INTERNATIONAL STANDARD

ISO 6916-2

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Flexible cellular polymeric materials — Sponge and expanded cellular rubber products — Specification —

Part 2: Mouldings and extrusions

Polymères alvéolaires souples — Caoutchoucs alvéolaires mousses et souples — Spécification —

Partie 2: Moulage et extrusion

Reference number
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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 3.

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 part of ISO 6916 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 6916-2 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 4, *Products (other than hoses)*.

ISO 6916 consists of the following parts, under the general title *Flexible cellular polymeric materials — Sponge and expanded cellular rubber products — Specification*:

— *Part 1: Sheeting*

— *Part 2: Mouldings and extrusions*

Annexes A to G form a normative part of this part of ISO 6916.

Flexible cellular polymeric materials — Sponge and expanded cellular rubber products — Specification —

Part 2:
Mouldings and extrusions

WARNING — Persons using this part of ISO 6916 should be familiar with normal laboratory practice. This part of ISO 6916 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 part of ISO 6916 classifies flexible cellular rubber products known as sponge and expanded rubber. The base material used in their manufacture may be natural rubber, reclaimed rubber, synthetic rubber or rubber-like material, either alone or in combination. Thermoplastic rubbers are not included. This part of ISO 6916 does not apply to latex foam rubbers or shoe soling.

Sheeting materials are covered by ISO 6916-1. This part (part 2) covers vulcanized cellular rubber products that are manufactured by a moulding or continuous vulcanization process, i.e. hot air, microwave, infra-red, liquid curing medium (LCM), shearing-head vulcanization or a combination of two or more of these methods.

In the case of conflict between the provisions of this part of ISO 6916 and those of the detailed specification or test method for a particular product, the latter shall take precedence. Reference to the methods shall specifically state the desired test or tests.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 6916. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 6916 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 188:1998, *Rubber, vulcanized and thermoplastic — Accelerated ageing and heat resistance tests*

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 1817:1999, *Rubber, vulcanized — Determination of the effect of liquids*

ISO 1923:1981, *Cellular plastics and rubbers — Determination of linear dimensions*

ISO 3865:1997, *Rubber, vulcanized or thermoplastic — Methods of test for staining in contact with organic material*

ISO 5893:—[1], *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification*

NOTE In some of the test methods referenced in this clause, the apparatus but not the procedure is used.

3 Classification (types, classes, grades and suffixes)

3.1 Types

Three types are specified, as follows:

Type 1: open-cell rubber

Type 2: closed-cell rubber

Type 3: self-skinned cellular rubber

3.2 Classes

Each type is divided into four classes designated by the letters A, B, C and D (for example type 1B), as follows:

Class A: Cellular rubbers made from natural rubber, where specific resistance to the action of petroleum-based oils is not required

Class B: Cellular rubbers having specific requirements for oil resistance with low swell

Class C: Cellular rubbers having specific requirements for oil resistance with medium swell

Class D: Cellular rubbers made from synthetic rubber or rubber-like materials, either alone or in combination, having specific requirements for both low- and high-temperature resistance (– 75 °C to + 250 °C), but where specific resistance to the action of petroleum-based oils is not required

3.3 Grades

Each class is divided into six different grades based on a specific range of firmness as expressed by compression deflection determined as described in annex B. Grades are designated by a digit (0 to 6), with the softer grades being identified with the lower numbers and the harder grades with the higher numbers:

Grade 0: For type 1 cellular rubbers only, a compression deflection range of 2,5 kPa to 15,0 kPa

Grade 1: For type 1 and 2 cellular rubbers, a compression deflection range of 15,1 kPa to 35,0 kPa

Grade 2: For type 1 and 2 cellular rubbers, a compression deflection range of 35,1 kPa to 65,0 kPa

Grade 3: For type 1 and 2 cellular rubbers, a compression deflection range of 65,1 kPa to 95,0 kPa

Grade 4: For type 1 and 2 cellular rubbers, a compression deflection range of 95,1 kPa to 125,0 kPa

Grade 5: For type 1 and 2 cellular rubbers, a compression deflection range of 125,1 kPa to 200,0 kPa

Grade 6: For type 1 and 2 cellular rubbers, a compression deflection range of 200,1 kPa to 300,0 kPa

1) To be published. (Revision of ISO 5893:1993)

3.4 Suffixes

3.4.1 Suffix letters

Suffix letters may be added singly or in combination after any grade number to indicate additional requirements beyond those specified in Tables 1 to 3 as basic requirements. The significance of the approved suffix letters is shown in Table 4.

3.4.2 Suffix numbers

Each suffix letter should preferably be followed by a suffix number. The suffix number indicates the particular test conditions. The test duration is part of the method and is taken from the listing in Table 5.

NOTE Products meeting requirements defined to the suffix number level should conform with national and supra-national health and safety regulations.

