Site Preparation

This chapter describes the steps to take and the considerations you should keep in mind prior to installing the modules in an open rack. It also contains information that applies to an MGX 8850 installation in a Cisco closed rack. If the switch arrives in a Cisco closed rack, your initial concerns would be the cabinet grounding, power connections, and optional seismic stability plate. For specifications on the enclosure and power system, see Appendix A, “System Specifications.”

The topics and section names in this chapter are:

- Descriptions of reserved slots and recommended card locations appear in “Card Slot Locations.”
- A list of general requirements for the site appear in “Site Preparation.”
- Earthquake provisions are introduced in “Seismic Considerations,” and instructions for installing the optional seismic stability plate appear in “Seismic Anchoring for a Cisco Rack.”
- “Power and Grounding” describes the policies and requirements for power and grounding at the switch enclosure and the building site.
- “Making the Frame Bonding (Ground) Connection” describes how to connect grounding.

Parts Checklist

Before proceeding with the installation, verify that all the ordered parts are present and in good condition. Store a record of the parts and serial numbers. If any parts are missing or damaged, contact your sales representative.

Card Slot Locations

The reserved slots are 7 and 8 for the primary and redundant Processor Switching Modules (PXMs) and 15, 16, 31, and 32 for the Service Resource Modules (SRMs). These slot reservations reflect a fully redundant configuration for these cards. The maximum number of slots remaining for service modules is 24—less when the unit contains one or more double-height cards such as the Route Processor Module (RPM). Also, although not reserved, slots 9 and 10 should be the first choices for the location of one or more RPMs due to backplane wiring.

If you are considering any future card changes in which you replace a single-height card with a double-height card, place the single-height replacement candidates as far left in the card cage as possible. The reason is that single to double-height slot conversions must begin at the left and proceed to the right.

The slots on the top half of the card cage are suitable for the T3/E3 and OC-3 cards because the higher speed Cellbuses reside in the upper portion of the backplane. Place the service modules that operate at T1 or E1 rates in the lower half of the switch.

Site Preparation

In addition to the power and grounding requirements detailed in subsequent sections, the site must satisfy requirements in the following categories:

- Telecommunications Requirements

  In some international service areas, telecommunication rules for a private network connected to the public switched networks may require that screws, bolts, or nuts that secure the cabling are tightened to the degree that removing them requires a tool.

- Space

  The MGX 8850 node requires floor space 19.9 inches (50.5 cm) wide or 23 inches wide (59 cm). Clearance around the cabinet must allow for access to the front and back of the cabinet while the door is open. The suggested clearance is 30 inches at the front and back and a nominal 12 inches on each side. DC-powered nodes occupy 28 vertical inches (71.1 cm). AC-powered nodes occupy 33.25 vertical inches (84.5 cm).

  The mounting rail pattern follows the EIA standard of 56 inches (32 rack-mount units).

- Operating Environment

  The operating environment should adhere to the following limits:

  - Temperature—0–40 degrees C (32–104 degrees F) normal operation, 50 degrees to 72 hours.
  - Humidity—up to 85% relative humidity, non-condensing.
  - Shock—maximum 10 G for 10 milliseconds at 1/2 sine wave.
  - Vibration—up to 1/4 G, 20 to 500 Hz.

- Wiring to AC or DC Power Source

  For AC-powered systems, Cisco provides 6-foot (1.8-meter) power cords. For DC-powered systems, the customer or installer determines the wire length and supplies the wire. The wire should be 6 AWG (10 square millimeters).

- Heat Dissipation

  A fully loaded, AC-powered MGX 8850 node dissipates up to 9560 BTUs (2.8 KW hour.)
  A DC-powered MGX 8850 node dissipates up to 8200 BTUs (2.4 KW hour.)

- Weight

  A DC-powered system can weigh up to 190 lbs (87 kgs). An AC-powered system can weigh up to 250 lbs (112.5 kgs).

Caution If you move a Cisco-supplied cabinet, do not push it at its sides. Push at the front or back.

