Preparing the Site

Temperature Requirements

The switch requires a operating temperature of 32 to 104° F (0 to 40° C). If the switch is not operating, the temperature must be between –40 to 158° F (–40 to 70° C).

Humidity Requirements

High humidity can cause moisture to enter the switch. Moisture can cause corrosion of internal components and degradation of properties such as electrical resistance, thermal conductivity, physical strength, and size. The switch is rated to operate at 8 to 80 percent relative humidity, with a humidity gradation of 10 percent per hour. For nonoperating conditions, the switch can withstand from 5 to 95 percent relative humidity. Buildings in which the 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 the switch equipment. However, if the switch is located in an unusually humid location, you should use a dehumidifier to maintain the humidity within an acceptable range.

Altitude Requirements

If you operate a switch at a high altitude (low pressure), the efficiency of forced and convection cooling is reduced and can result in electrical problems that are related to arcing and corona effects. This condition can also cause sealed components with internal pressure, such as electrolytic capacitors, to fail or to perform at a reduced efficiency. This switch is rated to operate at altitudes from –500 to 13,123 feet (–152 to 4,000 meters). You can store the switch at altitudes of –1,000 to 30,000 feet (–305 to 9,144 meters).

Dust and Particulate Requirements

Exhaust fans cool power supplies and system fan trays cool switches by drawing in air and exhausting air out through various openings in the chassis. However, fans also ingest dust and other particles, causing contaminant buildup in the switch 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 switch.

In addition to regular cleaning, follow these precautions to avoid contamination of your switch:

- Do not permit smoking near the switch.
- Do not permit food or drink near the switch.

Minimizing Electromagnetic and Radio Frequency Interference

Electromagnetic interference (EMI) and radio frequency interference (RFI) from the switch can adversely affect other devices such as radio and television (TV) receivers operating near the switch. Radio frequencies that emanate from the switch can also interfere with cordless and low-power telephones. Conversely, RFI from high-power telephones can cause spurious characters to appear on the switch monitor.

RFI is defined as any EMI with a frequency above 10 kHz. This type of interference can travel from the switch 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 that can be emitted by computing equipment. Each switch meets these FCC regulations.

To reduce the possibility of EMI and RFI, follow these guidelines:

- Cover all open expansion slots with a blank filler plate.
- Always use shielded cables with metal connector shells for attaching peripherals to the switch.

When wires are run for any significant distance in an electromagnetic field, interference can occur between the field and the signals on the wires with the following implications:

- Bad wiring 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 prevent strong EMI, you might need to consult experts in radio frequency interference (RFI).

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

Caution 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 switches. You might want to consult experts in electrical surge suppression and shielding if you had similar problems in the past.

Shock and Vibration Requirements

The switch has been shock- and vibration-tested for operating ranges, handling, and earthquake standards.

Grounding Requirements

The switch is sensitive to variations in voltage supplied by the power sources. Overvoltage, undervoltage, and transients (or spikes) can erase data from the memory or cause components to fail. To protect against these types of problems, ensure that there is an earth-ground connection for the switch. You can connect the grounding pad on the switch either directly to the earth-ground connection or to a fully bonded and grounded rack.

You must provide the grounding cable to make this connection, but you can connect the grounding wire to the switch using a grounding lug that ships with the switch. Size the grounding wire to meet 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 (for those installations, we recommend that you use commercially available 6 AWG wire). The length of the grounding wire depends on the proximity of the switch to proper grounding facilities.

Note You automatically ground the AC power supplies when you connect them to a power source. You must also connect the chassis to the facility earth ground.

Planning for Power Requirements

To plan for the power requirements of a switch, you must determine each of the following:

- Power requirements for all of the switch components
- Minimum number of power supplies required to power the components installed in the switch

- Power mode to use and the number of additional power supplies required for that mode

You must also ensure that the circuit used for the switch is dedicated to the switch to minimize the possibility of circuit failure.

When you know the amount of power that is required for operations (available power) and redundancy (reserve power), you can plan for the required number of input power receptacles within reach of the switch location.

Step 1 Determine the power requirement for the switch by summing the maximum wattage for each installed module (see the following table).

