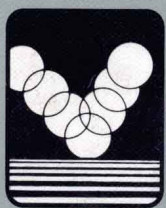


1996



ANNUAL BOOK OF ASTM STANDARDS

SECTION

9

Rubber



VOLUME

09.01

Rubber, Natural and Synthetic—
General Test Methods; Carbon Black

Revision issued annually



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Library of Congress Catalog Card Number: 83-641658

ISBN 0-8031-2356-6 (set)

ISBN 0-8031-2322-1 (section)

ISBN 0-8031-2323-X (volume)

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Foreword

Organized in 1898, ASTM has grown into one of the largest voluntary standards development systems in the world. ASTM is a not-for-profit organization which provides a forum for producers, users, ultimate consumers, and those having a general interest (representatives of government and academia) to meet on common ground and write standards for materials, products, systems, and services.

From the work of 132 standards-writing committees, ASTM publishes more than 9,800 standards each year. These standards and other related technical information are sold throughout the world.

ASTM Headquarters has no technical research or testing facilities; such work is done voluntarily by 35,000 technically qualified ASTM members located throughout the world. Membership in the Society is open to all concerned with the fields in which ASTM is active. A membership application may be found at the back of this volume. Additional information may be obtained from Member and Committee Services, ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428; tel. (610) 832-9693.

1996 Annual Book of ASTM Standards

The 1996 *Annual Book of ASTM Standards* consists of 71 volumes, divided among 16 sections, of which this volume is one. It contains approved ASTM standards, provisional standards, and related material. These terms are defined as follows in the *Regulations Governing ASTM Technical Committees*:

Categories:

standard—as used in ASTM, a document that has been developed and established within the consensus principles of the Society and that meets the approval requirements of ASTM procedures and regulations.

Discussion—The term “standard” serves in ASTM as an adjective in the title of documents, such as test methods or specifications, to connote specified consensus and approval. The various types of standard documents are based on the needs and usages as prescribed by the technical committees of the Society.

provisional standard—a document published for a limited period of time by the Society to meet a demand for more rapid issuance of specific documents, such as an emergency situation, regulatory requirements, or other special circumstances.

Discussion—Provisional standards are not full consensus documents because they require subcommittee consensus only. (These documents replace emergency standards and proposals.)

Types:

The various types of ASTM documents are to provide a flexibility of form, communication, and usage for both the technical committees and the myriad users of ASTM documents. The type of ASTM document that is developed and titled is based on the technical content and intended use, not on the degree of consensus achieved. The two categories of ASTM documents (standard and provisional standard) can be of the following forms and types:

classification—a systematic arrangement or division of materials, products, systems, or services into groups based on similar characteristics such as origin, composition, properties, or use.

guide—a series of options or instructions that do not recommend a specific course of action.

Discussion—Whereas a practice prescribes a general usage principle, a guide only suggests an approach. The purpose of a guide is to offer guidance, based on a consensus of viewpoints, but not to establish a fixed procedure. A guide is intended to increase the awareness of the user to available techniques in a given subject area and to provide information from which subsequent evaluation and standardization can be derived.

practice—a definitive procedure for performing one or more specific operations or functions that does not produce a test result. (Compare *test method*.)

Discussion—A practice is not a downgraded test method. Examples of practices include procedures for conducting interlaboratory testing programs or other statistical procedures; for writing statements on sampling or precision and bias; and for selection, preparation, application, inspection, necessary precautions for use or disposal, installation, maintenance, and operation of testing equipment.

specification—a precise statement of a set of requirements to be satisfied by a material, product, system, or service that indicates the procedures for determining whether each of the requirements is satisfied.

Discussion—It is desirable to express the requirements numerically in terms of appropriate units together with their limits.

terminology—a document comprising definitions of terms; descriptions of terms; and explanations of symbols, abbreviations, or acronyms.

test method—a definitive procedure for the identification, measurement, and evaluation of one or more qualities, characteristics, or properties of a material, product, system, or service that produces a test result. (Compare *practice*.)

A new edition of the Book of Standards is published annually because of additions of new standards and significant revisions to existing standards. Approximately 30 % of each volume is new or revised. Each volume contains all actions approved by the Society at least six months before the publication date. New and revised standards approved by the Society between the annual editions of any given volume are made available as separate copies. Users are cautioned to follow the most current issue of a standard except when a specific edition of a standard is cited, for example, as in a contract.

Development and Use of ASTM Standards

ASTM believes that technically competent standards result when a full consensus of all concerned parties is achieved and rigorous due process procedures are followed. This philosophy and standards development system ensure technically competent standards having the highest credibility when critically examined and used as the basis for commercial, legal, or regulatory actions.

ASTM standards are developed voluntarily and used voluntarily. Standards become legally binding only when a government body references them in regulations, or when they are cited in a contract. Any item that is produced and marked as conforming to an ASTM standard must meet all applicable requirements of that standard.

