



Impact Resistance for an Interior Speaker Grille

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 standard defines the impact resistance performance requirements and test conditions for interior speaker grilles.

1.2 Applicability. The speaker grilles as integral or add-on components of a larger interior subsystem.

1.3 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW3059 GMW14124

2.3 Additional References.

- Performance requirements.
- Subsystem Technical Specification.

3 Test Preparation and Evaluation

3.1 Resources.

3.1.1 Facilities.

3.1.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.1.2 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.

Approved alternatives are shown in Section 4.

3.1.2 Equipment. The following apparatus shall be used for the determination of impact resistance:

3.1.2.1 Apparatus A - Pendulum Impact Testing Machine (see Figure 1). A pendulum impact testing machine where a steel ball, suspended from a tripod by means of a cable or rod, drops from a predetermined height to produce the specified impact energy on the test part. The length of the pendulum relative to the center of the ball shall be (1000 ± 3) mm. The steel ball shall have the following dimensions:

- Diameter: (50 ± 1) mm.
- Mass: (500 ± 3) g.

3.1.2.2 Apparatus B - Steel Ball (see Figure 2). A steel ball, having a weight of (510 ± 1) g, which drops from a predetermined height to produce the specified impact energy in free fall onto the test part.

3.1.2.3 Climatic chamber that is large enough to accommodate the component and the test apparatus.

3.1.3 Test Vehicle/Test Piece.

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3.1.3.1 Test Vehicle. Not applicable.

3.1.3.2 Test Part. The finished component shall be tested. The test sample should be a production representative part. If plastic, the test part should be molded in the highest pigment loaded color, if possible. Unless otherwise specified in the applicable Subsystem Technical Specification (SSTS), at least three test parts shall be tested (that are randomly selected from a minimum lot of 50 parts) at each environmental condition shown, if not otherwise agreed upon with the responsible Validation Engineer.

3.1.3.2.1 A new test part is to be used for each impact.

3.1.3.3 Test parts shall not be tested within 72 h of manufacture.

3.1.3.4 Test Part Supports/Fixtures.

3.1.3.4.1 Door Trim Fixtures. The door trim panel with speaker grille for testing shall be installed on a fixture or door assembly that simulates the in-vehicle position of the door trim panel.

3.1.3.4.2 Test Part Supports. Supports shall be provided for all non-door trim interior speaker grilles such that the test parts may be securely fastened to simulate the in-vehicle position as closely as possible and to ensure that the test apparatus will strike at the correct angle relative to any designated spot on the surface. The supports shall be rigid enough to ensure that the impact force is completely absorbed by the test part.

3.1.4 Test Time.

Calendar time: 13 days

Test hours: 180 h

Coordination hours: 16 h

3.1.5 Test Required Information. Not applicable.

3.1.6 Personnel/Skills. Not applicable.

3.2 Preparation. Not applicable.

3.3 Conditions.

3.3.1 Environmental Conditions. If not otherwise stated, all testing shall be performed at $(-30 \pm 3) ^\circ\text{C}$.

3.3.2 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.

The test is to be conducted in the climatic chamber after a minimum part soak time of 1 h. The tests are to be performed in the chamber at the temperature specified. Parts to be tested are not to be soaked in the chamber and subsequently removed from the chamber for the duration of the test (i.e., soaking the parts in the chamber and bringing them into an ambient temperature lab for the duration of the test is not permissible under this specification).

3.4 Instructions. Not applicable.

3.5 Data.

3.5.1 Calculations of Impact Energy. In order to clarify how impact energies are calculated for the test apparatus specified in 3.1.2, the following examples are given using the variables shown in Table 1.

