

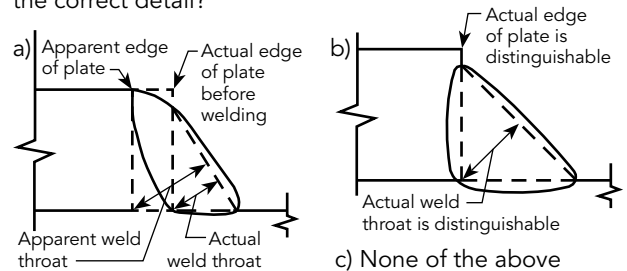
steel quiz

This month's quiz is all about industrial buildings. Most of the answers can be found in the *AISC Specification*, *AISC Steel Construction Manual* and *AISC Design Guides*, as well as on the AISC and *Modern Steel Construction* websites (www.aisc.org and www.modernsteel.com).

- 1 Use of the _____ yield strength is recommended when checking lateral-torsional buckling of crane girders built up from an A36 cap channel and A992 wide-flange.
a) Smaller b) Larger c) Average
- 2 True or False: When checking shear strength in plate girders, single-sided transverse stiffeners are required to be attached to the compression flange.
- 3 True or False: Tapped holes in structural steel plates are easily used in lieu of a high-strength nut for structural steel connections.
- 4 True or False: Post weld heat treatment (PWHT) is not required for thick flanges of hot-rolled wide flanges subjected to seismic loading.
- 5 True or False: Web-tapered member design requirements are included in an Appendix to the *AISC Specification*.
- 6 True or False: Chapter M in the *AISC Specification* requires drain or vent holes in all HSS.
- 7 True or False: In general, welding of quenched and tempered fastener components (such as bolts and

nuts) is not recommended as it can affect the material properties in unpredictable ways.

- 8 *AISC Specification* Section J2.2 provides a maximum weld size for thicknesses greater than $\frac{1}{4}$ in. to ensure sufficient edge remains. Which figure below illustrates the correct detail?



- 9 *AISC Specification* Table J2.4 provides the minimum fillet weld sizes that are based on "material thickness of the _____ part joined."
a) thicker b) thinner
c) average d) None of the above
- 10 True or False: The *AISC Specification* allows bolt holes to be thermally cut. **TURN PAGE FOR ANSWERS**

- 1 a) Smaller. Crane girder design is discussed in Section 18 of AISC *Design Guide 7, Industrial Buildings—Roofs to Anchor Rods* (www.aisc.org/dg). It states on page 57 that “If A36 channel caps are used on A992 steel beams, lateral-torsional buckling requirements must be based on the A36 material. Also, the weak axis strength must be based on the channel cap material.” Bonus info: Did you know that 50-ksi channels are increasingly common today?
- 2 True. This is discussed in AISC 360 Section G2.2 and its associated Commentary. A connection to the compression flange is required for single-sided stiffeners in order to resist uplift due to torsion in the flange. This requirement applies whether or not tension field action is considered.
- 3 False. The nuts used with high-strength bolts are matched so that they develop the strength of the shank of the bolt. This simplifies the design of the connection by eliminating failure modes like thread stripping. Using a tapped plate in lieu of a properly matched nut would require much more than the usual bolting limit states to ensure a proper design.
- 4 True. PWHT is not required in the AISC *Specification* or in the AISC *Seismic Provisions*. The use of PWHT is not common in steel building construction. (If you’re welding a steel tank, however, Section 5.8 of AWS D1.1-10 provides guidance.)
- 5 False (but take half a point if you know that it used to be true). Recent AISC specifications have eliminated the old appendix, and current design recommendations can be found in AISC *Design Guide 25, Frame Design Using Web-Tapered Members*.
- 6 False. The AISC *Specification* does not require vent or drain holes in all HSS. However, it does require that water be kept out of the member, both during construction and in the final structure. AISC *Specification* Section M2.10 states: “When water can collect inside HSS or box members, either during construction or during service, the member shall be sealed, provided with a drain hole at the base or protected by other suitable means.”
- 7 True. AISC *Design Guide 21, Welded Connections—A Primer for Engineers* Section 4.5.2 says: “As a general principle, welding should not be done on bolts or nuts. However, if essential, the composition of the bolt (and nuts, if involved) must be carefully considered.” In addition, standard structural fastener material standards, such as A563 for nuts, are not considered prequalified by AWS D1.1 Clause 3; thus the weld would need to be qualified per AWS D1.1 Clause 4.
- 8 b) For lap joints over ¼ in. thick, it is possible for the welder to melt away the upper corner, resulting in a weld that appears to be full size but actually lacks the required weld throat dimension as shown in answer (a). Accordingly, the maximum fillet weld size is ¼ in. less than the plate thickness, t , which is sufficient to ensure that the edge remains as shown in answer (b). Below ¼-in. thickness, t , the full weld throat is achieved, even if the edge is melted away.
- 9 b) The minimum fillet weld size is based on the thinner part joined. This is a change from practice long ago that has been made possible by use of low-hydrogen consumables and modern preheat requirements.
- 10 True. AISC 360 Section M2.5 states: “...thermally cut [bolt] holes are permitted with a surface roughness profile not exceeding 1,000 μin . (25 μm) as defined in ASME B46.1. Gouges shall not exceed a depth of ¼ in. (2 mm). Water jet-cut holes are also permitted.” The Commentary clarifies that “the use of controlled or mechanically guided equipment is anticipated for the forming of thermally cut holes.”



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