

A SAFE PATH TO WATER AND HEAT



The comprehensive Guide for the trade

Filling of heating installations



Commissioning and maintenance of a heating installation associated with increased liability risks for specialist sanitation, heating and A/C companies and planners.

With this Guide, we provide you with answers to your questions, prepare background knowledge in a comprehensible manner and explain the required measures.

Dear business partners,

Ever since the introduction of the VDI Guideline 2035 which regulates the filling and water quality of heating installations, we have been receiving questions from hesitant colleagues in the trade on a daily basis. Not only have the commissioning and maintenance of a heating installation today become more complex, but they are also associated with an increased liability risk for specialist sanitation, heating and A/C companies as well as planners.

Modern heat generators are known to react more sensitively to hard and corrosive filling water. For this reason, heating technology manufacturers have combined their guarantee and warranty claims to certain standard values for the heating water. This leads to new responsibilities for the specialist sanitation, heating and A/C company: it has to check and ensure the water quality and, if necessary, treat the heating water accordingly.

Against this background, we as your business partner would like to provide answers to your questions via this Guide. We have prepared the relevant background knowledge in a comprehensible way and explained the necessary measures in order to make your work on site a little easier.

Here's to further good cooperation!



Table of Contents

Objectives of the new standards and instructions	4
Liability consequences for the specialist company	6
Water, chemistry and heating installations	8
Softening or demineralisation - Comparison of two conditioning processes	10
Standard-conforming, fully automatic protection of the heating system	12
Stationary or mobile heater filling	14
Determining the system volume	16
Corrosion protection and pH	18
Step by Step: Practical Guide	20
Heating water quality - Measuring devices and analytics	22
Keeping a system logbook	24
Specifications	25

” It wasn't like this before! Why do you prescribe a certain quality of water for heating installations?

Objectives of the new standards and instructions

The core objectives of Guideline VDI 2035 are to prevent limescale, the accumulation of sludge and corrosion damage caused by water.

Important changes to VDI 2035 from 01 March 2021 at a glance

- Corrosion and scale formation are summarised on one sheet.
- The limit value for complete softening was raised to 0.3 °dH/0.05 mol/m³
- The limit value for oxygen concentration has been dropped, but should still be observed.
- A pH of up to 9.0 is now permitted for aluminium materials

Modern heating systems are quite sensitive to hard and corrosive filling water. Increased heat loads and more compact heat exchangers result in higher surface temperatures and thus in the formation of lime deposits, which then thwarts a better heat transfer and could limit or endanger the functioning of the system. In addition, materials such as aluminium or stainless steel also react with accelerated corrosion processes to an improper composition of the water.

For these reasons, heating system manufacturers require the use of conditioned filling water. Guideline VDI 2035 includes the corresponding set of regulations updated on 01 March 2021. The objective of Guideline VDI 2035 is to prevent corrosion, scale formation and the accumulation of sludge, the smooth operation of the heating installation, maintaining a good heat transfer and efficiency, energy and cost savings as well as the protection of the environment through CO² savings.

To achieve these objectives, the Guideline foresees different procedures applicable to heating water conditioning for water heating installations in accordance with DIN EN 12828 within a building when the flow temperature does not exceed 100 °C. Depending on the requirements, softening, demineralisation, hardness stabilisation and the stabilisation of the pH are applied.

According to the current Guidelines and manufacturer's specifications, planners and installers have to check on site whether the total hardness of the filling water present for the filling of the heating installation is suitable. The result of this check must be submitted to the developer/operator in writing. The heat output and the specific volumes of the installation are the decisive factors.



These limit values gain in importance when considering that in Germany around half of all buildings are supplied with „hard“ drinking water ($> 14 \text{ }^\circ\text{dH}$) and that even in smaller properties the use of underfloor heating systems or buffer storage tanks increases the specific system volume.

Manufacturer's specifications that exceed the specifications of the VDI are permissible and must be adhered to. Many manufacturers require low-salt operation with conductivities below $100 \text{ } \mu\text{S/cm}$ for filling and make-up water.

Filling and make-up water as well as heating water, depending on heat output

Total heat output (kW)	Total hardness in $^\circ\text{dH}$ and mol/m^3 Specific system volume in l/kW heat output		
	< 20	≥ 20 to 40	≥ 40
$\leq 50 \text{ kW}$ Specific water volume heat generator $\geq 0.3\text{l/kW}^1$	none	$16.8 / \leq 3,0$	$< 0.3 / \leq 0,05$
$\leq 50 \text{ kW}$ Specific water volume heat generator $\leq 0.3\text{l/kW}^2$	$16.8 / \leq 3,0$	$8.4 / \leq 1,5$	$< 0.3 / \leq 0,05$
$50 \text{ kW to } \leq 200 \text{ kW}$	$11.2 / \leq 2,0$	$5.6 / \leq 1,0$	$< 0.3 / \leq 0,05$
$> 200 \text{ kW to } 600 \text{ kW}$	$8.4 / \leq 1,5$	$0.3 / \leq 0,05$	$< 0.3 / \leq 0,05$
$> 600 \text{ kW}$	$0.11 / \leq 0,05$	$0.3 / \leq 0,05$	$< 0.3 / \leq 0,05$

Heating water, independent of heat output

Operating mode	Electrical conductivity in $\mu\text{S/cm}$
Low-salt ³	> 10 to ≤ 100
Salt-based	> 100 to ≤ 1.500
	Appearance: clear, free from sedimentary substances
Materials in the installation	pH
without aluminium alloys	8.2 to 10.0
with aluminium alloys	8.2 to 9.0

- 1 For the calculation of the specific system volume, the smallest individual heat output is to be used for systems with several heat generators.
2. In installations with several heat generators with different specific water volumes, the smallest specific water volume is decisive.
- 3 Full softening is not recommended for installations with aluminium alloys, cf. section 6.4.4 in VDI 2035.



Can I be held liable for damage to the heating installation caused by inappropriate filling water?

Liability consequences for the specialist company

During the construction phase and in the case of renovation, the responsibility for the standard-conforming operation and correct filling of the heating system lies with the specialist sanitation, heating and A/C company. If the system is refilled by the operator, the operator must ensure the correct quality of the filling water.

Guideline VDI 2035 provides for a documentation obligation, from the advice and counselling phase to planning and acceptance of the installation all the way up to maintenance.

Indeed, the liability risk for the specialist sanitation, heating and A/C company has actually increased with Guideline VDI 2035. Although it is the operator of such installation who is responsible for the proper state of its heating water and who has to have it checked at regular intervals (at least once a year), Guideline VDI 2035 assumes at the same time that the operator, as a layman, is unable to shoulder this responsibility on his own. This is why it includes the obligation of the planner and the installer of the heating installation to enable the operator to do so through appropriate counselling and advice.

