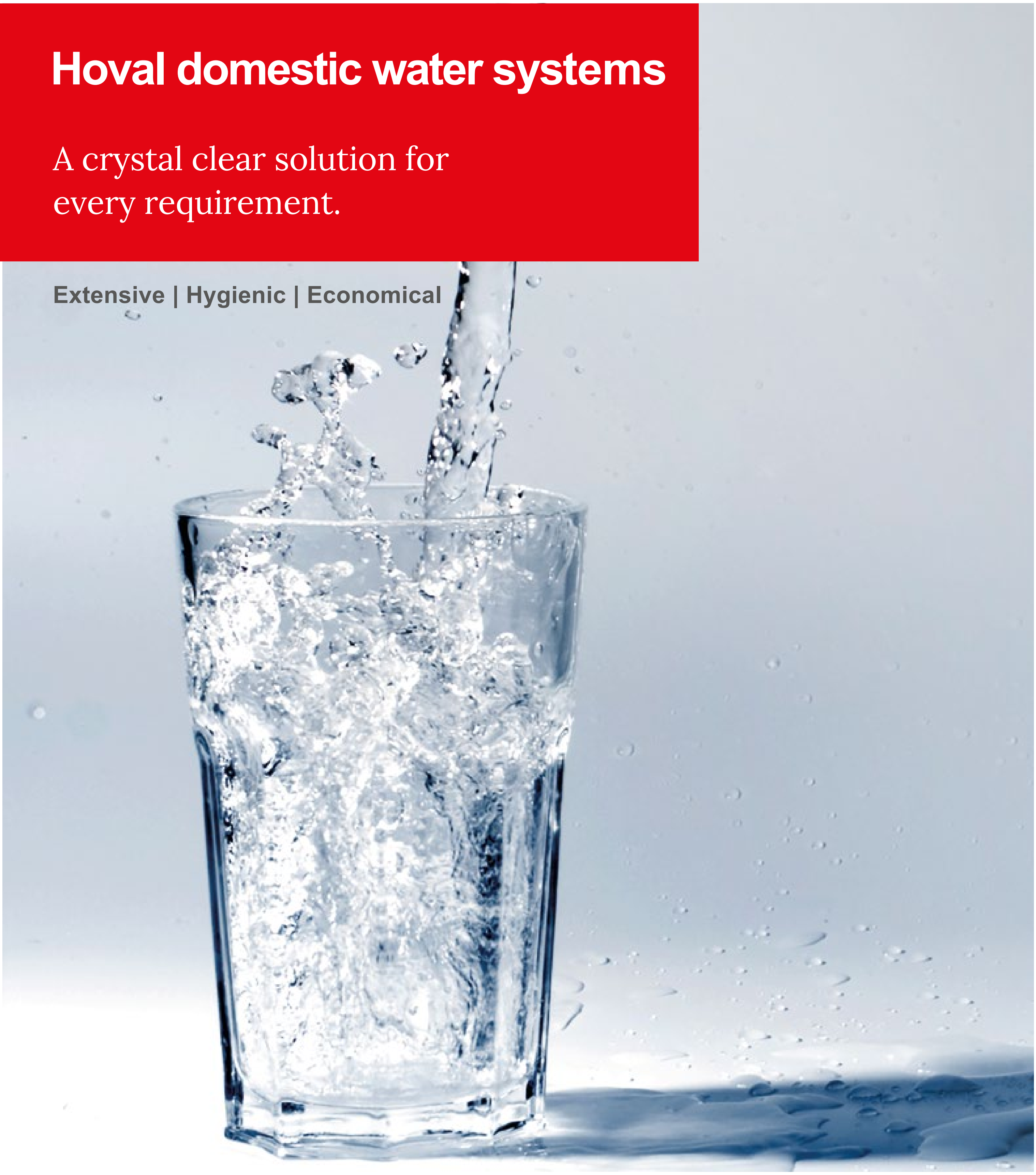
FACTBOOK

Hoval domestic water systems

A crystal clear solution for
every requirement.

Extensive | Hygienic | Economical



Hoval | Responsibility for energy and environment

Hoval domestic water systems
Careful handling of a valuable resource.

Water is life!
However, water does not only mean life, it is also a habitat. This underlines how domestic water heating systems are subject to stringent hygiene requirements with regard to "water" for drinking. This is also covered in the relevant standards for the operation, planning and execution of domestic water heating systems. Hoval is very aware of its responsibilities in this regard and fulfils these requirements conscientiously.

Content

Basics – Water
Introduction.