4 Material and workmanship

4.1 Cellular rubbers produced to this part of ISO 6916 shall be manufactured from natural rubber, synthetic rubber, reclaimed rubber or rubber-like material, together with added compounding ingredients of such nature and quality that the product complies with the requirements of this part of ISO 6916.

4.2 In permitting choice in the use of materials, it is not intended to imply that the resulting different rubber materials are equivalent in respect of all physical properties. Any special characteristics other than those specified in this part of ISO 6916 that may be desired for a specific application shall be detailed in the particular product specification. All materials and workmanship shall be in accordance with good commercial practice, and the resulting cellular rubbers shall be free from defects affecting serviceability.

5 Physical properties

The various types, classes and grades of cellular rubber shall conform to the physical-property requirements given in Tables 1 to 3, together with any additional requirements indicated by any suffix letter as described in Table 4 and any suffix number given in the designation as described in 3.4.

6 Methods of test

6.1 Unless specifically stated otherwise, all tests shall be carried out in accordance with the methods specified in the annexes to this part of ISO 6916.

6.2 Test pieces shall not be tested for at least 72 h after manufacture. Prior to testing, the test pieces shall be stored for at least 16 h at either (23 ± 2) °C and (50 ± 5) % relative humidity or (27 ± 2) °C and (65 ± 5) % relative humidity. This period may form the latter part of the period following manufacture.

7 Dimensional tolerances

The tolerances allowable on the dimensions of cellular rubber in moulded and extruded form shall be as specified in Table 6.

8 Inspection and rejection

8.1 All tests and inspections shall be made at the place of manufacture prior to shipment, unless otherwise specified. The manufacturer shall afford the inspector all reasonable facilities for tests and inspections.

8.2 The purchaser may carry out the tests and inspections governing acceptance or rejection of the material at his own laboratory or elsewhere. Such tests and inspections shall be made not later than 15 days after receipt of the material.

8.3 All test pieces prepared as specified in clause 11 shall be visually inspected to determine compliance with the material, workmanship and colour requirements.

8.4 Any material that fails one or more of the test requirements may be re-tested. For this purpose, two additional tests shall be made for the requirement for which failure occurred. Failure of either of the re-tests shall be cause for final rejection.

8.5 Rejected material shall be disposed of as directed by the manufacturer.

9 Packaging and marking

The material shall be properly and adequately packaged. Each package or container shall be legibly marked with the name of the material, the name or trademark of the manufacturer, and any required purchaser's designations.

10 Sampling

10.1 When possible, the complete finished product shall be used for the tests specified. Representative samples of the lot being examined shall be selected at random as required.

10.2 When it is necessary or advisable to obtain test pieces from the article, as in those cases where the finished product is not required or suitable for testing, the method of cutting and the exact position from which test pieces are to be taken shall be specified. The apparent density and the state of cure may vary in different parts of the finished product, especially if the article is of complicated shape or of varying thickness, and these factors will affect the physical properties of the test pieces. Also, the apparent density is affected by the number of cut surfaces as opposed to the number of skin-covered surfaces on the test piece.

10.3 When the finished product does not lend itself to testing or to the preparation of test pieces because of its complicated shape, its small size, the presence of metal or fabric inserts, the presence of surface skins, a tendency to adhere to metal, or for other reasons, standard test sheets shall be prepared. When differences in test values arise due to the difficulty in obtaining suitable test pieces from the finished product, manufacturer and purchaser may agree on acceptable deviations. This can be done by comparing results obtained with standard test pieces and those obtained on actual products.

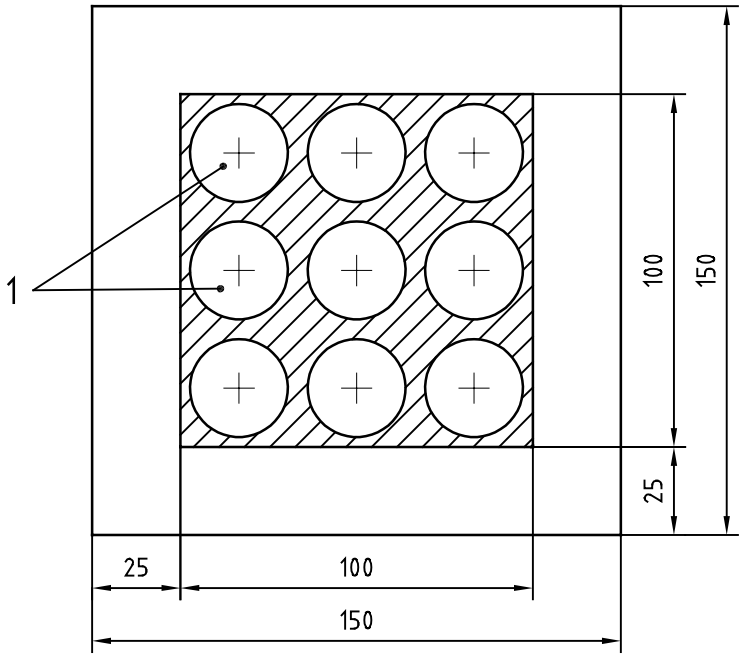
11 Standard test pieces, standard test sheets and specially prepared extruded shapes