This requirement has existed for quite some time on paper (VOB/C EN 12828) - however, in the past, planners or installers only rarely met this obligation. This is why Guideline VDI 2035 now includes a documentation obligation for these tasks (see also page 24 „keeping a system logbook“).

When building new installations, every step has to be documented, from the advice and counselling stage to planning and acceptance of the installation all the way to its maintenance. Any modification of existing installations (replacement of components, change of water, extension) has to be assessed and documented additionally in a system logbook with regard to the compatibility of the water present within the installation and the newly fitted parts.

In the meantime, insurance companies, too, refer to this standard as an opportunity to save costs in the millions. Thus, the operator's insurance company and the manufacturer of any damaged parts may possibly have the right to withhold performance if no complete documentation can be submitted. This right to withhold performance is based upon the presumption mentioned in Guideline VDI 2035, namely that considerable damage is almost inevitable due to non-observance of the Guideline's requirements.



For this reason, the operator of an installation will address the planner or installer when it comes to claims for damages, and the latter will subsequently have to prove that the respective job had been done properly and professionally. Should this prove to be impossible, they will have to provide evidence that the damage was not caused by their own work.

The backwashable HF 3425 Compact heating filter

Effective protection against sludge: The backwashable HF 3425 Compact heating filter with magnetic separation protects and ensures the longevity of heat generators, heating pumps, thermostatic and other valves in the heating installation.

The heating filter HF 3425 Compact is a valuable backwash filter for the heating system. It comes with a 100 µm filter mesh and collects dirt particles. The dry magnet bar additionally collects all magnetic particles. The new developed construction of the heating filter avoid blocking due to pollution. This ensures a constant water flow in a closed heating circuit.

The flexible use with the 360° turnable connection flange allows a vertical and horizontal installation. The backwash process is a self-cleaning function of the heating filter. Another advantage is the use of backwash during the normal process. Just backwash and refill the water you used for the backwash process.

The installation of a heating filter as a preventive measure is absolutely recommended. We also recommend the installation of the HF 3425 to capture the dissolved particles before cleaning the heating system.



The operator's insurance and the manufacturer of any damaged parts may possibly have the right to withhold performance if no complete documentation can be submitted.

Our product tip

Compact heating filter HF 3425

- 360 ° turnable connection flange for vertical and horizontal installation
- Backwash function with hose connection
- Dry-mounted magnetic bar for collection of magnetite particles
- Connection size DN 25
- Water flow guarantee for closed heating circuits

Heating filter HF 3425

Serial no.	3425.25.000
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Degree of hardness, pH, conductivity – can anybody please explain?

Water, chemistry and heating installations

One German degree of water hardness (1 °dH) corresponds to 10 mg of calcium oxide or 7.19 mg of magnesium oxide per litre of water.

One millimole (mmol) of water hardness corresponds to 100 mg of calcium carbonate (CaCO₃) per litre of water.

The pH of the heating water must be within the alkaline range, between 8.2 and 10.0, in case of aluminium parts up to a maximum of 9.0 pH.

For a proper functioning and a long service life of modern heating installations, the quality of the filling water is important - which is why VDI Guideline 2035 was drawn up.

Yet what properties of the filling water have an effect on the heating installations? And how does it work? What is the link between the pH and the degree of hardness, conductivity and corrosion?

Degree of water hardness

High concentrations of calcium and magnesium salts make for hard water. This is why calcium and magnesium are also referred to as hardeners. Their presence determines the „total hardness“ of the water, measured in °dH / mol/m³. One German degree of water hardness (1 °dH) corresponds to 10 mg of calcium oxide or 7.19 mg of magnesium oxide per litre of water. One millimole (mmol) of calcium and magnesium ions corresponds to 100 mg of calcium carbonate (CaCO₃).

The degree of hardness (°dH / mol/m³) of the heating water should correspond to the indications given in Guideline VDI 2035. Accordingly, the recommended total water hardness is to be seen in the context of total heat output and the specific system volume. The installation should be filled with conditioned water (partly softened or completely demineralised), under consideration of the manufacturer's specifications.

The pH

The pH is the measure of the acidity or basicity of the water. The pH in heating water is an important factor and must be within the alkaline range between 8.2 to 10.0, as acidic water activates and accelerates corrosion processes. It affects the surface layers developing on the metals in the heating installation which serve as a natural protection against corrosion.

The aluminium parts (heat exchangers, radiators) can be damaged as from a pH of 8.2, so that a maximum pH of 9.0 can be tolerated.

The pH value must be measured annually with an electronic measuring instrument calibrated by means of two-point measurement.

Aluminium	8.2 to 9.0 *
other materials	8.2 bis 10.0 *

* Measuring tolerance of max. ± 0.2 in compliance with the specified conditions of VDI 2035

Electrical conductivity

Electrical conductivity ($\mu\text{s}/\text{cm}$) refers to the water's total salinity and should be as low as possible with regard to corrosion. High electrical conductivity of heating water speeds up or promotes corrosion processes. Low conductivity can be reached by using completely demineralised water (hardness grade ~ 0 °dH, conductivity < 100 ($\mu\text{s}/\text{cm}$)). The pH of the completely demineralised heating water should be checked after approx. eight to twelve weeks.

In case of completely demineralised water, permanent protection of the heating installation against corrosion can be achieved by using a protection concentrate for the heating installation such as HSK 2 from SYR.

Corrosion can occur via a reaction with oxygen. This is why the installation should not be filled with water unnecessarily and/or should not have any leaking parts in order to prevent oxygen injection. The oxygen content of the heating water should be around or below 0.1 mg/l. In case of low electrical conductivity of the water, slightly higher oxygen concentrations are acceptable.

Analysis of the heating water

Guideline VDI 2035 details how to carry out the measurements for the heating water analysis. It also defines the type of measuring devices to be used.

The analysis case from SYR contains all the necessary measuring devices and calibration solutions for a standard-conforming analysis of the heating water. The compact case is the ideal tool for measuring the water hardness and the electrical conductivity after the initial filling of the system, for checking the pH after 10 weeks at the earliest and for the annual maintenance measurements.

Important: The measurement and documentation of the parameters of total hardness, conductivity, pH and the visual check of the heating water during maintenance is mandatory.

Note: The pH of the heating water must be measured annually.

The electrical conductivity ($\mu\text{s}/\text{cm}$) refers to the water's total salinity and should be as low as possible.

Our product tip

Heating protection concentrate **HSK 2**

- Use with completely demineralised water to protect against corrosion
- Conductivity is maintained, the pH is raised
- Dosage with the SYR Canister pump 3200
- Cost and time saving: no further conditioning necessary
- ideal for initial fillings

Serial numbers on page 27

Avoid oxygen injection caused by unnecessary filling procedures at all costs - danger of corrosion.

