INTERNATIONAL STANDARD

ISO 4635

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Rubber, vulcanized — Preformed joint seals for use between concrete paving sections of highways — Specification

Caoutchouc vulcanisé — Joints d'étanchéité préformés utilisés entre les dalles en béton des routes — Spécifications

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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 4635 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 4635:1982), which has been technically revised.

The main modifications are as follows:

— The hardness classes have been changed from IRHD 55, IRHD 60, IRHD 65 and IRHD 70 to IRHD 40, IRHD 50, IRHD 60, IRHD 70 and IRHD 80. Hardness tolerances have been added. Requirements have been added for compression set at low temperature, stress relaxation in compression and protection against over-extension.

— Clauses have been included on functional testing for cold climates, the effect of water, and marking, labelling and packaging.

— The requirements for recovery at low and elevated temperatures have been changed. In addition, the ozone resistance is now measured only under normal conditions (50 pphm ozone) and not under the alternative severe conditions (200 pphm ozone).

— The temperature at which the compression set at elevated temperature is measured has been changed from 100 °C to 70 °C.

Rubber, vulcanized — Preformed joint seals for use between concrete paving sections of highways — Specification

CAUTION — Manufacturers shall ensure that emissions from their products of substances which could be hazardous to health or to the environment are not in excess of the legally permitted level in the country of use.

1 Scope

This International Standard specifies requirements for material for preformed vulcanized rubber joint seals used between concrete paving sections of highways.

It is applicable to seals for joints in new concrete highways as well as to maintenance work on such highways.

It does not cover the design or dimensions of seals, but general requirements for finished seals are given.

NOTE This International Standard is based on experience with chloroprene (CR) rubber and ethylene-propylene-diene monomer (EPDM) rubber.

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

ISO 48:2010, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

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

ISO 815-1:2008, *Rubber, vulcanized or thermoplastic — Determination of compression set — Part 1: At ambient or elevated temperatures*

ISO 815-2:2008, *Rubber, vulcanized or thermoplastic — Determination of compression set — Part 2: At low temperatures*

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

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

ISO 2230, *Rubber products — Guidelines for storage*

ISO 2285, *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 3384:2005[1)], *Rubber, vulcanized or thermoplastic — Determination of stress relaxation in compression at ambient and at elevated temperatures*

ISO 3387, *Rubber — Determination of crystallization effects by hardness measurements*

ISO 5893, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
joint
vertical discontinuity between the adjacent faces of paving slabs in a concrete highway, formed for the purpose of providing some movement capability

3.2
joint chamber
cut made in the upper part of the joint to offer a seating for a preformed joint seal

NOTE The width of the chamber depends on the movement capability required of the preformed joint seal. The bottom of the chamber supports the preformed joint seal, enabling it to withstand the vertical forces caused by traffic.

3.3
preformed joint seal
extruded (preformed) and vulcanized elastic rubber profile that, when inserted by special machines into the joint chamber, is compressed by the adjacent surfaces of the paving slabs, thus filling the joint and preventing the ingress of water

NOTE A fibre reinforcement can be incorporated in the preformed joint seal as additional protection against over-extension.

3.4
international rubber hardness degree
IRHD
measure of hardness, the magnitude of which is derived from the depth of penetration of a specified indentor into a test piece under specified conditions

NOTE 1 The reaction forces produced by compressed preformed joint seals depend on the geometry and hardness of the seal. The higher the IRHD value, the higher the reaction force. The lower the IRHD value, the better the lips of the rubber profile grip the surfaces of the joint chamber.

NOTE 2 ISO 48 specifies a method of measuring hardness in terms of IRHD values.

4 Classification

The hardness of materials for preformed joint seals shall be divided into five classes, as given in Table 1.

Table 1 — Hardness classification

Hardness class	40	50	60	70	80
Range of IRHD	> 35 but ⩽ 45	> 45 but ⩽ 55	> 55 but ⩽ 65	> 65 but ⩽ 75	> 75 but ⩽ 85

1) Under revision as ISO 3384-1.

5 Test pieces and temperature of test

5.1 Unless otherwise specified, the test pieces shall be cut from the finished product by the method specified in ISO 23529. If the test pieces specified in a particular test method cannot be prepared from the finished seals, they shall be taken from moulded test slabs of suitable dimensions, made from the same batch of material as used for the seal, and vulcanized under conditions which are comparable with the conditions used in production.

5.2 Unless otherwise specified, the test shall be carried out at a standard laboratory temperature in accordance with ISO 23529.

6 Requirements

6.1 General

6.1.1 The seal materials shall be made from an ozone-resistant rubber (see 6.11) and shall not depend for ozone resistance solely on surface protection, as this can be removed by abrasion, detergents or other means.

6.1.2 The material shall be black.

6.2 Dimensional tolerances

The dimensions shall be determined in accordance with ISO 3302-1 and the result shall conform to class E1 or E2 as defined in ISO 3302-1:1996.

6.3 Imperfections and defects

Imperfections and defects shall be determined by visual inspection. The surfaces of preformed seals shall be free of surface defects or irregularities, as these can affect their proper functioning.

6.4 Hardness

6.4.1 The hardness shall be determined in accordance with ISO 48:2010, method M. The result shall conform to the relevant value given in Table 2, line 1.1.

