INTERNATIONAL STANDARD

ISO 3934

Second edition
2002-09-01

Rubber, vulcanized and thermoplastic — Preformed gaskets used in buildings — Classification, specifications and test methods

Caoutchouc vulcanisé et thermoplastique — Profilés d'étanchéité utilisés dans le bâtiment — Classification, spécifications et méthodes d'essai

Reference number
ISO 3934:2002(E)

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Printed 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.

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

ISO 3934 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 3934:1978), which has been technically revised.

Annexes A to E form a normative part of this International Standard.

Introduction

Preformed gaskets used in buildings have conditions of use which differ depending on their function and position in the building. When preparing this International Standard, it was felt necessary to take into account the various conditions to which the gaskets are subjected in order to define the material specifications. The tests take into account the static and dynamic stresses to which the gaskets are subjected.

Rubber, vulcanized and thermoplastic — Preformed gaskets used in buildings — Classification, specifications and test methods

WARNING — Persons using this International Standard 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 and to ensure compliance with any national regulatory conditions.

1 Scope

This International Standard specifies a system of classification of materials used in preformed gaskets for buildings. It applies to the following products:

a) gaskets for use round the inside of door or window casings, i.e. weatherstripping (dynamic gaskets);

b) gaskets for glazing (static gaskets);

c) gaskets for use round infilling;

d) gaskets for use between façade parts;

e) gaskets for use between masonry walls.

In addition to specifying the characteristics required for the constituent materials, some functional tests on the gaskets themselves are specified. The corresponding test procedures are given in the annexes.

This International Standard applies to preformed gaskets made from vulcanized or thermoplastic rubber. It also applies to preformed gaskets made of cellular rubber designed for use at temperatures between − 20 °C and + 55 °C (thermal conditions category P_1) and between − 40 °C and + 70 °C (thermal conditions category P_3) (see clause 4).

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 37:1994, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 105-A02:1993, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour*

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

ISO 812:1991, *Rubber, vulcanized — Determination of low-temperature brittleness*

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 2285:2001, *Rubber, vulcanized or thermoplastic — Determination of tension set under constant elongation, and of tension set, elongation and creep under constant tensile load*

ISO 4892-2:1994, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc sources*

ISO 7619:1997, *Rubber — Determination of indentation hardness by means of pocket hardness meters*

3 Terms and definitions

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

3.1
compression force
force needed to compress a test piece through its working range to its minimum width

3.2
compression recovery
the ability of a gasket to recover its shape after being compressed through its working range

3.3
minimum width
the lower limit of the working compression range

NOTE 1 For a glazing gasket, the minimum width is the sum of the gaps between the glass and the frame on each side of the glass. For weatherstripping, it is the gap between the door or window and the casing, measured at the hinge side.

NOTE 2 It is recommended that the minimum width of weatherstripping and the minimum clearance between glazing and frame for a glazing gasket be agreed by consultation between designer, manufacturer and user.

3.4
sample
a complete batch of test material (gaskets) as supplied by the manufacturer for test purposes and from which test pieces are cut

3.5
stress relaxation
time-dependent decrease in stress at a constant deformation

3.6
weathering resistance
resistance to combined detrimental influences of the outdoor environment (for example sunlight, ozone, oxygen, humidity, temperature) on a material

3.7
working compression range
range, stated by the manufacturer, through which the gasket performs its function of being compressed or otherwise deformed when used in any particular product (see annex A)

EXAMPLE For a gasket of free height 7,5 mm, the manufacturer states a working range of 3 mm to 6 mm.

3.8
free height
height of a gasket measured without causing any significant deformation (see Figure 1)

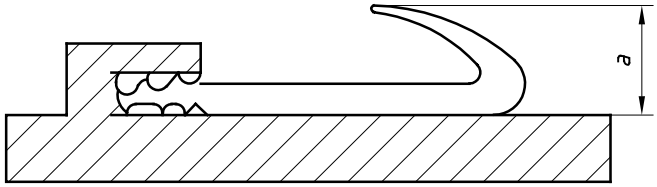


Figure 1 — Example of measurement of free height

4 Environmental conditions

The conditions to which gaskets may be subjected in the working environment are divided into the following categories:

a) Thermal conditions (depending on the climate and the position in the construction)