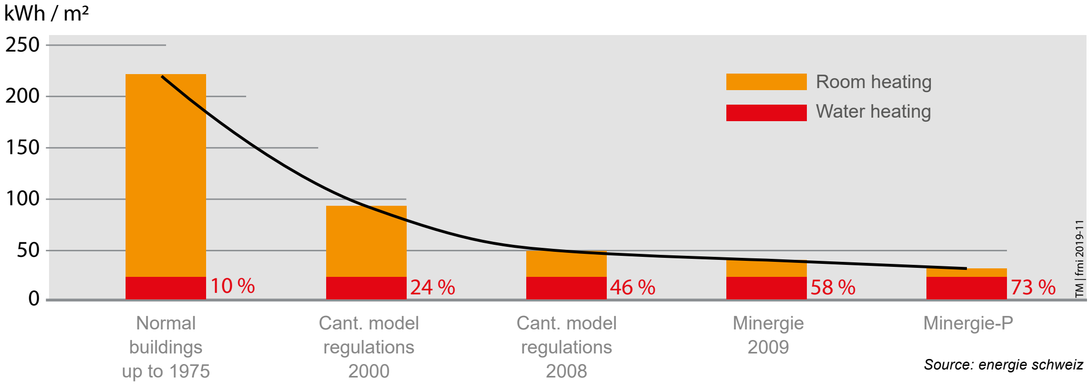
Water – a valuable resource.

Water – and particularly domestic hot water – is valuable. The costs for cold water and waste water alone (assuming this is charged along with the water) can be in the order ofmagnitude of the electricity costs of a flat. Added to this are the costs for heating the domestic hot water. Economical use of domestic hot water therefore pays off.

Heat demand for room heating and domestic hot water

In well-insulated residential buildings, the heat demand of the hot water supply is often higher than the heat demand for room heating (diagram). This is because, thanks to better thermal insulation and exploitation of solar radiation through the windows, less and less energy is used for room heating, while the domestic hot water requirement remains more or less the same.

Therefore, choosing an efficient domestic hot water supply system is as important as any heating system. Although many building owners are interested in their new heating system, they are not aware that the hot water system is equally important for the energy demand of a building.



Source: energie schweiz

Meeting consumption and demand

Domestic hot water is needed all year round. It must be provided throughout the year.
The requirement for domestic hot water must be identified in order to design the system. Average values have been defined for water consumption in the household on a per capita basis. In order to meet peak demand, the draw-off characteristics of the particular application, i.e. when how much water is demanded, are also decisive. All of the information stated above can be influenced by various factors.

How much domestic hot water do we need?

On average, each person uses around 140 litres of water per day, of which about 50 litres is domestic hot water. Thus, a 4-person household can manage on around 75,000 litres of domestic hot water per year, which costs around CHF 1,000 to heat up, depending on the system and efficiency. A large part of this can be saved through efficient systems and economical use. Very frugal households need less than half the average.

Source: energie schweiz

Consumption for	litres / day and person
Cooking, drinking	3
Washing car	3
Watering garden	6
Other	8
Washing dishes	9
Physical hygiene	9
Washing laundry	17
Showers	44
Flushing toilet	46
Total	**145**

Properties of the water
Requirements / water hardness / hygiene.

Properties of the water
The properties of water are of fundamental importance for life on Earth. These physical, chemical, electrical and visual properties are based on the structure of the water molecule and the resulting chains and interactions between water molecules.
In nature, water does not occur in its pure form, it almost always contains dissolved substances (predominantly salt ions), even though these may only be in scarcely measurable concentrations. Such dissolved substances change the properties of the water.

General information about water
- Countries have different domestic water source intakes, such as ground water, water from primary rock and limestone.
- The factors that determine reactions in all waters are the temperature, salt load, free and bound gases – these determine positive, negative and unpleasant reactions in the system.
- Water containing lime results in a protective covering layer (to a greater or lesser extent/as an advantage/disadvantage).
- Water without lime can lead to problems -> counteracted by correct installation.
- In an increasing number of cases, water from public sources requires post-treatment.
- Limescale and salt stains on the washbasin etc. are not always a reason to install water softening systems. Detergents contain additives to counteract limescale. Washing machines receive their softening agent along with the washing powder (dosage quantity).
- Small appliances are/can be delimed using vinegar or citric acid.
- Protection for calorifiers: magnesium or inert (external current) anodes.

Water hardness
Water hardness is created when water passes through the earth and/or ground water channels (aquifers). As a result, which hardening substances, and what quantity of them, enter into solution with the water significantly depends on the geographical conditions underground. That explains the geographical distribution of water hardness.
Hardness is understood to be the calcium and magnesium compounds dissolved in the water.
The total hardness is composed of carbonic hardness and non-carbonic hardness:

Subdivisions and conversion of degrees of hardness
The total hardness of water can be referred to in degrees:
1 degree of German hardness (1 °dH)
1 °dH = 10 mg calcium oxide (CaO) / 1 litre or corresponding to 7.2 mg (Ca) / 1 litre water
Extended conversion tables in the appendix.

