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 Steel Solutions Center. Sharpen your pencils and go!

1 What does C_b represent?

2 What value of C_b is permitted to be used for a simple span beam, braced at each end, supporting a uniform load for the entire span length?

3 What is the difference between Z_x and S_x?

4 Neglecting the fillets, how is Z_x of a W-shape calculated?

5 Where can one find a summary of the appropriate limit states required to be checked for a flexural member of a specific shape configuration?

6 When is it permitted to use the plastic section modulus Z_x for a flexural member design?

7 What is L_p and how is it determined?

8 How is the weak-axis nominal flexural strength of a compact W-shape determined?

9 How is the nominal flexural strength of a compact round HSS determined?

10 How is the nominal shear strength of a round HSS determined?

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ANSWERS

1 C_b designates the lateral-torsional buckling modification factor for non-uniform moment diagrams when both ends of the unsupported segment are braced. Equation (F1-1) of the AISC specification defines the permitted C_b.

2 C_b = 1.14 is permitted for this case. See Table 3-1 in the 13th edition *Steel Construction Manual* for values of C_b for other support conditions for simply supported beams.

3 Z_x represents the plastic section modulus about the X-axis of a shape, where the full cross-section of the shape has yielded. S_x represents the elastic section modulus about the x-axis of a shape where the extreme fibers of the cross-section have reached the yield point.

4 Neglecting the fillets:

$Z_x = [(b_f\, t_f)(d - t_f)] + [(t_w)(d - 2t_f)^2/4]$ for a W-shape.

5 These limit states are provided in Chapter F of the 2005 AISC specification. Table User Note F1.1 in the 2005 specification provides a guide for the application of Chapter F Sections.

6 The plastic section modulus Z_x is permitted to be used in the design of a flexural member if: (1) the slenderness of all elements in the cross-section is $\leq \lambda_p$; and (2) the unbraced length of the member is $\leq L_p$.

7 L_p is the limiting laterally unbraced length of a flexural member for the limit state of yielding:

$L_p = 1.76\, r_y\, \text{sqrt}\, (E/F_y)$
Equation (F2-5)

8 The weak-axis nominal flexural strength of a compact W-shape is based on the limit state of yielding (plastic moment):

$M_n = M_p = F_y\, Z_y \leq 1.6\, F_y\, S_y$
Equation (F6-1)

9 The nominal flexural strength of a compact round HSS is based on the limit state of yielding (plastic moment):

$M_n = M_p = F_y\, Z$
Equation (F8-1)

10 The nominal shear strength of a round HSS is calculated based on the critical shear stress times one-half of the gross area of the cross section:

$V_n = F_{cr}\, A_g/2$
Equation (G6-1)

Anyone is welcome to submit questions and answers 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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