- P_1: temperature of preformed gasket − 20 °C to + 55 °C
- P_2: temperature of preformed gasket – 20 °C to + 85 °C
- P_3: temperature of preformed gasket – 40 °C to + 70 °C
- P_4: temperature of preformed gasket – 40 °C to + 100 °C

b) Mechanical conditions

- X: static uses (see Table 1), i.e. between fixed elements
- Y: dynamic uses (see Table 1), i.e. between moving elements

c) Weathering

- R_1: protected from solar radiation
- R_2: exposed to solar radiation

5 Classification and specification

5.1 Classification

From the results of the tests carried out in accordance with this International Standard, the classification of a particular type of gasket shall be determined using Table 1. The numbers from Table 1, taken in the order given, form the classification code for that gasket, viz:

A	B	C	D	E	F	G

— A: type of gasket

— B: working compression range

— C: compression force

— D: working temperature range

— E: compression recovery

— F: stress relaxation

— G: weathering resistance

Table 2 gives a typical example of a classification code.

5.2 Specifications

Tables 3 to 10 give the specifications for different classification criteria.

6 Test pieces

Test pieces shall be prepared in accordance with the relevant standard test method or the relevant annex of this International Standard and, whenever possible, shall be cut from the gasket to be tested.

Failing this, they shall be taken from extruded ribbon (2 mm thick, 30 mm in width) or from appropriately dimensioned test slabs prepared from the same batch of material used to produce the gaskets being assessed and obtained under conditions that have been shown by experience to give comparable results.

If measurements are made on test pieces not conforming to the standard referenced in Tables 3 to 10 (for example part of a gasket), the results may be different and the requirements to be met shall be subject to agreement between the interested parties.

Table 1 — Classification of gaskets

Code-letter	Characteristic	Class									
		0	1	2	3	4	5	6	7	8	9
A	Type of gasket	X: static use Y: dynamic use									
B	Working compression range (mm) Annex A		⩽ 1	> 1 but ⩽ 2	> 2 but ⩽ 4	> 4 but ⩽ 6	> 6 but ⩽ 8	> 8 but ⩽ 10	> 10 but ⩽ 15	> 15 but ⩽ 30	> 30
C	Compression force (N/m) Annex B		⩽ 10	> 10 but ⩽ 20	> 20 but ⩽ 50	> 50 but ⩽ 100	> 100 but ⩽ 200	> 200 but ⩽ 500	> 500 but ⩽ 700	> 700 but ⩽ 1 000	> 1 000
D	Working temperature range (°C)		– 20 to + 55 (P_1)	– 20 to + 85 (P_2)	– 40 to + 70 (P_3)	– 40 to + 100 (P_4)					
E	Compression recovery (%) Annex C		⩽ 20	> 20 but ⩽ 30	> 30 but ⩽ 40	> 40 but ⩽ 50	> 50 but ⩽ 60	> 60 but ⩽ 70	> 70 but ⩽ 80	> 80 but ⩽ 90	> 90
F	Stress relaxation (%) Annex D		⩽ 20	> 20 but ⩽ 30	> 30 but ⩽ 40	> 40 but ⩽ 50	> 50 but ⩽ 60	> 60 but ⩽ 70	> 70 but ⩽ 80	> 80 but ⩽ 90	> 90
G	Weathering resistance		R_1 Table 9	R_2 Table 10							

