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Vibration Damping Materials and Underbody Coatings

RATIONALE

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1. Scope

1.1 Description of Material—The materials classified under this specification are:

a. Mastic vibration damping materials used to reduce the sound emanating from metal panels.
b. Mastic underbody coatings used to give protection and some vibration damping to motor vehicle underbodies, fenders, and other parts.

1.2 Numbering System

1.2.1 PREFIXES—The prefix "D" is used to indicate a cut back vibration damping material and the prefix "U" is used to indicate a cut back underbody coating material. Should a water emulsion be desired, the prefix should be followed by the letter "E." Should a solvent-water emulsion be desired, the prefix should be followed by the letter "F."

1.2.2 TYPES—The materials are further divided into types, based on the decay rate in decibels per second (dB/s) at 21 °C, and classes, based on the percentage of solids contained in the material.

Types and classes are as follows in Tables 1A and 1B:

TABLE 1A—NOMINAL DECAY RATE, dB/s

Type	Nominal Decay Rate, dB/s
5	5
10	10
15	15
20	20
25	25
30	30

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TABLE 1B—NOMINAL SOLIDS CONTENT, %(1)

Class	Nominal Solids Content, %
60	60
65	65
70	70
75	75
85	85
90	90

1. This table will be expanded as additional data is submitted and confirmed.

1.3 Example of the Use of Numbers—A cut back underbody coating having a decay rate of 5 dB/s and a solids content of 65% would be designated by the number U-565. An emulsion body damping material of medium decay rate and maximum solids content would be numbered DE-1090. Any combination of type and class could be used to suit the needs of the application.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein.

2.1.1 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 93—Test Methods for Flash Point by Pensky-Martens Closed Tester
ASTM D 217—Test Method for Cone Penetration of Lubricating Grease

3. Physical Properties

3.1 Test Specifications—For testing procedures, see 4.1.

3.1.1 VIBRATION DAMPING MATERIAL—The material shall have a decay rate as shown in Table 2.

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TABLE 2—MINIMUM DECAY RATE(1)

Type	Min Decay Rate, dB/s 21 °C	Min Decay Rate, dB/s –18 °C	Min Decay Rate, dB/s 38 °C
5	5	2	2
10	10	4	4
15	15	4	4
20	20	5	5
25	25	—	—
30	30	—	—

1. This table will be expanded as additional data is submitted and confirmed.

3.1.2 SOLIDS—The solids content of the material shall be as specified in Table 3.

TABLE 3—MINIMUM SOLIDS CONTENT BY WEIGHT (1)

Class	Min Solids Content, % by Weight
60	60
65	65
70	70
75	75
85	83
90	88

1. This table will be expanded as additional data is submitted and confirmed.

3.1.3 COLD ADHESION—The average retention of material on three cold test panels shall be as shown in Table 4.

TABLE 4—MINIMUM MATERIAL ON COLD-TEST PANEL

Angle of Slam, degree	Min Material on Panel, %
70	50
60	80
50	100

3.1.4 FLASH POINT—The flash point of an underbody coating shall be at least 38 °C; that of a vibration damping material shall be as agreed upon by the purchaser and the manufacturer.

3.1.5 ABRASION RESISTANCE (WHEN SPECIFIED)—The average retention on three abrasion test panels shall be not less than 95% of the material by weight. Each panel must retain at least 90% of the material, and there shall be no exposed metal surfaces.

3.1.6 SAGGING—The material shall not sag more than 6 mm when tested on an inverted 45-degree panel.

3.1.7 SPRAYABILITY—FLOW RATE—The material shall have a flow rate as follows:

a. Underbody Coatings—45 s/l., max
b. Vibration Damping Material—57 s/l., max

3.1.8 SPRAYABILITY—STABILITY—Emulsion materials shall not break under usual working pressures or conditions.

3.1.9 SPRAYABILITY—SPRAYBACK AND FOGGING—The average of three sprayback and three fogging tapes shall contain no more sprayback and fogging than the standard tapes held by the consumer.

3.1.10 CONSISTENCY (PENETROMETER VISCOSITY)—This shall be agreed between consumer and supplier.

3.1.11 SETTING—The material shall not settle nor separate within a reasonable period of transit and storage to such an extent as to cause difficulty in its use. For the purpose of this specification, the minimum time period shall be 30 days at room temperature.

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3.1.12 TOXIC PROPERTIES—The material shall not contain dangerous amounts of toxic ingredients.

NOTE—Although this specification defines special properties necessary in a satisfactory product, it is not to be construed that compliance with this specification relieves the vendor of the responsibility of supplying material commercially suitable for the use specified.

4. Physical Properties—Methods of Test

4.1 Decay Rate (Vibration Damping Materials)—A 500 x 500 x 6 mm steel panel with a decay rate at room temperature of not more than 3 dB/s and a natural frequency of 145 to 165 Hz shall be sprayed with a uniform coating of the material to the test weight of 2.34 to 2.54 kg/m^2 dry weight. After air drying at room temperature for a minimum of 12 h, the panels containing vibration damping materials shall be baked 3 h at 135 °C ± 3 °C. Those containing underbody coatings shall be baked 24 h at 71 °C ± 3 °C.

