GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW15183

Suspension Knuckle Bending Fatigue

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 standard is to determine the fatigue life characteristics of a front and/or rear knuckles when subjected to repeated lateral loads.

1.2 Applicability. Passenger cars and light duty trucks.

1.3 Remarks. The criteria for bending fatigue performance is suggested. The actual requirements for validation should be stated in the Subsystem Technical Specification (SSTS) or Component Technical Specification (CTS) for each model year by program.

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.

- CG583 Development/Validation Test and Vehicle Review Form
- Component Technical Specification (CTS)
- Subsystem Technical Specification (SSTS)

3 Resources

3.1 Facilities. Bedplate, approximately 3.1 m × 3.1 m (10 ft × 10 ft), with hydraulic power supply and control.

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 One (1) actuator capable of applying the required force for lateral loading.

3.2.2 One (1) actuator capable of applying the required force for vertical loading.

3.2.3 Two (2) load cells.

3.2.4 Two (2) channel load readout devices.

3.2.5 Fixturing to hold the brake corner/knuckle assembly in position. This may include angle stands, hemi joints, and other fasteners to complete the setup.

3.2.5.1 Load arm to simulate the rolling radius of the largest wheel and tire assembly released for the vehicle being tested. The load arm is constructed such that the lateral load is applied at the tire patch and the vertical load is applied along the wheel centerline.

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3.2.5.2 Design representative wheel bearings, control arms/links, brake caliper brackets and rotor, along with the design-intent fasteners to attach them to the knuckle.

3.3 Test Vehicle/Test Piece.

3.3.1 Sample quantity of the knuckle shall be three (3) left-hand and three (3) right-hand.

3.3.1.1 For knuckles incorporating an integral spindle; a hub and wheel studs assembly, plus both inner and outer bearings is required.

3.3.1.2 For knuckles which utilize a live spindle, the spindle assembly, complete with bearing, spacing, and retention components, is required.

3.4 Test Time.

Calendar time:	40 days to 105 days
Test time:	240 hours to 720 hours
Coordination time:	80 hours to 120 hours

3.5 Test Required Information. Front/Rear Gross Axle Weight Rating (GAWR) is needed to determine the test loads. Static Loaded Radius (SLR), wheel offset, and suspension hard point coordinates are needed for test setup.

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

4 Procedure

4.1 Preparation.

4.1.1 Calculation of Test Loads. Test loads are to be determined by use of the following formulae, based on the GAWR of the vehicle and axle for which the knuckle being tested is being considered (all loads in newtons):

- GAWR is maximum rated mass (kilograms) of axle (front or rear) appropriate for knuckle undergoing test.
- Peak Inboard Force (L_i) = 6.54 × GAWR.
- Peak Outboard Force (L_o) = 0.79 × L_i.
- Inboard Test Load (T_i) = 0.88 × L_i.
- Outboard Test Load (T_o) = 0.88 × L_o.
- Vertical Test Load (V) = 4.9 × GAWR.

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.

4.2.2.1 These requirements shall also be documented on the CG583 Development/Validation Test and Vehicle Review form, including photographs and/or layouts of the test setup.

4.3 Instructions.

4.3.1 Pretest. All samples should be magnetic particle inspected prior to test, or dye penetrate inspected in the case of aluminum. If any cracks or indications are found, notify the Design Responsible Engineer. X-rays of the castings should be taken to document the level of porosity that is being validated.

4.3.2 Setup for Front and Rear Independent Suspensions.

4.3.2.1 For knuckles incorporating an integral spindle (Gen0 wheel bearing), install hub and wheel bolt assembly with bearings. Pack inner and outer bearings with wheel bearing grease. Tighten the spindle nut to minimum specified torque. If required to install a cotter pin, tighten with minimal additional nut rotation.

4.3.2.2 For knuckles incorporating a Gen1 wheel bearing, install the spindle assembly with appropriate bearing and spacing components. Tighten the spindle nut to the minimum specified torque.

4.3.2.3 For knuckles using a Gen3 wheel bearing, install the bearing with the bearing bolts tightened to the minimum specified torque. Index bolt heads with a paint mark.

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