Table 1: Force Diagram Variables

Symbol	Item	Unit
E	Impact Energy	J
H_p	Release Angle	degree
m	Mass of Ball	kg
h	Drop Height (distance between ball and test part surface)	m

3.5.1.1 Apparatus A - Pendulum Impact Test. See Figure 1.

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Impact energy: $E = 0.5kg \cdot 9.81 \frac{m}{s^2} \cdot 1m \cdot (1 - \cos Hp)$ J

- or - $Hp = \arccos(1 - \frac{E}{(0.5kg \cdot 9.81 \frac{m}{s^2} \cdot 1m)})$ degree

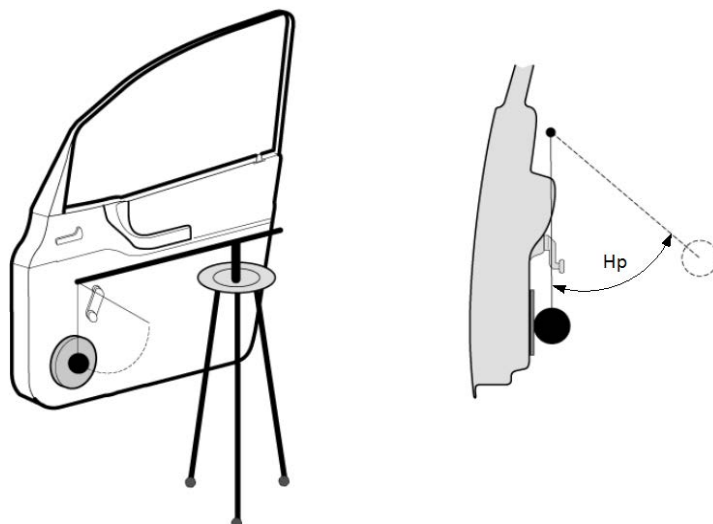


Figure 1: Apparatus A with Door Trim Panel Test Part

3.5.1.2 Apparatus B - Steel Ball Test. See Figure 2.

Impact energy: $E = m \cdot g \cdot h$ J

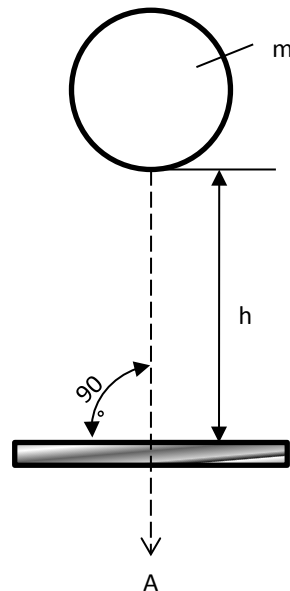
- or - $h = E / (m \cdot g)$ m

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A = Direction of Impact Force

Figure 2: Apparatus B in Principle

3.6 Safety. This standard may involve hazardous materials, operations, and equipment. This standard does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

3.7 Documentation. Samples of components or material released to this standard shall be tested for conformity with the requirements of this standard and approved by the responsible GM Department prior to the start of delivery of production level components or materials.

Any change to the component or material, e.g., design, function, properties, manufacturing process and/or location of manufacture requires a new release of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process, and to apply for a new release.

If not otherwise agreed to, the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases, a shorter test can be agreed to between the responsible GM department and the supplier.

3.7.1 Test Results. The results of the testing shall be presented in a test report along with pictures of the speaker grille prior to the testing and at the end of test.

4 Requirements and Procedure

4.1 General. Each interior speaker grille is located within one of two zones of the interior of the vehicle, above the armrest or below the armrest. Figure 3 shows an example of the zones in a sedan application.

