

# steel quiz

This month's quiz is all about industrial buildings. The answers can be found in the *AISC Specification*, *AISC Steel Construction Manual* and *AISC Design Guides*, as well as on the *AISC* and *Modern Steel Construction* websites ([www.aisc.org](http://www.aisc.org) and [www.modernsteel.com](http://www.modernsteel.com)).

- 1 True or False: The requirements in AISC 360 and AISC 341 are the same for buildings and nonbuilding structures similar to buildings.
- 2 True or False: It is appropriate to use the steel properties from AISC 360 Table A-4.2.1 for nonbuilding structures designed for elevated temperatures during normal service conditions.
- 3 Can a nonbuilding structure with a building-like structural steel system in Seismic Design Category D be designed with an  $R$  less than 3?
- 4 Is an ordinary moment frame connection allowed to be designed based on the moment and shear corresponding to an analysis using  $R = 1$ ?
- 5 Industrial structures are often exposed to extreme low and high temperatures. Which of the following properties are affected by changes in temperature?
  - a) Ductility
  - b) Yield Strength
  - c) Tensile Strength
  - d) Modulus of Elasticity
  - e) All of the Above
- 6 What is the most common way to resist very large shear loads at exposed base plate connections?
  - a) Friction
  - b) Anchor Rod Shear
  - c) Shear Lugs
  - d) Shear friction
- 7 Beams and columns in ordinary moment frames must comply with which of the following requirements specified in the *AISC Seismic Provisions*?
  - a) Width-Thickness Ratios
  - b) Stability Bracing
  - c) Protected Zone
  - d) None of the Above
- 8 True or False: Bolted end plate moment connections must be tightened such that no gaps exist between the faying surfaces, and failure to do so is cause for rejection.
- 9 In the design of crane runway beams, which of the following contribute to side thrust?
  - a) Runway Misalignment
  - b) Crane Skew and Steering
  - c) Trolley Acceleration
  - d) All of the above and Braking
- 10 True or False: The design of crane runway girders should consider fatigue.

TURN PAGE FOR ANSWERS

- 1 True. Although ASCE 7 may have different requirements for nonbuilding structures similar to buildings, neither AISC 360 nor AISC 341 differentiate between the two; the requirements apply equally to both.
- 2 False. The AISC *Specification* does list material properties at elevated temperatures in Appendix 4 *Structural Design for Fire Conditions*. However, the yield strengths listed are based on a 2% offset method because large deformations are acceptable in fire conditions. For design for sustained loading at elevated temperatures, values from a 0.2% offset method will be more appropriate.
- 3 Yes. ASCE 7 Table 15.4-1 “Seismic Coefficients for Nonbuilding Structures Similar to Buildings” has several steel lateral systems with  $R$  less than 3 that are allowed for use in Seismic Design Categories D, E or F. Some of these systems require design and detailing in accordance with AISC 341, even though the  $R$  is less than 3.
- 4 Yes. AISC 341 Section E1.6b(b) allows the connection to be designed for the maximum moment and corresponding shear that can be transferred to the connection by the system. The Commentary to this section lists using the forces based on an analysis with  $R = 1$  as one of the acceptable methods for determining this maximum load. As a shortcut to performing this additional analysis, an equivalent method is to use the original analysis and design the connection for amplified seismic forces with  $\Omega_0 = R$ .
- 5 e) In general, ductility increases with temperature and the remaining properties decrease with temperature.
- 6 c) Shear lugs are shop welded to the bottom of the base plate and can be designed to resist very large shear loads (see AISC Design Guide 1 for more information).
- 7 d) In general, there are requirements for width-to-thickness ratios, stability bracing and protected zones in the AISC *Seismic Provisions* (AISC 341). However, since ordinary moment frames are expected to undergo only minimal inelastic deformation, they are only required to meet the basic requirements in AISC 360; the AISC 341 requirements for width-thickness ratios and stability bracing and protected zone do not apply.
- 8 False. Whether a connection is specified as snug-tightened or pretensioned, the installation procedure as defined in the RCSC *Specification* involves bringing the connected plies into firm contact. Firm contact is defined by the RCSC *Specification* as plies solidly seated against each other, but also allows that the plies may not necessarily be in continuous contact. The Commentary to the RCSC *Specification* further points out that not reaching continuous contact is generally not detrimental to the performance of the joint. Shims may be used to attain solid seating of the plies, but gaps may still exist and are permissible.
- 9 d) According to AISC Design Guide 7 *Industrial Buildings*, all of these items can produce horizontal forces on a crane runway beam.
- 10 True. The runway girder must be designed considering the fatigue design requirements in AISC 360 Appendix 3.