

CHANGE NOTICES ARE NOT
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IS REVISED.

FED. TEST METHOD STD. NO. 601

April 12, 1955

Change Notice 2

December 15, 1961

FEDERAL TEST METHOD STANDARD

RUBBER: SAMPLING AND TESTING

The following changes in Federal Test Method Standard No 601 dated April 12, 1955, have been approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies

1. Revision.—The following method of this standard has been revised and supersedes the method listed:

<i>Revision</i>	<i>Superseded</i>
Method 5311.1	Method 5311
December 5, 1961	April 12, 1955

RETAIN THIS COVER PAGE AND INSERT BEFORE THE TABLE OF
CONTENTS OF THIS STANDARD.

BRITTLENESS, LOW-TEMPERATURE, MOTOR-DRIVEN APPARATUS

1. SCOPE

1.1 This method is intended for use in determining the brittleness of soft vulcanized rubber compounds at low temperature by impact, using a motor-driven apparatus.

1.2 For the purpose of this method, failure of the specimen is the occurrence of cracks, fissures, or rupture.

2. SPECIMEN

2.1 The specimen shall consist of a portion of the test unit at least 30 mm. in length. The width shall be 6 ± 0.5 millimeters (mm.).

2.1.1 Unless otherwise specified in the detail specification, the thickness of the specimen shall be the thickness of the material undergoing test, but shall not exceed 2.2 mm. and shall be of the same thickness within ± 0.2 mm., method 2011.

3. APPARATUS

3.1 The apparatus shall be as follows:

3.1.1 *Clamp and striking arm.*—A specimen clamp designed to hold the specimen as a cantilever beam. The striking arm moves relative to the clamp at a linear speed of 2 ± 0.15 meters per second at impact and during at least 6 mm. of travel after impact. The distance between the center line of the striking edge and the edge of the clamp shall be between 7.6 and 8.1 mm. at impact. The striking edge shall have a radius of 1.6 ± 0.1 mm. The clearance between the striking arm and the specimen clamp shall be between 6.1 and 6.6 mm. at, and immediately after, impact. These dimensional requirements are shown in figure 5311B.

3.1.2 A motor for driving the striking arm.

3.1.3 Apparatus such as thermometers, copper-constantan thermocouple and potentiometer, or other device for measuring the temperature to within 0.5° C. (0.9° F.).

3.1.4 A suitable apparatus including the above parts and the equipment described in 3.1.5 for use with a liquid heat-transfer medium is shown in figure 5311A.

3.1.5 *Liquid heat-transfer medium.*

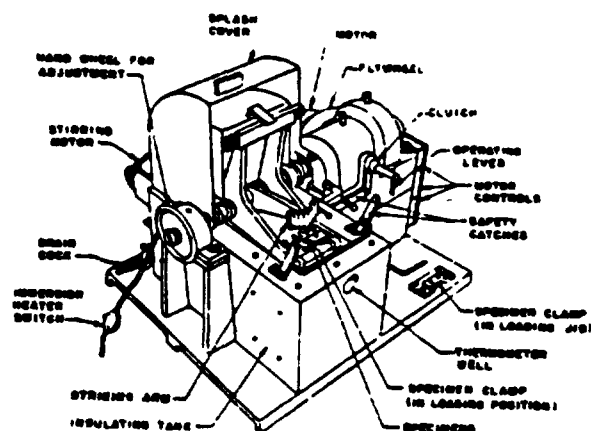


FIGURE 5311A.—Motor-driven brittleness tester.