- Flooring

  Cisco recommends raised flooring with sufficient under-floor space for the cables.

- Mounting

Node location should accommodate the routing of data cables and the termination of the telephone company or common carrier circuits.

- Electrostatic Discharge

  The building should provide enough grounding to prevent damage from electrostatic discharge. For details, see "Bonding and Grounding." Each node comes with a protective wrist strap.

Seismic Considerations

To secure a Cisco-supplied cabinet, holes in the upper and lower corners accommodate 3/8" or 1/2" bolts. Also, an optional *stability plate* can be purchased with the Cisco cabinet. The stability plate is bolted to the floor, then the Cisco cabinet is bolted to the stability plate. Instructions for installing the stability plate appear in the section "Seismic Anchoring for a Cisco Rack."

Power and Grounding

This section describes the requirements for electrical power and grounding at the switch and the site. These requirements apply to Central Office (CO) and Private Enterprise (PE) sites.

AC Power Circuit Breakers

AC power must come from dedicated, AC branch circuits. Each circuit must be protected by a dedicated, two-pole circuit breaker. The circuit breakers at the source must have a rated current and trip delay greater than those of the MGX 8850 circuit breaker. Cisco recommends that the site have a 20-Amp, 2-pole AC circuit breaker with a long trip delay at each branch circuit.

The MGX 8850 switch uses a 20-Amp, 2-pole circuit breaker for each AC input. The manufacturer of this circuit breaker is ETA. The ETA part number is 8340-F120-P1P2-B2H020A.

DC Power Circuit Breakers

For a DC-powered system, verify that its power comes from a dedicated DC branch circuit. This branch circuit must be protected by a dedicated circuit breaker. The circuit breaker must have a rated current and trip delay that is greater than those of the MGX 8850 circuit breaker. Cisco Systems recommends the site have a dedicated 60-Amp, 1-pole circuit breaker with a medium trip delay at each branch circuit.

DC-powered nodes use a 60-Amp, 1-pole circuit breaker with a short trip delay on each –48-V input.

Electrical Power for AC-Powered Nodes

The MGX 8850 AC power requirement are 220 VAC with a worst-case range of 180–240 VAC or 110 VAC with a worst case range 100-240 VAC. See also Appendix A, "System Specifications." The AC power source must be within 6 feet (1.8 m) of the system and easily accessible. Before turning on the power, verify that the power supplied to the node comes from a dedicated branch circuit.

The 110 VAC power supply has a maximum output power of 1200W per power supply module. However, because of safety limitation imposed on the line cord, the 110 VAC power supply output power is shown in Table 3-1.

Table 3-1 110 VAC Power Module Output Power

Input voltage (Volts AC)	Power output (Watts)
100	900
110	1000
120	1100
130 - 264	1200

The 220 VAC power supply module has a maximum power output of 2500 Watts with 2 fan trays and 1500 Watts with one fan tray.

Note If the power requirement of installed cards exceed the power capability of the system, an error message is generated.

Caution Consult Cisco engineering if the plans for MGX 8850 AC power include a portable, uninterruptible power source (UPS). Cisco recommends a UPS with a low output impedance and the capacity to provide the necessary fault current to trip the protection devices. Do not use a UPS or any power source with a Ferro-Resonant transformer.

The power receptacles to which the node connects must be of the grounding type. The grounding conductors that connect to the receptacles should connect to protective earth at the service equipment. For reference, Figure 3-1 shows the electrical relationship in the three-wire wall plug.

Cisco can provide 220 VAC power cords with the following plugs:

- 20 A NEMA L620, 3-prong plug (domestic U.S.)
- 13 A 250 VAC BS1363, 3-prong fused plug (UK, Ireland)
- CEE 7/7 (Continental Europe)
- AS3112 (Australia/New Zealand)
- CEI23-16/VII (Italy)

Figure 3-1 Electrical Relationship of AC Plug Wiring

Electrical Power for DC-Powered Switches

This section describes the safety and standards-body compliance issues for DC-powered systems. For the bonding and grounding issues related to electrical noise, see the "Bonding and Grounding" section on page 3-5.

