC-2500W (2500 W AC-input power supply).</li> <li>– WS-CDC-2500W (2500 W DC-input power supply).</li> <li>– WS-CAC-3000W (3000 W AC-input power supply).</li> <li>– WS-CAC-4000W-US (4000 W AC-input power supply).</li> <li>– WS-CAC-4000W-INT (4000 W AC-input power supply).</li> <li>– PWR-4000-DC (4000 W DC-input power supply).</li> <li>– WS-CAC-6000W (6000 W AC-input power supply).</li> <li>– PWR-6000-DC (6000 W DC-input power supply).</li> <li>– WS-CAC-8700W-E (8700 W AC-input power supply).</li> </ul> </li> </ul> <p><b>Note</b> The 6000 W AC-input and DC-input power supplies and the 8700 W AC-input power supply are limited to 4500 W maximum output when installed in the Catalyst 6509-NEB-A chassis.</p> <ul style="list-style-type: none"> <li>• Installed power supplies can be of different ratings. Installed power supplies can also be both AC-input, both DC-input, or one AC-input and one DC-input. Power supplies can be configured in either redundant or combined mode.</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC. Source AC can be out of phase between multiple power supplies or multiple AC-power plugs on the same power supply because all AC power supply inputs are isolated.</li> </ul> <p><b>Note</b> For proper operation of the power supply OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

Table 1-18 lists the environmental and physical specifications of the Catalyst 6509-NEB-A switch chassis.

**Table 1-18 Catalyst 6509-NEB-A Switch Specifications**

Item	Specification
Environmental	
Temperature, operating	Certified for operation: 32° to 104°F (0° to 40°C) Designed and tested for operation: 32° to 131°F (0° to 55°C) <b>Note</b> The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 104°F (40°C) generating a minor alarm and at 131°F (55°C) generating a major alarm.
Temperature, nonoperating and storage	Chassis unpackaged: -4° to 149°F (-20° to 65°C) Chassis in protective shipping package: -40° to 158°F (-40° to 70°C)
Thermal transition	0.5°C per minute (hot to cold) 0.33°C per minute (cold to hot)
Humidity (RH), ambient (noncondensing) operating	5% to 90%
Humidity (RH), ambient (noncondensing) nonoperating and storage	5% to 95%
Altitude, operating	Certified for operation: 0 to 6500 ft (0 to 2000 m) Designed and tested for operation: -200 to 10,000 ft (-60 to 3000 m)
Shock and vibration	This switch complies with Network Equipment Building Systems (NEBS) (Zone 4 per GR-63-Core) in the following areas: <ul style="list-style-type: none"> <li>• Earthquake environment and criteria</li> <li>• Office vibration and criteria</li> <li>• Transportation vibration and criteria</li> </ul> <b>Shock</b> <ul style="list-style-type: none"> <li>• Operational—5 G 30 ms, half-sine (IEC 68-2-27)</li> <li>• Nonoperational—20 G, 7.5 ms, trapezoidal</li> </ul> <b>Vibration</b> <ul style="list-style-type: none"> <li>Operational—3 Hz to 500 Hz.</li> <li>Power Spectral Density (PSD)—0.0005 G<sup>2</sup>/Hz at 10 Hz and 200 Hz.</li> <li>5 dB/octave roll off at each end. 0.5 hours per axis (1.12 Grms).</li> </ul>
Acoustic noise	67 to 77 dB. International Organization for Standardization (ISO) 7779: Bystander position operating to an ambient temperature of 86°F (30°C).

**Table 1-18 Catalyst 6509-NEB-A Switch Specifications (continued)**

Item	Specification
Physical characteristics Dimensions (H x W x D)  Weight	<ul style="list-style-type: none"> <li>• 36.65 x 17.20 x 20.32 in. (93.09 x 43.68 x 51.61 cm).</li> <li>• Chassis requires 21 RU<sup>1</sup>.</li> <li>• The Catalyst 6509-NEB-A switch chassis is designed to install in standard 19-inch equipment racks that meet ANSI/EIA 310-D, IEC 60297, and ETS 300-119 standards.</li> </ul> Chassis only: 121 lb (54.9 kg). Chassis fully configured with 1 supervisor engine, 8 modules, 2 AC-input power supplies: 270 lb (122.47 kg).
Airflow	FAN-MOD-09 (High-speed fan tray)—760 CFM  <b>Note</b> To maintain proper air circulation through the Catalyst switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis air exhaust. You should also allow a minimum separation of 12 inches (30.5 cm) between the hot air exhaust on one chassis and the air intake on another chassis. Failure to maintain adequate air space can cause the chassis to overheat and the system to fail. On Catalyst chassis in which the airflow is from front to back, the chassis may be placed side-by-side.

1. RU = rack units

# Catalyst 6509-V-E Switch

The Catalyst 6509-V-E switch is an enhanced version of the Catalyst 6509-NEB-A switch. The 9-slot vertical chassis supports redundant power supplies, redundant supervisor engines, redundant fan trays, and slots for up to eight modules. It also supports a greater power capacity per slot than the Catalyst 6509-NEB-A switch chassis. The Catalyst 6509-V-E switch chassis is NEBS L3 compliant. [Figure 1-13](#) shows a front view of the Catalyst 6509-V-E switch chassis.

**Figure 1-13 Catalyst 6509-V-E Switch Chassis**

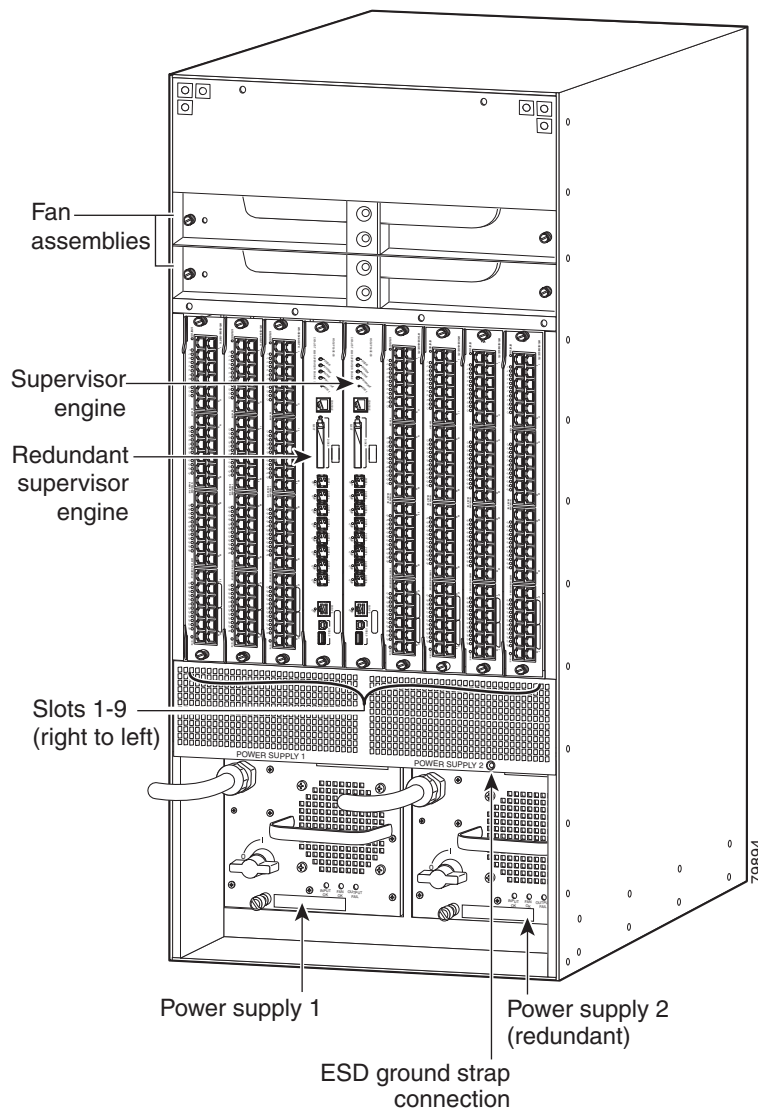


Table 1-19 lists the features of the Catalyst 6509-V-E switch chassis.

**Table 1-19 Catalyst 6509-V-E Switch Features**

Feature	Description
Chassis	<ul style="list-style-type: none"> <li>• Nine vertical slots. Slots are numbered from 1 (right) to 9 (left).</li> </ul>
Supervisor engines	<ul style="list-style-type: none"> <li>• Supports Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T.</li> </ul> <p><b>Note</b> Refer to your software release notes for the minimum software release versions required to support the supervisor engines.</p> <ul style="list-style-type: none"> <li>• Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T must be installed in slot 5 and slot 6.</li> </ul> <p><b>Note</b> Slots not occupied by supervisor engines can be used for modules. Check your software release notes for any restrictions on the type of module that can be installed.</p> <ul style="list-style-type: none"> <li>• Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T have a built-in switching fabric. Switch Fabric Modules are not supported.</li> <li>• Supervisor Engine 32 and Supervisor Engine 32 PISA do not support the Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2).</li> <li>• The uplink ports are fully functional on all redundant supervisor engine models when they are in standby mode.</li> </ul> <p><b>Note</b> In systems with redundant supervisor engines, both supervisor engines must be the same model and have the same daughter card configurations. Each supervisor engine must have the resources to run the switch on its own, which means that all supervisor engine resources are duplicated. Identical supervisor engine memory configurations are recommended, but are not required as long as the supervisor engine with the smaller memory configuration is sufficient to run the configured features of the switch. Additionally, each supervisor engine must have its own flash device and console port connections.</p>
Modules	<ul style="list-style-type: none"> <li>• Supports up to eight Catalyst 6500 series modules.</li> <li>• Some Catalyst 6500 series modules may: <ul style="list-style-type: none"> <li>– Not be supported</li> <li>– Require that you install a Supervisor Engine 720</li> <li>– Have chassis slot restrictions</li> <li>– Require a specific software release level to operate</li> </ul> </li> </ul> <p><b>Note</b> Check your software release notes for specific information on supported modules and restrictions.</p>
Backplane bandwidth	<ul style="list-style-type: none"> <li>• 32 GBps shared bus.</li> <li>• 720 GBps switch fabric.</li> </ul>

Table 1-19 Catalyst 6509-V-E Switch Features (continued)

Feature	Description
Clock and VTT modules	<ul style="list-style-type: none"> <li>• Two replaceable clock modules (CLK-7600=) provide clocking signals to the EOBC channel and the switching bus.</li> <li>• Three replaceable voltage termination (VTT) modules (WS-C6K-VTT=) provide reference voltage for bus signals.</li> </ul>
Fan tray	<ul style="list-style-type: none"> <li>• The chassis supports either one or two hot-swappable fan trays. With only one fan tray installed, the chassis supports operating temperatures up to 104°F (40°C). With two fan trays installed, the chassis supports operating temperatures up to 131°F (55°C). One fan tray model is available: <ul style="list-style-type: none"> <li>– WS-C6509-V-E-FAN (High-speed fan tray—760 CFM). Supports Supervisor Engine 32, and Supervisor Engine 720.</li> </ul> </li> </ul> <p><b>Note</b> Each fan tray contains four individual fans. The individual fans are not field replaceable; you must replace the fan tray in the event of a fan failure.</p> <p><b>Note</b> Two fan trays are shipped as the chassis default configuration.</p> <ul style="list-style-type: none"> <li>• Fan tray STATUS LED <ul style="list-style-type: none"> <li>– Red—One or more individual fans have failed.</li> <li>– Green—Fan tray is operating normally.</li> </ul> </li> </ul>

Table 1-19 Catalyst 6509-V-E Switch Features (continued)

Feature	Description
Power supply	<ul style="list-style-type: none"> <li>• Supports one or two power supplies. The following models are supported:               <ul style="list-style-type: none"> <li>– WS-CAC-2500W (2500 W AC-input power supply).</li> <li>– WS-CDC-2500W (2500 W DC-input power supply).</li> <li>– WS-CAC-3000W (3000 W AC-input power supply).</li> <li>– WS-CAC-4000W-US (4000 W AC-input power supply).</li> <li>– WS-CAC-4000W-INT (4000 W AC-input power supply).</li> <li>– PWR-4000-DC (4000 W DC-input power supply).</li> <li>– WS-CAC-6000W (6000 W AC-input power supply).</li> <li>– PWR-6000-DC (6000 W DC-input power supply).</li> <li>– WS-CAC-8700W-E (8700 W AC-input power supply).</li> </ul> </li> <li>• Installed power supplies can be of different ratings. Installed power supplies can also be both AC-input, both DC-input, or one AC-input and one DC-input. Power supplies can be configured in either redundant or combined mode.</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC. Source AC can be out of phase between multiple power supplies or multiple AC-power plugs on the same power supply because all AC power supply inputs are isolated.</li> <li>• Supervisor Engine 2T requires a 3000 W or greater power supply to operate.</li> </ul> <p><b>Note</b> For proper operation of the power supply OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>



Table 1-20 lists the environmental and physical specifications of the Catalyst 6509-V-E switch chassis.

**Table 1-20 Catalyst 6509-V-E Switch Specifications**

Item	Specification
Environmental Temperature, operating  Temperature, nonoperating and storage  Thermal transition  Humidity (RH), ambient (noncondensing) operating  Humidity (RH), ambient (noncondensing) nonoperating and storage  Altitude, operating	Certified for operation: 32° to 104°F (0° to 40°C) Designed and tested for operation: 32° to 131°F (0° to 55°C) <b>Note</b> The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 104°F (40°C) generating a minor alarm and at 131°F (55°C) generating a major alarm.  Chassis unpackaged: –4° to 149°F (–20° to 65°C) Chassis in protective shipping package: –40° to 158°F (–40° to 70°C)  0.5°C per minute (hot to cold) 0.33°C per minute (cold to hot)  5% to 90%  5% to 95%  Certified for operation: 0 to 6500 ft (0 to 2000 m) Designed and tested for operation: –200 to 10,000 ft (–60 to 3000 m)
Shock and vibration	This switch complies with Network Equipment Building Systems (NEBS) (Zone 4 per GR-63-Core) in the following areas: <ul style="list-style-type: none"> <li>• Earthquake environment and criteria</li> <li>• Office vibration and criteria</li> <li>• Transportation vibration and criteria</li> </ul> <b>Shock</b> <ul style="list-style-type: none"> <li>• Operational—5 G 30 ms, half-sine (IEC 68-2-27)</li> <li>• Nonoperational—20 G, 7.5 ms, trapezoidal</li> </ul> <b>Vibration</b> Operational—3 Hz to 500 Hz. Power Spectral Density (PSD)—0.0005 G <sup>2</sup> /Hz at 10 Hz and 200 Hz. 5 dB/octave roll off at each end. 0.5 hours per axis (1.12 Grms).
Acoustic noise	67 to 77 dB. International Organization for Standardization (ISO) 7779: Bystander position operating to an ambient temperature of 86°F (30°C).

**Table 1-20 Catalyst 6509-V-E Switch Specifications (continued)**

Item	Specification
Physical characteristics Dimensions (H x W x D)  Weight	<ul style="list-style-type: none"> <li>• 36.65 x 17.20 x 20.7 in. (93.3 x 43.1 x 53.3 cm).</li> <li>• Chassis requires 21 RU<sup>1</sup>.</li> <li>• The Catalyst 6509-V-E switch chassis is designed to install in standard 19-inch equipment racks that meet ANSI/EIA 310-D, IEC 60297, and ETS 300-119 standards.</li> </ul> Chassis only: 121 lb (54.9 kg). Chassis fully configured with 1 supervisor engine, 8 modules, 2 AC-input power supplies: 270 lb (122.47 kg).
Airflow	WS-C6509-V-E-FAN (High-speed fan tray)—760 CFM  <b>Note</b> To maintain proper air circulation through the Catalyst switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis air exhaust. You should also allow a minimum separation of 12 inches (30.5 cm) between the hot air exhaust on one chassis and the air intake on another chassis. Failure to maintain adequate air space can cause the chassis to overheat and the system to fail. On Catalyst chassis in which the airflow is from front to back, the chassis may be placed side-by-side.

1. RU = rack units

# Catalyst 6513 Switch

The Catalyst 6513 switch is a 13-slot horizontal chassis supporting redundant power supplies, redundant supervisor engines, and slots for up to twelve modules. The chassis is NEBS L3 compliant. [Figure 1-14](#) shows a front view of the Catalyst 6513 switch chassis.

**Figure 1-14** Catalyst 6513 Switch

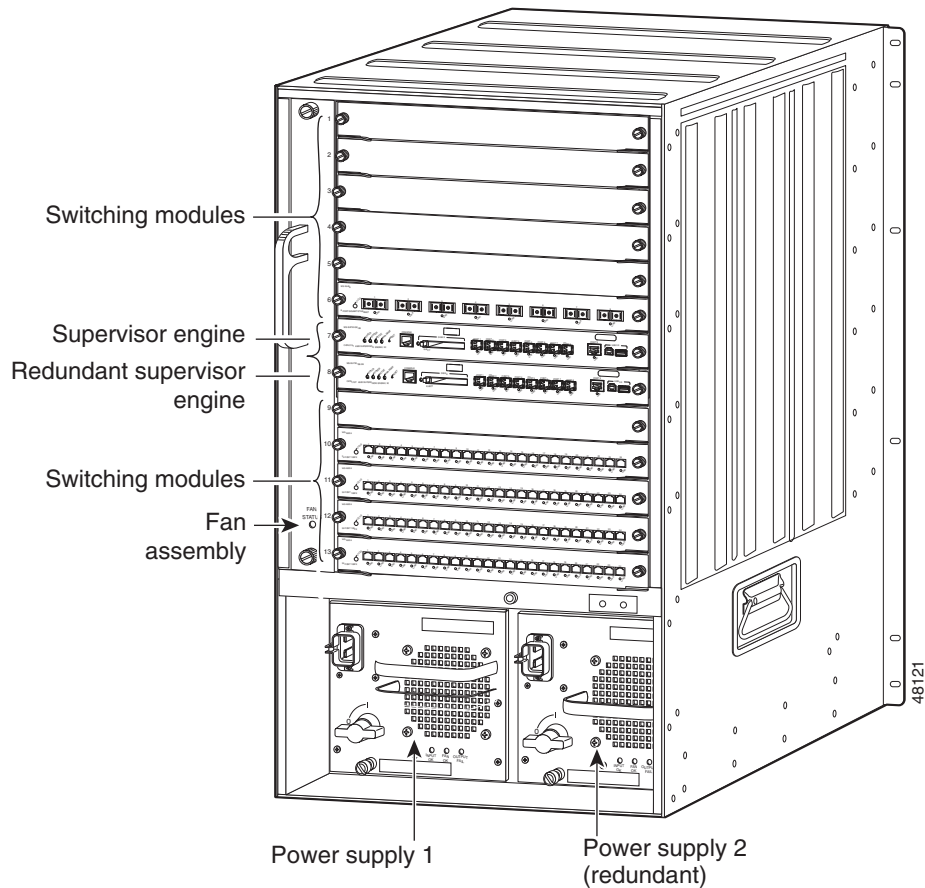


Table 1-21 lists the features of the Catalyst 6513 switch chassis.

**Table 1-21 Catalyst 6513 Switch Features**

Feature	Description
Chassis	<ul style="list-style-type: none"> <li>Thirteen horizontal slots. Slots are numbered from (1) top to (13) bottom.</li> </ul>
Supervisor engines	<ul style="list-style-type: none"> <li>Supports Supervisor Engine 2, Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE.</li> </ul> <p><b>Note</b> Refer to your software release notes for the minimum software release versions required to support the supervisor engines.</p> <ul style="list-style-type: none"> <li>Supervisor Engine 2 must be installed in slot 1 and slot 2.</li> <li>Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE must be installed in slot 7 and slot 8.</li> </ul> <p><b>Note</b> Slots not occupied by supervisor engines can be used for modules. Check your software release notes for any restrictions on the type of module that can be installed.</p> <ul style="list-style-type: none"> <li>Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, and Supervisor Engine 720-10GE require that you install the high-speed fan tray (WS-C6K-13SLT-FAN2) be installed in the chassis. You must also install a 2500 W or higher capacity power supply in the chassis to power the high-speed fan tray.</li> <li>Supervisor Engine 720 and Supervisor Engine 720-10GE have a built-in switching fabric. Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2) are not supported by Supervisor Engine 720 and Supervisor Engine 720-10GE.</li> <li>Supervisor Engine 32 and Supervisor Engine 32 PISA do not support the Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2).</li> <li>The uplink ports are fully functional on all redundant supervisor engine models when they are in standby mode.</li> </ul> <p><b>Note</b> In systems with redundant supervisor engines, both supervisor engines must be the same model and have the same daughter card configurations. Each supervisor engine must have the resources to run the switch on its own, which means that all supervisor engine resources are duplicated. Identical supervisor engine memory configurations are recommended, but are not required as long as the supervisor engine with the smaller memory configuration is sufficient to run the configured features of the switch. Additionally, each supervisor engine must have its own flash device and console port connections.</p>

Table 1-21 Catalyst 6513 Switch Features (continued)

Feature	Description
Modules	<ul style="list-style-type: none"> <li>• Supports up to 12 Catalyst 6500 series modules.</li> <li>• When using a Supervisor Engine 2 the WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules must be installed in slot 7 or slot 8.</li> </ul> <p><b>Note</b> Mixing WS-C6500-SFM and WS-X6500-SFM2 Switch Fabric Modules is not allowed in the Catalyst 6513 chassis.</p> <ul style="list-style-type: none"> <li>• Slots 1–8 support a single fabric channel; slots 9–13 support dual fabric channels.</li> <li>• The following modules are supported only in chassis slots 9–13 and do not power up when they are installed in the other chassis slots: <ul style="list-style-type: none"> <li>– WS-X6748-SFP</li> <li>– WS-X6748-GE-TX</li> <li>– WS-X6704-10GE</li> <li>– WS-X6708-10GE</li> <li>– WS-X6716-10GE</li> <li>– WS-X6816-GBIC</li> <li>– WS-SVC-WISM-1-K9</li> </ul> </li> </ul> <p><b>Note</b> The WS-X6724-SFP Ethernet module has a single fabric channel and is supported in all Catalyst 6513 switch chassis slots.</p> <ul style="list-style-type: none"> <li>• Check your software release notes for specific information on module support. Some Catalyst 6500 series modules may: <ul style="list-style-type: none"> <li>– Not be supported</li> <li>– Require that you install a Supervisor Engine 720</li> <li>– Have chassis slot restrictions</li> <li>– Require a specific software release level to operate</li> </ul> </li> </ul>
Backplane bandwidth	<ul style="list-style-type: none"> <li>• 32 GBps shared bus.</li> <li>• 256 GBps switch fabric.</li> <li>• 720 GBps switch fabric.</li> </ul>
Clock and VTT module	<ul style="list-style-type: none"> <li>• Two replaceable clock modules (WS-C6513-CL=) provide clocking signals to the EOBC channel and the switching bus.</li> <li>• Three replaceable voltage termination (VTT) modules (WS-C6K-VTT=) provide reference voltage for bus signals.</li> </ul>

Table 1-21 Catalyst 6513 Switch Features (continued)

Feature	Description
Fan tray	<ul style="list-style-type: none"> <li>• The chassis supports one hot-swappable fan tray. Two fan tray models are available:               <ul style="list-style-type: none"> <li>– WS-C6K-13SLOT-FAN (Standard fan tray—641 CFM). Supports Supervisor Engine 2 only; does not provide sufficient cooling for the Supervisor Engine 32, Supervisor Engine 32 PISA, Supervisor Engine 720, or the Supervisor Engine 720-10GE.</li> <li>– WS-C6K-13SLT-FAN2 (Optional high-speed fan tray—1090 CFM). Provides sufficient cooling for all supervisor engine types.</li> </ul> </li> </ul> <p><b>Note</b> You must install a high-speed fan tray when using a Supervisor Engine 32 or a Supervisor Engine 720. You must install a 2500 W or higher capacity power supply in the chassis to power the high-speed fan tray. The 2500 W power supply can be powered from either 120 VAC or 220 VAC.</p> <p><b>Note</b> Both fan tray models contain 15 individual fans. The individual fans are not field replaceable; you must replace the fan tray in the event of a fan failure.</p> <ul style="list-style-type: none"> <li>• Fan tray STATUS LED               <ul style="list-style-type: none"> <li>– Red—One or more individual fans have failed.</li> <li>– Green—Fan tray is operating normally.</li> </ul> </li> </ul>

Table 1-21 Catalyst 6513 Switch Features (continued)

Feature	Description
Power supply	<ul style="list-style-type: none"> <li>• Supports one or two power supplies. The following models are supported:               <ul style="list-style-type: none"> <li>– WS-CAC-2500W (2500 W AC-input power supply).</li> <li>– WS-CDC-2500W (2500 W DC-input power supply).</li> <li>– WS-CAC-3000W (3000 W AC-input power supply).</li> <li>– WS-CAC-4000W-US (4000 W AC-input power supply).</li> <li>– WS-CAC-4000W-INT (4000 W AC-input power supply).</li> <li>– PWR-4000-DC (4000 W DC-input power supply).</li> <li>– WS-CAC-6000W (6000 W AC-input power supply).</li> <li>– PWR-6000-DC (6000 W DC-input power supply).</li> <li>– WS-CAC-8700W-E (8700 W AC-input power supply).</li> </ul> </li> </ul> <p><b>Note</b> The 8700 W power supply is limited to 6000 W maximum output when installed in the Catalyst 6513 switch chassis.</p> <ul style="list-style-type: none"> <li>• Installed power supplies can be of different ratings. Installed power supplies can also be both AC-input, both DC-input, or one AC-input and one DC-input. Power supplies can be configured in either redundant or combined mode.</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC. Source AC can be out of phase between multiple power supplies or multiple AC-power plugs on the same power supply because all AC power supply inputs are isolated.</li> <li>• You must install a 2500 W or higher capacity power supply when using the Supervisor Engine 32 or the Supervisor Engine 720 and the high-speed fan tray.</li> </ul> <p><b>Note</b> For proper operation of the power supply OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

Table 1-22 lists the environmental and physical specifications of the Catalyst 6513 switch chassis.

**Table 1-22 Catalyst 6513 Switch Specifications**

Item	Specification
Environmental Temperature, operating  Temperature, nonoperating and storage  Thermal transition  Humidity (RH), ambient (noncondensing) operating  Humidity (RH), ambient (noncondensing) nonoperating and storage  Altitude, operating	Certified for operation: 32° to 104°F (0° to 40°C) Designed and tested for operation: 32° to 131°F (0° to 55°C) <b>Note</b> The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 104°F (40°C) generating a minor alarm and at 131°F (55°C) generating a major alarm.  Chassis unpackaged: -4° to 149°F (-20° to 65°C) Chassis in protective shipping package: -40° to 158°F (-40° to 70°C)  0.5°C per minute (hot to cold) 0.33°C per minute (cold to hot)  5% to 90%  5% to 95%  Certified for operation: 0 to 6500 ft (0 to 2000 m) Designed and tested for operation: -200 to 10,000 ft (-60 to 3000 m)
Shock and vibration	This switch complies with Network Equipment Building Systems (NEBS) (Zone 4 per GR-63-Core) in the following areas: <ul style="list-style-type: none"> <li>• Earthquake environment and criteria</li> <li>• Office vibration and criteria</li> <li>• Transportation vibration and criteria</li> </ul> <b>Shock</b> <ul style="list-style-type: none"> <li>• Operational—5 G 30 ms, half-sine (IEC 68-2-27)</li> <li>• Nonoperational—20 G, 7.5 ms, trapezoidal</li> </ul> <b>Vibration</b> Operational—3 Hz to 500 Hz. Power Spectral Density (PSD)—0.0005 G <sup>2</sup> /Hz at 10 Hz and 200 Hz. 5 dB/octave roll off at each end. 0.5 hours per axis (1.12 Grms).
Acoustic noise	61.4 to 77 dB. International Organization for Standardization (ISO) 7779: Bystander position operating to an ambient temperature of 86°F (30°C).



**Table 1-22 Catalyst 6513 Switch Specifications (continued)**

Item	Specification
Physical characteristics	
Dimensions (H x W x D)	<ul style="list-style-type: none"> <li>• 33.3 x 17.3 x 18.1 in. (84.6 x 43.7 x 46.0 cm).</li> <li>• Chassis requires 20 RU<sup>1</sup>.</li> <li>• The Catalyst 6513 switch chassis is designed to install in standard 19-inch equipment racks that meet ANSI/EIA 310-D, IEC 60297, and ETS 300-119 standards.</li> </ul>
Weight	Chassis fully configured with 2 supervisor engines, 11 switching modules, and 2 power supplies: 280 lb (127 kg).
Airflow	<ul style="list-style-type: none"> <li>• WS-C6K-13SLOT-FAN (Standard fan tray)—641 CFM</li> <li>• WS-C6K-13SLT-FAN2 (Optional high-speed fan tray)—1090 CFM</li> </ul> <p><b>Note</b> To maintain proper air circulation through the Catalyst switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis air exhaust. You should also allow a minimum separation of 12 inches (30.5 cm) between the hot air exhaust on one chassis and the air intake on another chassis. Failure to maintain adequate air space can cause the chassis to overheat and the system to fail. On Catalyst chassis in which the airflow is from front to back, the chassis may be placed side-by-side.</p>

1. RU = rack units

## Catalyst 6513-E Switch

The Catalyst 6513-E switch is a 13-slot horizontal chassis supporting redundant power supplies, redundant supervisor engines, and slots for up to twelve modules. The chassis is NEBS L3 compliant. [Figure 1-15](#) shows a front view of the Catalyst 6513-E switch chassis.

Figure 1-15 Catalyst 6513-E Switch

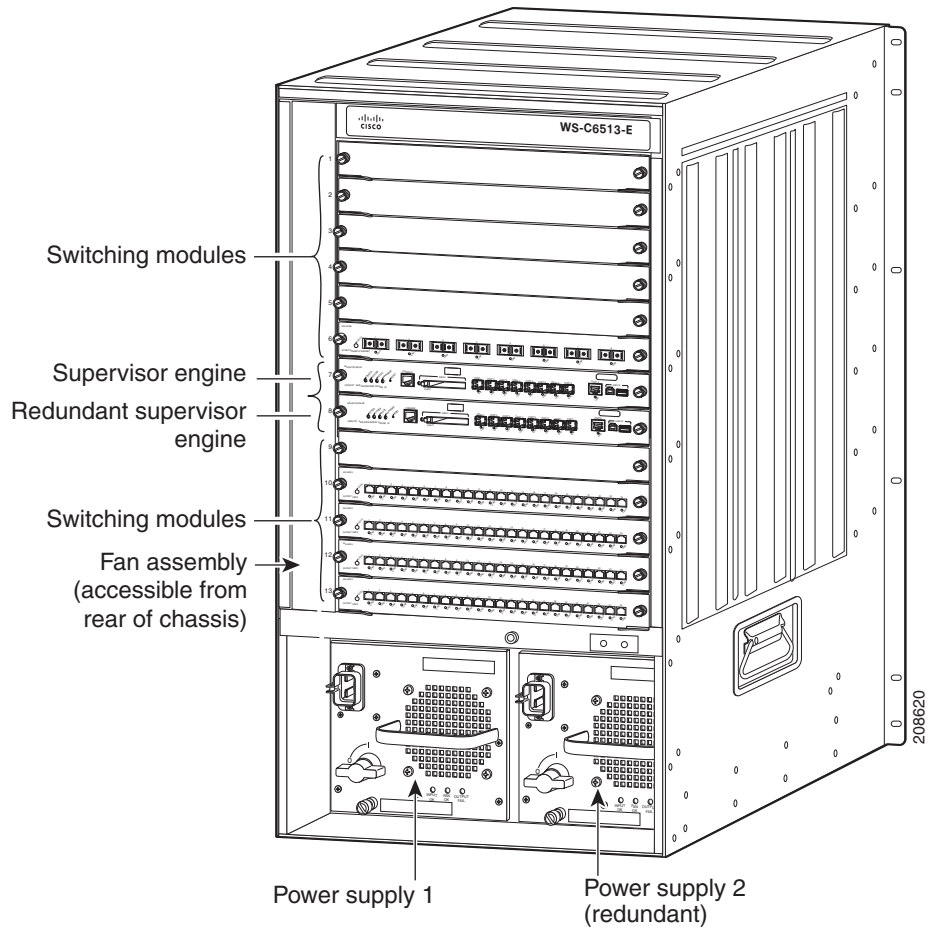


Table 1-23 lists the features of the Catalyst 6513-E switch chassis.

**Table 1-23 Catalyst 6513-E Switch Features**

Feature	Description
Chassis	<ul style="list-style-type: none"> <li>Thirteen horizontal slots. Slots are numbered from (1) top to (13) bottom.</li> </ul>
Supervisor engines	<ul style="list-style-type: none"> <li>Supports Supervisor Engine 32, Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T.</li> </ul> <p><b>Note</b> Refer to your software release notes for the minimum software release versions required to support the supervisor engines.</p> <ul style="list-style-type: none"> <li>Supervisor Engine 32, Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T must be installed in slot 7 and slot 8.</li> </ul> <p><b>Note</b> Slots not occupied by supervisor engines can be used for modules. Check your software release notes for any restrictions on the type of module that can be installed.</p> <ul style="list-style-type: none"> <li>Supervisor Engine 720, Supervisor Engine 720-10GE, and Supervisor Engine 2T have a built-in switching fabric. Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2) are not supported.</li> <li>Supervisor Engine 32 does not support the Switch Fabric Modules (WS-C6500-SFM and WS-X6500-SFM2).</li> <li>The uplink ports are fully functional on all redundant supervisor engine models when they are in standby mode.</li> </ul> <p><b>Note</b> In systems with redundant supervisor engines, both supervisor engines must be the same model and have the same daughter card configurations. Each supervisor engine must have the resources to run the switch on its own, which means that all supervisor engine resources are duplicated. Identical supervisor engine memory configurations are recommended, but are not required as long as the supervisor engine with the smaller memory configuration is sufficient to run the configured features of the switch. Additionally, each supervisor engine must have its own flash device and console port connections.</p>
Modules	<ul style="list-style-type: none"> <li>Supports up to 12 Catalyst 6500 series modules.</li> <li>Slots 1–13 support dual fabric channels.</li> <li>Check your software release notes for specific information on module support. Some Catalyst 6500 series modules may:             <ul style="list-style-type: none"> <li>Not be supported</li> <li>Require that you install a specific supervisor engine</li> <li>Have chassis slot restrictions</li> <li>Require a specific software release level to operate</li> </ul> </li> </ul>
Backplane bandwidth	<ul style="list-style-type: none"> <li>2 Tbps system bandwidth</li> <li>80 Gbps per slot for all thirteen slots</li> </ul>

Table 1-23 Catalyst 6513-E Switch Features (continued)

Feature	Description
Clock and VTT module	<ul style="list-style-type: none"> <li>• Two clock modules provide clocking signals to the EOBC channel and the switching bus.</li> <li>• Three voltage termination (VTT) modules provide reference voltage for bus signals.</li> </ul>
Fan tray	<ul style="list-style-type: none"> <li>• The chassis supports one hot-swappable fan tray. One fan tray model is available: <ul style="list-style-type: none"> <li>– WS-C6513-E-FAN(=)—1755 CFM</li> </ul> </li> </ul> <p><b>Note</b> The fan tray contains 15 individual fans. The individual fans are not field replaceable; you must replace the fan tray in the event of a fan failure.</p> <ul style="list-style-type: none"> <li>• The Catalyst 6513-E fan tray is accessible only from the rear of the chassis.</li> <li>• Fan tray FAN STATUS LEDs (two LEDs: one located on the front of the chassis and one located on the fan tray at the rear of the chassis) <ul style="list-style-type: none"> <li>– Red—One or more individual fans have failed.</li> <li>– Green—Fan tray is operating normally.</li> </ul> </li> </ul>

Table 1-23 Catalyst 6513-E Switch Features (continued)

Feature	Description
Power supply	<ul style="list-style-type: none"> <li>• Supports one or two power supplies. The following models are supported:               <ul style="list-style-type: none"> <li>– WS-CDC-2500W (2500 W DC-input power supply).</li> <li>– WS-CAC-3000W (3000 W AC-input power supply).</li> <li>– WS-CAC-4000W-US (4000 W AC-input power supply).</li> <li>– WS-CAC-4000W-INT (4000 W AC-input power supply).</li> <li>– PWR-4000-DC (4000 W DC-input power supply).</li> <li>– WS-CAC-6000W (6000 W AC-input power supply).</li> <li>– PWR-6000-DC (6000 W DC-input power supply).</li> <li>– WS-CAC-8700W-E (8700 W AC-input power supply).</li> </ul> </li> <li>• Installed power supplies can be of different ratings. Installed power supplies can also be both AC-input, both DC-input, or one AC-input and one DC-input. Power supplies can be configured in either redundant or combined mode.</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC. Source AC can be out of phase between multiple power supplies or multiple AC-power plugs on the same power supply because all AC power supply inputs are isolated.</li> <li>• Supervisor Engine 2T requires a 3000 W or greater power supply to operate.</li> </ul> <p><b>Note</b> For proper operation of the power supply OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

Table 1-24 lists the environmental and physical specifications of the Catalyst 6513-E switch chassis.

**Table 1-24 Catalyst 6513-E Switch Specifications**

Item	Specification
Environmental	
Temperature, operating	Certified for operation: 32° to 104°F (0° to 40°C) Designed and tested for operation: 32° to 131°F (0° to 55°C) <b>Note</b> The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 104°F (40°C) generating a minor alarm and at 131°F (55°C) generating a major alarm.
Temperature, nonoperating and storage	Chassis unpackaged: -4° to 149°F (-20° to 65°C) Chassis in protective shipping package: -40° to 158°F (-40° to 70°C)
Thermal transition	0.5°C per minute (hot to cold) 0.33°C per minute (cold to hot)
Humidity (RH), ambient (noncondensing) operating	5% to 90%
Humidity (RH), ambient (noncondensing) nonoperating and storage	5% to 95%
Altitude, operating	Certified for operation: 0 to 6500 ft (0 to 2000 m) Designed and tested for operation: -200 to 10,000 ft (-60 to 3000 m)
Shock and vibration	This switch complies with Network Equipment Building Systems (NEBS) (Zone 4 per GR-63-Core) in the following areas: <ul style="list-style-type: none"> <li>• Earthquake environment and criteria</li> <li>• Office vibration and criteria</li> <li>• Transportation vibration and criteria</li> </ul> <b>Shock</b> <ul style="list-style-type: none"> <li>• Operational—5 G 30 ms, half-sine (IEC 68-2-27)</li> <li>• Nonoperational—20 G, 7.5 ms, trapezoidal</li> </ul> <b>Vibration</b> Operational—3 Hz to 500 Hz. Power Spectral Density (PSD)—0.0005 G <sup>2</sup> /Hz at 10 Hz and 200 Hz. 5 dB/octave roll off at each end. 0.5 hours per axis (1.12 Grms).
Acoustic noise	61.4 to 77 dB. International Organization for Standardization (ISO) 7779: Bystander position operating to an ambient temperature of 86°F (30°C).

Table 1-24 Catalyst 6513-E Switch Specifications (continued)

Item	Specification
Physical characteristics Dimensions (H x W x D)  Weight	<ul style="list-style-type: none"> <li>• 33.3 x 17.3 x 18.1 in. (84.6 x 43.9 x 46.0 cm).</li> <li>• Chassis requires 20 RU<sup>1</sup>.</li> <li>• The Catalyst 6513-E switch chassis is designed to install in standard 19-inch equipment racks that meet ANSI/EIA 310-D, IEC 60297, and ETS 300-119 standards.</li> </ul> Chassis fully configured with 2 supervisor engines, 11 switching modules, and 2 power supplies: 280 lb (127 kg). Empty chassis weight: 102 lb (46.3 kg)
Airflow	<ul style="list-style-type: none"> <li>• WS-C6500-E-FAN (Standard fan tray)—1755 CFM</li> </ul> <p><b>Note</b> To maintain proper air circulation through the Catalyst switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis air exhaust. You should also allow a minimum separation of 12 inches (30.5 cm) between the hot air exhaust on one chassis and the air intake on another chassis. Failure to maintain adequate air space can cause the chassis to overheat and the system to fail. On Catalyst chassis in which the airflow is from front to back, the chassis may be placed side-by-side.</p>

1. RU = rack units







# CHAPTER 1

## Preparing for Installation

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### Note

In this publication, the term Catalyst 6500 series refers only to the switch chassis listed in Chapter 1. The Catalyst 6000 series switches (Catalyst 6006 and Catalyst 6009 switches) are described in a separate publication, the *Catalyst 6000 Series Switch Installation Guide*.

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Planning a proper location for the switch and the layout of your equipment rack or wiring closet is essential for successful system operation. You should install the switch in an enclosed, secure area, ensuring that only qualified personnel have access to the switch and control of the environment. Equipment placed too close together or inadequately ventilated can cause system overtemperature conditions. In addition, poor equipment placement can make chassis panels inaccessible and difficult to maintain.

This chapter describes how to prepare your site for switch installation and contains these sections:

- [Safety, page 1-2](#)
- [Site Requirements, page 1-2](#)
- [Power Requirements, page 1-22](#)
- [Cabling Requirements, page 1-24](#)
- [Site Preparation Checklist, page 1-24](#)

# Safety

Safety warnings appear throughout this publication in procedures that may harm you if performed incorrectly. A warning symbol precedes each warning statement. The warnings below are general warnings that are applicable to the entire publication.



**Warning**

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**Only trained and qualified personnel should be allowed to install, replace, or service this equipment.**  
Statement 1030

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**Warning**

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**This unit is intended for installation in restricted access areas. A restricted access area can be accessed only through the use of a special tool, lock and key, or other means of security.**  
Statement 1017

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**Warning**

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**Before you install, operate, or service the system, read the *Site Preparation and Safety Guide*. This guide contains important safety information you should know before working with the system.**  
Statement 200

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**Warning**

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**Voltages that present a shock hazard may exist on Power over Ethernet (PoE) circuits if interconnections are made using uninsulated exposed metal contacts, conductors, or terminals. Avoid using such interconnection methods, unless the exposed metal parts are located within a restricted access location and users and service people who are authorized within the restricted access location are made aware of the hazard. A restricted access area can be accessed only through the use of a special tool, lock and key or other means of security.** Statement 1072

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## Site Requirements

These sections describe some of the basic site requirements that you should be aware of as you prepare to install your Catalyst 6500 series switch. Environmental factors can adversely affect the performance and longevity of your system. Planning a proper location for the switch and layout of your equipment rack or wiring closet is essential for successful system operation. You should install the switch in an enclosed, secure area, ensuring that only qualified personnel have access to the switch and control of the environment. Equipment that is placed too closely together or that is inadequately ventilated can cause system overtemperature conditions leading to premature component failures. In addition, poor equipment placement can make chassis panels inaccessible and difficult to maintain.

The switch requires a dry, clean, well-ventilated, and air-conditioned environment. To ensure normal operation, maintain ambient airflow. If the airflow is blocked or restricted, or if the intake air is too warm, an overtemperature condition can occur. The switch environmental monitor can then shut down the system to protect the system components.

Multiple switches can be rack-mounted with little or no clearance above and below the chassis. However, when mounting a switch in a rack with other equipment, or when placing it on the floor near other equipment, ensure that the exhaust from other equipment does not blow into the air intake vent of the switch chassis. Refer to [Table 1-2](#) for specific air flow clearances needed.

## Temperature

Temperature extremes can cause a system to operate at reduced efficiency and cause a variety of problems, including premature aging and failure of chips, and failure of mechanical devices. Extreme temperature fluctuations can cause chips to become loose in their sockets. Observe the following guidelines:

- Ensure that the system is operating in an environment no colder than 50°F (10°C) or hotter than 95°F (35°C).
- Ensure that the chassis has adequate ventilation.
- Do not place the chassis within a closed-in wall unit or on top of cloth, which can act as insulation.
- Do not place it where it will receive direct sunlight, particularly in the afternoon.
- Do not place it next to a heat source of any kind, including heating vents.
- Adequate ventilation is particularly important at high altitudes. Make sure that all slots and openings on the system remain unobstructed, especially the fan vent on the chassis.
- Clean the installation site at regular intervals to avoid buildup of dust and debris, which can cause a system to overheat.
- If the system has been exposed to abnormally cold temperatures, allow a 2-hour warm-up period to bring it up to normal operating temperature before turning it on.

Failure to observe these guidelines can damage internal components.

**Note**

The Catalyst 6500 series switches are equipped with internal air temperature sensors that are triggered at 104°F (40°C) generating a minor alarm and at 131°F (55°C) generating a major alarm.

## Air Flow

The Catalyst 6500 series switch is designed to be installed in an environment where there is a sufficient volume of air available to cool the supervisor engines, modules, and power supplies. Any constraints placed on the free flow of air through the chassis or an elevated ambient air temperature can cause the switch to overheat and shut down.

To maintain proper air circulation through the Catalyst 6500 series switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis hot air exhaust. In situations where the switch chassis are installed in adjacent racks, you should allow a minimum of 12-inches (30.5 cm) between the air intake of one chassis and the hot air exhaust of another chassis. Failure to maintain adequate spacing between chassis can cause the switch chassis that is drawing in the hot exhaust air to overheat and fail. On Catalyst 6500 series chassis in which the airflow is from front to back, the chassis may be placed side-to-side.

If you are installing your Catalyst 6500 series switch in an enclosed or partially enclosed rack, we strongly recommend that you verify that your site meets the following guidelines:

- Verify that there is a minimum of 6 inches (15 cm) of clearance between the sides of the rack and both the chassis air intake grill and the chassis air exhaust grill.
- Verify that the ambient air temperature within the enclosed or partially enclosed rack is within the chassis operating temperature limits. After installing the chassis in the rack, power up the chassis and allow the chassis temperature to stabilize (approximately 2 hours). Measure the ambient air temperature at the chassis air intake grill and at the chassis air exhaust grill by positioning an external temperature probe approximately 1 inch (2.5 cm) away from the grills, in line with the chassis slot occupied by the supervisor engine.
  - If the ambient intake air temperature is less than 104°F (40°C), the rack meets the intake air temperature criterion.
  - If the ambient intake air temperature exceeds 104°F (40°C), the system might experience minor temperature alarms and is in danger of overheating.
  - If the ambient intake air temperature equals or is greater than 131°F (55°C), the system will experience a major temperature alarm and shut down.
- Verify that the enclosed or partially enclosed rack allows an adequate flow of air through the switch chassis as follows:
  - If the difference between the measured intake air temperature and the exhaust air temperature does not exceed 10°C, there is sufficient airflow in the rack.
  - If the difference in air temperature exceeds 10°C, there is insufficient airflow to cool the chassis.




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**Note** The 10°C temperature differential between the intake and the exhaust must be determined by taking measurements using external digital temperature probes. Do not use the chassis internal temperature sensors to measure the temperature differential.

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- Plan ahead. Your Catalyst 6500 series switches currently installed in an enclosed or partially enclosed rack might meet ambient air temperature and air flow requirements now. However, if you add more chassis to the rack or you add more modules to a chassis in the rack, the additional heat generated might cause the ambient air temperature within the rack to exceed 104°F (40°C) and can cause minor alarms.

## Selecting the Proper Rack-Enclosure or Cabinet

Cisco Systems has identified two rack-enclosures that are determined to be Cisco-compatible:

Panduit Corporation—The Net-Access Cabinet (p/n CN4-1) is determined to be Cisco-compatible for the Catalyst 6500 series product line. Contact Panduit Corporation for further information on this rack enclosure. Their corporate website is <http://www.panduit.com>. Their Customer Service and Technical Support phone number is 800 777-3300.

Chatsworth Products, Inc.—The N-Series TeraFrame Network Cabinet (p/n NF2K-113C-C42) is determined to be Cisco-compatible for the Catalyst 6500 series product line. Contact Chatsworth Products, Inc. for further information on this rack enclosure. Their corporate website is <http://www.chatsworth.com>. Their Customer Service and Technical Support phone number is 800 834-4969 (Monday to Friday, 5 a.m. to 5 p.m., (0500 to 1700) Pacific Time).

## Chassis Fan Trays

The chassis fan assembly provides cooling air for the supervisor engine and the switching modules. [Table 1-1](#) lists the Catalyst 6500 series switch chassis along with the supported and unsupported fan trays. [Table 1-2](#) lists the chassis air flow architecture and requirements for the Catalyst 6500 series switches. If an individual fan within the assembly fails, the FAN STATUS LED turns red. Individual fans within a fan tray assembly cannot be replaced; you must replace the entire fan tray assembly. To replace a fan tray assembly, see the [“Removing and Installing the Fan Tray”](#) section on page 1-82.

Refer to your software configuration guide for information on environmental monitoring.

**Table 1-1 Catalyst 6500 Series Chassis Fan Tray Support**

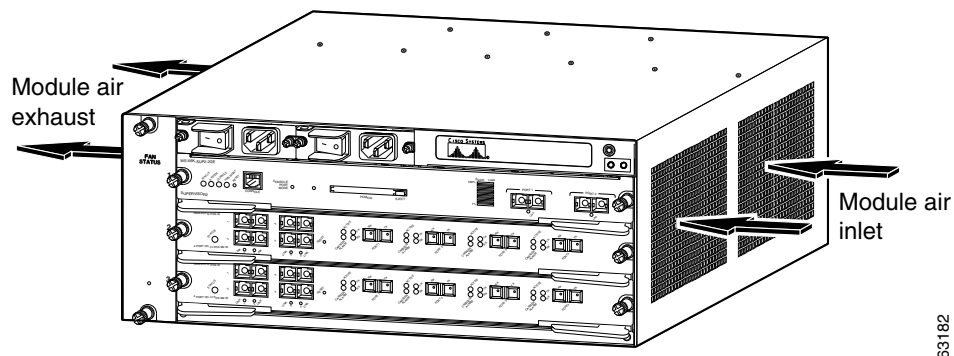
Chassis Model	Supported Fan Trays	Unsupported Fan Trays
Catalyst 6503	FAN-MOD-3 FAN-MOD-3HS (high speed)	WS-C6503-E-FAN
Catalyst 6503-E	WS-C6503-E-FAN	FAN-MOD-3 FAN-MOD-3HS (high speed)
Catalyst 6504-E	FAN-MOD-4HS (high speed)	—
Catalyst 6506	WS-C6K-6SLOT-FAN WS-C6K-6SLOT-FAN2 (high speed)	WS-6506-E-FAN
Catalyst 6506-E	WS-6506-E-FAN (high speed)	WS-C6K-6SLOT-FAN WS-C6K-6SLOT-FAN2 (high speed)
Catalyst 6509	WS-C6K-9SLOT-FAN WS-C6K-9SLOT-FAN2 (high speed)	WS-6509-E-FAN
Catalyst 6509-E	WS-6509-E-FAN (high speed)	WS-C6K-9SLOT-FAN WS-C6K-9SLOT-FAN2 (high speed)
Catalyst 6509-NEB	WS-C6509-NEB-FAN WS-6509-NEB-UPGRD <sup>1</sup> (high speed)	—
Catalyst 6509-NEB-A	FAN-MOD-09 (high speed)	—
Catalyst 6509-V-E	WS-C6509-V-E-FAN (high speed)	—
Catalyst 6513	WS-C6K-13SLOT-FAN WS-C6K-13SLT-FAN2 (high speed)	WS-C6513-E-FAN
Catalyst 6513-E	WS-C6513-E-FAN	WS-C6K-13SLOT-FAN WS-C6K-13SLT-FAN2

- Optional high-speed fan tray is part of the WS-6509-NEB-UPGRD kit. For systems operating with DC-input power supplies, all you need is the upgrade kit. For systems operating with AC-input power supplies, you need the upgrade kit plus WS-CAC-3000W (3000 W power supply) or better to operate the fan tray.

**Table 1-2 Chassis Air Flow Requirements**

Chassis Model	Airflow Intake	Airflow Exhaust	Air Filter Available	Fan Tray P/N	Air Volume	Reference Illustration
Catalyst 6503	Right side	Left side	No	FAN-MOD-3 FAN-MOD-3HS	170 CFM 270 CFM	<a href="#">Figure 1-1</a>
Catalyst 6503-E	Right side	Left side	No	WS-C6503-E-FAN	282 CFM	<a href="#">Figure 1-1</a>
Catalyst 6504-E	Right side	Left side	No	FAN-MOD-4HS	300 CFM	<a href="#">Figure 1-2</a>
Catalyst 6506	Right side	Left side	No	WS-C6K-6SLOT-FAN WS-C6K-6SLOT-FAN2	227 CFM 420 CFM	<a href="#">Figure 1-3</a>
Catalyst 6506-E	Right side	Left side	No	WS-C6506-E-FAN	564 CFM	<a href="#">Figure 1-4</a>
Catalyst 6509	Right side	Left side	No	WS-C6K-9SLOT-FAN WS-C6K-9SLOT-FAN2	340 CFM 630 CFM	<a href="#">Figure 1-5</a>
Catalyst 6509-E	Right side	Left side	No	WS-C6509-E-FAN	846 CFM	<a href="#">Figure 1-6</a>
Catalyst 6509-NEB	Front	Rear	No	WS-C6509-NEB-FAN Optional high-speed fan tray <sup>1</sup>	294 CFM 630 CFM	<a href="#">Figure 1-7</a>
Catalyst 6509-NEB-A <sup>2</sup>	Front	Rear	Yes <sup>3</sup>	FAN-MOD-09	760 CFM	<a href="#">Figure 1-8</a>
Catalyst 6509-V-E <sup>2</sup>	Front	Rear	Yes <sup>3</sup>	WS-C6509-V-E-FAN	760 CFM	<a href="#">Figure 1-8</a>
Catalyst 6513	Right side	Left side	No	WS-C6K-13SLOT-FAN WS-C6K-13SLOT-FAN2	641 CFM 1090 CFM	<a href="#">Figure 1-9</a>
Catalyst 6513-E	Right side	Left side	No	WS-C6513-E-FAN	1755 CFM	<a href="#">Figure 1-10</a>

1. Part of the WS-6509-NEBUPGRD kit.
2. Chassis supports two fan trays.
3. An optional air filter assembly is available for the Catalyst 6509-NEB-A and the Catalyst 6509-V-E switch chassis. The air filter assembly consists of three components: INTAKEPNL-09= (intake panel), FLTRASSM-09= (filter cage assembly), and FLTRINSERTS-09= (air filter inserts).

**Figure 1-1 Catalyst 6503 and Catalyst 6503-E Switch Internal Airflow**

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Figure 1-2 Catalyst 6504-E Switch Internal Airflow

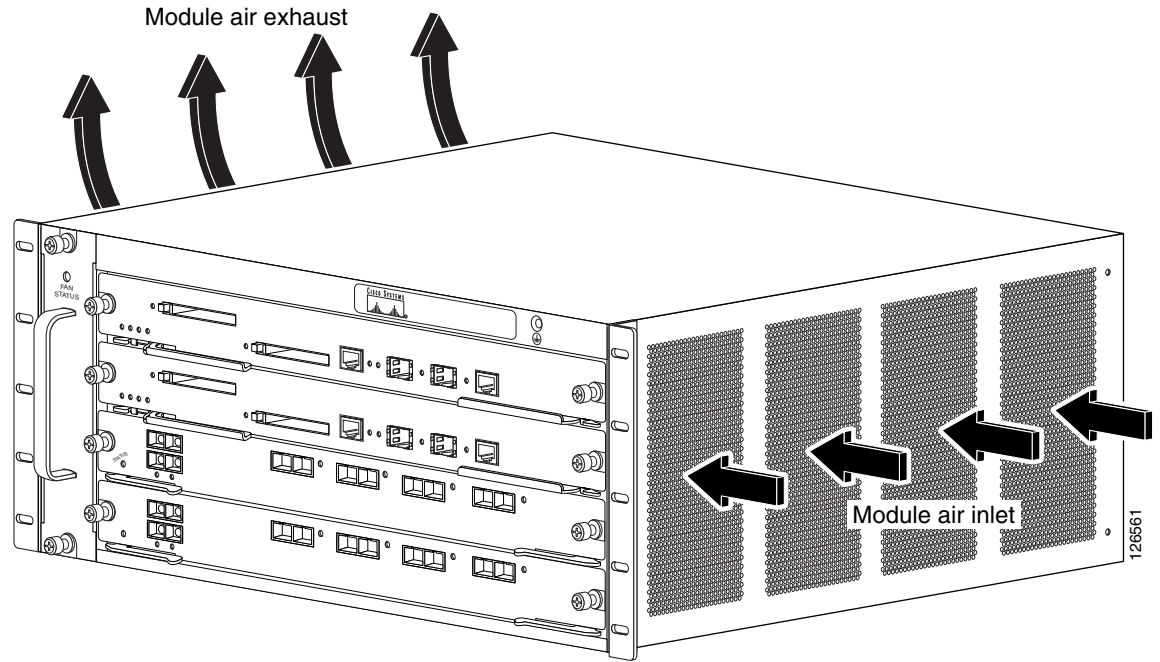


Figure 1-3 Catalyst 6506 Switch Internal Airflow

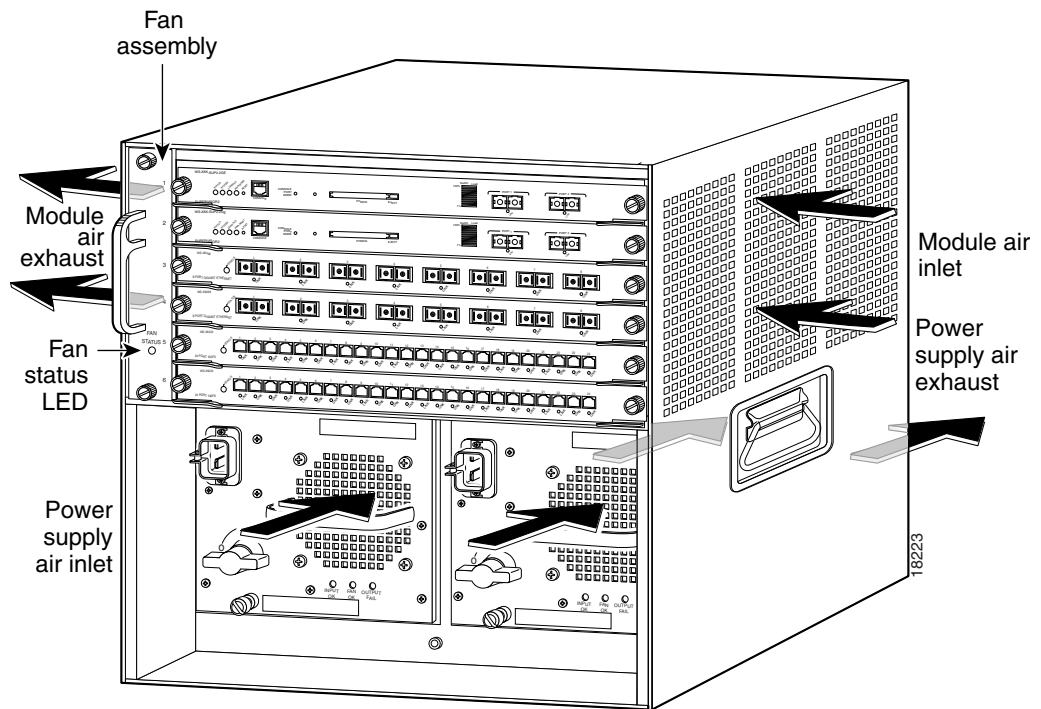


Figure 1-4 Catalyst 6506-E Switch Internal Airflow

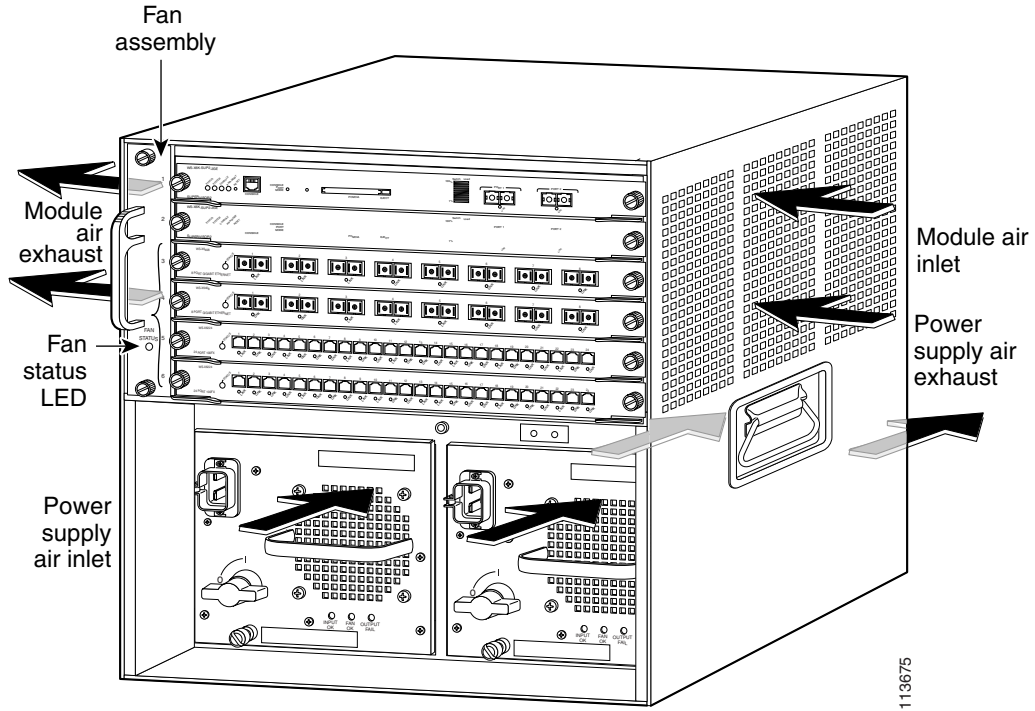




Figure 1-5 Catalyst 6509 Switch Internal Airflow

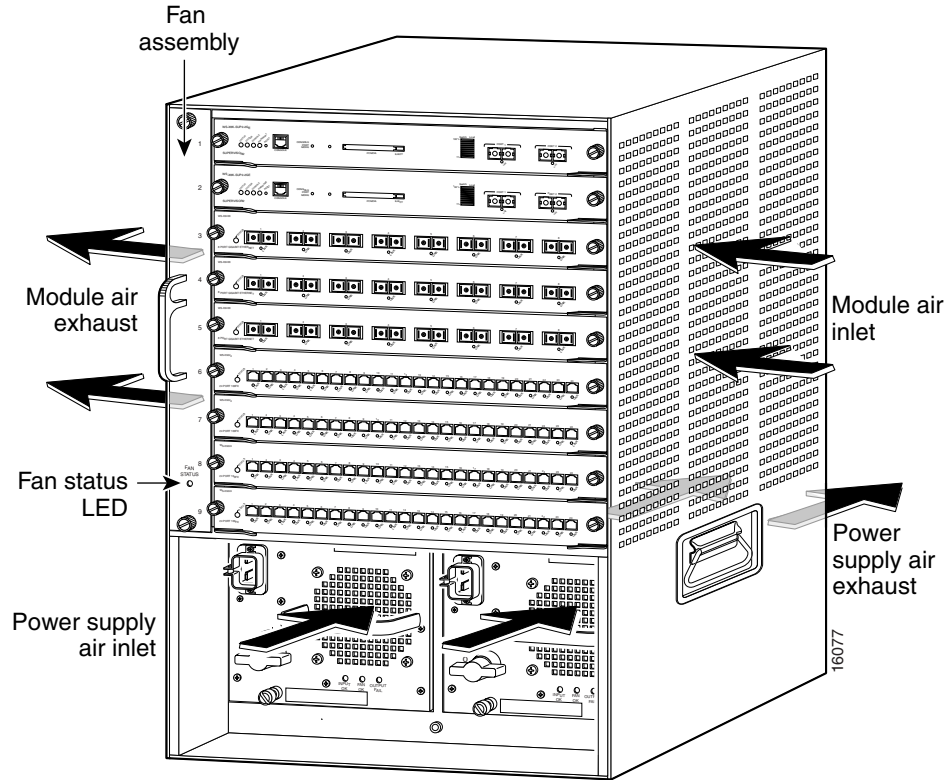
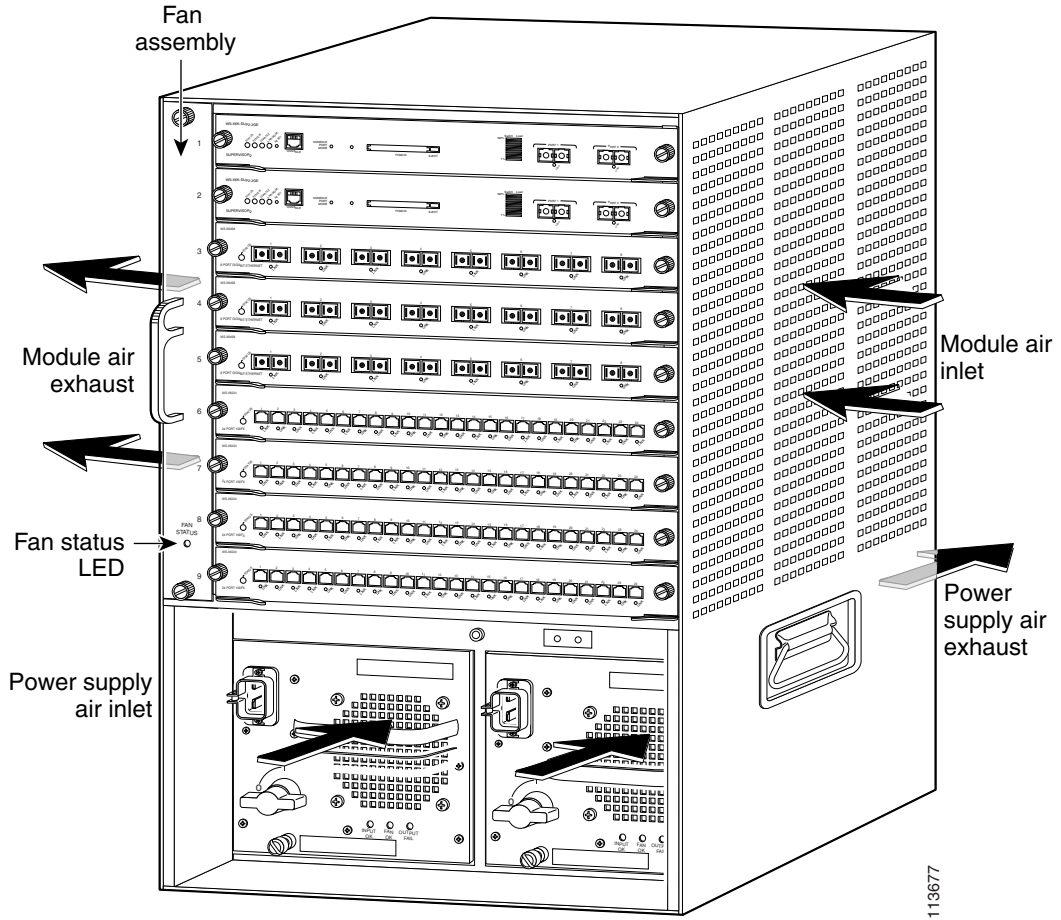


Figure 1-6 Catalyst 6509-E Switch Internal Airflow



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Figure 1-7 Catalyst 6509-NEB Switch Internal Airflow

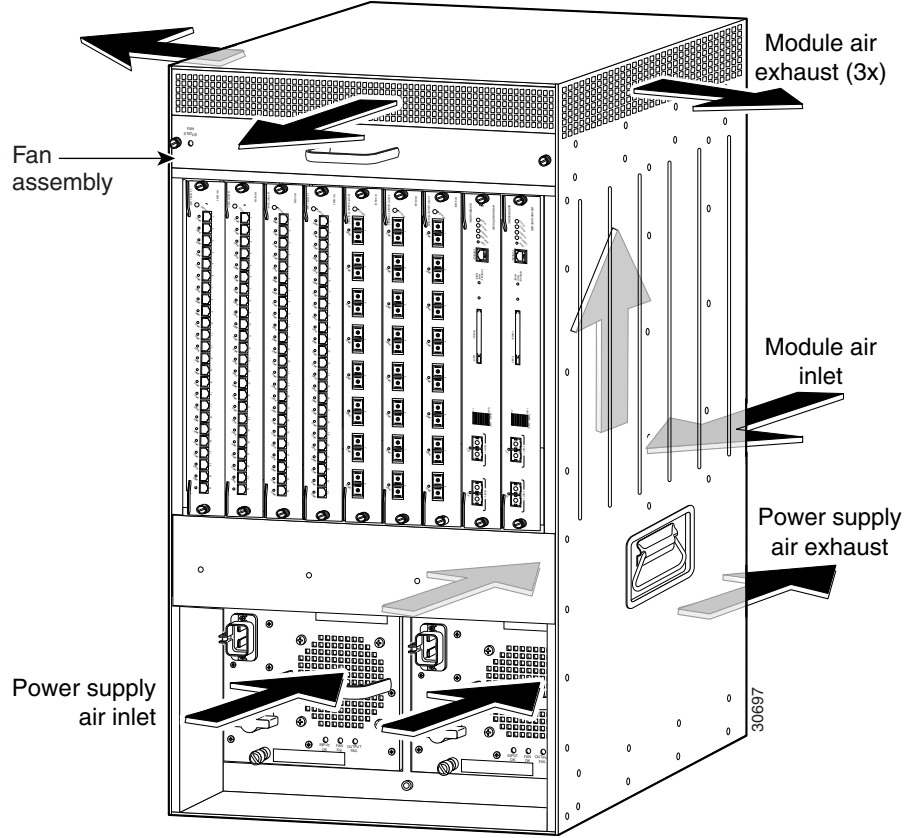


Figure 1-8 Catalyst 6509-NEB-A and Catalyst 6509-V-E Switch Internal Airflow

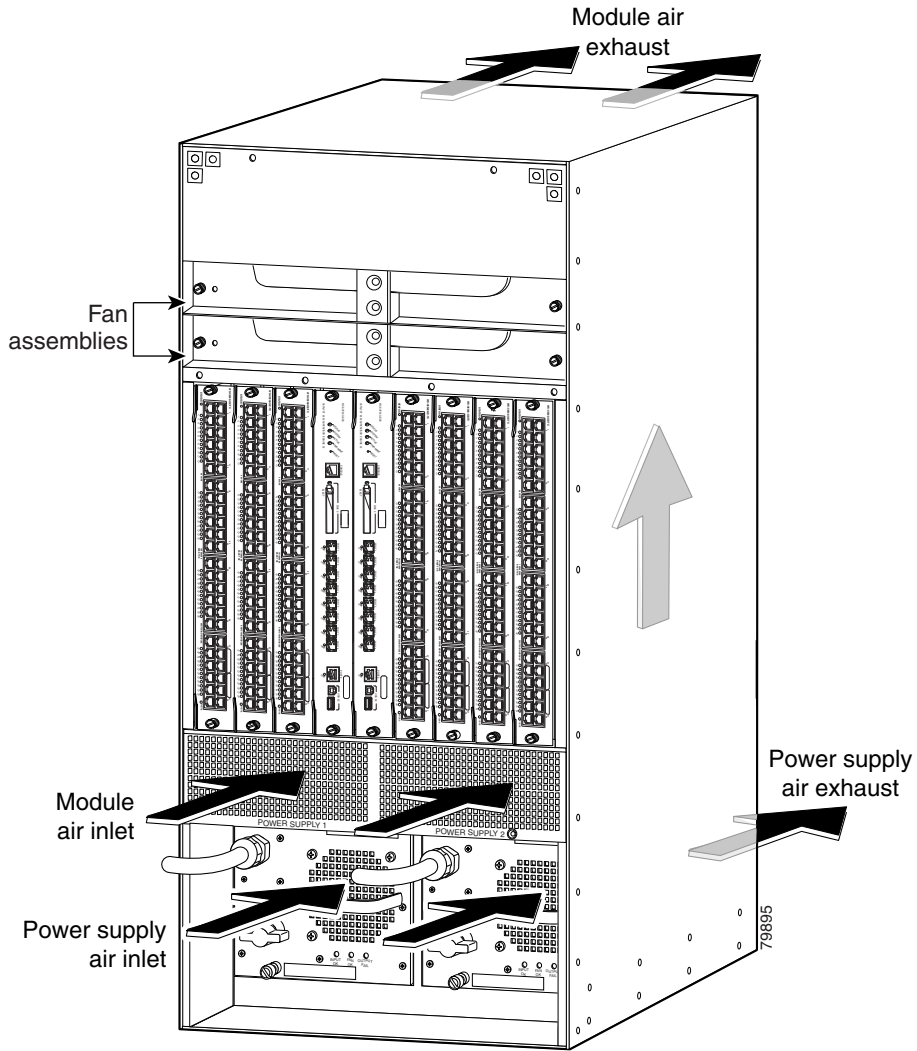
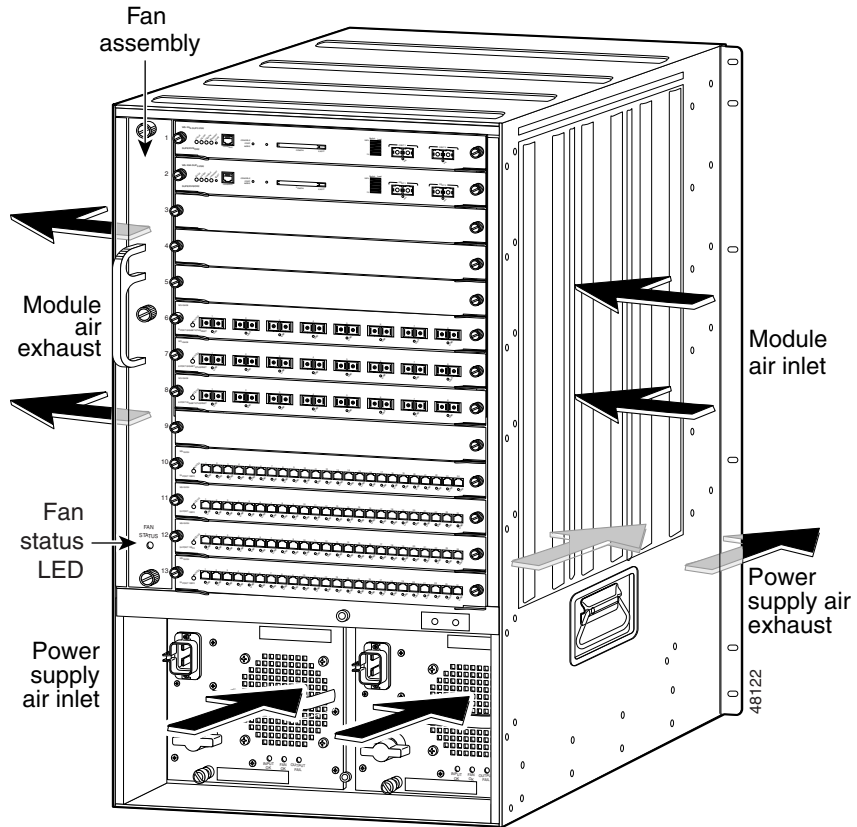
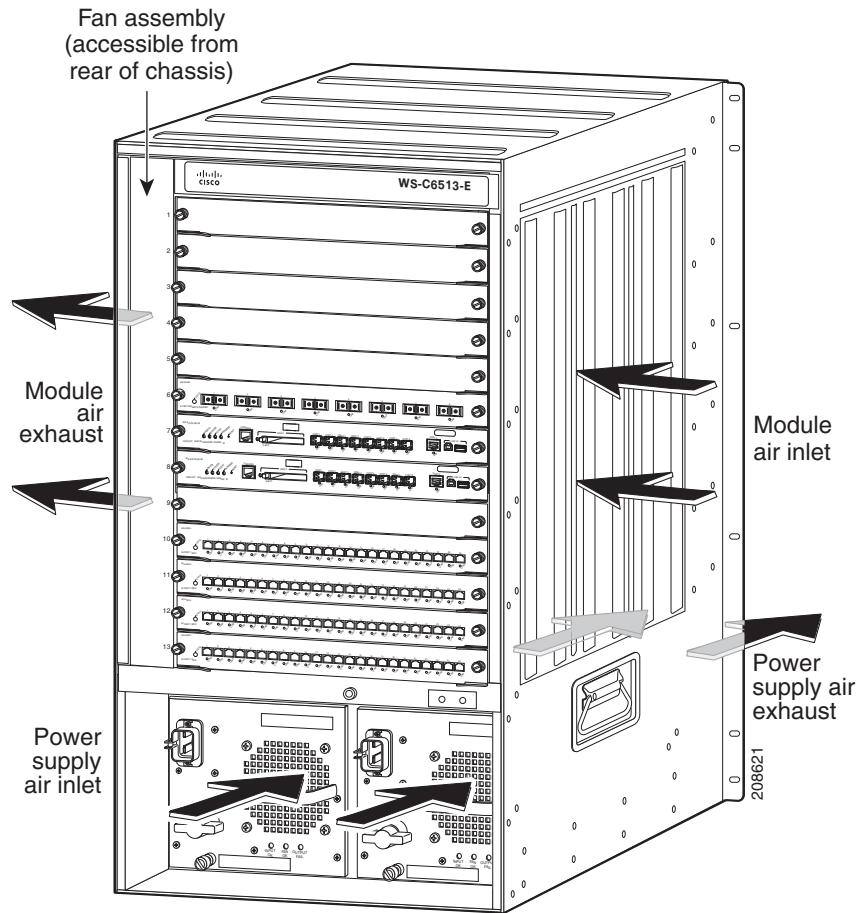


Figure 1-9 Catalyst 6513 Switch Internal Airflow



**Figure 1-10 Catalyst 6513-E Switch Internal Airflow**



## Humidity

High-humidity conditions can cause moisture migration and penetration into the system. This moisture can cause corrosion of internal components and degradation of properties such as electrical resistance, thermal conductivity, physical strength, and size. Extreme moisture buildup inside the system can result in electrical shorts, which can cause serious damage to the system. Each system is rated to operate at 8 to 80 percent relative humidity, with a humidity gradation of 10 percent per hour. In storage, a system can withstand from 5 to 95 percent relative humidity. Buildings in which climate is controlled by air-conditioning in the warmer months and by heat during the colder months usually maintain an acceptable level of humidity for system equipment. However, if a system is located in an unusually humid location, a dehumidifier can be used to maintain the humidity within an acceptable range.

## Altitude

Operating a system at high altitude (low pressure) reduces the efficiency of forced and convection cooling and can result in electrical problems related to arcing and corona effects. This condition can also cause sealed components with internal pressure, such as electrolytic capacitors, to fail or perform at reduced efficiency. Each system is rated to operate at altitudes from –50 to 6500 feet (–16 to 1981 meters) and can be stored at altitudes of –50 to 35,000 feet (–16 to 10,668 meters).

## Dust and Particles

Fans cool power supplies and system components by drawing in room temperature air and exhausting heated air out through various openings in the chassis. However, fans also ingest dust and other particles, causing contaminant buildup in the system and increased internal chassis temperature. A clean operating environment can greatly reduce the negative effects of dust and other particles, which act as insulators and interfere with the mechanical components in the system. The standards listed below provide guidelines for acceptable working environments and acceptable levels of suspended particulate matter:

- Network Equipment Building Systems (NEBS) GR-63-CORE
- National Electrical Manufacturers Association (NEMA) Type 1
- International Electrotechnical Commission (IEC) IP-20

## Corrosion

Corrosion of system connectors is a gradual process that can eventually lead to intermittent failures of electrical circuits. The oil from a person's fingers or prolonged exposure to high temperature or humidity can corrode the gold-plated edge connectors and pin connectors on various components in the system. To prevent corrosion, avoid touching contacts on boards and cards, and protect the system from extreme temperatures and moist, salty environments.

## Electromagnetic and Radio Frequency Interference

Electromagnetic interference (EMI) and radio frequency interference (RFI) from a system can adversely affect devices such as radio and television (TV) receivers operating near the system. Radio frequencies emanating from a system can also interfere with cordless and low-power telephones. Conversely, RFI from high-power telephones can cause spurious characters to appear on the system monitor. RFI is defined as any EMI with a frequency above 10 kilohertz (kHz). This type of interference can travel from the system to other devices through the power cable and power source or through the air like transmitted radio waves. The Federal Communications Commission (FCC) publishes specific regulations to limit the amount of EMI and RFI emitted by computing equipment. Each system meets these FCC regulations. To reduce the possibility of EMI and RFI, follow these guidelines:

- Only operate the system with the chassis covers installed.
- Ensure that all chassis slots are covered by a metal filler bracket and that an unused power supply bay has a metal cover plate installed.
- Ensure that the screws on all peripheral cable connectors are securely fastened to their corresponding connectors on the back of the chassis.
- Always use shielded cables with metal connector shells for attaching peripherals to the system.

When wires are run for any significant distance in an electromagnetic field, interference can occur between the field and the signals on the wires. This fact has two implications for the construction of plant wiring:

- Bad wiring practice can result in radio interference emanating from the plant wiring.
- Strong EMI, especially when it is caused by lightning or radio transmitters, can destroy the signal drivers and receivers in the chassis, and even create an electrical hazard by conducting power surges through lines into equipment.

**Note**

To predict and remedy strong EMI, you may also need to consult experts in radio frequency interference (RFI).

If you use twisted-pair cable in your plant wiring with a good distribution of grounding conductors, the plant wiring is unlikely to emit radio interference. If you exceed the recommended distances, use a high-quality twisted-pair cable with one ground conductor for each data signal when applicable.

**Caution**

Category 5e, Category 6, and Category 6a cables can store large levels of static electricity because of the dielectric properties of the materials used in their construction. Always ground the cables (especially in new cable runs) to a suitable and safe earth ground before connecting them to the module.

If the wires exceed the recommended distances, or if wires pass between buildings, give special consideration to the effect of a lightning strike in your vicinity. The electromagnetic pulse caused by lightning or other high-energy phenomena can easily couple enough energy into unshielded conductors to destroy electronic devices. If you have had problems of this sort in the past, you may want to consult experts in electrical surge suppression and shielding.

## Shock and Vibration

Catalyst 6500 series switches have been shock- and vibration-tested for operating ranges, handling, and earthquake standards to NEBS (Zone 4 per GR-63-Core). These tests have been conducted in earthquake environment and criteria, office vibration and criteria, transportation vibration and criteria, and packaged equipment shock.

## Power Source Interruptions

Systems are especially sensitive to variations in voltage supplied by the AC power source. Overvoltage, undervoltage, and transients (or spikes) can erase data from memory or even cause components to fail. To protect against these types of problems, power cables should always be properly grounded. Also, place the system on a dedicated power circuit (rather than sharing a circuit with other heavy electrical equipment). In general, do not allow the system to share a circuit with any of the following:

- Copy machines
- Air conditioners
- Vacuum cleaners
- Space heaters
- Power tools
- Teletype machines
- Laser printers
- Facsimile machines
- Any other motorized equipment



Besides these appliances, the greatest threats to a system power supply are surges or blackouts that are caused by electrical storms. Whenever possible, turn off the system and any peripherals, and unplug them from their power sources during thunderstorms. If a blackout occurs—even a temporary one—while the system is turned on, turn off the system immediately and disconnect it from the electrical outlet. Leaving the system on may cause problems when the power is restored; all other appliances left on in the area can create large voltage spikes that can damage the system.

## System Grounding

You must install a NEBS-compliant system ground as part of the chassis installation process. Chassis installations that rely only on the AC third-prong ground are insufficient to properly and adequately ground the systems.

Proper grounding practices ensure that the buildings and the installed equipment within them have low-impedance connections and low-voltage differentials between chassis. When you include NEBS-compliant system grounds, you reduce or prevent shock hazards, greatly reduce the chances of equipment damage due to transients, and substantially reduce the potential for data corruption.

Without proper and complete system grounding you run the risk of increased component damage due to ESD. Additionally, you have a greatly increased chance of data corruption, system lockup and frequent system reboot situations by not using a system (NEBS compliant) ground.



### Caution

Installations that rely solely on system grounding using only an AC third-prong ground run a substantially greater risk of equipment problems and data corruption than those installations that use both the AC third-prong ground and a properly installed system (NEBS compliant) ground.

Table 1-3 lists some general grounding practice guidelines.

**Table 1-3**      **Grounding Practice Guidelines**

Environment	Electromagnetic Noise Severity Level	Grounding Recommendations
Commercial building is subjected to direct lightning strikes.  For example, some places in the United States, such as Florida, are subject to more lightning strikes than other areas.	High	All lightning protection devices must be installed in strict accordance with manufacturer recommendations. Conductors carrying lightning current should be spaced away from power and data lines in accordance with applicable recommendations and codes. Best grounding practices must be closely followed.
Commercial building is located in an area where lightning storms frequently occur but is not subject to direct lightning strikes.	High	Best grounding practices must be closely followed.
Commercial building contains a mix of information technology equipment and industrial equipment, such as welding.	Medium to High	Best grounding practices must be closely followed.

**Table 1-3** Grounding Practice Guidelines (continued)

Environment	Electromagnetic Noise Severity Level	Grounding Recommendations
Existing commercial building is not subject to natural environmental noise or man-made industrial noise. This building contains a standard office environment. This installation has a history of malfunction due to electromagnetic noise.	Medium	Best grounding practices must be closely followed. Determine source and cause of noise if possible, and mitigate as closely as possible at the noise source or reduce coupling from the noise source to the victim equipment.
New commercial building is not subject to natural environmental noise or man-made industrial noise. This building contains a standard office environment.	Low	Best grounding practices should be followed as closely as possible. Electromagnetic noise problems are not anticipated, but installing a best practice grounding system in a new building is often the least expensive route and the best way to plan for the future.
Existing commercial building is not subject to natural environmental noise or man-made industrial noise. This building contains a standard office environment.	Low	Best grounding practices should be followed as much as possible. Electromagnetic noise problems are not anticipated, but installing a best practice grounding system is always recommended.

**Note**

In all situations, grounding practices must comply with Section 250 of the National Electric Code (NEC) requirements or local laws and regulations. A 6 AWG grounding wire is preferred from the chassis to the rack ground or directly to the common bonding network (CBN). The equipment rack should also be connected to the CBN with 6 AWG grounding wire.

**Note**

In installations where FXS modules are installed, supplemental grounding is required.

**Note**

Always ensure that all of the modules are completely installed and that the captive installation screws are fully tightened. In addition, ensure that all I/O cables and power cords are properly seated. These practices are normal installation practices and must be followed in all installations.

**Caution**

Category 5e, Category 6, and Category 6a cables can store large levels of static electricity because of the dielectric properties of the materials used in their construction. Always ground the cables (especially in new cable runs) to a suitable and safe earth ground before connecting them to the module.

## Maintaining Safety with Electricity

When working on electrical equipment, follow these guidelines:

- Do not work alone if potentially hazardous conditions exist anywhere in your work space.
- Never assume that power is disconnected from a circuit; always check the circuit before working on it.
- Look carefully for possible hazards in your work area, such as damp floors, ungrounded power extension cables, frayed or damaged power cords, and missing safety grounds.
- If an electrical accident occurs, proceed as follows:
  - Use extreme caution; do not become a victim yourself.
  - Disconnect power from the system.
  - If possible, send another person to get medical aid. Otherwise assess the condition of the victim, and then call for help.
  - Determine if the person needs rescue breathing or external cardiac compressions; then take appropriate action.
- Use the product within its marked electrical ratings and product usage instructions.
- Install the product in compliance with local and national electrical codes.
- If any of the following conditions occur, contact the Cisco Technical Assistance Center:
  - The power cable or plug is damaged.
  - An object has fallen into the product.
  - The product has been exposed to water or other liquids.
  - The product has been dropped or shows signs of damage.
  - The product does not operate correctly when you follow the operating instructions.
- Use the correct external power source. Operate the product only from the type of power source indicated on the electrical ratings label. If you are not sure of the type of power source required, consult the Cisco Technical Assistance Center or a local electrician.
- Use approved power cables only. You have been provided with one or more power cables with your chassis power supply that are intended for use in your country, based on the shipping location. Should you need to purchase additional power cables, ensure that they are rated for the product and for the voltage and current marked on the product's electrical ratings label. The voltage and current rating of the power cable should be greater than the ratings marked on the label.
- To help prevent electrical shock, plug all power cables into properly grounded electrical outlets. These power cables are equipped with three-prong plugs to help ensure proper grounding. Do not use adapter plugs or remove the grounding prong from a power cable.
- Observe power strip ratings. Make sure that the total current rating of all products that are plugged into the power strip does not exceed 80 percent of the power strip rating.
- Do not modify power cables or plugs yourself. Consult with a licensed electrician or your power company for site modifications. Always follow your local and national wiring codes.

## Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when modules or other FRUs are improperly handled, results in intermittent or complete failures. Modules consist of printed circuit boards that are fixed in metal carriers. Electromagnetic interference (EMI) shielding and connectors are integral components of the carrier. Although the metal carrier helps to protect the board from ESD, always use an ESD grounding strap when handling modules.

To prevent ESD damage, follow these guidelines:

- Always use an ESD wrist strap and ensure that it makes maximum contact with bare skin. ESD grounding straps are available with banana plugs, metal spring clips, or alligator clips. All Catalyst 6500 series chassis are equipped with a banana plug connector (identified by the ground symbol next to the connector) somewhere on the front panel. If you have an older Catalyst 6500 series chassis equipped with a plastic banana plug connector, we recommend that you use either the supplied ESD grounding wrist strap (with a metal clip) or an ESD grounding wrist strap equipped with an alligator clip. If you have a newer Catalyst 6500 series chassis that has a bare metal hole as the banana plug connector (also identified by the ground symbol next to the connector), we recommend that you use a personal ESD grounding strap equipped with a banana plug.
- If you choose to use the disposable ESD wrist strap supplied with most FRUs or an ESD wrist strap equipped with an alligator clip, you must attach the system ground lug to the chassis in order to provide a proper grounding point for the ESD wrist strap.




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**Note** This system ground is also referred to as the network equipment building system (NEBS) ground.

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- If your chassis does not have the system ground attached, you must install the system ground. See [“Establishing the System Ground”](#) section on page 1-52 for installation instructions and locations of the chassis system ground pads.

After you install the system ground lug, follow these steps to correctly attach the ESD wrist strap:

- 
- Step 1** Attach the ESD wrist strap to bare skin as follows:
- If you are using the ESD wrist strap supplied with the FRUs, open the wrist strap package and unwrap the ESD wrist strap. Place the black conductive loop over your wrist and tighten the strap so that it makes good contact with your bare skin.
  - If you are using an ESD wrist strap equipped with an alligator clip, open the package and remove the ESD wrist strap. Locate the end of the wrist strap that attaches to your body and secure it to your bare skin.
- Step 2** Grasp the spring or alligator clip on the ESD wrist strap and momentarily touch the clip to a bare metal spot (unpainted surface) on the rack. We recommend that you touch the clip to an unpainted rack rail so that any built-up static charge is then safely dissipated to the entire rack.
- Step 3** Attach either the spring clip or the alligator clip to the ground lug screw as follows (See [Figure 1-11](#)):
- If you are using the ESD wrist strap that is supplied with the FRUs, squeeze the spring clip jaws open, position the spring clip to one side of the system ground lug screw head, and slide the spring clip over the lug screw head so that the spring clip jaws close behind the lug screw head.



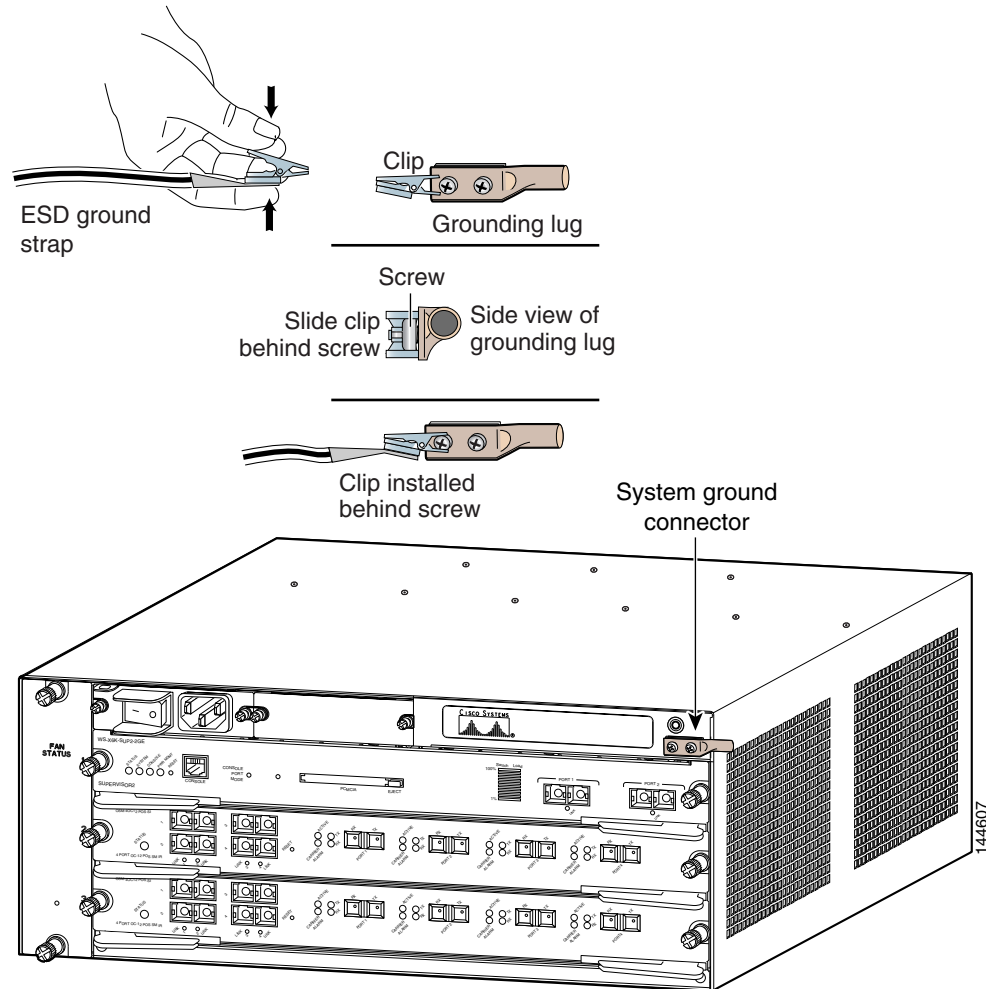

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**Note** The spring clip jaws do not open wide enough to fit directly over the head of the lug screw or the lug barrel.

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- b. If you are using an ESD wrist strap that is equipped with an alligator clip, attach the alligator clip directly over the head of the system ground lug screw or to the system ground lug barrel.

**Figure 1-11 Attaching the ESD Wrist Strap Clip to the System Ground Lug Screw**



When handling modules, follow these guidelines:

- Handle carriers by available handles or edges only; avoid touching the printed circuit boards or connectors.
- Place a removed component board-side-up on an antistatic surface or in a static shielding container. If you plan to return the component to the factory, immediately place it in a static shielding container.
- Never attempt to remove the printed circuit board from the metal carrier.



**Caution**

For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohm (Mohm).

# Power Requirements

When preparing your site for the switch installation, follow these requirements:

- In systems configured with two power supplies, connect each of the two power supplies to a separate input power source. If you fail to do this, your system might be susceptible to total power failure due to a fault in the external wiring or a tripped circuit breaker.
- To prevent a loss of input power, be sure that the total maximum load on each source circuit is within the current ratings of the wiring and breakers.
- In some systems, you may decide to use an uninterruptible power supply (UPS) to protect against power failures at your site. Be aware when selecting a UPS that some UPS models that use ferroresonant technology can become unstable when operating with the Catalyst 6500 series switch power supplies which use power factor correction (PFC). This can cause the output voltage waveform to the switch to become distorted resulting in an undervoltage situation in the system.
- The AC-input power supply has a detachable power cord (except for the 4000 W power supplies) that allows you to connect each power supply to the site power source. The 4000 W AC-input power supply power cords are hard-wired to the power supply and cannot be removed.
- You can connect the DC-input power supply to the power source with heavy-gauge wiring connected to a terminal block. The wire gauge size is determined by local electrical codes and restrictions.
- If you are using a 200/240 VAC power source in North America, the circuit must be protected by a two-pole circuit breaker.
- The source AC outlet must be within 6 feet (1.8 meters) of the system and should be easily accessible.
- 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.

## Power Connection Guidelines for AC-Powered Systems

This section provides the basic guidelines for connecting the Catalyst 6500 series switch AC power supplies to the site power source:

- Each chassis power supply should have a separate, dedicated branch circuit.
- For North America:
  - The 950 W power supply requires a 15 A circuit.
  - The 1000 W power supply requires a 15 A or 20 A circuit.
  - The 1300 W, 1400 W, 2500 W, 2700 W, and 3000 W power supplies require a 20 A circuit.
  - The 4000 W power supply requires a 30 A circuit.
  - The 6000 W power supply requires one or two 20 A circuits.
  - The 8700 W power supply requires one, two, or three 20 A circuits.

- For International:
  - Circuits should be sized according to local and national codes.
- If you are using a 200/240 VAC power source in North America, the circuit must be protected by a two-pole circuit breaker.
- The source AC outlet must be within 6 feet (1.8 meters) of the system and should be easily accessible.
- 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.

## Power Connection Guidelines for DC-Powered Systems

This section provides the basic guidelines for connecting the Catalyst 6500 series switch DC-input power supplies to the site power source:

- All power connection wiring should conform to the rules and regulations in the National Electrical Code (NEC), as well as any local codes.
- The DC return must remain isolated from the system frame and the chassis (DC-I).
- For DC power cables, we recommend that you use commensurately rated, high-strand-count copper wire cable. Connection to the DC-input power supply requires one earth ground cable, one source DC (–), and one source DC return (+). The length of the cables depends on your switch location. These cables are not available from Cisco Systems. They are available from any commercial cable vendor.
- 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 indicate that the cable is a ground cable. Because there is no color code standard for source DC wiring, you must ensure that the power cables are connected to the DC-input power supply terminal block in the proper (+) and (–) polarity. In some cases, 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 DC-input power supply terminal block.
- DC power cables must be terminated by cable lugs at the power supply end.
- The circuit breaker is considered to be the disconnect device and should be easily accessible.
- The circuit must be protected by a dedicated two-pole circuit breaker. The circuit breaker should be sized according to the power supply input rating and local or national code requirements.
- For proper DC-input redundant power configurations on systems with multiple-input DC-input power supplies, all pairs of source DC cables for one DC-input power supply must come from the same battery system (A feed); all pairs of source DC cables for the second DC-input power supply must come from a different battery system (B feed).
- For DC-input power supplies with multiple inputs, each DC input must be protected by a dedicated circuit breaker or a fuse. The circuit breaker or the fuse must be sized according to the power supply input rating and local or national electrical codes.

# Cabling Requirements

**Caution**

The intrabuilding port(s) of the equipment or subassembly is suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding port(s) of the equipment or subassembly must not be metallically connected to interfaces that connect to the Outside Plant (OSP) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection to connect these interfaces metallically to OSP wiring.

When running power and data cables together in overhead cable trays or subfloor cable trays, be aware of the following caution:

**Caution**

We strongly recommend that power cabling runs and other potential noise sources be located as far away as practical from LAN cabling that terminates on Cisco equipment. In situations, where this type of long parallel cable runs exist which cannot be separated by at least 3.3 feet (1 meter), we recommend that you shield these potential noise sources. To avoid interference, the source should be shielded by housing it in a grounded metallic conduit.

Also be aware of the following caution concerning the use of Category 5e and Category 6 Ethernet cables:

**Caution**

Category 5e, Category 6, and Category 6a cables can store large levels of static electricity because of the dielectric properties of the materials used in their construction. Always ground the cables (especially in new cable runs) to a suitable and safe earth ground before connecting them to the module.

## Site Preparation Checklist

[Table 1-4](#) lists the site planning activities that you should perform prior to installing the Catalyst 6500 series switch. Completing each activity helps ensure a successful switch installation.



Table 1-4 Site Planning Checklist

Task No.	Planning Activity	Verified By	Time	Date
1	Space evaluation: <ul style="list-style-type: none"> <li>• Space and layout</li> <li>• Floor covering</li> <li>• Impact and vibration</li> <li>• Lighting</li> <li>• Maintenance access</li> </ul>			
2	Environmental evaluation: <ul style="list-style-type: none"> <li>• Ambient temperature</li> <li>• Humidity</li> <li>• Altitude</li> <li>• Atmospheric contamination</li> <li>• Airflow</li> </ul>			
3	Power evaluation: <ul style="list-style-type: none"> <li>• Input power type</li> <li>• Power receptacles (Depends on power supply)<sup>1</sup></li> <li>• Receptacle proximity to the equipment</li> <li>• Dedicated (separate) circuits for redundant power supplies</li> <li>• UPS for power failures<sup>2</sup></li> <li>• DC systems: Proper gauge wire and lugs</li> </ul>			
4	Grounding evaluation: <ul style="list-style-type: none"> <li>• Circuit breaker size</li> <li>• CO ground (AC- and DC-powered systems)</li> </ul>			
5	Cable and interface equipment evaluation: <ul style="list-style-type: none"> <li>• Cable type</li> <li>• Connector type</li> <li>• Cable distance limitations</li> <li>• Interface equipment (transceivers)</li> </ul>			
6	EMI evaluation: <ul style="list-style-type: none"> <li>• Distance limitations for signaling</li> <li>• Site wiring</li> <li>• RFI levels</li> </ul>			

1. Verify that each power supply installed in the chassis has a dedicated AC source or DC source circuit.
2. Refer to the power supply's kVA rating as a sizing criteria in determining the output required by the UPS. The power supply's kVA rating value is listed in the specifications table for each power supply in Appendix A.





# CHAPTER 1

## Installing the Switch



### Note

In this publication, the term Catalyst 6500 series refers only to the switch chassis listed in Chapter 1. The Catalyst 6000 series switches (Catalyst 6006 and Catalyst 6009 switches) are described in a separate publication, the *Catalyst 6000 Series Switch Installation Guide*.

This chapter describes how to install a Catalyst 6500 series switch. The chapter is divided into sections that cover installing the different Catalyst 6500 series chassis. Pointers within the overall chassis installation procedures point to separate installation procedures that cover installing various components and assemblies. The process of installing the switch can be broken down into a series of tasks. These tasks are listed in [Table 1-1](#).

**Table 1-1** Catalyst 6500 Series Switch Installation Process

Task	Description
Unpacking the switch	Remove the switch from the packaging materials. <b>Note</b> We recommend that you save the packaging material for use later if you need to move the chassis.
Installing the switch	All Catalyst 6500 series chassis can be rack-mounted. Some chassis offer the option of installation as a freestanding unit through the use of rubber feet or stabilizer brackets.
Connecting the chassis to system ground	Construct and attach a system ground wire from the building (earth) ground to the system ground point on the chassis.
Installing and cabling the power supply or supplies	Normally, one power supply is shipped installed in the chassis. The second power supply, if part of the switch configuration, is shipped separately. You now install the second power supply and connect the power supplies to source power, either AC or DC.
Cabling the supervisor engine and modules to the network	The various ports on the supervisor engine and on the modules that are installed in the chassis must be connected to the network. This process can involve only attaching a network interface cable to the module port, or it can include the installation of a transceiver of some type in the supervisor engine or module port, and then attaching the network interface cable to the transceiver.
Powering up the chassis	After completing the network cabling and making sure that system ground is connected, the power supplies can be turned on. The system powers up and runs through a set of built-in diagnostics.

The chapter contains the following sections:

- [Rack-Mounting Guidelines, page 1-3](#)
- [Unpacking the Switch, page 1-5](#)
- [Chassis Installation Kits and Cable Guides, page 1-5](#)
- [Installing a Catalyst 6503 or Catalyst 6503-E Switch Chassis, page 1-8](#)
- [Installing a Catalyst 6504-E Switch Chassis, page 1-12](#)
- [Installing a Catalyst 6506 or Catalyst 6506-E Switch Chassis, page 1-17](#)
- [Installing a Catalyst 6509 or Catalyst 6509-E Switch Chassis, page 1-21](#)
- [Installing a Catalyst 6509-NEB or Catalyst 6509-NEB-A Switch Chassis, page 1-26](#)
- [Installing a Catalyst 6509-V-E Switch Chassis, page 1-36](#)
- [Installing a Catalyst 6513 or Catalyst 6513-E Switch Chassis, page 1-42](#)
- [Generic Installation Procedures, page 1-47](#)
- [Establishing the System Ground, page 1-52](#)
- [Installing the Power Supplies in the Switch Chassis, page 1-61](#)
- [Attaching the Interface Cables, page 1-61](#)
- [Verifying Switch Chassis Installation, page 1-84](#)



**Warning**

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**Class 1 laser product.** Statement 1008

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**Warning**

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**This unit is intended for installation in restricted access areas. A restricted access area can be accessed only through the use of a special tool, lock and key, or other means of security.**

Statement 1017

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**Warning**

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**Only trained and qualified personnel should be allowed to install, replace, or service this equipment.**

Statement 1030

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**Warning**

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**Ultimate disposal of this product should be handled according to all national laws and regulations.**

Statement 1040

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**Warning**

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**This equipment must be installed and maintained by service personnel as defined by AS/NZS 3260. Incorrectly connecting this equipment to a general-purpose outlet could be hazardous. The telecommunications lines must be disconnected 1) before unplugging the main power connector or 2) while the housing is open, or both.** Statement 1043

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**Warning**

**This product requires short-circuit (overcurrent) protection, to be provided as part of the building installation. Install only in accordance with national and local wiring regulations.** Statement 1045

**Warning**

**During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.** Statement 94

**Note**

If you are installing a freestanding (not rack-mounted) Catalyst 6509-NEB, Catalyst 6513, or Catalyst 6513-E switch, you must install the stabilizer bracket kit, which is included as part of the accessory kit for these two switch chassis.

Before starting the installation procedures in this chapter, see the “[Site Preparation Checklist](#)” section on page 1-24 to verify that all site planning activities were completed.

## Rack-Mounting Guidelines

The Catalyst 6500 series switches are designed to be installed in both open and enclosed racks. Before rack-mounting the switch, ensure that the equipment rack complies with the following guidelines:

- The width of the rack, measured between the two front-mounting strips or rails, must be 17.75 inches (45.09 cm).
- The depth of the rack, measured between the front- and rear-mounting strips, must be at least 19.25 inches (48.9 cm).

**Note**

All of the Catalyst 6500 series switch chassis are designed to install in standard 19-inch racks.

- The rack must have sufficient vertical clearance to insert the chassis. These are the chassis heights:

Catalyst Switch Chassis	Height		
6503	7 inches	17.8 cm	4 RU
6503-E	7 inches	17.8 cm	4 RU
6504-E	8.7 inches	22.1 cm	5 RU
6506	20.1 inches	51.1 cm	12 RU
6506-E	19.2 inches	48.8 cm	11 RU
6509	25.2 inches	64.0 cm	15 RU
6509-E	24.5 inches	62.2 cm	14 RU
6509-NEB	33.3 inches	84.6 cm	20 RU
6509-NEB-A	36.65 inches	93.1 cm	21 RU
6509-V-E	36.65 inches	93.1 cm	21 RU
6513	33.3 inches	84.6 cm	20 RU
6513-E	33.3 inches	84.6 cm	20 RU

**Note**

Chassis height is sometimes measured in rack units (RU or just U) where 1 RU or 1 U equals 1.75 in (44.45 mm). A typical server rack is 42 RU or 42 U in height.