Table 2 — Typical example of classification code

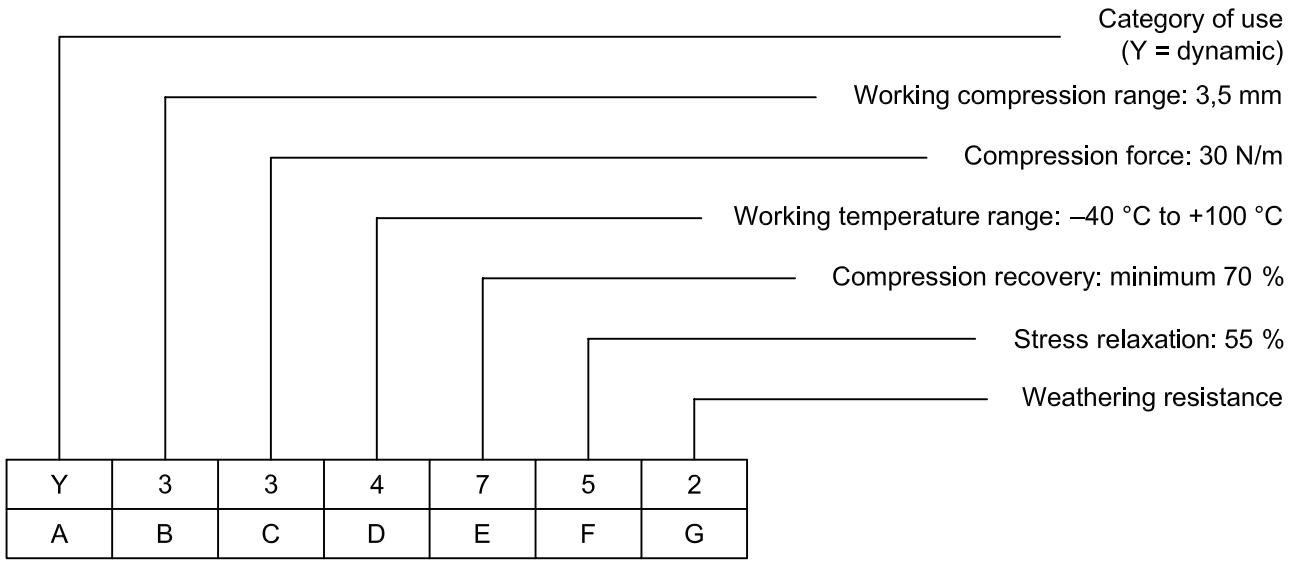


Table 3 — Requirements for thermal conditions category P_1

Characteristic	Unit	Specification		Test method
Tolerance on nominal hardness	Shore A	+ 3 – 3		ISO 7619 For thermoplastic rubber read after 15 s
Brittleness temperature limit	°C	– 35		ISO 812
Deformation tests		X	Y	ISO 815
Compression set				
Type B test piece 25 % compression 22 h in air at 55 °C 22 h recovery at standard lab temp.				
— Vulcanized rubber max.	%	30	30	
— Thermoplastic rubber max.	%	50	50	
— Cellular rubber max.	%	50	50	
Tension set				ISO 2285:2001, method A
T50 test piece 25 % elongation 22 h in air at 55 °C 22 h recovery at standard lab temp.				
— Vulcanized rubber max.	%	15	15	
— Thermoplastic rubber max.	%	40	40	
— Cellular rubber max.	%	40	40	
Ageing: 14 days in air at 70 °C				ISO 188:1998, method A
Change in:				
Hardness	Shore A	between + 10 and – 5		ISO 7619
Stress at 100 % elongation (for thermoplastic rubber)	%	between + 20 and – 15		ISO 37
Elongation at break	%	between + 10 and – 30		ISO 37
Length max.	%	– 2		Annex E
Elongation at break minimum absolute value	%	100		ISO 37

Table 4 — Requirements for thermal conditions category P_2

Characteristic	Unit	Specification		Test method
Tolerance on nominal hardness	Shore A	+ 3 – 3		ISO 7619 For thermoplastic rubber read after 15 s
Brittleness temperature limit	°C	– 35		ISO 812
Deformation tests		X	Y	
Compression set Type B test piece 25 % compression 22 h in air at 85 °C 22 h recovery at standard lab temp.				ISO 815
— Vulcanized rubber max.	%	35	35	
— Thermoplastic rubber max.	%	70	55	
Tension set T50 test piece 25 % elongation 22 h in air at 85 °C 22 h recovery at standard lab temp.				ISO 2285:2001, method A
— Vulcanized rubber max.	%	20	20	
— Thermoplastic rubber max.	%	60	50	
Ageing: 14 days in air at 100 °C Change in:				ISO 188:1998, method A
Hardness	Shore A	between + 10 and – 5		ISO 7619
Stress at 100 % elongation (for thermoplastic rubber)	%	between + 20 and – 15		ISO 37
Elongation at break	%	between + 10 and – 30		ISO 37
Length max.	%	– 2		Annex E
Elongation at break minimum absolute value	%	100		ISO 37