Hygiene


Legionella are bacteria that can cause Legionnaire's disease, which is often fatal. Drinking legionella in domestic water is considered harmless, but spraying and inhaling them as aerosol is dangerous. According to the present state of knowledge, legionella proliferate most when they remain in areas of warm water between 32 and 42 °C for long periods; they are killed at 60 to 65 °C.
Hot water storage tanks with temperature stratification are unfavourable. Regular desludging is recommended, as sludge provides a good breeding ground. Rarely used pipe branches represent a risk of contamination and should therefore be shut down.
Circulation up to the draw-off point should be the objective, as well as high hot water temperatures, at least for a short time, to kill the legionella.
In the case of electrical trace heating without circulation pipe, it is possible to heat up temporarily to 65 °C via an automatic switching device (thermal disinfection).

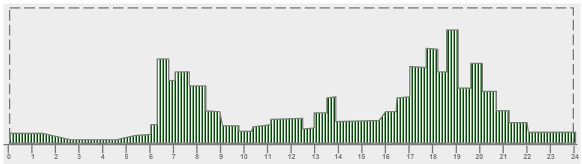
Properties of the water

Drawing-off characteristics / simultaneity.

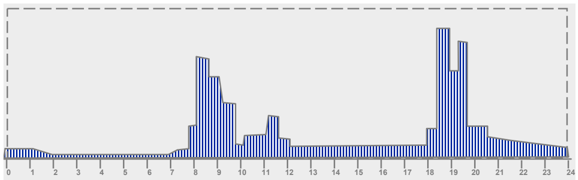
Draw-off characteristics

The draw-off characteristics represent the domestic hot water consumption over 24 hours. Below, there are some examples of draw-off characteristics from various sectors. As the diagrams show, the requirements differ considerably from sector to sector.

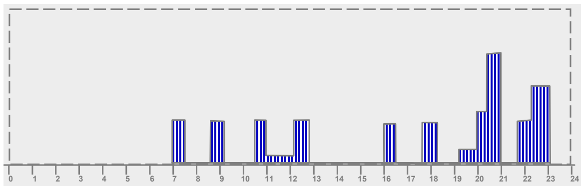
Housing scheme



Hotel

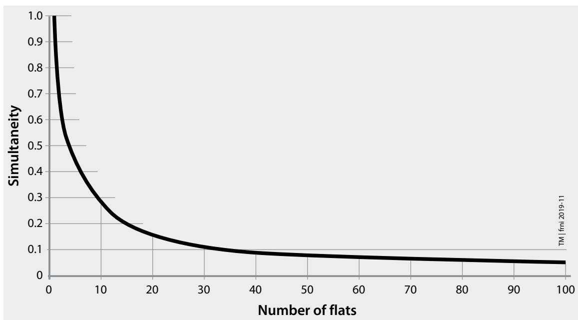


Schools, gymnasiums and sports halls



Simultaneity of drawing off domestic hot water

Simultaneous opening of all draw-off points in an entire system can usually be excluded. The maximum expected simultaneity of drawing off domestic hot water is primarily influenced by the consumption characteristics.



Principles / concepts

Overview.

Hoval

Content

Domestic water concepts

Every person is dependent on water being available every day. Domestic hot water accounts for a considerable part of this demand. A reliable and constantly available supply of hot water is necessary. Different solutions are conceivable from conventional instantaneous water heaters to modern technologies.

Domestic hot water means makes for an uncomplicated everyday lifestyle

It comes from the Wall and flows out through taps and shower heads easily and conveniently: domestic hot water.
No household can do without Water at a pleasant temperature. For our daily hygiene and for relaxation, hot Water is more of a fundamental than a luxury. Washing, showering and bathing are activities we have learned from childhood and up to wash off the dirt of the day from our body.

The effort involved in heating up Water is quite considerable from the standpoint of energy. Conventional gas and oil-fired heating systems must have integrated parallel circuits for heating domestic hot water. Some sensible strategies exist to bring energy consumption under control. In addition, modern technologies such as the use of heat pumps and solar panels can enable considerable savings without sacrificing comfort.

With its broad product portfolio, Hoval offers a complete package – HovalSolution – consisting of heat generation, distribution and domestic water systems, and this is overlaid by a uniform TopTronic® E system controller.

Hoval domestic water systems – the right solution for every requirement.

