

**SECTION 13 05 41**  
**SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS**

SPEC WRITER NOTE: Delete between //----//  
 if not applicable to the project. Also,  
 delete any other item or paragraph not  
 applicable in the section and renumber  
 the paragraphs.

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. Provide seismic restraint in accordance with the requirements of the drawings, VA Handbook H18-8: Seismic Design Requirements and this specification in order to maintain the integrity of non-structural components and equipment of the building so that they remain safe and functional in case of seismic event.
- B. The design of seismic restraints of non-structural components to resist seismic load shall be based on Seismic Design parameters indicated below in accordance with VA H-18-8 in conjunction with ASCE 7// and ASCE 41//, as specified in H-18-8 Section 4.0, for existing building retrofit projects. Specific requirements for Critical and Essential facilities are covered in Section 4.0 of H-18-8, including applying  $I_p = 1.5$  for all nonstructural components in Critical facilities.
  - 1. International Building Code //2018// Edition
  - 2. // American Society of Civil Engineers Seismic Evaluation and Retrofit of Existing Buildings ASCE 41-17.//
  - 3. American Society of Civil Engineers Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7)//7-16//
  - 4. Facility Occupancy Category per VA H-18-8: //Critical//  
//Essential// // Ancillary// Facility
  - 5. Site Class: //A// //B// //C// //D// //E// //F//
  - 6. Building Risk Category: //I// //II// //III// //IV//
  - 7. Mapped  $MCE_R$  0.2 s period Spectral Response Acceleration Parameter ( $S_s$ ): // //
  - 8. Mapped  $MCE_R$  1.0 s period Spectral Response Acceleration Parameter ( $S_1$ ): // //
  - 9. Short period Spectral Response Acceleration Parameter ( $S_d$ ): // //
  - 10. Short period Spectral Response Acceleration Parameter ( $S_{d1}$ ): // //
  - 11. Building Seismic Design Category: //A// //B// //C// //D// //E//  
//F//

12. Component//s// Importance Factor//s// (Ip): //1.0 // //1.5//

13. Component//s// Response Modification Factor//s// (Rp): // //

14. Component//s// Overstrength Factor//s//: // //

C. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include but are not limited to (Refer to VA H-18-8, ASCE 7 and ASCE 41 for additional examples):

1. Architectural Elements: Facades that are not part of the structural system and its shear resistant elements; cornices and other architectural projections and parapets that do not function structurally; glazing; nonbearing partitions; suspended ceilings; stairs isolated from the basic structure; cabinets; bookshelves; medical equipment; and storage racks, etc.
2. Electrical Elements: Power and lighting systems; substations; switchgear and switchboards; auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems, etc.
3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems; boiler/chiller/utility plant/other equipment and components, etc.
4. Transportation Elements: Mechanical, electrical and structural elements for transport systems, i.e., elevators and dumbwaiters, including hoisting equipment and counterweights.

## 1.2 RELATED WORK:

SPEC WRITER NOTE: Include here all applicable specification sections.

Related specifications include but are not limited to those shown below. Coordinate all work with the applicable specification for that work.

- A. Cast-In-Place Concrete: Section 03 30 00, CAST-IN-PLACE CONCRETE
- B. Structural Steel Framing: Section 05 12 00, STRUCTURAL STEEL FRAMING
- C. Metal Fabrication: Section 05 50 00, METAL FABRICATIONS
- D. Accordion Folding Partitions: Section 10 22 26.13, FOLDING ACCORDION PARTITIONS
- E. Acoustical Ceilings: Section 09 51 00 ACOUSTICAL CEILINGS
- F. Linear Metal Ceilings: Section 09 54 23, LINEAR METAL CEILINGS

G. Interior Lighting: Section 26 51 00, INTERIOR LIGHTING

**1.3 QUALITY CONTROL:**

A. Shop-Drawing Preparation:

1. Non-structural seismic restraint systems shop drawings and delegated design calculations shall be prepared by a professional structural engineer with a minimum of 5 years' experience in the design and detailing of seismic force restraints. The professional structural engineer shall be registered in the state where the project is located and submit qualifications with list of projects illustrating compliance with the experience requirement of this section.
2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State where project is located.

B. Coordination:

1. Do not install seismic restraints until seismic restraint submittals are approved by the Contracting Officers Representative (COR).
2. Coordinate trapezes or other multi-pipe hanger systems prior to submission of shop drawings for review.

C. Seismic Certification:

In structures assigned to Seismic Design Category C, D, E, or F, permanent equipment and components are to have Special Seismic Certification in accordance with requirements of section 13.2.2 of ASCE 7, including those required in existing buildings within Section 13.7.1.3.3, 13.7.7.3.3 and 13.7.8.3.3 of ASCE 41, except for equipment and components that are considered inherently rugged as listed in Section 4.2.2 of VA H18-8, and shall comply with section 13.2.6 of ASCE 7.

