THE VMC GROUP

IBC Seismic and Wind Load Compliance for Non-Structural Building Components

Presented By:
Danielle Taylor
Sr. National Sales Manager
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Aeroflex International Isolators | Amber/Booth | Korfund Dynamics | Vibration Mountings & Controls

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We are We Here?

The primary focus of this discussion is to offer a guide to meeting the different requirements specified in the various building codes in ways that are more easily understood than in the original code format. The key to the manual is its ability to link both code and project requirements to products and design solutions with a minimum of effort.

- To acquaint you with the seismic/wind load “on line” requirements of the International Building Code (IBC)
- To teach you how to help minimize your exposure to risk and liability

THE VMC GROUP

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The Beginnings of a New Code

The International Code Council (ICC) was established in 1994 as a non-profit organization dedicated to developing a single set of comprehensive and coordinated national model construction codes.

- January 17, 1994 the Northridge, California earthquake occurred
- 6.7 Magnitude
- Epicenter located 20 mi. from Los Angeles
- Number of injured was 9000, number of deaths was 51
- 9 Hospitals damaged and closed
- Resulted in new Code Development & Legislation

What is the IBC Code

The ICC was formed after the Northridge earthquake in 1994. Government agencies reviewed the emergency response after Northridge and determined that many “emergency services” type building such as hospitals went off line – not because of structural deficiencies in the buildings themselves but in many cases because the mechanical, electrical and plumbing systems (MEP systems) failed resulting in the buildings being rendered useless.

- International Building Code (IBC) is a publication developed by the International Code Council (ICC)
- ICC was assembled to develop a single set of national model construction codes
- IBC publications are funded and supported by NEHRP (National Science Foundation, National Institute and Standards of Technology, FEMA and USGS)
- Code specifically addresses design and installation of building systems with emphasis on performance
- Until now, only anchorage of a unit to the structure was considered – equipment performance was never considered
- For the first time, critical equipment is now considered a component of the structure

What is the IBC Code

The ICC was formed after the Northridge earthquake in 1994. Government agencies reviewed the emergency response after Northridge and determined that many “emergency services” type building such as hospitals went off line – not because of structural deficiencies in the buildings themselves but in many cases because the mechanical, electrical and plumbing systems (MEP systems) failed resulting in the buildings being rendered useless.

- The IBC is the first of 14 volumes of the code group known as the International Codes
- It is the Structural Handbook for the building
- The American Society of Civil Engineer’s handbook, ASCE 7 is the IBC’s companion reference standard for design of buildings as well as architectural, mechanical, electrical and plumbing components
- The information and application of seismic & wind loads as they apply to these components do not appear in any of the other 13 International Code volumes
- Chapters 16 & 17 of the IBC Code define the design, testing and inspection requirements for all components that must demonstrate “on line” capability

Roles and Responsibilities

As with any design job, there is certain basic information that is required before seismic restraints can be selected and placed.

The building owner, architect, and structural engineer make the decisions that form the basis for the information required to select the seismic restraints for the mechanical, electrical and plumbing systems in the building.

- Architect
- Structural Engineer
- Equipment Specifying Engineer
- Equipment Dealer and OEM
- Installing Contractor
- Code Officials and Inspectors

The Architect

Architects will work with the owner to help you define what they want to build, present options and help the owner get the most for your valuable investment.

- Risk Category I: Low hazard to human life in the event of failure
- Risk Category II: Other buildings not defined as I, III, or IV
- Risk Category III: Substantial hazard to life in the event of failure
- Risk Category IV: Essential facility

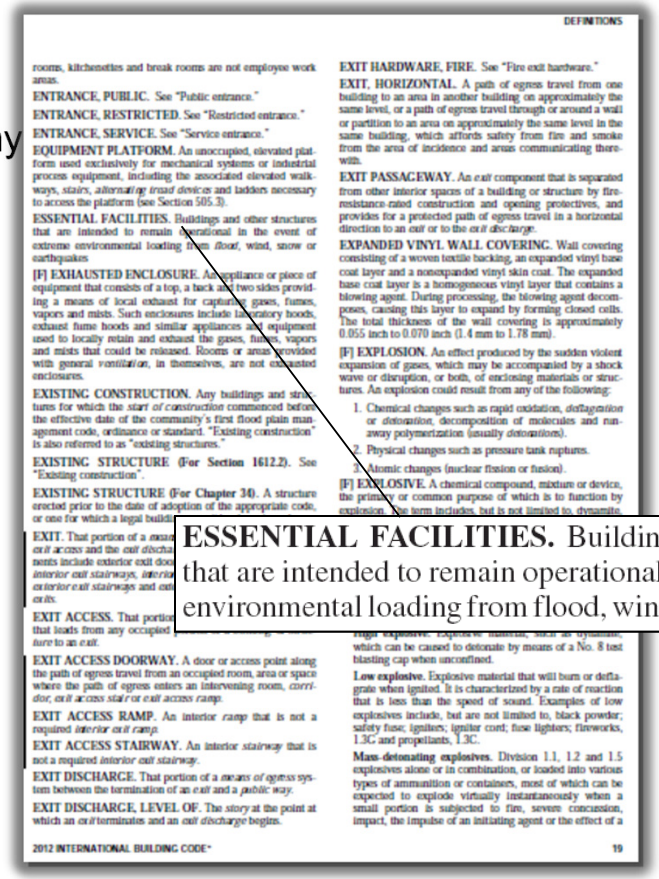
TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing elementary school, secondary school or day care facilities with an occupant load greater than 250. • Buildings and other structures containing adult education facilities, such as colleges and universities, with an occupant load greater than 500. • Group I-2 occupancies with an occupant load of 50 or more resident care recipients but not having surgery or emergency treatment facilities. • Group I-3 occupancies. • Any other occupancy with an occupant load greater than 5,000[a]. • Power-generating stations, water treatment facilities for potable water, waste water treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released [b].
IV	Buildings and other structures designated as essential facilities, including but not limited to: • Group I-2 occupancies having surgery or emergency treatment facilities. • Fire, rescue, ambulance and police stations and emergency vehicle garages. • Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released [b]. • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

Essential Facilities

Essential Facilities are defined as building that are intended to remain operational. This can be from any environmental loading.

- Flood
- Wind
- Snow
- Earthquakes



DEFINITIONS

rooms, kitchenettes and break rooms are not employee work areas.

ENTRANCE, PUBLIC. See "Public entrance."

ENTRANCE, RESTRICTED. See "Restricted entrance."

ENTRANCE, SERVICE. See "Service entrance."

EQUIPMENT PLATFORM. An unoccupied, elevated platform used exclusively for mechanical systems or industrial process equipment, including the associated elevated walkways, *stairs*, *alternating tread devices* and ladders necessary to access the platform (see Section 505.3).

ESSENTIAL FACILITIES. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from *flood*, wind, snow or earthquakes.

[F] EXHAUSTED ENCLOSURE. An appliance or piece of equipment that consists of a top, a back and two sides providing a means of local exhaust for capturing gases, fumes, vapors and mists. Such enclosures include laboratory hoods, exhaust fume hoods and similar appliances and equipment used to locally retain and exhaust the gases, fumes, vapors and mists that could be released. Rooms or areas provided with general *ventilation*, in themselves, are not exhausted enclosures.

EXISTING CONSTRUCTION. Any buildings and structures for which the *start of construction* commenced before the effective date of the community's first flood plain management code, ordinance or standard. "Existing construction" is also referred to as "existing structures."

EXISTING STRUCTURE (For Section 1612.2). See "Existing construction".

EXISTING STRUCTURE (For Chapter 34). A structure erected prior to the date of adoption of the appropriate code, or one for which a legal build

EXIT. That portion of a *means* *exit access* and the *exit* disch nents include exterior exit doo *interior exit stairways*, *interio exterior exit stairways* and *exit* *exits*.

EXIT ACCESS. That portion that leads from any occupied *ture* to an *exit*.

EXIT ACCESS DOORWAY. A door or access point along the path of egress travel from an occupied room, area or space where the path of egress enters an intervening room, *corridor*, *exit access stair* or *exit access ramp*.

EXIT ACCESS RAMP. An interior *ramp* that is not a required *interior exit ramp*.

EXIT ACCESS STAIRWAY. An interior *stairway* that is not a required *interior exit stairway*.

EXIT DISCHARGE. That portion of a *means of egress* system between the termination of an *exit* and a *public way*.

EXIT DISCHARGE, LEVEL OF. The *story* at the point at which an *exit* terminates and an *exit discharge* begins.

EXIT HARDWARE, FIRE. See "Fire exit hardware."

EXIT, HORIZONTAL. A path of egress travel from one building to an area in another building on approximately the same level, or a path of egress travel through or around a wall or partition to an area on approximately the same level in the same building, which affords safety from fire and smoke from the area of incidence and areas communicating therewith.

EXIT PASSAGEWAY. An *exit* component that is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a horizontal direction to an *exit* or to the *exit discharge*.

