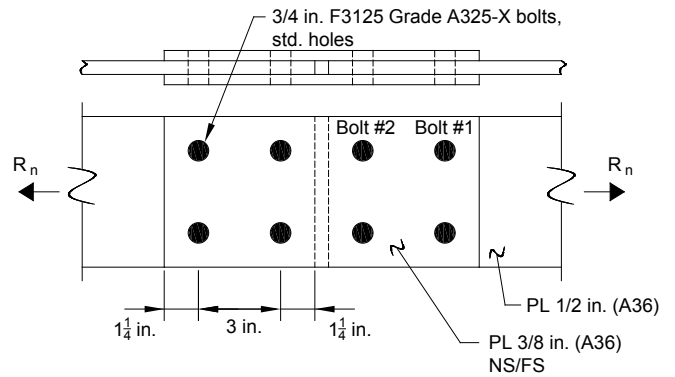# steel quiz

This month's Steel Quiz is based on the May 2017 SteelWise article "A Tale of Tearouts," which can be found in the Archives section at **www.modernsteel.com**.

1 True or False: The limit state of bolt tearout has been removed from the 2016 *Specification for Structural Steel Buildings* (ANSI/AISC 360-16, available at **www.aisc.org/specifications**).

2 When one multiplies the least strength of any of the bolts in a connection by the total number of bolts in the connection, this typically conservative method has been referred to as the:
   a. KISS method
   b. Create Flintstones designs method
   c. Poison bolt method
   d. Bolt supplier method

3 True or False: The *Specification* contains a requirement on how to sum the individual bearing/shear strengths of the bolts.

4 True or False: Tearout between bolt holes, in addition to bolt bearing, is a possible limit state.

5 True or False: Tearout along the edge will generally not govern if the thickness of the plies is equal to the bolt diameter.

6 When determining the strength of a bolt group, how many limit states need to be considered? Bonus points for listing each limit state by name.

7 Determine the maximum permitted nominal strength, R_n, based on the strength of the bolt group for the connection shown in Figure 1, below. Use Tables 7-1, 7-4 and 7-5 in the 15 Edition AISC *Steel Construction Manual* (**www.aisc.org/manual**).

▼ Figure 1
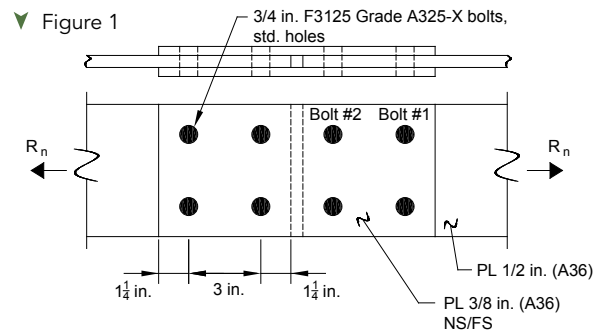
TURN PAGE FOR THE ANSWERS

1 False. A minor change was made in the 2016 *Specification*, where the bolt bearing and tearout checks have been broken into two separate equations.

2 **c.** Poison bolt method. This method can be less work for the designer but can also result in a significant reduction in the predicted strength of a bolted connection.

3 False. A user note is provided in Section J3.6 of the 2016 *Specification*, describing the preferred method, but other options, such as the poison bolt method mentioned in question 2, could be used. An additional method is also discussed in the Commentary.

4 True. However, for common connection configurations, tearout is typically not a concern between the rows of bolts.

5 True.

6 Five limit states: (1) bolt shear, (2) bearing on the main material, (3) bearing on the connection material, (4) tearout on the main material and (5) tearout on the connection material.

3/4 in. F3125 Grade A325-X bolts, std. holes

Bolt #2   Bolt #1

R_n R_n

PL 1/2 in. (A36)

PL 3/8 in. (A36) NS/FS

$1\frac{1}{4}$ in.   3 in. $1\frac{1}{4}$ in.

7 $R_n = \left(2 \text{ bolts} \times 44 \dfrac{\text{kips}}{\text{bolt}}\right) + \left(2 \text{ bolts} \times 29.3 \dfrac{\text{kips}}{\text{bolt}}\right) = 146.6 \text{ kips}$