**Caution**

If the rack is on wheels, ensure that the brakes are engaged and that the rack is stabilized.

**Warning**

**To prevent bodily injury when mounting or servicing this unit in a rack, you must take special precautions to ensure that the system remains stable. The following guidelines are provided to ensure your safety:**

- **This unit should be mounted at the bottom of the rack if it is the only unit in the rack.**
- **When mounting this unit in a partially filled rack, load the rack from the bottom to the top with the heaviest component at the bottom of the rack.**
- **If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the unit in the rack.** Statement 1006

**Note**

To maintain proper air circulation through the Catalyst switch chassis, we recommend that you maintain a minimum 6-inch (15 cm) separation between a wall and the chassis air intake or a wall and the chassis air exhaust. You should also allow a minimum separation of 12 inches (30.5 cm) between the hot air exhaust on one chassis and the air intake on another chassis. Failure to maintain adequate air space can cause the chassis to overheat and the system to fail. On Catalyst switch chassis in which the airflow is from front to back, the chassis may be placed side-by-side.

# Unpacking the Switch



**Tip**

Do not discard the shipping container when you unpack the switch. Flatten the shipping cartons and store them with the pallet. You will need these containers if you need to move or ship the switch in the future. Repacking instructions are provided in [Appendix A, “Repacking the Switch.”](#)

To check the contents of the shipping container, perform the following:

- Check the contents of the accessory kit. Verify that you received all listed equipment, which should include the following:
  - Optional equipment that you ordered, such as network interface cables, transceivers, or special connectors
- Check the modules in each slot. Ensure that the configuration matches the packing list and that all of the specified interfaces are included.
- Blank power supply covers are shipped as part of the accessory kit. They are not installed on the chassis.



**Note**

The Catalyst 6503-E and the Catalyst 6504-E switch chassis are shipped with a shipping bracket installed across the front of the chassis slots. Do not remove the shipping bracket at this time; remove the shipping bracket after you have installed the chassis in the rack.

## Chassis Installation Kits and Cable Guides

Each Catalyst 6500 series chassis ships with an accessory kit. Shipped as part of the accessory kit are chassis installation kits and cable guides. The chassis installation kits and cable guide contents vary between chassis. Installation kits and cable guides for each Catalyst 6500 series chassis are listed in [Table 1-2](#).

**Table 1-2**      **Chassis Installation Kits and Cable Guides**

Chassis	Installation Kits and Cable Guides
Catalyst 6503 and Catalyst 6503-E	<ul style="list-style-type: none"> <li>• Standard 19-inch rack-mount brackets (factory-installed on the chassis). Associated rack-mounting hardware is included in the accessory kit.</li> <li>• Two 3-slot cable management guides are included in the accessory kit.</li> </ul>
Catalyst 6504-E	<ul style="list-style-type: none"> <li>• Standard 19-inch L brackets (factory-installed on the chassis). Associated rack-mounting hardware is included in the accessory kit.</li> <li>• Two 4-slot cable management guides are included in the accessory kit.</li> </ul>

Table 1-2 Chassis Installation Kits and Cable Guides (continued)

Chassis	Installation Kits and Cable Guides
Catalyst 6506 and Catalyst 6506-E	<ul style="list-style-type: none"> <li>• Standard 19-inch rack-mount L brackets (factory-installed on the chassis). Associated rack-mounting hardware is included in the accessory kit.</li> <li>• 3 RU rack-mount shelf kit is included in the accessory kit.</li> <li>• Two 6-slot cable management guides are included in the accessory kit.</li> <li>• Catalyst 6506-E only—Rubber feet installation kit is included in the accessory kit. (The kit is used when installing the chassis as a freestanding unit on a table or shelf.)</li> </ul> <p><b>Note</b> An optional center rack-mount kit for 23-inch, telco-style racks is available for both of these chassis. The kit is not included as part of the standard accessory kit, but is available as a separately orderable item (WS-C6597=). Installation instructions are included with the kit.</p>
Catalyst 6509 and Catalyst 6509-E	<ul style="list-style-type: none"> <li>• Standard 19-inch rack-mount L brackets (factory-installed on the chassis). Associated rack-mounting hardware is included in the accessory kit.</li> <li>• 3 RU rack-mount shelf kit is included in the accessory kit.</li> <li>• Two 9-slot cable management guides are included in the accessory kit.</li> <li>• Catalyst 6509-E only—Rubber feet installation kit is included in the accessory kit. (The kit is used when installing the chassis as a freestanding unit on a table or shelf.)</li> </ul> <p><b>Note</b> An optional center rack-mount kit for 23-inch, telco-style racks is available for both of these chassis. The kit is not included as part of the standard accessory kit, but is available as a separately orderable item (WS-C6597=). Installation instructions are included with the kit.</p>
Catalyst 6509-NEB	<ul style="list-style-type: none"> <li>• Standard 19-inch rack-mount L brackets (factory-installed on the chassis). Associated rack-mounting hardware is included in the accessory kit.</li> <li>• 3 RU rack-mount shelf kit is included in the accessory kit.</li> <li>• Stabilizer bracket installation kit is included in the accessory kit. (The kit is required when installing the chassis as a freestanding unit.)</li> <li>• One cable management guide is included in the accessory kit.</li> </ul>



**Table 1-2** Chassis Installation Kits and Cable Guides (continued)

<b>Chassis</b>	<b>Installation Kits and Cable Guides</b>
Catalyst 6509-NEB-A	<ul style="list-style-type: none"> <li>• Standard 19-inch rack-mount L brackets (factory-installed on the chassis). Associated rack-mounting hardware is included in the accessory kit.</li> <li>• 3 RU rack-mount shelf kit is included in the accessory kit.</li> <li>• One 9-slot vertical chassis cable management system is included in the accessory kit.</li> </ul>
Catalyst 6509-V-E	<ul style="list-style-type: none"> <li>• Standard 19-inch rack-mount L brackets (factory-installed on the chassis). Associated rack-mounting hardware is included in the accessory kit.</li> <li>• 3 RU rack-mount shelf kit is included in the accessory kit.</li> <li>• One cable management system is included in the accessory kit.</li> </ul>
Catalyst 6513 or Catalyst 6513-E	<ul style="list-style-type: none"> <li>• Standard 19-inch rack-mount L brackets (factory-installed on the chassis). Associated rack-mounting hardware is included in the accessory kit.</li> <li>• 3 RU rack-mount shelf kit is included in the accessory kit.</li> <li>• Stabilizer bracket installation kit is included in the accessory kit. (The kit is required when installing the chassis as a freestanding unit.)</li> <li>• Two 13-slot cable management guides are included in the accessory kit.</li> </ul> <p><b>Note</b> An optional center rack-mount kit for 23-inch, telco-style racks is available for this chassis. The kit is not included as part of the standard accessory kit, but is available as a separately orderable item (WS-6513-RACK-MNT=). Installation instructions are included with the kit.</p>

# Installing a Catalyst 6503 or Catalyst 6503-E Switch Chassis

This section provides procedures for installing either a Catalyst 6503 or a Catalyst 6503-E switch chassis in a rack assembly and installing the optional cable guide assemblies.

## Installation Accessory Kit

The Catalyst 6503 and Catalyst 6503-E switch chassis are both designed to be installed in a standard 19-inch rack, either open or enclosed, using 19-inch rack-mount brackets that are factory installed on the left-front and right-front of the chassis. Included in the installation accessory kit are both 10-32 x 0.75-inch and 12-24 x 0.75-inch screws that are used to secure the chassis in the rack.

**Note**

Depending on the manufacturer, the rack posts might be prethreaded to accept either 10-32 or 12-24 screws. If the rack posts are not prethreaded, you must install 10-32 or 12-24 clip nuts or cage nuts to secure the rack-mount screws. The clip nuts or the cage nuts are not included as part of the accessory kit and must be obtained on your own.

Also included in the accessory kit are two optional cable guides. The two cable guides are installed on the front left- and right-sides of the chassis using the same sets of screws (either 10-32 or 12-24) that secure the chassis rack-mount brackets to the rack posts.

## Rack-Mount Brackets on the Catalyst 6503 and the Catalyst 6503-E Switch Chassis

The Catalyst 6503 and the Catalyst 6503-E switch chassis are shipped with the two rack-mount brackets factory-installed on the front sides of the chassis. The rack-mount brackets are secured to the chassis with eight M3 Phillips-head countersunk screws (four screws on each side) as shown in [Figure 1-1](#).

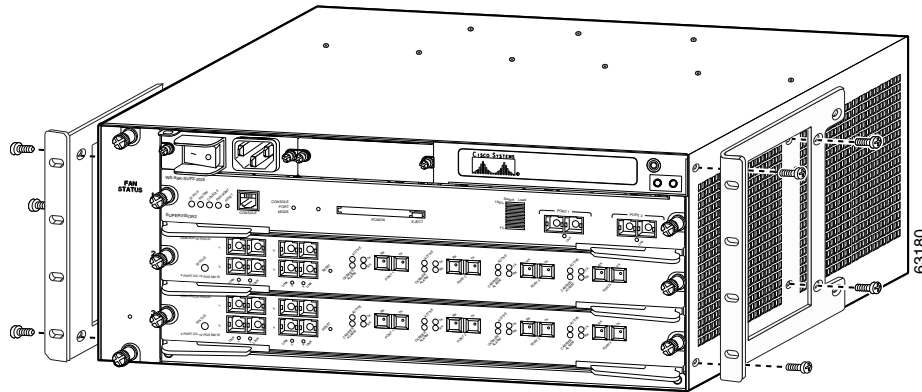
**Note**

The Catalyst 6503-E chassis has a chassis shipping bracket installed across the module slots. The bracket has been removed for clarity in [Figure 1-1](#). The Catalyst 6503 switch chassis does not have this shipping bracket.

**Note**

The rack-mount brackets can also be reversed and installed on the rear of the chassis as an alternative method of installation.

**Figure 1-1** Rack-Mount Brackets on the Catalyst 6503 and the Catalyst 6503-E Switch Chassis



## Rack-Mounting the Chassis



### Note

The chassis are designed to be mounted in equipment racks that meet ANSI/EIA 310-D and ETS 300-119 standards.



### Warning

**Two people are required to lift the chassis. To prevent injury, keep your back straight and lift with your legs, not your back.** Statement 164



### Tip

We recommend that you have a third person to assist in this procedure.

To install the switch chassis into the equipment rack, follow these steps:

- Step 1** Determine the positioning of the chassis in the rack enclosure. Identify the rack post holes that will be used. If the rack post holes are prethreaded, determine if the threads are 10-32 or 12-24. If the rack post holes are unthreaded, install either 10-32 or 12-24 clip or cage nuts over the holes to accept the installation screws.

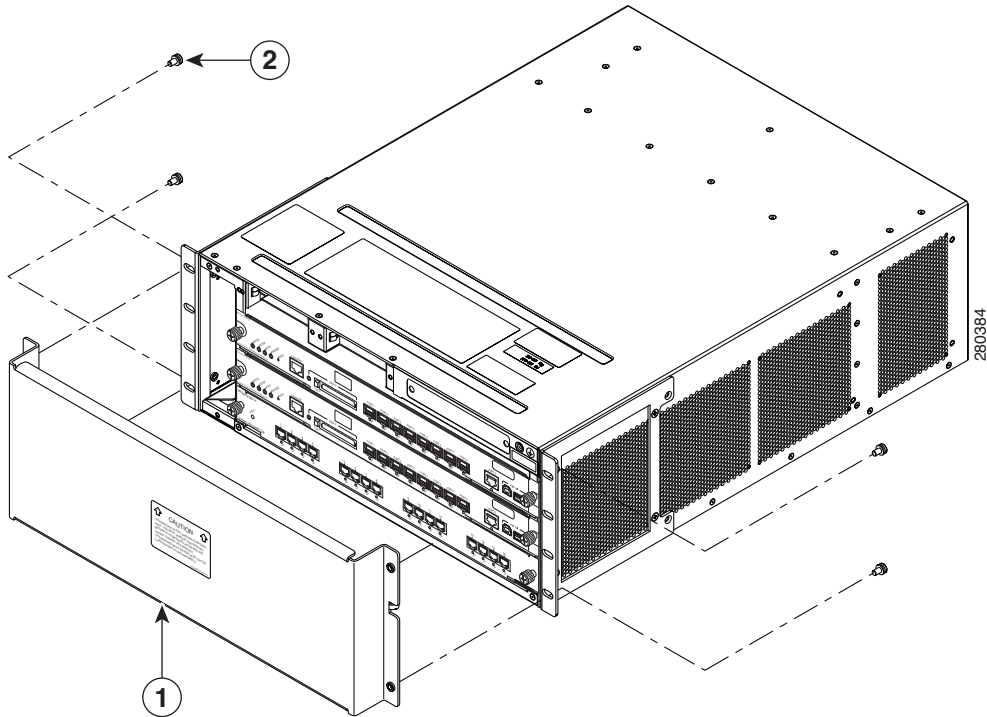


### Note

Clip or cage nuts are not included as part of the accessory kit that comes with the chassis. You must obtain them yourself.

- Step 2** If you are installing a Catalyst 6503-E switch chassis, you must remove the chassis shipping bracket before you install the chassis in the rack. Perform the following substeps:
- Loosen and remove the four M5 screws that secure the chassis shipping bracket to the chassis rack mount brackets. (See [Figure 1-2](#).)
  - Lift up slightly on the shipping bracket to disengage the two bracket hooks from the rack-mount brackets.
  - Remove the shipping bracket and save it. You must reinstall the shipping bracket if you relocate the chassis.

**Figure 1-2** Removing the Catalyst 6503-E Chassis Shipping Bracket



<b>1</b>	Chassis shipping bracket	<b>2</b>	M5 Phillips-head screws (4x)
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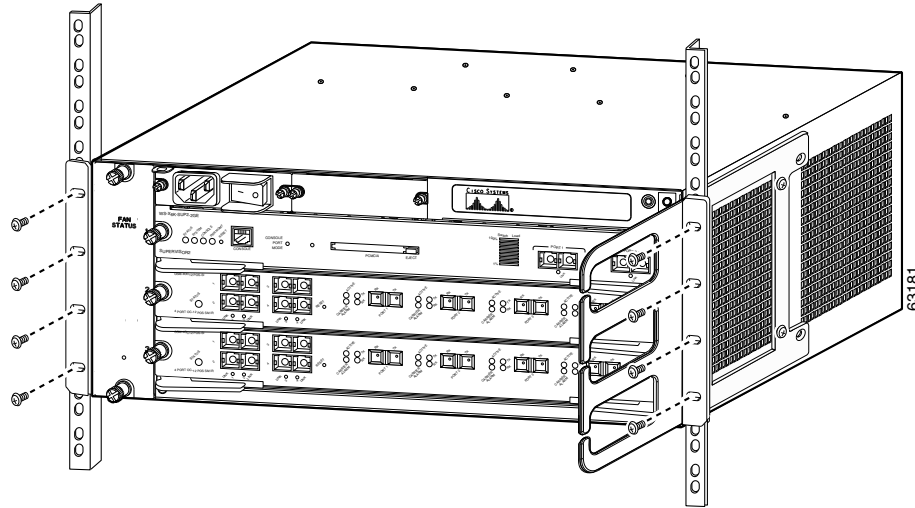
- Step 3** With a person standing at each side of the chassis, grasp the chassis handle with one hand, and use the other hand near the back of the chassis for balance. Slowly lift the chassis in unison. Avoid sudden twists or moves to prevent injury.



- Tip** Have a third person install the rack-mount screws while two people support the chassis in the rack enclosure.

- Step 4** Align the mounting holes in the rack-mount bracket with the mounting holes in the equipment rack.
- Step 5** If you want to install one or both of the optional cable guides, position the cable guide so that the cable guide mounting holes are aligned with rack-mount holes and the rack post holes. (See [Figure 1-3](#).)
- Step 6** Install a minimum of eight 10-32 or 12-24 screws (four on each side) through the cable guide mounting holes, rack-mount bracket holes, rack post holes, and into the clip nuts to secure the cable guides and the chassis to the rack post. (See [Figure 1-3](#).)
- Step 7** Use a tape measure or level to verify that the chassis is installed straight and level.

**Figure 1-3** Installing a Catalyst 6503 or Catalyst 6503-E Switch Chassis in a Rack



## What is Next

After installing the chassis in its location, complete the installation process by following these procedures:

- Connecting the chassis to system ground. See [“Establishing the System Ground”](#) section on page 1-52.
- Installing and connecting the Power Entry Modules (PEMs) and the power supplies to source power. Go to Chapter 4 for information on how to install and cable the PEMs and the power supplies.
- Connecting the network interface cables to the supervisor engine and modules. This may involve installing transceivers before you attach the network interface cables. See [“Attaching the Interface Cables”](#) section on page 1-61.
- Powering-up the chassis and verifying the installation. See [“Verifying Switch Chassis Installation”](#) section on page 1-84.

## Optional Installation Kits

There are no optional installation kits available for either the Catalyst 6503 or the Catalyst 6503-E switch chassis.

# Installing a Catalyst 6504-E Switch Chassis

This section provides procedures for installing a Catalyst 6504-E switch chassis in a rack assembly and installing the optional cable guide assemblies.

## Installation Accessory Kit

The Catalyst 6504-E switch chassis is designed to be installed in a standard 19-inch rack, either open or enclosed. The chassis is shipped with the 19-inch rack-mount L brackets factory installed on the left-front and right-front of the chassis. Included in the accessory kit are both 10-32 x 0.75-inch and 12-24 x 0.75-inch screws that are used to secure the chassis in the rack.

**Note**

Depending on the manufacturer, the rack posts might be prethreaded to accept either 10-32 or 12-24 screws. If the rack posts are not prethreaded, you must install 10-32 or 12-24 clip nuts or cage nuts to secure the rack-mount screws. The clip nuts or the cage nuts are not included as part of the accessory kit and must be obtained on your own.

Also included in the accessory kit are two optional cable guides. The two cable guides are installed on the front left- and right-side of the chassis using the same sets of screws (10-32 or 12-24) that secure the chassis rack-mount L brackets to the rack posts.

## L Brackets on the Catalyst 6504-E Switch Chassis

The Catalyst 6504-E switch chassis is shipped with the two L brackets installed on the front sides of the chassis. The L brackets are secured to the chassis with six M4 Phillips-head countersunk screws (three screws on each side) as shown in [Figure 1-4](#).

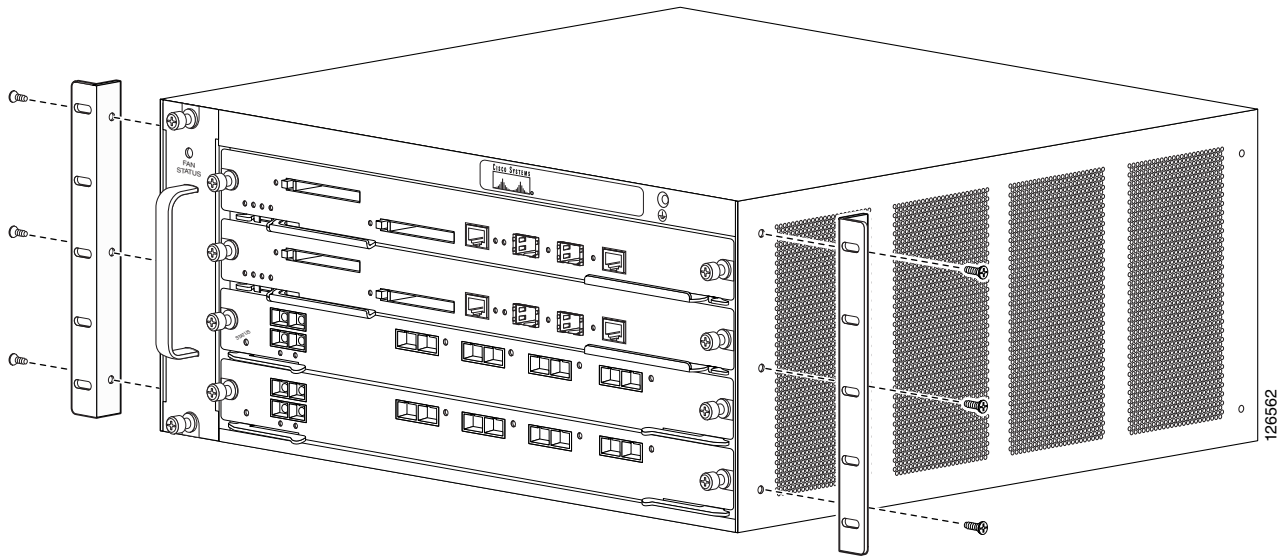
**Note**

The Catalyst 6504-E chassis has a chassis shipping bracket installed across the module slots. The bracket has been removed in [Figure 1-4](#) for clarity.

**Note**

The L brackets can also be reversed and installed on the rear of the chassis as an alternative method of installation.

Figure 1-4 L Brackets on the Catalyst 6504-E Switch Chassis



## Rack-Mounting the Chassis



### Note

The chassis are designed to be mounted in equipment racks that meet ANSI/EIA 310-D and ETS 300-119 standards.



### Warning

**Two people are required to lift the chassis. To prevent injury, keep your back straight and lift with your legs, not your back.** Statement 164



### Tip

We recommend that you have a third person to assist in this procedure.

To install the switch chassis into the equipment rack, follow these steps:

### Step 1

Determine the positioning of the chassis in the rack enclosure. Identify the rack post holes that will be used. If the rack post holes are prethreaded, determine if the threads are 10-32 or 12-24. If the rack post holes are unthreaded, install either 10-32 or 12-24 clip or cage nuts over the holes to accept the installation screws.

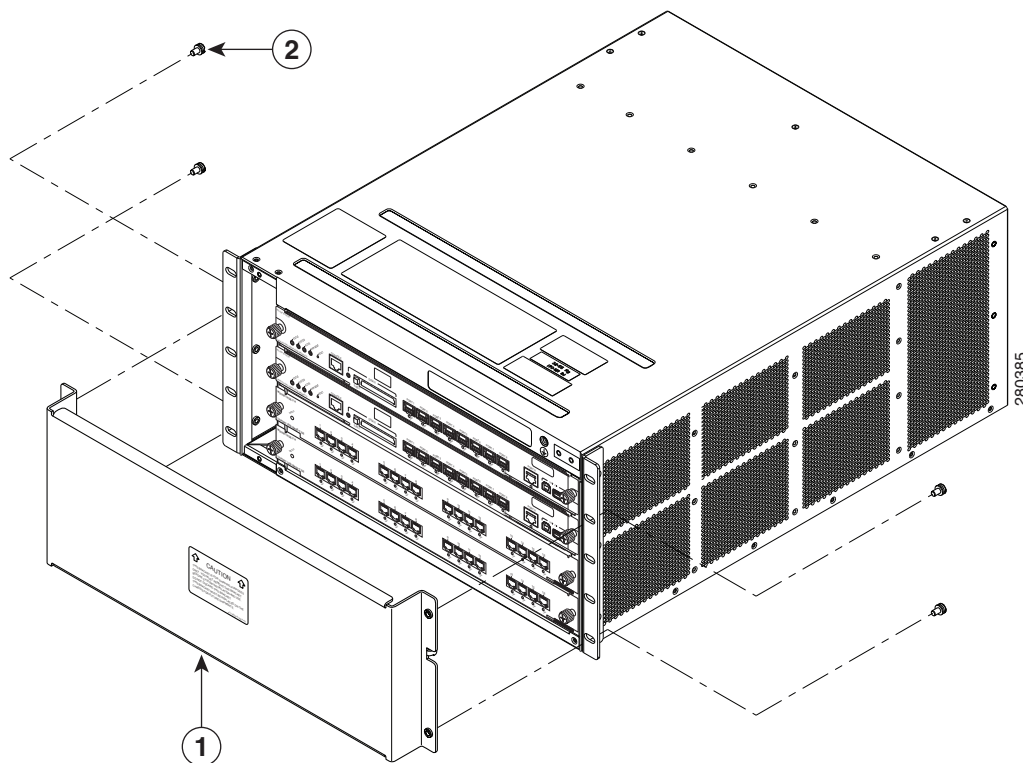


### Note

Clip or cage nuts are not included as part of the accessory kit that comes with the chassis. You must obtain them yourself.

- Step 2** Remove the chassis shipping bracket before you install the chassis in the rack. Perform the following substeps:
- Loosen and remove the four M5 screws that secure the chassis shipping bracket to the chassis rack mount brackets. (See [Figure 1-5](#).)
  - Lift up slightly on the shipping bracket to disengage the two shipping bracket hooks from the rack-mount L brackets.
  - Remove the shipping bracket and save it. You must reinstall the shipping bracket if you relocate the chassis.

**Figure 1-5** Removing the Catalyst 6504-E Chassis Shipping Bracket



1	Chassis shipping bracket	2	M5 Phillips-head screws (4x)
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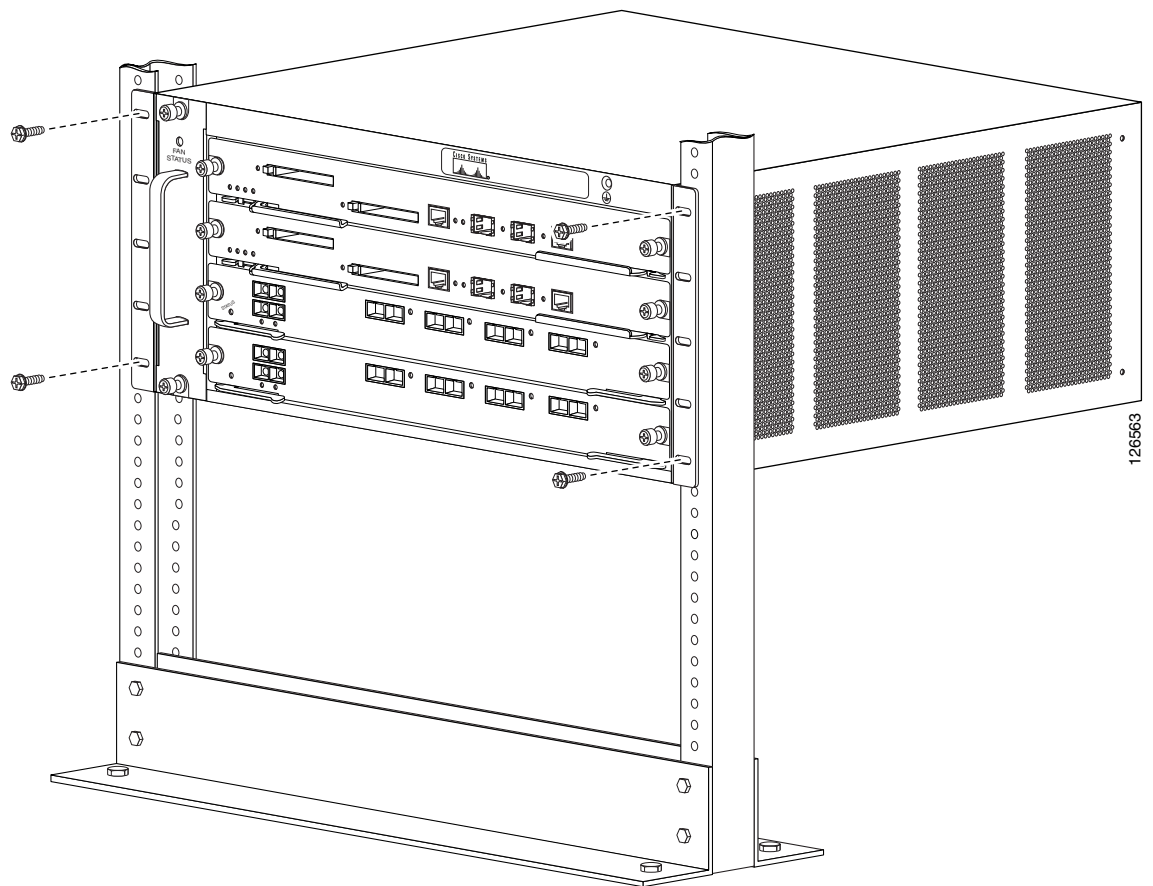
- Step 3** With a person standing at each side of the chassis, grasp the chassis handle with one hand, and use the other hand near the back of the chassis for balance. Slowly lift the chassis in unison. Avoid sudden twists or moves to prevent injury.



**Tip** Have a third person install the rack-mount screws while two people support the chassis in the rack enclosure.

- Step 4** Align the mounting holes in the rack-mount bracket with the mounting holes in the equipment rack.
- Step 5** If you want to install one or both of the optional cable guides, position the cable guides so that the cable guide mounting holes are aligned with rack-mount holes and the rack post holes.
- Step 6** Install a minimum of eight 10-32 or 12-24 screws (four on each side) through the cable guide mounting holes, rack-mount bracket holes, rack post holes, and into the clip nuts to secure the cable guides and the chassis to the rack post. (See [Figure 1-6](#).)
- Step 7** Use a tape measure or a level to verify that the chassis is installed straight and level.

**Figure 1-6** Installing a Catalyst 6504-E Switch Chassis in a Rack



## What is Next

After installing the chassis in its location, continue with the installation process by following these procedures:

- Connecting the chassis to system ground. See [“Establishing the System Ground” section on page 1-52](#).
- Installing and connecting the power supplies to source power. Go to Chapter 4 for information on how to install and cable power supplies.
- Connecting the network interface cables to the supervisor engine and modules. This may involve installing transceivers before you attach the network interface cables. See [“Attaching the Interface Cables” section on page 1-61](#).
- Powering-up the chassis and verifying the installation. See [“Verifying Switch Chassis Installation” section on page 1-84](#).

## Optional Installation Kits

There are no optional installation kits available for the Catalyst 6504-E switch chassis.

# Installing a Catalyst 6506 or Catalyst 6506-E Switch Chassis

This section provides procedures for installing either a Catalyst 6506 or a Catalyst 6506-E switch chassis in a rack assembly and installing the optional cable guide assemblies.

## Installation Accessory Kits

The Catalyst 6506 and Catalyst 6506-E switch chassis are designed to be installed in a standard 19-inch rack, either open or enclosed. Both chassis are normally shipped with the 19-inch rack-mount L brackets factory installed on the left-front and right-front of the chassis. Included with the accessory kit are 10-32 x 0.75-inch and 12-24 x 0.75-inch screws that are used to secure the chassis in the rack enclosure.

**Note**

Depending on the manufacturer, the rack posts might be prethreaded to accept either 10-32 or 12-24 screws. If the rack posts are not prethreaded, you must install 10-32 or 12-24 clip nuts or cage nuts to secure the rack-mount screws. The clip nuts or the cage nuts are not included as part of the accessory kit and must be obtained on your own.

Depending on the chassis model, the accessory kit might also contain the following chassis installation kits:

- Rack-mount shelf kit (Catalyst 6506 and Catalyst 6506-E). The rack-mount shelf kit is used to support the weight of the chassis while you secure the chassis L brackets to the rack enclosure.
- Rubber feet mount kit (Catalyst 6506-E accessory kit only). This kit should be installed when you want to install the Catalyst 6506-E chassis as a freestanding unit on a shelf or a table.

Also included in the accessory kit:

- Two optional cable guides—The two cable guides are installed on the front left- and right-sides of the chassis using the same sets of screws (either 10-32 or 12-24) that secure the chassis rack-mount L brackets to the rack posts.
- Power supply blank panel—The power supply blank panel must be installed on an unused power supply bay to maintain chassis airflow and EMI shielding.

## L Brackets on the Catalyst 6506 and the Catalyst 6506-E Switch Chassis

The Catalyst 6506 and the Catalyst 6506-E switch chassis are shipped with two L brackets installed on the front sides of the chassis. The L brackets are secured to the chassis with eight M3 Phillips-head countersunk screws (four M3 screws on each side) as shown in [Figure 1-7](#).

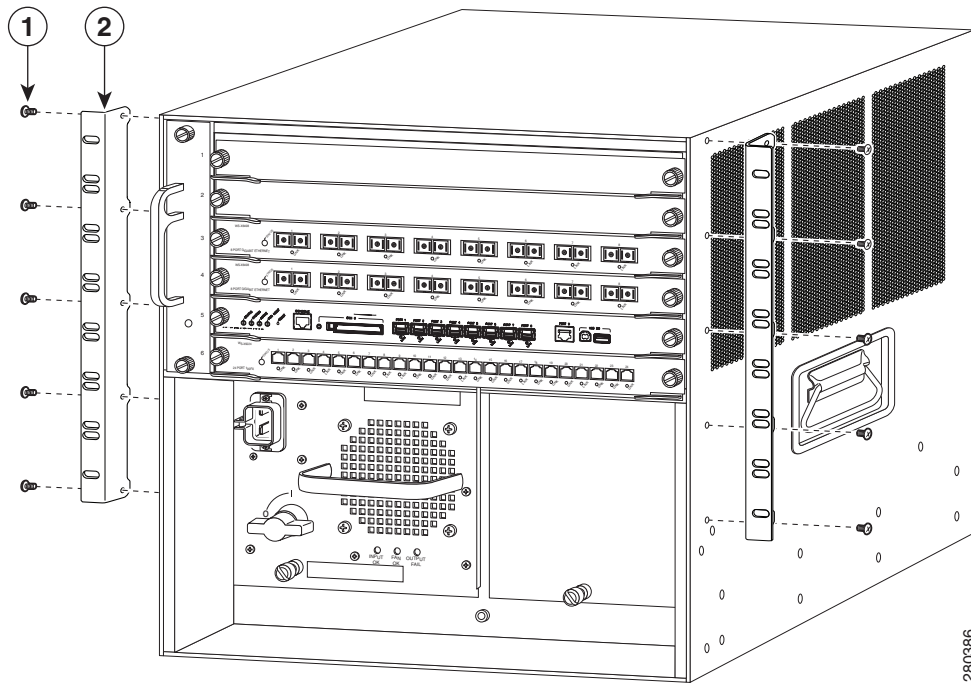
**Note**

The L brackets can also be reversed and installed on the rear of the chassis as an alternative method of installation.

**Note**

The L brackets for the Catalyst 6506 and Catalyst 6506-E switches are stamped with an L and an R to identify them as left and right.

**Figure 1-7** L Brackets on the Catalyst 6506 and the Catalyst 6506-E Switch Chassis



1	M4 Phillips-head countersunk screws (10x)	2	Rack-mount L bracket (2x)
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## Installing the 3 RU Rack-Mount Shelf Kit

The 3 RU rack-mount shelf kit is included as part of the accessory kit for both the Catalyst 6506 and the Catalyst 6506-E switch chassis. You need to install this kit first before you install the chassis in the rack. The shelf kit supports the weight of the chassis while you install and secure the chassis in the rack.

The procedure for installing the shelf kit is located at [“Installing the 3 RU Rack-Mount Shelf Kit” section on page 1-47.](#)

## Rack-Mounting the Chassis

**Note**

The chassis are designed to be mounted in equipment racks that meet ANSI/EIA 310-D and ETS 300-119 standards.


**Warning**

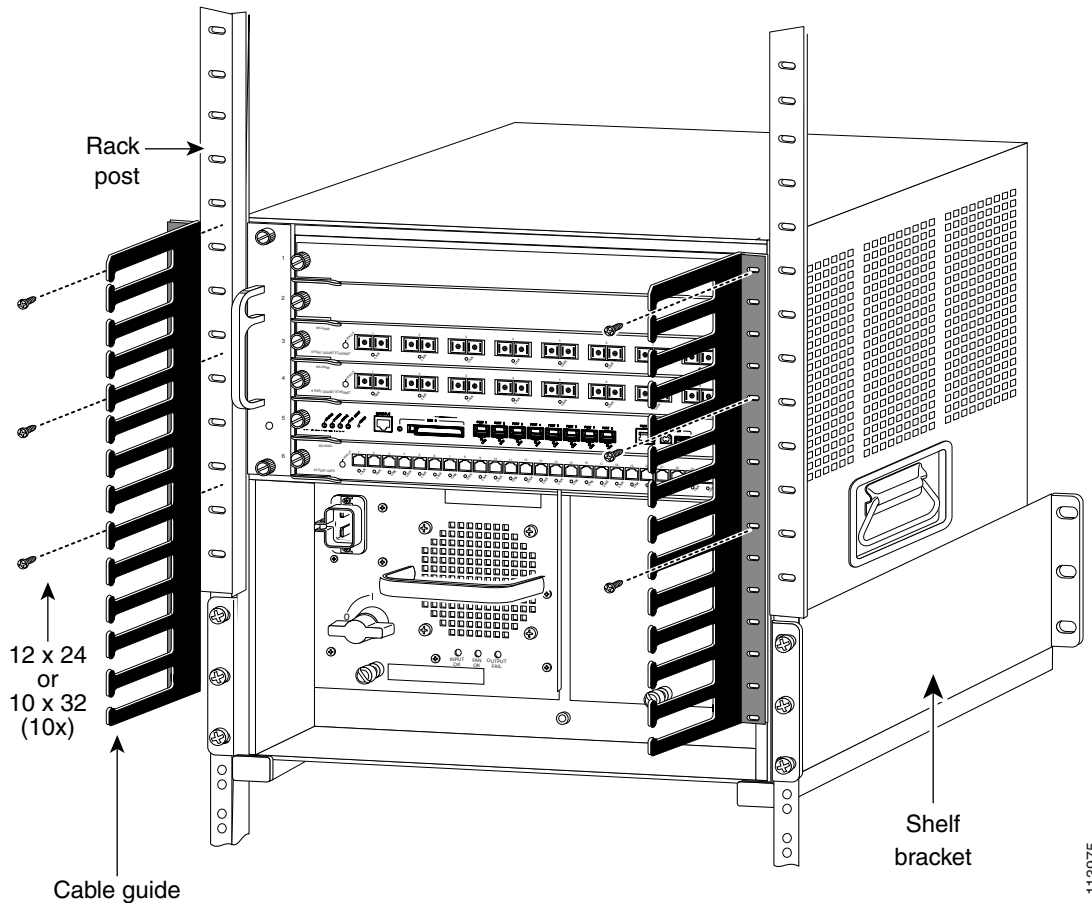
**Two people are required to lift the chassis. To prevent injury, keep your back straight and lift with your legs, not your back.** Statement 164

**Tip**

We recommend that you have a third person to assist in this procedure.

To install the switch chassis into the equipment rack, follow these steps:

- Step 1** With a person standing at each side of the chassis, grasp the chassis handle with one hand, and use the other hand near the back of the chassis for balance. Slowly lift the chassis in unison. Avoid sudden twists or moves to prevent injury.
- Step 2** Rest the back end of the chassis on the edges of the rack-mount shelf kit rails and carefully slide the chassis fully into the rack.
- Step 3** Locate the rack post holes that align with the chassis L bracket holes. If the rack post holes are prethreaded, determine if the threads are 10-32 or 12-24. If the rack post holes are unthreaded, install a minimum of eight (four on each side) either 10-32 or 12-24 clip or cage nuts over the rack post holes to accept the installation screws.
-  **Note** Clip nuts or cage nuts are not included as part of the accessory kit that comes with the chassis. You must obtain them yourself.
- Step 4** If you want to install one or both of the optional cable guides, position the cable guides so that the cable guide mounting holes are aligned with rack-mount bracket holes and the rack post holes. (See [Figure 1-8](#).)
- Step 5** Install a minimum of eight 10-32 or 12-24 screws (four on each side) through the cable guide mounting holes, rack-mount L bracket holes, rack post holes, and into the clip nuts to secure the cable guides and the chassis to the rack post. Tighten the screws securely.

**Figure 1-8** Installing a Catalyst 6506 or a Catalyst 6506-E Switch in a Rack

## What is Next

After installing the chassis in its location, complete the installation process by following these procedures:

- Connecting the chassis to system ground. See [“Establishing the System Ground”](#) section on page 1-52.
- Installing and connecting the power supplies to source power. Go to Chapter 4 for information on how to install and cable power supplies.
- Connecting the network interface cables to the supervisor engine and modules. This may involve installing transceivers before you attach the network interface cables. See [“Attaching the Interface Cables”](#) section on page 1-61.
- Powering-up the chassis and verifying the installation. See [“Verifying Switch Chassis Installation”](#) section on page 1-84.

## Optional Installation Kits

An optional rubber feet installation kit is included in the accessory kit for the Catalyst 6506-E switch chassis. This kit contains the parts necessary to install four non-slip rubber feet on the bottom of the chassis allowing the chassis to be placed on a shelf or a table. To install the rubber feet, go to [“Installing the Rubber Feet Kit” section on page 1-50](#).

A center rack-mount kit for 23-inch, telco-style racks is available as an option for both the Catalyst 6506 and the Catalyst 6506-E switch chassis. The kit is not included in the accessory kits, but is available as a separately orderable item (p/n WS-C6597=). Installation instructions are included with the kit.

## Installing a Catalyst 6509 or Catalyst 6509-E Switch Chassis

This section provides procedures for installing either a Catalyst 6509 or a Catalyst 6509-E switch chassis in a rack assembly and installing the optional cable guide assemblies.

### Installation Accessory Kits

The Catalyst 6509 and Catalyst 6509-E switch chassis are designed to be installed in a standard 19-inch rack, either open or enclosed. Both chassis are normally shipped with the 19-inch rack-mount L brackets factory installed on the left-front and right-front of the chassis. Included with the accessory kit are 10-32 x 0.75-inch and 12-24 x 0.75-inch screws that are used to secure the chassis in the rack enclosure.

**Note**

Depending on the manufacturer, the rack posts might be prethreaded to accept either 10-32 or 12-24 screws. If the rack posts are not prethreaded, you must install 10-32 or 12-24 clip nuts or cage nuts to secure the rack-mount screws. The clip nuts or the cage nuts are not included as part of the accessory kit and must be obtained on your own.

Depending on the chassis model, the accessory kit might also contain the following chassis installation kits:

- Rack-mount shelf kit (Catalyst 6509 and Catalyst 6509-E). The rack-mount shelf kit is used to support the weight of the chassis while you secure the chassis L brackets to the rack enclosure.
- Rubber feet mount kit (Catalyst 6509-E accessory kit only). This kit can be installed when you want to install the Catalyst 6509-E chassis as a freestanding unit on a shelf or a table.

Also included in the accessory kit:

- Cable guides— Two cable guides can be installed on the front of the chassis using the same sets of screws that secure the chassis rack-mount brackets to the rack posts.
- Power supply blank panel—The power supply blank panel must be installed on an unused power supply bay to maintain chassis airflow and EMI shielding.

## L Brackets on the Catalyst 6509 and Catalyst 6509-E Switches

The Catalyst 6509 and Catalyst 6509-E switch chassis are shipped with two L brackets installed on the front sides of the chassis. The L brackets are secured to the chassis with ten M3 Phillips-head countersunk screws (five M3 screws on each side) as shown in [Figure 1-9](#).



**Note**

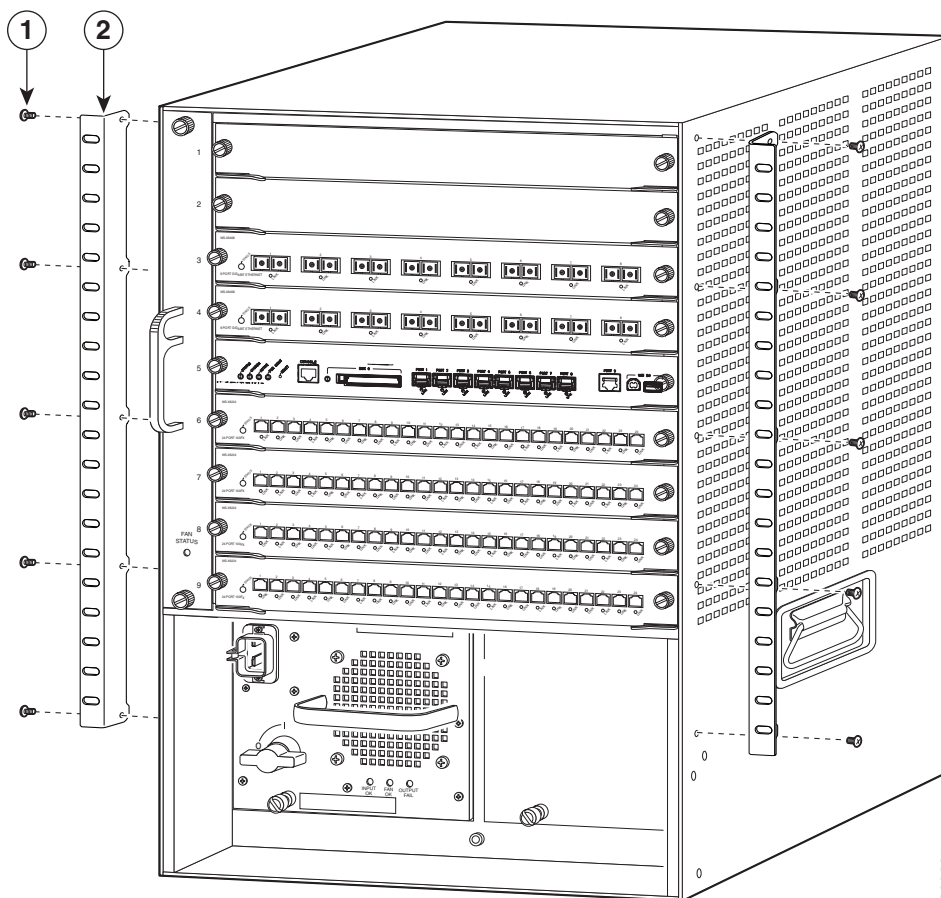
The L brackets can also be reversed and installed on the rear of the chassis as an alternative method of installation.



**Note**

The L brackets for the Catalyst 6509 and the Catalyst 6509-E switches are stamped with an L and an R to identify them as left and right.

**Figure 1-9** L Brackets on the Catalyst 6509 and the Catalyst 6509-E Switch Chassis



<b>1</b>	M4 Phillips-head countersunk screws (10x)	<b>2</b>	Rack-mount L bracket (2x)
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## Installing the 3 RU Rack-Mount Shelf Kit

The 3 RU rack-mount shelf kit is included as part of the accessory kit for both the Catalyst 6509 and the Catalyst 6509-E switch chassis. You need to install this kit first before you install the chassis in the rack. The shelf kit supports the weight of the chassis while you install and secure the chassis in the rack.

The procedure for installing the shelf kit is located at [“Installing the 3 RU Rack-Mount Shelf Kit” section on page 1-47.](#)



## Rack-Mounting the Chassis

**Note**

The chassis are designed to be mounted in equipment racks that meet ANSI/EIA 310-D and ETS 300-119 standards.

**Warning**

**Two people are required to lift the chassis. To prevent injury, keep your back straight and lift with your legs, not your back.** Statement 164

**Tip**

We recommend that you have a third person to assist in this procedure.

To install the switch chassis in the equipment rack, follow these steps:

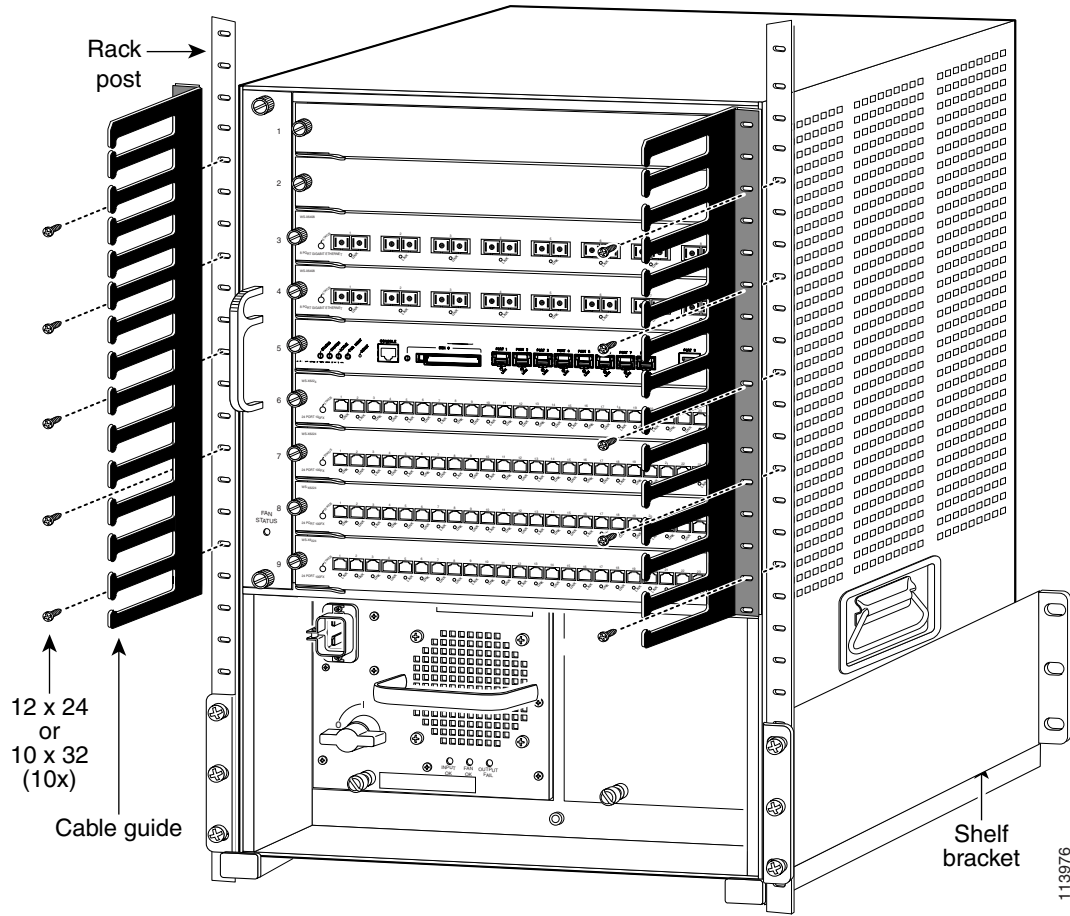
- Step 1** With a person standing at each side of the chassis, grasp the chassis handle with one hand, and use the other hand near the back of the chassis for balance. Slowly lift the chassis in unison. Avoid sudden twists or moves to prevent injury.
- Step 2** Rest the back end of the chassis on the edges of the rack-mount shelf kit rails and carefully slide the chassis fully into the rack.
- Step 3** Locate the rack post holes that align with the chassis L bracket holes. If the rack post holes are prethreaded, determine if the threads are 10-32 or 12-24. If the rack post holes are unthreaded, install eight or ten (four or five on each side) either 10-32 or 12-24 clip or cage nuts over the rack post holes to accept the installation screws.

**Note**

Clip nuts or cage nuts are not included as part of the accessory kit that comes with the chassis. You must obtain them yourself.

- Step 4** If you want to install one or both of the optional cable guide assemblies, position the cable guides so that the cable guide mounting holes are aligned with rack-mount bracket holes and the rack post holes as shown in [Figure 1-10](#).
- Step 5** Install a minimum of eight 10-32 or 12-24 screws (four on each side) through the cable guide mounting holes, rack-mount L bracket holes, rack post holes, and into the clip nuts to secure the cable guides and the chassis to the rack post. Tighten the screws securely.

Figure 1-10 Installing a Catalyst 6509 Switch or a Catalyst 6509-E Switch Chassis in a Rack



## What is Next

After installing the chassis in its location, complete the installation process by following these procedures:

- Connecting the chassis to system ground. See [“Establishing the System Ground” section on page 1-52.](#)
- Installing and connecting the power supplies to source power. Go to Chapter 4 for information on how to install and cable power supplies.
- Connecting the network interface cables to the supervisor engine and modules. This may involve installing transceivers before you attach the network interface cables. See [“Attaching the Interface Cables” section on page 1-61.](#)
- Powering-up the chassis and verifying the installation. See [“Verifying Switch Chassis Installation” section on page 1-84.](#)

## Optional Installation Kits

An optional rubber feet installation kit is included in the accessory kit for the Catalyst 6509-E switch chassis. This kit contains the parts necessary to install four non-slip rubber feet on the bottom of the chassis allowing the chassis to be placed on a shelf or a table. To install the rubber feet, go to [“Installing the Rubber Feet Kit” section on page 1-50.](#)

A center rack-mount kit for 23-inch, telco-style racks is available as an option for both the Catalyst 6509 and the Catalyst 6509-E switch chassis. The kit is not included in the accessory kits, but is available as a separately orderable item (p/n WS-C6597=). Installation instructions are included with the kit.

# Installing a Catalyst 6509-NEB or Catalyst 6509-NEB-A Switch Chassis

This section provides procedures for installing either a Catalyst 6509-NEB or a Catalyst 6509-NEB-A switch chassis in a rack assembly and installing the optional cable guides.

## Installation Accessory Kits

The Catalyst 6509-NEB and Catalyst 6509-NEB-A switch chassis are designed to be installed in a standard 19-inch rack, either open or enclosed. Both chassis are normally shipped with the 19-inch rack-mount L brackets factory installed on the left-front and right-front of the chassis. Included with the accessory kit are 10-32 x 0.75-inch and 12-24 x 0.75-inch screws that are used to secure the chassis in the rack enclosure.

**Note**

Depending on the manufacturer, the rack posts might be prethreaded to accept either 10-32 or 12-24 screws. If the rack posts are not prethreaded, you must install 10-32 or 12-24 clip nuts or cage nuts to secure the rack-mount screws. The clip nuts or the cage nuts are not included as part of the accessory kit and must be obtained on your own.

Depending on the chassis model, the accessory kit might contain the following chassis installation kits:

- Rack-mount shelf kit (Catalyst 6509-NEB and Catalyst 6509-NEB-A). The rack-mount shelf kit is used to support the weight of the chassis while you secure the chassis L brackets to the rack enclosure.
- A stabilizer bracket kit (Catalyst 6509-NEB only). If you are not installing the Catalyst 6509-NEB switch in a rack, you must install the stabilizer brackets to the bottom of the chassis. The stabilizer brackets reduce the possibility that the freestanding switch chassis will tip over.

Also included in the Catalyst 6509-NEB accessory kit:

- One cable guide—The optional cable guide can be mounted to the front of the chassis.
- Power supply blank panel—The power supply blank panel must be installed on an unused power supply bay to maintain chassis airflow and EMI shielding.

Also included in the Catalyst 6509-NEB-A accessory kit:

- Cable management system—The optional cable management kit can be installed on the upper front of the chassis.
- Power supply blank panel—The power supply blank panel must be installed on an unused power supply bay to maintain chassis airflow and EMI shielding.

## L Brackets and the Optional Cable Guide on the Catalyst 6509-NEB Switch

The Catalyst 6509-NEB switch chassis is shipped with the two L brackets installed on the front sides of the chassis. The L brackets are secured to the chassis with eight M4 Phillips-head countersunk screws (four screws on each side) as shown in [Figure 1-12](#).

**Note**

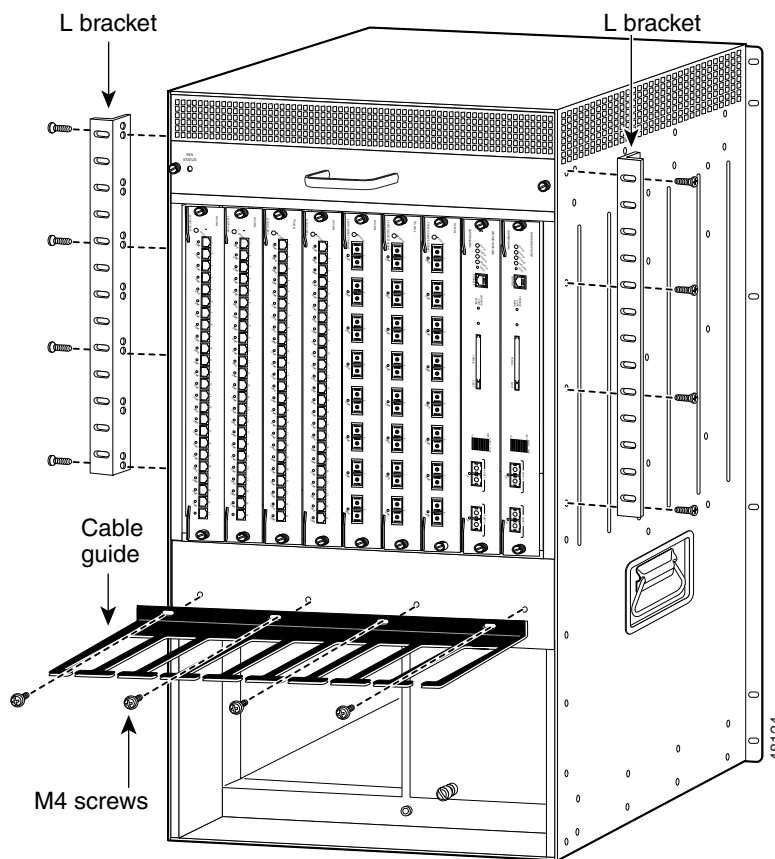
The L brackets can also be reversed and installed on the rear of the chassis as an alternative method of installation.

**Note**

The Catalyst 6509-NEB L bracket screw holes are stamped + and -. You can install the brackets on either the left or right side of the chassis; use the + holes on one side and the - holes on the other side.

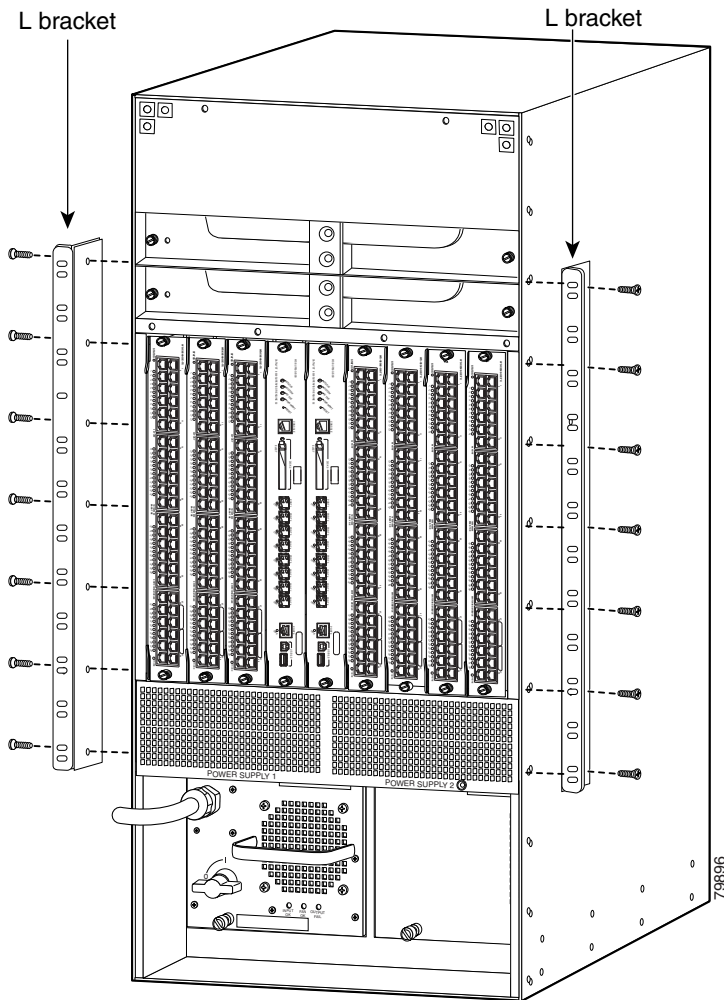
The optional cable guide attaches to the front of the chassis using four M4 screws supplied in the accessory kit. (See [Figure 1-11](#).)

**Figure 1-11** L Brackets and Cable Guide Attachment on the Catalyst 6509-NEB Switch Chassis



## L Brackets on the Catalyst 6509-NEB-A Switch Chassis

The Catalyst 6509-NEB-A switch chassis is shipped with the two L brackets installed on the front sides of the chassis. The L brackets are secured to the chassis with 14 M3 Phillips-head countersunk screws (seven screws on each side) as shown in [Figure 1-12](#). These brackets can also be installed on the rear of the chassis if necessary.

**Figure 1-12** L Brackets on the Catalyst 6509-NEB-A Switch Chassis

## Installing the 3 RU Rack-Mount Shelf Kit

The 3 RU rack-mount shelf kit is included as part of the accessory kit for both the Catalyst 6509-NEB and the Catalyst 6509-NEB-A switch chassis. You need to install this kit first before you install the chassis in the rack. The shelf kit supports the weight of the chassis while you install the chassis in the rack.

The procedure for installing the shelf kit is located in the [“Installing the 3 RU Rack-Mount Shelf Kit”](#) section on page 1-47.

## Rack-Mounting the Chassis

This section provides procedures for installing either the Catalyst 6509-NEB or the Catalyst 6509-NEB-A switch chassis in a 19-inch rack enclosure.

**Note**

The chassis are designed to be mounted in equipment racks that meet ANSI/EIA 310-D and ETS 300-119 standards.

**Warning**

**Two people are required to lift the chassis. To prevent injury, keep your back straight and lift with your legs, not your back.** Statement 164

**Tip**

We recommend that you have a third person to assist in this procedure.

To install the switch chassis in the equipment rack, follow these steps:

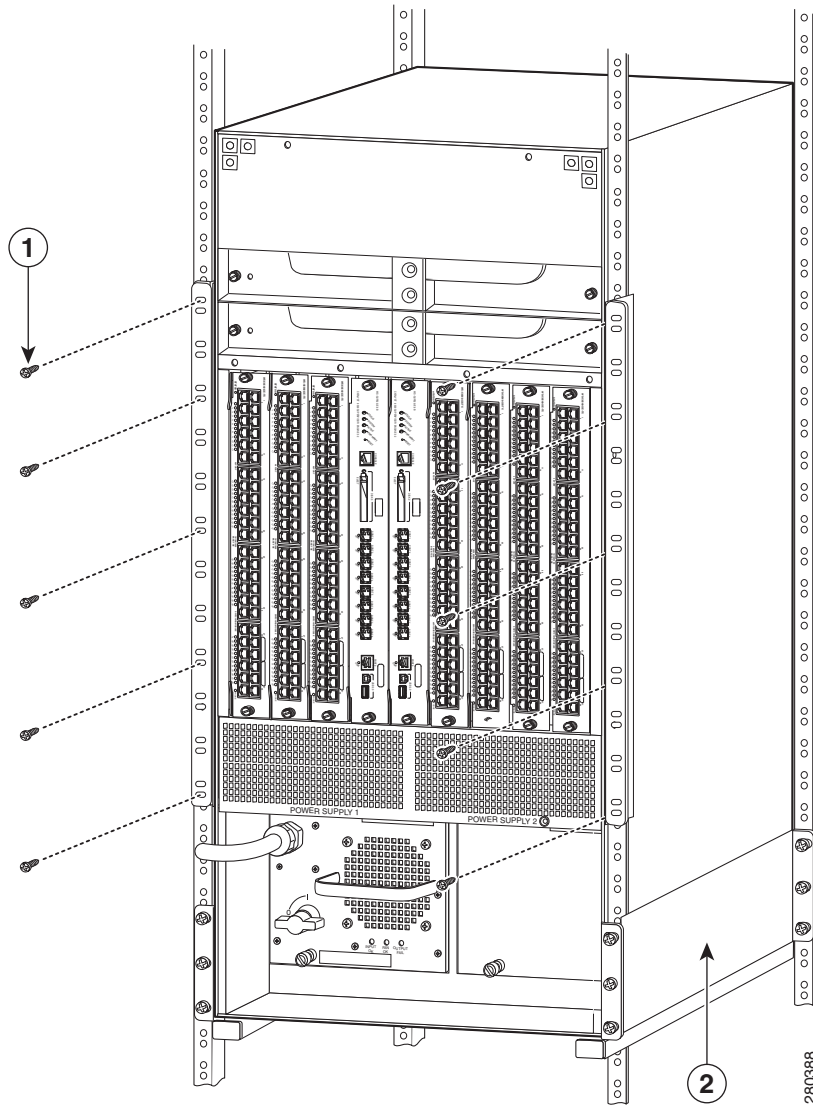
- Step 1** With a person standing at each side of the chassis, grasp the chassis handle with one hand, and use the other hand near the back of the chassis for balance. Slowly lift the chassis in unison. Avoid sudden twists or moves to prevent injury.
- Step 2** Rest the back end of the chassis on the edges of the rack-mount shelf kit rails and carefully slide the chassis fully into the rack.
- Step 3** Locate the rack post holes that align with the chassis L bracket holes. If the rack post holes are prethreaded, determine if the threads are 10-32 or 12-24. If the rack post holes are unthreaded, install eight or ten (four or five on each side) either 10-32 or 12-24 clip or cage nuts over the rack post holes to accept the installation screws.

**Note**

Clip nuts or cage nuts are not included as part of the accessory kit that comes with the chassis. You must obtain them yourself.

- Step 4** Install a minimum of eight 10-32 or 12-24 screws (four on each side) through the cable guide mounting holes, rack-mount L bracket holes, rack post holes, and into the clip nuts to secure the cable guides and the chassis to the rack post, as shown in [Figure 1-13](#). Tighten the screws securely.

Figure 1-13 Installing a Catalyst 6509-NEB or a Catalyst 6509-NEB-A Switch Chassis in a Rack



1	12-24 or 10-32 rack-mounting screws (10x)	2	Shelf bracket
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## Installing the Cable Management System (Catalyst 6509-NEB-A Only)

This section describes the installation procedures for the cable management system (CABLETRAY-09) on the Catalyst 6509-NEB-A switch.

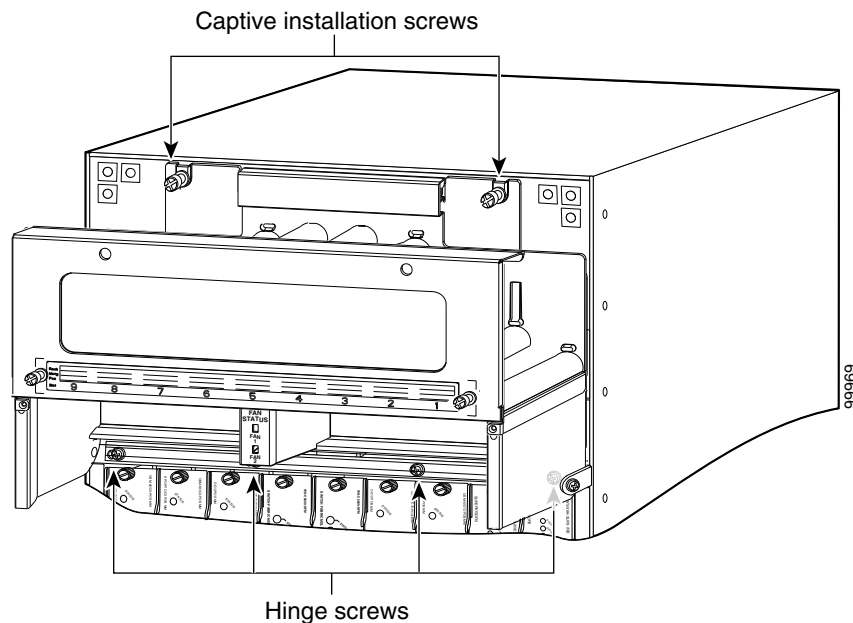
**Note**

The cable management system is shipped with the extended cable guide installed but can be used with the supplied standard cable guide. Use the extended cable guide with Ethernet and Fast Ethernet modules (24 to 48 ports) using 10/100 cable. Use the standard cable guide with low port-density modules (up to 16 ports) using fiber and coax cable. We recommend that you install the cable management system before replacing the cable guide. See the [“Replacing the Cable Guide”](#) section on page 1-33 for replacement procedures.

To install the cable management system, perform these steps:

- Step 1** Place the cable management system against the chassis, as shown in [Figure 1-14](#), and tighten the captive installation screws.
- Step 2** Assure that the hinge is flat against the chassis, and install four 6-32 screws to secure the back plate to the chassis.

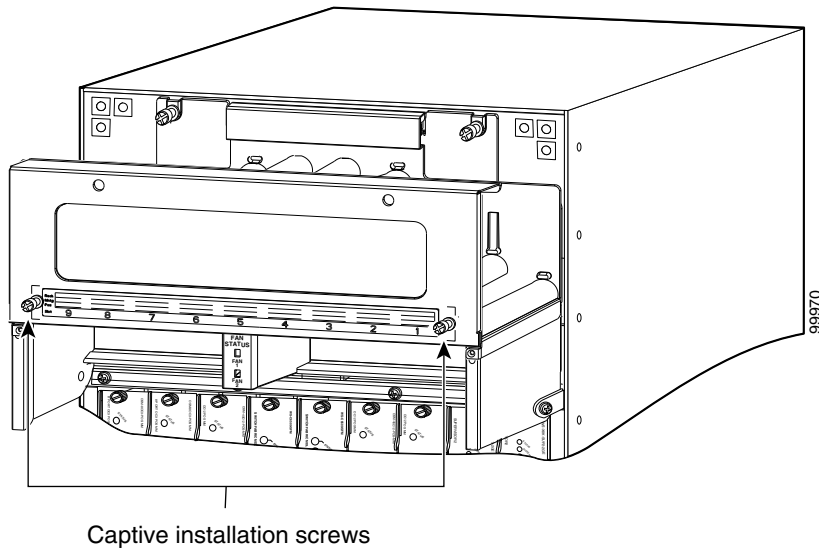
**Figure 1-14** Installing the Catalyst 6509-NEB-A Cable Management System

**Note**

To route the cables through the cable guide, remove the front panel, and attach the interface cables to the modules. See the [“Attaching the Interface Cables”](#) section on page 1-61 for information on attaching the interface cables.

- Step 3** Loosen the two captive installation screws on the front panel. (See [Figure 1-15](#).)

**Figure 1-15** Removing the Front Panel



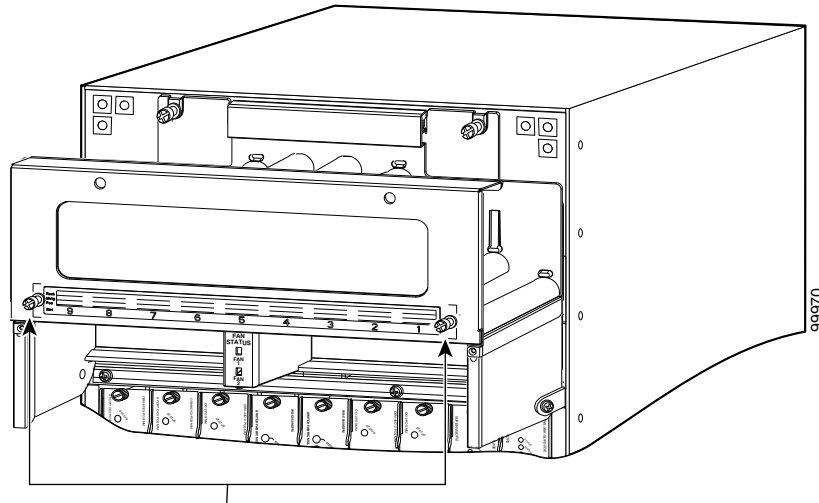
- Step 4** Remove the front panel, and set it aside.
- Step 5** Attach the interface cables to the modules, and route the cables through the cable guide.
- Step 6** Install the front panel by positioning the top of the front panel over the cable guide.
- Step 7** Tighten the two captive installation screws. (See [Figure 1-15](#).)
-

## Replacing the Cable Guide

To replace the cable guides on the cable management system, perform these steps:

- Step 1** Loosen the two captive installation screws on the front panel. (See [Figure 1-16](#).)

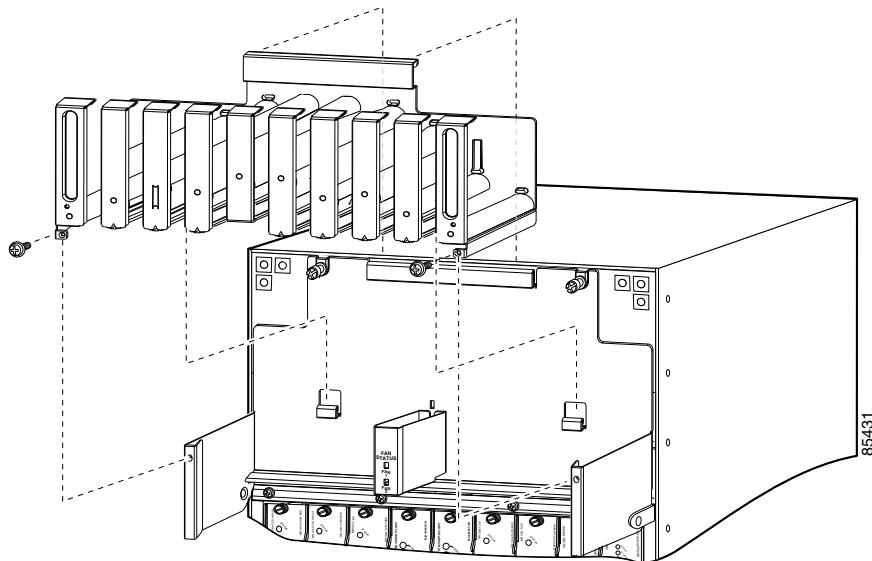
**Figure 1-16** Removing the Front Panel



Captive installation screws

- Step 2** Remove the front panel, and set it aside.
- Step 3** Remove the two screws that secure the cable guide to the back panel, and remove the cable guide by lifting it up and away from the back panel. (See [Figure 1-17](#).)

**Figure 1-17** Removing the Cable Guide



**Step 4** Install the standard cable guide to the back panel by securing the lip of the cable guide to the back panel. (See [Figure 1-17](#).)

**Step 5** Install the two screws to secure the cable guide to the back plate. (See [Figure 1-17](#).)



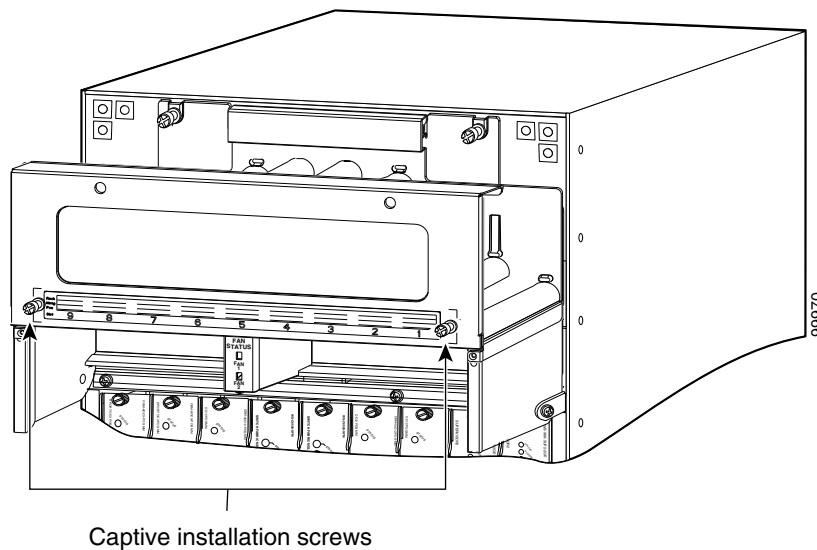
**Note** Before installing the front panel, attach the interface cables to the modules, and route the cables through the cable guide. See the “[Attaching the Interface Cables](#)” section on page 1-61 for information on attaching the interface cables.

**Step 6** Attach the interface cables to the modules, and route the cables through the cable guide.

**Step 7** Install the front panel by hooking the top of the front panel over the cable guide.

**Step 8** Tighten the two captive installation screws. (See [Figure 1-18](#).)

**Figure 1-18** *Front Panel Installation*



## What is Next

After installing the chassis in its location, complete the installation process by performing these procedures:

- Connecting the chassis to system ground. See [“Establishing the System Ground” section on page 1-52.](#)
- Installing and connecting the power supplies to source power. Go to Chapter 4 for information on how to install and cable power supplies.
- Connecting the network interface cables to the supervisor engine and modules. This may involve installing transceivers before you attach the network interface cables. See [“Attaching the Interface Cables” section on page 1-61.](#)
- Powering-up the chassis and verifying the installation. See [“Verifying Switch Chassis Installation” section on page 1-84.](#)

## Optional Installation Kits

The Catalyst 6509-NEB accessory kit has an optional stabilizer bracket installation kit included. This kit contains the parts necessary to install two brackets on the bottom of the chassis to provide additional stability for the chassis when the chassis is not rack mounted allowing the chassis to be placed on a shelf or a table. To install the stabilizer brackets, go to [“Installing the Stabilizer Bracket Kit” section on page 1-50.](#)

# Installing a Catalyst 6509-V-E Switch Chassis

This section provides procedures for installing a Catalyst 6509-V-E switch chassis in a rack assembly and installing the optional cable guide system.

## Installation Accessory Kit

The Catalyst 6509-V-E switch chassis is designed to be installed in a standard 19-inch rack, either open or enclosed. The chassis is shipped with the 19-inch rack mount L brackets installed on the left-front and right-front of the chassis. Included in the accessory kit are 10-32 x 0.75-inch and 12-24 x 0.75-inch screws used to secure the chassis in the rack enclosure.

**Note**

Depending on the manufacturer, the rack posts might be prethreaded to accept either 10-32 or 12-24 screws. If the rack posts are not prethreaded, you must install 10-32 or 12-24 clip nuts or cage nuts to secure the rack-mount screws. The clip nuts or the cage nuts are not included as part of the accessory kit and must be obtained on your own.

Included in the accessory kit is the rack-mount shelf kit. The rack-mount shelf kit is used to support the weight of the chassis while you secure the chassis L brackets to the rack enclosure.

Also included in the Catalyst 6509-V-E switch accessory kit:

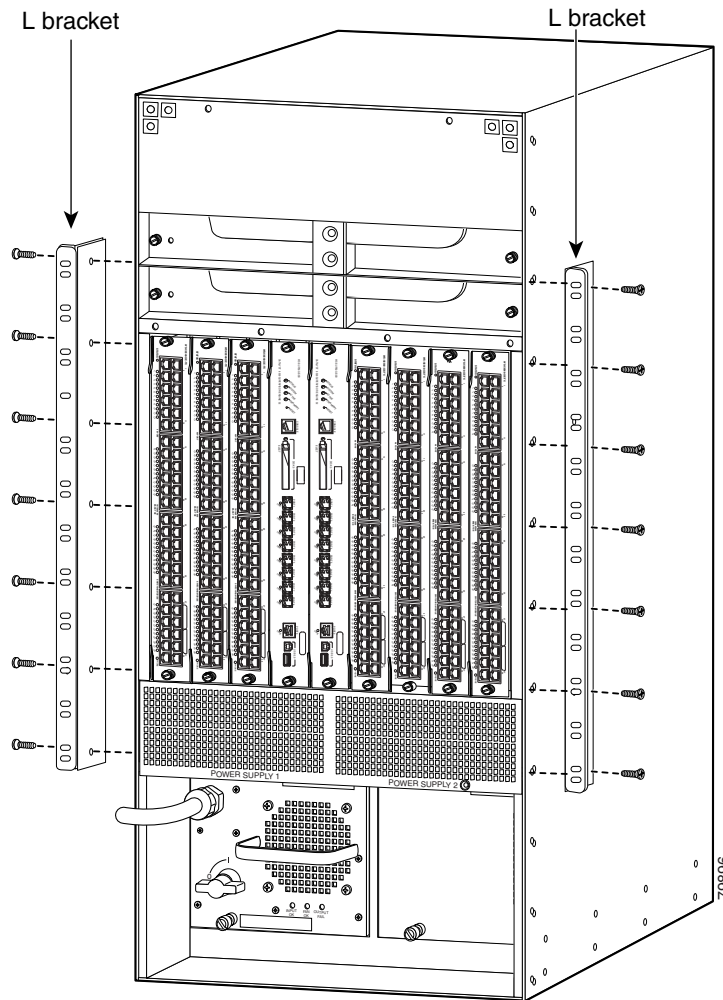
- Cable management system—The optional cable management system can be attached to the front of the chassis.
- Power supply blank panel—The power supply blank panel must be installed on an unused power supply bay to maintain chassis airflow and EMI shielding.

## L Brackets on the Catalyst 6509-V-E Switch Chassis

The Catalyst 6509-V-E switch chassis is shipped with the two L brackets installed on the front sides of the chassis. Each L bracket is secured to the chassis with 14 M4 Phillips-head countersunk screws (seven screws on each side) as shown in [Figure 1-19](#).

**Note**

The L brackets can also be reversed and installed on the rear of the chassis as an alternative method of installation.

**Figure 1-19** L Brackets on the Catalyst 6509-V-E Switch Chassis

## Installing the 3 RU Rack-Mount Shelf

The 3 RU rack-mount shelf is included as part of the accessory kit for the Catalyst 6509-V-E switch chassis. You need to install this kit first before you install the chassis in the rack. The shelf kit supports the weight of the chassis while you install the chassis in the rack.

The procedure for installing the shelf kit is located in the [“Installing the 3 RU Rack-Mount Shelf Kit”](#) section on page 1-47.

## Rack-Mounting the Chassis

**Tip**

We recommend that you have a third person to assist in this procedure.

**Caution**

For easier installation, the chassis should be empty when you install it in the rack.

**Warning**

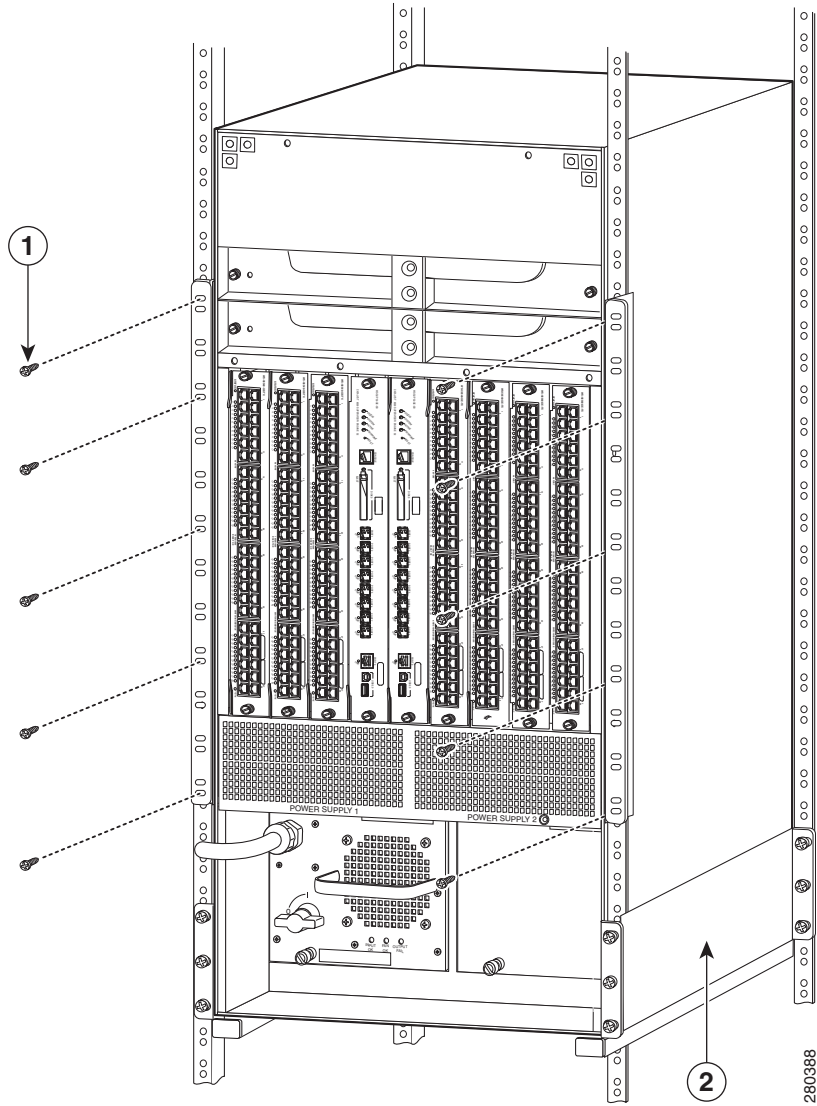
**Two people are required to lift the chassis. To prevent injury, keep your back straight and lift with your legs, not your back.** Statement 164

To install the switch chassis in the equipment rack, follow these steps:

- 
- Step 1** With a person standing at each side of the chassis, grasp the chassis handle with one hand, and use the other hand near the back of the chassis for balance. Slowly lift the chassis in unison. Avoid sudden twists or moves to prevent injury.
- Step 2** Position the chassis in the rack as follows:
- If the front of the chassis (front panel) is at the front of the rack, insert the rear of the chassis between the mounting posts, resting the chassis on the shelf brackets, and then carefully slide the chassis into the rack.
  - If the rear of the chassis is at the front of the rack, insert the front of the chassis between the mounting posts, resting the chassis on the shelf brackets, and then carefully slide the chassis into the rack.
- Step 3** Align the mounting holes in the L bracket with the mounting holes in the equipment rack.
- Step 4** Install the eight or ten (four or five per side) 12-24 x 3/4-inch or 10-32 x 3/4-inch screws through the holes in the L bracket mounting holes, and into the threaded holes in the equipment rack posts. (See [Figure 1-20](#).)
- Step 5** Use a tape measure and level to verify that the chassis is installed straight and level.



**Figure 1-20** Installing a Catalyst 6509-V-E Switch Chassis in a Rack



<b>1</b>	12-24 or 10-32 rack-mounting screws (10x)	<b>2</b>	Shelf bracket
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## Installing the Cable Management System (Optional)

The accessory kit for the Catalyst 6509-V-E switch chassis includes an optional cable management system that is installed on the front of the switch chassis. This cable management system is only available for the Catalyst 6509-V-E switch chassis.

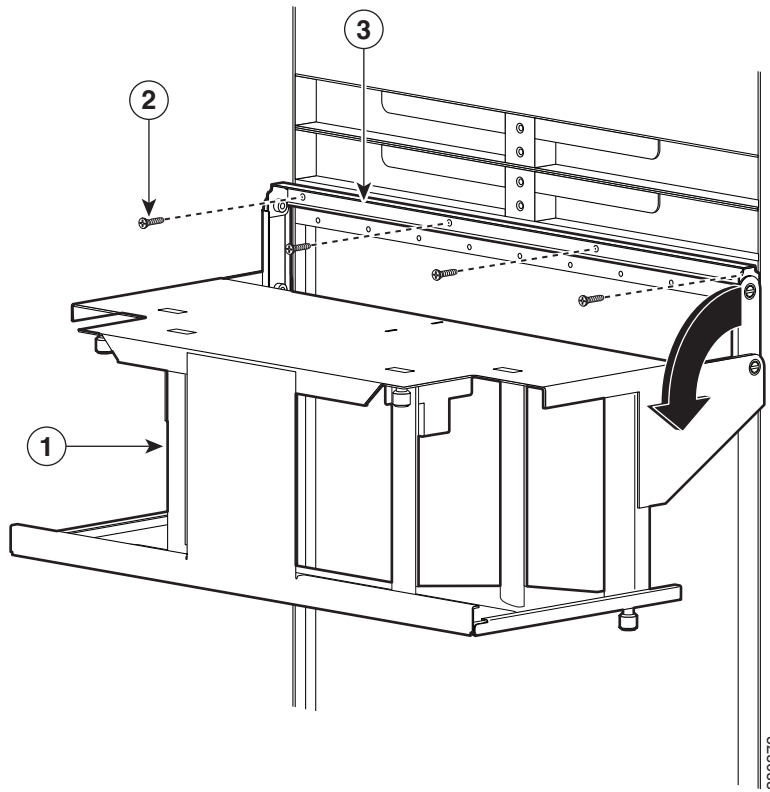
**Note**

The cable management system adds an additional 6.8 inches (17.3 cm) (measured to the outside of the thumbscrews) to the overall depth of the chassis.

To install the cable management system on the chassis, perform the following steps:

- Step 1** Remove the cable management assembly from the packing material.
- Step 2** Locate the bag containing the four 6-32 screws that accompanied the cable management assembly.
- Step 3** Loosen the two captive screws on the inside of the cable management assembly and pivot the cable guide assembly away from the attachment bracket. (See [Figure 1-21](#).)
- Step 4** Position the cable management assembly in front of the chassis, align the four screw holes in the attachment bracket with the corresponding screw holes in the chassis, and secure the cable management assembly in place with the four 6-32 screws. (See [Figure 1-21](#).)

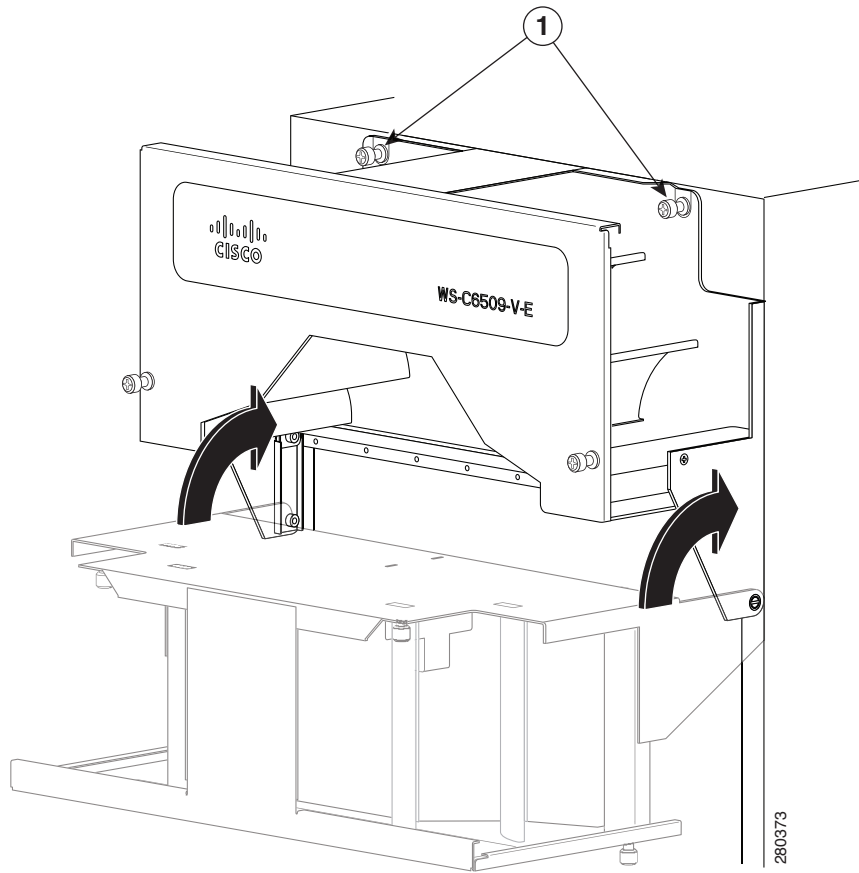
**Figure 1-21** Installing the Catalyst 6509-V-E Cable Management Assembly



<b>1</b>	Cable guide assembly	<b>2</b>	6-32 screws (4x)
<b>3</b>	Attachment bracket		

**Step 5** Pivot the cable management assembly up on its hinges so that the back plate of the assembly is flush against the chassis. Secure the cable management assembly in place to the front of the chassis with the two captive installation screws. (See [Figure 1-22](#).)

**Figure 1-22** Securing the Cable Management Assembly to the Front of the Chassis



<b>1</b>	Captive installation screws (2x)		
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## What is Next

After installing the chassis in its location, complete the installation process by following these procedures:

- Connecting the chassis to system ground. See [“Establishing the System Ground”](#) section on page 1-52.
- Installing and connecting the power supplies to source power. Go to Chapter 4 for information on how to install and cable power supplies.
- Connecting the network interface cables to the supervisor engine and modules. This may involve installing transceivers before you attach the network interface cables. See [“Attaching the Interface Cables”](#) section on page 1-61.



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**Note** If you are going to use the cable management system to route the network interface cables, refer to [“Using the Catalyst 6509-V-E Cable Management System”](#) section on page 1-78.

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- Powering-up the chassis and verifying the installation. See [“Verifying Switch Chassis Installation”](#) section on page 1-84.

## Optional Installation Kits

There are no optional installation kits for the Catalyst 6509-V-E switch chassis.

## Installing a Catalyst 6513 or Catalyst 6513-E Switch Chassis

This section provides a procedure for installing either a Catalyst 6513 or Catalyst 6513-E switch chassis in a rack assembly and installing the optional cable guide assemblies.

## Installation Accessory Kit

The Catalyst 6513 and the Catalyst 6513-E switch chassis are designed to be installed in a standard 19-inch rack either open or enclosed. The chassis is shipped with the 19-inch rack-mount brackets factory installed on the left-front and right-front of the chassis. Included in the accessory kit are 10-32 x 0.75-inch and 12-24 x 0.75-inch screws that are used to secure the chassis in the rack.



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**Note** Depending on the manufacturer, the rack posts might be prethreaded to accept either 10-32 or 12-24 screws. If the rack posts are not prethreaded, you must install 10-32 or 12-24 clip nuts or cage nuts to secure the rack-mount screws. The clip nuts or the cage nuts are not included as part of the accessory kit and must be obtained on your own.

---

The accessory kit also contains the following chassis installation kits:

- A rack-mount shelf kit. The rack-mount shelf kit is used to support the weight of the chassis while you secure the chassis L brackets to the rack enclosure.
- A stabilizer bracket kit. If you are not installing the Catalyst 6513 or Catalyst 6513-E switch in a rack, you must install the stabilizer brackets to the bottom of the chassis. The stabilizer brackets reduce the possibility that the freestanding switch chassis will tip over.

Also included in the accessory kit:

- Two optional cable guides—The two cable guides can be installed on the front left- and right-sides of the chassis using the same sets of screws (either 10-32 or 12-24) that secure the chassis rack-mount L brackets to the rack posts.
- Power supply blank panel—The power supply blank panel must be installed on an unused power supply bay to maintain chassis airflow and EMI shielding.

## L Brackets on the Catalyst 6513 and Catalyst 6513-E Switch Chassis

The Catalyst 6513 and the Catalyst 6513-E switch chassis are shipped with the two L brackets installed on the front sides of the chassis. The L brackets are secured to the chassis with 14 M3 Phillips-head countersunk screws (seven screws on each side) as shown in [Figure 1-23](#).



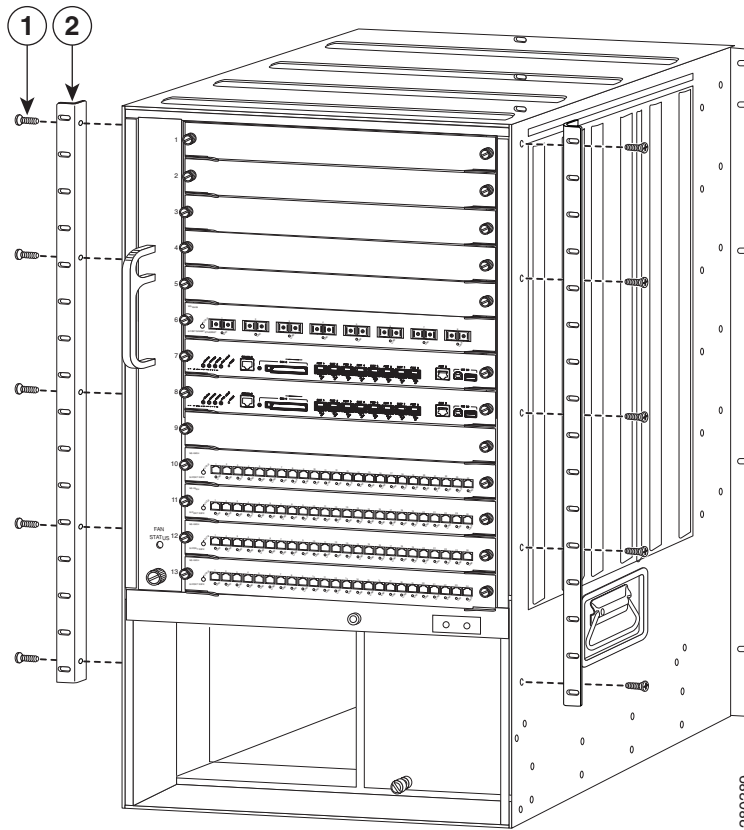
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**Note**

The L brackets can also be reversed and installed on the rear of the chassis as an alternative method of installation.

---

**Figure 1-23** L Brackets on the Catalyst 6513 Switch Chassis



<b>1</b>	M4 Phillips-head countersunk screws (10x)	<b>2</b>	Rack-mount L brackets (2x)
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## Installing the 3 RU Rack-Mount Shelf Kit

The 3 RU rack-mount shelf kit is included as part of the accessory kit for the Catalyst 6513 and the Catalyst 6513-E switch chassis. You need to install this kit first before you install the chassis in the rack. The shelf kit supports the weight of the chassis while you install the chassis in the rack.

The procedure for installing the shelf kit is located in the [“Installing the 3 RU Rack-Mount Shelf Kit”](#) section on page 1-47.

## Rack-Mounting the Chassis

**Tip**

We recommend that you have a third person to assist in this procedure.

**Caution**

For easier installation, the chassis should be empty when you install it in the rack.

**Warning**

**Two people are required to lift the chassis. To prevent injury, keep your back straight and lift with your legs, not your back.** Statement 164

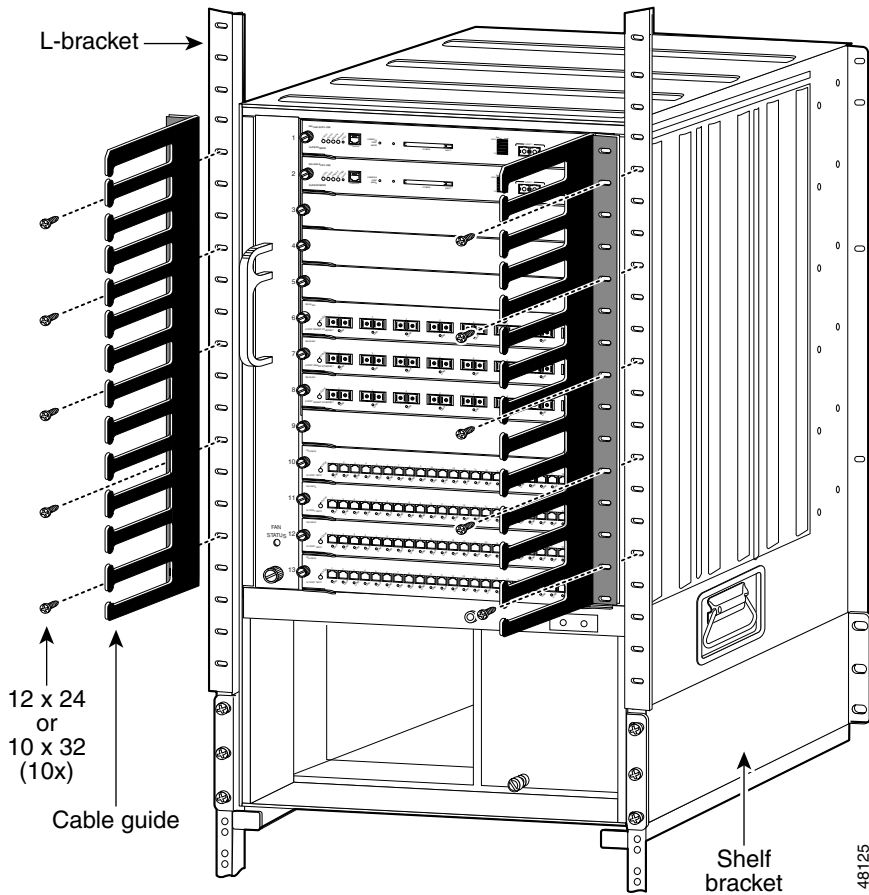
To install the switch chassis in the equipment rack, follow these steps:

- Step 1** With a person standing at each side of the chassis, grasp the chassis handle with one hand, and use the other hand near the back of the chassis for balance. Slowly lift the chassis in unison. Avoid sudden twists or moves to prevent injury.
- Step 2** Position the chassis in the rack as follows:
- If the front of the chassis (front panel) is at the front of the rack, insert the rear of the chassis between the mounting posts, resting the chassis on the shelf brackets, and then carefully slide the chassis into the rack.
  - If the rear of the chassis is at the front of the rack, insert the front of the chassis between the mounting posts, resting the chassis on the shelf brackets, and then carefully slide the chassis into the rack.
- Step 3** Locate the rack post holes that align with the chassis L bracket holes. If the rack post holes are prethreaded, determine if the threads are 10-32 or 12-24. If the rack post holes are unthreaded, install eight or ten (four or five on each side) either 10-32 or 12-24 clip or cage nuts over the rack post holes to accept the installation screws.
- Step 4** If you want to install one or both of the optional cable guide assemblies, position the cable guides so that the cable guide mounting holes are aligned with rack-mount bracket holes and the rack post holes as shown in [Figure 1-24](#).
- Step 5** Install a minimum of ten (five on each side) 10-32 or 12-24 screws through the cable guide mounting holes, rack-mount L bracket holes, rack post holes, and into the clip nuts to secure the cable guides and the chassis to the rack post. Tighten the screws securely. (See [Figure 1-24](#).)
- Step 6** Use a tape measure and level to verify that the chassis is installed straight and level.

**Note**

If you are not rack-mounting the Catalyst 6513 or the Catalyst 6513-E switch and you are installing the optional cable guide assemblies, you must obtain ten 12-24 or 10-32 nuts. Use the screws supplied in the accessory kit and the nuts you obtained to attach the cable guide assembly to the L bracket.

**Figure 1-24** Installing the Catalyst 6513 Switch Chassis in the Rack



## What is Next

After installing the chassis in its location, complete the installation process by following these procedures:

- Connecting the chassis to system ground. See [“Establishing the System Ground”](#) section on page 1-52.
- Installing and connecting the power supplies to source power. Go to Chapter 4 for information on how to install and cable power supplies.
- Connecting the network interface cables to the supervisor engine and modules. This may involve installing transceivers before you attach the network interface cables. See [“Attaching the Interface Cables”](#) section on page 1-61.
- Powering-up the chassis and verifying the installation. See [“Verifying Switch Chassis Installation”](#) section on page 1-84.



## Optional Installation Kits

An optional stabilizer bracket installation kit is included in the accessory kit for the Catalyst 6513 and the Catalyst 6513-E switch chassis. This kit contains the parts necessary to install two brackets on the bottom of the chassis to provide additional stability for the chassis when the chassis is not rack mounted allowing the chassis to be placed on a shelf or a table. To install the stabilizer brackets, go to “[Installing the Stabilizer Bracket Kit](#)” section on page 1-50

A center rack-mount kit for 23-inch, telco-style racks is available as an option for the Catalyst 6513 and the Catalyst 6513-E switch chassis. The center rack-mount kit is not included in the accessory kit, but is available as a separately orderable item (p/n WS-6513-RACK-MNT=). Installation instructions are included with the kit.

## Generic Installation Procedures

This section provides procedures covering how to install three installation kits that are included in multiple Catalyst 6500 series chassis accessory kits. The following procedures are provided in this section:

- [Installing the 3 RU Rack-Mount Shelf Kit, page 1-47](#)
- [Installing the Rubber Feet Kit, page 1-50](#)
- [Installing the Stabilizer Bracket Kit, page 1-50](#)

## Installing the 3 RU Rack-Mount Shelf Kit

This section describes how to install the 3 RU rack-mount shelf kit. The kit contains shelf brackets, a crossbar bracket, and screws. The shelf brackets attach directly to the rack and help support the weight of the chassis while you secure the L brackets to the rack enclosure. The rack-mount shelf kit is shipped as part of the Catalyst 6500 series switch accessory kit with the following chassis:

- Catalyst 6506 and Catalyst 6506-E
- Catalyst 6509 and Catalyst 6509-E
- Catalyst 6509-NEB and Catalyst 6509-NEB-A
- Catalyst 6509-V-E
- Catalyst 6513 and Catalyst 6513-E

[Table 1-3](#) lists and describes the contents of the rack-mount shelf kit.

**Table 1-3** *Rack-Mount Kit Contents and Description*

Part	Quantity	Description
Rack-mount shelf bracket	2	Attaches to the rack posts to form a shelf for the switch chassis to rest on.
Crossbar bracket	1	Attaches between the two side rack-mount brackets to secure them together.
12-24 x 0.75-inches Phillips binder-head screw	6	Secures the brackets (three for each bracket) to a rack that requires 12-24 screws.

**Table 1-3 Rack-Mount Kit Contents and Description (continued)**

Part	Quantity	Description
10-32 x 0.75-inches Phillips binder-head screw	6	Secures the brackets (three for each bracket) to a rack that requires 10-32 screws.
M3 x 8 mm Phillips pan-head screw	2	Secures the crossbar bracket to the rack-mount side brackets.

**Note**

This rack-mounting kit is not suitable for use with racks that have obstructions (such as power strips) because the obstructions could impair access to switch field-replaceable units (FRUs).

## Required Tools

These tools and equipment are required to install the rack-mount shelf kit:

- Number 1 and number 2 Phillips screwdrivers
- 3/16-inch flat-blade screwdriver
- Tape measure and level

## Installing the Shelf Brackets and Crossbar Bracket

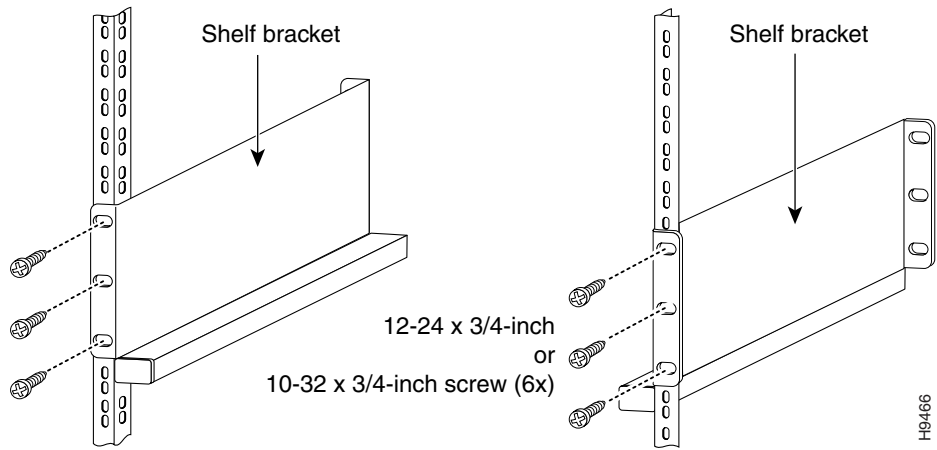
**Note**

On many older equipment racks, the rack posts are prethreaded to accept either 10-32 or 12-24 screws. Newer rack enclosure posts might not be prethreaded. These rack enclosure posts require that you install 10-32 or 12-24 clip nuts or cage nuts to secure the rack-mount screws. The clip nuts or the cage nuts are not included as part of the accessory kit and must be obtained on your own.