**1.4 SUBMITTALS:**

A. Submit a complete and coordinated set of bracing and signed and sealed anchorage drawings and calculations for all non-structural elements requiring seismic restraint by the delegated professional structural engineer mentioned in Section 1.3.A.1 for review prior to installation including:

1. Description, layout, and location of all items to be anchored or braced with anchorage or brace points noted and dimensioned.
2. Details of all anchorage and bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified. Details shall be

coordinated with all project conditions and trades prior to shop drawing submission for review.

3. Complete calculations including but not limited to seismic design criteria, computer model input and output, seismic design forces and capacities, design tables and information used for all proprietary design elements such as post installed anchors, stamped and signed by a professional structural engineer specified in section 1.3 A.1.
  4. For all post installed anchorages submit the appropriate International Code Council Engineering Service (ICC-ES) evaluation reports, California's Office of Statewide Health Planning and Development (OSHPD) pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.
  5. Delegated professional structural engineer qualifications.
- B. Submit for review prior to installation, the following for seismic protection of piping in addition to items noted in Section 1.4.A:
1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.
  2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
  3. Pipe contents.
  4. Structural framing for the seismic and gravity support and the main superstructure for which the bracing and or anchorage is attached.
  5. Location of all gravity load pipe supports and spacing requirements.
  6. Numerical value of gravity load reactions.
  7. Location of all seismic bracing.
  8. Numerical value of applied seismic brace loads.
  9. Type of connection (Vertical support, vertical support with seismic brace etc.).
  10. Seismic brace reaction type (tension or compression): Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.
- C. Submit for review prior to installation, the following items for seismic protection of suspended ductwork and suspended electrical and communication cables, in addition to items noted in Section 1.4.A:
1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
  2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.

3. Maximum spacing of hangers and bracing.

**1.5 APPLICABLE PUBLICATIONS:**

A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.

SPEC WRITER NOTE: Edit applicable publications to indicate the most recent edition.

B. American Concrete Institute (ACI):

355.2-19.....Qualification for Post-Installed Mechanical  
Anchors in Concrete and Commentary

C. American Institute of Steel Construction (AISC):

Load and Resistance Factor Design, Volume 1, Second Edition

D. ASTM International (ASTM):

A36/A36M-19.....Standard Specification for Carbon Structural  
Steel

A53/A53M-18.....Standard Specification for Pipe, Steel, Black  
and Hot-Dipped, Zinc-Coated, Welded and  
Seamless

A307-14e1.....Standard Specifications for Carbon Steel Bolts,  
Studs, and Threaded Rod 60,000 PSI Tensile  
Strength

A325-14.....Standard Specification for Structural Bolts,  
Steel, Heat Treated, 120/105 ksi Minimum  
Tensile Strength

A325M-14.....Standard Specification for High-Strength Bolts  
for Structural Steel Joints [Metric]

A490-14a.....Standard Specification for Heat-Treated Steel  
Structural Bolts, 150 ksi Minimum Tensile  
Strength

A490M-14a.....Standard Specification for High-Strength Steel  
Bolts, Classes 10.9 and 10.9.3, for Structural  
Steel Joints [Metric]

A500/A500M-18.....Standard Specification for Cold-Formed Welded  
and Seamless Carbon Steel Structural Tubing in  
Rounds and Shapes

- A501/A501M-14.....Standard Specification for Hot-Formed Welded  
and Seamless Carbon Steel Structural Tubing
- A615/A615M-20.....Standard Specification for Deformed and Plain  
Carbon Steel Bars for Concrete Reinforcement
- A992/A992M-11(2015).....Standard Specification for Steel for Structural  
Shapes for Use in Building Framing
- A996/A996M-16.....Standard Specification for Rail Steel and Axle  
Steel Deformed Bars for Concrete Reinforcement
- E488/E488M-18.....Standard Test Methods for Strength of Anchors  
in Concrete Elements

E. American Society of Civil Engineers

- 1. Minimum Design Loads and Associated Criteria for Buildings and Other  
Structures (ASCE 7) Edition as indicated in section 1.1 B of this  
specification. Associated Criteria for Buildings and Other  
Structures (ASCE 7): //7-16//

F. International Building Code (IBC) Edition as indicated in Section 1.1 B  
of this specification.

G. VA Handbook H18-8 Seismic Design Requirements, VA H-18-8, November  
2019 (REVISED MAY 1, 2020)

H. National Uniform Seismic Installation Guidelines (NUSIG)

I. Sheet Metal and Air Conditioning Contractors National Association

J. (SMACNA): Seismic Restraint Manual - Guidelines for Mechanical Systems,  
3<sup>RD</sup> EDITION 2008 and Addendum

**1.6 REGULATORY REQUIREMENT:**

- A. IBC as shown in Section 1.1 B of this specification.