EXPANDED VINYL WALL COVERING. Wall covering consisting of a woven textile backing, an expanded vinyl base coat layer and a nonexpanded vinyl skin coat. The expanded base coat layer is a homogeneous vinyl layer that contains a blowing agent. During processing, the blowing agent decomposes, causing this layer to expand by forming closed cells. The total thickness of the wall covering is approximately 0.055 inch to 0.070 inch (1.4 mm to 1.78 mm).

[F] EXPLOSION. An effect produced by the sudden violent expansion of gases, which may be accompanied by a shock wave or disruption, or both, of enclosing materials or structures. An explosion could result from any of the following:

1. Chemical changes such as rapid oxidation, *deflagration* or *detonation*, decomposition of molecules and runaway polymerization (usually *detonation*).
2. Physical changes such as pressure tank ruptures.
3. Atomic changes (nuclear fission or fusion).

[F] EXPLOSIVE. A chemical compound, mixture or device, the primary or common purpose of which is to function by explosion. The term includes, but is not limited to, dynamite,

High explosive. Explosive materials, such as dynamite, which can be caused to detonate by means of a No. 8 test blasting cap when unconfined.

Low explosive. Explosive material that will burn or deflagrate when ignited. It is characterized by a rate of reaction that is less than the speed of sound. Examples of low explosives include, but are not limited to, black powder; safety fuse; igniters; igniter cord; fuse lighters; fireworks, 1.3C and propellants, 1.3C.

Mass-detonating explosives. Division 1.1, 1.2 and 1.5 explosives alone or in combination, or loaded into various types of ammunition or containers, most of which can be expected to explode virtually instantaneously when a small portion is subjected to fire, severe concussion, impact, the impulse of an initiating agent or the effect of a

2012 INTERNATIONAL BUILDING CODE®

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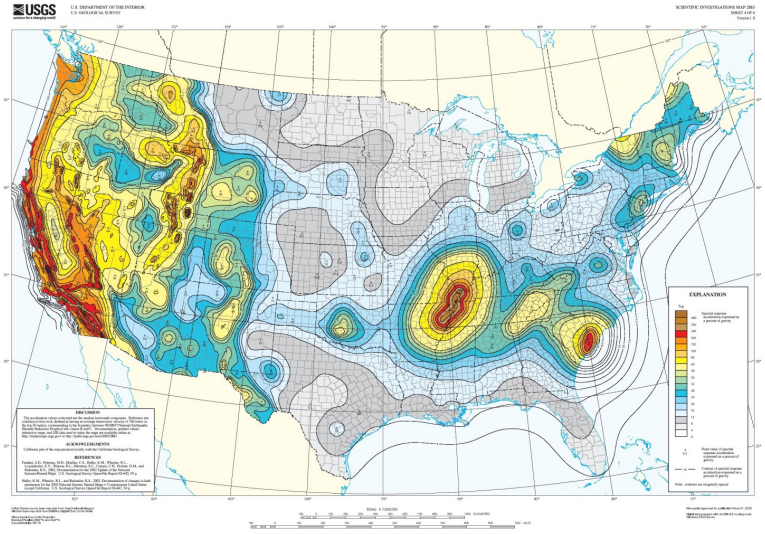
ESSENTIAL FACILITIES. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes.

The Structural Engineer

Short Period Spectral Response

The USGS, has mapped all of the known fault lines in the United States and assigned ground level acceleration values to each location based on the Maximum Considered Earthquake (MCE). We use the short period values when evaluating nonstructural components as they respond more strongly to the short period excitation due to their relatively low mass and high stiffness.



Site Classification

As seismic waves travel though the ground, they travel faster through hard rock than soft soil. As a result, when the waves move from hard rock to soft soil, the amplitude (largeness) of the waves needs to increase to be able to carry the same amount of energy, creating stronger shaking. This same principle accounts for the site effects of sediment thickness. The deeper the sediment above bedrock, the more soft soil there is for seismic waves to travel through, therefore creating stronger amplifications.

Table 20.3-1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard rock	>5,000 ft/s	NA	NA
B. Rock	2,500 to 5,000 ft/s	NA	NA
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the following characteristics: —Plasticity index $PI > 20$, —Moisture content $w \geq 40\%$, —Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1 ft/s = 0.3048 m/s; 1 lb/ft^2 = 0.0479 kN/m^2.

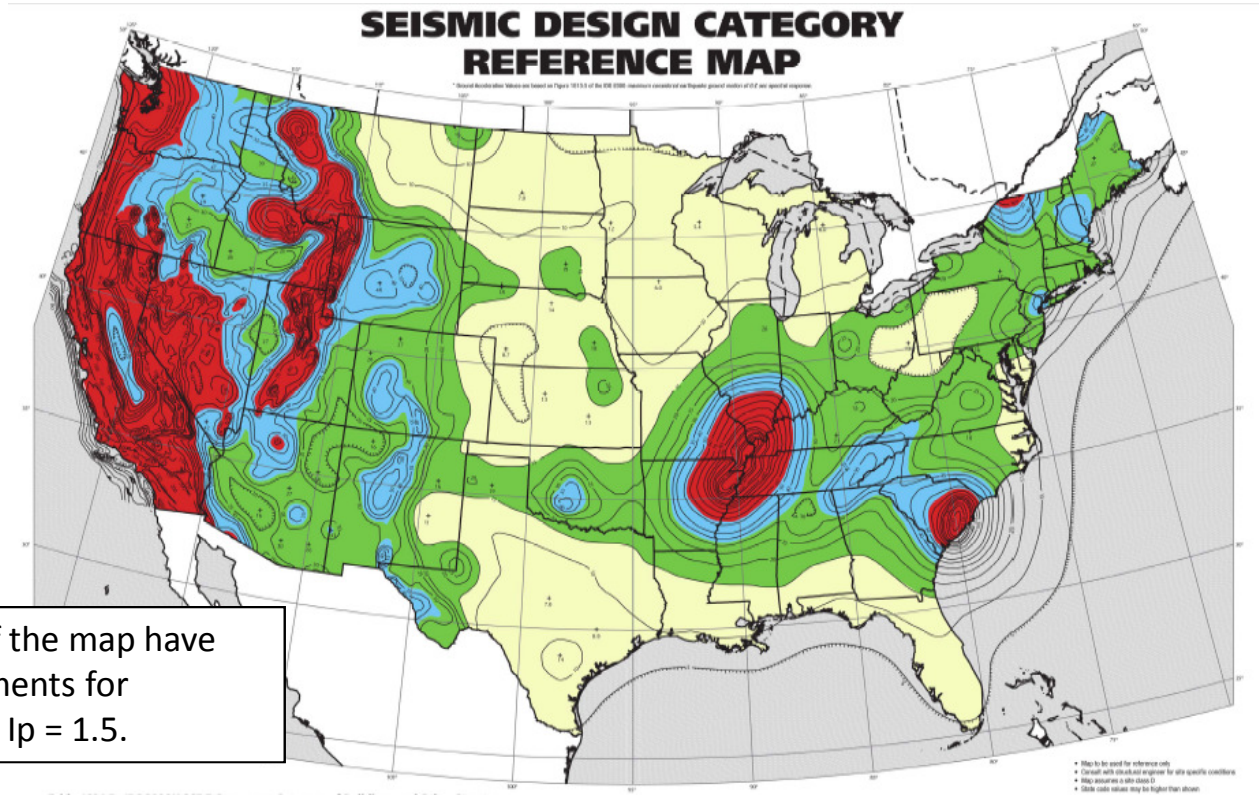
Seismic Design Category

These modified accelerations together with the Occupancy Category are used to determine the Seismic Design Category.

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATIONS

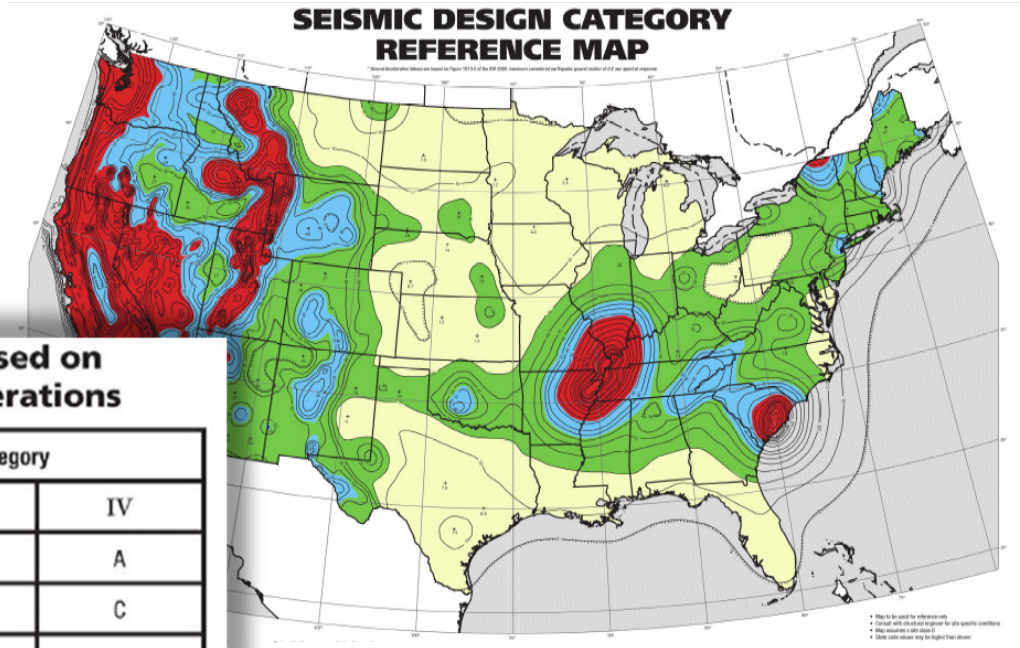
VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

When Do I Need Seismic?