Our product tip



For more information go to page 23

Guideline VDI 2035 stipulates that all measuring results must be documented and entered in a system logbook.

” When is the time to demineralise, when for softening? What’s the best way to do that?

Comparison of two conditioning procedures



It is imperative to respect the latest manufacturer’s specifications regarding the degree of hardness of the heating water.

The water softening procedure consists in replacing calcium and magnesium (hardeners) by sodium. The conductivity of the water remains unchanged, the other ingredients stay in the water.

It used to be so simple: just connect the filling hose to the drinking water system, open the draw-off valve and close it again once the system pressure was reached. Today, the specialist installer will need some knowledge of chemistry: softening, demineralisation, pH, conductivity of the water, etc.

Basically, there are different methods to prevent scaling (lime deposits) and to effectively protect heat generators, regulating valves, heating circuit pumps and other components.

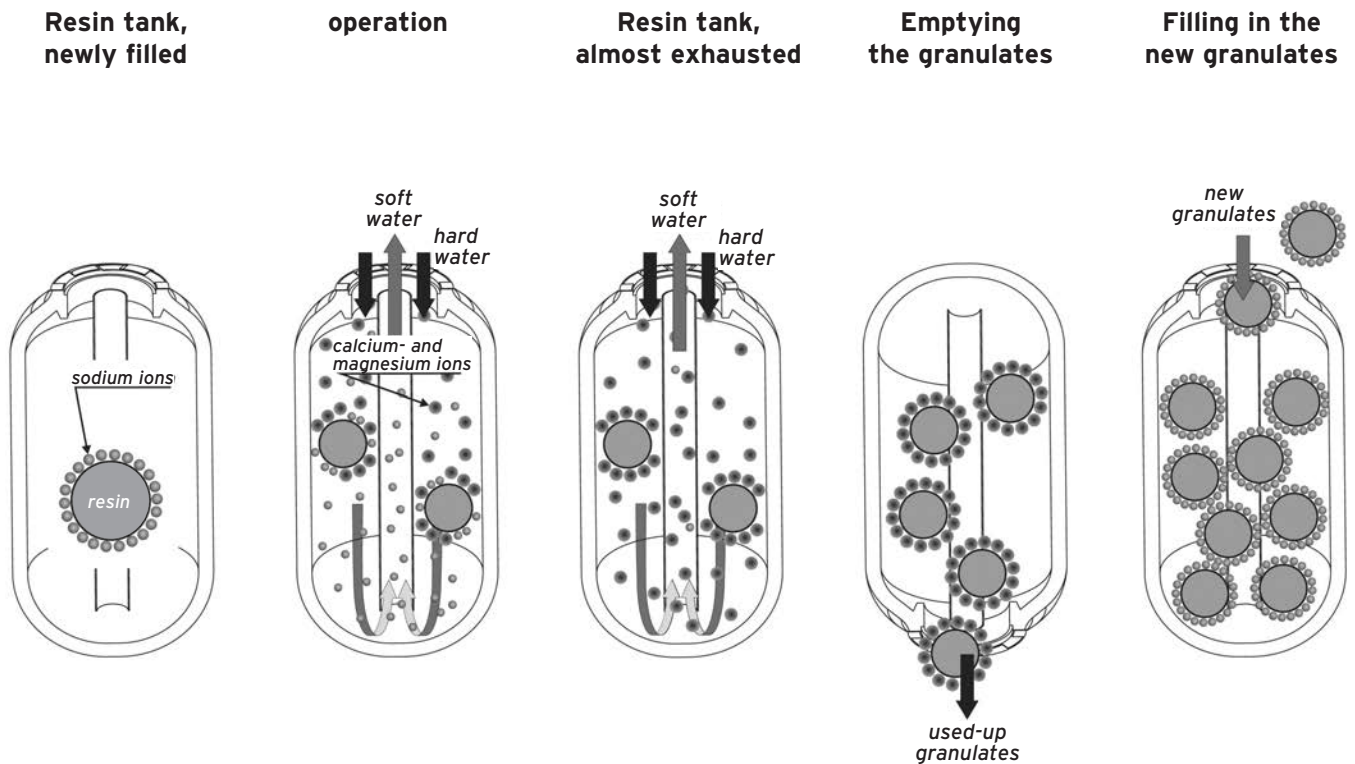
According to VDI 2035, filling water must either be softened or demineralised to guarantee the prescribed water quality. It is imperative to respect the manufacturer’s specifications.

The decision in favour of the one or the other conditioning method depends on the respective manufacturer’s specifications and on the desired conductivity of the water. This defines the total salinity (= total amount of minerals in the water) and can be easily determined by conductivity meters (see page 23 „Measuring devices for the purposes of analytics“).

Conditioning by water softening

The water softening procedure consists in replacing calcium and magnesium (hardeners) by sodium. During this procedure, the water flows through a cartridge with ion-exchange resin. The resin traps the minerals calcium and magnesium and replaces them by sodium ions. The conductivity of the water remains unchanged with this principle, so that the other ingredients stay in the water. Once the absorption capacity of the resin is exhausted, the replacement resin has to be renewed. This is referred to as a “salt-based operation” in heating installations. It comes at a rather reasonable price. The salts present in the water maintain a largely neutral pH.

Functional diagram of the refillable HWE cartridge



Conditioning by complete demineralisation

Other than in softening procedures with the replacement of ions in the water, complete demineralisation uses mixed bed resins to effectively remove all salts from the filling water.

The difference between demineralisation and softening lies in the conductivity of the water, as mentioned above. If one removes all the salts from the heating water, the conductivity drops, too. This then results in demineralised, particularly soft water - which is referred to as a „low-salt operation“ of the heating installation.

Given the low level of conductivity, galvanic corrosion between metals of different electrochemical series is reduced. However, the pH needs monitoring because it may drop below a particular value or see an extreme increase, which would then endanger materials such as aluminium, for example. Here, you can achieve permanent protection of the heating installation against corrosion by using a protection concentrate for heating installations such as HSK 2 from SYR.

Different "modes of operation"

Salt-based ↔ **Low-salt**

Softening
e.g. approx. 8 °dH
1,4 mol/m³

Demineralisation
e.g. 100 µs/cm

↓
**Conductivity
is maintained**

↓
**Conductivity
drops**

In case of complete demineralisation, the conductivity of the water decreases, the water is particularly soft - however, the pH should be monitored regularly.

The pH should not be checked until 10 weeks after filling.

” Filling and conditioning of the heating installation – is that possible without me having to take care of it?

Standard-conforming, fully automatic protection



**The All-in-One+ Connect
is the COMFORT model
for highest demands and
reliable safety.**

With our Connection Center All-in-One+ Connect, we offer a solution that keeps both, the specialist installer and the customer safe. The All-in-One+ Connect guarantees the smooth and effective operation of the heating installation - with fully automatic monitoring of the filling and water conditioning, determination of the conductivity and special leakage protection. Comfort at its best.

