



Axle Shaft Torsional Fatigue 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. The purpose of the Axle Shaft Torsional Fatigue test is to determine the torsional fatigue life of axle shafts.

1.2 Applicability This test is applicable for Axle Shafts used in light trucks and passenger vehicles.

2 References

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

2.1 External Standards/Specifications.

MET ASTM E1444

2.2 GM Standards/Specifications.

GMW17233

2.3 Additional References.

- CG583
- CG5152 Data Sheet
- Component Technical Specification (CTS)
- Statement of Requirements (SOR)
- Subsystem Technical Specification (SSTS)
- Validation Cross Reference Index (VCRI)

3 Resources

3.1 Facilities. GM Milford Proving Grounds (MPG) Building 27 - Driveline Component Lab.

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.

3.1.3 A bedplate large enough for securing the test rig, and hydraulic equipment capable of withstanding long term dynamic loading of the rig/specimen are required.

3.2 Equipment. See Appendix A, Figure A1.

3.2.1 Hydraulic Rotary Test Machine.

Note: Verify that the test equipment capability is adequate to meet the loading and displacement necessary to conduct this test.

3.2.2 Specimen Jaw Coupling.

3.2.3 Fixtures, reaction members, and/or Adapters to mount axle shaft.

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Note: See 3.5.2 to determine the length of spline engagement between the side gear and the axle shaft being tested when selecting tooling from 3.2.3. Record on CG5152 Data Sheet. Verify that tooling will engage spline within length representing actual application conditions.

3.2.4 Load Cell.

3.2.5 Vibration monitoring device to provide automatic shutdown if failure occurs.

3.2.6 Counter to record pinion gear cycles.

3.3 Test Vehicle/Test Piece.

3.3.1 Axle Shaft(s).

3.3.2 Unless other direction is provided by the requesting engineer, a minimum of six (6) samples are to be tested at each torque load in order to facilitate Weibull analysis.

3.4 Test Time.

Calendar time: 12 days

Test time: 96 hours

Coordination time: 8 hours

3.5 Test Required Information.

- CG583 ^{Note 1}.
- Component Technical Specification (CTS).
- Statement of Requirements (SOR).
- Subsystem Technical Specification (SSTS) (for front or rear axle, Transfer Case (Tcase), Power Transfer Unit (PTU), Rear Drive Module (RDM), Front Drive Unit (FDU)).
- Validation Cross Reference Index (VCRI).
- GMW17233 Pinion Stem Torsional Fatigue Test.
- MET ASTM E1444.

Note 1: Obtain a copy of CG583 and begin entering information relative to the test procedure. Emphasize to Program Design Release Engineers (DRE) the importance of confirming parts, installation and test set up prior to the start of test.

3.5.1 Obtain appropriate 100% Torsional Axle Capacity (TAC) (aka, torsional fatigue loading force) and Cycle count (equivalent to the duty cycle) for the testing requirements from Technical Specifications. If these values are not readily available from Technical Specifications, obtain the values from a consensus of the DRE and Driveline Computer Aided Engineering (CAE) Group (UA625). Record 100% TAC and Cycle Count on CG5152 Data Sheet.

Note: The CG5152 Data Sheet will automatically calculate the 60% and 72% fatigue values necessary to fulfill the testing requirements when the 100% value is input.

Note: This test procedure will use equivalent fatigue values calculated from the duty cycle that are then run to failure over different load ranges and subsequently used to calculate and establish the T-N curve through Weibull analysis.

3.5.2 Obtain appropriate math data that depicts the length of spline engagement between the side gear and the axle shaft being tested (this is critical for obtaining proper torsional loading results). Acquire concurrence from Program Team DRE. Record on CG5152 Data Sheet.

3.6 Personnel/Skills. Test Technician should be proficient in operation of the facilities listed in 3.1, as well as in proper selection and operation of the equipment listed in 3.2 and familiar with the general operation of axle assemblies.

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