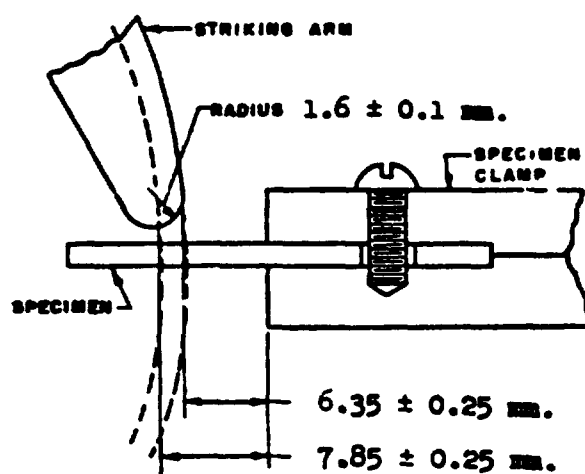


FIGURE 5311B.—Dimensional requirements between specimen clamp and striking edge.

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December 3, 1951

3.1.5.1 A stirrer that insures complete circulation of the liquid medium.

3.1.5.2 An insulated tank for holding the liquid medium.

3.1.5.3 Equipment with suitable controls for maintaining the required temperature throughout the medium during the exposure period within $\pm 0.5^\circ \text{C}$ (0.9°F .)

3.1.5.3.1 Powdered dry ice and liquid nitrogen have been found satisfactory for lowering the temperature and an electric immersion heater for raising the temperature

3.1.5.3.2 If automatic regulation of temperature for a liquid medium is desired, satisfactory equipment is shown in figure 5311C. The apparatus consists of an externally cooled tank connected to the test area with copper tubing, thermoregulator, pump, electric immersion heater, and mercury switches. The regulator alternately actuates the pump and heater through the mercury switches controlling the

amount of liquid coolant being pumped around the specimen as well as the amount of heat added by means of the heater.

3.1.5.4 Liquid medium.

3.1.5.4.1 The heat-transfer medium consists of any liquid that remains fluid at the temperature of the test and does not materially affect the material undergoing test. When a flammable solvent is used as the cooling medium, the usual precaution in handling should be observed including the use of explosion-proof electrical parts of the apparatus.

3.1.5.4.2 The following materials have been used down to the indicated temperatures:

Silicone fluid (see 6.1)

5 centistokes

viscosity . . . -60°C . (-76°F .)

2 centistokes

viscosity . . . -76°C . (-104.3°F .)

Methyl alcohol . . . -90°C . (-130°F .)

3.1.6 Air heat-transfer medium.

3.1.6.1 The apparatus described in 3.1.6.2 replaces the equipment described in 3.1.5 when air or a mixture of air and carbon dioxide is used as the heat-transfer medium.

3.1.6.2 Low-temperature cabinet.—A cabinet or testroom with suitable controls for maintaining the required temperature throughout the cabinet or room during the exposure period within $\pm 1^\circ \text{C}$. (1.8°F .) and of sufficient size to hold the impact apparatus. The cabinet is equipped with facilities such as glass windows, handholes with insulated sleeves, etc., that permit operating the brittleness tester at the specified temperature.

4. PROCEDURE

4.1 If the material is too thick or has an uneven surface that may interfere with the test, the material shall be buffed as described in method 1111. The thickness of thick material shall not be reduced beyond 1.7 mm.

4.2 Liquid heat-transfer medium.

4.2.1 The specimen shall be exposed at the temperature specified in the detail specification.

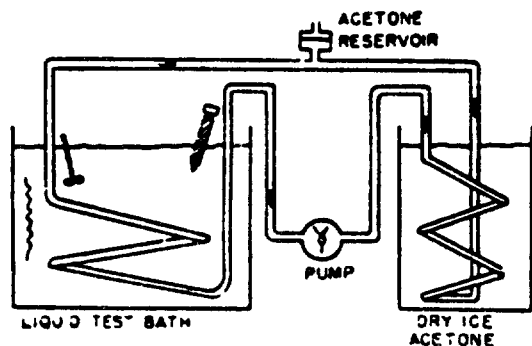
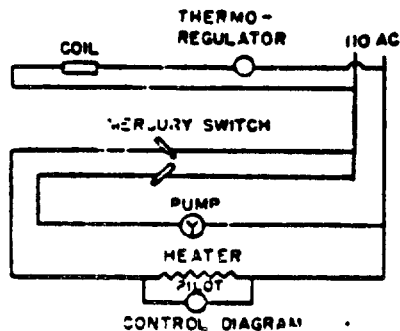


FIGURE 5311C.—Constant temperature cooling system.