Colored areas of the map have seismic requirements for structures when Ip = 1.5.

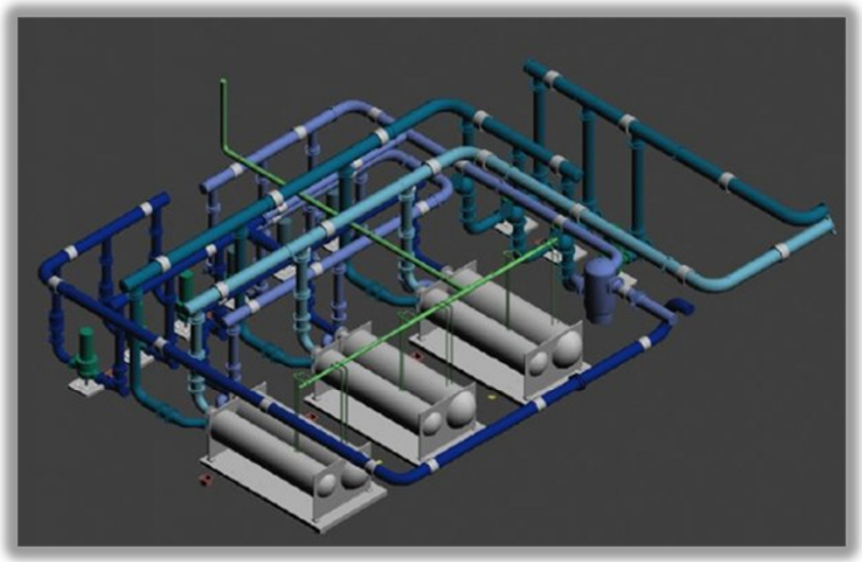
When Do I Need Seismic?

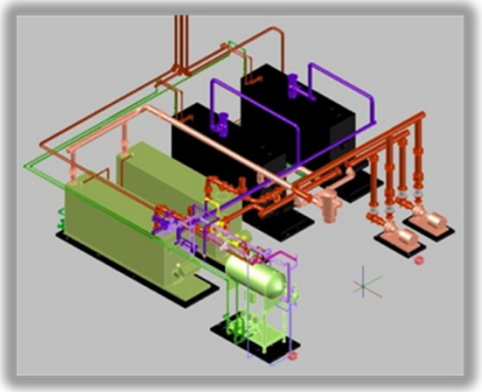


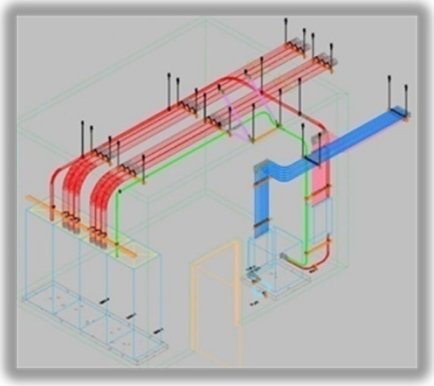
Seismic Design Category Based on Short-Period Response Accelerations

Value of S_{DS}	Occupancy Category		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

The Specifying Engineer







Component Importance Factor

There are just two values for the Component Importance Factors for non-structural components, 1.0 and 1.5, which are not directly linked to the importance factor for the building structure.
All non-structural components must be assigned a component importance factor. The design professional that has responsibility for the MEP system in question is also responsible for assigning the Component Importance Factor to that system.
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Component Importance Factor to that system

Component Importance Factor

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 and egress stairways.
2. The component conveys, supports, or otherwise contains toxic, highly toxic, or explosive substances where the quantity of the material exceeds a threshold quantity established by the authority having jurisdiction and is sufficient to pose a threat to the public if released.
3. The component is in or attached to a Risk Category IV structure and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.
4. The component conveys, supports, or otherwise contains hazardous substances and is attached to a structure or portion thereof classified by the authority having jurisdiction as a hazardous occupancy.

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

Component Importance Factor

DESIGNATED SEISMIC SYSTEMS: The seismic force-resisting system and those architectural, electrical, and mechanical systems or their components that require design in accordance with Chapter 13 and for which the component importance factor, I_p, is greater than 1.0.

Interrelationship Clause

13.2.3 Consequential Damage

The functional and physical interrelationship of components, their supports, and their effect on each other shall be considered so that the failure of an essential or nonessential architectural, mechanical, or electrical component shall not cause the failure of an essential architectural, mechanical, or electrical component.

Components, Supports and Attachments

13.2.7 Construction Documents. Where design of nonstructural components or their supports and attachments is required by Table 13.2-1, such design shall be shown in construction documents prepared by a registered design professional for use by the owner, building officials, contractors, and inspectors. Such documents shall include a quality assurance plan if required by Appendix 11A.

Alert: The MEP engineer is at risk if the information in the construction documents is inaccurate or incomplete. Clearly written specifications and details need to be provided in the construction documents in order to minimize exposure to risk and liability.

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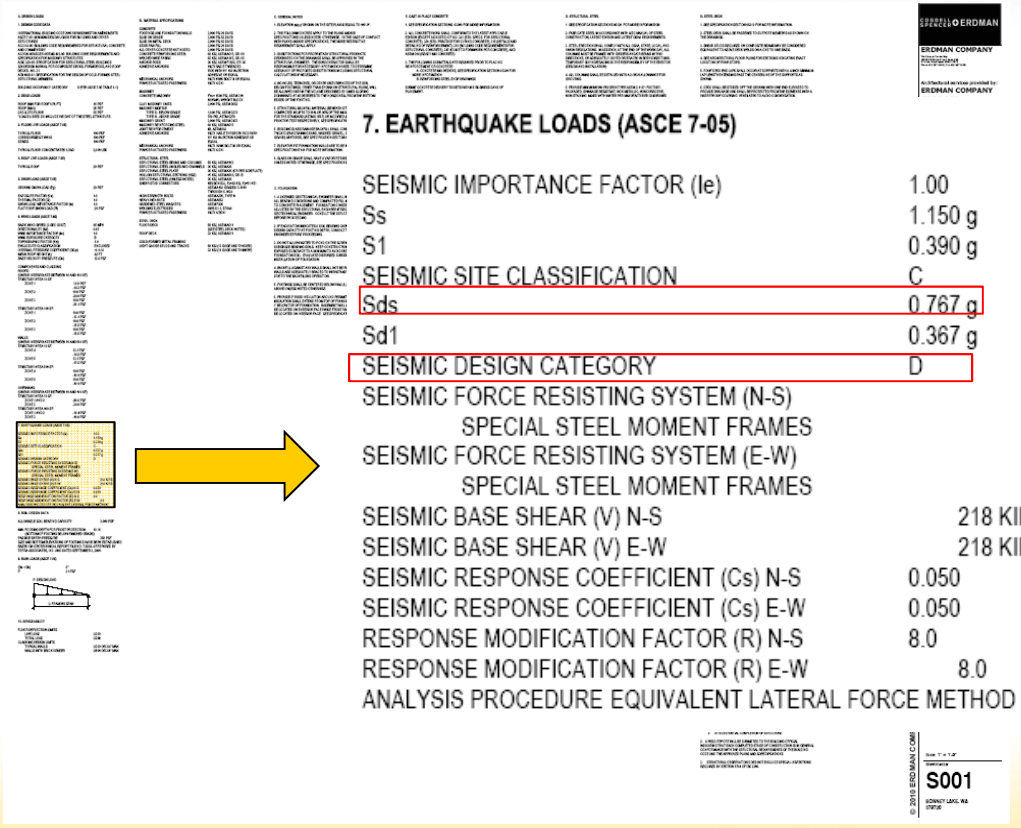
Where to Find Seismic Values



