



Clutch Energy Test

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 steering maneuvers, engine speeds, accelerations and brake operations representing customer behavior and vehicles in GMW15531 and GMW15550, especially for city and hill section. The statistical evaluation of the launch energy will be used for thermal clutch analysis and to generate parameters for clutch powertrain test benches.

1.2 Applicability. This procedure is applicable for testing all Front Wheel Drive (FWD), All Wheel Drive (AWD) and Rear Wheel Drive (RWD) Manual Transmissions (MT) with dry friction clutch systems.

1.3 Remarks. Refer to the appropriate parent specifications in GMW3425 and GMW3428.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW3241	GMW3428	GMW15550
GMW3425	GMW15531	

2.3 Additional References. None.

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 Hill tracks with grades of 0%, 8% and 12%.

- -12% and skid pad designed as GMW15550 Nueva Italia – City Course.

3.2 Equipment.

3.2.1 Data recording device for the following measurements:

- Ambient temperature.
- Gear box oil temperature.
- Air temperature in the clutch housing near upper circumference of clutch pressure plate.
- Clutch pedal travel bus-signal or sensor.
- Speed of gearbox input shaft sensor.
- Engine speed on bus-signal or sensor at flywheel.

GM Confidential

© Copyright 2018 General Motors Company All Rights Reserved

April 2018

Page 1 of 9

- Vehicle speed bus-signal.
- Engine torque bus-signal.

Optional:

- Accelerator pedal position sensor.
- Gear input shaft torque.
- Longitudinal vehicle acceleration on bus or sensor.
- Air temperature at the clutch disc hub close to the release bearing.
- Global Positioning System to detect the track position (i.e., road gradient).

Measuring data sampling rate ≥ 20 Hz.

3.2.2 Biggest optional tires, if available.

3.2.3 Optional instrumentation shall be determined by the responsible test engineer.

3.3 Test Vehicle/Test Piece. Vehicle with clutch system and manual transmission.

- Engine calibration milestone level for test 65% minimum.
- One new clutch set and new flywheel according to specification.

3.4 Test Time.

Calendar time: 10 d

Test time: 80 h

Coordination time: 6 d

3.5 Test Required Information. Possible sources are:

- Statement of Requirements (SOR).
- Vehicle Technical Specifications (VTS).
- Subsystem Technical Specifications (SSTS).
- Component Technical Specifications (CTS).
- Analysis Development Validation (ADV) Plan.
- Validation Cross Reference Index (VCRI).
- Application Engineer.
- Development Groups.
- Drawings.

3.6 Personnel/Skills.

3.6.1 Trained and skilled test driver to run test.

3.6.2 Test Engineer to evaluate results.

3.6.3 Skilled mechanic to determine component characteristics.

4 Procedure

4.1 Preparation. Refer to the appropriate parent specification GMW15531.

4.2 Conditions.

4.2.1 Environmental Conditions. All tests shall be performed at dry conditions.

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 Test Load. Test shall be performed with Gross Vehicle Mass (GVM) and Light Vehicle Mass (LVM). If it is necessary to execute clutch tests for another road grade. See 2.3 to estimate the necessary payload.

4.3 Instructions. Unless otherwise specified the test shall be performed with three (3) different drivers in the following sequence:

GM Confidential

© Copyright 2018 General Motors Company All Rights Reserved

April 2018

Page 2 of 9

4.3.1 Fix measurement system in vehicle.

4.3.2 Connect measurement device to measuring connector for vehicle- Controller Area Network (CAN)-signals e.g., engine-speed, vehicle-speed, actual engine torque, clutch pedal position, gas pedal position, engine coolant temperature.

4.3.3 Connect Trigger to "ignition-on" supply.

4.3.4 Connect all required sensors to measurement system.

4.3.5 Turn "ignition" on and check status- Light Emitting Diode (LED) at the measurement system.

4.3.6 Check configuration of measurement-system.

4.3.7 Validate all signals online.

4.3.8 Every driver performs one selected modules according to GMW15531.

- Repaired asphalt road.
- Torture tracks to the end of gravel.
- Left lane Durability Test (DT) for GMW3428 with 2nd short cut.
- From 2nd short cut to hill section right lane.
- Hill section two (2) laps (one (1) lap with reverse).
- Ramp 16 degree (GMW3241).
- Ramp 13 degree (GMW3241).
- Comfort and Noise track.
- High speed.
- City track (GMW15550).

After each city cycle cooling cycles on high speed track with 120 km/h in the highest gear shall be performed until clutch housing air temperature reaches approximately +100 °C.

4.3.9 Every driver performs additional two (2) hill section cycles for the evaluation purpose of collective clutch launch energy. Every hill section cycle consists of 5x double laps, each lap including hill launches at 0%, 8%, 12% and -12% and one (1) rearward uphill launches at +12% (see Appendix A, Figure A1) example for one (1) hill cycle. After five (5) double laps have been finished a cooling cycle on high speed track with 120 km/h in the highest gear shall be performed until clutch housing air temperature reaches approximately +100 °C.

5 Data

5.1 Calculations. Record the data listed in 3.2.1 (the test engineer may require additional data).

5.1.1 Calculation Method. Analysis of the friction energy (in Joules (J)) and temperature changes during the test:

$$P_K = M_K \cdot \omega \quad \text{angular velocity } \omega$$

$$P_K = M_K \cdot \frac{\pi \cdot \Delta n}{30} \quad \text{with } \Delta n \left[\frac{1}{\text{min}} \right], P_K [W]$$

Where:

P_K = Frictional Performance in Watts

M_K = Clutch torque=Engine Torque in Newton meters (Nm)

ω = Angular Velocity

Δn = Delta RPM's

GM Confidential

© Copyright 2018 General Motors Company All Rights Reserved

April 2018

Page 3 of 9

AVA Documents
Document Sharing Hub