The DC-powered model of the MGX 8850 switch uses one or two Power Entry Modules (PEMs) to accept DC current. The DC PEMs should connect to a source capable of supplying 60 Amps of current. Each branch circuit at the source should have a 60-Amp circuit breaker, and the wires connecting the PEMs to the sources should be capable of carrying 60 Amps. A 6 AWG (10 square millimeters) copper wire is adequate. Also, consult the local or national codes for conductor sizing for DC supply connections if necessary. Conductors must be suitable for 60 Amps.

Be sure to connect the grounding wire conduit to a solid earth ground. Cisco recommends a closed loop to terminate the ground conductor at the ground stud. (See also "Bonding and Grounding" section on page 3-5.)

In summary, note the following for DC systems:

Caution This equipment has a connection between the earth conductor of the DC power supply circuit and the earthing conductor.

This equipment shall be connected directly to the DC supply system earthing electrode conductor or to a bonding jumper from an earthing terminal bar or bus to which the DC supply system earthing electrode is connected.

This equipment shall be located in the same immediate area (such as adjacent cabinets) as any other equipment that has a connection between the earthed conductor to the same DC supply circuit and the earthing connector and also the point of earthing of the DC system. The DC system shall not be earthed elsewhere.

The DC supply source is to be located within the same premises as this equipment. Switching or disconnecting devices shall not be in the earthed circuit conductor between the DC source and the point of the connection of the earthing electrode conductor.

Additional guidelines are

- At the input of each Power Entry Module (PEM) in an MGX 8850 node, connect only a –48 VDC source that complies with the Safety Extra Low Voltage (SELV) requirements in UL 1950, EC 950, EN 60950, and CSA C22.2 No. 950-95.

A DC-powered MGX 8850 node should be installed in a *restricted access* location. In the United States, restricted access is defined in Articles 10-116, 10-117, and 10-118 of the National Electrical Code ANSI/NFPA 70.

Bonding and Grounding

To maintain the full EMI and EMC integrity of this equipment, it must be bonded to an *integrated ground plane* or a *non-isolated ground plane* network. The purpose is to mitigate the damaging effects of electrostatic discharge or lightning. Refer to the latest edition of ITU-T Recommendation K.27 or Bellcore GR-1089-CORE to ensure that the correct bonding and grounding procedures are followed. As recommended in these documents, a frame bonding connection is provided on the Cisco cabinet for rack-mounted systems. To see how to make a connection, see "Making the Frame Bonding (Ground) Connection" later in this chapter.

Except for the AC power supply modules, every module in a rack-mount system uses the rack for grounding. Therefore, the rack must connect to protective earth ground and the equipment must be secured to the rack so as to ensure good bonding.

A DC-powered node must have grounding conductors that connect at two separate locations:

- The grounding conductor provided with the supply source must connect to the correct terminal of the Power Entry Module (PEM).
- A grounding conductor must connect to an appropriate terminal on a rack or the chassis of a node.

For DC-powered systems, the Cisco MSSBU has designed the MGX 8850 node and other WAN switches to connect to a *non-isolated* ground system. In contrast, routers and other LAN equipment often use an *isolated* grounding scheme. If properly wired together through an *equalization connection* as described in ITU-T recommendation K.27, the isolated and non-isolated ground systems can form a mixed grounding system. The potential between any points in the ground system —whether or not the ground system is mixed—must not exceed 2% of the referenced voltage (2% of 48 volts is 960 millivolts).

Wiring a Mixed Ground System With Redundant Supplies

A mixed ground system appears in Figure 3-2. This figure shows safety and earth grounds and the primary and redundant DC sources Battery A and Battery B. Individual ground conductors are labeled Z1, Z2, ..., Z5. The Z represents the impedance of the ground conductor between a chassis, for example, and a connection to the building's ground system. The numbers 1, ..., 4 represent building ground points and indicate that an impedance can exist between different points in the ground system of the building. Each of these symbols indicate that a voltage drop may result (but must not exceed 2% of the referenced voltage). See Table 3-2 for a definition of each Z1–Z5.

