

CODE APPLICATION NOTICE

Subject: Certification of Equipment and
Nonstructural Components

CAN NO. 2-1708A.5
EFFECTIVE: 10/31/08
REVISED: 6/26/09

CODE SECTIONS

Sections 1708A.2, 1708A.5, 1702A and 1707A.9
2007 California Building Code (CBC)
(see Appendix A)

Sections 13.2.1, 13.2.2, 13.2.5, 13.2.6, 13.1.3 and 13.1.4
American Society of Civil Engineers (ASCE/SEI)
7-05 Minimum Design Loads for Buildings and Other Structures
(see Appendix A)

PURPOSE

The purpose of this Code Application Notice (CAN) is to clarify the requirements for seismic qualification/certification of mechanical and electrical equipment/components. This CAN also provides an interpretation for code sections of the 2007 CBC and ASCE/SEI 7-05 that appear to be in conflict.

Note: This CAN will be updated regularly as additional data on seismic qualification and certification of critical components becomes available.

BACKGROUND

The 2007 California Building Code (CBC) and ASCE/SEI 7-05 introduces new concepts for seismic design of nonstructural components. These concepts are intended to improve the performance of essential nonstructural systems subject to strong ground shaking. The full texts of the related code sections are included in Appendix A of this document.

INTERPRETATION

1.0 Identification of Seismic Design requirements

The design and documentation requirements for nonstructural components and systems vary, depending upon the importance of the component and whether the component is required to be functional immediately following the design earthquake. Figure 1-1 provides a process for determining the appropriate design and documentation approach. Definitions of useful terms are presented in Appendix B.

