

# Seismic Compliance Review

What you should know about Siemens' commitment to compliance with seismic regulations.

## Low Voltage Power Distribution

### Low voltage seismic compliance

Today, strict seismic requirements are not limited to areas prone to earthquakes. Engineers in all locations must be aware of, and comply with, earthquake protection regulations. In addition to construction materials and techniques, these regulations cover nonstructural building systems, including electrical components. In critical applications, such as healthcare facilities, these components must be designed to go beyond surviving an earthquake in order to remain operational after the event is over.

At Siemens, we are committed to making it easier for you to comply with all building requirements, including seismic ratings.

The following compliance overview is based on earthquake loading (shake) tests performed by Wyle Laboratories, NTS Huntsville, Clark Testing and Environmental Testing Laboratory in accordance with ICC-ES-AC 156, "Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems" and ASCE 7-10.

The purpose of this compliance assessment is to document the seismic compliance of Siemens power distribution products to the following building codes:

#### Building Code

International Building Code (IBC)
California Building Code (CBC)
Uniform Building Code (UBC)
American Society of Civil Engineers (ASCE)
National Fire Protection Association (NFPA 5000)

#### Notes:

1. The codes and standards referenced in this document are published by independent organizations, institutes or agencies. All copyrights and trademarks related to such codes and publications and the use thereof belong to the entities owning rights to the same.
2. These test results indicate third party analysis of the Siemens product for compliance to the referenced codes and editions. Nothing in this publication should be taken as endorsements, official approvals or official test results provided by the publishers of the referenced codes or any code enforcement authorities
3. Siemens power distribution equipment is designed and built to function successfully after seismic activity. The structural integrity of Siemens power distribution equipment has been verified by extensive shake-table testing at engineering labs.
4. Certificates of seismic compliance are available upon request. Contact your Siemens Sales Representative.



Item No.	Description	Maximum Level Ratings					
		Building Codes					
		1997 UBC/ 1998 CBC/ 2001 CBC (see note 1)	2000 IBC/ 2003 IBC ASCE 7-02/ 2003 NFPA-5000 (see note 1)	2006 IBC/ 2007 CBC ASCE 7-05/ 2006 NFPA-5000 (see note 1)	2009 IBC/ 2010 CBC ASCE 7-10/ 2009 NFPA-5000 (see note 1)	2012 IBC/ 2013 CBC/ ASCE 7-10 (see note 1)	2015 IBC/ ASCE 7-10 (see note 1)
1	All Single-Width (W1) Sentron Busway	Zone 4	$S_S = 187\% g$	$S_S = 180\% g$ ( $S_{ds} = 1.20$ )	$S_{ds} = 1.11g$	$S_{ds} = 1.33g$	$S_{ds} = 1.33g$
2	All Double-Width (W2) Sentron Busway	Zone 3	$S_S = 93\% g$	$S_S = 89\% g$ ( $S_{ds} = 0.59$ )	$S_{ds} = 0.54g$	$S_{ds} = 0.65g$	$S_{ds} = 0.65g$
3	General Purpose Dry Type Transformer (1000kVA Max.)	Zone 4	$S_S = 187\% g$	$S_S = 300\% g$ ( $S_{ds} = 2.00$ ) (see note 3)	$S_{ds} = 2.00g$ (see note 3)		
4	Tiastar Motor Control Center - Indoor	Zone 4	Maximum considered earthquake	$S_S = 300\% g$ ( $S_{ds} = 2.00$ )	$S_{ds} = 2.00g$	$S_{ds} = 2.00g$	$S_{ds} = 2.00g$
5	Tiastar Motor Control Center - Outdoor	Zone 4	Maximum considered earthquake	$S_S = 300\% g$ ( $S_{ds} = 2.00$ )	$S_{ds} = 2.00g$	$S_{ds} = 2.00g$	$S_{ds} = 2.00g$
6	Sentron Wall-Mount Panelboard - Lighting And Appliance Panelboards P1, P2 And P3	Zone 4	$S_S = 249\% g$	$S_S = 239\% g$ ( $S_{ds} = 1.59$ )	$S_{ds} = 1.80g$	$S_{ds} = 1.80g$	
7	Sentron Wall-Mount Panelboard - Power Panelboards P4 And P5	Zone 4	$S_S = 249\% g$	$S_S = 239\% g$ ( $S_{ds} = 1.59$ )	$S_{ds} = 1.80g$	$S_{ds} = 1.80g$	
8	SB1 Front Connected Switchboard	Zone 4	$S_S = 249\% g$	$S_S = 239\% g$ ( $S_{ds} = 1.59$ )	$S_{ds} = 1.47g$	$S_{ds} = 1.69g$	$S_{ds} = 1.69g$
9	SB2 Front Connected Switchboard	Zone 4	$S_S = 249\% g$	$S_S = 239\% g$ ( $S_{ds} = 1.59$ )	$S_{ds} = 1.47g$	$S_{ds} = 1.69g$	$S_{ds} = 1.69g$
10	SB3 Front Connected Switchboard	Zone 4	$S_S = 249\% g$	$S_S = 239\% g$ ( $S_{ds} = 1.59$ )	$S_{ds} = 1.47g$	$S_{ds} = 1.69g$	$S_{ds} = 1.69g$
11	Blue Pennant Switchboard	Zone 4	$S_S = 249\% g$	$S_S = 239\% g$ ( $S_{ds} = 1.59$ )	$S_{ds} = 1.47g$	$S_{ds} = 1.73g$	$S_{ds} = 1.73g$
12	SMM Front Connected Switchboard	Zone 4	$S_S = 249\% g$	$S_S = 239\% g$ ( $S_{ds} = 1.59$ )	$S_{ds} = 1.47g$	$S_{ds} = 1.69g$	$S_{ds} = 1.69g$
14	Type RCS Rear Connected Switchboard	Zone 4	Maximum considered earthquake	$S_S = 300\% g$ ( $S_{ds} = 2.13$ ) (see note 2)	$S_{ds} = 2.13g$ (see note 2)	$S_{ds} = 2.13g$ (see note 2)	$S_{ds} = 2.13g$ (see note 2)
15	Type WL LV Switchgear	Zone 4	Maximum considered earthquake	$S_S = 300\% g$ ( $S_{ds} = 2.13$ ) (see note 2)	$S_{ds} = 2.13g$ (see note 2)	$S_{ds} = 2.13g$ (see note 2)	$S_{ds} = 2.13g$ (see note 2)
16	High Voltage Disconnect Switch, 600/1200A, 5/15Kv Fused Switch Unit	Zone 4	$S_S = 187\% g$	$S_S = 180\% g$ ( $S_{ds} = 1.20$ )	$S_{ds} = 1.11g$		
17	Safety Switches	Zone 4	$S_S = 300\% g$	$S_S = 300\% g$ ( $S_{ds} = 2.00$ )	$S_{ds} = 1.85g$	$S_{ds} = 1.85g$	