11.1 Standard test pieces

Standard test pieces shall be discs, cut out with a die, either $(30^{+0,04}_{0})$ mm or $(19^{+0,04}_{0})$ mm in diameter and at least $(6^{+0,5}_{0})$ mm thick. The test pieces may be cut out with a revolving die using a soap solution as a lubricant. If a lubricant is used, the test pieces shall be thoroughly dried before proceeding with testing. In some cases, it may be necessary to freeze the cellular rubber to obtain parallel cut edges. When cut from standard test sheets, the test pieces shall be cut from the central area as shown in Figure 1. The exact dimensions of the test pieces shall be measured as specified in clause 12. Plied-up test pieces may be used as indicated in the test methods for compression deflection and compression set.

NOTE Where available material widths are too small to allow standard test pieces to be cut, then smaller-diameter discs may be used. Test results obtained on smaller discs may not be the same as on standard test pieces.

Dimensions in millimetres



Key

1 Nine holes, diameter 30 mm, with centres spaced 33,3 mm apart

Figure 1 — Locations from which standard test pieces are to be cut when preparing them from standard test sheets or commercial sheets

11.2 Standard test sheets

11.2.1 Standard test sheets for all types of cellular rubber shall be (150 ± 5) mm square and (12,5 ± 0,5) mm in thickness, made from the same compound and having the same apparent density and state of cure as the product they represent. In all cases, the surface skin shall be left intact on both top and bottom faces of the test sheet. Standard test sheets shall be prepared either by cutting them from commercial sheets of the specified thickness or as described in 11.2.2 or 11.2.3.

11.2.2 When specially prepared standard test sheets of sponge rubber are required, they shall be made using the frame shown in Figure 2 together with top and bottom plates each approximately 12,5 mm in thickness. The frame and plates shall be made of aluminium or steel. The compound shall be cut into squares slightly smaller than the frame cavities. The thickness shall be such as to give the required apparent density when the material is blown during cure to fill the moulding cavities. The squares of compound shall be dusted with talc and the excess brushed off to avoid pitting. They shall then be placed in the frame, and fabric sheeting shall be applied on the top and bottom between the frame and the plates to allow venting of gases produced during curing. This fabric shall be a commercial sheet with a mass per unit area of approximately 135 g/m^2 and having approximately 2,75 ends/mm and 2,36 picks/mm. The sheets shall be vulcanized in a platen press under conditions of time and temperature chosen to produce the same state of cure in the standard sheets as in the finished products that they represent.

11.2.3 Where specially prepared standard test sheets of expanded rubber are required, such test sheets shall be prepared to have approximately the same density and shall be vulcanized under conditions of time and temperature chosen to produce the same state of cure as in the finished products that they represent.

12 Measurement of test piece dimensions

The dimensions of all test pieces shall be measured in accordance with ISO 1923.

Dimensions in millimetres

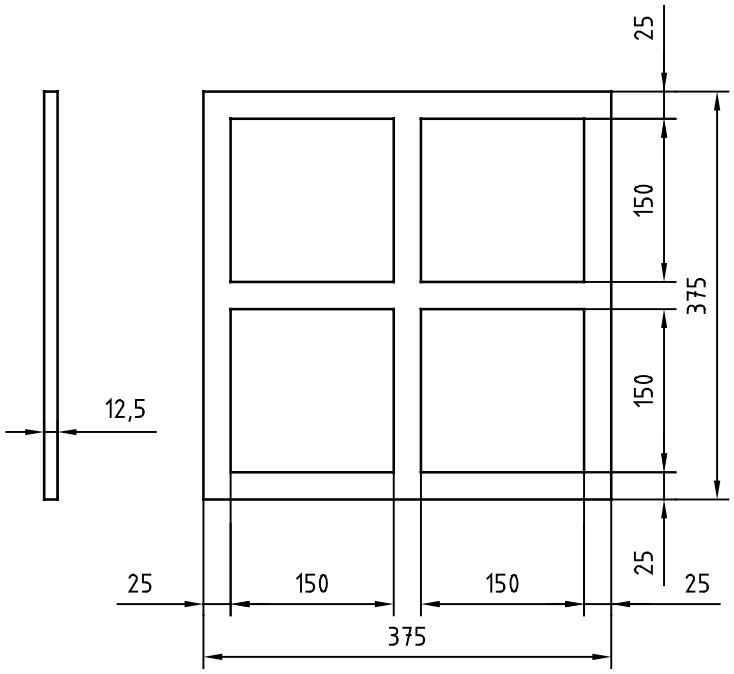


Figure 2 — Four-cavity frame for standard test sheets of cellular rubbers

Table 1 — Physical requirements for type 1 cellular rubbers [open-cell (sponge) rubbers]