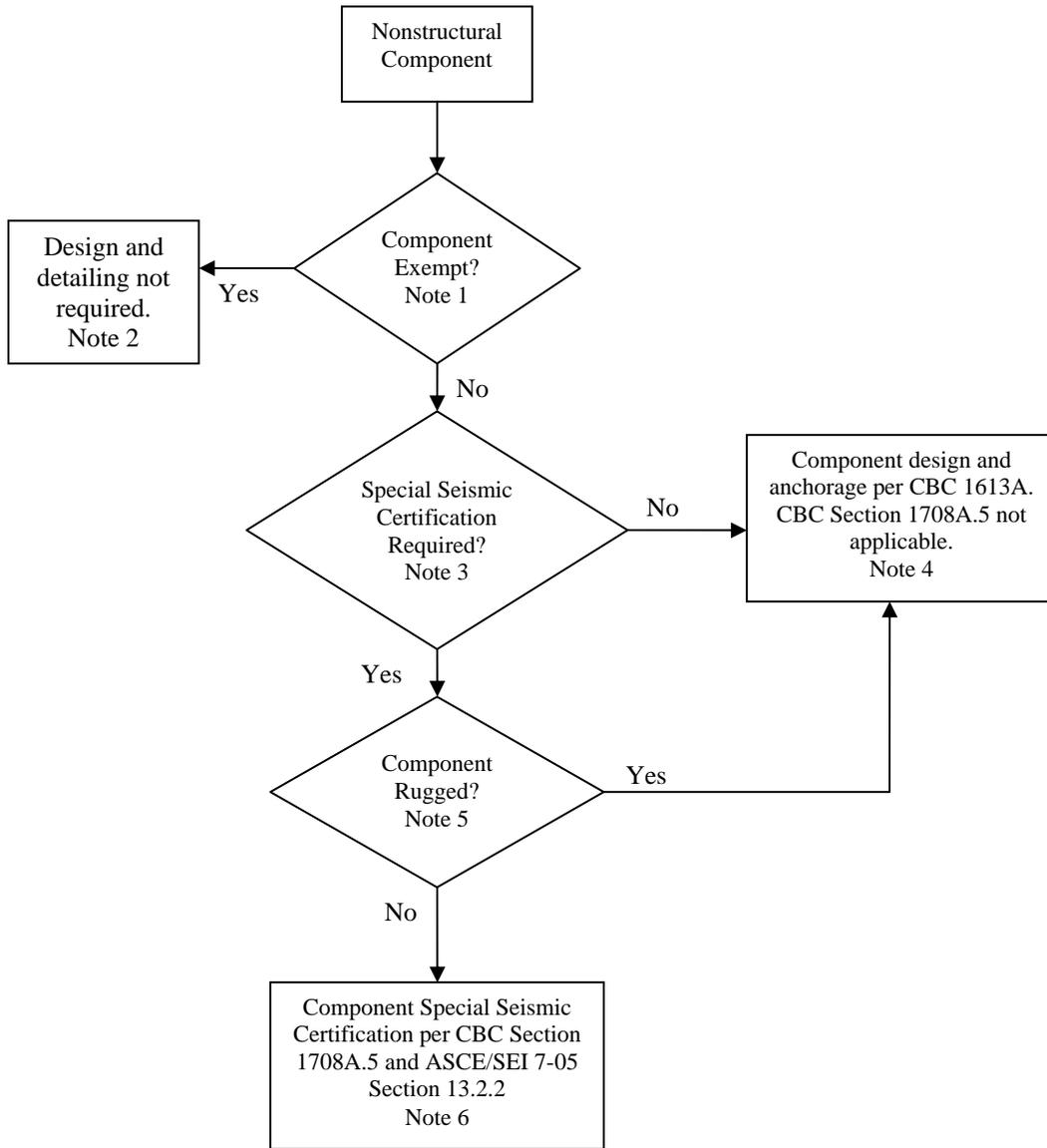


Figure 1-1. Identification of Seismic Design Requirements

Notes

1. Certain components are exempt from seismic design requirements. The exemptions are listed in Section 1614A.1.14 of the 2007 CBC; Sections 13.1.4, 13.6.5.5, 13.6.7, 13.6.8 of ASCE/SEI 7-05; and Section 7-125(c) 3.C., 2007 California Administrative Code (CAC).
2. See Appendix A for important corrections to ASCE/SEI 7-05 Section 13.1.4 that are based on errata to ASCE/SEI 7-05 dated May 3, 2007.
3. Special Seismic Certification is required for certain equipment and components that are part of the designated seismic system pursuant to Section 13.2.2 of ASCE/SEI 7-05. Equipment and components requiring Special Seismic Certification are identified in Item 2.1 of this CAN.
4. Equipment and components not requiring Special Seismic Certification must comply with the requirements of Section 13.2.1 in ASCE/SEI 7-05. Two options are available: 1) project-specific calculations and details, or 2) manufacturer's (Seismic) certification, including anchorage pre-approval. The testing alternative in Section 13.2.5 of ASCE/SEI 7-05 is also available. These options are discussed in Items 3.0 and 4.0 of this CAN.

Component supports, and attachments design for position retention shall use importance factor, $I_p = 1.5$, in accordance with CAN 2-1613A.1.

5. Experience in past earthquakes has shown that certain types of equipment are inherently rugged, as defined in Appendix B. A list of equipment and components deemed to be rugged is presented in Item 2.2 of this CAN. Rugged equipment and components are considered to satisfy the requirements of Section 13.2.6 of ASCE/SEI 7-05.
6. Equipment and components that require Special Seismic Certification must meet the requirements of Section 13.2.2 of ASCE/SEI 7-05 and Section 1708A.5 of 2007 CBC. Acceptable procedures for Special Seismic Certification are presented in Item 3.2 of this CAN.

2.0 Equipment and Components Requiring Special Seismic Certification

Special Seismic Certification is required for certain equipment and components that are part of the designated seismic system pursuant to Section 13.2.2, ASCE/SEI 7-05. Only active mechanical and electrical components that must remain operable following the design earthquake require Special Seismic Certification.

