

	Certification programme ZP 3100.100 Tests for boilers for gaseous fuels for a hydrogen content of 100 % by volume		53100.100-00-E-GB	
			Doc. type	ZP
			Author	DVGW CERT GmbH
			Stand	03.11.2025

Certification programme ZP **“Zertifizierungsprogramm” 3100.100** **of DVGW CERT GmbH, Bonn**

Supplementary tests for boilers for gaseous fuels for a hydrogen content of 100 % by volume

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0 Preliminary remark

This is the English version of document 53100.100-02-DE from 03.04.2025.

The following certification and test basis describes the necessary tests that supplement or replace the requirements of DIN EN 15502-1 and DIN EN 15502-2-1 to qualify gas appliances for 100 % hydrogen by volume. In this context, 100 % hydrogen by volume means hydrogen in accordance with DVGW Worksheet G 260, 5th gas family Group A, unless otherwise specified. This certification programme (ZP) applies until there is a uniform European standard. This ZP refers to new appliances.

This ZP covers the following cases of certification in accordance with the Gas Appliances Regulation EU/2016/426:

- Independent certification for 100 % hydrogen by volume
- Extension of an existing certification to 100 % hydrogen by volume (this also includes the conversion kit for the devices)

A conformity assessment under the Gas Appliances Regulation is used, as the appliances are made available on the market and put into operation in accordance with Art. 3 of Regulation (EU) 2016/426.

This certification and testing programme is based on DVGW research projects (e.g. G 201205 [1], G 201615 [2], G 201824 [3], G 202138 [4], G 202021 [5]), industrial research and the diverse literature on hydrogen use in chemistry and industry (e.g. Marchi et al. [6], NASA publication series [7]).

The main results were that the elastomeric or polymeric (PTFE, fibre sealants/adhesive sealants) sealing materials for their respective temperature ranges of application do not exhibit any chemical incompatibility with hydrogen when used even with 100 % hydrogen.

The basic material compatibility of materials with hydrogen can be verified using the material tables in DIN EN ISO 11114-1 and DIN EN ISO 11114-2. These standards relate to the entire range of pressurised gas cylinders and the usual working pressures of 0 to 300 bar.

The DVGW research project G 201615 [2] also used this series of standards, along with other sources, for the compatibility classification. The mentioned standards in the DIN EN ISO 11114 series incorporate findings regarding the service life, durability, and long-term behaviour of various material groups. The compatibility data contained therein relates to individual gases but can also be used to a certain extent for gas mixtures. This also applies to the gases of the 2nd and 5th gas family defined in DVGW Worksheet G 260:2. However, it is expressly pointed out that DIN EN ISO 11114-1 and DIN EN ISO 11114-2 only deal with the materials qualitatively. These standards can therefore be used as an aid for assessing the compatibility of gas/material combinations. 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 11114-1 and DIN EN ISO 11114-2.

For the pressure and temperature conditions in gas appliances, no further material requirements are necessary, even for metallic materials, in accordance with the assessments from [2], among others, which go beyond the requirements of the DIN EN 15502 series of standards.

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The soundness of hydrogen-carrying gas paths must be tested with the test medium standard test gas (NPG) or line gas (LG). Testing with NPG/LG and the limit values from section 8.2.1.1 of DIN EN 15502-1 is classified as permissible.

As soon as reliable findings from test results (e.g. DVGW G 202148) regarding an alternative test with air and/or other test media are available, these will be included here.

