



Dual Clutch Transmission Judder Evaluation Procedure

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. This procedure is used to provide an objective measurement of Dual Clutch Transmission (DCT) Judder. This procedure has been correlated to GMW14264 subjective ratings and may be used to estimate subjective ratings from objective data.

1.2 Foreword. Clutch Judder is a vibration that typically occurs during vehicle launch from a stationary start. It occurs at low vehicle speed and low engine speed when the clutch goes from disengaged to fully engaged. During this event, the slip speed between the flywheel and transmission input shaft, goes from engine revolutions per minute (rpm) to 0 rpm. Before this slip speed reaches 0 rpm the clutch goes through a period of stick/slip which generates the judder. Judder can also occur when the clutch slip speed (Hz) passes through driveline resonances.

1.3 Applicability. The test is applicable to rear wheel drive (RWD), front wheel drive (FWD), and all wheel drive (AWD) configurations with DCT.

2 References

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

2.1 External Standards/Specifications.

IEC 651

2.2 GM Standards/Specifications.

GMW14264

3 Resources

3.1 Facilities. This test will be performed on three test surfaces. The 1st a test surface that is smooth, straight, and has an uphill grade of approximately 7%. The 2nd a test surface that is smooth, straight, and has an uphill grade of approximately 4%. The

3rd, a test surface that is smooth, straight, and has a 0% grade. The 7.2% hill at the Milford Proving Ground (MPG) is the preferred test track.

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.

3.2 Equipment.

3.2.1 Accelerometers. Two low mass triaxial accelerometers with a frequency range of 0.5 Hz to 1000 Hz are required.

3.2.2 Hand Switch and Dry Cell Battery. A battery controlled by a hand switch to a data channel will be used to trigger data acquisition.

3.2.3 Tachometer. One tachometer capable of collecting engine rpm measurements is required.

3.2.4 Portable Data Acquisition System. A data acquisition system capable of digitally sampling all channels of data at 1 kHz, with a minimum of 80 dB dynamic range is required. This hardware shall meet Class 1 accuracy corresponding to IEC 651 or be equivalent for the application (precision ± 0.7 dB or $\pm 8\%$). The preferred data acquisition system consists of a personal computer running Leuven Measurement System (LMS) Test.Lab software with Kalman filtering capability, connected to a Scadas III frontend.

3.2.5 Optional Equipment. This procedure may be used as a diagnostic procedure if any or all of the following equipment is installed: Tachometers on the "odd" and "even" clutch input shafts to measure their speeds (this may require an instrumented controller on the transmission). A tachometer on the transmission input shaft (this may require an instrumented controller on the transmission also), a thermocouple to measure clutch temperature, a laptop computer with software to monitor the clutch state and concentric slave cylinder (CSC) conditions such as ETAS/INCA.

GM Confidential

© Copyright 2013 General Motors Company All Rights Reserved

March 2013

Page 1 of 5

3.3 Test Vehicle/Test Piece.

3.3.1 Vehicle. This procedure may be performed on development vehicles, production vehicles or competitive vehicles.

Prior to conducting the evaluation, note the following vehicle configuration information. Record the configuration information electronically such that it is stored with the test data.

- Vehicle Information Number (VIN)
- GM Fleet Number
- Build Stage (if appropriate)
- Engine Displacement
- Cylinder Configuration (V or in-line)
- Driveline Configuration:
 - Front Wheel Drive (FWD)
 - Rear Wheel Drive (RWD)
 - All Wheel Drive (AWD)
- Transmission Clutch Type
 - Wet or Dry
- Tire Make
- Tire Model
- Tire Size
- Testing Date
- Test Location
- Transmission and Engine Calibration Revision Level and Identification
- GM or Competitor

3.4 Test Time.

Calendar time: 1 day
 Test hours: 4 hours
 Cool down hours: 4 hours
 Coordination hours: 2 hours

3.5 Test Required Information.

3.6 Personnel/Skills. One qualified engineer or technician trained in the use of data acquisition and having basic knowledge of digital signal processing of acoustic or vibration signals.

4 Procedure

4.1 Preparation.

4.1.1 Vehicle. Eliminate any unwanted content or known problems. Verify and note the status of all hardware relative to the current release status. Adjust tire pressures to nominal values as stated by the vehicle manufacturer (cold). Ensure fuel

tank is at least 75% full. Also ensure the radio/entertainment system and heating ventilation and air conditioning (HVAC) is turned "on". Position the seats and headrests in the middle positions.

4.2 Conditions.

4.2.1 Environmental Conditions. For a winter test the surface should be free of snow and ice.

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.

Data collected on the 7.2% and 4.0% grade hill will be with the vehicle in drive with the transmission both cold and warm.

Data collected on the 0% Grade will be taken with the vehicle in drive and reverse, and again with the transmission both cold and warm. See Glossary for the definition of "Cold", "Warm" and "Extended" clutch.

Note: Data Sheet 1 is a sample data sheet.

Data Sheet 1: Sample Test Data Sheet

	Drive		Reverse	
Grade	Clutch Cold	Clutch Warm	Clutch Cold	Clutch Warm
7.2%				
4.0%				
0.0%				
0.0% Extended CSC				

4.2.3 Instrumentation

4.2.3.1 Tachometers. Install one pulse per revolution optical tachometer on crankshaft pulley to measure engine speed.

4.2.3.2 Transducer Locations. Install triaxial accelerometers at the following locations:

- Driver's inboard seat track
- Steering Wheel at 12 o'clock

See Appendix A Figures A1 and A2 for illustrations of the transducer locations. Data from the seat track location is used to evaluate the vehicle's performance against a standard such as the Vehicle Technical Specifications (VTS).

4.2.4 Acquisition System. Assure the acquisition system is safely secured in the vehicle.

GM Confidential

© Copyright 2013 General Motors Company All Rights Reserved

March 2013

Page 2 of 5



Documents
 Document Sharing Hub