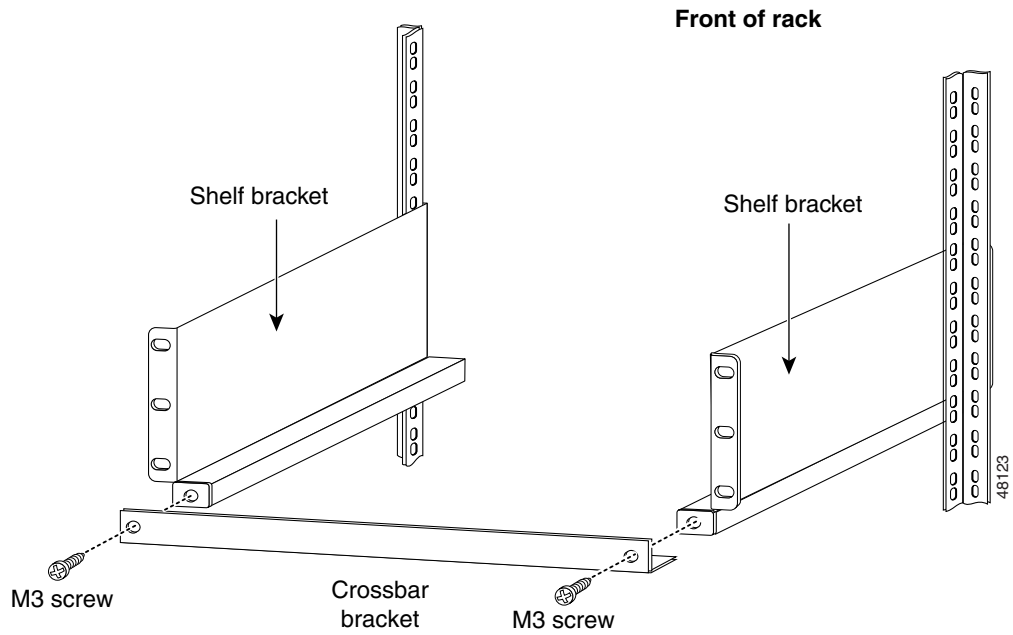
To install the shelf bracket and crossbar bracket, follow these steps:

- Step 1** Position one of the two shelf brackets in the rack as shown in [Figure 1-25](#).
- Step 2** Secure the shelf bracket to the rack by using three 12-24 x 3/4-inch or 10-32 x 3/4-inch screws.
- Step 3** Repeat Steps 1 and 2 for the second shelf bracket. Make sure that the second shelf bracket is level with the first bracket.
- Step 4** Attach the crossbar bracket to the back of the shelf brackets using two M3 screws as shown in [Figure 1-26](#).

**Figure 1-25** *Installing the Shelf Brackets*



**Figure 1-26** *Attaching the Crossbar Bracket to the Shelf Brackets*



## Installing the Rubber Feet Kit

This section describes how to install the rubber feet kit. The kit contains four rubber feet and mounting screws. The rubber feet attach directly to the bottom of the chassis and support the weight of the chassis. The rubber feet kit is shipped as part of the Catalyst 6500 series switch accessory kit with the following chassis:

- Catalyst 6506-E
- Catalyst 6509-E

To install the rubber feet kit, perform the following steps:

- 
- Step 1** Tilt the chassis to one side to access the bottom of the chassis.
  - Step 2** Position one of the rubber feet over the threaded hole on the bottom corner of the chassis.
  - Step 3** Secure the rubber foot to the chassis with one of the M5 x 12 mm Phillips screws provided in the installation kit.
  - Step 4** Repeat step 1 through step 3 to install the remaining three rubber feet in the bottom corners of the chassis.
  - Step 5** Position the chassis upright so that it rests on the four rubber feet.
- 

## Installing the Stabilizer Bracket Kit

The stabilizer bracket kit is included as part of the accessory kits for the following chassis:

- Catalyst 6509-NEB switch
- Catalyst 6513 switch and Catalyst 6513-E switch

If you are not installing the Catalyst 6509-NEB, Catalyst 6513, or Catalyst 6513-E switch in a rack, you must install stabilizer brackets to the bottom of the chassis. The stabilizer brackets reduce the possibility that the freestanding switch chassis will tip over.

[Table 1-4](#) lists and describes the contents of the rack-mount shelf kit.

**Table 1-4**      **Stabilizer Kit Contents**

Quantity	Part Description
16	M4 Phillips-head countersunk screws used to secure the stabilizer brackets to the chassis
2	Stabilizer brackets



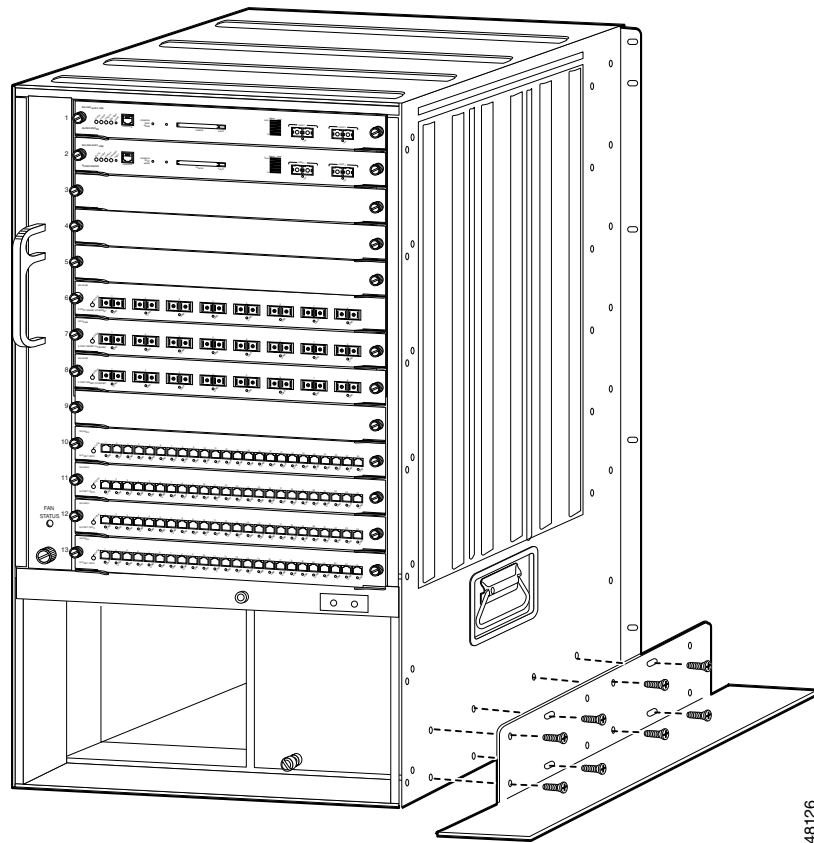
**Note**

You will need the assistance of a second person to perform this installation.

To install the stabilizer brackets, follow these steps:

- Step 1** Have one person tilt and hold the chassis to one side.
- Step 2** With the chassis slightly tilted, attach the stabilizer bracket to the side of the chassis with the eight M4 screws, as shown in [Figure 1-27](#).
- Step 3** Tilt the chassis to the other side.
- Step 4** Attach the second stabilizer bracket to the other side of the chassis with eight M4 screws.
- Step 5** Lower the chassis so that it rests on both stabilizer brackets.

**Figure 1-27** Installing the Stabilizer Brackets



**Note**

If you are not rack-mounting the Catalyst 6513 or the Catalyst 6513-E switch chassis and you want to install the optional cable guide assemblies, you must obtain ten 12-24 or 10-32 nuts. Use the screws supplied in the accessory kit and the nuts you obtained to attach the cable guide assembly to the L bracket.

# Establishing the System Ground

This section describes how to connect a system ground to the Catalyst 6500 series switches.

**Note**

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This system ground is also referred to as the network equipment building system (NEBS) ground.

---

**Caution**

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Installations that rely solely on system grounding using only an AC third-prong ground run a substantially greater risk of equipment problems and data corruption than those installations that use both the AC third-prong ground and a properly installed system (NEBS compliant) ground.

---

The system (NEBS) ground provides additional grounding for EMI shielding requirements and grounding for the low voltage supplies (DC-DC converters) on the modules and is intended to satisfy the Telcordia Technologies NEBS requirements for supplemental bonding and grounding connections. You must observe the following system grounding guidelines for your chassis:

- You must install the system (NEBS) ground connection with any other rack or system power ground connections that you make. The system (NEBS) ground connection is required if FXS modules are installed or if this equipment is installed in a U.S. or European Central Office.
- You must connect both the system (NEBS) ground connection and the power supply ground connection to an earth ground. The system (NEBS) ground connection is required if FXS modules are installed or if this equipment is installed in a U.S. or European Central Office.
- For Catalyst 6503 or Catalyst 6503-E chassis that are equipped with DC-input power supplies, you must install the system (NEBS) ground before you attach the source DC power cables to the DC PEM. If the Catalyst 6503 or Catalyst 6503-E chassis is powered up, you must power down the chassis before attaching the system (NEBS) ground. If you are installing the system (NEBS) ground on other models of the Catalyst 6500 series chassis that are equipped with either AC-input or DC-input power supplies, you do not need to power down the chassis.
- If you are installing the 8700 W AC-input power supply on a Catalyst 6506, Catalyst 6509, or on a Catalyst 6509-NEB chassis, you must install the system ground (NEBS ground) on the power supply rather than on the switch chassis. The extended depth of the 8700 W power supply blocks access to the system ground pad on those chassis. There are two ground posts located on the power supply faceplate where the system ground connection can be made.

**Note**

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In all situations, grounding practices must comply with Section 250 of the National Electric Code (NEC) requirements or local laws and regulations. A 6 AWG grounding wire is preferred from the chassis to the rack ground or directly to the common bonding network (CBN). The equipment rack should also be connected to the CBN with 6 AWG grounding wire.

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**Note**

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The system (NEBS) ground serves as the primary safety ground for the Catalyst 6503 and Catalyst 6503-E chassis that are equipped with DC-input power supplies. The DC-input power supplies for these chassis do not have a separate ground.

---

## Required Tools and Equipment

To connect the system ground, you need the following tools and materials:

- Grounding lug—A two-hole standard barrel lug. Supports up to 6 AWG wire. Supplied as part of accessory kit.
- Grounding screws—Two M4 x 8 mm (metric) pan-head screws. Supplied as part of the accessory kit.
- Grounding wire—Not supplied as part of accessory kit. The grounding wire should be sized according to local and national installation requirements. Depending on the power supply and system, a 12 AWG to 6 AWG copper conductor is required for U.S. installations. Commercially available 6 AWG wire is recommended. The length of the grounding wire depends on the proximity of the switch to proper grounding facilities.
- No. 1 Phillips screwdriver.
- Crimping tool to crimp the grounding wire to the grounding lug.
- Wire-stripping tool to remove the insulation from the grounding wire.

## Connecting the System Ground

To attach the grounding lug and cable to the grounding pad, follow these steps:

- 
- Step 1** Use a wire-stripping tool to remove approximately 0.75 inch (19 mm) of the covering from the end of the grounding wire.
  - Step 2** Insert the stripped end of the grounding wire into the open end of the grounding lug.
  - Step 3** Crimp the grounding wire in the barrel of the grounding lug. Verify that the ground wire is securely attached to the ground lug.
  - Step 4** Locate and remove the adhesive label from the system grounding pad on the switch. The location of the system grounding pad differs among Catalyst 6500 series chassis.

Refer to these figures to locate the system grounding pad on your chassis:

- Catalyst 6503 and Catalyst 6503-E chassis—[Figure 1-28](#)



### Caution

The system (NEBS) ground serves as the primary safety ground for the Catalyst 6503 and Catalyst 6503-E chassis that are equipped with DC-input power supplies. You must install the system (NEBS) ground before you attach the source DC power cables to the DC PEM. If the Catalyst 6503 or Catalyst 6503-E chassis are already powered up, we recommend that you remove the source DC from the Catalyst 6503 and Catalyst 6503-E chassis before attaching the system (NEBS) ground.

- Catalyst 6504-E chassis—[Figure 1-29](#)
- Catalyst 6506, Catalyst 6509, and Catalyst 6509-NEB chassis—[Figure 1-30](#)
- Catalyst 6506-E, Catalyst 6509-E, Catalyst 6513, and Catalyst 6513-E chassis—[Figure 1-31](#)
- Catalyst 6509-NEB-A and Catalyst 6509-V-E chassis—[Figure 1-32](#)

- Step 5** Place the grounding wire lug against the grounding pad, making sure that there is solid metal-to-metal contact.



**Note** There are two system grounding pads on the Catalyst 6509-NEB-A and the Catalyst 6509-V-E switch chassis. One pad is located in the upper-left corner of the chassis, and the other is located in the upper-right corner of the chassis. Additionally, both system grounding pads have 3 M4 screw holes so that the system grounding lug can be installed either horizontally or vertically.

- Step 6** Secure the grounding lug to the chassis with two M4 screws. Ensure that the grounding lug and the grounding wire will not interfere with other switch hardware or rack equipment.
- Step 7** Prepare the other end of the grounding wire, and connect it to an appropriate grounding point in your site to ensure adequate earth ground for the switch.

**Figure 1-28** System Ground Location (Catalyst 6503 and Catalyst 6503-E Chassis)

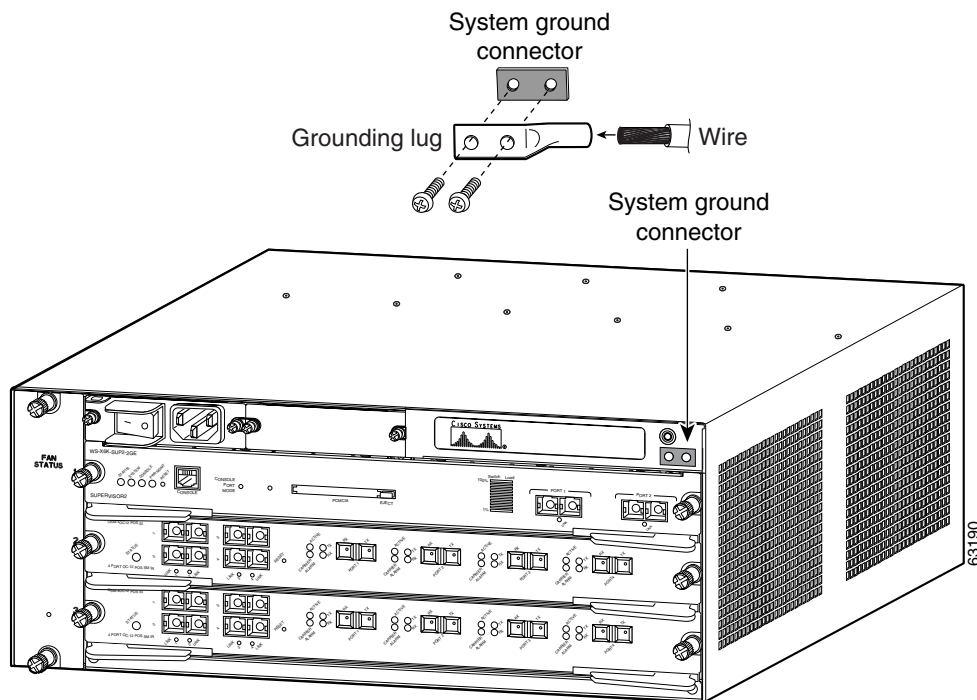




Figure 1-29 System Ground Location (Catalyst 6504-E Chassis)

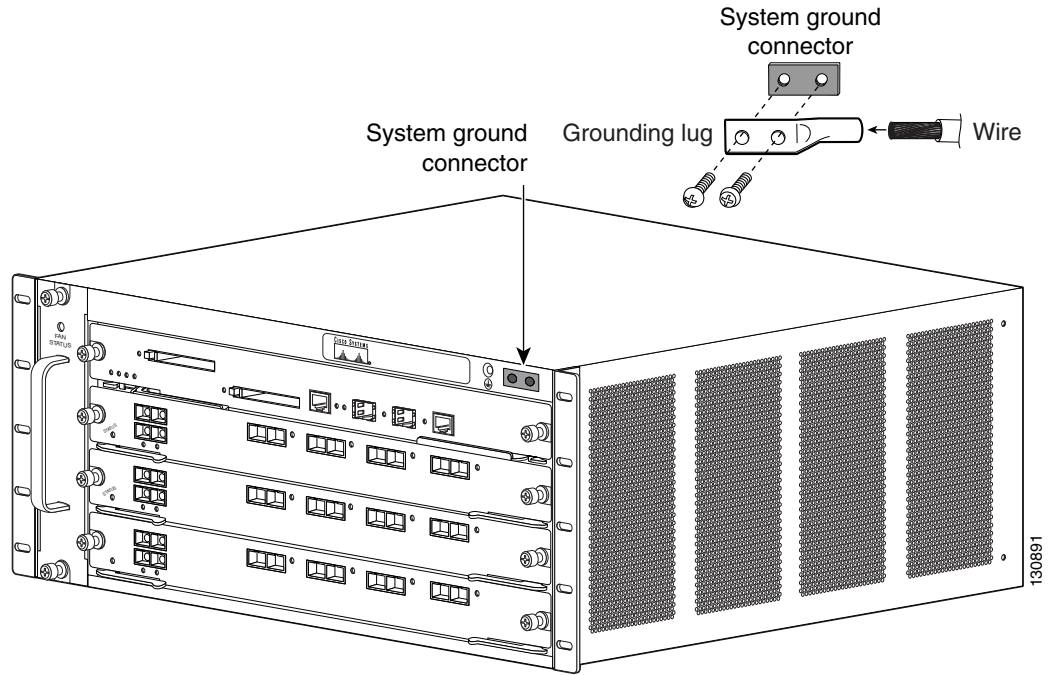
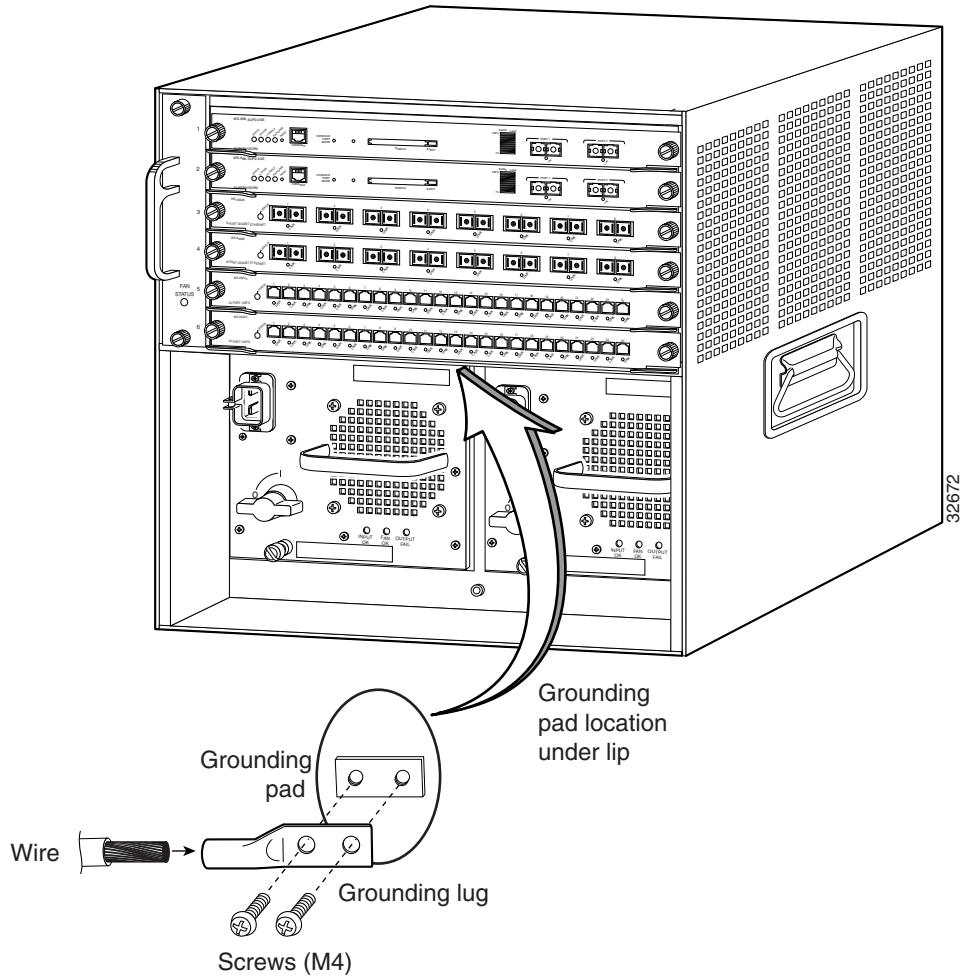


Figure 1-30 System Ground Location (Catalyst 6506, Catalyst 6509, and Catalyst 6509-NEB Chassis)



**Figure 1-31** System Ground Location (Catalyst 6506-E, Catalyst 6509-E, Catalyst 6513, and Catalyst 6513-E Chassis)

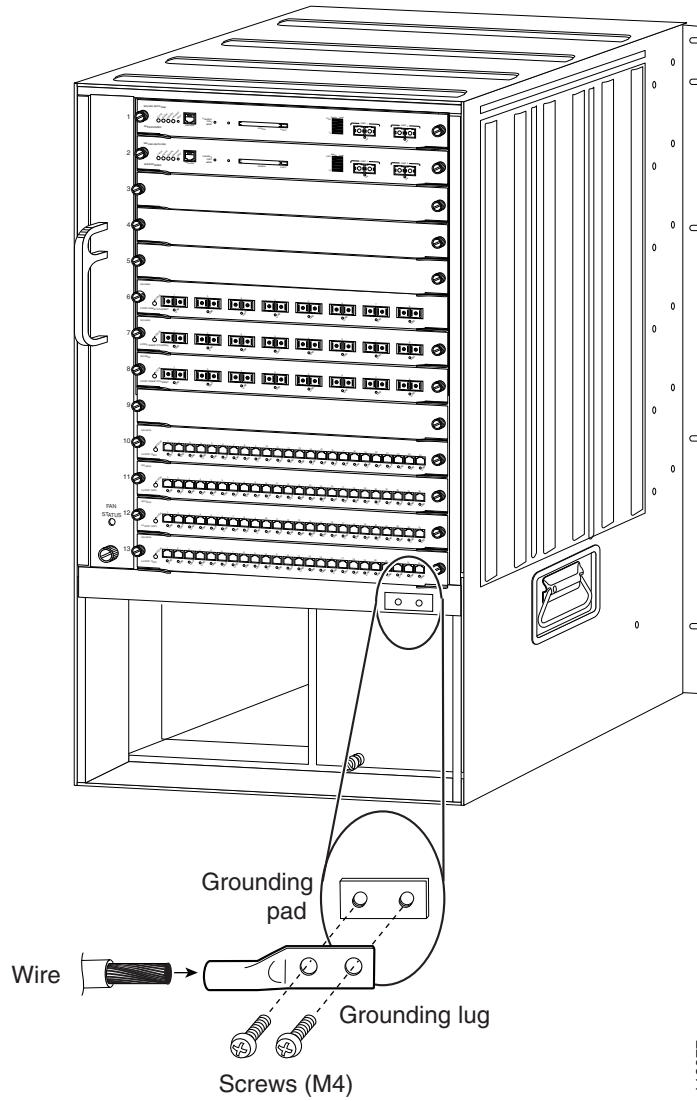
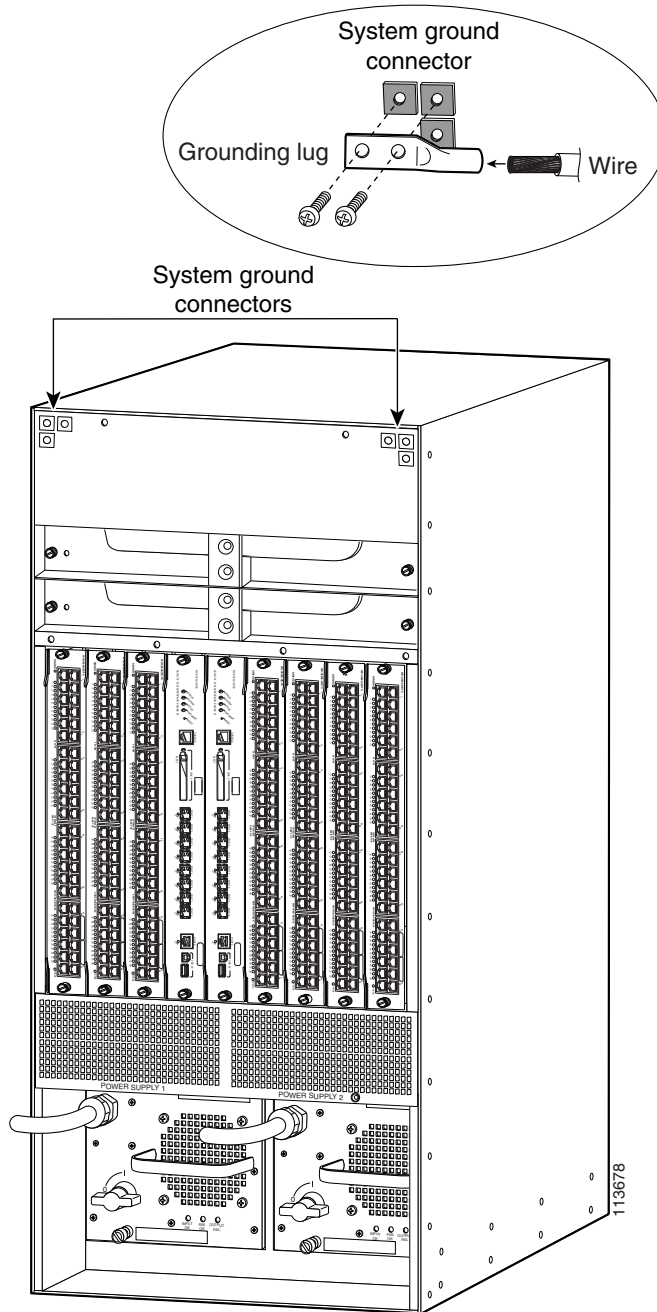


Figure 1-32 System Ground Location (Catalyst 6509-NEB-A and Catalyst 6509-V-E)



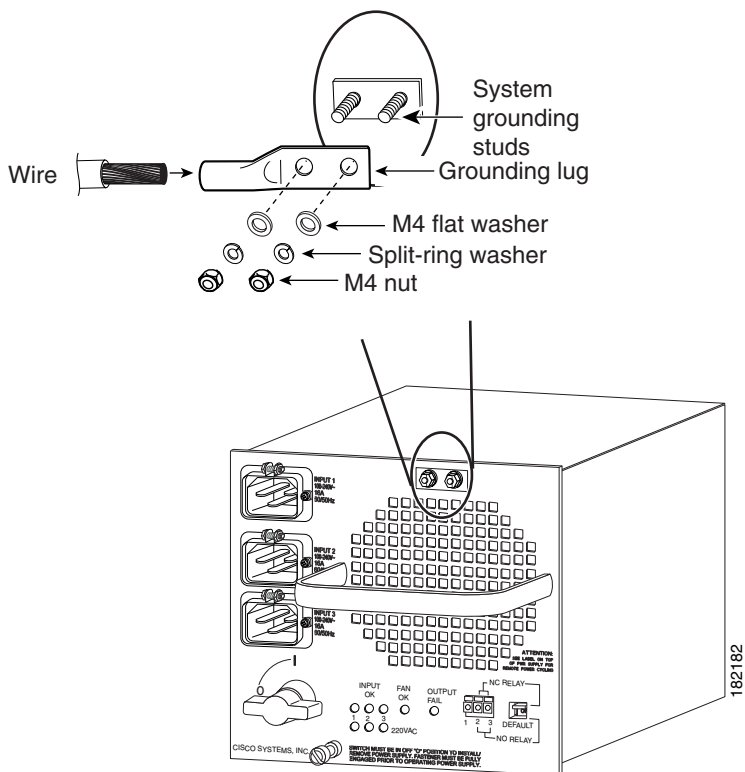
## Installing the System Ground on an 8700 W Power Supply

If you have a Catalyst 6506, Catalyst 6509, or Catalyst 6509-NEB chassis with an 8700 W power supply installed, you must attach the system ground lug to the two system ground studs on the power supply faceplate. The extended depth of the 8700 W power supply blocks access to the system ground pad on the switch chassis.

To attach the system ground lug and cable to the power supply ground studs, follow these steps:

- 
- Step 1** Use a wire-stripping tool to remove approximately 0.75 inch (19 mm) of the covering from the end of the grounding wire.
  - Step 2** Insert the stripped end of the grounding wire into the open end of the grounding lug.
  - Step 3** Crimp the grounding wire in the barrel of the grounding lug. Verify that the ground wire is securely attached to the ground lug.
  - Step 4** Remove the M4 nuts, split-ring washers, flat washers from the two system ground studs on the power supply.
  - Step 5** Position the grounding lug over the two system ground studs on the 8700 W power supply faceplate. (See [Figure 1-33](#).) Ensure that the grounding lug and the grounding wire will not interfere with other switch hardware or rack equipment.
  - Step 6** Install one flat washer and one split-ring washer over each system ground stud. Secure the system grounding lug and washers in place with the two M4 nuts.
  - Step 7** Prepare the other end of the grounding wire, and connect it to an appropriate grounding point in your site to ensure adequate earth ground for the switch.

Figure 1-33 Installing the System Ground Lug on the 8700 W Power Supply



# Installing the Power Supplies in the Switch Chassis

The chassis secondary power supplies (AC or DC) are shipped separately from the switch chassis. Remove the power supply from its shipping packaging, and then install and connect it to the site power by referring to the “[Removing and Installing the AC-Input Power Supplies](#)” section on page 1-2 or the “[Removing and Installing the DC-Input Power Supplies](#)” section on page 1-15. Verify that you have the correct power supply (AC-input or DC-input and the correct wattage) for your configuration.

**Note**

AC-input and DC-input power supplies can be mixed in a chassis.

## Attaching the Interface Cables

This section provides general information on attaching interface cables to the supervisor engines and to the modules.

**Note**

Refer to the *Catalyst 6500 Series Switch Module Guide* for additional module information.

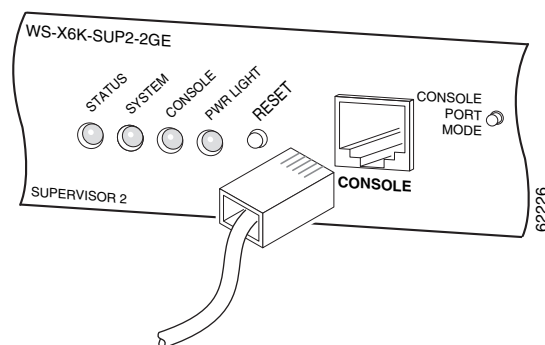
## Connecting the Supervisor Engine Console Port

This section describes how to connect to the supervisor engine console port from a terminal or modem. The console port on the supervisor engine allows you to perform the following functions:

- Configure the switch from the CLI.
- Monitor network statistics and errors.
- Configure SNMP agent parameters.
- Download software updates to the switch, or distribute software images residing in flash memory to attached devices.

The console port, located on the front panel of the supervisor engine, is shown in [Figure 1-34](#).

**Figure 1-34** Supervisor Engine Console Port Connector



**Note**

---

The accessory kit that shipped with your Catalyst 6500 series switch contains the necessary cable and adapters to connect a terminal or modem to the console port.

---

To connect a terminal to the console port using the cable and adapters provided, follow these steps:

---

- Step 1** Place the console port mode switch in the *in* position (factory default).
  - Step 2** Connect to the port using the RJ-45-to-RJ-45 cable and RJ-45-to-DB-25 DTE adapter or RJ-45-to-DB-9 DTE adapter (labeled “Terminal”).
  - Step 3** Position the cable in the cable guide (if installed). Make sure there are no sharp bends in the cable.
  - Step 4** Check the terminal documentation to determine the baud rate. The baud rate of the terminal must match the default baud rate (9600 baud) of the console port. Set up the terminal as follows:
    - 9600 baud
    - 8 data bits
    - No parity
    - 2 stop bits
- 

To connect a terminal using a Catalyst 5000 family Supervisor Engine III console cable, follow these steps:

---

- Step 1** Place the console port mode switch in the *out* position.
  - Step 2** Connect to the port using the Supervisor Engine III cable and the appropriate adapter for the terminal connection.
  - Step 3** Position the cable in the cable guide (if installed). Make sure there are no sharp bends in the cable.
  - Step 4** Check the terminal documentation to determine the baud rate. The baud rate of the terminal must match the default baud rate (9600 baud) of the console port. Set up the terminal as follows:
    - 9600 baud
    - 8 data bits
    - No parity
    - 2 stop bits
- 

To connect a modem to the console port, follow these steps:

---

- Step 1** Place the console port mode switch in the *in* position.
  - Step 2** Connect to the port using the RJ-45-to-RJ-45 rollover cable and the RJ-45-to-DB-25 DCE adapter (labeled “Modem”).
  - Step 3** Position the cable in the cable guide (if installed). Make sure there are no sharp bends in the cable.
-



## Connecting the Supervisor Engine Uplink Ports

This section describes how to connect to the supervisor engine uplink ports. Refer to [Table 1-5](#) for information on which uplink ports each type of supervisor engine has.



**Warning**

**Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051



**Warning**

**Class 1 laser product.** Statement 1008



**Note**

In a redundant configuration with two supervisor engines, the uplink ports on the redundant (standby) supervisor engine are active and can be used for normal traffic like any other ports in the chassis.

**Table 1-5** *Installing Supervisor Engine Uplink Ports*

Supervisor Engine	Uplink Port	Procedures
Supervisor Engine 2	Two uplink ports. Both ports require that GBIC transceivers be installed.	<a href="#">“Installing and Cabling GBIC Transceiver Uplink Ports”</a> section on page 1-64
Supervisor Engine 32	WS-SUP32-GE-3B—Nine uplink ports. Eight ports require that 1000BASE-X SFP transceivers be installed. One port is a 10/100/1000 port with an RJ-45 connector. WS-SUP32-10GE-3B—Three uplink ports. Two ports require that 10GBASE XENPAK transceivers be installed. One port is a 10/100/1000 port with an RJ-45 connector.	<a href="#">“Installing and Cabling Optical SFP Transceiver Uplink Ports”</a> section on page 1-66 <a href="#">“Installing and Cabling Copper SFP Transceiver Uplink Ports”</a> section on page 1-68 <a href="#">“Installing and Cabling 10GBASE-X XENPAK Transceiver Uplink Ports”</a> section on page 1-70
Supervisor Engine 32 PISA	WS-S32-GE-PISA—Nine uplink ports. Eight ports require that 1000BASE-X SFP transceivers be installed. One port is a 10/100/1000 port with an RJ-45 connector. WS-S32-10GE-PISA—Three uplink ports. Two ports require that 10GBASE XENPAK transceivers be installed. One port is a 10/100/1000 port with an RJ-45 connector.	<a href="#">“Installing and Cabling Optical SFP Transceiver Uplink Ports”</a> section on page 1-66 <a href="#">“Installing and Cabling Copper SFP Transceiver Uplink Ports”</a> section on page 1-68 <a href="#">“Installing and Cabling 10GBASE-X XENPAK Transceiver Uplink Ports”</a> section on page 1-70

**Table 1-5** *Installing Supervisor Engine Uplink Ports (continued)*

Supervisor Engine	Uplink Port	Procedures
Supervisor Engine 720	Three uplink ports. Two ports require 1000BASE-X GBIC transceivers be installed. One port is a 10/100/1000 port with an RJ-45 connector.	<a href="#">“Installing and Cabling GBIC Transceiver Uplink Ports”</a> section on page 1-64
Supervisor Engine 720-10GE	Five uplink ports. Two ports require SFP transceivers be installed. One port is a 10/100/1000 port with an RJ-45 connector. Two ports require that 10GBASE X2 transceivers be installed.	<a href="#">“Installing and Cabling Optical SFP Transceiver Uplink Ports”</a> section on page 1-66 <a href="#">“Installing and Cabling Copper SFP Transceiver Uplink Ports”</a> section on page 1-68 <a href="#">“Installing and Cabling 10GBASE-X X2 Transceiver Uplink Ports”</a> section on page 1-73

## Installing and Cabling GBIC Transceiver Uplink Ports



### Caution

We strongly recommend that you do not install or remove the GBIC transceiver module with fiber-optic cables attached to it because of the potential damage to the cables, the cable connector, or the optical interfaces in the SFP transceiver. Disconnect all cables before removing or installing an SFP transceiver.



### Caution

Removing and installing an GBIC transceiver can shorten its useful life. Do not remove and insert GBIC transceivers more often than is absolutely necessary.



### Caution

The GBIC transceiver modules are static-sensitive devices. Always use an ESD wrist strap or a similar individual grounding device when handling GBIC transceivers or coming in contact with modules.

To install and cable an GBIC transceiver uplink port, follow these steps (see [Figure 1-35](#)):

**Step 1** Attach an ESD-preventive wrist strap to your wrist and to the ESD ground connector or a bare metal surface on your chassis.

**Step 2** Remove the GBIC transceiver from its protective packaging.



**Note** Do not remove the optical bore dust plugs until you are directed to do so later in the procedure.

**Step 3** Check the label on the GBIC transceiver body to verify that you have the correct model for your network.

**Step 4** Find the transmit (TX) and receive (RX) markings that identify the top side of the GBIC transceiver.



**Note** On some GBIC transceivers, the TX and RX marking might be replaced by arrowheads pointing from the GBIC transceiver connector (transmit direction or TX) and toward the connector (receive direction or RX).

**Step 5** Position the GBIC transceiver in front of the socket opening and insert the GBIC transceiver into the socket until you feel the GBIC transceiver module connector snap into place in the socket connector.



**Note** For optical GBIC transceivers, before removing the dust plugs and making any optical connections, observe the following guidelines:

- Always keep the protective dust plugs on the unplugged fiber-optic cable connectors and the transceiver optical bores until you are ready to make a connection.
- Always inspect and clean the SC connector end-faces just before making any connections.
- Always grasp the SC connector housing to plug or unplug a fiber-optic cable.

**Step 6** Remove the dust plugs from the network interface cable SC connectors. Save the dust plugs for future use.

**Step 7** Inspect and clean the SC connector's fiber-optic end-faces. (Refer to [“Cleaning the Fiber-Optic Connectors”](#) section on page A-38.)

**Step 8** Remove the dust plugs from the GBIC transceiver optical bores.

**Step 9** Immediately attach the network interface cable SC connector to the GBIC transceiver.

**Step 10** To connect 1000BASE-T GBIC transceivers to a copper network, perform the following substeps:



**Caution** To comply with GR-1089 intrabuilding lightning immunity requirements, you must use grounded, shielded, twisted-pair, Category 5 cabling.

- a. Insert the Category 5 network cable RJ-45 connector into the GBIC transceiver.



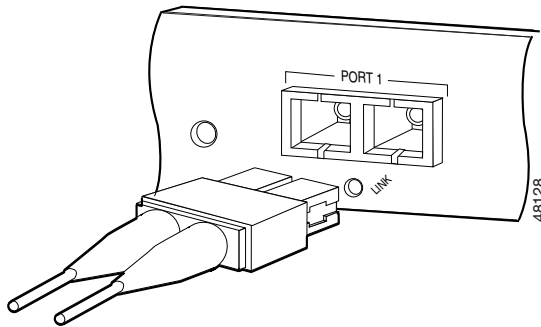
**Note** When connecting to a 1000BASE-T-compatible server, workstation, or router, use four twisted-pair, straight-through Category 5 cabling for the GBIC transceiver port. When connecting to a 1000BASE-T-compatible switch or repeater, use four twisted-pair, crossover Category 5 cabling.

- b. Insert the other end of the network cable into an RJ-45 port on a 1000BASE-T-compatible target device.

**Step 11** Observe the port status LED:

- The LED turns green when the GBIC transceiver and the target device have an established link.
- The LED turns amber while the GBIC discovers the network topology and searches for loops. This process takes about 30 seconds, and then the LED turns green.
- If the LED is off, the target device might not be turned on, there might be a cable problem, or there might be a problem with the adapter that is installed in the target device.

**Figure 1-35 Connecting the Supervisor Engine Uplink Ports**



**Note**

If you are using the LX/LH GBIC with MMF, you need to install a patch cord between the GBIC and the MMF cable.

## Installing and Cabling Optical SFP Transceiver Uplink Ports



**Caution**

We strongly recommend that you do not install or remove the SFP transceiver module with fiber-optic cables attached to it because of the potential damage to the cables, the cable connector, or the optical interfaces in the SFP transceiver. Disconnect all cables before removing or installing an SFP transceiver.



**Caution**

Removing and installing an SFP transceiver can shorten its useful life. Do not remove and insert SFP transceivers more often than is absolutely necessary.



**Caution**

The SFP transceiver modules are static-sensitive devices. Always use an ESD wrist strap or similar individual grounding device when handling SFP transceivers or when coming in contact with modules.

To install and cable an optical SFP transceiver uplink port, follow these steps:

- Step 1** Attach an ESD-preventive wrist strap to your wrist and to the ESD ground connector on the chassis or to a properly grounded bare metal surface.
- Step 2** Remove the optical SFP transceiver module from its protective packaging.



**Note**

Do not remove the optical bore dust plugs until you are directed to do so later in the procedure.

- Step 3** Check the label on the SFP transceiver body to verify that you have the correct model for your network.

**Step 4** Find the transmit (TX) and receive (RX) markings that identify the top side of the SFP transceiver.



**Note** On some SFP transceivers, the TX and RX marking might be replaced by arrowheads pointing from the SFP transceiver connector (transmit direction or TX) and toward the connector (receive direction or RX).

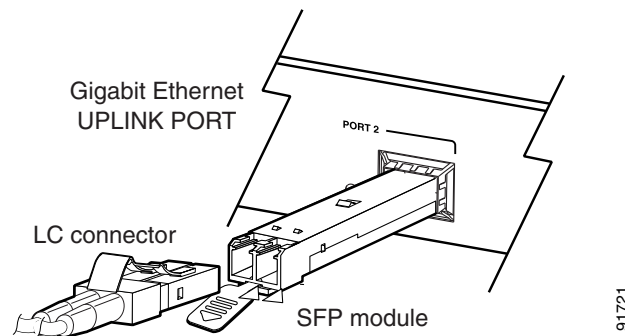
**Step 5** Position the SFP transceiver in front of the socket opening. (See [Figure 1-36](#).)



**Note** Different Cisco devices have different SFP module socket configurations. Your Cisco device could have either a latch-up or a latch-down orientation. Ensure that you are installing the SFP transceiver in the correct orientation for your Cisco device. For more details, refer to the hardware installation instructions that shipped along with your Cisco device.

**Step 6** Leave the bale-clasp in the closed (locked) position and slide the SFP transceiver into the socket until you feel the SFP transceiver snap into place in the socket. An audible click might also be heard as the SFP transceiver latch engages in the socket. (See [Figure 1-39](#).)

**Figure 1-36 Supervisor Engine 720 SFP Uplink Port**



**Note** Before removing the dust plugs and making any optical connections, observe the following guidelines:

- Always keep the protective dust plugs on the unplugged fiber-optic cable connectors and the transceiver optical bores until you are ready to make a connection.
- Always inspect and clean the LC connector end-faces just before making any connections.
- Always grasp the LC connector housing to plug or unplug a fiber-optic cable.

**Step 7** Remove the dust plugs from the network interface cable LC connectors. Save the dust plugs for future use.

**Step 8** Inspect and clean the LC connector's fiber-optic end-faces. (Refer to the Tip below for a pointer to more information about fiber-optic inspection and cleaning.)

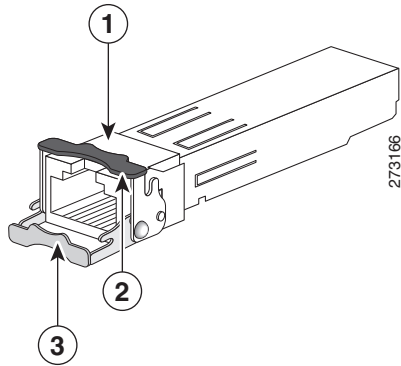
**Step 9** Remove the dust plugs from the SFP transceiver optical bores. Inspect and clean the LC connector's fiber-optic end faces. (Refer to [“Cleaning the Fiber-Optic Connectors”](#) section on page A-38.)

**Step 10** Immediately attach the network interface cable LC connector to the SFP transceiver.

## Installing and Cabling Copper SFP Transceiver Uplink Ports

The copper SFP transceiver, see [Figure 1-37](#), has a bale-clasp locking mechanism that secures the transceiver in the module socket. An RJ-45 connector provides the transceiver's interface point to the network.

**Figure 1-37** SFP Transceiver (Copper)



<b>1</b>	RJ-45	<b>3</b>	Bale-clasp latching mechanism shown in the open (unlocked) position
<b>2</b>	Bale-clasp latching mechanism shown in the closed (locked) position		



### Caution

To comply with GR-1089 intrabuilding lightning immunity requirements, you must use grounded, shielded, twisted-pair, Category 5 cabling.



### Note

When connecting to a 1000BASE-T-compatible server, workstation, or router, use four twisted-pair, straight-through Category 5 cabling for the SFP transceiver port. When connecting to a 1000BASE-T-compatible switch or repeater, use four twisted-pair, crossover Category 5 cabling.

To install a copper SFP transceiver, follow these steps:

- Step 1** Attach an ESD-preventive wrist strap to your wrist and to the ESD ground connector on the chassis or to a properly grounded bare metal surface.



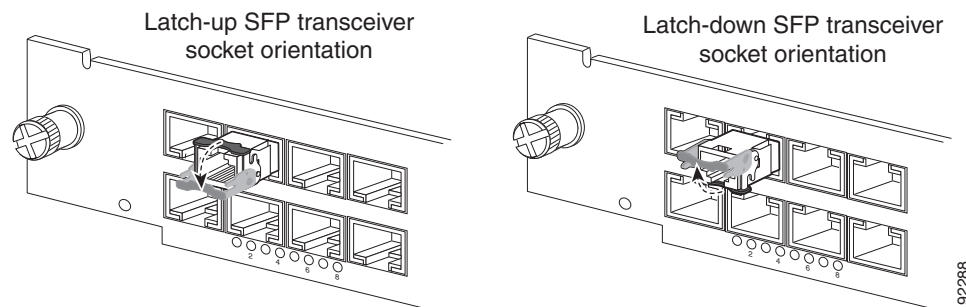
**Caution** To avoid ESD damage, handle the SFP by its sides; do not touch the connector pins.

- Step 2** Remove the new copper SFP from its protective packaging.
- Step 3** Check the markings on the SFP transceiver to verify that you have the correct model for your network.
- Step 4** Position the SFP transceiver in front of the port socket opening.



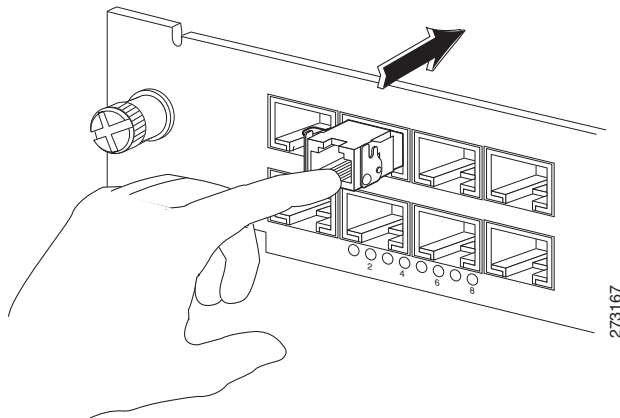
**Note** Different Cisco devices have different SFP transceiver socket configurations. Your Cisco device might require that the SFP transceiver be installed with the bale-clasp either in a latch-up or a latch-down orientation. [Figure 1-38](#), left view, shows the SFP installed in a latch-up orientation where the bale-clasp latching mechanism pivots up to the closed (locked) position. [Figure 1-38](#), right view shows the SFP installed in a latch-down orientation where the bale-clasp latching mechanism pivots down to the closed (locked) position. Verify that you have the SFP transceiver oriented correctly when you position it in front of the port socket.

**Figure 1-38 SFP Transceiver Socket Orientations**



- Step 5** Leave the bale-clasp in the closed (locked) position and slide the SFP transceiver into the socket until you feel the SFP transceiver snap into place in the socket. An audible click might also be heard as the SFP transceiver latch engages in the socket. (See [Figure 1-39](#).)

**Figure 1-39** Installing the Copper SFP Transceiver



**Step 6** Connect the network interface cable RJ-45 plug to the SFP RJ-45 connector.

**Step 7** Observe the port status LED:

- The LED turns green when the SFP transceiver and the target device have an established link.
- The LED turns amber while the port discovers the network topology and searches for loops. This process takes about 30 seconds, and then the LED turns green.
- If the LED is off, the target device might not be turned on, there might be a cable problem, or there might be a problem with the adapter that is installed in the target device. Refer to the Troubleshooting section of your switch hardware guide for solutions to cabling problems.

## Installing and Cabling 10GBASE-X XENPAK Transceiver Uplink Ports



**Caution**

We strongly recommend that you do not install or remove the XENPAK transceiver with fiber-optic cables attached to it because of the potential damage to the cables, the cable connector, or the optical interfaces in the XENPAK transceiver. Disconnect all cables before removing or installing an XENPAK transceiver.



**Caution**

Removing and installing an XENPAK transceiver can shorten its useful life. Do not remove and insert XENPAK transceivers more often than is absolutely necessary.





**Caution**

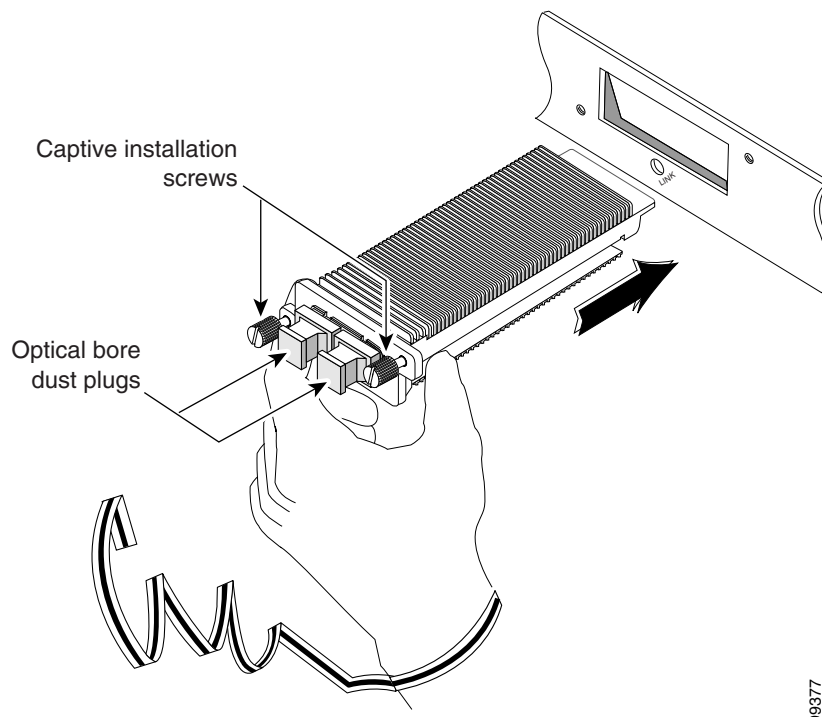
The XENPAK transceivers are static-sensitive devices. Always use an ESD wrist strap or similar individual grounding device when handling XENPAK transceivers or when coming in contact with modules.



To install and cable a XENPAK transceiver uplink port, follow these steps:

- Step 1** Attach an ESD-preventive wrist strap to your wrist and to the ESD ground connector or to a properly grounded bare metal surface.
- Step 2** Loosen the two screws that secure the uplink port cover plate to the supervisor engine faceplate and remove the cover plate. Save the cover plate for future use.
- Step 3** Remove the XENPAK transceiver from its protective packaging.
-  **Note** Do not remove the optical bore dust plugs until you are directed to do so later in the procedure.
- Step 4** Check the label on the XENPAK transceiver body to verify that you have the correct model for your network.
- Step 5** Find the transmit (TX) and receive (RX) markings that identify the top side of the XENPAK transceiver.
-  **Note** On some XENPAK transceivers, the TX and RX marking might be replaced by arrows pointing from the XENPAK transceiver connector (transmit direction or TX) and toward the connector (receive direction or RX).
- Step 6** Position the XENPAK transceiver in front of the uplink port opening and slide the XENPAK transceiver into the opening until you determine that the XENPAK transceiver faceplate is in contact with the supervisor engine faceplate. (See [Figure 1-40](#).) This step ensures that the XENPAK transceiver is fully seated in the supervisor engine socket.

**Figure 1-40** Installing a XENPAK Transceiver



99377

- Step 7** Tighten the two captive installation screws to secure the XENPAK transceiver in the socket. Avoid cross-threading or overtightening the captive screws.

**Note**

For optical XENPAK transceivers, before removing the dust plugs and making any optical connections, observe the following guidelines:

- Always keep the protective dust plugs on the unplugged fiber-optic cable connectors and the transceiver optical bores until you are ready to make a connection.
- Always inspect and clean the SC connector end-faces just before making any connections. (See the Tip on this page for a pointer to more information about fiber-optic inspection and cleaning.)
- Always grasp the LC connector housing to plug or unplug a fiber-optic cable.

- Step 8** Remove the dust plugs from the network interface cable SC connectors. Save the dust plugs for future use.

- Step 9** Inspect and clean the SC connector's fiber-optic end faces. (Refer to [“Cleaning the Fiber-Optic Connectors”](#) section on page A-38.)

- Step 10** Remove the dust plugs from the XENPAK transceiver optical bores.

- Step 11** Immediately attach the network interface cable SC connector to the XENPAK transceiver. (See [Figure 1-41](#).)

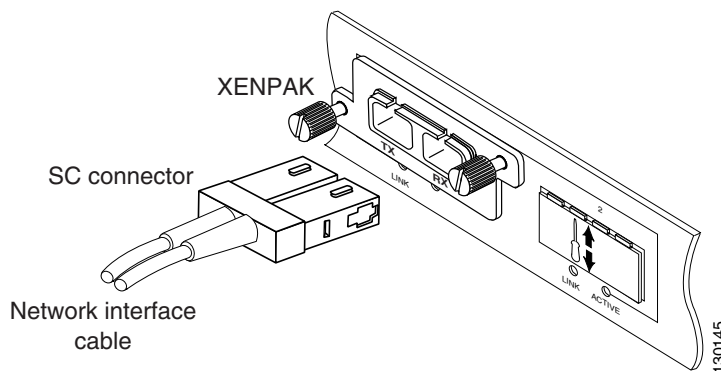
- Step 12** To connect XENPAK-10GB-CX4 transceivers to a network, perform the following substeps:

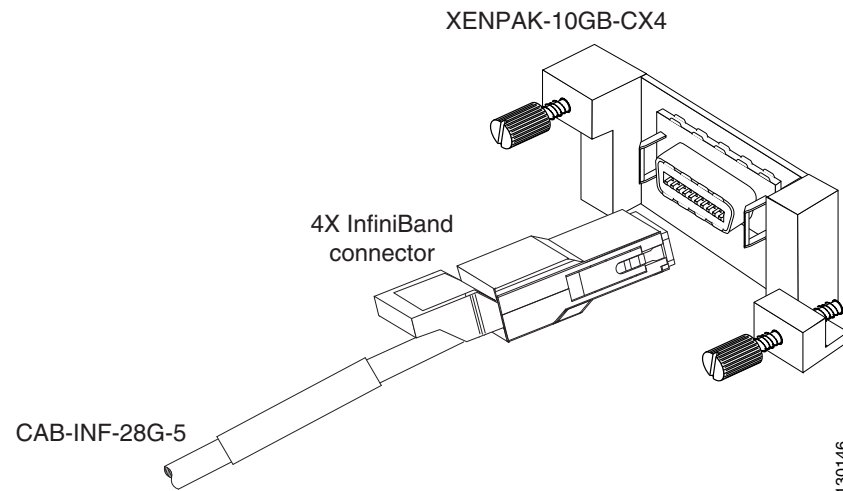
- Insert the network cable InfiniBand 4x connector into the XENPAK transceiver port. (See [Figure 1-42](#).)
- Insert the other end of the network cable into a InfiniBand-compatible target device.

- Step 13** Observe the port status LED:

- The LED turns green when the SFP transceiver and the target device have an established link.
- The LED turns amber while STP discovers the network topology and searches for loops. This process takes about 30 seconds, and then the LED turns green.
- If the LED is off, the target device might not be turned on, there might be a cable problem, or there might be a problem with the adapter that is installed in the target device. Refer to the Troubleshooting section of your switch hardware guide for solutions to cabling problems.

**Figure 1-41** Cabling an Optical XENPAK Transceiver



**Figure 1-42** Cabling a CX4 (Copper) XENPAK Transceiver

## Installing and Cabling 10GBASE-X X2 Transceiver Uplink Ports


The 10-Gigabit X2 transceiver can have either a spring-loaded latch sleeve or a latch sleeve that is not spring loaded. Both transceiver types are functionally identical.



### Caution

The X2 transceiver is a static-sensitive device. Always use an ESD wrist strap or similar individual grounding device when handling X2 transceivers or coming in contact with system modules.

To install an X2 transceiver uplink port, follow these steps:

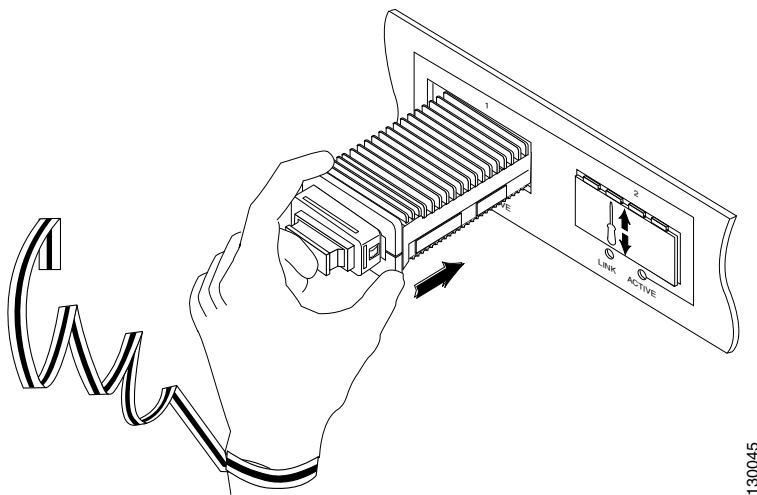
- Step 1** Using a small flat-blade screwdriver, carefully pry the X2 transceiver port cover off of the supervisor engine faceplate.
- Use the two arrows on the port cover as guides for inserting the screwdriver blade. Save the port cover for future use.
- Step 2** Remove the X2 transceiver from its protective packaging.
-  **Note** Do not remove the optical bore dust plugs until directed to do so later in the procedure.
- Step 3** Check the label on the X2 transceiver body to verify that you have the correct model for your network.

- Step 4** To install the X2 transceiver, do the following:
- Insert the X2 transceiver into the transceiver socket on the supervisor engine faceplate. (See [Figure 1-43](#), top view.) Continue sliding the X2 transceiver into the socket until the X2 transceiver EMI gasket is flush against the system module faceplate. The X2 transceiver connector is now mated to the socket connector.
  - Verify that the X2 transceiver latches are fully engaged and secure by sliding the transceiver latching sleeve toward the supervisor engine faceplate. (See [Figure 1-43](#), bottom view.)

**Caution**

If the latches are not fully engaged, you may accidentally disconnect the X2 transceiver.

**Figure 1-43** Installing the 10-Gigabit X2 Transceiver

**Note**

10-Gigabit X2 transceivers are keyed to prevent incorrect insertion.

**Step 5** If you are cabling an optical X2 transceiver, perform the following substeps. If you are cabling a CX4 X2 transceiver, go to Step 6.

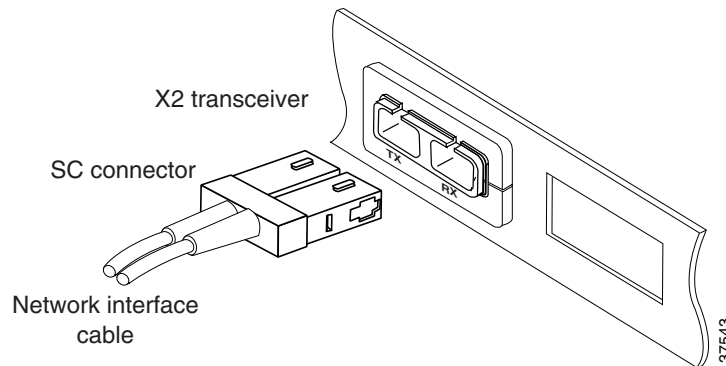


**Note**

Before removing the dust plugs and making any optical connections, observe the following guidelines:

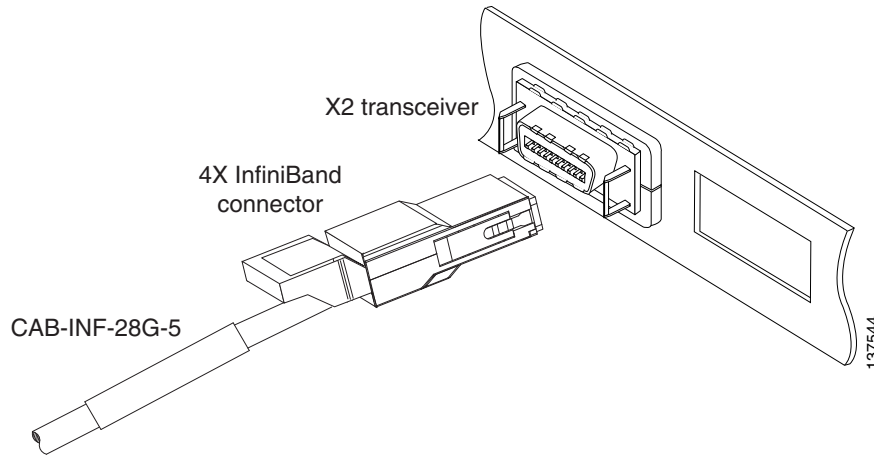
- Always keep the protective dust plugs on the unplugged fiber-optic cable connectors and the transceiver optical bores until you are ready to make a connection.
  - Always inspect and clean the SC connector end-faces just before making any connections. Refer to the Tip on this page for a pointer to a fiber-optic inspection and cleaning white paper.
  - Always grasp the SC connector housing to plug or unplug a fiber-optic cable.
- 
- a. Remove the dust plugs from the optical network interface cable SC connectors. Save the dust plugs for future use.
  - b. Inspect and clean the SC connector's fiber-optic end faces. Refer to [“Cleaning the Fiber-Optic Connectors”](#) section on page A-38.
  - c. Remove the dust plugs from the X2 transceiver optical bores.
  - d. Immediately attach the network interface cable SC connectors to the X2 transceiver. (See [Figure 1-44](#) for cabling an optical X2 transceiver.)

**Figure 1-44** Cabling an Optical 10-Gigabit X2 Transceiver



- Step 6** Plug the InfiniBand cable connector into the CX4 X2 transceiver connector. (See [Figure 1-45](#).) Make sure that the InfiniBand cable connector is aligned with the X2 transceiver.

**Figure 1-45** *Cabling a CX4 (Copper) 10-Gigabit X2 Transceiver*

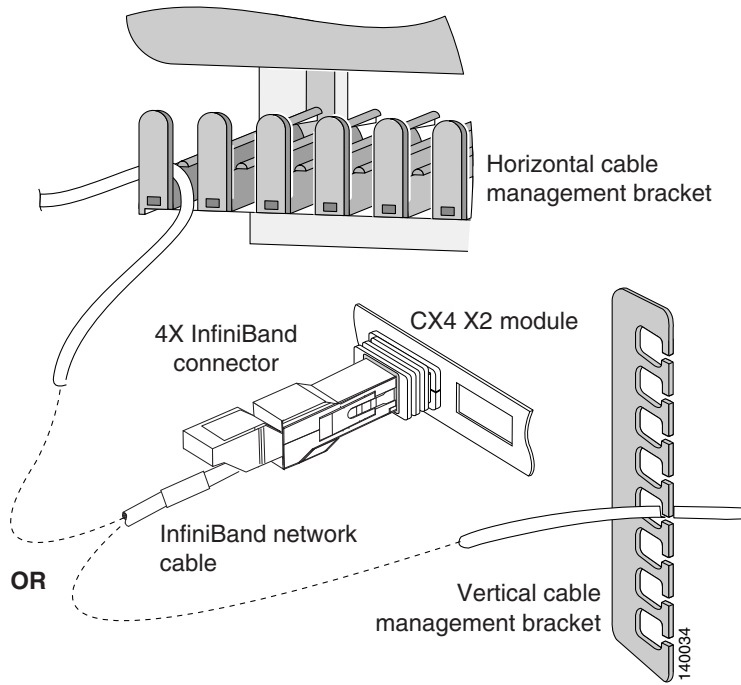


- Step 7** Carefully route the InfiniBand network cable through the cable management brackets on your system. [Figure 1-46](#) shows how the InfiniBand cable should be routed through either a horizontal cable management bracket or a vertical cable management bracket to provide adequate strain relief and support to prevent connector sag or skew.



**Note** Make sure that you route the InfiniBand cable through cable management brackets to provide adequate strain relief and cable support when cabling CX4 X2 transceivers. The InfiniBand cable is heavy. Without proper support, the InfiniBand cable can cause the cable connector to sag or skew. Misalignment between the cable connector and the transceiver connector can cause intermittent connections between the cable connector pins and the CX4 X2 transceiver pins.

Figure 1-46 InfiniBand Cable Support



## Using the Catalyst 6509-V-E Cable Management System

The optional cable management system on the Catalyst 6509-V-E switch chassis has the capacity to hold several hundred Category 5, 6, or 6a copper network interface cables or fiber-optic network interface cables. In order to maximize the capacity of this cable management system, observe the following guidelines:

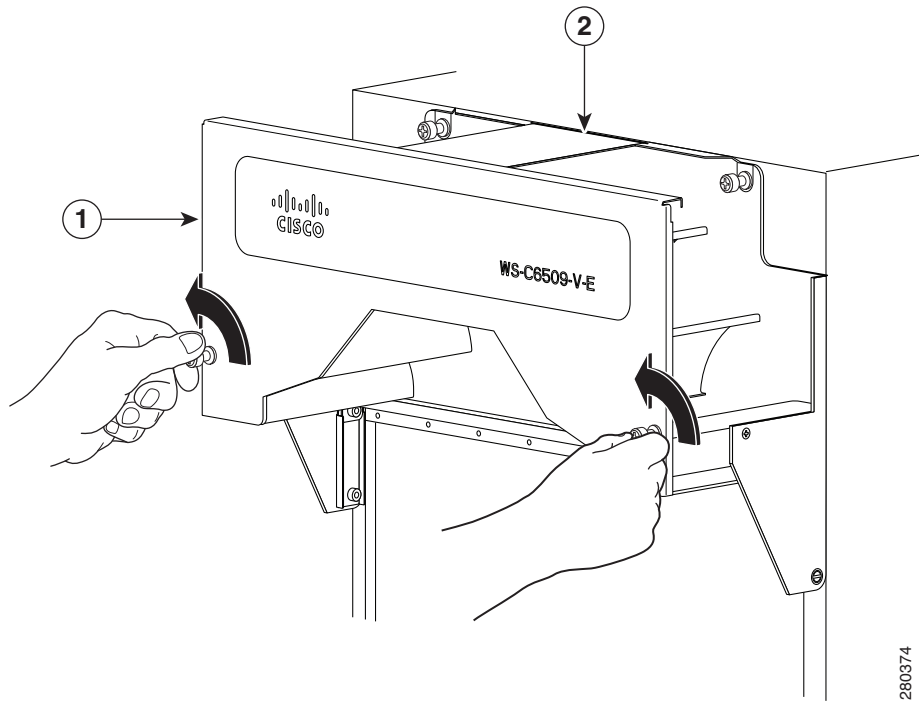
- In a fully populated chassis with every port in use, you may want to route the network cables coming from the ports on the module in slot 9 (left-most slot in the chassis) out the left side of the chassis and the network cables coming from the ports on the module in slot 1 (right-most slot in the chassis) out of the right side of the chassis and up to the room's overhead cable trough instead of routing them through the chassis cable management system. Routing the cables this way provides additional room for the cables from the chassis inner slots (slot 2 through slot 8 to be routed through the cable management assembly guides then to the overhead trough).
- You must make sure that there is adequate slack in each network cable so that the cable management assembly can be disengaged and pivoted down to allow access to the fan trays.
- When you route the network cables up from the module port through the cable management guides, you must also allow adequate cable slack to maintain a shallow radius of curvature. Excessive bend in the network cables can break wires and damage connectors. This is especially true with optical-fiber cables, which are more prone to damage from excessive bending and inadequate strain relief than copper cables.

If you are attaching and routing network interface cables on a Catalyst 6509-V-E switch chassis that has the cable management system installed, perform the following steps:

- 
- Step 1** Remove the cable management system's front panel assembly by loosening the two captive installation screws. (See [Figure 1-47](#).)
  - Step 2** Pivot the front panel assembly up to disengage the front panel tab from the slot at the rear of the cable management assembly. (See [Figure 1-48](#).) This exposes the six cable guides allowing you to route the network interface cables. Set the front panel aside.

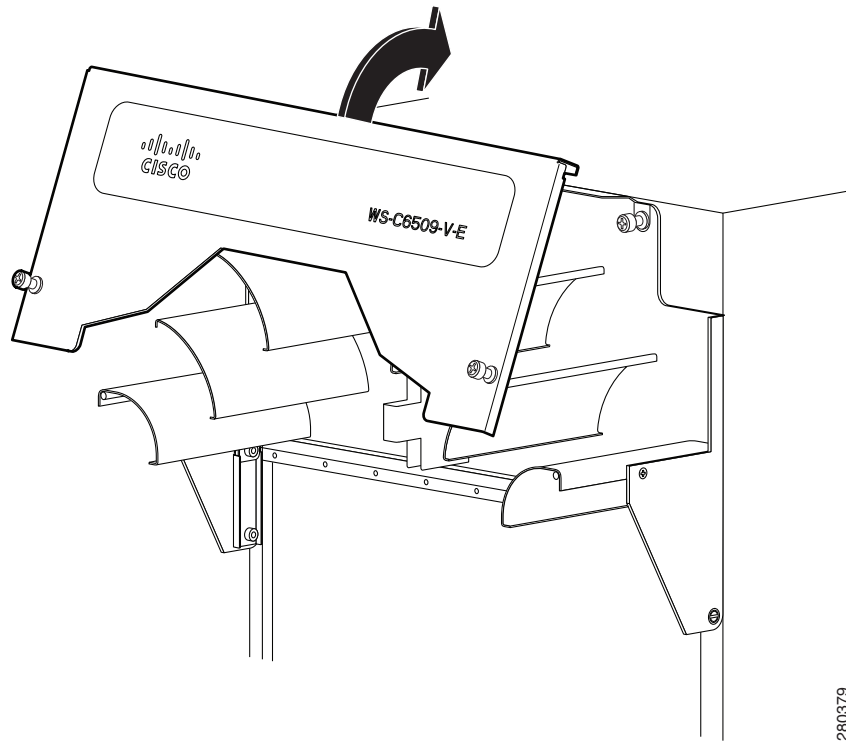


**Figure 1-47** Removing the Cable Management Front Panel Assembly



<b>1</b>	Front panel assembly	<b>2</b>	Front panel tab
----------	----------------------	----------	-----------------

**Figure 1-48** Disengaging the Front Panel Tab from the Rear of the Cable Guide Assembly



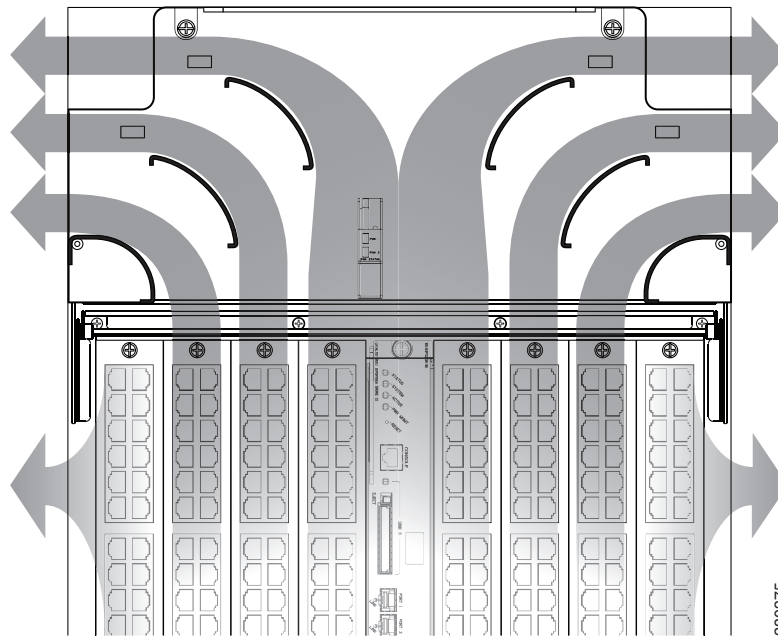
280379

- Step 3** Connect and route a network cable from one of the chassis module ports up through the cable management guides and up to the room's overhead cable trough. When routing network interface cables through the cable guides, you must allow adequate slack in the network cable so that the cable's bend radius is always shallow and so that the cable management assembly can be pivoted down to permit access to the chassis fan tray assembly.

**Tip**

To keep the network interface cables organized and minimize the space they occupy, try bundling them in groups of 12 cables (4 bundles of 12 cables per 48-port module). (See [Figure 1-49](#).)

**Figure 1-49 Routing Network Cables Through the Cable Management Assembly**



- Step 4** Repeat step 3 for the remainder of the network interface cables. After routing the remaining network interface cables through the cable management guides, you are ready to reinstall the cable management assembly front panel.
- Step 5** Position the front panel assembly and insert the front panel tab into the slot at the back of the cable guide system. (See [Figure 1-50](#).)
- Step 6** Pivot the front panel assembly down. Make sure that all of the network cables are properly routed, clear of the front panel and that none of them are being pinched. Align the front panel so that you can start the two captive installation screws on the front panel.

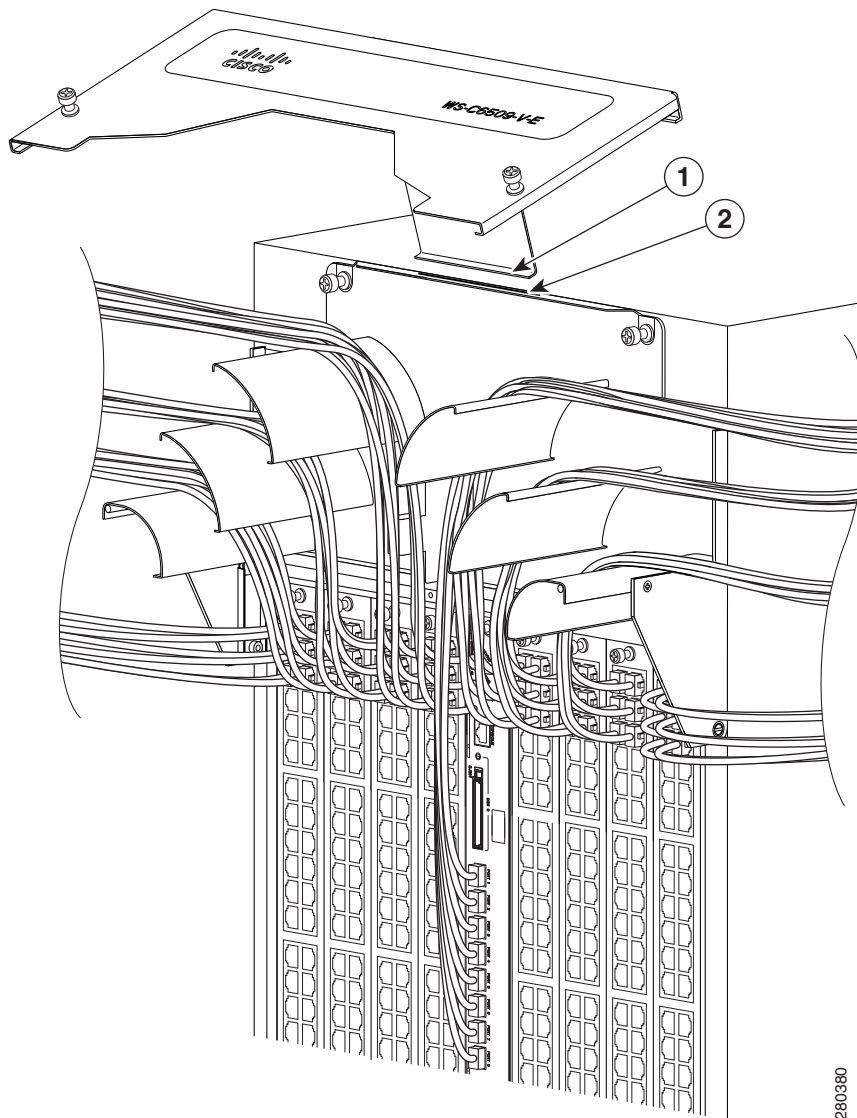


**Caution**

As you reinstall the front panel assembly, make sure that all of the network cables are properly routed over the cable guides, that all network cables maintain the proper bend radius, and that none of the network cables are being pinched between the cable guides and the front panel assembly.

- Step 7** Verify that the tab is still engaged in the slot on the back of the cable guide assembly and tighten the two captive installation screws on the front panel assembly. (See [Figure 1-51](#).)

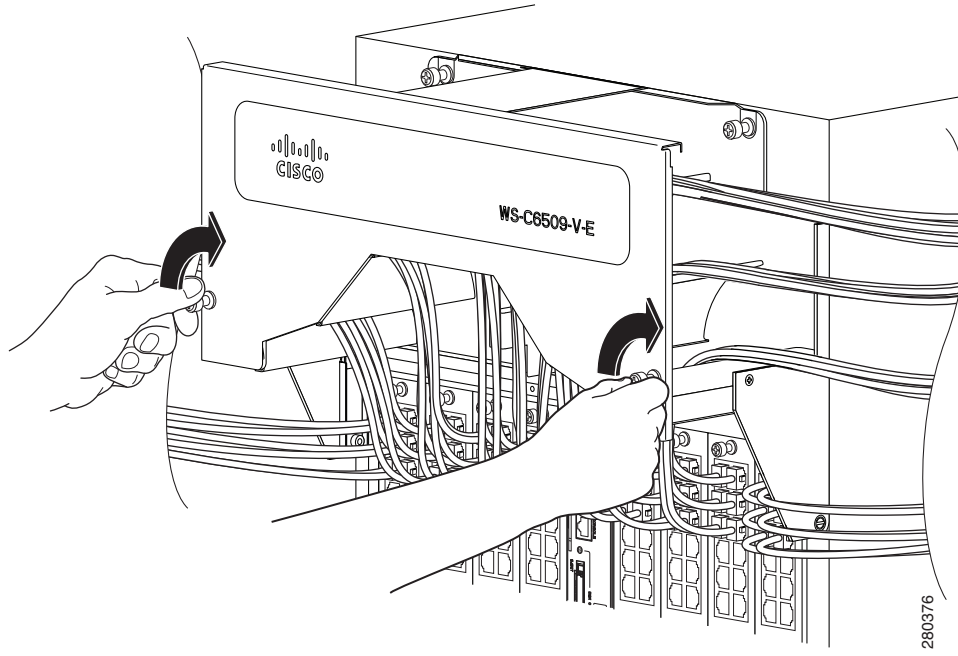
**Figure 1-50** Reinstalling the Cable Guide Front Panel Assembly



280380

1	Front panel assembly tab	2	Slot
---	--------------------------	---	------

Figure 1-51 Securing the Cable Guide Front Panel Assembly



# Verifying Switch Chassis Installation

To verify the switch chassis installation, follow these steps:

- 
- Step 1** Verify that the ejector levers of each module are fully closed (parallel to the faceplate) to ensure that the supervisor engine and all switching modules are fully seated in the backplane connectors.
  - Step 2** Check the captive installation screws of each module, the power supply, and the fan assembly. Tighten any loose captive installation screws.
  - Step 3** Verify that all empty module slots have blank faceplates installed and that the screws holding the plates in place are tight. The blank faceplates optimize the air flow through the chassis and contain electromagnetic interference.

**Warning**

---

**Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.**

Statement 1029

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- Step 4** Turn on the power supply switches to power up the system. During the power-up sequence, the system performs a series of bootup diagnostic tests.

Additional system diagnostic tests are available. These tests allow you to perform a complete sanity check on the system prior to inserting the system into your network and to monitor the health of the system while the system is running. Refer to the [“Online Diagnostics” section on page 1-84](#) for further information.

**Tip**

---

When prestaging systems in a nonproduction environment, we recommend that you run all diagnostic tests, including the disruptive tests, to prescreen the systems for any failures.

---

## Online Diagnostics

The Catalyst 6500 series systems running Cisco IOS have many levels of online diagnostic capabilities. The online diagnostics are divided into four categories:

- **Bootup**—Bootup diagnostics automatically run during bootup, module OIR, or switchover to a backup supervisor engine.
- **Background health**—Monitoring diagnostic tests are continuously run by the system to monitor system health.

- On-demand online diagnostics—On-demand online diagnostics can be used to run any test from the CLI. You can also run on-demand online diagnostics to perform a sanity check on the system hardware. Some of these tests are disruptive and will impact traffic flow. You must follow the on-demand diagnostic guidelines exactly to avoid false failures.
- Scheduled diagnostics—Scheduled diagnostics can be used to run any of the above tests at user-designated intervals.

For complete information on the online diagnostic tests and how to run them, refer to Chapter 51 in the *Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide, Release 12.2SX*.







# CHAPTER 1

## Removal and Replacement Procedures

---



### Note

In this publication, the term Catalyst 6500 series refers only to the switch chassis listed in Chapter 1. The Catalyst 6000 series switches (Catalyst 6006 and Catalyst 6009 switches) are described in a separate publication, the *Catalyst 6000 Series Switch Installation Guide*.

---

This chapter describes how to perform the following removal and replacement procedures for the Catalyst 6500 series field-replaceable units (FRUs):

- [Online Insertion and Removal, page 1-1](#)
- [Removing and Installing the AC-Input Power Supplies, page 1-2](#)
- [Removing and Installing the DC-Input Power Supplies, page 1-15](#)
- [Removing and Installing PEMs, page 1-75](#)
- [Removing and Installing the Fan Tray, page 1-82](#)
- [Installing the Air Filter Assembly on a Catalyst 6509-NEB-A Switch or a Catalyst 6509-V-E \(Optional\), page 1-93](#)
- [Installing the Remote Power Cycling Feature Control Wires \(Optional\), page 1-98](#)



### Warning

**Only trained and qualified personnel should be allowed to install, replace, or service this equipment.**  
Statement 1030

---

## Online Insertion and Removal

The online insertion and removal (OIR) feature supported on the Catalyst 6500 series switches allows you to remove and replace modules while the system is online. You can shut down the modules before removal and restart them after insertion without causing other software or interfaces to shut down.



### Note

Do not remove or install more than one module at a time. After you remove or install a module, check the module LEDs before continuing.

---

When a module has been removed or installed, the Catalyst 6500 series switch stops processing traffic for the module and scans the system for a configuration change. Each interface type is verified against the system configuration, and then the system runs diagnostics on the new module. There is no disruption to normal operation during the module insertion or removal.

The switch can bring up only an identical replacement module online. To support OIR of an identical module, the module configuration is not removed from the running-config file when you remove a module.

If the replacement module is different from the removed module, you must configure it before the switch can bring it online.

Layer 2 MAC addresses are stored in an EEPROM, which allows modules to be replaced online without requiring the system to update switching tables and data structures. Regardless of the types of modules installed, the Layer 2 MAC addresses do not change unless you replace the supervisor engine. If you do replace the supervisor engine, the Layer 2 addresses of *all* ports change to those specified in the address allocator on the new supervisor engine.

For instructions on installing and replacing modules, refer to the *Catalyst 6500 Series Ethernet Modules Installation Guide*.

## Removing and Installing the AC-Input Power Supplies

This section describes how to remove and install AC power supplies in the Catalyst 6500 series chassis. The AC-input power supplies have three different form factors, which are not interchangeable between the Catalyst 6500 series chassis. [Table 1-1](#) lists the AC-input power supplies, the chassis that they are supported on, and the corresponding removal and replacement procedures.

**Table 1-1 Catalyst 6500 Series AC-Input Power Supplies Removal and Installation Procedures**

Power Supply	Chassis Supported	Removal and Installation Procedure
950 W (PWR-950-AC) 1400 W (PWR-1400-AC)	Catalyst 6503 Catalyst 6503-E	<a href="#">“Removing and Installing the 950 W and 1400 W AC-Input Power Supplies”</a> section on page 1-3
2700 W (PWR-2700W-AC)	Catalyst 6504-E	<a href="#">“Removing and Installing the 2700 W AC-Input Power Supply”</a> section on page 1-6
1000 W (WS-CAC-1000W) 1300 W (WS-CAC-1300W)	Catalyst 6506 Catalyst 6509 Catalyst 6509-NEB	<a href="#">“Removing and Installing the 1000 W, 1300 W, 2500 W, 3000 W, 4000 W, 6000 W, and 8700 W AC-Input Power Supplies”</a> section on page 1-9
2500 W (WS-CAC-2500W) 3000 W (WS-CAC-3000W) 4000 W (WS-CAC-4000W) 6000 W (WS-CAC-6000W) 8700 W <sup>1</sup> (WS-CAC-8700W-E)	Catalyst 6506 Catalyst 6506-E Catalyst 6509 Catalyst 6509-E Catalyst 6509-NEB Catalyst 6509-NEB-A Catalyst 6509-V-E Catalyst 6513 Catalyst 6513-E <sup>2</sup>	<a href="#">“Removing and Installing the 1000 W, 1300 W, 2500 W, 3000 W, 4000 W, 6000 W, and 8700 W AC-Input Power Supplies”</a> section on page 1-9

1. While the 8700 W power supply can be installed in any Catalyst 6500 series chassis with the exception of the 3-slot and the 4-slot chassis, the power supply’s form-factor is slightly different from the other power supplies listed. The form-factor difference requires you to move the system ground from the chassis ground pad on the Catalyst 6506, Catalyst 6509, or Catalyst 6509-NEB chassis to the power supply system ground lugs.
2. The 2500 W AC-input power supply is not supported on the Catalyst 6513-E switch chassis.

**Note**

The following power supply restrictions exist for the Catalyst 6500 series chassis:

- The 6000 W and the 8700 W power supplies are limited to 4000 W when they are installed in the Catalyst 6506, Catalyst 6509, and Catalyst 6509-NEB chassis.
- The 8700 W power supply is limited to 4500 W when it is installed in a Catalyst 6509-NEB-A chassis.
- The 8700 W power supply is limited to 6000 W when it is installed in a Catalyst 6513 chassis.

## Removing and Installing the 950 W and 1400 W AC-Input Power Supplies

This section describes how to remove and install the 950 W and 1400 W AC-input power supplies for the Catalyst 6503 and the Catalyst 6503-E switches. The section is divided into the following topics:

- [Required Tools, page 1-3](#)
- [Removing a 950 W or 1400 W AC-Input Power Supply, page 1-3](#)
- [Installing a 950 W or 1400 W AC-Input Power Supply, page 1-5](#)

**Note**

The 950 W and 1400 W AC-input power supplies can be installed in the Catalyst 6503 and the Catalyst 6503-E switch chassis only.

### Required Tools

You might need a flat-blade or number 2 Phillips-head screwdriver to loosen or tighten the captive installation screws on the power supply.

### Removing a 950 W or 1400 W AC-Input Power Supply

**Warning**

**Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing.** Statement 1034

**Note**

In systems with redundant power supplies, you can replace the faulty supply while the system is operating.

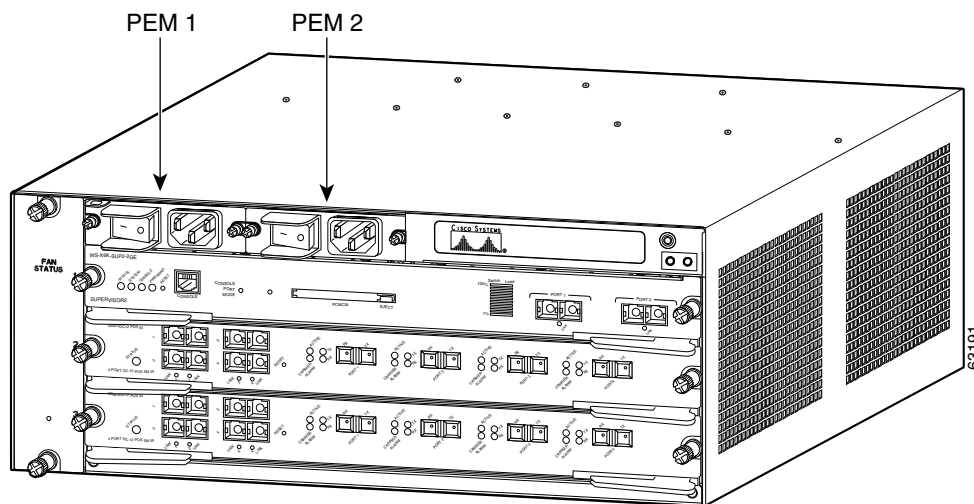
**Note**

This procedure covers the removal of the power supply only. For information on removing the power entry module (PEM), see the [“Removing and Installing PEMs” section on page 1-75](#).

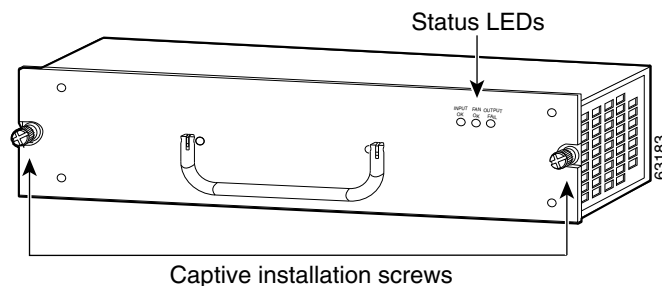
To remove a power supply, follow these steps:

- Step 1** Turn the power switch to the Off (0) position on the PEM for the power supply that you are removing. [Figure 1-1](#) shows the location of the AC-input PEMs on the Catalyst 6503 and Catalyst 6503-E switch chassis.
- Step 2** Disconnect the power cord from the power source. Do not touch the metal prongs on the power cord when it is still connected to the PEM.
- Step 3** Remove the power cord from the power connection on the PEM. Do not touch the metal prongs embedded in the PEM.
- Step 4** Loosen the captive installation screws on the power supply. See [Figure 1-2](#) for the Catalyst 6503 and 6503-E switches.
- Step 5** Grasp the power supply handle with one hand, and slide the power supply part of the way out of the chassis. Place your other hand underneath the power supply, as shown in [Figure 1-3](#), and slide the power supply completely out of the chassis.
- Step 6** If the power supply bay is to remain empty, install a blank power supply filler plate (Cisco part number 800-16727-01 for the Catalyst 6503 and Catalyst 6503-E switches) over the opening, and secure it with the captive installation screws.

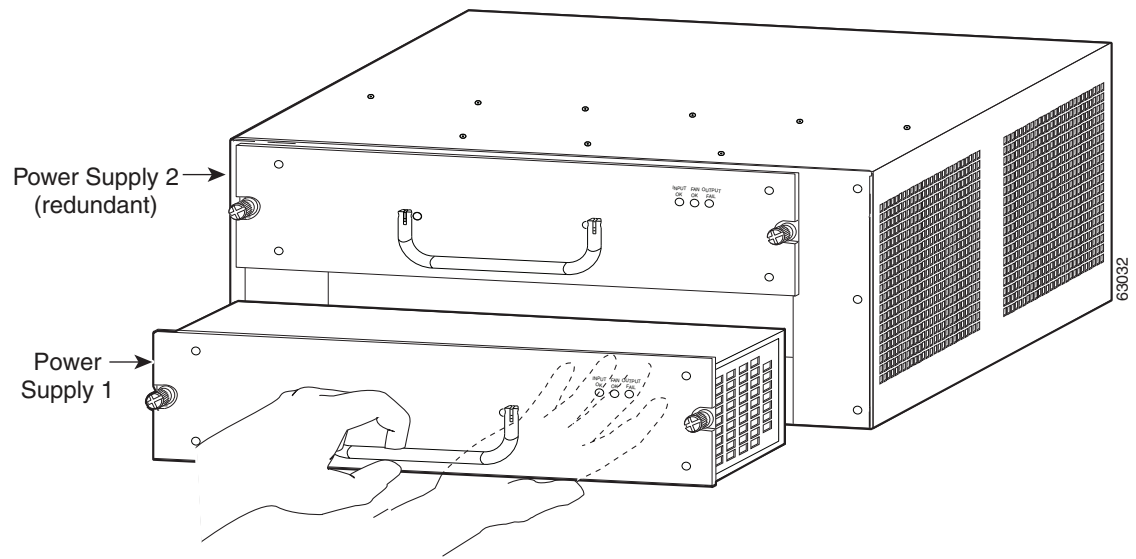
**Figure 1-1 Catalyst 6503 and Catalyst 6503-E Switches—PEM Location**



**Figure 1-2 Power Supply Captive Installation Screws**



**Figure 1-3 Handling an AC-Input Power Supply**



## Installing a 950 W or 1400 W AC-Input Power Supply

To install an AC-input power supply, follow these steps:

- 
- Step 1** Ensure that the system (earth) ground connection has been made.  
For ground connection instructions, see the [“Establishing the System Ground”](#) section on page 1-52.
  - Step 2** If necessary, remove the blank power supply filler plate from the chassis power supply bay opening by loosening the captive installation screws.
  - Step 3** Grasp the power supply handle with one hand. Place your other hand underneath the power supply, as shown in [Figure 1-3](#). Slide the power supply into the power supply bay. Make sure that the power supply is fully seated in the bay.
  - Step 4** Securely tighten the power supply captive installation screws.  
See [Figure 1-2](#) for the Catalyst 6503 and Catalyst 6503-E switches.



**Caution**

Power supply captive installation screws must be tight to ensure protective grounding continuity.

- Step 5** At the front of the chassis, plug the power cord into the PEM.

**Step 6** Connect the other end of the power cord to an AC-input power source.

**Caution**

In a system with dual power supplies, connect each power supply to a separate input source. In case of a power source failure, the second source should still be available.

**Step 7** Turn the PEM power switch to the On (I) position.

**Step 8** Verify the power supply operation by checking that the power supply LEDs are in the following states:

- INPUT OK LED is green
- FAN OK LED is green
- OUTPUT FAIL LED is not lit

If the LEDs indicate a power problem, see the [“Identifying Startup Problems”](#) section on page A-3 for troubleshooting information.

## Removing and Installing the 2700 W AC-Input Power Supply

This section describes how to remove and install the 2700 W AC-input power supply in the Catalyst 6504-E switch. The section is divided into the following topics:

- [Required Tools, page 1-6](#)
- [Removing a 2700 W AC-Input Power Supply, page 1-7](#)
- [Installing a 2700 W AC-Input Power Supply, page 1-8](#)

**Warning**

**Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing.** Statement 1034

**Note**

In systems with redundant power supplies, you can replace the faulty supply while the system is operating.

## Required Tools

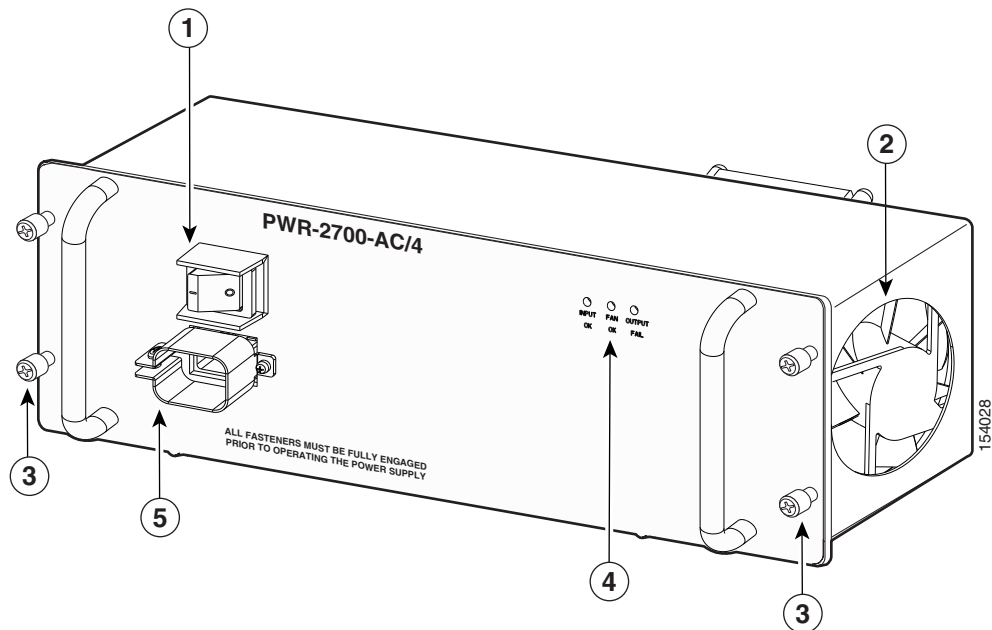
You might need a flat-blade or number 2 Phillips-head screwdriver to loosen or tighten the captive installation screws on the power supply.

## Removing a 2700 W AC-Input Power Supply

To remove a 2700 W AC-input power supply, follow these steps:

- Step 1** Turn the power switch to the off (0) position on the power supply you are removing.
- Step 2** Disconnect the power cord from the power source. Do not touch the metal prongs on the power cord while it is still connected to the power supply.
- Step 3** Remove the power cord from the power connection on the power supply.
- Step 4** Loosen the captive installation screws on the power supply. (See [Figure 1-4](#).)

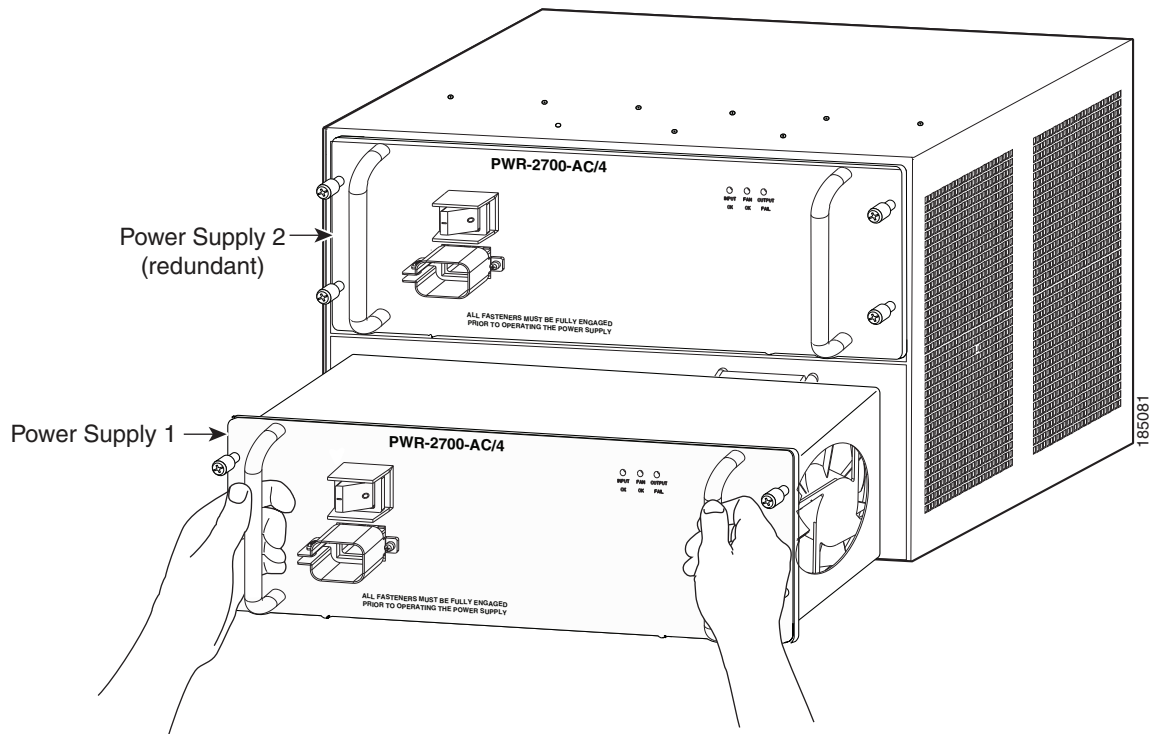
**Figure 1-4** 2700 W AC-Input Power Supply Captive Installation Screws



<b>1</b>	Power on/off switch	<b>4</b>	Status LEDs
<b>2</b>	Power supply fan	<b>5</b>	AC In receptacle
<b>3</b>	Captive installation screw		

- Step 5** Grasp both power supply handles, as shown in [Figure 1-5](#), and slide the power supply completely out of the chassis.

Figure 1-5 Handling a 2700 W AC-Input Power Supply



- Step 6** If the power supply bay is to remain empty, install a blank power supply filler plate (Cisco part number 800-16727-01) over the opening and secure it with the captive installation screws.

## Installing a 2700 W AC-Input Power Supply



### Warning

**This product requires short-circuit (overcurrent) protection, to be provided as part of the building installation. Install only in accordance with national and local wiring regulations.** Statement 1045

To install an AC-input power supply, follow these steps:

- Step 1** Ensure that the system (earth) ground connection has been made. For ground connection instructions, see the [“Establishing the System Ground”](#) section on page 1-52.
- Step 2** If necessary, remove the blank power supply filler plate from the chassis power supply bay opening by loosening the captive installation screws.
- Step 3** Verify that the power switch on the power supply is in the off (0) position.
- Step 4** Grasp both power supply handles. (See [Figure 1-5](#).) Slide the power supply into the power supply bay. Make sure that the power supply is fully seated in the bay.
- Step 5** Securely tighten the power supply captive installation screws.



### Warning

**Power supply captive installation screws must be tight to ensure protective grounding continuity.** Statement 289



- Step 6** Plug the power cord into the power supply AC-in receptacle.
- Step 7** Connect the other end of the power cord to the AC-input power source.

**Caution**

In a system with dual power supplies, connect each power supply to a separate source circuit. In case of a power source failure, the second source will most likely still be available.

- Step 8** Turn the switch on the power supply to the on (I) position.
- Step 9** Verify power supply operation by checking that the power supply LEDs are in the following states:
- INPUT OK LED is green
  - FAN OK LED is green
  - OUTPUT FAIL LED is not lit

If the LEDs indicate a power problem, see the “[Identifying Startup Problems](#)” section on page A-3 for troubleshooting information.

## Removing and Installing the 1000 W, 1300 W, 2500 W, 3000 W, 4000 W, 6000 W, and 8700 W AC-Input Power Supplies

This section describes how to remove and install the 1000 W, 1300 W, 2500 W, 3000 W, 4000 W, 6000 W, and 8700 W AC-input power supplies in the Catalyst 6500 series switches that support them. The section is divided into the following topics:

- [Required Tools, page 1-9](#)
- [Removing the 1000 W, 1300 W, 2500 W, 3000 W, 4000 W, 6000 W, and 8700 W AC-Input Power Supplies, page 1-10](#)
- [Installing the 1000 W, 1300 W, 2500 W, 3000 W, 4000 W, 6000 W, and 8700 W AC-Input Power Supplies, page 1-13](#)

All six power supplies have the same basic form factor and are removed and installed using the same procedures.

**Note**

Installing the 8700 W power supply in a Catalyst 6506, Catalyst 6509, or Catalyst 6509-NEB chassis requires you to install the system ground wire on the power supply’s system ground lugs rather than on the chassis system ground pad.

**Note**

In systems with redundant power supplies, you can replace the faulty supply while the system is operating.

### Required Tools

You might need a flat-blade or number 2 Phillips-head screwdriver to loosen or tighten the captive installation screws on the power supply.

## Removing the 1000 W, 1300 W, 2500 W, 3000 W, 4000 W, 6000 W, and 8700 W AC-Input Power Supplies



### Warning

**Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing.** Statement 1034

To remove an AC-input power supply, follow these steps:

- 
- Step 1** Turn the power switch to the off (0) position on the power supply that you are removing. (See [Figure 1-6](#).) Turning the power switch off also disengages a pawl that unlocks the power supply from the chassis.
- Step 2** Disconnect the power cord from the power source.
- Step 3** If you are removing an 8700 W power supply from a Catalyst 6506, Catalyst 6509, or Catalyst 6509-NEB chassis, perform the following substeps to remove the system ground wire from the system ground posts on the power supply:
- a. Loosen and remove the two M4 nuts securing the system ground lug to the two system ground posts on the power supply. Set the two nuts aside.
  - b. Remove and set aside the two washers from each post.
  - c. Remove the system ground lug from the system ground posts and set it aside.
- Step 4** Loosen the screw on the cable retention device, and disconnect the power cord from the power supply being removed.



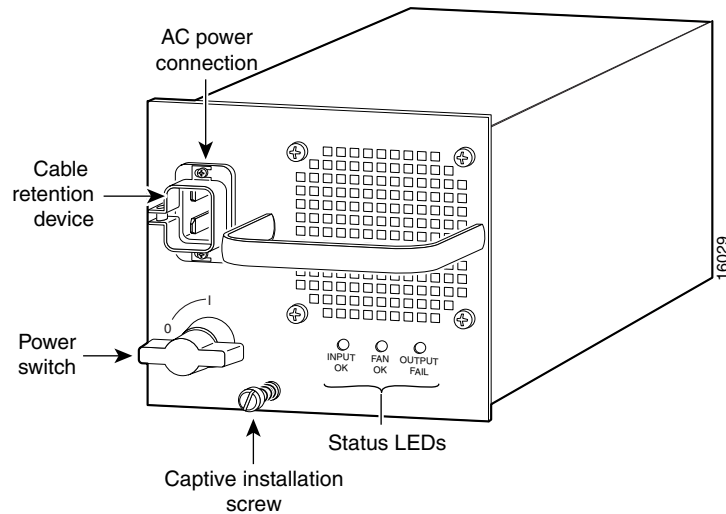
**Note** The AC power cord for the 4000 W power supply is hard wired to the power supply and cannot be removed.

- Step 5** Loosen the captive installation screw. (See [Figure 1-6](#).)



