



Halfshaft Load To Stroke Evaluation Procedure

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 procedure is to measure the force required to displace a plunging halfshaft joint through its stroke range of motion under a specified torque and range of articulation angles. The procedure is intended to be conducted with the halfshaft mounted in a test fixture. The halfshaft supplier shall use this procedure for development and validation of halfshafts in compliance with the Halfshaft Subsystem Technical Specification (SSTS) document.

1.2 Applicability. This procedure is applicable to all halfshaft plunging joints for which a load to stroke requirement has been specified in the program specific SSTS. This procedure is also applicable to a halfshaft mounted in a bench level test fixture. It is not applicable to the halfshaft installed in the vehicle.

1.3 Remarks. The measured load to stroke value is an integration driven subsystem requirement for noise and vibration (N&V). Exceeding the limit value specified in the program specific halfshaft SSTS may result in unacceptable powertrain vibration transmissibility through the halfshaft in the axial direction.

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.

Halfshaft Subsystem Technical Specification (SSTS)

3 Resources

3.1 Facilities.

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 special purpose test fixture is required for this procedure. The test fixture shall be capable of securely and accurately positioning the halfshaft across the complete range of motion of the joint to be evaluated for both articulation and plunge. The test fixture shall be capable of applying 1000 Nm torque to the halfshaft while simultaneously stroking the joint at a controlled rate of 2 mm/s.

3.2.2 Instrumentation shall be provided to measure and record the applied torque and stroke rate (stroke position versus time).

3.3 Test Vehicle/Test Piece. The test piece shall consist of a complete production halfshaft assembly as would be installed on a production vehicle.

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3.4 Test Time.

Calendar time: 1 day
Test hours: 6 hours
Coordination hours: 2 hours

3.5 Test Required Information. Prior to performing this procedure, the plunging joint articulation angle(s) and torque at which the load to stroke will be measured must be known. For validation testing, the required not-to-exceed load to stroke limit value must be known. This information is contained in the halfshaft SSTS document for the specific halfshaft under test.

3.6 Personnel/Skills. This test requires a minimum of one (1) technician or engineer trained in making halfshaft load to stroke measurements.

4 Procedure

4.1 Preparation. Not applicable.

4.2 Conditions.

4.2.1 Environmental Conditions. This procedure shall be conducted at ambient laboratory conditions, at a temperature of $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

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. Stroke displacement is referenced from the mid stroke position.

4.3.1 Mount the halfshaft in the test fixture such that the plunging joint is at mid stroke with an articulation angle of zero degrees. Connect the plunging joint input stub shaft to the test fixture, such that the applied torque and stroke mechanisms function properly without binding. Ensure that the output stub shaft is securely supported and attached to fixture ground.

4.3.2 Connect and ensure proper operation of torque and stroke displacement measurement instrumentation.

4.3.3 For joints with rated capacity of 2300 Nm and above, apply a torque of 1000 Nm to the input stub shaft, to be maintained during the stroke. For joints with rated capacity of less than 2300 Nm, apply a torque of 500 Nm.

Note: Conduct a break in period of three (3) cycles at each position prior to recording data.

4.3.4 While measuring axial force, stroke the joint $\pm 20\text{ mm}$ ($\pm 10\text{ mm}$ for the multipoint checking) for a total of 40 mm stroking distance at a rate of 2 mm/s with a 2 s pause at the beginning and end of each plunge. If joint is not capable of 40 mm stroke, run test at 80% of joint capability.

4.3.5 Repeat the test at plunging joint articulation angles of 0 degrees, 3 degrees, 5 degrees, 9 degrees, and 15 degrees, or as specified in the program specific SSTS for the halfshaft under test.

4.3.6 For SSTS requirement validation, repeat the test on a minimum of two (2) additional production samples for a minimum of three (3) samples total.

5 Data

5.1 Calculations. Data shall be expressed in terms of axial force vs. linear displacement. Test data run at 900 Nm torque may be extrapolated to 1000 Nm. Both the raw and extrapolated data must be reviewed with GM.

5.2 Interpretation of Results. Data shall be examined for conformance to SSTS requirements. If the load to stroke exceeds the value specified in the SSTS document, the responsible General Motors supplier quality engineer shall be notified, and the test specimen shall be clearly marked with indelible paint so as not to be used in a production vehicle.

5.3 Test Documentation. The supplier shall provide a hardcopy data sheet containing test results (measured axial force versus linear displacement at each articulation angle tested, and pass/fail results relative to SSTS requirement) for each halfshaft tested. The data sheet shall be annotated with the applied torque value, part number, specimen identification number, test date, and test conductor's name.

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