2.1 List of Equipment and Components Requiring Special Seismic Certification

The following equipment and components require Special Seismic Certification:

1. Emergency and standby power systems equipment including generators, turbines, fuel tanks, and automatic transfer switches.
2. Elevator equipment (except elevator cabs).
3. Components with hazardous contents excluding pipes, and ducts.
4. Smoke control fans.
5. Switchgear.
6. Motor control centers.
7. Built-up or field assembled mechanical equipment.
8. X-Ray machine(s) in the fluoroscopy room (as required to meet the minimum basic radiological/imaging service space requirements of Section 1224.18, 2007 CBC).
9. Air conditioning units.
10. Air handling units.
11. Chillers used for HVAC.
12. Cooling Towers designed as components.
13. Transformers.
14. Electrical substations.
15. UPS and associated batteries.
16. Distribution panels including electrical panel boards.
17. Control panels, including fire alarm, fire suppression, preaction, and auxiliary or remote power supplies.

Equipment and components that are considered to be rugged pursuant to Item 2.2 of this CAN are deemed to comply with Section 13.2.6, ASCE/SEI 7-05 and are exempt from the requirements of this section.

2.2 Rugged Equipment and Components

The equipment and components listed below are considered rugged and shall not require Special Seismic Certification:

1. Valves (not in cast-iron housings, except for ductile cast iron).
2. Pneumatic operators.
3. Hydraulic operators.
4. Motors and motor operators.
5. Horizontal and vertical pumps (including vacuum pumps).
6. Air compressors.
7. Sterilizers.
8. Blanket warmers.
9. Anesthesia power columns, ceiling or wall mounted.
10. Refrigerators and freezers.
11. Microwave ovens for patient service.
12. Film illuminators.
13. Elevator cabs.
14. Underground tanks.
15. Equipment and components weighing not more than 20 lbs. supported directly on structures (and not mounted on other equipment or components) with supports and attachments in accordance with Chapter 13, ASCE/SEI 7-05, as modified by Section 1614A, 2007 CBC.

Exemptions in this section are for factory assembled discrete equipment and components only and do not apply to site assembled or field assembled equipment or equipment anchorage. The list is based in part on the 1999 SEAOC Blue Book commentary Section C 107.

3.0 General Seismic Design Requirements

There are several approaches to comply with the general seismic design requirements for nonstructural components. The steps to complete the design, certification, and OSHPD approval process are summarized in Figure 3 -1.