Basic requirements							
Grade No.	Compression deflection at 25 % Deflection at (23 ± 2) °C or (27 ± 2) °C	Compression deflection after conditioning — Change from original value			Compression set under constant deflection of 50 %		Oil resistance 22 h at (70 ± 1) °C Change in volume in ISO 1817 oil No. 3
		168 h at (70 ± 1) °C	22 h at (150 ± 2) °C	5 h at (–55 ± 2) °C	22 h at (70 ± 1) °C	22 h at (100 ± 1) °C	
	kPa (limits)	% (limits)	% (limits)	% (max.)	% (max.)	% (max.)	% (limits)
Class A, non-oil-resistant							
1A0	2,5 to 15	± 20 [a]	—	25	15	—	—
1A1	15,1 to 35	± 20	—	25	15	—	—
1A2	35,1 to 65	± 20	—	25	15	—	—
1A3	65,1 to 95	± 20	—	25	15	—	—
1A4	95,1 to 125	± 20	—	25	15	—	—
1A5	125,1 to 200	± 20	—	25	15	—	—
1A6	200,1 to 300	± 20	—	25	15	—	—
Class B, oil-resistant, low-swell							
1B0	2,5 to 15	± 20 [a]	—	—	40	—	–25 to +10
1B1	15,1 to 35	± 20	—	—	40	—	–25 to +10
1B2	35,1 to 65	± 20	—	—	40	—	–25 to +10
1B3	65,1 to 95	± 20	—	—	40	—	–25 to +10
1B4	95,1 to 125	± 20	—	—	40	—	–25 to +10
1B5	125,1 to 200	± 20	—	—	40	—	–25 to +10
1B6	200,1 to 300	± 20	—	—	40	—	–25 to +10
Class C, oil-resistant, medium-swell							
1C0	2,5 to 15	± 20 [a]	—	—	50	—	+10 to +60
1C1	15,1 to 35	± 20	—	—	50	—	+10 to +60
1C2	35,1 to 65	± 20	—	—	50	—	+10 to +60
1C3	65,1 to 95	± 20	—	—	50	—	+10 to +60
1C4	95,1 to 125	± 20	—	—	50	—	+10 to +60
1C5	125,1 to 200	± 20	—	—	50	—	+10 to +60
1C6	200,1 to 300	± 20	—	—	50	—	+10 to +60
Class D, high-temperature-resistant							
1D0	2,5 to 15	—	± 5	5	—	50	—
1D1	15,1 to 35	—	± 5	5	—	30	—
1D2	35,1 to 65	—	± 5	5	—	30	—
1D3	65,1 to 95	—	± 5	5	—	30	—
1D4	95,1 to 125	—	± 5	5	—	30	—
1D5	125,1 to 200	—	± 5	5	—	30	—

[a] If, after ageing, this grade still falls within the compression-deflection requirement of 2,5 kPa to 15 kPa, it shall be considered acceptable even though the change from the original value is greater than ± 20 %.

Table 2 — Physical requirements for type 2 cellular rubbers [close-cell (expanded) rubbers]

Basic requirements								
Grade No.	Compression deflection at 25 %	Compression deflection after conditioning — Change from original value			Compression set under constant deflection of 50 %		Water absorption 3 min at (23 ± 2) °C or (27 ± 2) °C	Fluid resistance 168 h at (23 ± 2) °C or (27 ± 2) °C
	Deflection at (23 ± 2) °C or (27 ± 2) °C	168 h at (70 ± 1) °C	22 h at (150 ± 2) °C	5 h at (23 ± 2) °C or (27 ± 2) °C	5 h at (23 ± 2) °C or (27 ± 2) °C	22 h at (100 ± 1) °C	Mass of water uptake	Change in mass in ISO 1817 liquid B
	kPa	%	%	%	%	%	%	%
	(limits)	(limits)	(limits)	(max.)	(max.)	(max.)	(max.) [a]	(max.) [b]
Class A, non-oil-resistant								
2A1	15,1 to 35	± 30	—	—	25	—	5	—
2A2	35,1 to 65	± 30	—	—	25	—	5	—
2A3	65,1 to 95	± 30	—	—	25	—	5	—
2A4	95,1 to 125	± 30	—	—	25	—	5	—
2A5	125,1 to 200	± 30	—	—	25	—	5	—
2A6	200,1 to 300	± 30	—	—	25	—	5	—
Class B, oil-resistant, low-swell								
2B1	15,1 to 35	± 30	—	—	25	—	5	50
2B2	35,1 to 65	± 30	—	—	25	—	5	50
2B3	65,1 to 95	± 30	—	—	25	—	5	50
2B4	95,1 to 125	± 30	—	—	25	—	5	50
2B5	125,1 to 200	± 30	—	—	25	—	5	50
2B6	200,1 to 300	± 30	—	—	25	—	5	50
Class C, oil-resistant, medium-swell								
2C1	15,1 to 35	± 30	—	—	25	—	5	150
2C2	35,1 to 65	± 30	—	—	25	—	5	150
2C3	65,1 to 95	± 30	—	—	25	—	5	150
2C4	95,1 to 125	± 30	—	—	25	—	5	150
2C5	125,1 to 200	± 30	—	—	25	—	5	150
2C6	200,1 to 300	± 30	—	—	25	—	5	150
Class D, high-temperature-resistant								
2D1	15,1 to 35	—	± 5	—	—	80	5	—
2D2	35,1 to 65	—	± 5	—	—	60	5	—
2D3	65,1 to 95	—	± 5	—	—	60	5	—
2D4	95,1 to 125	—	± 5	—	—	60	5	—
2D5	125,1 to 200	—	± 5	—	—	60	5	—

