INTERNATIONAL STANDARD

ISO 4633

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Corrected version
2004-04-01

Rubber seals — Joint rings for water supply, drainage and sewerage pipelines — Specification for materials

Joints étanches en caoutchouc — Garnitures de joints de canalisations d'adduction et d'évacuation d'eau (égouts inclus) — Spécification des matériaux

Reference number
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Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 4633 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 4, *Products (other than hoses)*.

This third edition cancels and replaces the second edition (ISO 4633:1996), which has been technically revised.

Annex A forms a normative part of this International Standard. Annexes B and C are for information only.

This corrected version of ISO 4633:2002 incorporates the following corrections:

— Page 5, Subclause 4.2.9 (ozone resistance): the exposure time has been corrected from $(72\,^{0}_{-2})$ h to $(48\,^{0}_{-2})$ h.

— Page 12, Bibliography:
  1) the year of publication of ISO 2230 has been inserted and the footnote deleted;
  2) the year of publication of ISO 7743 has been updated.

NOTE At the time of publication of this corrected version, a new edition of ISO 6914:1985 (see Clause 2 and 4.2.7, last paragraph) was about to be published.

Rubber seals — Joint rings for water supply, drainage and sewerage pipelines — Specification for materials

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

This International Standard specifies requirements for materials used in vulcanized rubber seals for

a) cold drinking-water supplies (up to 50 °C);

b) drainage, sewerage and rainwater systems (continuous flow up to 45 °C and intermittent flow up to 95 °C).

The different designations of seals specified are defined according to their type, application and requirements (see Table 3).

General requirements for finished joint seals are also given: any additional requirements called for by the particular application are specified in the relevant product standards, taking into account that the performance of pipe joints is a function of the seal material properties, seal geometry and pipe joint design. This International Standard is intended to be used where appropriate with product standards which specify performance requirements for joints.

This International Standard is applicable to joint seals for all pipeline materials, including iron, steel, clay, fibre cement, concrete, reinforced concrete, plastics and glass-reinforced plastics.

It is applicable to elastomeric components of composite or non-composite seals. In the case of composite seals for materials of hardness ranges from 76 IRHD to 95 IRHD, the requirements for elongation at break, compression set and stress relaxation apply only when the material is participating in the sealing function or in the long-term stability of the seal.

Joint seals made with an enclosed void as part of their design are included in the scope of this International Standard.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

ISO 48:1994, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 188:1998, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 815:1991, *Rubber, vulcanized or thermoplastic — Determination of compression set at ambient, elevated or low temperatures*

ISO 1431-1:1989, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static strain test*

ISO 1629:1995, *Rubber and latices — Nomenclature*

ISO 1817:1999, *Rubber, vulcanized — Determination of the effect of liquids*

ISO 2285:2001, *Rubber, vulcanized or thermoplastic — Determination of tension set under constant elongation, and of tension set, elongation and creep under constant tensile load*

ISO 3302-1:1996, *Rubber — Tolerances for products — Part 1: Dimensional tolerances*

ISO 3384:1999, *Rubber, vulcanized or thermoplastic — Determination of stress relaxation in compression at ambient and at elevated temperatures*

ISO 3387:1994, *Rubbers — Determination of crystallization effects by hardness measurements*

ISO 4661-1:1993, *Rubber, vulcanized or thermoplastic — Preparation of samples and test pieces — Part 1: Physical tests*

ISO 6914:1985, *Rubber, vulcanized — Determination of ageing characteristics by measurement of stress at a given elongation*

ISO 9691:1992, *Rubber — Recommendations for the workmanship of pipe joint rings — Description and classification of imperfections*

3 Classification

Six classes of material for pipe joint seals are specified in Table 2 and three classes of material in Table 3. A nominal hardness shall be specified within the ranges in Table 1.

4 Requirements

4.1 Requirements for materials

4.1.1 General

The materials shall be free of any substances which may have a deleterious effect on the fluid being conveyed, or on the life of the sealing ring, or on the pipe or fitting. Elastomeric components of composite seals not exposed to the contents of the pipeline are not required to meet the requirements of 4.1.2.

4.1.2 Effect on water quality

For cold-water applications, the materials shall not impair the quality of the water under the conditions of use. The materials shall comply with the national requirements in the country of use.

4.1.3 Microbiological deterioration

The materials shall be resistant to microbiological deterioration if the application so requires. The test methods and the requirements shall be as specified in national standards.

4.2 Requirements for finished seals

4.2.1 Dimensional tolerances

Tolerances shall be specified from the appropriate classes in ISO 3302-1.

4.2.2 Imperfections and defects

The seals shall be free of defects or irregularities which could affect their function. Classification of imperfections shall be in accordance with ISO 9691, as follows:

— surface imperfections in zones involved in the sealing function, as described in 4.1.1 of ISO 9691:1992, shall be considered as defects;

— surface imperfections in zones not involved in the sealing function, as described in 4.1.2.1 b) of ISO 9691:1992, shall not be considered as defects.

Major surface imperfections in zones not involved in the sealing function, as described in 4.1.2.1 a) of ISO 9691:1992, could be considered as defects. This shall be agreed between the interested parties: the acceptance criteria depend upon the seal type or design.

Internal imperfections as described in 4.2 of ISO 9691:1992 could be considered as defects. The compressive force referred to in ISO 9691:1992 can be determined in accordance with ISO 7743 (see the bibliography). The acceptable limiting values of the compressive force shall be agreed between the interested parties. These values depend upon the seal type or design.

