

STEEL 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 copy of the 1997 AISC Publications List, please call 800/644-2400 or fax 312/670-5403.**

QUESTIONS:

1. What is ASTM A572 grade 50 enhanced?
2. The permissible range of strain rate for use in tension testing of a steel coupon is specified in ASTM A370 Section 11.4.1. If the test is run at the maximum speed permitted therein, the resulting yield strength F_y will be greater than that which would be obtained had the test been run at the minimum speed permitted therein, True or False.
3. Why is pin bearing strength (LRFD Specification Section J8) lower than bolt bearing strength (LRFD Specification Section J3.10) for the identical standard hole size and material thickness (assume that edge distance is not a consideration)?
4. What is a spreader beam?
5. Why is the galvanizing of ASTM A490 bolts not permitted?
6. The relative cost of a CJP groove weld is approximately proportional to the amount of weld metal that must be deposited. Which of the following combinations of root opening and bevel angle is preferred for a tee joint involving a $\frac{3}{4}$ " plate thickness? A $\frac{3}{8}$ " plate thickness?
 - a. root opening = $\frac{1}{4}$ ", bevel angle = 45 degrees
 - b. root opening = $\frac{3}{8}$ ", bevel angle = 30 degrees
7. When making a fillet welded joint, the root gap is observed to exceed $\frac{1}{16}$ -in. This gap can be accounted for by increasing the fillet weld size by the amount of the root gap, True or False?
8. What do the abbreviations SMF and OMF stand for?
9. In the rehabilitation of an existing structure, a cover plate is to be added to the bottom of a non-composite wide-flange beam that is both compact and braced. The beam will remain under the existing dead load during modification. What impact does the presence of the existing dead load on the unreinforced cross-section have on the design of the reinforced cross-section for strength? For deflection?
10. Is the 1"-diameter bolt with head marking as illustrated below suitable for use in a slip-critical shear connection?

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ANSWERS:

1. It is an improved material specification for structural steel that is based on ASTM A572 Grade 50 but with additional chemical, tensile and optional supplementary requirements as specified in AISC Technical Bulletin 3, dated March 1997. AISC recommends that this material be specified as the basic grade of steel for building structures. To obtain a copy of this bulletin, fax your request to Jeri Irwin of AISC Marketing at 312/670-5403.
2. True. Unlike the tensile strength F_u , the yield strength F_y varies slightly with the range of strain rate that is permitted in ASTM A370.
3. In the latter case, the bolt head and nut provide confinement to the material that will undergo bearing deformations, which stiffens the material and increases the strength. However, a pin-connected assembly usually does not benefit from the same level of confinement and the design strength is lower.
4. A spreader beam, also known as a lifting beam, is a device that can be used in the hoisting process to favorably distribute the forces that are induced in a member during erection. For more information, see "Design and Construction of Lifting Beams" by David T. Ricker in the AISC Engineering Journal (4th Qtr 1991).
5. As indicated in the Commentary on the RCSC LRFD Specification for Structural Joints Using ASTM A325 or A490 Bolts, the as-produced tensile strength of ASTM A490 bolts can approach the range wherein embrittlement due to the introduction of hydrogen into the steel during the galvanizing process is a concern.
6. For the 3/4-in. plate thickness, (b) requires less weld metal. For the 3/8-in. plate thickness, (a) requires less weld metal.
7. True, per AWS D1.1-96 Section 5.22 (up to a 3/16-in. maximum root gap for most practical cases).
8. SMF and OMF are abbreviations for Special Moment Frame(s) and Ordinary Moment Frame(s), respectively. In high-seismic design, these distinctions (special and ordinary) denote moment-frame systems that offer differing levels of energy dissipation capability. SMF are designed and detailed to achieve a higher level of energy dissipation through inelastic deformations than are OMF.
9. The design strength of a non-composite wide-flange beam that is both braced and compact will be controlled either by the limit state of flexural yielding (strength) or the limit state of deflection (serviceability). From a strength perspective, the flexural yielding limit state occurs in the inelastic range (i.e., after stress is no longer proportional to strain), so the presence of stress due to the initial dead load is not of consequence. However, it is significant to the total deflection, which includes both the initial deflection of the unreinforced cross-section under the existing dead load and the subsequent deflection of the reinforced cross-section after the additional load is added.
10. No. The head marking shown is for an ASTM A449 Type 2 bolt. From LRFD Specification Section A3.3, the use of ASTM A449 bolts in slip-critical connections is prohibited. Thanks to Peter Higgins for contributing toward this question.