INTERNATIONAL STANDARD

ISO 9631

Third edition
2018-03

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

Reference number
ISO 9631:2018(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document 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 9631:2003), which has been technically revised.

The main changes compared to the previous edition are as follows.

— Three different temperature classes (T1, T2 and T3) have been introduced. The requirements for the lowest class (T1) are similar to the requirements in the second edition of this standard, while classes T2 and T3 have been added in Table 2 to specify more severe requirements in order to deal with more demanding applications.

— The test procedure for the hot water compression set (Annex B) has been revised to be more in line with experiences over the last years.

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

WARNING — Persons using this document 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.

1 Scope

This document specifies material requirements for vulcanized rubber seals for hot drinking and non-drinking 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 2).

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 document is intended to be used where appropriate, in conjunction with product standards which specify performance requirements for joints.

This document is applicable to joint seals for use with all pipeline materials, including metals, 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 hardness 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.

The material requirements specified in this document are designed for long term performances and a potential lifetime of 50 years. The lifetime of a sealing depends not only on material performance but also on other parameters which are not defined in this document like the mounting design, the quality of assembly and the combination with operating conditions. Joint rings made from cellular rubber materials are not covered by this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *Rubber, vulcanized or thermoplastic — Determination of tear strength — Part 2: Small (Delft) test pieces*

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

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

ISO 188:2011, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 815-1, *Rubber, vulcanized or thermoplastic — Determination of compression set — Part 1: At ambient or elevated temperatures*

ISO 1431-1, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

ISO 1629, *Rubber and latices — Nomenclature*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

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

ISO 3384-1:2011, *Rubber, vulcanized or thermoplastic — Determination of stress relaxation in compression — Part 1: Testing at constant temperature*

ISO 6914:2013, *Rubber, vulcanized or thermoplastic — Determination of ageing characteristics by measurement of stress relaxation in tension*

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

ISO 10508:2006, *Plastics piping systems for hot and cold water installations — Guidance for classification and design*

ISO 15510, *Stainless steels — Chemical composition*

ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

4 Classification

4.1 Materials for pipe joint seals are classified based on their nominal hardness. 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

4.2 On top of that, three classes for the use of the materials are specified in Table 2.

Table 2 — Classes and designation of elastomeric joint seals by type, application and requirements

Class	Application	Requirements	Subclause
T1	Hot water systems where the temperature is high (up to 85 °C) during tapping and low (ambient) when no water is used.	Tables 3 and 4 (Effect on water quality)	5.1.2
T2	Hot water circulation systems based on the classification class 2 in ISO 10508:2006	Tables 5 and 6 (Effect on water quality)	5.1.2
T3	District heating, secondary systems with hot water circulation between 75 °C and 95 °C[a]	Tables 7 and 8 (Effect on water quality)	5.1.2

[a] T3 is based on EN 253.

A material of one type qualified for one class is automatically qualified for the inferior class.

4.3 Furthermore a difference is made for two types of sealing principle:

— Type A: Seals based on EPM, EPDM, NBR, SBR or equivalent polymers as typical materials;

— Type B: Seals based on IIR, CIIR or BIIR (butylic rubbers) or equivalent as typical materials.

4.4 If products are intended for drinking water, the letter D is added to the designation.

5 Requirements and test methods

5.1 Requirements for material

5.1.1 General

Requirements are summarized in Tables 3, 4, 5, 6, 7 and 8 for each class. The material shall be free of any substances which could have a deleterious effect on the water transported, 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 5.1.2.

Table 3 — Physical-property requirements for type A materials used in class T1 applications