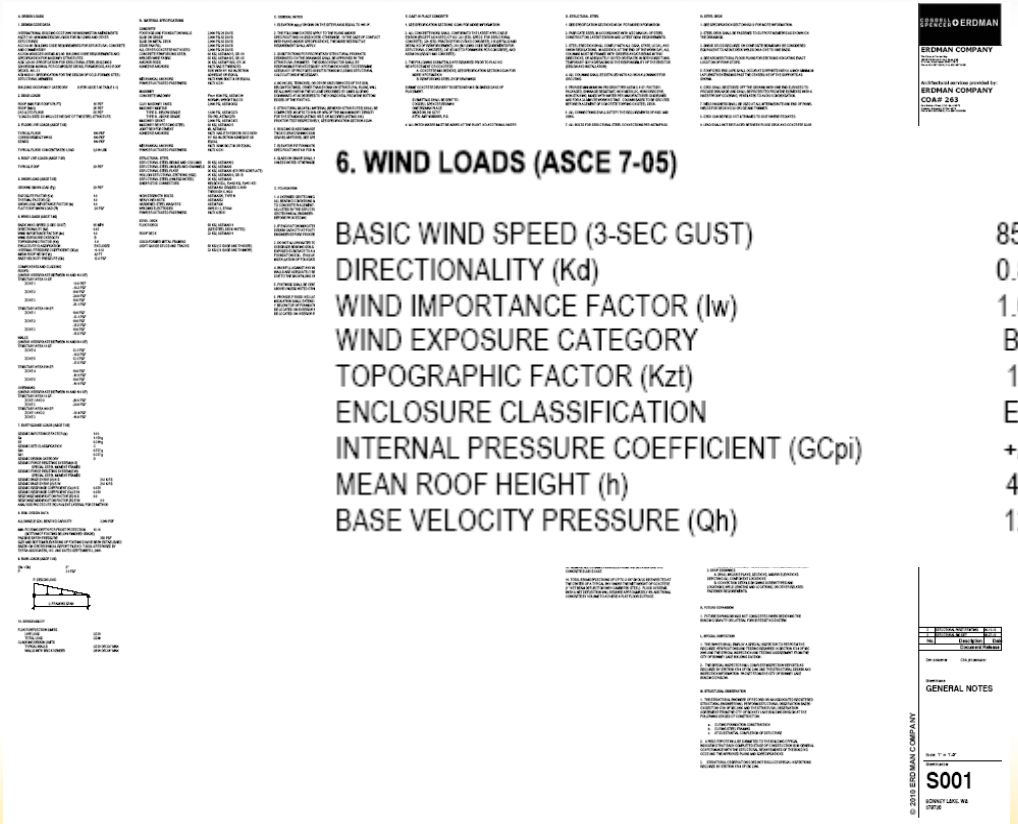
ERDMAN COMPANY

7. EARTHQUAKE LOADS (ASCE 7-05)

SEISMIC IMPORTANCE FACTOR (Ie)	1.00
Ss	1.150 g
S1	0.390 g
SEISMIC SITE CLASSIFICATION	C
Sds	0.767 g
Sd1	0.367 g
SEISMIC DESIGN CATEGORY	D
SEISMIC FORCE RESISTING SYSTEM (N-S)	
SPECIAL STEEL MOMENT FRAMES	
SEISMIC FORCE RESISTING SYSTEM (E-W)	
SPECIAL STEEL MOMENT FRAMES	
SEISMIC BASE SHEAR (V) N-S	218 KIPS
SEISMIC BASE SHEAR (V) E-W	218 KIPS
SEISMIC RESPONSE COEFFICIENT (Cs) N-S	0.050
SEISMIC RESPONSE COEFFICIENT (Cs) E-W	0.050
RESPONSE MODIFICATION FACTOR (R) N-S	8.0
RESPONSE MODIFICATION FACTOR (R) E-W	8.0
ANALYSIS PROCEDURE	EQUIVALENT LATERAL FORCE METHOD

S001

Where to Find Seismic Values



6. WIND LOADS (ASCE 7-05)

BASIC WIND SPEED (3-SEC GUST)	85 MPH
DIRECTIONALITY (Kd)	0.85
WIND IMPORTANCE FACTOR (Iw)	1.0
WIND EXPOSURE CATEGORY	B
TOPOGRAPHIC FACTOR (Kzt)	1.0
ENCLOSURE CLASSIFICATION	ENCLOSED
INTERNAL PRESSURE COEFFICIENT (GCpi)	+/- 0.18
MEAN ROOF HEIGHT (h)	42 FT
BASE VELOCITY PRESSURE (Qh)	12.8 PSF

The Equipment Dealer and OEM

OEM Responsibility (IBC 2009)

1708.4 Seismic certification of nonstructural components. The *registered design professional* shall state the applicable seismic certification requirements for nonstructural components and designated seismic systems on the *construction documents*.

1. The manufacturer of each designated seismic system components subject to the provisions of ASCE 7 Section 13.2.2 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* responsible for the design of the designated seismic system and for approval by the *building official*. Certification shall be based on 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 more rigorous analysis providing for equivalent safety.
2. Manufacturer's certification of compliance for the general design requirements of ASCE 7 Section 13.2.1 shall be based on analysis, testing or experience data.

OEM Responsibility (IBC 2012)

1705.12.3 Seismic certification of nonstructural components. The *registered design professional* shall specify on the construction documents the requirements for certification by analysis, testing or experience data for nonstructural components and designated seismic systems in accordance with Section 13.2 of ASCE 7, where such certification is required by Section 1705.12.

OEM Responsibility (IBC 2012)

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 submitted for approval to the authority having jurisdiction after review and acceptance by a registered design professional.
2. Submittal of the manufacturer's certification that the component is seismically qualified by at least one of the following:
   a. Analysis, or
   b. Testing in accordance with the alternative set forth in Section 13.2.5, or
   c. Experience data in accordance with the alternative set forth in Section 13.2.6.

OEM Responsibility (IBC 2012)

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:

1. Active mechanical and electrical equipment that must remain operable following the design earthquake ground motion shall be certified by the manufacturer as operable whereby active parts or energized components shall be certified exclusively on the basis of approved shake table testing in accordance with Section 13.2.5 or experience data in accordance with Section 13.2.6 unless it can be shown that the component is inherently rugged by comparison with similar seismically qualified components. Evidence demonstrating compliance with this requirement shall be submitted for approval to the authority having jurisdiction after review and acceptance by a registered design professional.
2. Components with hazardous substances and assigned a component importance factor, I_p, of 1.5 in accordance with Section 13.1.3 shall be certified by the manufacturer as maintaining containment following the design earthquake ground motion 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 with this requirement shall be submitted for approval to the authority having jurisdiction after review and acceptance by a registered design professional.

OEM Responsibility (IBC 2012)

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Special Seismic Certification

Special Seismic Certification is an approval process in which equipment and nonstructural components are evaluated for their ability to withstand the effects of earthquakes and meet functional requirements following these events.

- Special seismic certification for the equipment is required
- Labeling of equipment is required
- Proper seismic installation is required
- Special Inspections may be required

Every manufacturer providing a component (equipment) with an Ip = 1.5, must now warrant and guarantee through specified outside testing and/or analysis that their component and/or system will start and continue to run after being subjected to the specified seismic forces.

Certificate of Compliance

CERTIFICATE OF COMPLIANCE

NON-STRUCTURAL
COMPONENTS AND SYSTEMS

THE VMC GROUP
The Power of Together™

EMERSON
Network Power

SEISMIC DESIGN REQUIREMENTS

Emerson Network Power has qualified the listed ASCO Power Control Systems Paralleling Switchgear Products as CERTIFIED[1] for seismic application. The basis of qualification was by shake testing and analysis, in accordance with the following International Building Code[2] (IBC) releases.

IBC 2000, IBC 2003, IBC 2006, IBC 2009

The following products are included in this certification. A complete list of certified models, options, and installation methods are detailed in report number VMA-45810-01 as issued by The VMC Group.

Power Control Systems - Paralleling Switchgear Product Series

Primary Application	300 Commercial	4000 Commercial / Industrial	7000 Critical Mission Critical Power	7000 Custom Customized
Low Voltage (LV)	Up to 600V	Up to 600V	Up to 600V	Up to 600V
Product Type				
Standby	Yes	Yes	Yes	Yes
Prime Power	Yes	Yes	Yes	Yes
Utility Parallel	N/A	In Development	Yes	Yes
Construction				
Main Bus Amp size available	Up to 3,000A	Std - 3,000; 6,000 & 10,000A	Any - up to 10,000A	Any - up to 10,000A
Circuit Beakers				
Maximum Generator Breaker Frame Size	3,200A	5,000A	5,000A	5,000A
Generator Paralleling Breakers	2 per cubicle	2 per cubicle	1 or 2 per cubicle	
Cicuit Breaker Manufacturer	Sq D	Sq D, Siemens	Sq D, Siemens, Cutler Hammer, ABB, GE	
Utility Tie Circuit Breaker available	No	In Development	Optional	Optional
Utility Circuit Breaker	No	No	Optional	Optional
Master Controls				
Master Controls available	N/A	Yes	Yes	Yes
Master Controls Touch Screen	N/A	Yes	Yes	Yes
Engine - Generator Info Screen	N/A	Yes	Yes	Yes
Master PLC Type	Zelio	GE, Fanuc 90-30		GE 90-30 or 90-70
Hot Standby Master PLC	None	Optional 90-30		
Hot Standby Synchronized Master PLC	None	None	Optional 90-70	
Generator Controls				
Generator Controller type	Digital	Digital	Digital	Digital
Generator Controls Touch Screen	N/A	Optional	Yes	Yes
Generator Control Section Configuration	2G	1G/2G	1G/2G	1G
Power Metering				
Digital	Digital	Digital	Digital	Analog & Digital
Enclosures				
Type	1, 3R	1, 3R	1, 3R, 4, 12	1, 3R, 4, 4X, 12
Width x Depth	26", 32" x 72"	26", 32", 36", 40" x 72", 84"		

All listed options MUST be installed per the manufacturer supplied seismic installation instructions. This certification includes the unit, as factory supplied, and installed directly to a housekeeping pad using the anchoring system defined in the unit manufacturer seismic installation instructions. This certification excludes all non-factory supplied accessories.