Figure 3-2 Mixed Grounding System

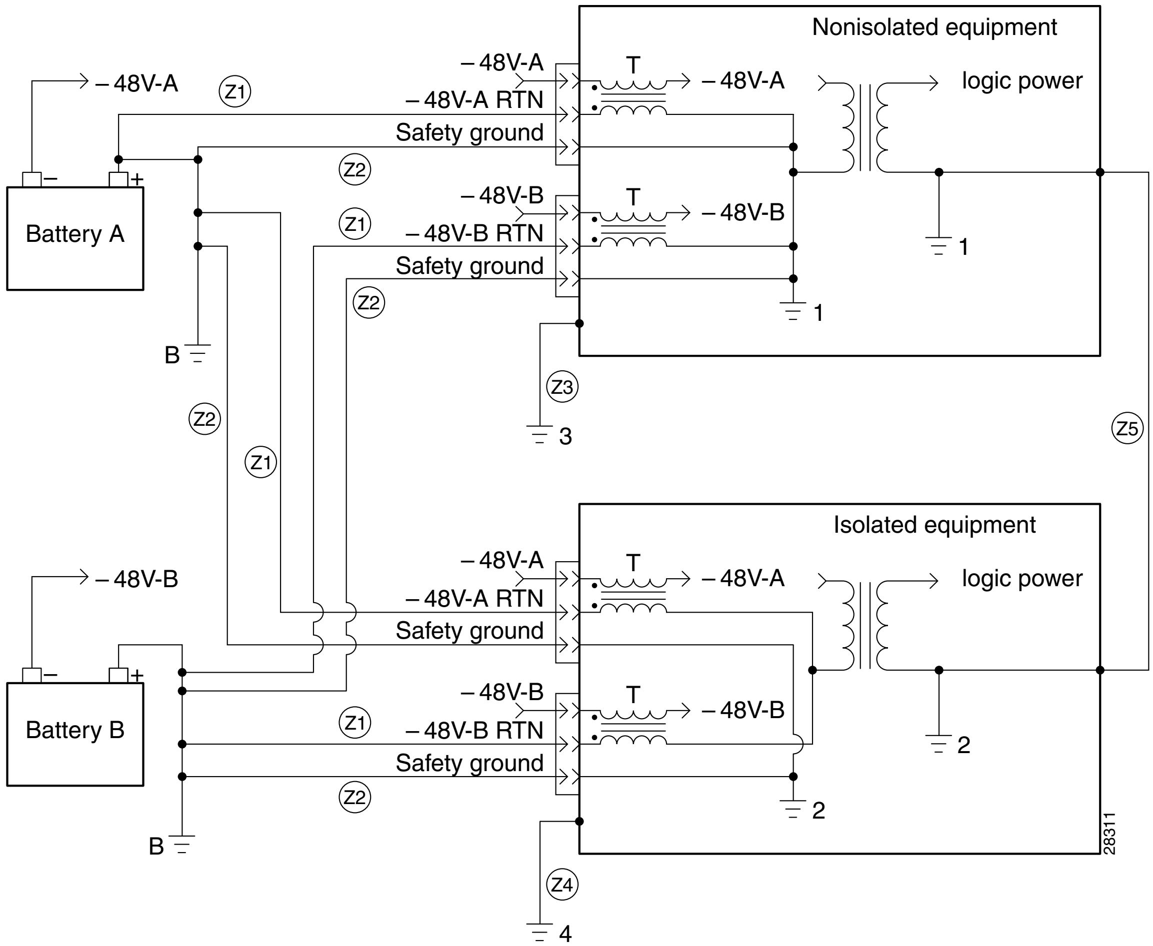


Table 3-2 Ground Point Descriptions for Mixed Grounding

Connection	Description
Z1	–48 VDC return.
Z2	Protective earth or safety ground (green/yellow).
Z3	Equipment ground for non-isolated equipment.
Z4	Equipment ground for isolated equipment.
Z5	Equalizing frame ground. This ground creates low-impedance equalization between frames.
B	Battery ground.
1, 2, 3, 4	Connection points to the building's ground system: a potential can exist between these points within the ground system.
T	Common-mode EMI filters.

