INTERNATIONAL STANDARD

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Rubber — Dimensional tolerances for use with products

Caoutchouc — Tolérances dimensionnelles à utiliser pour les produits

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 3302 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*.

This second edition cancels and replaces the first edition (ISO 3302:1976), of which it constitutes a technical revision including, in particular, the addition of a new clause (clause 7) dealing with calendered sheet.

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Introduction

Rubber products are subject to changes in their dimensions after processing and vulcanization. This may be due to a variety of factors, such as mould shrinkage or relaxation of die swell.

These changes should be determined and allowed for when designing such items as moulds and dies used in the manufacture of a given product.

The closer tolerance classes outlined in this specification should not be demanded unless required by the final application and should be restricted to those dimensions deemed to be critical. The greater the degree of accuracy demanded, the closer the control which must be exercised during manufacture, and hence the higher the costs.

When particular physical properties are required in the product, it may not always be possible to provide them in a mix which is capable of fabrication to close tolerances. It is advisable, in these circumstances, that consultation should take place between the interested parties. In general, softer vulcanizates (i.e. those of hardness below 50 IRHD — see ISO 48) need greater tolerances than harder ones.

Rubber — Dimensional tolerances for use with products

1 Scope

This International Standard specifies classes of dimensional tolerances, and their values, for moulded, extruded and calendered solid rubber products. The relevant test methods necessary for the establishment of compliance with this International Standard are also specified.

The tolerances are primarily intended for use with vulcanized rubber but may also be suitable for products made of thermoplastic rubbers.

This standard does not apply to precision toroidal sealing rings or to calendered composite products such as rubber-coated fabrics or products where a rubber coating is applied by the process of topping or skim coating.

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 48:1979, *Vulcanized rubbers — Determination of hardness (Hardness between 30 and 85 IRHD).*

ISO 471:1983, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces.*

ISO 2230:1973, *Vulcanized rubber — Guide to storage.*

ISO 4648:1978, *Rubber, vulcanized — Determination of dimensions of test pieces and products for test purposes.*

3 Measurement of dimensions

3.1 General

For solid products, measurements of dimensions shall not be made until 16 h have elapsed after vulcanization, this minimum time being extended to 72 h in cases of dispute. Measurements shall be completed within 3 months after the date of despatch to the purchaser or before the product is put into use, whichever is the shorter time. Measurements shall be made at standard temperature, after conditioning (see ISO 471). Care shall be taken to ensure that the products are not subjected to adverse storage conditions (see ISO 2230) and that they are not distorted during measurement.

3.2 Test instruments

3.2.1 Depending on the circumstances, measurements shall be made using one or more of the following types of instrument:

3.2.1.1 For solid products, a **micrometer dial gauge**, the foot of which shall exert a pressure of 22 kPa $\pm$ 5 kPa for rubber of hardness equal to or greater than 35 IRHD or of 10 kPa $\pm$ 2kPa for rubber of hardness less than 35 IRHD (see ISO 4648 and ISO 48).

3.2.1.2 A suitable optical measuring instrument.

3.2.1.3 Fixed gauges, for upper and lower limits appropriate to the dimensions being measured.

3.2.1.4 Other devices, including tape measures (with or without vernier), sliding calipers and micrometer calipers.

3.2.2 All instruments shall be capable of measuring the dimension with an error within the tolerances specified.

3.2.3 In all measurements intended to be comparative, the same measuring device shall be used.

4 Tolerances

For the purposes of this International Standard, nominal dimensions and tolerances are based on the R 5 and R 10 series of preferred numbers respectively.

The dimensions of certain parameters of a particular product may not all require the application of the same class of tolerance. Dimensions of different parameters of the product on the same drawing may have different class tolerances applied to them. When drawings do not indicate a required class tolerance, the largest tolerance given in the related table shall be applied.

NOTES

1 Tolerances that are specified in this International Standard in terms of a positive value and an equal negative value (e.g. $\pm$ 0,35) may also be expressed in terms of unequal positive and negative values, providing the difference between the two values remains the same. For example, $\pm$ 0,35 may also be expressed as $^{+0,2}_{-0,5}$ or $^{+0,7}_{-0}$ or $^{+0}_{-0,7}$, etc.

2 Special consideration of tolerances will be necessary for a vulcanizate with a low hardness and a high tensile strength (e.g. natural rubber gum vulcanizate).

5 Mouldings

5.1 General

The dimensional tolerances stated in this International Standard may be wider than those used in some other engineering practice. The following considerations apply:

a) All rubber shows some shrinkage when cooled after moulding, and allowance for this is made in the mould design. The amount of shrinkage is dependent on the rubber type and the mix used, but also varies from batch to batch of the same mix. Products made from some silicone rubbers, fluorocarbon elastomers and other special-purpose elastomers are subject to larger shrinkages; therefore tolerance classes M1 and M2 (see 5.2) are very difficult to obtain with these rubbers.

b) Non-rubber parts bonded to the rubber will affect the shrinkage and, therefore, the practicable tolerances.

c) Moulds are made in various ways depending on the type of product and accuracy demanded. In general, the product can be no more accurate than the mould, and the greater the degree of accuracy demanded, the more expensive become the moulds and their maintenance.

d) Care shall be taken in applying the standard tolerances to products having wide sectional variations.

e) In cases where the rubber product is unavoidably distorted during removal from the mould, the dimensions of the products may be affected, and special allowance may be needed.

5.2 Classification

This clause establishes four classes of tolerance for fixed and closure dimensions (see 5.3) for products moulded in solid rubber, namely:

a) Class M1 for precision mouldings. Such mouldings require precision moulds, fewer cavities per mould, close mix controls, etc., which results in high cost. Optical comparators or other, similar, measuring devices may be required to minimize distortion of the rubber by the measuring instrument. This type of part requires expensive control and inspection procedures.

b) Class M2 for high-quality mouldings involving much of the close control required for class M1.

c) Class M3 for good-quality mouldings.

d) Class M4 for mouldings where dimensional control is non-critical.

5.3 Fixed dimensions and closure dimensions

In moulding a rubber product, more rubber is used than is required to fill the cavity, and the excess is flashed. This flash tends to prevent the mould sections from fully closing and thus affects the finished-part dimensions.

NOTE 3 For products moulded by transfer or injection, it is possible to regard all dimensions as fixed.

Two sets of tolerances, F and C, are given and are defined below.

5.3.1 fixed dimensions (F): Dimensions which are not affected by deforming influences like flash thickness or lateral displacement of different mould parts (upper and lower parts or cores). See figure 1, dimensions l_1, l_2 and l_3.

5.3.2 closure dimensions (C): Dimensions which can be altered by variation in the flash thickness or lateral displacement of different mould parts. See figure 1, dimensions d_1, d_2, d_3 and h.

NOTE 4 The dimensions for F and C can only be toleranced insofar as they are independent of each other.