International Standard 4633

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

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

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4633 was developed by Technical Committee ISO/TC 45, *Rubber and rubber products*, and was circulated to the member bodies in June 1981.

It has been approved by the member bodies of the following countries :

Austria	India	South Africa, Rep. of
Brazil	Italy	Spain
Canada	Korea, Rep. of	Sweden
China	New Zealand	Thailand
Czechoslovakia	Poland	USA
France	Portugal	USSR
Hungary	Romania	Yugoslavia

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Australia
Belgium
Germany, F.R.
Netherlands
Switzerland
United Kingdom

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

1 Scope and field of application

This International Standard specifies requirements for materials used in vulcanized, solid rubber joint rings for urban and rural water supply and drainage systems, drain pipes, sewers and rainwater pipes. Some general requirements for the finished joint rings are also given. Any other requirements for the performance of the finished joint rings, particularly functional tests for the actual sealing system and related pipeline materials, shall be specified in national standards.

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

It is not necessarily applicable to materials for joint rings used in pipelines carrying industrial chemical effluents or hot water.

Joint rings made from cellular rubber material or with an enclosed void as part of their design are excluded from the scope of this International Standard.

2 References

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

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

ISO 188, *Rubber, vulcanized — Accelerated ageing or heat-resistance tests.*

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

ISO/R 812, *Method of test for temperature limit of brittleness for vulcanized rubbers.*

ISO 815, *Vulcanized rubbers — Determination of compression set under constant deflection at normal and high temperatures.*

ISO 1817, *Vulcanized rubbers — Resistance to liquids — Methods of test.*

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

ISO 3302, *Rubber — Dimensional tolerances of solid moulded and extruded products.*

ISO 3384, *Rubber, vulcanized — Determination of stress relaxation in compression at normal and at elevated temperatures.*

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

ISO 4661, *Rubber — Preparation of test pieces.*

3 Classification

Six classes of material for pipe joint rings are specified; these correspond to preferred nominal hardnesses of 40, 50, 60, 70, 80 and 88 IRHD.

If required, intermediate nominal hardnesses may be used, as indicated in table 1.

4 Materials

4.1 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 fittings.

4.2 For drinking water applications, the materials shall not impair the quality of the water under the conditions of use. Moreover, they shall conform to the official regulations of the country in which they are to be used.

4.3 Compression set and stress relaxation requirements for materials of nominal hardness 80 or 88 IRHD shall apply only when the material is directly participating in the sealing function.

5 General requirements for materials

5.1 Testing and test pieces

Unless otherwise specified, tests shall be carried out at a standard laboratory temperature in accordance with ISO 471.

Test pieces shall be cut from the finished product by the method specified in ISO 4661 and other corresponding International Standards. If satisfactory test pieces cannot be prepared in accordance with the instructions given for the appropriate test method, they shall be taken from test slabs or sheets, of suitable dimensions, made from the same batch of the rubber mix used to make the rings and vulcanized under conditions which are comparable to those used in production.

5.2 Hardness

When determined by the micro-test method specified in ISO 48, the hardness shall comply with the requirements given in table 1. If the dimensions of the ring 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 ring, or along the greatest length of an extruded profile cut to make a ring, hardness values shall not vary by more than 4 IRHD. Each value shall be within the specified tolerances.

NOTE — For the purpose of this International Standard, which requires hardness measurements of up to 95 IRHD, the micro-test method specified in ISO 48 is considered satisfactory.

5.3 Tensile strength and elongation at break

The tensile strength and elongation at break shall be determined by the method specified in ISO 37, using type 2 dumb-bell shaped test pieces.

Other types of test pieces may be used, if agreement is reached upon the relationship between the values obtained on type 2 dumb-bell shaped test pieces and those obtained on the proposed test pieces.

The elongation at break shall comply with the requirements given in table 1. The tensile strength shall comply with the requirements given in table 3 and shall be used for quality control purposes, the minimum values varying according to the polymer used.

NOTE — Table 3 will be deleted when sufficient experience has been obtained with stress relaxation.

5.4 Compression set

When determined by the method specified in ISO 815, using the small test piece, the compression set shall comply with the requirements given in table 1.

The test piece shall be cut as far as possible in the direction of compression of the ring in service.

5.5 Accelerated ageing in air

When the test pieces required by 5.2 for the determination of hardness and by 5.3 for the determination of tensile strength and elongation at break are aged in air at 70 °C for 7 days, by the oven method specified in ISO 188, the changes in hardness, tensile strength and elongation at break shall comply with the requirements given in the table 1.

5.6 Stress relaxation in compression

When determined by method A specified in ISO 3384, and after applying mechanical and thermal conditioning, the stress relaxation in compression after 7 days at standard laboratory temperature shall comply with the requirements given in table 1.

The test piece shall be cut as far as possible in the direction of compression of the ring in service.

5.7 Water immersion

When determined by the method specified in ISO 1817, the change in volume after 7 days immersion in distilled or deionized water at 70 °C shall comply with the requirements given in table 1.

6 Optional requirements for materials

Each of the following tests is optional and shall be carried out only if expressly specified by the purchaser.

6.1 Stress relaxation in compression

When determined by method A specified in ISO 3384, and after applying mechanical and thermal conditioning, the stress relaxation in compression after 90 days at standard laboratory temperature shall comply with the requirements given in table 2.

The test piece shall be cut as far as possible in the direction of compression of the ring in service.

