steel quiz

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 Raised-pattern floor plates are made to which ASTM standard?
- **a.** A36
- **b.** A572
- **c.** A709
- **d.** A786

2 What is the difference between *fracture* and *rupture*?

3 For a bolt in shear, the maximum available strength is obtained in a:
- **a.** bearing joint, threads included, single-shear loading
- **b.** bearing joint, threads excluded, double-shear loading
- **c.** slip-critical joint, threads included, single-shear loading
- **d.** slip-critical joint, threads excluded, double-shear loading

4 What is the maximum thickness of an undeveloped filler plate or shim that will not reduce the available strength of a bolted joint?

5 Designing with fatigue involves comparing the live load stress range to the design stress range. Which of the following is not true?
- **a.** Live load stress range can be defined as the magnitude of stress change due to the application or removal of the service live load.
- **b.** If live load stress range is less than the threshold fatigue range, fatigue is not a concern.
- **c.** If the number of cycles of live load is less than 20,000 cycles, fatigue is not a concern.
- **d.** AISC fatigue requirements are applicable to structures in all service temperatures.

6 **True/False**: The top angle in a seated shear connection is usually sized for a calculated strength requirement.

7 Which of the following are nondestructive tests for examining welds? Choose all that apply.
- **a.** penetrant testing (PT)
- **b.** magnetic particle testing (MT)
- **c.** radiographic testing (RT)
- **d.** ultrasonic testing (UT)

8 In fillet-welded lap joints, the minimum amount of lap is:
- **a.** 5 times the thickness of thinner part joined, but not less than 1 in.
- **b.** 4 times the thickness of thinner part joined, but not less than 1 in.
- **c.** 3 times the thickness of thinner part joined, but not less than 1 in.
- **d.** 2 times the thickness of thinner part joined, but not less than 1 in.

9 **True/False:** Beams with asymmetrical cross sections can be designed using the 2005 AISC specification.

10 The Uniform Force Method (UFM) is based on selecting the geometry of the connection so that the gusset-to-beam, gusset-to-column, and beam-to-column connection interfaces are designed for (select all that apply):
- **a.** uniform moment
- **b.** uniform shear
- **c.** uniform tension
- **d.** uniform compression

TURN PAGE FOR ANSWERS

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ANSWERS

1 **d**. Floor plate can be made from practically any steel. However, the raised-pattern that helps increase slip resistance is designated under the ASTM A786 standard and is available in widths up to 120 inches.

2 Fracture is generally associated with the separation action of material when exposed to tensile fatigue loading. Rupture is usually understood as separation in the absence of tensile fatigue loading. Thus, if a rod is loaded in tension and pulled until it separates into two pieces, it would be described as rupture rather than fracture.

3 **b**. Bolted bearing joints have a greater available strength than slip-critical joints. The threads-excluded condition will provide greater available strength compared to the case of threads included. Double-shear loading produces twice the shear strength compared to single-shear loading.

4 **¼ in.** The concern is to avoid significant bending of the bolt due to the eccentricity caused by the thickness of the undeveloped fillers when the bolt is loaded in shear. Referring to Section J5 of the 2005 AISC specification (www.aisc.org/2005spec), the shear strength of the bolts is used without reduction if the filler is ¼ in. in thickness or less. If the undeveloped filler is greater than ¼ in., but does not exceed ¾ in., a linear reduction in shear strength is specified. Alternatively, the fillers can be extended beyond the joint, secured by sufficient bolts to uniformly distribute the total force over the combined cross section of the connected elements and fillers. Refer to Section J5 for additional alternatives.

5 **d** is untrue. Appendix 3 of the 2005 AISC specification states that the cyclic load resistance is applicable to structures subject to temperatures not exceeding 300 °F.

6 **False.** In both stiffened and unstiffened seated shear connections, the bottom seat angle is assumed to carry the entire end reaction of the supported beam. The top angle is provided as a standard detail for stability of the beam end. Refer to Chapter 10 of the 13th edition *Manual* (www.aisc.org/bookstore) for additional information.

7 The answer is all: **a**, **b**, **c,** and **d**. All listed are non-destructive tests to examine welds. One test not mentioned is the most economical and commonly used method: Visual Testing (VT). For detailed information on each of these five weld inspection methods, refer to pages 8-4 through 8-7 of the 13th edition *Manual*. Requirements are outlined in Chapter 6 of the AWS D1.1:2006 welding code (www.aws.org).

8 **a**. In lap joints, the minimum amount of lap shall be five times the thickness of the thinner part joined, but not less than 1 in. It is also required that if longitudinal fillet welds are used alone in end connections of flat-bar tension members, the length of each fillet weld shall not be less than the perpendicular distance between them. Refer to Section J2.2b of the 2005 AISC specification for additional information.

9 **True**. Section F12 of the 2005 AISC specification addresses the design requirements for asymmetrical shapes for both LRFD and ASD designs.

10 **b and c**, or **b and d**. The idea behind the Uniform Force Method is to select a connection geometry such that moments do not exist on the three connection interfaces. Thus, the calculations are simplified and the design is based on shear and/or tension for a brace in tension, or shear and/or compression for a brace in compression. The origin of the name Uniform Force Method signifies the goal to eliminate moments (or at least minimize them).

Anyone is welcome to submit questions for Steel Quiz. If you are interested in submitting one question or an entire quiz, contact AISC's Steel Solutions Center at 866.ASK.AISC or at **solutions@aisc.org**.

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