The above referenced equipment is APPROVED for seismic application when properly installed,[3] used as intended, and located in the United States. Lookup the actual, project specific, Design Spectral Response Acceleration at Short Periods, S_{DS}, value in the table below as it pertains to the applicable building code and compare to the allowed value. Below grade, grade, and roof-level installations are permitted and included in this certification.

The basis of this certification was through successful tri-axis shake testing at nationally recognized Clark Dynamic / ANDI Test Laboratory under the witness of and analytical evaluation by an independent approval agency, The VMC Group. Seismic shake table testing was conducted in accordance with ICC-ES AC-156 to envelope a required response spectrum (RRS) defined by a maximum flexible region acceleration (A_{FLEX}) of 3.94g and a zero period acceleration (A_{ZPA}) of 2.95g.

CERTIFICATE OF COMPLIANCE

NON-STRUCTURAL
COMPONENTS AND SYSTEMS

THE VMC GROUP
The Power of Together™

EMERSON
Network Power

SEISMIC DESIGN REQUIREMENTS

Notes and Comments:

1. All equipment listed herein successfully passed the seismic acceptance criteria for shake testing non-structural components and systems as set forth in the ICC AC-156 (2007). The test response spectrum (TRS) enveloped the design response spectrum (DRS) for all units tested. The units cited in this certification were representative samples of a contingent of models and all remained captive and structurally sound after the seismic shake simulation. The units also remained functionally operational after the simulation testing as functional testing was completed by the equipment manufacturer before and after the seismic simulations. Although a seismic qualified unit inherently contains some wind resisting capacity, that capacity is undetermined and is excluded from this certification. Snow/Ice loads have been neglected and thus limit the unit to be installed indoors.

2. The following building codes are addressed under this certification:

   IBC 2009 – referencing ASCE 7-05 and ICC AC-156
   IBC 2006 – referencing ASCE 7-05 and ICC AC-156
   IBC 2003 – referencing ASCE 7-02 and ICC AC-156
   IBC 2000 – referencing ASCE 7-98 and ICC AC-156

3. Refer to the manufacturer supplied installation drawings for anchor requirements and mounting considerations for seismic applications. Required anchor locations, size, style, and load capacities (tension and shear) are specified on the installation drawings. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection, wall design, and attachment to non-building structures must be outlined and approved by the Engineer of Record for the project or building. Structural walls, structural floors, and housekeeping pads must also be seismically designed and approved by the project or building Structural Engineer of Record to withstand the seismic anchor loads as defined on the installation drawings. The installing contractor is responsible for observing the installation requirements detailed in the seismic installation drawings and the proper installation of all anchors and mounting hardware.

4. The Seismic Design Acceleration, F_p/W_p, used for anchor analysis, is defined per the building code (or respective design standard) for the section titled Seismic Design Requirements for Non-structural (architectural, mechanical, and electrical) Components. The LRFD calculation and seismic design level is shown below.

   IBC 2009 / 2006 $F_p/W_p = 0.4 \times 2/3(S_s=3.51) \times (F_a=1.0) \times (I_p=1.5) \times (a_p/R_p=0.42) \times (1+2(z/h=1.0)) = 1.77g$
   IBC 2003 / 2000 $F_p/W_p = 0.4 \times 2/3(S_s=3.69) \times (F_a=1.0) \times (I_p=1.5) \times (a_p/R_p=0.40) \times (1+2(z/h=1.0)) = 1.77g$

   When the site soil properties or final equipment installation location are not known, the soil site coefficient, F_a, defaults to the Soil Site Class D coefficient. Soil Classes A, B, C, D, E, Seismic Use groups I, II, III, IV, and Seismic Design Categories A, B, C, D, E, and F are all covered under this certification, limited by the S_{DS} values on page 1, respective to the applicable building code, importance factor, and z/h ratio. A seismic importance factor, I_p=1.5, applies to this certification to include essential facility requirements and life safety applications for post event functionality.

   This certification covers all applications that fall below the limitations in the chart below.

IBC 2009 / 2006	IBC 2003 / 2000
S_{DS} <= 2.34	S_{DS} <= 2.46
I_p <= 1.5	I_p <= 1.5
z/h <= 1.0 (roof)	z/h <= 1.0 (roof)

John P. Giuliano, PE
President, The VMC Group

Certification Issued By: The VMC Group
Document Control Number: VMA-45810-01A
Issue Date: ## / ## / ##
Revision Level: 0

[Company Representative]
[Representative Title]
ASCO Power

The VMC Group • 113 Main Street, Bloomingdale, NJ 07403 • Tel: 973-838-1780 • Fax: 973-492-8430 • www.thevmcgroup.com Page 2 of 2

Equipment Label

EMERSON
Network Power

THE VMC GROUP

Seismic Certification per Applicable Building Codes:
IBC 2000, IBC 2003, IBC 2006, IBC 2009
Tested and Analyzed In Accordance With:
ASCE 7-02, ASCE 7-05, ICC-ES AC-156

ASCO PCS PARALLELING SWITCHGEAR

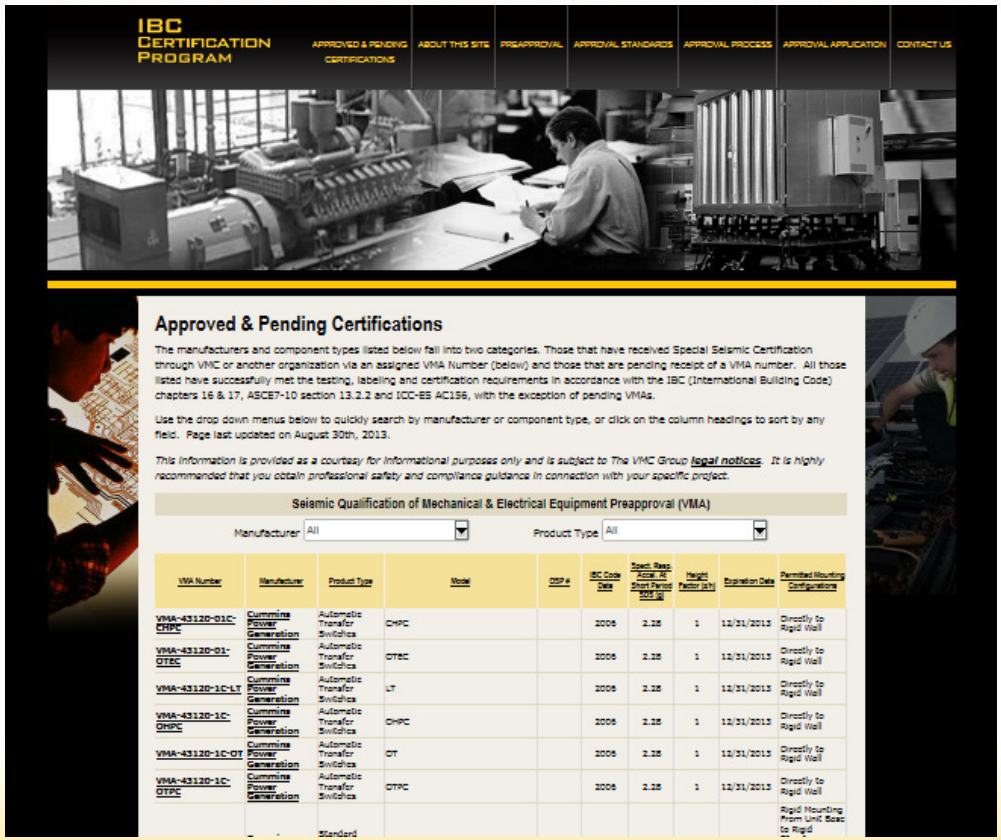
300/4000/7000 Series 3000A – 10000A Bus
Low Voltage (<= 600V) Standby/Prime Power/Utility Power

Approved to a Design Spectral Response Acceleration, Sds, not to exceed 2.46g
Approved for component factor ratio, ap/Rp, not to exceed 0.42
Approved for installation on any building level, z/h <= 1.0
Approved life safety applications, Ip <= 1.5

Ref. Report VMA-45810-01 by The VMC Group

Shake Table Testing

IBC Certification Listings



IBC CERTIFICATION PROGRAM

APPROVED & PENDING CERTIFICATIONS | ABOUT THIS SITE | PREAPPROVAL | APPROVAL STANDARDS | APPROVAL PROCESS | APPROVAL APPLICATION | CONTACT US

Approved & Pending Certifications

The manufacturers and component types listed below fall into two categories. Those that have received Special Seismic Certification through VMC or another organization via an assigned VMA Number (below) and those that are pending receipt of a VMA number. All those listed have successfully met the testing, labeling and certification requirements in accordance with the IBC (International Building Code) chapters 16 & 17, ASCE7-10 section 13.2.2 and ICC-ES AC156, with the exception of pending VMAs.

