



Customer Actuated Sound Subjective 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. To provide a common procedure for subjectively evaluating the sounds of subsystems (that can be directly actuated by the customer, "Customer Actuated Sounds" (CAS)) for sound quality.

1.2 Applicability. Any subsystem or component that is installed on vehicles and can be directly actuated by the customer.

1.3 Remarks. Many subsystems have multiple modes of operation. Each mode of operation must be evaluated independently for evaluation and comparison. This procedure is intended to describe the operating conditions of the subsystems and the attributes applicable to sound quality evaluations.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14264

2.3 Additional References.

GM Research and Development (R&D) Report AS-598, "Hearing Acuity Standard for Squeak and Rattle Evaluators.

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.

3.1.3 Indoor Test Area (Preferred). Hemi anechoic room free from interfering noises. Unless otherwise specified, the maximum Zwicker specific loudness of the background noise is not to exceed 0.2 sones/bark from 0 bark to 5 bark and 0.1 sones/bark at any frequency greater than 5 bark and the overall Zwicker loudness is not to exceed 1.2 soneGF. Background noise is considered to include room or test cell ambient noise and room support equipment noise.

3.1.4 Outdoor Test Area (Optional). Any background noise present shall not mask even subtle sound characteristics. Outdoor evaluations should be performed in moderate temperatures, and dry conditions.

3.2 Equipment.

3.2.1 Hardware.

3.2.2 Software.

3.3 Test Vehicle/Test Piece. The following shall be to design or test intent:

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3.3.1 All exterior closures alignments.

3.3.2 All component and system attachment locations and torque settings.

3.3.3 All exterior closing and latching efforts.

3.3.4 All other subsystem characteristics.

3.4 Test Time. The following is an estimate of the time (work hours) needed to perform this procedure. Consider preparation and other downtime, actual test and analysis of data in capturing a total calendar time.

Calendar time: 1 day

Test time: 4 to 6 hours

Coordination time: 2 hours

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills.

3.6.1 Auditor Skill Level. Evaluators shall have completed 2 to 3 prior CAS vehicle evaluations under the supervision of an experienced CAS Evaluator.

3.6.2 Hearing Requirements. It is recommended that all evaluators for customer actuated sound have a hearing test. Any professional hearing test is acceptable, but the following test is given as a reference: GM R&D Report AS-598, "Hearing Acuity Standard for Squeak and Rattle Evaluators."

4 Procedure

4.1 Preparation.

4.1.1 Wash the vehicle.

4.1.2 Allow the vehicle to acclimate to the environmental conditions in test cell or garage area for an appropriate time to allow the vehicle systems to reach test room temperature before the test.

4.1.3 Remove camouflage to prevent unintentional damping of exterior body panels.

4.1.4 Eliminate or reduce sounds not directly associated with the component or system being tested, (e.g., tape the outside rearview mirror to the mirror housing if it rattles during door closing). Note any modifications required.

4.1.5 Evaluate interior systems with the seat and steering wheel set to the evaluator's normal driving position unless otherwise noted in this procedure.

4.1.6 Evaluate all subsystems from the seat adjacent to the subsystem except as follows:

4.1.6.1 Evaluate all systems located on the centerline of vehicle (e.g., consoles and sunroofs) from the driver seat.

4.1.6.2 Evaluate the glove box from the driver's seat.

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. Manually Operated Exterior Closures Sound Quality Subjective Evaluation Specific Information.

4.3.1 Resources.

4.3.1.1 Equipment. All equipment listed previously.

4.3.1.2 Test Vehicle/Test Piece. All test vehicle conditions as listed previously.

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4.3.1.3 Test Time.

Calendar time: 1 day

Test time: 1 hour

Coordination time: 1 to 8 hours

4.3.2 General Vehicle Preparation.

4.3.2.1 All general vehicle preparation listed previously.

4.3.2.2 Place manual transmissions in neutral and automatic transmissions in park.

4.3.2.3 Apply the parking brake.

4.3.2.4 The following applies only to closures that seal off the main cabin such as van lift gates.

4.3.2.5 Set the HVAC system to "recirculate" if so equipped.

4.3.2.6 Set the HVAC system to "off".

4.3.2.7 Close all of the windows, sunroof, sunshades etc.

4.3.2.8 Close the rear seat pass-through and return all rear seat backs to the upright and latched position.

4.3.2.9 Remove the license plate(s) or otherwise secure or cushion it to prevent it from rattling when evaluating exterior closures.