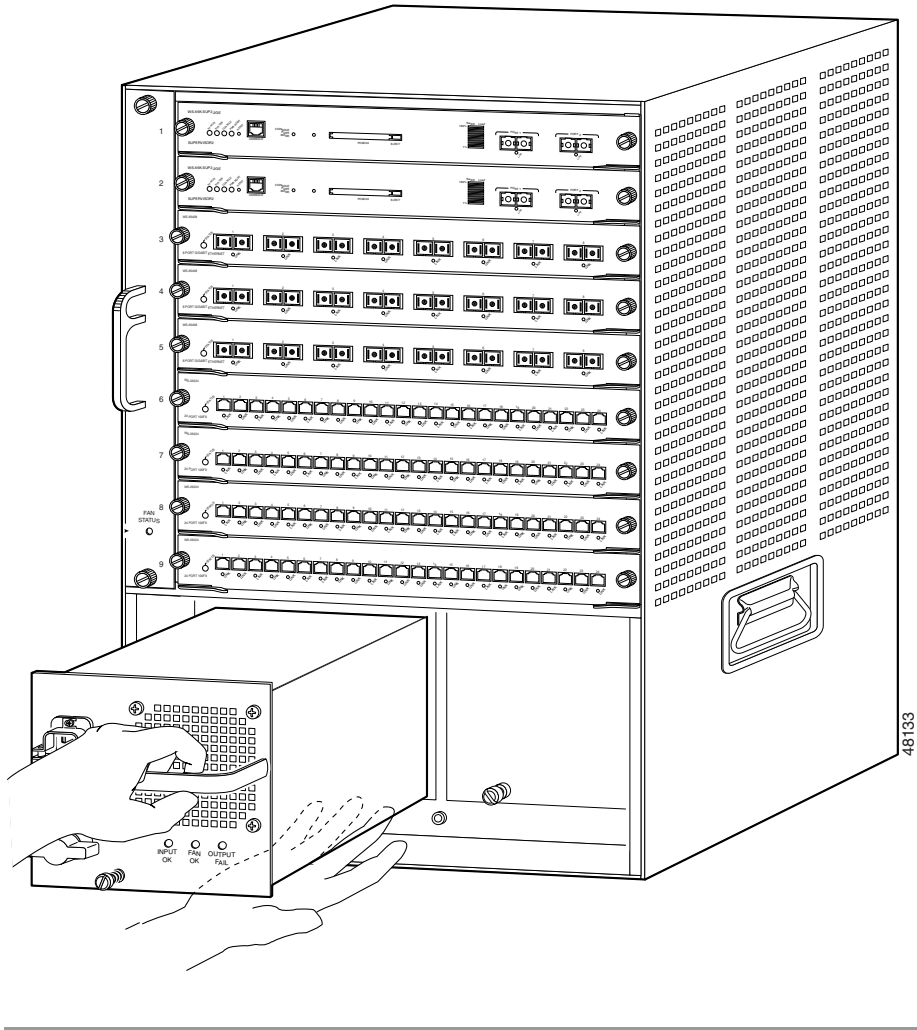
### Caution

Use both hands to install and remove power supplies. Catalyst 6500 series AC-input power supplies weigh between 14.5 pounds (6.58 kg) and 29.0 pounds (13.15 kg).

**Figure 1-6 AC-Input Power Supply Front Panel**

- Step 6** Grasp the power supply handle with one hand, and slide the power supply part of the way out of the chassis. Place your other hand underneath the power supply, as shown in [Figure 1-7](#), and slide the power supply completely out of the chassis.
- Step 7** If the power supply bay is to remain empty, install a blank faceplate (Cisco part number 700-03104-01) over the opening, and secure it with the captive installation screw.
- Step 8** If you have removed an 8700 W power supply from either a Catalyst 6506, Catalyst 6509, or Catalyst 6509-NEB chassis and you have disconnected the system (NEBS) ground from the power supply system ground studs, make sure that you reattach the system ground lug to either the chassis system ground pad if you are not installing a new 8700 W power supply or to the system ground studs if you are installing a new 8700 W power supply.

Figure 1-7 Handling an AC-Input Power Supply



## Installing the 1000 W, 1300 W, 2500 W, 3000 W, 4000 W, 6000 W, and 8700 W AC-Input Power Supplies

**Caution**

Use both hands to install and remove power supplies. Each Catalyst 6500 series AC-input power supply weighs between 14.5 pounds (6.6 kg) and 40 pounds (18.14 kg).

To install an AC-input power supply, follow these steps:

- Step 1** Ensure that the system (earth) ground connection has been made. For ground connection instructions, see the [“Establishing the System Ground”](#) section on page 1-52.

**Note**

If you are installing an 8700 W power supply in a Catalyst 6506, Catalyst 6509, or Catalyst 6509-NEB chassis, you must install the system (NEBS) ground lug on the system ground studs on the power supply faceplate rather than the system ground pad on the chassis. The increased depth of the 8700 W power supply covers the system (NEBS) ground pad on these three chassis. To install the system ground on the 8700 W power supply, see [“Installing the System Ground on an 8700 W Power Supply”](#) section on page 1-59.

- Step 2** If necessary, remove the blank faceplate (Cisco part number 800-27924-xx) from the chassis power supply bay opening by loosening the captive installation screw.
- Step 3** Remove the power supply from its shipping packaging.
- Step 4** Verify that the power switch is in the off (0) position on the power supply that you are installing. (See [Figure 1-6](#).)
- Step 5** Grasp the power supply handle with one hand. Place your other hand underneath the power supply, as shown in [Figure 1-7](#). Slide the power supply into the power supply bay. Make sure that the power supply is fully seated in the bay.
- Step 6** Tighten the power supply captive installation screw. (See [Figure 1-6](#).)
- Step 7** If you are installing an 8700 W power supply in a Catalyst 6506, Catalyst 6509, or Catalyst 6509-NEB chassis, install the system (NEBS) ground lug on the power supply system ground studs. For installation instructions, see [“Installing the System Ground on an 8700 W Power Supply”](#) section on page 1-59
- Step 8** Plug the power cord into the power supply, and tighten the screw on the cable retention device. Refer to Appendix A for a list of supported AC power cords for your particular AC-input power supply.

**Note**

The AC power cords for the 4000 W power supply are hard wired to the power supply.

**Step 9** Connect the other end of the power cord to an AC-input power source.

**Caution**

In a chassis with dual power supplies or power supplies with multiple AC inputs, connect each AC power cord to a separate input source. In case of a power source failure, the alternate input source should still be available.

**Step 10** On 8700 W power supplies, there is a relay controller switch located in the lower right quadrant of the power supply faceplate. If you are not using the 8700 W power supply's remote power-cycling feature or you have the remote power-cycling feature installed and you are using a normally open (NO) relay, make sure that the switch is in the down (DEFAULT) position otherwise the power supply will not power up.

**Step 11** Turn the power switch to the on (I) position on the power supply. Switching the power switch to on also engages a pawl that locks the power supply in the bay.

**Step 12** Verify the power supply operation by ensuring that the power supply front panel LEDs are in these states:

- INPUT OK LED is green

**Note**

On the 6000 W and the 8700 W power supplies, there is a separate INPUT LED for each AC power cord. Only the LED for a power supply input that has an AC power cord attached will light.

- FAN OK LED is green
- OUTPUT FAIL LED is not lit

If the LEDs indicate a power problem, see the [“Identifying Startup Problems”](#) section on page A-3 for troubleshooting information.

# Removing and Installing the DC-Input Power Supplies

This section covers the DC-input power supply removal and installation procedure for the Catalyst 6500 series switches and is divided into the following topics:

- [Removing and Installing a 950 W DC-Input Power Supply, page 1-15](#)
- [Removing and Installing a 1300 W or 2500 W DC-Input Power Supply, page 1-19](#)
- [Removing and Installing the 2700 W DC-Input Power Supply, page 1-27](#)
- [Removing and Installing a 4000 W DC-Input Power Supply, page 1-36](#)

**Note**

---

The DC return is to remain isolated from the system frame and the chassis (DC-I).

---

## Removing and Installing a 950 W DC-Input Power Supply

This section describes how to remove and install the 950 W and 1400 W AC-input power supplies for the Catalyst 6503 and the Catalyst 6503-E switches. The section is divided into the following topics:

- [Tools Required, page 1-15](#)
- [Removing a 950 W DC-Input Power Supply, page 1-16](#)
- [Installing a 950 W DC-Input Power Supply, page 1-18](#)

**Note**

---

The 950 W DC-input power supply can be installed in the Catalyst 6503 and the Catalyst 6503-E switch chassis only.

---

## Tools Required

You might need a flat-blade or number 2 Phillips-head screwdriver to loosen or tighten the captive installation screws on the power supply.

## Removing a 950 W DC-Input Power Supply



**Warning**

Before performing any of the following procedures, ensure that power is removed from the DC circuits. To ensure that all power is removed, locate the circuit breakers or fuses on the DC power lines that service the DC circuits. Turn OFF the DC power line circuit breakers and remove the DC power line fuses. Statement 322



**Warning**

Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing. Statement 1034

To remove a DC-input power supply, follow these steps:

- Step 1** Identify which PEM is connected to the power supply you are removing (PEM 1 or PEM 2). Verify that the source power is off to the circuit that is connected to that PEM.

Figure 1-8 shows the location of the DC-input PEMs on the Catalyst 6503 switch chassis.

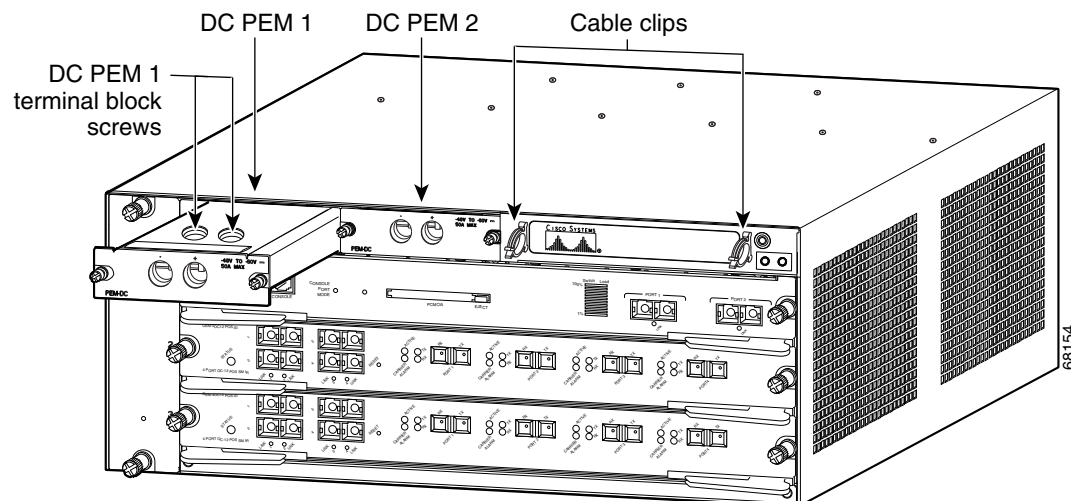


**Note**

The system (NEBS) ground serves as the primary safety ground for the Catalyst 6503 and Catalyst 6503-E chassis that are equipped with DC-input power supplies. The DC-input power supplies for these chassis do not have a separate ground. Make sure that the chassis you are working on has the system (NEBS) ground installed.

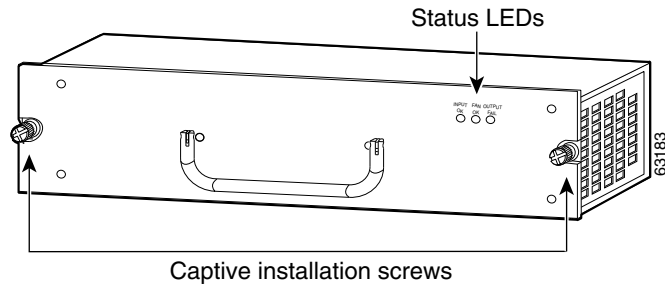
- Step 2** Loosen the captive installation screws on the power supply. (See Figure 1-9.)
- Step 3** Grasp the power supply handle with one hand, and slide the power supply part of the way out of the chassis. Place your other hand underneath the power supply, as shown in Figure 1-10, and slide the power supply completely out of the chassis.
- Step 4** If the power supply bay is to remain empty, install a blank power supply filler plate (Cisco part number 800-16727-01) over the opening, and secure it with the captive installation screws.

**Figure 1-8 Catalyst 6503 Switch—DC-Input PEM Location**

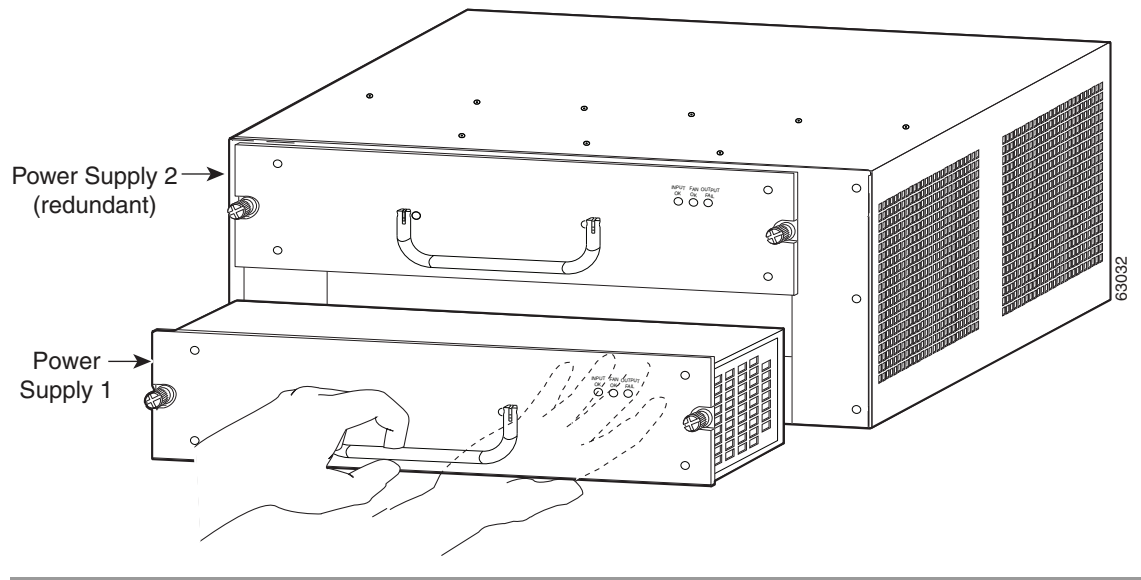




**Figure 1-9 950 W DC-Input Power Supply Captive Installation Screws**



**Figure 1-10 Catalyst 6503 Switch—Handling a DC-Input Power Supply**



## Installing a 950 W DC-Input Power Supply



### Warning

**Before performing any of the following procedures, ensure that power is removed from the DC circuits. To ensure that all power is removed, locate the circuit breakers or fuses on the DC power lines that service the DC circuits. Turn OFF the DC power line circuit breakers and remove the DC power line fuses.** Statement 322

To install a 950 W DC-input power supply, follow these steps:

### Step 1

Ensure that the system (earth) ground connection has been made. For ground connection installation instructions, see the [“Establishing the System Ground”](#) section on page 1-52.



### Note

The system (NEBS) ground serves as the primary safety ground for the Catalyst 6503 and Catalyst 6503-E chassis that are equipped with DC-input power supplies. The DC-input power supplies for these chassis do not have a separate ground. Make sure that the chassis you are working on has the system (NEBS) ground installed.

### Step 2

Verify that power is off to the DC circuit connected to the DC PEM for the power supply that you are installing. As an added precaution, place the appropriate safety flag and lockout devices at the source power circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.

### Step 3

Grasp the power supply handle with one hand. Place your other hand underneath the power supply, as shown in [Figure 1-10](#). Slide the power supply into the power supply bay. Make sure that the power supply is fully seated in the bay.

### Step 4

Tighten the power supply captive installation screws. (See [Figure 1-9](#).)



### Caution

Power supply captive installation screws must be tight to ensure protective grounding continuity.



### Caution

In a system with dual power supplies, connect each power supply to a separate input line. In case of a line failure, the second source should still be available.

### Step 5

Verify that all connections to the DC PEM are secure.

### Step 6

Remove any safety flags, lockout devices, or tape from the circuit breaker switch handle, and restore power by moving the circuit breaker switch handle to the On (I) position.

### Step 7

Verify the power supply operation by ensuring that the power supply front panel LEDs are in the following states:

- INPUT OK LED is green
- FAN OK LED is green
- OUTPUT FAIL LED is not lit

If the LEDs indicate a power problem, see the [“Identifying Startup Problems”](#) section on page A-3.

## Removing and Installing a 1300 W or 2500 W DC-Input Power Supply

This section covers the power supply removal and installation procedures for the 1300 W and the 2500 W DC-input power supplies and is divided into the following topics:

- [Required Tools](#), page 1-19
- [Removing a 1300 W or 2500 W DC-Input Power Supply](#), page 1-19
- [Installing a 1300 W or 2500 W DC-Input Power Supply](#), page 1-24

### Required Tools

Use a flat-blade or number 2 Phillips-head screwdriver to perform these procedures. You might also need cutters to cut any cable ties that are installed on the power supply.

### Removing a 1300 W or 2500 W DC-Input Power Supply



**Warning**

**Before performing any of the following procedures, ensure that power is removed from the DC circuits. To ensure that all power is removed, locate the circuit breakers or fuses on the DC power lines that service the DC circuits. Turn OFF the DC power line circuit breakers and remove the DC power line fuses.** Statement 322



**Warning**

**Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing.** Statement 1034



**Warning**

**When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046

To remove a DC-input power supply, follow these steps:

- Step 1** Verify that power is off to the DC circuit on the power supply that you are removing. As an added precaution, place the appropriate safety flag and lockout devices at the source power circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.
- Step 2** Turn the power switch to the off (O) position on the power supply that you are removing. Turning the power switch off also disengages a pawl that unlocks the power supply from the chassis.  
See [Figure 1-11](#) for the 1300 W DC power supply or [Figure 1-12](#) for the 2500 W DC power supply.
- Step 3** Remove the two screws securing the terminal block cover, and slide the cover off the terminal block.  
See [Figure 1-11](#) for the 1300 W DC power supply or [Figure 1-12](#) for the 2500 W DC power supply.

- Step 4** Disconnect the source DC cable lugs from the terminal block (see [Figure 1-13](#) for the 1300 W DC power supply or [Figure 1-14](#) for the 2500 W DC power supply) in this order:
1. Positive (+)
  2. Negative (-)
  3. Ground



**Note** The terminals on the 1300 W DC power supply DC power cable terminal block are labeled (from top to bottom) +, -, ground. The terminals on the 2500 W DC power supply DC power cable terminal block are labeled (from top to bottom) -, +, ground.

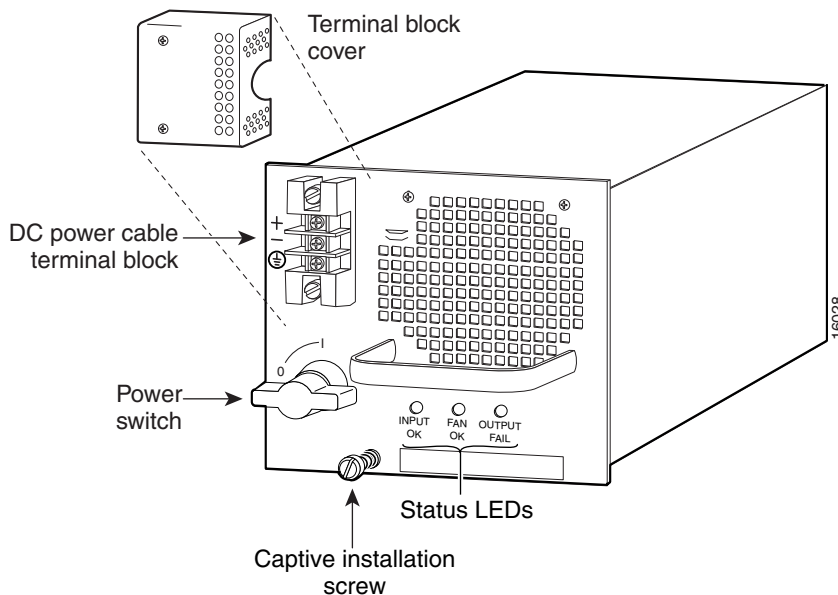
- Step 5** Loosen the captive installation screw on the power supply.  
See [Figure 1-13](#) for the 1300 W DC power supply or [Figure 1-14](#) for the 2500 W DC power supply.



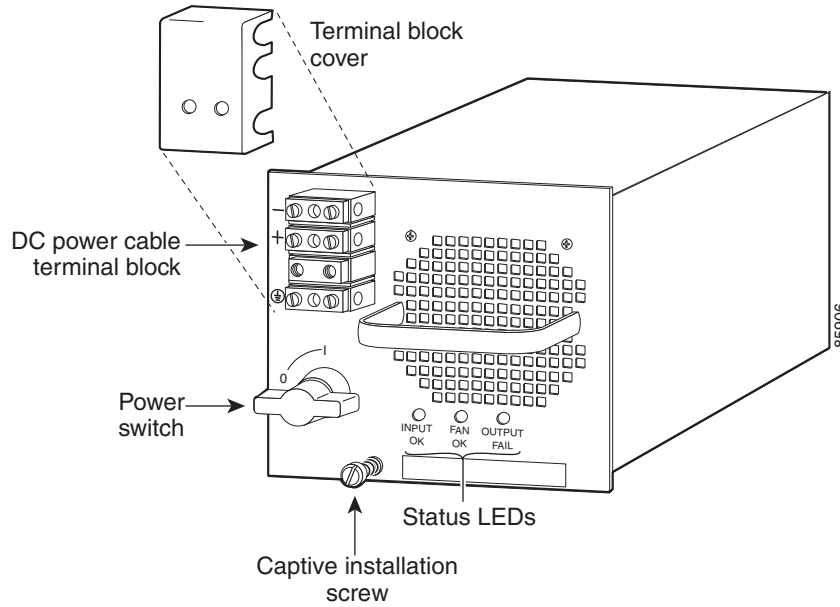
**Caution** Use both hands to install and remove power supplies. Each Catalyst 6500 series DC-input power supply weighs between 22 pounds (10 kg) and 33 pounds (15 kg).

- Step 6** Grasp the power supply handle with one hand, and slide the power supply halfway out of the chassis. Place your other hand underneath the power supply, as shown in [Figure 1-15](#), and slide the power supply completely out of the chassis. Set the power supply aside.
- Step 7** If the power supply bay is to remain empty, install a blank faceplate (Cisco part number 700-03104-01) over the opening, and secure it with the captive installation screw.

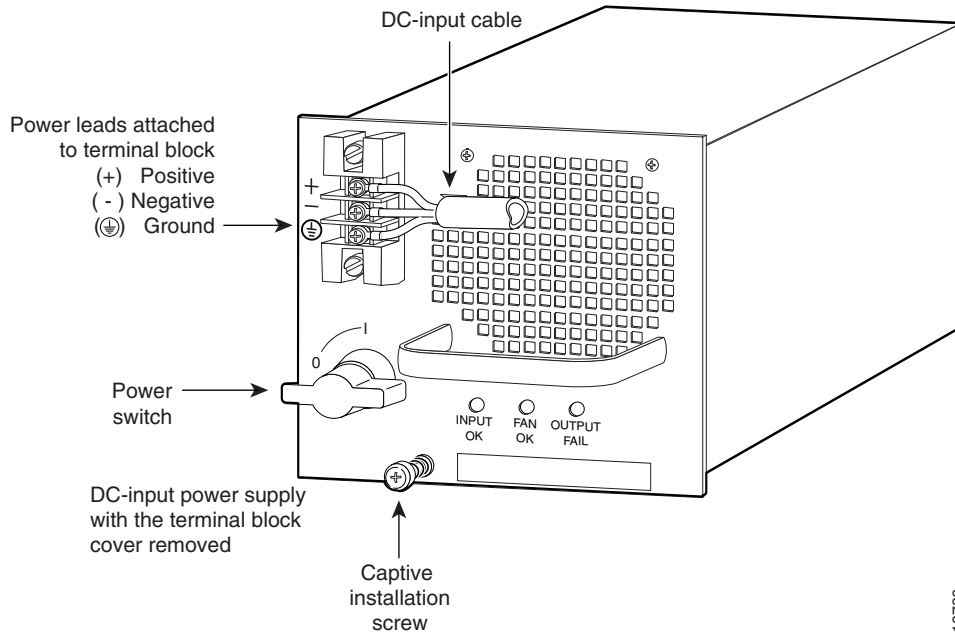
**Figure 1-11 DC-Input Power Supply Front Panel (WS-CDC-1300W)**



**Figure 1-12 DC-Input Power Supply Front Panel (WS-CDC-2500W)**



**Figure 1-13 DC-Input Wire Connections on the Terminal Block (WS-CDC-1300W)**



**Figure 1-14** DC-Input Wire Connections on the Terminal Block (WS-CDC-2500W)

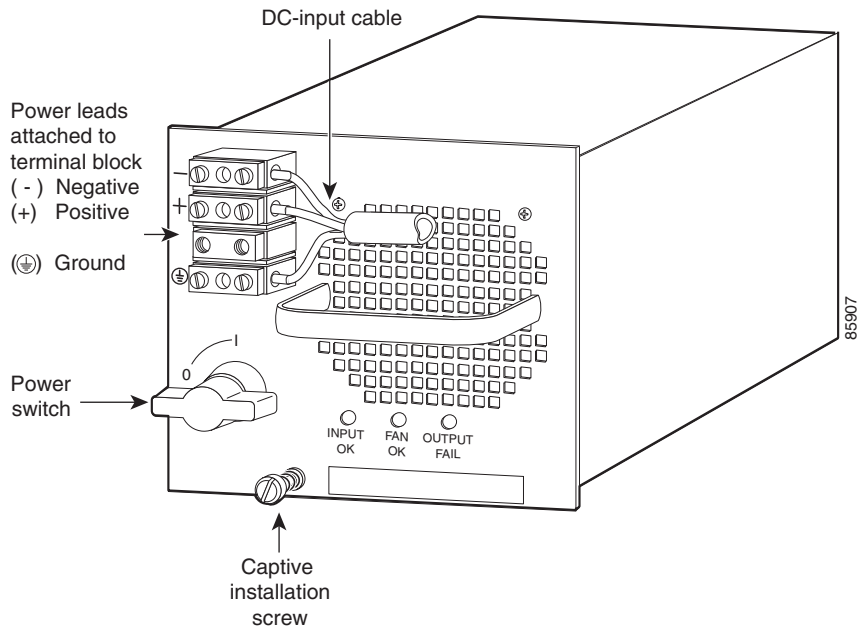
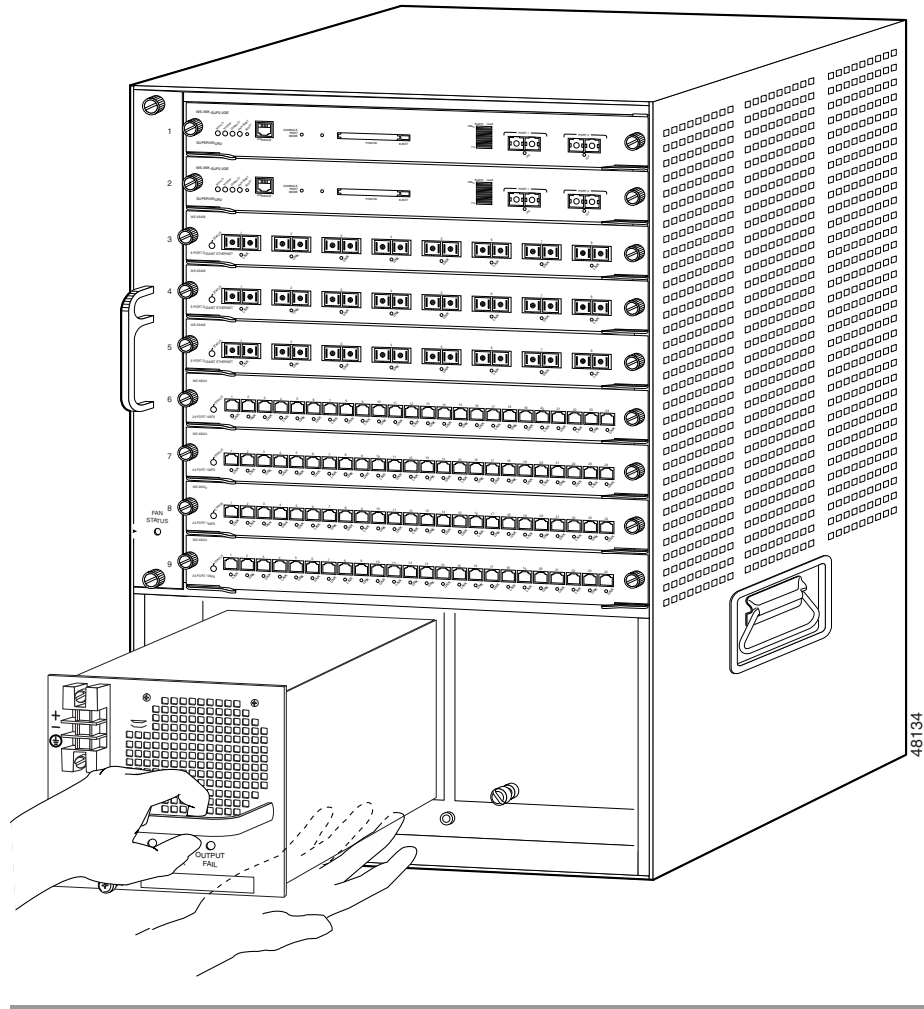


Figure 1-15 Handling a DC-Input Power Supply



## Installing a 1300 W or 2500 W DC-Input Power Supply



### Warning

**Before performing any of the following procedures, ensure that power is removed from the DC circuits. To ensure that all power is removed, locate the circuit breakers or fuses on the DC power lines that service the DC circuits. Turn OFF the DC power line circuit breakers and remove the DC power line fuses.** Statement 322



### Warning

**When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046

To install a DC-input power supply, follow these steps:

- Step 1** Ensure that the system (earth) ground connection has been made. For ground connection installation instructions, see the [“Establishing the System Ground”](#) section on page 1-52.
- Step 2** Verify that power is off to the DC circuit on the power supply that you are installing. As an added precaution, place the appropriate safety flag and lockout devices at the source power circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.
- Step 3** Verify that the power switch is in the off (0) position on the power supply that you are installing. See [Figure 1-11](#) for the 1300 W DC power supply or [Figure 1-12](#) for the 2500 W DC power supply.



### Caution

Use both hands to install and remove power supplies. Each Catalyst 6500 series DC-input power supply weighs between 22 pounds (10 kg) and 28 pounds (12.7 kg).

- Step 4** Grasp the power supply handle with one hand, and place your other hand underneath the power supply. Slide the power supply into the power supply bay. Make sure that the power supply is fully seated in the bay. (See [Figure 1-15](#).)
- Step 5** Tighten the power supply captive installation screw. (See [Figure 1-11](#) for the 1300 W DC power supply or [Figure 1-12](#) for the 2500 W DC power supply.)
- Step 6** Remove the two screws securing the terminal block cover, and slide the cover off of the terminal block. See [Figure 1-11](#) for the 1300 W DC power supply or [Figure 1-12](#) for the 2500 W DC power supply.



**Step 7** Attach the appropriate lugs to the DC-input wires. The maximum width of a lug is 0.300 inch (7.6 mm).



**Note** The wire should be sized according to local and national installation requirements and electrical codes. Use only copper wire. For North American installations of 2500 WDC-input power supplies, use fine-stranded copper conductors rated for 90°C.

**Step 8** Attach the source DC cables to the terminal block (see [Figure 1-16](#) for the 1300 W DC power supply or [Figure 1-17](#) for the 2500 W DC power supply) in this order:

1. Source ground cable to the power supply terminal block ground post
2. Source DC negative (–) cable to the power supply terminal block negative (–) post
3. Source DC positive (+) cable to the power supply terminal block positive (+) post



**Note** The terminals on the 1300 W DC power supply DC power cable terminal block are labeled (from top to bottom) +, –, ground. The terminals on the 2500 W DC power supply DC power cable terminal block are labeled (from top to bottom) –, +, ground.

**Step 9** After ensuring that all wire connections are secure, reinstall the terminal block cover.



**Caution** To prevent a short circuit or shock hazard after wiring the DC-input power supply, you must reinstall the terminal block cover.



**Caution** In a system with dual power supplies, connect each power supply to a separate power source. In case of a power source failure to one supply, the second power source should still be available.

**Step 10** Remove any safety flag and lockout devices or any tape from the circuit breaker switch handle, and restore power by moving the circuit breaker switch handle to the on (I) position.

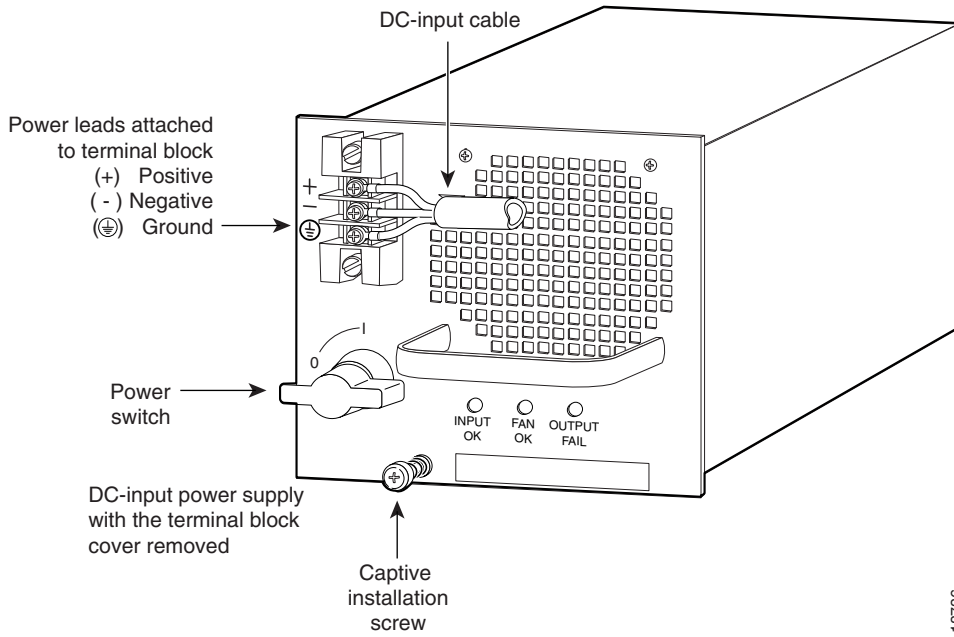
**Step 11** Turn the power switch to the on (I) position on the power supply. Turning on the power switch also engages a pawl that locks the power supply in the chassis.

**Step 12** Verify the power supply operation by ensuring that the power supply front panel LEDs are in these states:

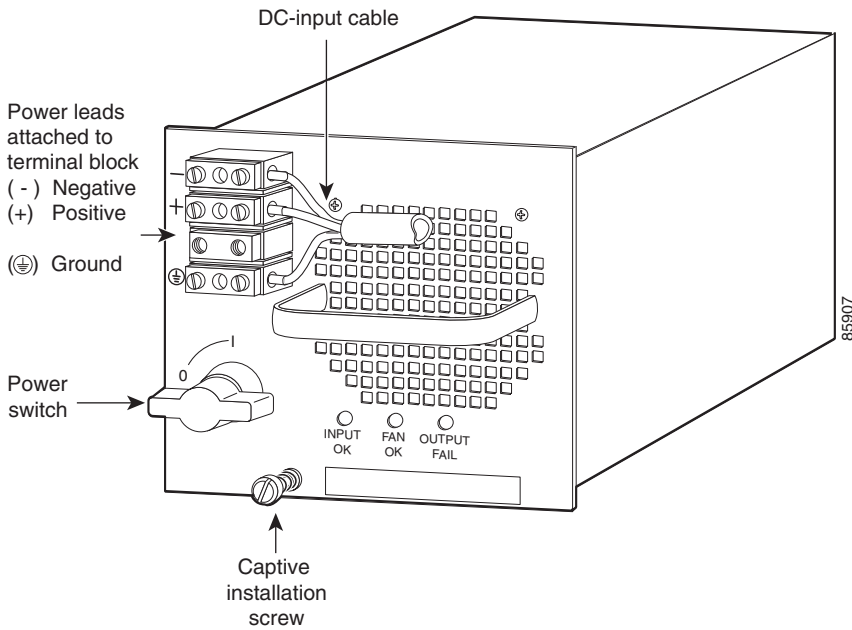
- INPUT OK LED is green
- FAN OK LED is green
- OUTPUT FAIL LED is not lit

If the LEDs indicate a power problem, see the [“Identifying Startup Problems”](#) section on page A-3.

**Figure 1-16 DC-Input Power Supply Connectors (WS-CDC-1300W)**



**Figure 1-17 DC-Input Power Supply Connectors (WS-CDC-2500W)**



## Removing and Installing the 2700 W DC-Input Power Supply

This section covers the power supply removal and installation procedures for the 2700 W DC-input power supply on the Catalyst 6504-E chassis and is divided into the following topics:

- [Required Tools, page 1-28](#)
- [Removing a 2700 W DC-Input Power Supply, page 1-29](#)
- [Installing a 2700 W DC-Input Power Supply, page 1-32](#)

The 2700 W DC-input power supply can operate at either 1350 W or at 2700 W. If you want to operate the power supply at 1350 W, you only need to connect one pair of source DC cables to either the VE-1 or the VE-2 pair of posts on the power supply terminal block. If you want to operate the power supply at 2700 W, you need to connect two pairs of source DC cables to the VE-1 and the VE-2 pairs of posts on the power supply terminal block.

**Note**

For proper 2700 W DC-input redundant power configurations, all of the source DC for one 2700 W DC-input power supply must come from the same battery system (A feed); all of the source DC for the other 2700 W DC-input power supply must come from another battery system (B feed).

**Note**

For multiple DC-input power supplies, each DC input must be protected by a dedicated circuit breaker or a fuse. The circuit breaker or fuse must be sized according to the power supply input rating and the local or national electrical code requirements.

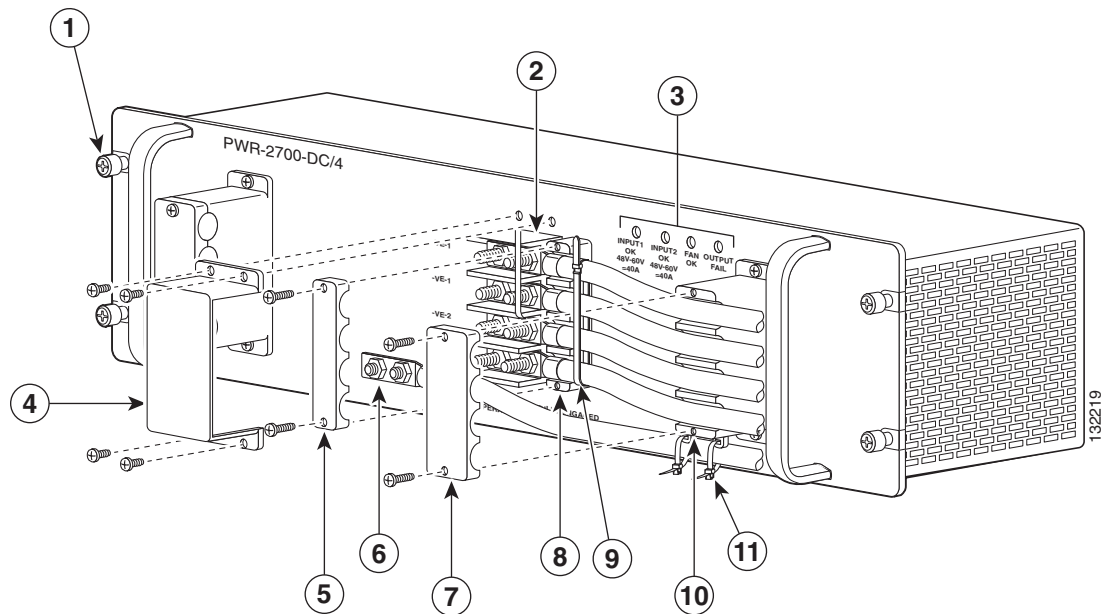
[Figure 1-18](#) shows a 2700 W DC-input power supply (p/n PWR-2700-DC/4) cabled for 2700 W operation with the installation components identified.

**Note**

This illustration shows the source DC cables and the ground cable routed into the power supply from the right side. Two pairs of source DC cables are shown indicating that the power supply is operating at 2700 W. The source DC cables and the ground cable can also be routed out of the left-side of the power supply, if necessary.

Use this illustration as a reference for identifying components when removing or installing the power supply.

Figure 1-18 2700 W DC-Input Power Supply Features



1	Captive installation screw (4x)	7	Fixed cable guide, top half
2	Source DC terminal block	8	Detached cable guide, bottom half
3	Status LEDs	9	Tie wrap (for source DC cables)
4	Terminal block cover	10	Fixed cable guide, bottom half
5	Detached cable guide, top half	11	Tie wrap (for ground cable)
6	Ground terminal block		

## Required Tools

The following tools are required for the power supply removal and installation procedures:

- Number 2 Phillips-head screwdriver
- 1/4-inch open-ended wrench or 1/4-inch nutdriver
- Wire cutters to cut the cable tie wraps

Additional tools might be necessary to install the lugs on the source DC and the ground cables. Additionally, the lugs for the source DC cables and the ground cable are not provided; you must obtain them on your own.

## Removing a 2700 W DC-Input Power Supply

**Warning**

**Before performing any of the following procedures, ensure that power is removed from the DC circuits. To ensure that all power is removed, locate the circuit breakers or fuses on the DC power lines that service the DC circuits. Turn OFF the DC power line circuit breakers and remove the DC power line fuses.** Statement 322

**Warning**

**Voltage is present on the backplane when the system is operating. To reduce risk of an electric shock, keep hands and fingers out of the power supply bays and backplane areas.** Statement 166

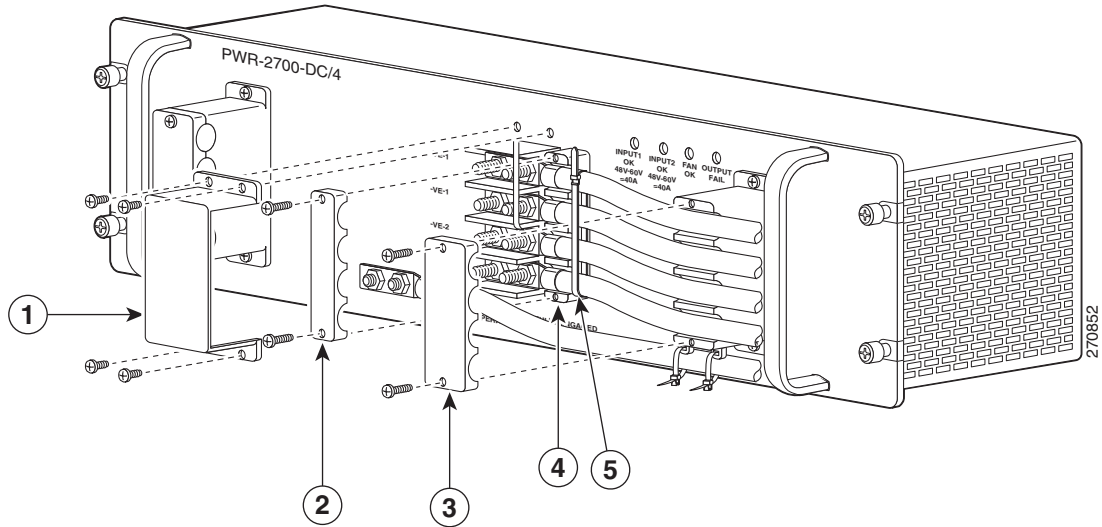
To remove a DC-input power supply, follow these steps:

- Step 1** Verify that source DC power is off to the DC circuit that feeds the power supply that you are removing. As an added precaution, place the appropriate safety flag and lockout devices at the source DC power circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.
- Step 2** Remove the four screws that secure the terminal block cover (clear plastic) and slide the cover off of the terminal block. Set the cover and the screws aside. (See [Figure 1-19](#).)
- Step 3** Remove the two screws securing the fixed cable guide top half and set the cable guide piece and the screws aside. (See [Figure 1-19](#).)
- Step 4** Remove the two screws securing the detached cable guide top half to the bottom half. Remove both cable guide pieces and the screws and set them aside.

**Note**

In addition to the two cable guides, there might be a tie wrap securing the source DC cables and two tie wraps securing the ground cable to the fixed cable guide. You will need to cut all of these tie wraps in order to free the source DC cables and the ground cable for removal.

Figure 1-19 Removing the Terminal Block Cover and the Cable Guides



1	Terminal block cover	4	Detached cable guide, bottom half
2	Detached cable guide, top half	5	Tie wrap (for source DC cables)
3	Fixed cable guide, top half		

**Step 5** Disconnect the DC-input cables from the terminal block (see Figure 1-20) in this order:

- Positive (+) source DC cable from the +VE-1 terminal block post
- Negative (-) source DC cable from the -VE-1 terminal block post



**Note** If you have a second pair of source DC cables attached to the VE-2 terminal block posts, you need to remove the second positive (+) and negative (-) source DC cables, in that order, before you remove the ground cable.

- Ground cable from the ground terminal posts

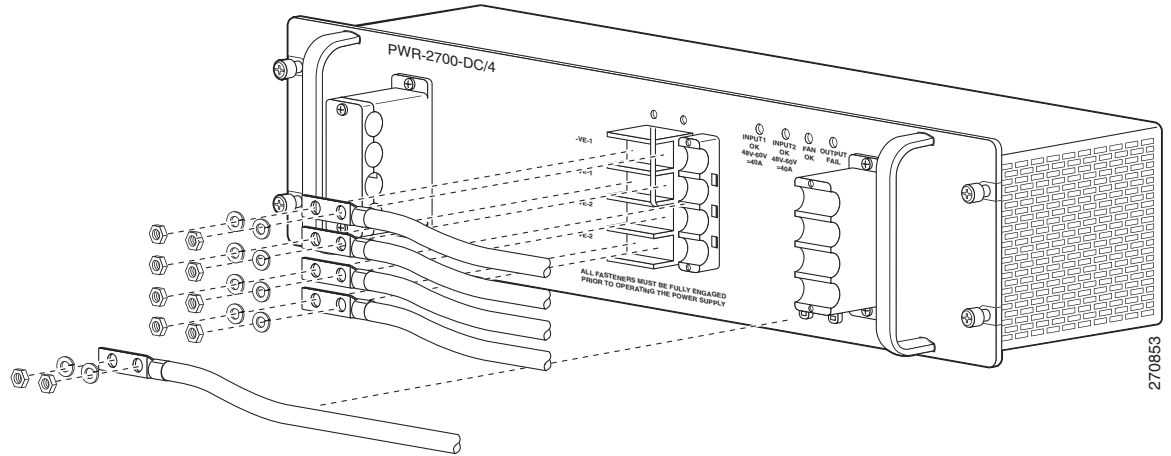
Save the 1/4-20 nut and the split-ring washer from each terminal block post and set them aside.



**Warning**

**When installing the unit, always make the ground connection first and disconnect it last.** Statement 42

**Figure 1-20** Disconnecting the Source DC Cables and Ground Cable



**Step 6** Loosen the four captive installation screws on the power supply.

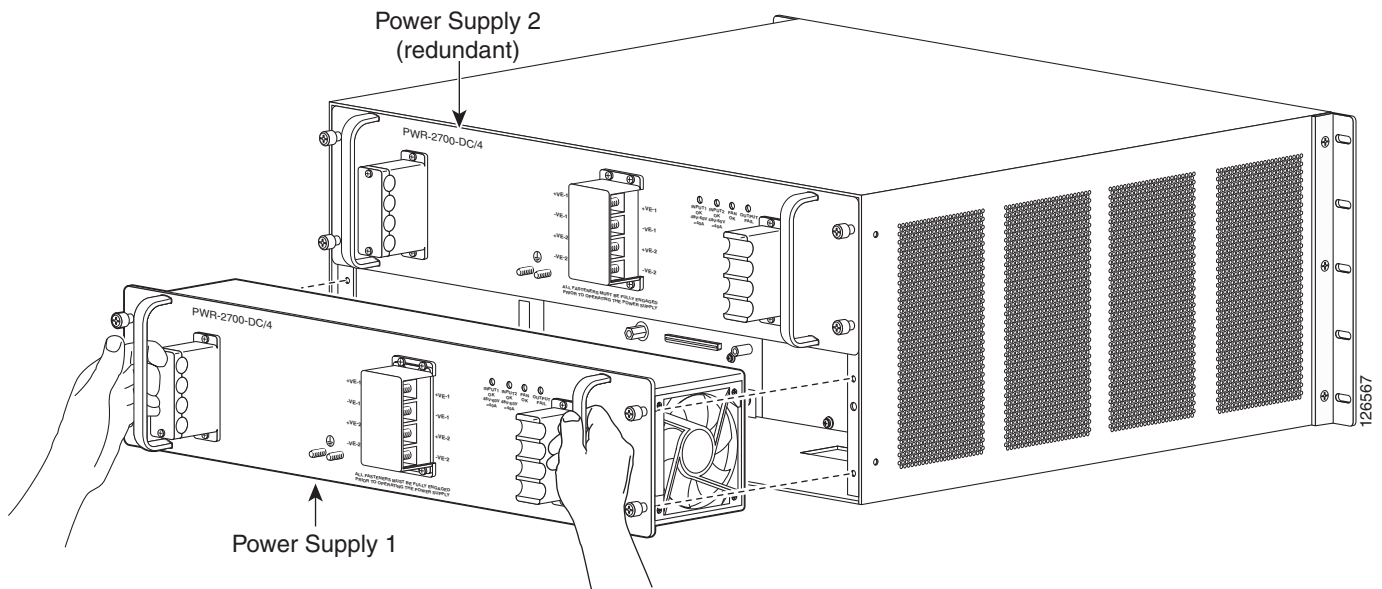


**Caution**

Use both hands to install and remove power supplies. Each PWR-2700-DC/4 DC-input power supply weighs 19.8 pounds (9.0 kg).

**Step 7** Grasp both power supply handles, as shown in [Figure 1-21](#), and slide the power supply completely out of the chassis and set it aside.

**Figure 1-21** Handling a DC-Input Power Supply



**Step 8** If the power supply bay is to remain empty, install a blank power supply filler plate (Cisco part number 700-03104-01) over the opening, and secure it with the captive installation screws.

## Installing a 2700 W DC-Input Power Supply

This section provides the procedures for installing a 2700 W DC-input power supply in the Catalyst 6504-E switch chassis. The 2700 W DC-input power supply can operate at either 1350 W or at 2700 W. If you want to operate the power supply at 1350 W you only need to connect one pair of source DC cables to either the VE-1 or the VE-2 lugs on the power supply terminal block. If you want to operate the power supply at 2700 W, you need to connect two pairs of source DC cables to the VE-1 and the VE-2 lugs on the power supply terminal block.



### Warning

**Before performing any of the following procedures, ensure that power is removed from the DC circuits. To ensure that all power is removed, locate the circuit breakers or fuses on the DC power lines that service the DC circuits. Turn OFF the DC power line circuit breakers and remove the DC power line fuses.** Statement 322



### Note

For proper 2700 W DC-input redundant power configurations, all of the source DC for one 2700 W DC-input power supply must come from the same battery system (A feed); all of the source DC for the other 2700 W DC-input power supply must come from another battery system (B feed).



### Note

For multiple DC-input power supplies, each DC input must be protected by a dedicated circuit breaker or a fuse. The circuit breaker or fuse must be sized according to the power supply input rating and the local or national electrical code requirements.

To install the 2700 W DC-input power supply in the Catalyst 6504-E chassis and cable it to source DC, follow these steps:

- Step 1** Ensure that the system (earth) ground connection has been made. For system ground connection installation instructions, see the [“Establishing the System Ground”](#) section on page 1-52.
- Step 2** Remove the power supply from its shipping container and remove any packaging material.
- Step 3** Locate the plastic bags that accompanied the power supply and set them aside. One bag contains one source DC cable guide, terminal block cover (plastic) with four screws, and two cable ties. The other plastic bag contains the 1/4-20 nuts and lock-washers for the terminal posts. You will use these items later in the procedure.
- Step 4** Verify that source DC power is off to the DC circuit that feeds the power supply that you are installing. As an added precaution, place the appropriate safety flag and lockout devices at the source DC circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.
- Step 5** Grasp both power supply handles, as shown in [Figure 1-22](#). Slide the power supply into the power supply bay. Make sure that the power supply is fully seated in the bay. Tighten the four captive installation screws.

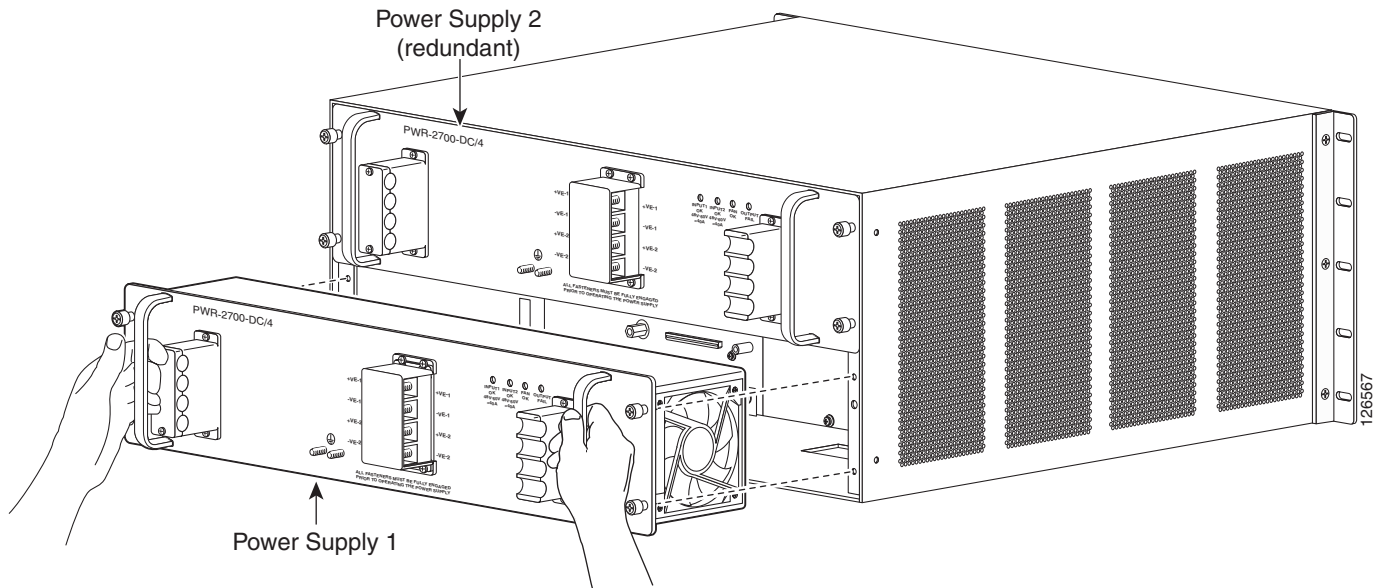


### Warning

**Power supply captive installation screws must be tight to ensure protective grounding continuity.** Statement 289



Figure 1-22 Installing the Power Supply in the Chassis



**Step 6** Determine whether you will be routing the source DC cables on the left- or right-side of the power supply. Loosen and remove the two screws securing the top half of the fixed cable guide on the side you will be routing the source DC cables. Remove the top half of the cable guide and set it and the screws aside.

**Step 7** Attach the appropriate size and type of lugs to the source DC cables and the ground cable.

The maximum width of a lug is 0.300 inch (7.6 mm). The source DC cables and the ground cable must be sized according to local and national installation requirements. Use only copper wire. The power supply terminal block lug opening width is 0.62 inch (15.8 mm). The terminal posts are centered 0.63 inches (15.88 mm) apart and have a 1/4-20 thread. We recommend that you use an appropriately sized industry standard 2-hole, standard barrel compression lug. The power supply ground posts also have 1/4-20 threads and require two 1/4-inch split-ring washers and two 1/4-20 hex nuts (one for each post).



**Note** For 2700 W power supplies, use fine-stranded copper conductors that are rated for 90°C Celsius for North American installations.



**Note** For proper 2700 W DC-input redundant power configurations, all of the source DC for one 2700 W DC-input power supply must come from the same battery system (A feed); all of the source DC for the other 2700 W DC-input power supply must come from another battery system (B feed).



**Note** For multiple DC-input power supplies, each DC input must be protected by a dedicated circuit breaker or a fuse. The circuit breaker or fuse must be sized according to the power supply input rating and the local or national electrical code requirements.

**Step 8** Connect the source DC cable lugs to the 2700 W power supply terminal block posts (Figure 1-23) in this order:

- Ground cable lug to the ground terminal posts
- Negative (–) source DC cable lug to terminal post –VE-1
- Positive (+) source DC cable lug to terminal post +VE-1



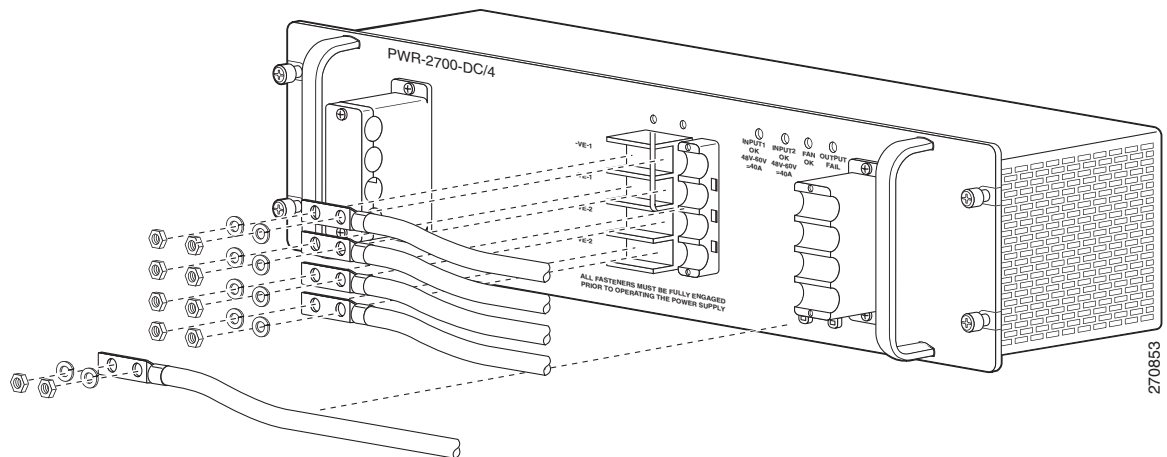
**Note** If you are only going to install one pair of source DC cables (1350 W operation), you can attach the source DC cables to either the VE-1 or VE-2 pair of terminal posts. Also notice that there is only one ground connection on the power supply faceplate.



**Caution**

When you tighten the terminal nuts, make sure that they are snug. Do not overtighten them. Overtightening the terminal nuts can damage the terminal block. The recommended torque values for tightening the terminal nuts are 15 inch-pounds (1.7 newton-meters) (minimum) and 20 inch-pounds (2.2 newton-meters) (maximum).

**Figure 1-23 Attaching the Source DC Cables and the Ground Cable**



Position the source DC cables in the fixed cable guide. Place the top half of the fixed cable guide over the source DC cables and secure the top half of the cable guide to the bottom half with two screws.

Figure 1-24 shows how the source DC cables are routed from the left side of the power supply.

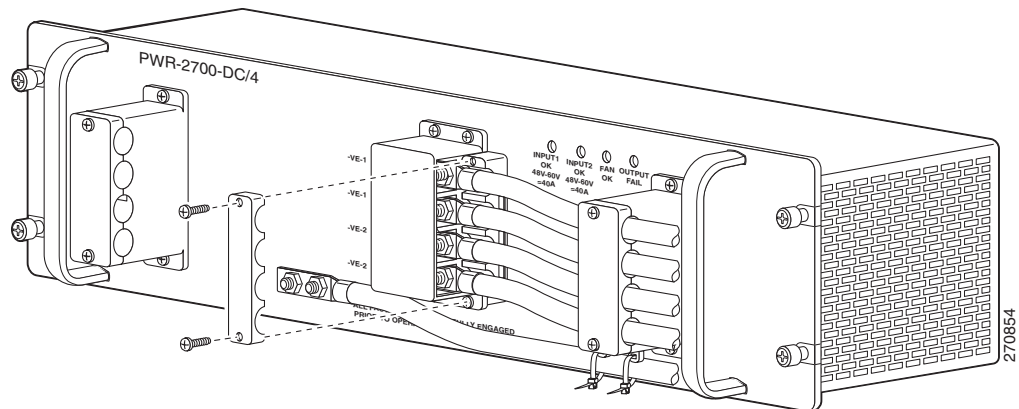


**Warning**

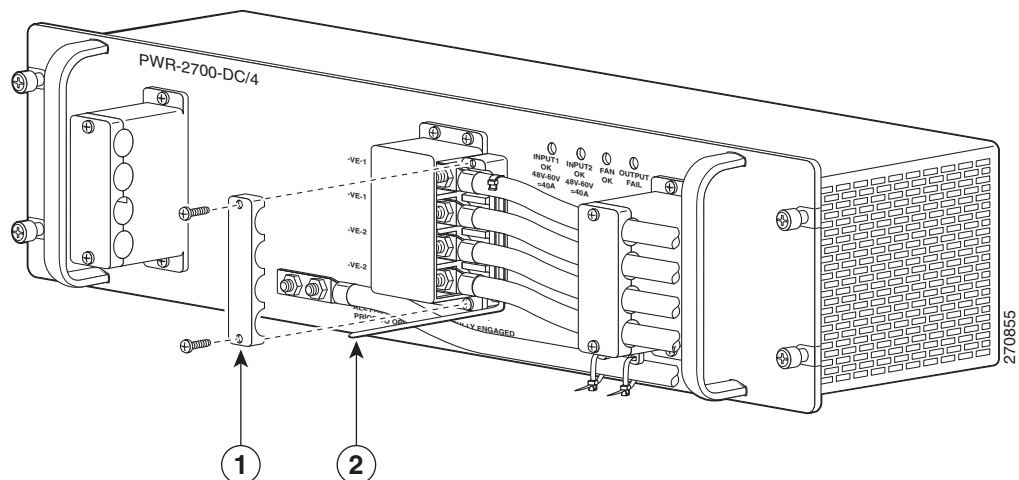
**When installing the unit, always make the ground connection first and disconnect it last.** Statement 42

**Step 9** Route and secure the ground cable to the fixed cable guide loops with the two cable-ties supplied with the power supply. (See Figure 1-24.)

**Step 10** Position the clear plastic terminal block cover over the terminal block and secure it to the power supply using the four supplied screws. (See Figure 1-24.)

**Figure 1-24** *Securing the Cables to the Cable Guides*

- Step 11** Install the detached source DC cable guide that is supplied with the power supply (see [Figure 1-25](#)):
- Position the thicker half of the cable guide under the two or four source DC cables and align the cables with the grooves in the cable guide. The cable guide should be placed between the terminal block and the fixed cable guide.
  - Place the upper half of the cable guide over the source DC cables and secure the two halves of the cable guide together with the two supplied screws. Do not tighten the screws at this time.
  - Slide the cable guide toward the terminal block and position it as close to the terminal block as possible.
  - Tighten the two cable guide screws.
  - Place a tie wrap around the source DC cables near the detached cable guide. Position the tie wrap next to the detached cable guide and tighten the tie wrap securely. Make sure that the detached cable guide cannot slide away from the terminal block.

**Figure 1-25** *Installing the Detached Source DC Cable Guide*

<b>1</b>	Detached cable guide, top half	<b>2</b>	Tie wrap (for source DC cables)
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- Step 12** Remove the warning flags and cautionary tape from the source DC mains and switch the source DC on.
- Step 13** Verify the power supply operation by checking that the power supply front panel LEDs are in the following states:
- INPUT 1 OK LED—If you have source DC cables attached to the VE-1 pair of power supply inputs, verify that the LED is green, otherwise the LED should not be lit.
  - INPUT 2 OK LED—If you have source DC cables attached to the VE-2 pair of power supply inputs, verify that the LED is green, otherwise the LED should not be lit.
  - FAN OK LED is green.
  - OUTPUT FAIL LED is not lit.

If the LEDs indicate a power problem, see the [“Identifying Startup Problems”](#) section on page A-3.

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## Removing and Installing a 4000 W DC-Input Power Supply

This section covers the power supply removal and installation procedures for the 4000 W DC-input power supply and is divided into the following topics:

- [Required Tools](#), page 1-37
- [Removing a 4000 W DC-Input Power Supply](#), page 1-38
- [Installing a 4000 W DC-Input Power Supply](#), page 1-40



### Note

For proper 4000 W DC-input redundant power configurations, all of the source DC for one 4000 W DC-input power supply must come from the same battery system (A feed); all of the source DC for the other 4000 W DC-input power supply must come from another battery system (B feed).

---

The 4000 W DC-input power supply can operate at either 2700 W or at 4000 W. If you want to operate the power supply at 2700 W, you need to connect two pairs of source DC cables to the VE-1 and the VE-2 posts on the power supply terminal block. If you want to operate the power supply at 4000 W, you need to connect a third pair of source DC cables to the VE-3 terminal block posts.



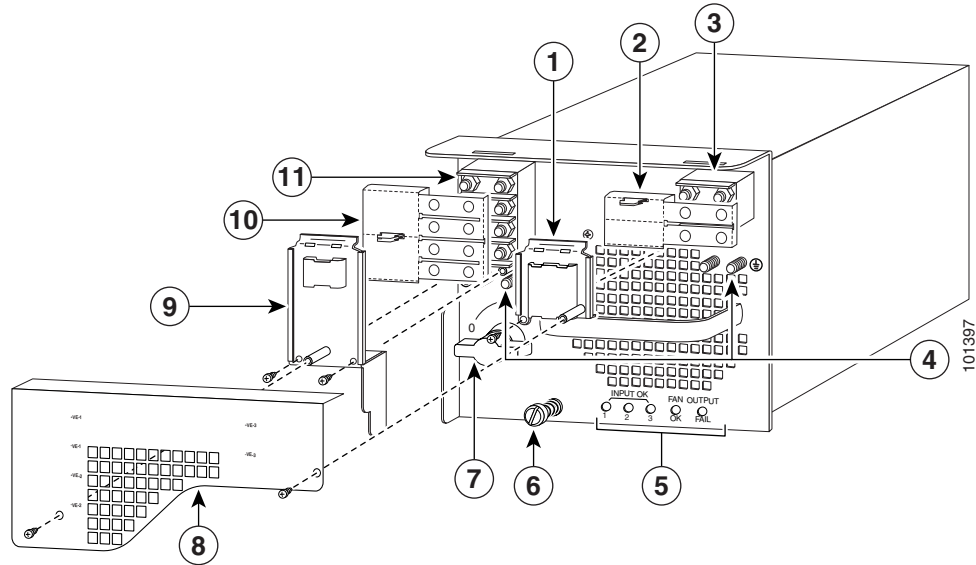
### Note

For multiple DC-input power supplies, each DC input must be protected by a dedicated circuit breaker or a fuse. The circuit breaker or fuse must be sized according to the power supply input rating and the local or national electrical code requirements.

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[Figure 1-26](#) shows the features on a 4000 W DC-input power supply. Use the illustration for reference as you remove and install the power supply.

Figure 1-26 4000-W DC-Input Power Supply Installation Features



1	Inner terminal block cover (covers VE-3)	7	Power switch
2	Plastic insulator (covers VE-3)	8	Outer terminal block cover
3	DC power cable terminal block VE-3	9	Inner terminal block cover (covers VE-1/VE-2)
4	Ground posts	10	Plastic insulator (covers VE-1/VE-2)
5	Status LEDs	11	DC power cable terminal block VE-1/VE-2
6	Captive installation screw		

## Required Tools

The following tools are required for the power supply removal and installation procedures:

- Number 2 Phillips-head screwdriver
- 1/4-inch open-ended wrench or 1/4-inch nutdriver
- Wire cutters to cut the cable tie-wraps

Additional tools might be necessary to install the lugs on the source DC and the ground cables. Additionally, the lugs for the source DC cables and the ground cable are not provided; you must obtain them on your own.

## Removing a 4000 W DC-Input Power Supply



**Warning**

**When installing the unit, always make the ground connection first and disconnect it last.** Statement 42



**Warning**

**Before performing any of the following procedures, ensure that power is removed from the DC circuits. To ensure that all power is removed, locate the circuit breakers or fuses on the DC power lines that service the DC circuits. Turn OFF the DC power line circuit breakers and remove the DC power line fuses.** Statement 322



**Warning**

**Voltage is present on the backplane when the system is operating. To reduce risk of an electric shock, keep hands and fingers out of the power supply bays and backplane areas.** Statement 166

To remove a 4000 W DC-input power supply, follow these steps:

**Step 1** Verify that power is off to the DC circuit that feeds power to the power supply that you are removing. As an added precaution, place the appropriate safety flag and lockout devices at the source power circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.

**Step 2** Turn the power switch to the off (0) position on the power supply that you are removing. (See [Figure 1-26](#).)

Turning off the power switch also disengages a pawl that unlocks the power supply from the chassis.



**Note**

[Figure 1-26](#) shows the PWR-4000-DC power supply with an outer terminal block cover. An earlier version of this power supply does not have an outer terminal block cover. To order a retrofit kit containing this cover, use Cisco Systems part number CVR-4000DC-TERM=.

**Step 3** Remove the two screws securing the outer terminal block cover. Lift the cover up to detach the two tabs from the slots on the power supply. Remove the cover and set it aside along with the screws. (See [Figure 1-26](#).)

**Step 4** Remove the two screws securing the left inner terminal block cover (covering the VE-1/VE-2 terminal block). Lift up on the cover to detach the tab from the slot on the power supply. Remove the cover and set it aside along with the screws.

**Step 5** Remove the one screw securing the right inner terminal block cover (covering the VE-3 terminal block). Lift up on the cover to detach the tab from the slot on the power supply. Remove the cover and set it aside along with the screw.

**Step 6** Disconnect the source DC cables from the terminal blocks in this order:

1. Positive (+) source DC cables from the +VE-1, +VE-2, and +VE-3 terminal posts
2. Negative (–) source DC cables from the –VE-1, –VE-2, and –VE-3 terminal posts
3. Ground cable from the ground terminal posts

You must remove all DC-input wiring from both terminal blocks before physically removing the power supply chassis.

**Step 7** Loosen the captive installation screw on the power supply. (See [Figure 1-27](#).)

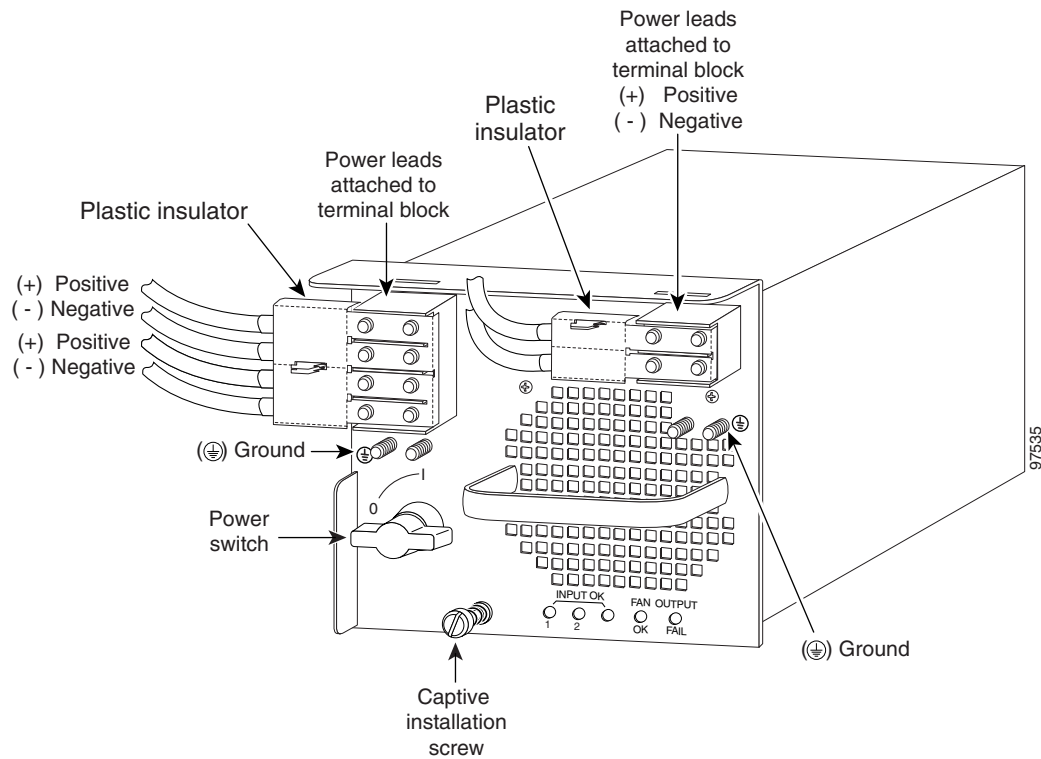


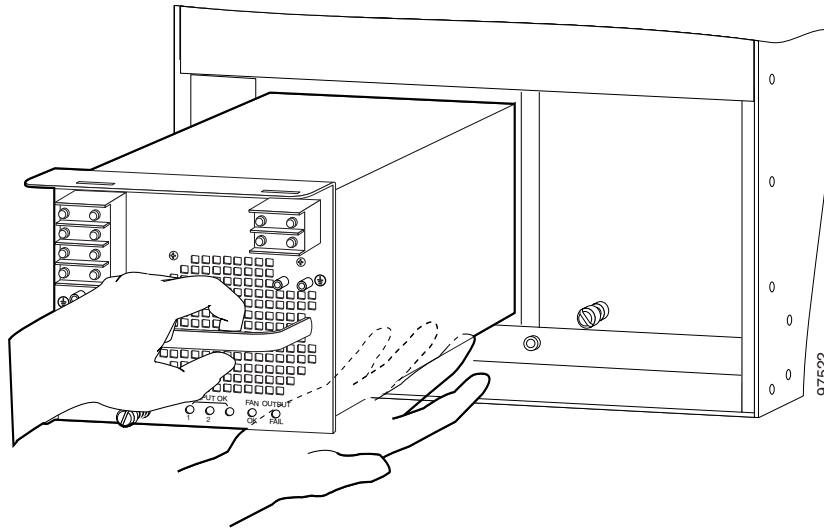
**Caution**

Use both hands to install and remove power supplies. The 4000 W DC-input power supply weighs 32 pounds (14.5 kg).

**Step 8** Grasp the power supply handle with one hand, and slide the power supply part of the way out of the chassis. Place your other hand underneath the power supply, as shown in [Figure 1-28](#), and slide the power supply completely out of the chassis and set it aside.

**Figure 1-27 Source DC Cable Connections for 4000-W DC-Input Power Supply**



**Figure 1-28 Handling a 4000 W DC-Input Power Supply**

- Step 9** If the power supply bay is to remain empty, install a blank power supply filler plate (Cisco part number 700-03104-01) over the opening, and secure it with the captive installation screw.

## Installing a 4000 W DC-Input Power Supply

The 4000 W DC-input power supply can be wired for either 2700 W or 4000 W operation. The type of power output from the power supply determines the number of source DC power cables and how they are routed and connected in the chassis. Refer to [Table 1-2](#) to select the appropriate installation procedure for your site.

**Table 1-2 4000 W DC-Input Power Supply Installation Options**

<b>If you are wiring the 4000 W power supply for...</b>	<b>And you are installing...</b>	<b>Use this procedure</b>
2700 W operation	A single 4000 W power supply in the left power supply bay	<a href="#">“Installing the 4000 W Power Supply (Wiring for 2700 W Operation; Left Power Bay)”</a> section on page 1-42
2700 W operation	A redundant (second) 4000 W power supply in the right power supply bay	<a href="#">“Installing the 4000 W Power Supply (Wiring for 2700 W Operation; Right Power Bay)”</a> section on page 1-46
4000 W operation	A single 4000 W power supply in the left power supply bay	<a href="#">“Installing the 4000 W Power Supply (Wiring for 4000 W Operation; Left Power Bay)”</a> section on page 1-50
4000 W operation	A redundant (second) 4000 W power supply in the right power supply bay	<a href="#">“Installing the 4000 W Power Supply (Wiring for 4000 W Operation; Right Power Bay)”</a> section on page 1-54



When installing a 4000 W DC-input power supply, observe the following guidelines:

- For proper 4000 W DC-input redundant power configuration, all source DC cables for one 4000 W DC-input power supply must come from the same battery system (A feed), and all source DC cables for the second 4000 W DC-input power supply must come from a different battery system (B feed).




---

**Note** For multiple DC-input power supplies, each DC input must be protected by a dedicated circuit breaker or a fuse. The circuit breaker or fuse must be sized according to the power supply input rating and the local or national electrical code requirements.

---

- The 4000 W DC-input power supply is designed to operate at either 2700 W or 4000 W. To operate the power supply at 2700 W, you can wire any two positive (+) negative (-) terminal pairs (VE-1 and VE-2, VE-2 and VE-3, or VE-1 and VE-3). To operate the power supply at 4000 W, you must wire all three terminal pairs.




---

**Note** The 4000 W DC-input power supply does not operate with only one pair of source DC cables connected.

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- For a single 4000 W DC-input power supply installation, install the power supply in the left-side power bay (POWER 1).



**Warning**

---

**Before performing any of the following procedures, ensure that power is removed from the DC circuits. To ensure that all power is removed, locate the circuit breakers or fuses on the DC power lines that service the DC circuits. Turn OFF the DC power line circuit breakers and remove the DC power line fuses.** Statement 322

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**Warning**

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**Power supply captive installation screws must be tight to ensure protective grounding continuity.** Statement 289

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Refer to [Figure 1-26](#) for a front view of the power supply with the major features called out.



**Note**

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[Figure 1-26](#) shows the PWR-4000-DC power supply with an outer terminal block cover. An earlier version of this power supply does not have an outer terminal block cover. To order a retrofit kit containing this cover, use Cisco Systems part number CVR-4000DC-TERM=.

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## Installing the 4000 W Power Supply (Wiring for 2700 W Operation; Left Power Bay)

Refer to [Figure 1-26](#) for item location and identification on the 4000 W DC-input power supply.



### Note

You should allow a minimum of 2.5 to 3 inches (63.5 mm to 76.2 mm) of space between the side of the power supply and any obstructions (such as the side of an enclosed equipment rack). This space is needed to install and secure the DC-input power cables correctly. Incorrectly routing the DC-input power cables can cause airflow blockage into the power supply and inadequate strain relief in the cables. The exact amount of space required depends upon the gauge and flexibility of the DC-input power cables that you are using.



### Note

For proper 2700 W redundant power configurations, source DC for one 4000 W DC-input power supply must come from the same battery system (A feed); source DC for the other 4000 W DC-input power supply must come from another battery system (B feed).



### Note

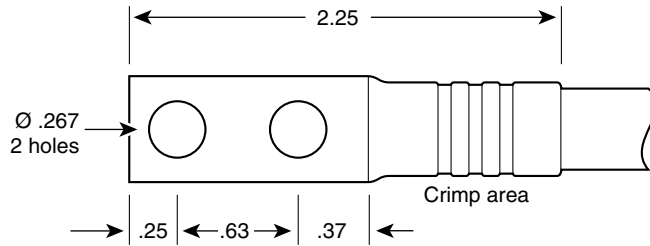
For multiple DC-input power supplies, each DC input must be protected by a dedicated circuit breaker or a fuse. The circuit breaker or fuse must be sized according to the power supply input rating and the local or national electrical code requirements.

To install a 4000 W DC-input power supply and wire it for 2700 W operation in the left power bay (POWER 1), follow these steps:

- 
- Step 1** Ensure that the system (earth) ground connection has been made.  
For ground connection installation instructions, see the “[Establishing the System Ground](#)” section on [page 1-52](#).
- Step 2** Remove the power supply from its shipping container and remove any packaging.
- Step 3** Verify that source DC power is off to the DC circuit that feeds the power supply that you are installing. As an added precaution, place the appropriate safety flag and lockout devices at the source power circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.
- Step 4** Prepare the source DC power cables by attaching the appropriately sized lugs.

The power supply terminal block lug opening width is 0.62 inch (15.8 mm). The terminal posts are centered 0.63 inches (15.88 mm) apart and have a 1/4-20 thread. We recommend that you use an appropriately sized industry standard 2-hole, standard barrel compression lug. (See [Figure 1-29](#).) The power supply ground posts, located below the terminal block, also have 1/4-20 threads and require two 1/4-inch split-ring washers and two 1/4-20 hex nuts.

The DC-input wires and the DC power supply ground wires should be sized according to the local and national installation requirements. Use only copper wire. For North American installations, use 90°C-rated, fine-strand copper conductors.

**Figure 1-29 DC Power Cable Lug**

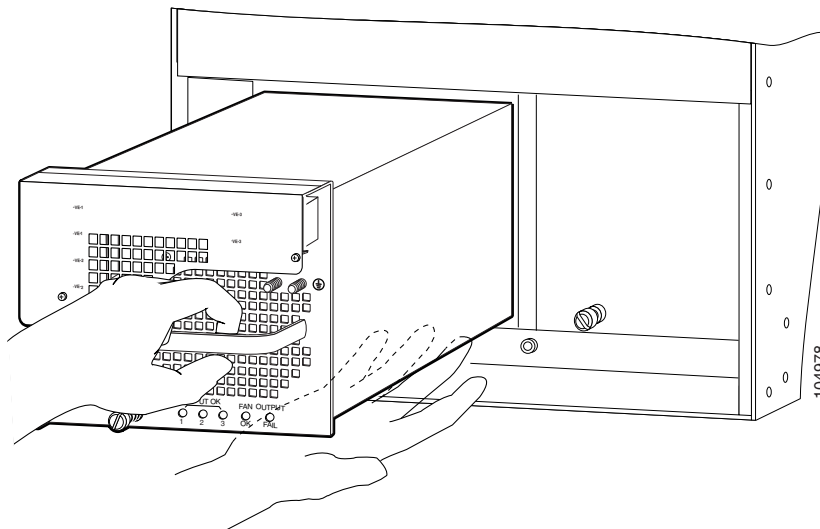
All measurements in inches

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**Caution**

Use both hands to install and remove the power supplies. Each DC-input power supply weighs 32 pounds (14.5 kg).

- Step 5** Grasp the power supply handle with one hand, and place your other hand underneath the power supply. Slide the power supply into the power supply bay. Make sure that the power supply is fully seated in the bay. (See [Figure 1-30](#).)

**Figure 1-30 Handling a 4000 W DC-Input Power Supply**

- Step 6** Tighten the power supply captive installation screw. (See [Figure 1-26](#).)
- Step 7** Remove the two screws that secure the outer terminal block cover. Lift the cover up to detach the cover tabs from the slots in the power supply. Set the cover and the screws aside.

- Step 8** Remove the two screws that secure the left inner terminal block cover. Lift up on the cover to detach the cover tab from the slot in the power supply. Set the cover and the screws aside.
- Step 9** Remove the one screw that secures the right inner terminal block cover. Lift up on the cover to detach the cover tab from the slot in the power supply. Set the cover and the screw aside.
- Step 10** Remove the two plastic insulators from the plastic bag that shipped with the power supply. Position the larger plastic insulator (eight holes) over the eight-post terminal block (VE-1/VE-2). Align the holes in plastic with the terminal block posts. The end flap on the insulator should face away from the DC source cable entry direction.
- Step 11** Position the smaller plastic insulator (four holes) over four-post terminal block VE-3. Align the holes in the plastic with the terminal block posts. The end flap on the insulator should face away from the DC source cable entry direction.
- Step 12** Fold the end flaps down on both insulators to cover the open side of the terminal blocks (opposite side from cable entry).




---

**Note** Be sure to place a plastic insulator over both terminal blocks, even if you are not attaching source DC cables to it; this ensures that the plastic insulator is available for future use.

---

- Step 13** From the left side of the power supply, connect the power supply ground cable and the source DC cables to the power supply terminal blocks in this order (Figure 1-31):
1. Ground cable lug to the ground terminal posts
  2. Negative (-) source DC cables to any two pairs of (-) terminal posts (VE-1 and VE-2, VE-1 and VE-3, or VE-2 and VE-3)
  3. Positive (+) source DC cables to any two pairs of (+) terminal posts (VE-1 and VE-2, VE-1 and VE-3, or VE-2 and VE-3)

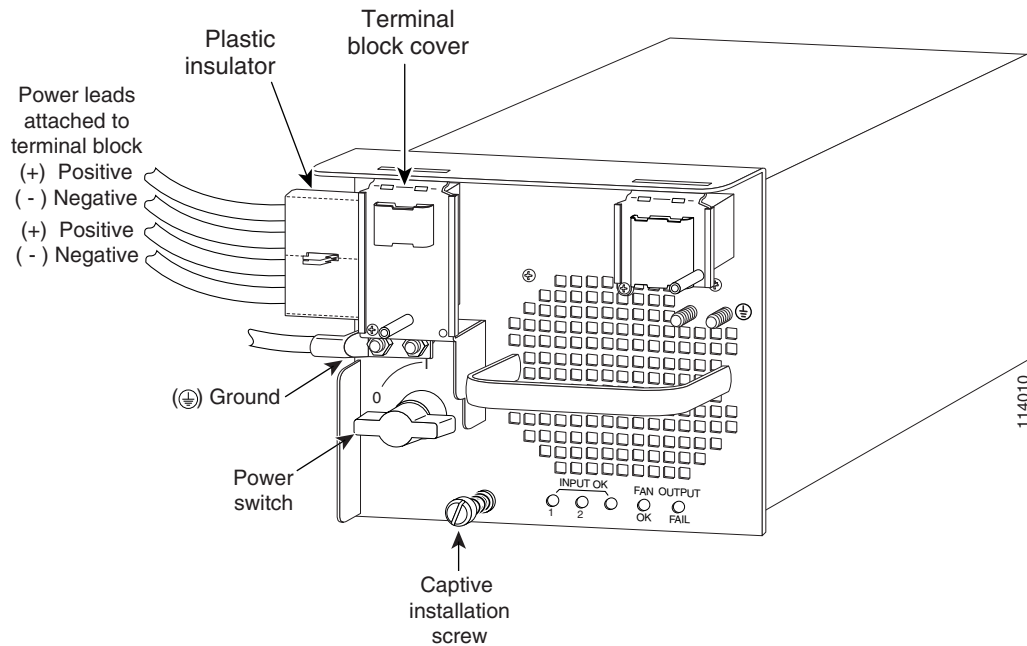



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**Caution**

When you tighten the terminal nuts, make sure that they are snug. Do not overtighten them. Overtightening the terminal nuts can damage the terminal block. The recommended torque values for tightening the terminal nuts are 15 inch-pounds (1.7 newton-meters) (minimum) and 20 inch-pounds (2.2 newton-meters) (maximum).

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**Figure 1-31 DC-Input Wire Connections for 2700 W Operation (Left-Side Power Bay)**

- Step 14** Wrap the large perforated flaps of the insulators around each pair of source DC cables, inserting each locking tab into the rear of the slot. Pull the tab until the cover is secured around the power cabling trim, and discard excess tab plastic.
- Step 15** Position and secure the left inner terminal block cover with two screws. Position and secure the right inner terminal block cover with one screw.
- Step 16** Install and secure the outer terminal block cover with the two screws.
- Step 17** If you are installing a second power supply operating at 2700 W in the right-side power supply bay, proceed to [“Installing the 4000 W Power Supply \(Wiring for 2700 W Operation; Right Power Bay\)”](#) section on page 1-46; otherwise, go to [Step 18](#).

**Caution**

To prevent a short circuit or shock hazard after wiring the DC-input power supply, reinstall the terminal block covers.

- Step 18** After you confirm that all installation steps are completed correctly, remove any safety flags, lockout devices, or adhesive tape from the source DC circuit breakers, and energize the input circuits to the power supplies.

- Step 19** Turn the power switch to the on (I) position on the power supply. Turning on the power switch also engages a pawl that locks the power supply in the chassis.
- Step 20** Verify the power supply operation by ensuring that the power supply front panel LEDs are in the following states:
- INPUT OK 1 LED—If you have source DC cables attached to the VE-1 pair of power supply inputs, verify that the LED is green. If source DC cables are attached and the LED is not lit, source DC might not be on or the source DC voltage is less than or equal to  $-33$  VDC. If the source DC voltage is between  $-33$  VDC and  $-40.5$  VDC, the LED can be either on, off, or flashing.
  - INPUT OK 2 LED—If you have source DC cables attached to the VE-2 pair of power supply inputs, verify that the LED is green. If source DC cables are attached and the LED is not lit, source DC might not be on or the source DC voltage is less than or equal to  $-33$  VDC. If the source DC voltage is between  $-33$  VDC and  $-40.5$  VDC, the LED can be either on, off, or flashing.
  - INPUT OK 3 LED—If you have source DC cables attached to the VE-3 pair of power supply inputs, verify that the LED is green. If source DC cables are attached and the LED is not lit, source DC might not be on or the source DC voltage is less than or equal to  $-33$  VDC. If the source DC voltage is between  $-33$  VDC and  $-40.5$  VDC, the LED can be either on, off, or flashing.
  - FAN OK LED is green.
  - OUTPUT FAIL LED is not lit.

If the LEDs indicate a power problem, see the [“Identifying Startup Problems”](#) section on page A-3.

### Installing the 4000 W Power Supply (Wiring for 2700 W Operation; Right Power Bay)

See [Figure 1-26](#) for item location and identification on the 4000 W DC-input power supply.



**Note**

You should allow a minimum of 2.5 to 3 inches (63.5 mm to 76.2 mm) of space between the side of the power supply and any obstructions (such as the side of an enclosed equipment rack). This space is needed to install and secure the DC-input power cables correctly. Incorrectly routing the DC-input power cables can cause airflow blockage into the power supply and inadequate strain relief in the cables. The exact amount of space required depends upon the gauge and flexibility of the DC-input power cables that you are using.



**Note**

For proper 2700 W DC-input redundant power configurations, source DC for one 4000 W DC-input power supply must come from the same battery system (A feed); source DC for the other 4000 W DC-input power supply must come from another battery system (B feed).



**Note**

For multiple DC-input power supplies, each DC input must be protected by a dedicated circuit breaker or a fuse. The circuit breaker or fuse must be sized according to the power supply input rating and the local or national electrical code requirements.

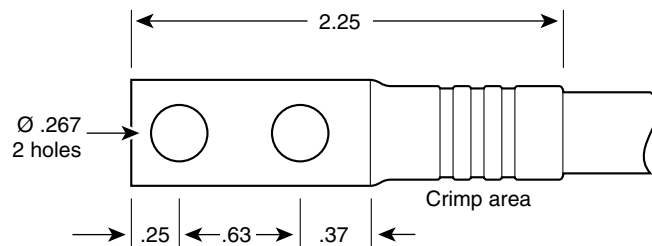
To install a 4000 W DC-input power supply and wire it for 2700 W operation in the right power supply bay (POWER 2), follow these steps:

- Step 1** Ensure that the system (earth) ground connection has been made.  
For ground connection installation instructions, see the “Establishing the System Ground” section on page 1-52.
- Step 2** Remove the power supply from its shipping container and remove any packaging.
- Step 3** Verify that source DC is off to the DC circuit that feeds the power supply that you are installing. As an added precaution, place the appropriate safety flag and lockout devices at the source power circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.
- Step 4** Prepare the source DC power cables by attaching the appropriately sized lugs.

The power supply terminal block lug opening width is 0.62 inch (15.8 mm). The terminal posts are centered 0.63 inches (15.88 mm) apart and have a 1/4-20 thread. We recommend that you use an appropriately sized industry standard 2-hole, standard barrel compression lug. (See Figure 1-32.) The power supply ground posts, located below the terminal block, also have 1/4-20 threads and require two 1/4-inch split-ring washers and two 1/4-20 hex nuts.

The DC-input wires and the DC power supply ground wires should be sized according to the local and national installation requirements. Use only copper wire. For North American installations, use 90°C-rated, fine-strand copper conductors.

**Figure 1-32 DC Power Cable Lug**



All measurements in inches

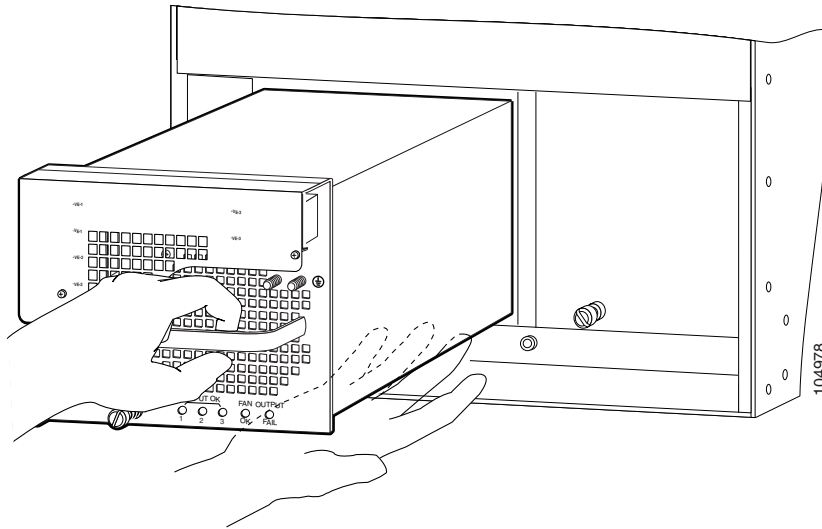
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**Caution** Use both hands to install and remove power supplies. Each DC-input power supply weighs 32 pounds (14.5 kg).

- Step 5** Grasp the power supply handle with one hand, and place your other hand underneath the power supply. Slide the supply into the right-side power supply bay. Make sure that the power supply is fully seated in the bay. (See Figure 1-33.)

**Figure 1-33 Handling a 4000 W DC-Input Power Supply**



- Step 6** Tighten the power supply captive installation screw.
- Step 7** Remove the two screws that secure the outer terminal block cover. Lift the cover up to detach the cover tabs from the slots in the power supply. Set the cover and the screws aside.
- Step 8** Remove the two screws that secure the left inner terminal block cover. Lift up on the cover to detach the cover tab from the slot in the power supply. Set the cover and the screws aside.
- Step 9** Remove the one screw that secures the right inner terminal block cover. Lift up on the cover to detach the cover tab from the slot in the power supply. Set the cover and the screw aside.
- Step 10** Remove the two plastic insulators from the plastic bag that shipped with the power supply. Position the larger plastic insulator (eight holes) over terminal block VE-1/VE-2. Align the holes in plastic with the terminal block posts. The end flap on the insulator should face away from the DC source cable entry direction.
- Step 11** Position the smaller plastic insulator (four holes) over the four-post terminal block VE-3. Align the holes in the plastic with the terminal block posts. The end flap on the insulator should face away from the source DC cable entry direction.
- Step 12** Fold the end flaps down on both insulators to cover the open side of the terminal block (opposite side from cable entry).



**Note** Be sure to place a plastic insulator over both terminal blocks, even though you might not attach source DC cables to the terminal block; installing both of the insulators ensures that they are available for future use.



**Step 13** From the right side of the power supply, connect the power supply ground cable and the source DC cables to the DC-input wires to the terminal block (Figure 1-34) in this order:

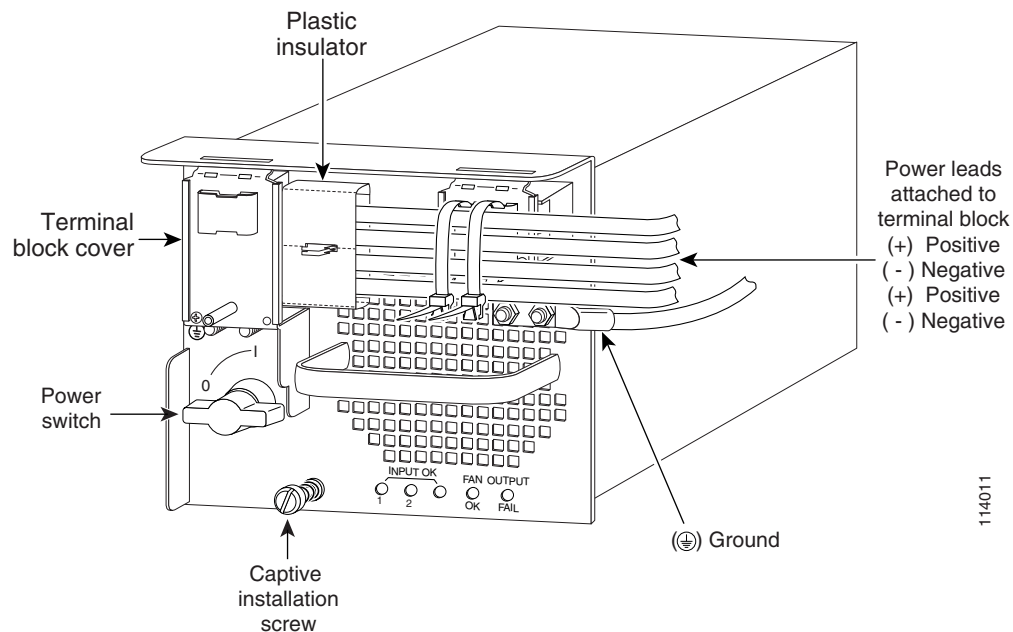
1. Ground cable lug to the ground terminal posts
2. Negative (-) source DC cables to any two pairs of (-) terminal posts (VE-1 and VE-2, VE-1 and VE-3, or VE-2 and VE-3)
3. Positive (+) source DC cables to any two pairs of (+) terminal posts (VE-1 and VE-2, VE-1 and VE-3, or VE-2 and VE-3)



**Caution**

When you tighten the terminal nuts, make sure that they are snug. Do not overtighten them. Overtightening the terminal nuts can damage the terminal block. The recommended torque values for tightening the terminal nuts are 15 inch-pounds (1.7 newton-meters) (minimum) and 20 inch-pounds (2.2 newton-meters) (maximum).

**Figure 1-34 DC-Input Wire Connections for 2700 W Operation (Right-Side Power Bay)**



**Step 14** Wrap the large perforated flaps of the insulators around each pair of source DC cables, inserting each locking tab into the rear of the slot. Pull the tab until the cover is secured around the power cabling trim, and discard excess tab plastic.

**Step 15** Position and secure the left inner terminal block cover with two screws. Position and secure the right inner terminal block cover with one screw.

**Step 16** Using the cable tie provided, place the cable tie through the slot at the top of the right terminal block cover, and secure the wiring to the left terminal block.

**Step 17** Install and secure outer terminal block cover with the two screws.



**Caution**

To prevent a short circuit or shock hazard after wiring the DC-input power supply, reinstall the terminal block covers.

- Step 18** After you confirm that all installation steps are completed correctly, remove any safety flags, lockout devices, or adhesive tape from the source DC circuit breakers, and energize the input circuits to the power supplies.
- Step 19** Turn the power switch to the on (I) position on the power supply. Turning on the power switch also engages a pawl that locks the power supply in the chassis.
- Step 20** Verify the power supply operation by ensuring that the power supply front panel LEDs are in the following states:
- INPUT OK 1 LED—If you have source DC cables attached to the VE-1 pair of power supply inputs, verify that the LED is green. If source DC cables are attached and the LED is not lit, source DC might not be on or the source DC voltage is less than or equal to  $-33$  VDC. If the source DC voltage is between  $-33$  VDC and  $-40.5$  VDC, the LED can be either on, off, or flashing.
  - INPUT OK 2 LED—If you have source DC cables attached to the VE-2 pair of power supply inputs, verify that the LED is green. If source DC cables are attached and the LED is not lit, source DC might not be on or the source DC voltage is less than or equal to  $-33$  VDC. If the source DC voltage is between  $-33$  VDC and  $-40.5$  VDC, the LED can be either on, off, or flashing.
  - INPUT OK 3 LED—If you have source DC cables attached to the VE-3 pair of power supply inputs, verify that the LED is green. If source DC cables are attached and the LED is not lit, source DC might not be on or the source DC voltage is less than or equal to  $-33$  VDC. If the source DC voltage is between  $-33$  VDC and  $-40.5$  VDC, the LED can be either on, off, or flashing.
  - FAN OK LED is green.
  - OUTPUT FAIL LED is not lit.

If the LEDs indicate a power problem, see the [“Identifying Startup Problems” section on page A-3](#).

### Installing the 4000 W Power Supply (Wiring for 4000 W Operation; Left Power Bay)

See [Figure 1-26](#) for item location and identification on the 4000 W DC-input power supply.



**Note**

You should allow a minimum of 2.5 to 3 inches (63.5 mm to 76.2 mm) of space between the side of the power supply and any obstructions (such as the side of an enclosed equipment rack). This space is needed to install and secure the DC-input power cables correctly. Incorrectly routing the DC-input power cables can cause airflow blockage into the power supply and inadequate strain relief in the cables. The exact amount of space required depends upon the gauge and flexibility of the DC-input power cables you are using.



**Note**

For proper 4000 W DC-input redundant power configurations, source DC for one 4000 W DC-input power supply must come from the same battery system (A feed); source DC for the other 4000 W DC-input power supply must come from another battery system (B feed).



**Note**

For multiple DC-input power supplies, each DC input must be protected by a dedicated circuit breaker or a fuse. The circuit breaker or fuse must be sized according to the power supply input rating and the local or national electrical code requirements.

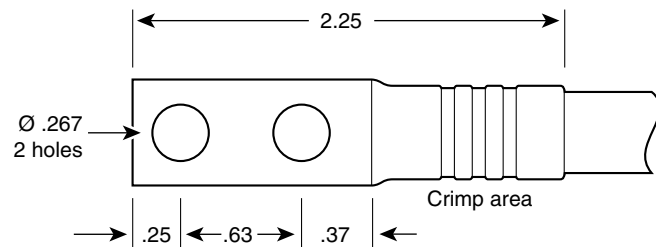
To install a 4000 W DC-input power supply and wire it for 4000 W operation in the left power bay (POWER 1), follow these steps:

- Step 1** Ensure that the system (earth) ground connection has been made.  
For ground connection installation instructions, see the “Establishing the System Ground” section on page 1-52.
- Step 2** Remove the power supply from its shipping container and remove any packaging.
- Step 3** Verify that source DC power is off to the DC circuit that feeds the power supply that you are installing. As an added precaution, place the appropriate safety flag and lockout devices at the source power circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.
- Step 4** Prepare the source DC power cables by attaching the appropriately sized lugs.

The power supply terminal block lug opening width is 0.62 inch (15.8 mm). The terminal posts are centered 0.63 inches (15.88 mm) apart and have a 1/4-20 thread. We recommend that you use an appropriately sized industry standard 2-hole, standard barrel compression lug. (See Figure 1-35.) The power supply ground posts, located below the terminal block, also have 1/4-20 threads and require two 1/4-inch split-ring washers and two 1/4-20 hex nuts.

The DC-input wires and the DC power supply ground wires should be sized according to the local and national installation requirements. Use only copper wire. For North American installations, use 90°C-rated, fine-strand copper conductors.

**Figure 1-35 DC Power Cable Lug**



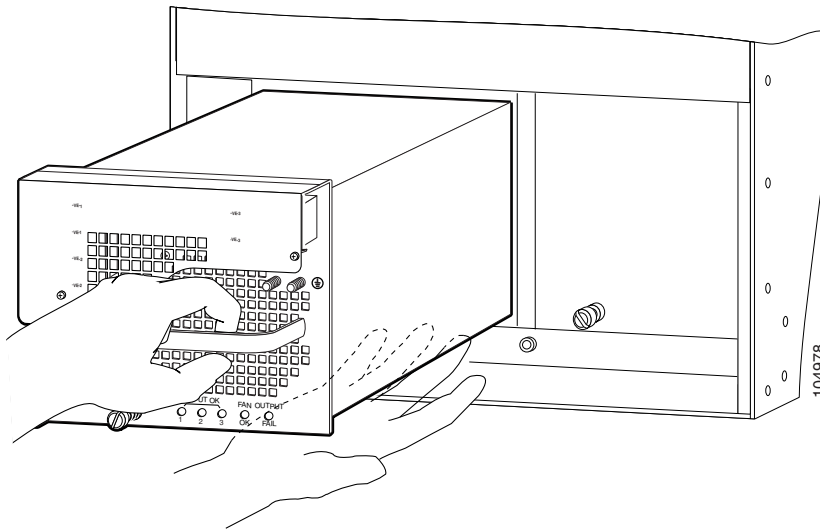
All measurements in inches

120563



**Caution** Use both hands to install and remove power supplies. Each DC-input power supply weighs 32 pounds (14.5 kg).

- Step 5** Grasp the power supply handle with one hand, and place your other hand underneath the power supply. Slide the power supply into the power supply bay. Make sure that the power supply is fully seated in the bay. (See Figure 1-36.)

**Figure 1-36 Handling a 4000 W DC-Input Power Supply**

- Step 6** Tighten the power supply captive installation screw.
- Step 7** Remove the two screws that secure the outer terminal block cover. Lift the cover up to detach the cover tabs from the slots in the power supply. Set the cover and the screws aside. (See [Figure 1-26](#).)
- Step 8** Remove the two screws that secure the left inner terminal block cover. Lift up on the cover to detach the cover tab from the slot in the power supply. Set the cover and the screws aside.
- Step 9** Remove the one screw that secures the right inner terminal block cover. Lift up on the cover to detach the cover tab from the slot in the power supply. Set the cover and the screw aside.
- Step 10** Remove the two plastic insulators from the plastic bag that shipped with the power supply. Position the larger plastic insulator (eight holes) over terminal block VE-1/VE-2. Align the holes in plastic with the terminal block posts. The end flap on the insulator should face away from the DC source cable entry direction.
- Step 11** Position the smaller plastic insulator (four holes) over the four-post terminal block VE-3. Align the holes in the plastic with the terminal block posts. The end flap on the insulator should face away from the source DC cable entry direction.
- Step 12** Fold the end flaps down on both insulators to cover the open side of the terminal block (opposite side from cable entry).
- Step 13** From the left side of the power supply, connect the power supply ground cable and the source DC cables to the DC-input wires to the terminal block (see [Figure 1-37](#)) in this order:
1. Ground cable lug to the ground terminal posts
  2. Negative (-) source DC cables to terminal posts -VE-1 and -VE-2
  3. Positive (+) source DC cables to terminal posts +VE-1 and +VE-2

**Caution**

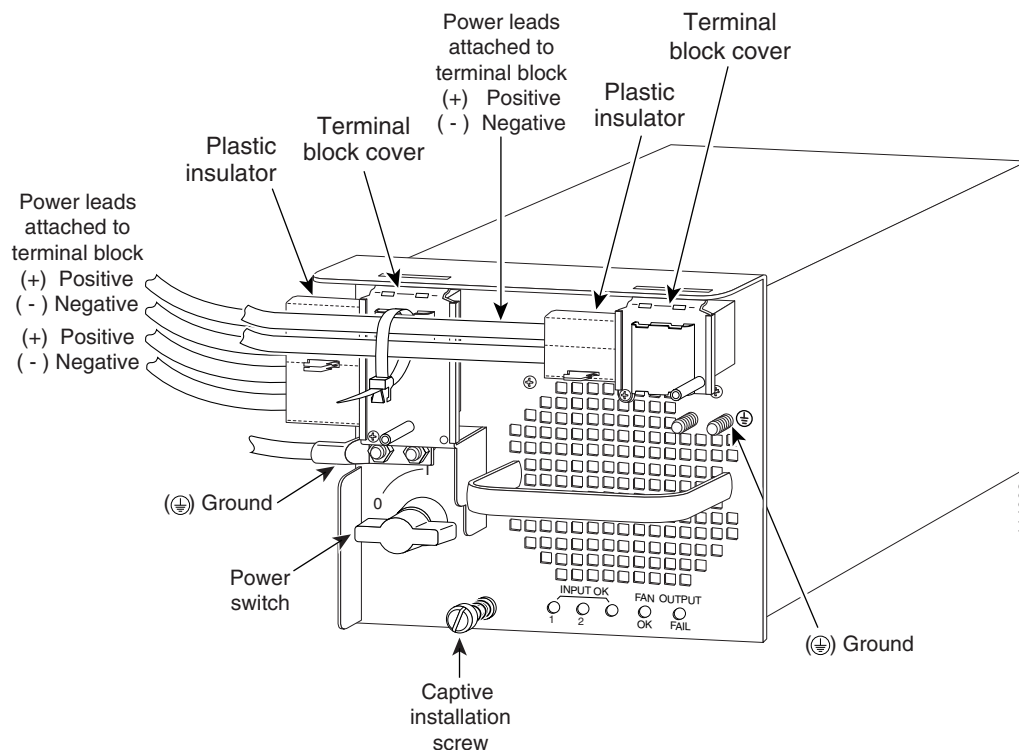
When you tighten the terminal nuts, make sure that they are snug. Do not overtighten them. Overtightening the terminal nuts can damage the terminal block. The recommended torque values for tightening the terminal nuts are 15 inch-pounds (1.7 newton-meters) (minimum) and 20 inch-pounds (2.2 newton-meters) (maximum).

