

Rubber/cork and rubber/cork synthetic fibre
based gasket materials for use with gas valves,
gas appliances and gas pipework
Safety requirements and testing**DIN**
3535
Part 5

Dichtungen für die Gasversorgung; Dichtungswerkstoffe aus Gummi, Kork und synthetischen Fasern für Gasarmaturen, Gasgeräte und Gasleitungen; sicherheitstechnische Anforderungen, Prüfung

Supersedes April 1983 edition.

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

This standard, in clauses 4 and 5, includes safety requirements within the meaning of the *Gerätesicherheitsgesetz* (German Equipment Safety Law).

This standard has been jointly prepared by *DIN Deutsches Institut für Normung e.V.* and *DVGW Deutscher Verein des Gas- und Wasserfaches e.V.* (German Society of Gas and Water Engineers). It has been included in the body of DVGW Codes of practice for gas.

Dimensions in mm

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1 Scope

This standard specifies requirements for and methods of testing gasket materials made from rubber bonded cork (type A) or rubber bonded cork/synthetic fibre (type C) intended for use with gas valves, gas appliances and gas pipework in contact with gases conforming to *DVGW-Arbeitsblatt* (DVGW Code of practice) G 260, with the exception of liquefied petroleum gas.

Type A materials are rated for an allowable operating pressure of 1 bar and service temperatures of up to 100 °C, and type C materials for 4 bar and service temperatures of up to 150 °C.

Designs which, as a result of continuing technical development, differ in some details from the specifications given here may, on application, be accepted as complying with the standard by a special committee. Such applications are to be addressed to the *Normenausschuß Gastechnik* (Gas Technology Standards Committee), Hauptstraße 71–79, D-65760 Eschborn. A test report issued by an impartial test house recognized by the *Normenausschuß Gastechnik* shall be submitted together with the application. The test house shall

have carried out tests in accordance with the specifications of this standard.

The special committee which considers the application and decides whether the gasket material in question conforms to the standard is made up as follows:

- the chairman of Technical Committee *Dichtungen und Schmierstoffe in Gasanlagen* of the *Normenausschuß Gastechnik*, and his deputy;
- the head of the test house commissioned to carry out the test;
- the chairman of the *DVGW* Technical Committee *Gasgeräte*;
- the technical secretary of the *Normenausschuß Gastechnik*.

The decision as to whether gasket materials are to be recognized as conforming to this standard shall be based on whether the requirements specified here with regard to safety, performance, etc. are satisfied in some other manner than provided for in the standard.

Continued on pages 2 to 6.

Recognition of conformity by the special committee is not effective until it has been confirmed by the technical committee responsible for DIN 3535 Part 5.

An application for recognition of conformity with this standard is deemed to be a request for standardization. Recognition by the special committee signifies the acceptance of this request. Notification of such will be given in the relevant section of the *DIN-Mitteilungen* (DIN News), together with a note to the effect that a correspondingly revised edition of the standard is to be published under the abridged procedure. If the four-week period allowed for comments elapses without any objections being received, then the confirmation already given by the technical committee with respect to conformity with this standard shall count as approval of the revised edition.

The addresses of test houses may be obtained from:

- a) *Normenausschuß Gastechnik*, Hauptstraße 71–79, D-65760 Eschborn,
- b) *DVGW Deutscher Verein des Gas- und Wasserfaches e.V.*, Postfach 52 40, E-65727 Eschborn.

2 Concepts

2.1 Rubber bonded cork gasket materials

Rubber bonded cork gasket materials (type A) consist of a vulcanisate made from rubber and fine granule cork. The gasket properties are determined by the type of rubber used, the cork content and the particle size of the cork granules.

A distinction is made between type 25 materials (low compressibility) and type 40 material (high compressibility).

2.2 Rubber bonded cork/synthetic fibre gasket materials

Rubber bonded cork/synthetic fibre gasket materials (type C) consist of a vulcanizate made from rubber, fine granule cork and synthetic fibres. The gasket properties determined by the type of rubber used, the cork content and the particle size of the cork granules, as well as the proportion of fibres and their length.