Heating water conditioning with refillable cartridge system

You can connect the All-in-One+ Connect to the SYR cartridge system with the connection set available as an accessory. Choose the respective method - and the corresponding cartridge - according to the result of the heating water analysis and the requirements of the system manufacturer.

Cartridges are available with different granulates: HWE to soften heating water, HVE to completely demineralise it and HVE Plus for heating water demineralisation with pH stabilisation. The built-in blending valve of the Connection Center can be switched from one procedure to the other. The digital capacity control continuously monitors the filling level of the cartridge and clearly displays the remaining amount of filling water. Cartridges come in various sizes and are easy to refill with the appropriate replacement granulate (tundish included). The specialist installers thus save a lot of time on site, as they do not have to get a new cartridge first.

If the connected cartridge is exhausted, the motor-driven stop valve automatically interrupts the filling process. This reliably prevents the heating installation from being filled with water that has not been conditioned.



Our product tip

ConnectionCenter All-in-One+ Connect

The internet-enabled COMFORT model

- Built-in Wi-Fi
- Control and monitoring via SYR App
- Messages via push notification/email (in online mode)
- Type BA backflow preventer
- Leakage protection module
- Electronic pressure monitoring and pressure reducing valve
- Control of conductivity
- Blending device
- Continuous monitoring of the filling water quality
- Motor-driven stop valve automatically interrupts the filling process when the cartridge is exhausted
- Digital display (indicates, among other things, the remaining capacity of the cartridge)
- Connection for cartridge
- Mounting on universal flange



Please find the specifications on page 25

Fully automatic filling process

Thanks to electronic pressure monitoring, the filling process is stopped once the desired system pressure has been reached or the system has been refilled with conditioned water in case of pressure loss. The filling frequencies are recorded, displayed in statistics and can be called up at any time. The initial system filling may also include the display of the total filling volume.

Suitable accessories may be added to the Connection Center All-in-One+ Connect such as to ensure that heating water can be conditioned or replaced without interrupting the operation of the system.

Built-in Wi-Fi

The All-in-One+ Connect is Wi-Fi-enabled: The built-in access point creates a local Wi-Fi network. The SYR app can then be used to create, monitor, check and control a project. For example, the smart valve informs you and/or the operator via push notification that the connected cartridge will soon be exhausted. That way, replacement granulates can be provided in good time.



Our product tip

Cartridge system HWE, HVE, HVE Plus

- Compact installation dimensions
- Softening (HWE) or complete demineralisation (HVE, HVE Plus with pH stabilisation)
- Available in sizes of 2.5, 4, 7, 14 and 30 litres
- Already filled
- Reusable with replacement granulates

Please find the specifications on page 25

” What solutions does SYR offer for filling the heating installation and for the conditioning of heating water?

Stationary and mobile filling of the heating installation

The stationary variant is preferable because it is the only one to guarantee a permanent filling of the installation with conditioned water.

Our product tips

Please find the specifications on page 25



There are two possibilities to fill heating installations: the stationary and the mobile variant. In general, the stationary variant is preferable as this is the only one to guarantee a permanent filling of the installation with conditioned water.

Stationary filling of the heating installation

The specialist installer has three SYR Connection Centers available for stationary filling: the BASIC 3200 model, the SPACE-SAVING 3228 All-in-One model and the COMFORT All-in-One+ Connect model. They can all be connected to the refillable SYR cartridge system for softening or complete demineralisation of the heating water. The built-in blending valve is simply set to the desired water conditioning method.

The digital capacity control of the Connection Center continuously calculates the remaining filling quantity of the connected cartridge and displays the remaining capacity in litres.

The type BA backflow preventer required for standard-conforming filling of the system in accordance with DIN EN 1717 is a built-in feature of the All-in-One+ Connect and the 3228 All-in-One. For the 3200, a FillingCombi BA has to be connected upstream.

The SPACE-SAVING 3228 All-in-One features pressure sensors and pressure reducing valves, and indicates inlet and outlet pressures on its LCD display.

The Connection Center All-in-One+ Connect is the COMFORT model with fully automatic monitoring of filling and water conditioning, determination of conductivity and special leakage protection.



Our product tips

Mobile filling of the heating installation

Whether for mobile initial filling or refilling - the SYR MobiFill or the SYR Fill-Caddy are always the right choice.

The SYR MobiFill filling station ensures an uncomplicated and inexpensive way for mobile initial filling of heating installations and for heating water conditioning as well as for refilling the installation at different locations. Simply screw the MobiFill onto the required cartridge for heating water conditioning. Cartridges for heating water softening (HWE), heating water complete demineralisation (HVE) or heating water complete demineralisation with pH stabilisation (HVE Plus) come in sizes of 2.5, 4, 7 and 14 litres. Replacement granulate is available for all cartridges.

Thanks to the digital capacity control, you can instantly check the remaining capacity of the cartridge. Even in case of variations in water hardness in different supply areas, we offer safe and flexible solutions by simply setting the parameters accordingly.

The SYR Fill-Caddy is particularly suitable for filling larger heating installations. With its tank fitted on a hand truck, it is easy to use on site. Connection is simple as the plug-in coupling fits on regular hose systems. Everything you need for standard-conforming filling is built-in: a type BA backflow preventer, a pressure reducing valve, two connecting hoses, a digital capacity control and an already filled 30-litre cartridge (HWE, HVE or HVE Plus). Of course, the cartridge can be refilled with replacement granulates.

Filling station MobiFill

- Convenient carrying recess for easy handling (up to 4-litre cartridge)
- Digital capacity control
- Connection to the SYR cartridge system
- Flexible connecting hoses (included)
- Ideally combined with the SYR back-flow preventers STBA 200 and 220

Please find the specifications on page 26

Our product tips



Fill-Caddy 3200

- 30 litre cartridge (already filled, refillable)
- ConnectionCenter 3200
- Prefilter upstream
- Filling Combi BA Euro (DVGW-tested)
- Digital capacity control
- Hardness tester
- Two connecting hoses
- Sturdy hand truck with pneumatic tyres

Please find the specifications on page 26

” How do I calculate the system volume?

Determining the system volume

The filling water volume can be easily determined by considering the total boiler output and the different heating surfaces.

The decision as to whether or how to condition the filling water depends on the one hand on the hardness of regional water (to determine the total hardness of the water, please cf. page 23 „Measuring devices for the purposes of analytics“), on the other hand on total heat output and the system volume according to VDI 2035 in addition to the manufacturer’s specifications.

The filling water volume can be easily determined from the total boiler output and the different heating surfaces.