The decay rate shall be determined as follows:

Support the panel at one or more nodal points for the fundamental natural frequency (the nodal pattern is a square connecting the midpoints of the edges of the panel). Excite vibration of the panel at its fundamental frequency and measure the rate of decay for free vibration. This rate of decay expressed in decibels per second is the decay rate.

NOTE—The number of decibels corresponding to the ratio between any two vibration amplitudes is equal to 20 times the logarithm to the base ten of that ratio.

4.2 Solids—The solid content shall be determined by placing 3 to 5 g of the material in a weighted container (anointment can, approximately 50 mm in diameter) and drying 3 h at 105 °C ± 3 °C, and reweighed after heating.

4.3 Cold Adhesion—Thoroughly clean three 305 x 305 x 1 mm cold-rolled steel test panels by immersing them in a solution of:

a. 30% by volume concentrated phosphoric acid
b. 30% by volume cellosolve
c. 40% by volume water

and washing thoroughly with a clean rag. Remove the panel from the solution and wipe dry with another clean rag. These panels must have a surface finish of not less than 0.89 nor more than 1.52 µm and each panel may be used only once for cold adhesion testing. Proceed according to the following schedule:

a. Coat a 230 x 230 mm area on each of three panels with a uniform coating to a test weight of 2.34 to 2.54 kg/m^2 dry weight of material.
b. Air dry at room temperature for a minimum of 12 h. A shorter drying time may be considered if the actual application time interval is shorter.
c. Bake

    1. Vibration damping material—3 h at 135 °C ± 3 °C.
    2. Underbody coating—24 h at 71 °C ± 3 °C.

d. Cool to room temperature.
e. Cool for 3 h at –23 °C ± 1 °C.
f. Slam each panel in the cold adhesion test fixture, Figure 1, beginning at an angle of 10 degrees and increasing the angle of slam 10 degrees each successive slam until the 90 degree position is reached. The amount of material remaining on the panel is estimated between each slam.

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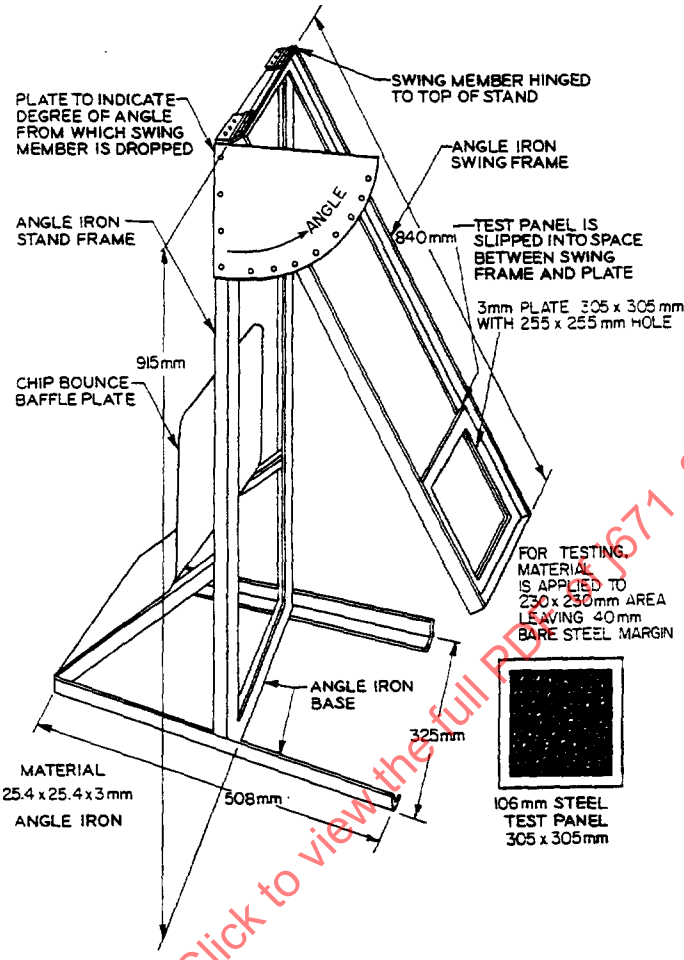

FIGURE 1—SLAMMING FIXTURE

4.4 Flash Point—The flash point shall be determined by the ASTM Pensky-Martens closed tester, ASTM D 93.

4.5 Abrasion Resistance—Clean three 305 x 125 x 1 mm cold-rolled steel panels as specified for the Cold Adhesion Test. Mask each panel to give an exposed area 100 x 305 mm and spray to the test weight of 2.34 to 2.54 kg/m^2 dry weight of material. Air dry at room temperature 12 h minimum and bake 24 h ± 15 min at 71 °C ± 3 °C.

Insert each panel in the abrasion tester, Figure 2, and subject to ten cycles of abrasion with 45.3 kg (a total of 453 kg) of No. 780 iron shot at 550 kPa air pressure. Allow the panel to cool to room temperature between cycles. The amount of material retained on each panel shall be determined by weighing.

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