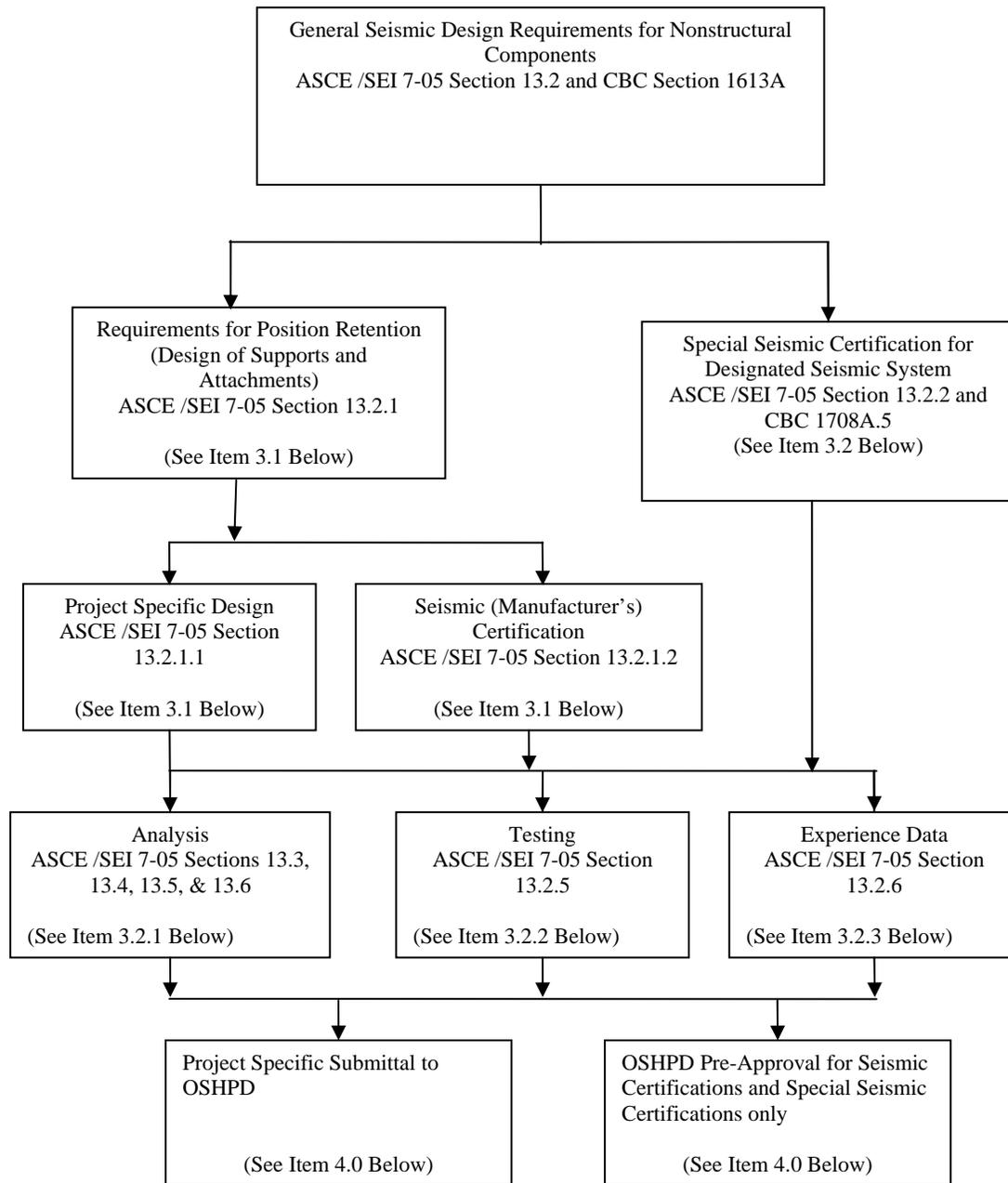


Figure 3 -1. General Seismic Design Requirements for Nonstructural Components

3.1 Seismic Certification

A manufacturer may provide seismic certification in accordance with Section 13.2.1.2 of ASCE/SEI 7-05, as a voluntary alternative to project-specific design and documentation in accordance with Section 13.2.1.1 of ASCE/SEI 7-05. Seismic certification of architectural, mechanical, and electrical components, supports, and attachments, if provided, shall be pursuant to Section 13.2.1.2 of ASCE/SEI 7-05. Seismic certifications can be a project-specific submittal or a pre-approval.

3.2 Special Seismic Certification

Special Seismic Certification is required for certain equipment and components pursuant to ASCE/SEI 7-05 Section 13.2.2. The following three methods are acceptable for Special Seismic Certification.

3.2.1 Analysis Section 1708A.5, 2007 CBC, permits Special Seismic Certification by analytical method for active mechanical and electrical equipment, even though it is not permitted by Section 13.2.2.a of ASCE/SEI 7-05.

3.2.2 Test Active mechanical/electrical equipment and components with hazardous contents may be certified by an actual test on a shake table or by three dimensional shock tests pursuant to Section 13.2.5 of ASCE/SEI 7-05.

3.2.3 Experience Data Active mechanical/electrical equipment and components with hazardous contents may be certified by experience data pursuant to Section 13.2.6 of ASCE/SEI 7-05. Rugged equipment listed in Item 2.2 of this CAN shall be considered to satisfy the experience data requirements of Section 13.2.6 of ASCE/SEI 7-05.

When experience data is used to certify equipment/components, it shall be shown that the database used contains the similar type/model equipment that is manufactured with the similar structural integrity. The Owner of the special seismic certification shall maintain a quality assurance program that will continually evaluate the performance of installed equipment experiencing new earthquake to determine if a new type of failure may exist.

