



Clutch System Impact 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. Test of clutch wear and durability.

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

1.3 Remarks. None.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW15627

GMW15628

GMW16905

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 Circular track and hill tracks with grades of 0%, 8% and 12% (for check of judder).

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).
- Air temperature at the clutch disc hub, close to the release bearing.
- Clutch pedal travel sensor (or bus).
- Speed of gearbox input shaft.
- Engine speed at crankshaft.
- Accelerator pedal position (bus, option).
- Engine torque bus/sideshafts (option).

3.2.2 Attached tachometer and speedometer.

3.2.3 New standard tires.

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3.2.4 Writing material.

3.2.5 Measurement equipment to measure the clutch pedal characteristic (according to GMW15628).

3.2.6 Optional instrumentation shall be determined by the responsible Test Engineer.

3.3 Test Vehicle/Test Piece.

3.3.1 Any vehicle with clutch and manual transmission and 65% or greater engine calibration. Vehicle Curb Weight +150 kg including driver.

3.3.2 Transmission, assembled according to specification.

3.3.3 Hydraulic clutch actuation components according to development phase.

3.3.4 Two (2) Dual Mass Flywheel (DMF) (condition: as new) with lower friction tolerance and two (2) new clutch sets with lower clamp force tolerance.

3.3.5 The engine type and the vehicle equipment shall correspond to the release.

3.4 Test Time.

Calendar time: 4 d

Test time: 24 h

Coordination time: 2 h

3.5 Test Required Information. Possible sources are:

- Statement of Requirements (SOR).
- Vehicle Technical Specifications (VTS).
- Subsystem Technical Specifications (SSTS).
- Analysis Development Plan (A/D/V).
- 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.

4.1.1 Measure test parts according to Appendix A, Data Sheet A2.

4.1.2 Check fuel, engine oil, cooling fluid, tire pressure and transmission oil level.

4.1.3 Check of pedal travel and force before the test according to GMW15628, if necessary readjust and/or bleed hydraulic clutch system.

4.1.4 Check engine performance on a dynamometer.

4.1.5 Prepare data sheet (see Appendix A, Data Sheet A1).

4.1.6 Activate measurement equipment.

4.2 Conditions.

4.2.1 Environmental Conditions. The test shall be performed on a dry plane track, for judder cycles a circular track and dry hill track.

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.

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4.3 Instructions.

4.3.1 Warm up the clutch system with twenty (20) cycles of GMW15627.

4.3.2 Perform compressed warm judder (according to GMW16905) one time forwards and rearwards in plane, 8% and 12% gradient (see 3.3.1 for weight). Note the temperatures in the clutch housing.

4.3.3 Stop the vehicle on a plane dry area and pull the park brake firmly. Engage straight gear (4th), increase engine speed to $0.6 \times n_{\text{fuel cut off}}$ for 15 s, stall the engine by releasing clutch pedal abruptly with simultaneous wide open throttle.

4.3.4 Repeat 4.3.3 every 15 s for 25 times.

4.3.5 Measure the disengagement reserve in the reverse gear after 10 cycles and 25 cycles.

4.3.6 Cool down the clutch system and engine by driving in the 5th gear at ≈ 120 km/h until reaching clutch housing temperature noted according to 4.3.2.

4.3.7 Repeat 4.3.3 every 15 s for 25 times.

4.3.8 Measure the disengagement reserve in the reverse gear after 35 cycles and 50 cycles.

4.3.9 Perform compressed warm judder (according to GMW16905) one time forwards and rearwards in plane, 8% and 12% gradient (see 3.3.1 for weight). Note the temperatures in the clutch housing.

4.3.10 Check of pedal travel, force and disengagement reserve according to GMW15628.

4.3.11 Measure test parts according Appendix A, Data Sheet A2.

5 Data

5.1 Calculations. Record the data mentioned in 3.2.1 (the Test Engineer may require additional data).

Calculation of the Impact Torque Moment of Inertia on primary side:

$$W_{KS} = \frac{\int_{t_0}^{t_1} P_K \cdot dt}{A_{Cl}}$$

Where:

$$M = \Theta \cdot \ddot{\varphi}$$

$$P_K = M_K \cdot 2\pi \cdot \Delta n$$

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

P_K = Frictional performance in Watts

M_K = Clutch torque = engine torque in Newton meters (Nm)

Δn = Delta

W_{KS} = Specific frictional work per frictional clutch facing in Joules per square centimeter (J/cm²)

5.2 Interpretation of Results. The program shall be performed with two (2) clutch sets. Test aim is fulfilled as follows:

- No slipping during test cycles.
- Judder rating within SSTs target.
- Clutch wear < SSTs.
- Clutch Housing Temperature < SSTs Target.

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