Certification programme ZP “Zertifizierungsprogramm” 4110 of DVGW CERT GmbH, Bonn

Supplementary tests for valves with metallic body for gaseous fuels for a hydrogen content of up to 100 % by volume

0 Preliminary remark

This certification programme describes the supplementary tests required to assess the conformity of valves with metallic bodies for the following areas

- gas supply
- gas distribution
- gas installation

for any admixture of hydrogen (H_2) to natural gas up to 100 % hydrogen by volume.

The list of valves with DVGW CERT product codes within the scope of this ZP can be found as a table in chapter 5.

The ZP refers to the gases of the 2nd gas family (methane-rich gases) and the 5th gas family (hydrogen) defined in DVGW G 260 as well as mixtures of these gases.

This ZP applies until the described requirements and supplementary tests for hydrogen suitability have been regulated in the corresponding regulations for basic certification or in test standards. The ZP refers to new valves to be placed on the market.

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), industrial research and the diverse literature on hydrogen use in chemistry and industry (e.g. Marchi et al. [5], NASA publication series [6]).

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 Bestand, 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 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] C. S. Marchi, B. P. Somerday, Technical Reference for Hydrogen Compatibility of Materials, Sandia Report SAND2012-7321 (unlimited release), (2012)

[6] 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)

1 Certification procedure

Products in the scope of

- national DVGW certification (non-harmonised under European legislation),
- 2014/68/EU Pressure Equipment Directive (PED),
- EU 2016/426 Gas Appliances Regulation (GAR),
- EU 305/2011 Construction Products Regulation (CPR).

2 Accreditations

An accreditation No. D-ZE-16028-01 exists for the national, non-harmonised procedure at German accreditation body (die Deutsche Akkreditierungsstelle GmbH) (DAkkS), Berlin.

3 Marks

3.1 Certification mark

CE 0085

Labelling in accordance with Pressure Equipment Directive 2014/68/EU (surveillance by NB 0085)

DVGW CERT

DIN DVGW CERT

Registration number scheme:
DG-4110DN0001 resp. NG-4110DN0001

DG = DVGW certification mark for gas,
NG = DIN-DVGW certification mark for gas,
4110 = product code, DN = 2022, 0001 = consecutive no.

Labelling in accordance with national DVGW or DIN-DVGW certification. Products that have passed the supplementary tests described in this ZP should be labelled accordingly.

3.2 Note on use

Note: The H_2-Ready mark of DVGW CERT GmbH has no direct reference to the tests described in this ZP. The H_2-Ready mark is an indication that the valve can be used with natural gas-H_2 mixtures or pure hydrogen.

4 Type of certificate and test procedure

This ZP covers tests on valves which have already been certified for gases of the 1st, 2nd, and 3rd gas family (specified in DIN EN 437) or for which such certification has been applied for.

The above-mentioned certifications are extended according to this ZP. The terms of the type examination certificates, and the registration number scheme of the above-mentioned certifications remain unchanged.

5 Scope

Table 1: Test bases and assigned product codes within the scope of the ZP

Product Code	Product type	Test basis	Field of application [1]	Procedure [2]
4104	Multi functional control	DIN EN 161:2024 DIN EN 126:2012	Installation	GAR PED
4110	Shutt-off valve	DIN EN 331:2016	Installation	GAR PED
4126	Automatic function control	DIN EN 16678:2024	Installation	GAR PED
4128	Automatic shut-off valve	DIN EN 161:2024, DIN EN 16678:2024	Installation	GAR PED
4307	Shut-off valve, magnetic/ motor/ pneumatic operated	DIN EN 161:2024 DIN EN 16678:2024	Installation	GAR National
4312	Shut-off valve <= MOP 5	DIN EN 331:2011	Installation	EU-CPR
4312	Shut-off valve <= MOP 5	DIN EN 331:2016	Installation	GAR National
4312	Shut-off valve <= MOP 5	DIN 3537-1:2011	Installation	National
4313	Shut-off valve for local gas distribution <= PN 16	DIN EN 13774:2013	Installation	GAR PED National