Design of the system

Type of installation	Filling volume in litres/kW approx.
Column and steel radiators	35
Cast iron radiators	25
Underfloor heating ca. 60 W/m ²	20
Plate radiator	15
Convectors	10
Buffer storage system	> 20

Thanks to the three SYR connection centres in combination with the refillable SYR cartridge system, both heating water softening and complete demineralisation are possible. For each process, cartridges in sizes of 2.5, 4, 7, 10, 14 or 30 litres are available.

All three SYR connection centres have a digital capacity control, continuously calculate the remaining filling volume of the connected cartridge and display the remaining capacity in litres.





So which cartridge size should be chosen for which particular system?

The size depends on the capacity of the cartridge divided by the total hardness (in case of complete demineralisation) or on the difference between the raw water hardness minus the final hardness of the respective regional water (in case of softening).

Calculation of capacities

Example: 4 litre cartridge



HWE
 $^{\circ}\text{dH}$ 14,560 l capacity
 Raw water: 20 $^{\circ}\text{dH}$
 Softening to: 8 $^{\circ}\text{dH}$
 Hardness difference:
 $20 - 8 = 12$
 $14,560 \text{ litres} / 12 =$
1,213 litres capacity

mol/m^3 2,600 l capacity
 Raw water: 4 mol/m^3
 Softening to: 1 mol/m^3
 Hardness difference:
 $4 - 1 = 3$
 $2,600 \text{ litres} / 3 =$
866 litres capacity



HVE
 5,000 l capacity / $^{\circ}\text{dH}$
 Raw water: 20 $^{\circ}\text{dH}$
 Softening to: 0 $^{\circ}\text{dH}$
 Hardness difference:
 20
 $5,000 \text{ litres} / 20 =$
250 litres capacity

900 l capacity
 Raw water: 4 mol/m^3
 Softening to: 0 mol/m^3
 Hardness difference:
 4
 $900 \text{ litres} / 4 =$
225 litres capacity



HVE-Plus
 3,500 l capacity / $^{\circ}\text{dH}$
 Raw water: 20 $^{\circ}\text{dH}$
 Softening to: 0 $^{\circ}\text{dH}$
 Hardness difference:
 20
 $3,500 \text{ litres} / 20 =$
175 litres capacity

600 l capacity
 Raw water: 4 mol/m^3
 Softening to: 0 mol/m^3
 Hardness difference:
 4
 $600 \text{ litres} / 4 =$
150 litres capacity

Used-up cartridges can be refilled with the appropriate replacement granulate (for heating water softening or complete demineralisation; cartridges come in sizes of 2.5, 4, 7, 10, 14 and 30 liters).

Calculation formula for 4 litre softening cartridge

$$\frac{\text{Capacity}}{\text{Hardness difference (20 } ^{\circ}\text{dH} / 4 \text{ mol}/\text{m}^3 - \text{final hardness level)}} = \frac{14,560 / 2,600 \text{ litres}}{(20 ^{\circ}\text{dH} - 8 ^{\circ}\text{dH} = 12 ^{\circ}\text{dH}) (4 \text{ mol}/\text{m}^3 - 1 \text{ mol}/\text{m}^3 = 3 \text{ mol}/\text{m}^3)} = \mathbf{1,213 / 866 \text{ litres}}$$

Calculation formula for 4 litre demineralisation cartridge

$$\frac{\text{Capacity}}{\text{Total hardness (20 } ^{\circ}\text{dH} / 4 \text{ mol}/\text{m}^3)} = \frac{5,000 / 900 \text{ litres}}{(20 ^{\circ}\text{dH} / 4 \text{ mol}/\text{m}^3)} = \mathbf{250 / 225 \text{ litres}}$$

” What has to be considered in respect of pH and oxygen concentrations of the heating water?

Corrosion protection and pH

Our product tip

Protection concentrate for heating installations HSK 1

- Use with untreated, softened or low-salt water as corrosion protection and for hardness stabilisation
- Raising the pH
- Dosage with the SYR Canister pump 3220
- Ideal for heating installations in existing buildings or for new filling after purging the installation

Serial numbers on page 27

Our product tip

Protection concentrate for heating installations HSK 2

- Used with fully demineralised water for corrosion protection
- Conductivity is maintained, the pH level rises
- Dosage with the SYR Canister pump 3220
- cost and time saving: no further conditioning required
- only for initial fillings

Serial numbers on page 27

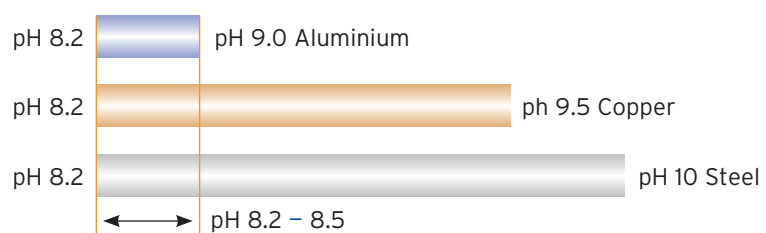
The pH level

In addition to scale formation due to excessive water hardness, corrosion is the enemy of your heating installation. A low pH and high temperatures favour corrosion of metallic materials, and even low oxygen concentrations can lead to corrosion and erosion of metallic boiler and pipe materials (manifested in an increasing discoloration of the boiler water and/or accumulation of sludge within the system).

To avoid such damage in heating installations, VDI Guideline 2035 lists the possibilities of corrosion protection via water conditioning.

If, for example, the installation is fitted with the three materials aluminium, copper and steel, the pH of the heating water should be between 8.2 and 9.0. This is where the protected range of the three materials overlaps - and thus corrosion cannot occur.

„Protected“ pH-range of different materials





Oxygen concentration

Apart from the pH, the oxygen content in the heating water plays a significant role when it comes to corrosion. Air or oxygen is added during the feed-in of fresh water; however, it can also get into the system through leaks, areas of negative pressure or pipe materials that are not diffusion-resistant.

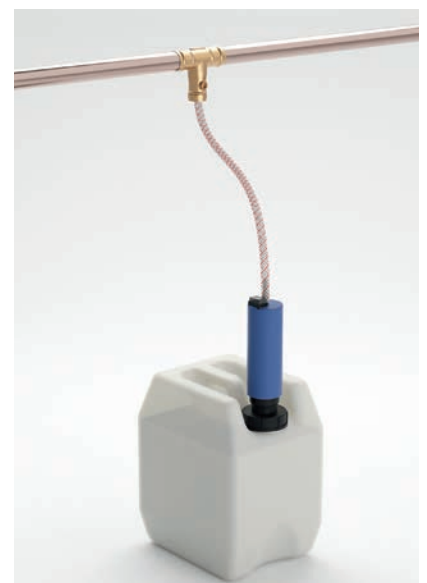
Adding corrosion inhibitors to the heating water prevents potential corrosion and the formation of rusty water when there is oxygen in the system.