4.0 OSHPD Approval

Seismic Certification and Special Seismic Certification approval by OSHPD can be either a project-specific approval or a pre-approval. When repetitive review of the same equipment or component is anticipated, a pre-approval is encouraged.

4.1 Approval by Analysis

All analysis submitted to OSHPD shall be prepared pursuant to Section 7-115 of the 2007 CAC.

Active parts or energized components shall be certified exclusively on the basis of approved shake table testing in accordance with Section 13.2.5, ASCE/SEI 7-05 or experience data in accordance with Section 13.2.6, ASCE/SEI 7-05, unless it can be shown that the component is inherently rugged by comparison with similar seismically qualified components.

For multi-component system, where active parts or energized components are certified by tests or considered to be rugged in accordance with item 2.2 of this CAN, connecting elements, attachments, and supports can be justified by supporting analysis.

4.2 Approval by Testing

All tests shall be performed by an independent laboratory having accreditation to the International Standards Organization (ISO) accreditation standard 17025 by an organization such as the International Accreditation Service (IAS) of the International Code Council (ICC) or shall be under the responsible charge of a California Licensed structural, civil or mechanical engineer. Test reports shall be prepared by a California Licensed structural, civil or mechanical engineer. If test reports are prepared by a California Licensed civil or mechanical engineer, they shall be reviewed and accepted by a -California licensed structural engineer.

Testing at the manufacturer's facility will be accepted if it is performed under the responsible charge of a California Licensed structural, civil or mechanical engineer, not permanently employed by the manufacturer, who must witness the test and certify the report. Test reports witnessed and certified by a California Licensed structural, civil or mechanical engineer shall be reviewed and accepted by a California licensed structural engineer.

Use of specific test results shall be limited to the configuration tested, unless otherwise approved by OSHPD. The mounting brackets shall be part of the equipment qualified by testing and shall contain provisions for anchorage of the equipment to the supporting structure at the site. The components from the mounting brackets to the supporting structure shall have the similar flexibility and strength to what is used in the equipment qualification test and may be qualified by a supporting analysis. The flexibility of the support structure shall be considered when certifying the anchorage by analysis.

Where individual components of a multi-component system are certified by test, the flexibility of the supporting structure in the equipment to point of anchorage shall be replicated in the test setup. Alternately, the input motions for the test setup may be modified to account for this flexibility using any rational analytical method.

APPENDIX A – Code Sections

2007 California Building Code

SECTION 1708A STRUCTURAL TESTING FOR SEISMIC RESISTANCE

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1708A.2 Testing for seismic resistance. The tests specified in Section 1708A.3 through 1708A.6 are required for the following:

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2. Designated seismic systems in structures assigned to Seismic Design Category D, E, or F.
3. Architectural, mechanical and electrical components in structures assigned to Seismic Design Category D, E, or F that are required in Section 1708A.5.

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1708A.5 Seismic qualification of mechanical and electrical equipment. The registered design professional in responsible charge shall state the applicable seismic qualification requirements for designated seismic systems on the construction documents. Each manufacturer of designated seismic system components shall test or analyze the component and its mounting system or anchorage and submit a certificate of compliance for review and acceptance by the registered design professional in responsible charge of the design of the designated seismic system and for approval by the building official. Qualification shall be by an actual test on a shake table, by three-dimensional shock tests, by an analytical method using dynamic characteristics and forces, by the use of experience data (i.e., historical data demonstrating acceptable seismic performance) or by a more rigorous analysis providing for equivalent safety.

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SECTION 1702A DEFINITIONS

1702A.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

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CERTIFICATE OF COMPLIANCE. A certificate stating that materials and products meet specified standards or that work was done in compliance with approved construction documents.

DESIGNATED SEISMIC SYSTEM. Those architectural, electrical and mechanical systems and their components that require design in accordance with Chapter 13 of ASCE 7 and for which the component importance factor, I_p , is greater than 1 in accordance with Section 13.1.3 of ASCE 7.