Table 5 — Requirements for thermal conditions category P_3

Characteristic	Unit	Specification		Test method
Tolerance on nominal hardness	Shore A	+ 3 – 3		ISO 7619 For thermoplastic rubber read after 15 s
Brittleness temperature limit	°C	– 55		ISO 812
Deformation tests		X	Y	
Compression set				
Type B test piece 25 % compression 22 h in air at 70 °C 22 h recovery at standard lab temp.				ISO 815
— Vulcanized rubber max.	%	35	35	
— Thermoplastic rubber max.	%	65	55	
— Cellular rubber max.	%	65	50	
Tension set				
T50 test piece 25 % elongation 22 h in air at 70 °C 22 h recovery at standard lab temp.				ISO 2285:2001, method A
— Vulcanized rubber max.	%	20	20	
— Thermoplastic rubber max.	%	60	50	
— Cellular rubber max.	%	60	50	
Ageing: 14 days in air at 85 °C				ISO 188:1998, method A
Change in:				
Hardness	Shore A	between + 10 and – 5		ISO 7619
Stress at 100 % elongation (for thermoplastic rubber)	%	between + 20 and – 15		ISO 37
Elongation at break	%	between + 10 and – 30		ISO 37
Length max.	%	– 2		Annex E
Elongation at break minimum absolute value	%	100		ISO 37

Table 6 — Requirements for thermal conditions category P_4

Characteristic	Unit	Specification		Test method
Tolerance on nominal hardness	Shore A	+ 3 – 3		ISO 7619 For thermoplastic rubber read after 15 s
Brittleness temperature limit	°C	– 55		ISO 812
Deformation tests		X	Y	
Compression set				
Type B test piece 25 % compression 22 h in air at 100 °C 22 h recovery at standard lab temp.				ISO 815
— Vulcanized rubber max.	%	35	35	
— Thermoplastic rubber max.	%	70	55	
Tension set				
T50 test piece 25 % elongation 22 h in air at 100 °C 22 h recovery at standard lab temp.				ISO 2285:2001, method A
— Vulcanized rubber max.	%	20	20	
— Thermoplastic rubber max.	%	60	50	
Ageing: 14 days in air at 125 °C				ISO 188:1998, method A
Change in:				
Hardness	Shore A	between + 10 and – 5		ISO 7619
Stress at 100 % elongation (for thermoplastic rubber)	%	between + 20 and – 15		ISO 37
Elongation at break	%	between + 10 and – 30		ISO 37
Length max.	%	– 2		Annex E
Elongation at break minimum absolute value	%	100		ISO 37

Table 7 — Mechanical requirements for static use

Characteristic	Unit	Specification	Test method
Stress relaxation		To be agreed between manufacturer, designer and user	Annex D
Initial counterforce	N		
Counterforce after ageing	N		
Result	%		

Table 8 — Mechanical requirements for dynamic use

Characteristic	Unit	Specification	Test method
Compression set Type B test piece 25 % compression (for P_1, P_2, P_3, P_4) 22 h at – 25 °C max.			
— Vulcanized rubber — Thermoplastic rubber	% %	max. 80 max. 90	ISO 815
Compression recovery test	%	As per classification	Annex C

Table 9 — Requirements for weathering resistance category R_1

Characteristic	Specification	Test method
Ozone resistance test Condition for 96 h at 20 % elongation Ozone concentration 50 pphm Temperature 40 °C	No cracking	ISO 1431-1