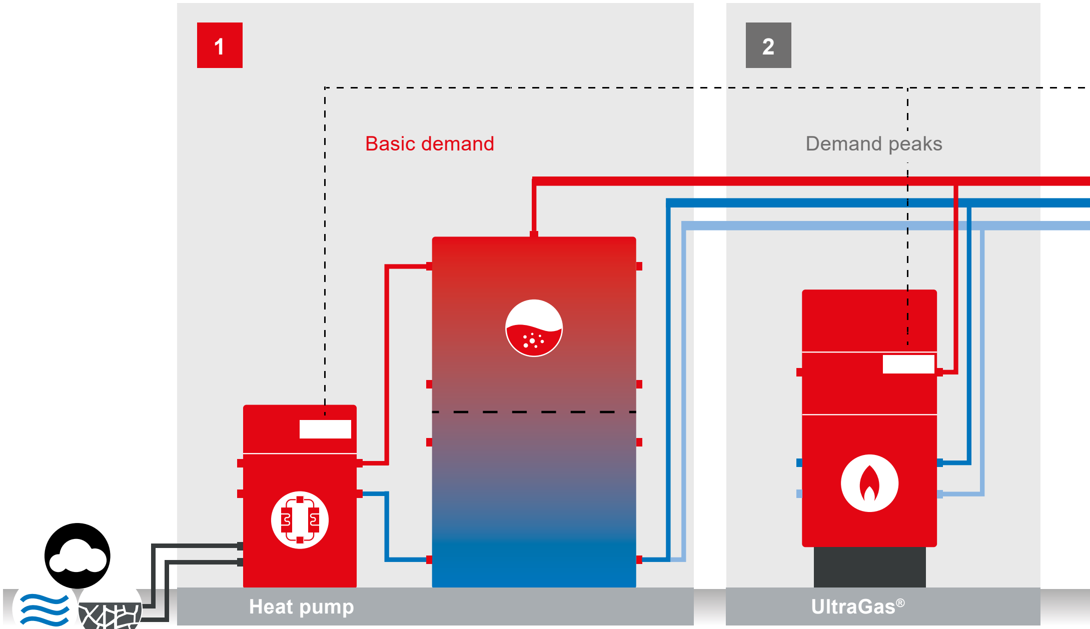
HovalSolution

A modular system for individual solutions.

Hoval energy systems – HovalSolutions – are made up of individual modules. Together, these modules form a complete system that is more efficient than the sum of its parts. Each individual module is responsible for a particular task within the complete system. The standardised system control serves as the basis for virtually any combination of modules.

Modern heat generation
Heat and/or power? Gas, oil, pellets, sun and ambient energy or district heating? Reliable technologies for cost-effective operation. Hoval has the right product for you!

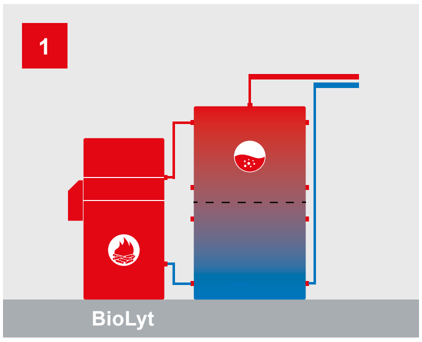
Heat generation



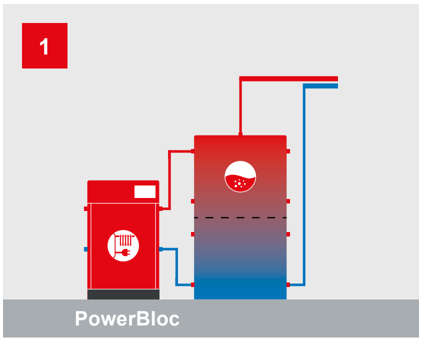
Hybrid system with renewable energy.
Use of renewable energy (geothermal or air-source heat pump). Basic load is covered by the heat pump.

State-of-the-art heat generator.
Gas condensing boiler with stepless power adjustment and maximum efficiency.

Alternative domestic water systems



System solution with pellet boiler.
Meets legal requirements (EEWärmeG (German Renewable Energy Sources Act), MuKEn (Swiss energy regulations for buildings)), gas condensing boiler for peak load and hot water in summer.



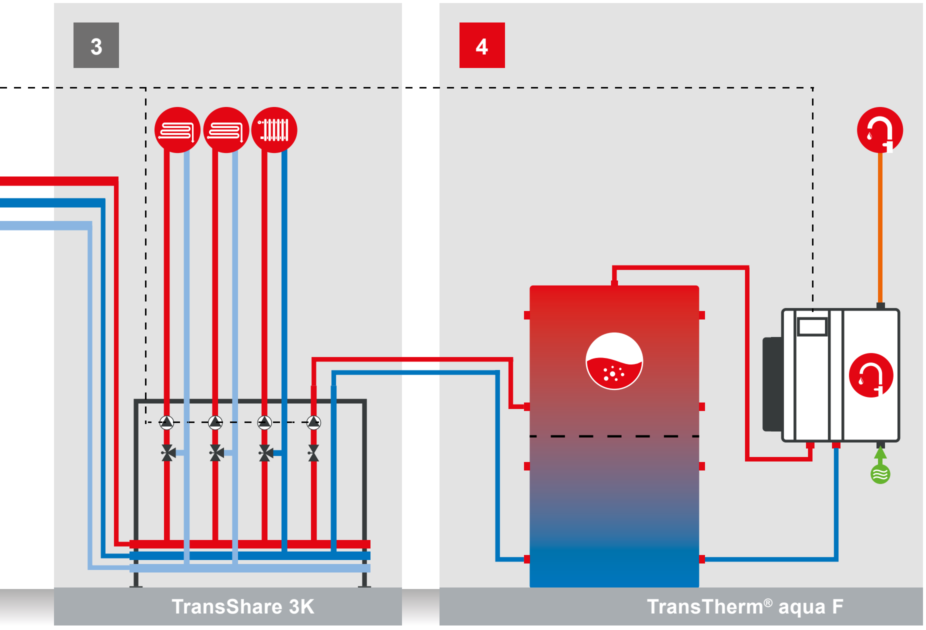
Heat and power in the smallest of spaces.
CHP plants provide heat and power reliably and cost-effectively.