[a] For cellular materials with densities of 160 kg/m^3 or less, the value of water absorption allowed is 10 % max. by mass. For densities greater than 160 kg/m^3, the maximum permitted value of water absorption is 5 % by mass.

[b] This test (annex F) of mass change in liquid B is used in place of the usual oil resistance test of volume change in oil No. 3 for the following reason. Oil or solvent immersion of flexible closed-cell materials usually causes loss of gas, by diffusion through the softened cell walls, which results in some shrinkage of the test piece. This shrinkage counteracts the swell which would normally occur, thus invalidating test data based on volume change. Liquid B is used because it produces a wider and more consistent differentiation between classes A, B and C than does oil No. 3.

Standard oil resistance test methods give inconsistent results on closed-cell materials. This test gives a general indication of oil resistance, but more reliable information should be obtained by testing in actual or simulated service conditions.

The figures of 150 % max. for class C and 50 % max. for class B apply to cellular materials having densities of more than 160 kg/m^3. For cellular materials with densities of 160 kg/m^3 or less, the maximum permitted values of mass change are 250 % for class C and 100 % for class B.

Table 3 — Physical requirements for type 3 cellular rubbers (self-skinned rubbers)

Basic requirements								
Grade No.	Compression deflection at 25 %	Compression deflection after conditioning — Change from original value			Compression set under constant deflection of 50 %		Water absorption 3 min at (23 ± 2) °C or (27 ± 2) °C	Fluid resistance 168 h at (23 ± 2) °C or (27 ± 2) °C
	Deflection at (23 ± 2) °C or (27 ± 2) °C	168 h at (70 ± 1) °C	22 h at (150 ± 2) °C	5 h at (23 ± 2) °C or (27 ± 2) °C	22 h at (70 ± 1) °C	22 h at (100 ± 1) °C	Mass of water uptake	Change in mass in ISO 1817 liquid B
	kPa	%	%	%	%	%	%	%
	(limits)	(limits)	(limits)	(max.)	(max.)	(max.)	(max.) [a]	(max.) [b]
Class A, non-oil-resistant								
3A1	15,1 to 35	± 30	—	—	25	—	5	—
3A2	35,1 to 65	± 30	—	—	25	—	5	—
3A3	65,1 to 95	± 30	—	—	25	—	5	—
3A4	95,1 to 125	± 30	—	—	25	—	5	—
3A5	125,1 to 200	± 30	—	—	25	—	5	—
3A6	200,1 to 300	± 30	—	—	25	—	5	—
Class B, oil-resistant, low-swell								
3B1	15,1 to 35	± 30	—	—	25	—	5	50
3B2	35,1 to 65	± 30	—	—	25	—	5	50
3B3	65,1 to 95	± 30	—	—	25	—	5	50
3B4	95,1 to 125	± 30	—	—	25	—	5	50
3B5	125,1 to 200	± 30	—	—	25	—	5	50
3B6	200,1 to 300	± 30	—	—	25	—	5	50
Class C, oil-resistant, medium-swell								
3C1	15,1 to 35	± 30	—	—	25	—	5	150
3C2	35,1 to 65	± 30	—	—	25	—	5	150
3C3	65,1 to 95	± 30	—	—	25	—	5	150
3C4	95,1 to 125	± 30	—	—	25	—	5	150
3C5	125,1 to 200	± 30	—	—	25	—	5	150
3C6	200,1 to 300	± 30	—	—	25	—	5	150
Class D, high-temperature-resistant								
3D1	15,1 to 35	—	± 5	—	—	80	5	—
3D2	35,1 to 65	—	± 5	—	—	60	5	—
3D3	65,1 to 95	—	± 5	—	—	60	5	—
3D4	95,1 to 125	—	± 5	—	—	60	5	—
3D5	125,1 to 200	—	± 5	—	—	60	5	—

[a] For cellular materials with densities of 160 kg/m^3 or less, the value of water absorption allowed is 10 % max. by mass. For densities greater than 160 kg/m^3, the maximum permitted value of water absorption is 5 % by mass.

