

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 312/670-5403.**

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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).

This month's steel quiz column was submitted by **Victor Shneur**, P.E., from LeJeune Steel Company in Minneapolis.

QUESTIONS:

1. What is killed steel?
2. What is the AISC washer requirement for fully-tensioned A490 bolts over one inch in diameter when these bolts are used in slotted or oversize holes in external plies?
3. Can A325 and A490 bolts be galvanized?
4. Please list the accepted procedures for fully tensioning high strength bolts.
5. When W-shapes are shop-spliced with complete/partial joint penetration welds, why should the web weld be applied first?
6. What is the effective size of a flare-V-groove weld?
7. Why is an increased weld throat allowed for fillet welds made by the submerged arc process?
8. What are the limit states for the HSS wall at a single-plate shear connection?
9. When is tension field action not permitted in plate girder design?
10. What is the maximum acceptable variation in elevation of the top of anchor rods?

ANSWERS

1. From ASTM A6, Section 3.1.9: "killed steel - steel deoxidized, either by addition of strong deoxidizing agents or by vacuum treatment, to reduce the oxygen content to such a level that no reaction occurs between carbon and oxygen during solidification."
2. From LRFD Specification Section J3.1: When fully tensioned A490 bolts over one inch in diameter are used in slotted or oversize holes in external plies, a single hardened washer conforming to ASTM F436, except with $\frac{5}{16}$ " minimum thickness, shall be used in lieu of the standard washer.
3. Per ASTM A325, A490 and the RCSC LRFD Specification for structural joints using ASTM A325 or A490 Bolts (June 3, 1995) Commentary C2, A325 bolts can be galvanized by the hot-dip galvanizing process or by the mechanical galvanizing process. A490 bolts should not be galvanized.
4. The RCSC LRFD Specification for Structural Joints Using ASTM A325 or A490 Bolts (June 3, 1994) section 8(d) describes the following four methods for fully tensioning high-strength bolts:
 - (1) Turn-of-Nut Tightening
 - (2) Calibrated Wrench Tightening
 - (3) Installation of Alternative Design Bolts
 - (4) Direct Tension Indicator Tightening
5. The web should be welded first, then the flanges. Welding the flanges first would place too much restraint on the web.
6. Per AWS D1.1-98 Table 2.1, the effective size of a flare-V-groove weld is $1/2R$ typically, except $3/8R$ for the GMAW process (except short circuiting transfer) when R is $1/2$ " or greater. Note R = radius of outside corner.
7. As explained in LRFD Commentary Section J2.2a, "This increased weld throat is allowed because the submerged arc process produces deep penetration of welds of consistent quality.
8. Base metal shear at weld and punching shear are the two limit states for the HSS wall at a single-plate shear connection.
9. Tension field action is not permitted for end-panels in non-hybrid plate girders, for all panels in hybrid and web-tapered plate girders, for all panels containing large web penetrations, when a/h exceeds 3.0 or $[260/(h/t_w)]^2$. Reference LRFD Specification Appendix G3.
10. As specified in the AISC Code of Standard Practice for Steel Buildings and Bridges (June 10, 1992) Section 7.5.1.c, the elevation of the top of anchor rods must not vary from the dimensions shown on the erection drawings by more than $\pm 1/2$ inch.