GM	WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW14166

Torque, Angle 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. Determine the dynamic torque angle characteristics, failure mode, if any, of the threaded fastener joint.

1.2 Applicability. Unless otherwise specified, this procedure applies to the initial tightening event of joints using new threaded fasteners, bearing surfaces and clamped members for each joint.

1.3 Remarks.

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

1.3.2 Unless otherwise specified, any requirements or direction provided in the 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.

None

2.2 GM Standards/Specifications.

GMW25

2.3 Additional References.

Data Acquisition System Manufacturer's Operating Procedure

3 Resources

3.1 Facilities. GM Approved Laboratory or location for this test procedure.

3.1.1 Calibration. The 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.

3.2.1 Torque angle transducer.

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 the curve.

3.2.3 Tightening tool.

3.2.4 Appropriate fixtures, bedplate, or slotted table.

3.3 Test Vehicle/Test Piece.

3.3.1 A complete bill of materials of required test pieces will be specified in the test request documentation.

3.3.2 Unless otherwise specified, a minimum of 8 samples are to be used for this procedure.

© Copyright 2017 General Motors Company All Rights Reserved

Documents
Document Sharing Hub

Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
Reproduction, distribution or publication of these standards is expressly prohib
Full document details: GMW GMW14166 2017

Licensee=/, User=,
Not for Resale,

3.4 Test Time.

Calendar time:	2 days
Test time:	12 h
Coordination time:	4 h

3.5 Test Required Information. Test request documentation shall outline specific information and test parameters (see Appendix A, Data Sheet A1 as a guide).

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

4 Procedure

4.1 Preparation.

4.1.1 Unless otherwise specified in the test request, samples are to be tested in the as-received condition. This excludes any condition specifically caused by material storage or configuration (e.g., if debris falls into a threaded hole from laboratory rework, it is acceptable to blow debris out of holes).

4.1.2 Any modifications to parts, not specifically requested in the test request, which may affect test results, are to be documented in the test notes. All test configurations, parts and noted deviations to be approved prior to executing test.

4.2 Conditions.

4.2.1 Environmental Conditions.

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 outlined in the 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 the methods outlined in GMW25.

4.3 Instructions.

4.3.1 Review part quantities and condition.

4.3.2 Secure test part to T-slot table or fixture.

4.3.3 Select proper tool and transducer with angle encoder.

4.3.4 Configure data acquisition system to collect torque and angle data (reference Manufacturer's Operating Procedure).

4.3.5 Align tool and torque transducer to prevent side loading.

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

4.3.7 Take photograph or digital image of test configuration.

4.3.8 Measure and document tool free spinning speed.

4.3.9 Unless otherwise specified, run the first sample to joint failure recording torque, angle, and failure mode (if any). Review with requestor and receive approval prior to proceeding.

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

4.3.11 Complete test matrix.

4.3.12 Summarize results according to requirements in Section 5 of this procedure.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Not applicable.

5.2.1 Summary of Results. Required.

5.2.1.1 Provide statistical analysis of maximum torques. Calculate averages, minimum values, maximum values, and standard deviation.

© Copyright 2017 General Motors Company All Rights Reserved

Documents
Document Sharing Hub

Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
Reproduction, distribution or publication of these standards is expressly prohib
Licensee=/, User=,
Not for Resale,
Full document details: GMW GMW14166 2017

5.2.1.2 Provide detail of failure modes consisting of, but not limited to, fastener fracture, component fracture, component distortion or internal or external thread stripping (if applicable).

5.2.1.3 Test incidents to be recorded on Test Data Summary Sheet (similar to Appendix B, Data Sheet B1).

5.2.1.4 Test data summarization to be on Test Data Log Sheet (similar to Appendix C, Data Sheet C1) and Torque Angle Data Sheet (similar to Appendix D, Data Sheet D1).

5.2.1.5 Required plots and tabular data tables include items shown in Table 1 Example.

Where:

- I Individual sample plots
- M Multiple sample plot
- D Dual Y axis plots
- S Statistical plot
- T Tabular data table followed by the incremental value

Table 1: Torque Tightening Strategy Example

Y-Axis \ X-Axis	Torque	Tension	Angle	Compression	Load	Disp.	RPM	Time
Torque			M					
Tension								
Angle								
Compression								
Load								
Displacement								
RPM								

5.2.2 Summary of Results Optional. After reviewing required data summarization, requestor may ask for additional items, including but not limited to the following:

5.2.2.1 Summary of results including, but not limited to: upper proportional limit torques, lower proportional limit torques, ultimate torques, and prevailing torques.

5.2.2.2 Optional plots and tabular data tables include items shown in Table 2 example.

Where:

- I Individual sample plots
- M Multiple sample plot
- D Dual Y axis plots
- S Statistical plot
- T Tabular data table followed by the incremental value

© Copyright 2017 General Motors Company All Rights Reserved

Documents
Document Sharing Hub

Copyright General Motors Company
Provided by IHS Markit under license with General Motors Company
Reproduction, distribution or publication of these standards is expressly prohib
Licensee=/, User=,
Not for Resale,
Full document details: GMW GMW14166 2017