

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

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 ►

Steel Solutions Center

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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. What is the definition of nominal design, and allowable strengths?
2. Which of the following ASTM standards pertains to Compressible-Washer-Type Direct Tension Indicators?
 - a. A194
 - b. F436
 - c. F959
 - d. F1852
3. The Euler buckling of columns 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
4. Should shop primer be counted on for corrosion protection?
5. What are the tolerances for cambered beams 50' or less in length?
 - a. $-1/2''$, $+0$
 - b. $-1/4''$, $+0$
 - c. $-0''$, $+1/2''$
 - d. $-0''$, $+1/4''$
6. Block shear in the Specification is checked assuming which of the following assumptions?
 - a. shear yielding and tension rupture
 - b. shear rupture and tension yielding
 - c. shear and tension rupture
 - d. shear and tension yielding
7. True/False: All SMAW electrodes are low-hydrogen.
8. Which of the following is not a serviceability concern?
 - a. drift
 - b. deflection
 - c. yield point
 - d. floor vibration
9. True/False: For cantilevered beams, bracing the bottom compression flange at the free end significantly reduces instability.
10. What are the three grade identification colors for ASTM F1554 anchor rods?
 - a. blue, yellow and red
 - b. green, yellow and red
 - c. blue, white and red
 - d. green, white and red

Turn page for answers

Answers

1. **Nominal strength** is the capacity of a structure or component (without any resistance factors or factors of safety applied) to resist loads. As determined by the AISC *Specification*, it is a prediction of the ultimate strength of the structure or component. **Design strength** is the nominal strength multiplied by the resistance factor used in LRFD design. **Allowable strength** is the nominal strength divided by a factor of safety used in ASD design.

2. **c.** ASTM F959.

3. **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).

4. **No.** Although any primer or paint will provide at least some minimum level of corrosion protection, the thin 2-3 mil shop primer does not have weathering durability and is intended as a base for adhesion of subsequent coats, not for corrosion resistance. Proper corrosion resistance can be provided by hot-dipped galvanization, the use of inorganic or epoxy anti-corrosion coatings, or multi-coat painting systems. A selected corrosion protection system, if

required, should be specified in the contract documents.

5. **c.** That is, for beams 50' or less in length, the member can be over-cambered by as much as 1/2". However, the member cannot be under-cambered. Refer to Section 6.4.4. of the 2000 AISC *Code of Standard Practice* (a free download from www.aisc.org/code) for details concerning the under-camber exception specific to certain mill cambered beams.

6. **a., b., and c.** **A trick question!** Block shear is a tearing out failure of a block of material. The edges of the block are exposed to either tension or shear. Two block shear strengths can be calculated using the *Specification*, with the larger one governing. Rupture strength on the net tensile area combined with shear yielding of the gross shear area, or rupture on the net shear area combined with yielding in the gross yielding area. In neither case can the combined total exceed the sum of the two rupture strengths. Refer to Section J4.3. of the 1999 AISC *LRFD Specification* for current block shear requirements.

7. **True.** According to AWS A5.1, SMAW electrodes must have a moisture content less than 0.6% when tested at 1800° F. The low moisture level corresponds to a low diffusible hydrogen level in the deposited weld metal.

8. **c.** **Yield point** does not limit the ability of a structure to preserve its appearance, maintainability, durability, or the comfort of its occupants or function of machinery under normal usage.

9. **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 AISC *Engineering Journal* paper "Fundamentals of Beam Bracing" by Yura (www.aisc.org/ej).

10. **a.** That is, blue, yellow and red for grades 36, 55, and 105 ksi, respectively. Refer to the ASTM F1554 Standard for product marking information. ★

Do you have an idea for *Steel Quiz*?
Send it to:

The logo for Steel SolutionsCenter, featuring the word "Steel" in a small font above "SolutionsCenter" in a larger, bold, blue font.

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