3 Designation

Designation of a type 25 rubber bonded cork gasket material (A):

Seal DIN 3535 – A 25

4 Safety requirements

4.1 Limit deviations for thickness

Table 1

	Nominal thickness, in mm	Limit deviations
Rubber bonded cork (A)	$\leq 1,5$	$\pm 0,2\text{ mm}$
	$> 1,5$	$\pm 15\%$
Rubber bonded cork/synthetic fibre (C)	≤ 1	$\pm 0,15\text{ mm}$
	> 1	$\pm 15\%$

4.2 Properties on supply

Table 2

	Expressed in	Rubber bonded cork (A)		Rubber bonded cork/synthetic fibre (C)	Testing as in subclause
		Type 25	Type 40		
Compressibility	%	25 to < 40	40 to 65	15 to 35	5.5.1
Recovery	%	≥ 75	≥ 75	≥ 40	5.5.1
Tensile strength	N/mm ²	$\geq 1,0$	$\geq 0,5$	≥ 8	5.5.2
Gas permeability	cm ³ /min	$\leq 0,05$	$\leq 0,05$	$\leq 0,05$	5.5.3

4.3 Properties after ageing

Table 3

	Expressed in	Rubber bonded cork (A)		Rubber bonded cork/synthetic fibre (C)	Testing as in subclause
		Type 25	Type 40		
Tensile strength	N/mm ²	$\geq 1,0$	$\geq 0,5$	≥ 8	5.6.1
Gas permeability	cm ³ /min	$\leq 0,05$		Not applicable.	5.6.2
Compressive strength	N/mm ²	Not applicable.		≥ 10	5.6.3

4.4 Properties after swelling and redrying

Table 4

	Expressed in	Rubber bonded cork (A)	Rubber bonded cork/synthetic fibre (C)	Testing as in subclause
Change in thickness	%	≤ 3	Not applicable.	5.7
Change in mass	%	Not applicable.	≤ 3	5.7

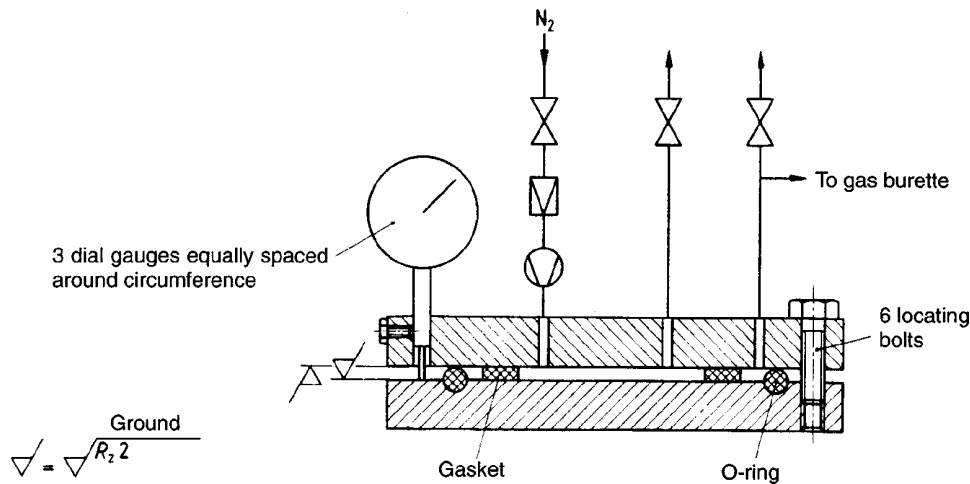


Figure 1: Typical test apparatus for determining the gas permeability of type A gasket materials

5 Testing

5.1 Test houses

Recognized test houses (cf. subclause 1.2) shall be commissioned to test gasket materials as specified in this standard.

5.2 Types of test

Cf. DVGW-Arbeitsblatt G 669.

5.3 Sample material

For testing gaskets, the manufacturer shall provide the test house with eight sheets of gasket material, 2 mm thick each, of size A4 as specified in DIN 476 Part 1.

5.4 Testing thickness

Thickness shall be tested as specified in DIN 28 091 Part 1.

5.5 Testing of properties on supply

5.5.1 Testing compressibility and recovery

Compressibility and recovery shall be tested as specified in ASTM F 36-95, except that, in this case, specimens are conditioned for 48 hours prior to testing in a DIN 50 014 – 23/50-2 standard atmosphere.

5.5.2 Testing tensile strength

Tensile strength shall be determined in accordance with DIN 52 910, except that, in this case, specimens are conditioned for 48 hours prior to testing in a DIN 50 014 – 23/50-2 standard atmosphere.

5.5.3 Testing gas permeability

5.5.3.1 Type A gasket materials

The gas permeability of type A gasket materials shall be determined by using a test apparatus as shown in figure 1.

Prior to testing, specimens shall be conditioned for at least 48 hours in a DIN 50 014 – 23/50-2 standard atmosphere.