SYR offers effective protection concentrates for the heating installation for both applications: HSK 1 for existing systems with untreated, softened, low-salt water as well as for refilling once the system has been purged; and HSK 2 for the initial filling of new heating installations with fully demineralised water. When using HSK 2, the conductivity of the heating water remains almost unchanged. The protection concentrates for the heating installations are fed into the closed heating water system by means of the SYR canister pump 3220.

The optimum solution for completely demineralised water

In case of complete demineralisation of the heating water, we recommend the combination of the SYR canister pump 3220 and our HSK 2 protection concentrate for heating installations. The pump is simply mounted onto the filling tank and connected to the heating installation. The suitable dose of 0.5 percent HSK 2 is introduced - thus preventing corrosion permanently and reliably stabilising the pH level.

In case of heating water containing oxygen, protection concentrates for heating installations prevent potential corrosion.



Our product tip

Canister pump 3220 with filling set

- For filling protection concentrates into closed heating water systems
- Can be screwed directly onto the filling tank
- Set with connecting hose included

Please find the specifications on page 27

Practical Guide - two case studies

Step by step - filling heating installations

Calculation formula for 7-litre complete demineralisation cartridge

$$\frac{\text{Capacity}}{\text{Total hardness (20 °dH / 4 mol/m}^3\text{)}}$$

$$\frac{8,750 / 4,550 \text{ litres}}{(20 \text{ °dH / 4 mol/m}^3)} \\ = \mathbf{437.50 / 1,137.5 \text{ litres}}$$

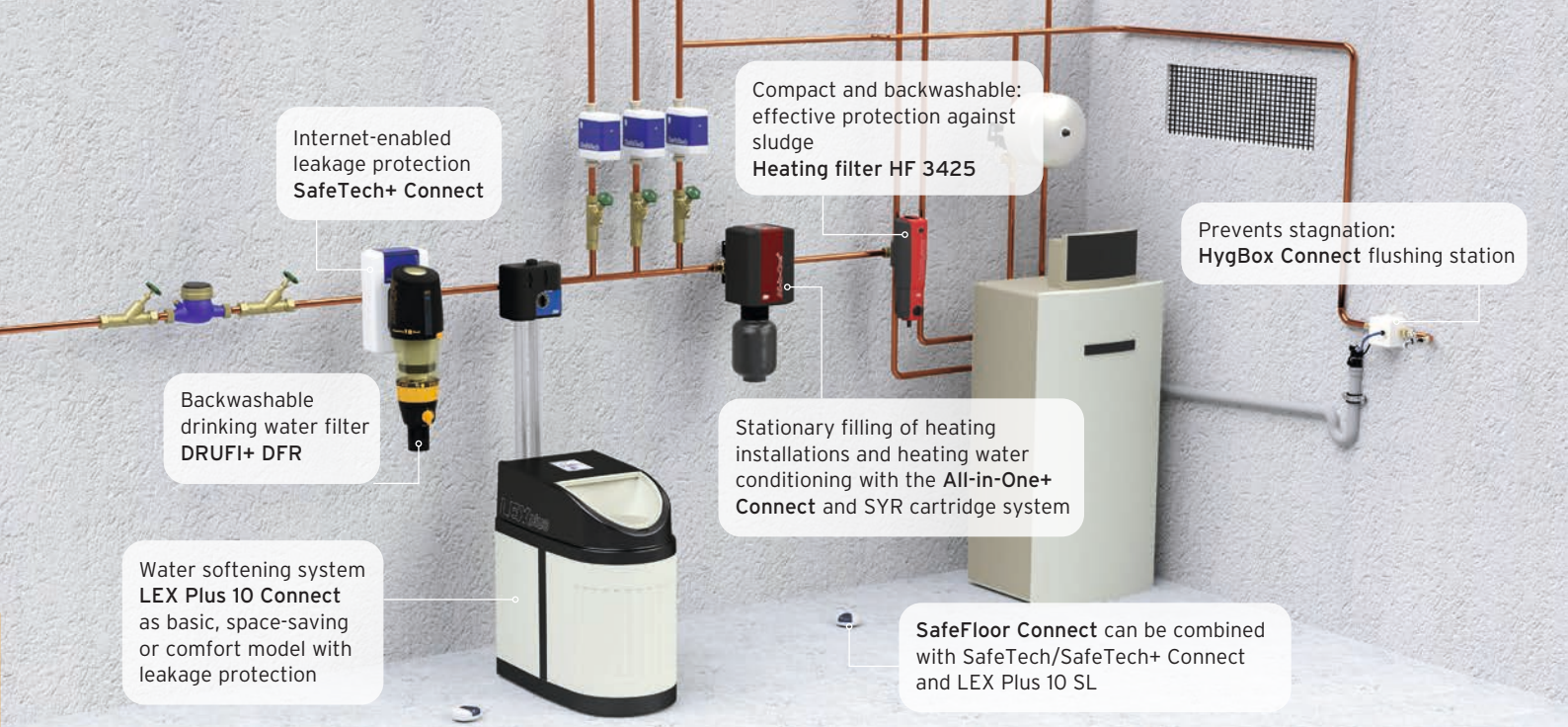
**The upstream installation
of a filling combination
according to DIN EN 1717
for filling heating installations
is mandatory.**



Please find the specifications on page 27

Condensing boiler, 20 kW, underfloor heating Manufacturer's instruction: complete demineralisation

- Step 1** Determining the initial hardness by means of the SYR titration test
Example: 20 °dH / 4 mol/m³
- Step 2** Determining the system volume:
20 kW x 20 litres /kW = 400 litres
- Step 3** Selection of the cartridge:
Capacity of a 7-litre cartridge HVE:
8,750 litres / 20 °dH = 437.50 litres
4,550 litres / 4 mol/m³ = 1,137.5 litres
- Step 4** Installation of a SYR Connection Center (for the BASIC model 3200 a BA filling combination is mandatory upstream) and 7-liter HVE cartridge
- Step 5** Control of conductivity with a conductivity meter
- Step 6** Document filling procedure
- Step 7** After 10 weeks at the earliest, check hardness, conductivity and pH parameters (two-point measurement pH 7/10) and document the measured values.
In case of an incorrect pH corrosion protection can be reached by using the protection concentrate for heating installations HSK 2.
- Step 8** Annual documentation of pressure maintenance, the pH, conductivity and volumes of make-up water, regularly flush filtration
During maintenance, measuring and documenting the total hardness, the conductivity, the pH as well as performing a visual check of the heating water is mandatory.