HovalConnect app HovalConnect HovalSupervisor

Hoval

Hoval TopTronic® system controller.
All Hoval products have a standardised controller, allowing them to be combined quickly to form a customised and efficient energy solution. Simple, standardised operation and connection to Internet or control system for remote access.

Heat distribution system **Domestic water system**



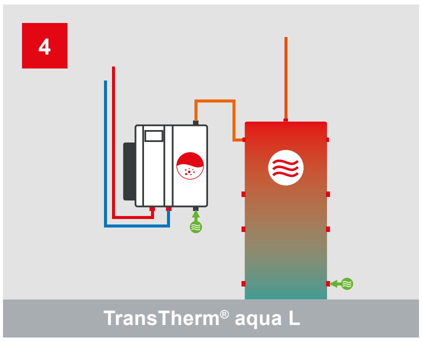
Ready-to-connect distribution systems.
Standard distributor or configurable distributor systems

Instantaneous calorifier with buffer storage tank.
High hygiene standards because there is no storage of domestic water, excellent protection against legionella bacteria.

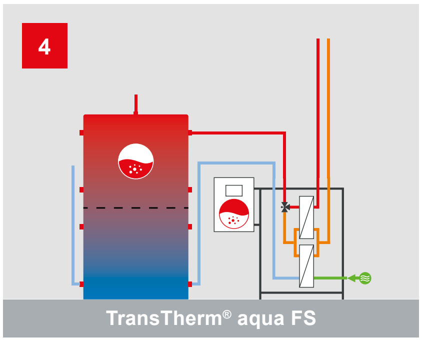
Hygienic domestic water preparation

Humans need domestic water to survive – but bacteria can thrive in it too. This underlines how important it is for domestic water heating systems to meet stringent hygiene requirements. This is also covered in the relevant standards for the operation, planning and execution of domestic water heating systems. Hoval is very aware of its responsibilities in this regard and fulfils these requirements in full.