Table 10 — Requirements for weathering resistance category R_2

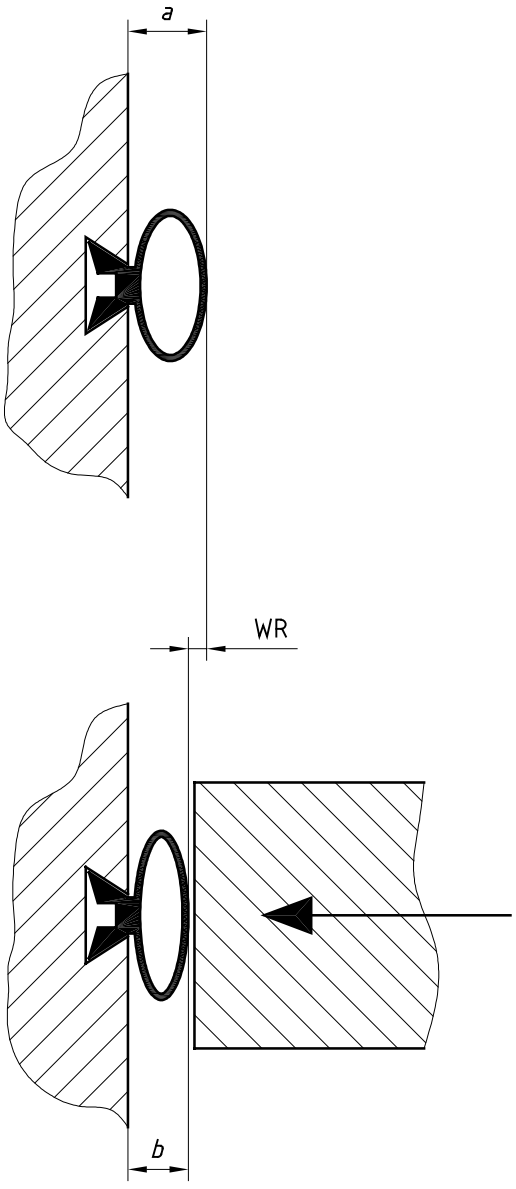
Characteristic	Specification	Test method
Ozone resistance test Condition for 96 h at 20 % elongation Ozone concentration 200 pphm Temperature 40 °C	No cracking	ISO 1431-1
Weathering resistance test Expose to xenon-arc lamp operating at 550 W/m^2 to 1 000 W/m^2 and between 290 nm and 800 nm Black-panel temperature 55 °C ± 3 °C Spraying time 18 min Interval between spraying 102 min		ISO 4892-2 (See also Table 11)
For 3 GJ/m^2, change in: — Colour	Grey-scale rating ⩾ 3	ISO 105-A02
For 8 GJ/m^2, change in: — Stress at 100 % elongation, in % — Elongation at break, in % — Appearance	Not more than ± 15 Between + 10 and – 30 No cracking	

Table 11 — Examples of exposure time calculations for 550 W/m^2 and 1 000 W/m^2

Wavelength of xenon-arc lamp	Energy of exposure	Total energy received by gaskets	Exposure time
Between 290 nm and 800 nm	550 W/m^2	3 GJ/m^2	$\frac{3\times10^9}{550\times3\,600}\cong1500$ h
		8 GJ/m^2	$\frac{8\times10^9}{550\times3\,600}\cong4\,000$ h
	1 000 W/m^2	3 GJ/m^2	$\frac{3\times10^9}{1000\times3\,600}\cong800$ h
		8 GJ/m^2	$\frac{8\times10^9}{1000\times3\,600}\cong2\,200$ h

Annex A
(normative)

Working compression range



EXAMPLE WR (working range) = $a - b$

a = 7 mm
b = 5 mm

$\therefore$ WR = 2 mm

Figure A.1 — Working compression range of preformed gaskets

Annex B
(normative)

Compression force

B.1 General

This annex specifies the method to be used to test a sample of static or dynamic gaskets to determine the compression force required to compress them by a predetermined amount under the conditions laid down in the test.

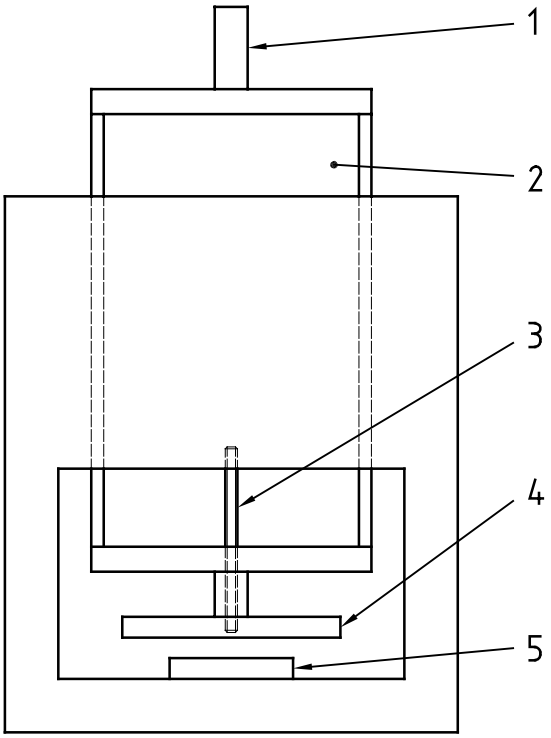
The test has been devised to cover all likely gasket shapes and materials.

B.2 Apparatus

B.2.1 Compression device (see Figure B.1), enabling three test pieces to be mounted separately or together and compressed in accordance with the manufacturer's design concept.

