

steel quiz

LOOKING FOR A CHALLENGE?

Modern Steel Construction's monthly Steel Quiz tests your knowledge of steel design and construction. Most answers can be found in the 2005 *Specification for Structural Steel Buildings*, available as a free download from AISC's web site, www.aisc.org/2005spec. Where appropriate, other industry standards are also referenced.

This month's Steel Quiz was developed by **Victor Shneur** of the LeJeune Steel Company, Minneapolis. Sharpen your pencils and go!

- 1 How does bolt pretensioning affect the available shear and tensile strengths of ASTM A325 and A490 bolts?
- 2 When does the combined tension and shear stress in ASTM A325 and A490 bolts need not be investigated?
- 3 In single-angle shear connections at the end of a beam, when should the eccentricity on the welds be considered?
- 4 In single-angle shear connections at the end of a beam, when should the eccentricity on the bolts be considered?
- 5 How should the fillet weld between the plate of single plate shear connection and the support be sized?
- 6 Where can one find recommended maximum sizes for anchor rod holes in base plates?
- 7 Does the 2005 AISC *Specification* allow an increase in the strength of fillet welds depending on the direction of applied load?
- 8 Where can one find a design procedure for extended single plate shear connections?
- 9 **True or False:** The design procedure to determine the required thickness of a bolted hanger connection with prying action is based on F_u , the specified minimum tensile strength of the connected hanger flange.
- 10 When using the Uniform Force Method for bracing connections, what is the intent of applying Special Case 2?

TURN PAGE FOR ANSWERS

steel quiz

ANSWERS

1 The shear and tensile strengths of ASTM A325 or A490 bolts are not affected by pre-tensioning. Pre-tensioning affects the slip-capacity of the faying surfaces in the connection into which the bolts are installed.

2 Per the User Note in Section 3.7 of the 2005 *Specification*, "when the required stress, f , in either shear or tension, is less than or equal to 20 percent of the corresponding available stress, the effect of combined stress need not be investigated."

3 Eccentricity is always considered in the design of welds.

4 Per the procedure for single-angle connections on page 10-123 in the 13th Edition AISC *Steel Construction Manual*, the eccentricity on the bolts in a single-angle shear connection at the end of a beam should be considered:

- a. In the angle leg attached to the support;
- b. In the case of a double vertical row of bolts to the web of the supported beam;
- c. For bolts to the web of the supported beam if the eccentricity

exceeds 3 in. ($2\frac{3}{4}$ in. gage plus $\frac{1}{4}$ in. half web).

5 Per the procedure for single-plate connections on page 10-101 in the 13th Edition AISC *Steel Construction Manual*, this weld (on both sides of the plate) should be sized for as $\frac{5}{8}$ times the plate thickness, which is sufficient to develop the strength of either a 36 ksi or 50 ksi plate.

6 Table 14-2 in the 13th Edition AISC *Steel Construction Manual* lists recommended maximum sizes for anchor rod holes.

7 **Yes.** Section J2.4 of the AISC *Specification* permits a capacity based on the in-plane angle of loading with respect to the weld longitudinal axis. Tables 8-4 through 8-11 in the 13th Edition AISC *Steel Construction Manual* list coefficients for eccentrically loaded weld groups that include this permitted increase, as applicable.

8 The 13th Edition AISC *Steel Construction Manual* provides a design procedure for extended single plate shear connections starting on page 10-102. This procedure is useful for any single plate connection configuration

that does not meet the limitations of the conventional configuration.

9 **True.** Unlike the previous method for evaluating prying action in hanger connections, which was based on the specified minimum yield strength F_y , the current procedure employed in the 13th Edition AISC *Steel Construction Manual* is based on the tensile strength of the material. Otherwise, the procedure is similar to that used in the past.

This slight modification better matches the numerical prediction of prying action to that observed during the testing upon which the method is based. The current procedure is explained starting on page 9-10 of the *Manual*.

10 Special Case 2 is useful for braced-frame connections to minimize shear in the beam-to-column connection, such as when the calculated shear would otherwise require a non-standard beam shear connection. Essentially, the gusset plate is used as a haunch in addition to being the end connection for the bracing member. See page 13-7 in the 13th Edition AISC *Steel Construction Manual* for the suggested application and design concept.