Use the drop down menus below to quickly search by manufacturer or component type, or click on the column headings to sort by any field. Page last updated on August 30th, 2013.

*This information is provided as a courtesy for informational purposes only and is subject to The VMC Group **legal notices**. It is highly recommended that you obtain professional safety and compliance guidance in connection with your specific project.*

Seismic Qualification of Mechanical & Electrical Equipment Preapproval (VMA)

Manufacturer: All Product Type: All

VMA Number	Manufacturer	Product Type	Model	OSP #	IBC Code Date	Spect. Resp. Accel. At Short Period (Ss)	Height Factor (kh)	Expiration Date	Permitted Mounting Configurations
VMA-43120-01C-CHPC	Cummins Power Generation	Automatic Transfer Switches	CHPC		2006	2.28	1	12/31/2013	Directly to Rigid Wall
VMA-43120-01-OTEC	Cummins Power Generation	Automatic Transfer Switches	OTEC		2006	2.28	1	12/31/2013	Directly to Rigid Wall
VMA-43120-1C-LT	Cummins Power Generation	Automatic Transfer Switches	LT		2006	2.28	1	12/31/2013	Directly to Rigid Wall
VMA-43120-1C-OHPC	Cummins Power Generation	Automatic Transfer Switches	OHPC		2006	2.28	1	12/31/2013	Directly to Rigid Wall
VMA-43120-1C-OT	Cummins Power Generation	Automatic Transfer Switches	OT		2006	2.28	1	12/31/2013	Directly to Rigid Wall
VMA-43120-1C-OTPC	Cummins Power Generation	Automatic Transfer Switches	OTPC		2006	2.28	1	12/31/2013	Directly to Rigid Wall
		Standard							Rigid Mounting From Unit Base to Rigid

The Installing Contractor

Contractor Responsibility

1704.4 Contractor responsibility. Each contractor responsible for the construction of a main wind- or seismic force-resisting system, designated seismic system or a wind- or seismic-resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the *building official* and the owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of *special inspection*.

Component Attachment per the IBC Code

1604.9 Counteracting structural actions. Structural members, systems, components and cladding shall be designed to resist forces due to earthquake and wind, with consideration of overturning, sliding, and uplift. Continuous load paths shall be provided for transmitting these forces to the foundation. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

1604.10 Wind and seismic detailing. Lateral-force-resisting systems shall meet seismic detailing requirements and limitations prescribed in this code and ASCE 7, excluding Chapter 14 and Appendix 11A, even when wind code prescribed load effects are greater than seismic load effects.

Component Attachment per the IMC Code

301.12 Wind resistance. Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressures determined in accordance with the *International Building Code*.

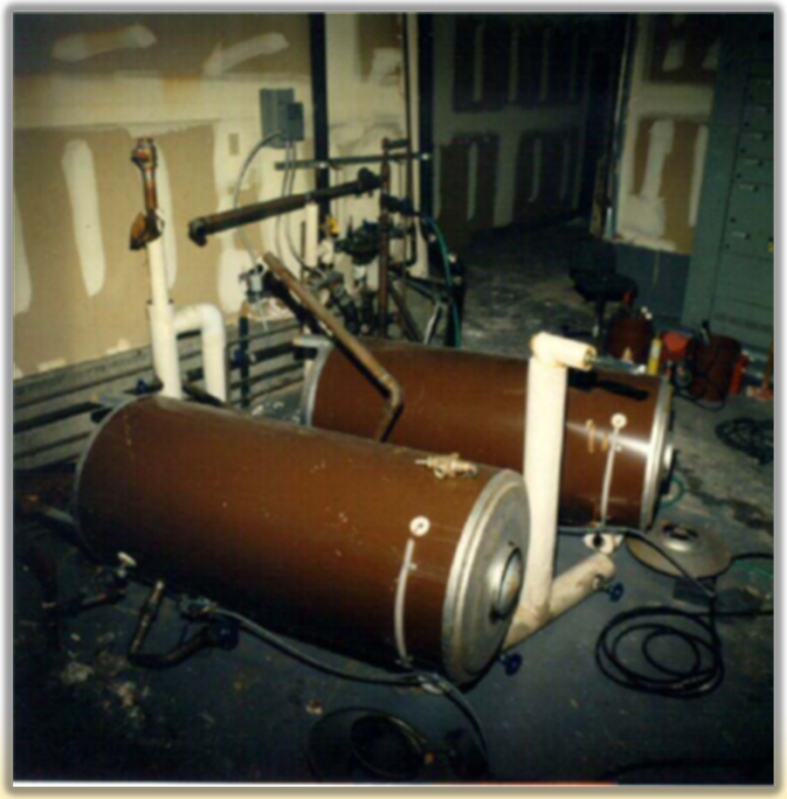
301.15 Seismic resistance. When earthquake loads are applicable in accordance with the *International Building Code*, mechanical system supports shall be designed and installed for the seismic forces in accordance with the *International Building Code*.

General Exemptions

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

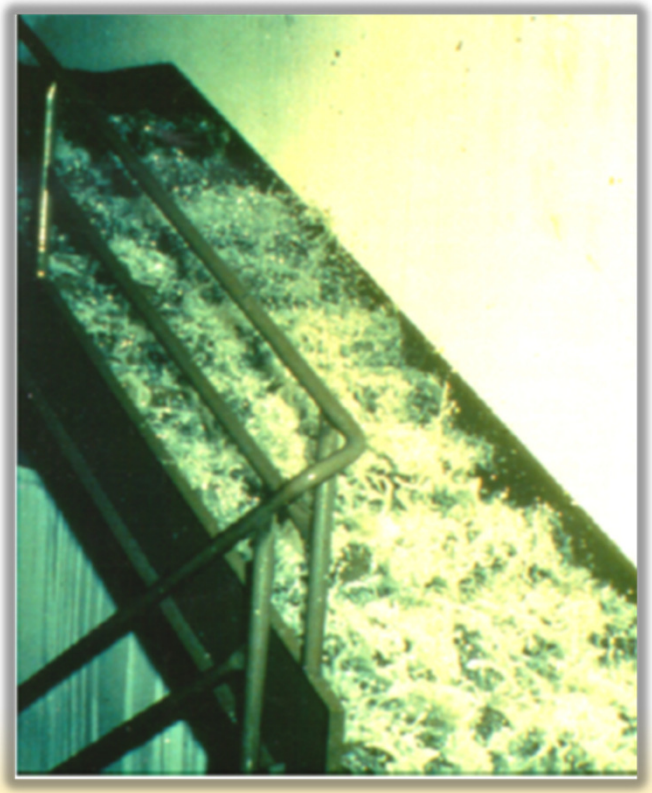
1. Architectural components in Seismic Design Category B other than parapets supported by bearing walls or shear walls provided that the component importance factor, I_p, is equal to 1.0.
2. Mechanical and electrical components in Seismic Design Category B.
3. Mechanical and electrical components in 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, and F where the component importance factor, I_p, is equal to 1.0 and either:
   a. Flexible connections between the components and associated ductwork, piping, and conduit are provided.
   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
   a. Flexible connections between the components and associated ductwork, piping, and conduit are provided.
   b. The components weigh 20 lb (89 N) or less or, for distribution systems, weighing 5 lb/ft (73 N/m) or less.

Equipment Anchorage



Equipment Anchorage

Equipment Anchorage



Code Officials and the Special Inspector

Special Inspection Requirements

1704.2 Special inspections. Where application is made for construction as described in this section, the owner or the *registered design professional in responsible charge* acting as the owner's agent shall employ one or more *approved agencies* to perform inspections during construction on the types of work listed under Section 1705. These inspections are in addition to the inspections identified in Section 110.

Quality Assurance Requirements

1704.3 Statement of special inspections. Where *special inspection* or testing is required by Section 1705, the *registered design professional in responsible charge* shall prepare a statement of special inspections in accordance with Section 1704.3.1 for submittal by the applicant in accordance with Section 1704.2.3.

Exception: The statement of *special inspections* is permitted to be prepared by a qualified person *approved* by the *building official* for construction not designed by a *registered design professional*.

1704.3.1 Content of statement of special inspections. The statement of special inspections shall identify the following:

1. The materials, systems, components and work required to have *special inspection* or testing by the *building official* or by the *registered design professional* responsible for each portion of the work.
2. The type and extent of each *special inspection*.
3. The type and extent of each test.
4. Additional requirements for *special inspection* or testing for seismic or wind resistance as specified in Sections 1705.10, 1705.11 and 1705.12.
5. For each type of *special inspection*, identification as to whether it will be continuous *special inspection* or periodic *special inspection*.

