
	Certification program Compatibility and permeation properties of elastomer materials for seals and diaphragms in gas appliances and equipment against hydrogen for a content of up to 100 vol. % H₂ ZP 5101	55101-01-N-GB	
		Dok.-Art	ZP
		Verfasser	DVGW CERT GmbH
		Stand	07.12.2021

Purpose:

- This certification and test specification (Zertifizierungsprogramm ZP) describes the requirements, motivation, and tests to characterize elastomer materials for seals and diaphragms in gas equipment and systems for the use with up to 100% by volume hydrogen (H₂) with respect to permeation of H₂. The permeation properties can be used for material selection and for the design of components in an application.
- The objective of this certification program are material tests on elastomer materials with DIN-DVGW certification according to DIN EN 549 or DIN EN 682.
- Generally the material compatibility of elastomer materials with hydrogen is given based on the information given in the material table in DIN EN ISO 11114-2. The DVGW research project G 201615 [1] also referred to this standard, along with other sources, to classify compatibility. EN ISO 11114-2 incorporates findings on the service life, durability and long-term behaviour of various groups of plastics and elastomers. The compatibility data contained therein refer to single gases, but can also be used to a certain extent for gas mixtures. This therefore also applies to elastomers tested and certified according to DIN EN 549 or DIN EN 682 with regard to the gases of the 2nd and 5th gas families defined in DVGW G 260 [1]. This ZP supplements the application notes on elastomer materials according to DVGW G 481 [3].
- However, it is expressly pointed out that DIN EN ISO 11114-2 deals only qualitatively with the subject of permeation. This standard can therefore only support the evaluation of the compatibility of gas/material combinations. Only the effect of the gas on changes in the material properties (e.g. due to a chemical reaction or changes in the physical state) is considered. The basic material properties required for design purposes, such as mechanical properties, are usually provided by the material supplier and are not considered in DIN EN ISO 11114-2.
- The method described in this ZP leads to an additional material property regarding H₂ permeability. This technical parameter can be used to compare different materials with regard to the permeation of hydrogen. Therefore the ZP supports the selection of elastomer materials with regard to their specific behaviour for hydrogen applications. A limit value for H₂ permeation is not specified. The technically relevant H₂ permeation on material samples with standardized dimensions is considered.


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- Since design aspects play a significant role no statement with regard to the permeation or tightness of components is made. This ZP therefore makes the statement "**H₂ tested**" for the elastomer material.
- Since elastomer materials are used as seals and diaphragms in products and systems, the leak test of the system is still decisive and cannot be replaced by the permeability information.

The method is based on ISO 15105-1 "Plastics - Film and sheeting - Determination of gas-transmission rate - Part 1: Differential-pressure methods".

Bibliography

- [1] DVGW e. V., DVGW G 260 "gas properties", Bonn: DVGW, 2021.
- [2] F. Scholten, H. Dörr, and M. Werschy, „Mögliche Beeinflussung von Bauteilen der Gasinstallation durch Wasserstoffanteile im Erdgas unter Berücksichtigung der TRGI“ (translation of title: Possible influence of hydrogen components in natural gas on gas installation components considering TRGI), Bonn: DVGW e.V., 2018.
- [3] DVGW e.V., DVGW G 481 "Use of non metallic sealing materials in gas supply and gas utilization" Bonn: DVGW e.V., 2000.

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1. Certification procedure

Products Gas conformity mark national.

The possibility of using elastomer materials with natural gas-H₂ mixtures or pure hydrogen is indicated and listed in a directory of H₂ certification programs maintained by DVGW CERT GmbH.

2. Accreditations

An accreditation No. D-ZE-16028-01-05 exists for the procedure at the Deutsche Akkreditierungsstelle GmbH (DAkkS), Berlin.

3. Mark

3.1 Certification mark

Marking according to national DVGW certification



3.2 Note on use




Note: The H₂-Ready mark of DVGW CERT GmbH has no direct reference to the tests described in this ZP. It is an indication that the material can be used with natural gas-H₂ mixtures or pure hydrogen.

4. Type of certificate and test procedure

The subject of the certification are material tests on elastomer materials with DIN-DVGW certification according to DIN EN 549 or DIN EN 682.

The duration of validity of the confirmation of conformity according to this certification scheme is linked to the existing DIN-DVGW certificate according to DIN EN 549 or DIN EN 682.


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5. Scope

Product group	Product code	Product type
Elastomer materials for seals and diaphragms	5101	Elastomer material for seals in gas appliances and equipment with life assessment
	5102	Elastomer material for diaphragm and seals in gas appliances and equipment with life assessment
	5104	Elastomer material for seals in gas supply mains and pipelines with life assessment
	5105	Materials for diaphragm in gas appliances and equipment, not reinforced, with life assessment
	5106	Materials for diaphragm in gas appliances and equipment, reinforced, with life assessment
	5111	Elastomer material for seals in gas installations
	5112	Elastomer material for seals in gas appliances
	5113	Elastomer material for seals in gas supply mains and pipelines
	5131	Materials for diaphragms for gas appliances and equipment, not reinforced
	5132	Materials for diaphragms for gas appliances and equipment, reinforced
	5133	Materials for diaphragms for gas equipment
	5134	Materials for diaphragms for gas meters and their equipment
	5139	Elastomer material for diaphragm and seals for gas appliances and equipment

6. Test laboratories

Test laboratories accredited in accordance with EN ISO/IEC 17025 for the relevant test specifications and contracted to DVGW CERT GmbH.

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7. Requirements

7.1 General requirements:

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


The materials tested and certified according to ZP 5101 are listed in a directory issued by DVGW CERT GmbH.

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

An additional material property is determined without specifying a limit value. This technical parameter supports the selection of elastomer materials and dimensioning of the components to be manufactured from them.

7.3 Tests:

Test conditions	<p>In accordance to ISO 15105-1, "<i>Plastics - Film and sheeting - Determination of gas-transmission rate - Part 1: Differential-pressure methods</i>".</p> <p>Method with a pressure measurement according to Annex A of ISO 15105-1 (manometric method)</p> <p>Partial pressure difference (1 ± 0.1) bar (1 atmosphere = 1.01325 bar)</p> <p>Sample thickness d (2 ± 0.2) mm => Determination of the actual thickness according to DIN ISO 23529</p> <p>Medium H₂ (purity at least 99.9% by volume)</p> <p>Test temperature (23 ± 2) °C</p> <p>The gas transmission rate (GTR) is determined according to ISO 15105-1. For reasons of practicability, the GTR is to be given in the unit [cm³ / (m² (24 h) bar)].</p> <p>Accordingly, the gas permeability as the relevant material parameter $P = \text{GTR} \times d$ is to be given in the unit of [(cm³ mm) / (m² 24 h bar)].</p>
Evaluation	To determine the gas permeability, the gas transmission rate and the actual thickness shall be considered.

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8. Applicable documents

- Rules of procedure of DVGW CERT GmbH <40014> for the Certification of Products in the Non-harmonized Sector
- DIN EN 549:2019, Rubber materials for seals and diaphragms for gas appliances and gas equipment
- DIN EN 682:2006, Elastomeric seals - Material requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids
- DIN EN ISO 11114-2:2013, Gas cylinders - Compatibility of cylinder and valve materials with gas contents - Part 2: Non-metallic materials
- ISO 15105-1:2007, Plastics - Film and sheeting - Determination of gas-transmission rate - Part 1
- DIN ISO 23529:2020, Rubber - General procedures for preparing and conditioning test pieces for physical test methods

The currently valid version applies.

9. Period of validity

This certification program will become effective on 11/19/2021.