



SURFACE VEHICLE RECOMMENDED PRACTICE

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Test Method for Determining Cold Cracking of Flexible Plastic Materials

RATIONALE

The technical report covers technology, products, or processes which are mature and not likely to change in the foreseeable future.

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1. SCOPE

This SAE Recommended Practice is applicable for determining the cold characteristics of flexible plastic materials, as applicable. It consists of three different methods for determining low-temperature properties of materials depending on type of material and end use. The method used shall be as specified by the contractual parties.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of the specification to the extent specified herein.

2.1.1 ASTM Publication

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D 3574 Standard Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams

3. METHOD A, MANDREL TEST

3.1 Apparatus and Materials

3.1.1 Mandrel

Steel mandrel nominally 6.35 mm in diameter and 152 mm long attached to a suitable stand. Other diameters may be specified depending on the thickness and rigidity of the material to be tested.

3.1.2 Oven

Air-circulating oven capable of maintaining a temperature of $82\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

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3.1.3 Cold Box

A cold box capable of maintaining a temperature of $-34\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and large enough to permit bending the test specimen while it remains in the box.

3.1.4 Gloves

Heavy cloth gloves to prevent heat transfer when handling specimens.

3.2 Procedure

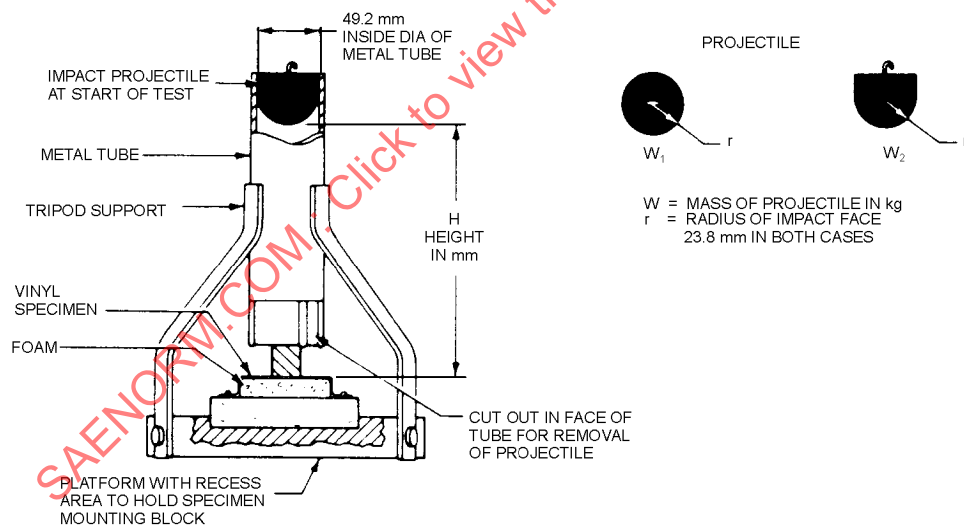
Cut 50 x 200 mm specimens in the machine and across machine direction and condition in the oven at $82\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for $24\text{ h} \pm 0.1\text{ h}$ or as specified. (The dimensions of the specimen may vary for extruded or molded parts.) Remove specimens from the oven and condition at room temperature until reaching equilibrium. Place specimens, gloves, and mandrel with stand in the cold box at $-34\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for $4\text{ h} \pm 0.1\text{ h}$ or as specified. Put on gloves and grasp each end of the sample and bend, around the mandrel in approximately 0.5 s with a uniform motion. Remove specimens from cold box and examine visually for evidence of cracks.

4. METHOD B, IMPACT TEST

4.1 Apparatus and Materials

4.1.1 Impact Tester

Impact tester capable of applying a 10.8 J impact with a spherical ball head having a radius of 23.81 mm. (See Figure 1.)



NOTE: Both H and W may be varied as long as $HW = 10.8\text{ J}$ and H is not less than 3.048 mm. Dimension r of projectile must be 23.8 mm and is not variable.

