GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW17301

Steering Gear Reversal Clunk 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. The purpose of this procedure is to provide instructions for performing laboratory testing to quantify the reversal clunk sensitivity of a steering gear.

1.2 Applicability. This test procedure is applicable to any electrically or hydraulically assisted rack and pinion steering system, including column electric.

2 References

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

2.1 External Standards/Specifications.

ISO 9001

2.2 GM Standards/Specifications.

GMW16794

2.3 Additional References.

MTS Systems Corporation, Eden Prairie, Minnesota, www.mts.com

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.

3.2 Equipment.

3.2.1 Test Bench. MTS Steering Gear Performance Test Stand (with Hydraulic Power Steering (HPS) capability if applicable), including MTS FlexTest 60 Digital Controller, a Personal Computer (PC) with MTS Series 793 control and application software installed, and integrated or standalone capability to transmit the necessary Controller Area Network (CAN) messages to an Electric Power Steering (EPS) system for it to fully function or, in the case of a variable effort HPS gear, a power supply that can deliver an appropriate level of current to the gear matching the calibration value at 0 km/h.

3.2.2 Position Transducers. Linear and rotary encoders with minimum resolution and full scale values as specified in Table 1 for direct measurements of rack axial position, housing position along the rack axis, input shaft rotational position, and rack rotation or roll angle, all with respect to ground.

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Table 1: Minimum Position Transducer Resolution and Full Scale Values

Transducer	Minimum Resolution	Minimum Full Scale
Rack Axial Position	0.005 mm	270 mm
Rack Housing Position	0.007 mm	20 mm
Input Shaft Angle	0.005 degree	2000 degrees
Rack Rotation/Roll Angle	0.0005 degree	15 degrees

3.2.3 Force Transducer. Force transducer with a minimum resolution of 0.45 N and a full scale of ± 15 000 N for direct measurement of axial rack force.

3.2.4 Torque Transducer. Torque transducer with a minimum resolution of 0.000013 N·m and a full scale of ± 113.125 N·m for direct measurement of steering input torque.

3.2.5 Accelerometer. Single axis accelerometer with a sensitivity of 100 mV/G, range of ± 50G peak, and broadband resolution of 0.00015G Root Mean Square (RMS) for measurement of rack linear acceleration along its axis.

3.3 Test Vehicle/Test Piece.

3.3.1 Test Parts. Following parts are required:

a. Steering gear including inner tie rods
b. Intermediate shaft (Column Electric Power Steering (CEPS) system only)
c. Steering column (CEPS only)
d. Wiring harness with proper electrical connectors to interface with the test specimen
e. Fixtures and other hardware necessary to mount the test specimen on the test stand

3.4 Test Time.

Calendar time:	1 day
Test hours:	1 hour
Coordination hours:	0.5 hour

Note: The test time listed above does not include the design and build time for any new and/or special test fixtures required for testing.

3.5 Test Required Information.

3.5.1 Steering Geometry (CEPS Only). The in-vehicle X, Y and Z coordinates of steering geometry points are required for the set up of steering intermediate shaft and column.

3.5.2 Channels. Following signals (units) are required:

a. Time (seconds)
b. Specimen voltage (volts)
c. Specimen current (amperes)
d. Steer torque (newton·meters)
e. Steer angle (degrees)
f. Right tie rod force (newtons)
g. Rack displacement (millimeters)
h. Rack rotation (degrees)
i. Rack housing displacement (millimeters)
j. Rack acceleration (meters/second squared)

3.5.3 Sample Rate. Sample rate is 2000 samples/s**.**

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