

STEEL QUIZ

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QUESTIONS

1. True or False? The nominal lateral design force to be applied at the top of the rail on crane runways is required to be 20 percent of the sum of weights of the lifted load, crane trolley and all other moving parts of the crane.
2. The in-plane gusset plate design strength in tension yielding and compression buckling in a diagonal brace connection may be conservatively estimated by utilizing which of the following:
 - a. Whitney Stress Block
 - b. Web Buckling Criteria
 - c. Whitmore Section
 - d. Web Crippling Criteria
 - e. Net Section Area
3. What is the maximum recommended spacing of building expansion joints in an unheated, steel-framed, rectangular warehouse, assuming the column bases are pinned and the expected temperature variation is 70 degrees F?
 - a. 500 feet
 - b. 400 feet
 - c. 300 feet
 - d. 267 feet
4. Can high-strength bolts be considered to share the load in combination with welds in the same connection?
5. True or False? Tension-only bracing members are permitted in concentrically braced frames (CBFs) in one and two story buildings assigned to Seismic Categories D and E.
6. A composite steel beam has 20 studs field welded through steel decking to the top flange. How many studs require field testing?
7. What is the maximum effective length of a fillet weld loaded by forces parallel to the weld, such as in a lap splice?
 - a. 70 times the fillet weld leg
 - b. 50 times the fillet weld leg
 - c. no limit
 - d. smaller width of the two connected elements
8. True or False? A hardened washer is not required where an A325 bolt is installed and tightened in a short slotted hole in an outer ply.
9. For Ordinary Steel Moment Frames, Seismic Provisions for Structural Steel Buildings (AISC, April 15, 1997) requires the connection flexural strength M to be at least $1.1R_yM_p$ of the girder. For what do the coefficients 1.1 and R_y account?
10. What is the AISC allowable plan erection tolerance for cantilevered members?

ANSWERS

1. False. In AISC LRFD Specification Section A4.3, a minimum of 20 percent of the lifted load and crane trolley shall be considered, but other parts of the crane may be excluded.
2. c. The Whitmore Section width is defined by the intersection of two imaginary lines oriented 30 degrees outward from the bolt row farthest from the brace member-end with an imaginary line perpendicular through the bolt row nearest to the brace member-end. The stress in the gusset plate is estimated by dividing the brace force by the effective cross-sectional area (the Whitmore section width times the gusset plate thickness). The computed gusset plate stress is compared to the tensile yield strength, or the compression buckling strength based on the laterally unbraced portion of the gusset plate acting as a column. Examples of this procedure may be found in the AISC LRFD Manual Volume II, Chapter 11 and in "Connections" (Thornton and Kaner, McGraw-Hill, 1997).
3. d. From the AISC LRFD Manual Volume I, page 1-13, since the building is unheated, the specified maximum spacing from Figure 1-1 of 400 feet should be decreased by 33 percent.
4. Yes, if the bolts are designed as slip critical. From AISC LRFD Specification Section J1.9, high-strength bolts in slip-critical connection are permitted to share the load with welds only if the bolts are fully tensioned before the welds are made. However, welds in bearing-type bolted connections must be designed for the entire load.
5. True. Per the latest AISC *Seismic Provisions for Structural Steel Buildings* (April 15, 1997) section 14.5 and Commentary section C14.5, the special provisions for OCBF systems in one or two story buildings may be waived if the seismic resisting system has been designed using the amplified seismic loads given in load combinations 4-1 and 4-2 of the Provisions.
6. Probably none. Only two studs need to be tested at the beginning of each shift's production. If those two studs are not on the beam in question, none on the beam require testing. Studs welded directly to the top flange of the beam (that is, not through decking,) are considered pre-qualified and do not require testing, assuming the beam is made of a steel that qualifies as a Group I or II steel per AWS D1.1. See ANSI/AWS D1.1, Chapter 7, Stud Welding, for details.
7. a. From AISC LRFD Specification Section J2.2b, a uniform stress distribution may be assumed over a length of 70 times the fillet weld leg.
8. False. The LRFD Specification for Structural Joints Using ASTM A325 or A490 Bolts (June 3, 1994) section 7(c) (6) states that "Where A325 bolts of any diameter and A490 bolts equal to or less than 1 in. in diameter are to be installed and tightened in an oversize or short slotted hole in an outer ply, a hardened washer conforming to ASTM F436 shall be used".
9. Per the latest AISC *Seismic Provisions for Structural Steel Buildings* (April 15, 1997) section 6.2, the coefficient R_y is to account for the Expected Yield Strength of the connected member which will normally be higher than the specified minimum value (F_y). From the Provisions Commentary section C11.2, the coefficient 1.1 is to account for strain hardening of the connected member.
10. From the AISC Code of Standard Practice for Steel Buildings and Bridges (June 10, 1992) section 7.11.3.2(e). "The elevation and alignment of cantilevered members shall be considered plumb, level and aligned if the angular variation of the working line from a straight line extended in the plan direction from the working point at its supported end does not exceed 1:500." See also section 7.11 in the Commentary on the Code of Standard Practice for practical construction considerations when designing frame members.

Note: Check out AISC's newest publications:

- LRFD Manual of Steel Construction, Metric Conversion of the 2nd Edition (items M022, M023)
- Design Guide 12: Modification of Existing Steel Welded Moment Frame Connections for Seismic Resistance (item D812)
- Design Guide 13: Wide-Flange Column Stiffening at Moment Connections (item D813)

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