



Low Speed Steering Roughness Evaluation 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. Provide an objective measurement of low speed steering roughness.

1.2 Applicability. The test is applicable to any/all passenger vehicles to quantify low speed steering roughness.

1.3 Remarks. This procedure describes the vibration measurement on the steering wheel at low speeds on a coarse aggregate surface.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14172 GMW14227

2.3 Additional References.

- Accelerometers available from PCB Piezotronics at www.pcb.com/Products.aspx
- Vehicle Technical Specification (VTS)

3 Resources

3.1 Facilities. This test procedure requires driving on a coarse aggregate surface (e.g., The Fenn Holden area at Milford Proving Ground or equivalent).

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.

- Data Acquisition System (DAS)
- Accelerometer (e.g., PCB 356A07 or equivalent)
- Transducer cabling
- Signal conditioning

Refer to GMW14227 for transducer key characteristics.

3.3 Test Vehicle/Test Piece. The tests shall be performed on a production vehicle or development vehicle, which represents the current release status. Eliminate any unwanted content or 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 $\frac{3}{4}$ full and radio/entertainment system and Heating Ventilation and Air Conditioning is turned off.

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Position the seats and headrests in the middle positions. If equipped with tilt steering, position the steering column in the center position of the travel.

Record Vehicle Identification Number, GM fleet number, and the build stage if appropriate. Record tire make and model, size and air pressure. Record the testing date, time and location.

3.4 Test Time.

Calendar time: 1 day

Test time: 4 hours

Coordination time: 2 hours

3.5 Test Required Information. Record engine revolutions per minute (rpm) (or power steering pump rpm) and the lateral (Y axis) steering wheel acceleration.

3.6 Personnel/Skills. Engineer or qualified technician with basic knowledge of vibration.

4 Procedure

4.1 Preparation. Check that the vehicle meets the requirements outlined in 3.3. Drive the vehicle to ensure that the vehicle is free from squeaks and rattles and extraneous noises. Eliminate all extraneous noises prior to testing. Remove all camouflage for validation testing.

Seats, headrests, and steering wheel shall be adjusted to the middle position. All windows, sliding roof and sun screen are closed.

Run engine until operating temperature is reached. Switch off the air conditioning at least 10 minutes before the start of the test. Heater fan off. Radio off.

4.2 Conditions. Check that the engine speed is stable and that the engine cooling fan is not cycling on/off during the actual data acquisition process. Verify that the windows, sunroofs, hood and trunk/tailgate are closed.

4.2.1 Environmental Conditions. Check that the environmental conditions meet the requirements outlined in 3.1. If conditions are outside of the specified range, make a note in the deviation section of the test log.

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. Before the start of the test, the instrument settings and the vehicle settings shall be checked again.

4.3.1 Calibration Verification. Wholly contained in GMW14172.

4.3.2 Measurement Pre-test. Make a pre-test if necessary.

4.3.3 Transducer Location. An accelerometer is positioned at the top center or 12:00 o'clock position of the steering wheel, oriented laterally (Y axis).

4.3.4 Data Acquisition System (DAS). Set up DAS to acquire the narrow band acceleration spectrum in the units of decibel(s) (dB) re: 1 m/s² from 0 Hz to 100 Hz with 1 Hz resolution. The acquisition time for one (1) sweep is 30 s. Apply Root Means Square (RMS) averaging using a Hanning Window with the number of averages equal to 24.

4.3.5 Measurement of Low Speed Steering Roughness. Operate the vehicle in drive on the coarse aggregate surface at a speed under 16 km/h. Slowly steer the steering wheel (approximately 2 s/cycle) 45 degrees to the left and then 45 degrees to the right with hands at 10:00 o'clock and 2:00 o'clock positions. Perform a minimum of three (3) sweeps, verify the repeatability and store the sweeps.

5 Data

5.1 Calculations. With each run, calculate the overall 1/3-octave RMS acceleration. Using the overall RMS accelerations for each run, the average shall be computed.

5.2 Interpretation of Results. The average overall RMS acceleration is the low speed steering roughness value in decibels in reference to 1 m/s² (dB re: 1 m/s²). Record this metric and compare to VTS requirements. Determine if VTS requirements are satisfied.

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