[b] This test (annex F) of mass change in liquid B is used in place of the usual oil resistance test of volume change in oil No. 3 for the following reason. Oil or solvent immersion of flexible closed-cell materials usually causes loss of gas, by diffusion through the softened cell walls, which results in some shrinkage of the test piece. This shrinkage counteracts the swell which would normally occur, thus invalidating test data based on volume change. Liquid B is used because it produces a wider and more consistent differentiation between classes A, B and C than does oil No. 3.

Standard oil resistance test methods give inconsistent results on closed-cell materials. This test gives a general indication of oil resistance, but more reliable information should be obtained by testing in actual or simulated service conditions.

The figures of 150 % max. for class C and 50 % max. for class B apply to cellular materials having densities of more than 160 kg/m^3. For cellular materials with densities of 160 kg/m^3 or less, the maximum permitted values of mass change are 250 % for class C and 100 % for class B.

Table 4 — Physical requirements for cellular rubbers with added suffix letter

Basic requirements						
	Suffix					
	A4	B1	C1	C2	C3	C4
Grade No.	Compression deflection after conditioning for 22 h at (250 ± 2) °C Change from original compression deflection % (limits)	Compression set under constant deflection of 50 % 22 h at (70 ± 1) °C % (max.)	Ozone test at 25 pphm Visual examination	Ozone test at 50 pphm Visual examination	Ozone test at 200 pphm Visual examination	Low-temperature test at (−40 ± 2) °C Change from original compression deflection % (max.)
Class A, non-oil-resistant						
1A0	—	—	Crack-free	Crack-free	Crack-free	25
1A1	—	—	Crack-free	Crack-free	Crack-free	25
1A2	—	—	Crack-free	Crack-free	Crack-free	25
1A3	—	—	Crack-free	Crack-free	Crack-free	25
1A4	—	—	Crack-free	Crack-free	Crack-free	25
1A5	—	—	Crack-free	Crack-free	Crack-free	25
1A6	—	—	Crack-free	Crack-free	Crack-free	25
Class B, oil-resistant, low-swell						
1B0	—	—	Crack-free	Crack-free	Crack-free	50
1B1	—	—	Crack-free	Crack-free	Crack-free	50
1B2	—	—	Crack-free	Crack-free	Crack-free	50
1B3	—	—	Crack-free	Crack-free	Crack-free	50
1B4	—	—	Crack-free	Crack-free	Crack-free	50
1B5	—	—	Crack-free	Crack-free	Crack-free	50
1B6	—	—	Crack-free	Crack-free	Crack-free	50
Class C, oil-resistant, medium-swell						
1C0	—	25	Crack-free	Crack-free	Crack-free	50
1C1	—	25	Crack-free	Crack-free	Crack-free	50
1C2	—	25	Crack-free	Crack-free	Crack-free	50
1C3	—	25	Crack-free	Crack-free	Crack-free	50
1C4	—	25	Crack-free	Crack-free	Crack-free	50
1C5	—	25	Crack-free	Crack-free	Crack-free	50
1C6	—	25	Crack-free	Crack-free	Crack-free	50
Class D, high-temperature-resistant						
1D0	—	—	Crack-free	Crack-free	Crack-free	—
1D1	—	—	Crack-free	Crack-free	Crack-free	—
1D2	—	—	Crack-free	Crack-free	Crack-free	—
1D3	—	—	Crack-free	Crack-free	Crack-free	—
1D4	—	—	Crack-free	Crack-free	Crack-free	—
1D5	—	—	Crack-free	Crack-free	Crack-free	—

Table 5 — Test methods

Requirement or suffix letter	Basic requirements	Suffix numbers		
		1	2	3
Compression deflection	Annex B			
Suffix A, heat resistance	Annex A Change in deflection a) Classes A, B, C 168 h at (70 ± 1) °C b) Class D 22 h at (150 ± 1) °C	Annex A 22 h at (175 ± 2) °C		
Suffix B, compression set	Annex D a) Classes A, B, C 22 h at (70 ± 1) °C b) Class D 22 h at (100 ± 1) °C	Annex D 22 h at (70 ± 1) °C		
Suffix C, ozone resistance		ISO 1431-1 20 % strain 40 °C 25 pphm	ISO 1431-1 20 % strain 40 °C 50 pphm	ISO 1431-1 20 % strain 40 °C 200 pphm
Suffix E, fluid resistance	Annex C a) Type 1 22 h at (70 ± 1) °C Oil No. 3 Annex F b) Types 2 and 3 168 h at (23 ± 2) °C or (27 ± 2) °C Liquid B			
Suffix F, low-temperature resistance	Annex G Change in compression deflection (– 55 ± 2) °C	Annex G (– 40 ± 2) °C	Annex G (– 55 ± 2) °C	Annex G (– 75 ± 2) °C
Suffix L, water absorption (type 2 only)	Annex E			
Suffix M, flammability resistance	Customer agreement			
Suffix P, staining resistance, xenon arc	Fastness grade 3 fading to grade 4	ISO 3865:1997, method A2 No contact stain	ISO 3865:1997, methods A2 and B No contact stain No leaching	