B.2.2 Means of measuring height of test piece to an accuracy of ± 0,01 mm.

B.2.3 Means of measuring the compression force to an accuracy of better than 1 %.



Key

1 Transmission spindle
2 Locking system
3 Compensating spring
4 Plate
5 Test piece

Figure B.1 — Example of compression device

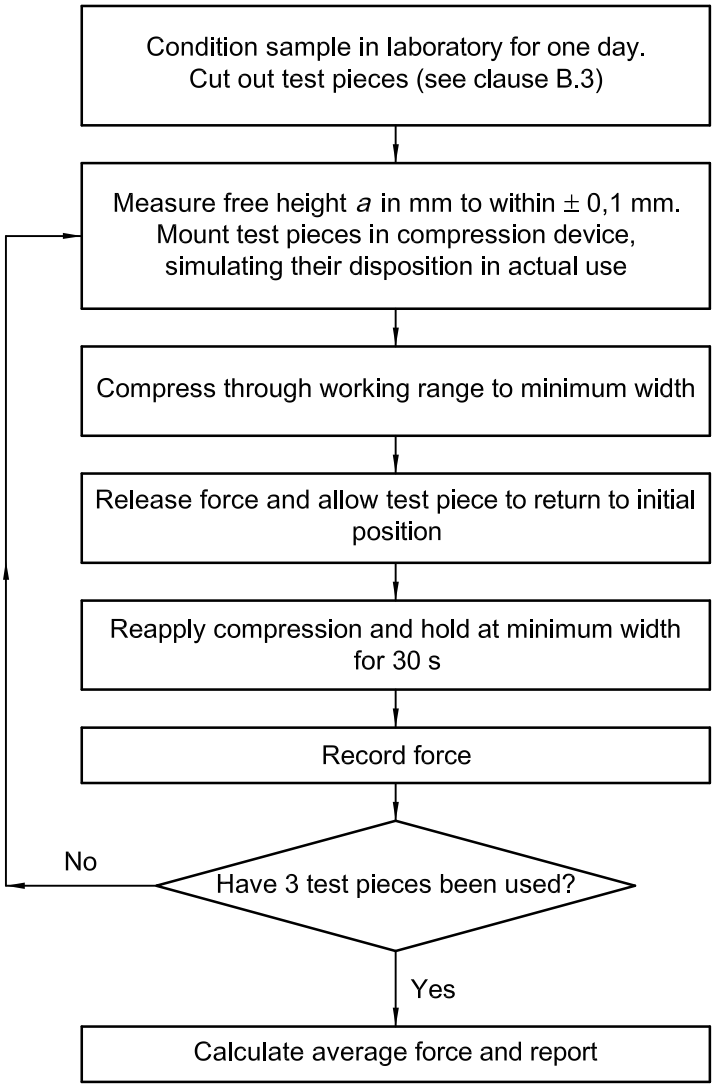
B.3 Test pieces

A sample of the gasket to be tested shall be provided by the manufacturer, together with drawings depicting its declared free shape and disposition in use, as well as a statement as to the gasket's working compression range.

The sample shall be supplied in a condition truly representative of the requirements for use and stored in the relaxed state for at least one day at standard laboratory temperature and humidity.

After this conditioning period, cut three test pieces of minimum length 100 mm and maximum length 500 mm from various positions within the sample.

B.4 Procedure



Annex C
(normative)

Compression recovery test

C.1 General

This annex specifies the method to be used to test a sample of gaskets to determine the percentage recovery after being compressed through their working range under the conditions laid down in the test.

C.2 Apparatus

C.2.1 Compression device (see Figure B.1), enabling three test pieces to be mounted separately or together and compressed in accordance with the user's design concept.

C.2.2 Means of measuring height of test piece to an accuracy of $\pm 0{,}01$ mm.

C.2.3 Oven, of one of the types specified in ISO 188:1998, method A.

