



Shock Bracket 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. The purpose of the Shock Bracket Fatigue test is to provide a structural evaluation of the axle shock brackets and their attachment points after being exposed to durability schedules (block cycles) of shock absorber loads.

1.2 Applicability. This test is applicable for live beam axles that have provisions for shock bracket attachment.

1.3 Remarks. This test standard provides severe chassis structural inputs representing customer vehicle usage under programmed or non-programmed Proving Ground Road Load Data Analysis.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ASTM E1444

2.2 GM Standards/Specifications.

GMW14048

GMW15694

GMW15980

GMW16285

2.3 Additional References.

- CG4913 Data Log Sheet
- Component Technical Specification (CTS)
- Statement of Requirements (SOR)
- Subsystem Technical Specification (SSTS)
- Validation Cross Reference Index (VCRI)

3 Resources

3.1 Facilities. Lab facility with bedplate and hydraulic capability suitable for long term fatigue testing.

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 Bracket Fatigue Table. See Appendix A, Figure A1.

3.2.2 Hydraulic Actuators with sufficient force to exert the maximum loads and highest frequency required.

3.2.3 Structural test machine.

3.2.4 Tube clamp coupling to mount the axle tube rigidly to the bedplate in the shock absorber bracket area.

3.2.5 Load cell.

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3.2.6 Imminent failure detecting device (unusual load or displacements increases) to provide automatic shutdown if failure occurs.

3.2.7 Shock bracket adapter rod and stud to adapt the actuator to the shock absorber bracket. Load is to be applied to the bracket through the shock fitting representing the production condition.

3.2.8 Test control computer.

3.3 Test Vehicle/Test Piece. Axle tube assembly with three (3) attached shock bracket pieces (six (6) pieces if a Weibull analysis is required).

3.4 Test Time.

Calendar time: 4 days

Test time: 75 hours

Coordination time: 8 hours

3.5 Test Required Information.

- CG4913 data log sheet.
- Component Technical Specification (CTS).
- Statement of Requirements (SOR).
- Subsystem Technical Specification (SSTS) (for front or rear axle, Transfer Case, Power Transfer Unit (PTU), Rear Drive Module (RDM), Front Drive Unit (FDU)).
- Validation Cross Reference Index (VCRI).
- GMW16285.
- GMW15980.
- GMW15694.
- GMW14048.

3.5.1 Contact Structural Development Laboratories (department D0400), Technical Lead: Controls and Computer Infrastructures, for determination of durability test loads necessary for block cycle test.

Note: Using GMW16285 and specific tools in a GM nCode process, the Structural Computer Aided Engineering (CAE) Group will formulate a dataset of programmed durability test loads (road surface/ballast combinations), counts, application rates, and angle of application that represent the Structural Durability Test Schedule (i.e., GMW15980) applicable to the vehicle that will utilize the axle subject to this test.

See Table 1.

Table 1: Example of Test Loads

Run Order	Load Level	Range	Mean	Max	Min	Counts	Hz
4	1	8850	-840	3585	-5265	10	1
3	2	8290	-1175	2970	-5320	2000	1
2	3	6880	-840	2600	-4280	5000	5
1	4	5350	170	2845	-2505	390000	10

Note: Max = maximum; Min = minimum.

Note: Test loads in Newtons (N).

Note: For this test, the load was applied at approximately 80.5 degrees.

3.5.2 Record actual target tests loads and required counts and application frequency in Table 2.

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Table 2: Test Loads

Run Order	Load Level	Range	Mean	Max	Min	Counts	Hz

Note: Test loads in (select one): Newtons (N)/Pounds-force (lbf).

Note: For this test, apply load at angle of _____.

3.5.3 The load axis for the actuator is to be the same as the relative orientation of the shock absorber to axle when installed in the vehicle at the mean operational ride height.

3.6 Personnel/Skills. Test technician should be proficient in operation of the facilities listed in 3.1, as well as the proper selection and operation of the equipment listed in 3.2. Test technician should also be familiar with the general operation of Axle/RDM/FDUs.

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 Stencil Ink. Crack highlighting paint (white stencil ink) should be applied to areas of interest on the test piece. Cracks will show up as a black line. Do not use regular spray paint as it can hide cracks or show false signs of cracking.

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 (BOM) Family Owner (BFO). Photographs and/or Computer Aided Design (CAD) images of the test must be provided.

4.2 Conditions.

4.2.1 Environmental Conditions. Unless otherwise specified, the typical environmental conditions for this procedure are the temperature, humidity and pressure at the test facility. Unless otherwise noted, these conditions are typically 22 °C to 25 °C, Relative Humidity (RH) of 40% to 60%, and atmospheric pressure equivalent to the local barometric pressure.

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

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

4.2.5 Adjust imminent failure detecting parameters (i.e. load or displacement) to affect shutdown when loads or displacements increase to predetermined levels.

Note: Visual cracks are grounds for pausing the test and evaluating. Acquire consensus from Program Team DRE and SVE concerning crack evaluation. GMW14048 can be considered, but is not obligatory.

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