Alternative domestic water systems



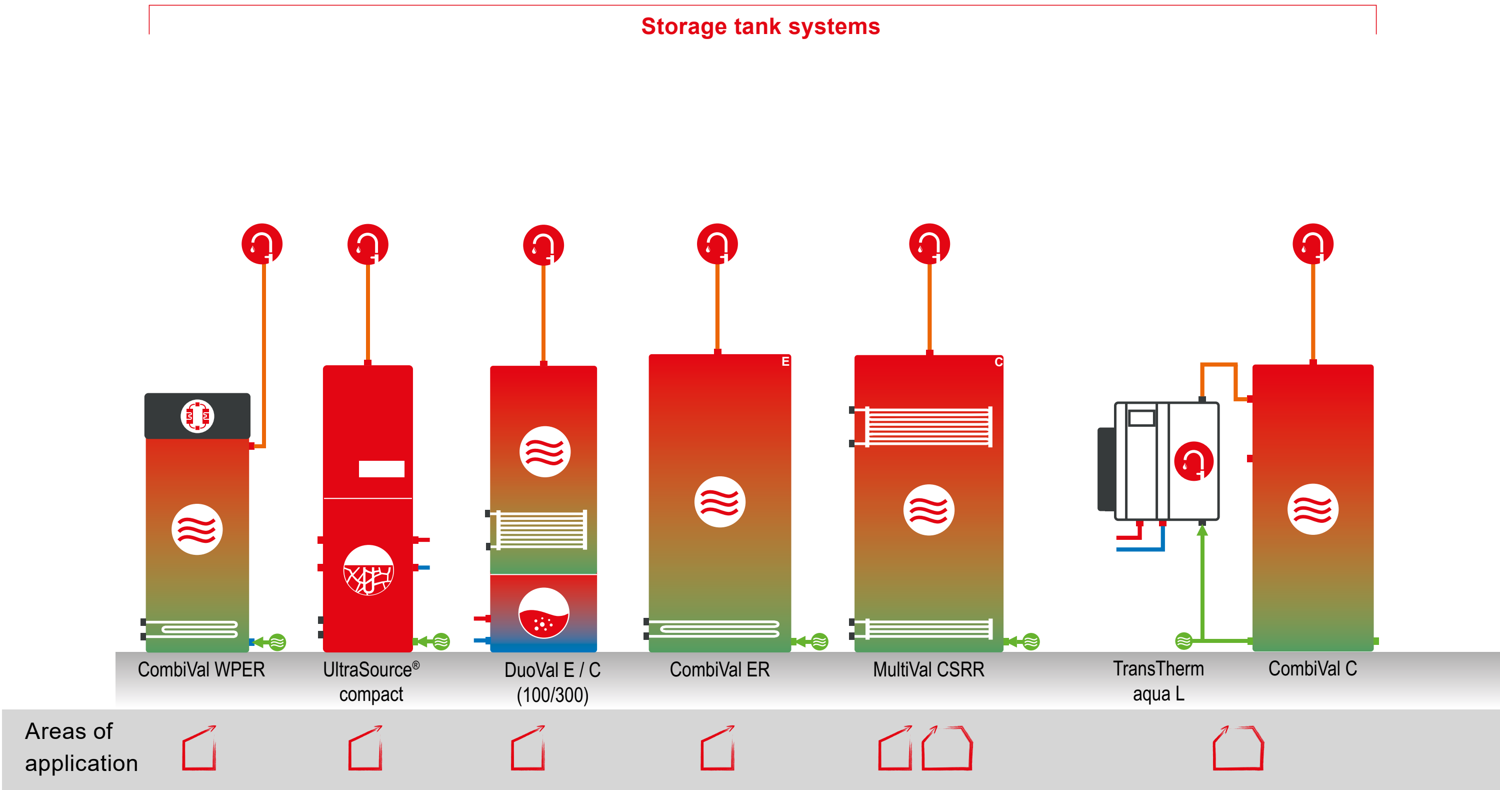
Buffer storage solutions in conjunction with charging heat exchangers.
Storage and heating during draw-off by the heat exchanger (output allocation).



Fresh water module in conjunction with 2 heat exchangers.
Low return temperatures in the heating water when charging by means of two-stage heat exchanger switching. Ideal for connection to condensing boilers, solar-thermal systems, district heating networks.

Domestic water concepts
Overview.

Domestic water concepts
Basic distinction between domestic water storage systems and continuous flow systems. With **storage tank systems**, domestic water is stored for immediate use, i.e. at the desired temperature. The storage of domestic hot water also leads to the general topic of hygiene / legionella.

