UWS
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Specialist information

Hot water treatment according to VDI 2035

Basic information on the guidelines

Guidelines for heating technology

The guidelines of the VDI (Association of German Engineers) and the DIN (German Institute for Standardisation) are a set of rules on the current state of the art and form the working basis for the field of „sanitary, heating and air conditioning technology". VDI 2035 plays a central role in the installation, filling and maintenance of heat systems. This guideline provides specifications for the protection of water quality, e.g. to prevent stone formation and corrosion damage (VDI 2035).

VDI 2035

(new version from 1 March 2021)

Prevention of stone formation and corrosion in hot water heating systems

Stone formation and corrosion are frequent causes of damage to heating systems. For these reasons, VDI 2035 specifies reference values for the filling water. These form the basis of many guarantee conditions, which planners, installers and operators should always bear in mind. Hot water treatment enables compliance with the specified values. Desalinating and softening are among the most common treatment measures.

Consequences of non-compliance with the guidelines

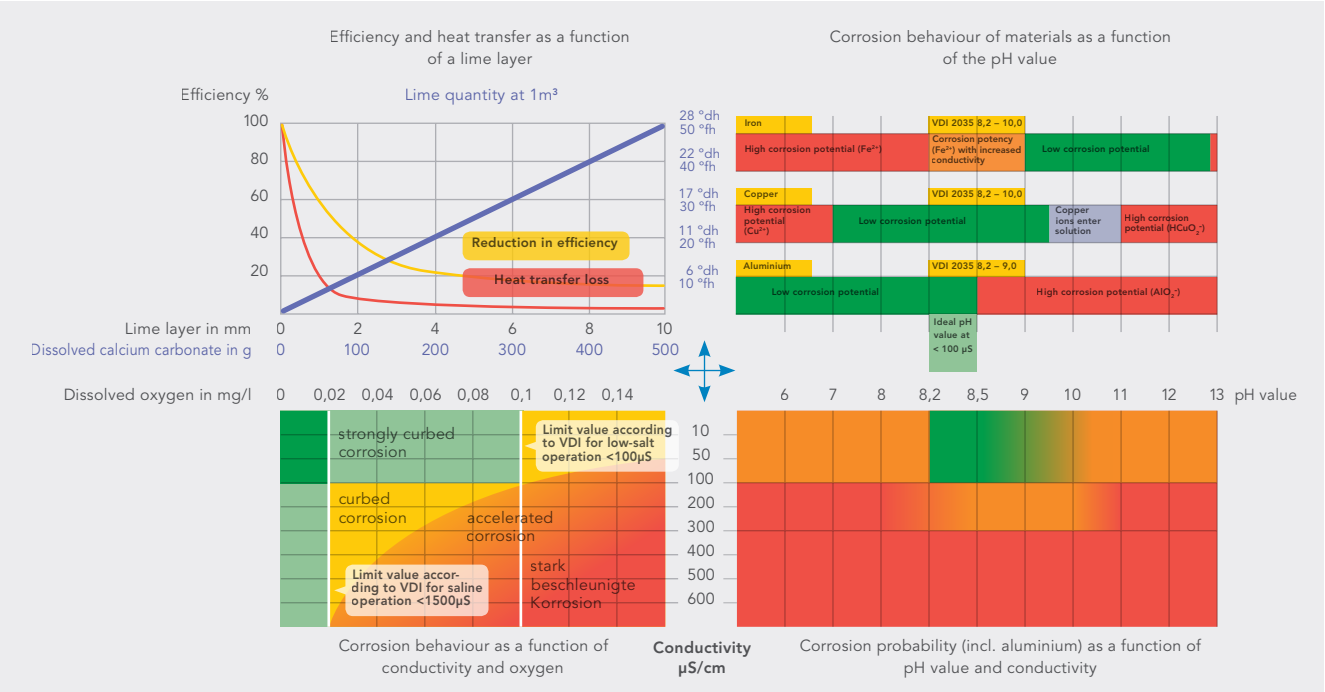
If the specified guidelines are not adhered to, the following disadvantages may arise:

- Refusal of commissioning by the manufacturer
- Refusal to honour warranty claims in the event of damage
- Loss of performance and efficiency
- Medium/long-term damage to the heating system

The following must be taken into account when planning and installing heat systems:

- Calculation of the water volume for existing and new systems
- Fully demineralised water plus pH value equalisation
- Keeping a system log
- Regular inspection
- If necessary, additional corrosion protection measures through sludge removal (especially for underfloor heating systems)

Four components in the heating water circuit are largely responsible for corrosion and scale formation: water hardness, oxygen, pH value and conductivity.