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INSPECTION CERTIFICATE. An identification applied on a product by an approved agency containing the name of the manufacturer, the function and performance characteristics, and the name and identification of an approved agency that indicates that the product or material has been inspected and evaluated by an approved agency (see Section 1703A.5 and "Label," "Manufacturer's designation" and "Mark").

LABEL. An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency (see Section 1703A.5 and "Inspection certificate," "Manufacturer's designation" and "Mark").

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MANUFACTURER'S DESIGNATION. An identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules (see also "Inspection certificate," "Label" and "Mark").

MARK. An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material (see also "Inspection certificate," "Label" and "Manufacturer's designation").

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SECTION 1707A SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

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1707A.9 Designated seismic system verifications. The special inspector shall examine designated seismic systems requiring seismic qualification in accordance with Section 1708A.5 and verify that the label, anchorage or mounting conforms to the certificate of compliance.

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ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures

13.2 GENERAL DESIGN REQUIREMENTS

13.2.1 Applicable Requirements for Architectural, Mechanical, and Electrical Components, Supports, and Attachments. Architectural, mechanical, and electrical components, supports, and attachments shall comply with the sections referenced in Table 13.2-1. These requirements shall be satisfied by one of the following methods:

1. Project-specific design and documentation prepared and submitted by a registered design professional.

2. Submittal of the manufacturer's certification that the component is seismically qualified by
 - a. Analysis.
 - b. Testing in accordance with the alternative set forth in Section 13.2.5.
 - c. Experience data in accordance with the alternative set forth in Section 13.2.6.

13.2.2 Special Certification Requirements for Designated Seismic Systems.

Certifications shall be provided for designated seismic systems assigned to Seismic Design Categories C through F as follows:

- a. Active mechanical and electrical equipment that must remain operable following the design earthquake shall be certified by the supplier as operable based on approved shake table testing in accordance with Section 13.2.5 or experience data in accordance with Section 13.2.6. Evidence demonstrating compliance of this requirement shall be submitted to the authority having jurisdiction after review and approval by the registered design professional.
- b. Components with hazardous contents shall be certified by the supplier as maintaining containment following the design earthquake by (1) analysis, (2) approved shake table testing in accordance with Section 13.2.5, or (3) experience data in accordance with Section 13.2.6. Evidence demonstrating compliance of this requirement shall be submitted to the authority having jurisdiction after review and approval by the registered design professional.

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13.2.5 Testing Alternative for Seismic Capacity Determination. As an alternative to the analytical requirements of Sections 13.2 through 13.6, testing shall be deemed as an acceptable method to determine the seismic capacity of components and their supports and attachments. Seismic qualification by testing based upon a nationally recognized testing standard procedure such as ICC Evaluation Service, Inc. (ICC-ES) AC156, Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems, acceptable to the authority having jurisdiction shall be deemed to satisfy the design and evaluation requirements provided that the substantiated seismic capacities equal or exceed the seismic demands determined in accordance with Sections 13.3.1 and 13.3.2.

13.2.6 Experience Data Alternative for Seismic Capacity Determination. As an alternative to the analytical requirements of Sections 13.2 through 13.6, use of experience data shall be deemed as an acceptable method to determine the seismic capacity of components and their supports and attachments. Seismic qualification by experience data based upon nationally recognized procedures acceptable to the authority having jurisdiction shall be deemed to satisfy the design and evaluation requirements provided that the substantiated seismic capacities equal or exceed the seismic demands determined in accordance with Sections 13.3.1 and 13.3.2.

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13.1 GENERAL

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13.1.3 Component Importance Factor. All components shall be assigned a component importance factor as indicated in this section. The component importance factor, I_p , shall be taken as 1.5 if any of the following conditions apply:

1. The component is required to function for life-safety purposes after an earthquake, including fire protection sprinkler systems.
2. The component contains hazardous materials.
3. The component is in or attached to an Occupancy Category IV structure and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.

All other components shall be assigned a component importance factor, I_p , equal to 1.0.

