

**S**TEEL QUIZ, A MONTHLY FEATURE IN *MODERN STEEL CONSTRUCTION*, allows you to test your knowledge of steel design and construction. Unless otherwise noted, all answers can be found in the *LRFD Manual of Steel Construction*. To receive a free catalog of AISC publications, circle #10 on the reader service card in the back of this magazine.

Send Steel Quiz Questions & Answers to Charlie Carter, AISC, One East Wacker Dr., Suite 3100, Chicago, IL 60601-2001; fax: 312/670-5403.

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## QUESTIONS:

1. For which of the following purposes is an intumescent coating used?
  - a. fire protection
  - b. to coat the faying surfaces of slip-critical connections
  - c. to touch-up abrasions and bare spots on galvanized members
  - d. none of the above
2. A cambered beam has additional flexural strength because of the prestressing effect that is induced during cambering, True or False?
3. Both the AISC *LRFD Specification for Structural Steel Buildings* and the RCSC *LRFD Specification for Structural Joints Using ASTM A325 or A490 Bolts* make reference to the *Guide* for the background of many concepts and issues in bolted construction. What is the *Guide*?
4. A WT tension member is connected to a gusset with six bolts (total) on two gage lines through its flange. What are the potential patterns of failure for block shear rupture?
5. Why is wind speed a factor in field work involving gas-shielded flux-cored arc welding (FCAW-g)?
6. What is AESS?
7. Within the limits as specified in AWS D1.1, which of the following discontinuities is allowed in welds?
  - a. porosity
  - b. undercut
  - c. cracking
  - d. convexity
8. A 2-in.-diameter headed anchor rod is ordered as ASTM A490. Is this acceptable?
9. A bridge girder to be hot-dip galvanized is too long to fit in the tank. However, the galvanizer indicates that it can be double dipped. What does this mean?
10. In steel design least weight always equals least cost, True or False?

## ANSWERS:

1. a. An intumescent coating is a special paint system that chars and expands, forming tiny air bubbles when exposed to the heat of a fire. The resulting expanded coating insulates the steel to slow the process of heat transfer and provide for the necessary hourly fire rating.
2. False. Camber affects only the service deformations and computed stresses at that level. The ultimate flexural strength, however, occurs in the inelastic range and therefore does not change.
3. The *Guide* is a short name for the *Guide to Design Criteria for Bolted and Riveted Joints*, Second Edition, by G.L. Kulak, J.W. Fisher, and J.H.A. Struik. In addition to the RCSC Specification and Commentary, this book is an invaluable reference on bolted construction.
4. Two potential patterns of failure for block shear rupture are illustrated below. The latter pattern was the subject of a paper in the *AISC Engineering Journal*, 4th Qtr, 1996, "Block Shear of Structural Tees in Tension-Alternate Paths," by Howard Epstein.
5. The molten weld metal in FCAW-g is shielded by an envelope of gas that is introduced as the weld is made. If the wind blows the gas shielding away, the molten weld metal is exposed to the atmosphere, which can be detrimental to the quality of the weld. For this reason, the FCAW-ss (self-shielded flux-cored arc welding) process is generally preferred in field work.
6. AESS stands for Architecturally Exposed Structural Steel. AISC *Code of Standard Practice* Section 10 covers fit, finish, and other related requirements for steel that is designated in the contract documents as AESS. Structural steel can be designat-

ed as AESS when the desired architectural effect or appearance of exposed structural steel is such that the additional cost of more stringent tolerances and preparation is justified.

7. a, b, and d. Porosity, undercut, and convexity are all acceptable within the limits specified in AWS D1.1. Cracking, however, is not permitted.
8. No. ASTM A490 is a structural bolt material specification that covers diameters up to and including 1½ in. (only). Additionally, it is doubtful that ASTM A490 material can be obtained in lengths suitable for anchor-rod applications, except by special order. ASTM A354 material (the strength equivalent to ASTM A490) is a suitable alternative when this strength level is required. Side note: ASTM A449 is similarly a suitable alternative for ASTM A325.
9. When double dipped, a member to be galvanized is first dipped to coat part of its length, flipped around, and dipped to coat the remaining length. If the visible region of galvanized overlap is acceptable, this practice markedly extends the practical range of length than can be galvanized.
10. False. Today, steel prices are lower and labor costs are higher, so the driving force in steel economy is the minimization of labor in fabrication and erection. In fact, the reckless pursuit of the least-weight assembly of members will most often result in a more costly structure because of the increased need for labor-intensive detail materials like stiffeners and reinforcing plates at the connections. With modern cost ratios, it is usually beneficial to trade some inexpensive additional steel weight in members to eliminate labor-intensive detail pieces. Your local fabricator can best show you where the cost is (and isn't).



## Question 4