Table 6 — Tolerances on dimensions of moulded and extruded cellular-rubber products for general applications

Form	Thickness		Length and width	
	Dimension	Tolerance	Dimension	Tolerance
	mm	mm	mm	mm
Sponge rubbers				
Moulded or special shapes	⩽ 6,4 > 6,4 but ⩽ 76,2	± 0,8 ± 1,6	⩽ 6,4 > 6,4 but ⩽ 76,0 > 76,0 but ⩽ 456 > 456	± 0,8 ± 1,6 ± 3,2 ± 0,75 %
Expanded rubbers				
Moulded or special shapes	3,2 to 12,7 incl. > 12,7 but ⩽ 38,1 > 38,1 but ⩽ 76,2	± 1,6 ± 2,4 ± 3,2	⩽ 152 > 152 but ⩽ 305 > 305	± 6,4 ± 9,6 ± 3 %

Annex A
(normative)

Heat-resistance test

A.1 Test pieces

The test pieces used in any of the ageing tests shall be those required by the cellular-rubber methods for the particular determination to be used for measuring the effects of ageing exposure. Test at least three test pieces.

A.2 Procedure

Use the air-oven ageing test described in ISO 188 except that the test piece size shall be appropriate for compression deflection testing. Express deterioration as the percentage change in the compression deflection values. The compression deflection test shall be based on the original (before ageing) test piece thickness. Report the average of the values obtained for the individual test pieces.

Annex B
(normative)

Compression deflection tests

B.1 Apparatus

Any compression-testing machine that meets the following requirements will be satisfactory. The machine shall be capable of compressing a test piece at a rate of 0,20 mm/s to 0,85 mm/s gently without impact. The machine may be motor- or hand-driven. It may be equipped with a gauge to measure the deflection caused by the increase in load. The rate of compression of the test piece is specified rather than the rate of movement of the compression platen of the machine. This is an important consideration when a graduated scale is used to measure the deflection, since sponges of various compression deflection characteristics will require different times to compress by 25 % due to the travel of the plate on which the scale is mounted. The accuracy of the test machine shall conform to grade A of ISO 5893:—.

The deflection shall be read on a dial gauge graduated in units of 0,02 mm (no gauge is necessary if the machine compresses the test piece by 25 % automatically).

The two plates of the test machine shall be at least 38 mm in diameter.

B.2 Test pieces

Use at least three standard test pieces as defined in 11.1 for this test. Cut out each test piece so that opposite edges are parallel, either from the finished product in a manner agreed upon by the parties concerned or, as shown in Figure 1, from standard test sheets or from commercial sheets. The thickness of the test pieces may vary, but shall be measured and stated in the test report. The minimum thickness shall be 6,35 mm. Thin samples shall be plied up to obtain this thickness, or a standard test sheet may be used if agreed upon by the parties concerned.

NOTE In sponge rubbers, using the same compound, thin sections under 6,35 mm develop different cell structures to those over 6,35 mm. Thinner sections are usually higher in compression deflection and density. However, in closed-cell (expanded) rubbers where thin sheets are split from thicker sheets, there is usually very little difference between the thin sheets and the thicker sheets.

B.3 Procedure

Insert a test piece in the test machine and place a sheet of sandpaper (400 grit, waterproof) between the surfaces of the test piece and the test machine platens. The sandpaper helps avoid lateral slippage of the test piece at the contact surfaces and shall be slightly larger than the test piece. Compress the test piece between the plates of the machine until the thickness has been reduced by 25 %, and read the load immediately. Repeat the test with the same test piece until the load reading does not change by more than 5 %. Record the load required for this last reading.

B.4 Test report

Report the individual results, expressed in kilopascals, for each test piece and the thickness of each test piece.

Annex C
(normative)

Oil resistance test

C.1 Test pieces

Use at least three standard test pieces approximately 12,5 mm in thickness for this test.

C.2 Procedure

Follow the procedure given in ISO 1817, measuring the diameter and thickness of each test piece before and after immersion in ISO 1817 oil No. 3 (IRM 903) for 22 h at (70 ± 1) °C. Calculate the percentage change in volume of each test piece. Report the average of the values obtained for the individual test pieces.

