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Standard Practice for Rubber Conditioning For Low Temperature Testing¹

This standard is issued under the fixed designation D832; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This practice covers the characteristic mechanical behavior of rubbers at low temperatures, and outlines the conditioning procedure necessary for testing at these temperatures.

1.2 One of the first stages in establishing a satisfactory technique for low temperature testing is the specification of the time and temperature of exposure of the test specimen. It has been demonstrated that any one or more of the following distinct changes, which are detailed in Table 1, may take place on lowering the test temperature:

- 1.2.1 Simple temperature effects,
- 1.2.2 Glass transitions, and
- 1.2.3 First order transitions (crystallization), and solubility and other effects associated with plasticizers.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

- D471 Test Method for Rubber Property—Effect of Liquids
- D1053 Test Methods for Rubber Property—Stiffening at Low Temperatures: Flexible Polymers and Coated Fabrics
- D1329 Test Method for Evaluating Rubber Property—

Retraction at Lower Temperatures (TR Test)

D1566 Terminology Relating to Rubber

D2136 Test Method for Coated Fabrics—Low-Temperature Bend Test

D5964 Practice for Rubber IRM 901, IRM 902, and IRM 903 Replacement Oils for ASTM No. 1, ASTM No. 2, ASTM No. 3 Oils, and IRM 905 formerly ASTM No. 5 Oil

3. Significance and Use

3.1 Low temperature testing of rubber can yield repeatable results only if the preconditioning of the samples is consistent. Properties such as brittleness and modulus are greatly affected by variations in time/temperature exposures. This practice is intended to provide uniform conditioning for the various low temperature tests conducted on rubbers.

4. General Conditioning

4.1 At least 16 h should elapse between vulcanization and testing of a sample.

4.1.1 If the time between vulcanization and testing is less than 16 h, it shall be agreed upon between customer and supplier and noted in the report section of the test method employed.

5. Simple Temperature Effects (Viscoelasticity)

5.1 Most elastic properties of rubber change as the temperature is changed. As the temperature is reduced toward the glass transition temperature, T_g , the specimen becomes increasingly stiff, loses resilience, and increases in modulus and hardness. At some point, still above T_g , the resilience reaches a minimum. As the temperature is lowered beyond this point, the resilience then increases until a temperature just above T_g is reached.

5.2 Viscoelastic changes are usually complete as soon as the specimen has reached thermal equilibrium. Longer exposure time should be avoided to minimize crystallization or plasticizer-time effects that might influence the test results. The magnitude of these changes depends on the composition of the material and the test temperature.

¹ This practice is under the jurisdiction of ASTM Committee D11 on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee D11.10 on Physical Testing.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.