Steel Quiz

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.

Many thanks to **Victor Shneur, P.E.**, of **LeJeune Steel Company** for contributing the questions and answers for this month's *Steel Quiz*.

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. Select all that apply: Bearing strength at bolt holes is dependent on:
   a. material being connected.
   b. type of bolt hole.
   c. presence or absence of threads on the bearing area;
   d. allowable deformation around the bolt holes.
   e. spacing.
   f. edge distance.

2. True or False? The block shear failure mode should be checked only at bolted connections.

3. Yes, No, or Maybe? Gaps may be present in column splices.

4. Why should simple shear connections have adequate inelastic rotation capacity?

5. Why would a bolt stick-through requirement decrease the ductility (ability to stretch) of A325 and A490 bolts?

6. What is the minimum corner radius of beam-web penetrations/openings?

7. List the four types of porosity in welds.

8. True or False? K-type braced frames are not permitted for Special Concentrically Braced Frames in Seismic Force Resisting Systems.

9. What is the purpose of a ceramic ferrule at the end of a headed shear stud?

10. What does the acronym FCAW-S stand for?

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Answers

1. a, b, d, e, and f.

2. False. It is also required to check the block shear failure mode around the periphery of welded connections.

3. Maybe. From AISC LRFD Specification Section M4.4, "*…lack of contact bearing not exceeding a gap of 1/16 in., regardless of the type of splice used [i.e., welded or bolted] is permitted.*" If the gap exceeds 1/16 in., but is less than 1/4 in., and an engineering investigation shows that the actual area in contact (within 1/16 in.) is adequate to transfer the load, then the gap is acceptable. Otherwise, from AISC LRFD Specification Section M4.4, the gap must be packed with non-tapered steel shims to within 1/16".

4. It is required to avoid overstress of the fasteners or welds.

5. From the section titled *Stickout* of the Structural Bolting Handbook (published by SSTC): *Bolt ductility (ability to stretch) is highest when the nut is flush with the end of the bolt because of the maximum number of threads available for stretching. [The greater the} stickout, the [more the] bolt's ductility is reduced because the stretch is limited to [a shorter] length of thread in the grip.*

6. The corners should have a minimum radius of at least twice the web thickness, or 5/8", whichever is greater. See *Beam-Web Penetrations* on page 12-11 of the 2nd ed. LRFD *Manual* for references and other requirements for beam-web penetrations.

7. Table B1 in AWS D1.5, the bridge welding code, lists the following types of porosity: uniformly scattered, cluster, linear, and piping.

8. True.

9. A ceramic ferrule is required to hold the molten weld metal in place and shield the arc.

10. Flux-cored arc welding—self-shielded. From Annex B of AWS D1.1-2000: *a flux cored arc welding process where shielding is exclusively proved by a flux contained within the tubular electrode.*