

Modern Steel Construction's monthly Steel Quiz allows you to test your knowledge of steel design and construction. All references to LRFD specifications pertain to the 1999 *LRFD Specification for Structural Steel Buildings*, available as a free download from AISC's web site:

[www.aisc.org/lrfdspec](http://www.aisc.org/lrfdspec)

ASD references pertain to the 1989 *ASD Specification for Structural Steel Buildings*. Where appropriate, other industry standards are also referenced.

Anyone is welcome to submit questions for Steel Quiz—one question or 10! If you or your firm are interested in submitting a Steel Quiz question or column, contact ►

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**This month's Steel Quiz was developed by the staff of AISC's Steel Solutions Center. Sharpen your pencils and go!**

**1.** Are washers required for turn-of-the-nut installations using ASTM A325 bolts in standard holes?

**2. True/False:** A Snug-Tightened Joint requires a specific level of pretension during bolt installation.

**3.** Which is the correct ASTM designation for twist-off-type tension control bolt assemblies?

- a. F959
- b. F1554
- c. F1852

**4.** What is the maximum diameter of a standard hole for a 3/4 inch diame-

ter bolt when considering hole tolerances?

- a. 13/16 inch
- b. 27/32 inch
- c. 7/8 inch

**5.** For Architecturally Exposed Structural Steel (AESS), is weld show-through acceptable per the 2000 AISC *Code of Standard Practice*?

**6.** What is ERW HSS? Does it use a filler metal?

**7.** Are steel stairs, tanks and pressure vessels considered structural steel?

**8.** How does the  $C_b$  factor affect the design strength of flexural members controlled by lateral-torsional buckling?

- a. by increasing the design strength

- b. by decreasing the design strength
- c. by increasing the unbraced length
- d. by decreasing the unbraced length

**9. True/False:** Seismically compact width-thickness ratios for compression elements are usually smaller than conventional compactness ratios.

**10.** Which one of the following limit states does not pertain to cap plates on HSS columns under compressive load:

- a. flexural strength of the cap plate
- b. bearing strength of the cap plate
- c. local compression yielding of the HSS wall
- d. local compression crippling of the HSS wall

**Turn page for answers**

## Answers

**1.** Washers are not required for this case, except when the material has  $F_y$  less than 40 ksi or the holes are oversized or slotted. Refer to Section 6.2 of the 2000 RCSC Bolt Specification (a free download from [www.boltcouncil.org](http://www.boltcouncil.org)) for additional information.

**2.** **False.** Section 8.1 of the 2000 RCSC *Bolt Specification* (a free download from [www.boltcouncil.org](http://www.boltcouncil.org)) defines snug-tightened as “the tightness that is attained with a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench to bring the connected plies into firm contact.”

**3.** The correct answer is **c.** ASTM F1852 refers to the fastener assemblies commonly known as TC bolts. Tension-control bolts that fall under the ASTM F1852 Specification can be manufactured with round, heavy hex, or alternative bolt heads, and provide a tensile strength equivalency to ASTM A325.

**4.** The correct answer is **b.** For standard holes, we must add  $1/16$  in. to the nominal bolt diameter. However, per

Table 3.1 of the 2000 RCSC *Bolt Specification*, the upper tolerance for round bolt holes is  $1/32$  inch. Adding this tolerance results in a  $27/32$  inch maximum hole diameter for a  $3/4$  inch diameter bolt.

**5.** Yes, unless a specific visual acceptance criteria for weld show-through is specified in the contract documents. Refer to Section 10.2.3. of the 2000 AISC *Code of Standard Practice* (a free download from [www.aisc.org/code](http://www.aisc.org/code)).

**6.** ERW HSS are electric resistance welded hollow structural sections, the most common type of HSS produced in the United States. The ERW process does not use filler metal, thereby eliminating the need for a backing bar. The base metal on the two edges of a cold rolled HSS are butted together and fused during production.

**7.** **No.** Steel stairs, tanks and pressure vessels are classified as other steel, iron or metal items. Refer to Section 2.2 of the 2000 AISC *Code of Standard Practice*.

**8.** The answer is **a.** The  $C_b$  modification factor is a multiplier used to increase the design strength of flexural

members based on the lateral-torsional buckling limit state. It accounts for the additional reserve capacity in the flexural member due to loading patterns that result in non-uniform bending moment diagrams. Refer to Section F1.2 of the 1999 AISC *LRFD Specification*.

**9.** **True.** The seismically compact width-thickness ratios found in the 2002 AISC *Seismic Provisions* (a free download from [www.aisc.org/seismic](http://www.aisc.org/seismic)) are smaller than the compactness ratios found in Chapter B of the 1999 AISC *LRFD Specification*. Hence it is possible that a compression element may be compact, but not seismically compact.

**10.** The correct answer is **b.** The bearing strength of the cap plate is not a required limit state check in this instance, since the other applicable limit states will always be more critical. As outlined in Chapter 7 of the AISC *HSS Connections Manual* (purchase through [www.aisc.org/bookstore](http://www.aisc.org/bookstore)), the compressive load on this configuration results in a flexural check of the cap plate, in addition to local yielding and crippling checks of the HSS wall. ★