

**Certification programme ZP  
“Zertifizierungsprogramm” 5123  
of DVGW CERT GmbH, Bonn**

**Supplementary tests for gasket materials  
against a hydrogen content of up to  
100 % by volume**

Doc. type	ZP
Author	DVGW CERT GmbH
Stand	22.04.2024

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	<b>Certification programme ZP 5123</b> <b>Supplementary tests for gasket materials</b> <b>against a hydrogen content of up to 100 % by</b> <b>volume</b>	55123.100-00-N-GB	
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## 0 Preliminary remark

The following certification and test specification describes the requirements, motivation and tests for characterising gasket materials for use with up to 100 % hydrogen (H<sub>2</sub>) by volume with regard to the specific leakage rate with H<sub>2</sub>. Optionally, the specific leakage rate can also be determined comparatively for nitrogen, methane, helium, and possibly other gases. The specific leakage rates can be used for application-specific material selection.

The subject of this certification programme is material testing of gasket materials that have already received DIN-DVGW certification in accordance with DIN 3535-6 (for materials based on synthetic fibres, graphite or polytetrafluoroethylene (PTFE)).

The basic material compatibility of gasket materials based on synthetic fibres, graphite, and polytetrafluoroethylene (PTFE) with hydrogen, methane, helium, and nitrogen is verified using the material table in DIN EN ISO 11114-2. Gasket materials cover a wide range of applications. Manufacturers also have experience in the industrial environment, mostly for H<sub>2</sub> applications, among other things, and these are listed in their technical data sheets.

The DVGW research project G 201615 [1] has used this material table in addition to other sources for compatibility classification. The compatibility data it contains relates to individual gases but can also be used to a certain extent for gas mixtures or the gases of the 2<sup>nd</sup> and 5<sup>th</sup> gas families defined in DVGW Worksheet G 260.

In the current DVGW research project 202208 [2], the H<sub>2</sub>-specific leakage rate is determined in accordance with DIN 3535-6.

With the specific leakage rate with H<sub>2</sub> as a material property, the method presented in this ZP provides an additional technical characteristic value that makes it possible to compare the material with regard to the specific leakage rate of hydrogen with that of nitrogen or methane as well as different materials with each other. The ZP thus supports the selection of gasket materials with regard to their specific behaviour for hydrogen applications. A threshold for the H<sub>2</sub>-specific leakage rate is not specified. The H<sub>2</sub>-specific leakage rate is considered on material samples with standardised dimensions. For gaskets, gasket parameters and tightness classes are available for He in accordance with DIN EN 13555. For gasket materials, the gas permeability is given for N<sub>2</sub>, determined in accordance with DIN 3535-6. These characteristic values can be found, for example, on the manufacturers' technical data sheets and in the ESA database [3], which is used for considerations in accordance with TA Luft.

No statement is made regarding the leakage rate or tightness of moulded parts, as design aspects play a significant role here. This ZP therefore makes the statement "**H<sub>2</sub> tested**" for the specialised gasket material. A mass or volume-related threshold for the leakage is not given. The assessment of the specific leakage rate determined within the scope of this ZP shall be carried out by the user, taking into account the surrounding volume (e.g. installation space) and the ventilation of the application. Information on this is given, for example, in CEN/TR 17924.

Since gasket materials are used in products and systems, the leak test in the system is still decisive and is not replaced by the indication of the specific leakage rate.

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The procedure is based on DIN 3535-6 Gaskets for gas supply - Part 6: Gasket materials based on fibres, graphite or polytetrafluoroethylene (PTFE) for gas valves, gas appliances and gas mains.

**Bibliography**

- [1] F. Scholten, H. Dörr und M. Werschy, Mögliche Beeinflussung von Bauteilen der Gasinstallation durch Wasserstoffanteile im Erdgas unter Berücksichtigung der TRGI, Bonn: DVGW e.V., 2018. (G 201615)
- [2] DVGW G 202208 - Ermittlung von wissenschaftlichen Grundlagen für Wasserstoffanwendungen von Elastomeren, Kunststoffen, Schmier- und Dichtmitteln in der Gasinfrastruktur (DVGW-Innovationsprogramms Wasserstoff (<https://www.dvgw.de/themen/forschung-und-innovation/forschungsprojekte/dvgw-forschungsprojekt-h2werkstoffe>))
- [3] ESA Gasket Database <https://www.esadata.org/>

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## 1 Certification procedure

Products Gas, national conformity mark (European non-harmonised area).