- Step 14** From the left side of the power supply, connect the third pair of source DC cables to the power supply terminal block VE-3 (see [Figure 1-37](#)) in this order:
1. Negative (-) source DC cable to terminal posts -VE-3
  2. Positive (+) source DC cable to terminal posts +VE-3

**Caution**

When you tighten the terminal nuts, make sure that they are snug. Do not overtighten them. Overtightening the terminal nuts can damage the terminal block. The recommended torque values for tightening the terminal nuts are 15 inch-pounds (1.7 newton-meters) (minimum) and 20 inch-pounds (2.2 newton-meters) (maximum).

**Figure 1-37 DC-Input Wire Connections for 4000 W Operation (Left-Side Power Bay)**



- Step 15** Wrap the large perforated flaps of the insulators around each pair of source DC cables, inserting each locking tab into the rear of the slot. Pull the tab until the cover is secured around the power cabling trim, and discard excess tab plastic.
- Step 16** Position and secure the left inner terminal block cover with two screws. Position and secure the right inner terminal block cover with one screw.
- Step 17** Using the cable tie provided, place the cable tie through the slot at the top of the left terminal block cover, and secure the wiring to the right terminal block.
- Step 18** Install and secure outer terminal block cover with the two screws.
- Step 19** If you are installing a second power supply that operates at 4000 W in the right side power supply bay, proceed to [“Installing the 4000 W Power Supply \(Wiring for 4000 W Operation; Right Power Bay\)”](#) section on page 1-54; otherwise, go to [Step 20](#).

**Caution**

To prevent a short circuit or shock hazard after wiring the DC-input power supply, reinstall the terminal block covers.

- Step 20** After you confirm that all installation steps are completed correctly, remove any safety flags, lockout devices, or adhesive tape from the source DC circuit breakers, and energize the input circuits to the power supplies.
- Step 21** Turn the power switch to the on (I) position on the power supply. Turning on the power switch also engages a pawl that locks the power supply in the chassis.
- Step 22** Verify the power supply operation by ensuring that the power supply front panel LEDs are in the following states:
- INPUT OK 1 LED—If you have source DC cables attached to the VE-1 pair of power supply inputs, verify that the LED is green. If source DC cables are attached and the LED is not lit, source DC might not be on or the source DC voltage is less than or equal to  $-33$  VDC. If the source DC voltage is between  $-33$  VDC and  $-40.5$  VDC, the LED can be either on, off, or flashing.
  - INPUT OK 2 LED—If you have source DC cables attached to the VE-2 pair of power supply inputs, verify that the LED is green. If source DC cables are attached and the LED is not lit, source DC might not be on or the source DC voltage is less than or equal to  $-33$  VDC. If the source DC voltage is between  $-33$  VDC and  $-40.5$  VDC, the LED can be either on, off, or flashing.
  - INPUT OK 3 LED—If you have source DC cables attached to the VE-3 pair of power supply inputs, verify that the LED is green. If source DC cables are attached and the LED is not lit, source DC might not be on or the source DC voltage is less than or equal to  $-33$  VDC. If the source DC voltage is between  $-33$  VDC and  $-40.5$  VDC, the LED can be either on, off, or flashing.
  - FAN OK LED is green.
  - OUTPUT FAIL LED is not lit.

If the LEDs indicate a power problem, see the [“Identifying Startup Problems”](#) section on page A-3.

### Installing the 4000 W Power Supply (Wiring for 4000 W Operation; Right Power Bay)

See [Figure 1-26](#) for item location and identification on the 4000 W DC-input power supply.

**Note**

You should allow a minimum of 2.5 to 3 inches (63.5 mm to 76.2 mm) of space between the side of the power supply and any obstructions (such as the side of an enclosed equipment rack). This space is needed to install and secure the DC-input power cables correctly. Incorrectly routing the DC-input power cables can cause airflow blockage into the power supply and inadequate strain relief in the cables. The exact amount of space required depends upon the gauge and flexibility of the DC-input power cables you are using.

**Note**

For proper 4000 W DC-input redundant power configurations, source DC for one 4000 W DC-input power supply must come from the same battery system (A feed); source DC for the other 4000 W DC-input power supply must come from another battery system (B feed).

**Note**

For multiple DC-input power supplies, each DC input must be protected by a dedicated circuit breaker or a fuse. The circuit breaker or fuse must be sized according to the power supply input rating and the local or national electrical code requirements.

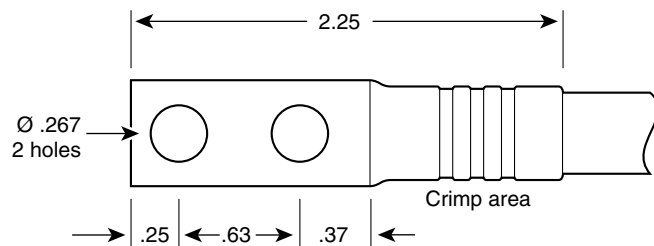
To install a 4000 W DC-input power supply and wire it for 4000 W operation in the right power bay (POWER 2), follow these steps:

- Step 1** Ensure that the system (earth) ground connection has been made. For ground connection installation instructions, see the “Establishing the System Ground” section on page 1-52.
- Step 2** Verify that source DC power is off to the DC circuit that feeds the power supply that you are installing. As an added precaution, place the appropriate safety flag and lockout devices at the source power circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.
- Step 3** Prepare the source DC-input power cables by attaching the appropriately sized lugs.

The power supply terminal block lug opening width is 0.62 inch (15.8 mm). The terminal posts are centered 0.63 inches (15.88 mm) apart and have a 1/4-20 thread. We recommend that you use an appropriately sized industry standard 2-hole, standard barrel compression lug. (See Figure 1-38.) The power supply ground posts, located below the terminal block, also have 1/4-20 threads and require two 1/4-inch split-ring washers and two 1/4-20 hex nuts.

The DC-input wires and the DC power supply ground wires should be sized according to the local and national installation requirements. Use only copper wire. For North American installations, use 90°C-rated, fine-strand copper conductors.

**Figure 1-38 DC Power Cable Lug**



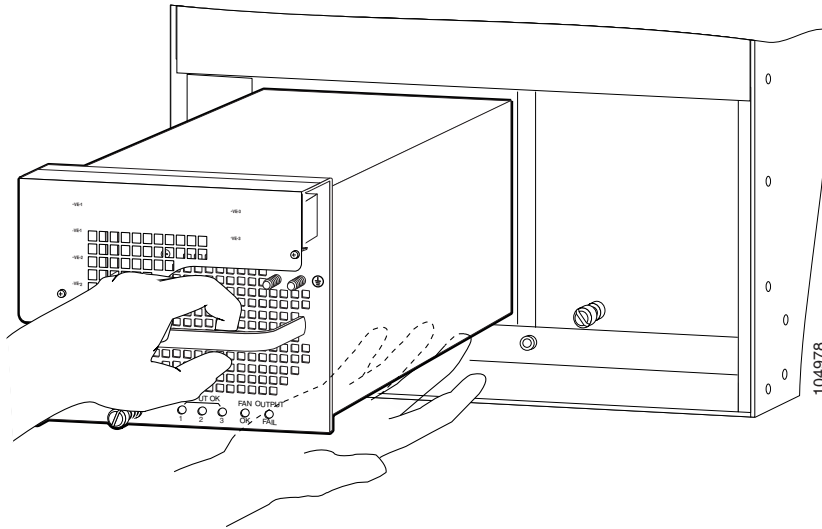
All measurements in inches

**Caution**

Use both hands to install and remove power supplies. Each DC-input power supply weighs 32 pounds (14.5 kg).

- Step 4** Grasp the power supply handle with one hand, and place your other hand underneath the power supply. Slide the power supply into the power supply bay. Make sure that the power supply is fully seated in the bay. (See Figure 1-39.)

**Figure 1-39 Handling a 4000 W DC-Input Power Supply**



- Step 5** Tighten the power supply captive installation screws
- Step 6** Remove the two screws that secure the outer terminal block cover. Lift the cover up to detach the cover tabs from the slots in the power supply. Set the cover and the screws aside
- Step 7** Remove the two screws that secure the left inner terminal block cover. Lift up on the cover to detach the cover tab from the slot in the power supply. Set the cover and the screws aside.
- Step 8** Remove the one screw that secures the right inner terminal block cover. Lift up on the cover to detach the cover tab from the slot in the power supply. Set the cover and the screw aside.
- Step 9** Remove the two plastic insulators from the plastic bag that shipped with the power supply. Position the larger plastic insulator (eight holes) over terminal block VE-1/VE-2. Align the holes in plastic with the terminal block posts. The end flap on the insulator should face away from the DC source cable entry direction.
- Step 10** Position the smaller plastic insulator (four holes) over the four-post terminal block VE-3. Align the holes in the plastic with the terminal block posts. The end flap on the insulator should face away from the source DC cable entry direction.
- Step 11** Fold the end flaps down on both insulators to cover the open side of the terminal block (opposite side from cable entry).
- Step 12** From the right side of the power supply, connect the power supply ground cable and the source DC cables to the DC-input wires to the terminal block (see [Figure 1-40](#)) in this order:
1. Ground cable lug to the ground terminal posts
  2. Negative (-) source DC cables to terminal posts -VE-1 and -VE-2
  3. Positive (+) source DC cables to terminal posts +VE-1 and +VE-2



**Caution**

When you tighten the terminal nuts, make sure that they are snug. Do not overtighten them. Overtightening the terminal nuts can damage the terminal block. The recommended torque values for tightening the terminal nuts are 15 inch-pounds (1.7 newton-meters) (minimum) and 20 inch-pounds (2.2 newton-meters) (maximum).

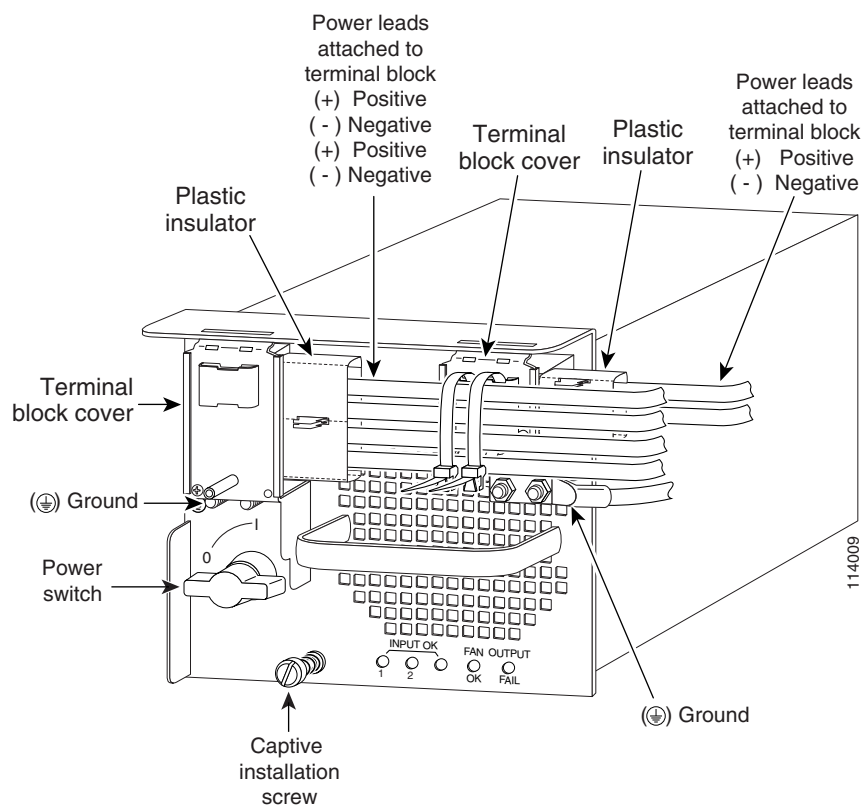


- Step 13** From the right side of the power supply, connect the third pair of source DC cables to the power supply terminal block VE-3 (see [Figure 1-40](#)) in this order:
1. Negative (-) source DC cable to terminal posts -VE-3
  2. Positive (+) source DC cable to terminal posts +VE-3

**Caution**

When you tighten the terminal nuts, make sure that they are snug. Do not overtighten them. Overtightening the terminal nuts can damage the terminal block. The recommended torque values for tightening the terminal nuts are 15 inch-pounds (1.7 newton-meters) (minimum) and 20 inch-pounds (2.2 newton-meters) (maximum).

**Figure 1-40 DC-Input Wire Connections for 4000 W Operation (Right-Side Power Bay)**



- Step 14** Wrap the large perforated flaps of the insulators around each pair of source DC cables, inserting each locking tab into the rear of the slot. Pull the tab until the cover is secured around the power cabling trim, and discard excess tab plastic.
- Step 15** Position and secure the left inner terminal block cover with two screws. Position and secure the right inner terminal block cover with one screw.
- Step 16** Using the cable tie provided, place the cable tie through the slot at the top of the right terminal block cover, and secure the wiring to the left terminal block.
- Step 17** Install and secure outer terminal block cover with the two screws.

**Warning**

**When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046

**Caution**

To prevent a short circuit or shock hazard after wiring the DC-input power supply, reinstall the terminal block covers.

**Step 18** After you confirm that all installation steps are completed correctly, remove any safety flags, lockout devices, or adhesive tape from the source DC circuit breakers, and energize the source DC circuits to the power supplies.

Turn the power switch to the On (I) position on the power supply. Turning on the power switch also engages a pawl that locks the power supply in the chassis.

**Step 19** Verify the power supply operation by ensuring that the power supply front panel LEDs are in the following states:

- INPUT OK 1 LED—If you have source DC cables attached to the VE-1 pair of power supply inputs, verify that the LED is green. If source DC cables are attached and the LED is not lit, source DC might not be on or the source DC voltage is less than or equal to  $-33$  VDC. If the source DC voltage is between  $-33$  VDC and  $-40.5$  VDC, the LED can be either on, off, or flashing.
- INPUT OK 2 LED—If you have source DC cables attached to the VE-2 pair of power supply inputs, verify that the LED is green. If source DC cables are attached and the LED is not lit, source DC might not be on or the source DC voltage is less than or equal to  $-33$  VDC. If the source DC voltage is between  $-33$  VDC and  $-40.5$  VDC, the LED can be either on, off, or flashing.
- INPUT OK 3 LED—If you have source DC cables attached to the VE-3 pair of power supply inputs, verify that the LED is green. If source DC cables are attached and the LED is not lit, source DC might not be on or the source DC voltage is less than or equal to  $-33$  VDC. If the source DC voltage is between  $-33$  VDC and  $-40.5$  VDC, the LED can be either on, off, or flashing.
- FAN OK LED is green.
- OUTPUT FAIL LED is not lit.

If the LEDs indicate a power problem, see the [“Identifying Startup Problems”](#) section on page A-3.

## Removing and Installing a 6000 W DC-Input Power Supply

This section covers the power supply removal and installation procedures for the 6000 W DC-input power supply (PWR-6000-DC) and is divided into the following topics:

- [Required Tools](#), page 1-59
- [Removing a 6000 W DC-Input Power Supply](#), page 1-59
- [Installing a 6000 W DC-Input Power Supply](#), page 1-64

**Note**

For proper 6000 W DC-input redundant power configurations, all of the source DC for one 6000 W DC-input power supply must come from the same battery system (A feed); all of the source DC for the other 6000 W DC-input power supply must come from another battery system (B feed).

## Required Tools

The following tools are required for the power supply removal and installation procedures:

- Number 2 Phillips-head screwdriver
- 1/4-inch open-ended wrench or 1/4-inch nutdriver
- Wire cutters to cut the cable tie-wraps

Additional tools might be necessary to install the lugs on the source DC and the ground cables. Additionally, the lugs for the source DC cables and the ground cable are not provided; you must obtain them on your own.

## Removing a 6000 W DC-Input Power Supply



**Before performing any of the following procedures, ensure that power is removed from the DC circuits. To ensure that all power is removed, locate the circuit breakers or fuses on the DC power lines that service the DC circuits. Turn OFF the DC power line circuit breakers and remove the DC power line fuses.** Statement 322



**Voltage is present on the backplane when the system is operating. To reduce risk of an electric shock, keep hands and fingers out of the power supply bays and backplane areas.** Statement 166

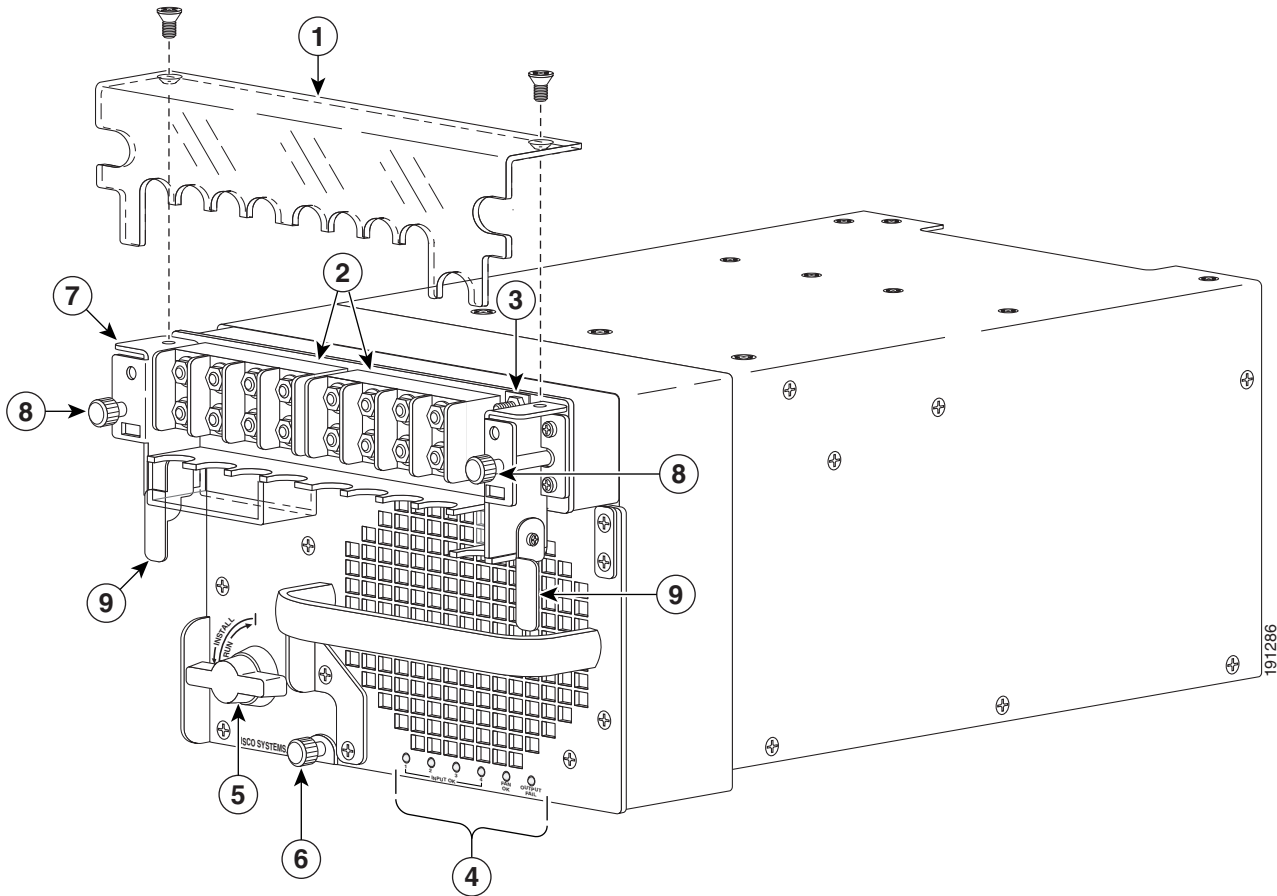


With the 6000 W DC-input power supply, you have the option of removing the Input Power Module (IPM) without disconnecting the DC-input wires and the ground wires. You can then replace your power supply and insert the fully-wired IPM. Read through this procedure carefully before removing your power supply.

To remove a DC-input power supply, follow these steps:

- Step 1** Verify that power is off to the DC circuit connected to the DC-input power supply you are removing. As an added precaution, place the appropriate safety flag and lockout devices at the source DC power circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.
- Step 2** Turn the power switch to the Off (0) position on the power supply you are removing (Figure 1-41). Turning the power switch off also disengages a pawl that unlocks the power supply from the chassis.

Figure 1-41 DC-Input Front Panel for 6000-W DC-Input Power Supply



1	Terminal block cover	6	Captive installation screw
2	DC power cable terminal block	7	Input Power Module (IPM)
3	Ground	8	IPM captive screws
4	Status LEDs	9	IPM latches
5	Power switch		



**Note** With the PWR-6000-DC power supply, you have the option of removing the Input Power Module (IPM) without disconnecting the DC-input wires and the ground wires. You can then replace your power supply and insert the fully-wired IPM. To use this option, do not perform steps 3 through 6 and go to step 7.

- Step 3** Remove the two A4 screws securing the terminal block cover, and remove the cover from the power supply (Figure 1-42).
- Step 4** Cut any cable tie-wraps being careful not to cut or nick the DC-input wires.

**Note**

The 6000 W DC-input power supply provides voltages of 2800 W, 4500 W, or 6000 W for single and redundant configurations. Some configurations require cable tie-wraps, depending on available DC input pairs.

**Step 5** Disconnect the DC-input wires from the terminal block in this order:

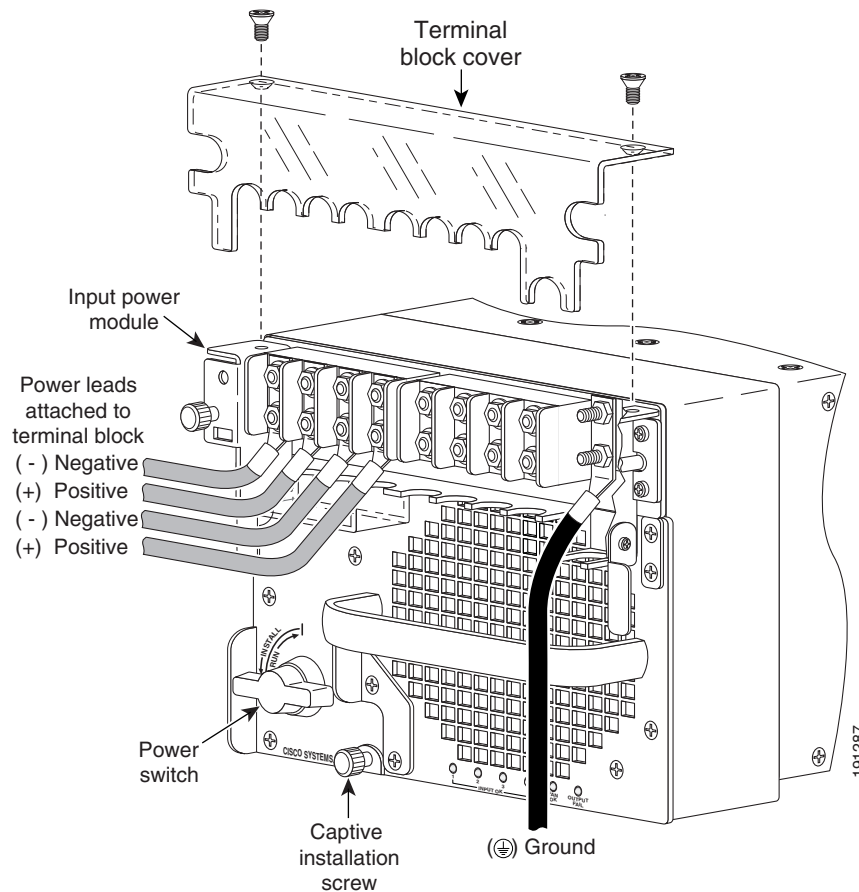
- Positive (+)
- Negative (-)

**Step 6** Disconnect the DC power supply ground.

**Warning**

**When installing the unit, always make the ground connection first and disconnect it last.** Statement 42

**Figure 1-42 DC-Input Wire Connections for 6000-W DC-Input Power Supply (2800W DC-input shown)**



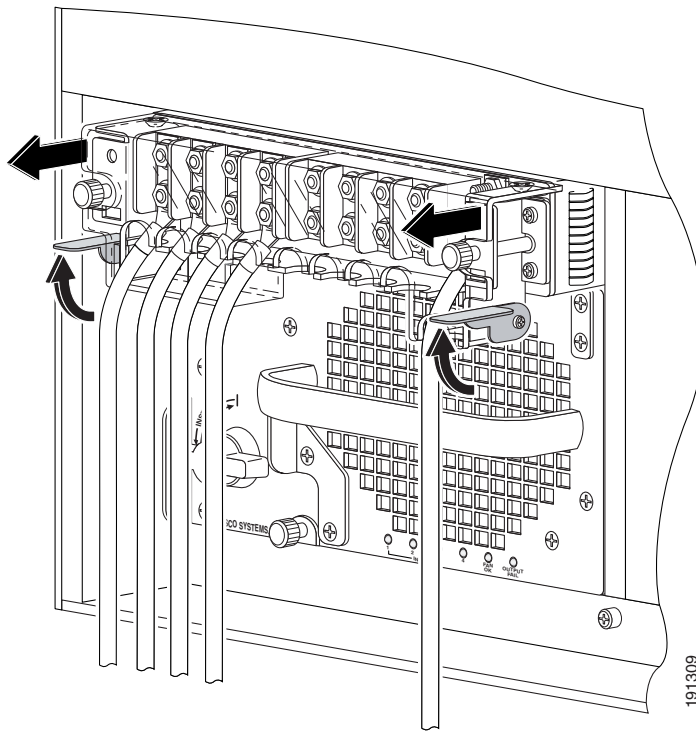


**Note** If you are not going to remove the IPM, skip steps 7 and 8 and go to step 9.

**Step 7** Loosen the IPM captive installation screws on the power supply. See [Figure 1-41](#).

**Step 8** Lift up on both IPM latches and remove the IPM. See [Figure 1-43](#).

**Figure 1-43** Removing the IPM Module



**Step 9** Loosen the captive installation screw on the power supply ([Figure 1-41](#)).



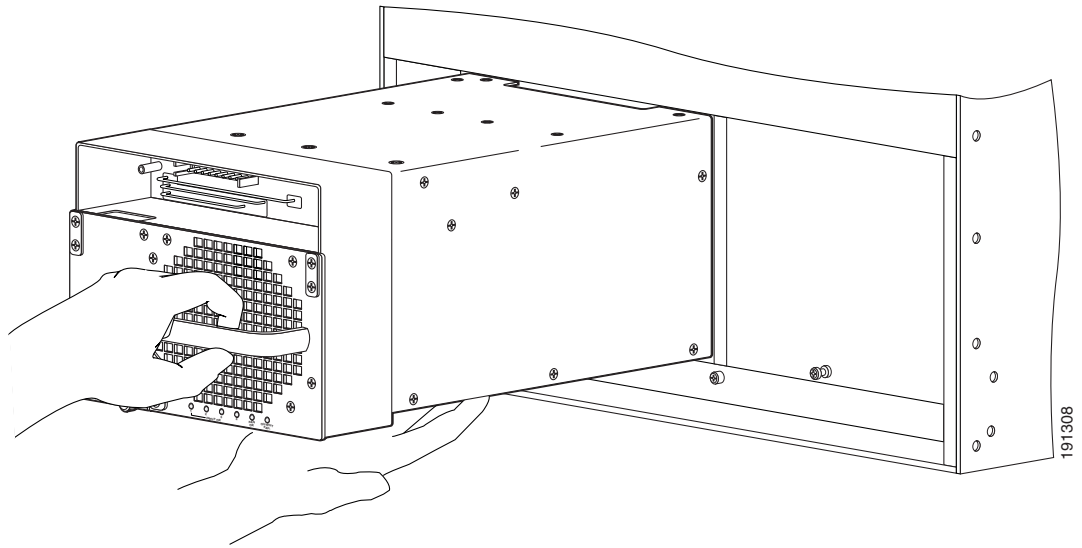
**Caution** Use both hands to install and remove power supplies. Each DC-input power supply weighs 35 pounds (16 kg).

**Step 10** Grasp the power supply handle with one hand and slide the power supply part of the way out of the chassis. Place your other hand underneath the power supply, as shown in [Figure 1-44](#) (without IPM) and in [Figure 1-45](#) (with IPM), and slide the power supply completely out of the chassis.

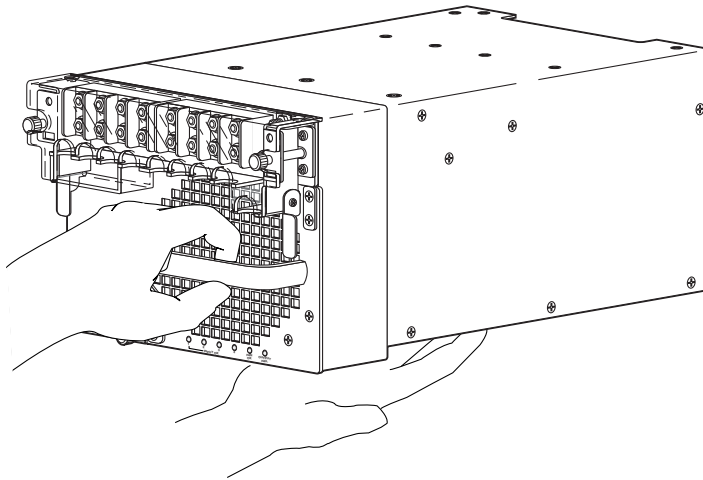


**Note** If the power supply bay is to remain empty, install a blank power supply filler plate (Cisco part number 700-03104-01) over the opening, and secure it with the captive installation screws.

**Figure 1-44** Handling a DC-Input Power Supply without IPM



**Figure 1-45** Handling a DC-Input Power Supply with IPM



## Installing a 6000 W DC-Input Power Supply



### Note

With the PWR-6000-DC power supply, you have the option of installing an Input Power Module (IPM) (previously removed) with the DC-input wires and the ground wires still connected. You can then install your power supply and insert the fully-wired IPM. Read through this procedure carefully before installing your power supply.



### Warning

**Before performing any of the following procedures, ensure that power is removed from the DC circuits. To ensure that all power is removed, locate the circuit breakers or fuses on the DC power lines that service the DC circuits. Turn OFF the DC power line circuit breakers and remove the DC power line fuses.** Statement 322



### Note

For proper 6000W DC-input redundant power configuration, all input wires (two pairs for 2800W DC-input, three pairs for 4500W DC-input, and four pairs for 6000W DC-input) for one 6000W DC-input power supply must come from the same battery system (A feed); all input wires (two pairs for 2800W DC-input, three pairs for 4500W DC-input, and four pairs for 6000W DC-input) for the other 6000W DC-input power supply must come from another battery system (B feed).



### Note

For multiple DC input power supply, each DC input must be protected by dedicated circuit breaker or fuse. The circuit breaker or fuse should be sized according to the power supply input rating and local or national electrical code requirements.



### Warning

**When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046



### Note

The 6000 W DC-input power supply provides power of 2800 W, 4500 W, or 6000 W. Select 2800 W by wiring any two positive (+)/negative (-) terminal pairs in any sequence. Select 4500 W by wiring any three positive (+)/negative (-) terminal pairs in any sequence. Select 6000 W by wiring all four positive (+)/negative (-) terminal pairs. The Cisco IOS software detects the wired inputs and sets the proper system power.



### Note

The 6000 W DC-input power supply ground provides the system ground connection when the PWR-6000-DC power supply is installed in a Catalyst 6500 series chassis. Install the ground as described in this procedure.



### Note

For redundant power supplies, you must connect the 6000 W DC-input power supply ground for both power supplies.



**Note**

You should allow a minimum of 2.5 to 3 inches (63.5 mm to 76.2 mm) of space between the side of the power supply and any obstructions (such as the side of an enclosed equipment rack). This space is needed to install and secure the DC-input power cables correctly. Incorrectly routing the DC-input power cables can cause airflow blockage into the power supply and inadequate strain relief in the cables. The exact amount of space required depends upon the gauge and flexibility of the DC-input power cables you are using.

To install a 6000 W DC-input power supply, follow these steps:

**Step 1**

Verify that power is off to the DC circuit that is connected to the power supply you are installing. Place appropriate safety flag and lockout devices at power switch handle to avoid any circuit inputs from becoming energized.

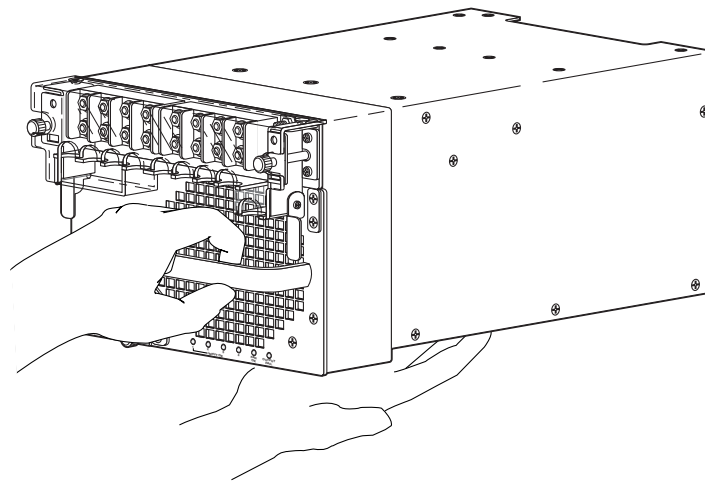
**Caution**

Use both hands to install and remove power supplies. Each 6000 W DC-input power supply weighs 35 pounds (16 kg).

**Step 2**

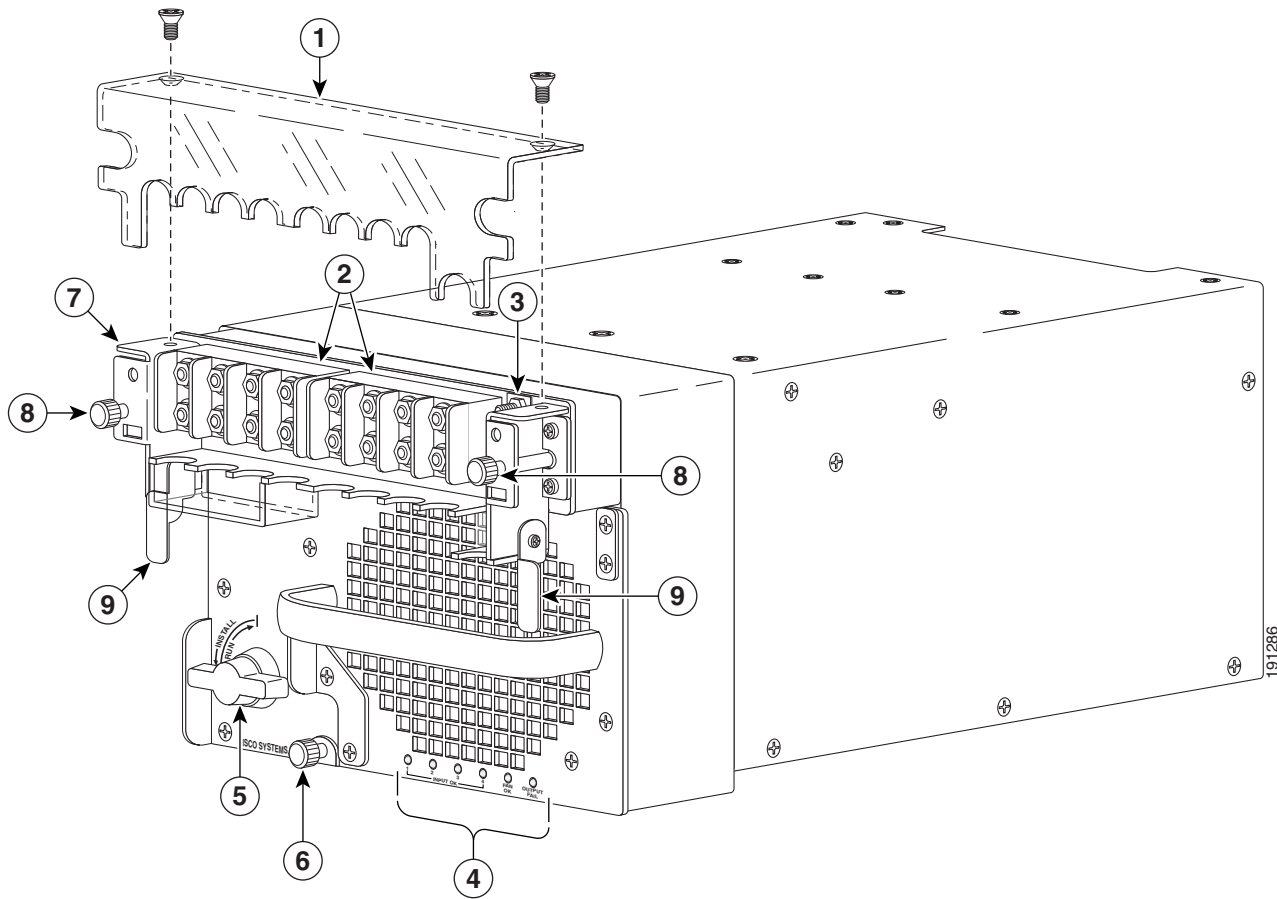
Grasp the power supply handle with one hand, and place your other hand underneath the power supply. Slide the power supply into the power supply bay. Make sure that the power supply is fully seated in the bay ([Figure 1-46](#)).

**Figure 1-46** Handling a DC-Input Power Supply

**Step 3**

Tighten the power supply captive installation screw (see [Figure 1-47](#)).

Figure 1-47 6000 W DC-Input Power Supply Front Panel



1	Terminal block cover	6	Captive installation screw
2	DC power cable terminal block	7	Input Power Module (IPM)
3	Ground	8	IPM captive screws
4	Status LEDs	9	IPM latches
5	Power switch		

**Warning**

**Power supply captive installation screws must be tight to ensure protective grounding continuity.**  
Statement 289

**Note**

With the PWR-6000-DC power supply, you have the option of installing an Input Power Module (IPM) (previously removed) with the DC-input wires and the ground wires still connected. You can then install your power supply and insert the fully-wired IPM. If you are going to install an IPM with DC-input wires and ground wires still connected, skip steps 4 through 12 and go directly to step 13.

- Step 4** Remove the two A4 screws securing the outer terminal block cover, and remove the cover from the power supply (Figure 1-47).
- Step 5** Attach the appropriate lugs to the DC-input wires and ground wire. The wires should be sized according to local and national installation requirements. Use only copper wire.



**Note** 6000 W power supplies ship with AWG #4 lugs with 45-degree angled, 2-hole compression lug for both power and ground wiring. Additional lugs for different wire size should be purchased separately.



**Note** The power supply terminal block lug opening width is 0.62 inch (15.8 mm). The terminal posts are centered 0.625 inches (15.88 mm) apart and are 1/4-20 threaded. We recommend that you use an appropriately sized industry standard 45 degree angled, 2-hole, standard barrel compression lug for both power and ground lugs (for example, on AWG #4 wires, Panduit part number LCC4-14AWH-L or equivalent). The power supply ground studs, located beside the terminal block.



**Note** For 6000 W power supplies, use fine-stranded copper conductors rated for 90-degrees Celsius for North American installations.



**Note** The 6000 W DC-input power supply provides voltages of 2800 W, 4500 W, or 6000 W. Select 2800 W by wiring any two positive (+)/negative (-) terminal pairs in any sequence. Select 4500 W by wiring any three positive (+)/negative (-) terminal pairs in any sequence. Select 6000 W by wiring all four terminals. The Cisco IOS software detects the wired inputs and sets the proper system power.



**Note** If you are wiring for 2800 W for a single power supply, proceed to Step 7; if you are wiring 2800 W for a redundant power supply, proceed to Step 7 and then Step 10. In either case, proceed to step 14 upon completion.



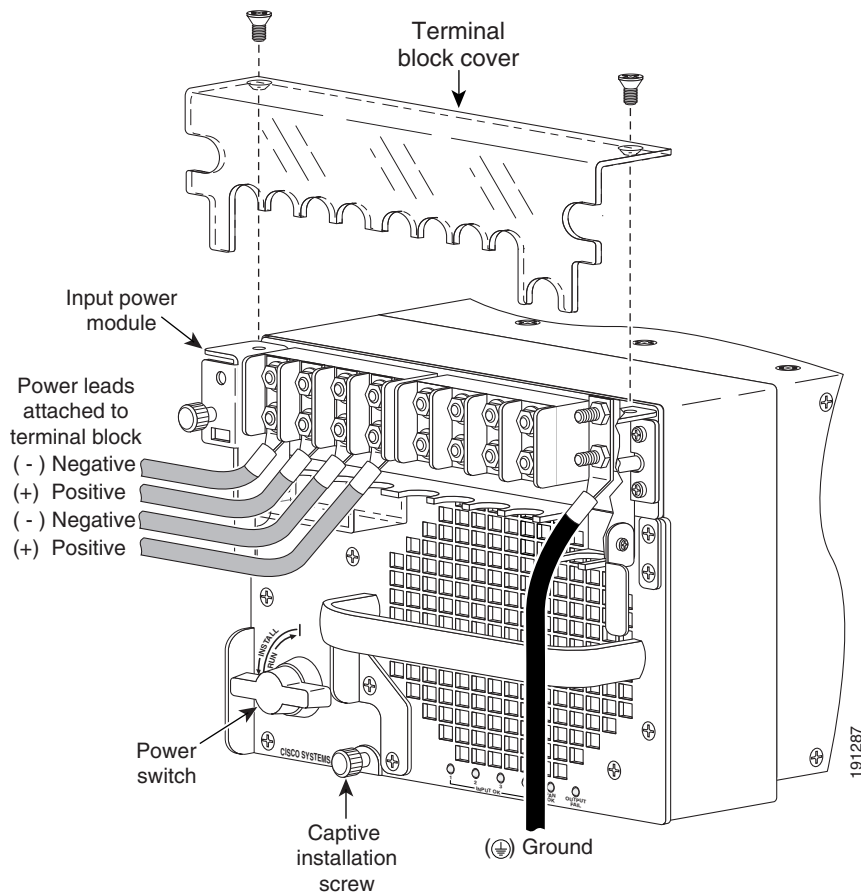
**Note** If you are wiring for 4500 W for a single power supply, proceed to Step 8; if you are wiring 4500 W for a redundant power supply, proceed to Step 8 and then Step 11. In either case, proceed to step 14 upon completion.



**Note** If you are wiring for 6000 W for a single power supply, proceed to Step 9; if you are wiring 6000 W for a redundant power supply, proceed to Step 9 and then Step 12. In either case, proceed to step 14 upon completion.

- Step 6** Wire for 2800 W (left side of power supply bay) as follows:
- From the left side of the power supply, connect the ground wire to the ground (Figure 1-48).

**Figure 1-48** DC-Input Wire Connections for 2700-W DC-Input Power Supply for Left Side of Power Bay



- From the left side of the power supply, connect each of the DC-input wires to the terminal block (Figure 1-48 and Figure 1-49) in this order:

Negative (-)

Positive (+)



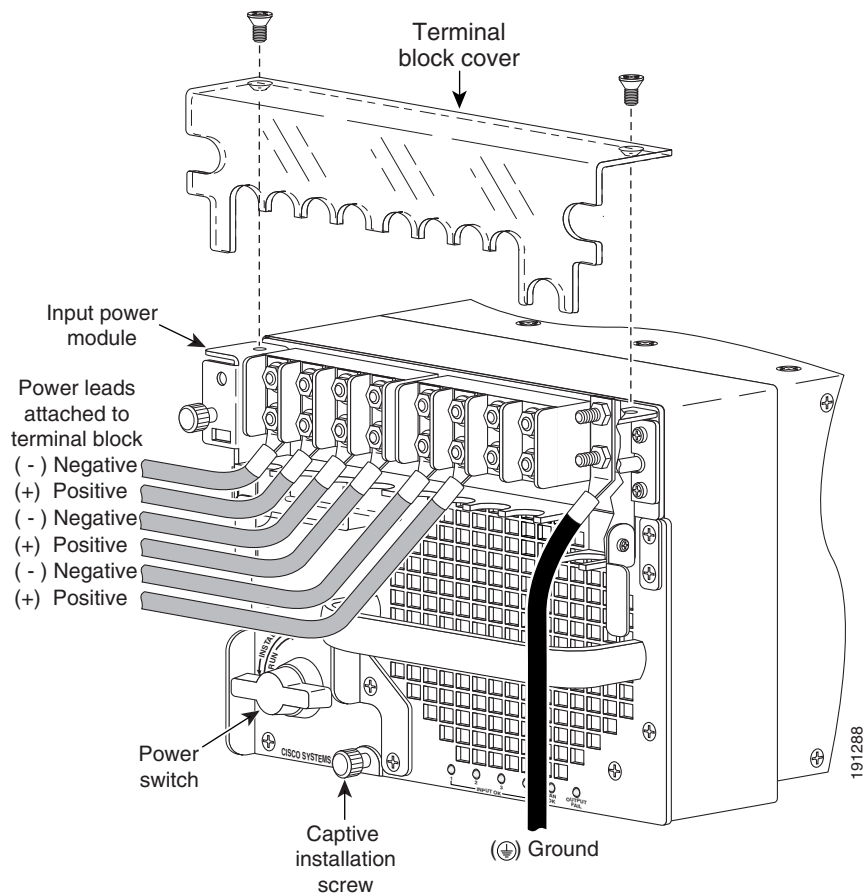
**Note** When you tighten the terminal nuts, make sure they are snug. Do not over tighten them. Recommended torque strength is 20 inch-pounds. Over tightening the terminal nuts can break the terminal block (Maximum torque: 36 inch-pounds).

- Secure outer block cover.

**Step 7** Wire for 4500 W (left side of power supply bay) as follows:

- From the left side of the power supply, connect the ground wire to the ground (see Figure 1-49).

**Figure 1-49** DC-Input Wire Connections for 4000-W DC-Input Power Supply for Left Side of Power Bay



- b. From the left side of the power supply, connect each of the DC-input wires to the terminal block in this order (see [Figure 1-47](#) and [Figure 1-49](#)):

Negative (-)

Positive (+)



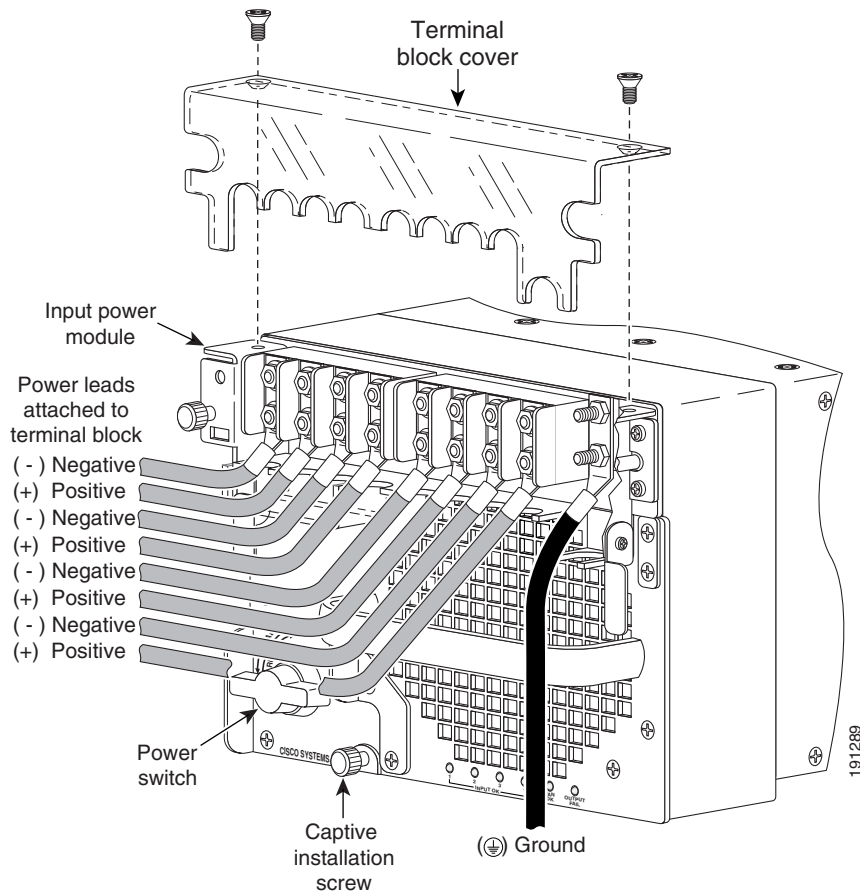
**Note** When you tighten the terminal nuts, make sure they are snug. Do not over tighten them. Recommended torque strength is 20 inch-pounds. Over tightening the terminal nuts can break the terminal block (Maximum torque: 36 inch-pounds).

- c. Secure outer block cover.

**Step 8** Wire for 6000 W (left side of power supply bay) as follows:

- a. From the left side of the power supply, connect the ground wire to the ground (see [Figure 1-50](#)).

**Figure 1-50** DC-Input Wire Connections for 6000-W DC-Input Power Supply for Left Side of Power Bay



- b. From the left side of the power supply, connect each of the DC-input wires to the terminal block in this order (see [Figure 1-47](#) and [Figure 1-50](#)):

Negative (-)

Positive (+)



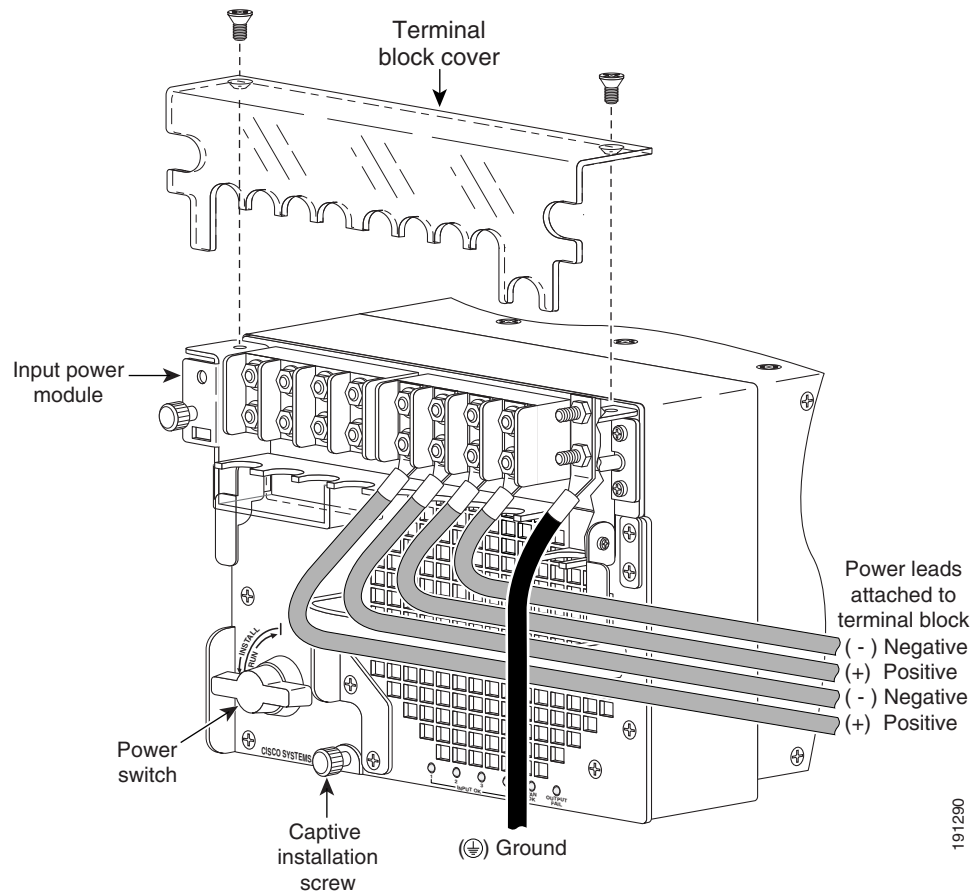
**Note**

When you tighten the terminal nuts, make sure they are snug. Do not over tighten them. Recommended torque strength is 20 inch-pounds. Over tightening the terminal nuts can break the terminal block (Maximum torque: 36 inch-pounds).

**Step 9** Wire for 2800 W (right side of power supply bay) as follows:

- a. From the right side of the power supply, connect the ground wire to the ground (see [Figure 1-51](#)).

**Figure 1-51 DC-Input Wire Connections for 2700-W DC-Input Power Supply, Right Side of Power Bay**



- b. From the right side of the power supply, connect the DC-input wires to the terminal block (see [Figure 1-47](#) and [Figure 1-51](#)) in this order:

Negative (-)

Positive (+)



**Note**

When you tighten the terminal nuts, make sure they are snug. Do not over tighten them. Recommended torque strength is 20 inch-pounds. Over tightening the terminal nuts can break the terminal block (Maximum torque: 36 inch-pounds).

- c. Secure outer block cover.



**Note**

For proper 2800W DC-input redundant power configuration, both pairs of input wires for one 6000W DC-input power supply must come from the same battery system (A feed); both pairs of input wires for the other 6000W DC-input power supply must come from another battery system (B feed).

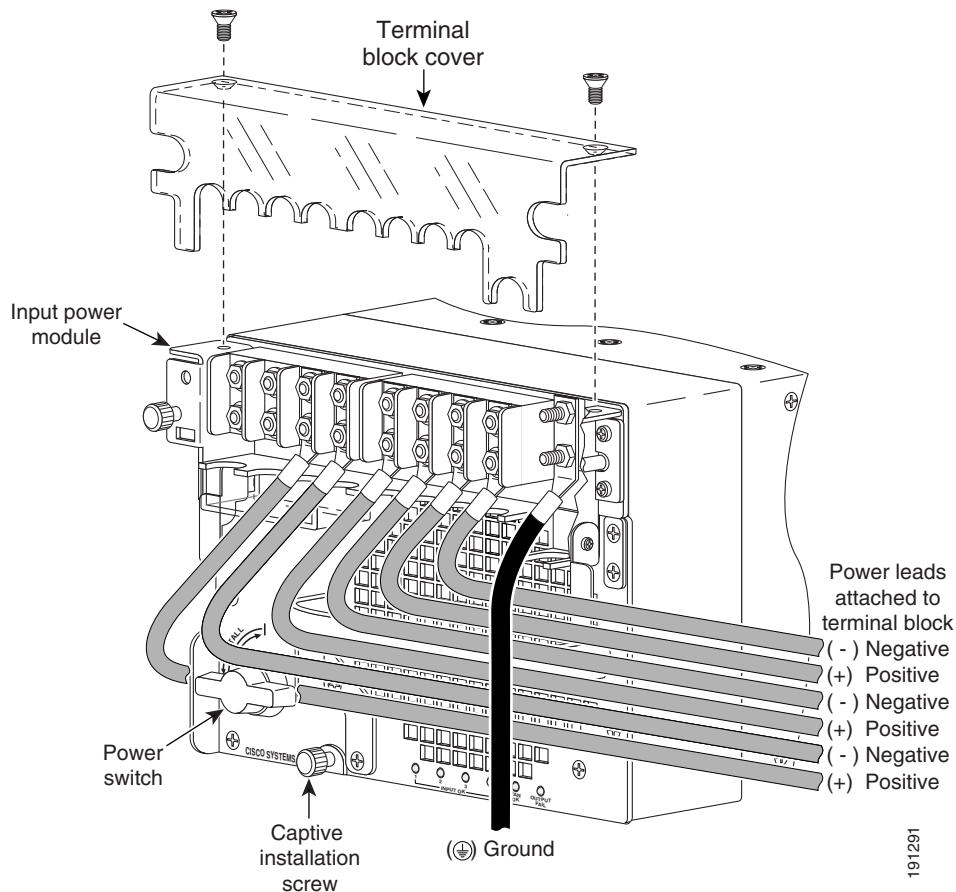


**Note** For multiple DC input power supply, each DC input must be protected by dedicated circuit breaker or fuse. The circuit breaker or fuse should be sized according to the power supply input rating and local or national electrical code requirements.

**Step 10** Wire for 4500 W (right side of power supply bay) as follows:

- a. From the right side of the power supply, connect the ground wire to the ground (see [Figure 1-52](#)).

**Figure 1-52** DC-Input Wire Connections for 4000-W DC-Input Power Supply, Right Side of Power Bay



- b. From the right side of the power supply, connect each of the DC-input wires to the right power supply terminal block (see [Figure 1-47](#) and [Figure 1-52](#)) in this order:

Negative (-)

Positive (+)



**Note** When you tighten the terminal nuts, make sure they are snug. Do not over tighten them. Recommended torque strength is 20 inch-pounds. Over tightening the terminal nuts can break the terminal block (Maximum torque: 36 inch-pounds).

- c. Secure outer block cover.





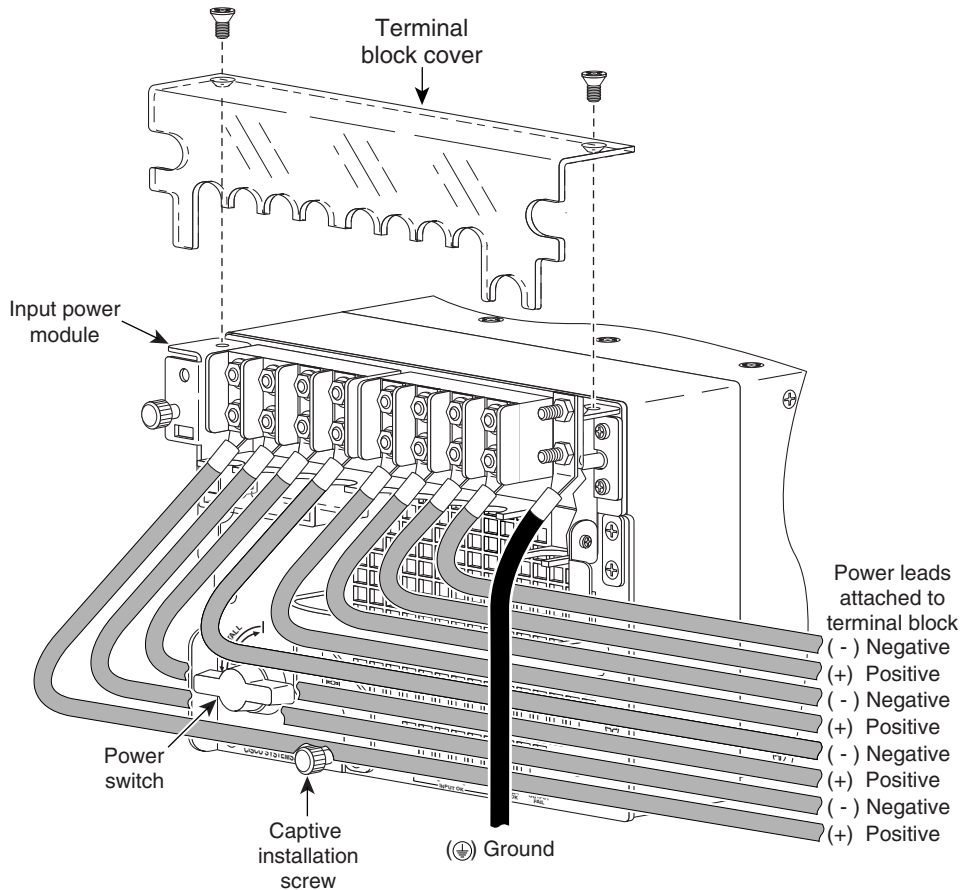
**Note** For proper 4500W DC-input redundant power configuration, three pairs of input wires for one 6000W DC-input power supply must come from the same battery system (A feed); three pairs of input wires for the other 6000W DC-input power supply must come from another battery system (B feed).



**Note** For multiple DC input power supply, each DC input must be protected by dedicated circuit breaker or fuse. The circuit breaker or fuse should be sized according to the power supply input rating and local or national electrical code requirements.

- Step 11** Wire for 6000 W (right side of power supply bay) as follows:
- a. From the right side of the power supply, connect the ground wire to the ground (see [Figure 1-53](#)).

**Figure 1-53 DC-Input Wire Connections for 6000-W DC-Input Power Supply for Right Side of Power Bay**



191293

- b. From the right side of the power supply, connect each of the DC-input wires to the terminal block (Figure 1-47 and Figure 1-53) in this order:

Negative (-)

Positive (+)



**Note**

When you tighten the terminal nuts, make sure they are snug. Do not over tighten them. Recommended torque strength is 20 inch-pounds. Over tightening the terminal nuts can break the terminal block (Maximum torque: 36 inch-pounds).



**Note**

For proper 6000W DC-input redundant power configuration, all four pairs of input wires for one 6000W DC-input power supply must come from the same battery system (A feed); all four pairs of input wires for the other 4000W DC-input power supply must come from another battery system (B feed).



**Note**

For multiple DC input power supply, each DC input must be protected by dedicated circuit breaker or fuse. The circuit breaker or fuse should be sized according to the power supply input rating and local or national electrical code requirements.



**Warning**

**When installing the unit, always make the ground connection first and disconnect it last.** Statement 42

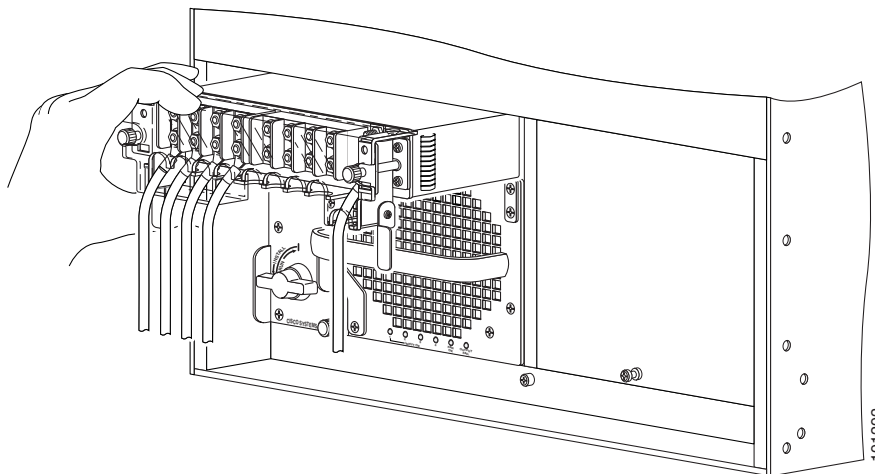


**Caution**

To prevent a short circuit or shock hazard after wiring the DC-input power supply, reinstall the terminal block covers.

- Step 12** If you are installing a previously-wired IPM, insert the IPM firmly into the power supply and tighten the IPM captive screws. (See Figure 1-54.)

**Figure 1-54 Inserting Previously-Wired IPM (2700W DC-input shown)**



- Step 13** After confirming all installation steps are correctly completed, safety flags and lockout devices can be removed, and the input circuits to the supplies can be energized.
- Step 14** Use the power switch to turn the power supply on.
- Step 15** Verify power supply operation by checking that the power supply front panel LEDs are in the following states:
- INPUT OK LED is green
  - FAN OK LED is green
  - OUTPUT FAIL LED is not lit

## Removing and Installing PEMs

This section describes how to remove and install the Power Entry Modules (PEMs) for the Catalyst 6503 and Catalyst 6503-E switches. There are three PEM models:

- 950 W AC-input PEM—PEM-15A-AC
- 1400 W AC-input PEM—PEM-20A-AC+
- 950 W DC-input PEM—PEM-DC/3



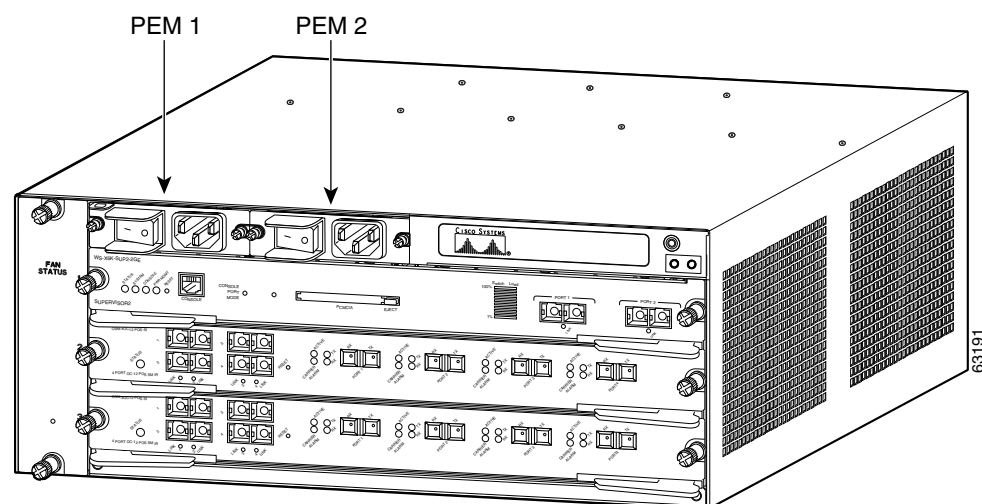
**Note**

The PEM is used on the Catalyst 6503 and Catalyst 6503-E switches only.

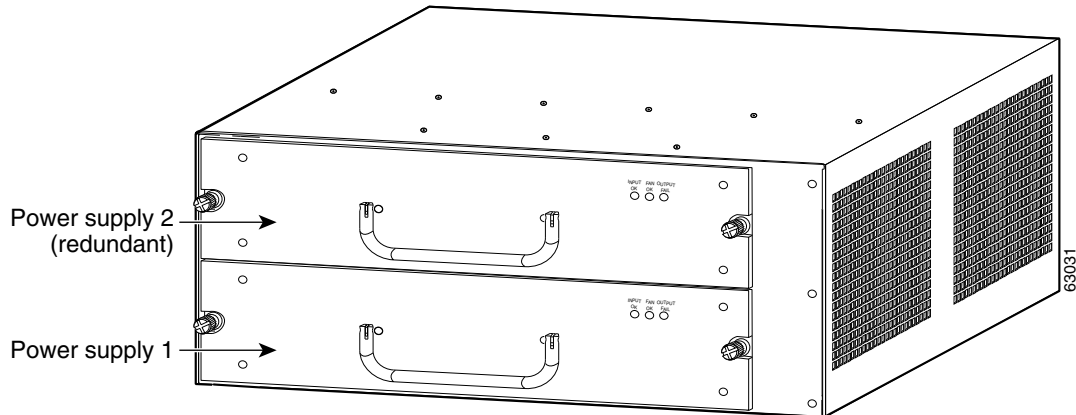
The PEM provides an input power connection on the front of the chassis to connect the site power source to the power supply. In addition to providing an input power connection, the PEM also has an illuminated power switch (AC-input only), current protection, surge and EMI suppression, and filtering functions.

See [Figure 1-55](#) for the location of the PEM; see [Figure 1-56](#) for the location of the power supplies. The PEM on the left (PEM 1) connects the site power source to power supply 1; the PEM on the right (PEM 2) connects the site power source to power supply 2.

**Figure 1-55 Catalyst 6503—PEM Location**



**Figure 1-56 Catalyst 6503 Switch—Power Supply Location**



## Required Tools

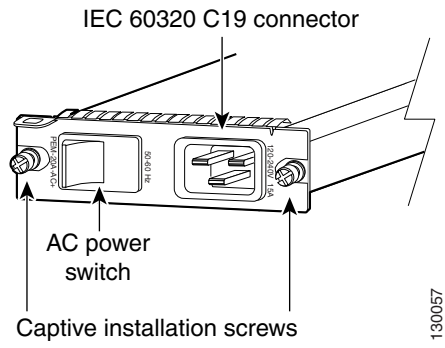
Use a flat-blade or number 2 Phillips-head screwdriver to perform these procedures. Additionally, wire cutters may be necessary to cut cable tie wraps.

## Removing the AC-Input PEM

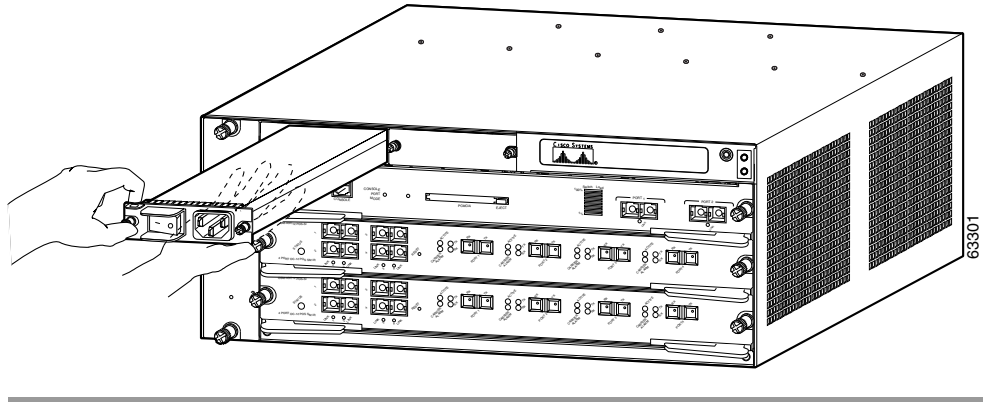
To remove an AC-input PEM, follow these steps:

- Step 1** Turn the power switch to the off (0) position on the PEM that you are removing. (See [Figure 1-55](#).)
- Step 2** Disconnect the power cord from the power source. Do not touch the metal prongs on the power cord when it is still connected to the PEM.
- Step 3** Remove the power cord from the power connection on the PEM. Do not touch the metal prongs embedded in the PEM.
- Step 4** Loosen the two captive installation screws. (See [Figure 1-57](#).)
- Step 5** Grasp the PEM with one hand, and slide it part of the way out of the chassis. Place your other hand underneath the PEM, as shown in [Figure 1-58](#), and slide it completely out of the chassis.
- Step 6** If the PEM bay is to remain empty, install a blank PEM filler plate (Cisco part number 800-16719-01) over the opening, and secure it with the captive installation screws.

**Figure 1-57 AC-Input PEM (PEM-20A-AC+ Shown)**



**Figure 1-58 Handling a PEM**



## Installing the AC-Input PEM

To install an AC-input PEM, follow these steps:

- 
- Step 1** Ensure that the system (earth) ground connection has been made.  
For ground connection instructions, see the “[Establishing the System Ground](#)” section on page 1-52.
- Step 2** If necessary, remove the blank PEM filler plate (Cisco part number 800-16719-01) from the chassis PEM bay opening by loosening the captive installation screws. Retain the blank PEM filler plate for future use.
- Step 3** Grasp the PEM with one hand. Place your other hand underneath the PEM, as shown in [Figure 1-58](#). Slide the PEM into the PEM bay. Make sure that the PEM is fully seated in the bay.
- Step 4** Tighten the PEM captive installation screws. (See [Figure 1-57](#).)
- Step 5** Plug the power cord into the PEM.




---

**Note** See Appendix A for a list of supported AC power cords.

---

- Step 6** Connect the other end of the power cord to an AC-input power source.



**Caution**

---

In a system with dual power supplies, connect each power supply to a separate input source. In case of a power source failure, the second source will most likely still be available.

---

- Step 7** Turn the power switch to the on (I) position on the PEM.
- 

## Removing the DC-Input PEM



**Warning**

---

**Before performing any of the following procedures, ensure that power is removed from the DC circuit.** Statement 1003

---



**Warning**

---

**Hazardous voltage or energy is present on the backplane when the system is operating. Use caution when servicing.** Statement 1034

---



**Warning**

---

**When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046

---

To remove a DC-input PEM, follow these steps:

- 
- Step 1** Verify that power is off to the DC circuit for the PEM that you are removing. As an added precaution, place the appropriate safety flag and lockout devices at the source power circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.
- Step 2** Loosen the two captive installation screws on the PEM. (See [Figure 1-59](#).)
- Step 3** Slide the PEM part way out of the chassis so that you have access to the PEM terminal block screws. (See [Figure 1-60](#).)
- Step 4** Disconnect the DC-input wires from the PEM terminal block in this order:
1. Positive (+)
  2. Negative (-)




---

**Note** It is not necessary to disconnect the system ground connection.

---

- Step 5** Grasp the PEM with one hand, and place your other hand underneath the PEM, as shown in [Figure 1-61](#), and slide the PEM completely out of the chassis. Set the PEM aside.
- Step 6** If the PEM bay is to remain empty, install a blank PEM filler plate (Cisco part number 800-16719-01) over the opening, and secure it in place with the two captive installation screws.

**Figure 1-59 DC-Input PEM**

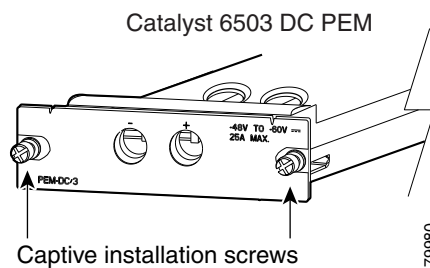


Figure 1-60 DC-Input PEM Terminal Block Screws

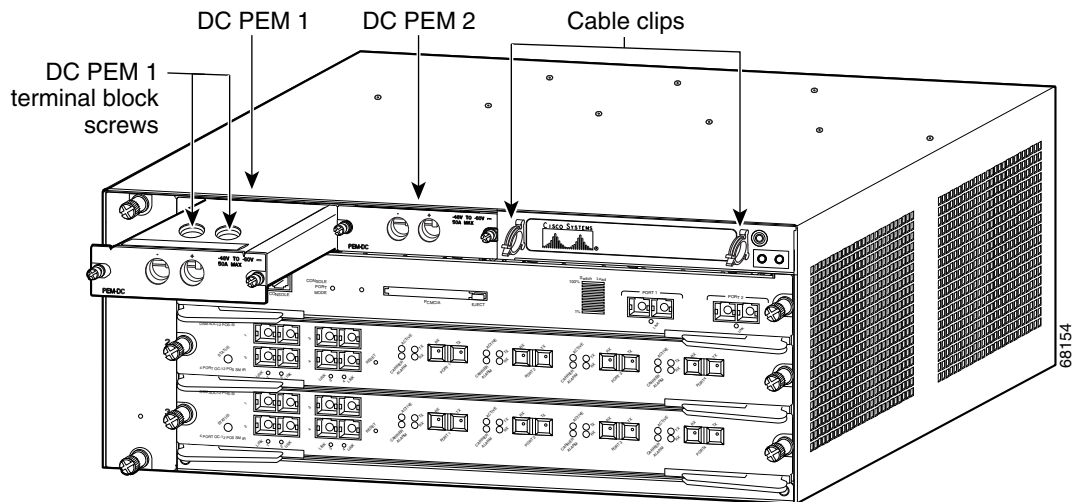
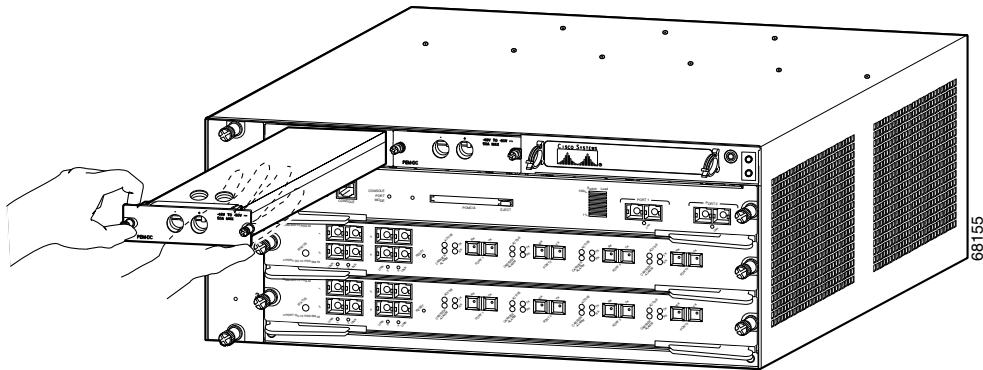


Figure 1-61 Handling a DC-Input PEM



## Installing the DC-Input PEM



**Warning**

**Before performing any of the following procedures, ensure that power is removed from the DC circuit.** Statement 1003



**Warning**

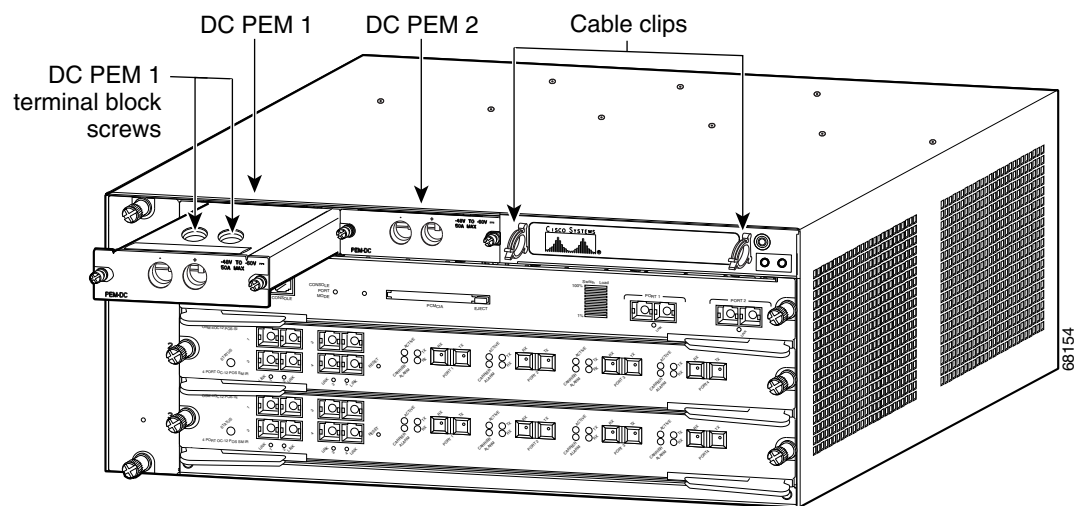
**When installing or replacing the unit, the ground connection must always be made first and disconnected last.** Statement 1046



To install a DC-input PEM, follow these steps:

- Step 1** Ensure that the system (earth) ground connection has been made. For ground connection installation instructions, see the “[Establishing the System Ground](#)” section on page 1-52.
- Step 2** Verify that power is off to the DC circuit for the PEM that you are installing. As an added precaution, place the appropriate safety flag and lockout devices at the source power circuit breaker, or place a piece of adhesive tape over the circuit breaker handle to prevent accidental power restoration while you are working on the circuit.
- Step 3** Install the PEM partially into the chassis so that you still have access to the PEM terminal block screws. (See [Figure 1-62](#).)

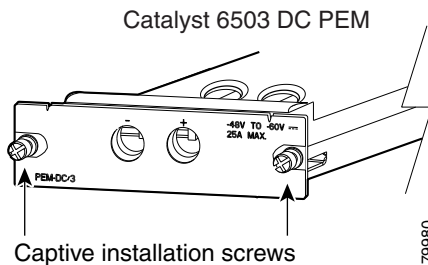
**Figure 1-62 DC-Input PEM Terminal Block Screws**



- Step 4** Connect the DC-input wires to the terminal block in this order:
1. Negative (-)
  2. Positive (+)
- Step 5** After ensuring that all wire connections are secure, install the PEM in the bay.

**Step 6** Tighten the power supply captive installation screws. (See [Figure 1-63](#).)

**Figure 1-63 DC-Input PEM**



**Caution**

In a system with dual power supplies, connect each power supply to a separate input line. In case of a line failure, the second source will most likely still be available.

**Step 7** Remove the safety flag, lockout devices, or tape from the circuit breaker switch handle, and restore power by moving the circuit breaker switch handle to the on (I) position.

**Step 8** Verify the power supply operation by ensuring that the power supply front panel LEDs are in the following states:

- INPUT OK LED is green
- FAN OK LED is green
- OUTPUT FAIL LED is not lit

If the LEDs indicate a power problem, see the [“Identifying Startup Problems”](#) section on page A-3.

## Removing and Installing the Fan Tray

This section describes how to remove and install fan trays for the Catalyst 6500 series switches.



**Note**

If your Catalyst 6506, Catalyst 6509, or Catalyst 6509-NEB chassis is equipped with a Supervisor Engine 2 and you are using the fan tray removal and replacement procedure to upgrade the chassis from a fan tray 1 (low-speed) to a fan tray 2 (high-speed), you must first check the chassis configuration using the **hw-module fan-tray version 2** command to check for configuration problems, such as power supply compatibility and power sufficiency. If the system does not detect any configuration issues, a message is displayed saying that it is OK to change the fan trays. This command applies to Catalyst 6500 series switches that are configured with a Supervisor Engine 2 only. This command is not required in systems that are configured with either a Supervisor Engine 720 or a Supervisor Engine 32.

## Required Tools

You might need a flat-blade or number 2 Phillips-head screwdriver to loosen or tighten the captive installation screws on the fan tray.

## Removing the Fan Tray

The fan Tray is designed to be removed and replaced while the system is operating without presenting an electrical hazard or damage to the system.



### Warning

**When removing the fan tray, keep your hands and fingers away from the spinning fan blades. Let the fan blades completely stop before you remove the fan tray.** Statement 258

To remove the existing fan assembly, follow these steps:

**Step 1** If you are upgrading your chassis from a fan tray 1 (low speed) to a fan tray 2 (high speed) and your chassis is equipped with a Supervisor Engine 2, you need to check that the current chassis configuration supports the fan tray upgrade. To do this, use the command **hw-module fan-tray version 2** to check for configuration problems, such as power supply compatibility and power sufficiency.

If the system does not detect any configuration issues, a message is displayed saying that it is OK to change the fan trays. If your chassis has either a Supervisor Engine 32 or a Supervisor Engine 720, skip this step and proceed to Step 2.

**Step 2** Locate the fan assembly in the chassis as follows:

- Catalyst 6503 and Catalyst 6503-E switches—The fan tray is located to the left of the module cage. (See [Figure 1-64](#).)
- Catalyst 6504-E switch—The fan tray is located to the left of the module cage. (See [Figure 1-65](#).)
- Catalyst 6506 and Catalyst 6506-E switches—The fan tray is located to the left of the module cage. (See [Figure 1-66](#).)
- Catalyst 6509 and Catalyst 6509-E switches—The fan tray is located to the left of the module cage. (See [Figure 1-67](#).)
- Catalyst 6509-NEB switch—The fan tray is located above the module cage. (See [Figure 1-68](#).)
- Catalyst 6509-NEB-A and Catalyst 6509-V-E switches —On those switch chassis equipped with the optional cable management system, you must first loosen the two captive installation screws located at the top of the cable management system and fold the cable guide down to access the fan assembly. (See [Figure 1-69](#).) See [Figure 1-70](#) for the location of the two fan trays on the Catalyst 6509-NEB-A switch.



### Note

Make sure there is adequate slack in the network interface cables to allow the cable guide to pivot down far enough to access the fan tray. If there is insufficient slack in the cables, the cable guide will not pivot far enough to give you access to the fan trays.



### Caution

A fully loaded cable management system can be heavy. Make sure that you provide proper support when lowering the cable guide.

- Catalyst 6513 switch—The fan tray is located to the left of the module cage. (See [Figure 1-71](#).)
- Catalyst 6513-E switch—The fan tray is located to the left of the module cage. Access to the fan tray is from the rear of the chassis. (See [Figure 1-72](#).)

**Step 3** Loosen the two fan tray captive installation screws by turning them counterclockwise.

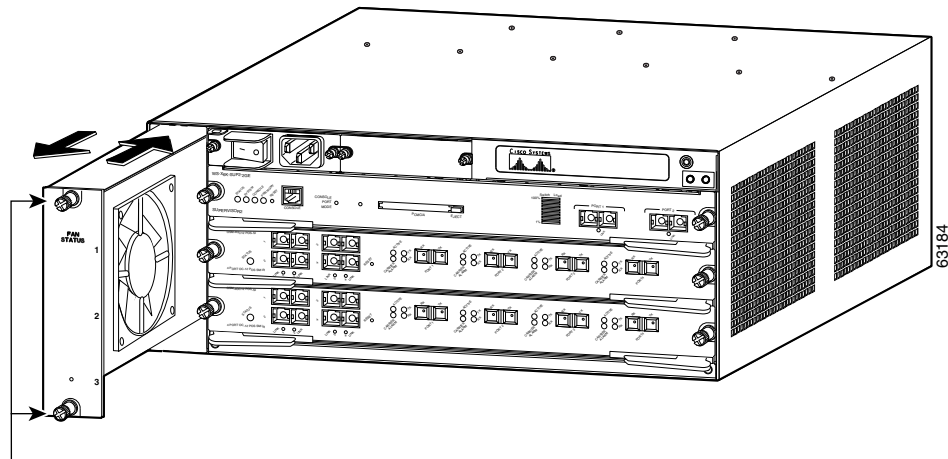
- Step 4** Grasp the fan assembly with both hands, and pull it outward; rock it gently, if necessary, to unseat the fan assembly power connector from the backplane.

**Caution**

When removing the fan tray, keep your hands and fingers away from the spinning fan blades. Let the fan blades stop completely before you remove the fan tray.

- Step 5** Pull the fan assembly clear of the chassis, and set it aside.

**Figure 1-64** Fan Assembly: Catalyst 6503 and Catalyst 6503-E Switches



Captive installation screws

**Figure 1-65** Fan Assembly: Catalyst 6504-E Switch

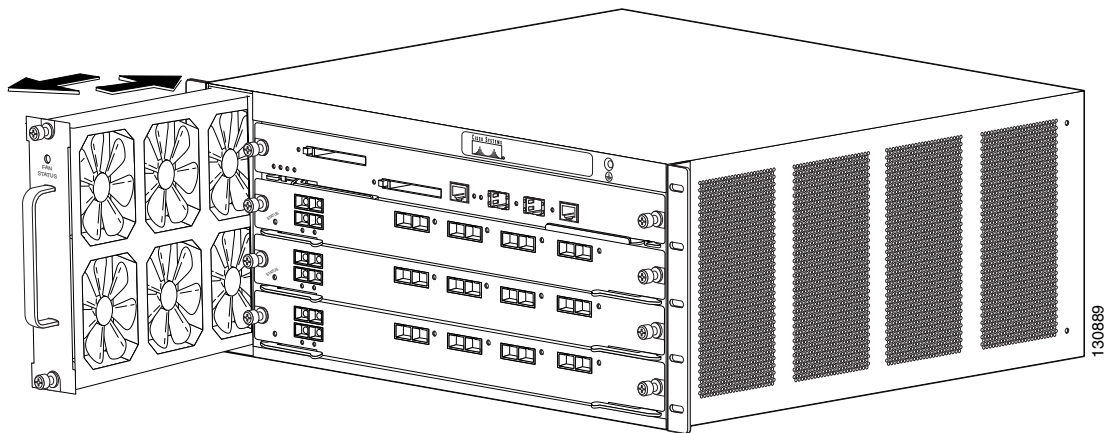


Figure 1-66 Fan Assembly: Catalyst 6506 and Catalyst 6506-E Switches

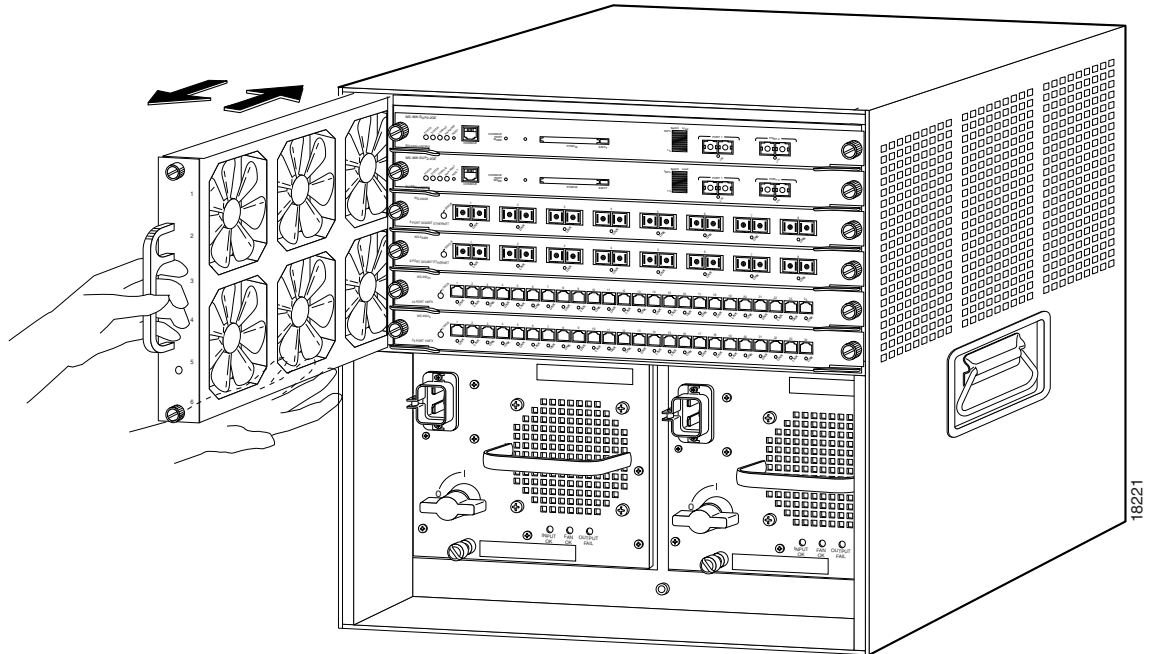


Figure 1-67 Fan Assembly: Catalyst 6509 and Catalyst 6509-E Switches

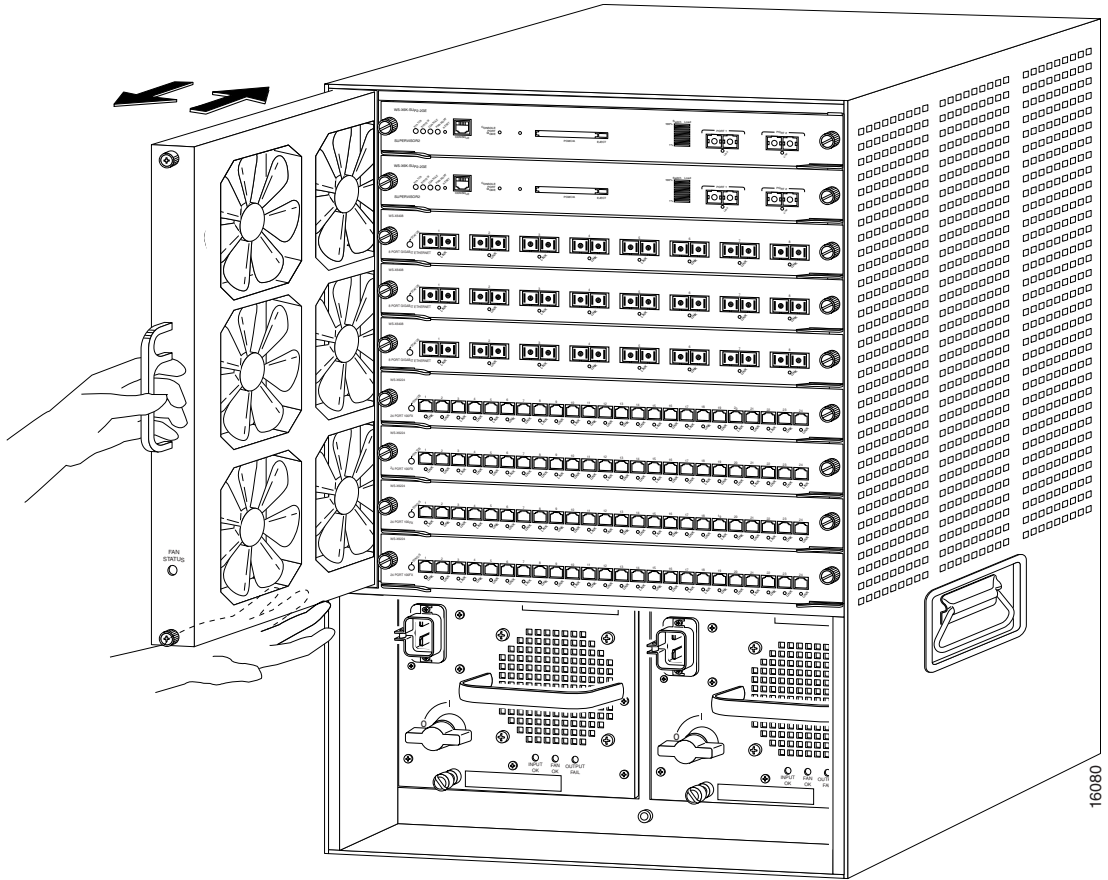
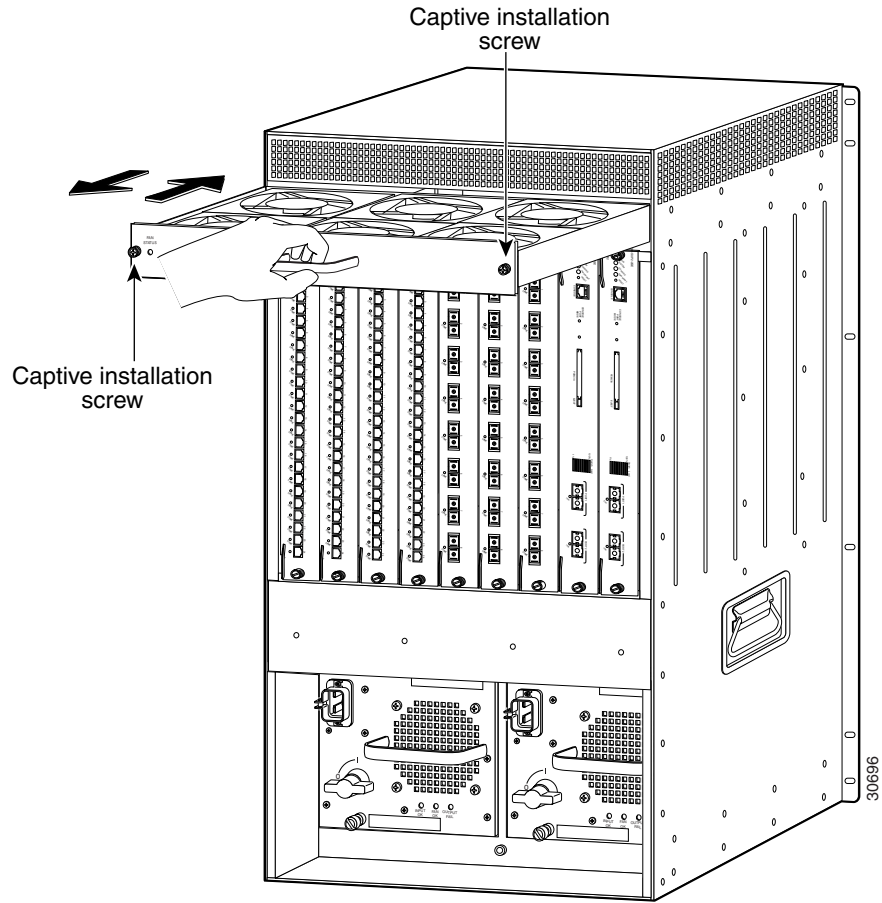


Figure 1-68 Fan Assembly: Catalyst 6509-NEB Switch



**Figure 1-69** *Accessing the Fan Trays on the Catalyst 6509-NEB-A and the Catalyst 6509-V-E Switches*

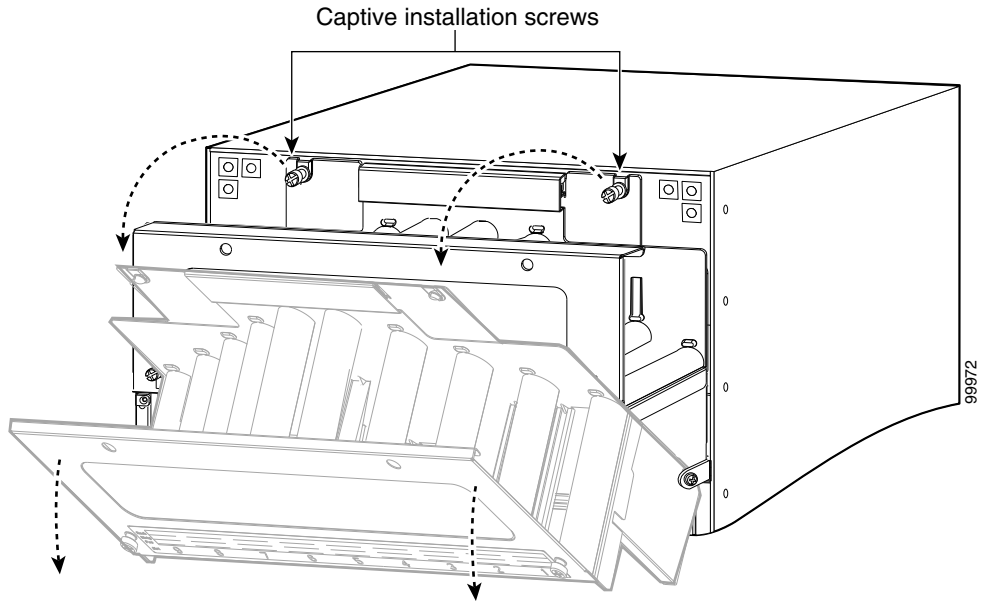
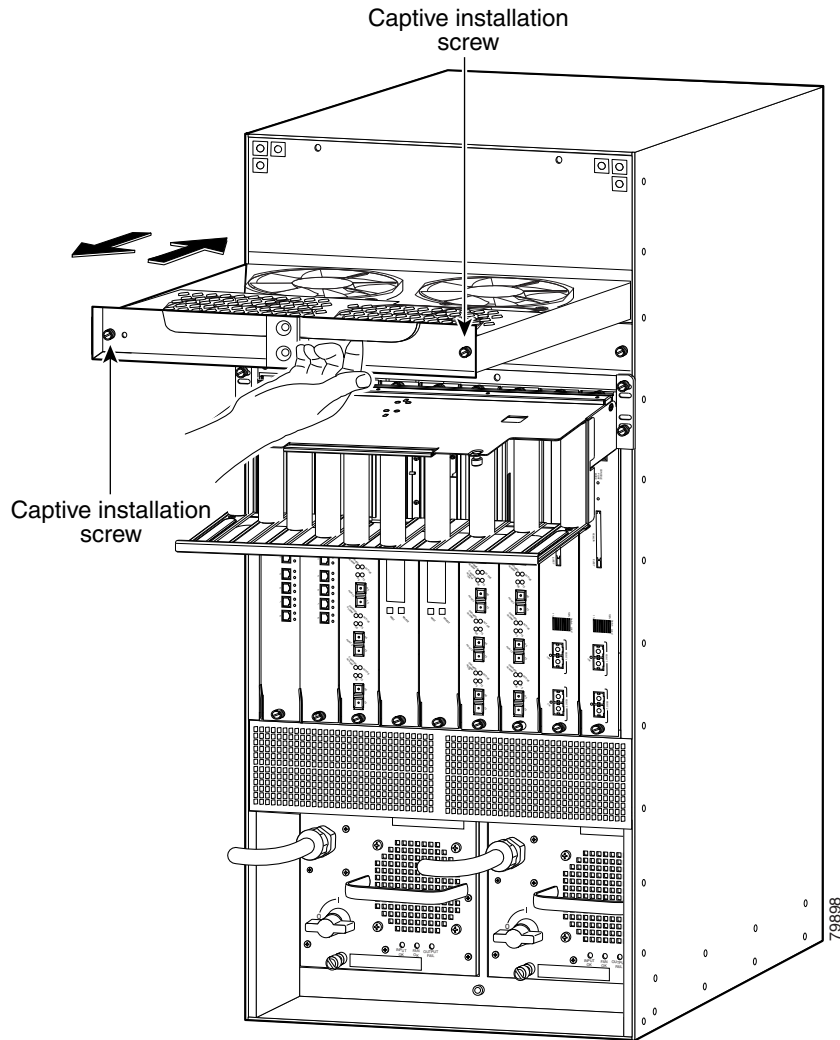




Figure 1-70 Fan Assembly: Catalyst 6509-NEB-A and Catalyst 6509-V-E Switches



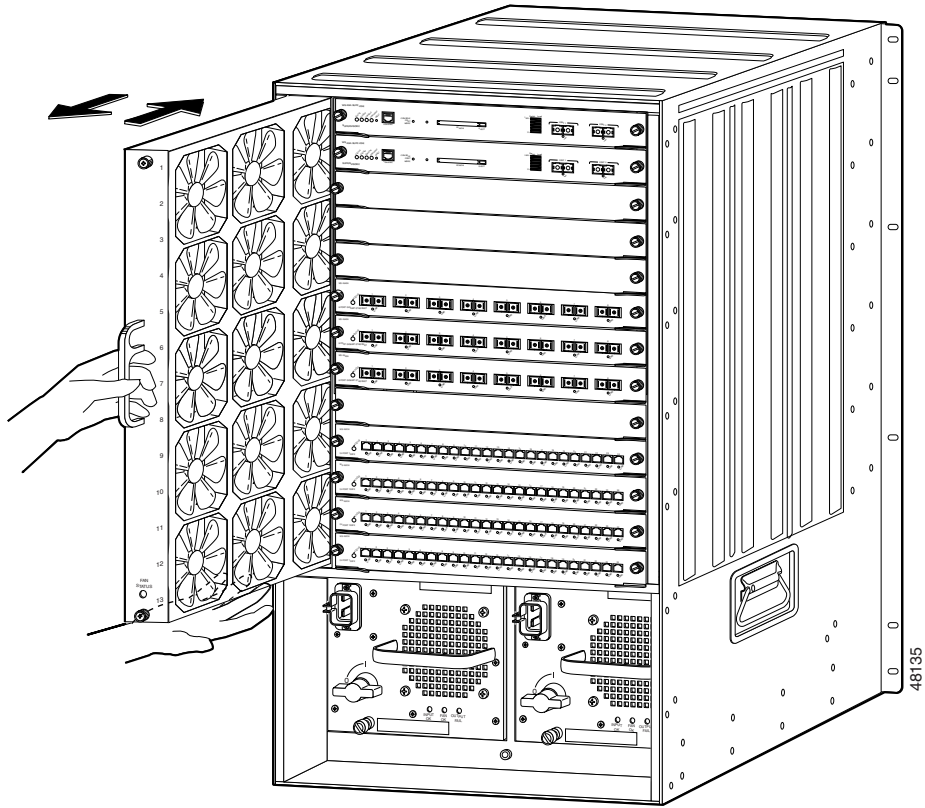
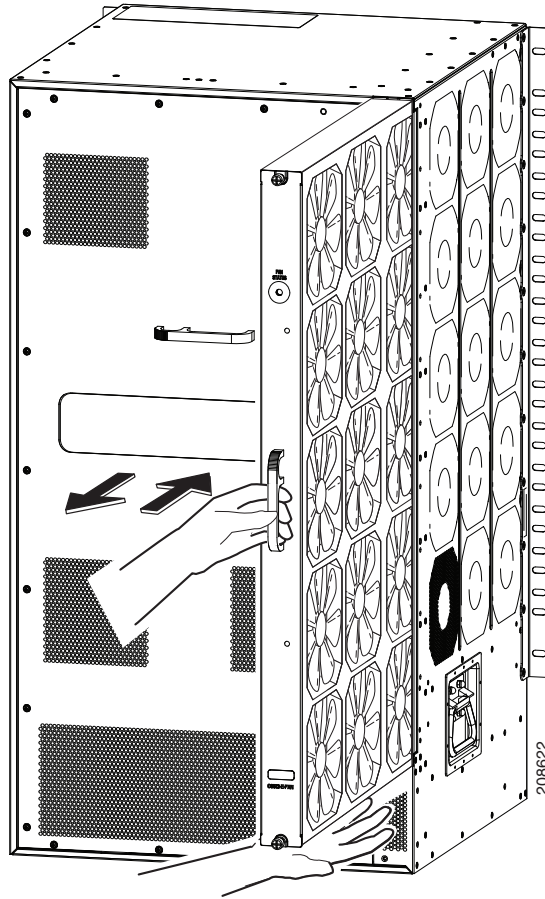
**Figure 1-71 Fan Assembly: Catalyst 6513 Switch**

Figure 1-72 Fan Tray: Catalyst 6513-E Switch



## Installing the Fan Assembly

To install the new fan assembly, follow these steps:

---

**Step 1** Hold the fan assembly with the fans facing to the right and the FAN STATUS LED at the bottom.

- See [Figure 1-64](#) for the Catalyst 6503 and Catalyst 6503-E switches.
- See [Figure 1-65](#) for the Catalyst 6504-E switch.
- See [Figure 1-66](#) for the Catalyst 6506 and Catalyst 6506-E switches.
- See [Figure 1-67](#) for the Catalyst 6509 and Catalyst 6509-E switches.
- See [Figure 1-71](#) for the Catalyst 6513 switch.
- See [Figure 1-72](#) for the Catalyst 6513-E switch

For the Catalyst 6509-NEB switch, hold the fan assembly with the fans facing down and the FAN STATUS LED on the left. (See [Figure 1-68](#).) For the Catalyst 6509-NEB-A and the Catalyst 6509-V-E switches, hold the fan assembly so that the handle is at the top of the assembly. (See [Figure 1-70](#).)

**Step 2** Place the fan assembly into the front chassis cavity so that it rests on the chassis, and then lift the fan assembly up slightly, aligning the top and bottom chassis guides.

**Step 3** Push the fan assembly into the chassis until the power connector seats in the backplane and the captive installation screws make contact with the chassis.

**Step 4** Tighten the captive installation screws.

**Step 5** On the Catalyst 6509-NEB-A and the Catalyst 6509-V-E switches, fold the cable guide up, and tighten the two captive installation screws at the top of the chassis. (See [Figure 1-69](#).)

