GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW17654

Initial Function Check
(Bench and Dynamometer Test for Axles)

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. Perform a series of basic checks and load cycling for axles and Rear Drive Modules (RDM) under varying conditions to evaluate for initial functionality, buds of problems, and develop confidence in early build units. The purpose is to assess units for wear, damage, mechanical issues/flaws, and overall design robustness.

1.2 Applicability. This specification applies to axle/RDM applications in passenger cars and light trucks.

1.3 Remarks. This test procedure is intended to evaluate the axle/RDM for gear contact patterns, backlash, drag torque, and functionality during light loading conditions and speed targets.

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.

- CG4465
- Component Technical Specification (CTS)
- GM1829
- Subsystem Technical Specification (SSTS) (for axle/RDM)
- Validation Cross Reference Index (VCRI)

3 Resources

3.1 Facilities.

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.

3.1.3 The lab must be equipped with a dynamometer (power source) with a means of applying a minimum of 7000 rpm input speed (± 5 rpm) to the axle/RDM and delivering required pinion torque (within 1.0% of target) under varying speed conditions.

3.1.4 Two (2) energy absorption devices capable of absorbing the output of the input source and regulating the output speed (± 5 rpm) under the varying conditions of this procedure. See Appendix A, Figure A1 and Figure A2.

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3.1.5 Control equipment capable of accelerating and decelerating one (1) axle shaft on a linear function from base speed to test speed (± 5 rpm) while maintaining constant speed conditions on the opposite shaft and constant load on the input.

3.1.6 Vibration monitoring or similar device connected with drive and absorption device controls to provide automatic shutdown at failure.

Note: Preferred method of detecting imminent parts problem is to use delta analyzer for early warning.

3.1.7 Counters and timer to record time at test conditions.

3.2 Equipment.

3.2.1 Fixtures, reaction members, and adapters to mount test axle at the vehicle mount points.

3.2.2 Input adapter (provide for connection to dynamometer and sealing of input flange).

3.2.3 Output adapters (two (2) required) (provide for connection to dynamometer and sealing of output shafts; i.e., dummy joints).

3.2.4 External recirculating oil pump and cooler with adequate capacity to maintain the axle sump temperature at 82 °C ± 3 °C (180 °F ± 5 °F).

3.2.5 Temperature measuring device in sump with resolution 1 °C.

3.3 Test Vehicle/Test Piece.

3.3.1 Test sample size to be determined by test engineer.

3.3.2 Test samples must be built per 3.3.2.1 and 3.3.2.2.

3.3.2.1 Inspect and thoroughly clean all axle/RDM components with a suitable solvent to insure no chips or foreign materials are present in the assembly.

3.3.2.2 Lubricate with the test lubricant and assemble the differential case.

3.3.3 Sample Preparation. The following inspections are to be performed pretest and recorded for each differential assembly being tested. Record on CG4465 Data Sheet, table titled Pretest Inspection Results.

3.3.3.1 Adjust side bearing preload (drag torque) to mean specifications and record on table titled Pretest Inspection Results.

3.3.3.2 Adjust ring gear backlash to mean specification and record on table titled Pretest Inspection Results.

3.3.3.3 Adjust differential backlash to mean specification and record on table titled Pretest Inspection Results.

3.3.3.4 Adjust drive gear-set contact pattern to nominal production pattern at production test load or equivalent pattern at no load and record results on table titled Pretest Inspection Results. Take photographs of contact patterns for each unit or record on contact pattern sheet in CG4465 Data Log.

3.3.4 The test axle/RDM must be equipped with a means of monitoring and recording oil sump temperature.

3.3.4.1 Install a thermocouple the lower sump drain plug.

3.3.5 Run a pretest analysis of a sample of the test lubricant to insure that it meets specifications. Obtain sample from the same container from which the axle/RDM fill is obtained.

3.3.6 Balance of differential to be manufactured within production specifications.

Note: All new axle/RDMs require break-in. See 4.3.1 for procedure details.

3.4 Test Time.

Calendar time:	5 days
Test hours:	26 hours
Coordination hours:	8 hours

3.5 Test Required Information. Possible sources are:

- Statement of requirements (SOR)
- Subsystem Technical Specification (SSTS)
- Analysis/Development/Validation Plan and Report (ADVP&R), GM1829
- Validation Cross Reference Index (VCRI)

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3.5.1 Axle/RDM allowable oil temperature range.

3.5.2 Obtain appropriate value for Axle Torque Capacity (ATC) from Program Team Design Release Engineer (DRE). If ATC is not readily available from Technical Specifications, default is to select ATC from the table titled ATC (Axle Torque Capacity) Table in CG4465. Acquire concurrence from Program Team DRE. Record on CG4465 Data Sheet.

Note: If the load is measured at the pinion input, use an axle efficiency factor of 95%. This efficiency value is an approximated figure. If an efficiency curve is available from the test axle, select the appropriate value from the curve.

3.5.3 Calculate the final load values per table titled Load Table in CG4465 or as in Table B1 (Appendix B).

3.6 Personnel/Skills.

3.6.1 Test technician should be proficient in operation of the facilities listed in 3.1.

3.6.2 Test technician should be proficient in proper selection and operation of the equipment listed in 3.2.

3.6.3 Test technician should be familiar with the general operation of gearboxes with differential assemblies. See Appendix A, Figures A1 through A3.

4 Procedure

4.1 Preparation.

Note: Test samples that complete this test are not to be reused for other testing, unless approved by the DRE, due to the accrued damage that may be introduced in the parts.

4.1.1 Check the axle/RDM lubricant level and ensure it is set to the appropriate level.

4.1.2 Install axle/RDM in test cell. The axle/RDM shall be mounted on a test stand, which consists of an electric motor input and two electric motors at the outputs.

4.1.3 Connect torque cells and speed sensors at each input/output interface.

4.1.4 Connect thermocouple from the lower sump drain plug.

4.1.5 Attach a vent tube (clear tube recommended) to the axle/RDM vent fitting and position it at least 457 mm (18 in) above the vent outlet.

4.1.6 Record the sump temperature, torque (input, Left Hand (LH) and Right Hand (RH) output), and speed (input, LH and RH output), with frequency 10 Hz.

4.1.7 Set temperature control system to maintain 80 °C ± 3 °C (176 °F ± 5 °F) sump temperature.

4.1.8 Input (program) the Test Loads from table titled Load Table into table titled Run Table. See CG4465 Data Log Sheet.

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 Adjust vibration sensing device to affect shutdown when vibration level increases approximately 20%.

Note: Preferred method of detecting imminent parts problem is to use delta analyzer for early warning.

4.3 Instructions.

4.3.1 Break-in.

4.3.1.1 Run Device Under Test (DUT) at 20% ATC load for 20 minutes.

4.3.1.2 Set shaft speed counters to zero.

4.3.1.3 Adjust absorbing devices to obtain a 20 rpm delta speed between the two (2) axle shafts.

4.3.1.3.1 Run 10 minutes with LH axle shaft at speed = 90 rpm, and RH axle shaft at speed = 70 rpm.

4.3.1.3.2 Run 10 minutes with RH axle shaft at speed = 90 rpm, and LH axle shaft at speed = 70 rpm.

4.3.1.4 Apply test load and set ring gear speed to 100 rpm.

4.3.1.5 Adjust vibration sensing device to affect shutdown when vibration level increases approximately 20%.

Note: Preferred method of detecting imminent parts problem is to use delta analyzer for early warning.

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