As Figure 3-2 shows, the non-isolated system has a 48 VDC return that internally connects to the backplane. (This design calls for a hard-wired return and so does not allow for an *optional* or alternate ground connection.) The internal connection provides a low-impedance connection between 48 VDC return and frame ground. This grounding scheme protects the signals on the backplane from corruption by transients that can result from lightning or electrostatic discharge.

To improve protection against transients, the loop area (and resultant loop impedance) should be made as small as possible by locating the –48 VDC supply, 48 VDC return, and protective earth conductors as close to each other as possible.

As recommended in ITU-T K.27, the multi-point grounding in a mesh bonding network provides the best protection for equipment by providing the lowest impedance in the ground system. For more detailed information, refer to the recommendation itself.

Conductor Characteristics for Carrying Current and Ensuring Low Voltage Drops

To prevent signal degradation, a conductor must be large enough to prevent its impedance from creating a voltage drop equal to 2% of the reference voltage. Also, the protective earth conductor must be large enough to carry all the current if the 48 VDC return fails. This latter requirement is for safety. Full fault redundancy is achieved by having equal size conductors for the protective earth ground and the 48 VDC return of the switch.

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

Table 3-3 Wire Gauge For Current Loads Over Copper Wire Lengths

DC Current	**Distance in Feet**						
	25 feet	50 feet	75 feet	100 feet	150 feet	200 feet	400 feet
5 Amps	18	14	14	12	10	8	6
10 Amps	14	12	10	8	8	6	2
15 Amps	14	10	8	8	6	4	2
20 Amps	12	8	8	6	4	2	0
25 Amps	12	8	6	4	4	2	0
30 Amps	10	8	6	4	2	2	00
35 Amps	10	6	4	2	2	1	000
40 Amps	8	6	2	2	2	0	000
45 Amps	8	6	4	2	1	0	0000
50 Amps	8	4	4	2	1	00	______
55 Amps	8	4	2	2	0	00	______
60 Amps	8	4	2	2	0	00	______
65 Amps	6	4	2	1	0	000	______
70 Amps	6	4	2	1	00	000	______
75 Amps	6	4	2	1	00	000	______
100 Amps	4	2	1	00	000	______	______

Table 3-4 Resistance for Each Gauge of Copper Wire

Gauge	Ohms per 1000 Feet		Gauge	Ohms per 1000 Feet	
0000	0.0489		10	0.9968	
000	0,0617		11	1.257	
00	0.0778		12	1.5849	
0	0.098		13	1.9987	
1	0.1237		14	2.5206	
2	0.156		15	3.1778	
3	0.1967		16	4.0075	
4	0.248		17	5.0526	
5	0.3128		18	6.3728	
6	0.3944		19	8.0351	
7	0.4971		20	10.1327	
8	0.6268		21	12.7782	
9	0.7908		22	16.1059	

Seismic Anchoring for a Cisco Rack

This section describes how to install the Cisco cabinet with the optional stability plate for seismic anchoring. If you have no stability plate, go to Chapter 4, “Enclosure and Card Installation.”

To set up the Cisco cabinet with the stability plate, perform the following:

Step 1 Use the dimensions in Figure 3-3 to drill the holes for installing the stability plate.

Step 2 Remove the stability plate from the base of the Cisco cabinet. Save these nuts and bolts.

Step 3 With the user-provided anchoring bolts, attach the stability plate to the floor.

Step 4 Roll the Cisco cabinet over the stability plate as Figure 3-4 illustrates.