Annex D
(normative)

Compression set under constant deflection

D.1 Test pieces

Use at least three standard test pieces as defined in 11.1 for this test. Cut out each test piece so that opposite edges are parallel, either from the finished product in a manner agreed upon by the parties concerned or, as shown in Figure 1, from standard test sheets or from commercial sheets. The thickness of the test pieces may vary, but shall be measured and stated in the test report. The minimum thickness for open-cell (sponge) rubber shall be 5 mm. Thin samples of open-cell (sponge) rubber shall be plied up to obtain this thickness. The minimum thickness for closed-cell (expanded) rubber shall be 12,5 mm. Thin samples of closed-cell (expanded) rubber shall not be plied up to obtain this thickness.

D.2 Procedure

The apparatus and procedure shall be the same as that described in ISO 815, except as follows.

For open-cell (sponge) rubbers, compress each test piece to 50 % of its original thickness for 22 h at (70 ± 1) °C. Release the load at the end of the test period and measure the thickness after 30 min recovery at room temperature.

For closed-cell (expanded) rubbers, compress each test piece to 50 % of its original thickness for 22 h at (23 ± 2) °C or (27 ± 2) °C. Release the load at the end of the test period and measure the thickness after 24 h at room temperature.

In both cases (open-cell sponge and closed-cell expanded rubbers), measure the thickness as specified in clause 12. Chromium-plated metal plates are not required. Aluminium plates or any stiff plates that are clean and smooth, and will not deflect measurably under the load necessary for deflection of the test piece, may be used.

D.3 Calculation

Calculate the percentage compression set from the formula:

$$\frac{h_0 - h_1}{h_0 - h_s} \times 100$$

where

h_0 is the original thickness, in mm;

h_1 is the thickness, in mm, of the test piece after the specified recovery period;

h_s is the thickness, in mm, of the spacer bar used.

Report the result as specified in ISO 815.

Annex E
(normative)

Water absorption test

E.1 General

The water absorption test is applicable to closed-cell (expanded) rubbers. It shall not be used for open-cell (sponge) rubbers unless they are completely encased in an added skin.

E.2 Test pieces

Use at least three test pieces approximately 12,5 mm in thickness and 2 500 mm^2 in area for this test. Disc test pieces are preferable.

E.3 Procedure

Weigh each test piece to the nearest 0,01 g. Submerge them in distilled water at (23 ± 2) °C or (27 ± 2) °C, 50 mm below the surface of the water, and reduce the pressure above the water to 17 kPa for 3 min. Release the vacuum, and allow the test pieces to remain submerged for a further 3 min at atmospheric pressure. Remove the test pieces, blot dry and reweigh. Calculate the percentage change in mass. Report the average for all the test pieces tested.

Annex F
(normative)

Fluid resistance test

F.1 Apparatus and materials

Required is an analytical balance, tared weighing bottles, non-corrosive screens having 2 mm openings, ISO reference liquid B (see ISO 1817), filter paper and a 250 cm^3 can with lid.

F.2 Test pieces

Use at least three test pieces measuring ($25 \times 50 \times 6$) mm. It is preferable that the test pieces be cut with clean, square edges.

F.3 Procedure

Weigh each test piece to the nearest 0,01 g. Place a screen on the bottom of the can. Then place the test pieces, alternating with screens, into the can. Place a screen over the last test piece. Do not place test pieces of different materials in the same can. Fill the can with liquid B and seal with the lid. Store the can for 7 days at a temperature of (23 ± 2) °C or (27 ± 2) °C. Remove the test pieces one at a time from the test fluid. Without squeezing the test pieces, place each on top of a sheet of filter paper and immediately place a second sheet of filter paper on top of it. Blot lightly without squeezing, then remove the top filter paper and slide the test piece from the bottom filter paper into a tared weighing bottle. Determine the mass of the test piece to the nearest 0,01 g.

F.4 Calculation

Calculate the percentage change in mass of each test piece and report the median value.

Annex G
(normative)

Low-temperature resistance test

G.1 Apparatus

The apparatus shall consist of two parallel plates at least 38 mm in diameter, one of which is movable and the other one stationary, a means of applying a load, and a means of accurately measuring the distance between the plates.

G.2 Test pieces

Use at least three standard test pieces as defined in 11.1 for this test. The thickness of each test piece shall be measured and stated in the test report. The minimum thickness shall be 6,3 mm. Plied-up samples are not satisfactory. Dry the test pieces in a desiccator for 16 h before testing.

G.3 Procedure

Measure the compression deflection, at 25 % deflection, of each test piece at room temperature, recording in addition the load necessary to obtain this deflection. Place each test piece in a cold box for 5 h at the specified temperature. At the end of this period, apply the previously determined load (that necessary to give a 25 % deflection at room temperature) as rapidly as possible while the test piece is still in the cold box. Record the deflection within 30 s.

G.4 Calculation

Calculate the percentage change in deflection, C, from the equation:

$$C = \frac{D - E}{D} \times 100$$

where

D is the deflection at room temperature;

E is the deflection at the temperature of the cold box.

Report the average for all the test pieces tested.

ICS 83.100

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