

Specification for implementing DuraSquirt Direct Tension Indicators in accordance with RCSC - 2014

All DuraSquirt DTIs (DS-DTI) are Verification DTIs; which are enhanced versions of ASTM F959¹ DTIs. A Calibrated Gap for each lot has been provided that corresponds to the minimum installation tension requirements of the RCSC/AISC. DS-DTIs are thus to be implemented with the following as per the RCSC.

Hardware Verification Testing

The nut, bolt and washers (an assembly) shall be verified as suitable for use by the bolting crew and inspector; employing the following procedure and referenced RCSC sections:

1. Tighten 3 or more assemblies including the DS-DTI (using washers per Section 6 and oriented by Figure C-8.1) until squirt media is beyond the outer diameter in all locations, known as complete indication.
2. Verify the space formed by bumps of the DS-DTI is smaller than the calibrated gap around half (or more) of the DS-DTIs circumference; thus confirming achievement of minimum tension.

Installation

Assemblies shall be installed by the following procedure and referenced RCSC sections:

1. Install assemblies with the DS-DTI in the same manner as verification testing and ensure snug steel. If the DS-DTI gap is reduced to nil while snugging, the identified assemblies shall be replaced. See Section 8.1.
2. From the most rigid part of the joint, assemblies are to be fully tensioned until squirt indication is complete.

Inspection

Routinely inspect DS-DTIs implementation by the following procedure:

1. Observe the hardware verification testing and adherence to the snug step of installation.
2. Following tensioning, confirm complete indication of squirt media of the inspected DS-DTI assemblies. No further evidence or investigation is required in these cases.
3. When prevailing installation methods are employed to reduce the DS-DTIs bumps to less than the calibrated gap, inspection ratios acceptable to the site less than 100% may be used.²

A tension that is greater than the value in table 8.1 is not cause for rejection when using ASTM, and similar hardware. The ultimate shear strength of a bolt is not affected by the pretension in a bolt (Kulak et al. Guide to Design Criteria for Bolted and Riveted Joints, 1987, pp 47).

Arbitration

Assembly installation and inspection may be arbitrated by:

1. Tightening 3 assemblies in a tension calibrator until the tension calibrator indicates the minimum value specified in RCSC Table 8.1
2. Record the number of locations where indication media appears beyond the outer diameter of the DS-DTI. The count of indications then forms the minimum for the arbitrated installation and inspection criteria.²

¹ ASTM F959 Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.

² Lack of indication may be caused by oversized holes, poor quality hardware, uncured or excessively thick steel coatings, etc. Contact Applied Bolting Technology at (802) 460-3100 or info@appliedbolting.com for assistance.

RCSC Tables 7.1 and 8.1

Nominal Bolt Diameter, in.	Table 7.1 Minimum Verification Tension, kips ^a		Table 8.1 Minimum Installation tension, kips	
	A325 and F1852	A490 and F2280	A325 and F1852	A490 and F2280
1/2	13	16	12	15
5/8	20	25	19	24
3/4	29	37	28	35
7/8	41	51	39	49
1	54	67	51	64
1 1/8	59	84	56	80
1 1/4	75	107	71	102
1 3/8	89	127	85	121
1 1/2	108	155	103	148
^a equal to 1.05 times the specified minimum bolt pretension required in Table 8.1, rounded to the nearest kip				

DuraSquirt DTI Assembly Lot Details

	Bolt	Nut	Washer	DuraSquirt DTI
Manufacturer				Applied Bolting Technology
Lot Number				
Grade				
Finish				
Diameter				
Length		Verification Gap See DS-DTI Test Report		

Arbitration and Inspection Criteria

Squirt Media Indication Count At Minimum Installation Tension		
Test #1	Test #2	Test #3

Site Inspection Ratio