

Key Considerations for Selecting Server Cabinets for Seismic Areas

Protect Up to 1500 of Critical Network Equipment without Sacrificing Flexibility

Planning a data center in a seismically active area requires careful consideration on many levels. Though seismic events are more common in the state of California, there are other parts of the United States where earthquakes are also a concern. It is much easier to prepare for the next earthquake, than to predict when it will happen.

To reduce risk and injury and minimize equipment damage during an earthquake, proper seismic protection is essential. This is especially important in telecommunications and equipment rooms and data centers that cannot afford to be offline or are not backed up at a secondary location.

Selecting the right infrastructure products for your data center is crucial in order to get the most protection for servers, switches and cables. Specialized equipment and accessories such as racks, cabinets and bracing help minimize excessive motion that may cause undue strain on cable and network connections.

There are many seismic products and solutions available in the market today. To adequately protect equipment, it is important to understand the types of seismic ratings and additional features and benefits needed for proper cable and thermal management.

How Building Codes Affect Seismic Rating of Products

Because seismic areas require specific building codes and installation requirements for public buildings to ensure the safety of people and equipment, seismic products that will be installed in buildings must also comply with stringent guidelines.

The International Building Code (IBC) states that structures designed according to its requirements are expected to have a very low to no likelihood of collapsing during a seismic event.

The IBC also incorporates the ASCE 7, Minimum Design Loads for Buildings and Other Structures, developed by the American Society of Civil Engineers (ASCE), which provides guidelines and specific calculations to prevent nonstructural components from sliding or overturning in the event of an earthquake (Note that the state of California has its own set of codes, the California Building Code (CBC), which incorporates IBC's criteria and requirements substantially but with few adjustments to accommodate the state's laws).

Some facilities are considered essential and are required to continue operation even after an earthquake. According to the IBC, buildings can be ranked under four risk categories, as you can see in the table below.

Risk Category	Nature of Occupancy	What it means
I	Agricultural facilities, storage facilities	No real threat if equipment and systems stop functioning
II	Buildings that do not fall in Category I, III or IV	No real threat but possible
III	Education facilities, public utility facilities, telecoms, jails	Represent a substantial hazard risk to human life
IV	Hospitals, fire and police stations, emergency shelters, aviation control towers, national defense buildings, facilities containing highly toxic materials, etc.	Designed to be essential facilities and are required to maintain functionality in the case of an earthquake

Components and nonstructural elements that are going to be installed in the facility also get a grade—the component factor (Ip), which tells an engineer if there is a need for a special floor design or installation practice. Depending on the Ip (either a 1 or 1.5), building design anchorage, bracing requirements and the design robustness are either stricter or can be more flexible to meet code.

Chatsworth Products (CPI) designs its seismic products with Risk Category IV buildings and Ip 1.5 in mind, meaning they are engineered and tested to maintain functionality even after the most severe earthquakes.

Why Seismic Qualification Matters

There are three different ways manufacturers can claim their products are qualified to perform in seismic areas:

- Analysis and design calculations – take into consideration the importance factor of the component and Risk Category of the facility, among other variables
- Shaker table testing – tests products on a physical level with very stringent conditions, simulating a severe earthquake and ensuring the product will perform before, during and after an earthquake
- Experience data – requires manufacturers to submit evidence that the product has performed through a severe earthquake

Installers and contractors must look closely at the type of seismic rating a manufacturer is providing, as there are different methods to achieving a seismic rating for a product.

IBC compliance certification takes into consideration the products and their interaction with the entire building. Approval is either achieved through a mathematical equation that compares and extrapolates potential seismic effects to the components installed in a building or by providing sufficient data showing a component’s performance during a

strong earthquake (experience data). Using experience data would require the manufacturer to design the new component with the same specifications. Either way, many variables play into achieving IBC compliance.

Telcordia Technologies GR-63-CORE Network Equipment Building Systems Certification

Another common and widely sought after seismic certification is the Telcordia Technologies GR-63-CORE Network Equipment Building Systems (NEBS), which provides a set of directives to ensure the protection of telecommunications equipment. NEBS requires an enclosure to provide a level of protection for equipment so that it maintains operation during and after a seismic event. Unlike the IBC certification process, which is based on analysis, NEBS tests products on a physical level with very stringent conditions to prevent system downtime. Putting a product through a simulated earthquake is the most realistic way to verify its seismic performance.

To get a NEBS certification, the enclosure is loaded to maximum capacity and mounted on a shaker table. Anchorage, bracing and accessories required during actual product installation are also addressed in the test. The shaker table simulates an earthquake (up to 8.3 on the Richter scale) and shakes the enclosure front-back, side-side and up-down at different levels of intensity. To pass the test, the enclosure must not move more than three inches at the top of the enclosure relative to the base in each direction, and it must maintain operation during and after the shaker test. The enclosure must also return to within .24 inches at the highest point of its original position.