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13.1.4 Exemptions. The following nonstructural components are exempt from the requirements of this section:

1. Architectural components in Seismic Design Category B other than parapets supported by bearing walls or shear walls provided that the component importance factor, I_p , is equal to 1.0.
2. Mechanical and electrical components in Seismic Design Category B.
3. Mechanical and electrical components in Seismic Design Category C provided that the component importance factor, I_p , is equal to 1.0.
4. Mechanical and electrical components in Seismic Design Categories D, E, or F where the component importance factor, I_p , is equal to 1.0 and both of the following conditions apply:
 - a. Flexible connections between the components and associated ductwork, piping, and conduit are provided and
 - b. Components are mounted at 4 ft (1.22 m) or less above a floor level and weigh 400 lb (1780 N) or less.
5. Mechanical and electrical components in Seismic Design Categories D, E, and F where the component importance factor, I_p , is equal to 1.0 and both of the following conditions apply:
 - a. Flexible connections between the components and associated ductwork, piping, and conduit are provided and
 - b. The components weigh 20 lb (89 N) or less or, for distribution systems, weighing 5 lb/ft (73 N/m) or less.

APPENDIX B - Definitions

The following words and terms shall, for the purposes of this CAN, have the meanings shown herein:

Active Equipment. Equipment containing moving or rotating parts, electrical parts such as switches or relays, or other internal components that are sensitive to earthquake forces and critical to the function of the equipment.

Rugged Equipment. Rugged equipment refers to an ampleness of construction that gives such equipment the ability to survive earthquake strong motions without significant loss of function.

Seismic Certification. Seismic certification refers to a manufacturer's certification for architectural, mechanical, and electrical components, supports, and attachments pursuant to ASCE/SEI 7-05 Section 13.2.1.2.

Seismic Qualification. Same as Special Seismic Certification.

Significant Loss of Function. Significant loss of function for equipment or components means the equipment or component cannot be restored to its original function by competent technicians after a design earthquake because the equipment or component require parts that are not normally stocked by the hospital or not readily available.

Special Seismic Certification. Seismic certification of mechanical and electrical equipment based on ASCE/SEI 7-05 Section 13.2.2. Special Seismic Certification is required for active mechanical and electrical equipment that must remain operable following the design earthquake.

APPENDIX C – Frequently Asked Questions

- 1. We have equipment and components certified as Mission Critical Level 2 (MC-2) components under Uniform Facilities Criteria, UFC 3-310-04 (2007). Does OSHPD accept certified MC-2 components to be seismically qualified? If so, what documentation does OSHPD require?**

Yes, all equipment and components certified as MC-1 or MC-2 components under UFC 3-310-04 (2007) shall be considered to satisfy Special Seismic Certification (Seismic Qualification) requirements of the CBC 2007, Section 1708A.5, pursuant to Item 4 of CAN 2-1708A.5.

To verify the conditions for which MC-1 or MC-2 certification were given, a copy of the supporting documents for MC-1 or MC-2 certification, along with peer review reports shall be submitted to OSHPD.

- 2. The 2007 CBC and ASCE/SEI 7-05 Special Seismic Certification requirements by experience data are vague at best. Is there a usable procedure and/or example of Seismic Certification by experience data anywhere?**

Yes, appendix F of Uniform Facilities Criteria, UFC 3-310-04 (2007), has a detailed procedure and example for Special Seismic Certification by experience data.

- 3. Is there a way to obtain Special Seismic Certification of tanks by analysis?**

Yes. Tanks (without vibration isolators) designed by a registered design professional in accordance with ASME Boiler and Pressure Vessel Code, 2004 (BPVC 2004), and satisfying the force and displacement requirements of Sections 13.3.1 and 13.3.2 of ASCE 7-05 having an importance factor, $I = 1.5$ and reviewed by OSHPD shall be considered to satisfy the Special Seismic Certification requirements on the basis of ASCE 7-05 Section 13.6.9.

- 4. Since we have to obtain Special Seismic Certification for most jurisdictions now, if we get the Special Seismic Certification through the International Code Council – Evaluation Service (ICC-ES) based on AC-156, is that acceptable to OSHPD?**

Yes. Special Seismic Certification based on ICC AC-156 by ICC ES is acceptable to OSHPD pursuant to Item 4.2 of CAN 2-1708A.5.

