LOOKING FOR A CHALLENGE? Modern Steel Construction’s monthly Steel Quiz tests your knowledge of steel design and construction. Most answers can be found in the 2005 Specification for Structural Steel Buildings, available as a free download from AISC’s web site, www.aisc.org/2005spec. Where appropriate, other industry standards are also referenced.

This month’s Steel Quiz was developed by AISC’s Steel Solutions Center. Sharpen your pencils and go!

1. Which bolted joint type is not permitted by the AISC and RCSC specifications?
   a. finger-tightened
   b. snug-tightened
   c. pretensioned
   d. slip-critical

2. How can local buckling be avoided?

3. If the nominal strength is $R_n$ (kips), what are the design strength (LRFD) and allowable strength (ASD), respectively:
   a. $\Omega R_n$, $\phi R_n$
   b. $\Omega R_n$, $R_n / \phi$
   c. $\phi R_n$, $\Omega R_n$
   d. $\phi R_n$, $R_n / \Omega$

4. True/False. Structural steel shapes and plate can be made to ASTM A992.

5. Can eccentricity be ignored in the design of single-plate shear connections?

6. What is prying action?

7. True/False. It is recommended that ASTM A325/A490 high-strength bolts not be welded.

8. Which of the following seismic load resisting systems does not require conformance demonstration for moment connections?
   a. SMF, IMF, OMF
   b. SMF
   c. IMF
   d. OMF

9. The limitations for the maximum size of fillet welds found in the AISC specification address the:
   a. tendency of the thicker part joined to act as a heat sink; weld cracking concerns
   b. burn-through of the thinner part joined
   c. melting of the corner; actual weld throat smaller than anticipated
   d. potential for warping of the base metal

10. Which three limit states are used in the flexural design of an unsymmetric shape?
    a. yielding, lateral-torsional buckling and local buckling
    b. yielding, lateral-torsional buckling and torsion
    c. yielding, flexural-torsional buckling and local buckling
    d. yielding, flexural-torsional buckling and torsion

TURN PAGE FOR ANSWERS
The allowable strength used in ASD is the ASTM A992 standard. If plate of equivalent expressions, such as on the same set of nominal strength entire 2005 AISC specification is based on other shape is yet commonly available elastic rotation at first yield) of approximately 3 before the onset of local buckling. Similar criteria with more stringent width-thickness limitations are given for high-seismic design in the 2005 AISC Seismic Provisions.

Both true and false. True, because W-shapes today are most commonly made to ASTM A992. Although no other shape is yet commonly available in ASTM A992 material, the standard (www.astm.org) is written to include other rolled steel structural shapes for use in building frames or bridges, or for general structural purposes. False, because plates are not included in the ASTM A992 standard. If plate of equivalent yield strength is desired, it can be specified as ASTM A572 Grade 50.

Yes, as follows when the conventional procedure included in the 13th Edition AISC Steel Construction Manual is used. “Conventional” is defined for these connections as containing only a single row of bolts, and the number of bolts in the connection, n, is limited to 2 to 12. The distance from the bolt line to the weld line, a, must be equal to or less than 3.5”. If the conventional connection contains short slotted holes, eccentricity can be ignored for up to n = 12. If standard holes are used, eccentricity can be ignored for n = 2 to 9 bolts; but must be considered for 10 to 12 bolts. When the dimensional and other limitations of conventional single-plate shear connections cannot be satisfied, this connection is designed using the alternative procedure provided for the “extended configuration.” Eccentricity must be considered in the design of “extended” single-plate shear connections.

The effect of heat from welding to these fastener components can lead to reduction of strength and cracking. Thus, it is generally recommended that high-strength bolts should not be welded.

The answer is a. That is, one must design for the lowest value obtained from the limit states of yielding, lateral-torsional buckling, and local buckling—just like for most other flexural member cases. Note, however, that the critical buckling stress for lateral-torsional and local buckling of unsymmetric shapes generally must be determined by analysis. Refer to Section F12 of the 2005 AISC specification for additional information. Incidentally, the limit state of flexural-torsional buckling (a tempting option in the list of answers) applies only to certain compression members.