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| GM WORLDWIDE ENGINEERING STANDARDS | Test Procedure | GMW17711 |

# Vmax – High Speed Test (Axle/Rear Drive Module (RDM)/Front Drive Unit (FDU))

## 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.** Evaluate an axle/Rear Drive Module (RDM)/Front Drive Unit (FDU) for suitable lubrication at high speed operation, and its ability to operate without loss of function.

**1.2 Applicability.** This procedure applies to passenger cars and trucks.

**1.3 Remarks.**

**1.3.1** This test is intended to simulate operating a vehicle at maximum speed for one (1) full tank of fuel.

**1.3.2** A break-in run on the test unit is not necessary or desired for this test.

## 2 References

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

**2.1 External Standards/Specifications.**

None

**2.2 GM Standards/Specifications.**

9986290

**2.3 Additional References.**

- CG4654
- Component Technical Specification (CTS)
- Statement of Requirements (SOR)
- Subsystem Technical Specification (SSTS) (for Axle or RDM or FDU)
- Validation Cross Reference Index (VCRI)

## 3 Resources

**3.1 Facilities.** This test requires a lab/test cell for component 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.

**3.1.3** The lab must be equipped with a dynamometer (power source) with a means of applying the required input speed (rpm) (within 1.0%) and delivering required pinion torque (within 1.0% of target) under varying speed conditions.

**3.1.4** Two energy absorption devices capable of absorbing the output of the input source and regulating the output speed within 1.0% under the varying conditions of this procedure. See Appendix A, Figure A1.



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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, 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 absorption device controls to provide automatic shutdown in the event of failure of either test parts or equipment.

**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 the axle/RDM/FDU.

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

**3.2.3** Two (2) output adapters (provided for connection to dynamometer and sealing of output shafts; i.e., dummy joints).

**3.2.4** Temperature monitoring in sump with resolution within 1 °C (2 °F).

**3.2.5** Vibration monitoring, or similar device, connected with drive absorption device controls to provide automatic shutdown in the event of failure of either test parts or equipment.

**Note**: Preferred method of detecting part problems is to use a delta analyzer for early warning.

**3.2.6** Inclinometer to measure pinion angle.

**3.2.7** Thermocouples and temperature monitoring equipment (temperature vs. time).

**3.2.8** Tachometer or counter to measure pinion speed.

**3.3 Test Vehicle/Test Piece.** Axle/RDM/FDU Final Drive Assembly.

**3.4 Test Time.**

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| Calendar time: | 2 days |
| Test hours: | 8 hours |
| Coordination hours: | 4 hours |

**3.5 Test Required Information.** Possible sources are:

- Component Technical Specification (CTS).
- Statement of Requirements (SOR).
- Subsystem Technical Specification (SSTS) (for axle or RDM or FDU).
- Validation Cross Reference Index (VCRI).

**3.5.1** Ascertain the following requirements from the appropriate sources and record on CG4654 Data Sheet for Vmax-High Speed (Axle/RDM/FDU) Test External Supplement to GMW17711.

**3.5.1.1** Pinion bearing preload: (Newton·meters).

**3.5.1.2** Torques for fill and drain plugs: (Newton·meters).

**3.5.1.3** Pinion angle as defined in SSTS: (degrees).

**3.5.1.4** Gear oil amount and type: (e.g., 0.7 L of 9986290, which is 75W90 synthetic gear oil with a friction modifier).

**3.5.1.5** Input speed required to achieve Vmax as defined in SSTS: (rpm).

**3.5.1.6** Percent Axle Torque Capacity (ATC) required to maintain Vmax as defined in SSTS: (% ATC).

**3.5.1.7** Run time necessary to achieve 200 km (125 mi) at Vmax: (minutes).

**3.6 Personnel/Skills.** Test technician.

- Should be proficient in operation of the facilities listed in 3.1.
- Should be proficient in proper selection and operation of the equipment listed in 3.2.
- Should be familiar with the general operation of axle/RDM/FDU.

## 4 Procedure

**4.1 Preparation.**



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**4.1.1** Install thermocouples in the Axle/RDM/FDU housing sump.

**4.1.1.1** Prepare a drain plug with a thermocouple for measuring Axle/RDM/FDU sump temperature. Reference Figure A2, Appendix A.

**4.1.2** Set pinion bearing preload torque to maximum print specifications. Measure total Axle/RDM/FDU assembly torque at start of test. Record on CG4654 Data Log.

**4.1.3** Fill Axle/RDM/FDU with specified part number, type, and quantity of lubricant when set at design pinion angle (chassis layout design position). Use amount of lube specified in design specifications.

**4.2 Conditions.**

**4.2.1 Environmental Conditions.** This test can be run in any ambient 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.

**4.2.2.1** The test aggregates are to be installed immediately before test start and may not be driven before.

**4.3 Instructions.**

**4.3.1** Preliminary noise measurement.

**4.3.1.1** Install axle/RDM/FDU assembly into dynamometer test cell capable of noise measurements.

**4.3.1.2** Connect to dynamometer drives at each input/output interface.

**4.3.1.3** Program output loads to equivalent of 75% of vehicle capacity weight.

**4.3.1.4** Conduct a noise sweep on the axle without exceeding the equivalent of 5 km of vehicle run distance.

**4.3.1.5** Remove axle from noise dynamometer and move to test (durability) dynamometer.

**4.3.2** Install axle/RDM/FDU assembly into the test (durability) dynamometer test cell.

**4.3.2.1** Connect axle/RDM/FDU assembly to dynamometer drives at each input/output interface.

**4.3.2.2** Connect thermocouple from the lower sump drain plug.

**4.3.2.2.1** Monitor the axle/RDM/FDU sump temperature. Record at 1 Hz sample rate. Record on CG4654 Data Log.

**4.3.2.3** Set the axle/RDM/FDU to the design pinion angle.

**4.3.2.4** 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.

**4.3.2.5** Test stand review. The test setup and methodology must be reviewed with the GM System Validation Engineer (SVE). The GM SVE may request for a review by the DRE and/or the Bill of Material (BOM) Family Owner (BFO). Photographs and/or computer aided design images of the test must be provided.

**4.3.3** Run Vmax “loaded” to the run parameters in Table 1.

**4.3.3.1** Calculate “input speed” required to achieve Vmax (Table 1, Note 1). See CG4654 Data Log Sheet.

**4.3.3.2** Enter actual starting sump temperature.

**4.3.3.3** Calculate ATC required to simulate actual road load during Vmax (Table 1, Note 2).

**4.3.3.4** Calculate minutes of run time necessary to achieve 200 km (125 mi) at Vmax (Table 1, Note 3).

**4.3.3.5** Monitor and record “outputs” per Table 1.

**4.3.3.6** Check temperatures after every 5 km (3 mi). If overheating occurs, stop the test.



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