## Notes:

1. The following notes and conditions are applicable to the compliance levels listed:

Building code	Notes/conditions
1997 UBC/ 1998 CBC/ 2001 CBC	<p>A. The required response spectra are the horizontal and vertical components of the ground motion for the specified zone. Building amplifications, which may or may not be applicable, are not included.</p> <p>B. The required response spectra are not applicable for equipment located in an area with soil profile type SF. Site-specific required response spectra must be developed for those locations.</p> <p>C. The vertical required response spectra developed from the horizontal required response spectra shown may not be applicable to equipment installed within 5 km of the nearest seismic source. Site-specific vertical required response spectra must be developed for those locations.</p>
2000 IBC/ 2003 IBC/ 2006 IBC/ 2009 IBC/ 2012 IBC/ 2015 IBC  ASCE 7-02/ ASCE 7-05/ ASCE 7-10/  2003 NFPA-5000/ 2006 NFPA-5000/ 2009 NFPA-5000/  2007 CBC/ 2010 CBC/ 2013 CBC	<p>A. The required response spectra are the "worst-case" horizontal and vertical components based the following:</p> <ul style="list-style-type: none"> <li>a. Maximum considered earthquake spectral response acceleration of xxx% g.</li> <li>b. Equipment located in a building located at a site classified as Site Class A, B, C, or D.</li> <li>c. Equipment located in a concrete and steel, moment-resisting frame building not exceeding 12 stories in height with a minimum story height of 10 feet.</li> <li>d. Equipment located anywhere between ground level and roof level</li> </ul> <p>B. The 2005 ASCE 7-05, referenced in 2006 NFPA 5000 and in the 2006 IBC, divided various equipment types into more specific components, and increased the requirements for some types of electrical components, including the equipment described in this report, by approximately 4%. Therefore, the compliance levels for subsequent ASCE, NFPA and IBC building codes have been reduced.</p> <p>C. Sds ratings are based on the maximum Required Response Spectra (RRS) in accordance with ICC-ES-AC 156, "Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems".</p>

$S_s$ : Maximum considered earthquake spectral response acceleration parameter at short periods (% g). This value is based on the geographic location of the structure and defines the probability and severity of seismic activity derived from IBC maps. Assigned values range from 0% to 300% g.

$S_{ds}$ : Design spectral response acceleration parameter at short periods (g). This parameter is based on  $S_s$ , adjusted for soil properties at installation site. Calculated values range from 0.0 g to 2.13g.

$I_p$ : Importance factor. This factor (1.0 - 1.5) identifies whether components must be fully operational after a seismic event. An  $I_p$  rating equal to 1.5 is assigned if any of these three conditions apply: the component is required to function for life-safety purposes after an earthquake; the component contains hazardous materials; or the component is in or attached to an Occupancy Category IV structure and it is needed for continued operation of the facility. All other components are assigned an  $I_p$  rating equal to 1.0.

$z/h$ : Ratio (0.0 - 1.0) representing the component mounting height in relation to the the total building height.  $z$  is the component mounting height (above ground level) and  $h$  is the total building height (above ground level).  $z/h = 0.0$  if the component is mounted at ground level in the building.  $z/h = 1.0$  if the component is mounted on the highest level of the building (on the roof).

2. Ratings apply to IBC Occupancy Categories I, II, III and IV; Seismic Design Categories A, B, C and D; Site Classes A, B, C and D.
  - (a) For indoor Type WL low voltage switchgear, the maximum  $I_p$  rating is 1.5. If  $z/h = 0$ ,  $S_{ds} = 2.13g$ . If  $z/h = 1.0$ ,  $S_{ds} = 1.33g$ .
  - (b) For outdoor Type WL low voltage switchgear, the maximum  $I_p$  rating is 1.0,  $z/h = 0$  and  $S_{ds} = 2.00g$ .
3. For Transformers in Item 3 all encapsulated units 75kVA and below have an  $S_{ds} = 2.0$ . All standard ventilated Floor Mounted units have an  $S_{ds} = 1.6$ . Consult factory for ventilated designs that require  $S_{ds} = 2.0$ .

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