



Axle Shaft and Pinion Stem Torsional Yield and Ultimate Strength 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 this test is to determine the torsional yield and ultimate strength of rear axle shafts and front/rear pinion stems.

1.2 Applicability. This specification is applicable for rear axles and both front and rear drive pinions.

1.3 Remarks. This specification defines the method of obtaining the yield strength and ultimate strength of both rear axle shafts and front/rear pinion stems.

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.

- Component Technical Specification (CTS)
- Statement of Requirements (SOR)
- Subsystem Technical Specification (SSTS) (for Axle or Rear Drive Module)
- Validation Cross Reference Index (VCRI)

3 Resources

3.1 Facilities. The test facility shall have a valid International Organization for Standardization (ISO) certificate, which is noted in the test report.

A bedplate large enough for securing the test rig and capable of withstanding dynamic loading of the rig/specimen is required.

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 A hydraulic power system and test machine that is compatible with the strength of the components being tested. Since the test will be carried out using load control mode, the testing machine must have servo-hydraulic load-monitoring system mounted in series with specimen. The load and displacement must be monitored continuously until the failure occurs.

3.2.2 Equipment capable of applying and monitoring a high torque load on axle shafts, and recording torque vs. degrees of twist during the test.

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3.3 Test Vehicle/Test Piece. It is recommended that a minimum of six (6) samples be used in this testing.

3.4 Test Time.

Calendar time: 5 days
Test hours: 24 hours (6 parts × 4 hours each)
Coordination hours: 8 hours

3.5 Test Required Information. Possible sources are:

- Statement of Requirements (SOR)
- Subsystem Technical Specification (SSTS)
- Validation Cross Reference Index (VCRI)

3.6 Personnel/Skills. Test Technician. Should be proficient in proper selection and operation of the equipment listed in 3.2.

4 Procedure

4.1 Preparation. Fixturing should be designed and made to mount the test specimen to a bedplate.

4.1.1 All samples shall be inspected for geometrical conformance with the appropriate specimen drawing (and weld specification, if applicable). Any non-compliant specimens must be set aside and a compliant specimen be tested in its place.

4.1.2 Check that all parts and fixtures needed are included for the mounting.

4.1.3 Paint critical areas with an appropriate color (e.g., white) to make it easier to find cracks.

4.1.4 Test Stand Review. The test setup and methodology must be reviewed with the GM System Validation Engineer (SVE). The GM SVE may request review by the Design Release Engineer (DRE) and/or the Bill of Material Family Owner (BFO). Photographs and/or Computer Aided Design images of the test must be provided.

4.2 Conditions.

- **Axle Shafts:** Axle shaft spline end is to be fitted to a mating differential side gear and held stationary in a rigid fixture. Flange end of shaft is to be bolted to rigid adapter, which is to be driven by a rotary actuator or other equipment capable of required torsional loading.
- **Pinions:** Pinion spline end is to be fitted to a mating flange/yoke and connected to the drive end of rotary actuator or other equipment capable of required torsional loading. Pinion head should be squared off to allow it to be rigidly fixed to the machine. The overall height and width of the squared pinion head must be larger than the adjacent pinion diameter. The modification of the pinion for fixturing must not impact the strength of the test part.

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 Unless otherwise specified, the GM SVE is to approve test setup.

4.3.2 Take photograph or digital image of test configuration.

4.3.3 New test samples shall be used. For product validation testing off-tool parts are mandatory. For design validation testing prototype parts may be used.

4.3.4 The test sample orientation on the test bench shall be the same as within the vehicle. Any deviation needs to be approved by the GM SVE and/or the DRE.

4.3.5 Test shall be controlled and monitored by a computer program. Load, displacement and cycles of the specimen shall be monitored through entire test until failure.

4.3.6 Failure mode is to be recorded and failure location shall be identified for each test specimen. Pictures shall be taken for typical failure modes and any anomalous failures documented and photographed.

4.3.7 Install part and appropriate fixturing in the test machine and secure any necessary safety guards. Set torque and rotation scales to zero.

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