International Standard 6448

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Rubber seals — Joint rings used for petroleum product supply pipes and fittings — Specification for material

Caoutchouc — Garnitures d'étanchéité pour joints de canalisations de produits pétroliers — Spécifications des 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.

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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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Rubber seals — Joint rings used for petroleum product supply pipes and fittings — Specification for material

1 Scope and field of application

This International Standard specifies requirements for materials used in vulcanized solid rubber sealing rings for petroleum product supply pipe and fittings. It does not apply to petroleum products having an aromatic content higher than 30 % (*V*/*V*) nor to liquids polluted by traces of petroleum products (e.g. pipes for waste water).

Some general requirements for the finished joint rings are also given.

If there are other requirements for the performance of the finished joint rings, particularly functional tests for the actual sealing system and related pipeline materials, they shall be specified additionally in national standards.

This International Standard is applicable to joint rings for all pipeline materials including iron, steel, copper, plastics.

In the case of composite sealing rings, depending on their design and after agreement between the manufacturer and the user, the materials used for any rubber parts not coming into contact with petroleum products shall not have to comply with the requirements of 5.7 and 5.8 of this International Standard.

Joint rings made from cellular rubber materials or with enclosed voids as part of their design and joint rings with requirements of resistance to flame and to thermal stress are not included in 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 812, *Rubber, vulcanized — Determination of brittleness temperature.* [1]

ISO 815, *Rubber, vulcanized — Determination of compression set at normal and at high temperatures.* [2]

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

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 4661, *Rubber — Preparation of test pieces.*

3 Classification

Five classes of material are specified (see tables 1 and 2). These correspond to preferred nominal hardnesses of 50, 60, 70, 80 and 88 IRHD. If required, an intermediate nominal hardness different from those indicated in the table may be used.

4 Materials

4.1 The materials shall be free of any substance which may have a deleterious effect on the fluid to be conveyed, or on the life of the sealing ring, or on the pipe and fittings.

4.2 The requirements for materials of preferred nominal hardness 80 or 88 IRHD shall apply only when the material is directly participating in the sealing function.

1) At present at the stage of draft. (Revision of ISO/R 812-1968.)

2) At present at the stage of draft. (Revision of ISO 815-1972.)

5 General test requirements for material

5.1 Test pieces

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

Test pieces shall be cut from the finished product in accordance with ISO 4661 and the other corresponding International Standards. If satisfactory test pieces cannot be prepared in accordance with 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 allow, the "normal test"method specified in ISO 48 may be used, provided 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 more than 4 IRHD from the low to the high readings noted. Each value shall be within the specified tolerances.

NOTE — For the purpose of this International Standard, which requires hardness measurements up to 91 IRHD, the micro-test method described 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 described in ISO 37, using type 2 dumb-bell shaped test pieces.

Other types of test pieces may be used if an agreement is reached upon the relationship between the values obtained with 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 1 and shall be used for quality control purposes.

5.4 Compression set

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

When possible, test pieces for compression set shall be cut 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 table 1.

5.6 Stress relaxation in compression

When determined by method A specified in ISO 3384 using the small test piece 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.

5.7 Liquid B immersion

5.7.1 Volume change

When determined by the method specified in ISO 1817, the volume change after an immersion of 7 days at standard laboratory temperature in liquid B shall comply with the requirements given in table 1.

For approval tests only, the volume change when immersed in liquid B shall not exceed the specified maximum value given in table 1 at any time throughout the duration of the 7 days immersion.

5.7.2 Hardness change

When the test pieces described in 5.2 are tested in accordance with ISO 1817, the hardness change after an immersion of 7 days at standard laboratory temperature in liquid B shall comply with the requirements given in table 1.

5.8 Oil No. 3 immersion

5.8.1 Volume change

When determined by the method specified in ISO 1817, the volume change after an immersion of 7 days at 70 °C in Oil No. 3 shall comply with the requirements given in table 1.