Property	Unit	Test method	Sub-clause	Requirements for hardness classes				
				50	60	70	80	90
Permissible tolerance on nominal hardness	IRHD	ISO 48	5.2.3	±5	±5	±5	±5	±5
Tensile strength, min.	MPa	ISO 37	5.2.4	9	9	9	9	9
Elongation at break, min.	%	ISO 37	5.2.4	250	200	150	100	100
Compression set, max.								
72 h at 23 °C	%	ISO 815-1	5.2.5.2	15	15	15	15	15
24 h at 125 °C	%	ISO 815-1	5.2.5.2	20	20	20	20	20
Ageing, 7 days at 125 °C		ISO 188	5.2.6					
Hardness change, max.	IRHD	ISO 48		+8/−5	+8/−5	+8/−5	+8/−5	+8/−5
Tensile strength change, max.	%	ISO 37		−20	−20	−20	−20	−20
Elongation change, max.	%	ISO 37		+10/−30	+10/−30	+10/−30	+10/−40	+10/−40
Stress relaxation, max	%	ISO 3384-1 or ISO 6914	5.2.7					
7 days at 23 °C				15	15	15	18	18
7 days at 125 °C				30	30	30	30	30
Volume change in water, max. 7 days at 95 °C	%	ISO 1817	5.2.8	+8/−1	+8/−1	+8/−1	+8/−1	+8/−1
Ozone resistance	—	ISO 1431-1	5.2.9	No cracking when viewed without magnification				
Tear strength, min.	N	ISO 34-2	5.2.10	20	20	20	20	20

Table 4 — Physical-property requirements for type B materials used in class T1 applications

Property	Unit	Test method	Sub-clause	Requirements for hardness classes			
				50	60	70	80
Permissible tolerance on nominal hardness	IRHD	ISO 48	5.2.3	±5	±5	±5	±5
Tensile strength, min.	MPa	ISO 37	5.2.4	9	9	9	9
Elongation at break, min.	%	ISO 37	5.2.4	250	200	150	100
Compression set, max. 72 h at 23 °C 24 h at 125 °C	% %	ISO 815-1 ISO 815-1	5.2.5.2 5.2.5.2	 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	5.2.6	 +8/–5 –20 +10/–30	 +8/–5 –20 +10/–30	 +8/–5 –20 +10/–30	 +8/–5 –20 +10/–40
Stress relaxation, max 7 days at 23 °C	%	ISO 3384-1 or ISO 6914	5.2.7	15	15	15	18
Ozone resistance	—	ISO 1431-1	5.2.9	No cracking when viewed without magnification			
Compression set in water for 1 680 h at 110 °C, max.	%	Annex B	5.2.11	30	30	30	30

Table 5 — Physical-property requirements for type A materials used in class T2 applications

Property	Unit	Test method	Sub-clause	Requirements for hardness classes		
				60	70	80
Permissible tolerance on nominal hardness	IRHD	ISO 48	5.2.3	±5	±5	±5
Tensile strength, min.	MPa	ISO 37	5.2.4	9	9	9
Elongation at break, min.	%	ISO 37	5.2.4	200	150	100
Compression set, max. 72 h at 23 °C 24 h at 125 °C	% %	ISO 815-1 ISO 815-1	5.2.5.2 5.2.5.2	 15 20	 15 20	 15 20
Ageing, 7 days at 125 °C Hardness change Tensile strength change, max. Elongation change	IRHD % %	ISO 188 ISO 48 ISO 37 ISO 37	5.2.6	 +8/–5 –20 +10/–30	 +8/–5 –20 +10/–30	 +8/–5 –20 +10/–40
Stress relaxation, max 7 days at 23 °C 7 days at 125 °C	%	ISO 3384-1 or ISO 6914	5.2.7	 15 30	 15 30	 18 30
Stress relaxation, max. 21 days at 140 °C	%	ISO 6914	5.2.7	55	55	55
Volume change in water 7 days at 95 °C	%	ISO 1817	5.2.8	+8/–1	+8/–1	+8/–1

Table 5 *(continued)*

Property	Unit	Test method	Sub-clause	Requirements for hardness classes		
				60	70	80
Ozone resistance	—	ISO 1431-1	5.2.9	No cracking when viewed without magnification		
Tear strength, min.	N	ISO 34-2	5.2.10	20	20	20
Compression set in water at 110 °C						
After 3 000 h or else	%	Annex B	5.2.11	<20	<20	<20
After 10 000 h				<40	<40	<40

Table 6 — Physical-property requirements for type B materials used in class T2 applications