- A fully populated Catalyst 6509-V-E cable management system can be very heavy. As you pivot the cable guide back up after replacing the fan tray, you should gently rock the cable guide to allow the network interface cables to align themselves. This makes it easier for you to position the cable guide in front of the chassis so that the two captive installation screws can be engaged and tightened. Make sure that the network interface cables are not caught or pinched in the cable guide.
  - After positioning and securing the Catalyst 6509-V-E cable guide, verify that the tab at the back of the cable guide front panel is still engaged in the slot on the back of the cable guide next to the chassis. If the tab has popped loose, you must reinstall the tab in the slot.
- 

## Checking the Installation

To verify that the new fan assembly is installed correctly, follow these steps:

---

**Step 1** Listen for the fans; you should immediately hear them operating. If you do not hear them, ensure that the fan assembly is inserted completely in the chassis and that the faceplate is flush with the switch back panel.

**Step 2** Verify that the FAN STATUS LED is green. If the LED is red, one or more of the fans are faulty.

**Step 3** If after several attempts the fans do not operate or if you experience trouble with the installation (for instance, if the captive installation screws do not align with the chassis holes), contact a Cisco customer service representative for assistance.

---

# Installing the Air Filter Assembly on a Catalyst 6509-NEB-A Switch or a Catalyst 6509-V-E (Optional)

This section describes how to install the optional air filter assembly for the Catalyst 6509-NEB-A switch or the Catalyst 6509-V-E switch. The filter assembly is designed to prevent dust and other contaminants from being drawn into the switch chassis. It is not included with the chassis or bundle configurations because it is not needed in normal installation environments. We recommend that you use this assembly only in exceptionally dusty installation sites.



## Caution

In installation sites that have high levels of airborne dust and contaminants, we recommend that you install the air filter assembly on your Catalyst 6509-NEB-A or Catalyst 6509-V-E switch chassis.

The necessary parts can be ordered as listed in [Table 1-3](#). The filter assembly installation requires that INTAKEPNL-09= be installed on the chassis. This intake panel can be identified by the two filter assembly support loops extending from the bottom front of the panel and the thumbscrews on the front left and right sides of the panel. (See [Figure 1-74](#).)

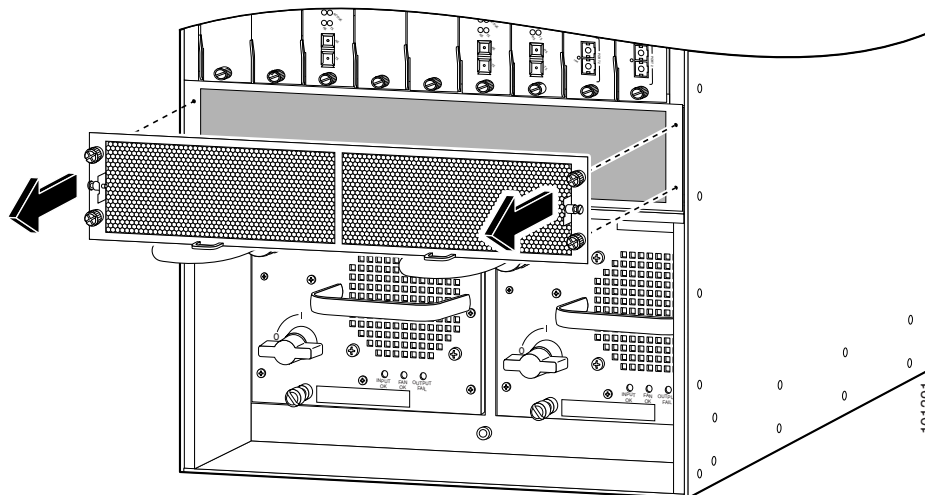
**Table 1-3** Air Filter Part Numbers

Part Number	Description
INTAKEPNL-09=	Replacement intake panel
FLTRASSM-09=	Filter cage assembly, no filter inserts included
FLTRINSERTS-09=	Set of five replacement air filter inserts for FLTRASSM-09=

To install the new filter assembly, follow these steps. If INTAKEPNL-09= is already installed, skip to [Step 3](#).

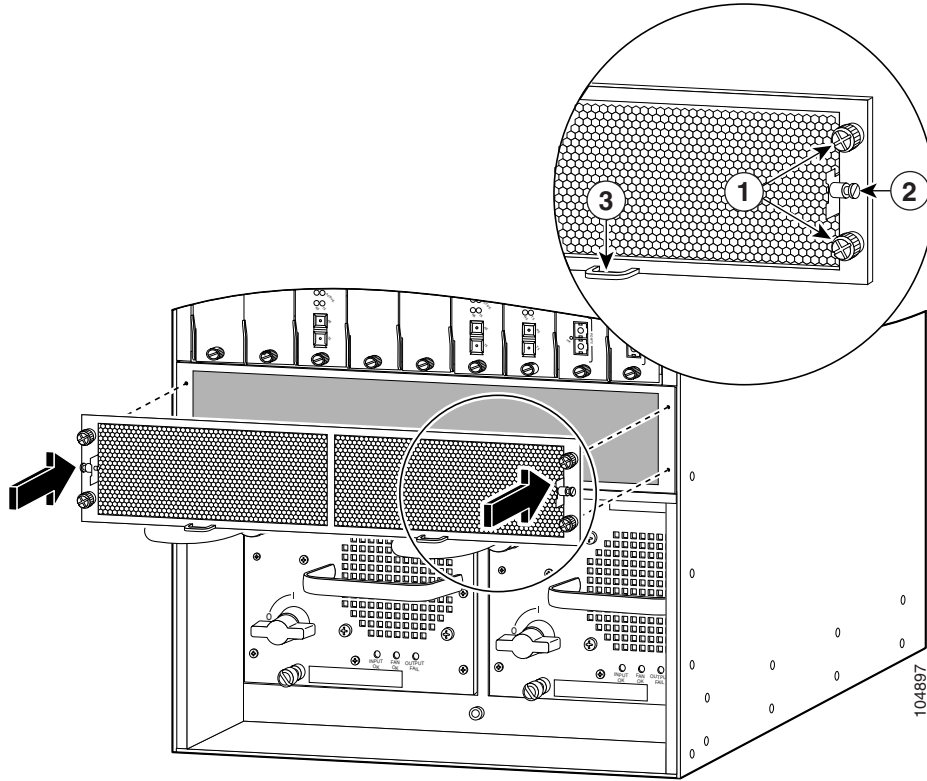
- Step 1** Remove the intake panel by unscrewing four thumbscrews. (See [Figure 1-73](#).)

**Figure 1-73** Removing the Intake Panel



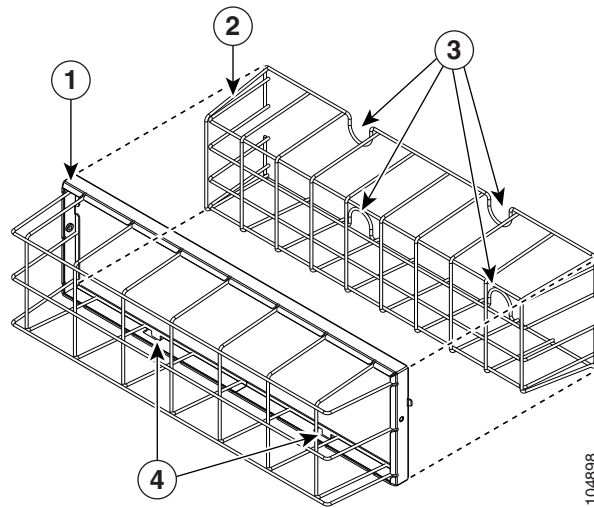
**Step 2** Install the new intake panel by tightening four thumbscrews. (See [Figure 1-74](#).)

**Figure 1-74** *Installing the New Intake Panel*



<b>1</b>	Thumbscrews	<b>3</b>	Support loop
<b>2</b>	Fastening screw		

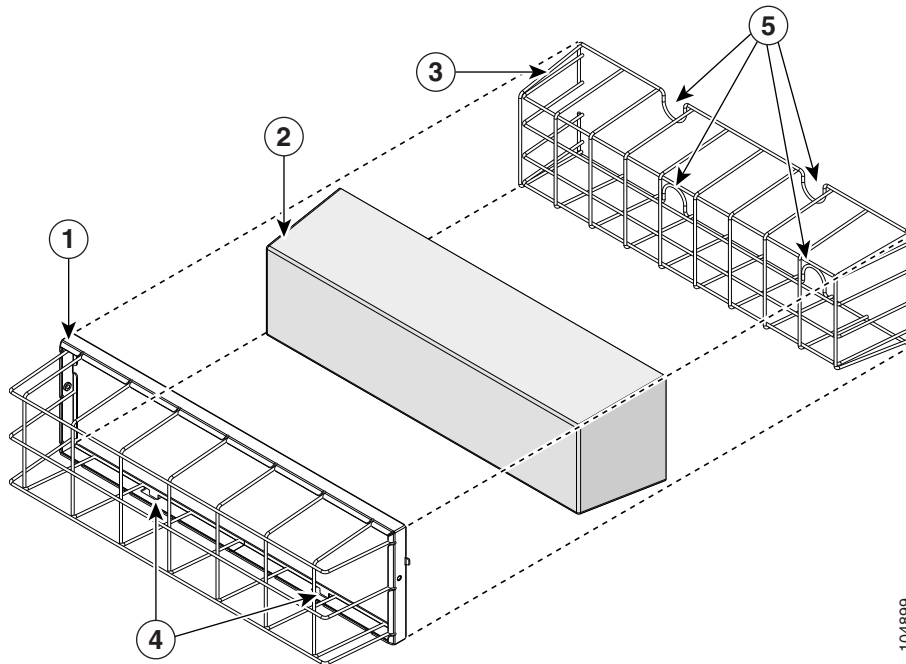
**Step 3** Remove the inner filter retainer from the filter cage assembly by depressing the thumb loops and carefully sliding filter retainer outwards. (See [Figure 1-75](#).)

**Figure 1-75** Removing the Inner Filter Retainer

<b>1</b>	Filter cage assembly	<b>3</b>	Thumb loops
<b>2</b>	Filter retainer	<b>4</b>	Tabs

- Step 4** Place the foam filter over the filter retainer. (See [Figure 1-76](#).)
- Step 5** Slide the retainer and filter into the cage assembly.

**Figure 1-76** Placing the Foam Filter Over the Filter Retainer



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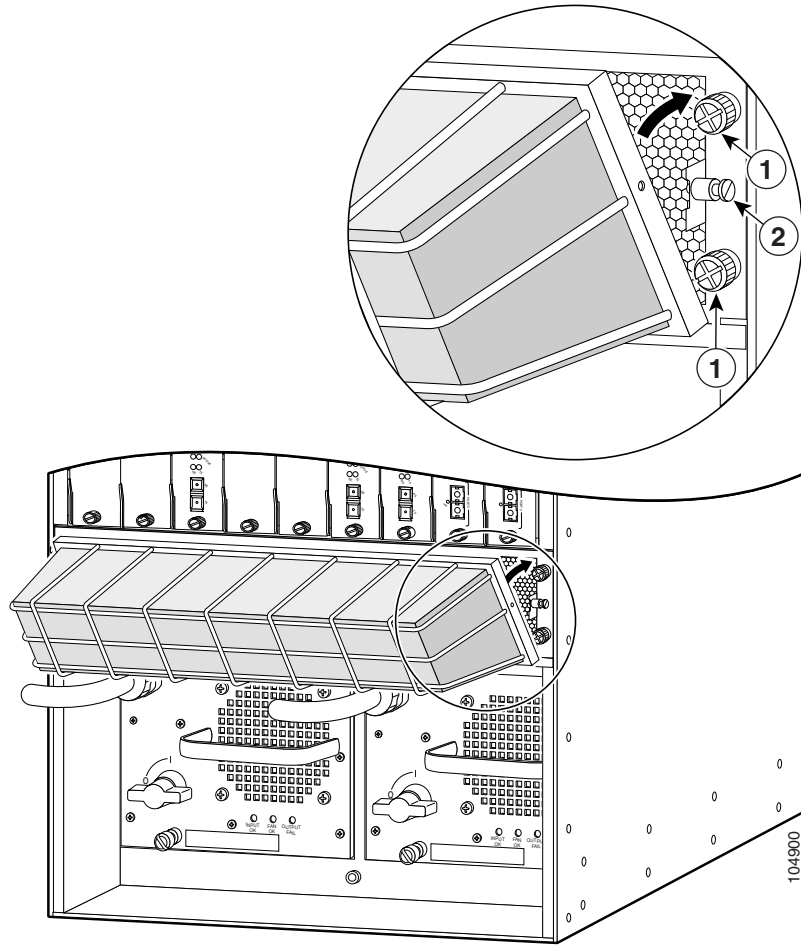
1	Filter cage assembly	4	Tabs
2	Filter	5	Thumb loops
3	Filter retainer		

**Step 6** Install the filter assembly with the tabs facing the floor, as follows:

- a. Fit the tabs (see [Figure 1-76](#)) on the bottom of the filter cage assembly into the lower support loops. (See [Figure 1-74](#).)
- b. Rotate the filter assembly towards the intake panel. (See [Figure 1-77](#).)
- c. Tighten the two fastening screws.



Figure 1-77 Installing the Filter Assembly



1 Thumbscrews	2 Fastening screw
---------------	-------------------

**Step 7** After installing the optional air filter assembly, establish a schedule for visually checking the air filter for contamination. (See “[Checking the Air Filter](#)” section on page 1-98.)

## Checking the Air Filter

Once you have installed the optional air filter assembly on the Catalyst 6509-NEB-A or Catalyst 6509-V-E switch chassis, you need to periodically check the air filter for damage and cleanliness. We recommend that you perform a visual inspection of the filter at least once a month, or more often in dusty environments. Replace the filter if appears clogged with dust, or you have detected an increase in the chassis internal operating temperature. Failure to periodically check the filter can result in restricted airflow through the filter leading to chassis overheating and degraded EMI performance.

**Caution**

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Damage to the air filter can restrict the airflow, cause overheating in the switch, and degrade EMI performance. Be careful handling the air filter when installing or cleaning the filter. We recommend that you inspect the filter once a month for signs of damage or change the air filters every three months, or more often in dusty environments.

---

## Installing the Remote Power Cycling Feature Control Wires (Optional)

The remote power cycling feature allows you to power down and power up a switch chassis through the network rather than being physically present to turn the power supply power switch off and on. The remote power cycling feature is only available on the 8700 W AC-input power supply.

Several vendors make remote power cycling relay controller boxes that can be used to power cycle the Catalyst 6500 series switch chassis. Most of these relay controller boxes have the capability of controlling multiple power supplies. The relay controller boxes have a network interface that allows the user to remotely access the relay controller box and toggle a built-in relay. The built-in relay can be either a normally open (NO) type or a normally closed (NC) type of relay. We strongly recommend that you purchase a relay controller box that uses a NO relay. The relay controller box is installed near the switch chassis and is attached to the network. Two control wires extend from the relay controller box to a three-position terminal block located on the front of the 8700 W power supply. A signal from the relay controller box travels through the control wires to toggle the power supply on or off.

This section only describes how to install the remote power cycling feature control wires; relay controller box installation instructions should be provided by the maker of the relay controller box.

**Note**

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The remote power cycling feature and this installation procedure are applicable only for the 8700 W AC-input power supply.

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## Required Tools and Components

The following tools and components are required to perform this procedure:

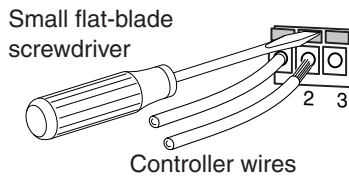
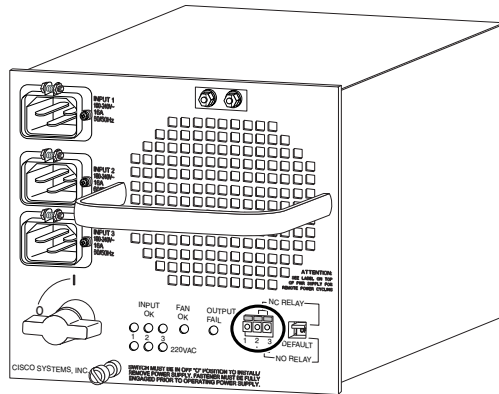
- Relay controller box.  
We strongly recommend that you purchase a relay controller box that uses a NO (normally open) relay to control the remote power cycling.
- Small flat-blade screwdriver
- 18 AWG (maximum) control wire
- Wire cutter
- Wire stripper

## Installing the Remote Power-Cycling Control Wires

To install the two control wires from the relay controller box to the 8700 W power supply, follow these steps:

- 
- Step 1** Remove the relay controller box from its shipping packaging.
  - Step 2** Install the relay controller box following the installation documentation supplied with the product.
  - Step 3** Measure and cut two pieces of 18 AWG control wire long enough to run between the relay controller box terminals and the terminal block on the 8700 W power supply.
  - Step 4** Strip approximately 1/4-inch of insulation from each end of both control wires.
  - Step 5** Connect the two control wires to the relay controller box terminals following the instruction documentation supplied with the relay controller box.
  - Step 6** Identify which pair of terminals on the power supply terminal block (either terminals 1 and 2 for a NO relay (recommended) or terminals 2 and 3 for a NC relay) where you need to connect the control wires. Using a small flat-blade screwdriver, depress the wire release mechanism for one of the terminals on the power supply terminal block and insert the bare wire into the terminal. (See [Figure 1-78](#).) Remove the screwdriver to secure the wire. Gently tug on the wire to verify that it is secure in the terminal block.
  - Step 7** Repeat Step 6 for the second control wire.

Figure 1-78 Installing the Relay Control Wires



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**Step 8** Check the position of the relay controller switch located next to the terminal block.

The switch should be in the down, NO (normally open) position if the relay controller box uses a NO relay. This is the default and the recommended position. If the relay controller box uses a NC relay, the relay controller switch should be in the up position.

You are now ready to install the ferrite bead on the control wires. Follow the installation instructions supplied in the package containing the ferrite bead or the installation procedure in the next section.

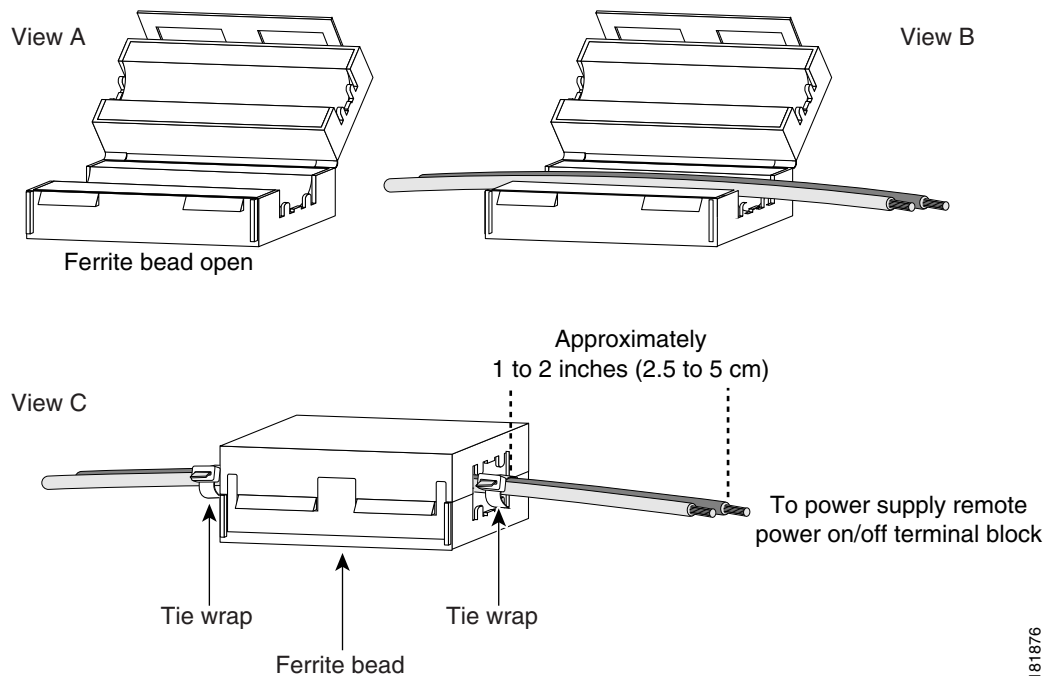
## Installing the Ferrite Bead

The ferrite bead is a passive device that limits high-frequency interference on interface and control cables, and it is only required when you install the remote power-cycling feature that is supported only by the 8700 Watt power supply. The ferrite bead is installed on the two control wires that link the external relay controller box with the remote power-cycling terminal block on the 8700 W power supply. You do not need the ferrite bead for 8700 Watt power supply installations that do not include the remote power-cycling feature.

To install the ferrite bead on the remote power-cycling control wires, follow these steps:

- Step 1** Remove the ferrite bead and the two plastic ties from the plastic bag.
- Step 2** Open the ferrite bead as shown in [Figure 1-79](#), View A.
- Step 3** Place the two remote power-cycling control wires (18 AWG maximum) in the ferrite bead as shown in [Figure 1-79](#), View B. Close the ferrite bead making sure that the two halves have completely snapped together and are secure.
- Step 4** Locate a point on the remote power-cycling control wires that leaves approximately 1 to 2 inches (2.5 to 5 cm) of exposed wire from the remote power cycling terminal block located on the front of the power supply. Wrap one of the 4-inch plastic ties around the remote power-cycling control wires at that point. Tighten the plastic tie so that it is snug against the control wires and cannot slide. See [Figure 1-79](#), View C.
- Step 5** Slide the ferrite bead so that it is positioned just behind the first plastic tie wrap. Take the second plastic tie and wrap it around the control wires directly behind the ferrite bead and tighten it so that the ferrite bead cannot slide up or down the control wires. See [Figure 1-79](#), View C.
- Step 6** To finish the procedure, trim the excess plastic strap from the two plastic tie wraps.

**Figure 1-79** Installing the Ferrite Bead



■ Installing the Remote Power Cycling Feature Control Wires (Optional)



# APPENDIX **A**

## Power Supply Specifications

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Revised: September 21, 2015

This appendix describes the Catalyst 6500 series power supplies and provides their specifications. This appendix contains the following sections:

- [Power Supply Compatibility Matrix, page A-2](#)
- [950 W AC-Input and DC-Input Power Supplies, page A-5](#)
- [1000 W AC-Input Power Supply, page A-10](#)
- [1300 W AC-Input and DC-Input Power Supplies, page A-13](#)
- [1400 W AC-Input Power Supply, page A-18](#)
- [2500 W AC-Input and DC-Input Power Supplies, page A-23](#)
- [2700 W AC-Input and DC-Input Power Supplies, page A-29](#)
- [3000 W AC-Input Power Supply, page A-36](#)
- [4000 W AC-Input and DC-Input Power Supplies, page A-41](#)
- [6000 W AC-Input and DC-Input Power Supplies, page A-46](#)
- [8700 W AC-Input Power Supply, page A-54](#)
- [AC Power Cord Illustrations, page A-63](#)
- [Power Supply Redundancy, page A-73](#)

[Table A-1](#) lists the currently available Catalyst 6500 series switch power supplies and the power supply description location.

**Table A-1** Catalyst 6500 Series Power Supplies

Power Supply Rating	AC-Input Model Product Number	DC-Input Model Product Number
950 W <sup>1</sup>	PWR-950-AC	PWR-950-DC
1000 W	WS-CAC-1000W	Not Available
1300 W	WS-CAC-1300W	WS-CDC-1300W
1400 W <sup>1</sup>	PWR-1400-AC	Not Available
2500 W	WS-CAC-2500W	WS-CDC-2500W
2700 W <sup>2</sup>	PWR-2700-AC/4	PWR-2700-DC/4

**Table A-1** Catalyst 6500 Series Power Supplies (continued)

Power Supply Rating	AC-Input Model Product Number	DC-Input Model Product Number
3000 W	WS-CAC-3000W	Not Available
4000 W	WS-CAC-4000W-US1 WS-CAC-4000W-INT	PWR-4000-DC
6000 W	WS-CAC-6000W	PWR-6000-DC
8700 W	WS-CAC-8700W-E	Not Available

1. For use with the Catalyst 6503 and Catalyst 6503-E switches only.

2. For use with the Catalyst 6504-E switch only.

**Note**

The Catalyst 6500 series switches allow you to mix AC-input and DC-input power supplies in the same chassis.

**Note**

Many telco organizations require a –48 VDC power supply to accommodate their power distribution systems. From an operational perspective, the DC-input power supply has the same characteristics as the AC-input version.

## Power Supply Compatibility Matrix

Table A-2 lists the compatibility of the power supplies with the Catalyst 6500 switch chassis.

**Table A-2** Catalyst 6500 Series Switch Supported Power Supply Configurations

Platform	Supported Power Supplies	Chassis/Power Supply Restrictions
Catalyst 6503	<ul style="list-style-type: none"> <li>950 W AC-input and DC-input</li> <li>1400 W AC-input</li> </ul>	<ul style="list-style-type: none"> <li>The 950 W AC-input power supply requires a PEM-15A-AC Power Entry Module (PEM).</li> <li>The 1400 W AC-input power supply requires a PEM-20A-AC+ Power Entry Module (PEM).</li> </ul>
Catalyst 6503-E	<ul style="list-style-type: none"> <li>950 W AC-input and DC-input</li> <li>1400 W AC-input</li> </ul>	<ul style="list-style-type: none"> <li>The 950 W AC-input power supply requires a PEM-15A-AC Power Entry Module (PEM).</li> <li>The 1400 W AC-input power supply requires a PEM-20A-AC+ Power Entry Module (PEM).</li> </ul>
Catalyst 6504-E	<ul style="list-style-type: none"> <li>2700 W AC-input and DC-input</li> </ul>	No restrictions



**Table A-2 Catalyst 6500 Series Switch Supported Power Supply Configurations (continued)**

<b>Platform</b>	<b>Supported Power Supplies</b>	<b>Chassis/Power Supply Restrictions</b>
Catalyst 6506	<ul style="list-style-type: none"> <li>• 1000 W AC-input</li> <li>• 1300 W AC-input and DC-input</li> <li>• 2500 W AC-input and DC-input</li> <li>• 3000 W AC-input</li> <li>• 4000 W AC-input and DC-input</li> <li>• 6000 W AC-input and DC-input</li> <li>• 8700 W AC-input</li> </ul>	The 6000 W AC-input, 6000 W DC-input, and the 8700 W AC-input power supplies are limited to 4000 W when they are installed in the Catalyst 6506 switch chassis.
Catalyst 6506-E	<ul style="list-style-type: none"> <li>• 2500 W AC-input and DC-input</li> <li>• 3000 W AC-input</li> <li>• 4000 W AC-input and DC-input</li> <li>• 6000 W AC-input and DC-input</li> <li>• 8700 W AC-input</li> </ul>	No restrictions.
Catalyst 6509	<ul style="list-style-type: none"> <li>• 1000 W AC-input</li> <li>• 1300 W AC-input, and DC-input</li> <li>• 2500 W AC-input and DC-input</li> <li>• 3000 W AC-input</li> <li>• 4000 W AC-input and DC-input</li> <li>• 6000 W AC-input and DC-input</li> <li>• 8700 W AC-input</li> </ul>	The 6000 W AC-input, 6000 W DC-input, and the 8700 W AC-input power supplies are limited to 4000 W when they are installed in the Catalyst 6509 switch chassis.
Catalyst 6509-E	<ul style="list-style-type: none"> <li>• 2500 W AC-input and DC-input</li> <li>• 3000 W AC-input</li> <li>• 4000 W AC-input and DC-input</li> <li>• 6000 W AC-input and DC-input</li> <li>• 8700 W AC-input</li> </ul>	No restrictions.
Catalyst 6509-NEB	<ul style="list-style-type: none"> <li>• 1000 W AC-input</li> <li>• 1300 W AC-input and DC-input</li> <li>• 2500 W AC-input and DC-input</li> <li>• 3000 W AC-input</li> <li>• 4000 W AC-input and DC-input</li> <li>• 6000 W AC-input and DC-input</li> <li>• 8700 W AC-input</li> </ul>	The 6000 W AC-input, 6000 W DC-input, and the 8700 W AC-input power supplies are limited to 4000 W when they are installed in the Catalyst 6509-NEB switch chassis.

**Table A-2 Catalyst 6500 Series Switch Supported Power Supply Configurations (continued)**

<b>Platform</b>	<b>Supported Power Supplies</b>	<b>Chassis/Power Supply Restrictions</b>
Catalyst 6509-NEB-A	<ul style="list-style-type: none"> <li>• 2500 W AC-input and DC-input</li> <li>• 3000 W AC-input</li> <li>• 4000 W AC-input and DC-input</li> <li>• 6000 W AC-input and DC-input</li> <li>• 8700 W AC-input</li> </ul>	The 6000 W AC-input, 6000 W DC-input, and the 8700 W AC-input power supplies are limited to 4500 W maximum output when they are installed in the Catalyst 6509-NEB-A switch chassis.
Catalyst 6509-V-E	<ul style="list-style-type: none"> <li>• 2500 W AC-input and DC-input</li> <li>• 3000 W AC-input</li> <li>• 4000 W AC-input and DC-input</li> <li>• 6000 W AC-input and DC-input</li> <li>• 8700 W AC-input</li> </ul>	No restrictions.
Catalyst 6513	<ul style="list-style-type: none"> <li>• 2500 W AC-input and DC-input</li> <li>• 3000 W AC-input</li> <li>• 4000 W AC-input and DC-input</li> <li>• 6000 W AC-input and DC-input</li> <li>• 8700 W AC-input</li> </ul>	The 8700 W AC-input power supply is limited to 6000 W maximum output when it is installed in the Catalyst 6513 switch chassis.
Catalyst 6513-E	<ul style="list-style-type: none"> <li>• 2500 W DC-input</li> <li>• 3000 W AC-input</li> <li>• 4000 W AC-input and DC-input</li> <li>• 6000 W AC-input and DC-input</li> <li>• 8700 W AC-input</li> </ul>	No restrictions.

## 950 W AC-Input and DC-Input Power Supplies

The 950 W AC-input (PWR-950-AC) and DC-input (PWR-950-DC) power supplies can be installed in the Catalyst 6503 and Catalyst 6503-E switch chassis only. Due to form factor differences, the 950 W AC-input and DC-input power supplies cannot be installed in any other Catalyst 6500 series switch chassis.

The 950 W power supplies (see [Figure A-1](#)) do not connect directly to source AC or source DC but use Power Entry Modules (PEMs), located on the front of the Catalyst 6503 and Catalyst 6503-E switch chassis, to connect the site power source to the power supply located in the back of the chassis. The form factor is the same for the AC-input and DC-input power supplies.

The AC-input PEM (shown in [Figure A-2](#)) and DC-input PEM (shown in [Figure A-3](#)) provide an input power connection on the front of the switch chassis to connect the site power source to the power supply. You can connect the DC-input power supply to the power source with heavy gauge wiring connected to a terminal block. The actual wire gauge size is determined by local electrical codes and restrictions.

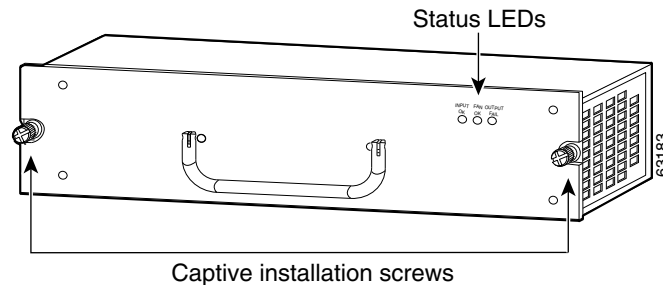


### Note

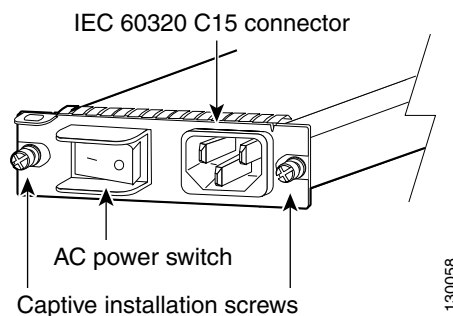
The system (NEBS) ground serves as the primary safety ground for Catalyst 6503 and Catalyst 6503-E chassis that are equipped with 950 W DC-input power supplies and DC-input PEMs. The DC-input power supplies for these chassis do not have a separate ground.

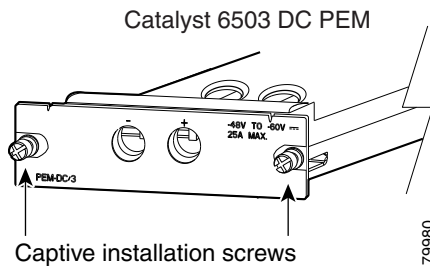
The PEMs have an illuminated power switch (AC-input model only), current protection, surge and EMI suppression, and filtering functions.

**Figure A-1** 950 W AC- and DC-Input Power Supplies



**Figure A-2** 950 W AC-Input PEM (PEM-15A-AC)



**Figure A-3** DC Power Entry Module (PEM)

## 950 W Power Supply Specifications

Table A-3 lists the specifications for the 950 W AC-input power supply.

**Table A-3** 950 W AC-Input Power Supply Specifications

Specification	Description
AC-input type	Autoranging input with power factor correction (PFC) <b>Note</b> Power factor correction is a standard feature on all Catalyst 6500 series AC-input power supplies. PFC reduces the reactive component in the source AC current allowing higher power factors (typically 99 percent or better) and lower harmonic current components.
AC-input voltage	<ul style="list-style-type: none"> <li>Low-line (120 VAC nominal)—90 VAC (min) to 132 VAC (max)</li> <li>High-line (230 VAC nominal)—170 VAC (min) to 264 VAC (max)</li> </ul>
AC-input current	<ul style="list-style-type: none"> <li>12 A @ 120 VAC</li> <li>6 A @ 230 VAC</li> </ul>
AC-input frequency	50/60 Hz (nominal)

**Table A-3 950 W AC-Input Power Supply Specifications (continued)**

Specification	Description
Branch circuit requirement	<p>Each chassis power supply should have its own dedicated, fused-branch circuit:</p> <ul style="list-style-type: none"> <li>• For North America—15 A</li> <li>• For International—Circuits sized to local and national codes</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC.</li> <li>• All AC power supply inputs are fully isolated. <ul style="list-style-type: none"> <li>– Source AC can be out of phase between multiple power supplies in the same chassis, which means that PS1 can be operating from phase A and PS2 can be operating from phase B.</li> <li>– For high-line operation, the power supply operates with the hot conductor wired to a source AC phase and the neutral conductor wired either to ground or to another source AC phase as long as the net input voltage is in the range of 170 to 264 VAC.</li> <li>– Source AC can be out of phase between AC inputs on power supplies that are equipped with multiple AC inputs, which means that power cord 1 can be plugged into phase A and power cord 2 can be plugged into phase B.</li> </ul> </li> </ul>
Power supply output capacity	950 W maximum (100–240 VAC)
Power supply output	<ul style="list-style-type: none"> <li>• 15 A @ +1.5 VDC</li> <li>• 2.5 A @ +3.3 VDC</li> <li>• 19.15 A @ +50 VDC</li> </ul>
Output holdup time	20 ms minimum
kVA rating <sup>1</sup>	1.32 kVA
Heat dissipation	4441 BTU/hour (approx.)
Weight	8.2 lb (3.7 kg)

1. The kVA rating listed for the power supply should be used as the sizing criteria for both UPS outputs as well as standard circuits and transformers to power a switch.

Table A-4 lists the specifications for the 950 W DC-input power supply.

**Table A-4** 950 W DC-Input Power Supply Specifications

Specification	Description
DC-input voltage	–48 VDC to –60 VDC continuous
DC-input current	<ul style="list-style-type: none"> <li>• 28 A @ –48 VDC</li> <li>• 23 A @ –60 VDC</li> </ul>
Power supply output capacity	950 W
Power supply output	<ul style="list-style-type: none"> <li>• 15 A @ +1.5 VDC</li> <li>• 2.5 A @ +3.3 VDC</li> <li>• 19.15 A @ +50 VDC</li> </ul>
Output holdup time	8 ms
Heat dissipation	4632 BTU/hour (approx.)
Weight	8.4 lb (3.8 kg)

Table A-5 lists the power supply LEDs and their meanings.

**Table A-5** 950 W AC-Input and DC-Input Power Supply LEDs

LED	Meaning
INPUT OK	<p>AC-input power supplies:</p> <ul style="list-style-type: none"> <li>• Green—Source AC voltage is OK. (Input voltage is 85 VAC or greater.)</li> <li>• Off—Source AC voltage falls below 70 VAC, is not present, or the PEM is turned off.</li> </ul> <p>DC-input power supplies:</p> <ul style="list-style-type: none"> <li>• Green—Source DC voltage is OK. (–40.5 VDC or greater.)</li> <li>• Off—Source DC voltage falls below –33 VDC or is not present at the PEM.</li> </ul>
FAN OK	<p>Green—Power supply fan is operating properly.</p> <p>Off—Power supply fan failure is detected.</p>
OUTPUT FAIL	<p>Red—Problem with one or more of the DC-output voltages of the power supply is detected.</p> <p>Off—DC-output voltages within acceptable margins.</p> <p><b>Note</b> For proper operation of the OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

## 950 W Power Supply AC Power Cords

Table A-6 lists the 950 W AC-input power supply AC power cords specifications. These power cords plug into the 950 W PEM(PEM-15A-AC), not directly into the power supply. The table includes references to power cord illustrations.



**Note** All 950 W power supply power cords are 8 feet 2 inches (2.5 meters) in length.



**Note** All 950 W power supply power cords have an IEC60320/C15 appliance connector at one end. The appliance connector has a 90° left bend.

**Table A-6** 950 W AC-Input Power Supply Power Cords

Locale	Power Cord Part Number	AC Source Plug Type	Cordset Rating	Power Cord Reference Illustration
Argentina	CAB-7KACR=	IRAM 2073	10 A, 250 VAC	<a href="#">Figure A-25</a>
Australia, New Zealand	CAB-AC10A-90L-AU=	SAA AS 3112	10 A, 250 VAC	<a href="#">Figure A-20</a>
Continental Europe	CAB-AC10A-90L-EU=	CEE 7/7	10 A, 250 VAC	<a href="#">Figure A-21</a>
Italy	CAB-AC10A-90L-IT=	CEI 23-16/7	10 A, 250 VAC	<a href="#">Figure A-22</a>
Japan, North America	CAB-AC15A-90L-US=	NEMA 5-15	15 A, 125 VAC	<a href="#">Figure A-23</a>
United Kingdom	CAB-AC10A-90L-UK=	BS 1363 <sup>1</sup>	10 A, 250 VAC	<a href="#">Figure A-24</a>

1. Plug contains a 13 A fuse.

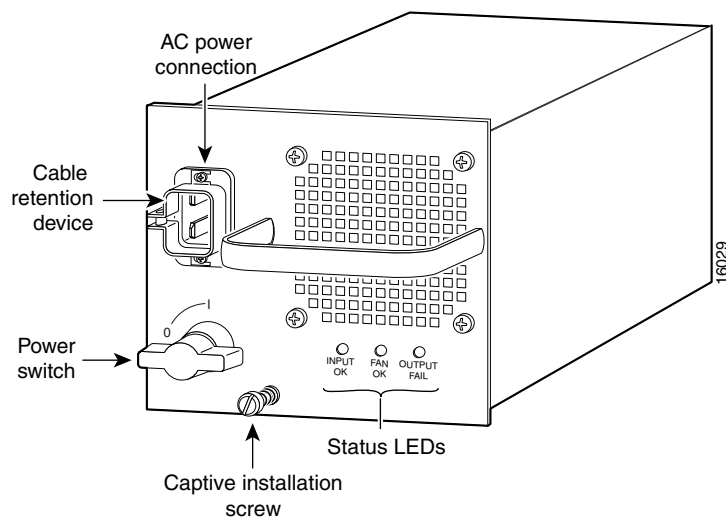
# 1000 W AC-Input Power Supply

The 1000 W AC-input power supply (WS-CAC-1000W) is supported in the following Catalyst 6500 series switches:

- Catalyst 6506
- Catalyst 6509
- Catalyst 6509-NEB

The 1000 W power supply (shown in [Figure A-4](#)) shares the same form factor as the 1300 W, 2500 W, 3000 W, 4000 W, and 6000 W AC-input power supplies.

**Figure A-4** 1000 W AC-Input Power Supply





## 1000 W Power Supply Specifications

Table A-7 lists the specifications for the 1000 W AC-input power supply.

**Table A-7** 1000 W Power Supply Specifications

Specification	Description
AC-input type	<p>Autoranging input with power factor correction (PFC)</p> <p><b>Note</b> Power factor correction is a standard feature on all Catalyst 6500 series AC-input power supplies. PFC reduces the reactive component in the source AC current allowing higher power factors (typically 99 percent or better) and lower harmonic current components.</p>
AC-input voltage	<ul style="list-style-type: none"> <li>• Low-line (120 VAC nominal)—90 VAC (min) to 132 VAC (max)</li> <li>• High-line (230 VAC nominal)—170 VAC (min) to 264 VAC (max)</li> </ul>
AC-input current	<ul style="list-style-type: none"> <li>• 12 A @ 120 VAC</li> <li>• 6 A @ 230 VAC</li> </ul>
AC-input frequency	50/60 Hz (nominal)
Branch circuit requirement	<p>Each chassis power supply should have its own dedicated, fused-branch circuit:</p> <ul style="list-style-type: none"> <li>• For North America—15 A or 20 A</li> <li>• For International—Circuits sized to local and national codes</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC.</li> <li>• All AC power supply inputs are fully isolated. <ul style="list-style-type: none"> <li>– Source AC can be out of phase between multiple power supplies in the same chassis, which means that PS1 can be operating from phase A and PS2 can be operating from phase B.</li> <li>– For high-line operation, the power supply operates with the hot conductor wired to a source AC phase and the neutral conductor wired either to ground or to another source AC phase as long as the net input voltage is in the range of 170 to 264 VAC.</li> <li>– Source AC can be out of phase between AC inputs on power supplies that are equipped with multiple AC inputs, which means that power cord 1 can be plugged into phase A and power cord 2 can be plugged into phase B.</li> </ul> </li> </ul>

**Table A-7** 1000 W Power Supply Specifications (continued)

Specification	Description
Power supply output capacity	1000 W
Power supply output	<ul style="list-style-type: none"> <li>• 15 A @ +3.3 VDC</li> <li>• 5 A @ +5 VDC</li> <li>• 6 A @ +12 VDC</li> <li>• 20.3 A @ +42 VDC</li> </ul>
Output holdup time	20 ms minimum
kVA rating <sup>1</sup>	1.25 kVA
Heat dissipation	4213 BTU/hour (approx.)
Weight	14.8 lb (6.7 kg)

1. The kVA rating listed for the power supply should be used as the sizing criteria for both UPS outputs as well as standard circuits and transformers to power a switch.

Table A-8 list the power supply LEDs and their meanings.

**Table A-8** 1000 W Power Supply LEDs

LED	Meaning
INPUT OK	<ul style="list-style-type: none"> <li>• Green—Source AC voltage is OK. (Input voltage is 85 VAC or greater.)</li> <li>• Off—Source AC voltage falls below 70 VAC, is not present, or the power supply is turned off.</li> </ul>
FAN OK	<ul style="list-style-type: none"> <li>• Green—Power supply fan is operating properly.</li> <li>• Off—Power supply fan failure is detected.</li> </ul>
OUTPUT FAIL	<ul style="list-style-type: none"> <li>• Red—Problem with one or more of the DC-output voltages of the power supply is detected.</li> <li>• Off—DC-output voltage with acceptable margins.</li> </ul> <p><b>Note</b> For proper operation of the OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

## 1000 W Power Supply AC Power Cords

Table A-9 lists the specifications for the AC power cords that are available for the 1000 W AC-input power supply. The table includes references to power cord illustrations.



**Note** All 1000 W power supply power cords are 8 feet 2 inches (2.5 meters) in length.



**Note** All 1000 W power supply power cords have an IEC60320/C15 appliance plug at one end.

**Table A-9** 1000 W AC-Input Power Supply Power Cords

Locale	Power Cord Part Number	AC Source Plug Type	Cordset Rating	Power Cord Reference Illustration
Argentina	CAB-7KACR=	IRAM 2073	10 A, 250 VAC	<a href="#">Figure A-25</a>
Australia, New Zealand	CAB-7KACA=	SAA AS 3112	15 A, 250 VAC	<a href="#">Figure A-26</a>
Continental Europe	CAB-7KACE=	CEE 7/7	16 A, 250 VAC	<a href="#">Figure A-27</a>
Italy	CAB-7KACI=	CEI 23-16/7	10 A, 250 VAC	<a href="#">Figure A-28</a>
Japan, North America	CAB-7KAC-15=	NEMA 5-15	15 A, 125 VAC	<a href="#">Figure A-29</a>
United Kingdom	CAB-7KACU=	BS 1363 <sup>1</sup>	10 A, 250 VAC	<a href="#">Figure A-30</a>

1. Plug contains a 13 A fuse.

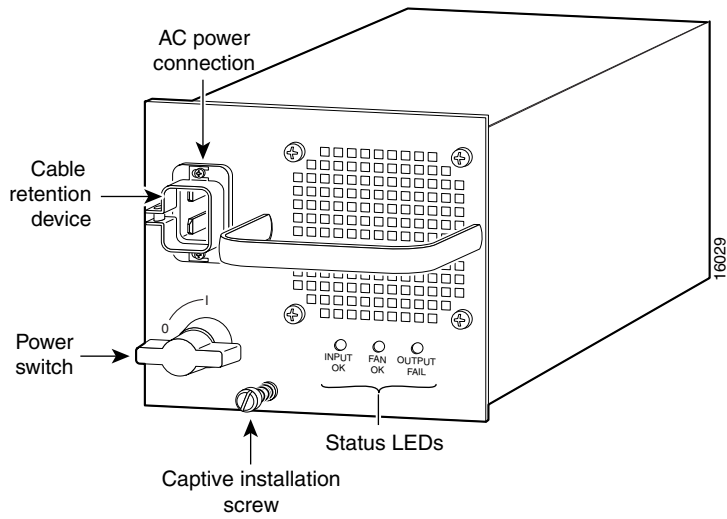
## 1300 W AC-Input and DC-Input Power Supplies

The 1300 W AC-input power supply (WS-CAC-1300W) and 1300 W DC-input power supply (WS-CDC-1300W) are supported in the following Catalyst 6500 series switches:

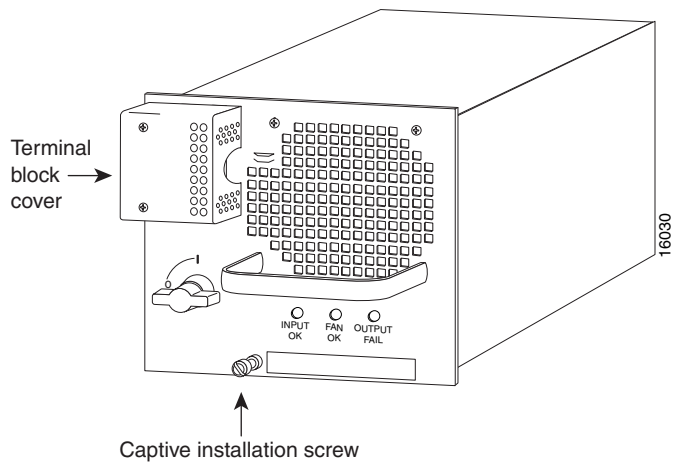
- Catalyst 6506
- Catalyst 6509
- Catalyst 6509-NEB

The 1300 W power supply (see [Figure A-5](#) for the 1300 W AC-input power supply and [Figure A-6](#) for the 1300 W DC-input power supply) shares the same form factor as the 1000 W, 2500 W, 3000 W, 4000 W, and 6000 W AC-input power supplies.

**Figure A-5 1300 W AC-input Power Supply**



**Figure A-6 1300 W DC-Input Power Supply**



## 1300 W Power Supply Specifications

Table A-11 lists the specifications for the 1300 W AC-input power supply.

**Table A-10** 1300 W AC-Input Power Supply Specifications

Specification	Description
AC-input type	<p>Autoranging input with power factor correction (PFC).</p> <p><b>Note</b> Power factor correction is a standard feature on all Catalyst 6500 series AC-input power supplies. PFC reduces the reactive component in the source AC current allowing higher power factors (typically 99 percent or better) and lower harmonic current components.</p>
AC-input voltage	<ul style="list-style-type: none"> <li>• Low-line (120 VAC nominal)—90 VAC (min) to 132 VAC (max)</li> <li>• High-line (230 VAC nominal)—170 VAC (min) to 264 VAC (max)</li> </ul>
AC-input current	<ul style="list-style-type: none"> <li>• 16 A @ 120 VAC</li> <li>• 8 A @ 230 VAC</li> </ul>
AC-input frequency	50/60 Hz (nominal) ( $\pm 3$ Hz for full range)
Branch circuit requirement	<p>Each chassis power supply should have its own dedicated, fused-branch circuit:</p> <ul style="list-style-type: none"> <li>• For North America—15 A or 20 A</li> <li>• For International—Circuits sized to local and national codes</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC.</li> <li>• All AC power supply inputs are fully isolated. <ul style="list-style-type: none"> <li>– Source AC can be out of phase between multiple power supplies in the same chassis, which means that PS1 can be operating from phase A and PS2 can be operating from phase B.</li> <li>– For high-line operation, the power supply operates with the hot conductor wired to a source AC phase and the neutral conductor wired either to ground or to another source AC phase as long as the net input voltage is in the range of 170 to 264 VAC.</li> <li>– Source AC can be out of phase between AC inputs on power supplies that are equipped with multiple AC inputs, which means that power cord 1 can be plugged into phase A and power cord 2 can be plugged into phase B.</li> </ul> </li> </ul>
Power supply output capacity	<ul style="list-style-type: none"> <li>• 1300 W maximum (AC-input)</li> <li>• 1360 W maximum (DC-input)</li> </ul>
Power supply output	<ul style="list-style-type: none"> <li>• 15 A @ +3.3 VDC</li> <li>• 5 A @ +5 VDC</li> <li>• 6 A @ +12 VDC</li> <li>• 27.46 A @ +42 VDC</li> </ul>
Output holdup time	20 ms minimum

**Table A-10** 1300 W AC-Input Power Supply Specifications (continued)

Specification	Description
kVA rating <sup>1</sup>	1.625 kVA
Heat dissipation	5478 BTU/hour (approx.)
Weight	18.4 lb (8.3 kg)

1. The kVA rating listed for the power supply should be used as the sizing criteria for both UPS outputs as well as standard circuits and transformers to power a switch.

Table A-11 lists the specifications for the 1300 W DC-input power supply.

**Table A-11** 1300 W DC-Input Power Supply Specifications

Specification	Description
DC-input voltage	-48 VDC to -60 VDC continuous
DC-input current	<ul style="list-style-type: none"> <li>• 39 A @ -48 VDC</li> <li>• 31 A @ -60 VDC</li> </ul>
Power supply output capacity	1360 W maximum (DC-input)
Power supply output	<ul style="list-style-type: none"> <li>• 15 A @ +3.3 VDC</li> <li>• 5 A @ +5 VDC</li> <li>• 6 A @ +12 VDC</li> <li>• 28.9 A @ +42 VDC</li> </ul>
DC input terminal block	Accepts 3 AWG to 10 AWG copper conductors. Actual size of the wire needed is determined by the installer or local electrician. Terminal block material is rated at 120°C.
Output holdup time	8 ms
Heat dissipation	6447 BTU/hour (approx.)
Weight	21.0 lb (9.5 kg)

Table A-12 lists the 1300 W power supply LEDs and their meanings.

**Table A-12** 1300 W AC-Input and DC-Input Power Supply LEDs

LED	Meaning
INPUT OK	<p>AC-input power supplies:</p> <ul style="list-style-type: none"> <li>Green—Source AC voltage is OK. (Input voltage is 85 VAC or greater.)</li> <li>Off—Source AC voltage falls below 70 VAC, is not present, or the power supply turned off.</li> </ul> <p>DC-input power supplies:</p> <ul style="list-style-type: none"> <li>Green—Source DC voltage is OK. (Input voltage is –40.5 VDC or greater.)</li> <li>Off—Source DC voltage falls below –33 VDC, is not present, or the power supply is turned off.</li> </ul>
FAN OK	<ul style="list-style-type: none"> <li>Green—Power supply fan is operating properly.</li> <li>Off—Power supply fan failure is detected.</li> </ul>
OUTPUT FAIL	<ul style="list-style-type: none"> <li>Red—Problem with one or more of the DC-output voltages of the power supply is detected.</li> <li>Off—DC-output voltages within acceptable margins.</li> </ul> <p><b>Note</b> For proper operation of the OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

## 1300 W Power Supply AC Power Cords

Table A-13 lists the specifications for the AC power cords that are available for the 1300 W AC-input power supply. The table includes references to power cord illustrations.



**Note**

All 1300 W power supply power cords are 14 feet (4.3 meters) in length.



**Note**

All 1300 W power supply power cords have an IEC60320/C19 appliance connector at one end.

**Table A-13** 1300 W Power Supply AC Power Cords

Locale	Power Cord Part Number	AC Source Plug Type	Cordset Rating	Power Cord Reference Illustration
Argentina	CAB-7513ACR=	IRAM 2073	10 A, 250 VAC	<a href="#">Figure A-31</a>
Australia, New Zealand	CAB-7513ACA=	SAA AS 3112	15 A, 250 VAC	<a href="#">Figure A-32</a>
Continental Europe	CAB-7513ACE=	CEE 7/7	16 A, 250 VAC	<a href="#">Figure A-33</a>
Israel	CAB-AC-2500W-ISRL=	SI16S3	16 A, 250 VAC	<a href="#">Figure A-34</a>
Italy	CAB-7513ACI=	CEI 23-16/7	16 A, 250 VAC	<a href="#">Figure A-35</a>
Japan, North America	CAB-7513AC=	NEMA 5-20 <sup>1</sup>	20 A, 125 VAC	<a href="#">Figure A-36</a>
People's Republic of China	CAB-AC16A-CH=	GB16C	16 A, 250 VAC	<a href="#">Figure A-37</a>
South Africa	CAB-7513ACSA=	IEC 884-1	16 A, 250 VAC	<a href="#">Figure A-38</a>
Switzerland	CAB-ACS-10=	SEV 1011	10 A, 250 VAC	<a href="#">Figure A-39</a>
United Kingdom	CAB-7513ACU=	BS 1363 <sup>2</sup>	13 A, 250 VAC	<a href="#">Figure A-40</a>
Power Distribution Unit (PDU) <sup>3</sup>	CAB-C19-CBN=	IEC 60320 C19 IEC 60320 C20	16 A, 250 VAC	<a href="#">Figure A-47</a>

1. For Japan, ask your local electrical contractor to prepare the NEMA 5-20 power plug.
2. Plug contains a 13 A fuse.
3. The PDU power cable is designed for users who power their switch from a PDU. The end of the cable that plugs into the chassis power supply has a C19 connector; the other end of the cable that connects to the PDU has a C20 connector.

## 1400 W AC-Input Power Supply

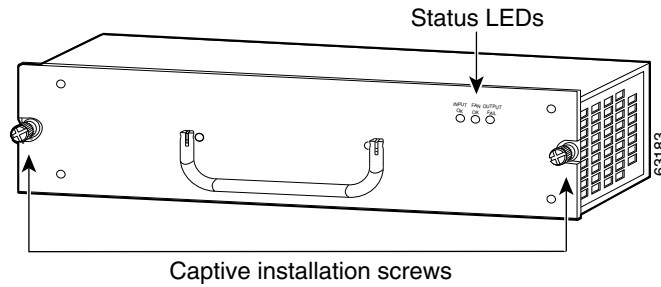
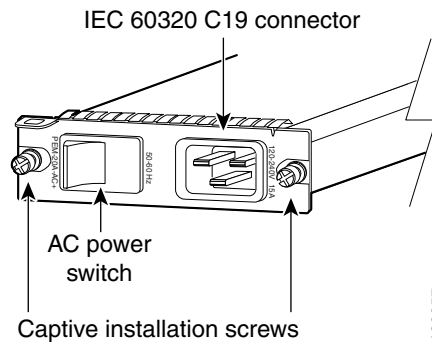
The 1400 W AC-input power supply (PWR-1400-AC) can be installed in the Catalyst 6503 switch and Catalyst 6503-E switch chassis only. Due to form factor differences, the 1400 W AC-input power supply cannot be installed in any other Catalyst 6500 series switch chassis.

The 1400 W power supplies (see [Figure A-7](#)) do not connect directly to source AC but use power entry modules (PEMs), located on the front of the Catalyst 6503 and Catalyst 6503-E switch chassis, to connect the site power source to the power supply located in the back of the chassis.

The AC-input PEM (PEM-20A-AC+) (shown in [Figure A-8](#)) provides an input power connection on the front of the router chassis to connect the site power source to the power supply.

The PEMs have an illuminated power switch, current protection, surge and EMI suppression, and filtering functions.



**Figure A-7** 1400 W AC-Input Power Supply (PWR-1400-AC)**Figure A-8** 1400 W AC-Input PEM (PEM-20A-AC+)

## 1400 W Power Supply Specifications

Table A-14 lists the specifications for the 1400 W AC-input power supply.

**Table A-14** 1400 W AC-Input Power Supply Specifications

Specification	Description
AC-input type	Autoranging input with power factor correction (PFC). <b>Note</b> Power factor correction is a standard feature on all Catalyst 6500 series AC-input power supplies. PFC reduces the reactive component in the source AC current allowing higher power factors (typically 99 percent or better) and lower harmonic current components.
AC-input voltage	<ul style="list-style-type: none"> <li>Low-line (120 VAC nominal)—90 VAC (min) to 132 VAC (max)</li> <li>High-line (230 VAC nominal)—170 VAC (min) to 264 VAC (max)</li> </ul>
AC-input current	<ul style="list-style-type: none"> <li>16 A @ 120 VAC</li> <li>8 A @ 230 VAC</li> </ul>
AC-input frequency	50/60 Hz (nominal) ( $\pm 3$ Hz for full range)

**Table A-14** 1400 W AC-Input Power Supply Specifications (continued)

Specification	Description
Branch circuit requirement	<p>Each chassis power supply should have its own dedicated, fused-branch circuit:</p> <ul style="list-style-type: none"> <li>• For North America—20 A</li> <li>• For International—Circuits sized to local and national codes</li> <li>• All AC power supply inputs are fully isolated. <ul style="list-style-type: none"> <li>– Source AC can be out of phase between multiple power supplies in the same chassis, which means that PS1 can be operating from phase A and PS2 can be operating from phase B.</li> <li>– For high-line operation, the power supply operates with the hot conductor wired to a source AC phase and the neutral conductor wired either to ground or to another source AC phase as long as the net input voltage is in the range of 170 to 264 VAC.</li> <li>– Source AC can be out of phase between AC inputs on power supplies that are equipped with multiple AC inputs, which means that power cord 1 can be plugged into phase A and power cord 2 can be plugged into phase B.</li> </ul> </li> </ul>
Power supply output capacity	1400 W
Power supply output	<ul style="list-style-type: none"> <li>• 15 A @ +1.5 V</li> <li>• 2.5 A @ +3.3 V</li> <li>• 27.4 A @ +50 V</li> </ul>
Output holdup time	20 ms minimum
kVA rating <sup>1</sup>	1.75 kVA
Heat dissipation	5976 BTU/hour (approx.)
Weight	7.8 lb (3.5 kg)

1. The kVA rating listed for the power supply should be used as the sizing criteria for both UPS outputs as well as standard circuits and transformers to power a switch.

Table A-15 lists the 1400 W AC-input power supply LEDs and their meanings.

**Table A-15** 1400 W AC-Input Power Supply LEDs

LED	Meaning
INPUT OK	<ul style="list-style-type: none"> <li>Green—Source AC voltage is OK. (Input voltage is 85 VAC or greater.)</li> <li>Off—Source AC voltage falls below 70 VAC, is not present, or the power supply is turned off.</li> </ul>
FAN OK	<ul style="list-style-type: none"> <li>Green—Power supply fan is operating properly.</li> <li>Off—Power supply fan failure is detected.</li> </ul>
OUTPUT FAIL	<ul style="list-style-type: none"> <li>Red—Problem with one or more of the DC-output voltages of the power supply is detected.</li> <li>DC-output voltages within acceptable margins.</li> </ul> <p><b>Note</b> For proper operation of the OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

## 1400 W Power Supply AC Power Cords

Table A-16 lists the specifications for the AC power cords that are available for the 1400 W AC-input power supply. These power cords plug into the 1400 W PEM (PEM-20A-AC+); not directly into the power supply. The table includes references to power cord illustrations.



**Note**

All 1400 W power supply power cords are 14 feet (4.3 meters) in length.



**Note**

All 1400 W power supply power cords have an IEC60320/C19 appliance plug at one end.

Table A-16 1400 W Power Supply AC Power Cords

Locale	Power Cord Part Number	AC Source Plug Type	Cordset Rating	Power Cord Reference Illustration
Argentina	CAB-7513ACR= CAB-IR2073-C19-AR=	IRAM 2073	16 A, 250 VAC	<a href="#">Figure A-31</a>
Australia, New Zealand	CAB-7513ACA=	SAA AS 3112	15 A, 250 VAC	<a href="#">Figure A-32</a>
People's Republic of China	CAB-AC16A-CH=	GB16C	16 A, 250 VAC	<a href="#">Figure A-37</a>
Continental Europe	CAB-7513ACE=	CEE 7/7	16 A, 250 VAC	<a href="#">Figure A-33</a>
	CAB-AC-2500W-EU=	CEE 7/7	16 A, 250 VAC	<a href="#">Figure A-41</a>
International	CAB-AC-2500W-INT=	IEC 309	16 A, 250 VAC	<a href="#">Figure A-42</a>
Israel	CAB-AC-2500W-ISRL=	SI16S3	16 A, 250 VAC	<a href="#">Figure A-34</a>
Italy	CAB-7513ACI=	CEI 23-16/7	16 A, 250 VAC	<a href="#">Figure A-35</a>
Japan, North America	CAB-7513AC=	NEMA 5-20 <sup>1</sup>	20 A, 125 VAC	<a href="#">Figure A-36</a>
	CAB-AC-2500W-US1=	NEMA 6-20 <sup>2</sup>	16 A, 250 VAC	<a href="#">Figure A-43</a>
	CAB-AC-C6K-TWLK=	NEMA L6-20 <sup>3</sup>	16 A, 250 VAC	<a href="#">Figure A-44</a>
South Africa	CAB-7513ACSA=	IEC 884-1	16 A, 250 VAC	<a href="#">Figure A-38</a>
Switzerland	CAB-ACS-10=	SEV 1011	10 A, 250 VAC	<a href="#">Figure A-39</a>
Switzerland	CAB-ACS-16=	SEV 5934-2 Type 23	16 A, 250 VAC	<a href="#">Figure A-45</a>
United Kingdom	CAB-7513ACU=	BS 1363	13 A, 250 VAC <sup>4</sup>	<a href="#">Figure A-40</a>
Power Distribution Unit (PDU) <sup>5</sup>	CAB-C19-CBN=	IEC 60320 C19 IEC 60320 C20	16 A, 250 VAC	<a href="#">Figure A-47</a>

1. For operation in Japan, ask your local electrical contractor to prepare the NEMA 5-20 power plug.
2. For operation in Japan, ask your local electrical contractor to prepare the NEMA 6-20 power plug.
3. For operation in Japan, ask your local electrical contractor to prepare the NEMA L6-20 power plug.
4. Plug contains a 13 A fuse.
5. The PDU power cable is designed for users who power their switch from a PDU. The end of the cable that plugs into the chassis power supply has a C19 connector; the other end of the cable that connects to the PDU has a C20 connector.

## 2500 W AC-Input and DC-Input Power Supplies

The 2500 W AC-input power supply (WS-CAC-2500W) and 2500 W DC-input power supply (WS-CDC-2500W) are supported in the following Catalyst 6500 series switches:

- Catalyst 6506
- Catalyst 6506-E
- Catalyst 6509
- Catalyst 6509-E
- Catalyst 6509-NEB
- Catalyst 6509-NEB-A
- Catalyst 6509-V-E
- Catalyst 6513
- Catalyst 6513-E (DC-input power supply only)

The 2500 W power supplies, shown in [Figure A-9](#) and [Figure A-10](#), share the same form factor as the 1000 W, 1300 W, 3000 W, 4000 W, and 6000 W AC-input power supplies.



### Note

With a fully populated Catalyst 6513 switch, two 2500 W power supplies are not fully redundant. If you operate the 2500 W power supply at the low range input (100 to 120 VAC), it is not redundant in a fully populated Catalyst 6509, Catalyst 6509-E, Catalyst 6509-NEB, Catalyst 6509-NEB-A, or Catalyst 6509-V-E switch.



### Note

The 2500 W AC-input power supply needs 220 VAC to deliver 2500 W of power. When powered with 110 VAC, it delivers only 1300 W. In addition, the power supply needs 16 A, regardless of whether it is plugged into 110 VAC or 220 VAC.

**Figure A-9** 2500 W AC-Input Power Supply

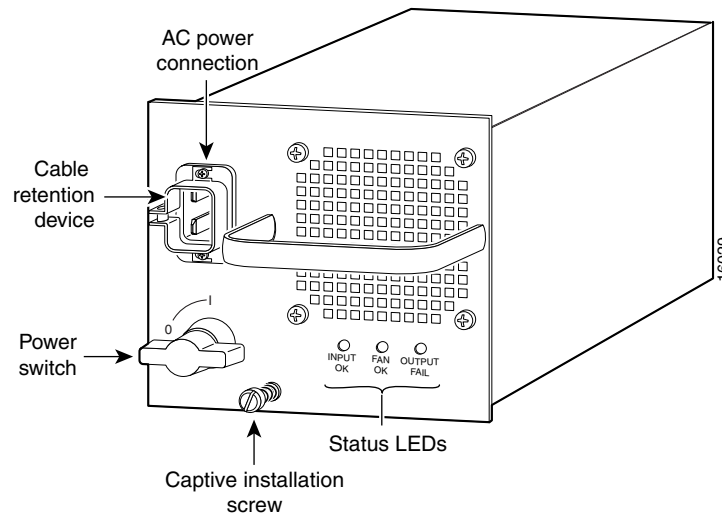
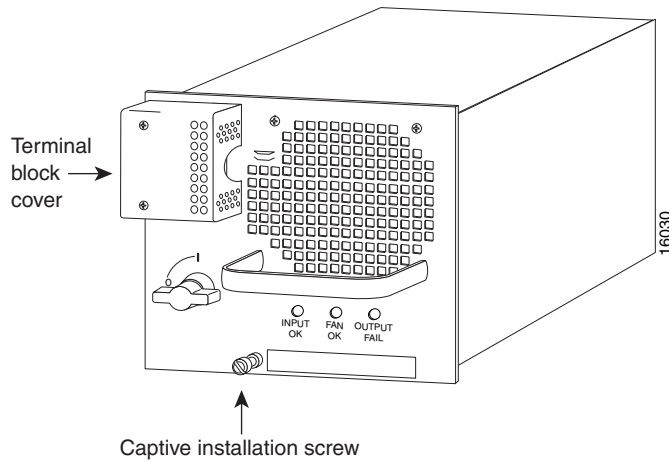


Figure A-10 2500 W DC-input Power Supply



## 2500 W Power Supply Specifications

Table A-17 lists the specifications for the 2500 W AC-input and DC-input power supplies.

Table A-17 2500 W AC-Input Power Supply Specifications

Specification	Description
AC-input type	Autoranging input with power factor correction (PFC). <b>Note</b> Power factor correction is a standard feature on all Catalyst 6500 series AC-input power supplies. PFC reduces the reactive component in the source AC current allowing higher power factors (typically 99 percent or better) and lower harmonic current components.
AC-input voltage	<ul style="list-style-type: none"> <li>Low-line (120 VAC nominal)—90 VAC (min) to 132 VAC (max)</li> <li>High-line (230 VAC nominal)—170 VAC (min) to 264 VAC (max)</li> </ul>
AC-input current	16 A maximum at 230 VAC at 2500 W output 16 A maximum at 120 VAC at 1300 W output
AC-input frequency	50/60 Hz (nominal) ( $\pm 3\%$ for full range)

**Table A-17** 2500 W AC-Input Power Supply Specifications (continued)

Specification	Description
Branch circuit requirement	<p>Each chassis power supply should have its own dedicated, fused-branch circuit:</p> <ul style="list-style-type: none"> <li>• For North America—20 A</li> <li>• For International—Circuits sized to local and national codes</li> <li>• All AC power supply inputs are fully isolated. <ul style="list-style-type: none"> <li>– Source AC can be out of phase between multiple power supplies in the same chassis, which means that PS1 can be operating from phase A and PS2 can be operating from phase B.</li> <li>– For high-line operation, the power supply operates with the hot conductor wired to a source AC phase and the neutral conductor wired either to ground or to another source AC phase as long as the net input voltage is in the range of 170 to 264 VAC.</li> <li>– Source AC can be out of phase between AC inputs on power supplies that are equipped with multiple AC inputs, which means that power cord 1 can be plugged into phase A and power cord 2 can be plugged into phase B.</li> </ul> </li> </ul>
Power supply output capacity	<ul style="list-style-type: none"> <li>• 1300 W maximum (100–120 VAC)</li> <li>• 2500 W maximum (200–240 VAC)</li> </ul>
Power supply output	<ul style="list-style-type: none"> <li>• 100/120 VAC operation <ul style="list-style-type: none"> <li>– 15.5 A @ +3.3 VDC</li> <li>– 5 A @ +5 VDC</li> <li>– 10 A @ +12 VDC</li> <li>– 27.5 A @ +42 VDC</li> </ul> </li> <li>• 200/240 VAC operation <ul style="list-style-type: none"> <li>– 15 A @ +3.3 VDC</li> <li>– 5 A @ +5 VDC</li> <li>– 10 A @ +12 VDC</li> <li>– 55.5 A @ +42 VDC</li> </ul> </li> </ul>
Output holdup time	20 ms minimum
kVA rating <sup>1</sup>	3520 W (total input power) or 3.6 KVA (high-line operation)
Heat dissipation	10,939 BTU/hour (approx.)
Weight	17.0 lb (7.7 kg)

1. The kVA rating listed for the power supply should be used as the sizing criteria for both UPS outputs as well as standard circuits and transformers to power a switch.

Table A-18 lists the specifications for the 2500 W DC-input power supply.

**Table A-18 2500 W DC-Input Power Supply Specifications**

Specification	Description
DC-input voltage	North America: -48 VDC (nominal) (-40.5 VDC to -56 VDC) International: -60 VDC (nominal) (-55 VDC to -72 VDC)
DC-input current	<ul style="list-style-type: none"> <li>• 70 A @ -48 VDC</li> <li>• 55 A @ -60 VDC</li> </ul>
Power supply output capacity	2500 W maximum (-48 to -60 VDC)
Power supply output	<ul style="list-style-type: none"> <li>• 15 A @ +3.3 VDC</li> <li>• 5 A @ +5 VDC</li> <li>• 10 A @ +12 VDC</li> <li>• 55.5 A @ +42 VDC</li> </ul>
DC input terminal block	Accepts 2–14 AWG copper conductors. Actual size of the wire needed is determined by the installer or local electrician. Terminal block material rated at 150°C.
Output holdup time	<ul style="list-style-type: none"> <li>• 20 ms minimum (AC-input power supply)</li> <li>• 4 ms (DC-input power supply)</li> </ul>
Heat dissipation	<ul style="list-style-type: none"> <li>• 10,939 BTU/hour (approx.) AC-input power supply</li> <li>• 11,377 BTU/hour (approx.) DC-input power supply</li> </ul>
Weight	20.2 lb (9.2 kg)

Table A-19 lists the power supply LEDs and their meanings.



**Table A-19** 2500 W AC-Input and DC-Input Power Supply LEDs

<b>LED</b>	<b>Meaning</b>
INPUT OK	AC-input power supplies: <ul style="list-style-type: none"> <li>• Green—Source AC voltage is OK. (Input voltage is 85 VAC or greater.)</li> <li>• Off—Source AC voltage falls below 70 VAC, is not present, or the power supply is turned off.</li> </ul> DC-input power supplies: <ul style="list-style-type: none"> <li>• Green—Source DC voltage is OK. (Input voltage is –40.5 VDC or greater.)</li> <li>• Off—Source DC voltage falls below –33 VDC, is not present, or the power supply is turned off.</li> </ul>
FAN OK	<ul style="list-style-type: none"> <li>• Green—Power supply fan is operating properly.</li> <li>• Off—Power supply fan failure is detected.</li> </ul>
OUTPUT FAIL	<ul style="list-style-type: none"> <li>• Red—Problem with one or more of the DC-output voltages of the power supply.</li> <li>• Off—DC-output voltages within acceptable margins.</li> </ul> <p><b>Note</b> For proper operation of the OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

## 2500 W Power Supply AC Power Cords

Table A-20 lists the specifications for the AC power cords that are available for the 2500 W AC-input power supply. The table includes references to power cord illustrations.

**Note**

All 2500 W power supply power cords are 14 feet (4.3 meters) in length.

**Note**

All 2500 W power supply power cords have an IEC60320/C19 appliance connector at one end.

**Table A-20** 2500 W Power Supply AC Power Cords

Locale	Power Cord Part Number	AC Source Plug Type	Cordset Rating	Power Cord Reference Illustration
Argentina	CAB-7513ACR= or CAB-IR2073-C19-AR=	IRAM 2073	16 A, 250 VAC	<a href="#">Figure A-31</a>
Australia, New Zealand	CAB-AC-16A-AUS=	AU20S3	16 A, 250 VAC	<a href="#">Figure A-46</a>
People's Republic of China	CAB-AC16A-CH=	GB16C	16 A, 250 VAC	<a href="#">Figure A-37</a>
Continental Europe	CAB-AC-2500W-EU=	CEE 7/7	16 A, 250 VAC	<a href="#">Figure A-41</a>
International	CAB-AC-2500W-INT=	IEC 309	16 A, 250 VAC	<a href="#">Figure A-42</a>
Israel	CAB-AC-2500W-ISRL=	SI16S3	16 A, 250 VAC	<a href="#">Figure A-34</a>
Japan, North America 200–240 VAC operation	CAB-AC-2500W-US1=	NEMA 6-20 (nonlocking plug)	16 A, 250 VAC	<a href="#">Figure A-43</a>
Japan, North America 200–240 VAC operation	CAB-AC-C6K-TWLK=	NEMA L6-20 (locking plug)	16 A, 250 VAC	<a href="#">Figure A-44</a>
Japan, North America 100–120 VAC operation <sup>1</sup>	CAB-7513AC=	NEMA 5-20	20 A, 125 VAC	<a href="#">Figure A-36</a>
Power Distribution Unit (PDU) <sup>2</sup>	CAB-C19-CBN	IEC 60320 C19 IEC 60320 C20	16 A, 250 VAC	<a href="#">Figure A-47</a>
Switzerland	CAB-ACS-16=	SEV 5934-2 Type 23	16 A, 250 VAC	<a href="#">Figure A-45</a>

1. The 2500 W power supply operating on 110 VAC delivers 1300 W.

2. The PDU power cable is designed for users who power their switch from a PDU. The end of the cable that plugs into the chassis power supply has a C19 connector; the other end of the cable that connects to the PDU has a C20 connector.

# 2700 W AC-Input and DC-Input Power Supplies

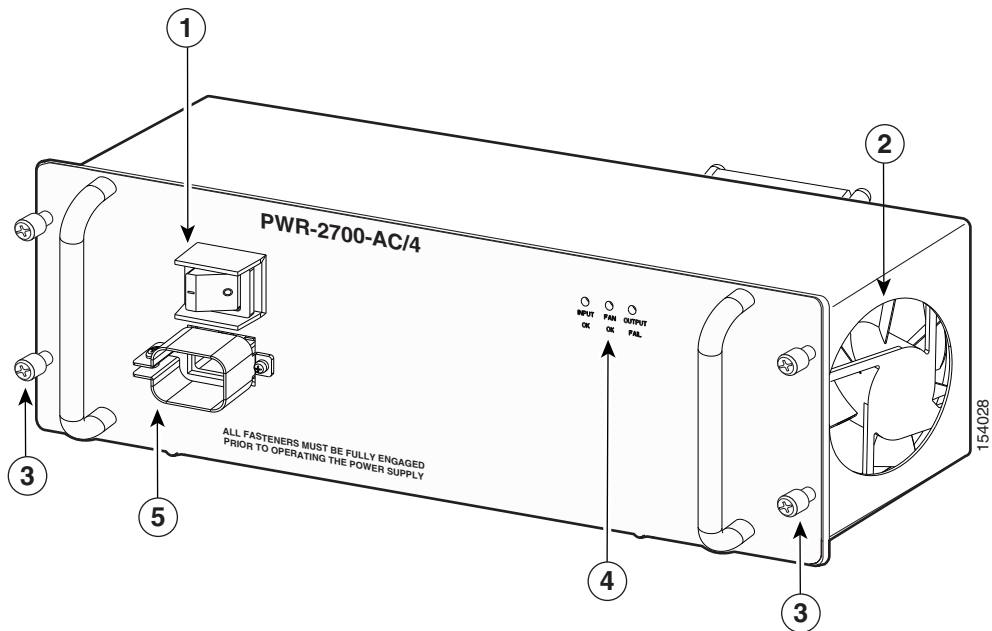
The 2700 W AC-input power supply (PWR-2700-AC/4) and 2700 W DC-input power supply (PWR-2700-DC/4) are supported only in the Catalyst 6504-E switch. See [Figure A-11](#) for the 2700 W AC-input power supply and [Figure A-12](#) for the 2700 W DC-input power supply.



**Note**

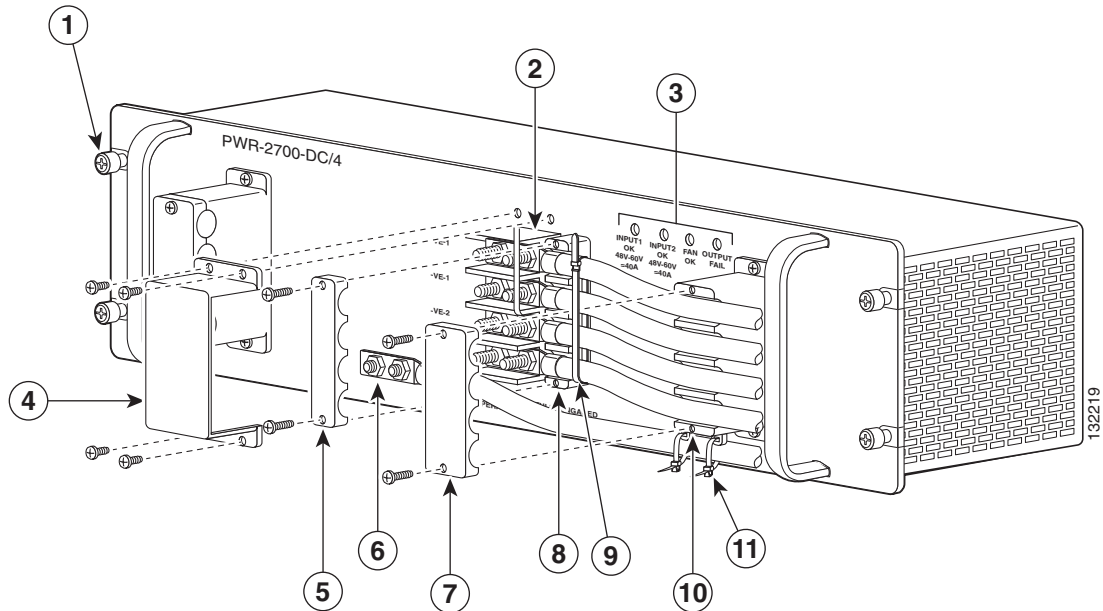
The 2700 W AC-input power supply needs 220 VAC to deliver 2700 W of power. When powered with 110 VAC, it delivers only 1350 W. In addition, the power supply needs 16 A, regardless of whether it is plugged into 110 VAC or 220 VAC.

**Figure A-11** 2700 W AC-Input Power Supply



1	Power on/off switch (I/O)	4	Status LEDs
2	Power supply fan	5	AC In receptacle
3	Captive installation screw (4x)		

Figure A-12 2700 W DC-Input Power Supply



1	Captive installation screw (4x)	7	Fixed cable guide, top half
2	Source DC terminal block	8	Detached cable guide, bottom half
3	Status LEDs	9	Tie-wrap (for source DC cables)
4	Terminal block cover	10	Fixed cable guide, bottom half
5	Detached cable guide, top half	11	Tie-wrap (for ground cable)
6	Ground terminal block		

## 2700 W Power Supply Specifications

Table A-22 lists the specifications for the 2700 W AC-input power supply.

**Table A-21** 2700 W AC-Input Power Supply Specifications

Specification	Description
AC-input type	<p>Autoranging input with power factor correction (PFC).</p> <p><b>Note</b> Power factor correction is a standard feature on all Catalyst 6500 series AC-input power supplies. PFC reduces the reactive component in the source AC current allowing higher power factors (typically 99 percent or better) and lower harmonic current components.</p>
AC-input voltage	<ul style="list-style-type: none"> <li>• Low-line (120 VAC nominal)—90 VAC (min) to 132 VAC (max)</li> <li>• High-line (230 VAC nominal)—170 VAC (min) to 264 VAC (max)</li> </ul>
AC-input current	<ul style="list-style-type: none"> <li>• 16 A maximum at 230 VAC at 2700 W output</li> <li>• 16 A maximum at 120 VAC at 1350 W output</li> </ul>
AC-input frequency	50/60 Hz (nominal) ( $\pm 3\%$ for full range)
Branch circuit requirement	<p>Each chassis power supply should have its own dedicated, fused-branch circuit:</p> <ul style="list-style-type: none"> <li>• For North America—20 A</li> <li>• For International—Circuits sized to local and national codes</li> <li>• All AC power supply inputs are fully isolated. <ul style="list-style-type: none"> <li>– Source AC can be out of phase between multiple power supplies in the same chassis, which means that PS1 can be operating from phase A and PS2 can be operating from phase B.</li> <li>– For high-line operation, the power supply operates with the hot conductor wired to a source AC phase and the neutral conductor wired either to ground or to another source AC phase as long as the net input voltage is in the range of 170 to 264 VAC.</li> <li>– Source AC can be out of phase between AC inputs on power supplies that are equipped with multiple AC inputs, which means that power cord 1 can be plugged into phase A and power cord 2 can be plugged into phase B.</li> </ul> </li> </ul>
Power supply output capacity	<ul style="list-style-type: none"> <li>• 1350 W maximum (100–120 VAC)</li> <li>• 2700 W maximum (200–240 VAC)</li> </ul>

**Table A-21** 2700 W AC-Input Power Supply Specifications (continued)

Specification	Description
Power supply output	<ul style="list-style-type: none"> <li>• 100/120 VAC operation               <ul style="list-style-type: none"> <li>– 15 A @ +1.5 VDC</li> <li>– 2.5 A @ +3.3 VDC</li> <li>– 27.49 A @ +50 VDC</li> </ul> </li> <li>• 200/240 VAC operation               <ul style="list-style-type: none"> <li>– 15 A @ +1.5 VDC</li> <li>– 2.5 A @ +3.3 VDC</li> <li>– 55.61 A @ +50 VDC</li> </ul> </li> </ul>
Output holdup time	20 ms minimum
kVA rating <sup>1</sup>	3.4 KVA (high-line operation)
Heat dissipation	10,841 BTU/hour (approx.)
Weight	18.5 lb (8.4 kg)

1. The kVA rating listed for the power supply should be used as the sizing criteria for both UPS outputs as well as standard circuits and transformers to power a switch.

Table A-22 lists the 2700 W DC-input power supply specifications.

**Table A-22** 2700 W DC-Input Power Supply Specifications

Specification	Description
DC-input voltage	<ul style="list-style-type: none"> <li>• –48 VDC @ 37 A for nominal –48 V battery backup system (operating range: –40.5 VDC to –56 VDC)</li> <li>• –60 VDC @ 29 A for nominal –60 V battery backup system (operating range: –55 VDC to –72 VDC)</li> </ul>
DC-input current (per DC input)	<ul style="list-style-type: none"> <li>• 43 A @ –40.5 VDC</li> <li>• 37 A @ –48 VDC</li> <li>• 29 A @ –60 VDC</li> </ul> <p><b>Note</b> For multiple DC input power supplies, each DC input must be protected by a dedicated circuit breaker or a fuse. The circuit breaker or the fuse must be sized according to the power supply input power rating and any local or national electrical code requirements.</p>
Power supply output capacity	<ul style="list-style-type: none"> <li>• 1350 W maximum (–48 to –60 VDC, with one DC input)</li> <li>• 2700 W maximum (–48 to –60 VDC, with two DC inputs)</li> </ul>

**Table A-22** 2700 W DC-Input Power Supply Specifications (continued)

Specification	Description
Power supply output	<ul style="list-style-type: none"> <li>• One DC input operation (1350 W operation) <ul style="list-style-type: none"> <li>– 15 A @ +1.5 VDC</li> <li>– 5 A @ +3.3 VDC</li> <li>– 27.49 A @ +50 VDC</li> </ul> </li> <li>• Two DC inputs operation (2700 W operation) <ul style="list-style-type: none"> <li>– 15 A @ +1.5 VDC</li> <li>– 5 A @ +3.3 VDC</li> <li>– 55.61 A @ +50 VDC</li> </ul> </li> </ul>
DC input terminal block	Accepts 2–14 AWG copper conductors. Actual size of the wire needed is determined by the installer or local electrician. Terminal block material rated at 150°C.
Output holdup time	4 ms
kVA rating <sup>1</sup>	3.5 KW
Heat dissipation	11,968 BTU/hour (approx.)
Weight	21.0 lb (9.5 kg)

1. The kVA rating listed for the power supply should be used as the sizing criteria for both UPS outputs as well as standard circuits and transformers to power a switch.

Table A-23 lists the power supply LEDs and their meanings.

**Table A-23** 2700 W AC-Input and DC-Input Power Supply LEDs

LED	Meaning
INPUT 1 OK  INPUT 2 OK (DC-input power supply only)	AC-input power supplies: <ul style="list-style-type: none"> <li>• Green—Source AC voltage is OK. (Input voltage is 85 VAC or greater.)</li> <li>• Off—Source AC voltage falls below 70 VAC, is not present, or the power supply is turned off.</li> </ul> DC-input power supplies: <ul style="list-style-type: none"> <li>• Green—Source DC is OK. (Input voltage is –40.5 VDC or greater.)</li> <li>• Off—Source DC voltage falls below –33 VDC, is not present, or the power supply is turned off.</li> </ul>
FAN OK	<ul style="list-style-type: none"> <li>• Green—Power supply fan is operating properly.</li> <li>• Off—Power supply fan failure is detected.</li> </ul>
OUTPUT FAIL	<ul style="list-style-type: none"> <li>• Red—Problem with one or more of the DC-output voltages of the power supply.</li> <li>• Off—DC-output voltages within acceptable margins.</li> </ul> <p><b>Note</b> For proper operation of the OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>



## 2700 W Power Supply AC Power Cords

Table A-24 lists the specifications for the AC power cords that are available for the 2700 W AC-input power supply. The table includes references to power cord illustrations.



**Note** All 2700 W power supply power cords are 14 feet (4.3 meters) in length.



**Note** All 2700 W power supply power cords have an IEC60320/C19 appliance connector at one end.

**Table A-24** 2700 W Power Supply AC Power Cords

Locale	Power Cord Part Number	AC Source Plug Type	Cordset Rating	Power Cord Reference Illustration
Argentina	CAB-7513ACR= or CAB-IR2073-C19-AR=	IRAM 2073	16 A, 250 VAC	<a href="#">Figure A-31</a>
Australia, New Zealand	CAB-AC-16A-AUS=	AU20S3	16 A, 250 VAC	<a href="#">Figure A-45</a>
People's Republic of China	CAB-AC16A-CH=	GB16C	16 A, 250 VAC	<a href="#">Figure A-37</a>
Continental Europe	CAB-AC-2500W-EU=	CEE 7/7	16 A, 250 VAC	<a href="#">Figure A-41</a>
International	CAB-AC-2500W-INT=	IEC 309	16 A, 250 VAC	<a href="#">Figure A-42</a>
Israel	CAB-AC-2500W-ISRL=	SI16S3	16 A, 250 VAC	<a href="#">Figure A-34</a>
Italy	CAB-7513ACI=	CEI 23-16/7	16 A, 250 VAC	<a href="#">Figure A-35</a>
Japan, North America 200–240 VAC operation	CAB-AC-2500W-US1=	NEMA 6-20 (nonlocking plug)	16 A, 250 VAC	<a href="#">Figure A-43</a>
Japan, North America 200–240 VAC operation	CAB-AC-C6K-TWLK=	NEMA L6-20 (locking plug)	16 A, 250 VAC	<a href="#">Figure A-44</a>
Japan, North America 100–120 VAC operation	CAB-7513AC=	NEMA 5-20	20 A, 125 VAC	<a href="#">Figure A-36</a>
Power Distribution Unit (PDU) <sup>1</sup>	CAB-C19-CBN=	IEC 60320 C19 IEC 60320 C20	16 A, 250 VAC	<a href="#">Figure A-47</a>
South Africa	CAB-7513ACSA=	IEC 884-1	16 A, 250 VAC	<a href="#">Figure A-38</a>
Switzerland	CAB-ACS-16=	SEV 5934-2 Type 23	16 A, 250 VAC	<a href="#">Figure A-45</a>

1. The PDU power cable is designed for users who power their switch from a PDU. The end of the cable that plugs into the chassis power supply has a C19 connector; the other end of the cable that connects to the PDU has a C20 connector.

# 3000 W AC-Input Power Supply

The 3000 W AC-input power supply (WS-CAC-3000W) is supported in the following Catalyst 6500 series switches:

- Catalyst 6506
- Catalyst 6506-E
- Catalyst 6509
- Catalyst 6509-E
- Catalyst 6509-NEB
- Catalyst 6509-NEB-A
- Catalyst 6509-V-E
- Catalyst 6513
- Catalyst 6513-E

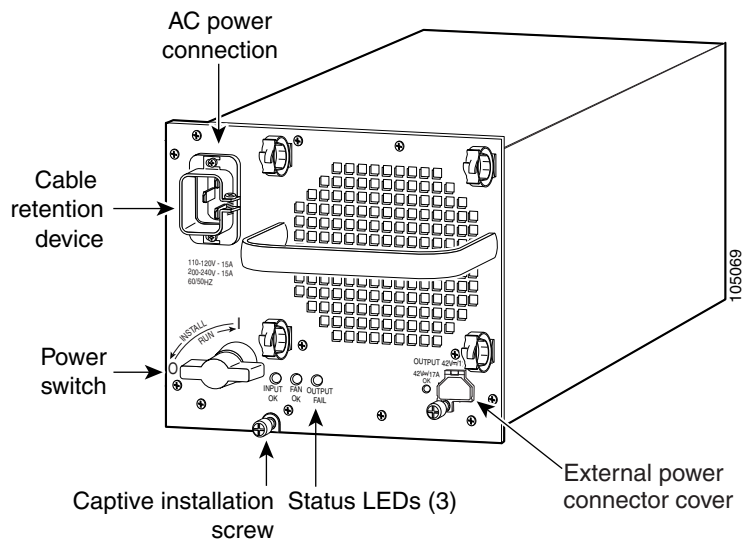
The 3000 W power supply (see [Figure A-13](#)) shares the same form factor as the 1000 W, 1300 W, 2500 W, 4000 W, and 6000 W AC-input power supplies.



## Note

The 3000 W AC-input power supply needs 220 VAC to deliver 3000 W of power. When operating with 110 VAC, it delivers only 1400 W. In addition, the power supply needs 16 A, regardless of whether it is plugged into 110 VAC or 220 VAC.

**Figure A-13** 3000 W AC-Input Power Supply



## 3000 W Power Supply Specifications

Table A-25 lists the specifications for the 3000 W AC-input power supply.

**Table A-25** 3000 W Power Supply Specifications

Specification	Description
AC-input type	<p>Autoranging input with power factor correction (PFC).</p> <p><b>Note</b> Power factor correction is a standard feature on all Catalyst 6500 series AC-input power supplies. PFC reduces the reactive component in the source AC current allowing higher power factors (typically 99 percent or better) and lower harmonic current components.</p>
AC-input voltage	<ul style="list-style-type: none"> <li>• Low-line (120 VAC nominal)—90 VAC (min) to 132 VAC (max)</li> <li>• High-line (230 VAC nominal)—170 VAC (min) to 264 VAC (max)</li> </ul>
AC-input current	<ul style="list-style-type: none"> <li>• 16 A @ 200 VAC (3000 W output)</li> <li>• 16 A @ 100 VAC (1400 W output)</li> </ul>
AC-input frequency	50/60 Hz (nominal) ( $\pm 3\%$ for full range)
Branch circuit requirement	<p>Each chassis power supply should have its own dedicated, fused-branch circuit:</p> <ul style="list-style-type: none"> <li>• For North America—20 A</li> <li>• For International—Circuits sized to local and national codes</li> <li>• All AC power supply inputs are fully isolated.               <ul style="list-style-type: none"> <li>– Source AC can be out of phase between multiple power supplies in the same chassis, which means that PS1 can be operating from phase A and PS2 can be operating from phase B.</li> <li>– For high-line operation, the power supply operates with the hot conductor wired to a source AC phase and the neutral conductor wired either to ground or to another source AC phase as long as the net input voltage is in the range of 170 to 264 VAC.</li> <li>– Source AC can be out of phase between AC inputs on power supplies that are equipped with multiple AC inputs, which means that power cord 1 can be plugged into phase A and power cord 2 can be plugged into phase B.</li> </ul> </li> </ul>
Power supply output capacity	<ul style="list-style-type: none"> <li>• 1400 W maximum (100–120 VAC)</li> <li>• 3000 W maximum (200–240 VAC)</li> </ul>

**Table A-25 3000 W Power Supply Specifications (continued)**

Specification	Description
Power supply output	<ul style="list-style-type: none"> <li>• 100/120 VAC operation               <ul style="list-style-type: none"> <li>- 25.0 A @ +3.3 V</li> <li>- 5 A @ +5 V</li> <li>- 12 A @ +12 V</li> <li>- 27.89 A @ +42 V</li> </ul> </li> <li>• 200/240 VAC operation               <ul style="list-style-type: none"> <li>- 25.0 A @ +3.3 V</li> <li>- 5 A @ +5 V</li> <li>- 12 A @ +12 V</li> <li>- 65.98 A @ +42 V</li> </ul> </li> </ul>
Front panel power connector	A two-pin male Molex connector is located in the lower right corner of the power supply front panel. The connector provides 42 VDC at a maximum of 17 A. This connector provides power to the WS-6509-NEB-UPGRD kit fan assembly through a power harness also provided in the kit. A hinged protective flap secured by a captive screw covers the connector when it is not in use.
Output holdup time	20 ms minimum
kVA rating <sup>1</sup>	3520 W (total input power) or 3.6 KVA (high-line operation)
Heat dissipation	12,046 BTU/hour (approx.)
Weight	15.8 lb (7.2 kg)

1. The kVA rating listed for the power supply should be used as the sizing criteria for both UPS outputs as well as standard circuits and transformers to power a switch.

Table A-26 lists the power supply LEDs and their meanings.

**Table A-26 3000 W AC-Input Power Supply LEDs**

<b>LED</b>	<b>Meaning</b>
INPUT OK	<ul style="list-style-type: none"> <li>• Green—Source AC voltage is OK. (Input voltage is 85 VAC or greater.)</li> <li>• Off—Source AC voltage falls below 70 VAC, is not present, or the power supply is turned off.</li> </ul>
FAN OK	<ul style="list-style-type: none"> <li>• Green—Power supply fan is operating properly.</li> <li>• Off—Power supply fan failure is detected.</li> </ul>
OUTPUT FAIL	<ul style="list-style-type: none"> <li>• Red—Problem with one or more of the DC-output voltages of the power supply.</li> <li>• Off—DC-output voltages within acceptable margins.</li> </ul> <p><b>Note</b> For proper operation of the OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>
42V OK	<ul style="list-style-type: none"> <li>• Green—42 VDC is present at the fan power connector.</li> <li>• Off—42 VDC is not present at the fan power connector.</li> </ul>

## 3000 W Power Supply AC Power Cords

Table A-27 lists the specifications for the AC power cords that are available for the 3000 W AC-input power supply. The table includes references to power cord illustrations.

**Note**

All 3000 W power supply power cords are 14 feet (4.3 meters) in length.

**Note**

All 3000 W power supply power cords have an IEC60320/C19 appliance connector at one end.

**Table A-27** 3000 W Power Supply AC Power Cords

Locale	Power Cord Part Number	AC Source Plug Type	Cordset Rating	Power Cord Reference Illustration
Argentina	CAB-7513ACR= or CAB-IR2073-C19-AR=	IRAM 2073	16 A, 250 VAC	<a href="#">Figure A-31</a>
Australia, New Zealand	CAB-AC-16A-AUS=	AU20S3	16 A, 250 VAC	<a href="#">Figure A-46</a>
People's Republic of China	CAB-AC16A-CH=	GB16C	16 A, 250 VAC	<a href="#">Figure A-37</a>
Continental Europe	CAB-AC-2500W-EU=	CEE 7/7	16 A, 250 VAC	<a href="#">Figure A-41</a>
International	CAB-AC-2500W-INT=	IEC 309	16 A, 250 VAC	<a href="#">Figure A-42</a>
Israel	CAB-AC-2500W-ISRL=	SI16S3	16 A, 250 VAC	<a href="#">Figure A-34</a>
Italy	CAB-7513ACI=	CEI 23-16/7	16 A, 250 VAC	<a href="#">Figure A-35</a>
Japan, North America (nonlocking plug) 200–240 VAC operation	CAB-AC-2500W-US1=	NEMA 6-20	16 A, 250 VAC	<a href="#">Figure A-43</a>
Japan, North America (locking plug) 200–240 VAC operation	CAB-AC-C6K-TWLK=	NEMA L6-20	16 A, 250 VAC	<a href="#">Figure A-44</a>
Japan, North America 100–120 VAC operation <sup>1</sup>	CAB-7513AC=	NEMA 5-20	20 A, 125 VAC	<a href="#">Figure A-36</a>
Power Distribution Unit (PDU) <sup>2</sup>	CAB-C19-CBN=	IEC 60320 C19 IEC 60320 C20	16 A, 250 VAC	<a href="#">Figure A-47</a>
Switzerland	CAB-ACS-16=	SEV 5934-2 Type 23	16 A, 250 VAC	<a href="#">Figure A-45</a>

1. The 3000 W power supply operating on 110 VAC delivers 1400 W.
2. The PDU power cable is designed for users who power their switch from a PDU. The end of the cable that plugs into the chassis power supply has a C19 connector; the other end of the cable that connects to the PDU has a C20 connector.

## 4000 W AC-Input and DC-Input Power Supplies

The 4000 W AC-input and DC-input power supplies, (WS-CAC-4000W-US, WS-CAC-4000W-INT, and PWR-4000-DC) are supported in the following Catalyst 6500 series switches:

- Catalyst 6506
- Catalyst 6506-E
- Catalyst 6509
- Catalyst 6509-E
- Catalyst 6509-NEB
- Catalyst 6509-NEB-A
- Catalyst 6509-V-E
- Catalyst 6513
- Catalyst 6513-E

The 4000 W AC-input and DC-input power supplies, shown in [Figure A-14](#) and [Figure A-15](#), share the same form factor as the 1000 W, 1300 W, 2500 W, and 3000 W power supplies.

**Figure A-14** 4000 W AC-Input Power Supply

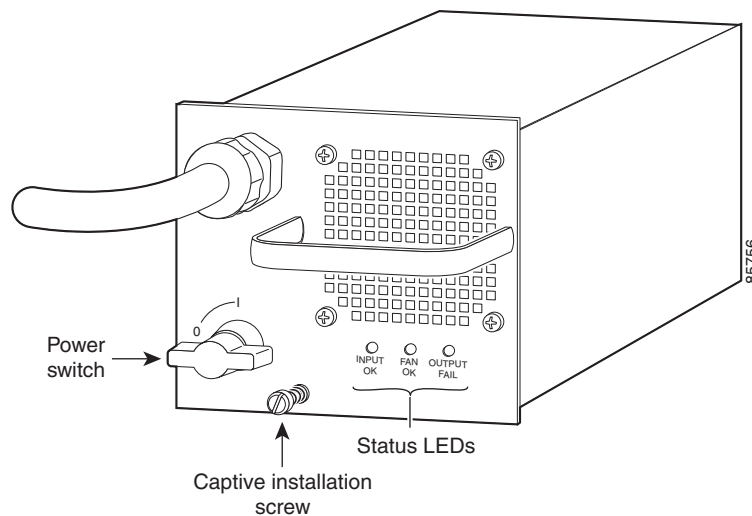
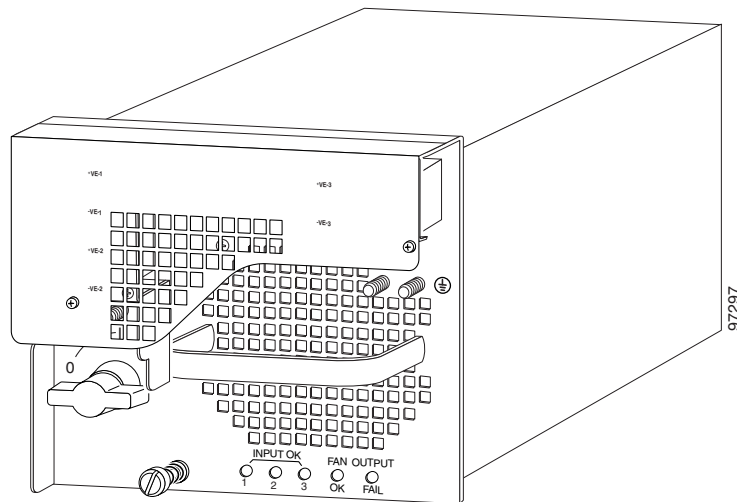


Figure A-15 4000 W DC-Input Power Supply



## 4000 W Power Supply Specifications

Table A-29 lists the specifications for the 4000 W AC-input power supply.

Table A-28 4000 W AC-Input Power Supply Specifications

Specification	Description
AC-input type	High-line input with power factor correction (PFC). <b>Note</b> Power factor correction is a standard feature on all Catalyst 6500 series AC-input power supplies. PFC reduces the reactive component in the source AC current allowing higher power factors (typically 99 percent or better) and lower harmonic current components.
AC-input voltage	High-line (230 VAC nominal)—170 VAC (min) to 264 VAC (max)
AC-input current	23 A
AC-input frequency	50/60 Hz (nominal) ( $\pm 3\%$ for full range)



**Table A-28** 4000 W AC-Input Power Supply Specifications (continued)

Specification	Description
Branch circuit requirement	<p>Each chassis power supply should have its own dedicated, fused-branch circuit:</p> <ul style="list-style-type: none"> <li>• For North America—30 A</li> <li>• For International—Circuits should be sized according to local and national codes</li> <li>• All AC power supply inputs are fully isolated. <ul style="list-style-type: none"> <li>– Source AC can be out of phase between multiple power supplies in the same chassis, which means that PS1 can be operating from phase A and PS2 can be operating from phase B.</li> <li>– For high-line operation, the power supply operates with the hot conductor wired to a source AC phase and the neutral conductor wired either to ground or to another source AC phase as long as the net input voltage is in the range of 170 to 264 VAC.</li> <li>– Source AC can be out of phase between AC inputs on power supplies that are equipped with multiple AC inputs, which means that power cord 1 can be plugged into phase A and power cord 2 can be plugged into phase B.</li> </ul> </li> </ul>
Output capacity	4000 W maximum
Power supply output	<ul style="list-style-type: none"> <li>• 15 A @ +3.3 VDC</li> <li>• 5 A @ +5 VDC</li> <li>• 10 A @ +12 VDC</li> <li>• 90.36 A @ +42 VDC</li> </ul>
Output holdup time	20 ms minimum
kVA rating <sup>1</sup>	5.4 kVA maximum
Heat dissipation	17,065 BTU/hour (approx.)
Weight	22.2 lb (10.1 kg)

1. The kVA rating listed for the power supply should be used as the sizing criteria for both UPS outputs as well as standard circuits and transformers to power a switch.

Table A-29 list the specification for the 4000 W DC-input power supply.

**Table A-29** 4000 W DC-Input Power Supply Specifications

Specification	Description
DC-input voltage	<ul style="list-style-type: none"> <li>–48 VDC @ 37 A for nominal –48 V battery backup system (operating range: –40.5 VDC to –56 VDC)</li> <li>–60 VDC @ 29 A for nominal –60 V battery backup system (operating range: –55 VDC to –72 VDC)</li> </ul> <p><b>Note</b> The 4000 W DC-input power supply requires two source DC-inputs to be connected; it cannot operate with only one positive (+)/negative (-) source DC terminal pair installed.</p>
DC-input current	<p>40 A per each DC input (three inputs)</p> <p><b>Note</b> For multiple DC input power supplies, each DC input must be protected by a dedicated circuit breaker or a fuse. The circuit breaker or the fuse must be sized according to the power supply input power rating and any local or national electrical code requirements.</p>
Power supply output capacity	<ul style="list-style-type: none"> <li>4000 W with three inputs active</li> <li>2700 W with two inputs active</li> </ul> <p><b>Note</b> The 4000 W power supply cannot operate with only one source DC-input connected.</p>
Power supply output	<ul style="list-style-type: none"> <li>15 A @ + 3.3 VDC</li> <li>5 A @ + 5 VDC</li> <li>12 A @ +12 VDC</li> <li>90.63 A (three inputs) or 59.68 A (two inputs) @ +42 VDC</li> </ul> <p><b>Note</b> The 4000 W power supply cannot operate with only one source DC-input connected.</p>
DC input terminal block	Accepts 4 AWG copper conductors. Actual size of the wire needed is determined by the installer or local electrician.
Output holdup time	8 ms
kVA rating <sup>1</sup>	5.4 kVA maximum
Heat dissipation	17,730 BTU/hour (approx.)
Weight	30.8 lb (14.0 kg)

1. The kVA rating listed for the power supply should be used as the sizing criteria for both UPS outputs as well as standard circuits and transformers to power a switch.

Table A-30 lists the power supply LEDs and their meanings.

