Accelerated Drivetrain Durability for Automatic Transmission Equipped Vehicles

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 evaluate the performance of automatic transmissions, axles and propshafts after being subjected to severe loads resulting from aggressive type of driving.

1.2 Applicability. Passenger cars, multipurpose passenger vans, and light commercial vehicles equipped with an automatic transmission.

1.3 Remarks. This test is typically run by Global Propulsion Systems Interface Group and is used for development and validation of the drivetrain. This system includes but, is not limited to: driveshaft, half shafts, axles, suspension bushings, etc.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14264

2.3 Additional References.

- Analysis/Development/Validation (ADV) Plan
- Statement of Requirements (SOR)
- Subsystem Technical Specification (SSTS)
- Validation Cross-Reference Index (VCRI)
- Vehicle Technical Specification (VTS)

3 Resources

3.1 Facilities.

Milford Proving Ground (MPG), North-South Straightaway.

- Desert Proving Ground Yuma (DPGY), 1.4 Mile Straightaway.
- Dudenhofen High Speed Track.
- Prepared Surface (if required by program management team or Vehicle Technical Specification (VTS)).

Note: Equivalent roads with similar friction characteristics may be acceptable. For performance oriented vehicles where customer usage is expected to include drag racing, the tests should be run on prepared drag racing surface (i.e., testing and/or Road Load Data Acquisition (RLDA) at actual drag racing facility on prepared surface).

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

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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 Transmission sump, axle sump and ambient thermocouples. All temperatures should be monitored with appropriate instrumentation on a continuous basis.

Note: All instrumentation shall be calibrated as required. Record instrumentation details and date of calibration on Appendix A, Data Sheet A1, unless information is maintained in the testing laboratory records.

3.3 Test Vehicle/Test Piece.

3.3.1 Test Vehicle. Vehicle shall be equipped for driveline being tested with:

3.3.1.1 Highest torque engine.

3.3.1.2 Wheels and tires that produce the highest rotating inertia (typically the largest released diameter and highest mass wheel/tire combination).

3.3.1.3 Tires that produce the highest tractive effort.

3.3.1.4 Lowest numerical final drive ratio.

Note: If highest inertia engine does not correspond with highest torque, multiple tests may be required. Impact load during launch and shift are inertia dependent. Steady state driveline loads during Wide Open Throttle (WOT) accelerations are dependent on engine torque.

3.3.2 Vehicle Ballast. Production intent vehicle curb weight plus driver and equipment.

3.3.3 Drivetrain Hardware. All drivetrain hardware that is being validated should be new.

3.4 Test Time.

Calendar time:	3 days
Test hours:	40 hours
Coordination hours:	16 hours

3.5 Test Required Information. Possible sources are:

- Statement of Requirements (SOR).
- Vehicle Technical Specification (VTS).
- Subsystem Technical Specification (SSTS).
- Analysis/Development/Validation (ADV) Plan.
- Validation Cross-Reference Index (VCRI).
- Application Engineer.
- Development Groups.
- Drawings for driveline components (i.e. axles, propshafts, transmissions, etc.)

3.6 Personnel/Skills. Trained and able to evaluate driveline noise in vehicles according to GMW14264. Ability to conduct end of test inspection of test parts, if required.

4 Procedure

4.1 Preparation.

4.1.1 Prior to the test, assure that Appendix B, Data Sheet B1 is available and complete the following:

4.1.1.1 Determine and record the number of test starts as defined in 4.3. Use 200 test starts as a default, and at least one (1) set of hardware to 500 cycles for development tests.

4.1.1.2 Determine and record maximum transmission and axle lubricant excursion and maximum continuous operating temperatures for test.

4.1.1.3 Record tire pressure specifications.

4.1.1.4 Determine and record responsible owner for disassembling transmission/axle or components (e.g., GM or Supplier).

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4.1.2 Check all fluid levels. Fill as required.

4.1.3 Set tire pressure to recommended specifications.

4.1.4 Install instrumentation to measure ambient temperature, transmission, and axle lubricant temperatures.

4.1.5 Pretest Rating. According to GMW14264.

4.1.5.1 Rate drivetrain for pretest noise using GMW14264 and record on Appendix B, Data Sheet B1.

4.1.5.2 Rate leaks using GMW14264 and record on Appendix B, Data Sheet B1.

4.1.5.3 Put vehicle on hoist and conduct inspection on the following:

- Engine Mounts.
- Suspension.
- Frame and Body Supports.
- Axle Housing.
- Other reaction supporting members.

4.1.6. Break-In. A break-in is recommended for new engines and transmissions. It is mandatory if a new axle is installed on test vehicle. Complete as follows:

- Accelerate lightly to 100 km/h (approximately 65 mph), then vary vehicle speed between 100 km/h to 125 km/h (approximately 65 mph to 75 mph) for a total of 10 km.
- Use light braking to bring vehicle to a stop.

Repeat cycles until a distance of 200 km is attained. A minimum of 200 km is mandatory if rear axle is included in the validation (in such case, measure axle sump temperature during the break-in cycle).

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.1.1 Road must be dry.

4.2.1.2 Ambient temperature should be between -7 °C and +27 °C. High ambient temperatures are not desired since engine power is lowered and may affect test results.

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 Axle lubricant temperature must be +70 °C (minimum) before starting.

4.2.2.2 Maximum temperature allowed, either on transmission or axle lubricant, is determined by the engineer and recorded in Appendix B, Data Sheet B1. Run cooling laps, if necessary, to cool lubricants as required.

4.2.2.3 If traction control is available as a driver selected option, it must be turned off during the test.

4.2.2.4 If vehicle powerhops during launch, contact the test engineer to determine if it should be mitigated or if the test should be completed with the powerhop. Comment on method of mitigation in Appendix B, Data Sheet B1.

4.3 Instructions.

Note: Terminate test if:

- Transmission oil temperature or rear axle temperature exceeds short or long term permissible value according to oil type and specifications.
- Engine temperature exceeds permissible value. If occurring, this is usually displayed on the vehicle's display.

4.3.1 Perform test according to defined total number of cycles per 4.1.1.1.

4.3.1.1 Record the ambient air, transmission and axle lubricant temperature at the start of the test and after every ten (10) cycles Appendix C, Data Sheet C1.

4.3.2 Launch.

4.3.2.1 Launch Method.

4.3.2.1.1 Cycles 1 thru 200. Launch vehicle in Wide Open Throttle.

4.3.2.2.2 Cycles 201 thru 500 (if required). Use same method as cycles 1 thru 200.

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