Bibliography:

- [1] Dörr, H., Kröger, P., Nitschke-Kowsky, P., Senner, J., Tali, E., Feldpausch-Jägers, S., „Untersuchungen zur Einspeisung von Wasserstoff in ein Erdgasnetz - Auswirkungen auf den Betrieb von Anwendungen im Be-stand, auf Gas-Plus-Technologien und auf Verbrennungsregelungsstrategien“, DVGW G 201205, DVGW Deutscher Verein des Gas- und Wasserfaches e. V. Technisch-wissenschaftlicher Verein, Bonn, 2016.
- [2] Scholten, F., Dörr, H., Wersch, M., „Mögliche Beeinflussung von Bauteilen der Gasinstallation durch Wasserstoffanteile im Erdgas unter Berücksichtigung der TRGI“, DVGW 201615, DVGW Deutscher Verein des Gas- und Wasserfaches e. V. Technisch-wissenschaftlicher Verein, Bonn, 2018.
- [3] Köppel, W., Mörs, F., Hüttenrauch, J., Burmeister, F., „Entwicklung einer Roadmap zur Umsetzung des DVGW-Energie-Impulses bis zum Jahr 2050“, DVGW G 201824, DVGW Deutscher Verein des Gas- und Wasserfaches e. V. Technisch-wissenschaftlicher Verein, Bonn, 2023.
- [4] Anghilante, R., Bhagwan, R., Dörr, H., Burmeister, F., Joormann, N., Oberschelp, L., Tali, E., „Experimentelle Charakterisierung der Leckraten von Prüflecks mit Wasserstoff und/oder Methan-Gasmischungen gegenüber Luft“, DVGW G 202138, DVGW Deutscher Verein des Gas- und Wasserfaches e. V. Technisch-wissenschaftlicher Verein, Bonn, 2023
- [5] Erler, F., Knorr, C., Wiersig, M., Strauß, A., Anghilante, R., Dörr, H., Elhami, O., Janßen, N., Burmeister, F., Kinnen, W., „F&E als Grundlage für den Einsatz von Wasserstoff in der Gasversorgung und der Umsetzung in Prüfgrundlagen – F&E für H₂“, DVGW G 202021, DVGW Deutscher Verein des Gas- und Wasserfaches e. V. Technisch-wissenschaftlicher Verein, Bonn, 2024.
- [6] C. S. Marchi, B. P. Somerday, Technical Reference for Hydrogen Compatibility of Materials, Sandia Report SAND2012-7321 (unlimited release), (2012)
- [7] NASA, SAFETY STANDARD FOR HYDROGEN AND HYDROGEN SYSTEMS, Guidelines for Hydrogen System Design, Materials Selection, Operations, Storage, and Transportation, Report NSS 1740.16 (1997)
- [8] K. E. Cox und K. D. Williamson, Hydrogen: Its Technology and Implications, Volume IV: Utilization of Hydrogen, Boca Raton, Florida: CRC Press, 1979.
- [9] W. U. u. G. V. H. Rottländer, Grundlagen der Lecksuchtechnik, Oerlikon Leybold Vacuum GmbH, 2014.

1 Certification procedure

Gas Appliance Regulation EU/2016/426

2 Declaration of conformity

Issue of an EU type-examination certificate in accordance with EU/2016/426, Module B

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3 Marks

3.1 Certification mark



Labelling in accordance with the gas appliance regulation EU/2016/426 (surveillance by NB 0085)

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 appliance can be used with pure hydrogen.

3.3 Labelling of the hydrogen admixture

In its "Guidance sheet Hydrogen in Gas certificate" dated 27 September 2023, the NBGA (Notified Bodies group Gas Appliances) defines that the suitability of gas appliances for burning H₂NG pending to include H₂NG in the new revision of the EN 437, should be mentioned in the EU Type Examination Certificate like the following:

Gas groups:			
Group	mbar	Group	mbar
H	20	HY100	20
E	20	EY100	20
N	20 - 25	NY100	20 - 25

The above gas groups can be combined according to the standard EN 437 and the national situation of countries.

Note: The suffix "Y100" means that the appliances are suitable for use with pure H₂ (5th gas family).

It should also be noted that the NBGA document only considers the admixture of up to 20 % hydrogen and is supplemented here analogously for pure H₂ (5th gas family).

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4 Type of certificate of conformity

Issue of an EU type examination certificate (duration ≤10 years)

Registration number scheme/ product identification number: CE-0085DQ0123

CE = Identification

0085 = No. notified body

DQ = 2025

0123 = consecutive no.