**Table A-30** 4000 W AC-Input and DC-Input Power Supplies LEDs

LED	Meaning
INPUT OK	<p>AC-input power supplies:</p> <ul style="list-style-type: none"> <li>• Green—Source AC voltage is OK. (Input voltage is 85 VAC or greater.)</li> <li>• Off—Source AC voltage falls below 70 VAC, is not present, or the power supply is turned off.</li> </ul> <p>DC-input power supplies:</p> <ul style="list-style-type: none"> <li>• Green—Source DC voltage is OK. (Input voltage is –40.5 VDC or greater.)</li> <li>• Off—Source DC voltage falls below –33 VDC, is not present, or the power supply is turned off.</li> </ul>
FAN OK	<ul style="list-style-type: none"> <li>• Green—Power supply fan is operating properly.</li> <li>• Off—Power supply fan failure is detected.</li> </ul>
OUTPUT FAIL	<ul style="list-style-type: none"> <li>• Red—Problem with one or more of the DC-output voltages of the power supply.</li> <li>• Off—DC-output voltages within acceptable margins.</li> </ul> <p><b>Note</b> For proper operation of the OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

## 4000 W Power Supply AC Power Cords

Table A-31 lists the specifications for the AC power cords that are available for the 4000 W AC-input power supply. Included in the table are references to illustrations of the power cords.


**Note**

The AC power cords for the 4000 W AC-input power supply are hardwired directly to the power supply; they do not have an IEC 60320 C19 appliance plug and cannot be removed from the power supply.

**Table A-31** 4000 W Power Supply AC Power Cords

Locale	Power Cord Part Number <sup>1</sup>	AC Source Plug Type	Cordset Rating	Power Cord Reference Illustration
International	WS-CAC-4000W-INT=	IEC 60309	32 A, 250 VAC	<a href="#">Figure A-48</a>
North America, Japan	WS-CAC-4000W-US=	NEMA L6-30 <sup>2</sup>	30 A, 250 VAC	<a href="#">Figure A-49</a>

1. This is the part number for the power supply. The AC power cords are hardwired to the 4000 W power supplies.
2. For Japan, ask your local electrical contractor to prepare the NEMA L6-30 power plug.

## 6000 W AC-Input and DC-Input Power Supplies

Catalyst 6500 series switch support for the 6000 W AC-input (WS-CAC-6000W) and the 6000 W DC-input (PWR-6000-DC) power supplies along with any power supply output restrictions are listed in [Table A-32](#).

**Table A-32** Chassis Support for the 6000 W AC-Input and DC-Input Power Supplies

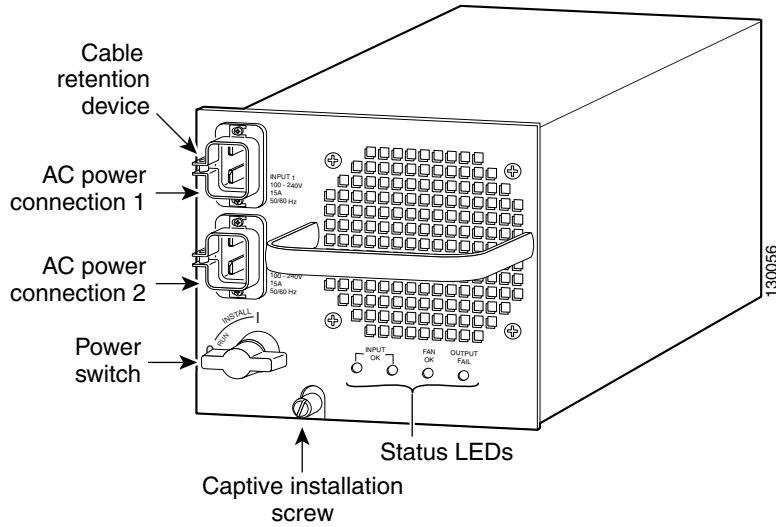
Catalyst 6500 Series Chassis	6000 W AC-Input Power Supply Restriction	6000 W DC-Input Power Supply Restriction
Catalyst 6506	Output limited to 4000 W	Output limited to 4000 W
Catalyst 6506-E	No restrictions	No restrictions
Catalyst 6509	Output limited to 4000 W	Output limited to 4000 W
Catalyst 6509-E	No restrictions	No restrictions
Catalyst 6509-NEB	Output limited to 4000 W	Output limited to 4000 W
Catalyst 6509-NEB-A	Output limited to 4500 W	Output limited to 4500 W
Catalyst 6509-V-E	No restrictions	No restrictions
Catalyst 6513	No restrictions	No restrictions
Catalyst 6513-E	No restrictions	No restrictions

The 6000 W AC-input power supply, shown in [Figure A-16](#), and the 6000 W DC-input power supply, shown in [Figure A-17](#), share the same form factor as the 1000 W, 1300 W, 2500 W, 3000 W, and 4000 W power supplies.

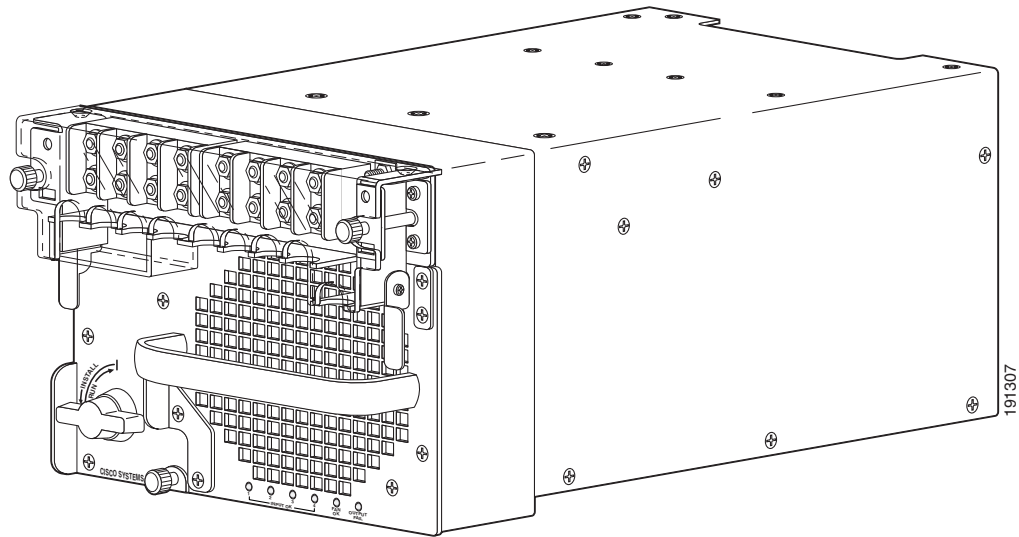
  
**Note**

Because of form-factor differences, the 6000 W AC-input and the 6000 W DC-input power supplies cannot be installed in the Catalyst 6503, Catalyst 6503-E, and Catalyst 6504-E switch chassis.

**Figure A-16 6000 W AC-Input Power Supply**



**Figure A-17 6000 W DC-Input Power Supply**



## 6000 W Power Supply Specifications

Table A-34 lists the specifications for the 6000 W AC-input power supply.

**Table A-33** 6000 W AC-Input Power Supply Specifications

Specification	Description
AC-input type	<p>2 AC-inputs per power supply. High-line input with power factor correction (PFC) included.</p> <p><b>Note</b> Power factor correction is a standard feature on all Catalyst 6500 series AC-input power supplies. PFC reduces the reactive component in the source AC current allowing higher power factors (typically 99 percent or better) and lower harmonic current components.</p>
AC-input voltage	<ul style="list-style-type: none"> <li>• Low-line (120 VAC nominal)—90 VAC (min) to 132 VAC (max)</li> <li>• High-line (230 VAC nominal)—170 VAC (min) to 264 VAC (max)</li> </ul>
AC-input current	16 A each input
AC-input frequency	50/60 Hz (nominal) ( $\pm 3\%$ for full range)

**Table A-33** 6000 W AC-Input Power Supply Specifications (continued)

Specification	Description
Branch circuit requirement	<p>Each power supply input should have its own dedicated, fused-branch circuit:</p> <ul style="list-style-type: none"> <li>• For North America—20 A</li> <li>• For International—Circuits should be sized according to local and national codes</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC.</li> <li>• All AC power supply inputs are fully isolated. <ul style="list-style-type: none"> <li>– Source AC can be out of phase between multiple power supplies in the same chassis, which means that PS1 can be operating from phase A and PS2 can be operating from phase B.</li> <li>– For high-line operation, the power supply operates with the hot conductor wired to a source AC phase and the neutral conductor wired either to ground or to another source AC phase as long as the net input voltage is in the range of 170 to 264 VAC.</li> <li>– Source AC can be out of phase between AC inputs on power supplies that are equipped with multiple AC inputs, which means that power cord 1 can be plugged into phase A and power cord 2 can be plugged into phase B.</li> </ul> </li> </ul>

Table A-33 6000 W AC-Input Power Supply Specifications (continued)

Specification	Description
Power supply output capacity	<p>The 6000 W power supply can operate at either 2900 W or 6000 W depending on the number of AC power cords attached and the source AC voltage.</p> <p><b>Note</b> The 6000 W AC-input power supply is limited to 4000 W maximum output when it is installed in a Catalyst 6506, Catalyst 6509, or Catalyst 6509-NEB switch chassis. The power supply is limited to 4500 W maximum output when it is installed in the Catalyst 6509-NEB-A switch chassis.</p> <ul style="list-style-type: none"> <li>• 2900 W maximum with the following source AC arrangements: <ul style="list-style-type: none"> <li>– INPUT 1 and INPUT 2 both connected to low-line (120 VAC nominal)</li> <li>– INPUT 1 connected to high-line (230 VAC nominal); INPUT 2 not connected</li> <li>– INPUT 1 not connected; INPUT 2 connected to high-line (230 VAC nominal)</li> <li>– INPUT 1 connected to high-line (230 VAC nominal); INPUT 2 connected to low-line (120 VAC nominal)</li> <li>– INPUT 1 connected to low-line (120 VAC nominal); INPUT 2 connected to high-line (230 VAC nominal)</li> </ul> </li> <li>• 6000 W maximum with the following source AC arrangements: <ul style="list-style-type: none"> <li>– INPUT 1 and INPUT 2 both connected to high-line (230 VAC nominal)</li> </ul> </li> </ul> <p><b>Note</b> The 6000 W power supply will not power up if you have only one power cord plugged into either INPUT 1 or INPUT 2 and source AC is low-line (120 VAC nominal).</p>



**Table A-33** 6000 W AC-Input Power Supply Specifications (continued)

Specification	Description
Power supply output capacity	<ul style="list-style-type: none"> <li>• 2900 W operation (one 220 VAC source or two 110 VAC sources) <ul style="list-style-type: none"> <li>– 25 A @ +3.3 VDC</li> <li>– 12 A @ +12 VDC</li> <li>– 63.6 A @ +42 VDC</li> </ul> </li> <li>• 6000 W operation (two 220 VAC sources) <ul style="list-style-type: none"> <li>– 25 A @ +3.3 VDC</li> <li>– 12 A @ +12 VDC</li> <li>– 137.4 A @ +42 VDC</li> </ul> </li> </ul>
Output holdup time	20 ms minimum
kVA rating <sup>1</sup>	7.5 kVA
Heat dissipation	23,812 BTU/hour (approx.)
System power dissipation	7034 W
Weight	25.4 lb (11.5 kg)

1. The kVA rating listed for the power supply should be used as the sizing criteria for both UPS outputs as well as standard circuits and transformers to power a switch.

Table A-34 list the specifications for the 6000 W DC-input power supply.

**Table A-34** 6000 W DC-Input Power Supply Specifications

Specification	Description
Input voltage	<ul style="list-style-type: none"> <li>• –48 VDC nominal @ 37 A in North America (operating range: –40.5 VDC to –56 VDC)</li> <li>• –60 VDC nominal @ 30 A for international (operating range: –55 VDC to –72 VDC)</li> </ul>
Input current	40 A per DC input @ –48 VDC input voltage (total of 4 inputs)
Power supply output capacity	<p>The 6000 W DC-input power supply can operate at either:</p> <ul style="list-style-type: none"> <li>• 2800 W—2 DC inputs active</li> <li>• 4500 W—3 DC inputs active</li> <li>• 6000 W—4 DC inputs active</li> </ul>

**Table A-34** 6000 W DC-Input Power Supply Specifications (continued)

Specification	Description
Power supply output	<p>The 6000 W DC-input power supply can operate at either 2800 W, 4500 W, or 6000 W depending on the number of source DC power cables attached.</p> <p><b>Note</b> The 6000 W DC-input power supply is limited to 4000 W maximum output when it is installed in a Catalyst 6506, Catalyst 6509, or Catalyst 6509-NEB switch chassis. The power supply is limited to 4500 W maximum output when it is installed in the Catalyst 6509-NEB-A switch chassis.</p> <ul style="list-style-type: none"> <li>• 2800 W operation (two DC inputs) <ul style="list-style-type: none"> <li>– 25.0 A @ 3.3 VDC</li> <li>– 12.0 A @ 12 VDC</li> <li>– 61.2 A @ 42 VDC</li> </ul> </li> <li>• 4500 W operation (three DC inputs) <ul style="list-style-type: none"> <li>– 25.0 A @ 3.3 VDC</li> <li>– 12.0 A @ 12 VDC</li> <li>– 101.9 A @ 42 VDC</li> </ul> </li> <li>• 6000 W operation (four DC inputs) <ul style="list-style-type: none"> <li>– 25.0 A @ 3.3 VDC</li> <li>– 12.0 A @ 12 VDC</li> <li>– 137.4 A @ 42 VDC</li> </ul> </li> </ul>
DC input terminal block	<ul style="list-style-type: none"> <li>• Accepts 2-hole copper compression-type lugs.</li> </ul> <p><b>Note</b> The actual size of the wire needed is determined by the power engineer or local electrician in accordance with national or local electrical codes.</p> <ul style="list-style-type: none"> <li>• Terminal posts accept 1/4-inch-20 hex nuts.</li> </ul>
Output holdup time	20 ms minimum
Weight	35 lbs (16 kg)

Table A-35 list the 6000 W AC-input and DC-input power supply LEDs and their meanings.

**Table A-35** 6000 W AC-Input and DC-Input Power Supply LEDs

LED	Meaning
INPUT OK 1, INPUT OK 2 (AC-input power supply only)	<ul style="list-style-type: none"> <li>Green—Source voltage is OK. Input voltage is 85 VAC or greater.</li> <li>Off—Source AC voltage falls below 70 VAC, is not present, or the power supply is turned off.</li> </ul>
INPUT OK 1, INPUT OK 2, INPUT OK 3, and INPUT OK 4 (DC-input power supply only)	<ul style="list-style-type: none"> <li>Green—Source DC voltage is greater than or equal to –40.5 VDC.</li> <li>Off—Source DC voltage is less than or equal to –37.5 VDC.</li> <li>Green, off, or flashing—Source DC voltage is between –37.5 and –40.5 VDC.</li> </ul>
FAN OK	<ul style="list-style-type: none"> <li>Green—Power supply fan is operating properly.</li> <li>Off—Power supply fan failure is detected.</li> </ul>
OUTPUT FAIL	<ul style="list-style-type: none"> <li>Red—Problem with one or more of the DC-output voltages of the power supply.</li> <li>Off—DC-output voltages within acceptable margins.</li> </ul> <p><b>Note</b> For proper operation of the OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

## 6000 W Power Supply AC Power Cords

Table A-36 lists the specifications for the AC power cords that are available for the 6000 W AC-input power supply. Included in the table are references to illustrations of the power cords.

**Table A-36** 6000 W Power Supply AC Power Cords

Locale	Power Cord Part Number	AC Source Plug Type	Cordset Rating	Power Cord Reference Illustration
Argentina	CAB-7513ACR= or CAB-IR2073-C19-AR=	IRAM 2073	16 A, 250 VAC	<a href="#">Figure A-31</a>
Australia, New Zealand	CAB-AC-16A-AUS=	AU20S3	16 A, 250 VAC	<a href="#">Figure A-46</a>
People's Republic of China	CAB-AC16A-CH=	GB16C	16 A, 250 VAC	<a href="#">Figure A-37</a>
Continental Europe	CAB-AC-2500W-EU=	CEE 7/7	16 A, 250 VAC	<a href="#">Figure A-41</a>
International	CAB-AC-2500W-INT=	IEC 309	16 A, 250 VAC	<a href="#">Figure A-42</a>
Israel	CAB-AC-2500W-ISRL=	SI16S3	16 A, 250 VAC	<a href="#">Figure A-34</a>
Italy	CAB-7513ACI=	CEI 23-16/7	16 A, 250 VAC	<a href="#">Figure A-35</a>

**Table A-36** 6000 W Power Supply AC Power Cords (continued)

Locale	Power Cord Part Number	AC Source Plug Type	Cordset Rating	Power Cord Reference Illustration
Japan, North America (nonlocking plug) 200–240 VAC operation	CAB-AC-2500W-US1=	NEMA 6-20	16 A, 250 VAC	<a href="#">Figure A-43</a>
Japan, North America (locking plug) 200–240 VAC operation	CAB-AC-C6K-TWLK=	NEMA L6-20	16 A, 250 VAC	<a href="#">Figure A-44</a>
Japan, North America 100–120 VAC operation <sup>1</sup>	CAB-7513AC= <sup>2</sup>	NEMA 5-20	16 A, 125 VAC	<a href="#">Figure A-36</a>
Power Distribution Unit (PDU) <sup>3</sup>	CAB-C19-CBN=	IEC 60320 C19 IEC 60320 C20	16 A, 250 VAC	<a href="#">Figure A-47</a>
Switzerland	CAB-ACS-16=	SEV 5934-2 Type 23	16 A, 250 VAC	<a href="#">Figure A-45</a>

1. The 6000 W power supply operating on two 110 VAC inputs delivers 2900 W.
2. When operating with 100–120 VAC, you must use two AC power cords and the power supply output is limited to 2900 W.
3. The PDU power cable is designed for users who power their switch from a PDU. The end of the cable that plugs into the chassis power supply has a C19 connector; the other end of the cable that connects to the PDU has a C20 connector.

## 8700 W AC-Input Power Supply

Catalyst 6500 series switch support for the 8700 W AC-input (WS-CAC-8700W-E) power supply along with any power supply output restrictions are listed in [Table A-37](#).

**Table A-37** Chassis Support for the 8700 W Power Supply

Catalyst 6500 Series Chassis	8700 W Power Supply Restriction
Catalyst 6506	Output limited to 4000 W
Catalyst 6506-E	No restrictions
Catalyst 6509	Output limited to 4000 W
Catalyst 6509-E	No restrictions
Catalyst 6509-NEB	Output limited to 4000 W
Catalyst 6509-NEB-A	Output limited to 4500 W
Catalyst 6509-V-E	No restrictions
Catalyst 6513	Output is limited to 6000 W
Catalyst 6513-E	No restrictions

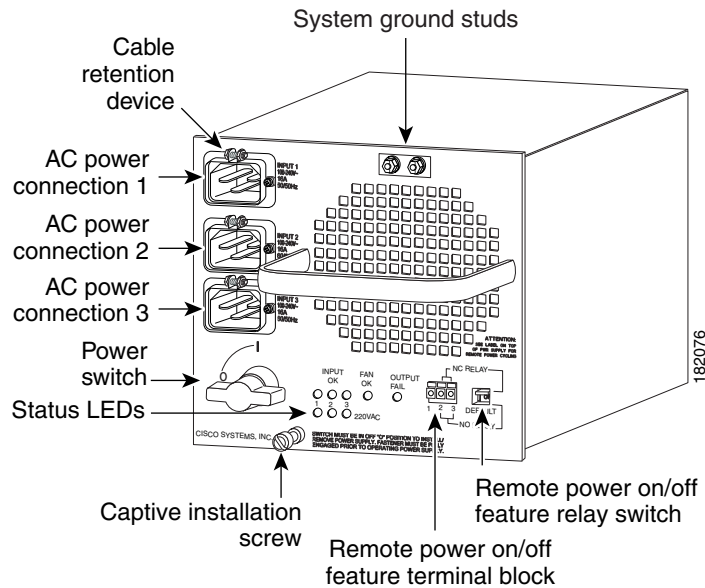
The 8700 W AC-input power supply, shown in [Figure A-18](#), shares a similar, but not identical, form-factor as the 1000 W, 1300 W, 2500 W, 3000 W, 4000 W, and 6000 W power supplies.

**Note**

Because of the form-factor difference, when you install an 8700 W power supply in a Catalyst 6506, Catalyst 6509, or Catalyst 6509-NEB chassis you must relocate the system ground connection from the chassis ground pad connection to the two system ground studs located on the 8700 W power supply faceplate. Installing an 8700 W power supply in the other Catalyst 6500 series chassis does not require that you move the chassis system ground connection to the power supply.

The 8700 W power supply cannot be installed in the Catalyst 6503, Catalyst 6503-E, and Catalyst 6504-E switch chassis.

**Figure A-18** 8700 W AC-Input Power Supply



## 8700 W Power Supply Specifications

Table A-38 lists the specifications for the 8700 W AC-input power supply.

**Table A-38** 8700 W AC-Input Power Supply Specifications

Specification	Description
AC-input type	3 AC-inputs per power supply. High-line input with power factor correction (PFC) included.  <b>Note</b> Power factor correction is a standard feature on all Catalyst 6500 series AC-input power supplies. PFC reduces the reactive component in the source AC current allowing higher power factors (typically 99 percent or better) and lower harmonic current components.
AC-input voltage (One-phase)	<ul style="list-style-type: none"> <li>Low-line (120 VAC nominal)—90 VAC (min) to 132 VAC (max)</li> <li>High-line (230 VAC nominal)—170 VAC (min) to 264 VAC (max)</li> </ul>

**Table A-38** 8700 W AC-Input Power Supply Specifications (continued)

Specification	Description
AC-input current	16 A each input
AC-input frequency	50/60 Hz (nominal) ( $\pm 3\%$ for full range)
Branch circuit requirement	<p>Each power supply input should have its own dedicated, fused-branch circuit:</p> <ul style="list-style-type: none"> <li>• For North America—20 A</li> <li>• For International—Circuits should be sized according to local and national codes</li> <li>• All Catalyst 6500 series AC-input power supplies require single-phase source AC.</li> <li>• All AC power supply inputs are fully isolated. This means that source AC can be out of phase between multiple AC inputs on the same power supply or different AC power supplies that are installed in the same chassis. For the 8700 W power supply, this means that power cord 1 can be plugged into phases A-B, power cord 2 can be plugged into phases B-C, and power cord 3 can be plugged into phases C-A, A-B, or B-C.</li> </ul>

**Table A-38 8700 W AC-Input Power Supply Specifications (continued)**

Specification	Description
Power supply output capacity	<p>The power supply output capacity is dependent on the number of AC power cords (1, 2, or 3) attached and the source AC voltage (110 VAC [low-line] or 220 VAC [high-line]) applied to the power supply inputs.</p> <p>The 8700 W AC-input power supply is limited to reduced wattage ratings when it is installed in the following Catalyst 6500 series chassis:</p> <ul style="list-style-type: none"> <li>• 4000 W maximum output when it is installed in a Catalyst 6506, Catalyst 6509, or Catalyst 6509-NEB switch chassis.</li> <li>• 4500 W maximum output when it is installed in the Catalyst 6509-NEB-A switch chassis.</li> <li>• 6000 W maximum output when it is installed in the Catalyst 6513 switch chassis.</li> </ul> <p><b>Note</b> The power supply will not power up if you attach only one power cord and the power cord is connected to low-line (110 VAC nominal) source AC.</p>
2800 W operation	<p>2800 W maximum with the following combinations of power cords and source AC voltage applied to the power supply inputs:</p> <ul style="list-style-type: none"> <li>• Two AC inputs are connected to low-line (110 VAC nominal); the third AC input is not connected.</li> <li>• One AC input is connected to low-line (110 VAC nominal); one AC input is connected to high-line (220 VAC nominal); the third AC input is not connected.</li> <li>• One AC input is connected to high-line (220 VAC nominal); two AC inputs are not connected.</li> </ul>
4200 W operation	<p>4200 W maximum with the following combinations of power cords and source AC voltage applied to the power supply inputs:</p> <ul style="list-style-type: none"> <li>• All three AC inputs are connected to low-line (110 VAC nominal).</li> <li>• Two AC inputs are connected to low-line (110 VAC nominal); one AC input is connected to high-line (220 VAC nominal).</li> </ul>
5800 W operation	<p>5800 W maximum with the following combinations of power cords and source AC voltage applied to the power supply inputs:</p> <ul style="list-style-type: none"> <li>• Two AC inputs are connected to high-line (220 VAC nominal); the third AC input is connected to low-line (110 VAC nominal).</li> <li>• Two AC inputs are connected to high-line (220 VAC nominal); the third AC input is not connected.</li> </ul>
8700 W operation	<p>8700 W maximum with the following combinations of power cords and source AC voltage applied to the power supply inputs:</p> <ul style="list-style-type: none"> <li>• All three AC inputs are connected to high-line (220 VAC nominal).</li> </ul>

**Table A-38** 8700 W AC-Input Power Supply Specifications (continued)

Specification	Description
Power supply output	<ul style="list-style-type: none"> <li>• 2800 W operation <ul style="list-style-type: none"> <li>– 25.0 A @ +3.3 VDC</li> <li>– 12.0 A @ +12 VDC</li> <li>– 61.29 A @ +42 VDC</li> </ul> </li> <li>• 4200 W operation <ul style="list-style-type: none"> <li>– 25.0 A @ +3.3 VDC</li> <li>– 12.0 A @ +12 VDC</li> <li>– 94.62 A @ +42 VDC</li> </ul> </li> <li>• 5800 W operation <ul style="list-style-type: none"> <li>– 25.0 A @ +3.3 VDC</li> <li>– 12.0 A @ +12 VDC</li> <li>– 132.71 A @ +42 VDC</li> </ul> </li> <li>• 8700 W operation <ul style="list-style-type: none"> <li>– 25.0 A @ +3.3 VDC</li> <li>– 12.0 A @ +12 VDC</li> <li>– 201.75 A @ +42 VDC</li> </ul> </li> </ul>
Output holdup time	20 ms minimum
kVA rating <sup>1</sup>	10.4 kVA
Heat dissipation	<ul style="list-style-type: none"> <li>• 11,200 BTU/hour @ 2800 W</li> <li>• 16,800 BTU/hour @ 4200 W</li> <li>• 23,200 BTU/hour @ 5800 W</li> <li>• 34,800 BTU/hour @ 8700 W</li> </ul>
System power dissipation	10,360 W
Weight	39.7 lb (18 kg)

1. The kVA rating listed for the power supply should be used as the sizing criteria for both UPS outputs as well as standard circuits and transformers to power a switch.

Table A-39 lists the power supply LEDs and their meanings.



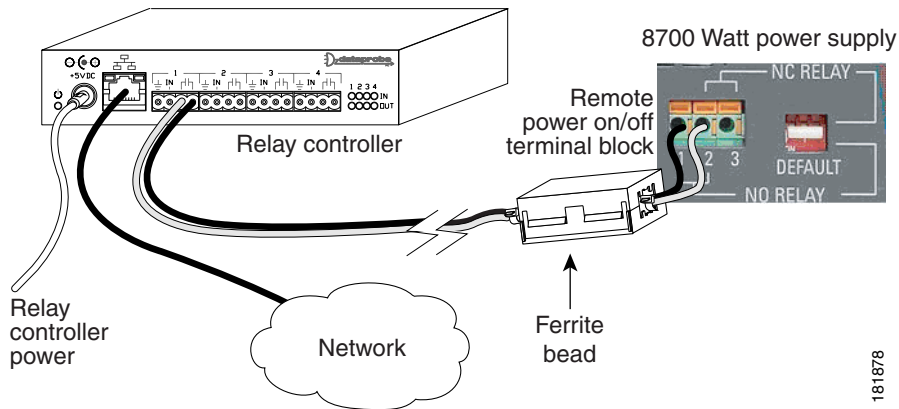
**Table A-39** 8700 W AC-Input Power Supply LEDs

LED	Meaning
INPUT OK 1, INPUT OK 2, and INPUT OK 3	<ul style="list-style-type: none"> <li>• Green—Source voltage is OK. (Input voltage is 85 VAC or greater.)</li> <li>• Off—Source AC voltage falls below 70 VAC, is not present, or the power supply is turned off.</li> </ul>
220VAC 1, 2, and 3	<ul style="list-style-type: none"> <li>• Green—High-line AC is present on the respective AC inputs. (Input voltage is 170 VAC or higher.)</li> <li>• Off—Source AC voltage falls below 170 VAC (running at low-line voltage), is not present, or the power supply is turned off.</li> </ul>
FAN OK	<ul style="list-style-type: none"> <li>• Green—Power supply fan is operating properly.</li> <li>• Off—Power supply fan failure is detected.</li> </ul>
OUTPUT FAIL	<ul style="list-style-type: none"> <li>• Red—One or more of the power supply DC-output voltages is out of the normal operating range: <ul style="list-style-type: none"> <li>– For +3.3 VDC output: 2.7–3.0 VDC (min); 3.6–3.8 VDC (max)</li> <li>– For +12 VDC output: 10.5–11.5 VDC (min); 12.6–13.0 VDC (max)</li> <li>– For +42 VDC output: 38.0–40.0 VDC (min); 45.0–52.0 VDC (max)</li> </ul> </li> <li>• Off—All DC-output voltages are within normal operating ranges.</li> </ul> <p><b>Note</b> For proper operation of the OUTPUT FAIL LED, systems with single power supplies must be configured with a minimum of one fan tray and one supervisor engine. Systems with dual power supplies must have a minimum configuration of one fan tray, one supervisor engine, and one additional module. Failure to meet these minimum configuration requirements can cause a false power supply output fail signal.</p>

## Remote Power Cycling Feature

The 8700 W power supply is equipped with a remote power cycling feature that allows you to remotely turn on or turn off the power supply through an external relay controller box. [Figure A-19](#) shows a typical remote power on/off setup. A three-position terminal block and a switch, located on the lower right quadrant of the power supply faceplate (see [Figure A-18](#)), provide the interface to the external relay controller box.

**Figure A-19 Remote Power On/Off Feature Components**



### Terminal Block

The terminal block has three contacts labeled 1, 2, and 3. Two control wires from an external relay controller box attach to either positions 1 and 2 or positions 2 and 3. Positions 1 and 2 are used when the relay controller box contains a normally-open (NO) type of relay. Positions 2 and 3 are used when the relay controller box contains a normally-closed (NC) type of relay.

### Relay Controller Box Switch

The relay controller box switch, located next to the terminal block, allows you to match the power supply power control signal's active state with the type of relay contained in the external relay controller box (either a normally-open type of relay or a normally-closed type of relay).

### Ferrite Bead

A plastic bag containing one ferrite bead and two 4-inch plastic ties is included with the 8700 W power supply AC power cords. The ferrite bead is a passive device that limits high-frequency interference on interface and control cables, and is only required when you install the remote power-cycling feature that is supported by the 8700 Watt power supply. The ferrite bead is installed on the two control wires that come from the relay controller box to the terminal block on the 8700 W power supply. The ferrite bead should be installed as close as possible to the power supply terminal block for the bead to be effective. You do not need the ferrite bead for 8700 Watt power supply installations that do not include the remote power-cycling feature. If you need to install the ferrite bead, refer to [“Installing the Ferrite Bead” procedure on page 1-100](#).

## Remote Power-Cycling Operation

This feature allows you to remotely power cycle the Catalyst 6500 series switch using any appropriate third-party relay controller. This eliminates the need for you to have access to the supervisor engine console or CLI to control power cycling. [Table A-40](#) lists the relay controller box relay type, the corresponding power supply terminal block positions, and a description of the power-cycling operation.

**Table A-40** 8700 W Power Supply Relay Controller Switch Settings and Operation

External Relay Controller Box Relay Type	Power Supply Relay Controller Switch Setting	Power Supply Terminal Block Positions Used	Remote Power-Cycling Operation
Normally open (NO) relay.	NO RELAY (DEFAULT)	Control wires from the external relay controller box attach to terminal block positions 1 and 2.	<ul style="list-style-type: none"> <li>Power supply cycled from on to off—The power supply is powered off by energizing the relay (relay contacts go from open to closed) for more than 30 seconds.</li> <li>Power supply cycled from off to on—The power supply is powered on by deenergizing the relay (relay contacts go from closed to open) for more than 10 seconds.</li> </ul>
Normally closed (NC) relay.	NC RELAY	Control wires from the external relay controller box attach to terminal block positions 2 and 3.	<ul style="list-style-type: none"> <li>Power supply cycles from on to off—The power supply is powered off by energizing the relay (relay contacts go from closed to open) for more than 30 seconds.</li> <li>Power supply cycles from off to on— The power supply is powered on by deenergizing the relay (relay contacts go from open to closed) for more than 10 seconds.</li> </ul>
No relay attached. Remote power-cycling feature not installed.	NO RELAY (DEFAULT)	—	—

## 8700 W Power Supply AC Power Cords

Table A-41 lists the specifications for the AC power cords that are available for the 8700 W AC-input power supply. Included in the table are references to illustrations of the power cords.

**Table A-41** 8700 W Power Supply AC Power Cords

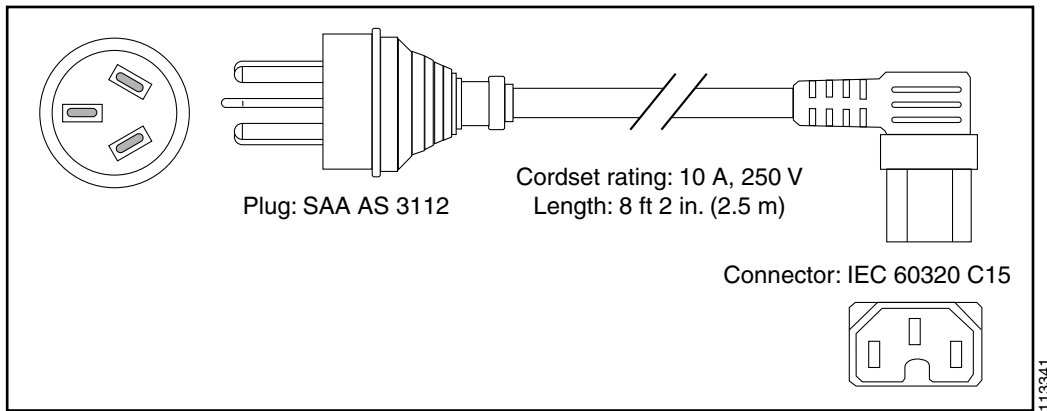
Locale	Power Cord Part Number	AC Source Plug Type	Cordset Rating	Power Cord Reference Illustration
Argentina	CAB-7513ACR= or CAB-IR2073-C19-AR=	IRAM 2073	16 A, 250 VAC	<a href="#">Figure A-31</a>
Australia, New Zealand	CAB-AC-16A-AUS=	AU20S3	16 A, 250 VAC	<a href="#">Figure A-46</a>
People's Republic of China	CAB-AC16A-CH=	GB16C	16 A, 250 VAC	<a href="#">Figure A-37</a>
Continental Europe	CAB-AC-2500W-EU=	CEE 7/7	16 A, 250 VAC	<a href="#">Figure A-41</a>
International	CAB-AC-2500W-INT=	IEC 309	16 A, 250 VAC	<a href="#">Figure A-42</a>
Israel	CAB-AC-2500W-ISRL=	SI16S3	16 A, 250 VAC	<a href="#">Figure A-34</a>
Italy	CAB-7513ACI=	CEI 23-16/7	16 A, 250 VAC	<a href="#">Figure A-35</a>
Japan, North America (nonlocking plug) 200–240 VAC operation	CAB-AC-2500W-US1=	NEMA 6-20	16 A, 250 VAC	<a href="#">Figure A-43</a>
Japan, North America (locking plug) 200–240 VAC operation	CAB-AC-C6K-TWLK=	NEMA L6-20	16 A, 250 VAC	<a href="#">Figure A-44</a>
Japan, North America 100–120 VAC operation	CAB-7513AC= <sup>1</sup>	NEMA 5-20	16 A, 125 VAC	<a href="#">Figure A-36</a>
Power Distribution Unit (PDU) <sup>2</sup>	CAB-C19-CBN=	IEC 60320 C19 IEC 60320 C20	16 A, 250 VAC	<a href="#">Figure A-47</a>
Switzerland	CAB-ACS-16=	SEV 5934-2 Type 23	16 A, 250 VAC	<a href="#">Figure A-45</a>

1. When operating with 100–120 VAC, you must use two or three AC power cords and the power supply output is limited to either 2800 W (2 inputs) or 4200 W (3 inputs).
2. The PDU power cable is designed for users who power their switch from a PDU. The end of the cable that plugs into the chassis power supply has a C19 connector; the other end of the cable that connects to the PDU has a C20 connector.

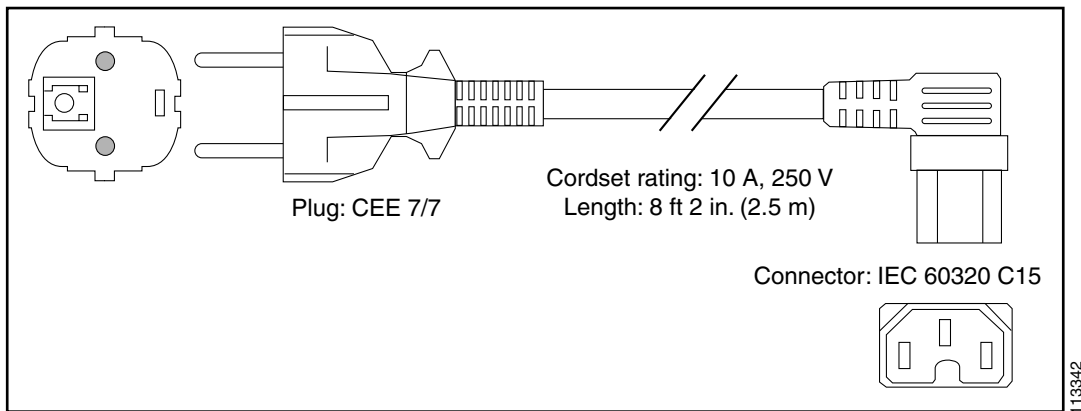
## AC Power Cord Illustrations

This section contains the AC power cord illustrations (see Figures A-19 through A-48). An AC power cord may be used with several power supplies. See the power supply specifications tables for the AC power cord illustrations that are applicable for your power supply.

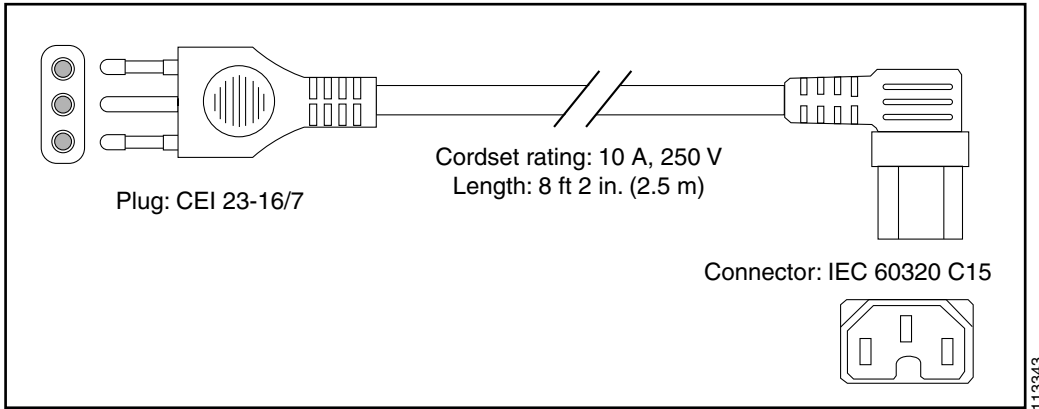
**Figure A-20** CAB-AC10A-90L-AU= (Australia and New Zealand)



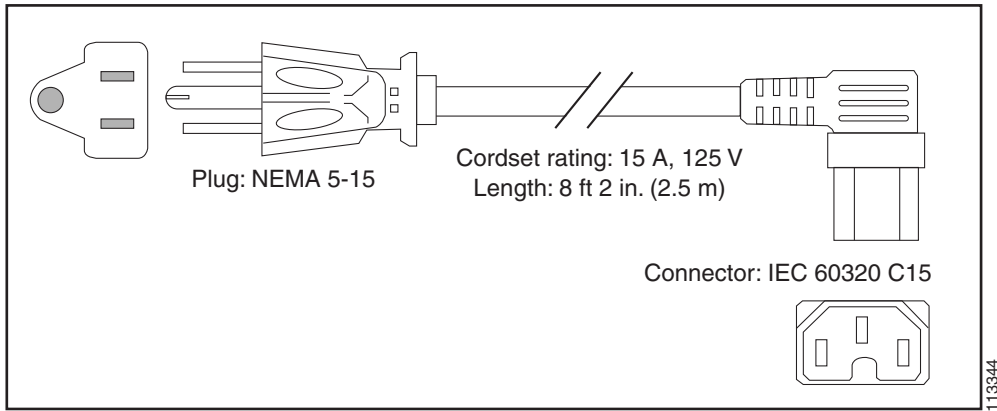
**Figure A-21** CAB-AC10A-90L-EU= (Continental Europe)



**Figure A-22 CAB-AC10A-90L-IT= (Italy)**



**Figure A-23 CAB-AC15A-90L-US= (Japan and United States)**



**Figure A-24 CAB-AC10A-90L-UK= (United Kingdom)**

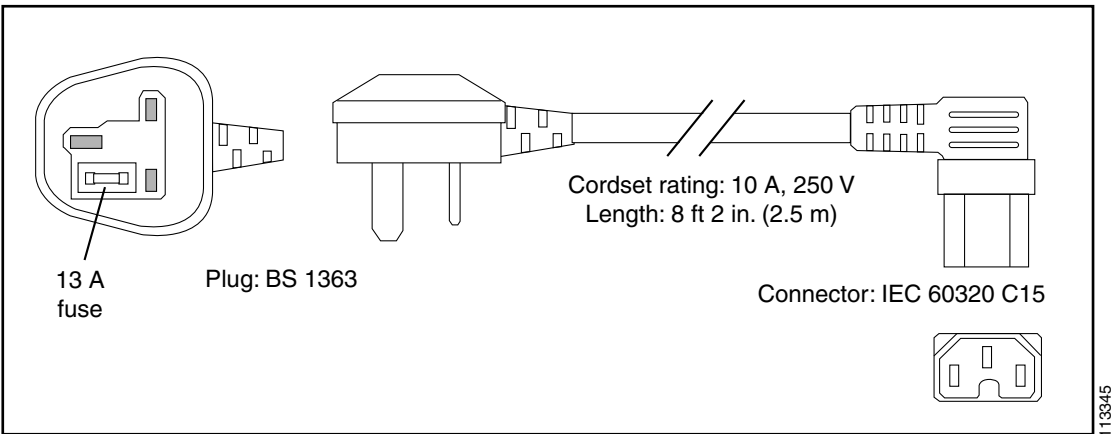


Figure A-25 CAB-7KACR= (Argentina)

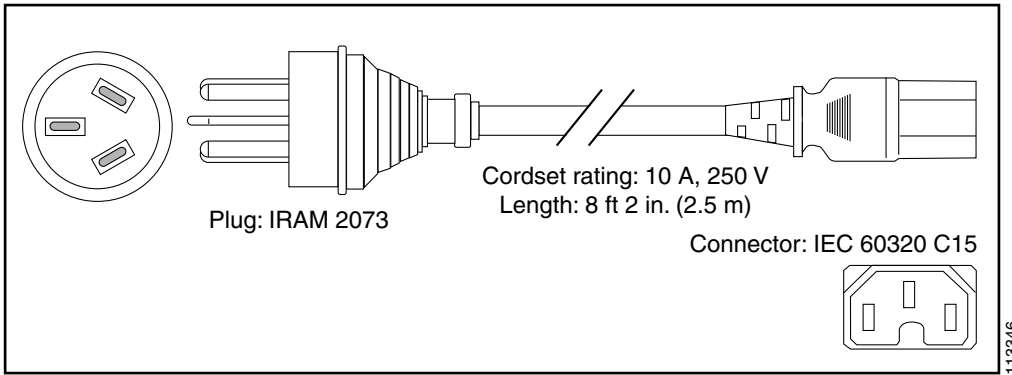


Figure A-26 CAB-7KACA= (Australia and New Zealand)

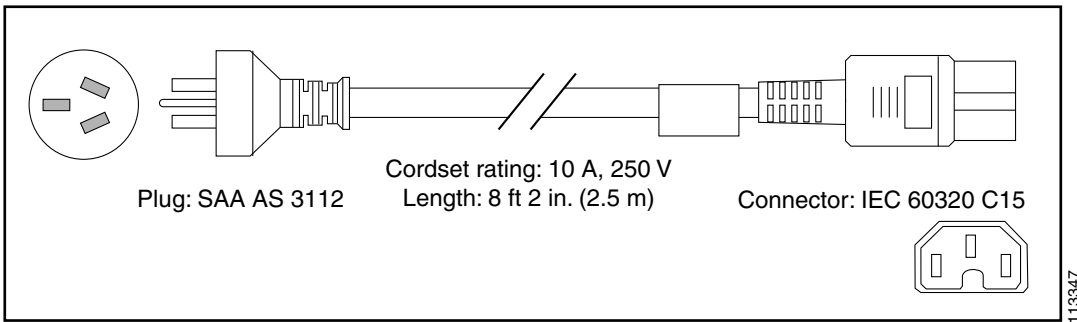


Figure A-27 CAB-7KACE= (Continental Europe)

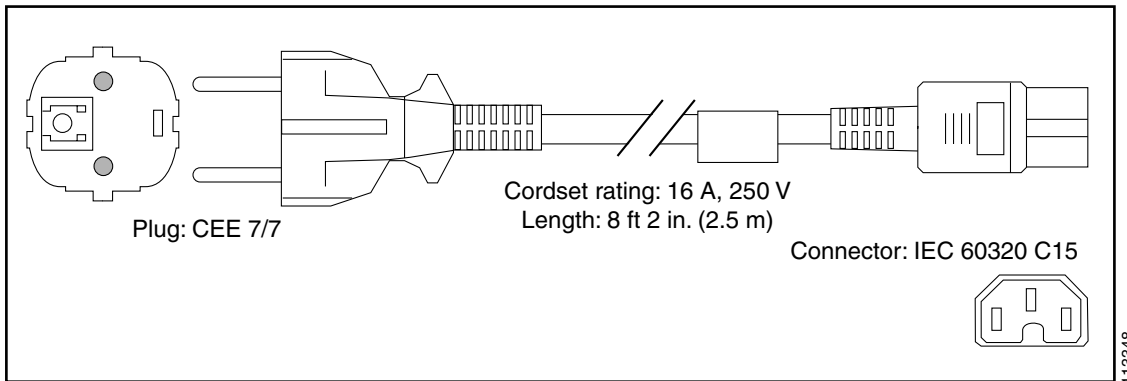


Figure A-28 CAB-7KACI= (Italy)

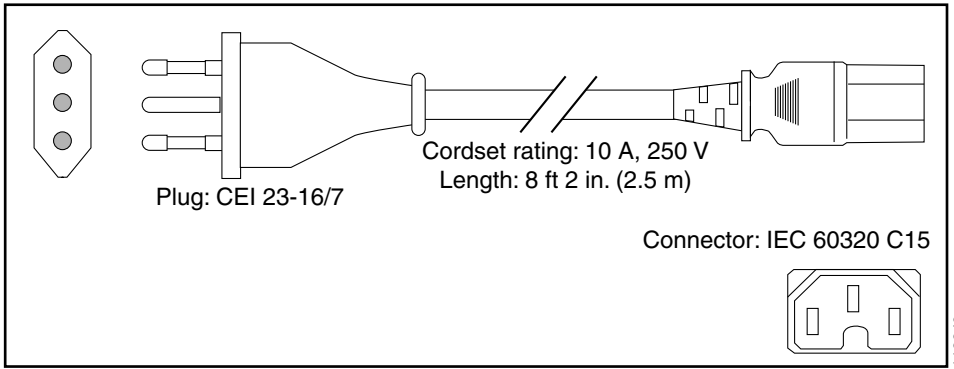


Figure A-29 CAB-7KAC-15= (Japan and United States)

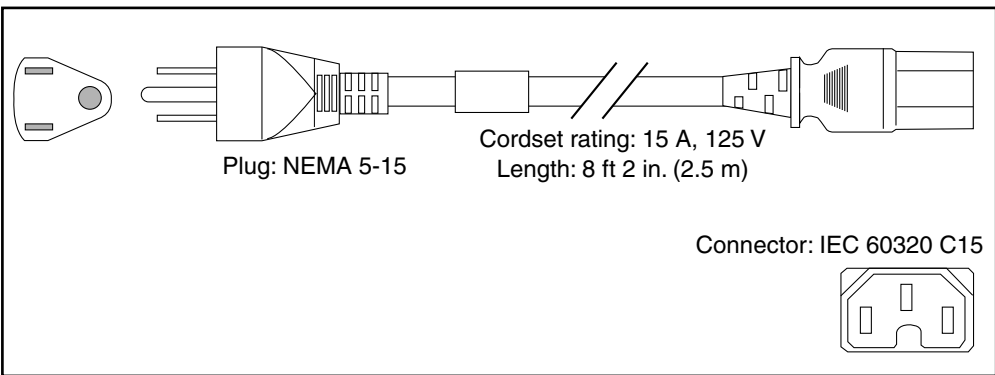
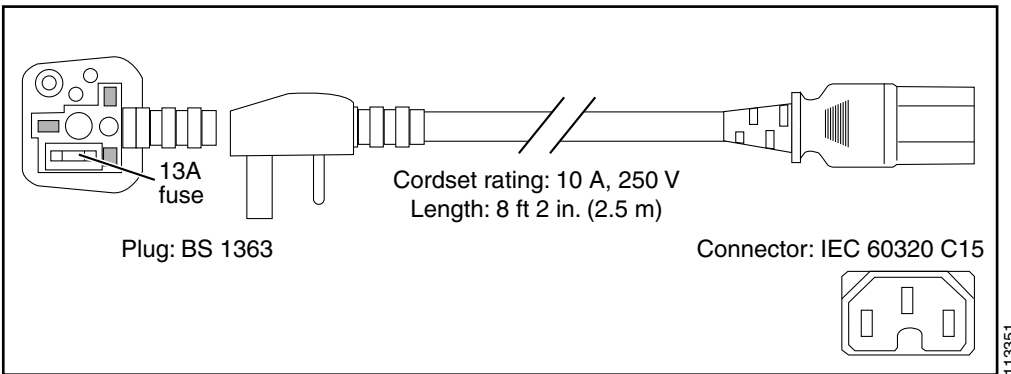
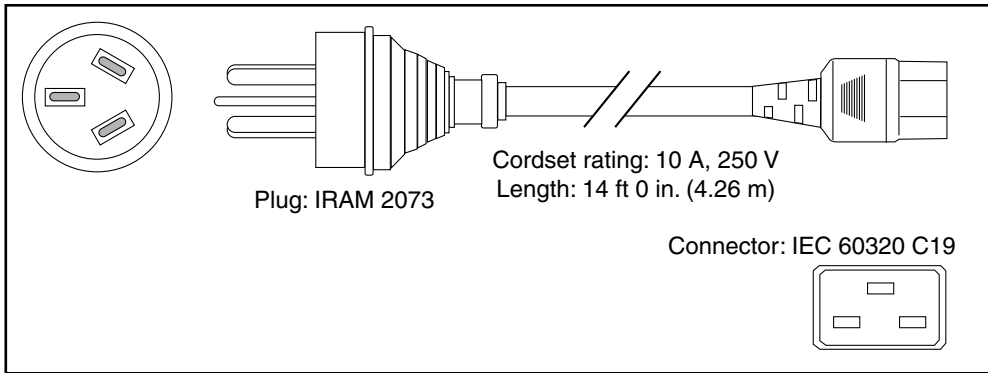


Figure A-30 CAB-7KACU= (United Kingdom)

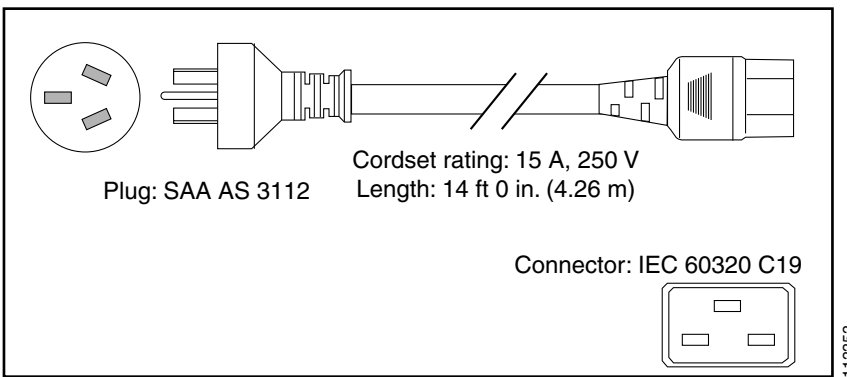




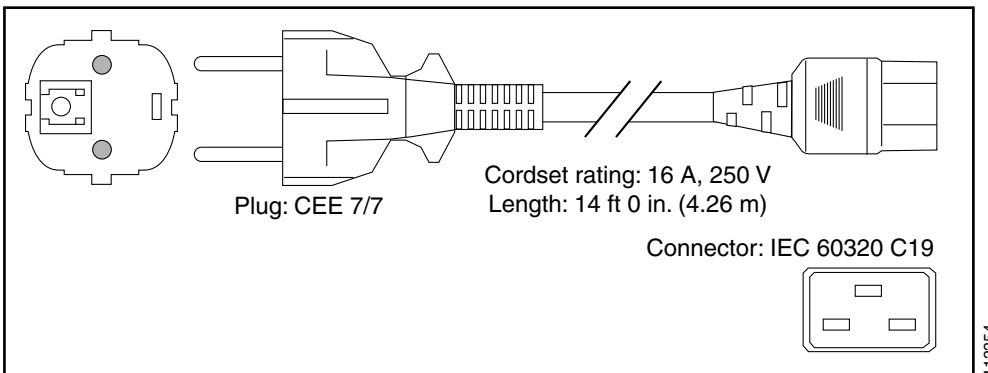
**Figure A-31** CAB-7513ACR= and CAB-IR2073-C19-AR= (Argentina)



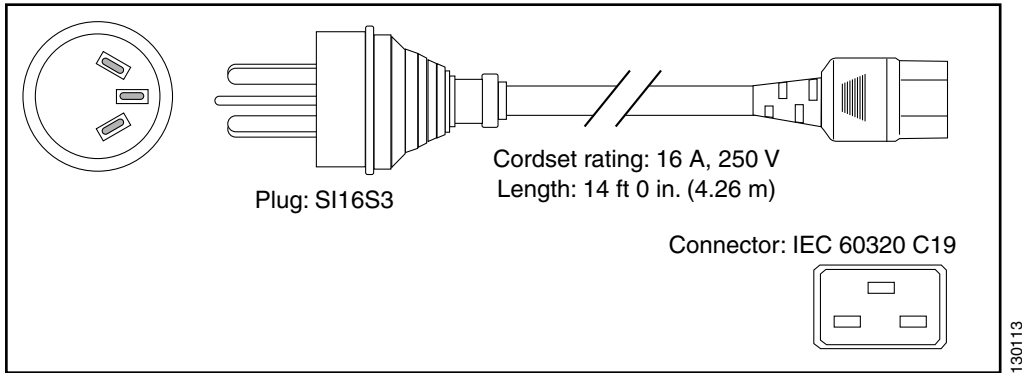
**Figure A-32** CAB-7513ACA= (Australia and New Zealand)



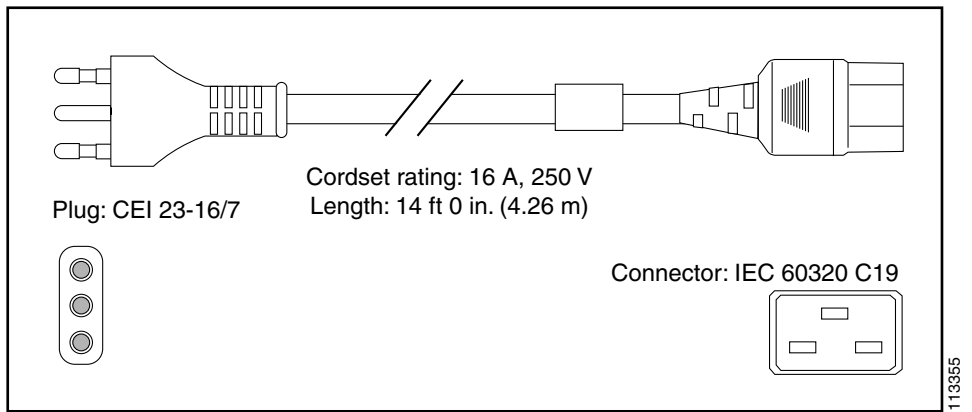
**Figure A-33** CAB-7513ACE= (Continental Europe)



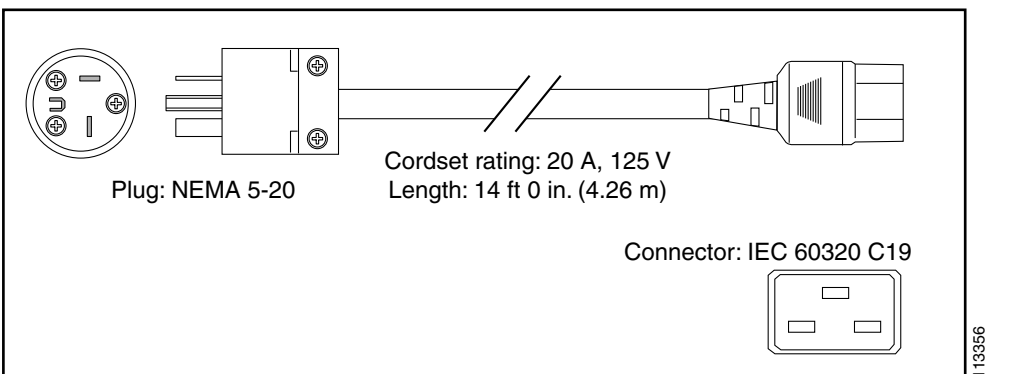
**Figure A-34 CAB-AC-2500W-ISRL (Israel)**



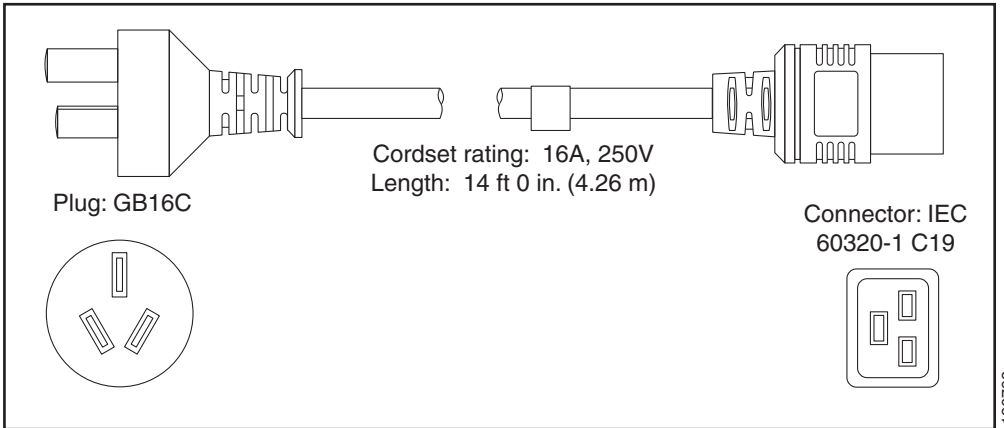
**Figure A-35 CAB-7513ACI= (Italy)**



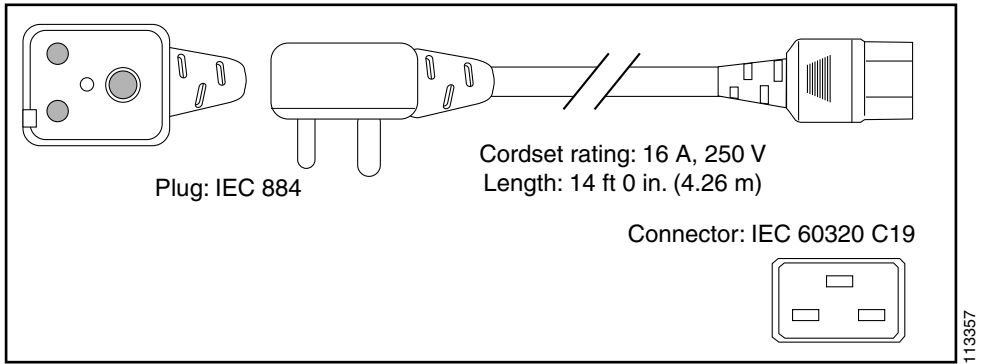
**Figure A-36 CAB-7513AC= (Japan and United States)**



**Figure A-37 CAB-AC16A-CH= (People's Republic of China)**



**Figure A-38 CAB-7513ACSA= (South Africa)**



**Figure A-39 CAB-ACS-10= (Switzerland)**

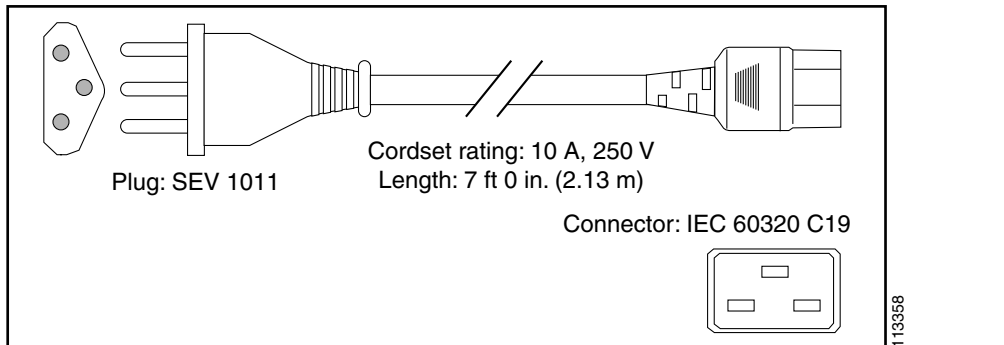


Figure A-40 CAB-7513ACU (United Kingdom)

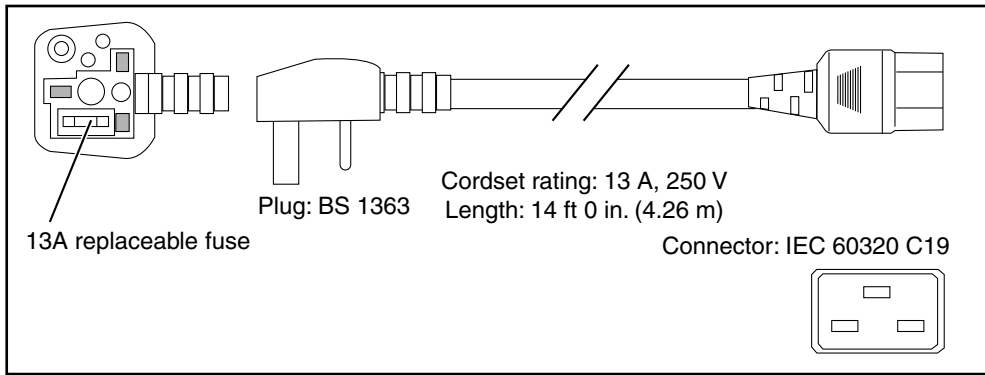


Figure A-41 CAB-AC-2500W-EU (Continental Europe)

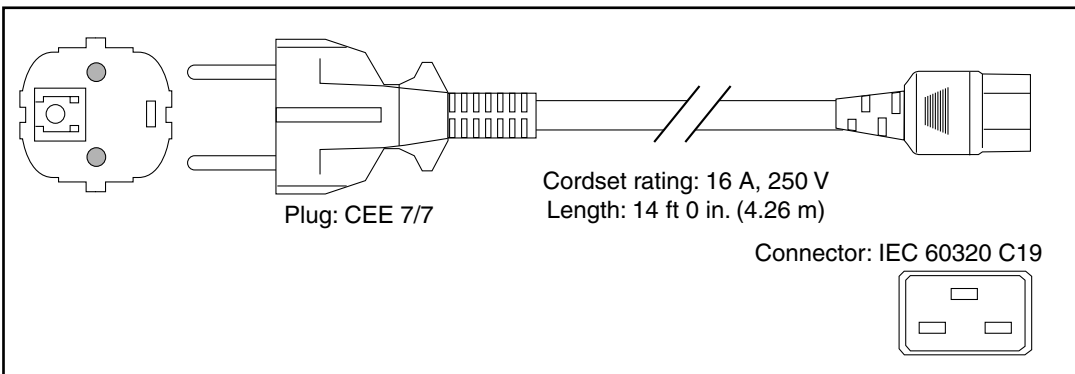


Figure A-42 CAB-AC-2500W-INT= (International)

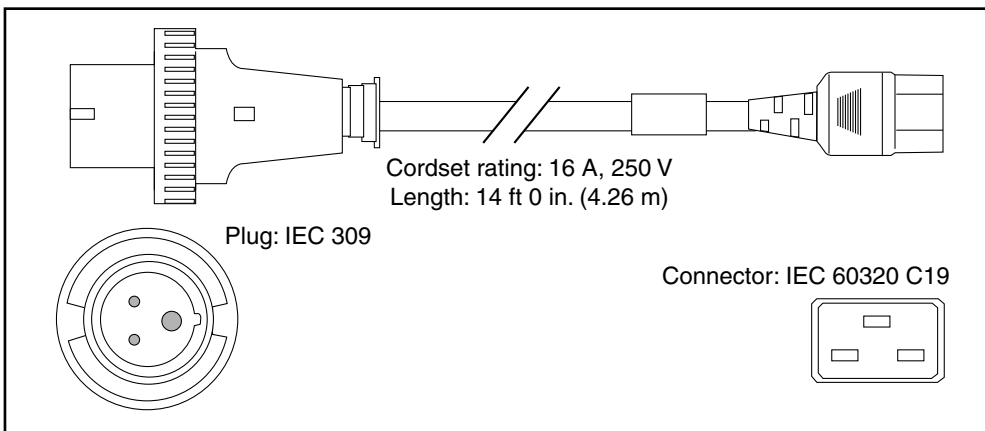
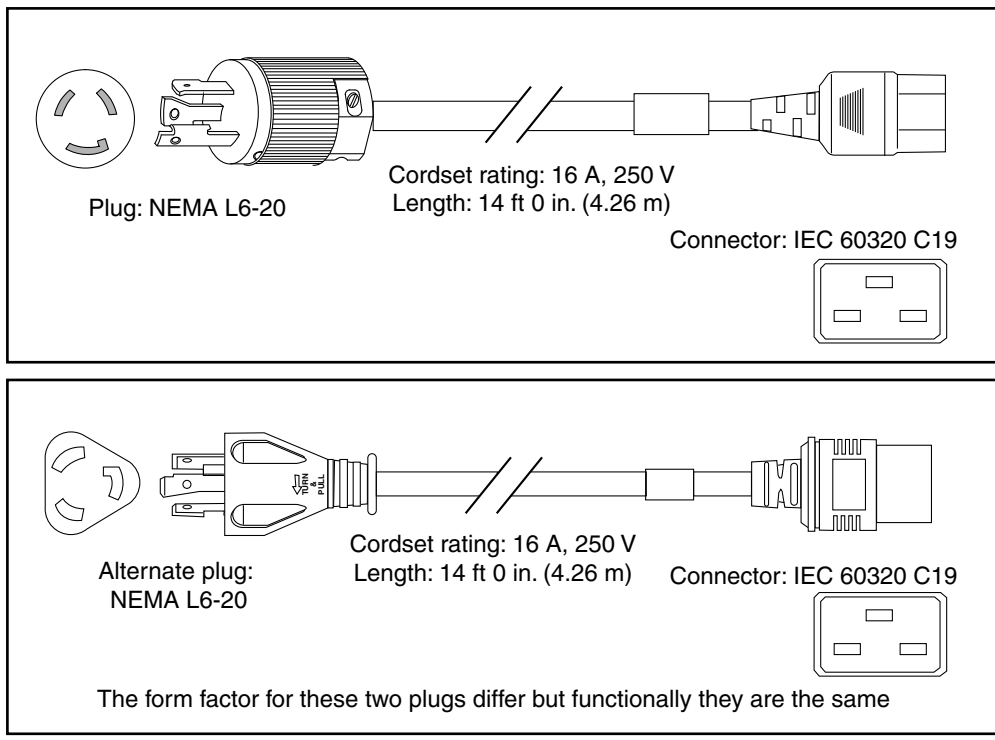
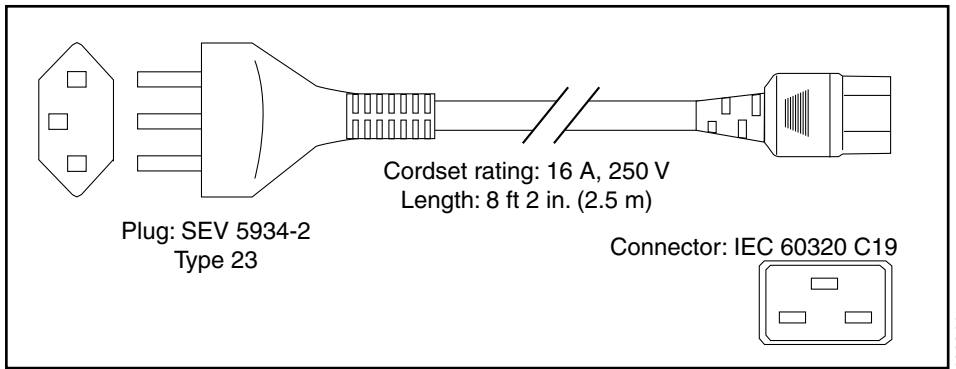


Figure A-43 CAB-AC-2500W-US1= (Japan and United States)

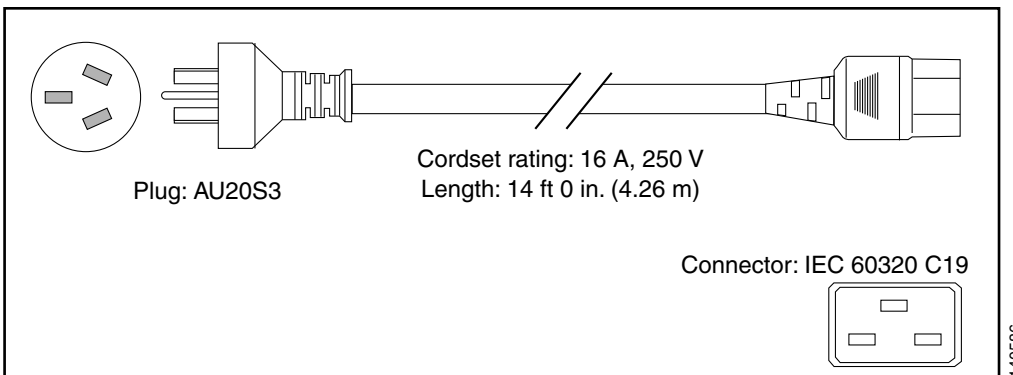
Figure A-44 CAB-AC-C6K-TWLK= (Japan and United States)



**Figure A-45 CAB-ACS-16= (Switzerland)**



**Figure A-46 CAB-AC-16A-AUS= (Australia and New Zealand)**



**Figure A-47 CAB-C19-CBN= (PDU)**

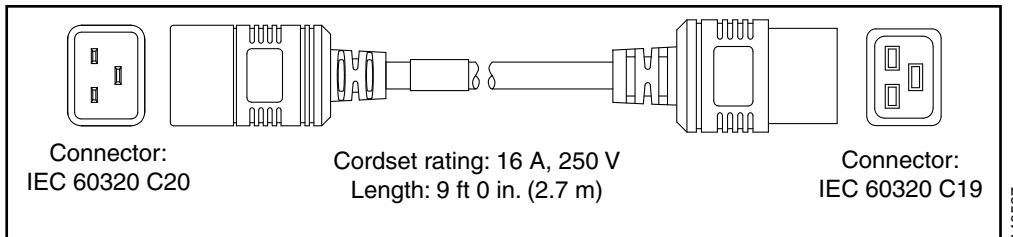


Figure A-48 WS-CAC-4000W-INT= (International)

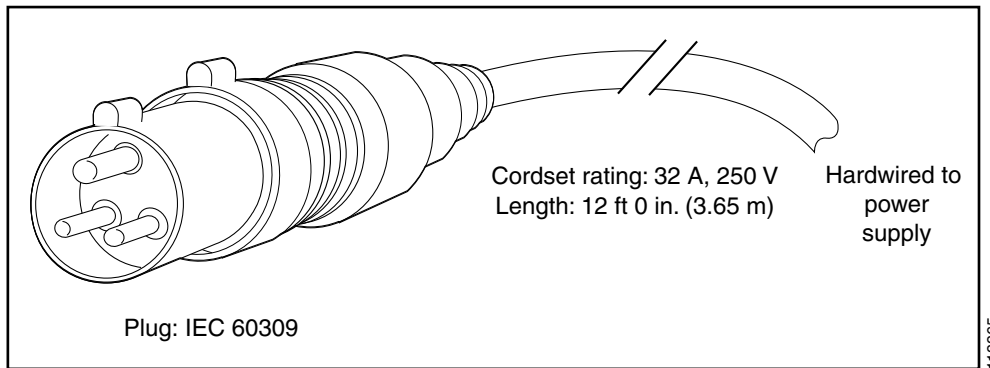
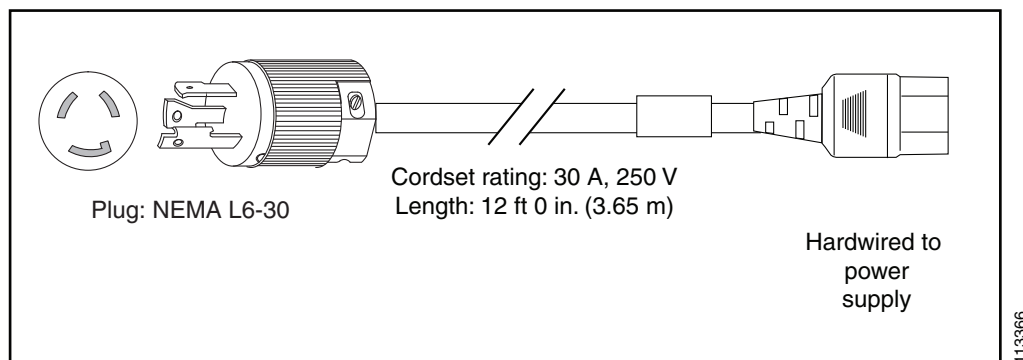


Figure A-49 WS-CAC-4000W-US= (United States)



## Power Supply Redundancy

Catalyst 6500 series switching modules have different power requirements. Depending upon the wattage of the power supply, certain switch configurations might require more power than a single power supply can provide.

The Catalyst 6500 series switches can use two power supplies to function in either combined or redundant mode. The following table explains the differences between the two modes.

Table A-42 Power supply modes

Redundant mode	Combined mode
Each power supply operates at ~50% of its capacity	Each power supply provides up to 83% of its capacity
Neither of the power supplies operates at greater than 60% or less than 40% of its capacity	The total system power available is 167% of the capacity of a single supply

Table A-42 Power supply modes

Redundant mode	Combined mode
If one power supply fails, the second power supply can power the system on its own	If one power supply fails, the other power supply may not be able to power the system on its own and will shut down the devices or line cards
This is the default and the recommended configuration for the power supplies	This is not the recommended mode for production

Although the power management feature allows you to supply power to all installed modules with two power supplies, redundancy is not supported in this configuration. Redundant and combined power configurations are summarized in [Table A-43](#). The effects of changing the power supply configurations are summarized in [Table A-44](#).

**Note**

For proper load-sharing operation in a redundant power supply configuration, you must install two modules in the chassis. If you fail to install two modules, you might receive spurious OUTPUT FAIL indications on the power supply.

**Note**

In systems that have two different sized power supplies installed, you may not have true redundancy. If the larger wattage power supply fails, the smaller wattage power supply might not be able to handle the entire load by itself.

Table A-43 Power Supply Redundancy

If you have two power supplies of	and redundancy is	Then
Equal wattage	Enabled	The total power drawn from both supplies is never greater than the capability of one supply. If one supply malfunctions, the other supply can take over the entire system load. Each power supply provides approximately half of the required power to the system. Load sharing and redundancy are enabled automatically; no software configuration is required.
Unequal wattage	Enabled	Both power supplies initially come online. If the difference between the two power supply's output wattage is less than 10 percent of the higher output wattage power supply, redundancy is enabled. If the difference is greater than 10 percent, the lesser wattage power supply is disabled.  For Cisco IOS, both power supplies come on. The total available wattage is the output wattage of the higher wattage power supply.
Equal or unequal wattage	Disabled	The total power available to the system is approximately 167 percent of the lower-wattage power supply. The system powers up as many modules as the combined capacity allows. If the higher-wattage power supply fails, the lower-wattage supply might also shut down due to overcurrent protection to prevent damage to the lower-wattage power supply.



Table A-44 Effects of Power Supply Configuration Changes

Configuration Change	Effect
Redundant to combined	<ul style="list-style-type: none"> <li>System log and syslog messages are generated.</li> <li>System power is increased to approximately 167 percent of the lower-wattage power supply.</li> <li>The modules marked as <i>power-deny</i> in the <b>show module</b> Status field are powered up if there is sufficient power.</li> </ul>
Combined to redundant	<ul style="list-style-type: none"> <li>System log and syslog messages are generated.</li> <li>System power is the power capability of the higher-wattage supply.</li> <li>If there is not enough power for all previously powered-up modules, some modules are powered down and marked as <i>power-deny</i> in the <b>show module</b> Status field.</li> </ul>
Equal wattage power supply is inserted with redundancy enabled	<ul style="list-style-type: none"> <li>System log and syslog messages are generated.</li> <li>System power equals the power capability of one supply. (Both supplies provide approximately one half of the total current.)</li> <li>No change in the module status because the power capability is unchanged.</li> </ul>
Equal wattage power supply is inserted with redundancy disabled	<ul style="list-style-type: none"> <li>System log and syslog messages are generated.</li> <li>System power is the combined power capability of both supplies.</li> <li>The modules marked as <i>power-deny</i> in the <b>show module</b> Status field are brought up if there is sufficient power.</li> </ul>
Higher or lower wattage power supply is inserted with redundancy enabled	<ul style="list-style-type: none"> <li>System log and syslog messages are generated.</li> <li>If the system power used is more than 83% of the higher wattage power supply capacity, the lower wattage power supply shuts down. The system will operate in redundant mode, with only higher wattage power supply.</li> <li>If the system power used is less than 83% of the higher wattage power supply capacity, the lower wattage power supply comes online. The system will operate in non-redundant combined mode, with both the power supplies.</li> </ul>
Higher or lower wattage power supply is inserted with redundancy disabled	<ul style="list-style-type: none"> <li>System log and syslog messages are generated.</li> <li>System power is increased to the combined power capability of both supplies.</li> <li>The modules marked as <i>power-deny</i> in the <b>show module</b> Status field are brought up if there is sufficient power.</li> </ul>

Table A-44 Effects of Power Supply Configuration Changes (continued)

Configuration Change	Effect
Power supply is removed with redundancy enabled	<ul style="list-style-type: none"> <li>System log and syslog messages are generated.</li> <li>If the power supplies are of equal wattage, there is no change in the module status because the power capability is unchanged.</li> </ul> <p>If the power supplies are of unequal wattage and the lower-wattage supply is removed, there is no change in the module status.</p> <p>If the power supplies are of unequal wattage and the higher-wattage supply is removed, the lower-wattage power supply must be turned on manually. (The system had previously turned off the lower-wattage power supply.)</p>
Power supply is removed with redundancy disabled	<ul style="list-style-type: none"> <li>System log and syslog messages are generated.</li> <li>System power is decreased to the power capability of one supply.</li> <li>If there is not enough power for all previously powered-up modules, some modules are powered down and marked as <i>power-deny</i> in the <b>show module</b> Status field.</li> </ul>
System is booted with power supplies of different wattage installed and redundancy enabled	<ul style="list-style-type: none"> <li>System log and syslog messages are generated.</li> <li>If the system power used is more than 83% of the higher wattage power supply capacity, the lower wattage power supply shuts down. The system will operate in redundant mode, with only higher wattage power supply.</li> <li>If the system power used is less than 83% of the higher wattage power supply capacity, the lower wattage power supply comes online. The system will operate in non-redundant combined mode, with both the power supplies.</li> </ul>
System is booted with power supplies of equal or different wattage installed and redundancy disabled	<ul style="list-style-type: none"> <li>System log and syslog messages are generated.</li> <li>System power equals the combined power capability of both supplies.</li> <li>The system powers up as many modules as the combined capacity allows.</li> </ul>

When running redundant 4000 W, 6000 W, or 8700 W power supplies in Catalyst 6506 and Catalyst 6509 non-E series systems, if you remove the power supply in bay 1, the total system power will be reduced to 2940 W (70 A at 42 VDC) after 180 seconds (3 minutes). You can avoid this reduction in the total system power by leaving the power supply in bay 1, even in a powered down state.

If the total system power usage is greater than 2940 W, the following scenario will apply if a 4000 W, 6000 W, or a 8700 W power supply is removed from bay 1 (these scenarios are specific to only these three power supplies running in redundant mode in either the Catalyst 6506 or Catalyst 6509 non-E series systems).

- If the power supplies in bay 1 and bay 2 are running in redundant mode, the total system power will be 4000 W.
- If power supply 1 is running and you power off or remove power supply 2, the total system power will be 4000 W. The system will issue a normal power supply 2 down/remove indication warning.

- If you power down power supply 1 while power supply 2 is operating, the system will issue a normal power supply 1 down indication warning with another warning asking the user not to remove power supply 1. If power supply 1 is left in the system, even if it is powered off, the total system power will be 4000 W.
  - If you remove power supply 1 from the system, a major alarm will be issued to warn that the total system power will be reduced to 2940 W and that any modules or PoE devices that cause the system to exceed 2940 W will power down in 180 seconds (3 minutes). If you insert a replacement power supply 1 in the 180-second timeframe, no action will be taken.
-

**Note**

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In systems that are equipped with two power supplies, if one power supply fails and the other power supply cannot fully power all of the installed modules, system power management will shut down devices in the following order:

- Power over Ethernet (PoE) devices— The system will power down PoE devices in descending order, starting with the highest numbered port on the module in the highest numbered slot.
- Modules—If additional power savings are needed, the system will power down modules in descending order, starting with the highest numbered slot. Slots containing supervisor engines or Switch Fabric Modules are bypassed and are not powered down.

This shut down order is fixed and cannot be changed.

---

You can change the configuration of the power supplies to redundant or combined at any time. If you switch from a redundant to a combined configuration, both power supplies are enabled (even a power supply that was disabled because it was of a lower wattage than the other power supply). If you change from a combined to a redundant configuration, both power supplies are initially enabled, and if they are of the same wattage, they remain enabled. If they are of different wattage, a syslog message displays and the lower wattage supply is disabled.

For additional information about the power management feature and individual module power consumption, refer to your software configuration guide.



# APPENDIX **A**

## Transceivers, Module Connectors, and Cable Specifications

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Revised: October 13, 2011

This chapter describes the pluggable transceivers, connectors, and cables used with the Catalyst 6500 series switches. The chapter is divided into these sections:

- [Pluggable Transceivers, page A-1](#)
- [Module Connectors, page A-24](#)
- [Cables, page A-31](#)
- [Cleaning the Fiber-Optic Connectors, page A-38](#)

### Pluggable Transceivers

This section provides brief descriptions of the pluggable transceivers that install in Catalyst 6500 series modules and supervisor engines.

The section is divided into these topics:

- [100-MB Transceivers, page A-1](#)
- [1-GB Transceivers, page A-3](#)
- [10-GB Transceivers, page A-10](#)
- [WDM Transceivers, page A-17](#)

### 100-MB Transceivers

100-MB Small Form-Factor Pluggable (SFP) transceivers are currently the only 100-MB transceivers that are supported on a Catalyst 6500 series Ethernet switching module. They are supported only on the WS-X6148-FE-SFP Ethernet module.

The 100-MB SFP transceiver module is shown in [Figure A-1](#). [Table A-1](#) lists the types of 100-MB SFP transceivers and their cabling distances.



**Note**

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The 100-MB and the 1-GB SFP transceivers share the same form factor, but are not interchangeable.

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Figure A-1 100-MB SFP Transceiver Module

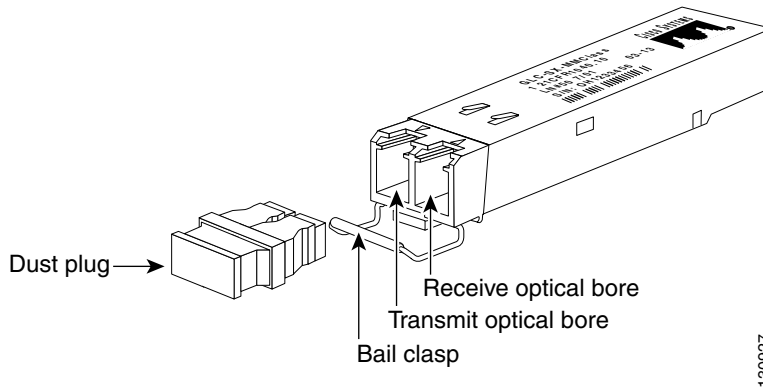


Table A-1 100-MB SFP Transceiver Cabling Specifications

100-MB SFP Transceiver Product Number	Description	Interface Connector	Nominal Wavelength (nm)	Network Cable Type	Fiber Core Size <sup>1</sup> (micron)	Cable Distance <sup>2</sup>
GLC-FE-100FX	100BASE-FX SFP for 100 Mb (Fast Ethernet) ports	Dual LC	1310	MMF	50/62.5	1.24 miles (2 km)
GLC-FE-100LX	100BASE-LX10 SFP for 100 Mb (Fast Ethernet) ports	Dual LC	1310	SMF	G.652 <sup>3</sup>	6.21 miles (10 km)
GLC-FE-100BX-D	100BASE-FX SFP for 100 Mb (Fast Ethernet) ports	Single LC	1550 (receive) 1310 (transmit)	Single-strand SMF	G.652 <sup>3</sup>	6.21 miles (10 km)
GLC-FE-100BX-U	100BASE-FX SFP for 100 Mb (Fast Ethernet) ports	Single LC	1310 (receive) 1550 (transmit)	Single-strand SMF	G.652 <sup>3</sup>	6.21 miles (10 km)
GLC-FE-100EX	100BASE-EX for 100 Mb (Fast Ethernet) ports	Dual LC	1310	SMF	G.652 <sup>3</sup>	24.86 miles (40 km)
GLC-FE-100ZX	100BASE-ZX for 100 Mb (Fast Ethernet) ports	Dual LC	1550	SMF	G.652 <sup>3</sup>	49.7 miles (80 km)

1. The numbers given for multimode fiber-optic (MMF) cable refer to the core diameter.
2. Cable distances are based on fiber loss. Additional factors, such as the number of splices and the optical quality of the fiber, can affect cabling distances.
3. ITU-T G.652 SMF as specified by the IEEE 802.3z standard.

**Note**

The minimum cable distance for all 100-MB SFP transceivers listed, both MMF and SMF (G.652), is 6.5 feet (2 meters).

Table A-2 lists the fiber loss budgets for the 100-MB SFP transceivers.

**Table A-2** *Fiber Loss Budgets for the 100-MB SFP Transceivers*

<b>100-MB SFP Transceiver Product Number</b>	<b>Transmit (dBm)</b>	<b>Receive (dBm)</b>
GLC-FE-100FX	-14 (maximum)	-14 (maximum)
	-20 (minimum)	-31 (minimum)
GLC-FE-100LX	-8 (maximum)	-8 (maximum)
	-15 (minimum)	-28 (minimum)
GLC-FE-100BX-U	-8 (maximum)	-7 (maximum)
	-14 (minimum)	-28.2 (minimum)
GLC-FE-100BX-D	-8 (maximum)	-7 (maximum)
	-14 (minimum)	-28.2 (minimum)
GLC-FE-100EX	0 (maximum)	-8 (maximum)
	-5 (minimum)	-28 (minimum)
GLC-FE-100ZX	2 (maximum)	-8 (maximum)
	-3 (minimum)	-30 (minimum)

Table A-3 lists the physical and environmental specifications for the 100-MB SFP transceivers.

**Table A-3** *100-MB SFP Transceiver Physical and Environmental Specifications*

<b>Item</b>	<b>Specification</b>
Dimensions (H x W x D)	0.04 x 0.53 x 2.22 in. (8.5 x 13.4 x 56.5 mm)
Operating temperature	32° to 122°F (0° to 50°C)
Storage temperature	-40° to 185°F (-40° to 85°C)

## 1-GB Transceivers

The 1-GB transceivers include the Gigabit Interface Converter (GBIC) transceiver and the SFP transceiver. The GBIC transceivers and SFP transceivers differ in both form-factor and in connector type; they are not interchangeable. Table A-4 lists both 1-GB transceiver types, the modules that support them, the applicable transceiver illustrations, and the applicable specification tables.

**Table A-4** 1-GB Transceiver Types

1-GB Transceiver Type	Supported on these Modules <sup>1</sup>	Transceiver Illustration	Transceiver Specification Table
GBIC	<ul style="list-style-type: none"> <li>• WS-X6408A-GBIC</li> <li>• WS-X6416-GBIC</li> <li>• WS-X6516-GBIC</li> <li>• WS-X6516A-GBIC</li> <li>• WS-X6816-GBIC</li> </ul>	<p><a href="#">Figure A-2</a> (1000BASE-T copper GBIC)</p> <p><a href="#">Figure A-3</a> (1000BASE-X optical GBIC)</p>	<p><a href="#">Table A-5</a> (cabling specifications)</p> <p><a href="#">Table A-6</a> (fiber loss budgets)</p> <p><a href="#">Table A-7</a> (environmental specifications)</p>
SFP	<ul style="list-style-type: none"> <li>• WS-X6724-SFP</li> <li>• WS-X6748-SFP</li> <li>• WS-SUP32-GE-3B</li> <li>• WS-SUP32P-GE</li> <li>• WS-SUP720</li> <li>• WS-SUP720-3B</li> <li>• WS-SUP720-3BXL</li> </ul>	<p><a href="#">Figure A-4</a> (1000BASE-T copper SFP)</p> <p><a href="#">Figure A-5</a> (1000BASE-X optical SFP)</p>	<p><a href="#">Table A-8</a> (cabling specifications)</p> <p><a href="#">Table A-9</a> (fiber loss budgets)</p> <p><a href="#">Table A-10</a> (environmental specifications)</p>

1. Not all GBIC transceiver types or SFP transceiver types may be supported on your module. Refer to your software release notes to determine if a specific GBIC transceiver or SFP transceiver is supported on your module.

## 1-GB GBIC Transceivers

[Figure A-2](#) shows a 1000BASE-T (copper) GBIC transceiver. [Figure A-3](#) shows a 1000BASE-X (optical) GBIC transceiver. [Table A-5](#) lists the cabling specifications for the GBIC transceivers.

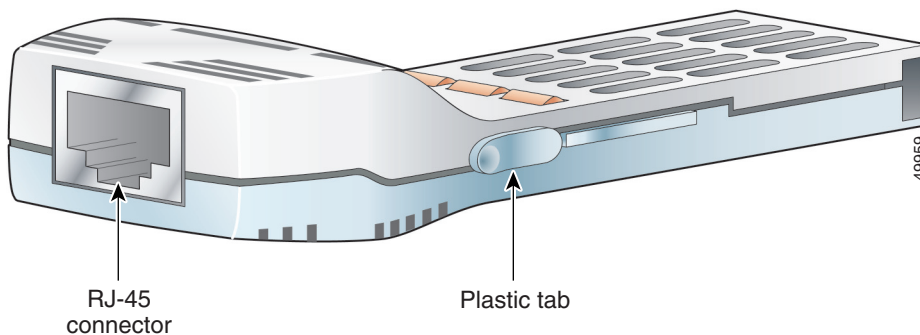
**Figure A-2** 1000BASE-T GBIC Transceiver (WS-G5483)



Figure A-3 1000BASE-X GBIC Transceiver Modules (WS-G5484, WS-G5486, and WS-G5487)

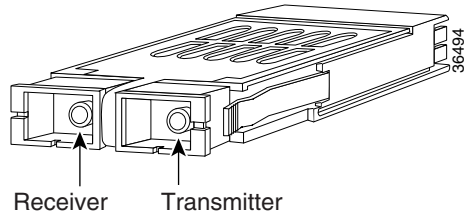


Table A-5 GBIC Transceiver Module Cabling Specifications

GBIC Transceiver Model and Product Number	Interface Connector	Nominal Wavelength (nm)	Network Cable Type	Fiber Core Size <sup>1</sup> (micron)	Modal Bandwidth (MHz km)	Cable Distance <sup>2</sup>
1000BASE-T (WS-G5483)	RJ-45	—		—	—	328 ft (100 m)
1000BASE-SX <sup>3</sup> (WS-G5484)	SC duplex	850	MMF	62.5	160	722 ft (220 m)
				62.5	200	902 ft (275 m)
				50.0	400	1640 ft (500 m)
				50.0	500	1804 ft (550 m)
1000BASE-LX/LH (WS-G5486)	SC duplex	1310	MMF <sup>4</sup>	62.5	500	1804 ft (550 m)
				50.0	400	1804 ft (550 m)
				50.0	500	1804 ft (550 m)
			SMF	G.652 <sup>5</sup>	—	6.2 mi (10 km)
1000BASE-ZX <sup>6</sup> (WS-G5487)	SC duplex	1550	SMF	G.652 <sup>5</sup>	—	43.5 mi (70 km) <sup>8</sup>
			SMF <sup>7</sup>	G.652 <sup>5</sup>	—	62.1 mi (100 km)

- The numbers given for multimode fiber-optic (MMF) cable refer to the core diameter.
- Cable distances are based on fiber loss. Additional factors, such as the number of splices and the optical quality of the fiber, can affect cabling distances.
- Use with MMF only.
- Refer to the product bulletin for the usage of mode conditioning patch cords in 1000BASE and 10GBASE Ethernet laser-based transmissions at this URL: [http://www.cisco.com/en/US/prod/collateral/modules/ps5455/product\\_bulletin\\_c25-530836.html](http://www.cisco.com/en/US/prod/collateral/modules/ps5455/product_bulletin_c25-530836.html)
- ITU-T G.652 SMF as specified by the IEEE 802.3z standard.
- Use with SMF only.
- Dispersion-shifted single-mode fiber-optic cable.
- The minimum link distance for ZX GBICs is 6.2 miles (10 km), when an 8-dB attenuator is installed at each end of the link. Without attenuators, the minimum link distance is 24.9 miles (40 km).

Table A-6 lists the fiber loss budgets for the GBIC transceivers.

**Table A-6** *Fiber Loss Budgets for the 1-GB GBIC Transceivers*

<b>1-GB GBIC Transceiver Product Number</b>	<b>Transmit (dBm)</b>	<b>Receive (dBm)</b>
WS-G5484 (1000BASE-SX)	–3 (maximum) –9.5 (minimum)	0 (maximum) –17 (minimum)
WS-G5486 (1000BASE-LX/LH)	–3 (maximum) –9.5 (minimum)	–3 (maximum) –19 (minimum)
WS-G5487 (1000BASE-ZX)	5 (maximum) 0 (minimum)	–3 (maximum) –23 (minimum) <sup>1</sup>

1. The 1000BASE-ZX GBIC transceiver provides a minimum optical power budget of 23 dB. To determine the supported link distance, you need to measure your cable plant with an optical loss test set to verify that the optical loss of the cable plant (including connectors and splices) is less than or equal to this value. The optical measurement must be performed with a 1550 nanometer light source.

Table A-7 lists the physical and environmental specifications for the GBIC transceivers.

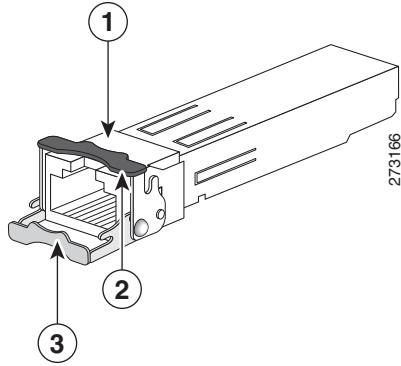
**Table A-7** *1-GB GBIC Transceiver Physical and Environmental Specifications*

<b>Item</b>	<b>Specification</b>
Dimensions (H x W x D)	0.75 x 1.54 x 3.50 inches (19.0 x 39.1 x 88.9 mm)
Operating temperature	32° to 122°F (0° to 50°C)
Storage temperature	–40° to 185°F (–40° to 85°C)

## 1-GB SFP Transceivers

Figure A-4 shows a 1000BASE-T (copper) SFP transceiver. Figure A-5 shows a 1000BASE-X (optical) SFP transceiver. Table A-8 lists the cabling specifications for the SFP transceivers.

**Figure A-4 1000BASE-T SFP Transceiver (GLC-T)**



1	RJ-45 connector	3	Bale-clasp shown in the open (unlocked) position
2	Bale-clasp shown in the closed (locked) position		

**Figure A-5 1000BASE-X SFP Transceivers**

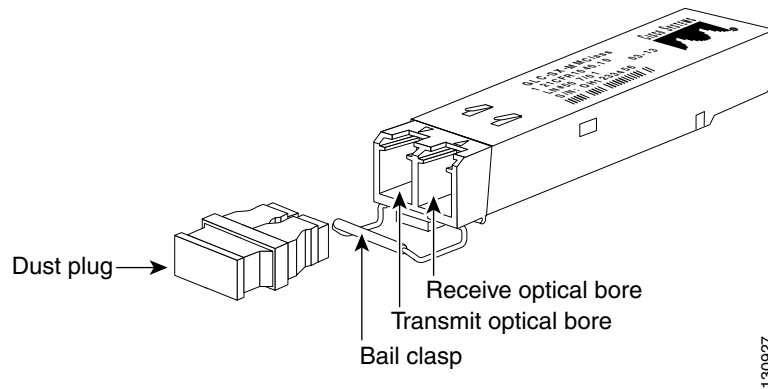


Table A-8 SFP Transceiver Cabling Specifications

SFP Transceiver Module and Product Number	Interface Connector	Nominal Wavelength (nm)	Network Cable Type	Fiber Core Size (micron)	Modal Bandwidth (MHz/km)	Cable Distance <sup>1</sup>
1000BASE-T (GLC-T=)	RJ-45	—	Category 5, 5e, or 6 UTP/FTP	—	—	328 ft (100 m)
1000BASE-SX (GLC-SX-MM=)	LC duplex	850	MMF	62.5 62.5 50.0 50.0	160 200 400 500	722 ft (220 m) 902 ft (275 m) 1640 ft (500 m) 1804 ft (550 m)
1000BASE-LX/LH (GLC-LH-SM=)	LC duplex	1300	MMF <sup>2</sup>  SMF	62.5 50.0 50.0 G.652 <sup>3</sup>	500 400 500 —	1804 ft (550 m) 1804 ft (550 m) 1804 ft (550 m) 6.21 mi (10 km)
1000BASE-ZX (GLC-ZX-SM=)	LC duplex	1550	SMF	G.652 <sup>3</sup>	—	43.4 to 62 mi (70 to 100 km) <sup>4</sup>
1000BASE-BX-D (GLC-BX-D=)	LC single	1310	SMF	G.652 <sup>3</sup>	—	6.21 mi (10 km)
1000BASE-BX-U (GLC-BX-U=)	LC single	1490	SMF	G.652 <sup>3</sup>	—	6.21 mi (10 km)

1. Cable distances are based on fiber loss. Additional factors, such as the number of splices and the optical quality of the fiber, can affect cabling distances.
2. Refer to the product bulletin for the usage of mode conditioning patch cords in 1000BASE and 10GBASE Ethernet laser-based transmissions at this URL: [http://www.cisco.com/en/US/prod/collateral/modules/ps5455/product\\_bulletin\\_c25-530836.html](http://www.cisco.com/en/US/prod/collateral/modules/ps5455/product_bulletin_c25-530836.html)
3. ITU-T G.652 SMF as specified by the IEEE 802.3z standard.
4. 1000BASE-ZX SFP modules can reach up to 62 miles (100 km) by using dispersion-shifted SMF or low-attenuation SMF; the actual distance depends on the fiber quality, the number of splices, and the connectors.

Table A-9 lists the fiber loss budgets for the 1-GB SFP transceivers.

**Table A-9** *Fiber Loss Budgets for the 1-GB SFP Transceivers*

1-GB SFP Transceiver Product Number	Transmit (dBm)	Receive (dBm)
GLC-SX-MM (1000BASE-SX)	-4 (maximum) -9.5 (minimum)	0 (maximum) -17 (minimum)
GLC-LH-SM (1000BASE-LX/LH)	-3 (maximum) -9.5 (minimum)	-3 (maximum) -20 (minimum)
GLC-ZX-SM (1000BASE-ZX)	5 (maximum) 0 (minimum)	-3 (maximum) -23 (minimum)
GLC-BX-U	-3 (maximum) -9 (minimum)	-3 (maximum) -19.5 (minimum)
GLC-BX-D	-3 (maximum) -9 (minimum)	-3 (maximum) -19.5 (minimum)

Table A-10 lists the physical and environmental specifications for the 1-GB SFP transceivers.

**Table A-10** *1-GB SFP Transceiver Physical and Environmental Specifications*

Item	Specification
Dimensions (H x W x D)	0.04 x 0.53 x 2.22 in. (8.5 x 13.4 x 56.5 mm)
Operating temperature	32° to 122°F (0° to 50°C)
Storage temperature	-40° to 185°F (-40° to 85°C)



**Note**

You can use any combination of SFP modules that your Cisco device supports. The only restrictions are that each SFP port must match the wavelength specifications on the other end of the cable and that the cable must not exceed the stipulated cable length for reliable communications.

## 10-GB Transceivers

The 10-GB transceivers include the XENPAK transceiver and the X2 transceiver. The XENPAK transceivers and X2 transceivers differ in form-factor; they are not interchangeable. [Table A-11](#) lists both 10-GB transceiver types, the modules that support them, and the applicable transceiver illustrations and specification tables.

**Table A-11** 10-GB Transceiver Types and Module Support

10-GB Transceiver Type	Supported on these Modules <sup>1</sup>	Transceiver Illustration	Transceiver Specification Table
XENPAK transceivers	<ul style="list-style-type: none"> <li>WS-X6704-10GE</li> <li>WS-SUP32-10GE-3B</li> <li>WS-SUP32P-10GE</li> </ul>	<a href="#">Figure A-6</a>	<a href="#">Table A-12</a> (cabling specifications) <a href="#">Table A-13</a> (fiber loss budgets) <a href="#">Table A-14</a> (environmental specifications)
X2 transceivers	<ul style="list-style-type: none"> <li>WS-X6708-10G-3C<sup>2</sup></li> <li>WS-X6708-10G-3CXL<sup>2</sup></li> <li>VS-S720-10G-3C</li> <li>VS-S720-10G-3CXL</li> </ul>	<a href="#">Figure A-7</a>	<a href="#">Table A-15</a> (cabling specifications) <a href="#">Table A-16</a> (fiber loss budgets) <a href="#">Table A-17</a> (environmental specifications)

1. Not all 10-GB transceiver versions may be supported on your module. Refer to your software release notes to determine if a specific 10-GB transceiver is supported on your module.

2. Only X2 transceivers with part number revision -02 or later are supported on the module. Check the part number label on the X2 transceiver to verify its usability.

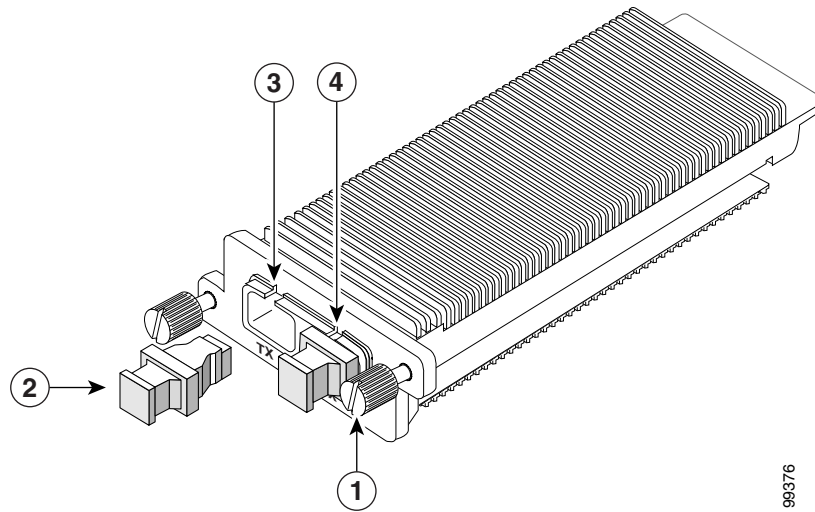
## XENPAK Transceivers



### Note

The dual SC connector on the X2 transceivers support network interface cables with either Physical Contact (PC) or Ultra-Physical Contact (UPC) polished face types. The connectors do not support network interface cables with an Angle Polished Connector (APC)-polished face type.

Figure A-6 10-Gigabit XENPAK Transceiver



1	Captive installation screw	3	Transmit optical bore
2	Optical bore dust plug	4	Receive optical bore

Table A-12 10-GB XENPAK Transceiver Specifications and Cabling Distances

XENPAK	Connector	Nominal Wavelength	Network Fiber Type	Fiber Core Size (microns)	Modal Bandwidth (Mhz/km)	Maximum Cable Distance <sup>1</sup>
XENPAK-10GB-CX4	InfiniBand 4X	N/A	CX4 (copper)	—	—	49 ft (15 m) <sup>2</sup>
XENPAK-10GB-SR	SC duplex	850 nm	MMF	62.5	160	83.3 ft (25 m)
				62.5	200	108.3 ft (33 m)
				50.0	400	216.5 ft (66 m)
				50.0	500	269.0 ft (82 m)
				50.0	2000	984.3 ft (300 m)
XENPAK-10GB-LX4	SC duplex	1310 nm	MMF	62.5	500	984.3 ft (300 m)
				50.0	400	787.4 ft (240 m)
				50.0	500	984.3 ft (300 m)

**Table A-12 10-GB XENPAK Transceiver Specifications and Cabling Distances (continued)**

XENPAK	Connector	Nominal Wavelength	Network Fiber Type	Fiber Core Size (microns)	Modal Bandwidth (Mhz/km)	Maximum Cable Distance <sup>1</sup>
XENPAK-10GB-LR XENPAK-10GB-LW <sup>3</sup>	SC duplex	1310 nm	SMF	G.652 <sup>4</sup>	—	6.2 mi (10 km)
XENPAK-10GB-ER <sup>5</sup>	SC duplex	1550 nm	SMF	G.652 <sup>4</sup>	—	24.9 mi (40 km)
XENPAK-10GB-ZR	SC duplex	1550 nm	SMF	G.652	—	50 mi (80 km)

- Cable distances are based on fiber loss. Additional factors, such as the number of splices and the optical quality of the fiber, can affect cabling distances. Minimum cabling distance for all types is 2 m according to the IEEE 802.3ae standard.
- The Cisco XENPAK-10GB-CX4 transceiver supports link lengths of up to 49.2 feet (15 m) on CX4 cable. Cisco offers four CX4 cables: CAB-INF-28G-1= (1 meter cable), CAB-INF-28G-5= (5 meter cable), CAB-INF-28G-10= (10 meter cable), and CAB-INF-26G-15= (15 meter cable).
- The XENPAK-10GB-LW (WAN PHY) supports a link length of 6.2 miles (10 km) on standard SMF (G.652). The WAN PHY allows
- ITU-T G.652 SMF as specified by the IEEE 802.3z standard.
- Requires a 5 db 1550 nm fixed loss attenuator for cable distances less than 12.43 miles (20 km). The attenuator is available from Cisco Systems (p/n WS-X6K-5DB-ATT=). The attenuator is installed on the receiver side of the transceiver.