1) Field of application: Transport, supply or installation
2) Procedure: National, Pressure Equipment Directive (PED), Gas Appliances Regulation (GAR) or Construction Products Regulation (CPR)

4314	Shut-off valve for gas transmission >PN 16	DIN EN 14141:2013	Installation	PED National
4315	Shut-off valve for manometers	DIN 3590-1:2021	Installation	GAR National
4316	Multi-way ball valve	DIN 3590-1:2021	Installation	National
4340	Thermically triggered shut-off device	DIN 3586:2003	Installation	GAR PED National
4370	Test valve	DIN EN 14141:2013	Installation	National
4396	Valve with regulating function, electric/ pneumatic operated	DIN EN 16678:2024	Installation	GAR PED National
4510	Tapping valve for metallic pipes	DIN 3588-2:2021	Supply	PED National
4515	Protection device for pressure gauge	DIN 3590-1:2021	Installation	PED National
4606	Safety gas connection valve	DIN EN 15069:2010	Supply	GAR National

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

Certification by DVGW CERT GmbH for use with gases of the 1st, 2nd, and 3rd gas family (specified in DIN EN 437) must be available or applied for the valves.

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

The additional tests listed below are intended to consider that the valves can be operated with different hydrogen concentrations between 0 and 100 % by volume and that the basic requirements for the respective gas category are still covered. In general, only properties such as pressure and temperature range are confirmed that have been specified in the type examination certificate.

8 Tests

8.1 Sample selection

For a series with a proven identical design, the qualification of this series is carried out by testing one sample each of the smallest and largest valve (but maximum DN 400) and a selected medium size of the series.

If series of a type consist of 2 to 4 nominal sizes, it is sufficient to test only one sample of the smallest and largest valve. Larger valves up to a nominal size of DN 1400 (56"), which are demonstrably manufactured under the same design aspects, are also considered to have been tested by testing the DN 400 valve. If the smallest or medium sized valve in the series is not a common stock standard, a sufficiently representative nominal size can be used in consultation with the testing laboratory.

8.2 Test schedule

Except for the "safety test for leaks", the following tests are carried out in addition to the tests defined in the mentioned standards for methane-rich gases (2nd gas family, DVGW G 260).
The detailed test schedule for safety gas connection valves for the connection of gas appliances with gas hose lines in the domestic installation for flammable gases (product code 4606) in accordance with DIN EN 15069:2010 is described in Appendix A1. No. 1 of Table 2 must also be fulfilled.

For multifunctional controls in accordance with DIN EN 126, automatic shut-off valves in accordance with DIN EN 161 and safety and control devices in accordance with DIN EN 16678, a risk analysis updated for the hydrogen application must be submitted to the test laboratory. In addition, No. 1 of Table 2 must be fulfilled. With reference to PD CEN/TR 17924:2023, Annex C, no further tests are required for these products, as the previous requirements are considered sufficient.

Table 2: Supplementary tests, assigned to the corresponding product standards

No.	Section according to	Requirements	Test condition	Comment	Test gas
1	-	Material suitability	A valve must be explicitly designed for static or dynamic stress caused by hydrogen pressure load changes. This must be verified as part of the supplementary test by a manufacturer's declaration or by test reports + acceptance test certificates 3.1 in accordance with DIN EN 10204 for the raw material batches.	The use and certification of the valve must be labelled according to its design. Corresponding recommendations for testing are set out, for example, in ASME B 31.12 EIGA 121/14	
2	DIN EN 331:2016 Section 4.4 DIN 3537-1:2011, section 6.2	Safety test for leak tightness Leakage rate measurement	The external and internal leak tightness must be verified using air or nitrogen as the test medium in accordance with the applicable standard sections on the left. The requirements regarding permissible leakage quantities remain as in the standard sections.		Air or N2