California's OSHPD Special Seismic Certification Preapproval

In the state of California, the Office of Statewide Health Planning and Development (OSHPD) also provides special seismic certification to products that will be installed in hospitals and health care facilities. In addition to IBC and NEBS, OSHPD certification is based on requirements from the CBC and ASCE 7-10.

Depending on the type of product, an OSHPD Special Seismic Certification Preapproval of Manufacturer's Certification (OPM), or OSHPD Special Seismic Certification Pre-approval (OSP) may be required.

OPM is a preapproval of manufacturer's certification, a process that allows manufacturers to submit analysis or test data prepared by a registered design professional to support design requirements of the code. If approved, this OPM can be referenced in construction documents. It is intended to accelerate the approval process for standard installations. This is not required; the submission can be project-specific requiring separate review. Also, if any alterations are made, those changes must be submitted for review and re-approval.

OSP, on the other hand, is the OSHPD preapproval of Designated Seismic Systems for critical components ($I_p=1.5$) with moving parts that must function after an event, such as HVAC, Uninterruptible Power Supply (UPS) or a cabinet frame with system components and electrical connection included. The manufacturer conducts an evaluation of the product using a shaker test to confirm function after the event, and the event is labeled with seismic-application information.

OSP reviews the evaluation and labeling and preapproves the application of the component. OSP approval does not apply to the type of products CPI manufactures.

Many data centers in California and around the globe rely on CPI for products of the highest quality and standards. CPI is a manufacturer of solutions that optimize, store and secure technology equipment. CPI's engineered seismic racks, cabinets and accessories provide the extra support needed to protect equipment and help prevent downtime during earthquakes.

CPI's Z4-Series SeismicFrame® Cabinet System and Seismic Frame® Two-Post Rack were tested to the highest standards and meet both NEBS and OSPHD requirements.

Mounting Considerations

Installers and contractors must also address the way nonstructural components are anchored and braced in a seismic zone or Risk Category IV building.

Bracing and anchorage must be strong enough to resist seismic activity. Fasteners and anchors with high-shear and high-tensile strength ratings should be used to secure components. When mounting on a concrete floor, choose seismically rated floor anchors that can support the load of the rack and equipment. A minimum of four floor anchors, one at each corner, is typically required for a two- or four-post equipment rack or cabinet installation.

CPI has a Floor Anchor Kit, which features four heavy-duty anchors to attach to the four corners of the Z4-Series SeismicFrame Cabinet or Seismic Frame Two-Post Rack.

As important as complying with building and telecommunications standards and acquiring seismic-rated products is, the actual product design should also be considered carefully. When it comes to selecting the right enclosures for telecommunications rooms and data centers in seismic areas, it is important to ask the following questions:

Is the enclosure seismic-rated? The enclosure you choose should be designed, certified and tested for use in seismic areas. If the enclosure was put under a physical test, such as the one required by NEBS or the ICC-EC AC 156, another recognized testing standard procedure, the manufacturer should be able to provide the lab test report, calculations and even a video of the shaker table testing. Because shaker table testing provides a defined result of "pass" or "fail" without affecting performance and operability, it is easy to compare products that go through the same type of certification to find the best fit for your requirements.

CPI's Z4-Series SeismicFrame Cabinet and Seismic Frame Two-Post Rack are tested by a Telecommunications Carrier Group and are ISO 17025 certified by Independent Testing Laboratory to meet Telcordia Technologies GR-63-CORE, Issue 4, April 2012, Sections 4.4 per Zone 4 requirements.

What is the seismic load rating? When choosing an enclosure, one with a high seismic load capacity will provide the most benefits. A seismic load capacity indicates how much weight a cabinet or rack can hold and how well it protects equipment during a seismic event. The higher the seismic load, the more equipment and weight it can support. Note the difference: Seismic load indicates a load that has been tested for dynamic movement in a simulated seismic event, whereas static load is qualified by a standard load test (not a shaker table test) without motion.

CPI's Z4-Series SeismicFrame Cabinet features an industry-leading 1500 lb (680 kg) seismic equipment load with an additional 100 lb (45 kg) top load for cabling. It is also UL 2416 Listed for a 3000 lb static equipment payload. CPI's Seismic Frame Two-Post Rack features a 1000 lb (453.6 kg) load rating.

Is the enclosure big enough for my equipment? Most manufacturers limit the size of their seismic cabinets in order to have a smaller, sturdier product that will pass seismic tests. This limits the depth of equipment that can be installed. Most equipment can be more than 30" (762 mm) deep. Current TIA-569-C standards provide size and clearance requirements for equipment and cabling cabinets to address equipment sizes, cable management and power distribution unit (PDU) installation. To ensure these standards are met, cabinets 42" deep or larger are recommended.

CPI went the extra mile to engineer the Z4-Series SeismicFrame Cabinet in eight frame sizes, both 600 and 800 mm widths, so size and depth are not compromised. A unique 47.2" (1200 mm) deep option is available to accommodate deeper equipment, while maintaining a small footprint. The Seismic Frame Two-Post Rack supports 19" EIA-310-D compliant or 23" wide equipment.