Step 5 Use the nuts and bolts from the shipping setup to secure the cabinet to the stability plate.

Figure 3-3 Stability Plate Dimensions

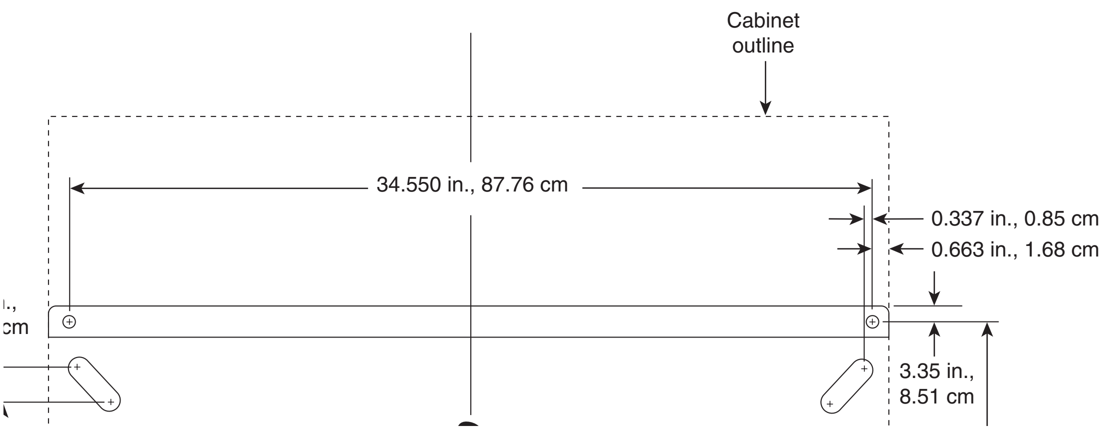
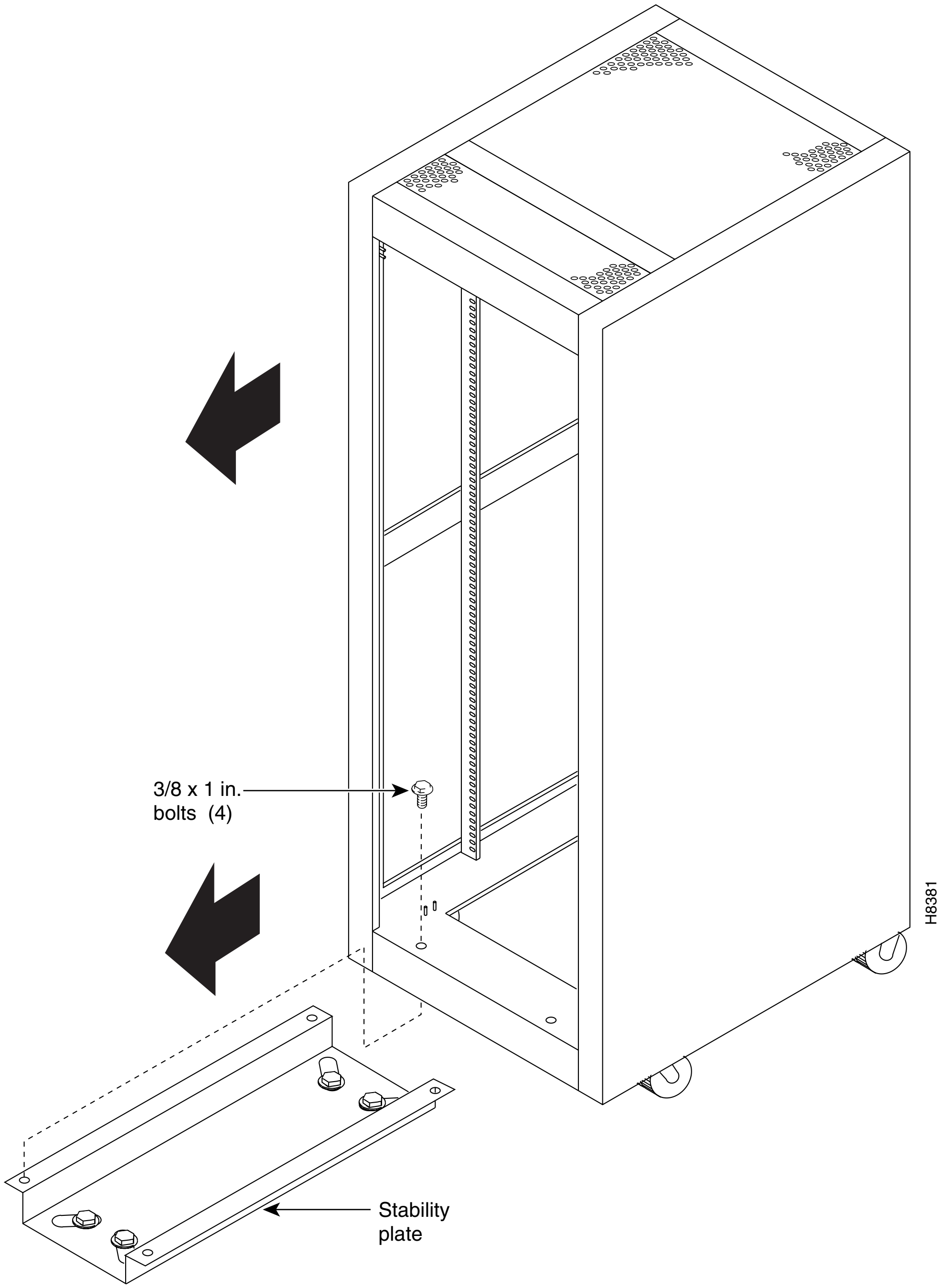