No.	Section according to	Requirements	Test condition	Comment	Test gas
3	DIN EN 13774:2013, section 5.10 DIN EN 14141:2013, section 5.7 DIN 3588-2:2021, Section 4.9 DIN 3590-1:2021, Section 4.5.4.1 DIN 3586:2003, Section 5.10.1	Safety test for leak tightness Bubble test	Leak tightness test in delivery condition: The tests for external leak tightness must be carried out in accordance with the standard sections listed on the left using air or nitrogen (N_2) as the test medium; the requirements remain as in the standard sections (**no bubble formation)**.	This measurement is used to check and assess leaks, which should prevent dangerous situations when measuring with hydrogen afterwards. If there are no signs of a gross leak, the other tests can be carried out with the test medium hydrogen	Air or N2
4	DIN EN 13774:2013, section 5.10 DIN EN 14141:2013, section 5.7 DIN 3588-2:2021, Section 4.9 DIN 3590-1:2021, Section 4.5.4.1 DIN 3586:2003, Section 5.10.1	Leak tightness	External leak tightness: The tests for external leak tightness must be carried out in accordance with the standard sections listed on the left using hydrogen as the test medium; the requirements remain the same as for air as the test medium - no bubble formation.	To qualify the H_2-Ready suitability, the additional leak tightness tests of the shut-off valves must be carried out with hydrogen as the test medium. These differ in two leak tightness tests (external, line 4, and internal, line 5) at room temperature (RT).	NPG

No.	Section according to	Requirements	Test condition	Comment	Test gas
5	DIN EN 13774:2013, section 5.11 DIN EN 14141:2013, section 5.8 DIN 3588-2:2021, Section 4.11 DIN 3590-1:2021, Section 4.5.4.2	Leak tightness	Internal leak tightness: The tests for internal leak tightness are to be carried out in accordance with the standard sections listed on the left using hydrogen as the test medium; the requirements remain the same as for air as the test medium - no bubble formation.	see above.	NPG
6	DIN EN 331:2016, section 4.10.2.1 DIN EN 331:2011 Section 6.7.1 DIN 3537-1:2011, Section 6.6.1 DIN EN 13774:2013, section 5.5.2 DIN EN 14141:2013, Annex D.2 and D.3 DIN 3590-1:2021, Section 4.5.5 DIN 3588:2021, sections 4.12.4.1 and 4.12.4.2	Durability and leak tightness	Permanent load: The test specimens are subjected to continuous switching in accordance with their basic standard depending on the nominal diameter. The actuation cycles are only carried out at room temperature. The tests are carried out according to the parameters: Number of switching cycles according to the product standards from the table in section §5	The test device must be set up in such a way that the valve can be tested without generating any other torsional or bending stress. The hand control must be moved from the fully closed to the fully open position and back again.	Air or N2
			Leak tightness test after permanent load: For the final leak tightness tests, the requirements and parameters apply as above (1. External leak tightness test, 2. Internal leak tightness test). However, these leak tightness tests must be carried out over the entire application temperature range of		NPG

No.	Section according to	Requirements	Test condition	Comment	Test gas
			the shut-off valve (Tmin, RT and Tmax).		
7	DIN EN 331:2016, section 4.4 DIN 3537-1:2011, Section 6.2	Safety test for leak tightness	The external and internal leak tightness must be verified using air or nitrogen as the test medium in accordance with the applicable standard sections on the left. The requirements regarding permissible leakage quantities remain as in the standard sections.		Air or N2
8	DIN EN 331:2016 Section 4.4 DIN 3537-1:2011, Section 6.2	Leak tightness	The external and internal leak tightness must be verified with hydrogen as the test medium in accordance with the applicable standard sections on the left. The requirements regarding permissible leakage quantities as in the standard sections are adjusted by a factor of 2.1 (e.g.: limit value air 40 cm3/h, limit value H_2 84 cm3/h)	The test with hydrogen is intended to provide proof of sufficient leak tightness even when used with hydrogen. The requirements are not changed within the framework of a laminar-viscous flow model.	NPG
9	DIN EN 15069:2010 Section 5.11 ff. Section 5.4.2	Fatigue strength External leak tightness	Leak tightness test after cyclic loading: The external leak tightness must be verified using hydrogen and/or hydrogen mixtures as the test medium in accordance with the applicable standard sections on the left.	Requirement and test sequence according to Annex A1	NP2 or mixture