Table 1: Power Requirements for the Switch

Component	Quantity	Maximum	Typical
Supervisor Modules	1 or 2	—	—
– Supervisor A (N9K-SUP-A)		80 W	69 W
– Supervisor B (N9K-SUP-B)		90 W	75 W
System Controller Modules	2	—	—
– System Controller (N9K-SC-A)		25 W	13 W
I/O Modules	1 to 4 (can mix types)	—	—
– 48-port 1-/10-Gigabit SFP+ plus 4-port 40-Gigabit QSFP+ I/O module (N9K-X9464PX)		430 W	300 W
– 48-port 1-/10-GBASE-T plus 4-port 40-Gigabit QSFP+ I/O module (N9K-X9464TX)		200 W	160 W
– 48-port 1-/10-GBASE-T plus 4-port QSFP+ I/O module (N9K-X9564TX)		550 W	450 W
– 48-port 1-/10-Gigabit SFP+ plus 4-port QSFP+ I/O module (N9K-X9564PX)		430 W	300 W
– 36-port 40-Gigabit QSFP+ aggregation I/O module (N9K-X9636PQ)		400 W	260 W
– 36-port 40-Gigabit QSFP+ I/O module (N9K-X9536PQ)		420 W	360 W
– 32-port 40-Gigabit QSFP+ I/O module (N9K-X9432PQ)		300 W	240 W
Fabric Modules (N9K-C9504-FM)	3 to 6	125 W	100 W
Fan Trays (N9K-C9504-FAN)	3	135 W	110 W

To determine the maximum amount of power that can be consumed by this switch when fully loaded with components, add the maximum power consumed by two supervisor A modules (2 x 80 W = 160 W), two system controllers (2 x 25 W = 50 W), four 48-port 1- and 10-Gigabit BASE-T I/O modules (4 x 550 W = 2200 W), six fabric modules (6 x 125 W = 750 W), and three fan trays (3 x 135 W = 405 W). The total is 3565 W.

Step 2 Determine the number of power supplies needed for the available power requirement by dividing the power requirement amount (see Step 1) by the output wattage of the power supplies installed in the switch.
For 3-kW power supplies, round up a fractional result to the nearest ones digit to determine the number of power supplies needed.

For example, if you are installing a switch with 3-kW power supplies and have a maximum consumption of 3565 W, you need two power supplies (3565 W / 3000 W = 1.18 [rounded up to 2 power supplies]) to operate the switch and its modules.

Step 3 Select one of the following power modes to determine the number of additional power supplies required for reserve power:

- Combined power—Do not add any power supplies to the number of power supplies calculated for the available power in Step 2. This power mode does not provide power redundancy, so no extra power supplies are needed.
- Power supply redundancy (*n*+1 redundancy)—Add one power supply (reserve power supply) that can output as much power as the most powerful power supply used for active power. This form of power redundancy provides a reserve power supply that can replace any active power supply that goes offline.
- Input source redundancy (grid or *n*+*n* redundancy)—Add enough power supplies (reserve power supplies) to at least equal the total output of the active power supplies (the number of power supplies calculated in Step 2). Typically, you double the number of power supplies. You must plan for a second power source for the reserve power supplies. For example, if you calculate that you need two 3-kW power supplies for 6 kW of available power, you need another two 3-kW power supplies for 6 kW of reserve power (for a total of four 3-kW power supplies used for available and reserve power).

Step 4 Be sure that the power source circuits are dedicated to the switch and not to other electrical equipment.
For combined power mode (no power redundancy) or power supply (*n*+1) redundancy, you need only one dedicated circuit. For input-source (grid or *n*+*n*) redundancy, you must have two dedicated power circuits, with each circuit powering half of the 3-kW power supplies. The requirements for each circuit are listed in the following table.

Power Supply	Number of Circuits	Requirement for Each Circuit
3-kW AC power supply (N9K-PAC-3000W-B)	1 (power supply redundancy or no power redundancy) 2 (input-source redundancy)	16 A at 210 to 240 VAC

Step 5 Plan the placement of the input power receptacles within reach of the power cables used for each power supply (see the following table for the maximum distances).
Typically, power receptacles are placed on the rack with the switch.

Power Supply	Maximum Distance Between Receptacle and Power Supply
All AC power supplies	12 feet (3.5 m)

Rack and Cabinet Requirements

You can install the following types of racks or cabinets for your switch:

- Standard perforated cabinets
- Solid-walled cabinets with a roof fan tray (bottom to top cooling)
- Standard open four-post Telco racks

To correctly install the switch in a cabinet that is located in a hot-aisle/cold-aisle environment, you should fit the cabinet with baffles to prevent exhaust air from recirculating into the chassis air intake.

Work with your cabinet vendors to determine which of their cabinets meet the following requirements or see the Cisco Technical Assistance Center (TAC) for recommendations:

- Use a standard 19-inch (48.3 cm), four-post Electronic Industries Alliance (EIA) cabinet or rack with mounting rails that conform to English universal hole spacing per section 1 of the ANSI/EIA-310-D-1992 standard.
- The height of the rack or cabinet must accommodate the 7.1-RU (12.4 inches or 31.6 cm) height of the switch and its bottom support bracket.
- The depth of a four-post rack must be 24 to 32 inches (61.0 to 81.3 cm) between the front and rear mounting brackets.
- Required clearances between the chassis and the edges of its rack or the interior of its cabinet are as follows:
    - 4.5 inches (11.4 cm) between the front of the chassis and the front of the rack or interior of the cabinet (required for cabling).
    - 3.0 inches (7.6 cm) between the rear of the chassis and the interior of the cabinet (required for airflow in the cabinet if used).
    - No clearance is required between the chassis and the sides of the rack or cabinet (no side airflow).

