GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW15153

Ball Stud 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. To determine the fatigue life of ball studs used in a ball joint assembly.

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 equipment which will apply cyclic loading at the prescribed frequency and forces.

3.2.2 A load applying adapter block to apply the load through the center of the ball. The bore in the block shall provide minimal clearance to the ball. The block should be manufactured of a tool steel such as O1 oil hardening tool steel quenched and tempered to HRc 57 to HRc 62 or equivalent.

3.2.3 The stud end shall be retained with a support fixture which simulates the interface to the mating part in vehicle application. This includes proper distance from the ball center to the support fixture. The support fixture can be made from a donor knuckle or tool steel as outlined in 3.2.2.

3.2.4 Tapered Studs. Verify the taper contact between the fixture and the stud. Apply die-markers bluing dye to the stud taper, place the stud into the fixture, apply approximately 44 N of axial load. While loaded, rotate the stud 180 degrees. Remove the stud and inspect for a minimum of 75% of the blue dye on the taper to bear witness of contact to the fixture taper. Additionally, the top (large end) ⅓ of the taper should bear witness of 100% contact.

3.2.5 Pinch Bolt Studs. The support fixture design must provide a well distributed clamping pressure on the stud.

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3.2.6 Straight Studs (Typically Stabilizer Bar Ball Link Studs). The fixture hole should provide minimal clearance to the stud.

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.

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. Install ball stud in fixture so that load will be applied in a radial direction to the ball portion of the stud, see Appendix A, Figure A1.

4.2 Conditions.

4.2.1 Environmental Conditions. Test to be performed in ambient temperature conditions.

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. Not applicable.

4.4 Procedure.

4.4.1 Install ball stud in test fixture, see Appendix A, Figure A1.

4.4.2 Recommended load is 30% of radial magnitude load on the 0.8G forward panic brake load case or as specified by the responsible GM engineer. Apply the sinusoidal test load at a frequency between 1 Hz and 5 Hz.

4.4.3 Continue the loading cycles until the stud fractures or a minimum cycle count threshold is met as specified by the responsible GM engineer.

4.4.4 At test termination for each sample, record cycle count.

5 Data

5.1 Calculations. Upon test completion; calculate the fatigue life prediction at R99C50.

5.2 Interpretation of Results. Recommended minimum R99C50 fatigue life is 300 000 cycles.

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.

7 Notes

7.1 Glossary.

R99C50: Reliability 99%, Confidence 50% statistical probability calculation.

7.2 Acronyms, Abbreviations, and Symbols.

HRc (Rockwell) Hardness Rating, “C” scale

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