



Threaded Joint Repetitive Tightening Test

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 the ability of the threaded fastener joint to attain specified clamp load after repeated tightening without stripping external and internal threads.

1.2 Applicability. This procedure applies to joints using threaded fasteners.

1.3 Remarks.

1.3.1 Limitations. This procedure does not apply to Pulse tools. This procedure is not to be used on fasteners that require replacement for each service event (i.e., fasteners with adhesive patches or fasteners tightened to yield).

1.3.2 Any deviations to this procedure are to be entered in the Test Notes or Log Sheets.

1.3.3 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.

None

2.3 Additional References. None.

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 (if applicable).

3.2.3 Tightening tool.

3.2.4 Appropriate fixtures, bedplate, or slotted table.

3.2.5 Strain indicator (if applicable).

3.2.6 Strain gaged fastener, force washer, or fastener prepared for ultrasonic measurement (if applicable).

3.3 Test Vehicle/Test Piece.

3.3.1 A complete Bill of Material (BOM) of required test pieces will be specified in the test request documentation.

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

3.4 Test Time.

Calendar time: 2 d

Test time: 12 h

Coordination time: 4 h

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

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, that 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. 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.

4.3 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, fastener prepared for ultrasonic measurement, transducer, or strain gaged fastener.

4.3.4 If applicable, configure ultrasonic measurement device to capture tension values.

4.3.5 If applicable, configure strain indicator measurement device to capture tension values.

4.3.6 Configure tooling to reproduce requested tightening strategy of the fastener.

4.3.7 Align tool and torque transducer to prevent side loading.

4.3.8 For ultrasonic measurement, verify fasteners have been length referenced and proper bolt files are in use.

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

4.3.10 Unless otherwise specified, run the first sample to the desired tightening specification, recording torque, tension (if requested), and angle. Typically, tightening will be run to the maximum specified assembly torque to ensure worst case evaluation. Review with requestor and receive approval prior to proceeding.

4.3.11 Remove fastener(s).

4.3.12 If fasteners are to be reused (reference Master Process Document (MPD)), repeat 4.3.10 and 4.3.11 four (4) times.

4.3.13 Tighten fasteners to failure on the sixth rundown recording torque, tension (if requested), and angle.

4.3.14 If fasteners are not to be reused (reference MPD) replace fastener(s) for each tightening event and repeat 4.3.10 and 4.3.11 four (4) times.

4.3.15 Tighten fasteners to failure on the sixth rundown recording torque, tension (if requested), and angle.

4.3.16 Record torque, tension (if requested), angle and failure modes (if any) of all samples.

4.3.17 Summarize results.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results.

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.

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 (reference Appendix B, Data Sheet B1 or similar.)

5.2.1.4 Test data summarization to be on Test Data File Log Sheet (reference Appendix C, Data Sheet C1 or similar) and (reference Appendix D, Data Sheet D1, Appendix E, Data Sheet E1, and Appendix F, Data Sheet F1 or similar).

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

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: Required Plots and Tabular Data

Y-Axis	X-Axis						
	Torque	Tension	Angle	Compression	Load	Displacement	rpm
Torque			M				
Tension							
Angle							
Compression							
Load							
Displacement							
Revolutions per minute (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.

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 2: Optional Plots and Tabular Data

Y-Axis	X-Axis							
	Torque	Tension	Angle	Compression	Load	Displacement	rpm	Time
Torque				DIT10				
Tension								
Angle								
Compression								
Load								
Displacement								
Revolutions per minute (rpm)				DIM				

5.2.2.3 Magnified Scale Plots. Additional plots re-scaled to magnify desired detail of curves.

5.3 Test Documentation. See 5.2.1.3 and 5.2.1.4.

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

7 Notes

7.1 Glossary.

Failure Modes: May consist of, but are not limited to, fastener fracture, component fracture, component distortion, or internal or external thread stripping. Fracture is defined as the partial or complete separation of one or more of the joint components.