ASTM standards are used by thousands of individuals, companies, and agencies. Purchasers and sellers incorporate standards into contracts; scientists and engineers use them in laboratories; architects and designers use them in plans; government agencies reference them in codes, regulations, and laws; and many others refer to standards for guidance.

Consideration of Comments on ASTM Standards

An ASTM standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of any standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

Using the Annual Book of ASTM Standards

The standards are assembled in each volume in alphanumeric sequence of their ASTM designation numbers except for Volumes 11.01, 11.02, and 05.04, which are assembled by subject matter. Volumes 03.06, 05.03, and 06.03 are assembled first by committee, then in alphanumeric sequence. Each volume has a table of contents, listing the standards in alphanumeric sequence by ASTM designation; and a list by subjects, categorizing the standards according to subject. A subject index of the standards in each volume appears at the back of each volume.

Availability of Individual Standards

Each ASTM standard is available as a separate copy from ASTM. Special quantity prices and discounts can be obtained from Customer Services. When ordering, provide the ASTM standard designation and year of issue, title, quantity desired, and shipping instructions.

Caveat Statements and Policies in Standards

ASTM caveat statements on Safety Hazards and Fire Hazards are required to appear in standards where appropriate. They are located in the scope section of applicable standards. The caveats on General Statement of ASTM Policy and Patents are contained in all standards and located at the end of each standard disclaimer. For more information on the caveats see Section F2 of the *Form and Style for ASTM Standards*.



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A complete Subject Index begins on p. 917

This contents includes only those standards included in Volumes 09.01 and 09.02 and those standards that appeared previously which have been superceded or discontinued within the past three years. Since the standards in this book are arranged in alphanumeric sequence, no page numbers are given in this contents.

In the serial designations prefixed to the following titles, the number following the dash indicates the year of adoption as standard or in the case of revision, the year of last revision. Thus, standards adopted or revised during the year 1996 have as their final number, 96. A letter following this number indicates more than one revision during that year, that is, 96a indicates the second revision in 1996, 96b the third revision, etc. Standards that have been reapproved without change are indicated by the year of last reapproval in parentheses as part of the designation number, for example, (1996). A superscript epsilon indicates an editorial change since the last revision or reapproval— $\epsilon 1$ for the first change, $\epsilon 2$ for the second change, etc.

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§ Approved for use by agencies of the Department of Defense and, if indicated on the standard, replaces corresponding Federal or Military document. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

† Although this standard has been officially withdrawn from Society approval, a brief description is included for information only.

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| D 5099 – 93 | Rubber—Measurement of Processing Properties Using Capillary Rheometry |
| §D 3183 – 84 (1992) | Rubber—Preparation of Pieces for Test Purposes from Products |
| §D 4678 – 94 | Rubber—Preparation, Testing, Acceptance, Documentation, and Use of Reference Materials (IRM) |
| §D 1349 – 87 (1992) ^{§1} | Rubber—Standard Temperatures for Testing |
| §D 832 – 92 | Rubber Conditioning for Low-Temperature Testing |
| E 104 – 85 (1991) | <i>Maintaining Constant Relative Humidity by Means of Aqueous Solutions (See Vol 11.03)</i> |

Specification for:

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| D 5900 – 96 | Physical and Chemical Properties of Industry Reference Materials (IRM) |
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Chemical Tests of Rubber

Test Methods for:

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| D 5461 – 93 | Rubber Additives—Wet Sieve Analysis of Powdered Rubber Chemicals |
| D 5667 – 95 | Rubber from Synthetic Sources—Total and Water Soluble Ash |
| D 5668 – 95 | Rubber from Synthetic Sources—Volatile Matter |
| §D 297 – 93 | Rubber Products—Chemical Analysis |
| D 3314 – 92 | Rubber—Chemical Analysis for Polystyrene Blocks in SBR (Styrene-Butadiene Rubber) and Styrene-Reinforced Latexes |
| §D 3677 – 90 (1995) ^{§1} | Rubber—Identification by Infrared Spectrophotometry |
| §D 4004 – 93 | Rubber—Metal Content by Flame Atomic Absorption (AAS) Analysis |
| D 1519 – 95 | Rubber Chemicals—Melting Range |
| §D 3900 – 95 | Rubber, Raw—Determination of Ethylene Units in EPM (Ethylene-Propylene Copolymers) and EPDM (Ethylene-Propylene-Diene Terpolymers) |

Practices for:

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|----------------------------------|---|
| D 3156 – 90 | Rubber—Chromatographic Analysis of Antidegradants (Stabilizers, Antioxidants, and Antiozonants) |
| D 3566 – 90 (1995) ^{§1} | Rubber—Determination of Bromine in the Presence of Chlorine by Oxygen Combustion |
| D 3452 – 93 | Rubber—Identification by Pyrolysis-Gas Chromatography |

§ Approved for use by agencies of the Department of Defense and, if indicated on the standard, replaces corresponding Federal or Military standard. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