5. We have obtained a Special Seismic Certification in Japan based on ICC AC-156. Is that acceptable to OSHPD?

Yes, provided testing was done in a laboratory accredited under International Standards Organization (ISO) 17025 by an organization that has a reciprocity agreement with ICC-IAS. The complete original laboratory test report must be available in English, which shall be reviewed and accepted by a California licensed structural engineer pursuant to section 4.2 of CAN 2-1708A.5.

6. Will OSHPD accept third party listing for Special Seismic Certification? If so, what are the requirements for such acceptance?

Yes. OSHPD will accept third party certification if all of the following are satisfied:

- 1) A Certification of Compliance is provided with the seismic capacity of the equipment in terms of g-levels and the site demand of the project or blanket certificate with the demand for the region or location where the equipment is planned to be installed.
- 2) The Certificate of Compliance identifies the manufacturer of the equipment and the certification agency (test laboratory or company performing analysis).
- 3) For certification by testing, the Certificate of Compliance identifies the Listing Agency as an accredited agency by ICC-IAS. The designation on the certificate shall ensure the following:
 - a. Listing Agency is accredited by ICC-IAS.
 - b. Accredited Listing Agency employs at least one inspector certified to the international inspection standard ISO 17020 by ICC-IAS.
 - c. The Listing Agency performs triennial reviews of the manufacturer's Quality Assurance Plan and verifies the equipment is still in compliance with the design basis used for seismic qualification.
- 4) Certification by analysis shall satisfy the requirements of Item 4.1 of this CAN.
- 5) Special Seismic Certification documentations shall be reviewed and accepted by a California Registered Structural Engineer.

7. Can the Special Seismic Certification be submitted to OSHPD as a deferred submittal on a project?

Until Further notice, OSHPD will permit a deferred submittal of the Special Seismic Certification requirement for equipment and nonstructural components specified on construction documents, under the following conditions:

- 1) The equipment or nonstructural component to be deferred shall not be the sole or major component of the project – for example, chiller, cooling tower, or boiler replacement projects.
- 2) Construction documents submitted to the appropriate region shall include a Special Seismic Certification Deferred Submittal table indicating the name of the equipment or nonstructural component requiring Special Seismic Certification, the projected date the Special Seismic Certification will be submitted to OSHPD, and the projected construction start date for the project.
- 3) The equipment or nonstructural component shall not be installed until the Special Seismic Certification has been submitted to OSHPD and approved.
- 4) OSHPD shall have sole discretion as to the Special Seismic Certifications that may be deferred.

8. Are there any exemptions for equipment and components in non-conforming OSHPD 1 buildings?

Special Seismic Certification is not required for equipment and nonstructural components installed in nonconforming OSHPD 1 buildings.

Exception: If Special Seismic Certification is required by Section 1708A.5 of the 2007 CBC and Section 13.2.2 of ASCE/SEI 7-05 and the equipment or nonstructural component provides a service/system or utility (as defined by Section 1224.4.1 of the 2007 CBC) to conforming OSHPD 1 buildings or buildings designated as SPC 3 or higher, then Special Seismic Certification is required.

9. Can a facility request exemption from the Special Seismic Certification requirements for emergency replacement of Equipment or Components?

Where a nonstructural component or equipment must be replaced in an emergency due to sudden failure or natural disaster, the applicability of the Special Seismic Certification requirement shall be determined by OSHPD on a case-by-case basis.

OSHPD will consider all circumstances regarding the emergency replacement of the equipment or nonstructural component such as efforts by the facility to locate equipment or a nonstructural component with a Special Seismic Certification and efforts by the equipment or nonstructural component manufacturer to obtain a Special Seismic Certification. Justification substantiating the need for the emergency replacement shall be submitted to OSHPD field staff. OSHPD field staff shall perform an on-site inspection to verify the extent of the emergency conditions.