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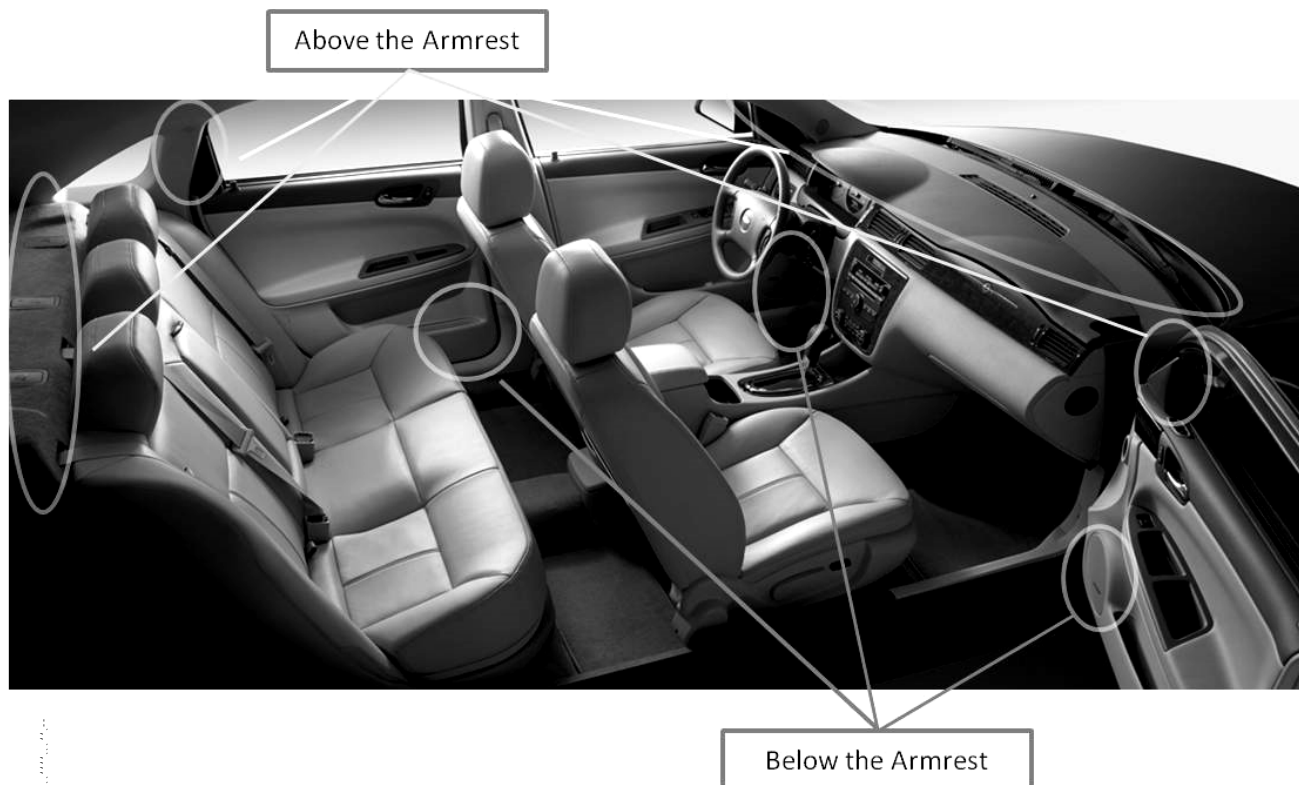


Figure 3: Vehicle Interior Zones in Principle

4.2 Impact Point. The impact point shall be (0 ± 10) mm from the center point of the speaker, as translated onto the speaker grille (Figure 4).

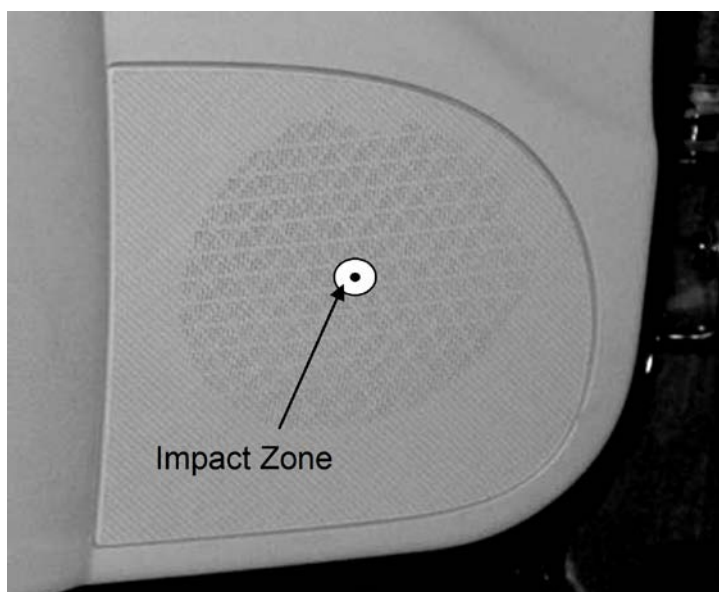


Figure 4: Impact Zone for Speaker Grille Impact Test

4.3 Above the Armrest Performance Requirements.

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