STEEL QUIZ

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 current AISC Publications List, please call 800/644-2400 or fax 847/364-1268.**

If you or your firm are interested in submitting a Steel Quiz column, please contact Scott Melnick at 312/670-5407 (email: melnick@aiscmail.com).

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QUESTIONS

1. What are the most likely modes of failure of cantilevered columns at bases during erection?

2. Is rolled steel an isotropic or an anisotropic material?

3. When ASTM A490 fully-tensioned bolts over one inch in diameter are used in slotted or oversize holes in external plies, why should a single hardened washer conforming to ASTM F436 with a 5/16-in. minimum thickness be used in lieu of the standard washer?

4. Why should ASTM A490 fully-tensioned bolts not be reused?.

5. What are the minimum and maximum yield stresses for ASTM A992 steel?

6. True or False? Block shear is a yielding limit state.

7. What is prying action?

8. When the gas metal arc welding (GMAW) process is specified for complete joint penetration welds, what is the suggested minimum nominal thickness of the backing bar?

9. List the four acceptable welding processes for prequalified complete and partial joint penetration welds.

10. Why it is not recommended to pretension high strength anchor rods?

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ANSWERS

1. AISC Design Guide 10, *Erection Bracing of Low-Rise Structural Steel Frames* Section 4.2 lists the following most likely modes of base failure for cantilevered columns during erection:

1. Fracture of the fillet weld that connects the column to the base plate.
2. Bending failure of the base plate.
3. Tension rupture of the anchor rods.
4. Buckling of the anchor rods.
5. Anchor rod nut pulling or pushing through the base plate hole.
6. Anchor rod "pull out" from the concrete pier or footing.
7. Anchor rod straightening.
8. Anchor rod "push out" of the bottom of the footing.
9. Pier spalling.
10. Pier bending failure.
11. Footing overturning.

2. Rolled steel is anisotropic material.

3. The commentary on *Specifications for Structural Joints Using ASTM A325 or A490 Bolts* (1994), Section C2, explains:

The requirement that heat-treated washers not less than 5/16-in. thick be used to cover oversize and slotted holes in external plies, when A490 bolts of 1-1/8-in. or larger diameter are used, was found necessary to distribute the high clamping pressure so as to prevent collapse of the hole perimeter and enable development of the desired clamping force.

4. ASTM A490 fully-tensioned bolts shall not be reused because when A490 bolts are repeatedly installed, they have a sharp decrease in induced bolt tension.

5. The minimum specified yield stress is 50 ksi and maximum specified yield stress is 65 ksi.

6. False. Block shear is a rupture or tearing phenomenon. Refer to the LRFD Specification Commentary Section J4 for detailed explanation.

7. From Part 11 of Volume II of the LRFD Manual, p. 11-6:

Prying action is a phenomenon associated with bolted construction and tensile loads only where either the connected fitting or the support deforms and thereby increases the tensile force in the bolt.

8. For this weld, the suggested minimum nominal thickness of backing bar is ¼ in. per AWS D1.1-98 Section 5.10.3.

9. LRFD Table 8-36 lists the following processes for prequalified complete and partial joint penetration welds:

1. Shielded metal arc welding (SMAW).
2. Submerged arc welding (SAW).
3. Gas metal arc welding (GMAW).
4. Flux cored arc welding (FCAW).

10. The LRFD Specification Commentary, Section A3.4, explains "...pretensioning anchor [rods] is not recommended due to relaxation and stress corrosion after pretensioning."