



Steering System Stick Slip 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 stick slip characteristics of a steering system.

1.2 Applicability. This test procedure is applicable to any electrically-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, 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.

3.2.2 Torsion Bar. Torsional rate = $0.4 \text{ N}\cdot\text{m}/\text{degree}$.

3.2.3 Flywheel Wheel. Moment of Inertia = $0.04 \text{ kg}\cdot\text{m}^2$. Design shall provide provisions to mechanically limit the torsion bar travel to ± 10 degrees when installed on the test bench as described in 4.1.2.1.

3.2.4 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, and input shaft rotational position, 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

3.2.5 Force Transducer. Force transducer with a minimum resolution of 0.45 N and a full scale of $\pm 15\,000$ N for direct measurement of axial rack force.

3.2.6 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.

3.3 Test Vehicle/Test Piece.

3.3.1 Test Parts. Following parts are required:

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

3.4 Test Time.

Calendar time: 1 day

Test hours: 4 hours

Coordination hours: 0.5 hours

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:

- Time (seconds)
- Specimen voltage (volts)
- Specimen current (amperes)
- Steer torque (newton·meters)
- Steer motor angle command (degrees)
- Steer angle (degrees)
- Rack force translation (newtons)
- Rack displacement (millimeters)
- Rack housing displacement (millimeters)

3.5.3 Sample Rate. 80 samples/s.

3.6 Personnel/Skills. Operator must be qualified and documented as capable to run this test as required by ISO 9001.

4 Procedure

4.1 Preparation.

4.1.1 Test Software Set Up.

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4.1.1.1 Follow the procedure in GMW16794 to set up the test software on the PC. For this test, both left and right tie rod actuators and matrix shall be turned on.

4.1.2 Test Bench Setup.

4.1.2.1 Install flywheel (3.2.3) and torsion bar (3.2.2) on the top of steer actuator using the proper hardware. Make sure to leave a gap of approximately 3 mm between the flywheel and the steer actuator output shaft, and center the flywheel within its rotational range of travel before tightening the clamp bolt at the upper end of torsion bar. See Figures 1 thru 3.

4.1.2.2 Insert four (4) bolts through holes in the flywheel hub and hand-tighten them to rotationally lock the flywheel to the steer actuator output shaft without closing the gap between them. See Figure 3.

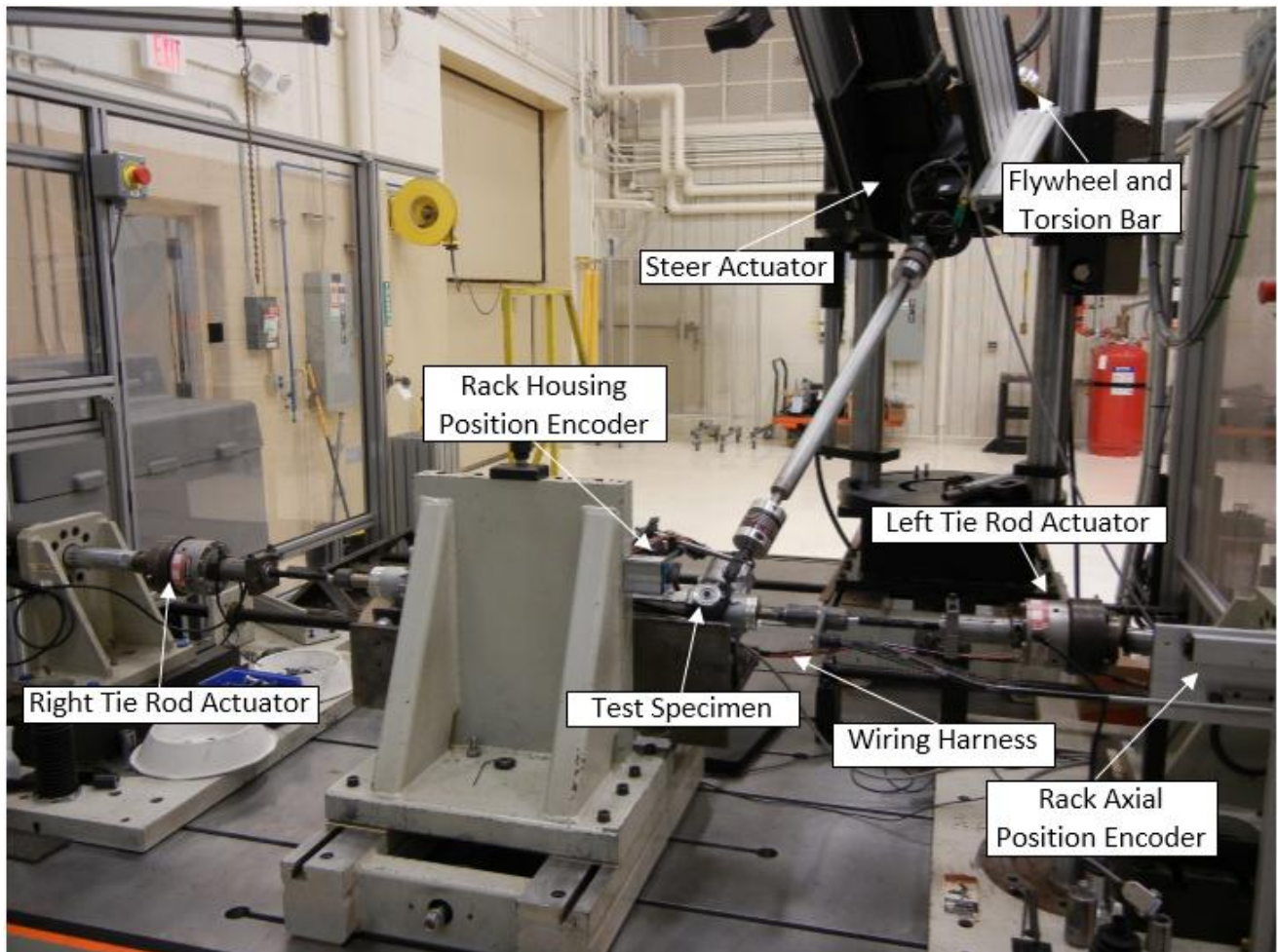


Figure 1: Test Setup

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