Physical Tests of Vulcanized Rubber

Test Methods for:

- D 575 – 91 Rubber Properties in Compression
 §D 945 – 92 Rubber Properties in Compression or Shear (Mechanical Oscillograph)
 §D 1630 – 94 Rubber Property—Abrasion Resistance (Footwear Abrader)
 D 2228 – 88 (1994)^{€1} Rubber Property—Abrasion Resistance (Pico Abrader)
 §D 413 – 82 (1993)^{€1} Rubber Property—Adhesion to Flexible Substrate
 §D 429 – 81 (1993)^{€1} Rubber Property—Adhesion to Rigid Substrates
 §D 2137 – 94 Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics
 D 1460 – 86 (1991)^{€1} Rubber Property—Change in Length During Liquid Immersion
 §D 395 – 89 (1994) Rubber Property—Compression Set
 §D 1229 – 87 (1992) Rubber Property—Compression Set at Low Temperatures
 §D 2240 – 95 Rubber Property—Durometer Hardness
 §D 471 – 95 Rubber Property—Effect of Liquids
 §D 1456 – 86 (1991)^{€1} Rubber Property—Elongation at Specific Stress
 §D 3137 – 81 (1994) Rubber Property—Hydrolytic Stability
 §D 1415 – 88 (1994) Rubber Property—International Hardness
 §D 531 – 89 (1994) Rubber Property—Pusey and Jones Indentation
 §D 2632 – 92 Rubber Property—Resilience by Vertical Rebound
 D 1054 – 91 Rubber Property—Resilience Using a Rebound Pendulum
 §D 624 – 91 Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
 D 814 – 86 (1991)^{€1} Rubber Property—Vapor Transmission of Volatile Liquids
 §D 991 – 89 (1994) Rubber Property—Volume Resistivity of Electrically Conductive and Antistatic Products
 §D 412 – 92^{€2} Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension

Practices for:

- ES 27 – 94 Rubber—Establishing Replacement Immersion Reference Oils for ASTM No. 2 and No. 3 Immersion Oils as Used in Test Method D 471 (Emergency Standard)
 D 2231 – 94 Rubber Properties in Forced Vibration

Test Methods:

- §D 2136 – 94 Coated Fabrics—Low-Temperature Bend Test
 E 28 – 92 Softening Point by Ring-and-Ball Apparatus (see Vol 06.03)
 D 1002 – 94 Strength Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal) (see Vol 15.06)

Terminology Relating to:

- D 1566 – 95a^{€1} Rubber

Aging, Degradation, and Fatigue Tests for Rubber

Specifications for:

- E 95 – 68 (1992) Cell-Type Oven with Controlled Rates of Ventilation (see Vol 14.02)
 E 145 – 94 Gravity-Convection and Forced-Ventilation Ovens (see Vol 14.02)
 E 171 – 94 Standard Atmospheres for Conditioning and Testing Materials (see Vol 15.09)

Test Methods for:

- §D 454 – 88 (1994)^{€1} Rubber Deterioration by Heat and Air Pressure
 §D 572 – 88 (1994)^{€1} Rubber—Deterioration by Heat and Oxygen
 §D 865 – 88 (1994)^{€1} Rubber—Deterioration by Heating in Air (Test Tube Enclosure)
 §D 813 – 95 Rubber Deterioration—Crack Growth
 §D 1052 – 85 (1994) Rubber Deterioration—Cut Growth Using Ross Flexing Apparatus
 §D 430 – 95 Rubber Deterioration—Dynamic Fatigue
 D 3395 – 86 (1991) Rubber Deterioration—Dynamic Ozone Cracking in a Chamber
 §D 573 – 88 (1994)^{€1} Rubber—Deterioration in an Air Oven
 D 750 – 95 Rubber Deterioration in Carbon—Arc Weathering Apparatus
 D 4575 – 86 (1991)^{€1} Rubber Deterioration: Reference and Alternative Method(s) for Determining Ozone Level in Laboratory Test Chambers
 §D 518 – 86 (1991) Rubber Deterioration—Surface Cracking
 §D 1149 – 91 Rubber Deterioration—Surface Ozone Cracking in a Chamber
 D 1171 – 94 Rubber Deterioration—Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
 D 3629 – 94 Rubber Property—Cut Growth Resistance
 D 4482 – 85 (1994) Rubber Property—Extension Cycling Fatigue
 D 623 – 93 Rubber Property—Heat Generation and Flexing Fatigue in Compression
 D 925 – 88 (1994)^{€1} Rubber Property—Staining of Surfaces (Contact, Migration, and Diffusion)

Practices for:

- §D 1349 – 87 (1992)^{€1} Rubber—Standard Temperatures for Testing
 E 104 – 85 (1991) Maintaining Constant Relative Humidity by Means of Aqueous Solutions (see Vol 11.03)
 E 144 – 94 Safe Use of Oxygen Combustion Bombs (see Vol 14.02)