Steel Quiz

Steel Quiz, a monthly feature in *Modern Steel Construction*, allows you to test your knowledge of steel design and construction. All references to LRFD specifications pertain to the 1999 *LRFD Specification for Structural Steel Buildings*, available as a free download at www.aisc.org. ASD references pertain to the 1989 *ASD Specification for Structural Steel Buildings*. Where appropriate, other industry standards are also referenced.

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This month's *Steel Quiz* was created by the Steel Solutions Center at AISC. All of the questions and answers to the quiz have been taken from the latest RCSC *Specification for Structural Joints Using ASTM A325 or A490 Bolts* (dated June 23, 2000 and available for free download at www.boltcouncil.org). This Specification will be referred to as the "bolt spec" in this month's questions and answers.

Questions

1. What is a snug-tight bolted joint?
2. What methods are available to pretension high strength bolts?
3. When can oversized bolt holes be used?
4. Does the installed bolt pretension affect the shear or tensile strength of the bolt?
5. When should beveled washers be used?
6. Are washers required in snug-tightened joints?
7. When are short-slotted holes allowed in a pretensioned joint?
8. Which ASTM Specification must twist-off-type tension-control bolt assemblies meet?
9. How is *grip* defined?
10. What constitutes *sufficient thread engagement* in a bolted connection?

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Answers

1. According to the glossary of the bolt spec, a snug-tight joint is one in which the bolts have been installed in accordance with Section 8.1. The snug-tightened condition is the tightness that is attained with a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench to bring the plies into firm contact.

2. According to the bolt spec (Section 8.2), one of the pretensioning methods in Sections 8.2.1 through 8.2.4 shall be used (which covers turn-of-nut pretensioning, calibrated wrench pretensioning, twist-off-type tension-control pretensioning, and direct-tension-indicator pretensioning), except when alternative-design fasteners that meet the requirements of Section 2.8 or alternative washer-type indicating devices that meet the requirements of Section 2.6.2 are used, in which case, installation instructions provided by the manufacturer and approved by the EOR shall be followed.

3. Per Section 3.3.2, oversized holes are permitted to be used in slip-critical joints when approved by the EOR.

4. No. See Section 5.1.

5. According to Section 6.1.1 of the bolt spec, “When the outer face of the joint has a slope that is greater than 1:20 with respect to a plane that is normal to the bolt axis, an ASTM F436 beveled washer shall be used to compensate for the lack of parallelism.”

6. Washers are not required in snug-tight joints except when a beveled washer is needed per Section 6.1.1 (see the answer to *Steel Quiz* question 5) or when a slotted hole occurs in an outer ply.

7. According to Section 3.3.3 of the bolt spec, short-slotted holes are permitted in "pretensioned joints as defined in Section 4.2, provided the applied load is approximately perpendicular (between 80 and 100 degrees) to the axis of the slot. When approved by the Engineer of Record, short-slotted holes are permitted in any or all plies of slip-critical joints as defined in Section 4.3 without regard for the direction of the applied load."

8. ASTM F1852. See Section 2.7.1.

9. *Grip* is defined in the glossary of the bolt spec as "the total thickness of the plies of a joint through which the bolt passes, exclusive of washers or direct-tension indicators."

10. *Sufficient thread engagement* is defined in the glossary as “Having the end of the bolt extending beyond or at least flush with the outer face of the nut; a condition that develops the strength of the bolt.”