This month’s Steel Quiz looks at the proper use of washers.

Use the 2014 RCSC Specification to correctly determine the placement of any required washers in the figures below. (You can download the RCSC Specification for free at www.boltcouncil.org.)

1 Snug-Tightened Joint
Gr. 50 PL
w/ SSLT. Hole
A325 Bolt

2 Tension-Control Bolt
Pretensioned Joint
A36 PL
w/ STD. Hole
Gr. 50 PL
w/ STD. Hole
ASTM-F2280 Bolt

3 Calibrated Wrench
Pretensioned Joint
Gr. 50 PL
w/ STD. Hole
A490 Bolt
Turned Element
A36 PL
w/ STD. Hole

4 Direct-Tension-Indicator
Pretensioned Joint
Gr. 50 PL
w/ STD. Hole
Gr. 50 PL
w/ STD. Hole
Gr. 50 PL
w/ STD. Hole
A490 Bolt
DTI Gap Measured Here
Turned Element

TURN PAGE FOR ANSWERS
Notes:
1. Though the joint is not pre-tensioned, a washer is required to completely cover the slotted hole.
2. The round head of the ASTM F2280 bolt provides a bearing area similar to a standard washer, hence the explicit exception provided in RCSC Specification Section 6.2.1.
3. One washer is required under the turned element and another to account for the A490 bearing on A36 material.
4. The direct-tension indicator (DTI) bumps must bear against a hardened surface (a washer, the nut or the bolt head) but cannot bear directly against the turned element (the nut in this case).