Standard test gas "NPG": H_2, purity at least 99.9 % by volume (based on ISO 14687:2019-11 Grade B)

9 Labelling

The product is labelled in accordance with the specifications of

- the corresponding product standard in accordance with chapter 5 Scope,
- the requirements of the DVGW CERT rules of procedure, section "Labelling"
- and may optionally include the indication "H_2-tested" in conjunction with the DVGW registration number. Example of labelling: "DG-4110DN0001 H_2-tested".

Note: An addition/modification of the CE mark (e.g. CE 0085) is not permitted

10 Applicable documents

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

- DVGW CERT GmbH <40014> Geschäftsordnung der DVGW CERT GmbH zur Zertifizierung von Produkten im nicht harmonisierten Bereich
- DVGW CERT GmbH <40005> „Geschäftsordnung zur Durchführung des Konformitätsbewertungsverfahrens nach den EU-Produktharmonisierungsrechtsakten“
- DVGW G 260:2021-09
  Gasbeschaffenheit
- DIN EN 437:2021-07
  Prüfgase - Prüfdrücke – Gerätekategorien
- DIN 3537-1:2011-09
  Gasabsperrarmaturen bis 5 bar für die Gas-Hausinstallation - Anforderungen und Prüfungen
- DIN 3586:2003-10
  Thermisch auslösende Absperreinrichtungen für Gas - Anforderungen und Prüfungen
- DIN 3588-2:2021-11
  Gas-Anbohrarmaturen - Teil 2: Mit und ohne Betriebsabsperrung für Guss- und Stahlrohre - Anforderungen und Prüfungen
- DIN 3590-1:2021-07
  Gas-Absperrarmaturen und Überdruckschutzvorrichtungen für Druckmessgeräte - Teil 1: Anforderungen und Prüfungen
- DIN EN 126:2012
  Mehrfachstellgeräte für Gasgeräte
- DIN EN 161:2024-02
  Automatische Absperrventile für Gasbrenner und Gasgeräte
- DIN EN 331:2011
  Handbetätigte Kugelhähne und Kegelhähne mit geschlossenem Boden für die Gas-Hausinstallation
- DIN EN 331:2016-04
  Handbetätigte Kugelhähne und Kegelhähne mit geschlossenem Boden für die Gas-Hausinstallation
- DIN EN 10204:2005-01
  Metallische Erzeugnisse - Arten von Prüfbescheinigungen
- DIN EN 13774:2013-05
  Armaturen für Gasverteilungssysteme mit zulässigen Betriebsdrücken kleiner oder gleich 16 bar - Anforderungen an die Gebrauchstauglichkeit

- DIN EN 14141:2013-08
  Armaturen für den Transport von Erdgas in Fernleitungen - Anforderungen an die Gebrauchstauglichkeit und deren Prüfung
- DIN EN 15069:2010-07
  Sicherheitsgasanschlussarmaturen für den Anschluss von Gasgeräten mit Gasschlauchleitungen in der Hausinstallation für brennbare Gase
- DIN EN 16678:2024-02
  Sicherheits- und Regeleinrichtungen für Gasbrenner und Gasbrennstoffgeräte - Automatische Absperrventile für einen Betriebsdruck über 500 kPa bis einschließlich 6300 kPa
- EN ISO/IEC 17025
  Allgemeine Anforderungen an die Kompetenz von Prüf- und Kalibrierlaboratorien
- PD CEN/TR 17924:2023-05-02
  Safety and control devices for burners and appliances burning gaseous and/or liquid fuels — Guidance on hydrogen specific aspects,
- Druckgeräterichtlinie 2014/68/EU
- EU 2016/426 Gasgeräteverordnung (GAR)
- EU 305/2011 Bauproduktenverordnung (EU-BauPVO)

The currently valid issue status applies.