4.3.2.10 Remove the contents from all interior storage compartments.

4.3.2.11 Fill the fuel tank to prevent fuel sloshing noises when evaluating exterior closures.

4.3.3 Instructions.**4.3.3.1 Side Swing Door Closing Sound.**

4.3.3.1.1 Open the door so that it can be comfortably closed without using an excessive or off balanced closing force.

4.3.3.1.2 Evaluate the sound of the door closing.

Note: If the vehicle has a convertible top or removable roof panel(s), the door closing shall be evaluated in two (2) configurations:

Evaluate with the top raised or panel(s) installed and windows in the full up position or default position. Repeat with the top retracted or panel(s) removed and windows in the full down position.

Note: If the vehicle's door window glass lowers slightly when opened and rises when closed give a rating for the door closed sound with and without the glass operation sound.

4.3.3.2 Manual Sliding Door Closing Sound.

4.3.3.2.1 The Evaluator shall stand in the position that one would normally use to actuate the closure. This position should allow the door to be comfortably closed without using an excessive or off balanced closing force.

4.3.3.2.2 Pull the door forward with a quick typical force to allow the door to slide freely forward and engage the latch.

4.3.3.2.3 Evaluate the sound of the door travel and close.

4.3.3.3 Hood/Decklid/Lift Gate/Lift Glass/ Tailgate Closing Sound.

4.3.3.3.1 The Evaluator shall stand in the position that one would normally use to actuate the closure. This position should allow the closure to be comfortably closed without using an excessive or off balanced closing force.

4.3.3.3.2 Open the closure enough to allow gravity to close the closure when possible. If the closure requires additional force to close, let go of the closure as quickly as possible. Avoid pressing the closure shut.

4.3.3.3.3 Evaluate the closing sound.

4.4 Instructions. Power Operated Exterior Closures Sound Quality Subjective Evaluation Specific Information.**4.4.1 Resources.**

4.4.1.1 Equipment. All equipment listed previously.

4.4.1.2 Digital Voltmeter (Optional).

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4.4.1.3 DC Power Supply capable of supplying electrical voltage and current to the vehicle. (Optional).

4.4.1.4 Software. All software listed previously.

4.4.1.5 Test Vehicle/Test Piece. All test vehicle conditions as listed previously.

4.4.1.6 Test Time.

Calendar time: 1 day

Test time: 1 hour

Coordination time: 1 to 8 hours

4.4.2 General Vehicle Preparation.

4.4.2.1 All general vehicle preparation listed previously.

4.4.2.2 Provide Electrical Power.

4.4.2.2.1 External Power Supply (Preferred).

4.4.2.2.1.1 Provide electrical power for the vehicle by first, disconnecting the leads to the battery and then, connecting the DC Power Supply to the leads using appropriate cables.

WARNING: Always disconnect the negative terminal of the battery first to prevent accidentally short circuiting the battery through the wrench to the body when disconnecting the positive terminal.

4.4.2.2.1.2 Use the Digital Voltmeter to monitor the voltage at the connection between leads and the DC Power Supply.

4.4.2.2.1.3 Turn the DC Power Supply on to provide an initial voltage of approximately 14 VDC.

4.4.2.2.1.4 Turn the key in the vehicle to Run.

Caution: Do not turn the key to attempt to start the engine. Doing so may result in damage to the DC Power Supply due to excessive current draw.

4.4.2.2.1.5 Turn the Headlights, the Interior Lights, the Entertainment System and all other accessories to Off to minimize current draw.

4.4.2.2.1.6 Adjust the DC Power Supply so the Digital Voltmeter reads 14.0 VDC $\pm$ 0.5 VDC.

4.4.2.2.2 Use Vehicle Power Supply (Optional). Idle the vehicle or use a battery charger to charge up the battery before evaluating the exterior power subsystems.

4.4.2.2.3 This evaluation can be conducted either in a vehicle test room or outside in a quiet location.

Caution: When conducting the evaluation inside of a test room, connect an exhaust fume exhaust system to the tailpipe(s) of the vehicle.

4.4.2.3 Turn off all accessories.

4.4.3 Instructions.

4.4.3.1 Power Sliding Door.

4.4.3.1.1 Evaluate from the outside and inside of the vehicle.

4.4.3.1.2 Move the door from the fully closed to the fully opened position.

4.4.3.1.3 Move the door from the fully opened to the fully closed position.

4.4.3.2 Power Lift gate.

4.4.3.2.1 Evaluate from the outside and inside of the vehicle.

4.4.3.2.2 Move the lift gate from the fully closed to the fully opened position.

4.4.3.2.3 Move the lift gate from the fully opened to the fully closed position.

4.4.3.3 Power Deck Lid.

4.4.3.3.1 Evaluate from the outside of the vehicle.

4.4.3.3.2 Move the deck lid from the fully closed to the fully opened position.

4.4.3.3.3 Move the deck lid from the fully opened to the fully closed position.

4.5 Instructions. Manually Operated Component Sound Quality Subjective Evaluation Specific Information.

4.5.1 Resources.

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