5 Scope

Product group	Product code	Product type
Gas boiler	31...	Appliances/product types within the scope of DIN EN 15502-1 and DIN EN 15502-2-1
Gas boiler with flue gas system	32...	

6 Testing laboratories

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

7 Requirements

All tests carried out in the laboratory must be performed with hydrogen with a minimum purity of 99.9 % by volume (based on ISO 14687 Grade B).

For the certification of gas appliances within the meaning of this certification programme, the following requirements must be met in addition to or as an alternative to the requirements of DIN EN 15502-1 and DIN EN 15502-2-1 for the verification of safe operation (combustion, ignition, flashback, escape of unburned gases, etc.) with hydrogen instead of natural gas:

Gas appliances within the scope of this certification programme with a nominal heat load ≥ 300 kW may be tested at the installation site with the line gas (LG) distributed there with 100 % hydrogen by volume (in accordance with DVGW worksheet G 260, 5th gas family group A). A corresponding current gas analysis of the line gas must be submitted to the test laboratory.

The on-site adjustment to the existing gas quality according to the manufacturer's specifications in accordance with the instructions means: The instructions must ensure a sufficient air number setting for low-emission and stable combustion for hydrogen in accordance with ISO 14687 Grade B (99.9 % by volume) as well as in accordance with DVGW Worksheet G 260, 5th gas family Group A (98 % by volume) hydrogen and to avoid thermal overloads.

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Section according to DIN EN 15502-1	Requirements	Test condition	Comment	Test gas
5.4.13.4	Chemical composition of condensate		As with 2nd gas family.	NPG or LG
	H ₂ -resistance of components and materials	Manufacturer's declaration of resistance in conjunction with risk assessment and safety concept (for integration of safety times, see also 8.11.6)	Manufacturer's Conformity attestation for the selection and assessment of compatibility with H₂ of metallic and non-metallic materials The basis can be the standard references from DIN EN 15502-1 and/or other standards such as DIN EN ISO 11114-1 and DIN EN ISO 11114-2	
5.2	Conversion to different gases		Information in the operating instructions for operation with 100 % vol. H ₂ or conversion to 100 % H ₂ operation	
8.2.1	Internal and external soundness on the gas side	Test pressure 50 mbar ¹	Limit values: - Air 0.14 dm³/h - alternatively - H₂ (NPG, LG) 0.29 dm³/h	NPG, LG or air
8.4.1	heat input configuration heat input measurement	Max. Min.	Standard condition	NPG or LG
8.6.2	Flame stability (All tests are carried out in the cold and steady state).	Ignition	0.7 x p _n	NPG or LG
		Ignition/cross lighting (flashback)	p_{min}; 0.84 x Q_{min} and 0.84 x Q_{max} H₂ in the exhaust gas < 0.2 % by vol.	
		Ignition/lift-off	p_{min}; 0.81 x Q_{min} and 0.81 x Q_{max} H₂ in the exhaust gas < 0.2 % by vol.	
8.7	Reduction of the gas pressure		Q_{min} up to stationarity at 70 % nominal pressure, Additional 70 % p_n down to 0 hPa without safety-relevant fault	NPG or LG
8.11.6.2.2	Safety time		Risk analysis/safety concept	NPG or LG
8.11.6.2.5	Delayed ignition		Risk analysis/safety concept	NPG or LG

¹ Different national operating pressures are not considered here. In Germany, for example, these are 100 mbar in accordance with DVGW worksheet G 600 (TRGI).