Component 1
Water hardness

The water hardness in conjunction with the filling and make-up water quantity as well as the wall temperature of the heat generator are largely responsible for the formation of stones in the heat system. The higher the temperature, the higher the risk of stone formation.

Component 2
Oxygen

If too much oxygen enters the heat system, this inevitably leads to rust. However, this does not refer to the oxygen that enters via the water during the initial filling and is usually consumed by the metal present, but rather the oxygen that enters beyond this. The most common cause of uncontrolled oxygen ingress is an incorrectly adjusted or defective expansion vessel.

Component 3
pH value

The pH value is a measure of the acid or alkali content in water and is shown on a scale between 0 and 14. It is important to know that the pH value is the result of a conversion formula that contains a logarithm of ten. This means that a pH jump (change in pH value by 1) represents a factor of 10 in the acid concentration: water with a pH value of 7 therefore contains 10 times more acid than water with a pH value of 8 and even 100 times more than water with a pH value of 9 (10 x 10 = 100).

Component 4
Conductivity

The higher the conductivity in the water, the greater the likelihood of corrosion. Conversely, this means that a low conductivity reduces or slows down corrosion in the heat system. The conductivity results from the salt content of the filling and make-up water. The rule here is that a high salt content causes high conductivity. Oxygen binding agents and corrosion inhibitors also increase conductivity.

Fully utilise capacities with demineralised water

VDI 2035 suggests softening or desalinating as measures for hot water treatment. The main differences are as follows:

Softening	Desalinating
Removes the hardness formers calcium and magnesium (part of the cations) and replaces them with sodium	Removes all salts (cations and anions)
Prevents stone formation	Prevents stone formation
The conductivity does not decrease. The negatively charged ions (anions) such as chloride are not removed. The presence of sodium ions can even increase conductivity by up to 20%.	The conductivity decreases considerably as all cations and anions and therefore conductive salts are removed.

Conclusion:

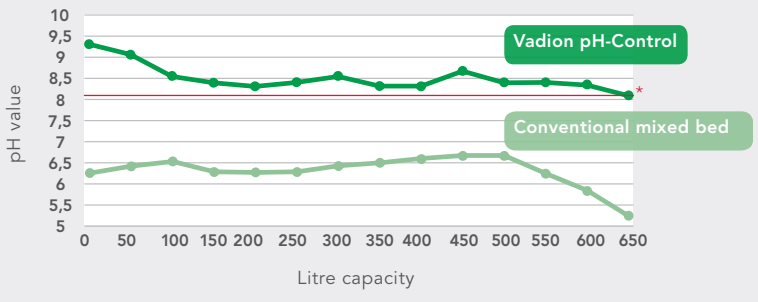
Advantages of low conductivity and thus desalinating

- The lower the conductivity, the higher the heat capacity
- Higher tolerable oxygen concentration
- Significantly reduced likelihood of corrosion
- Specifications of all manufacturers are fulfilled

Fully demineralised water with the mixed bed resin Vadion pH-Control

In order to meet the values recommended in VDI 2035 (hardness of 0.3 °dH, conductivity ≤ 100 µS/cm and a pH value of 8.2 - 10.0 in stainless steel systems or 8.2 - 9.0 for aluminium components), we have developed a special mixed bed resin.

Our **Vadion pH-Control** is a mixed bed resin which, in addition to desalinating the water to < 100 µS/cm (equivalent to 0-2 °dH), also provides a pH value* of the filling water within the required range. It can be used from 3 to 80 °C** water temperature. This also makes it possible to remove any residual hardness and dissolved salts in the hot water of a heat system in the bypass system up to temperatures of 80 °C.



*Recommended minimum value according to VDI 2035

The performance curves are based on the results of a laboratory test. In practice, deviations may occur due to the water quality.