5.8.2 Hardness change

When the test pieces described in 5.2 are tested in accordance with ISO 1817, the hardness change after an immersion of 7 days at 70 °C in Oil No. 3 shall comply with the requirements given in table 1.

6 Optional test requirements for material

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

Table 1 — General requirements

Property	Unit	Requirements				
		50	60	70	80	88
Preferred nominal hardness	IRHD	50	60	70	80	88
Range of nominal hardness	IRHD	46 to 55	56 to 65	66 to 75	76 to 84	85 to 91
Permissible tolerance on specified nominal hardness*	IRHD	± 5	± 5	± 5	± 4	± 3
Tensile strength, min.	MPa	9	10	10	10	10
Elongation at break, min.	%	400	300	200	150**	100**
Compression set						
after 70 h at standard laboratory temperature, max.	%	10	10	10	15**	15**
after 22 h at 70 °C, max.	%	20	20	20	20**	20**
Ageing — change from unaged values after 7 days in air at 70 °C						
hardness, max.	IRHD	± 6	± 6	± 6	± 6	± 6
tensile strength loss, max.	%	− 15	− 15	− 15	− 15	− 15
elongation at break, max.	%	− 25 to + 10	− 25 to + 10	− 25 to + 10	− 30 to + 10	− 40 to + 10
Stress relaxation in compression, max. after 7 days at standard laboratory temperature***	%	15	15	15	15**	15**
Liquid B immersion, after 7 days at standard laboratory temperature						
volume change, max.	%	+ 30	+ 30	+ 30	+ 30	+ 30
hardness change, max.	IRHD	− 16	− 15	− 15	− 14	− 12
Oil No. 3 immersion after 7 days at 70 °C						
volume change, max.	%	− 1 to + 10	− 1 to + 10	− 1 to + 10	− 1 to + 10	− 1 to + 10
hardness change, max.	IRHD	− 6	− 6	− 6	− 6	− 6

* In specific cases and after an agreement between manufacturer and user, the tolerance on hardness may be fixed at ± 3 IRHD.

** Requirements for material of nominal hardness 80 or 88 IRHD shall be applied only when this material participates directly in the sealing function.

*** It is recognized that values lower than the ones shown can be obtained. The intention is to reduce the limits once experience has been gathered.

Table 2 — Optional requirements

Property	Unit	Requirements				
		50	60	70	80	88
Stress relaxation in compression, max.* after 90 days at standard laboratory temperature	%	22	22	22	22**	22**
Low temperature brittleness — temperature of test: − 15 °C, − 25 °C or − 40 °C depending on the conditions of service or transportation of the joint rings		No test pieces shall break				

* It is recognized that values lower than the ones shown can be obtained. The intention is to reduce the limits once experience has been gathered.

** The requirement only applies when this material participates directly in the sealing function.

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. When this test is required, it shall be only a type approval test.

6.2 Low temperature brittleness

When tested by the method specified in ISO 812, using type A test pieces, at −15 °C, −25 °C or −40 °C, the results shall comply with the requirements given in table 2.

The test temperature shall be specified by the user as a function of the service conditions of the joint seal, the conditions of transportation or the temperature of installation.

7 Quality control of material

7.1 Having regard to the hazards associated with the transportation of flammable and explosive fluids, attention is particularly drawn to the need for stringent quality control procedure.

7.2 It is the responsibility of the manufacturer to carry out control tests to confirm that the material for the rings complies with the appropriate requirements of this International Standard.

Records of these control tests shall be available to the purchaser from the manufacturer of the rings 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.

8.2 Dimensions and tolerances

Dimensions and tolerances shall be the subject of agreement between the interested parties.

Tolerances shall be chosen fom the appropriate classes in ISO 3302.

8.3 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, shall be specified.

8.4 Marking

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

8.5 Quality assurance

8.5.1 Having regard to the hazards associated with the transportation of flammable and explosive fluids, attention is particularly drawn to the need for stringent quality assurance procedure.

8.5.2 Procedures for quality assurance shall be agreed between the interested parties to validate compliance with this International Standard.

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