Condensing boiler, 20 kW, radiators Manufacturer's instruction: Partial softening to 8 °dH

- Step 1** Determining the initial hardness with the SYR titration test
Example: 20 °dH / 4 mol/m³
- Step 2** Determining the system volume:
20 kW x 25 litres /kW = 500 litres
- Step 3** Selection of the cartridge:
Capacity of a 4-litre cartridge HWE:
14,560 litres / °dH = 14,560 litres / 12 °dH = 1,213 litres
2,600 litres / mol/m³ = 2,600 litres / 3 mol/m³ = 866 l
- Step 4** Installation of SYR Connection Center (for the BASIC model 3200 a BA filling combination is compulsory upstream) and 4-liter HWE cartridge
- Step 5** Control of initial hardness with the titration tes
- Step 6** Document filling procedure
- Step 7** After 10 weeks at the earliest, check hardness and pH parameters (two-point measurement pH 7/10) and document the measured values.

In case of an incorrect pH, corrosion protection can be reached by using protection concentrate for heating installations HSK 1.

- Step 8** Annual documentation of pressure maintenance, the pH, hardness and volumes of make-up water, regularly flush filtration

During maintenance, measuring and documenting the total hardness, the conductivity, the pH as well as performing a visual check of the heating water is mandatory.

Calculation formula for 4-litre softening cartridge

$$\frac{\text{Capacity}}{\text{Hardness difference}} \\ (20 \text{ °dH} / 4 \text{ mol/m}^3 - \text{final hardness})$$

$$\frac{14,560 / 2,600 \text{ litres}}{(20 \text{ °dH} - 8 \text{ °dH} = 12 \text{ °dH})} \\ (4 \text{ mol/m}^3 - 1 \text{ mol/m}^3 = 3 \text{ mol/m}^3) \\ = 1,213 / 866 \text{ litres}$$



How do I determine heating water quality myself?

Your path to perfect heating water



Water quality is crucial for perfect heating operations - optimum energy yield can only be achieved when the water quality matches the heating installation, thus making sure that your investment is secured in the long run.

Untreated water, on the other hand, can cause costly damage to the heating installation - and may even result in the loss of the manufacturer's warranty.

Professional analysis of the heating water

The SYR sampling set for professional heating water analysis can be ordered from your specialist wholesaler. The scope of delivery includes a set of bottles, instructions for use, a sample information sheet and a DHL return label.

Serial no. 3200.00.999

Fill the set of bottles according to the instructions, fill in the sample information sheet and the DHL return label, pack everything together and send it directly to SYR:

Hans Sasserath GmbH & Co. KG
Heizungswasseranalyse PROFI
Mühlenstr. 62 • D-41352 Korschenbroich

After about ten working days, you will receive the measurement results. Given that the test procedure is complex and time-consuming, this service is subject to a charge.

We at SYR will be happy to advise you on the implementation of suitable measures for optimum heating water on the basis of your measurement results.

Our product tip

Heating water analysis PROFI

- Set of bottles for the most accurate measurement results
- Easy sampling
- Competent SYR advice on the implementation of the necessary measures based upon the measurement result
- Ordering and invoicing via specialist wholesalers



DIY test of the heating water

Corrosion quick test HSK 1: The quick and inexpensive way to test the water for corrosive components. Two vials, each with an integrated steel plate (one with the HSK 1 additive), are filled with tap or heating system filling water. If the water contains any corrosive properties, it will turn rusty brown in the bottle without the HSK 1 additive after two days.

Serial no. 3200.00.025

Measuring filling water hardness: Hardness tester for total hardness and carbonate hardness, in two different versions.

Serial no. 3000.00.913 (complete), 3000.00.937 (mini)

Measuring electrical conductivity: conductivity meter as a simple aid for filling heating installations with demineralised water or for checking during operation (measurement results are indicated directly in microsiemens).

Serial no. 3200.15.905

pH-measuring device: Handy pH-measuring device with two-point measurement pH 7/10 for fast, VDI-conforming measurement of the pH.

Serial no. 3200.00.918

All in one - the SYR analysis case: pH-measuring device with two-point measurement pH 7/10 for fast, VDI-conforming measurement of the pH and the corresponding calibration/buffer solutions pH 7.01 and 10.01; conductivity meter as a simple aid for filling heating installations with demineralised water or for the purposes of checking the installation during operation (measurement results in microsiemens, with calibration solution); hardness tester for total hardness and carbonate hardness.

Serial no. 3200.00.010





How do I document, that I have filled the system properly?

Keeping a system logbook

**The Guideline
(VDI 2035, Annex C)
requires a system logbook
to be kept for systems
with a boiler output >50 kW.**

**The system logbook provides
an overview of the measures
required and those carried out -
for the safety of the manufacturer
and the operator of the system.**

The responsibility for the heating water and the operation of the installation lies with the operator. Given that the operator is usually a layman, the planner or the specialist sanitation, heating and A/C company is asked to counsel and advise the operator accordingly.

The Guideline therefore requires that a system logbook be created and kept for installations with a boiler output >50 kW.

The following values must be entered in this system logbook:

- Total hardness of the filling or make-up water
- System volume
- Total heating capacity, for multi-boiler systems also the individual heating capacities
- Quantity of filling and make-up water expected during the service life of the installation
- Additives for water conditioning (type and quantity)
- Water quality assessment
- pH
- Conductivity
- Pressure control data (static pressure control, inlet pressure with diaphragm expansion tank, final pressure, opening pressure of relief valve).

The quality of the heating water and pressure control shall be checked at least once a year and recorded in the system logbook.

Failure to keep a system logbook may result in warranty restrictions and claims for damages.

You can download a template for the system logbook at:
www.syr.de > Support > Forms/Service

Specifications

Stationary heating system filling and water treatment

Connection Center 3228 All-in-One+ Connect

Max. operating pressure type BA backflow preventer	10 bar
Max. operating temperature	30 °C (inlet), 65 °C (outlet)
Medium	drinking water
Outlet pressure	3 bar (factory setting 1.5 bar)
Filling capacity	0.5 m ³ /h
Mounting position	main axis horizontal
Connection size	DN 15
Serial no.	3228.15.015



The upstream connection of a filling combination is mandatory for the filling of a heating installation according to DIN EN 1717.

Connection Center 3228 All-in-One

Max. operating pressure	10 bar
Max. operating temperature	30 °C (inlet), 65 °C (outlet)
Medium	drinking water
Outlet pressure	1 - 5 bar (factory setting 1.5 bar)
Filling capacity	0.5 m ³ /h (0.3 m ³ /h with 2.5 l cartridge)
Mounting position	main axis horizontal
Connection size	DN 15
Werks-Nr.	3228.15.025



Connection Centers 3228 All-in-One+ Connect and 3228 All-in-One include a type BA backflow preventer.