4.2.3 Hardness

When determined by the micro-test method specified in ISO 48, the hardness shall comply with the requirements given in Table 2.

If the dimensions of a seal are appropriate, the normal test method specified in ISO 48 may be used, provided that the micro-test method is used for reference purposes.

For the same seal, or along the greatest length of an extruded profile cut to make the seal, the difference between the minimum and maximum hardness shall not be more than 5 IRHD. Each value shall be within the specified tolerances.

4.2.4 Tensile strength and elongation at break

The tensile strength and elongation at break shall be determined by the method specified in ISO 37. Dumb-bell-shaped test pieces of type 1, 2, 3 or 4 shall be used. Type 2 is the preferred type. The test report shall state the dumb-bell type whenever type 2 is not used.

The tensile strength and the elongation at break shall comply with the requirements given in Table 2.

4.2.5 Compression set in air

4.2.5.1 General

If the test piece is taken from a seal, then the measurement shall be carried out as far as possible in the direction of compression of the seal in service.

4.2.5.2 Compression set at 23 °C and 70 °C

When determined by the method specified in ISO 815, at 23 °C and 70 °C, using the small, type B, test piece, the compression set shall comply with the requirements given in Table 2.

Where the cross-section is too small to obtain compression buttons from the product, as an alternative to moulding buttons the tension set of the product may be determined using ISO 2285:1997, method A, with a strain of 50 % and applying the same test conditions (except strain) and requirements as for compression set.

4.2.5.3 Low-temperature compression set at – 10 °C

When determined by the method specified in ISO 815 at – 10 °C, using the small, type B, test piece and the (30 ± 3) min recovery measurement, the low-temperature compression set shall comply with the requirements given in Table 2.

4.2.6 Accelerated ageing in air

Test pieces prepared for the determination of hardness (see 4.2.3) and for the determination of tensile strength and elongation at break (see 4.2.4) shall be aged in air, by the normal oven method specified in ISO 188:1998 (method A) for 7 days at 70 °C.

The changes in hardness, tensile strength and elongation at break shall comply with the requirements given in Table 2.

4.2.7 Stress relaxation in compression

The stress relaxation shall be determined by method A of ISO 3384:1999, using the cylindrical test piece after carrying out thermal and mechanical conditioning.

Measurements shall be taken after 3 h, 1 day, 3 days and 7 days for the 7-day test and after 3 h, 1 day, 3 days, 7 days, 30 days and 100 days for the 100-day test.

The best-fit straight line shall be determined by regression analysis using a logarithmic time scale, and the correlation coefficients derived from these analyses shall not be lower than 0,93 for the 7-day test and 0,83 for the 100-day test. The 7-day and 100-day requirements in Table 2 are those derived from these straight lines. For continuous measurement, using the apparatus described in the first paragraph of 5.2 of ISO 3384:1991, the 7-day and 100-day requirements in Table 2 are those derived from the measurements at 7 days and 100 days.

The stress relaxation in compression shall comply with the requirements given in Table 2 at the following temperatures and times:

7 days at (23 ± 2) °C;

100 days at (23 ± 2) °C.

The test temperature shall be maintained within the specified tolerance during the whole period of the test and verified by suitable recording equipment on a continuous basis.

The 100-day test shall be considered as a type approval test.

Where the cross-section is too small to obtain compression buttons from the product, as an alternative to moulding test pieces the stress relaxation in tension of the product may be determined, using ISO 6914:1985, method A, with the same requirements as for stress relaxation in compression.

4.2.8 Volume change in water

When determined by the method specified in ISO 1817 after 7 days immersion in distilled or deionized water at 70 °C, the change in volume shall comply with the requirements given in Table 2.

4.2.9 Ozone resistance

When determined by the method specified in ISO 1431-1 under the conditions set out below:

ozone concentration	(50 ± 5) pphm
temperature	(40 ± 2) °C
pre-tension time	$(72^{\ 0}_{-2})$ h
exposure	$(48^{\ 0}_{-2})$ h
elongation:	
40 IRHD, 50 IRHD, 60 IRHD, 70 IRHD	(20 ± 2) %
80 IRHD	(15 ± 2) %
90 IRHD	(10 ± 1) %
relative humidity	(55 ± 10) %

the ozone resistance of vulcanized-rubber sealing elements which are attached to the pipe or fittings shall comply with the requirements given in Table 2.

Rubber sealing elements which are protected by packaging, whether packaged separately or not, up to the time of installation shall meet the same requirement but using an ozone concentration of (25 ± 5) pphm.

4.2.10 Splices of prevulcanized profile ends

4.2.10.1 Spliced joints

These shall be vulcanized.

4.2.10.2 Strength of spliced joints

When tested by the method specified in annex A, there shall be no visible separation in the cross-sectional area of the splice when viewed without magnification.

4.3 Optional requirements

4.3.1 Low-temperature performance at – 25 °C

When determined by the method specified in ISO 815, using the small, type B, test piece at – 25 °C, the compression set shall comply with the requirements given in Table 2.

When determined by the method specified in ISO 3387, the hardness change at – 25 °C shall comply with the requirements given in Table 2.

4.3.2 Volume change in oil

The resistance to oil shall be determined in accordance with ISO 1817. The volume change of test pieces, shall be determined after 72 h immersion in standard oils No. 1 and No. 3 at a temperature of 70 °C.

The volume change in oil shall comply with the requirements in Table 2.