If this test is specified, it shall be considered only as a type approval test.

6.2 Change in hardness at low temperatures

The change in hardness at low temperatures shall be determined by the method specified in ISO 3387 and shall be the difference between the initial hardness measured at standard laboratory temperature, and the hardness measured at −10 °C after 7 days at −10 °C, or at −25 °C after 7 days at −25 °C. The choice of test temperature shall be agreed between the interested parties.

The test shall apply to materials of nominal hardnesses 40 and 50 IRHD only and the change in hardness shall comply with the requirement given in table 2.

6.3 Low temperature brittleness

When tested by the method specified in ISO/R 812, using type A test pieces, at −25 °C, the results shall comply with the requirement given in table 2.

7 Quality control of materials

It is the responsibility of the manufacturer to carry out quality control tests to confirm that the materials for the rings complies with the appropriate requirements of this International Standard. Records of these control tests shall be made available to the purchaser upon request.

8 General requirements for finished joint rings

8.1 Workmanship

8.1.1 Workmanship shall be in accordance with good commercial practice.

8.1.2 The rings shall be free from porosity and shall not have surface defects or irregularities which could affect their function. Flash (sprue) shall be kept to a reasonable minimum.

Table 1 — General requirements for materials

Property	Unit	Requirement for class					
		40	50	60	70	80	88
Classification properties							
Preferred nominal hardness	IRHD	40	50	60	70	80	88
Range of nominal hardness	IRHD	36 to 45	46 to 55	56 to 65	66 to 75	76 to 84	85 to 91
General requirements							
Permissible tolerance on specified hardness[1]	IRHD	± 5	± 5	± 5	± 5	± 4	± 3
Elongation at break, min.	%	400	375	300	200	125	100
Compression set							
— after 70 h at standard laboratory temperature, max.	%	12	12	12	15	15[2]	15[2]
— after 22 h at 70 °C, max.	%	25	25	25	25	25[2]	25[2]
Ageing : change from unaged values after 7 days in air at 70 °C							
— Hardness, max.	IRHD	− 5 to + 8	− 5 to + 8	− 5 to + 8	− 5 to + 8	− 5 to + 8	± 5
— Tensile strength, max.	%	− 20	− 20	− 20	− 20	− 20	− 20
— Elongation at break, max.	%	−30 to +10	−30 to +10	−30 to +10	−30 to +10	−40 to +10	−40 to +10
Immersion in water : change in volume after immersion in distilled or deionized water for 7 days at 70 °C, max.	%	0 to + 8	0 to + 8	0 to + 8	0 to + 8	0 to + 8	0 to + 8
Stress relaxation in compression after 7 days at standard laboratory temperature, max.[3]	%	16	16	16	16	18[2]	18[2]

1) In specific cases, and after agreement between the manufacturer and user, the tolerances on hardness may be fixed at ± 3 IRHD.

2) The requirement applies only when the material is directly participating in the sealing function.

3) It is recognized that values lower than those shown can be obtained. The intention is to reduce the limits once experience has been obtained.

Table 2 — Optional requirements for materials

Property	Unit	Requirement for class					
		40	50	60	70	80	88
Stress relaxation in compression after 90 days at standard laboratory temperature, max.[1]	%	23	23	23	23	25[2]	25[2]
Change in hardness at low temperatures : increase in hardness after 7 days at − 10 °C, or − 25 °C, max.	IRHD	15	15	—	—	—	—
Low temperature brittleness at − 25 °C		no test piece shall break					

1) It is recognized that values lower than those shown can be obtained. The intention is to reduce the limits once experience has been obtained.

2) The requirement applies only when the material is directly participating in the sealing function.

Table 3 — Quality control requirements for tensile strength

Property	Unit	Requirement for class					
		40	50	60	70	80	88
Tensile strength, min.							
— for natural rubber	MPa	14	13	12	11	10	8
— for synthetic rubbers	MPa	9	9	9	9	9	9

8.2 Dimensions and tolerances

Dimensions and tolerances shall be the subject of agreement between the interested parties. Tolerances shall be chosen from the appropriate classes specified in ISO 3302.

8.3 Splice strength

Rings spliced from lengths of vulcanized rubber shall be submitted to the following test. The test shall be performed either on the ring itself or on a test piece 200 mm long with the splice at the mid-point, i.e. such that there is a length of 100 mm on each side of the splice.

Make two reference marks, equidistant from the splice and 50 mm apart, on the test piece. Extend the ring or test piece at a rate of 8,3 ± 0,8 mm/s until the elongation between the reference marks is that specified in table 4. Maintain this extension for 1 min and examine the ring or test piece under tension. There shall be no visible separation in the area of the splice.

For type approval tests, three test pieces shall be used.

8.4 Storage and handling of rings

At all stages between manufacture and use, the rings shall be stored in accordance with the recommendations of ISO 2230.

The attention of users is drawn to the need to avoid cracking during storage and handling. If it is considered that risks of cracking exist, additional tests, appropriate to the situation involved, should be specified.

8.5 Marking

Marking shall allow identification of the manufacturer and also the use of the ring as a function of the conveyed fluid.

8.6 Quality control

Procedures for quality control shall be agreed between the interested parties to validate compliance with the requirements of this International Standard.

Table 4 — Percentage elongation

Percentage elongation for class					
40	50	60	70	80	88
100	100	100	100	75	50