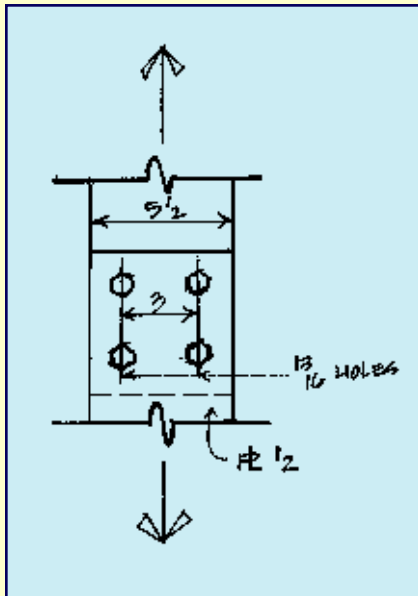


STEEL QUIZ, A MONTHLY FEATURE IN *MODERN STEEL CONSTRUCTION*, allows you to test your knowledge of steel design and construction. Unless otherwise noted, all answers can be found in the *LRFD Manual of Steel Construction*. To receive a free catalog of AISC publications, circle #10 on the reader service card in the back of this magazine.

QUESTIONS:

- From LRFD Manual Table 8-2, the thickness of an ASTM A563 nut for a $\frac{3}{4}$ -in. diameter ASTM A325 bolt is listed as $\frac{7}{16}$ in. What is the significance of this thickness?
- Composite beam design flexural strength is unaffected by whether the construction is shored or unshored, True or False?
- For the plate shown, what is the net tension area that would be used to calculate the block shear rupture design strength?



- A bolted tension hanger has been selected with a $\frac{3}{4}$ -in. flange thickness to satisfy

prying action. Must the designer now check the bolts for the sum of the applied tension and the additional tension due to prying action?

- In a typical "AISC" composite column, what percentage of the gross cross-section must the steel shape comprise for the AISC Specification to be applicable?
- Which of the following is not true about end returns:
 - their presence is considered in strength calculations
 - they help to ensure that the weld size is maintained over the full length of the weld
 - they enhance fatigue resistance
 - they enhance inelastic deformation capacity
- What is the theoretical K factor for a column that is fixed at the base and free at the top?
- For the top stabilizing angle in a seated connection, which of the following is true:
 - it must be field welded
 - it can be omitted if metal deck is present and sufficient to stabilize the beam in the final erected state
 - it must be thick enough to prevent significant deformation under load
 - none of the above
- AISC recommends that fillet welds connecting a heavy-bracing gusset plate to a beam or column be selected for the larger of the peak stress or 1.4 times the average stress. Why?
- In a chevron-configuration eccentrically braced frame, the length of beam between braces that is subject to inelastic action for energy dissipation is known as what?

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STEEL QUIZ

ANSWERS

1. ASTM A563 nut thickness is selected such that its strength exceeds that of the corresponding bolt. Accordingly, bolt design is simplified because the strength of the bolt shank will always be critical.
2. True and recognized in AISC's LRFD Specification. Because the nominal flexural strength is achieved after the composite beam has been loaded into the inelastic range (i.e., where stress is no longer proportional to strain), initial stresses in unshored construction need not be considered for the final composite cross-section. Note that the steel beam is checked under the wet weight of concrete separately.
3. For this plate, two block shear rupture patterns are possible: (1) a central block tearing out between the gage lines; or, (2) two edge blocks tearing out outside the gage lines. Because the shear planes for both modes are identical, the controlling mode depends upon which mode has the lesser tension area. For mode (1) the net width subject to tension after deducting for bolt holes is $2\frac{1}{8}$ in. For mode (2) the net width is $1\frac{5}{8}$ in. Mode (2) controls and the corresponding net tension area is 0.813 in.²
4. No. When the fitting thickness is properly selected in accordance with the AISC Manual prying action procedure, the per-bolt sum of the applied tension and the prying force will always be less than or equal to the per-bolt design strength.
5. From LRFD Specification Section I2.1, "... the steel shape, pipe, or tubing shall comprise at least four percent of the total composite cross-section."
6. a. End returns are normally not considered in strength calculations. LRFD Specification Commentary Section J2.2b provides the background discussion.
7. The theoretical K factor for this column is 2.0 because the column tends to buckle in the shape of a member that is twice the actual length; for design purposes, the $K = 2.1$ is recommended in LRFD Specification Commentary Table C-C2.1.
8. d. From LRFD Manual pages 9-128 through 9-146, the top stabilizing angle in a seated connection (stiffened or unstiffened) can be welded or bolted, is always required for erection stability as well as minor participation in the carrying load, and should be selected with a thickness that is small enough to accommodate the deformation required for simple beam rotation.
9. LRFD Manual page 11-27 indicates that "... when the gusset is directly welded to the beam or column, the connection must be designed for the larger of the peak stress and 1.4 times the average stress; this 40 percent increase is recommended to provide ductility to allow adequate force redistribution in the weld group."
10. The *link*. Inelastic action can be achieved either through shear yielding, which is preferred, or flexural yielding.

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