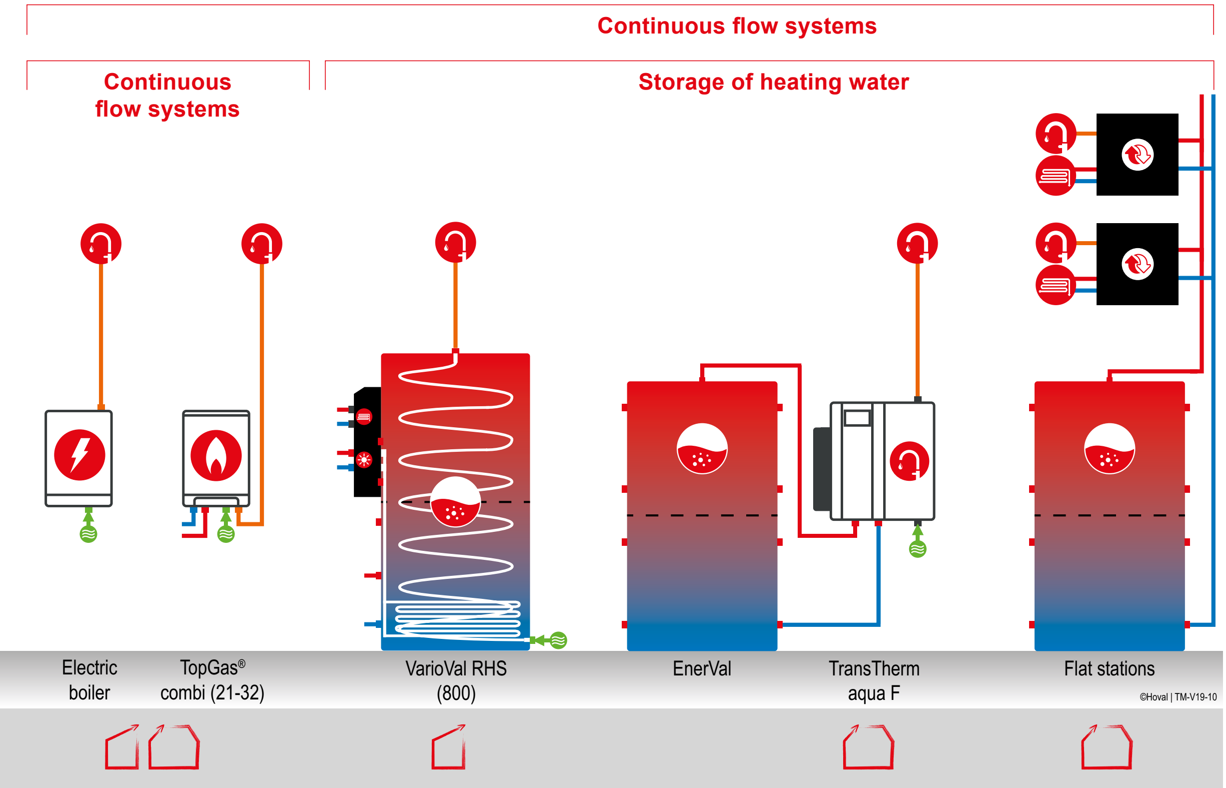


Storage tank systems
In practice, the storage tank system is often known as a "hot water storage tank". In the storage tank system, cold domestic water (cold water) is heated and stored until it is drawn off. For this purpose, the hot water storage tank has a storage tank with integrated heat exchanger.
The heat exchanger of a hot water storage tank is always located in the lower part of the storage tank. Therefore, according to the gravity principle, the heated domestic water, which is "light" due to the difference in density, can rise up to the hot water draw-off point by itself and then distribute itself evenly throughout the entire storage tank.

Buffer storage solutions
The main difference between a buffer storage solution and a storage tank system is the arrangement of the heat exchanger for water heating. In a storage tank system, a heat exchanger is integrated in each storage tank, whereas the buffer storage solution is charged via an external heat exchanger.

Legend
- Single-family home
- Block of flats, commercial building, hotel, sporting facilities, clinics, residential homes

With **continuous flow systems**, no or very little domestic water is stored, and even if it is, then only to cover the first peak demand. In case of higher demand, some systems store heating water to cover very high peaks.



Fresh water systems

Systems with fresh water stations differ from storage and buffer storage systems in that they do not have any hot water storage. The stations heat the domestic water via a heat exchanger as it flows through. To provide the amount of heat required, buffer storage tanks are used which are heated directly by a heat generator, or the power is provided directly (continuous flow system).

Characteristics values	
Domestic hot water requirement	50 litres / day and person
Energy requirement for hot water	100 litres fuel oil / year and person
Shower	6 - 20 l/min (15 - 45 kW)
Heat demand for single family house 150 m² with energy efficiency class A < 25 kWh/m² year	400 litres fuel oil / year

Properties
Advantages and disadvantages.

	Storage tank systems			
				
	Heat pumps Calorifier	**Heat pump UltraSource® compact**	**Compact storage tank DuoVal E / C**	**Storage tank Enamel**
+	Efficient domestic hot water heating	Efficient domestic hot water heating	Efficient domestic hot water heating	Large water quantities with relatively small thermal outputs
	Regenerative	Regenerative	Regenerative	Large draw-off capacities without delay
–	Small domestic hot water capacity, only suitable for single family house, long recharging times	Small domestic hot water capacity, only suitable for single family house	Small domestic hot water capacity, only suitable for single family house	For heat pumps, exact dimensioning of the coil surface area is necessary
	Danger of legionella	Danger of legionella	Danger of legionella	Danger of legionella
Evaluation				
Hygiene	■ ■	■ ■	■ ■	■ ■
Energy efficiency	■ ■ ■ ■ ■	■ ■ ■ ■ ■	■ ■ ■ ■	■ ■ ■
Cleaning	■ ■	■ ■	■ ■	■ ■ ■ ■
Operational safety	■ ■ ■ ■	■ ■ ■ ■ ■	■ ■ ■ ■ ■	■ ■ ■ ■ ■

		Continuous flow systems		
				
Storage tank Stainless steel	**Buffer storage solution**	**Combination storage tank (pipe coil)**	**Fresh water system**	**Home stations**
Large water quantities with relatively small thermal outputs	Rapid availability at the draw-off point, compl. heating of the water	Efficiency by stratification, small proportion at elevated temperature	Especially hygienic hot water preparation, as there is no water storage	for heating and water heating
Large draw-off capacities without delay	High peak consumption, full heat exchanger capacity depending on storage tank volume	Space-saving; only one storage tank required	Rapid availability	Compact and easy to install
With problematic domestic water qualities	Hygienic		Hygienic	Hygienic
For heat pumps, exact dimensioning of the coil surface area is necessary	Observe water hardness, danger of limescale build-up	Small domestic hot water capacity, only suitable for single family house	Observe water hardness, danger of limescale build-up	Observe water hardness, danger of limescale build-up
Danger of legionella	Exact planning and adjustment required during commissioning	Complex hydraulic integration	Exact planning and adjustment required during commissioning	Exact planning and adjustment required during commissioning
■ ■	■ ■ ■ ■	■ ■ ■	■ ■ ■ ■ ■	■ ■ ■ ■ ■
■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
■ ■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
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Hoval domestic water systems

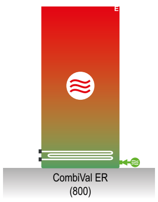
Overview.