When are Special Inspections Required?

1705.11 Special inspections for seismic resistance. *Special inspections* itemized in Sections 1705.11.1 through 1705.11.8, unless exempted by the exceptions of Section 1704.2, are required for the following:

1. The seismic force-resisting systems in structures assigned to *Seismic Design Category* C, D, E or F in accordance with Sections 1705.11.1 through 1705.11.3, as applicable.
2. Designated seismic systems in structures assigned to *Seismic Design Category* C, D, E or F in accordance with Section 1705.11.4.
3. Architectural, mechanical and electrical components in accordance with Sections 1705.11.5 and 1705.11.6.
4. Storage racks in structures assigned to *Seismic Design Category* D, E or F in accordance with Section 1705.11.7.
5. Seismic isolation systems in accordance with Section 1705.11.8.

Authority Having Jurisdiction (AHJ)

Office of
Statewide Health Planning and Development oshpd

FM Global

NJDOE

STATE FIRE MARSHAL

Building Codes Work

Haiti

- Little to no code
  - Requirements
  - Enforcement
- Magnitude 7.0
- 480 kilotons TNT
- Deaths > 200,000
- Homeless > 1 million

Chile

- Strict code
  - Requirements
  - Enforcement
- Magnitude 8.8
- 240 megatons TNT
- Deaths < 1,000

Wind

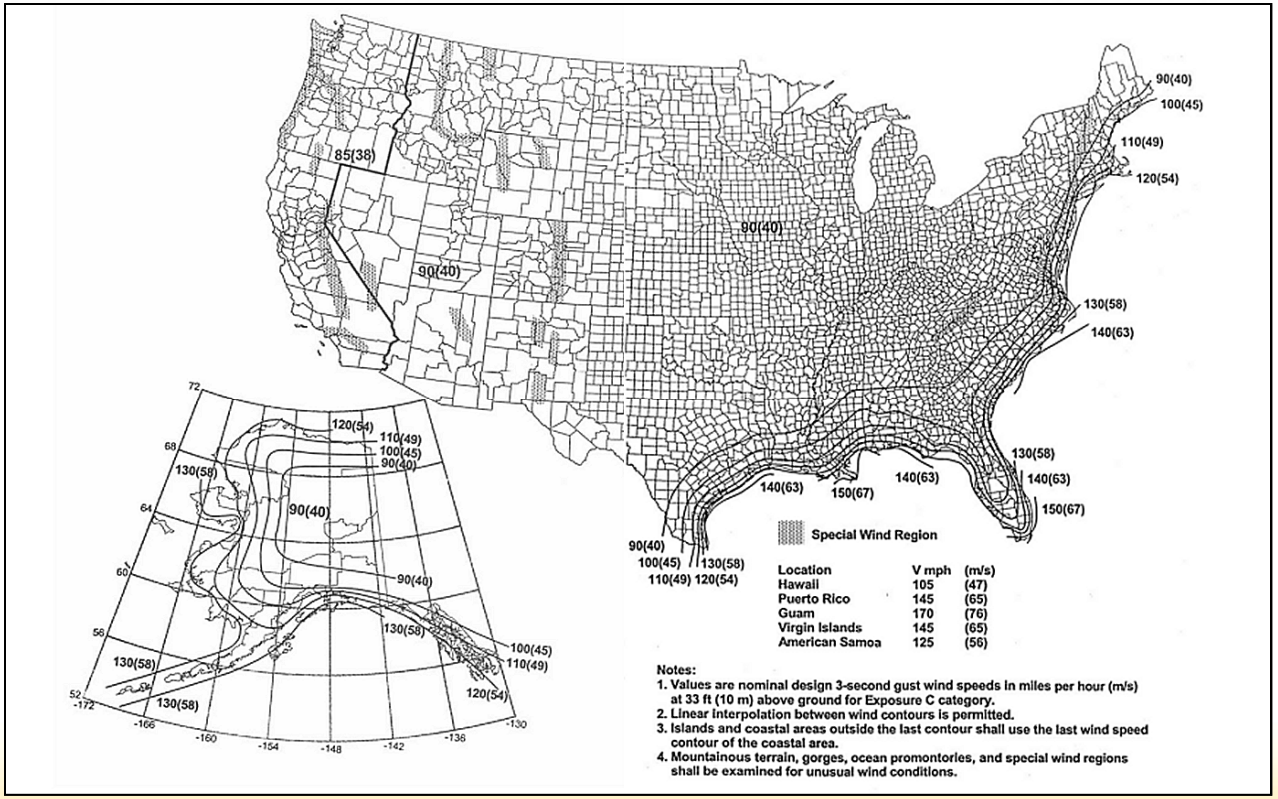
Applicable for all construction from shopping malls to hospitals in all areas of the United states, no exclusions!