Specimens shall have an annular form, with an outside diameter of (75_{-1}^{+0}) mm, a width of (10_{-1}^{+0}) mm and a thickness of

$(2 \pm 0,3)$ mm. The sealing faces of the compression plates (flanges) shall have been ground so that the ten point height of irregularities, R_z , does not exceed $2 \mu\text{m}$. Once the test has been carried out, the specimens shall be checked for signs of damage and their dimensions measured at three points 120° apart.

Clean the sealing faces of the compression plates carefully, centre the specimen and compress type 25 materials to 40 %, and type 40 materials to 50 % of their original thickness.

Make sure specimens are uniformly loaded using the three dial gauges on the test apparatus.

After a period of ten minutes, during which the gas tightness of the measuring system is to be checked, introduce nitrogen gas at a pressure of 1 bar. Two hours after the specimen has been fitted in the apparatus, measure the volume of gas escaping over a 10-minute period using a gas burette with a detection limit of $0,01 \text{ cm}^3$.

The gas permeability is equal to the mean value, expressed in cm^3/min , obtained from measurements taken for five specimens under standard conditions as specified in DIN 1343.

Gas permeability shall be tested again once ageing has been completed (cf. subclause 5.6.2).

5.5.3.2 Type C gasket materials

The gas permeability of type C gasket materials shall be determined by using a test apparatus as shown in figure 2. Prior to testing, specimens shall be conditioned for at least 48 hours in a DIN 50 014 – 23/50-2 standard atmosphere.

Specimens shall have an annular form, with an outside diameter of (90_{-1}^{+0}) mm, a width of (20_{-1}^{+0}) mm and a thickness of $(2 \pm 0,2)$ mm. The sealing faces of the compression plates (flanges) shall have been ground so that the ten point height of irregularities, R_z , does not exceed $2 \mu\text{m}$. Once the test has been carried out, the specimens shall be checked for signs of damage and their dimensions measured at three points 120° apart.

Clean the sealing faces of the compression plates carefully, cover the specimen on both sides with a 0,05 mm thick polyethylene film, centre the covered specimen and apply a uniform surface pressure of 10 N/mm². After a period of ten minutes, during which the gas tightness of the measuring system is to be checked, introduce a nitrogen gas pressure of 6 bar and maintain it for four minutes.

Two hours after the specimen has been fitted in the apparatus, measure the volume of gas escaping over a 10-minute period using a gas burette with a detection limit of 0,01 cm³.

The gas permeability is equal to the mean value, expressed in cm³/min, obtained from measurements taken for five specimens under standard conditions as specified in DIN 1343.

