

Physical testing of rubber —

**Part A64: Method for the preparation,
mixing and vulcanization of rubber test
mixes**

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee PRI/22, Physical testing of rubber, upon which the following bodies were represented:

- B P Chemicals Limited
- British Railways Board
- British Rubber Manufacturers' Association Ltd.
- GAMBICA (BEAMA Ltd.)
- Malaysian Rubber Producers' Research Association
- Ministry of Defence
- RAPRA Technology Ltd.
- SATRA Footwear Technology Centre

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National foreword

This Part of BS 903 has been prepared by Technical Committee PRI/22 and is identical with ISO 2393:1994 *Rubber test mixes — Preparation, mixing and vulcanization — Equipment and procedures*, published by the International Organization for Standardization (ISO). It supersedes BS 1674:1991 which is withdrawn.

This edition of Part A64 differs from BS 1674:1991 in the following respects.

- a) A second tangential type of internal mixer, having a nominal capacity of 2 000 cm³ (type A2) has been included (see **6.2**).
- b) A miniature internal mixer has been added.
- c) Preparation of ring test pieces has been included (see clause **9**), although these are very little used in the UK.

ISO 2393:1994 does not include the cavity mould for a stepped test sheet (Figure 2 in BS 1674:1991), nor the information on press platen temperature uniformity, (Appendix B in BS 1674:1991). These are now described in informative National annex NA and National annex NB.

Additional information. The dimension of 14 mm shown in Figure 2 for the bottom plate of the mould is seen as a minimum value, especially if constructed from an aluminium alloy and if there are more than four cavity sections. A dimension of 20 mm is recommended. Similarly a dimension of 15 mm is recommended for the hinged.

NOTE In the UK the standard temperature (see **7.2.4**) is 23 °C ± 2 °C.

The processes of mixing and vulcanizing are subject to a number of types of variability which are believed to arise from various causes including the following:

- a) the source and purity of rubber and compounding ingredients used;
- b) the accuracy of weighing the ingredients;
- c) the size or type of mixing equipment;
- d) the temperature of the rubber during the mastication and mixing processes;
- e) the manipulation during mixing, including loss of powders;
- f) the humidity and temperature of the atmosphere in which the unvulcanized mix is stored prior to vulcanization;
- g) the cooling of the mould during loading of the blank;
- h) the accuracy and constancy of the mould temperature during the course of vulcanization;
- i) the time taken to strip the vulcanized rubber from the mould, and to cool it to room temperature.

The contribution of such factors to the total variation depends on the type of mix.

WARNING. Mechanical guarding of apparatus should conform to current legislation and with BS 5304. Means need to be provided for exhaust ventilation at the apparatus to control injurious or offensive dust or vapour. Air flow quantities should be sufficient to conform to all relevant safety legislation.

Cross-references

International standard	Corresponding British Standard
	BS 903 <i>Physical testing of rubber</i>
ISO 37:1994	Part A2:1995 <i>Method for the determination of tensile stress-strain properties</i> (Identical)
ISO 471:1983	Part A35:1985 <i>Temperatures, humidities and times for conditioning and testing of test pieces</i> (Identical)
ISO 3417:1991	Part A60.2:1992 <i>Method for the determination of vulcanization characteristics using an oscillating disc curemeter</i> (Identical)

The Technical Committee has reviewed the provisions of ISO 289-1:1994, to which normative reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard. A related British Standard is BS 903-A58:1990.

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 to iv, pages 1 to 20, 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.

1 Scope

This International Standard specifies the equipment and procedures for the preparation, mixing and vulcanization of test mixes, as specified in the rubber evaluation procedures.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 37:1994, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*.

ISO 289-1:1994, *Rubber, unvulcanized — Determinations using a shearing-disc viscometer — Part 1: Determination of Mooney viscosity*.

ISO 471:—, *Rubber — Times, temperatures and humidities for conditioning and testing*¹⁾.

ISO 3417:1991, *Rubber — Measurement of vulcanization characteristics with the oscillating disc curemeter*.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1

formulation batch mass

the aggregate mass, in grams, of all the constituents in a formulation, with the rubber or oil-extended rubber polymer being taken as 100 g, or as specified in the appropriate rubber evaluation procedure

3.2

batch mass

the mass of test mix prepared in one mixing operation

3.3

total free volume

the volume of the mixing chamber with the rotors in place

3.4

nominal mixer capacity

the proportion of the total free volume which is used in the mixing process; a value of 0,75 times the total free volume has been found suitable for mixers with tangential rotors

4 Compounding ingredients

The compounding ingredients required for the various standard test formulations shall be in accordance with national or international standards as specified in the appropriate rubber evaluation procedure.

5 Preparation of materials

5.1 Batch masses

5.1.1 The standard batch mass for the laboratory mill, in grams, shall be four times the formulation batch mass unless otherwise stated in the appropriate rubber evaluation procedure.

NOTE 1 Smaller batch masses are used in some countries. These may not give identical results.

5.1.2 The batch mass for the internal mixer, in grams, shall be equal to the nominal mixer capacity, in cubic centimetres, multiplied by the compound density.

5.1.3 The batch mass for the miniature internal mixer, in grams, shall be equal to the nominal mixer capacity, in cubic centimetres, multiplied by the compound density.

5.2 Weighing tolerances

5.2.1 Rubber and carbon black shall be weighed to the nearest 1 g, oil to the nearest 1 g or $\pm 1\%$ whichever is the more accurate, vulcanizing agents and accelerators to the nearest 0,02 g and zinc oxide and stearic acid to the nearest 0,1 g. All other ingredients shall be weighed to an accuracy of $\pm 1\%$.

5.2.2 For miniature internal mixer mixes, the rubber and carbon black shall be weighed to the nearest 0,1 g, oil to the nearest 0,1 g or $\pm 1\%$ whichever is the more accurate, sulfur and accelerators to the nearest 0,002 g and zinc oxide and stearic acid to the nearest 0,01 g. All other ingredients shall be weighed to an accuracy of $\pm 1\%$.

¹⁾ To be published. (Revision of ISO 471:1983 and ISO 1826:1981)