

Steel Quiz, a monthly feature in *Modern Steel Construction*, allows you to test your knowledge of steel design and construction. Answers can generally be found in the *LRFD Manual of Steel Construction*, 2nd edition, but other industry standards are often referenced.

Questions and answers for this month's *Steel Quiz* were submitted by **Lutfur R. Khandaker** of Computerized Structural Design, Inc. in Englewood, CO.

If you or your firm are interested in submitting a *Steel Quiz* question or column, please contact Keith Grubb at grubb@blacksquirrel.net

Questions

1. Are short slotted holes allowed in bearing type connections?
2. Can the connection material (i.e. plate or angle) encroach on the fillet of a wide flange shape?
3. True or False: In computing the net area for tension and shear, the width of a bolt hole shall be taken as $\frac{1}{16}$ " greater than the nominal dimension of the hole.
4. True or False: Finger shims are not allowed in slip critical connections.
5. True or False: Per the LRFD Specification, the critical buckling stress ($\phi_c F_{cr}$) for a compression member is the same for 36 ksi and 50 ksi materials when KL/r is 130 or above.
6. True or False: The minimum size of the fillet weld depends upon the thicker of the two parts joined, except that the weld size need not exceed the thickness of the thinner part.
7. True or False: The recommended minimum hole sizes for anchor rods are different in ASD and LRFD.
8. True or False: The bolt bearing value is not dependent upon the spacing and edge distance.
9. Is it permitted practice in U.S. to use galvanized ASTM A490 bolts?
10. True or False: Oversized holes are permitted in bearing type connections.
11. What are the requirements to prevent "rust-pack" in weathering steel connections.

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Answers

1. Yes. See the LRFD *Specification* Section J3.2 (page 6-79) or ASD *Specification* Section J3.2 (page 5-71).
2. Yes. See the fillet encroachment chart, Table 9-1 in Volume II of the LRFD *Manual* (page 9-12).
3. True. See LRFD *Specification* Section B2.
4. False. Per RCSC *Specification* Section 5.1, finger shims are allowed in bolted joints, including slip-critical connections. Their presence may reduce the strength of bearing connections, however, as indicated therein.
5. True. See LRFD *Specification* Tables 3-36 and 3-50.
6. True. Refer to LRFD *Specification* Section J2.2b.
7. False (trick question). Neither the ASD *Specification* nor the LRFD *Specifications* includes requirements for anchor-rod holes. Maximum hole sizes are recommended, however, in the *Manual*. Recently, larger hole sizes were recommended in AISC *Design Guide No. 1 Column Base Plates* to accommodate the high variability in the accuracy of concrete work today. These larger hole sizes have been incorporated into the LRFD *Manual* (see p. 11-57).
8. False. Refer to Section 5.3 of the 2000 RCSC *Specification for Structural Joints Using ASTM A325 or A490 Bolts*.
9. No. Galvanized ASTM A490 bolts are currently not permitted for use in the U.S. This is primarily because in the normal zinc coating process, the pickling of the bolts puts hydrogen in contact with the steel and not allowed to escape during the subsequent processing. Because the strength level of ASTM A490 bolts approaches the critical range, this trapped hydrogen may cause "hydrogen embrittlement" of the bolt and under stressed condition the bolt may fracture.
10. False. Oversized holes are permitted in any or all piles of slip critical connections, but they shall not be used in bearing type connections. Refer to LRFD *Specification* Chapter J.
11. If water is allowed to flow over overlapping joints, capillary action can draw the water into the joint and cause "rust-pack" to form. Therefore the contact surfaces of overlapping joints must be protected from intrusion of rainfall and runoff. The faying surfaces should be painted or sealed to prevent the capillary penetration in non-slip-critical bolted connections as well as to overlapped joints. In slip-critical bolted splices, "rust-pack" should not occur when the bolts are spaced as per AASHTO specifications. (See the Technical Advisory of FHWA).