The possibility of using gasket materials with natural gas-H<sub>2</sub> mixtures or pure hydrogen is indicated and listed in a directory of H<sub>2</sub> certification programmes maintained by DVGW CERT GmbH.

## 2 Accreditation

An accreditation No. D-ZE-16028-01 exists for the procedure at German accreditation body („die Deutsche Akkreditierungsstelle GmbH“) (DAkS), Berlin.

## 3 Marks

### 3.1 Certification mark

DVGW resp. DIN-DVGW certification mark Products



Registration number scheme:

DG-5123DP0001      resp.      NG-5123DP0001

DG      = DVGW certification mark for gas,

NG      = DIN-DVGW certification mark for gas,

5123    = product code, DP = 2024, 0001 = serial no.

### 3.2 Note on use



Note: The H<sub>2</sub>-Ready mark of DVGW-CERT GmbH has no direct reference to the tests described in this ZP. The H<sub>2</sub>-Ready mark is an indication that the material can be used with natural gas-H<sub>2</sub> mixtures or pure hydrogen.

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#### 4 Type of certificate and test procedure

The certification covers material tests on gasket materials that have already received DIN-DVGW certification in accordance with DIN 3535-6.

The duration of validity of the confirmation in accordance with this certification programme is linked to the existing DIN-DVGW certificate in accordance with DIN 3535-6.

#### 5 Scope

Product group	Product code	Product type
Gaskets for gas supply: Gasket materials	5123	Flat sealing materials on synthetic fibre basis
	5124	Flat sealing materials on graphite basis
	5125	Flat sealing materials on PTFE basis

#### 6 Testing laboratories

Testing laboratories accredited in accordance with EN ISO/IEC 17025 for the relevant test bases and contractually bound to DVGW CERT GmbH.

#### 7 Requirements

##### 7.1 General requirements:

The gasket materials shall be certified by DVGW CERT GmbH in accordance with DVGW regulations for use with natural gas.

The materials tested and certified in accordance with ZP 5123 are listed in a directory issued by DVGW CERT GmbH.

##### 7.2 Requirements for use with up to 100 % hydrogen by volume:

An additional material parameter is determined without specifying a threshold. This material characteristic value serves as an aid for the user when selecting gasket materials and dimensioning the moulded parts to be manufactured from them.

According to DIN 3535-6, the mass-related threshold for the specific leakage rate is defined as 0.1 mg/(m\*s) for N<sub>2</sub>. As a volumetric threshold, this corresponds to 4.8 cm<sup>3</sup>/(m\*min) at 0 °C, 1013,25 hPa and a mean gasket circumference of 0.22 m.

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The volumetric unit is more practicable for risk assessment in applications with gaseous fuels. The indication of a permissible threshold for flammable gases is only useful to a limited extent. Measurements carried out show that the correlations between the gas measurements vary depending on the gasket. Furthermore, the permissible leakage rate differs depending on the application, installation space, air exchange rate, temperature, etc. (See also TA Luft and CEN/TR 17924)

DVGW G 406 (M), Appendix B, provides a basic procedure for assessing H<sub>2</sub> suitability according to characteristics and the basis of the assessment.


