



Component Level Fuel Tank Slosh and Clunk Noise 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. The purpose of this standard is to objectively quantify the level of fuel-generated noise, i.e., "slosh" and "clunk", in a fuel tank due to the motion of the fuel inside the tank.

1.2 Applicability. All fuel tanks from passenger cars and light-duty trucks with gasoline and diesel fuel systems, and diesel emissions fluid systems.

1.3 Remarks. This test procedure was designed using various fuel levels and fuel tank decelerations to attempt to cause "slosh" or "clunk" so that an objective noise measurement may be taken. However, since not all fuel levels or fuel tank decelerations can be done in a relatively short test, additional investigation may be needed. This test should be used to compare the performance of various design options. Vehicle level testing is still required to determine performance to vehicle noise level requirements.

2 References

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

2.1 External Standards/Specifications.

IEC 61672

IEC 80000

2.2 GM Standards/Specifications.

GMW14508

2.3 Additional References.

- PCB Group, Incorporated, Depew, New York (www.pcb.com)
- Uniform Parts Classification (UPC) Codes, UPC 8A and UPC 8B

3 Resources

3.1 Facilities. GM Global Fuel Laboratory Clunk and Slosh Noise Track or an equivalent testing 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 Single axis accelerometers with a mass < 2 g and a measurement range of $\pm 490 \text{ m/s}^2$ peak, e.g., PCB 352A56 or equivalent available from PCB Group, Incorporated, Depew, New York (www.pcb.com).

3.2.2 Equipment for measuring fluid fill level into the fuel tank.

3.2.3 Equipment for measuring sled speed. The sled speed may be captured using a tachometer on the axle shaft and converting to sled speed.

3.2.4 Free field microphones should be used.

3.2.5 Microphone and accelerometer calibrator.

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3.2.6 A 24-bit analog to digital converter is required along with processing software capable of analysis. This should allow for simultaneous acquisition of sled speed, tank surface acceleration, and sound pressure level. Software shall be capable of providing recorded time data in universal file format or other agreed to format for sled speed, tank surface acceleration, and sound pressure level.

All devices shall meet Class 1 accuracy corresponding to International Electrotechnical Commission (IEC) standard IEC 61672 or be equivalent for the application, i.e., precision ± 0.7 dB or $\pm 8\%$.

The measuring instruments used shall conform to the significant characteristics of the standards. The conformity to the tolerances is limited to the frequency range 22 Hz to 11 225 Hz.

3.3 Test Vehicle/Test Piece. Test piece shall consist of fuel tank (Uniform Parts Classification (UPC) 8A) with fuel pump/sender module (UPC 8B) installed. Fuel tank shall be production intent with regard to tank material and thickness. Production intent baffle system shall be included. External items mounted to the tank shall be removed. These include items such as heat shields, fuel lines, vent tubes, etc.

3.4 Test Time. Preparation and other downtime, actual test, and analysis of data were considered in the total calendar time.

Calendar time: 1 d

Test time: 8 h

Coordination time: 2 h

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Technician or engineer with experience in sound pressure level data acquisition.

4 Procedure

4.1 Preparation.

4.1.1 The fuel tank shall be fixed to the sled as to not allow movement of the tank. The tank shall be placed on strips of wood at the position the tank straps would normally be placed. Nylon straps with ratchets should be used to secure the tank. Ratchets should not touch the tank and should not be tightened to the point of deforming the tank. See Figure A1 in Appendix A. Alternatively, a fuel tank mounted in a stick fixture like those used in GMW14508 could be fixed to the sled.

4.1.2 Microphones shall be placed at 50 cm away from the surface of the tank. The microphone shall be positioned such that it points at the tank surface. The placement of the microphone shall be at the geometric center of the tank surface being measured. Microphones shall be placed to measure the front, top, and side surfaces. See Figure A2 in Appendix A.

4.1.3 (Optional). Single axis accelerometers shall be placed on the points where the tank or the pads on the tank meet the vehicle. Accelerometer shall be placed so the axis of sensitivity is normal to the tank surface.

4.2 Conditions.

4.2.1 Environmental Conditions. The overall background noise of the test area shall be < 35 dB(A). This shall be required for data acquisition and be processed in the same method described in 5.1.1. Do not record data in the event of interfering noise emissions

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.

4.3.1 Evaluation Preparation. Calculate 25%, 50%, 70%, 80%, 90%, and 100% of the fuel tank usable capacity, as defined by GMW14508, for the fuel levels at which to run this test. Approximations may be used at the discretion of the engineer. Record test volumes with data.

4.3.2 Evaluation. The following test maneuvers are done at 25%, 50%, 70%, 80%, 90%, and 100% of usable capacity per engineer in 4.3.1 using water as the fill fluid. It is optional to use Stoddard if the tank is to be used for subsequent fuel testing.

Note: Saddle type fuel tanks should have equal amounts of fuel distributed in each tank section for all fill levels evaluated.

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