



Column Electric Power Steering Zipper Noise Test Procedure

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. This procedure is designed to test vibration levels for a Column Electric Power Steering (CEPS).

1.2 Applicability. This test procedure is applicable to any electrically assisted column system.

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.

GMW17477

2.3 Additional References.

- Component Test Specification (CTS)
- Intrepid Control Systems, Incorporated, Madison Heights, Michigan (www.intrepidcs.com)
- LMS, Siemens Product Lifetime Management Software Incorporated, Plano, Texas (www.plm.automation.siemens.com)
- MathWorks, Incorporated, Natick, Massachusetts (www.mathworks.com)
- MB Dynamics, Cleveland, Ohio (www.mbdynamics.com)
- Thermotron, Incorporated, Holland, Michigan (www.thermotron.com)

3 Resources

3.1 Facilities. The bedplate and test equipment must be isolated from outside influences that can effect collected data.

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. The equipment listed in 3.2.1 thru 3.2.8 includes test rig, fixtures, transducers, instrumentation, and controllers typically used by the GMNA Global Steering Development Laboratory to perform this test. Other equipment may be substituted at the discretion of the local testing facility as long as it provides equivalent accuracy as specified herein or by the requestor. Any setup must be approved by the CEPS Bill of Material (BOM) Family Owner (BFO).

3.2.1 Motor. Driver Simulator (DS-10) motor and Road Reaction (DS-25) motor, and appropriate software/controllers are used to rotate the column Electric Power Steering (EPS) shaft. The DS-10 is capable of applying up to 10 N·m of constant torque. The DS-25 is capable of applying up to 25 N·m of constant torque.

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May 2016

Page 1 of 5

3.2.2 Fixtures. Adequate adjustability and appropriate mounting plates are required to hold column horizontal to DS motors shafts. Couplings are used at both ends of the column to secure shaft to DS motors.

3.2.3 Environmental Box. An insulated box is required to contain the desired thermal environment for any tests requiring an environment that is not room temperature.

3.2.4 Thermal Source(s). Thermal sources must be capable of controlling temperature of the environmental box to temperatures between -40 °C and 85 °C. Temperature must be held within ± 5 °C of the desired temperature for the duration of the test, measured on or near the test specimen. Thermal sources shall not be applied directly to the test specimen. The Steering Lab in GMNA uses a Thermotron model number SE-600-6-6.

3.2.5 Torque Transducer. A torque transducer, isolated from all loads other than axial torque, must be between the DS-10 and the test specimen, and the DS-25 and the test specimen. The torque transducer must be capable of measuring up to 30 N·m of torque for the DS-10 motor, and up to 100 N·m for the DS-25 motor; with rotating speeds of up to 100 rpm for both motors, and a resolution ≤ 0.001 N·m.

3.2.6 Servo Couplings. Servo couplings are used on either side of the torque transducer to isolate the transducer from any loads that are not axial torsion loads.

3.2.7 Rotary Encoder. Rotary encoders are used on the input and output sides of the test specimen to measure the angular displacement and velocity. The encoder must have a resolution less than or equal to 0.001 degrees and must be capable of turning up to 100 rpm. In the GMNA Steering Lab, the rotary encoders are built into the DS-10 motor and the DS-25 motor.

3.2.8 Data Acquisition. The angular displacement and torque are to be recorded at a minimum rate of 6400 samples/s. Use the SteerGSD11 laptop, or similar.

3.3 Test Vehicle/Test Piece. The column must be inline (horizontal) and at the same height of both DS motor shafts.

3.4 Test Time.

Calendar time: 0.5 day

Test hours: 1 hour

Coordination hours: 2 hours

3.5 Test Required Information. The requesting engineer is responsible for providing the Component Test Specification (CTS) which must include the performance objectives (sample size and failure criteria) for development and/or validation tests.

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 Attach the appropriate mounts to the fixture box. The mounts should be able to attach to the column and mount using the existing hole patterns on the fixture box.

4.1.3 Attach the coupling to the input shaft of the column from the DS-10 motor, and attach the coupling to the output shaft of the column from the DS-25 motor.

4.1.4 Make sure the rigid aluminum shaft is installed and not the torsion spring. Reference GMW17477, section titled, Rigid Aluminum Shaft Installation.

4.1.2 Make sure the column can fit in line with the DS motors.

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable.

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.

4.3 Instructions.

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Page 2 of 5