

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 AISC's Bender and Roller Committee. (Visit www.aisc.org/benders for a list of members and their locations.) Sharpen your pencils and go!

- 1 **True/False:** The true radius of material bent into a spiral/helix geometry is always larger than its plan view radius.
- 2 The neutral bending axis (location where no elongation or compression of material occurs) of an angle is located:
 - a. at the heel of the angle
 - b. in the center of the angle leg
 - c. closer to the toe of the angle leg being curved across its width
 - d. closer to the heel of the angle leg being curved across its width
- 3 **True/False:** The thinner the wall thickness of tubing being bent, the easier it is to bend with minimal distortion.
- 4 How much arc length is there (in inches) in a 90° bend on a 60" radius?
 - a. 75 $\frac{3}{8}$ "
 - b. 102 $\frac{1}{2}$ "
 - c. 47 $\frac{1}{8}$ "
 - d. 94 $\frac{1}{4}$ "
- 5 **True/False:** If you take any steel shape (i.e. rectangular tubing, pipe, angle, etc.) and bend it while holding tangents, with one tangent longer than the other, it does not matter which side of the bend the shorter or longer tangent is on.
- 6 Curving steel can be done by which of the following methods?
 - a. three-roll bending
 - b. four-roll bending
 - c. heat induction bending
 - d. ram bending
 - e. all of the above
- 7 What is the formula for determining the ovality of a pipe?
- 8 Bending of a rectangular tube is called bending "the hard way" when:
 - a. it is bending against the strong axis
 - b. it is the most difficult way to bend without distortion
 - c. it is bending on the y-y axis
 - d. all of the above
- 9 A flat-top straw hat with a brim but without the top would look something like:
 - a. an angle rolled leg-out
 - b. an angle rolled leg-in
 - c. an angle rolled apex-up
 - d. an angle rolled apex-out
 - e. an angle rolled apex-in
- 10 **True/False:** The best way to find answers to your questions about bending is to contact your local bender.

TURN PAGE FOR ANSWERS

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ANSWERS

1 True. The actual radius is derived by calculating the hypotenuse of a right triangle, with the plan diameter as the base of the triangle and the height in 180° of plan view arc (based on the elevation gain of the helix in a given degree of plan view arc) as the side of the triangle.

2 d. Angle is not symmetrical about the width of one leg of the angle. More mass is located closer to the heel because of the other leg.

3 False. The thinner the tube wall, the less mass the material has in its cross section to be structurally self-supporting. The inside wall of the tube undergoes compression during bending, and this will result in wrinkling or buckling at a certain minimum radius limitation. Based on the identical bend configuration, radius, and procedures, ¼" wall tubing will not bend to as tight a radius as a ⅜" wall with the same distortion.

4 d. Arc length can be calculated with the given information in one of two ways:

1. radius × degree × tangent of 1
(60" × 90 × .01745)

or

2. diameter × π × fraction of 360°
(120" × 3.14159... × .25)

5 False. On a piece of rectangular tubing or pipe, for instance, it does not matter because these materials are symmetrical in relation to their neutral axis and the part can be flipped end for end. An angle, on the other hand, is not symmetrical in relation to its neutral axis and would not be the same if flipped end for end.

6 e. There are several ways to bend a piece of steel as this list indicates, and any bending company will be able to do a range of these. Each method has its own advantages and disadvantages. For more information, see "What Engineers Should Know About Bending Steel" in the May 2006 issue of MSC, available online at www.modernsteel.com.

7 $(D_{\max} - D_{\min})/OD$. This is the difference between the minimum diameter of the pipe and the maximum diameter

divided by the outside diameter of the pipe, usually expressed as a percentage.

8 a. Bending a steel member around the strong axis is known as the "hard way," and bending around the weak axis is known as the "easy way."

9 a. It should be noted whether angle and channel legs are "in" or "out"—otherwise the bending company will have to send an RFI.

10 True. Bending and rolling companies have specialized knowledge they can share with you as you are planning your next bending or rolling project. Not sure about who your local bender is? Visit www.aisc.org/benders for list of AISC member benders in your area.

Anyone is welcome to submit questions for Steel Quiz. If you are interested in submitting one question or an entire quiz, contact AISC's Steel Solutions Center at 866.ASK.AISC or at solutions@aisc.org.



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