Additionally, you must consider the following site requirements for the rack:

- Power receptacles must be located within reach of the power cords used with the switch.

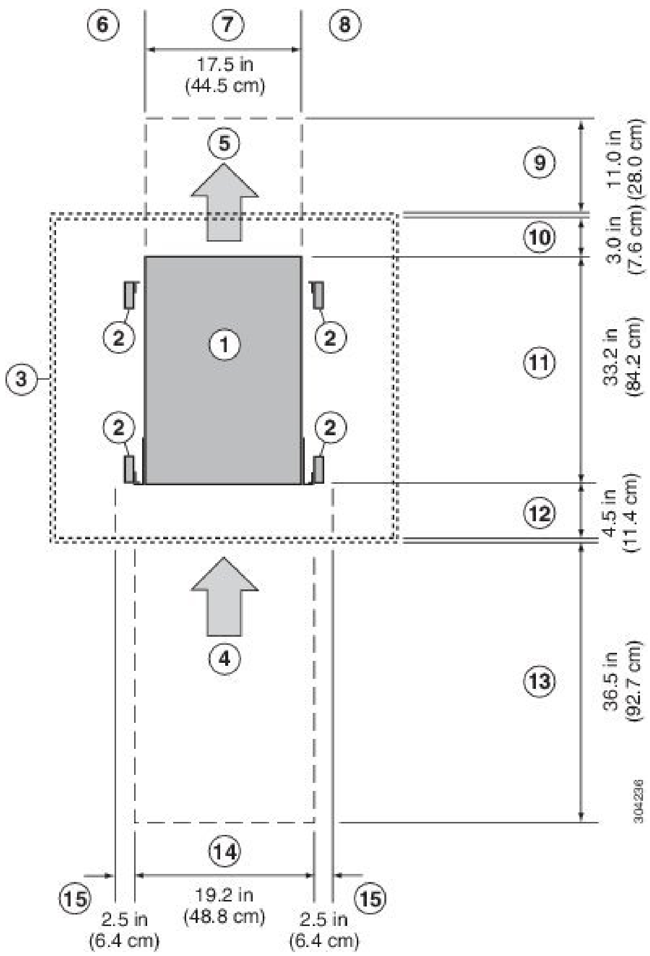
  Power cords for 3-kW AC power supplies are 8 to 12 feet (2.5 to 4.3 m) long. For the power cord specifications, see AC Power Cord Specifications.
- Clearance is required for cables that connect to as many as 192 ports (in addition to the cabling required for other devices in the same rack). These cables must not block access to any removable chassis modules or block airflow into or out of the chassis. Route the cables through the cable management frames on the left and right sides of the chassis.

> **Warning** **Statement 1048—**Rack Stabilization
>
> Stability hazard. The rack stabilizing mechanism must be in place, or the rack must be bolted to the floor before you slide the unit out for servicing. Failure to stabilize the rack can cause the rack to tip over.

Clearance Requirements

You must provide the chassis with adequate clearance between the chassis and any other rack, device, or structure so that you can properly install the chassis, route cables, provide airflow, and maintain the switch. For the clearances required for an installation of this chassis, see the following figure.

Figure 1: Clearances Required Around the Chassis



1	Chassis	9	Rear service clearance required to replace fan trays and fabric modules

2	Vertical rack-mount posts and rails	10	Clearance area required at the rear of the chassis within the cabinet (if used) or to the edge of the hot aisle (if no cabinet) for module handles
3	Nearest object or inside of cabinet (no side clearance required)	11	Chassis depth
4	Air intake from the cold aisle for all modules and power supplies	12	Clearance required between the front of the chassis and the inside of the cabinet (if used) or the edge of the cold aisle (if no cabinet) for cable management and ejector handles on I/O modules
5	Air exhaust to the hot aisle for all modules and power supplies	13	Front service clearance required for installing the chassis and replacing the modules on the front of the chassis
6	No left side clearance required (no airflow on left side)	14	Width of the chassis plus vertical mounting brackets on each side
7	Chassis width	15	Side clearance required by the front of the chassis for rotation of I/O module handles (keep this area clear of rack, cable management, and other components that can prevent full rotation of the ejector levers)
8	No right side clearance required (no airflow on right side)		