*** The prerequisite for an optimum pH value is a residue-free system (glycol, cleaner, etc.), no microbiological or other bacterial contamination. The systems must be state of the art. Depending on the condition of the system, it may be necessary to stabilise the pH value.**

****) From 50 °C hot water-compatible devices from the Heaty series must be used.**

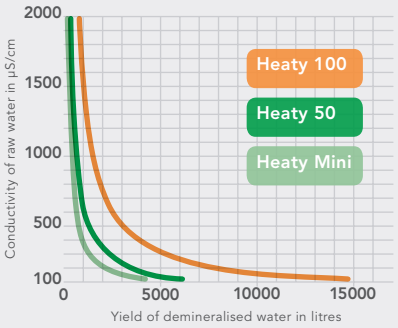
Our devices also fulfil the requirements of the updated VDI 2035

Treated filling water with mobile filling devices

With the mobile UWS filling units, you can fill any size of system - from small self-contained heating systems with a capacity of 50 litres to local heating networks with a water content of several 100 m³. We achieve values that fulfil all manufacturer specifications and are also suitable for all materials. This is particularly advantageous for the frequently encountered mixed installations.

Overview of the capacities of the UWS filling units

Capacity diagrams Heaty Mini/ 50s/ 100s



The capacity specifications are based on the ideal case. Deviations may occur due to application errors, water quality and temperature.

Easy to operate - safety of the blending bed quality thanks to LED display

Your advantages

- The right device for every suitable device
- One-step compliance with VDI 2035, ÖNORM H 5195-1 and SWKI BT 102-1
- Simple handling
- Safety through LED measurement
- High volume flow (up to 2,400 l/h)

Treated make-up water with pre-assembled replenishment unit

Today, both the filling water and the make-up water must be treated. It makes sense to install a permanently installed replenishment system that automatically secures the make-up water and treats it in accordance with the guidelines.

EN 1717 stipulates the installation of system separators to protect drinking water. If this is not available, our fully pre-assembled Heaty Complete Home replenishment unit can be installed, in which the system separator, water meter and shut-off valves are all integrated.

Your advantages

- Completely pre-assembled Replenishment unit
- The right device for every application
- Suitable for all manufacturers and materials
- Fulfils VDI 2035 and EN 1717 with one product
- Controlled replenishment through innovative mixed bed

Specifications according to VDI

VDI 2035 (version dated 01.03.2021):
Table 1: Reference values for the filling and make-up water and the hot water

Fill and make-up water and hot water, depending on heating capacity			
Total heating capacity in kW	**Total alkaline earths** in mol/m³ (total hardness in °dH)		
	Specific system volume in ℓ/kW Heating output[1]		
	≤ 20	**> 20 to ≥ 40**	**> 40**
≤ 50 kW Specific water content Heat generator ≥ 0.3 ℓ per kW[1]	none	≤ 3,0 (16,8)	< 0,05 (0,3)
≤ 50 kW Specific water content Heat generator ≥ 0.3 ℓ per kW[2] (e.g. circulating water heaters) and systems with electric heating elements	≤ 3,0 (16,8)	≤ 1,5 (8,4)	
> 50 kW to ≤ 200 kW	≤ 2,0 (11,2)	≤ 1,0 (5,6)	
> 200 kW to ≤ 600 kW	≤ 1,5 (8,4)	< 0,05 (0,3)	
> 600 kW	< 0,05 (0,3)		
Hot water, independent of heating capacity			
Mode of operation	**Electrical conductivity** in µS/cm		
Low salt[3]	> 10 to ≤ 100		
containing salt	> 100 to ≤ 1500		
	Appearance		
	clear, free from sedimenting substances		
Materials in the system	**pH value**		
without aluminium alloys	8,2 to 10,0		
with aluminium alloys	8,2 to 9,0		

[1] To calculate the specific system volume, the smallest individual heating output is to be used for systems with several heat generators.
[2] For systems with several heat generators with different specific water contents, the smallest specific water content is decisive.
[3] Full softening is not recommended for systems with aluminium alloys, see also section 6.4.4 in VDI 2035.

The decisive factor is therefore the specific system volume!

Note:
Manufacturer specifications that are higher than the VDI specifications must be complied with and are pe missible. Many manufacturers re- quire conductivities below 100µS/cm and therefore a low-salt operation.

