



Input Torque, Tension, Angle, and Thread Torque Evaluation of Fastened Joints

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. To determine thread, underhead, and combined coefficients of friction of a threaded fastener joint using simulated joint components in conjunction with a fastener torque/tension load cell, reference ISO 16047.

1.2 Applicability.

1.2.1 Unless otherwise specified, this procedure applies to initial tightening event of joints using threaded fasteners with new thread and bearing surfaces and new clamped members.

1.2.2 Limitations. This procedure does not apply to Pulse tools.

1.3 Remarks. Unless otherwise specified, any requirements or direction provided in test request documentation will supercede this test procedure.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ISO 273 ISO 2320 ISO 16047

2.2 GM Standards/Specifications.

GMW25 GMW17000

2.3 Additional References. None.

3 Resources

3.1 Facilities. Not applicable.

3.1.1 Calibration. Test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment. Torque angle transducer.

3.2.1 Torque/tension load cell.

3.2.2 Data acquisition system capable of collecting data at a sampling rate of at least 1000 Hz, plotting data at user specified scales, and identifying data at all points on curve.

3.2.3 Tightening tool.

3.2.4 Appropriate fixturing, bedplate, or slotted table.

3.3 Test Vehicle/Test Piece.

3.3.1 A complete bill of materials of required test pieces for joint to be evaluated will be specified in test request documentation.

3.3.2 Test pieces representative of joint to be evaluated must be selected, obtained and/or fabricated to fit in fastener torque/tension load cell.

GM Confidential

© Copyright 2018 General Motors Company All Rights Reserved

March 2018

Page 1 of 10

3.3.3 Unless otherwise specified, a minimum of twenty (20) samples is to be used for this procedure.

3.4 Test Time.

Calendar time: 13 d

Test time: 50 h

Coordination time: 50 h

3.5 Test Required Information. Test request documentation shall outline specific information and test parameters (reference Appendix A, Data Sheet A1, or use similar format).

3.6 Personnel/Skills. Test Technician shall be qualified on basis of appropriate education, training, experience, and/or demonstrated skills.

4 Procedure

4.1 Preparation.

4.1.1 Use same part number fasteners as actual joint with no modifications if possible.

4.1.2 If actual joint has a stud, a bolt of same thread size, material, and coating may be substituted. If actual joint grip length is less than minimum grip length capability of torque/tension load cell, a longer bolt of same thread size, material, coating and head type may be substituted. If actual joint has a bolt for stationary member, head type of substitute does not have to be the same.

4.1.3 If actual joint has a flange or captured washer design bolt as stationary member, one of the following two options may be necessary to enable bolt head to fit into slot of torque/tension load cell adapter:

4.1.3.1 Select a substitute hex bolt of same thread size, material, and coating.

4.1.3.2 Machine flats on flange or captured washer. Do not use any cutting oils or coolant for machining and do not overheat metal (no discoloration). Do not alter bolt material, threads, or coating during machining process.

4.1.4 If actual joint has a flange or captured washer design nut as stationary member, it may be necessary to machine flats on flange or captured washer in order to enable nut to fit into slot of torque/tension load cell adapter. Do not use any cutting oils or coolant for machining and do not overheat metal (no discoloration). Do not alter nut material, threads, or coating during machining process.

4.1.5 If actual joint has a tapped hole as stationary member, it may be necessary to fabricate tapped hole coupons which fit into slot of torque/tension load cell adapter. Use same material and thickness for tapped hole coupons as actual component with tapped hole. Do not use any cutting oils or coolant for machining and do not overheat metal (no discoloration).

4.1.6 Bearing surface coupons must be of same material, thickness and coating, surfaced by same manufacturing method, and have same clearance hole diameter or slot dimensions as actual joint. Shank configuration of bolt (reduced or full) should be duplicated in test if possible.

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.2.2.1 Unless otherwise specified, test conditions shall be as outlined on test request documentation.

4.2.2.2 Optional. Strength of fasteners with respect to minimum material specifications may be evaluated prior to this testing by one or more of methods outlined in GMW25.

4.3 Instructions.

4.3.1 Review part quantities and conditions.

4.3.2 Select proper torque/tension load cell fixture plate(s) and adapter. Bolt clearance hole diameter of fixturing to be in accordance with Table 1. Reference ISO 273.

GM Confidential

© Copyright 2018 General Motors Company All Rights Reserved

March 2018

Page 2 of 10



Documents

Document Sharing Hub

Table 1: Fixture Selection for Bolt Sizes

Bolt	Hole Diameter
Size	Millimeters
6 mm	6.40 to 6.55
8 mm	8.40 to 8.55
10 mm	10.50 to 10.68
12 mm	13.00 to 13.18
14 mm	15.00 to 15.18
16 mm	17.00 to 17.18
20 mm	21.00 to 21.21

4.3.3 Install fixture plate(s) and adapter on torque/tension load cell.

4.3.3.1 Grip length on torque/tension load cell should be same as actual joint if possible. Document actual joint grip length and torque/tension load cell grip length used.

4.3.3.2 Duplicate grip length on subject joint if possible. However, grip length on torque/tension load cell should be such that there are at least two (2) full bolt threads on either side of nut after joint is tightened.

4.3.3.3 Bearing surface on torque/tension load cell must be prevented from rotating.

4.3.4 Select proper tightening tool and torque transducer. Tool, tool speed, and tightening strategy should be same as used in production on actual joint if possible.

4.3.5 Loosely assemble driven member, stationary member, and bearing surface to torque/tension load cell. Non-driven end should be assembled on torque measurement adaptor side of load cell to measure thread (shank) torque. Optional: Driven member should be assembled on torque measurement adaptor side of load cell to measure underhead torque. Finger tighten joint one (1) turn to two (2) turns.

4.3.6 Configure data acquisition system to collect input torque, tension, angle, and thread (shank) torque data. Optional: Configure torque/tension load cell and data acquisition system to collect underhead torque and calculate thread (shank) torque by subtracting it from input torque.

4.3.7 Align tool and torque transducer to prevent side loading.

4.3.8 Unless otherwise specified, test requestor is to approve test setup.

4.3.9 Take photograph or digital image of test configuration.

4.3.10 Measure and document tool free spinning speed.

4.3.11 Joint shall be tightened to a minimum of 110% of fastener proofing load.

Note: Socket must not touch bearing surface during tightening. Determination of coefficient of friction shall be calculated at 75% proof load unless otherwise specified by test requestor.

4.3.12 Unless otherwise specified, run first sample recording input torque, tension, angle, and thread (shank) torque. Review with requestor and receive approval prior to proceeding.

4.3.13 If necessary, make corrections to test configuration to comply with instructions of requestor.

4.3.14 Complete Test Matrix (see Appendix A, Table A1 or use similar format).

4.3.15 Summarize results according to requirements in Section 5 of this standard.

5 Data

5.1 Calculations. Perform calculations in accordance with Appendix D, Data Sheet D1, and Appendix E, Data Sheet E1.

5.2 Interpretation of Results.

5.2.1 Summary of Results.

GM Confidential

© Copyright 2018 General Motors Company All Rights Reserved

March 2018

Page 3 of 10



Documents

Document Sharing Hub