6.4.2 In addition, make five measurements at points distributed at random over a 5 m length of the preformed joint seal. The difference between the minimum and the maximum hardness shall not be more than 5 IRHD. Each value shall be within the range specified for the relevant hardness class (see Table 2, line 1.2).

6.5 Tensile strength and elongation at break

6.5.1 These tests shall be carried out on test pieces from the product, with the textile material removed, using the technique specified in ISO 23529, where appropriate.

6.5.2 The tensile strength and elongation at break shall be determined in accordance with ISO 37, preferably using a type 2 dumb-bell test piece. The tensile strength and the elongation at break shall conform to the relevant values given in Table 2, lines 2 and 3.

Table 2 — Requirements for preformed joint seals

Line No.	Property	Unit	Sub-clause	Requirements for hardness classes				
				40	50	60	70	80
1.1	Hardness	IRHD	6.4	> 35 but ⩽ 45	> 45 but ⩽ 55	> 55 but ⩽ 65	> 65 but ⩽ 75	> 75 but ⩽ 85
1.2	Hardness tolerance	IRHD	6.4	⩽ 5				
2	Tensile strength	MPa	6.5	⩾ 9				
3	Elongation at break	%	6.5	⩾ 400	⩾ 375	⩾ 300	⩾ 200	⩾ 125
4	Compression set, 22^{+2}_{0} h		6.6					
	— at +70 °C	%	6.6.2	⩽ 20				
	— at −25 °C		6.6.3	⩽ 60				
5	Accelerated ageing in air, 72^{+2}_{0} h at 100 °C		6.7					
	— change in hardness, max. limits	IRHD		±5				
	— change in tensile strength, max. limits	%		−20/+40				
	— change in elongation at break, max. limits	%		−30/+10				−40/+10
6	Stress relaxation in compression, 100 days at 50 °C	%	6.8	50			55	
7	Recovery at low and elevated temperatures		6.9					
	— at −25 °C[a]	%		⩾ 65				
	— at +70 °C			⩾ 80				
8	Hardness increase after 168^{+2}_{0} h at −10 °C[a]	IRHD	6.10	+15 max.			+10 max.	
9	Ozone resistance		6.11	No cracking				
10	Effect of water (volume change after 168^{+2}_{0} h)	%	6.12	0/+5				
11	Protection against over-extension		6.13					
	— elongation at which fibre first starts to act	%		⩽ 2				
	— elongation at 300 N tensile force	%		⩽ 2				
	— tensile force at which fibre breaks	N		⩾ 300				
12	Functional testing for cold climates; minimum compressive force	kN/m	6.14	⩾ 0,03				

[a] These low-temperature tests are optional in the case of usage in tropical countries.

6.6 Compression set in air

6.6.1 General

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.

6.6.2 Compression set at elevated temperature

6.6.2.1 The compression set after 22^{+2}_{0} h at 70 °C shall be determined in accordance with ISO 815-1:2008 using a type B test piece. Where, however, the cross section is too small to allow type B test pieces to be taken from the product, the tension set at constant elongation shall be determined using the method specified in ISO 2285 at a strain of 50 %. The same length of time and the same temperature shall be used as for compression set.

6.6.2.2 The compression set at 70 °C shall conform to the relevant value given in Table 2, line 4. If the tension set is determined, it shall meet the same requirement.

6.6.3 Compression set at low temperature

6.6.3.1 The compression set after 22^{+2}_{0} h at low temperature (−25 °C) shall be determined in accordance with ISO 815-1:2008 using a type B test piece. Where, however, the cross section is too small to allow type B test pieces to be taken from the product, the tension set at constant elongation shall be determined using the method specified in ISO 2285 at a strain of 50 %. The same length of time and the same temperature shall be used as for compression set.

6.6.3.2 The compression set at −25 °C shall conform to the relevant value given in Table 2, line 4. If the tension set is determined, it shall meet the same requirement.

6.7 Accelerated ageing in air

After ageing the test pieces in air for 72^{+2}_{0} h at 100 °C by the method specified in ISO 188, the changes in hardness, tensile strength and elongation at break shall be within the relevant limits given in Table 2, line 5.

6.8 Stress relaxation in compression

The stress relaxation shall be determined by method B of ISO 3384:2005, using cylindrical test pieces after mechanical and thermal conditioning.

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.

The stress relaxation after 100 days at 50 °C shall conform to the relevant value given in Table 2, line 6.

6.9 Recovery at low and elevated temperatures

The recovery at low and elevated temperatures shall be determined in accordance with Annex A. The recovery at low and elevated temperatures shall conform to the relevant values given in Table 2, line 7.

6.10 Low-temperature hardness change

This low-temperature requirement is optional in the case of usage in tropical countries.

Where applicable, the low-temperature hardness change shall be determined in accordance with the method specified in ISO 3387. The increase in hardness, after 168^{+2}_{0} h at −10 °C, compared with the hardness at −10 °C shall conform to the relevant value given in Table 2, line 8.

6.11 Ozone resistance

6.11.1 The ozone resistance shall be determined by the method for static strain testing specified in ISO 1431-1, using test pieces taken from the seal and under the following conditions:

— ozone concentration: (50 ± 5) pphm;

— temperature: (40 ± 1) °C;

— length of conditioning in the strained state: (72 ± 2) h;

— exposure time: (96 ± 1) h;

— elongation for > 35 IRHD but ⩽ 75 IRHD: (20 ± 2) %;