In the VdTÜV leaflet „Explanations on VDI Guideline 2035, Sheet 2" under points 6 and 7, low-salt filling is regarded as the preferred solution, as higher oxygen contents (see table) in the water can also be tolerated with this mode of operation.

Conductivity and hardness with the low-salt driving style:

Required total hardness: **see table**
Conductivity: **< 100 µS/cm**
If additives such as corrosion protection or inhibitors are used: **1,000 - 1,500 µS/cm**

With low-salt filling with mixed bed resins, an average total hardness of < 0.3 °dH is achieved at values < 100 µS/cm.

Corrosion experts assume that the conductivity should not be higher than 1,000 µS/cm even when corrosion inhibitors are added.

pH value:

without aluminium: **8.2 - 10.0**[4]
with aluminium components: **8.2 - 9.0**[4]

[4] Measurement tolerance of max. ± 0.2 when complying with the conditions specified in VDI 2035

For selected aluminium alloys, pH values up to =< 9.0 can be tolerated in accordance with the manufacturer's specifications.

For other materials, the pH value must be between 8.2 and 10.0.

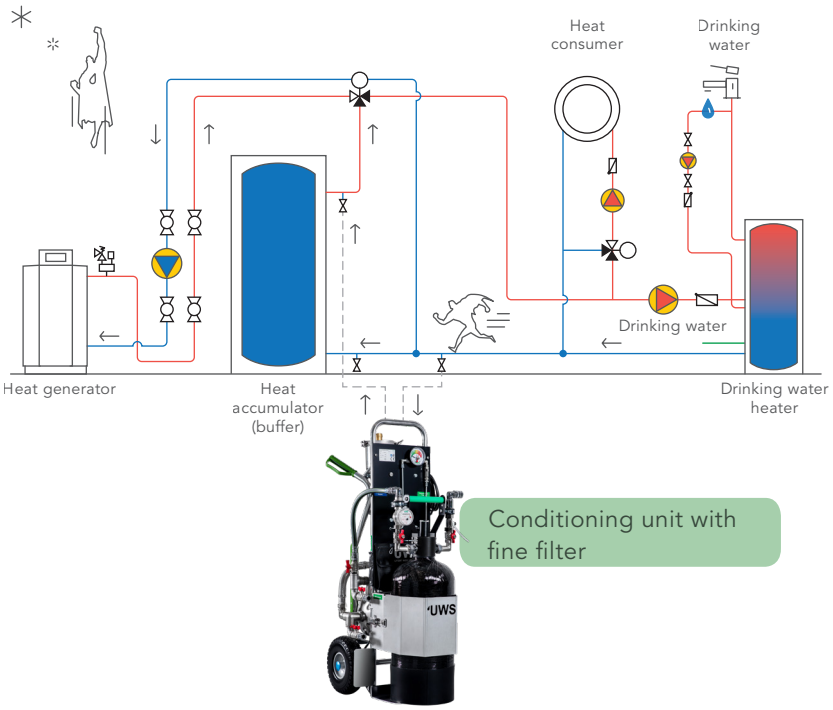
Oxygen content in the low-salt mode:

0,1 mg/l

This is due to the fact that the conductivity is < 100 µS/cm with low-salt operation and therefore the corrosion rate is greatly reduced due to the more difficult charge transport. The oxygen content in the saline mode may only be 0.02 mg/l.

Conductivity reduction during operation

Thanks to our bypass process, the heating water can be treated to the required quality a few days before the boiler replacement. The devices developed for this purpose and the special medium can be used at a return temperature of up to 80 °C. This means that the specified water values are already met before the boiler replacement or before commissioning and heating.



Conditioning unit with fine filter

Advantages of modern hot water treatment

Bypass treatment up to 80 °C
Only 1 work step to reduce conductivity and increase pH
No follow-up measurement after 8 to 12 weeks
Suitable for all manufacturers and materials

On the safe side with UWS technology

Suitable for all systems

From existing to new build and underfloor heating systems heating systems - all systems can be filled with our appliances and treated afterwards.

✓ **Cost savings**

On-site service

Measuring and analysing problem systems and proposing solutions

(Online) seminars and training courses

Practice-orientated and standard-compliant solutions? No problem!
We train your employees, so that you benefit from safety and warranty services.

Our water. sure.

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YOUR CONTACT