

Physical testing of rubber —

Part 0: Introduction

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Committees responsible for this British Standard

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- British Railways Board
- British Rubber Manufacturers' Association
- ERA Technology Ltd.
- GAMBICA (BEAMA Ltd.)
- Institution of Mechanical Engineers
- Institution of Water Engineers and Scientists
- Malaysian Rubber Producers' Research Association
- Ministry of Defence
- National College of Rubber Technology
- Rubber and Plastics Research Association of Great Britain
- SATRA Footware Technology Centre

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Foreword

This British Standard has been prepared under the direction of the Rubber Standards Policy Committee.

The title of BS 903 has been changed to “*Physical testing of rubber*”, as many of the methods in the BS 903-A series are suitable for testing thermoplastic as well as vulcanized rubber. The change of title also anticipates the transfer of the methods in the Part B series to a separate standard for the chemical testing of rubber and the omission of the words “Methods for” reflects the publication of this Part 0 “Introduction” and anticipates a future “Guide to the selection and use of methods of test”. Amendments are not being issued to the other Parts of BS 903, but their titles are being changed when these Parts are revised.

Its purpose is to provide a general introduction to the schema of methods investigating the pre-vulcanizing, physical and electrical properties of rubber, (including raw, unvulcanized, vulcanized and thermoplastic materials).

A detailed and comprehensive cross-reference is given in Appendix A of corresponding international standards, and Appendix C provides recommendations for the rounding-off of test results.

A guide to the selection and application of test methods is in preparation as a complementary adjunct to this introduction and will be published separately.

Methods for chemical testing in the BS 903-B series, along with BS 5293 and BS 1673-2, BS 1673-5, BS 1673-7 and BS 1673-9, are to be published as a new British Standard for the chemical testing of rubber.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Introduction

1 Scope

This Part of this British Standard provides a general introduction to the A and C series of BS 903, which describes, in Part format, a range of laboratory-scale methods for the physical testing of rubber (including raw, unvulcanized, vulcanized and thermoplastic materials). A list of other closely related British Standards, is also provided.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Contents

2.1 General

The individual test methods published in the A series of BS 903 are listed in Appendix A. Many are identical with those standardized by Technical Committee ISO/TC 45, "Rubber and rubber products", of the International Organization for Standardization (ISO) and, where this is so, the methods have been published as dual-numbered standards. In all cases the ISO equivalents are also listed. Additional methods are in preparation.

The methods fall into five main categories:

- a) unvulcanized rubber tests;
- b) preparative procedures;
- c) mechanical tests;
- d) viscoelastic tests;
- e) degradation tests.

In terms of properties and usage the existing Parts of this standard may be grouped as follows although there will be some overlap.

2.2 Unvulcanized rubber properties (see note)

Mooney viscometer tests	A58
Delta Mooney	A58
Prevulcanization characteristics	A58

Plastimeter tests	
Rapid plasticity	A59
Plasticity retention index	A59

Curemeter tests	A60 ^a
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^a In preparation.

NOTE Attention is also drawn to BS 1673-10 and BS 1674.

2.3 Preparative procedures

Test piece (see note to 2.2)	
preparation	A36
measurement of dimensions	A38
Test conditions (see note)	
standard test atmospheres	A35

general directions for achieving
elevated or subnormal temperatures A32

NOTE Attention is also drawn to BS 5214-1.

2.4 Mechanical properties

Density	A1
Stress-strain properties	
in tension	A2
in compression	A4
in shear	A14
cyclic	A24, A31
Hardness	A26
by pocket hardness meters	A57
Strength properties	
tensile	A2
tear	A3, A47
fatigue	A10, A11, A51
abrasion	A9

2.5 Viscoelastic properties

Set and recovery	
in tension	A5
in compression	A6, A39
Resilience	A8
Creep	A15
Stress relaxation	A34, A42
Dynamic testing	A24, A31
Heat build up (see note)	A49, A50

NOTE BS 903-A49 and BS 903-A50 may also be used to determine resistance to fatigue caused by thermal degradation during flexure.

