Certification programme ZP “Zertifizierungsprogramm” 3100.20 of DVGW CERT GmbH, Bonn

Supplementary tests for boilers for gaseous fuels for a hydrogen content of up to 20 % by volume

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0 Preliminary remark

The following certification and test basis describes the supplementary tests required to qualify boilers in accordance with DIN EN 15502-1 and DIN EN 15502-2-1 for the addition of up to 20 % hydrogen by volume to natural gas (G20) as fuel gas. This ZP applies until there is a standardised European regulation. In 2024, the Technical Specification CEN/TS 15502-3-1 was published, which defines requirements for the addition of up to 20 % hydrogen by volume to natural gas for boilers with adaptive combustion control function (ACCF) or pneumatic gas/air ratio controller (PGAR). Accordingly, the scopes of CEN/TS 15502-3-1 and this ZP differ in some respects. Boilers within the scope of CEN/TS 15502-3-1 can be certified on this basis and the H_2-ready mark of DVGW CERT GmbH can be awarded in accordance with chapter 3.2. Until the final transfer of CEN/TS 15502-3-1 into a standard, certification for boilers within the scope of CEN/TS 15502-3-1 and this ZP can continue to be carried out according to this ZP.

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 application ranges do not exhibit any chemical incompatibility with hydrogen, even when used with 100 % hydrogen. Under 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, that go beyond the requirements of the DIN EN 15502 series of standards. The tightness of hydrogen-carrying gas paths must be tested against the specifications for the test medium air or for the operating medium natural gas. For hydrogen contents of up to 20 % by volume, testing with air and the limit values from section 8.2.1 of DIN EN 15502-1 is classified as permissible.

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., Werschy, 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 Wasserfa-ches 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 H_2“, 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 Sys-tem 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 Vaccum GmbH, 2014

1 Certification procedure

Products, 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

3 Marks

3.1 Certification mark

CE 0085

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

3.2 Note on use

H2 20% DVGW CERT

Note: The H_2-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 natural gas H_2 mixtures with max. 20 % by volume H_2.

3.3 Labelling of the hydrogen admixture

In its "Guidance sheet Hydrogen in Gar 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
H	20
E	20
N	20 - 25

Group	mbar
HY20	20
EY20	20
NY20	20 – 25

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

Note: The suffix "Y20" means that the appliances are suitable for use of natural gas of the indicated gas group, mixed with hydrogen resulting in a gas mixture containing up to 20 % hydrogen (H_2) when the appliance is set to the reference gas G20.

4 Type of certificate of conformity

Issue of an EU type examination certificate, with <=10 years duration

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 Gas boiler with flue gas system	31… 32…	Appliances/product types within the scope of DIN EN 15502-1:20 and DIN EN 15502-2-1:20

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 for up to 20 % hydrogen by volume

In addition to the tests defined in DIN EN 15502-1: and DIN EN 15502-2-1: for natural gas (standard test gas G 20), the tests must also be carried out with a mixture consisting of 80 % by volume methane (G 20) / 20 % by volume hydrogen as standard test gas 2 (NPG2).

The introduction of NPG2 is intended to consider that the hydrogen concentration in the distributed gas can vary between 0 and 20% by volume and that the basic requirements for the respective gas category are still covered by the standard test gas G 20. They are supplemented by the following requirements. All tests are carried out with the manufacturer's specifications for the basic setting to G 20 and no adjustment to NPG2 is made.

For the certification of gas appliances within the meaning of this certification programme, the following requirements must also be met for proof of safe operation (combustion, ignition, exhaust gas leakage, escape of unburned gases):

Section	Requirements	Test condition	Comment	Test gas
	Resistance up to 20 vol.-% H_2 in natural gas Components and materials	Manufacturer's declaration of resistance in conjunction with risk assessment and safety concept (integration of safety times, see also 8.11.6)	Conformity Attestation of the manufacturer for the selection and assessment of compatibility with 20 vol.-% H_2 in natural gas of metallic and non-metallic materials The standard references from DIN EN 15502-1 can be used as a basis	
8.2.1	Internal and external tightness on the gas side	Test pressure 50[1] mbar	Limit values: • Air 0.14 dm³/h alternatively • H_2 (NPG, LG) 0.29 dm³/h	NPG, LG or air
8.4.1	heat input configuration heat input measurement	max. min.	Adjustment to G 20 - change to NPG2 determination of range of maximum and minimum heat inputs with NPG2	NPG NPG2
8.6.2	Flame stability	Ignition	Adjustment of Q_{max} with NPG - Reduction of the gas supply pressure to 0.7 x p_n - switch to NPG2 - Testing the ignition behaviour.	NPG2

[1] Deviating national operating pressures are not considered here. In Germany, for example, this is 100 mbar in accordance with DVGW worksheet G 600 (TRGI).