Wind

Wind Loads

And Anchorage Requirements for Rooftop Equipment

3 Second Wind Gust Speed



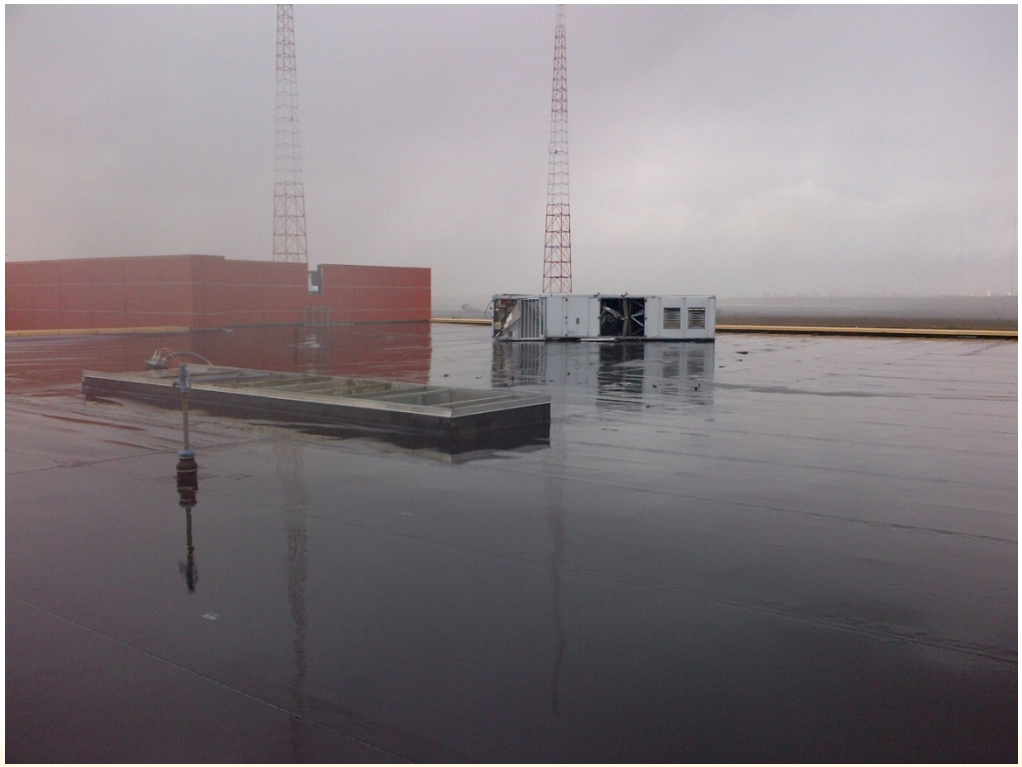
3 Second Wind Gust Speed

Wind Design


BREAKING NEWS
NAT'L WEATHER SERVICE: HAIL,
WIND GUSTS UP TO 70MPH IN FL
MSNBC

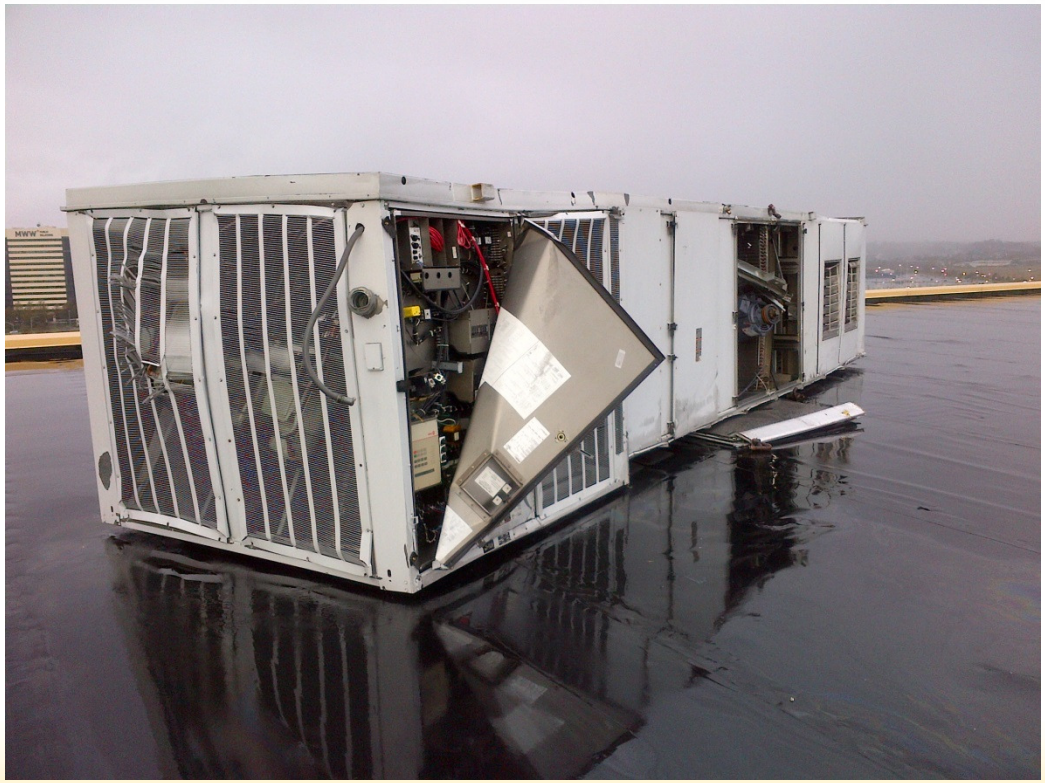
Wind Design

Wind Design



Wind Design

Wind Design

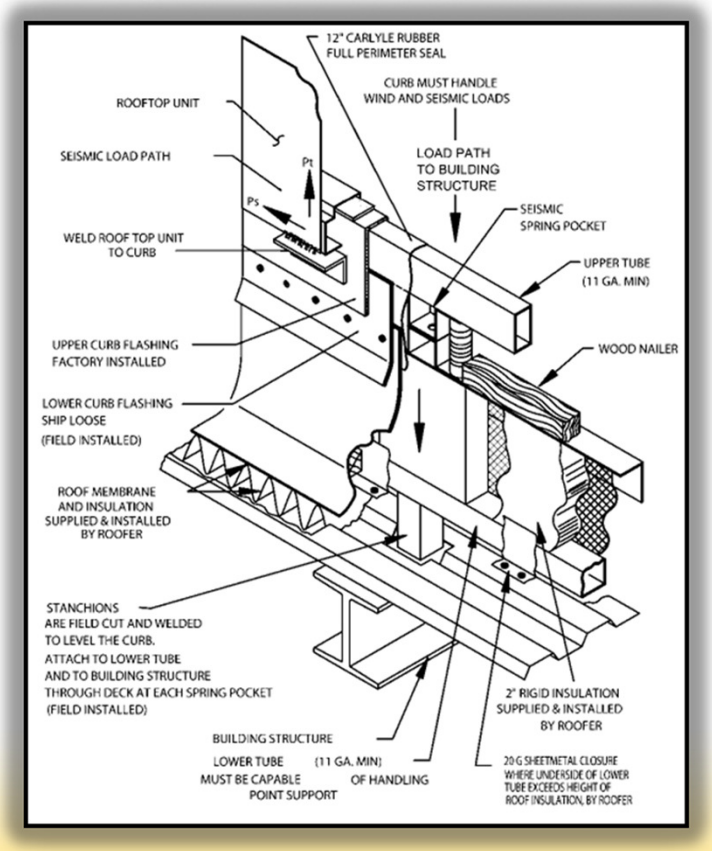


Component Attachment

1604.9 Counteracting structural actions. Structural members, systems, components and cladding shall be designed to resist forces due to earthquake and wind, with consideration of overturning, sliding, and uplift. Continuous load paths shall be provided for transmitting these forces to the foundation. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

1604.10 Wind and seismic detailing. Lateral-force-resisting systems shall meet seismic detailing requirements and limitations prescribed in this code and ASCE 7, excluding Chapter 14 and Appendix 11A, even when wind code prescribed load effects are greater than seismic load effects.

Component Attachment

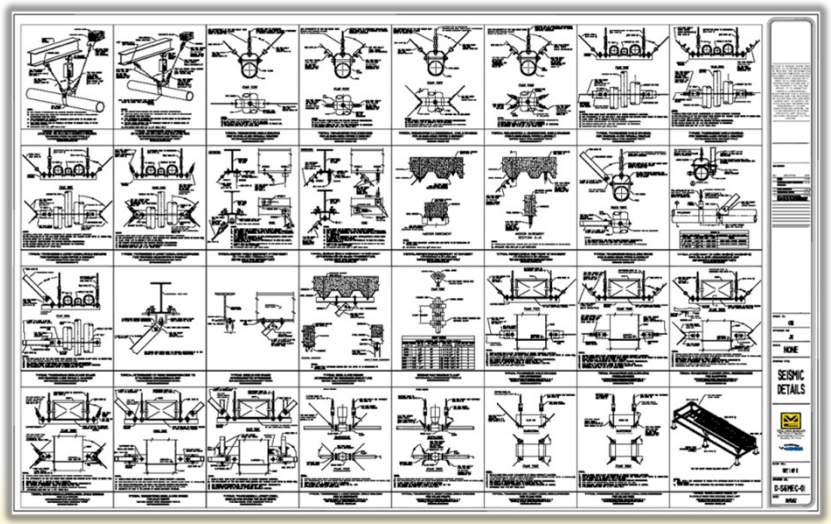


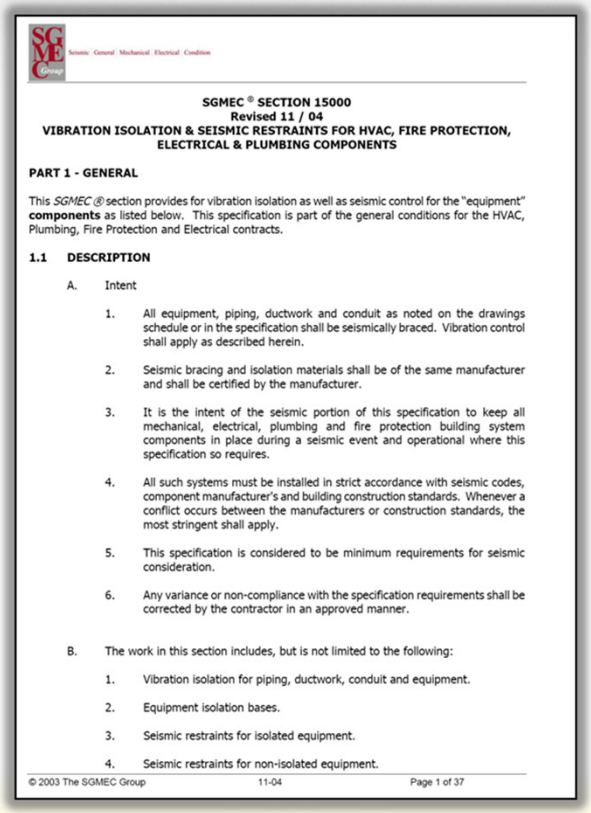
Component Attachment

- Metal deck is a non structural building component and cannot be anchored to unless the structural engineer designed it for such
- Roof mounted components and their base or curbs must demonstrate transference of the calculated wind/seismic load from the unit to the base/curb and into the structure. (continual load path)
- Base/curb mounted components, require anchorage of the base/curb directly to the building's structure. (steel or concrete)
- Components require anchorage (positive attachment) of the component to its supporting base/curb. (welding or bolting)

Reducing Risk

- Reduce risk through your project specifications
- Reduce risk through your drawing details
- Reduce risk through proper project management





SGMEC ® SECTION 15000
Revised 11 / 04
VIBRATION ISOLATION & SEISMIC RESTRAINTS FOR HVAC, FIRE PROTECTION, ELECTRICAL & PLUMBING COMPONENTS

PART 1 - GENERAL

This *SGMEC ®* section provides for vibration isolation as well as seismic control for the "equipment" **components** as listed below. This specification is part of the general conditions for the HVAC, Plumbing, Fire Protection and Electrical contracts.

1.1 DESCRIPTION

A. Intent

1. All equipment, piping, ductwork and conduit as noted on the drawings schedule or in the specification shall be seismically braced. Vibration control shall apply as described herein.
2. Seismic bracing and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.
3. It is the intent of the seismic portion of this specification to keep all mechanical, electrical, plumbing and fire protection building system components in place during a seismic event and operational where this specification so requires.
4. All such systems must be installed in strict accordance with seismic codes, component manufacturer's and building construction standards. Whenever a conflict occurs between the manufacturers or construction standards, the most stringent shall apply.
5. This specification is considered to be minimum requirements for seismic consideration.
6. Any variance or non-compliance with the specification requirements shall be corrected by the contractor in an approved manner.

B. The work in this section includes, but is not limited to the following:

1. Vibration isolation for piping, ductwork, conduit and equipment.
2. Equipment isolation bases.
3. Seismic restraints for isolated equipment.
4. Seismic restraints for non-isolated equipment.

THE VMC GROUP

IBC Seismic and Wind Load Compliance for Non-Structural Building Components

Presented By:
Danielle Taylor
Sr. National Sales Manager
December8, 2014