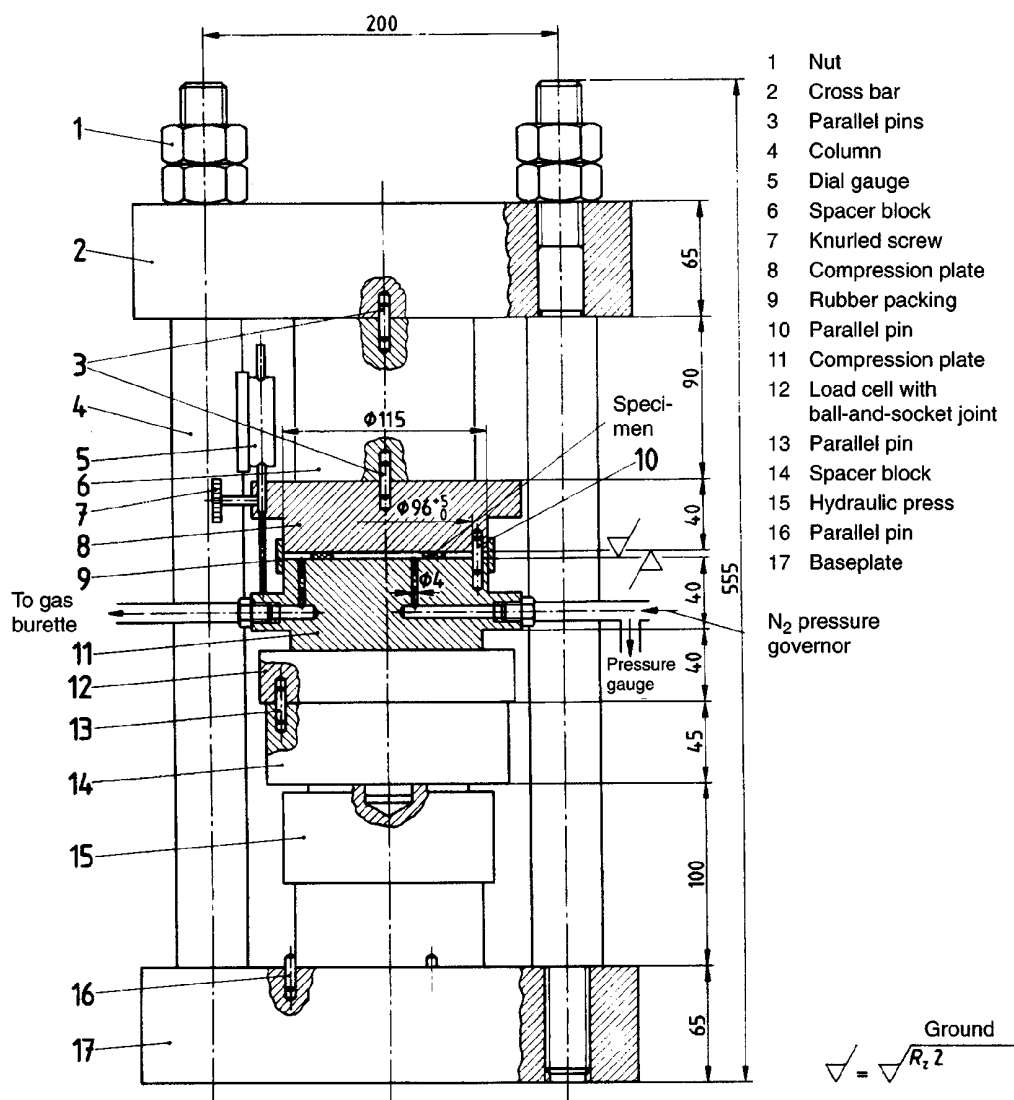


Figure 2: Typical test apparatus for determining the gas permeability of type C gasket materials

5.6 Testing properties after ageing

5.6.1 Testing of tensile strength

Perform the tensile strength test as specified in subclause 5.5.2 using specimens which have been aged for $(168 \pm \frac{0}{2})$ hours in an oven (e.g. an oven conforming to DIN 50 011 Part 2) at a temperature of $(125 \pm 2)^\circ\text{C}$ for type A and $(175 \pm 2)^\circ\text{C}$ for type C gasket materials.

After ageing, specimens shall be conditioned for at least 48 hours prior to testing in a DIN 50 014 – 23/50-2 standard atmosphere.

5.6.2 Testing of gas permeability of type A gasket materials

Following the gas permeability test as specified in subclause 5.5.3.1, place the compression plates enclosing the gasket in an oven (e.g. an oven conforming to DIN 50 011 Part 2) for $(168 \pm \frac{0}{2})$ hours at a temperature of $(125 \pm 2)^\circ\text{C}$. During this period circulate air through the oven at a rate of approximately $10\text{ cm}^3/\text{min}$. Allow the oven to cool to 23°C and repeat the gas permeability test as specified in subclause 5.5.3.1.

5.6.3 Testing of compressive creep strength of Type C gasket materials

Determine the compressive creep strength as specified in DIN 52 913 (accelerated test), except that, in this case, specimens are conditioned for at least 48 hours prior to testing in a DIN 50 014 – 23/50-2 standard atmosphere, the initial compressive stress being 25 N/mm^2 and the test temperature $(175 \pm 2)^\circ\text{C}$.

5.7 Testing of properties after swelling and redrying

Testing shall be performed using three specimens, each measuring $30\text{ mm} \times 30\text{ mm} \times 2\text{ mm}$. The test liquid for type A gasket materials shall be 160 cm^3 of isooctane (fuel No. 1 as in DIN 53 521) and for type C materials, a 70 : 30 isooctane/toluene mix (fuel No. 2 as in DIN 53 521).

After specimens have been conditioned for one hour at $(100 \pm 2)^\circ\text{C}$ and cooled for one hour in a desiccator operat-

ing with calcium chloride, weigh them or measure their thickness as specified in subclause 5.4. Then place them in the liquid so that they are completely immersed and do not touch each other or the walls of the vessel. Stir the test liquid at least once a day.

After the specimens have been immersed for 7 days in closed test vessels at a temperature of $(23 \pm 2)^\circ\text{C}$, remove them from the liquid and allow them to dry for three hours in an oven with forced ventilation as specified in DIN 50 011 Part 2 at a temperature of $(100 \pm 2)^\circ\text{C}$ before drying them for one hour at a temperature of $(18 \text{ to } 28)^\circ\text{C}$ in a desiccator operating with calcium chloride. Then, weigh them or measure their thickness as specified in subclause 5.4.