### 7.3 Tests

Test conditions	<p>Based on DIN 3535-6, "Gaskets for gas supply - Part 6: Gasket materials based on fibres - FA, graphite - GR or polytetrafluoroethylene (PTFE) -TF for gas valves, gas appliances and gas mains"</p> <p>Outer diameter of sample <math>d_a</math> (90 + 0.5) mm  Inner diameter of sample <math>d_i</math> (50 - 0.5) mm  Sample thickness FA and TF: <math>d</math> (2 ± 0.2) mm  Sample thickness GR: <math>d</math> (1.5 ± 0.15) mm  The actual thickness shall be determined in accordance with DIN 28090-2:2014-11.</p> <p><u>Conditioning</u>  for at least 48 h at &lt; 6 mbar, 23 ± 5°C</p> <p><u>Testing the specific leakage rate</u>  Test temperature (23 ± 5) °C  A foil to cover the samples is not permitted.  Surface pressure 32 N/mm<sup>2</sup>  Medium H<sub>2</sub> (purity at least 99.9 % by volume)  Medium N<sub>2</sub> (purity at least 99.9 % by volume)  Gas pressure 40 bar  Measurement of leakage using the differential pressure method *)  The specific leakage rate shall be documented in the unit cm<sup>3</sup>/(m*min) as a material characteristic value and refers to 0 °C, 1013.25 hPa a mean gasket circumference of 0.22 m **)</p>
Evaluation	<p>To determine the volume-specific leakage rate, the mass-specific leakage rate shall be converted accordingly.</p> <p>At least two samples per test gas shall be tested. The result shall be documented as an arithmetic mean with details of the individual values taken into account.</p>

Note: In addition, the specific leakage rate can also be determined with other gases, e.g. CH<sub>4</sub> or He.

\*) The differential pressure method with a resolution limit of approx. 10<sup>-4</sup> mg/(m\*s), based on the average circumference of the gasket, is considered to be sufficiently accurate for assessing the specific leakage rate.

\*\*) The mean gasket circumference calculated from the sample geometry is 0.225 m. The specific leakage rates calculated in the course of this ZP refer to the mean gasket circumference of 0.22 m specified in DIN 3535-6.

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## 8 Applicable documents

In the case of undated references, the current edition of the following documents applies.

- Geschäftsordnung (GO) der DVGW CERT GmbH zur Zertifizierung von Produkten im nicht harmonisierten Bereich, <40014>
- DVGW G 260 (A):2021-09  
Gasbeschaffenheit
- DVGW G 406 (M):2023-01  
Anforderungen an neue Gasarmaturen in H<sub>2</sub>-Anwendungen für Gastransport, Gasverteilung und Gasinstallation
- DIN 3535-6:2019-04  
Dichtungen für die Gasversorgung - Teil 6: Flachdichtungswerkstoffe auf Basis von Fasern, Graphit oder Polytetrafluorethylen (PTFE) für Gasarmaturen, Gasgeräte und Gasleitungen
- DIN 28090-2:2014-11  
Statische Dichtungen für Flanschverbindungen - Dichtungen aus Dichtungsplatten - Teil 2: Spezielle Prüfverfahren zur Qualitätssicherung
- DIN EN 13555:2021-04  
Flansche und ihre Verbindungen - Dichtungskennwerte und Prüfverfahren für die Anwendung der Regeln für die Auslegung von Flanschverbindungen mit runden Flanschen und Dichtungen
- DIN EN ISO 11114-2:2022-02  
Gasflaschen - Verträglichkeit von Werkstoffen für Gasflaschen und Ventile mit den in Berührung kommenden Gasen - Teil 2: Nichtmetallische Werkstoffe
- TA Luft:2021-08-18  
Neufassung der Ersten Allgemeinen Verwaltungsvorschrift zum Bundes-Immissionsschutzgesetz (Technische Anleitung zur Reinhaltung der Luft - TA Luft)
- PD CEN/TR 17924:2023<sup>1</sup>  
Sicherheits- und Regeleinrichtungen für Brenner und Brennstoffgeräte für gasförmige und/oder flüssige Brennstoffe. Leitfaden zu wasserstoffspezifischen Aspekten
- EN ISO/IEC 17025  
Allgemeine Anforderungen an die Kompetenz von Prüf- und Kalibrierlaboratorien

The currently valid issue status applies.

## 9 Period of validity

This certification programme is valid from 22.04.2024.

**In case of doubt, the German document is the legally binding document.**

<sup>1</sup> Note: 2nd edition expected for Q2/2024