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Section according to DIN EN 15502-1	Requirements	Test condition	Comment	Test gas
8.11.7	Pressure regulator		Gas flow should be within + 5 % / -7.5 % remain	NPG or LG
8.11.101.2	Combustion quality	Monitoring the air supply or exhaust gas discharge	a) Covering the combustion air b) H_2 in the exhaust gas < 0.2 % by vol. with stable combustion c) Covering of the flue gas path d) H_2 in the exhaust gas < 0.2 % by vol. e) with stable combustion Reducing the fan speed H_2 in flue gas < 0.2 % by vol. air-free, dry with stable combustion	NPG or LG
8.11.101.3.3	Combustion quality	Setting the gas/air ratio	Reduced cross-section of the combustion air and flue gas path at $\lambda_{\max}$ and $\lambda_{\min}$, $Q_{\max}$ H_2 in the exhaust gas < 0,2 % by vol. with stable combustion Reduced cross-section of the combustion air and flue gas path at $\lambda_{\max}$ and $\lambda_{\min}$, $Q_{\min}$ H_2 in the exhaust gas < 0.2 % by vol. with stable combustion	NPG or LG
8.12.2	Combustion quality	Boundary conditions	1.19 Q_n at $p_{\max}$ or at the maximum possible factor (minimum value 1.07) if 1.19 is not technically realisable H_2 in the exhaust gas < 0.2 % by vol. with stable combustion	NPG or LG
8.12.2.102	Combustion quality	Boiler with gas/air ratio control	1.1 $\lambda_{\max}$, Q_n , $Q_{\min}$ H_2 in flue gas < 0.2 % by vol. air-free, dry with stable combustion 0.9 $\lambda_{\min}$, Q_n , $Q_{\min}$ H_2 in flue gas < 0.2 % by vol. air-free, dry with stable combustion	NPG or LG
8.12.3.2	Combustion quality	U = 110 % U = 85 %	H_2 in the exhaust gas < 0.2 % by vol. with stable combustion H_2 in the exhaust gas < 0.2 % by vol. with stable combustion	NPG or LG
8.12.3.3	Special conditions	Lifting of the flame	see test 8.6.2 Ignition/lift-off	NPG or LG
8.13	NO _x		NO _x 56 mg/kWh (Ecodesign resp. level 6 DIN EN 15502-1)	NPG or LG

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Section according to DIN EN 15502-1	Requirements	Test condition	Comment	Test gas
8.17	Sound power level		Testing the sound power level L_{WA}	NPG or LG
9	Efficiencies	See analogue DIN EN 15502-1		NPG or LG
10	Electrical auxiliary energy	See analogue DIN EN 15502-1		NPG or LG

Standard test gas: "NPG": H₂, purity at least 99.9 vol.-% (based on ISO 14687:2019) Grade B)

Line gas: "LG": Line gas with 100 vol.-% H₂ in accordance with DVGW G 260:2021 (similar to H₂ according to ISO 14687:2019 Grade A)

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8 Applicable documents

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

- DVGW CERT <40005> Geschäftsordnung zur Durchführung des Konformitätsbewertungsverfahrens nach den EU-Produktharmonisierungsrechtsakten
- Gasgeräteverordnung EU/2016/426 (GAR)
- DVGW G 260:2021-9
Gasbeschaffenheit
- DVGW Arbeitsblatt G 600
DVGW-TRGI 2018. Technische Regel für Gasinstallationen
- DIN EN 437:2021-07
Prüfgase-Prüfdrücke-Gerätekatégorien
- DIN EN 15502-1:2024-08
Heizkessel für gasförmige Brennstoffe – Teil 1: Allgemeine Anforderungen und Prüfungen
- DIN EN 15502-2-1:2024-08
Heizkessel für gasförmige Brennstoffe – Teil 2-1: Heizkessel der Bauart C und Heizkessel der Bauarten B2, B3 und B5 mit einer Nennwärmebelastung nicht größer als 1.000 kW
- ISO 14687:2025-02
Hydrogen fuel quality – Product specification
- DIN EN ISO 11114-1:2024-01
Gasflaschen – Verträglichkeit von Werkstoffen für Gasflaschen und Ventile mit den in Berührung kommenden Gasen – Teil 1: Metallische Werkstoffe
- 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
- EN ISO/IEC 17025:2018-03
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 03.04.2025.

In case of doubt, the German document (53100.100-02-DE) is the legally binding document.