Connection Center 3200

Max. operating pressure	10 bar
Max. operating temperature	30 °C (inlet), 65 °C (outlet)
Medium	drinking water
Outlet pressure	1 - 5 bar (factory setting 1.5 bar)
Filling capacity	0.5 m ³ /h (0.3 m ³ /h with 2.5 l cartridge)
Mounting position	main axis horizontal
Connection size	DN 15
Werks-Nr.	3200.15.025



With the Connection Center 3200, a type BA backflow preventer must be connected upstream - such as the SYR Filling Combi BA (Serial no. 6628.20.000).



	Serial no.	Replacement granulate	Capacity
Cartridge softening (HWE)			
litres 2.5	3200.00.021	3200.00.942	9,100L/°dH / 1,600 mol/m ³
4	3200.00.001	3200.00.904	14,560L/°dH / 2,600 mol/m ³
7	3200.00.003	3200.00.906	25,480L/°dH / 4,550 mol/m ³
10		3200.00.937	6,500 mol/m ³
14	3200.00.004	Please order 2 x 7 litres	50,960L/°dH / 9,100 mol/m ³
30	3200.00.018	Please order 3 x 10 liters	109,200L/°dH / 19,500 mol/m ³
Cartridge complete demineralisation (HVE)			
litres 2.5	3200.00.022	3200.00.943	3,125L/°dH / 560 mol/m ³
4	3200.00.011	3200.00.914	5,000L/°dH / 900 mol/m ³
7	3200.00.013	3200.00.916	8,750L/°dH / 1,575 mol/m ³
10		3200.00.938	2,250 mol/m ³
14	3200.00.014	Please order 2 x 7 litres	17,500L/°dH / 3,150 mol/m ³
30	3200.00.017	Please order 3 x 10 liters	37,500L/°dH / 6,750 mol/m ³
Cartridge complete demineralisation (HVE Plus) with pH stabilisation			
Liter 2.5	3200.00.023	3200.00.944	2,185L/°dH / 390 mol/m ³
4	3200.00.015	3200.00.927	3,500L/°dH / 600 mol/m ³
7	3200.00.005	3200.00.926	6,500L/°dH / 1,050 mol/m ³
10		3200.00.939	1,500 mol/m ³
14	3200.00.006	Please order 2 x 7 litres	13,000L/°dH / 2,100 mol/m ³
30	3200.00.016	Please order 3 x 10 liters	27,850L/°dH / 4,500 mol/m ³

Mobile filling of the heating installation and water conditioning



MobiFill filling station

Max. operating pressure	6 bar
Max. operating temperature	30 °C (inlet), 65 °C (outlet)
Medium	drinking water
Max. filling capacity	0.5 m ³ /h (0.3 m ³ /h with 2.5 l cartridge)
Serial no.	3200.00.040

A type BA backflow preventer must be connected upstream when filling a heating installation according to DIN EN 1717. The backflow preventers STBA 200 or 220 are a perfect fit for a combination with the mobile filling station MobiFill.

Cartridge system up to 14 litres



Fill-Caddy 3200

Max. operating pressure	
Prefilter	16 bar
FüllCombi BA Euro	10 bar
ConnectionCenter	6 bar
Max. operating temperature	30 °C (inlet) / 65 °C (outlet)
Medium	Drinking water
Outlet pressure	1 – 5 bar
Weight	approx. 55 kg
Flow rate	0,5 m ³ /h

Supplied with filled cartridge of your choice.

	Serial no.	Replacement granulate 10 l	Capacity
Fill-Caddy 3200 (HWE) filled with 30 litre cartridge for softening	3200.15.030	3200.00.937 Please order 3 x 10 litres	109,200L/°dH 19,500 mol/m ³
Fill-Caddy 3200 (HVE) filled with 30-litre cartridge for complete demineralisation	3200.15.031	3200.00.938 Please order 3 x 10 litres	37,500L/°dH 6,750 mol/m ³
Fill-Caddy 3200 (HVE Plus) filled with 30-litre cartridge for complete demineralisation with pH stabilisation	3200.15.027	3200.00.939 Please order 3 x 10 litres	27,850L/°dH 4,500 mol/m ³

Effective protection against sludge



Heating filter HF 3425 compact

Max. operating pressure	10 bar
Operating temperature	10 °C to 110 °C
Fluid	heating water
Minimum pressure f. backwashing	1.5 bar
Mounting position	any
Mesh size	100 µm
Flow rate	2.56 m ³ /h at Δp 0.1 bar
	3.20 m ³ /h at Δp 0.15 bar
	3.60 m ³ /h at Δp 0.18 bar
Kvs-value	8.0
Serial no.	3425.25.000

Filling combinations (mandatory for filling according to DIN EN 1717)

Filling Combi BA 6628

Max. operating pressure	10 bar
Max. operating temperature	30 °C (inlet) / 65 °C (outlet)
Medium	drinking water
Filling capacity	1.35 m ³ /h at Δp 1.5 bar
Outlet pressure	0.5 - 4 bar (factory setting 1.5 bar)
Mounting position	horizontal, tundish connection pointing downwards
Serial no.	6628.20.000

Can be combined with the Connection Center 3200 without accessories!



FüllCombi BA 6628 Plus with double pressure gauge

Max. operating pressure	10 bar
Max. operating temperature	30 °C (inlet) / 65 °C (outlet)
Medium	drinking water
Filling capacity	1.5 m ³ /h at Δp 1.5 bar
Ausgangsdruck	1.5 - 5.5 bar (factory setting 1.5 bar)
Mounting position	horizontal, tundish connection pointing downwards
Serial no.	6628.20.008

Screw joints to connect the Filling Combi BA Plus with the Connection Center 3200: Serial no. 0805.20.902



BA 6628 Plus

Max. operating pressure	10 bar
Max. operating temperature	30 °C (inlet) / 65 °C (outlet)
Medium	drinking water
Filling capacity	0.9 m ³ /h at Δp 1.5 bar
Ausgangsdruck	1 - 5 bar (factory setting 1.5 bar)
Mounting position	horizontal, tundish connection pointing downwards
Serial no. BA 6628 Plus	6628.20.005

According to VDI 2035 / Sheet 2, Annex C, the installation of water meter is mandatory from 50 KW!



Corrosion protection and pH increase

Canister pump 3220

Max. operating pressure	5 bar
Medium	inhibitors, non-adhesive liquids (not suitable for sealants)
Mains connection	230 V / 50 Hz
IP Code	IP64
Max. output	100 l/h
Operating temperature	30 °C
Ambient temperature	40 °C
Serial no.	3220.00.012

Protection concentrates for heating installations

Serial no.	HSK 1	5 litre canister	3220.00.013
	HSK 1	10 litre canister	3220.00.014
Serial no.	HSK 2	5 litre canister	3220.00.015
	HSK 2	10 litre canister	3220.00.016



