



Designation: **D 5648 – 9401**

## **Standard Test Method for Torque-Tension Relationship of Adhesives Used on Threaded Fasteners (Lubricity)<sup>1</sup>**

This standard is issued under the fixed designation D 5648; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### **1. Scope**

1.1 This test method covers the determination of the torque-tension relationship (lubricity) of adhesives used for locking and sealing threaded fasteners.

1.2 The values stated in inch-pounds are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### **2. Referenced Documents**

2.1 *ASTM Standards:*

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<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D-14 on Adhesives and is the direct responsibility of Subcommittee D14.80 on Metal Bonding Adhesives. Current edition approved ~~Dec. 15, 1994~~, March 10, 2001. Published ~~February 1995~~, May 2001. Originally published as D 5648 - 94. Last previous edition D 5648 - 94.

D 907 Terminology of Adhesives<sup>2</sup>

2.2 *Society of Automotive Engineers Standards:*

SAE J174 Torque Tension Test Procedure for Steel Threaded Fasteners<sup>3</sup>

SAE J429 Mechanical and Material Requirements for Externally Threaded Fasteners<sup>3</sup>

2.3 *Federal Specification:*

FF-N-836 Nut: Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding and Single Ball Seat<sup>4</sup>

### 3. Terminology

3.1 *Definitions*—Many of the terms in this test method are defined in Terminology D 907.

### 4. Summary of Test Method

4.1 This test method consists of applying adhesive to a threaded fastener and measuring the developed tension applied to the fastener at specified torques. Alternatively, the torque required to reach specified levels of bolt tension may be measured.

### 5. Significance and Use

5.1 On some applications of threaded fasteners, it is desirable to control either the amount of developed tension when a specified range of torque has been applied or the torque required to develop a specified range of tension. This test method is used to determine the effect of using adhesives on the torque-tension relationship of threaded fasteners.

5.2 Accurate torque-tension relationships may be measured only by defining and controlling the many related test parameters.

### 6. Apparatus

6.1 *Tension-Measuring Device*, capable of measuring the axial tension induced in the bolt as it is tightened. ~~This device shall be accurate~~ tightened, having an accuracy within  $\pm 5$  % of the test load.

6.2 *Torque-Measuring Device*, of suitable capacity having an accuracy within  $\pm 5$  % of a given torque reading.

### 7. Test Specimens

7.1 *Bolts*—As-received, phosphate-and-oil-treated,  $\frac{3}{8}$ -in. size, 16 threads per inch, Unified National Coarse thread series ( $\frac{3}{8}$  by 16 UNC), Grade 5 bolts in accordance with SAE J429. ~~The bolts shall have J429,~~ having a minimum length of 1½ in. (38.1 mm) with hexagonal head.

7.2 *Steel Nuts*—As-received, Type II, Style 4, nominally  $\frac{2}{64}$  in. (8.3 mm) thick, conforming to Fed. Spec. FF-N-836.

NOTE 1—Other fastener sizes and substrates may be used upon agreement between the supplier and the user of adhesives.

7.3 *Hardened Washers*, conforming to the dimensional, metallurgical, mechanical, and finish requirements given in Table Number 1 of SAE J174.

### 8. Procedure

8.1 Determine the torque-tension relationship on not less than five specimens as follows:

8.1.1 For liquid adhesives, insert the bolt in the tension-measuring device and apply the adhesive to the exposed threads of the bolt. Also apply the adhesive to the threads of the nut.

8.1.2 Place a new hardened washer over the exposed end of the bolt until it squarely contacts the bearing surface of the device.

8.1.3 Assemble the nut onto the bolt by hand until it contacts the hardened washer.

8.1.4 Using the torque-measuring device, tighten the nut continuously and uniformly at a speed not to exceed 30 r/min, making sure that the washer and the bolt are restrained from turning.

8.1.5 When testing specimens in accordance with 7.1 and 7.2, record bolt tensions, not exceeding 75 % of the proof load, at 10, 20, 30, and 40-ft·lb (13.6, 27.1, 40.7, and 54.2-Nm) torque.

8.1.6 Alternatively, record torque at agreed-upon levels of bolt tension.

NOTE 2—When other fastener sizes are used, appropriate torque and load levels ~~shall be~~ are specified.

### 9. Report

9.1 Report the following information:

9.1.1 Complete identification of the adhesive tested, including type, source, date manufactured, manufacturer's code numbers, and form.

9.1.2 Description of the apparatus used to measure tension and torque.

9.1.3 Number of specimens tested.

<sup>2</sup> Annual Book of ASTM Standards, Vol 15.06.

<sup>3</sup> Available from the Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096.

<sup>4</sup> Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20403.

9.1.4 Maximum, minimum, and average tension values at each applied torque, or maximum, minimum, and average torque values at each level of bolt tension.

## 10. Precision and Bias

~~10.1 At the present time, there is no basis for a statement of precision~~

10.1 Precision and bias concerning the reproducibility of results among laboratories. Such information may for this test method are being determined and will be available in the future following round-robin testing among laboratories. by April 2005.

## 11. Keywords

11.1 adhesive; lubricity; threadlocking; torque tension

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