5.8 Test report

The test report shall make reference to the test method used and provide information concerning the gasket material manufacturer and the client who commissioned the test. It shall also list the test results, comparing the nominal and actual values. The test results shall be summarized at the end of the test report.

6 Marking

The packaging shall be legibly and indelibly marked with the following:

- a) manufacturer's name or trademark;
- b) type designation;
- c) DIN-DVGW test mark and registered number.

These details shall also be given in the manufacturer's documentation.

Gasket materials shall be marked with the DIN-DVGW test mark and registration number only if their compliance with the specifications of this standard has been certified by a recognized test house in a test report and the manufacturer has been granted a registration number.

Standards and other documents referred to

DIN 476 Part 1	Writing paper and certain classes of printed matter; trimmed sizes; A and B series (ISO 216 : 1975)
DIN 1343	Reference conditions, standard conditions and standard volume; concepts and values
DIN 28 091 Part 1	Technical delivery conditions for gaskets made of asbestos-free materials; general requirements
DIN 50 011 Part 2	Testing of materials, components and equipment; ovens; conditioning of test pieces
DIN 50 014	Artificial climates in technical applications; standard atmospheres
DIN 52 910	Tensile testing of asbestos plates and compressed asbestos fibre sheets
DIN 52 913	Compressive creep testing of compressed asbestos fibre sheets
DIN 53 521	Determination of the behaviour of rubber when exposed to fluid and vapours
ASTM F 36-95	Compressibility and recovery of gasket materials*)
DVGW-Arbeitsblatt G 260-1	<i>Gasbeschaffenheit</i> (Guidelines on gas quality)**)
DVGW-Arbeitsblatt G 260-2	<i>Gasbeschaffenheit; Ergänzungsregeln für Gase der 2. Gasfamilie</i> (Guidelines on gas quality; supplementary rules for 2nd family gases)**)
DVGW-Arbeitsblatt G 669	<i>Bedingungen und Verfahren zur Erteilung des DIN-DVGW- und des DVGW-Prüfzeichens für Erzeugnisse in der Gasversorgung</i> (Procedure for the award of the DIN-DVGW registered test mark and of the DVGW test mark for products used in gas supply systems)**)
Verordnung über Allgemeine Bedingungen für die Versorgung mit Gas	(German Regulation on general conditions of gas supply)

Previous editions

DIN 3535 Part 2: 01.72; DIN 3535 Part 5: 04.83.

Amendments

In comparison with the April 1983 edition, the following amendments have been made:

- Gasket materials containing asbestos are no longer specified; asbestos has been substituted by materials containing synthetic fibres, and the designation of these materials changed accordingly.
- In clause 5.4, reference is now made to DIN 28 091 Part 1 (instead of DIN 3754 Part 1).
- In subclause 5.5.3.1 (gas permeability test), a test pressure of 1 bar (instead of 0,15 bar) has been specified.

Explanatory notes

This standard has been prepared by Technical Committee *Dichtungen und Schmierstoffe* of the *Normenausschuß Gastechnik* (Gas Technology Standards Committee). Given the health risk caused by the use of asbestos, this standard provides specifications for non-asbestos gaskets made from synthetic fibre-reinforced materials.

The *Verordnung über Allgemeine Bedingungen für die Versorgung mit Gas* forms the contractual basis between the local gas utilities and customers. Article 12 (4) of this regulation stipulates that only materials and gas appliances be used that are manufactured in accordance with the state of the art and that proof of compliance with these requirements be provided by the DVGW test mark. If materials and appliances bear the DIN-DVGW or DVGW test mark together with a registration number, this indicates that they have been tested by a test house accredited by DVGW. It may therefore be assumed that the relevant regulations are regarded by the authorities as having been complied with.

Applications for a licence to use the mark are to be submitted to *DVGW Deutscher Verein des Gas- und Wasserfaches e.V.* Permission is granted under the terms of *DVGW-Arbeitsblatt G 669*.

International Patent Classification

F 16 J 015/10
G 01 D 005/02
G 01 L 001/00
G 01 N 033/44

*) Obtainable from *Beuth Verlag GmbH*, Burggrafestraße 6, D-10787 Berlin.

**) Obtainable from *Wirtschafts- und Verlagsgesellschaft Gas und Wasser mbH*, Josef-Wirmer-Straße 1–3, D-53056 Bonn.