Figure 3-4 Installing a Cisco Cabinet Over the Stability Plate



Making the Frame Bonding (Ground) Connection

This section describes the steps for making ground connections that comply with the Cisco MSSBU grounding policies. The descriptions cover optional ground connections from each node to the ground connector of the rack as well as the equalization connections between racks that are part of the earth grounding network.

The Cisco-supplied cabinet has two pairs of grounding studs and the hardware for securing a ground conductor to the studs at the top and bottom of the cabinet. The studs measure 1/4" by 20 threads per inch. The studs can accept the two-holed grounding connector designed to prevent rotation and possible loosening of the connector. Figure 3-5 shows the Cisco cabinet with the ground attachment studs in the upper and lower parts of the cabinet. A ground symbol on the Cisco rack indicates the points of attachment.

Making Cisco Cabinet Ground Connections

Cisco recommends the following steps for attaching a ground conductor to the frame of a Cisco rack:

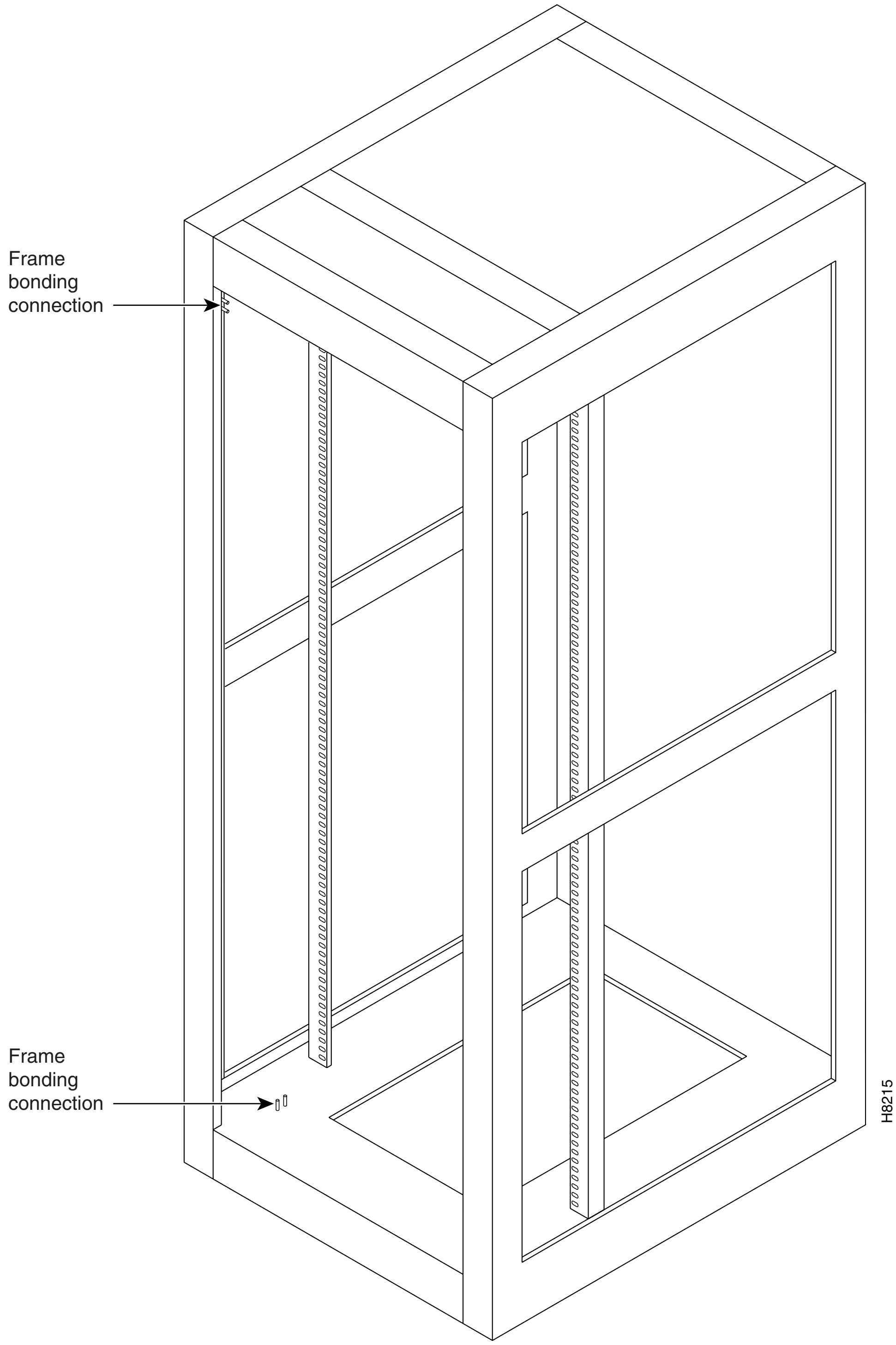
Step 1 Place an external, toothed star washer onto the stud.

Step 2 Place the connector terminating the grounding conductor closed-loop ring or two-hole compression fitting onto the stud.

Step 3 Place another external, toothed star washer or lock washer onto the stud.

Step 4 Screw a nut onto the threaded stud.

Figure 3-5 Frame Bonding Connection in Cisco-Supplied Rack



Using the Electrostatic Wrist Strap

The MGX 8850 switch ships with a wrist strap for grounding the user and protecting the electronic components from electrostatic shock. The wrist strap kit consists of a strap, a coiled cord, and a clip for holding the strap.

Cisco recommends you install the base of the wrist strap cable on the left front flange of one of the units at a convenient height. Use a front mounting screw to secure the ring lug to the flange and front rail. The other end of the cord connects to the strap with a snap connector. Peel the back off the clip to expose the adhesive surface and attach to the front of the unit above the ring lug. Mount the clip sideways to allow the strap to be held in a position that will not interfere with the removal of the number card. Use the clip to store the strap.

Co-Locating Cisco Units in the Same Rack

Different Cisco products can reside in the same rack. If a multi-system rack configuration includes an MGX 8600-series switch, it should reside as the bottom unit.