



Accelerated Shift System Durability for MT Equipped Vehicles

1 Scope

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 manual transmissions (particularly synchronizers), and external shift systems.

1.2 Foreword. This test is typically run by GM Powertrain and is used for development and validation.

This tests performance parts has formerly been known as GME R-7B1D-13 "High Performance Synchronizer Test" (HSLV Test).

Equivalent field life 160 000 km.

1.3 Applicability. Passenger cars, multipurpose passenger vans and light commercial vehicles (includes light duty pickup trucks) equipped with manual transmissions.

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

GMW15628

3 Resources

3.1 Facilities. Equivalent roads with similar friction characteristics may be acceptable.

3.1.1 Milford Proving Ground (MPG) – North-South Straightaway.

3.1.2 Desert Proving Ground (DPG) – East Straightaway.

3.1.3 Dudenhofen High Speed Track.

3.1.4 Brazil, Cruz Alta Proving Ground.

3.1.5 Korea.

3.2 Equipment.

3.2.1 Ambient thermocouple and temperature display. Transmission oil sump thermocouples and temperature display.

3.2.2 Calibrated tachometer or equivalent.

Note: All instrumentation shall be calibrated as required.

3.3 Test Vehicle/Test Piece.

3.3.1 Test Vehicle. Vehicle shall be equipped for driveline being tested with highest rotating inertia.

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

3.3.3 Clutch. New clutch assembly with measured clamp load that is within the design intent tolerance zone.

GM Confidential

© Copyright 2012 General Motors Company All Rights Reserved

November 2012

Originating Department: GME Specification Center

Page 1 of 7

3.3.4 Hydraulic or Mechanical Clutch System. Production intent clutch hydraulic with intended restrictive orifice and damper, if applicable. Production intent clutch pedal return spring / over center spring as released for the vehicle.

Measurement or subjective evaluation of declutch reserve according to GMW15628.

3.3.5 Transmission synchronizer with measured “wear gap” if applicable.

3.3.6 New test components, assembled according to specification.

3.3.7 If there is no request mentioned in SSTS or VTS perform the test with two samples.

3.4 Test Time.

Calendar time: 7 days

Test hours: 40 h

Coordination hours: 16 h

3.5 Test Required Information. Possible sources are:

- Statement of Requirements (SOR)
- Vehicle Technical Specifications (VTS)
- Sub System Technical Specifications (SSTS)
- Analysis Development Validation Plan (ADV)
- Validation Cross Reference Index (VCRI)
- Application engineer
- Development Groups
- Drawings

3.6 Personnel/Skills. Ability 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 the following shall be done by the engineer:

4.1.1.1 Determine and record the number of test starts as defined in paragraph 4.3. Use 500 as a default.

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 and transmission lubricant temperature.

4.1.5 Pre-test Rating according to GMW14264.

4.1.5.1 Rate drivetrain for “pre-test” noise using GMW14264 and record on Appendix A.

4.1.5.2 Rate leaks using GMW14264 and record on Appendix B.

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 not recommended for testing external shift system. Before performing the test, heat up the transmission oil with a minimum number of shifting to achieve transmission oil $> +50^{\circ}\text{C}$.

The following break-in procedure is required for testing of internal shift system and synchronizers.

- Accelerate lightly, while up-shifting lightly to 100 km/h (≈ 60 mph), then:
- Vary speed (80 to 100) km/h ($\approx (50$ to $60)$ mph) for a distance of 5 km (≈ 3 miles) in top gear, then:
- Decelerate lightly, while lightly downshifting to a stop, then:

GM Confidential

© Copyright 2012 General Motors Company All Rights Reserved

November 2012

Page 2 of 7

- Repeat cycles as above defined until a distance of ≈ 100 km is attained.
- Check the declutch reserve subjective

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.1.1 Road shall be dry.

4.2.1.2 Ambient temperature should be between $(-5$ to $+30)$ °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 Maximum temperature allowed on the transmission lubricants is determined by the engineer. Run cooling laps if necessary to cool lubricants as required.

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

4.3 Instructions.

Note: Terminate test if:

- transmission oil temperature exceeds short or long term permissible value according to oil type and specifications
- engine temperature exceeds permissible value. If occurring usually displayed on the vehicle's display
- shift system components temperature exceed permissible value according to material specifications, particularly with regard to shift system validation test performance.

4.3.1 Perform test according to defined total number of cycles for validation. Pre-defined total number of cycles per test is 500.

For development the test might be performed according to total number of test cycles specified by engineer.

4.3.2 Launch.

4.3.2.1 Launch Engine Speed. Perform launch at idle rpm. If the vehicle will not launch (stalls) at idle, increase launch rpm (in 200 min^{-1} (rpm) increments) until reaching minimum rpm at which vehicle will launch without stalling.

4.3.2.2 Launch Method. Standard clutch engagement (see paragraph 7.1.1.1) followed by maximum acceleration rate obtainable without breaking tires traction, then WOT.

4.3.3 Up-Shift.

4.3.3.1 Up-Shift Engine Speed. All next up-shifts at approx. engine redline (200 min^{-1} below fuel cut-off).

4.3.3.2 Up-Shift Method. Quick Shift (see paragraph 7.1.2.2) through all gears until peak vehicle test speed is reached (see paragraph 4.3.3.3).

4.3.3.3 Speed Restriction / Peak Vehicle Test Speed. Recommended maximum is at 220 km/h. This maximum may be deviated at the test engineer's discretion.

Note: Speed limit for specific facility may require prior permission. Request permission based on peak vehicle speed or according to SSTs requirement.

4.3.4 Down-Shift.

4.3.4.1 Down-Shift Method. Upon reaching peak vehicle test speed, lift throttle and allow the vehicle to coast. Select Down-Shift Engine Speed (see paragraph 4.3.4.2). Engage standard clutch engagement (see paragraph 7.1.1.1) and ensure tire traction not to be broken (if such case occurs release the clutch less rapidly). Quick Shift (see paragraph 7.1.2.2) down through all gears until first gear is reached (see paragraph 4.3.3.3).

4.3.4.2 Down-Shift Engine Speed. Engine speed (min^{-1}) in target (lower) gear should be between 95 % and 100 % of fuel redline (i.e. $(0$ to $50) \text{ min}^{-1}$ below engine redline) after engagement.

5 Data

5.1 Calculations. Not applicable.

GM Confidential

© Copyright 2012 General Motors Company All Rights Reserved

November 2012

Page 3 of 7