

steel quiz

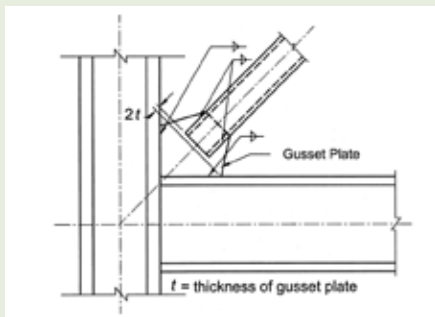
LOOKING FOR A CHALLENGE? *Modern Steel Construction's* monthly Steel Quiz tests your knowledge of steel design and construction. Most of the answers for this month's quiz can be found in the 2010 AISC *Seismic Provisions for Structural Steel Buildings* (ANSI/AISC 341-10) and the 2010 AISC *Specification for Structural Steel Buildings* (ANSI/AISC 360-10). Both documents are available as free downloads on the AISC website, www.aisc.org/freepubs.

- 1 At what level of organization does the 2010 AISC *Seismic Provisions* (ANSI/AISC 341-10) differ from the previous edition?
 - a) Parts
 - b) Chapters
 - c) Volumes
 - d) None of the above
- 2 Which American Welding Society (AWS) document is referenced by the 2010 AISC *Seismic Provisions* for additional requirements for welding in seismic force resisting systems?
 - a) D1.1 c) D1.8
 - b) D1.5 d) None of the above
- 3 True/False: The 2010 AISC *Seismic Provisions* contains new requirements for cantilevered column systems, perforated web plates in special plate shear walls, and box-shaped links in eccentrically braced frames.
- 4 True/False: Special seismic weld access holes are required for all CJP groove welds between beam flanges and a column.
- 5 How must gusset plates in SCBF be designed to accommodate buckling of the brace?
 - a) The gusset plate must be designed to accommodate the rotation imposed by brace buckling. Typically this is achieved by designing the gusset with a distance between the end of the brace and the line of restraint of twice the thickness of the gusset plate.
 - b) The gusset plate must be designed for the flexural force imposed by brace buckling, which is $1.1R_yM_p$ of the brace.
 - c) Either A or B above is acceptable.
 - d) There is no way to accommodate buckling of the brace.
- 6 True/False: 2010 AISC *Specification* Table B4.1 fully addresses the limiting width-to-thickness ratios for compression elements in seismic force resisting systems.
- 7 True/False: The values R_y and R_t listed in Table A3.1 of AISC 341-10 are strain hardening factors.
- 8 True/False: AISC 341-10 does not require that every member in a composite seismic force resisting system be a composite member.
- 9 True/False: The AISC *Seismic Provisions* contains requirements only for members that are part of the seismic force resisting system (SFRS).
- 10 True/False: All bolted connections in the seismic force resisting system (SFRS) must be designed as slip-critical joints.

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- 1 (b) The 2010 AISC *Seismic Provisions* has been reorganized into lettered chapters and now follows a format similar to the AISC *Specification for Structural Steel Buildings* (ANSI/AISC 360).
- 2 (c) AWS D1.8/D1.8M *Structural Welding Code—Seismic Supplement* has been incorporated into the 2010 *Seismic Provisions* by reference for welding related issues.
- 3 True. The design requirements for two cantilever column systems (ordinary and special), perforated web plates in special plate shear walls, and box-shaped links in eccentrically braced frames have all been added to the 2010 *Seismic Provisions*. The two cantilever column systems are consistent with the systems listed in ASCE/SEI 7-10.
- 4 False. Special seismic weld access holes are only required when specifically stated in the AISC *Seismic Provisions*, AISC 358 (*Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications*), or when incorporated in testing used to qualify a connection. The Welded Unreinforced Flange–Welded Web (WUF-W) connection is one example of a connection detail that uses the special seismic weld access hole detail.
- 5 (c) AISC 341-10, Section F2.6c(3) and its associated commentary explain these options. Answer A is illustrated in the figure below. The Committee currently is considering a modification of this approach to allow for an elliptical buckling line, based upon research that was presented by Charles Roeder as a part of the 2011 AISC T.R. Higgins Lecture. Answer B represents a detail with a gusset that can force a plastic hinge to form in the brace itself.
- 6 False. AISC *Seismic Provisions* Table D1.1 gives limiting width-to-thickness ratios for moderately and highly ductile members. This table is to be used in conjunction with the specific system requirements contained in the *Seismic Provisions*. Each seismic force resisting system in AISC 341-10 specifies the members of the system that need to meet Table D1.1 requirements for moderately or highly ductile members.
- 7 False. R_y is the ratio of the expected yield stress to the specified minimum yield stress. R_t is the ratio of the expected tensile strength to the specified minimum tensile strength. Neither of these ratios includes consideration of strain hardening.
- 8 True. Chapters G and H of AISC 341-10 list specific requirements for composite systems. For example, Section H2 for composite special concentrically braced frames states that columns shall be encased or filled composite members, beams shall be either structural steel or composite members, and braces shall be either structural steel or filled composite members.
- 9 False. It is rare, but the *Seismic Provisions* contains a few requirements for non-SFRS members by direct requirement and by reference. Two examples: Section D3 requires deformation compatibility between SFRS and non-SFRS members where required by the applicable building code and Section D2.5c contains strength requirements for column splices outside of the SFRS.
- 10 False. As stated in AISC *Seismic Provisions* D2.2(1), the available strength of bolted joints is calculated as that for bearing-type joints in accordance with the AISC *Specification*. However, Section D2.2(4) requires that faying surfaces satisfy the requirements for slip-critical connections with a Class A or higher slip coefficient and all bolts are required to be pretensioned. In other words, bolted joints are designed as bearing, but detailed, fabricated and erected with slip-critical faying surfaces and pretensioned bolts.



Brace-to-gusset plate requirement for buckling out-of-plane bracing systems.



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