

Jetzt
kaufen auf
shop.wvgw.de
Als Print oder
PDF-Download

Deutscher Verein des
Gas- und Wasserfaches e.V.



www.dvgw-regelwerk.de

DVGW Information

WATER No. 112 May 2022

Prevention of Damage caused by Corrosion
or Scaling in Potable Water Installations

WATER

The DVGW is the technical and scientific association of gas and water engineers and comprises approximately 14,000 members. For 160 years, the DVGW has been setting the technical standards for the safe, secure and reliable supply of gas and water, actively initiating the exchange of ideas and information in the gas and water sectors and encouraging and promoting on-going progress in the sectors through practical guidance.

The DVGW is an independent non-profit organisation free from economic lobbyism and political influence.

The DVGW Set of Rules is a key instrument for the DVGW to meet its statutable purpose and accomplish its tasks. The DVGW Set of Rules notably defines, on the basis of statutory regulations, the requirements on technical safety, hygiene, environmental protection, fitness for use and consumer protection and organisation for the supply and use of gas and water. The DVGW Set of Rules ensures that the DVGW complies with the statutory principle of self-responsibility of the utilities, for the benefit of technical safety and hygiene as well as environmental and consumer protection.

Note for users

The DVGW Set of Rules rests on the following principles:

- The DVGW Set of Rules has been elaborated in an honorary capacity in accordance with the applicable principles (DVGW Constitution, Rules of Procedure GW 100). On the basis of jurisdiction, both the content and the technical information can be assumed to be correct.
- Everybody can use the DVGW Set of Rules. Duties and obligations may arise from legal or administrative regulations or from a contract or from other legal grounds.
- Nobody can abdicate their responsibility for correct action when applying the DVGW Set of Rules. Anyone applying the DVGW Set of Rules shall ensure its correct application in each concrete case.
- While the DVGW Set of Rules is not the only source of knowledge when looking for professional solutions, it does constitute an important source of such knowledge. It cannot however cover all possible special cases that may require more comprehensive or restrictive measures.

Warning

This English-language version is an informal translation from the German original. However, only the original German language version has been exclusively authorised by the DVGW and its Technical Bodies. The DVGW reserves the right to revise this version at any time due to possible translation errors.

Anybody is free to use the DVGW system of rules. Users are responsible for the proper use of the DVGW system of rules in each individual case.

ISSN 0176-3504

Price group: 6

© DVGW, Bonn, May 2022

DVGW German Technical and Scientific Association for Gas and Water

Josef-Wirmer-Straße 1–3
D-53123 Bonn

Phone: +49 228 9188-5
Fax: +49 228 9188-990
Email: info@dvgw.de
Internet: www.dvgw.de

Reprinting and photomechanical reproduction, also of excerpts, is only permitted with the approval of the DVGW e. V., Bonn.

Distribution: Wirtschafts- und Verlagsgesellschaft Gas und Wasser mbH, Josef-Wirmer-Str. 3, D-53123 Bonn
Phone: +49 228 9191-40 · Fax: +49 228 9191-499
Email: info@wvbw.de · Internet: shop.wvbw.de
Art. Nr.: 512592 W

Prevention of Damage caused by Corrosion or Scaling in Potable Water Installations

Inhalt

Foreword	6
Introduction	7
1 Scope	7
2 Cited rules and regulations	7
3 Terms and definitions	12
3.1 Appliances/equipment	12
3.2 Component	12
3.3 Specified operation of the potable water installation	13
3.4 Double System	13
3.5 Water hardness (previously: total water hardness)	13
3.6 Hardness hydrogen carbonate (previously: carbonate hardness)	14
3.7 Cathodic protection	14
3.8 Types of corrosion	14
3.9 Corrosion damage	15
3.10 Non-carbonate hardness	15
3.11 Service life	15
3.12 Protective layer	15
3.13 Stagnation	15
3.14 Scaling	15
3.15 Potable water installation	15
3.16 Water conditioning	16
4 General information about corrosion	16
4.1 General	16
4.2 Types of corrosion	18
4.2.1 Uniform corrosion	18
4.2.2 Pitting corrosion	18
4.2.3 Crevice corrosion	19
4.2.4 Selective corrosion	19
4.2.5 Knife-line corrosion	20
4.2.6 Galvanic corrosion	20
4.2.7 Erosion corrosion	22

