INTERNATIONAL STANDARD

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Rubber seals — Joint rings for pipelines for hot-water supply up to 110 °C — Specification for the material

Joints étanches en caoutchouc — Garnitures d'étanchéité destinées aux joints de canalisations pour la fourniture d'eau chaude jusqu'à 110 °C — Spécifications pour les matériaux

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 9631 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 4, *Products (other than hoses)*.

This second edition cancels and replaces the first edition (ISO 9631:1991), which has been technically revised.

Rubber seals — Joint rings for pipelines for hot-water supply up to 110 °C — Specification for the material

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 hot potable and non-potable water supply (up to 110 °C).

The different seal designations specified are defined according to seal type, seal application and the requirements for a particular seal (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 use with 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 and non-composite seals. In the case of composite seals made from materials with hardnesses ranging from 76 IRHD to 95 IRHD, the requirements for elongation at break, compression set and stress relaxation apply only when the material participates in the sealing function or contributes to the long-term stability of the seal.

Joint rings made from cellular rubber materials or with enclosed voids as part of their design are not covered by this International Standard.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 34-2:1996, *Rubber, vulcanized or thermoplastic — Determination of tear strength — Part 2: Small (Delft) test pieces*

ISO 37:1994, *Rubber, vulcanized or themoplastic — 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 471:1995, *Rubber — Temperatures, humidities and times for conditioning and testing*

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, *Rubber — 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:—[1)], *Rubber, vulcanized or thermoplastic — Determination of ageing characteristics by measurement of stress relaxation*

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

3 Classification

Five classes of materials for pipe joint seals are specified in Table 2. A nominal hardness shall be specified within the ranges in Table 1.

Table 1 — Hardness classification

Hardness class	50	60	70	80	90
Range of hardness, IRHD	46 to 55	56 to 65	66 to 75	76 to 85	86 to 95

1) To be published. (Revision of ISO 6914:1985)

Table 2 — Physical-property requirements for materials used in continuous hot water up to 110 °C

Property	Unit	Test method	Sub-clause	Requirements for hardness classes				
				50	60	70	80	90
Permissible tolerance on nominal hardness	IRHD	ISO 48	4.2.3	±5	±5	±5	±5	±5
Tensile strength, min.	MPa	ISO 37	4.2.4	9	9	9	9	9
Elongation at break, min.	%	ISO 37	4.2.4	250	200	200	100	100
Compression set, max. 72 h at 23 °C 24 h at 125 °C	 % %	 ISO 815 ISO 815	 4.2.5.2 4.2.5.2	 15 20	 15 20	 15 20	 15 20	 15 20
Ageing, 7 days at 125 °C Hardness change, max. Tensile strength change, max. Elongation change, max.	 IRHD % %	ISO 188 ISO 48 ISO 37 ISO 37	4.2.6	 +8/–5 –20 +10/–30	 +8/–5 –20 +10/–30	 +8/–5 –20 +10/–30	 +8/–5 –20 +10/–40	 +8/–5 –20 +10/–40
Stress relaxation, max. [a] 7 days at 23 °C 7 days at 125 °C	%	ISO 3384	4.2.7	 15 30	 15 30	 15 30	 18 30	 18 30
Volume change in water, max. [a] 7 days at 95 °C	%	ISO 1817	4.2.8	 +8/–1	 +8/–1	 +8/–1	 +8/–1	 +8/–1
Ozone resistance	—	ISO 1431-1	4.2.9	No cracking when viewed without magnification				
Tear strength, min. [a]	N	ISO 34-2	4.2.10	20	20	20	20	20
Compression set in water, max. [b]	%	Annex B	4.2.11	30	30	30	30	30

[a] See 4.2.11 for seals manufactured from isobutylene-isoprene copolymers.

[b] This requirement only applies to isobutylene-isoprene copolymers.

Table 3 — Designation of elastomeric joint seals by type, application and requirements

Type	Application	Requirements	Subclause
WB	Hot potable water (continuous supply up to 110 °C)	Table 2 Effect on water quality	4.1.2
WD	Hot non-potable water (continuous supply up to 110 °C)	Table 2	
WE	Hot potable water (continuous supply up to 110 °C) (seals manufactured from isobutylene-isoprene copolymer)	Table 2 Effect on water quality Compression set in hot water	4.1.2
WF	Hot potable water (continuous supply up to 110 °C) (seals manufactured from isobutylene-isoprene copolymer)	Table 2 Compression set in hot water	

4 Requirements

4.1 Requirements for material

4.1.1 General

The material 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 Subclause 4.1.2.

4.1.2 Effect on water quality

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

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 ability to function correctly. 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;

— minor surface imperfections in zones not involved in the sealing function, as described in clause 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, however, be agreed between the interested parties. The acceptance criteria will depend upon the seal type and design.

Internal imperfections as described in 4.2 of ISO 9691:1992 could be considered as defects. The compressive force may be determined in accordance with ISO 7743. The acceptable limiting values of the compressive force shall be agreed between the interested parties. They will depend upon the seal type and 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 suitable, the normal test method specified in ISO 48 may be used, provided that the micro-test method is used for reference purposes.

For a particular seal, or along the greatest length of an extruded profile cut to make the seal, the difference between the highest and lowest hardness values measured shall not be more than 5 IRHD. Each value shall be with the specified tolerance limits.

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 being 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 pieces are taken from a seal, then the measurements 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 125 °C

When determined by the method specified in ISO 815, at 23 °C and 125 °C, using the small (type B) test piece cut from the seal, the compression set shall comply with the requirements given in Table 2.

If the cross-section of a seal is too small to obtain suitable test pieces, a type B test piece can be prepared either by cutting from a test slab or by moulding a disc (see 5.1). As an alternative, the tension set of the product may be determined using ISO 2285:2001, method A, with a strain of 50 % and applying the same test conditions (except strain) and requirements as for compression set.

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 using method A of ISO 188:1998 for 7 days at 125 °C.

The changes in hardness, tensile strength and elongation 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 small cylindrical test piece after thermal and mechanical conditioning.

Carry out the 7-day test at 23 °C and at 125 °C, taking measurements after 3 h, 1 day, 3 days and 7 days.

Determine the best-fit straight line by regression analysis using a logarithmic time scale. The correlation coefficients derived from these analyses shall not be lower than 0,93. The 7-day requirements in Table 2 are those derived from these straight lines. If continuous measurements are made using the apparatus described in the first paragraph of 5.2 of ISO 3384:1999, the 7-day requirements in Table 2 correspond to the measurement at 7 days.

The stress relaxation in compression shall comply with the requirements given in Table 2.

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.

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

If the cross-section of a seal is too small to obtain suitable test pieces, a type B test piece can be prepared either by cutting from a test slab or by moulding a disc (see 5.1). As an alternative, the stress relaxation in tension of the product may be determined, using ISO 6914:—, method A, with the same requirements as for stress relaxation in compression.

For seals manufactured from isobutylene-isoprene copolymers (IIR), see 4.2.11 for an alternative to the test at 125 °C.

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 95 °C, the change in volume shall comply with the requirements given in Table 2.

For seals manufactured from isobutylene-isoprene copolymers, see 4.2.11 for an alternative test.