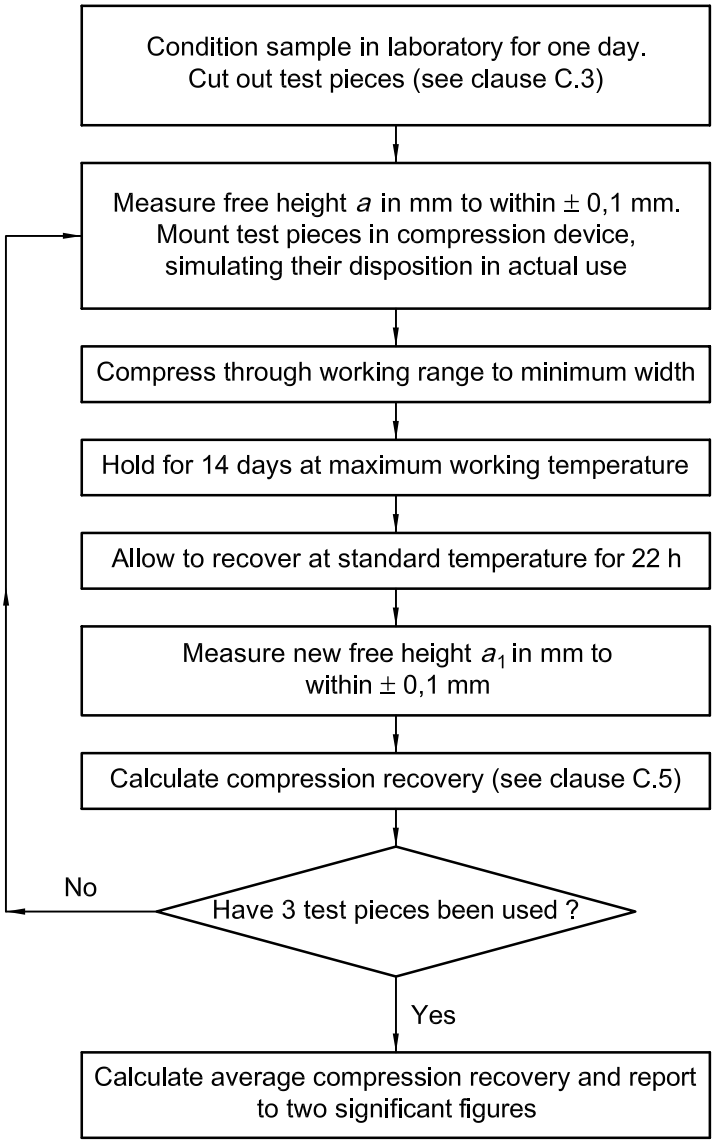
C.3 Test pieces

A sample of the gasket to be tested shall be provided by the manufacturer, together with drawings depicting its declared free shape and disposition in use. The manufacturer shall also append a statement as to the maximum temperature at which the gasket is intended to be used.

The sample shall be supplied in a condition truly representative of the requirements for use and stored in the relaxed state for at least one day at standard laboratory temperature and humidity.

After this conditioning period, cut three test pieces of minimum length 100 mm and maximum length 500 mm from various positions within the sample.

C.4 Procedure



C.5 Expression of results

Express the result as a percentage in accordance with the following equation:

$$CR = \left[1 - \frac{(a - a_1)}{WR}\right] \times 100$$

where

CR is the compression recovery, in %;

a is the free height, in mm;

a_1 is the height at the end of the test, in mm;

WR is the working compression range, in mm.

Annex D
(normative)

Stress relaxation under specified compression

D.1 General

This annex specifies the method to be used to test a sample of gaskets to determine the percentage stress relaxation after being compressed to the value specified by the manufacturer.

D.2 Apparatus

D.2.1 Compression device (see Figure B.1), enabling four test pieces to be mounted separately or together and compressed in accordance with the manufacturer's design concept.

D.2.2 Means of measuring a compression force to an accuracy of better than 1 %.