4.2.8	Stress corrosion cracking	22
4.2.9	Corrosion fatigue	23
5	Principles of corrosion-protected system design and construction	23
5.1	General	23
5.2	Choice of material	24
5.2.1	General	24
5.2.2	Notes on stainless steels	24
5.2.3	Notes on copper and internally tinned copper	26
5.2.4	Notes on hot dip galvanised ferrous materials	26
5.2.5	Combination of different materials	27
5.2.6	Notes on Copper-induced pitting corrosion, flow-direction-rule	28
5.2.7	Notes on polymeric materials	28
5.2.8	Pipe joints	29
5.3	Quality of potable water	29
5.4	Damage prevention and risk assesment	30
5.5	Notes on design	31
5.6	Corrosion-protected system construction	33
5.6.1	Comparison of requirements from the specifications with the delivered components	33
5.6.2	Avoiding contamination by foreign substances	33
5.6.3	Pipe joints	33
5.6.3.1	General	33
5.6.3.2	Avoiding burrs and ridges	34
5.6.3.3	Hot dip galvanised ferrous materials	34
5.6.3.4	Copper	34
5.6.3.5	Internally tin-plated copper	34
5.6.3.6	Stainless Steel	34
5.6.3.7	Avoidance of element formation by using electrical isolators	35
5.7	Code compliant material selection to avoid water conditioning measures	35
5.8	Cathodic Protection	35
5.8.1	General	35
5.8.2	Measures in detail	35
5.9	Completion of the construction work in a manner that protects against corrosion	37
6	Principles of corrosion-protected operation	37
6.1	Compliance with the predesigned operating conditions	37
6.2	Functional control of galvanic anodes as well as external current anode systems	38
6.3	Conditioning of potable water for corrosion-chemical purposes	38
6.3.1	General	38
6.3.2	Design	39
6.3.3	Notes for operation	39
7	Prevention damage caused by scaling	40
7.1	General information about scaling	40
7.2	Scaling in the potable water installation	42
7.3	Conditioning of potable water to reduce scaling	42
7.3.1	General	42
7.3.2	Evaluation of the potable water to be heated – Protection of the potable water installation against scaling according to DIN 1988-200	43
7.3.3	Evaluation of the cold potable water - Requirements for an extended usage of the portable water outside the potable water installation	45

7.3.4	Softening by cation exchange	46
7.3.4.1	Principle of operation	46
7.3.4.2	Blending device	48
7.3.4.3	Design, dimensioning and selection	49
7.3.5	Stabilisation by dosing polyphosphates	51
7.3.5.1	Principle of operatin.....	51
7.3.5.2	Design, dimensioning and selection	51
7.3.6	Stabilisation through limescale protection devices (physical water conditioning)	52
7.3.6.1	Principle of operation	52
7.3.6.2	Efficiency testing	52
7.3.6.3	Design, dimensioning and selection	53
7.3.7	Assembly, commissioning, maintenance	53
7.4	Measures and instructions to prevent detrimental scaling in drinking water heating systems	54
7.4.1	General.....	54
7.4.2	Measures to prevent damage caused by scaling in potable water heating systems	55
7.4.3	Cathodic scaling.....	55
Annex A (informative) – Flow charts		56
Annex B (informative) – Conversion of water hardness, calcium hardness, magnesium hardness and hardness hydrogen carbonate		58
B.1	General.....	58
B.2	Calcium and magnesium hardness.....	58
B.3	Water hardness	59
B.4	Hardness hydrogen carbonate	60
B.5	Conversion examples	61
Annex C (informative) – Conversion of phosphates		62

1 Foreword

2 This DVGW Information W 112 was prepared by a project group of the Technical Committee W-TK-3-4
3 "Internal corrosion and technical safety". It provides practical advice on how to prevent damage caused by
4 corrosion or scaling in installations conveying water intended for human consumption (potable water in-
5 stallations). The information relates this topic to the design, construction, operation and maintenance of
6 potable water installations in accordance with the Technical Rules for installations conveying water in-
7 tended for human consumption, other functional standards to be observed and product standards.

8 The Code of Practice for installations conveying water intended for human consumption (TRWI) are part
9 of the DVGW Technical Rules. The Code of Practice for installations conveying water for human consump-
10 tion consist of the series of standards DIN EN 806 and DIN 1988 as well as the DVGW Codes of Practice
11 and Technical Advice from W 551 series. These rules apply to the design, installation and operation of
12 potable water installations and describe basic functional interrelationships.

13 For the evaluation of the likelihood of corrosion in potable water installations, the series of standards
14 DIN EN 12502 shall be consulted in addition to the principles from the code of practice for installations
15 conveying water intended for human consumption. This series of standards is also part of the DVGW
16 Technical Rules and it is divided into five different parts, whereby the first part covers the general principles
17 and the remaining parts cover the material-specific aspects.

18 Equipment for water conditioning, e.g. to reduce scaling or corrosion, is described in more detail in Euro-
19 pean or national product standards. These product standards are the basis for standardised production
20 and certification of these equipment. Based on product standards, important requirements, e.g. regarding
21 dimensions, performance, efficiency, pressure resistance or hygiene, can be defined and made testable
22 and assessable. Functional standards refer to product standards, for example to specify a level of safety.

23 The presented DVGW Information takes up numerous aspects for the prevention of damage due to corro-
24 sion or scaling in potable water installations from the functional and product standards and comments on
25 them, especially for persons who design, construct, or operate potable water installations.