Table A-13 lists the fiber loss budgets for the 10-GB XENPAK transceivers.

**Table A-13 Fiber Loss Budgets for the 10-GB XENPAK Transceivers**

10-GB XENPAK Transceiver Product Number	Transmit (dBm)	Receive (dBm)
XENPAK-10GB-SR	-1 (maximum) -7.3 (minimum)	-1 (maximum) -9.9 (minimum)
XENPAK-10GB-LX4	-0.5 per lane (maximum) -6.75 (minimum)	-0.5 per lane (maximum) -14.4 per lane (minimum)
XENPAK-10GB-LR	0.5 (maximum)	0.5 (maximum)
XENPAK-10GB-LW	-8.2 (minimum)	-14.4 (minimum)
XENPAK-10GB-ER	4 (maximum) -4.7 (minimum)	-1 (maximum) -15.8 (minimum)
XENPAK-10GB-ZR	4 (maximum) 0 (minimum)	-7 (maximum) -24 (minimum)

Table A-14 lists the physical and environmental specifications for the XENPAK transceivers.

**Table A-14 10-GB XENPAK Transceiver Physical and Environmental Specifications**

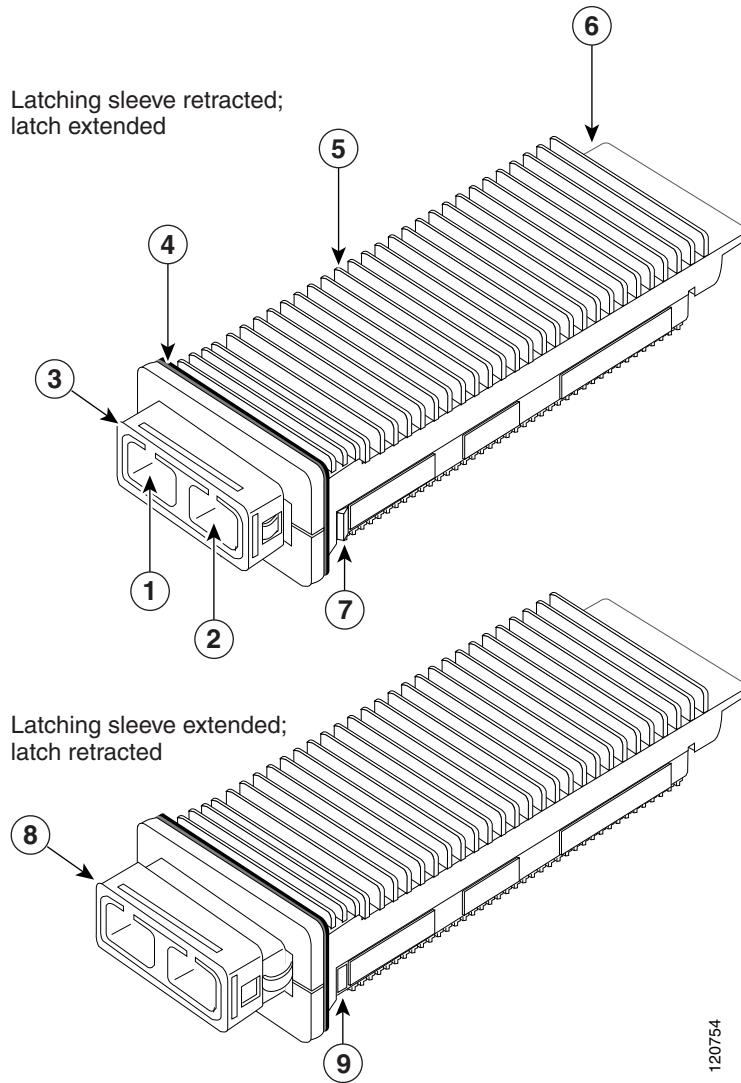
Item	Specification
Dimensions (H x W x D)	0.47 x 1.42 x 4.76 in. (18 x 36 x 121 mm)
Operating temperature	32° to 122°F (0° to 50°C)
Storage temperature	-40° to 185°F (-40° to 85°C)



## X2 Transceivers

Figure A-7 shows the X2 transceivers with the major features identified. Table A-15 lists the cabling specifications for the X2 transceivers.

**Figure A-7 10-GB X2 Transceiver**



1	Transmit optical bore	6	Module connector
2	Receive optical bore	7	Latch (extended)
3	Latching sleeve (retracted)	8	Latching sleeve (extended)
4	EMI gasket	9	Latch (retracted)
5	Transceiver heat sink		

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**Note**

X2 transceivers support patch cords with either PC or UPC connectors. The X2 transceivers do not support patch cords with APC connectors.

**Table A-15 X2 Transceiver Cabling Specifications**

X2 Transceiver Product Number	Connector Type	Wavelength (nm)	Cable Type	Core Size (microns)	Modal Bandwidth (MHz/km)	Maximum Cabling Distance <sup>1</sup>
X2-10GB-SR	SC duplex	850	MMF	62.5	160	85.3 feet (26 m)
				62.5	200	108.3 feet (33 m)
				50.0	400	216.5 feet (66 m)
				50.0	500	269 feet (82 m)
				50.0	2000	984.3 feet (300 m)
X2-10GB-LR	SC duplex	1310	SMF	G.652 fiber	—	6.21 miles (10 km)
X2-10GB-ER	SC duplex	1550	SMF	G.652 fiber	—	24.84 miles (40 km)
X2-10GB-LX4	SC duplex	1310	MMF	62.5	500	984.3 feet (300 m)
				50.0	400	787.4 feet (240 m)
				50.0	500	984.3 feet (300 m)
X2-10GB-CX4	InfiniBand 4X	—	InfiniBand (copper)	—	—	49.2 feet (15 m) <sup>2</sup>
X2-10GB-LRM	SC duplex	1310	MMF	62.5	500	721.8 feet (220 m)
				50.0	400	328 feet (100 m)
				50.0	500	721.8 feet (220 m)

- Cable distances are based on fiber loss. Additional factors, such as the number of splices and the optical quality of the fiber, can affect cabling distances.
- The Cisco X2-10GB-CX4 transceiver supports link lengths of up to 49.2 feet (15 m) on CX4 cable. Cisco offers four CX4 cables: CAB-INF-28G-1= (1 meter cable), CAB-INF-28G-5= (5 meter cable), CAB-INF-28G-10= (10 meter cable), and CAB-INF-26G-15= (15 meter cable).

**Table A-16 X2 Transceiver Optical Transmit and Receive Specifications**

X2 Transceiver Product Number	Transceiver Type	Transmit Power (dBm)	Receive Power (dBm)	Transmit and Receive Wavelength (nm)
X2-10GB-SR	10GBASE-SR, 850-nm MMF	-1.2 (maximum) <sup>1</sup> -7.3 (minimum)	-1.0 (maximum) -9.9 (minimum)	840 to 860
X2-10GB-LR	10GBASE-LR, 1310-nm SMF	0.5 (maximum) -8.2 (minimum)	0.5 (maximum) -14.4 (minimum)	1260 to 1355
X2-10GB-ER	10GBASE-ER, 1550-nm SMF	4.0 (maximum) -4.7 (minimum)	-1.0 (maximum) -15.8 (minimum)	1530 to 1565

Table A-16 X2 Transceiver Optical Transmit and Receive Specifications (continued)

X2 Transceiver Product Number	Transceiver Type	Transmit Power (dBm)	Receive Power (dBm)	Transmit and Receive Wavelength (nm)
X2-10GB-LX4	10GBASE-LX4 WWWDM 1300-nm MMF	-0.5 per lane (maximum) -6.75 (minimum) per lane	-0.5 (maximum) -14.4 per lane	Four lanes; overall range: 1269 to 1356
X2-10GB-LRM	10GBASE-LRM 1310-nm	0.5 (maximum) -6.5 (minimum)	0.5 (maximum) -8.4 (minimum) (in average) -6.4 (minimum) in OMA) <sup>2</sup>	1260 to 1355

1. The launch power shall be the lesser of the class 1 safety limit or the maximum receive power. Class 1 laser requirements are defined by IEC 60825-1: 2001.
2. Both the average and the OMA specifications must be met simultaneously.

X2 transceivers are required for use on the WS-X6708-10GE and the WS-X6716-10GE 10-Gigabit Ethernet modules. Not all X2 transceiver types are supported unconditionally by these two modules; the following caveats apply:

- X2-10GB-CX4—10GBASE for CX4 (copper) cable. No restrictions for use. The Cisco X2-10GB-CX4 transceiver supports link lengths of up to 49.2 feet (15 m) on CX4 cable. Cisco offers four CX4 cables: CAB-INF-28G-1= (1 meter cable), CAB-INF-28G-5= (5 meter cable), CAB-INF-28G-10= (10 meter cable), and CAB-INF-26G-15= (15 meter cable).
- X2-10GB-ER—10GBASE-ER serial 1550-nm extended-reach, single-mode fiber (SMF), dispersion-shifted fiber (DSF). X2-10GB-ER transceivers labeled with a serial number that ends in -02 do not provide EMI compliance when they are installed in the WS-X6716-10GE module. (See [Figure A-8](#) for the serial number location.)
- X2-10GB-LR—10GBASE-LR serial 1310-nm long-reach, single-mode fiber (SMF), dispersion-shifted fiber (DSF). X2-10GB-LR transceivers labeled with a serial number that ends in -02 do not provide EMI compliance when they are installed in the WS-X6716-10GE module. (See [Figure A-8](#) for the serial number location.)
- X2-10GB-LRM—10GBASE-LRM for FDDI-grade multimode fiber (MMF). The X2-10GB-LRM is not supported by the **show idprom** command.
- X2-10GB-LX4—10GBASE-LX4 serial 1310-nm multimode fiber (MMF). X2-10GB-LX4 transceivers that are labeled with a serial number that ends with -01, -02, or -03 do not provide EMI compliance when they are installed in the WS-X6716-10GE. (See [Figure A-8](#) for the serial number location.)
- X2-10GB-SR—10GBASE-SR serial 850-nm short-reach multimode fiber (MMF). No restrictions for use.

**Figure A-8 X2 Transceiver Serial Number Label Locator**

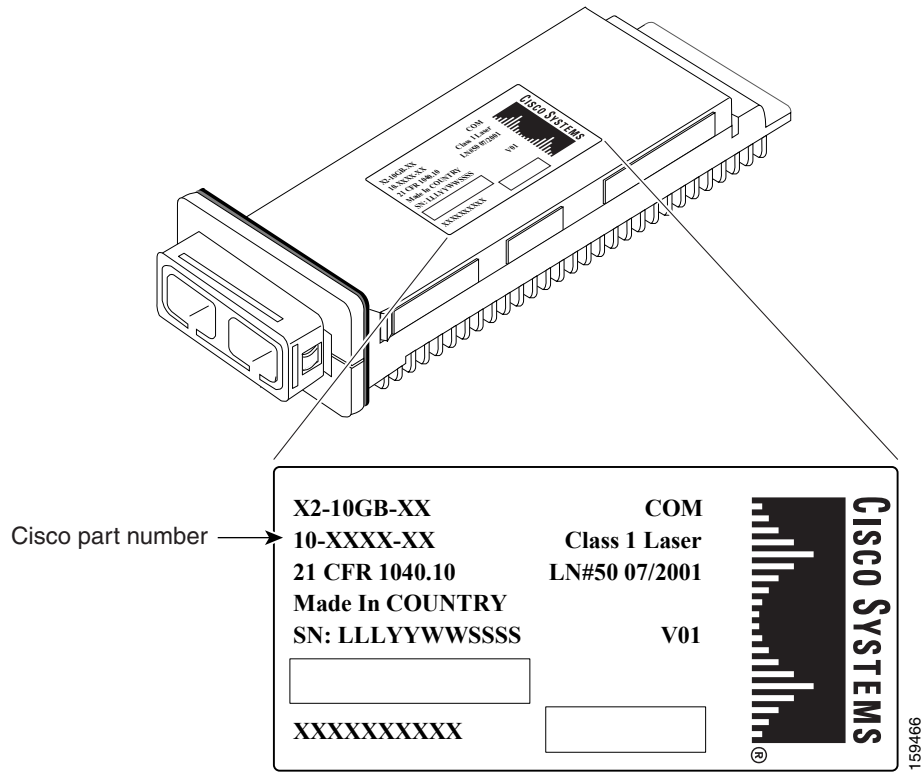


Table A-17 lists the physical and environmental specifications for the X2 transceiver.

**Table A-17 10-GB X2 Transceiver Physical and Environmental Specifications**

Item	Specification
Dimensions (H x W x D)	0.53 x 1.41 x 3.58 inches (13.46 x 36 x 91 mm)
Operating temperature	32° to 122°F (0° to 50°C)
Storage temperature	-40° to 185°F (-40° to 85°C)

## WDM Transceivers

The WDM transceiver modules are listed in [Table A-18](#) along with brief descriptions of the transceiver modules and illustration references.

**Table A-18** WDM Transceivers

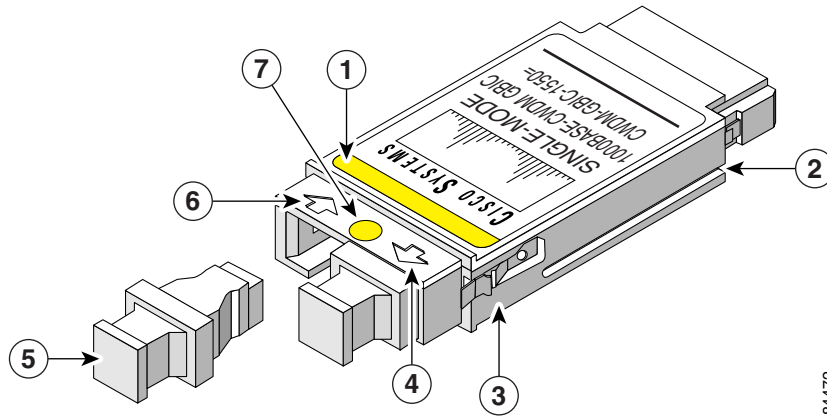
WDM Transceiver Type	Description	Supported on these Modules <sup>1</sup>	WDM Transceiver Illustration	WDM Transceiver Specification Table
CWDM GBIC	The CWDM GBIC transceivers provide 1000BASE-X full-duplex connectivity between the GBIC-compatible modules, supervisor engines, and the network. A set of eight CWDM GBICs are available for use with the CWDM Passive Optical System. The CWDM GBIC transceivers have a duplex SC connector.	<ul style="list-style-type: none"> <li>• WS-X6408A-GBIC</li> <li>• WS-X6416-GBIC</li> <li>• WS-X6516-GBIC</li> <li>• WS-X6516A-GBIC</li> <li>• WS-X6816-GBIC</li> </ul>	<a href="#">Figure A-9</a>	<a href="#">Table A-19</a>
DWDM GBIC	DWDM GBIC transceivers are used as part of a DWDM optical network to provide high-capacity bandwidth across an optical fiber network. There are 32 fixed-wavelength DWDM GBICs that support the International Telecommunications Union (ITU) 100 GHz wavelength grid. The DWDM GBIC transceivers have a duplex SC connector.	<ul style="list-style-type: none"> <li>• WS-X6408A-GBIC</li> <li>• WS-X6416-GBIC</li> <li>• WS-X6516-GBIC</li> <li>• WS-X6516A-GBIC</li> <li>• WS-X6816-GBIC</li> </ul>	<a href="#">Figure A-10</a>	<a href="#">Table A-20</a>
R/O WDM GBIC	The R/O WDM GBIC receiver (WDM-GBIC-REC) operates as a pluggable receiver on any unidirectional link in a CWDM or DWDM transport network; there is no transmitter in the GBIC. The receiver can be used for all wavelengths supported by Cisco CWDM and DWDM transceivers and can be used interchangeably with 1000BASE-SX, 1000BASE-LX/LH, and 1000BASE-ZX transceivers on a port-by-port basis. The W/O WDM receiver has a single SC connector.	<ul style="list-style-type: none"> <li>• WS-X6408A-GBIC</li> <li>• WS-X6416-GBIC</li> <li>• WS-X6516-GBIC</li> <li>• WS-X6516A-GBIC</li> <li>• WS-X6816-GBIC</li> </ul>	—	—

Table A-18 WDM Transceivers (continued)

WDM Transceiver Type	Description	Supported on these Modules <sup>1</sup>	WDM Transceiver Illustration	WDM Transceiver Specification Table
CWDM SFP	The Coarse Wavelength Division Multiplexing (CWDM) SFPs are hot-swappable, transceiver components that you plug into SFP-compatible modules and supervisor engines. The CWDM SFP transceiver uses an LC optical connector to connect to single-mode fiber-optic (SMF) cable. You can connect the CWDM SFPs to CWDM passive optical system optical add/drop multiplexer (OADM) modules or multiplexer/demultiplexer plug-in modules using single-mode fiber-optic cables.	<ul style="list-style-type: none"> <li>WS-X6724-SFP</li> <li>WS-X6748-SFP</li> </ul>	<a href="#">Figure A-11</a>	<a href="#">Table A-21</a>
DWDM XENPAK	DWDM XENPAK transceivers are used as part of a DWDM optical network to provide high-capacity bandwidth across an optical fiber network. There are 32 fixed-wavelength DWDM XENPAK transceivers that support the International Telecommunications Union (ITU) 100 GHz wavelength grid. The DWDM XENPAK transceivers have a duplex SC connector.	<ul style="list-style-type: none"> <li>WS-X6704-10GE</li> </ul>	<a href="#">Figure A-12</a>	<a href="#">Table A-22</a>
R/O WDM XENPAK	The R/O WDM XENPAK receiver (WDM-XENPAK-REC) operates as a pluggable receiver on any unidirectional link in a CWDM or DWDM transport network; there is no transmitter in the XENPAK. The receiver can be used for all wavelengths supported by Cisco DWDM XENPAK transceivers. The W/O WDM receiver has a single SC connector.	<ul style="list-style-type: none"> <li>WS-X6704-10GE</li> </ul>	—	—

1. Not all WDM transceivers may be supported on the modules. Refer to your software release notes for specific information on which WDM transceivers are supported and the software release level necessary to support them.

Figure A-9 CWDM GBIC Transceiver



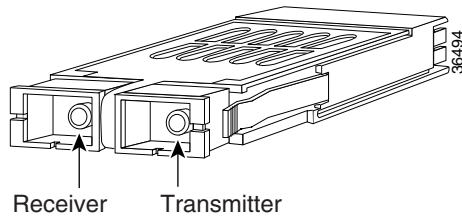
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1	Color arrow on label	5	Optical bore dust plug
2	Alignment groove	6	Receive optical bore
3	Spring clip	7	Color dot
4	Transmit optical bore		

Table A-19 CWDM GBIC Transceivers Wavelengths

Model Number	Color Code	CWDM GBIC Wavelength
CWDM-GBIC-1470=	Gray	1470 nm laser single-mode
CWDM-GBIC-1490=	Violet	1490 nm laser single-mode
CWDM-GBIC-1510=	Blue	1510 nm laser single-mode
CWDM-GBIC-1530=	Green	1530 nm laser single-mode
CWDM-GBIC-1550=	Yellow	1550 nm laser single-mode
CWDM-GBIC-1570=	Orange	1570 nm laser single-mode
CWDM-GBIC-1590=	Red	1590 nm laser single-mode
CWDM-GBIC-1610=	Brown	1610 nm laser single-mode

Figure A-10 DWDM GBIC Transceiver Module



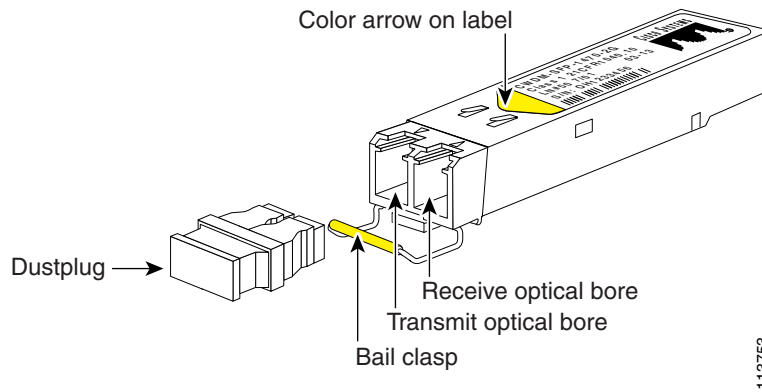
**Table A-20 DWDM GBIC Transceiver Product Numbers and ITU Channel Numbers**

<b>DWDM GBIC Product Number</b>	<b>Description</b>	<b>ITU Channel</b>
DWDM-GBIC-60.61	1000BASE-DWDM 1560.61 nm GBIC	21
DWDM-GBIC-59.79	1000BASE-DWDM 1559.79 nm GBIC	22
DWDM-GBIC-58.98	1000BASE-DWDM 1558.98 nm GBIC	23
DWDM-GBIC-58.17	1000BASE-DWDM 1558.17 nm GBIC	24
DWDM-GBIC-56.55	1000BASE-DWDM 1556.55 nm GBIC	26
DWDM-GBIC-55.75	1000BASE-DWDM 1555.75 nm GBIC	27
DWDM-GBIC-54.94	1000BASE-DWDM 1554.94 nm GBIC	28
DWDM-GBIC-54.13	1000BASE-DWDM 1554.13 nm GBIC	29
DWDM-GBIC-52.52	1000BASE-DWDM 1552.52 nm GBIC	31
DWDM-GBIC-51.72	1000BASE-DWDM 1551.72 nm GBIC	32
DWDM-GBIC-50.92	1000BASE-DWDM 1550.92 nm GBIC	33
DWDM-GBIC-50.12	1000BASE-DWDM 1550.12 nm GBIC	34
DWDM-GBIC-48.51	1000BASE-DWDM 1548.51 nm GBIC	36
DWDM-GBIC-47.72	1000BASE-DWDM 1547.72 nm GBIC	37
DWDM-GBIC-46.92	1000BASE-DWDM 1546.92 nm GBIC	38
DWDM-GBIC-46.12	1000BASE-DWDM 1546.12 nm GBIC	39
DWDM-GBIC-44.53	1000BASE-DWDM 1544.53 nm GBIC	41
DWDM-GBIC-43.73	1000BASE-DWDM 1543.73 nm GBIC	42
DWDM-GBIC-42.94	1000BASE-DWDM 1542.94 nm GBIC	43
DWDM-GBIC-42.14	1000BASE-DWDM 1542.14 nm GBIC	44
DWDM-GBIC-40.56	1000BASE-DWDM 1540.56 nm GBIC	46
DWDM-GBIC-39.77	1000BASE-DWDM 1539.77 nm GBIC	47
DWDM-GBIC-39.98	1000BASE-DWDM 1539.98 nm GBIC	48
DWDM-GBIC-38.19	1000BASE-DWDM 1538.19 nm GBIC	49
DWDM-GBIC-36.61	1000BASE-DWDM 1536.61 nm GBIC	51
DWDM-GBIC-35.82	1000BASE-DWDM 1535.82 nm GBIC	52
DWDM-GBIC-35.04	1000BASE-DWDM 1535.04 nm GBIC	53
DWDM-GBIC-34.25	1000BASE-DWDM 1534.25 nm GBIC	54
DWDM-GBIC-32.68	1000BASE-DWDM 1532.68 nm GBIC	56
DWDM-GBIC-31.90	1000BASE-DWDM 1531.90 nm GBIC	57
DWDM-GBIC-31.12	1000BASE-DWDM 1531.12 nm GBIC	58
DWDM-GBIC-30.33	1000BASE-DWDM 1530.33 nm GBIC	59



**Table A-21 CWDM SFP Transceivers**

Model Number	Color Code	CWDM GBIC Wavelength
CWDM-SFP-1470=	Gray	1470 nm laser, single-mode
CWDM-SFP-1490=	Violet	1490 nm laser, single-mode
CWDM-SFP-1510=	Blue	1510 nm laser, single-mode
CWDM-SFP-1530=	Green	1530 nm laser, single-mode
CWDM-SFP-1550=	Yellow	1550 nm laser, single-mode
CWDM-SFP-1570=	Orange	1570 nm laser, single-mode
CWDM-SFP-1590=	Red	1590 nm laser, single-mode
CWDM-SFP-1610=	Brown	1610 nm laser, single-mode

**Figure A-11 CWDM SFP Transceiver****Table A-22 DWDM XENPAK Transceiver Module Product Numbers and ITU Channel Numbers**

DWDM XENPAK Product Number	Description	ITU Channel
DWDM-XENPAK-60.61	1000BASE-DWDM 1560.61 nm XENPAK	21
DWDM-XENPAK-59.79	1000BASE-DWDM 1559.79 nm XENPAK	22
DWDM-XENPAK-58.98	1000BASE-DWDM 1558.98 nm XENPAK	23
DWDM-XENPAK-58.17	1000BASE-DWDM 1558.17 nm XENPAK	24
DWDM-XENPAK-56.55	1000BASE-DWDM 1556.55 nm XENPAK	26
DWDM-XENPAK-55.75	1000BASE-DWDM 1555.75 nm XENPAK	27
DWDM-XENPAK-54.94	1000BASE-DWDM 1554.94 nm XENPAK	28

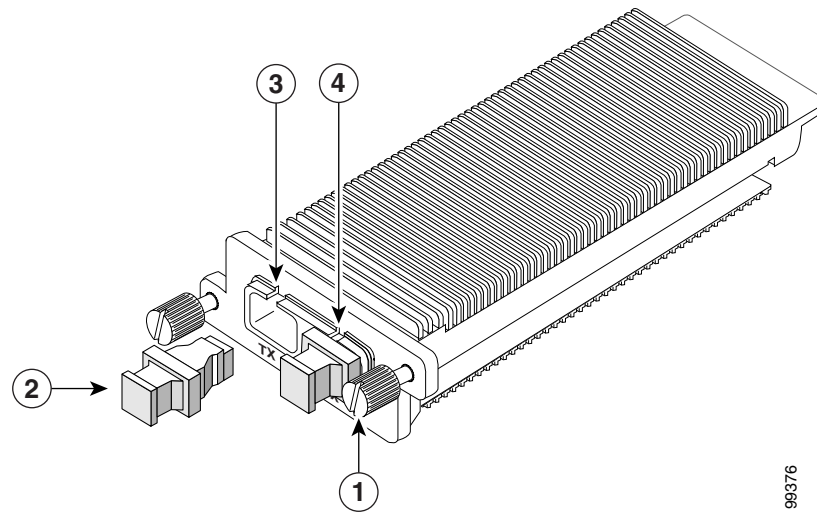
**Table A-22 DWDM XENPAK Transceiver Module Product Numbers and ITU Channel Numbers (continued)**

<b>DWDM XENPAK Product Number</b>	<b>Description</b>	<b>ITU Channel</b>
DWDM-XENPAK-54.13	1000BASE-DWDM 1554.13 nm XENPAK	29
DWDM-XENPAK-52.52	1000BASE-DWDM 1552.52 nm XENPAK	31
DWDM-XENPAK-51.72	1000BASE-DWDM 1551.72 nm XENPAK	32
DWDM-XENPAK-50.92	1000BASE-DWDM 1550.92 nm XENPAK	33
DWDM-XENPAK-50.12	1000BASE-DWDM 1550.12 nm XENPAK	34
DWDM-XENPAK-48.51	1000BASE-DWDM 1548.51 nm XENPAK	36
DWDM-XENPAK-47.72	1000BASE-DWDM 1547.72 nm XENPAK	37
DWDM-XENPAK-46.92	1000BASE-DWDM 1546.92 nm XENPAK	38
DWDM-XENPAK-46.12	1000BASE-DWDM 1546.12 nm XENPAK	39
DWDM-XENPAK-44.53	1000BASE-DWDM 1544.53 nm XENPAK	41
DWDM-XENPAK-43.73	1000BASE-DWDM 1543.73 nm XENPAK	42
DWDM-XENPAK-42.94	1000BASE-DWDM 1542.94 nm XENPAK	43
DWDM-XENPAK-42.14	1000BASE-DWDM 1542.14 nm XENPAK	44
DWDM-XENPAK-40.56	1000BASE-DWDM 1540.56 nm XENPAK	46
DWDM-XENPAK-39.77	1000BASE-DWDM 1539.77 nm XENPAK	47
DWDM-XENPAK-39.98	1000BASE-DWDM 1539.98 nm XENPAK	48
DWDM-XENPAK-38.19	1000BASE-DWDM 1538.19 nm XENPAK	49
DWDM-XENPAK-36.61	1000BASE-DWDM 1536.61 nm XENPAK	51
DWDM-XENPAK-35.82	1000BASE-DWDM 1535.82 nm XENPAK	52
DWDM-XENPAK-35.04	1000BASE-DWDM 1535.04 nm XENPAK	53

**Table A-22 DWDM XENPAK Transceiver Module Product Numbers and ITU Channel Numbers (continued)**

DWDM XENPAK Product Number	Description	ITU Channel
DWDM-XENPAK-34.25	1000BASE-DWDM 1534.25 nm XENPAK	54
DWDM-XENPAK-32.68	1000BASE-DWDM 1532.68 nm XENPAK	56
DWDM-XENPAK-31.90	1000BASE-DWDM 1531.90 nm XENPAK	57
DWDM-XENPAK-31.12	1000BASE-DWDM 1531.12 nm XENPAK	58
DWDM-XENPAK-30.33	1000BASE-DWDM 1530.33 nm XENPAK	59

**Figure A-12 DWDM XENPAK Transceiver**



<b>1</b>	Captive installation screw	<b>3</b>	Transmit optical bore
<b>2</b>	Dustplug	<b>4</b>	Receive optical bore

# Module Connectors

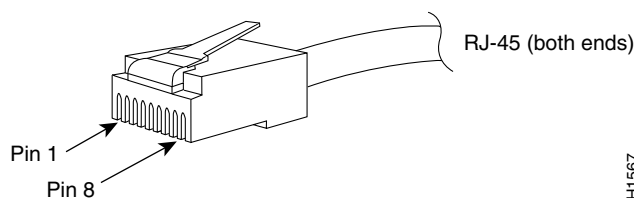
This section covers the types of module connectors used with the Catalyst 6500 series switches:

- [RJ-45 Connector, page A-24](#)
- [RJ-21 Connector, page A-25](#)
- [RJ-21 Connector \(WS-X6624-FXS Only\), page A-27](#)
- [SC Connector, page A-28](#)
- [MT-RJ Connector, page A-29](#)
- [LC Connector, page A-30](#)

## RJ-45 Connector

The RJ-45 connector (shown in [Figure A-13](#)) is used to connect a Category 3, Category 5, Category 5e, or Category 6 foil twisted-pair or unshielded twisted-pair cable from the external network to the module interface connector.

**Figure A-13** RJ-45 Interface Cable Connector



**Caution**

Category 5e, Category 6 and Category 6a cables can store large levels of static electricity because of the dielectric properties of the materials used in their construction. Always ground the cables (especially in new cable runs) to a suitable and safe earth ground before connecting them to the module.



**Caution**

To comply with GR-1089 intrabuilding, lightning immunity requirements, you must use foil twisted-pair (FTP) cable that is properly grounded at both ends.

## RJ-21 Connector

The RJ-21 connectors (shown in [Figure A-14](#)) are used on telco modules. Each RJ-21 connector has pins for 12 ports.



### Note

The RJ-21 connector for the WS-X6624-FXS module has pins for 24 ports. See the “[RJ-21 Connector \(WS-X6624-FXS Only\)](#)” section on page A-27.



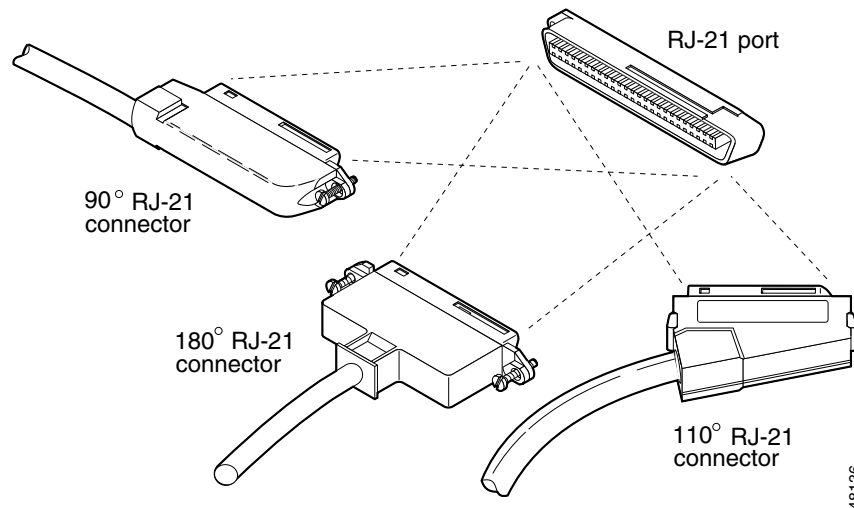
### Warning



**If the symbol of suitability with an overlaid cross appears above a port, you must not connect the port to a public network that follows the European Union standards. Connecting the port to this type of public network can cause severe personal injury or can damage the unit.** Statement 1031

To connect to 10/100BASE-TX RJ-21 telco interfaces, use Category 5 UTP cables with male RJ-21 connectors, as shown in [Figure A-14](#). The WS-X6224-FXS analog interface module also uses an RJ-21 connector, but the pinout arrangement is different than the 10/100BASE-TX.

**Figure A-14** RJ-21 Telco Interface Cable Connectors



[Table A-23](#) lists the output signals for the RJ-21 telco connector. The receive and transmit signals are polarized. One pin of each signal pair carries the positive (+) signal, and the other pin carries the negative (–) signal.



### Note

[Table A-23](#) lists the *output signals* for the RJ-21 telco connector, not the *pinouts* of the cable connecting to the module.

**Caution**

Category 5e and Category 6 cables can store large levels of static electricity because of the dielectric properties of the materials used in their construction. Always ground the cables (especially in new cable runs) to a suitable and safe earth ground before connecting them to the module.

**Caution**

To comply with GR-1089 intrabuilding, lightning immunity requirements, you must use foil-twisted pair (FTP) cable that is properly grounded at both ends.

**Table A-23 RJ-21 Connector Pinout**

<b>Ethernet Port No.</b>	<b>Connector Pin No.</b>	<b>Signal</b>	<b>Connector Pin No.</b>	<b>Signal</b>
1	1	RxD (-)	26	RxD (+)
	2	TxD (-)	27	TxD (+)
2	3	RxD (-)	28	RxD (+)
	4	TxD (-)	29	TxD (+)
3	5	RxD (-)	30	RxD (+)
	6	TxD (-)	31	TxD (+)
4	7	RxD (-)	32	RxD (+)
	8	TxD (-)	33	TxD (+)
5	9	RxD (-)	34	RxD (+)
	10	TxD (-)	35	TxD (+)
6	11	RxD (-)	36	RxD (+)
	12	TxD (-)	37	TxD (+)
7	13	RxD (-)	38	RxD (+)
	14	TxD (-)	39	TxD (+)
8	15	RxD (-)	40	RxD (+)
	16	TxD (-)	41	TxD (+)
9	17	RxD (-)	42	RxD (+)
	18	TxD (-)	43	TxD (+)
10	19	RxD (-)	44	RxD (+)
	20	TxD (-)	45	TxD (+)
11	21	RxD (-)	46	RxD (+)
	22	TxD (-)	47	TxD (+)
12	23	RxD (-)	48	RxD (+)
	24	TxD (-)	49	TxD (+)
—	25	Gnd	50	Gnd

## RJ-21 Connector (WS-X6624-FXS Only)

The pinout for the RJ-21 connector on the 24-port WS-X6624-FXS analog interface module is shown in [Table A-24](#).

**Table A-24** RJ-21 Connector Pinout (WS-X6224-FXS Analog Interface Module Only)

Port Number	Connector Pin Number	Signal	Port Number	Connector Pin Number	Signal
1	1 26	Ring Tip	13	13 38	Ring Tip
2	2 27	Ring Tip	14	14 39	Ring Tip
3	3 28	Ring Tip	15	15 40	Ring Tip
4	4 29	Ring Tip	16	16 41	Ring Tip
5	5 30	Ring Tip	17	17 42	Ring Tip
6	6 31	Ring Tip	18	18 43	Ring Tip
7	7 32	Ring Tip	19	19 44	Ring Tip
8	8 33	Ring Tip	20	20 45	Ring Tip
9	9 34	Ring Tip	21	21 46	Ring Tip
10	10 35	Ring Tip	22	22 47	Ring Tip
11	11 36	Ring Tip	23	23 48	Ring Tip
12	12 37	Ring Tip	24	24 49	Ring Tip
—	—	—	—	25, 50, 51, 52	GND

## SC Connector

The SC connector, shown in [Figure A-15](#), is used to connect fiber-optic module ports or transceivers with the external SMF or MMF network.



### Warning

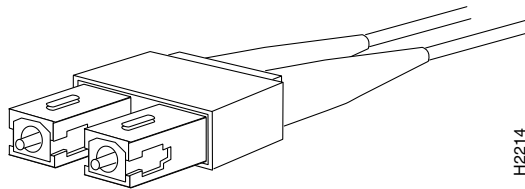
**Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051



### Note

Make sure that the optical connectors are clean before making the connections. Contaminated connectors can damage the fiber and cause data errors. For information on cleaning the optical connectors, see the [“Cleaning the Fiber-Optic Connectors”](#) section on page A-38.

**Figure A-15** SC Fiber-Optic Connector



Always insert the network connector completely into the socket. A secure connection is especially important when you are establishing a connection between a module and a long distance (1.24 miles) (2 km) network or a module and a suspected highly attenuated network. If the link LED does not light, try removing the network cable plug and reinserting it firmly into the module socket. It is possible that dirt or skin oils have accumulated on the plug faceplate (around the optical-fiber openings), generating significant attenuation and reducing the optical power levels below threshold levels so that a link cannot be made.



### Caution

Use extreme care when removing or installing connectors so that you do not damage the connector housing or scratch the end-face surface of the fiber. Always install protective covers on unused or disconnected components to prevent contamination. Always clean fiber connectors before installing them.



## MT-RJ Connector

The MT-RJ connector is a small form-factor fiber-optic connector used to connect modules to a SMF or MMF optical network. (See [Figure A-16](#).) The small size of the MT-RJ connector, as compared with the SC connector, allows for a greater port density on the modules. The MT-RJ connector is a two-fiber connector (transmit and receive) and has a form factor and clip lock retainer similar to the RJ-45 copper connector.

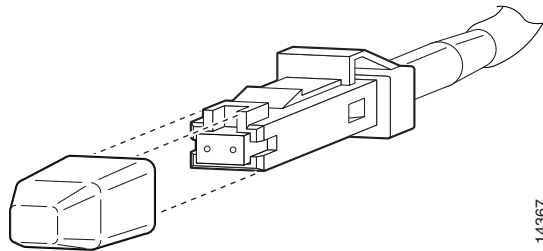


**Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051



Make sure that the optical connectors are clean before making the connections. Contaminated connectors can damage the fiber and cause data errors. For information on cleaning the optical connectors, see the [“Cleaning the Fiber-Optic Connectors”](#) section on page A-38.

**Figure A-16** MT-RJ Connector



## LC Connector

**Warning**

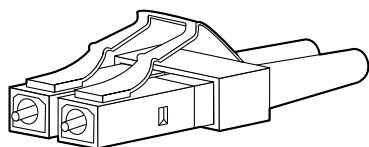
**Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

The LC fiber optic connector, shown in [Figure A-17](#), is a small form-factor fiber-optic connector that provides high-density fiber connectivity. The LC connector can be used with either MMF cable or SMF cable. The LC connector uses a latching clip mechanism that is similar to the one used on the RJ-45 copper connector.

**Note**

Make sure that the optical connectors are clean before making the connections. Contaminated connectors can damage the fiber and cause data errors. For information on cleaning the optical connectors, see the [“Cleaning the Fiber-Optic Connectors”](#) section on page A-38.

**Figure A-17** LC Fiber Optic Connector



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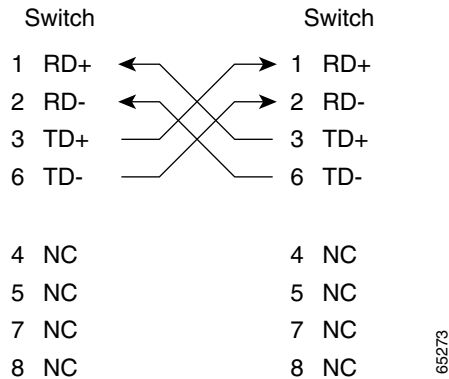
# Cables

Table A-25 lists the connector pinouts and signal names for a 10/100BASE-T crossover (MDI-X) cable. Figure A-18 shows a schematic of the 10/100BASE-T crossover cable. Table A-26 lists the connector pinouts and signal names for a 1000BASE-T crossover (MDI-X) cable. Figure A-19 shows a schematic of the 1000BASE-T crossover cable.

**Table A-25** 10/100BASE-T Crossover Cable Pinout (MDI-X)

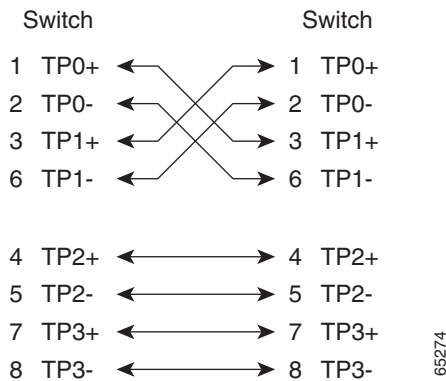
Side 1 Pin (Signal)	Side 2 Pin (Signal)
1 (RD+)	3 (TD+)
2 (RD-)	6 (TD-)
3 (TD+)	1 (RD+)
6 (TD-)	2 (RD-)
4 (Not used)	4 (Not used)
5 (Not used)	5 (Not used)
7 (Not used)	7 (Not used)
8 (Not used)	8 (Not used)

**Figure A-18** Twisted-Pair Crossover 10/100BASE-T Cable Schematic



**Table A-26** 1000BASE-T Crossover Cable Pinout (MDI-X)

Side 1 Pin (Signal)	Side 2 Pin (Signal)
1 (TP0+)	3 (TP1+)
2 (TP0-)	6 (TP1-)
3 (TP1+)	1 (TP0+)
6 (TP1-)	2 (TP0-)
4 (TP2+)	7 (TP3+)
5 (TP2-)	8 (TP3-)
7 (TP3+)	4 (TP2+)
8 (TP3-)	5 (TP2-)

**Figure A-19** Twisted-Pair Crossover 1000BASE-T Cable Schematic**Note**

Power over Ethernet (PoE), uses pairs 2 and 3 (pins 1, 2, 3, and 6) in a four-pair UTP cable to transmit power from the switch to a powered device. This method of supplying power is sometimes called “phantom power” because the PoE power travels over the same pairs of wires used to transmit the Ethernet signals. The PoE voltage is completely transparent to the Ethernet signals and does not interfere with their operation.

Catalyst 6500 series switches come with an accessory kit that contains the cable and adapters that you will need to connect a console (an ASCII terminal or PC running terminal emulation software) or modem to the console port. The accessory kit includes these items:

- RJ-45-to-RJ-45 rollover cable
- RJ-45-to-DB-9 female DTE adapter (labeled “Terminal”)
- RJ-45-to-DB-25 female DTE adapter (labeled “Terminal”)
- RJ-45-to-DB-25 male DCE adapter (labeled “Modem”)

## Console Port Mode Switch

The supervisor engine front-panel console port mode switch allows you to connect a terminal or modem to the console port as follows:

- Mode 1—Switch in the *in* position. Use this mode to connect a terminal to the console port using the RJ-45-to-RJ-45 rollover cable and DTE adapter (labeled “Terminal”).

You can also use this mode to connect a modem to the console port using the RJ-45-to-RJ-45 rollover cable and DCE adapter (labeled “Modem”).

See the “[Console Port Mode 1 Signaling and Pinouts](#)” section on page A-34.

- Mode 2—Switch in the *out* position. Use this mode to connect a terminal to the console port using the Catalyst 5000 family Supervisor Engine III console cable and the appropriate adapter for the terminal connection. (The cable and adapter are not provided.)

See the “[Console Port Mode 2 Signaling and Pinouts](#)” section on page A-35.



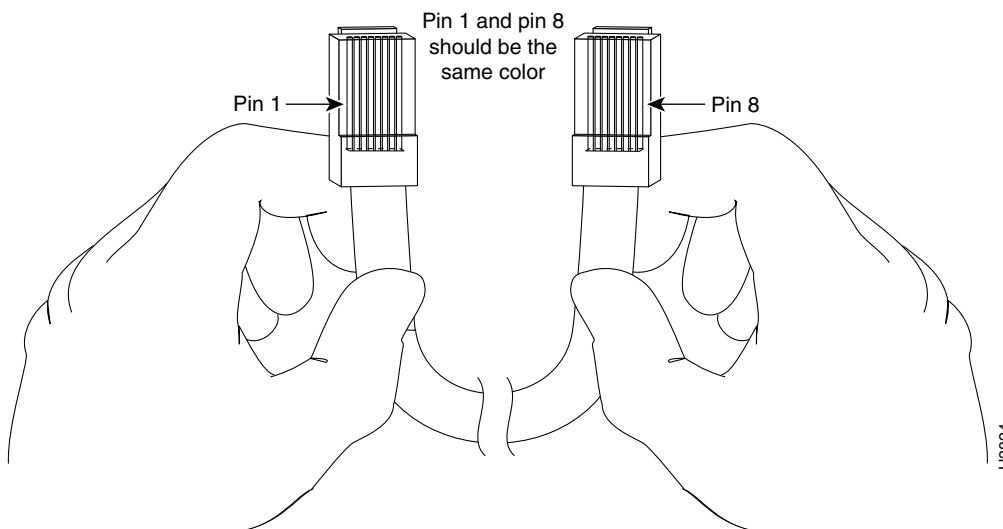
### Note

Use a ballpoint pen tip or other small, pointed object to access the console port mode switch. The switch is shipped in the *in* position.

## Identifying a Rollover Cable

You can identify a rollover cable by comparing the two ends of the cable. Holding the cables side by side, with the tab at the back, the wire connected to the pin on the outside of the left plug should be the same color as the wire connected to the pin on the outside of the right plug. (See [Figure A-20](#).) If your cable was purchased from Cisco Systems, pin 1 will be white on one connector, and pin 8 will be white on the other. (A rollover cable reverses pins 1 and 8, 2 and 7, 3 and 6, and 4 and 5.)

**Figure A-20** Identifying a Rollover Cable



## Console Port Mode 1 Signaling and Pinouts

This section provides the signaling and pinouts for the console port in mode 1. (The port mode switch is in the *in* position.)

### DB-9 Adapter (for Connecting to a PC)

Use the RJ-45-to-RJ-45 rollover cable and the RJ-45-to-DB-9 female DTE adapter (labeled “Terminal”) to connect the console port to a PC running terminal emulation software. [Table A-27](#) lists the pinouts for the asynchronous serial console port, the RJ-45-to-RJ-45 rollover cable, and the RJ-45-to-DB-9 female DTE adapter.

**Table A-27** Port Mode 1 Signaling and Pinouts (DB-9 Adapter)

Console Port	RJ-45-to-RJ-45 Rollover Cable		RJ-45-to-DB-9 Terminal Adapter	Console Device
	RJ-45 Pin	RJ-45 Pin	DB-9 Pin	
RTS	1 <sup>1</sup>	8	8	CTS
DTR	2	7	6	DSR
TxD	3	6	2	RxD
GND	4	5	5	GND
GND	5	4	5	GND
RxD	6	3	3	TxD
DSR	7	2	4	DTR
CTS	8 <sup>1</sup>	1	7	RTS

1. Pin 1 is connected internally to Pin 8.

### DB-25 Adapter (for Connecting to a Terminal)

Use the RJ-45-to-RJ-45 rollover cable and the RJ-45-to-DB-25 female DTE adapter (labeled “Terminal”) to connect the console port to a terminal. [Table A-28](#) lists the pinouts for the asynchronous serial console port, the RJ-45-to-RJ-45 rollover cable, and the RJ-45-to-DB-25 female DTE adapter.

**Table A-28** Port Mode 1 Signaling and Pinouts (DB-25 Adapter)

Console Port	RJ-45-to-RJ-45 Rollover Cable		RJ-45-to-DB-25 Terminal Adapter	Console Device
	RJ-45 Pin	RJ-45 Pin	DB-25 Pin	
RTS	1 <sup>1</sup>	8	5	CTS
DTR	2	7	6	DSR
TxD	3	6	3	RxD
GND	4	5	7	GND
GND	5	4	7	GND
RxD	6	3	2	TxD

**Table A-28** Port Mode 1 Signaling and Pinouts (DB-25 Adapter) (continued)

Console Port	RJ-45-to-RJ-45 Rollover Cable		RJ-45-to-DB-25 Terminal Adapter	Console Device
Signal	RJ-45 Pin	RJ-45 Pin	DB-25 Pin	Signal
DSR	7	3	20	DTR
CTS	8 <sup>1</sup>	1	4	RTS

1. Pin 1 is connected internally to Pin 8.

## Modem Adapter

Use the RJ-45-to-RJ-45 rollover cable and the RJ-45-to-DB-25 male DCE adapter (labeled “Modem”) to connect the console port to a modem. [Table A-29](#) lists the pinouts for the asynchronous serial auxiliary port, the RJ-45-to-RJ-45 rollover cable, and the RJ-45-to-DB-25 male DCE adapter.

**Table A-29** Port Mode 1 Signaling and Pinouts (Modem Adapter)

Console Port	RJ-45-to-RJ-45 Rollover Cable		RJ-45-to-DB-25 Modem Adapter	Modem
Signal	RJ-45 Pin	RJ-45 Pin	DB-25 Pin	Signal
RTS	1 <sup>1</sup>	8	4	RTS
DTR	2	7	20	DTR
TxD	3	6	3	TxD
GND	4	5	7	GND
GND	5	4	7	GND
RxD	6	3	2	RxD
DSR	7	3	8	DCD
CTS	8 <sup>1</sup>	1	5	CTS

1. Pin 1 is connected internally to Pin 8.

## Console Port Mode 2 Signaling and Pinouts

This section provides the signaling and pinouts for the console port in mode 2. (The port mode switch in the *out* position.) (See [Table A-30](#) for the pinouts.)

**Table A-30** Port Mode 2 Signaling and Pinouts (Port Mode Switch Out)

Console Port	Console Device
Pin (signal)	Input/Output
1 (RTS) <sup>1</sup>	Output
2 (DTR)	Output
3 (RxD)	Input

**Table A-30 Port Mode 2 Signaling and Pinouts (Port Mode Switch Out) (continued)**

Console Port	Console Device
4 (GND)	GND
5 (GND)	GND
6 (TxD)	Output
7 (DSR)	Input
8 (CTS) <sup>1</sup>	Input

1. Pin 1 is connected internally to Pin 8.

## Mode-Conditioning Patch Cord

When using the long wavelength/long-haul (LX/LH) GBIC with 62.5-micron diameter MMF, you must install a mode-conditioning patch cord (Cisco product number CAB-GELX-625 or equivalent) between the GBIC and the multimode fiber (MMF) cable on both the transmit and receive ends of the link. A mode-conditioning patch cord is required for 1000BASE-LX/LH applications over FDDI-grade, OM1, and OM2 fiber cable types. Mode-conditioning patch cords should not be used for applications over OM3 fiber cable (laser-optimized fiber cable). For additional information on mode-conditioning patch cords, refer to the *Use of Mode Conditioning Patch Cables in Gigabit Ethernet and 10 Gigabit Ethernet Laser-Based Transmissions* bulletin at:

[http://www.cisco.com/en/US/prod/collateral/modules/ps5455/product\\_bulletin\\_c25-530836.html](http://www.cisco.com/en/US/prod/collateral/modules/ps5455/product_bulletin_c25-530836.html)



### Note

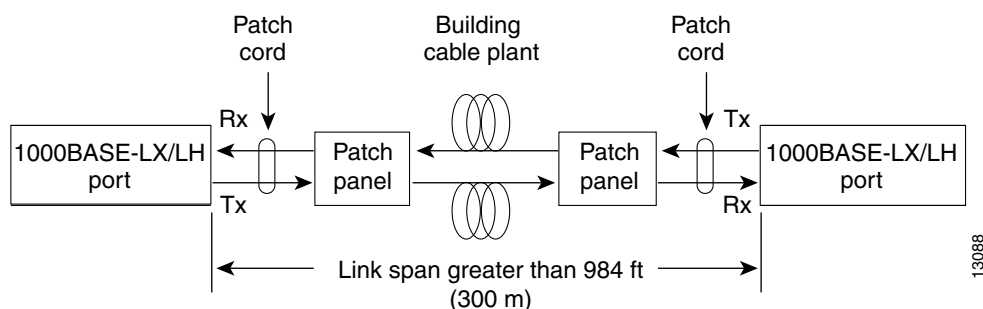
We do not recommend using the LX/LH GBIC and MMF without the patch cord for very short link distances of 33 to 328 feet (10 to 100 meters). The result could be an elevated bit error rate (BER).

The patch cord is required to comply with IEEE standards. IEEE found that link distances could not be met with certain types of fiber-optic cable due to a problem in the center of some fiber-optic cable cores. The solution is to launch light from the laser at a precise offset from the center by using the patch cord. At the output of the patch cord, the LX/LH GBIC complies with the IEEE 802.3z standard for 1000BASE-LX.

## Patch Cord Configuration Example

Figure A-21 shows a typical configuration using the patch cord.

**Figure A-21 Patch Cord Configuration**





## Patch Cord Installation

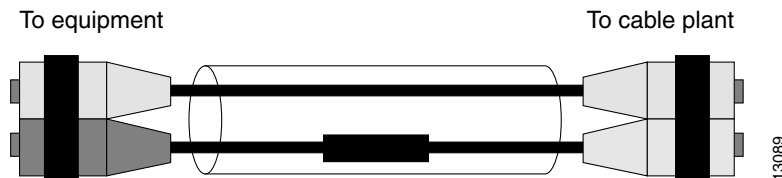


**Warning**

**Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

Plug the end of the patch cord labeled “To Equipment” into the GBIC. (See [Figure A-22](#).) Plug the end labeled “To Cable Plant” into the patch panel. The patch cord is 9.8 feet (3 meters) long and has duplex SC male connectors at each end.

**Figure A-22 Patch Cord Installation**



## Differential Mode Delay

When an unconditioned laser source designed for operation on an SMF cable is directly coupled to an MMF cable, differential mode delay (DMD) might occur. DMD can degrade the modal bandwidth of the fiber-optic cable. This degradation causes a decrease in the link span (the distance between the transmitter and the receiver) that can be reliably supported.

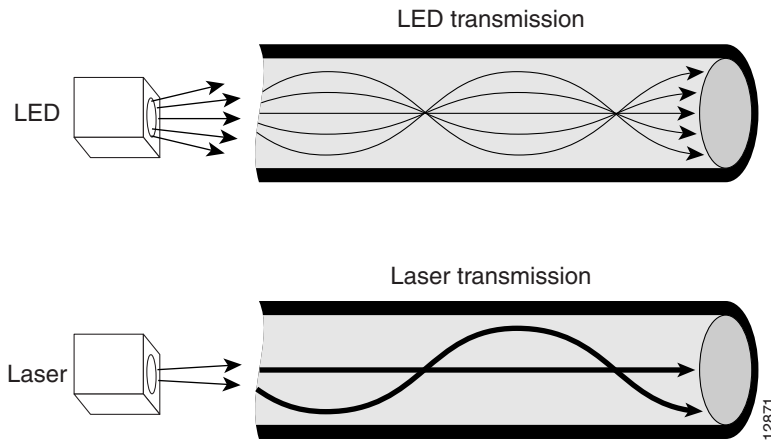
The Gigabit Ethernet specification (IEEE 802.3z) outlines parameters for Ethernet communications at a gigabit-per-second rate. The specification offers a higher-speed version of Ethernet for backbone and server connectivity using existing deployed MMF cable by defining the use of laser-based optical components to propagate data over MMF cable.

Lasers function at the baud rates and longer distances required for Gigabit Ethernet. The 802.3z Gigabit Ethernet Task Force has identified the DMD condition that occurs with particular combinations of lasers and MMF cable. The results create an additional element of jitter that can limit the reach of Gigabit Ethernet over MMF cable.

With DMD, a single laser light pulse excites a few modes equally within an MMF cable. These modes, or light pathways, then follow two or more different paths. These paths might have different lengths and transmission delays as the light travels through the cable. With DMD, a distinct pulse propagating down the cable no longer remains a distinct pulse or, in extreme cases, might become two independent pulses. Strings of pulses can interfere with each other making it difficult to recover data.

DMD does not occur in all deployed fibers; it occurs with certain combinations of worst-case fibers and worst-case transceivers. Gigabit Ethernet experiences this problem because of its very high baud rate and its long MMF cable lengths. SMF cable and copper cable are not affected by DMD.

MMF cable has been tested for use only with LED sources. LEDs can create an *overfilled launch condition* within the fiber-optic cable. The overfilled launch condition describes the way LED transmitters couple light into the fiber-optic cable in a broad spread of modes. Similar to a light bulb radiating light into a dark room, the generated light that shines in multiple directions can overfill the existing cable space and excite a large number of modes. (See [Figure A-23](#).)

**Figure A-23 LED Transmission Compared to Laser Transmission**

Lasers launch light in a more concentrated fashion. A laser transmitter couples light into only a fraction of the existing modes or optical pathways present in the fiber-optic cable. (See [Figure A-23](#).)

The solution is to condition the laser light launched from the source (transmitter) so that it spreads the light evenly across the diameter of the fiber-optic cable making the launch look more like an LED source to the cable. The objective is to scramble the modes of light to distribute the power more equally in all modes and prevent the light from being concentrated in just a few modes.

An unconditioned launch, in the worst case, might concentrate all of its light in the center of the fiber-optic cable, exciting only two or more modes equally.

A significant variation in the amount of DMD is produced from one MMF cable to the next. No reasonable test can be performed to survey an installed cable plant to assess the effect of DMD, so you must use the mode-conditioning patch cords for all uplink modules using MMF when the link span exceeds 984 feet (300 meters).

For link spans less than 984 feet (300 meters), you can omit the patch cord. (We do not recommend using the LX/LH GBIC and MMF without a patch cord for very short link distances of 33 to 328 feet [10 to 100 meters]. The result could be an elevated bit error rate [BER].)

## Cleaning the Fiber-Optic Connectors

Fiber-optic connectors are used to connect two fibers together. When these connectors are used in a communications system, proper connection becomes a critical factor.

Fiber-optic cable connectors can be damaged by improper cleaning and connection procedures. Dirty or damaged fiber-optic connectors can result in communication that is not repeatable or inaccurate.

Fiber-optic connectors differ from electrical or microwave connectors. In a fiber-optic system, light is transmitted through an extremely small fiber core. Because fiber cores are often 62.5 microns or less in diameter, and dust particles range from a tenth of a micron to several microns in diameter, dust and any contamination at the end of the fiber core can degrade the performance of the connector interface where the two cores meet. The connector must be precisely aligned, and the connector interface must be absolutely free of trapped foreign material.

Connector loss, or insertion loss, is a critical performance characteristic of a fiber-optic connector. Return loss is also an important factor. Return loss specifies the amount of reflected light; the lower the reflection, the better the connection. The best physical contact connectors have return losses greater than  $-40$  dB, although  $-20$  to  $-30$  dB is more common.

The connection quality depends on two factors: the type of connector and the proper cleaning and connection techniques. Dirty fiber connectors are a common source of light loss. Keep the connectors clean at all times, and keep the dust covers installed when the connectors are not in use.

Before installing any type of cable or connector, use a lint-free alcohol pad from a cleaning kit to clean the ferrule, the protective white tube around the fiber, and the end-face surface of the fiber.

As a general rule, whenever there is a significant, unexplained loss of light, clean the connectors.

**Caution**

Use extreme care when removing or installing connectors so that you do not damage the connector housing or scratch the end-face surface of the fiber. Always install protective covers on unused or disconnected components to prevent contamination. Always clean fiber connectors before installing them.

To clean the optical connectors, use a CLETOP cassette cleaner (type A for SC connectors or type B for MT-RJ connectors) and follow the product directions. If a CLETOP cassette cleaner is not available, follow these steps:

**Step 1** Use a lint-free tissue soaked in 99 percent pure isopropyl alcohol to gently wipe the faceplate. Wait five seconds for the surfaces to dry, and repeat.

**Step 2** Remove any residual dust from the faceplate with clean, dry, oil-free compressed air.

**Warning**

**Invisible laser radiation may be emitted from disconnected fibers or connectors. Do not stare into beams or view directly with optical instruments.** Statement 1051

**Step 3** Use a magnifying glass or inspection microscope to inspect the ferrule at an angle. Do not look directly into the aperture. Repeat the process if any contamination is detected.

The connectors used inside the system have been cleaned by the manufacturer and connected to the adapters in the proper manner. The operation of the system should be error free if the customer provides clean connectors on the application side, follows the previous directions, and follows these guidelines:

- Clean the connectors using either a CLETOP cassette cleaner (Type A for SC connectors and Type B for MT-RJ connectors) or lens tissues before connecting to the adapters. Use pure alcohol to remove contamination.
- Do not clean the inside of the connector adapters.
- Do not use force or quick movements when connecting the fiber-optic connectors in the adapters.
- Cover the connectors and adapters to keep the inside of the adapters or the surface of the connectors from getting dirty when you are not using the connectors or while you are cleaning the chassis.





## APPENDIX **A**

# Repacking the Switch

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If you need to return or move the Catalyst 6500 series switch chassis, follow these steps to repack the switch using the original packaging material:

- 
- Step 1** Set the chassis in the bottom pallet. (See [Figure A-1.](#))
  - Step 2** Place the packing bag over the chassis.
  - Step 3** Place the front-packing material and power supply packing material around the chassis.
  - Step 4** Place the power supplies in the spaces provided in the power supply packing material. (See [Figure A-1.](#))
  - Step 5** Place the top-packing material over the top of the chassis and power supplies.
  - Step 6** Place the rack-mount kit and the accessory kit on the top-packing material.

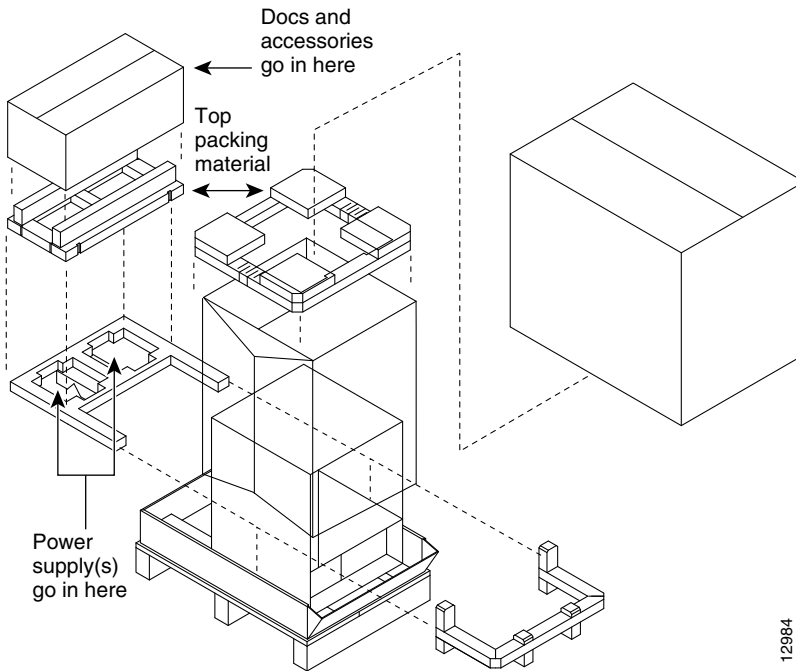
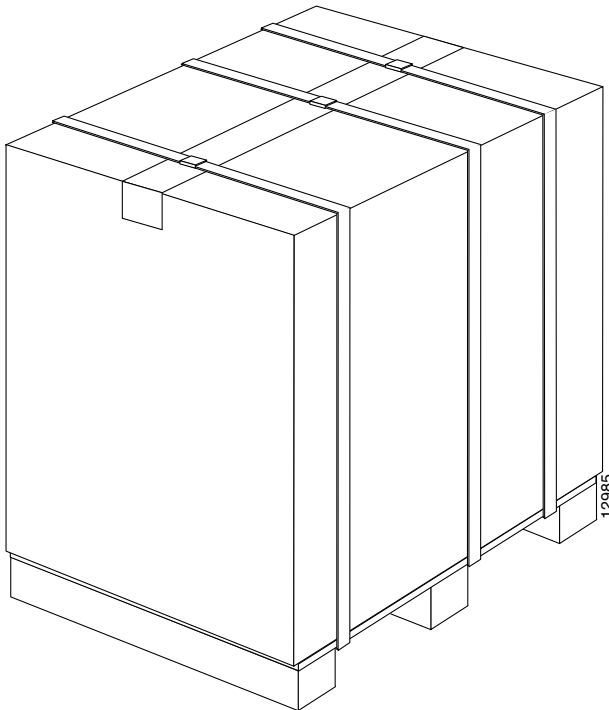


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**Note** You must include the accessory kit for the final packaging to fit properly.

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- Step 7** Place the outside carton over the entire package.
  - Step 8** Fold the outside carton down over the top and seal with packing tape.
  - Step 9** Wrap three packing straps tightly around the top and bottom of the package to hold the outside carton and the bottom pallet together. (See [Figure A-2.](#))
-

**Figure A-1** *Packing Material***Figure A-2** *Final Package***Note**

Do not use tape to hold the outside carton to the bottom pallet. Packing straps must be added to hold the entire package together and to add strength to the package.



# A

## APPENDIX

## Chassis and Module Power and Heat Values

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This appendix provides the power and heat numbers for the Catalyst 6500 series chassis and modules. The following power requirements and heat dissipation tables are provided:

- Chassis and fan trays—[Table A-1](#)
- IP phones—[Table A-2](#)
- Supervisor engines—[Table A-3](#)
- Policy Feature Cards (PFCs)—[Table A-4](#)
- Distributed Forwarding Cards (DFCs)—[Table A-5](#)
- Switch fabric modules—[Table A-6](#)
- 10-Gigabit Ethernet modules—[Table A-7](#)
- 40-Gigabit Ethernet modules—[Table A-8](#)
- Gigabit Ethernet modules—[Table A-9](#)
- 10/100/1000 Ethernet modules—[Table A-10](#)
- Fast Ethernet switching modules—[Table A-11](#)
- 10/100 Ethernet switching modules—[Table A-12](#)
- 10BASE Ethernet switching modules—[Table A-13](#)
- FlexWAN and Enhanced FlexWAN modules—[Table A-14](#)
- Service modules—[Table A-15](#)
- Miscellaneous modules—[Table A-16](#)

Unless otherwise noted, the information in the following tables is measured under fully loaded conditions (transceivers installed). Typical numbers are approximately 20 percent below the numbers listed in these tables.



**Note**

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Module power is the output from the power supply (internal to the system). The AC-input power is the input from the outlet to the power supply. The percentage difference between the two values is the efficiency of the power supply.

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Table A-1 Power Requirements and Heat Dissipation—Chassis and Fan Trays

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>Catalyst 6503 chassis</b>						
FAN-MOD-3 fan tray	0.80	34.00	43.00	145.00	46.00	156.00
FAN-MOD-3HS fan tray	2.98	125.16	156.45	534.28	168.23	574.49
<b>Catalyst 6503-E chassis</b>						
WS-C6503-E-FAN fan tray <sup>1</sup>	1.37	57.54	71.93	245.62	77.34	264.11
	3.10	130.20	162.75	555.79	175.00	597.63
<b>Catalyst 6504-E chassis</b>						
FAN-MOD-4HS fan tray <sup>1</sup>	1.43	60.06	75.08	256.38	80.73	275.68
	2.17	91.14	113.93	389.05	122.50	418.34
<b>Catalyst 6506 chassis</b>						
WS-C6K-6SLOT-FAN fan tray	0.71	30.00	37.48	128.00	40.00	136.88
WS-C6K-6SLOT-FAN2 fan tray	2.00	84.00	105.00	359.00	113.00	386.00
<b>Catalyst 6506-E chassis</b>						
WS-C6506-E-FAN fan tray <sup>1</sup>	2.35	98.70	123.40	421.33	132.66	453.04
	3.35	140.70	175.88	600.61	189.11	645.82
<b>Catalyst 6509 chassis</b>						
WS-C6K-9SLOT-FAN fan tray	1.10	46.00	58.00	196.00	62.00	212.00
WS-C6K-9SLOT-FAN2 fan tray	3.04	127.68	159.60	545.03	171.70	586.06
<b>Catalyst 6509-E chassis</b>						
WS-C6509-E-FAN fan tray <sup>1</sup>	3.58	150.36	187.95	641.85	202.10	690.16
	5.00	210.00	262.50	896.44	282.26	963.91
<b>Catalyst 6509-NEB chassis</b>						
WS-C6K-NEB-FAN fan tray	7.00	294.00	368.00	1255.00	395.00	1349.00



**Table A-1 Power Requirements and Heat Dissipation—Chassis and Fan Trays (continued)**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>Catalyst 6509-NEB-A chassis</b>						
FAN-MOD-09 <sup>2</sup> fan tray	5.75	242.00	302.00	1031.00	325.00	1108.00
<b>Catalyst 6509-V-E chassis<sup>3</sup></b>						
WS-C6509-V-E-FAN fan tray	5.75	242.00	302.00	1031.00	325.00	1108.00
<b>Catalyst 6513 chassis</b>						
WS-C6K-13SLOT-FAN fan tray	1.58	73.00	146.00	499.00	157.00	536.00
WS-C6K-13SLOT-FAN2 fan tray	7.10	298.20	372.75	1272.94	400.81	1368.75
<b>Catalyst 6513-E chassis</b>						
WS-C6513-E-FAN	7.10	298.20	372.75	1272.94	400.81	1368.75

1. Two sets of values are given for these fan trays. The Catalyst 6500-E series fan trays are designed to provide two levels of cooling. The lower set of values shown are for chassis where modules that do not require the additional cooling capacity are installed. The higher set of values shown are for chassis where modules that require additional cooling capacity are installed - they have been called out in the corresponding tables below.
2. Values given are per fan tray. The Catalyst 6509-NEB-A switch chassis ships with one fan tray installed by default. A second fan tray can be installed in the chassis. The power and heat numbers for a chassis equipped with two fan trays are double the values listed.
3. Values given are per fan tray. The Catalyst 6509-V-E switch chassis ships with one fan tray installed by default. A second fan tray can be installed in the chassis. The power and heat numbers for a chassis equipped with two fan trays are double the values listed.

**Table A-2 Power Requirements and Heat Dissipation—IP Phones**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
Cisco IP Phone 7960	0.15	6.3	7.88	26.89	8.47	28.92
Cisco IP Phone 7940	0.15	6.3	7.88	26.89	8.47	28.92
Cisco IP Phone 7910	0.13	5.46	6.83	23.31	7.34	25.06

The module power values are based on 42 VDC. Power is distributed to each slot in the chassis from the power supply's 42 VDC output. Each module has DC-to-DC power supplies that convert the 42 VDC into +2.5 VDC, +3.3 VDC, and +5 VDC to power the module. The 42 VDC is independent of the power supply's input voltage, either 110 VAC or 220 VAC.

Table A-3 lists the power and the heat numbers for the supervisor engines.

**Table A-3 Power Requirements and Heat Dissipation—Supervisor Engines**

Model Number/ Module Type	Module Current (A) @ 42 VDC	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6K-SUP1A-2GE</b> Supervisor Engine 1A	1.70	71.40	89.25	304.79	95.97	327.73
<b>WS-X6K-SUP1A-PFC</b> Supervisor Engine 1A with PFC daughter card	2.50	105	131.25	448.22	141.13	481.96
<b>WS-X6K-SUP1A-MSFC</b> Supervisor Engine 1A with PFC and MSFC daughter cards	3.30	138.60	173.25	519.65	186.29	559.18
<b>WS-X6K-SUP1A-MSFC2</b> Supervisor Engine 1A with PFC and MSFC2 daughter cards	2.90	121.80	152.25	519.93	163.71	559.07
<b>WS-X6K-S2-PFC2</b> Supervisor Engine 2 with PFC2 daughter card	3.06	128.52	160.65	548.62	172.74	589.91
<b>WS-X6K-S2-MSFC2</b> Supervisor Engine 2 with PFC2 and MSFC2 daughter cards	3.46	145.32	181.65	620.33	195.32	667.03
<b>WS-X6K-S2U-MSFC2</b> Supervisor Engine 2 with PFC2 and MSFC2 daughter cards—Has 512 MB of DRAM	3.46	145.32	181.65	620.33	195.32	667.03

**Table A-3 Power Requirements and Heat Dissipation—Supervisor Engines (continued)**

Model Number/ Module Type	Module Current (A) @ 42 VDC	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-SUP32-10GE-3B</b> Supervisor Engine 32 with PFC3B and MSFC2A daughter cards	4.19	175.98	219.98	751.21	236.53	807.76
<b>WS-SUP32-GE-3B</b> Supervisor Engine 32 with PFC3B and MSFC2A daughter cards	3.69	154.98	193.73	661.57	208.31	711.37
<b>WS-S32-GE-PISA</b> Supervisor Engine 32 with PFC3B and Programmable IP Services Accelerator (PISA) daughter cards.	2.96	124.32	155.40	530.69	167.10	570.64
<b>WS-S32-10GE-PISA</b> Supervisor Engine 32 with PFC3B and Programmable IP Services Accelerator (PISA) daughter cards	2.97	124.74	155.93	532.48	167.66	572.56
<b>WS-SUP720</b> Supervisor Engine 720 with PFC3A daughter card and integrated MSFC3 and switch fabric	7.50	315.0	393.75	1344.66	423.39	1445.87
<b>WS-SUP720-3B</b> Supervisor Engine 720 with PFC3B daughter card and integrated MSFC3 and switch fabric	6.72	282.24	350.80	1204.81	379.35	1295.5
<b>WS-SUP720-3BXL</b> Supervisor Engine 720 with PFC3BXL daughter card and integrated MSFC3 and switch fabric	7.82	328.44	410.55	1402.03	441.45	1507.56
<b>VS-S720-10G-3C</b> Supervisor Engine 720-10GE with PFC3C daughter card and integrated MSFC3 and switch fabric	8.05	338.10	422.63	1443.26	454.44	1551.90
<b>VS-S720-10G-3CXL</b> Supervisor Engine 720-10GE with PFC3CXL daughter card and integrated MSFC3 and switch fabric	8.65	363.30	454.13	1550.84	488.31	1667.57

Table A-4 lists the power and the heat numbers for the Policy Feature Cards (PFCs).

**Table A-4 Power Requirements and Heat Dissipation—Policy Feature Cards (PFCs)**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-F6K-PFC3A</b> Policy Feature Card 3A	2.25	94.50	118.13	403.40	127.02	433.76
<b>WS-F6K-PFC3B</b> Policy Feature Card 3B	1.47	61.74	77.18	263.55	82.98	283.39
<b>WS-F6K-PFC3BXL</b> Policy Feature Card 3BXL	2.57	107.94	134.93	460.77	145.08	495.45
<b>VS-F6K-PFC3C</b> Policy Feature Card 3C	1.90	79.80	99.75	340.65	107.26	366.29
<b>VS-F6K-PFC3CXL</b> Policy Feature Card 3CXL	2.50	105.00	131.25	448.22	141.13	481.96

Table A-5 lists the power and the heat numbers for the Distributed Forwarding Cards (DFCs).

**Table A-5 Power Requirements and Heat Dissipation—Distributed Forwarding Cards (DFCs)**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-F6K-DFC</b> Distributed Forwarding Card	2.10	88.20	110.25	376.50	118.55	404.84
<b>WS-F6K-DFC3A</b> Distributed Forwarding Card 3A	2.57	107.94	134.93	460.77	145.08	495.45
<b>WS-F6K-DFC3B</b> Distributed Forwarding Card 3B	1.67	70.14	87.68	299.41	94.27	321.95
<b>WS-F6K-DFC3BXL</b> Distributed Forwarding Card 3BXL	2.38	99.96	124.95	426.70	134.35	458.82
<b>WS-F6700-CFC</b> Centralized Forwarding Card	0.75	31.5	39.38	134.47	42.34	144.59

**Table A-5 Power Requirements and Heat Dissipation—Distributed Forwarding Cards (DFCs) (continued)**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-F6700-DFC3A</b> Distributed Forwarding Card 3A	3.0	126	157.5	537.86	169.35	578.35
<b>WS-F6700-DFC3B</b> Distributed Forwarding Card 3B	2.7	113.40	141.75	484.08	152.42	520.51
<b>WS-F6700-DFC3BXL</b> Distributed Forwarding Card 3BXL	3.3	138.60	173.25	591.65	186.29	636.18
<b>WS-F6700-DFC3C</b> Distributed Forwarding Card 3C for use on CEF720 modules. Supported only with Supervisor Engine 720 and Supervisor Engine 720-10GE	1.65	69.30	86.63	295.82	93.15	318.09
<b>WS-F6700-DFC3CXL</b> Distributed Forwarding Card 3CXL for use on CEF720 modules. Supported only with Supervisor Engine 720 and Supervisor Engine 720-10GE.	2.35	98.70	123.38	421.33	132.66	453.04

Table A-6 lists the power and the heat numbers for the switch fabric modules.

**Table A-6 Power Requirements and Heat Dissipation—Switch Fabric Modules**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-C6500-SFM</b> Switch Fabric Module	2.79	117.18	146.5	500.2	157.5	537.86
<b>WS-X6500-SFM2</b> Switch Fabric Module 2	3.09	129.78	162.23	554	174.4	595.7

Table A-7 lists the power and the heat numbers for the 10-Gigabit Ethernet modules.

**Note**

For the WS-X6502-10GE and WS-X6704-10GE Ethernet modules, the values shown are for the baseboard only. When the baseboard has a CFC or DFC3 daughter card installed, you must add the daughter card power to the baseboard power to get the total slot power. For the WS-X6708-10G-3C, WS-X6708-10G-3CXL, WS-X6716-10G-3C, and the WS-X6716-10G-3CXL Ethernet modules, the values shown include the factory installed WS-F6700-DFC3C or WS-F6700-DFC3CXL daughter cards.

**Table A-7 Power Requirements and Heat Dissipation—10-Gigabit Ethernet Modules**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6502-10GE</b> 2-port 10-Gigabit Ethernet module	3.30	138.60	173.25	591.65	186.29	636.18
<b>WS-X6704-10GE</b> 4-Port 10-Gigabit Ethernet module	6.28	263.76	329.70	1125.93	354.52	1210.67
<b>WS-X6708-10G-3C</b> 8-Port 10-Gigabit Ethernet module with WS-F6700-DFC3C daughter card. Requires additional cooling. See <a href="#">footnote<sup>1</sup></a> .	10.58	444.36	555.45	1896.86	600.49	2050.66
<b>WS-X6708-10G-3CXL</b> 8-Port 10-Gigabit Ethernet module with WS-F6700-DFC3CXL daughter card. Requires additional cooling. See <a href="#">footnote<sup>1</sup></a> .	11.28	473.76	592.20	2022.36	640.22	2186.34
<b>WS-X6716-10G-3C</b> 16-Port 10-Gigabit Ethernet module with WS-F6700-DFC3C daughter card. Requires additional cooling. See <a href="#">footnote<sup>1</sup></a> .	10.90	457.80	572.25	1954.23	615.32	2101.33
<b>WS-X6716-10G-3CXL</b> 16-Port 10-Gigabit Ethernet module with WS-F6700-DFC3CXL daughter card. Requires additional cooling. See <a href="#">footnote<sup>1</sup></a> .	11.60	487.20	609.00	2079.74	654.84	2236.27
<b>WS-X6716-10T-3C</b> 16-Port 10-Gigabit Ethernet module with WS-F6700-DFC3C daughter card.	11.53	484.26	605.33	2067.18	650.89	2222.78
<b>WS-X6716-10T-3CXL</b> 16-Port 10-Gigabit Ethernet module with WS-F6700-DFC3CXL daughter card.	12.23	513.66	642.08	2192.69	690.40	2357.73
<b>WS-X6908-10G-2T</b> 8-Port 10-Gigabit Ethernet module with WS-F6K-DFC4-E daughter card. Requires additional cooling. See <a href="#">footnote<sup>1</sup></a> .	14.00	488.0	610.05	2083.32	655.97	2240.13

Table A-7 Power Requirements and Heat Dissipation—10-Gigabit Ethernet Modules (continued)

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6908-10G-2TXL</b> 8-Port 10-Gigabit Ethernet module with WS-F6K-DFC4-EXL daughter card. Requires additional cooling. See <a href="#">footnote<sup>1</sup></a> .	17.03	715.26	894.08	3053.27	961.37	3283.08
<b>C6800-32P10G/C6800-32P10G-XL</b> 32-Port 10-Gigabit Ethernet module with WS-F6K-DFC4-E/WS-F6K-DFC4-EXL daughter card. Requires additional cooling. See <a href="#">footnote<sup>1</sup></a> .	14 <sup>1</sup>	588	588	2006.33	588	2006.33
<b>C6800-16P10G/C6800-16P10G-XL</b> 16-Port 10-Gigabit Ethernet modules with WS-F6K-DFC4-E/WS-F6K-DFC4-EXL daughter card. Requires additional cooling. See <a href="#">footnote<sup>1</sup></a> .	8.5 <sup>1</sup>	357	357	1218.13	357	1218.13
<b>C6800-8P10G or C6800-8P10G-XL</b> 8-Port 10-Gigabit Ethernet modules with WS-F6K-DFC4-E/WS-F6K-DFC4-EXL daughter card. Requires additional cooling. See <a href="#">footnote<sup>1</sup></a> .	8.5 <sup>1</sup>	357	357	1218.13	357	1218.13

1. On a Cisco Catalyst 6503-E and 6504-E module current is @50V; On all other Cisco Catalyst 6500-E Series switches, module current is @ 42V.

Table A-8 lists the power and the heat numbers for the 40-Gigabit Ethernet modules.

**Table A-8 Power Requirements and Heat Dissipation—40-Gigabit Ethernet Modules**

Model Number/Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6904-40G-2T</b> 4-Port 10-Gigabit Ethernet module with WS-F6K-DFC4-E daughter card. Requires additional cooling. See footnote <sup>1</sup> .	16.67	700.14	875.18	2988.72	941.05	3213.68
<b>WS-X6904-40G-2TXL</b> 4-Port 10-Gigabit Ethernet module with WS-F6K-DFC4-EXL daughter card. Requires additional cooling. See footnote <sup>1</sup> .	17.03	715.26	894.08	3053.27	961.37	3283.08

Table A-9 lists the power and the heat numbers for the Gigabit Ethernet modules.

**Table A-9 Power Requirements and Heat Dissipation—Gigabit Ethernet Modules**

Model Number/Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6316-GE-TX</b> 16-port 1000BASE-T Gigabit Ethernet module	5.15	216.3	270.38	923.33	290.73	992.83
<b>WS-X6408A-GBIC</b> 8-port 1000BASE-X Gigabit Ethernet module	2.00	84.00	105.00	358.58	112.90	385.56
<b>WS-X6416-GBIC</b> 16-port 1000BASE-X Gigabit Ethernet module	2.81	118.02	147.53	503.8	158.63	541.72
<b>WS-X6416-GE-MT</b> 8-port 1000BASE-SX Gigabit Ethernet module	2.50	105.00	131.25	448.22	141.13	481.96
<b>WS-X6516-GBIC</b> 16-port 1000BASE-X Gigabit Ethernet module	3.40	142.80	178.50	609.58	191.94	655.46
<b>WS-X6516A-GBIC</b> 16-port 1000BASE-X Gigabit Ethernet module	3.62	152.04	190.05	649.02	204.35	697.87
<b>WS-X6724-SFP</b> 24-Port 1000BASE-X Ethernet module	2.23	99.66	117.08	399.81	125.89	429.90



**Table A-9 Power Requirements and Heat Dissipation—Gigabit Ethernet Modules (continued)**

Model Number/Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6748-SFP</b> 48-Port 1000BASE-X Ethernet module	5.32	223.44	279.30	953.81	300.32	1025.60
<b>WS-X6816-GBIC</b> 16-Port 1000BASE-X Gigabit Ethernet module	3.84	161.28	201.60	688.46	216.77	740.28

Table A-10 lists the power and the heat numbers for the 10/100/1000 Ethernet switching modules.

**Table A-10 Power Requirements and Heat Dissipation—10/100/1000 Ethernet Switching Modules**

Model Number/Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6148-GE-TX</b> 48-port 10/100/1000 Ethernet module	2.47	104.0	130.0	443.0	139.0	476.0
<b>WS-X6148V-GE-TX</b> 48-port 10/100/1000 Ethernet module with WS-F6K-VPWR-GE PoE daughter card	2.89	121.38	151.72	518.14	163.15	557.14
<b>WS-X6148-GE-45AF</b> 48-port 10/100/1000 Ethernet module with WS-F6K-GE48-AF PoE daughter card	2.65	111.30	139.13	475.11	149.60	510.87
<b>WS-X6148A-GE-TX</b> 48-port 10/100/1000 Ethernet module	2.5	105.0	131.25	448.22	141.13	481.96
<b>WS-X6148A-GE-45AF</b> 48-port 10/100/1000 Ethernet module with WS-F6K-GE48-AF PoE daughter card	2.68	112.56	140.70	480.49	151.29	516.66
<b>WS-X6516-GE-TX</b> 16-port 10/100/1000 Ethernet module	3.45	144.90	181.13	618.54	194.76	665.10
<b>WS-X6548-GE-TX</b> 48-port 10/100/1000 Ethernet module	2.98	125.16	156.45	534.28	168.23	574.49

**Table A-10 Power Requirements and Heat Dissipation—10/100/1000 Ethernet Switching Modules (continued)**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6548V-GE-TX</b> 10/100/1000 Ethernet module with WS-F6K-VPWR-GE PoE daughter card	3.40	142.80	178.50	609.58	191.94	655.46
<b>WS-X6548-GE-45AF</b> 48-port 10/100/1000 Ethernet module with WS-F6K-GE48-AF PoE daughter card	3.16	132.72	165.90	566.55	178.39	609.19
<b>WS-X6748-GE-TX</b> 10/100/1000 Ethernet module	7.00	294.00	367.50	1255.01	395.16	1349.48

Table A-11 lists the power and the heat numbers for the Fast Ethernet switching modules.

**Table A-11 Power Requirements and Heat Dissipation—Fast Ethernet Switching Modules**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6148-FE-SFP</b> 48-port 100BASE-X module	2.3	96.60	120.75	412.36	129.84	443.40
<b>WS-X6224-100FX-MT</b> 24-port 100BASE-FX Ethernet module, MMF	1.90	79.8	99.75	340.65	107.26	366.3
<b>WS-X6324-100FX-MM</b> 24-port 100BASE-FX Ethernet module, MMF	1.52	63.84	79.8	272.52	85.81	293.03
<b>WS-X6324-100FX-SM</b> 24-port 100BASE-FX Ethernet module, SMF	1.52	63.84	79.8	272.52	85.81	293.03
<b>WS-X6524-100FX-MM</b> 24-port 100BASE-FX Ethernet module	1.90	79.8	99.75	340.65	107.3	366.3

Table A-12 lists the power and the heat numbers for the 10/100 Ethernet switching modules.

**Table A-12 Power Requirements and Heat Dissipation— 10/100 Ethernet Switching Modules**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6148-RJ-21</b> 48-port 10/100 Ethernet module	2.39	100.38	125.48	428.5	134.92	460.75
<b>WS-X6148-RJ21V</b> 48-port 10/100 Ethernet module with WS-F6K-VPWR PoE daughter card	2.39	100.38	125.48	428.50	134.02	460.75
<b>WS-X6148-21AF</b> 48-port 10/100 Ethernet module with WS-F6K-FE48-AF PoE daughter card	2.57	107.94	134.93	460.77	145.08	495.45
<b>WS-X6148-RJ-45</b> 48-port 10/100 Ethernet module	2.39	100.38	125.48	428.50	134.92	460.75
<b>WS-X6148-RJ45V</b> 48-port 10/100 Ethernet module with WS-F6K-VPWR PoE daughter card	2.39	100.38	125.48	428.50	134.92	460.75
<b>WS-X6148-45AF</b> 48-port 10/100 Ethernet module with WS-F6K-FE48-AF PoE daughter card	2.57	107.94	134.93	460.77	145.08	495.45
<b>WS-X6148A-RJ-45</b> 48-port 10/100 Ethernet module	1.00	42.0	52.5	179.29	56.45	192.78
<b>WS-X6148A-45AF</b> 48-port 10/100 Ethernet module	2.57	107.94	134.93	460.77	145.08	495.45
<b>WS-X6148X2-RJ-45</b> 96-port 10/100 Ethernet module	2.65	111.30	139.13	475.11	149.60	510.87
<b>WS-X6148X2-45AF</b> 96-port 10/100 Ethernet module with WS-F6K-FE48X2-AF PoE daughter card	3.07	128.94	161.18	550.41	173.31	591.84
<b>WS-X6196-RJ-21</b> 96-port 10/100 Ethernet module	2.74	115.08	143.85	491.25	154.68	528.22
<b>WS-X6196-21AF</b> 96-port 10/100 Ethernet module with WS-F6K-FE48X2-AF PoE daughter card	3.16	132.72	165.90	566.55	178.39	609.19
<b>WS-X6248A-TEL</b> 48-port 10/100 Ethernet module (telco)	2.69	113	141.23	482.28	151.85	518.58

**Table A-12 Power Requirements and Heat Dissipation—10/100 Ethernet Switching Modules (continued)**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6348-RJ21V</b> 48-port 10/100 Ethernet module with WS-F6K-VPWR PoE daughter card	2.39	100.38	125.48	428.5	134.92	460.75
<b>WS-X6348-RJ-45</b> 48-port 10/100 Ethernet module	2.39	100.38	125.48	428.5	134.92	460.75
<b>WS-X6348-RJ-45V</b> 48-port 10/100 Ethernet module with WS-F6K-VPWR PoE daughter card	2.39	100.38	125.48	428.5	134.92	460.75
<b>WS-X6548-RJ-21</b> 48-port 10/100 Ethernet module	2.90	121.80	152.25	519.93	163.71	559.07
<b>WS-X6548-RJ-45</b> 48-port 10/100 Ethernet module	2.90	121.80	152.25	519.93	163.71	559.07

Table A-13 lists the power and the heat numbers for the 10BASE Ethernet switching modules.

**Table A-13 Power Requirements and Heat Dissipation—10BASE Ethernet Switching Modules**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6024-10FL-MT</b> 24-port 10BASE-FL Ethernet module	1.52	63.84	79.8	272.52	85.81	293.0

Table A-14 lists the power and the heat numbers for the FlexWAN and the enhanced FlexWAN modules.

**Table A-14 Power Requirements and Heat Dissipation—FlexWAN and Enhanced FlexWAN Modules**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6182-2PA</b> FlexWAN module	2.38	99.96	125	426.7	134.35	458.82
<b>WS-X6582-2PA</b> Enhance FlexWAN module	2.50	105.00	131.25	448.22	141.13	481.96

Table A-15 lists the power and the heat numbers for the available service modules.

**Table A-15 Power Requirements and Heat Dissipation—Service Modules**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>ACE10-6500-K9</b> Applications Control Engine (ACE) module	5.23	219.66	274.58	937.67	295.24	1008.25
<b>WS-SVC-ADM-1-K9</b> Traffic Anomaly Detector Module	4.00	168.00	210.00	717.15	225.81	771.13
<b>WS-SVC-AGM-1-K9</b> Anomaly Guard Module	4.00	168.00	210.00	717.15	225.81	771.13
<b>WS-SVC-AON-1-K9</b> Application-Oriented Networking (AON) module	4.00	168.00	210.00	717.15	225.81	771.31
<b>WS-SVC-CMM</b> Communications Media Module	6.00	252.0	315.0	1075.73	338.71	1156.69
<b>WS-SVC-CSG-1</b> Content Services Gateway module	3.00	126.0	157.5	537.86	169.35	578.35
<b>WS-SVC-FWM-1-K9</b> Firewall Services Module	4.09	171.78	214.73	733.29	230.89	788.48
<b>WS-SVC-IDSM2-K9</b> Intrusion Detection System Module 2	2.50	105.00	131.25	448.22	141.13	481.96
<b>WS-SVC-IPSEC-1</b> IPSec VPN Services module	1.89	79.38	99.23	338.85	106.69	364.36
<b>WS-SVC-MWAM-1</b> Multiprocessor WAN Application Module	3.57	149.94	187.43	640.06	201.53	688.23
<b>WS-SVC-NAM-1</b> Network Analysis Module 1	2.89	121.38	151.73	518.14	163.15	557.14
<b>WS-SVC-NAM-2</b> Network Analysis Module 2	3.47	145.74	182.18	622.13	195.89	668.95
<b>WS-SVC-PSD-1</b> Persistent Storage Device module	4.00	168.0	210.0	717.15	225.81	771.13
<b>WS-SVC-WEBVPN-K9</b> WebVPN Services module	2.94	123.48	154.35	527.11	165.97	566.78
<b>WS-SVC-WISM-1-K9</b> Wireless Services Module (WiSM)	6.07	254.94	318.68	1088.25	342.66	1170.19

**Table A-15 Power Requirements and Heat Dissipation—Service Modules (continued)**

Model Number/ Module Type	Module Current (A)	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-SVC-WLAN-1-K9</b> Wireless LAN Services module	3.10	130.20	162.75	555.79	175.0	597.63
<b>WS-X6066-SLB-S-K9</b> Content Switching module with SSL	2.15	90.30	112.88	385.47	121.37	414.48

Table A-16 lists the power and the heat numbers for miscellaneous modules.

**Table A-16 Power Requirements and Heat Dissipation—Miscellaneous Modules**

Model Number/ Module Type	Module Current (A) @ 42 VDC	Module Power (Watts)	AC		DC	
			AC-Input Power (Watts)	Heat Diss. (BTU/HR)	DC-Input Power (Watts)	Heat Diss. (BTU/HR)
<b>WS-X6066-SLB-APC</b> Content Switching Module	3.0	126.0	157.5	537.9	169.35	578.35
<b>WS-X6101-OC12-SMF</b> <b>WS-X6101-OC12-MMF</b> 1-port ATM module	2.10	88.2	110.3	376.5	118.5	404.8
<b>WS-X6302-MSM</b> Multilayer Switch Module	5.20	218.4	273	932.3	293.55	1002.47
<b>WS-X6380-NAM</b> Network Analysis Module	1.31	55.02	68.78	234.87	73.95	252.54
<b>WS-X6608-T1/E1</b> 8-Port T1/E1 PSTN interface module	1.98	83.16	103.95	355	111.77	381.71
<b>WS-X6624-FXS</b> 24-Port FXS analog interface module	1.54	64.68	80.85	267.10	86.94	296.88



# APPENDIX **A**

## Troubleshooting

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**Note**

The information in this chapter applies to all Catalyst 6500 series switches unless otherwise noted.

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This chapter describes how to troubleshoot the Catalyst 6500 series switch hardware installation and contains these sections:

- [Getting Started, page A-1](#)
- [Solving Problems at the System Component Level, page A-2](#)
- [Identifying Startup Problems, page A-3](#)
- [Troubleshooting the Power Supply, page A-4](#)
- [Troubleshooting the Fan Assembly, page A-5](#)
- [Troubleshooting Modules, page A-5](#)
- [Contacting Customer Service, page A-7](#)

If your system has problems, use the information in this chapter to help isolate the cause. Problems with the initial startup are often caused by a switching module that has become dislodged from the backplane or a power supply that has been disconnected from the power cord connector. Although temperature conditions above the maximum acceptable level rarely occur at initial startup, you might encounter these conditions during extended operation. Long-term monitoring functions also include independent reporting of DC-output voltage problems.

**Note**

This chapter covers only the chassis component hardware aspects of troubleshooting. For module-specific information, refer to the *Catalyst 6500 Series Switch Module Installation Guide*.

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## Getting Started

When the initial system startup is complete, verify the following:

- Power supplies are supplying power to the system.
- The system fan assembly is operating.

- System software boots successfully.
- The supervisor engine and all switching modules are installed properly in their slots, and each was initialized without problems.

If one or more of the above conditions are not met, use the procedures in this chapter to isolate and, if possible, resolve the problem. If all of the above conditions are met, and the hardware installation is complete, refer to these publications to troubleshoot the software: *Catalyst 6500 Series Switch Software Configuration Guide*, the *Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide*, the *Catalyst 6500 Series Switch Command Reference*, or the *Catalyst 6500 Series Switch Cisco IOS Command Reference*. Also, refer to your software release notes for hardware support information and software caveats.

## Solving Problems at the System Component Level

The key to success when troubleshooting the system is to isolate the problem to a specific system component. The first step is to compare what the system *is doing* to what it *should be doing*. Because a startup problem can usually be attributed to a single component, it is more efficient to isolate the problem to a subsystem rather than troubleshoot each separate component in the system.

The switch consists of these subsystems:

- Power supply—Includes the power supplies and power supply fans.
- Fan assembly—The chassis fan assembly should operate whenever system power is on. You should see the FAN LED turn green and hear the fan assembly operating. A red FAN LED indicates that one or more fans in the fan assembly is not operating. You should immediately contact a customer service representative if the fan assembly is not functioning properly. (See the “[Contacting Customer Service](#)” section on page A-7.) There are no installation adjustments that you can make if the fan assembly does not function properly at initial startup.
- Supervisor engine—The supervisor engine contains the system operating software, so check your supervisor engine if you have trouble with the system software. Status LEDs on the supervisor engine indicate whether or not the supervisor engine is able to initialize the switching module.

If you have a redundant supervisor engine, refer to the *Catalyst 6500 Series Switch Software Configuration Guide* or the *Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide* publications for descriptions of how the redundant supervisor engine comes online and how the software images are handled.

- Switching modules—Status LEDs on each switching module indicate if the module has been initialized by the supervisor engine. A switching module that is partially installed in the backplane can cause the system to halt.



# Identifying Startup Problems

LEDs indicate all system states in the startup sequence. By checking the LEDs, you can determine when and where the system failed in the startup sequence.

To identify startup problems, follow these steps:

- 
- Step 1** Turn on the power supplies. You should immediately hear the system fan assembly begin to operate.
- If you do not hear the fans operating, see the [“Troubleshooting the Power Supply” section on page A-4](#).
  - If you determine that the power supplies are functioning normally and that the fan assembly is faulty, contact a customer service representative.
  - If the system fan assembly does not function properly at initial startup, there are no installation adjustments that you can make. To replace the fan assembly, see the [“Removing and Installing the Fan Tray” section on page 1-82](#).
- Step 2** Verify that the LEDs on the supervisor engine light as follows:
- The STATUS LED should flash orange once and stay orange during diagnostic boot tests. It turns green when the module is operational (online). If the system software is unable to start up, the STATUS LED stays orange.
  - The SYSTEM LED should turn green, indicating that all chassis environmental monitors are reporting that the system is OK. If one or more environmental monitor reports a problem, the SYSTEM LED is orange or red.
  - The ACTIVE LED should turn green, indicating that the supervisor engine is operational and active. If the supervisor engine is in standby mode, the ACTIVE LED is orange.
  - Each LINK LED should flash orange once and stay orange during diagnostic boot tests, and turn green when the module is operational (online). If no signal is detected, the LINK LED turns off. The LINK LED blinks orange if the port is bad.
- If any LEDs on the supervisor engine front panel are red or orange, see the [“Troubleshooting Modules” section on page A-5](#).
- If you have a redundant supervisor engine, refer to the *Catalyst 6500 Series Switch Software Configuration Guide* or the *Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide* publications for descriptions of how the redundant supervisor engine comes online and how the software images are handled.
- For a complete description of the supervisor engine LEDs, refer to the *Catalyst 6500 Series Switch Module Installation Guide*.
- Step 3** Verify that the STATUS LEDs on the supervisor engine and on each switching module are green when the supervisor engine completes initialization.
- The STATUS LED indicates that the supervisor engine or switching modules are receiving power, have been recognized by the supervisor engine, and contain a valid flash code version. This LED does not indicate the state of the individual interfaces on the switching modules. If a STATUS LED is red or orange, see the [“Troubleshooting Modules” section on page A-5](#).
- Step 4** If the startup information and system banner do not display at startup, refer to the *Catalyst 6500 Series Switch Module Installation Guide* to verify that the terminal is set correctly and that it is connected properly to the supervisor engine console port.
-

# Troubleshooting the Power Supply

If the INPUT OK LED does not light after you turn on the power switch, follow these steps to isolate a power subsystem problem:

- 
- Step 1** Verify that the INPUT OK LED on the power supply is green.
- If the INPUT OK LED is green, the AC or DC source is good and the power supply is functional.
  - If the INPUT OK LED is off, first ensure that the power supply is flush with the back of the chassis. Turn off the power switch, tighten the captive installation screw(s), and then turn on the power switch.
  - If the INPUT OK LED remains off, there might be a problem with the AC source, the DC source, or the power cable.
  - Turn off the power to the switch, connect the power cord to another power source if one is available, and turn on the power.
  - If the INPUT OK LED is green, the problem is the first power source.
  - If the INPUT OK LED fails to light after you connect the power supply to a new power source, replace the power cord, and turn on the switch.
  - If the INPUT OK LED then goes on, return the first power cord for replacement.

If this unit has more than one power cord, repeat Step 1 for each power supply.

If the INPUT OK LED still fails to light when the switch is connected to a different power source with a new power cord, the power supply is probably faulty.

If a second power supply is available, install it in the second power supply bay, and contact a customer service representative for further instructions.

- Step 2** If you have a second (redundant) power supply, repeat Step 1 for this power supply.
- 

If you are unable to resolve the problem or if you determine that either a power supply or backplane connector is faulty, see the [“Contacting Customer Service”](#) section on page A-7.

# Troubleshooting the Fan Assembly

To isolate a fan assembly problem, follow these steps:

- 
- Step 1** Verify that the FAN LED on the fan assembly is green.
- If the FAN LED is not green, see the “[Solving Problems at the System Component Level](#)” section on [page A-2](#) to determine whether or not the power subsystem is functioning properly.
- Step 2** Check to determine if the FAN LED is red. If the FAN LED is red, the fan assembly is not seated in the backplane or has malfunctioned.
- Do the following:
- To ensure that the fan assembly is seated properly, loosen the captive installation screws, remove the fan assembly, and reinstall it.
  - Tighten all captive installation screws, and then restart the system.
  - If the FAN LED is still red, the system detects an individual fan failure. Contact a customer service representative for instructions.
- 

# Troubleshooting Modules

To isolate a supervisor engine or switching module problem, follow these steps:

- 
- Step 1** Verify that all status LEDs are on.
- Step 2** If any status LEDs on the supervisor engine or any switching modules are red or off, the module might have shifted out of its slot. Reseat the module until both ejector levers are at right angles to the rear of the chassis. Tighten the captive installation screws at the left and right of the module front panel, and restart the system.
- 

# STATUS LED Indications

The STATUS LEDs can indicate two alarm types: major and minor. Major alarms indicate a critical problem that could lead to the system being shut down. Minor alarms are for informational purposes only, giving you notice of a problem that could turn critical if corrective action is not taken.

When the system has an alarm (major or minor) that indicates an overtemperature condition, the alarm is not canceled and no action is taken (such as a module reset or a shutdown) for 5 minutes. If the temperature falls 5°C (41°F) below the alarm threshold during this period, the alarm is canceled.

[Table A-1](#) lists the environmental indicators for the supervisor engine and switching modules.

**Note**

Refer to the *Catalyst 6500 Series Switch Module Installation Guide* for additional information on LEDs, including the supervisor engine SYSTEM LED.

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**Table A-1 Environmental Monitoring for Supervisor Engine and Switching Modules**

Component	Alarm Type	LED Indication	Action
Supervisor engine temperature sensor exceeds major threshold <sup>1</sup>	Major	STATUS <sup>2</sup> LED red <sup>3</sup>	Syslog message and SNMP trap generated.  If redundancy, system switches to redundant supervisor engine and the active supervisor engine shuts down.  If there is no redundancy and the overtemperature condition is not corrected, the system shuts down after 5 minutes.
Supervisor engine temperature sensor exceeds minor threshold	Minor	STATUS LED orange	Syslog message and SNMP trap generated.  Monitor the condition.
Redundant supervisor engine temperature sensor exceeds major or minor threshold	Major	STATUS LED red	Syslog message and SNMP trap generated.  If major alarm and the overtemperature condition is not corrected, the system shuts down after 5 minutes.
	Minor	STATUS LED orange	If minor alarm, monitor the condition.
Switching module temperature sensor exceeds major threshold	Major	STATUS LED red	Syslog message and SNMP trap generated.  Power down the module.
Switching module temperature sensor exceeds minor threshold	Minor	STATUS LED orange	Syslog message and SNMP trap generated.  Monitor the condition.

1. Temperature sensors monitor key supervisor engine components including daughter cards.
2. A STATUS LED is located on the supervisor engine front panel and all module front panels.
3. The STATUS LED is red on the failed supervisor engine. If there is no redundant supervisor, the SYSTEM LED is red also.

Refer to the *Catalyst 6500 Series Switch Software Configuration Guide*, the *Catalyst 6500 Series Switch Cisco IOS Software Configuration Guide*, the *Catalyst 6500 Series Switch Command Reference*, or the *Catalyst 6500 Series Switch Cisco IOS Command Reference* publications to configure or enable the interfaces. After the system reinitializes the interfaces, the status LED on the module should be green.

If you still experience trouble with the startup, see the [“Contacting Customer Service”](#) section on [page A-7](#).

## Contacting Customer Service

If you are unable to solve a startup problem after using the troubleshooting suggestions in this chapter, contact a customer service representative for assistance and additional instructions. Before you call, have the following information ready to help your service provider assist you as quickly as possible:

- Date you received the switch
- Chassis serial number (located on a label on the right of the rear panel of the chassis)
- Type of software and release number
- Maintenance agreement or warranty information
- Brief description of the problem
- Brief explanation of the steps you have already taken to isolate and resolve the problem