FIGURE 1 - IMPACT APPARATUS

4.1.2 Base

A 102 x 102 x 19 mm thick wood base with an 89 x 89 mm square marked off in the center for stapling specimen and a 76 x 76 mm square marked off for positioning urethane foam pad.¹

4.1.3 Oven

Air-circulating oven capable of maintaining a temperature of $82\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

4.2 Procedure

Cut a 100 x 100 mm specimen of the flexible plastic material and age it in the oven at $82\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for 7 days (or as specified by the contractual parties). Place a 75 x 75 x 19 mm thick urethane or latex foam pad in the center of the wood base and attach the aged specimen to the base by stapling 6 mm from the edge of the specimen as indicated in Figure 2 (staples should be 8 mm minimum length). Place the composite in the cold chamber at $-29\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for a minimum of 12 h (or as specified by the contractual parties). While still at $-29\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, the center of the test material shall be impacted with a force of 10.8 J energy criteria or as otherwise agreed upon by the contractual parties. The height of the drop and the mass of the impactor shall be such that it meets the 10.8 J energy criteria or as otherwise agreed upon by the contractual parties. Remove the composite from the cold box and examine the flexible plastic material for cracks.

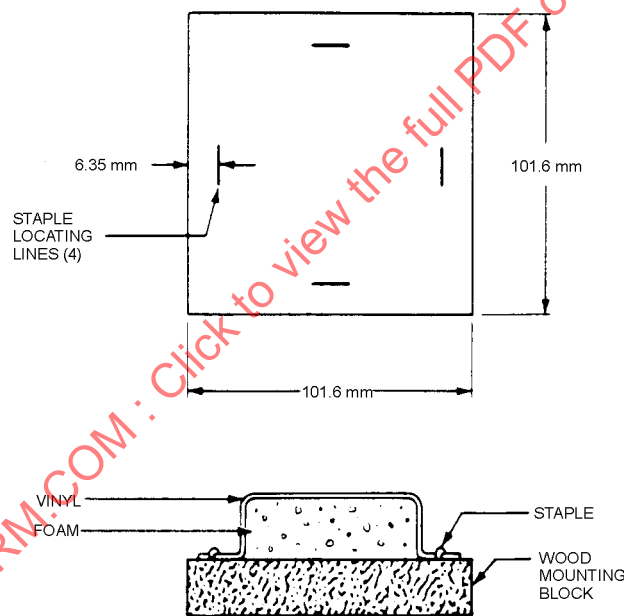


FIGURE 2 - SPECIMEN AND SPECIMEN ON BASE

¹ Unless otherwise specified, the foam base shall be either a urethane or latex foam with the following load deflection characteristics.

If using urethane the base material shall have the following load deflection characteristics when tested for CFD (Compression Force Deflection) per ASTM D 3574: the pressure on the specimen after compressing it 25% of its original thickness at room temperature and holding it there for one minute shall be 3.0 to 4.1 kPa. The foam shall also meet the following cold temperature requirement: After conditioning the specimen for 12 h at $-29\text{ }^{\circ}\text{C}$ immediately compress it with a pressure of $2.59 \pm 0.07\text{ kPa}$ and hold it for a minute. The compressed height of the specimen shall be 82 to 92% of the original specimen thickness.

If using latex the base material shall have the following load deflection characteristics when tested for CFD (Compression Force Deflection) per ASTM D 3574: the pressure on the specimen after compressing it 25% of its original thickness at room temperature and holding it there for one minute shall be 2.5 to 3.1 kPa. The foam shall also meet the following cold temperature requirement: After conditioning the specimen for 12 h at $-29\text{ }^{\circ}\text{C}$ immediately compress it with a pressure of $2.59 \pm 0.07\text{ kPa}$ and hold it for a minute. The compressed height of the specimen shall be 73 to 83% of the original specimen thickness.

NOTE: The wood and urethane foam base described previously was established primarily for vinyl-coated fabrics. Other flexible plastic materials may require modifications in the base depending on the flexibility of the material to be tested.