11 Period of validity

This certification programme is valid from 01.07.2024.

12 Annex A1 Supplementary tests for safety gas connection valves according to DIN EN 15069

Table 3: Information on safety gas connection valves

Product Code	Product type	Test basis	Application Range[1)]	Procedure[2)]
4606	Safety gas connection valves for metal hose assemblies used for the connection of domestic appliances using gaseous fuel	DIN EN 15069: 2010	Installation	GAR National

The material requirement according to Table 2, No. 1 must be met for the safety gas connection valves.

Table 4: Test schedule for safety gas connection valves

Section	Type of test	Requirement and testing	Pressure/value	Decision
5.11 ff.	Durability 5.11.1 Durability of the manually operated control SC valve (page 22)	5.11.1.1 Requirements 5.11.1.2 Examinations	Endurance test 5000 cycles	5.4.2 External leak tightness 5.4.3 Internal leak tightness 5.17 Actuating torque
5.11 ff.	Durability 5.11.2 Durability of connection and disconnection (Only for SC valves with safety quick connector) (page 23)	5.11.2.1 Requirements 5.11.2.2 Examinations	Endurance test 5000 cycles	5.4.2 External leak tightness 5.4.3 Internal leak tightness 5.17 Actuating torque
5.11 ff.	Fatigue strength 5.11.3 Rotation durability of the SC valve outlet (page 23)	5.11.3.1 Requirements 5.11.3.2 Testing With test sample no. 5	Endurance test 5000 cycles of rotation of ± 180°	5.4.2 External leak tightness 5.4.3 Internal leak tightness 5.17 Actuating torque
5.11 ff.	Fatigue strength 5.11.4 Temperature durability - Thermal ageing (page 24)	Only 5.11.4.2 Testing With test sample no. 6	This test consists of a cold cycle, a warm cycle and a further cold cycle.	5.4.2 External leak tightness 5.4.3 Internal leak tightness 5.17 Actuating torque
5.4.2	External leak tightness 5.4.2.2.2 Testing in connected position 5.4.2.2.3 Testing in disconnected state (page 15)	5.4.2.1 Requirements 5.4.2.2 Testing 5.4.2.2.1 General information	Pe1 = 20 mbar Pe2 = 1.5 MOP	External leak tightness less than or equal to 15 cm^3/h

5.4.2.1 Requirements

The external leak tightness must be less than or equal to 15 cm³/h in both the connected and disconnected position.

5.4.2.2.1 General information

The tests must be carried out in the direction of the normal gas flow with the following test pressures:
– Pe1 = 20 mbar;
– Pe2 = 1.5 x MOP.

The measurement accuracy must not exceed 4 cm³/h and the resolution must be greater than 1 cm³/h.

5.4.2.2.2 Testing in connected position

The test is carried out with the closed test connection piece attached to the SC valve. In cases where a flow switch can be operated manually and an independent manual override is available, it must be moved successively to the fully open, centre and fully closed position. The leakage rate must be measured successively with the Pe1 and Pe2 pressures.

5.4.2.2.3 Testing in disconnected state

Before the test, the SC valve must be pressurised when connected. The SC valve must then be disconnected and the leak rate measured after 2 seconds. If there is an independent manual override, this is moved successively to the fully open, centre and fully closed position.

The leakage rate must be measured at 1.5 x MOP.

Final test: Leak tightness with hydrogen and/or hydrogen mixtures. (NPG)

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