DESIGNER AND SPEC WRITER NOTES:

- 1. The design professional's  
responsibilities are to identify the  
components to be restrained, to  
identify the lateral force  
coefficient, to provide details for  
restraints on the construction  
drawings, and to review and approve  
seismic restraint shop drawing details  
prepared by the Contractor/Vendor.

2. The designer (structural engineer) shall specify on the drawings:
  - a) the short-period acceleration ( $S_{DS}$ );
  - b) the importance factor ( $I_p$ ) for non-structural elements; and
  - c) the maximum interstory drifts permitted in H-18-8.

B. Exceptions: The omission of seismic restraints shall be allowed only in accordance with VA H18-8, ASCE 7 and //ASCE 41//.

## **PART 2 - PRODUCTS**

### **2.1 STEEL:**

- A. Structural Steel: ASTM A36 // A36M // A992 //.
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53/A53M, Grade B.
- E. Bolts & Nuts: ASTM // A307 // A325 // A325M // A490 // A490M //.

### **2.2 CAST-IN-PLACE CONCRETE:**

- A. Concrete: 28 day strength,  $f'_c =$  // 20.7 MPa (3,000 psi) // 27.5 MPa (4,000 psi) // 34.5 MPa 5000 psi
- B. Reinforcing Steel: ASTM A615/615M or ASTM A996/A996M deformed.

## **PART 3 - EXECUTION**

### **3.1 CONSTRUCTION, GENERAL:**

- A. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.
- B. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.
- C. Construct seismic restraints and anchorage to allow for thermal expansion.
- D. Testing Before Final Inspection:
  1. Test 10-percent of anchors in masonry and concrete per ASTM E488, and ACI 355.2 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.
  2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.

3. Construct seismic restraints and anchorages to not interfere with other trades or damage existing or in-situ elements of the constructed building.

**3.2 EQUIPMENT RESTRAINT AND BRACING:**

- A. See drawings for equipment to be restrained or braced.

SPEC WRITER NOTE:

SMACNA does not cover all conditions such as, providing details for seismic restraints of equipment or details of flexible joints when crossing seismic or expansion joints, or bracing of in-line equipment, etc. Also, SMACNA provides guidelines and its details must be used with extreme care and verified per current VA H-18-8 requirements and Section 1.4A.

**3.3 MECHANICAL DUCTWORK AND PIPING; BOILER PLANT STACKS AND BREACHING; ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION WIRES AND CABLE TRAYS**

- A. Support and brace mechanical ductwork and piping; electrical busways, conduits and cable trays; and telecommunication wires and cable trays including boiler plant stacks and breeching to resist directional forces (lateral, longitudinal and vertical).
- B. Brace duct and breeching branches with a minimum of 1 brace per branch.
- C. Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.
- D. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

**3.4 PARTITIONS**

SPEC WRITER NOTE:

1. Masonry walls used as interior partitions or as exterior surfaces of buildings shall be properly anchored to the structure, and shall be designed to carry lateral loads imposed due to earthquake along with their own weight and other lateral dead, live and or wind load forces.

- A. In buildings with flexible structural frames, anchor partitions to only structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.
- B. Properly anchor masonry walls to the structure for restraint, so as to carry lateral loads imposed due to earthquake along with their own weight and other lateral forces.

### **3.5 CEILINGS AND LIGHTING FIXTURES**

- A. At intervals required to meet the seismic demand forces, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.
- B. Independently support and laterally brace all lighting fixtures. Refer to applicable portion of lighting specification, Section 26 51 00, INTERIOR LIGHTING.

### **3.6 FACADES AND GLAZING**

#### DESIGNER NOTES:

1. Heavy rigid facades should be used only on rigid structural systems; they should never be attached to relatively flexible building frames.
  2. Review building design to ensure contractor's ability to comply with the following paragraphs.
  3. Design brick veneer anchors and back-up wall for applicable seismic forces at the project location.
  4. Design attachments to structure for all façade materials to accommodate applicable seismic forces at the project location.
- A. Do not install concrete masonry unit filler walls in a manner that can restrain the lateral deflection of the building frame. Provide a gap with adequately sized resilient filler to separate the structural frame from the non-structural filler wall.
  - B. Tie brick veneers to a separate wall that is independent of the steel frame as shown on construction drawings to ensure strength against applicable seismic forces at the project location.
  - C. Install attachments to structure for all façade materials as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

### **3.7 STORAGE RACKS, CABINETS, AND BOOKCASES**

- A. Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.

- B. Anchor medical supply cabinets to the floor or walls and equip them with properly engaged, lockable latches.
- C. Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.
- D. Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

- - - E N D - - -