Section	Requirements	Test condition	Comment	Test gas
8.6.2	Flame stability	Ignition	Adjustment Q_{min} with NPG - Reduction of the gas supply pressure to 0.7 x p_n - switch to NPG2 - Testing the ignition behaviour	NPG2
8.6.2	Flame stability	Ignition/flash-back	Adjustment of Q_{max} for NPG – reduction of gas supply pressure to p_{min} – switch to limit gas I – testing of ignition and flash-back behaviour	I
8.6.2	Flame stability	Ignition/flash-back	Adjustment of Q_{min} for NPG – reduction of gas supply pressure to p_{min} – switch to limit gas I – testing of ignition and flash-back behaviour	I
8.7	Gas pressure reduction		Adjustment of Q_{min} for NPG – reduction of gas supply pressure to 0,7 x p_n – switch to NPG2 – reduction of p up to 0 hPa without occurrence of a safety-relevant fault.	NPG2
8.11.6.2.2	Safety time		For test conditions see DIN EN 15502-1. To be assessed/ measured according to risk analysis/ safety concept	NPG2
8.11.6.2.5	Delayed ignition		For test conditions see DIN EN 15502-1. To be assessed/ measured according to risk analysis/ safety concept	NPG2
8.11.7	Pressure regulator		Gas flow rate should remain within + 5 % / -7.5 %	NPG2
8.11.101.2	Combustion quality	Monitoring the air supply or flue gas discharge	Adjustment of Q_n, Q_{min}, Q_a with NPG - addition of NPG2 - Covering the combustion air	NPG2

Section	Requirements	Test condition	Comment	Test gas
8.11.101.2	Combustion quality	Monitoring the air supply or flue gas discharge	Adjustment of Q_n, Q_{min}, Q_a with NPG - addition of NPG2 - Closing the flue gas outlet	NPG2
8.11.101.2	Combustion quality	Monitoring the air supply or flue gas discharge	Adjustment of Q_n, Q_{min}, Q_a with NPG - addition of NPG2 - Reduction of the fan speed	NPG2
8.11.101.3.3	Combustion quality	Setting the gas/air ratio	Adjustment Q_n and Q_{min} with NPG - addition of NPG2 - Checking the CO setting specifications $_2$	NPG2
8.12.2	Combustion quality	Limit conditions, Thermal overload	Adjustment in accordance with 8.12.2 a) by increasing the connection pressure to p_{max} (for appliances without regulator or with gas-air compound control) or b) from 1.05 Q_n (for appliances with regulator) with NPG - addition of NPG2 - CO measurement	NPG2
8.12.2.3.102	Combustion quality	Boiler with gas/air ratio control	Adjustment Q_n at max. CO_2 + 0.5 vol.-% or by Δp + 5 Pa at Q_{min} with NPG - addition of NPG2 - CO measurement	NPG2
8.12.3.2	Combustion quality	U = 110%		NPG2
8.12.3.2	Combustion quality	U = 85%		NPG2

Standard test gas "NPG": G 20
Standard test gas 2 "NPG2": 80 vol.-% CH_4, 20 vol.-% H_2
Limit gas I: 65 vol.-% CH_4, 35 vol.-% H_2 ("knock-back", G 22), - counterpart to G 222
Line gas "LG": Hydrogen-rich line gas at the installation site with 200-5 % H2 content by volume

8 Applicable documents

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

- DVGW CERT GmbH <40005> „Geschäftsordnung zur Durchführung des Konformitätsbewertungsverfahrens nach den EU-Produktharmonisierungsrechtsakten“
- Gasgeräteverordnung EU/2016/426
- DVGW Arbeitsblatt G 600
  DVGW-TRGI 2018. Technische Regel für Gasinstallationen
- DIN EN 437:2021-07
  Prüfgase - Prüfdrücke - Gerätekategorien
- 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
- 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 13.03.2024.

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