



Halfshaft Generated Axial Force (GAF) Measurement

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 Generated Axial Force (GAF) produced by a tripot type inboard halfshaft constant velocity (CV) joint under specified torque, rotation speed and angle conditions. The procedure shall be conducted with the halfshaft mounted in a specialized test machine designed to measure GAF. The halfshaft supplier shall use this procedure for development and validation of halfshafts in compliance with the Halfshaft Subsystem Technical Specification (SSTS) CG932.

1.2 Applicability. This test procedure is applicable to halfshaft component level testing only. This test procedure establishes the common test and reporting method to be applied by all halfshaft suppliers.

1.3 Remarks. The results obtained from GAF testing are necessary to confirm specifications, benchmark various suppliers and establish input loads to Computer Aided Engineering (CAE) models for upfront assessment of low-speed drive away vibration.

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.

Subsystem Technical Specification (SSTS), CG932 Halfshaft

3 Resources

3.1 Facilities. The halfshaft supplier shall provide the required facilities, including the test machine and instrumentation.

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. A special purpose test machine is required for this procedure. The test machine shall be capable of securely and accurately positioning the halfshaft across the complete range of articulation angle of the joint to be evaluated. The test machine shall include a torque control motor (braking), torque sensor, axial load sensor, angle control mechanism, speed control motor (driving), and interface connections at both ends of the halfshaft. The test machine must be capable to maximum torque of 1000 Nm and test speed of 190 rpm.

3.2.1 Data Acquisition Equipment. The test facility shall include a digital data acquisition system (DAS) capable of recording time domain, Fast Fourier Transform (FFT) and order analysis of the GAF for each test condition. The DAS shall also be capable of recording the joint angle, torque and rotating speed for each test condition, to

GM Confidential

© Copyright 2016 General Motors Company All Rights Reserved

March 2016

Page 1 of 5

be stored with the corresponding GAF data. The DAS shall be capable of producing a plot of GAF versus joint angle, overlaid with a programmable specification curve to be obtained from the SSTS.

3.3 Test Vehicle/Test Piece. Complete halfshaft assembly as would be installed in a production vehicle.

3.4 Test Time.

Calendar time: 1 day

Test time: 3 hours

Coordination time: 1 hour

3.5 Test Required Information. Prior to performing this procedure, the joint articulation angles, rotating speeds and torques at which the GAF will be measured must be known. For validation testing, the required not-to-exceed GAF specification must be known. This information is contained in the halfshaft SSTS document for the specific halfshaft under test.

3.6 Personnel/Skills. One (1) technician skilled in operating the GAF test machine, one (1) engineer to collect GAF data, interpret results and assemble report.

4 Procedure

4.1 Preparation. Connect outboard end of halfshaft to the torque motor (braking) and attach inboard end to speed control motor (driving).

4.1.1 "Green" Test. Before conducting any break-in of part, conduct initial test and record data for "green" joint prior to break-in period. Part shall be tested at 190 rpm with recommended torques of 500 Nm and 1000 Nm (joint sizes (torque capacity) less than 2300 Nm should only be tested at 500 Nm). SSTS test torque requirements supercede recommendations in this procedure. The halfshaft running angles shall be set to 0, 3, 5, 7, 9 and 15 degrees. Allow 5 minutes stabilization time at stated conditions prior to recording data at each position. A total of 30 s of data should be recorded at each angle without exceeding 80 °C maximum temperature measured at the inboard plunging joint. Temperature is measured with infrared gun pointed at the plunging joint.

4.1.2 Break-in Conditions (after "Green" Test).

- 190 rpm
- 1000 Nm (torque)
- 15 degree running angle
- Positioned at mid-stroke of inboard joint
- Apply cooling air if plunging joint temperature exceeds 50 °C (80 °C maximum temperature to run test)
- 30 minutes minimum break-in time

4.1.3 Repeat Test Sequence for Broken-in Part. Part shall be tested at 190 rpm with recommended torques of 500 Nm and 1000 Nm (joint sizes (torque capacity) less than 2300 Nm should only be tested at 500 Nm). SSTS test torque requirements supercede recommendations in this procedure. The halfshaft running angles shall be set to 0, 3, 5, 7, 9 and 15 degrees. Allow 5 minutes stabilization time at above conditions prior to recording data at each position. A total of 30 s of data should be recorded at each angle without exceeding 80 °C maximum temperature at the inboard plunging joint.

4.1.4 Sample Size. Six (6) parts each for Production Part Approval Process (PPAP) and Design Validation (DV) testing.

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. See 4.1 thru 4.1.3.

5 Data

5.1 Calculations.

GM Confidential

© Copyright 2016 General Motors Company All Rights Reserved

March 2016

Page 2 of 5