2.6 Degradation and environmental tests

Thermal and thermal-oxidative ageing (see note 1)	
accelerated testing and heat resistance	A19
by stress relaxation	A52
Ozone and weathering resistance	
static ozone exposure ^c	A43
dynamic ozone exposure	A44
outdoor exposure	A53
artificial light exposure	A54
assessment of properties	A55
Resistance to liquids	A16
water vapour absorption	A18

Low temperature properties (see note 2)

torsion modulus	A13
impact brittleness	A25
temperature retraction	A29
compression set	A39

NOTE 1 BS 903-A6, BS 903-A15, BS 903-A34, BS 903-A42, BS 903-A49 and BS 903-A50 may also be used to measure the time dependent thermal stability of vulcanized rubber under specified conditions.

NOTE 2 Attention is also drawn to BS 5294.

2.7 Composite and contact properties

Adhesion strength

to fabrics	A12, A27, A47
to textile cord	A48
to metals	A21
to rigid materials	A40
to wire cord	A56

Contact properties

staining of organic materials	A33
corrosion of metals	A37

2.8 Effect of fluids

Resistance to liquids	A16
Water vapour absorption	A18
Gas permeability	A17, A30
Vapour transmission rate	A46

3 Usage

3.1 Application

For the testing of vulcanized rubber the use of BS 903 test methods should always be considered before resort is made to other methods or procedures.

The methods are intended for use with small, laboratory test pieces taken either from specially prepared test sheets or from finished rubber products. In most instances these test pieces will be cut by dies or knives from a representative sample, and here attention is drawn to the procedures specified in BS 903-A36, since the method of preparation can affect test performance, especially where strength measurements are involved. For some tests, the test pieces are best directly moulded. The A series of BS 903 is applicable to unvulcanized and vulcanized rubber prepared from dry rubber or latex, but many, although not all, of the test methods described are suitable for use with thermoplastic rubbers and their products.

NOTE The scopes of several ISO test methods are now being extended to include thermoplastic rubbers.

This standard is not applicable to cellular rubber (see BS 4443) or, in the majority of cases, to rubber-coated fabric (see BS 3424).

3.2 Selection of test method

Many of the methods give options for test piece size and shape, test procedure, test environment and, where appropriate, test duration. For example, heat ageing tests conducted in accordance with BS 903-A19 may be carried out at one or more of several recommended test temperatures and times. Such options should be selected to suit the particular application and in all cases the conditions used should be specified and reported.

Considerations will include size of sample or product, speed of testing, the anticipated service environment and for example whether or not the test is for quality control or type approval purposes. The following references should prove helpful when selecting test methods and choosing test conditions.

BS 6716, *Guide to the properties and types of rubber*.

Brown, R.P., *Physical testing of rubber*, Elsevier Applied Science Publishers, London.

NOTE Detailed guidelines on the application of BS 903 A series test methods for quality control, specification, design and material evaluation purposes are in preparation.

3.3 Expression of test results

At present few of the methods specify the number of significant figures to which the test results should be expressed. For comparative purposes it is desirable that the accuracy should be the same irrespective of the means by which the individual results of the appropriate measure of "central tendency" is calculated. Modern calculators express results to several significant figures, and these and other results need to be rounded off to an accuracy representative of the test method and the number of test pieces specified. Attention is therefore drawn to the recommendations given in Appendix C.

4 General features

4.1 Definitions

For the purposes of BS 903, the definitions given in BS 3558 apply unless otherwise specified.

4.2 Units

All values in BS 903 are expressed in the units of the International System of Units (SI) described in BS 5555.

4.3 Reproducibility

It is intended that all methods will include a statement on test precision as determined by an interlaboratory test programme.

NOTE Such work is now being undertaken within ISO/TC 45 for all new or revised test methods and the information will eventually be included in all dual-numbered Parts. In this respect attention is drawn to BS 5497 and to ISO/TR 9272.

5 Statistical analysis

Attention is drawn to BS 5324, in which statistical methods are applied to several of the test methods in the A series of BS 903, and also to BS 2846.

6 Electrical properties

For the determination of the electrical properties of vulcanized rubber, use should be made of the test methods described in the C series of BS 903. The following Parts are available:

- C1 Determination of surface resistivity
- C2 Determination of volume resistivity
- C3 Determination of loss tangent and permittivity at power and audio frequencies
- C4 Determination of electric strength

Attention is also drawn to BS 2044.