steel quiz

This month's Steel Quiz is all about angles. Look to the 2010 AISC *Specification* and 14th Edition AISC *Manual* for guidance.

1 True or False: The geometric axes of any shape define two orthogonal axes that correspond to the maximum and minimum moments of inertia for that section.

2 Section E5(a) in the 2010 AISC *Specification* gives provisions for angles that are "…web members of planar trusses with adjacent web members attached to the same side of the gusset plate or chord…" Why is it important for adjacent web members to be attached to the same side?

3 For an L6×4×⅜ angle, where can one look up the elastic section modulus about the W-axis at point C on the cross section, S_{wC}? (See idealized illustration in Figure 1.)

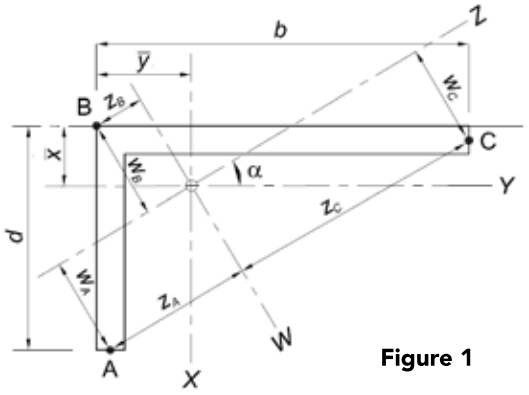

Figure 1

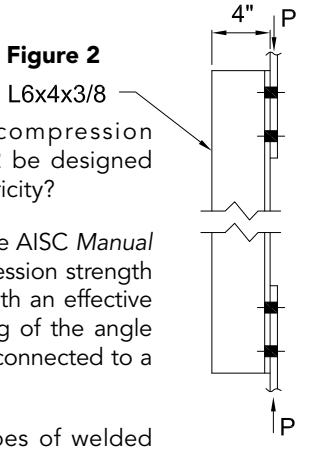

Figure 2

4 Can the single-angle compression member shown in Figure 2 be designed while neglecting the eccentricity?

5 Use the tables in Part 4 of the AISC *Manual* to calculate the axial compression strength of an A36 L8×4×7⁄16 angle with an effective length of 10 ft. The long leg of the angle is the attached leg and it is connected to a ⅝-in. gusset plate.

6 Figure 3 illustrates two types of welded angle connections. In the first connection, the welds are balanced about the neutral axis of the angle. In the second, the welds are balanced about the center line of the angle.

True or False: The 2010 AISC *Specification* does not permit the use of welds balanced about the center line of the angle unless provisions are made for the eccentricity.

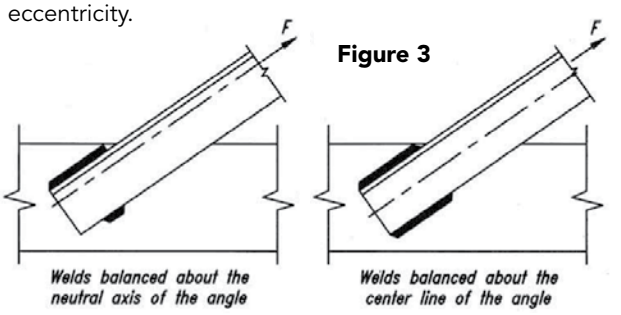

Figure 3

TURN PAGE FOR ANSWERS

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1 False. The principal axes (which are not always the geometric axes) correspond to the maximum and minimum moments of inertia for that section. Depending on the shape, they can be the same as the geometric axes (such as for a wide-flange shapes) or different (such as for angles).

2 At most panel points, one web member is in compression while the other is in tension. If they are applied to the opposite sides of the gusset or WT stem, web axial forces will cause a couple that creates torsion in the chord.

3 S_{wC} = 3.86 in^3 can be found along with others that are provided in the AISC Shapes Database, which is a free download at **www.aisc.org/shapesdatabase**.

4 Yes, if the design is performed using Section E5 of the AISC *Specification*. Section E5 provides a simplified design approach that permits eccentricity to be neglected as long as certain criteria are met. In this case, the member is loaded at the ends in compression through the same leg; the member is attached with a minimum of two bolts; there are no intermediate transverse loads; $b/t < 20$; and the long leg width to short leg width ratio is less than 1.7. As a result, it meets the criteria required to permit neglect of this eccentricity in the design.

5 Per Table 4-12 in the AISC *Manual*, the angle compressive strength is equal to:

LRFD: $\phi_c R_n$ = 34.9 kips ASD: $\frac{R_n}{\Omega_c}$ = 22.7 kips

6 False. Section J1.7 in the 2010 AISC *Specification* contains provisions on the placement of welds and bolts and states: "Groups of welds or bolts at the ends of any member which transmit axial force into that member shall be sized so that the center of gravity of the group coincides with the center of gravity of the member, unless provision is made for the eccentricity. The foregoing provision is not applicable to end connections of single-angle, double-angle and similar members." Note that this does not apply to angles that are subjected to cyclic loading, which would require balanced welds.