steel quiz

Steel Quiz made its first appearance in the November 1995 issue of *Modern Steel Construction*. This month's Quiz takes a look at some of the best questions from 2005.

1 **Yes or No:** Is there a temperature limitation placed on the use of the AISC *Specification* (ANSI/AISC 360) for fatigue loading?

2 **Yes or No:** Is it necessary to remove the ceramic insulator from a stud shear connector in composite construction?

3 **Yes or No:** If a beam bears on top of a column, is there any requirement for bracing?

4 In the special segment of special truss moment frames (STMF), why are flat bars used at diagonal web members?

5 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

TURN PAGE FOR ANSWERS

6 The Euler buckling of a column is best described as:
a. Elastic buckling of short columns
b. Elastic buckling of long columns
c. Inelastic buckling of short columns
d. Inelastic buckling of long columns

7 **True or False:** For cantilevered beams, bracing the bottom compression flange at the free end significantly reduces instability.

8 Which of the following is considered a stiffened element?
a. Leg of an angle
b. Flange of a channel
c. Web of a wide-flange shape
d. Wall of an HSS (hollow structural section)

9 What is the significance of width-to-thickness ratios in beam design?

10 For a built-up member composed of two or more shapes, is the nominal compressive strength determined based on the built-up section acting as a unit or on the components acting individually?

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1 **Yes.** The fatigue resistance determined using Appendix 3 of the AISC *Specification*, available at **www.aisc.org/specifications**, is applicable only to structures subject to temperatures not exceeding 300 °F (150 °C), as indicated in Section 3.1.

2 **Yes.** Section 7.4.6 in AWS D1.1 states: "After welding, arc shields shall be broken free from studs to be embedded in concrete, and, where practical, from all other studs." This is required for visual inspection of the weld.

3 **Yes.** Restraint against rotation about the longitudinal axis shall be provided at points of support (see Section B3.4 of the 2016 AISC *Specification*). This may be provided by a beam framing perpendicular into the beam on the top of the column. Stability bracing is discussed and example details given starting on page 2-17 of the AISC *Steel Construction Manual*, 14th Edition (available at **www.aisc.org/publications**).

4 Because of their high ductility. Section E4.4a of the AISC *Seismic Provisions* (ANSI/AISC 341), available at **www.aisc.org/specifications**, requires the use of flat bars for the diagonal members within the special segment.

5 **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 of the AISC *Specification*.

6 **b.** Euler buckling is the elastic buckling of a long column. However, if the column is short, the buckling can occur at inelastic stress levels. If the column is *extremely* short, buckling may not occur at all (yielding will be observed).

7 **False.** For cantilever beams, bracing the bottom compression flange at the free end has little effect in reducing instability, as the compression flange can still deflect laterally if cross-sectional distortion is not prevented. The best location to prevent twisting of the cross-section is the tension flange at the free end of the cantilever. Refer to the first quarter 2001 *Engineering Journal* paper "Fundamentals of Beam Bracing" by Yura (available at **www.aisc.org/ej**).

8 Both **c.** and **d.** The web of a wide-flange shape is stiffened at its end by the flanges, and HSS walls are stiffened. Refer to Table B4.1 in the AISC *Specification*.

9 Compression buckling strength is a function of the width-thickness ratio of the element or elements subject to compression. Flexural members will have portions of the cross section subject to compression, and thus a tendency to buckle if the components are too thin.

10 It depends upon the interconnection of the elements. If the built-up section is designed to act as a unit, the individual components of the built-up section must be so interconnected. This includes satisfying the requirement that the effective slenderness ratio of each of the component shapes between the fasteners does not exceed three-fourths times the governing slenderness ratio of the built-up member. See Section E6 of the AISC *Specification* and commentary for further guidance.

Steel SolutionsCenter

Everyone is welcome to submit questions and answers 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**.