How are you going to attach cable management and power products? Seismic-rated enclosures available today often have frames with limited cable management space. Products that leave adequate room for cable management and PDUs, such as the ones CPI offers, resolve this issue.

Vertical Power Strips and T-shaped Cable Management Fingers attach directly to CPI's Seismic Frame Two-Post Rack channel to provide power and cable distribution for equipment.

What about airflow? You should not have to sacrifice proper airflow for seismic stability. Servers still need to remain cool to function properly, even within seismic areas. Also, thermal management strategies and legislation enacted to reduce energy consumption do not provide exemptions to these products if installed in seismic areas. At a minimum, the enclosure's seismic bracing should not block the flow of cool air into your servers. At best, select an enclosure with airflow accessories to prevent hot air recirculation.

Thermal performance in accordance with industry best practices is maximized with accessories that manage airflow through the cabinet, keeping hot and cold air separated within the cabinet, allowing CPI's Z4-Series SeismicFrame Cabinet to be fully integrated into an aisle containment strategy. Additionally, optional air dam controls airflow through the cabinet and separates cable and power management brackets

How difficult is it to install? Enclosures in general are heavy and difficult to move on a job site. Seismic cabinets can be almost two times the weight of non-seismic cabinets. Look for a product with transport casters and recessed leveler feet to ease installation. The high-quality designed cabinets feature easily accessible leveler feet to raise the cabinet so that the transport casters can be removed. Be sure to anchor your cabinet directly to the floor using approved anchors. Designs that allow approved alternate mounting locations reduce the impact of site specific constraints.

CPI's Z4-Series SeismicFrame Cabinet features factory-installed transport casters to allow easy movement and recessed leveling feet to simplify installation. Floor anchorage eliminates the requirement for costly engineering calculations for external bracing.

Is the equipment inside the cabinet secure? Equally important to bracing, the cabinet should secure the equipment well. If the cabinet has slide-out drawers, be sure they have mechanical latches to keep the drawer closed when not in use, as is the case of slide-out LCD panels. For shelf-mounted equipment, be sure to secure equipment to the shelf. The rack manufacturer may offer specific accessories that secure equipment to the shelf or provide additional bracing to the equipment mounting rails.

Conclusion

Seismic events continue to draw attention on a global scale, acting as a catalyst for ever-increasing building codes and certifications. Be sure to check all codes, rules and regulations in your area. Consult a structural engineer when necessary.

As crucial as complying with building codes is, understanding what goes behind deeming a product seismic-ready is also important, as different approaches are used to make such determination.

Physical shaker table tests, such as the ones required by GR-63-CORE NEBS or ICC-ES AC 156, qualify the performance and endurance of a product during an earthquake. Performance analysis, such as the one required in the IBC and CBC, on the other hand, do not test the product physically. Their advantage is that they account for all variables that are involved in an installation and the building that could potentially affect a product's ability to protect equipment from an earthquake.

Prevent downtime and equipment damage during a seismic event and plan accordingly with CPI's products and accessories, specifically designed to protect equipment in seismically active areas. For more information about CPI's seismic products, visit the [website](#).



Selecting the right server cabinet for your data center is crucial in order to get the most protection for servers, switches and cables. However, you should not have to sacrifice good thermal and cable management for seismic protection.



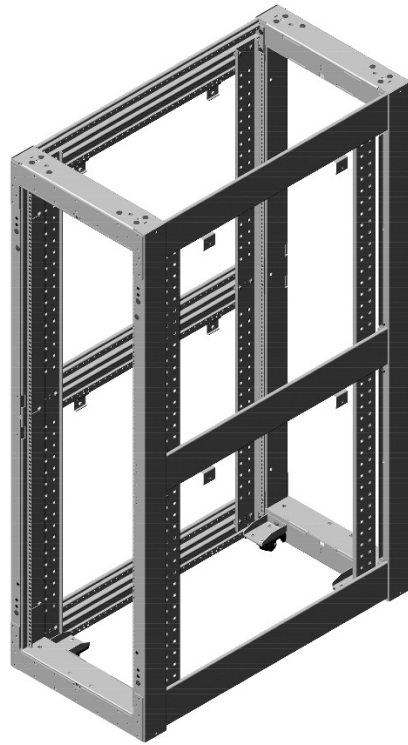
According to the International Building Code, hospitals are required to continue operation after a seismic event.



A shaker table test ensures that an enclosure will function properly during seismic events. The shaker table simulates an earthquake (up to 8.3 on the Richter scale) and shakes the enclosure front-back, side-side and up-down at different levels of intensity.



The Z4-Series SeismicFrame® Cabinet System from Chatsworth Products provides an industry-leading 1500 lb seismic load rating while accommodating today's cable and thermal management needs.



The enclosure you choose should be designed, certified and tested for use in seismic areas. If the enclosure is NEBS compliant, the manufacturer should be able to provide the lab test report.