Property	Unit	Test method	Sub-clause	Requirements for hardness classes		
				60	70	80
Permissible tolerance on nominal hardness	IRHD	ISO 48	5.2.3	±5	±5	±5
Tensile strength, min.	MPa	ISO 37	5.2.4	9	9	9
Elongation at break, min.	%	ISO 37	5.2.4	200	150	100
Compression set, max.						
72 h at 23 °C	%	ISO 815-1	5.2.5.2	15	15	15
24 h at 125 °C	%	ISO 815-1	5.2.5.2	20	20	20
Ageing, 7 days at 125 °C		ISO 188	5.2.6			
Hardness change	IRHD	ISO 48		+8/–5	+8/–5	+8/–5
Tensile strength change, max.	%	ISO 37		–20	–20	–20
Elongation change	%	ISO 37		+10/–30	+10/–30	+10/–40
Stress relaxation, max 7 days at 23 °C	%	ISO 3384-1 or ISO 6914	5.2.7	15	15	18
Ozone resistance	—	ISO 1431-1	5.2.9	No cracking when viewed without magnification		
Compression set in water for 10 000 h at 110 °C, max.	%	Annex B	5.2.11	40	40	40
Slope rate/1 000 h between 1 000 h and 10 000 h, max.				4	4	4

Table 7 — Physical-property requirements for type A materials used in class T3 applications

Property	Unit	Test method	Sub-clause	Requirements for hardness classes		
				60	70	80
Permissible tolerance on nominal hardness	IRHD	ISO 48	5.2.3	±5	±5	±5
Tensile strength, min.	MPa	ISO 37	5.2.4	9	9	9
Elongation at break, min.	%	ISO 37	5.2.4	200	150	100
Compression set, max.						
72 h at 23 °C	%	ISO 815-1	5.2.5.2	15	15	15
24 h at 125 °C	%	ISO 815-1	5.2.5.2	20	20	20

Table 7 *(continued)*

Property	Unit	Test method	Sub-clause	Requirements for hardness classes		
				60	70	80
Ageing, 7 days at 125 °C	IRHD	ISO 188	5.2.6			
Hardness change	%	ISO 48		+8/–5	+8/–5	+8/–5
Tensile strength change, max.	%	ISO 37		–20	–20	–20
Elongation change		ISO 37		+10/–30	+10/–30	+10/–40
Stress relaxation, max.	%	ISO 3384-1	5.2.7			
7 days at 23 °C		or		15	15	18
7 days at 125 °C		ISO 6914		30	30	30
Stress relaxation, max. 28 days at 140 °C	%	ISO 6914	5.2.7	55	55	55
Volume change in water 14 days at 95 °C	%	ISO 1817	5.2.8	+8/–1	+8/–1	+8/–1
Ozone resistance	—	ISO 1431-1	5.2.9	No cracking when viewed without magnification		
Tear strength, min	N	ISO 34-2	5.2.10	20	20	20
Compression set in water at 110 °C						
After 3 000 h or else	%	Annex B	5.2.11	<20	<20	<20
After 10 000 h				<40	<40	<40

Table 8 — Physical-property requirements for type B materials used in class T3 applications

Property	Unit	Test method	Sub-clause	Requirements for hardness classes		
				60	70	80
Permissible tolerance on nominal hardness	IRHD	ISO 48	5.2.3	±5	±5	±5
Tensile strength, min.	MPa	ISO 37	5.2.4	9	9	9
Elongation at break, min.	%	ISO 37	5.2.4	200	150	100
Compression set, max.						
72 h at 23 °C	%	ISO 815-1	5.2.5.2	15	15	15
24 h at 125 °C	%	ISO 815-1	5.2.5.2	20	20	20
Ageing, 7 days at 125 °C	IRHD	ISO 188	5.2.6			
Hardness change	%	ISO 48		+8/–5	+8/–5	+8/–5
Tensile strength change, max.	%	ISO 37		–20	–20	–20
Elongation change		ISO 37		+10/–30	+10/–30	+10/–40
Stress relaxation, max.	%	ISO 3384-1	5.2.7			
7 days at 23 °C		or		15	15	18
		ISO 6914				
Ozone resistance	—	ISO 1431-1	5.2.9	No cracking when viewed without magnification		
Compression set in water for 10 000 h at 110 °C, max.	%	Annex B	5.2.11	35	35	35
Slope rate 1 000 h between 1000 h and 10 000 h, max.				3	3	3