GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW15159

Ball Stud Impact Bending

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 ductility characteristics of ball joint studs when subjected to an impact force at ambient and cold temperatures.

1.2 Applicability. This procedure will apply to all passenger car and light truck suspension designs using ball joint assemblies.

1.3 Remarks. Not applicable.

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. Not applicable.

3 Resources

3.1 Facilities. The facility must be of adequate size to house the test equipment.

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 Test machine capable of applying impact energy forces to a maximum of 600 J.

3.2.2 The stud end shall be retained with a support fixture which simulates the interface to the mating part in vehicle application. This includes proper offset or distance from the ball center to support fixture **O** (see 4.4.3). The support fixture can be made from a donor knuckle or tool steel such as O1 oil hardening tool steel quenched and tempered to HRc 57 to HRc 62 or equivalent, see Appendix A, Figure A1.

3.3 Test Vehicle/Test Piece. Not applicable.

3.4 Test Time. Not applicable.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. The test technician should be familiar with the test machine and the instrumentation required to obtain test data.

3.7 Development/Validation Items.

3.7.1 Ball joint assemblies must conform to the drawings and details provided by GM Engineering.

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3.7.2 Sample material must be manufactured from production tooling, deviation requires signature approval from the design responsible engineer.

Note: All instrumentation is to be calibrated as required, record instrumentation details and date of calibration using Appendix B: Sample Data Sheet.

4 Procedure

4.1 Preparation.

4.1.1 Install ball stud in fixturing so that the ball portion of the stud can be impacted perpendicular to the longitudinal centerline of the stud at the oscillating pivot center, see Appendix A, Figure A1.

4.1.2 The fixture which holds the ball stud must provide clearance to allow deflection (bending) of the stud to occur. The stud should be retained in the fixture that simulates the vehicle application.

4.1.3 The impact area of the ball stud can be slightly flattened to avoid slippage of the impact mechanism.

4.2 Conditions.

4.2.1 Environmental Conditions. Test to be performed at ambient (20 °C ± 2 °C) temperature.

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.

4.2.3 Cold Temperature Conditions. Test to be performed after soaking the pre-assembled test specimen and support fixture at -30 °C ± 2 °C for > 12 h. Test impact to occur immediately following removal of the specimen from the cold chamber.

4.3 Instructions. Not applicable.

4.4 Procedure.

4.4.1 Install ball stud in test fixturing.

4.4.2 Impact the specimen with the recommended starting energy level specified by the responsible GM engineer.

4.4.3 Measure the ball stud radial deflection after the impact **D**. Calculate the angular deflection **A** as:

$$\text{Tan } A = D / O$$

Where:

A Angle of the deflected stud axis

D Deflection distance of the stud

O Offset distance from ball center to support

Note: Recommended deflection is approximately 10 degrees.

4.4.4 Adjust the impact energy level as necessary to meet the performance criteria and perform test on the required number of samples at the adjusted impact energy level.

4.4.5 Inspect the ball stud for surface cracks using a microscope at a magnification of 10x.

4.4.6 Record the required impact energy required, angular deflection and the results of the surface inspection.

5 Data

5.1 Calculations. Calculate the angular deflection **A** as shown in 4.4.3.

5.2 Interpretation of Results. Recommended criteria is no visible cracks in the stud using 10x magnification.

5.3 Test Documentation. Report the test and inspection results on a data sheet, including photographs of the post-test studs, see Figures A2 and A3 and Appendix B: Sample Data Sheet.

6 Safety

This standard may involve hazardous materials, operations, and equipment. This standard does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

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