Temperatures of $-40^{\circ} \pm 2^{\circ}$ C. ($-40^{\circ} \pm 3.6^{\circ}$ F.), $-55^{\circ} \pm 2^{\circ}$ C. ($-67^{\circ} \pm 3.6^{\circ}$ F.), or $-75^{\circ} \pm 2^{\circ}$ C. ($-103^{\circ} \pm 3.6^{\circ}$ F.) are normally used.

4.2.2 The liquid medium shall be as specified in the detail specification

4.2.3 The liquid medium shall be adjusted to the specified temperature. This may be accomplished by placing a suitable amount of dry ice in the insulated tank and slowly adding the heat-transfer liquid until the tank is filled to a level of approximately 25 to 50 mm. from the top or adjusted by means of the automatic regulator, 3.1.5.3.2.

4.2.4 The specimen shall be free from mechanical damage. The specimen shall be mounted in the testing apparatus as shown in figure 5311B with not less than 6 mm. of the specimen held in the clamp and 25 ± 5 mm. of the specimen extending beyond the edge of the clamp and immersed in the liquid medium. The level of the liquid in the apparatus at the time of impact shall be about 25 mm. above the specimen. The specimen shall remain immersed in the liquid medium maintained at the specified temperature for 30 minutes \pm 0.5 minute. At the end of the immersion period, with the specimen still immersed in the liquid medium, a single impact blow shall be delivered to the specimen by means of the striking arm. Not more than five specimens shall be subjected to a single impact blow of the striking arm. If the speed of the striking arm at impact is not maintained above 1.85 meters per second, the number of specimens tested at one time shall be reduced.

4.2.5 The specimen shall be examined for cracks, fissures, and rupture. Where a specimen has not ruptured, it shall be bent to an angle of 90° in the same direction as the bend caused by impact and examined for cracks or fissures at the bend.

4.3 Air Heat-transfer medium.

4.3.1 The specimen shall be exposed at the temperature specified in the detail specification. Temperatures of $-40^{\circ} \pm 2^{\circ}$ C. ($-40^{\circ} \pm 3.6^{\circ}$ F.), $-55^{\circ} \pm 2^{\circ}$ C. ($-67^{\circ} \pm 3.6^{\circ}$ F.), or $-75^{\circ} \pm 2^{\circ}$ C. ($-103^{\circ} \pm 3.6^{\circ}$ F.) are normally used.

4.3.2 The specimen shall be free from mechanical damage. The specimen shall be mounted in the testing apparatus as shown in figure 5311B, and the apparatus with specimen in position shall be placed in the low-temperature cabinet or testroom. The specimen shall be maintained at the specified temperature in a medium of air or a mixture of air and carbon dioxide for 60 ± 1 minute. At the end of the exposure period, with the specimen still at the specified temperature and still in the low-temperature testroom a single impact blow shall be immediately delivered to the specimen by means of the striking arm of the apparatus. Not more than five specimens shall be subjected to a single impact blow of the striking arm. If the speed of the striking arm at impact is not maintained above 1.85 meters per second, the number of specimens tested at one time shall be reduced.

4.3.3 The specimen shall be examined as described in 4.2.5.

5. RESULTS

5.1 Unless otherwise specified in the detail specification, five specimens from each test unit shall be tested.

5.2 The number of specimens tested from each test and the number from each test unit that show cracks, fissures, or rupture shall be recorded.

5.3 The heat-transfer medium used shall be recorded.

5.4 The temperature of exposure shall be recorded.

6. NOTES

6.1 Silicone fluids may be obtained from the Dow Corning Corporation, Midland, Michigan; Silicone Products Department, General Electric Co., Waterford, New York; and Silicones Division, Union Carbide Corp., 30 E. 42nd Street, New York 17, N. Y.

NAVY INTEREST:

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