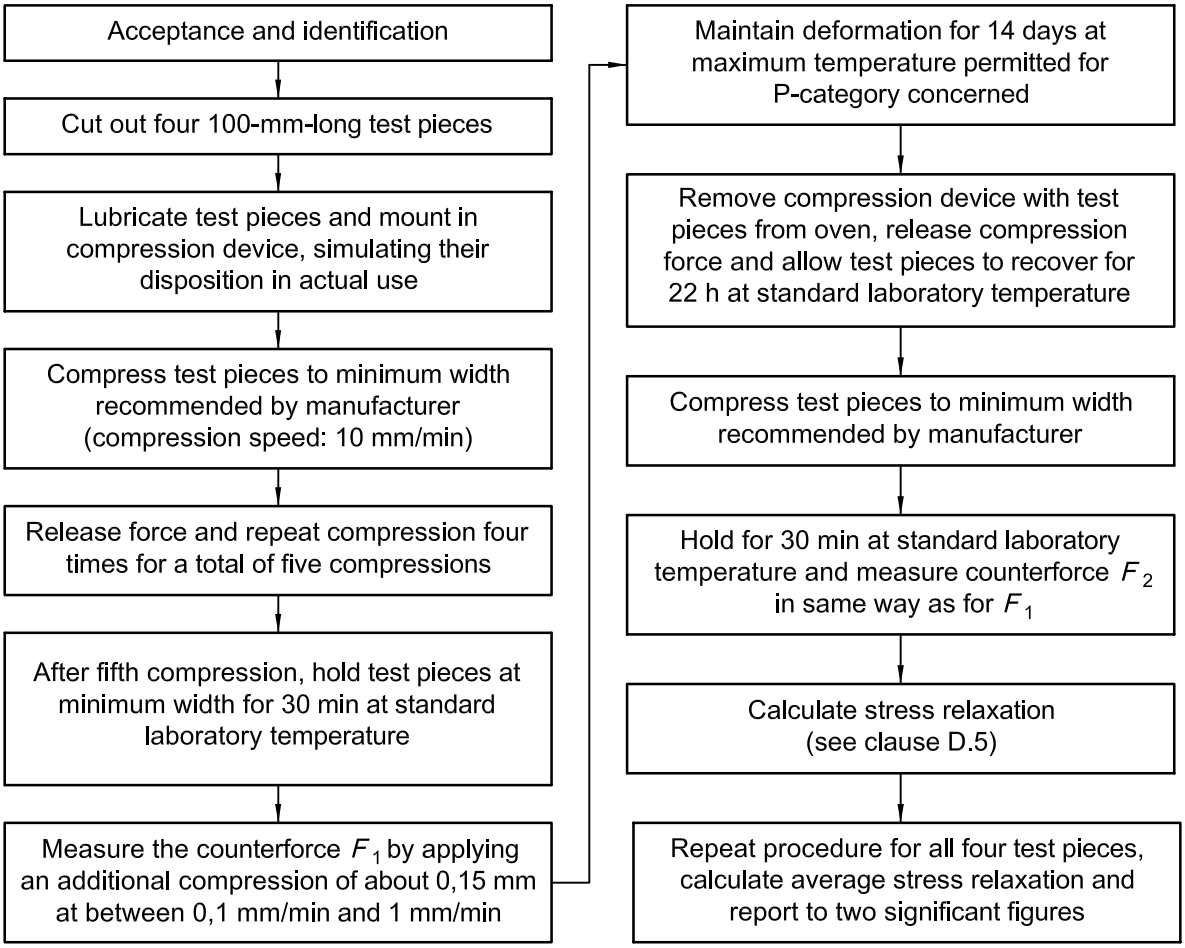
D.2.3 Oven, of one of the types specified in ISO 188:1998, method A.

D.3 Test pieces

A sample of the gasket to be tested shall be provided by the manufacturer, together with drawings depicting its declared free shape and disposition in use. The manufacturer shall also append a statement as to the maximum temperature at which the gasket is intended to be used.

Cut four test pieces of length 100 mm from various positions within the sample.

D.4 Procedure



D.5 Expression of results

The stress relaxation τ, expressed in %, is given by the equation:

$$\tau = \frac{F_1 - F_2}{F_1} \times 100$$

where

F_1 is the initial counterforce, in N;

F_2 is the counterforce after ageing, in N.

Annex E
(normative)

Variation in length

E.1 Cut three test pieces, each 300 mm in length, from the sample of gaskets and keep them at standard laboratory temperature for 24 h.

E.2 Make two reference marks 200 mm from each other on each test piece.

E.3 Place the test pieces on a metal plate covered with talcum powder in a temperature-controlled oven at the maximum temperature permitted for the P-category concerned (P_1, P_2, P_3 or P_4) and age for 22 h.

E.4 Take the plate with the test pieces out of the oven and allow them to cool for 2 h, on the plate, at standard laboratory temperature.

E.5 Measure the length l_1, in mm, of each test piece.

E.6 The variation in length, in %, is given by the formula:

$$\frac{200 - l_1}{200} \times 100$$

E.7 Record as the result the average variation in length for the three test pieces.

ICS 83.140.50; 91.100.50

Price based on 19 pages