			Storage tan
			
	Heat pumps Calorifier	**Heat pump UltraSource® compact**	**Compact storage tank DuoVal E / C**
Draw-off capacity			
[L] 45 °C / 10 min (70 °C flow)	270	200	360
[L] 45 °C / h	270	200	720
NL	1	1	2
Areas of application			
Single-family home	✓	✓	✓
Block of flats, central	×	×	×
Block of flats, decentralised	×	×	×
Commercial (industry)	×	×	×
Hotel	×	×	×
Sports facilities / communal showers	×	×	×
Clinic	×	×	×
Residential / retirement home	×	×	×
Technical features			
Circulation	✓	✓	✓
Use with heat pump	included	included	included
Water quality standard	medium	medium	medium
Water treatment recommendation	optional	optional	optional
Solar energy system integration	possible	×	×

nk systems			Continuous flow systems	
				
Storage tank Enamel	**Storage tank Stainless steel**	**Buffer storage solution**	**Fresh water system**	**Combination storage tank (pipe coil)**
290 - 1'000	370 - 3'300	340 - 4'700	27 - 2'000	> 350
520 - 3'000	500 - 3'600	1'000 - 10'000	270 - 12'000	> 600
1 - 31	1 - 105	13 - 200	13 - 198	13 - 200
✓	✓	×	✓	✓
✓	✓	✓	✓	✓
×	×	×	×	×
✓	✓	✓	✓	×
✓	✓	✓	✓	×
✓	✓	✓	✓	×
✓	✓	✓	✓	×
✓	✓	✓	✓	×
✓	✓	✓	✓	✓
possible	possible	×	possible	possible
medium	medium	high	high	medium
optional	optional	✓	✓	optional
possible	possible	×	possible	included

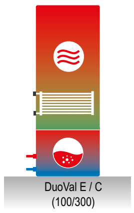
Product range
Overview.

Content



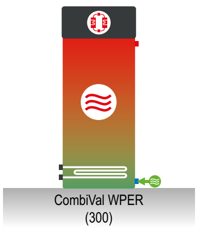
Domestic water storage tank

Domestic water storage tank for heating domestic water. Storage tank made from steel, enamelled on the inside or stainless steel. With one or two built-in heat exchangers.



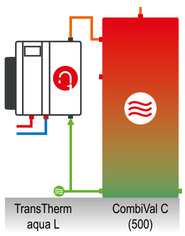
Compact storage tank DuoVal E / C

Compact storage tank for heat pumps with integrated buffer storage tank (100 litres) and a calorifier made of steel, enamelled inside, or stainless steel.



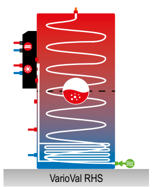
Heat pump calorifier

Turnkey domestic water storage tank with built-in air/water heat pump for heating domestic hot water.



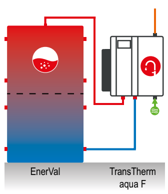
TransTherm® aqua L buffer storage solutions

Turnkey station for heating domestic water using the buffer storage principle.
With stainless steel plate heat exchangers. Wall-mounted, with built-in TopTronic® E system controller.



Stratified storage tank with fresh water system VarioVal RHS

Hygienic combination storage tank with stratification principle for heating domestic water and heating water. Steel storage tank for heating water. A built-in steel heat exchanger for solar integration and a built-in corrugated tube heat exchanger made from stainless steel for heating domestic water.



Fresh water system TransTherm® aqua F

Turnkey station for heating domestic water using the continuous flow principle. With plate heat exchanger made of stainless steel. Wall-mounted, with built-in TopTronic® E system controller.

DuoVal E / C (100/300)

Compact storage tank for heat pumps.

Compact storage tank for heat pumps with integrated buffer storage tank (100 litres) and a calorifier made of steel, enamelled inside, or stainless steel.

Application

Buffer storage tank and hot water storage tank for the classical two-storage-tank solution with heat pump combined in one component.

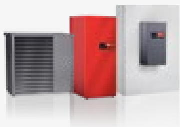
Optimum protection

Water heater with enamel coating on the inside with protective anode or completely made of stainless steel. Cleaning flange and optional electric heating element.

Energy efficiency

80 mm PU rigid foam insulation with soft jacket.

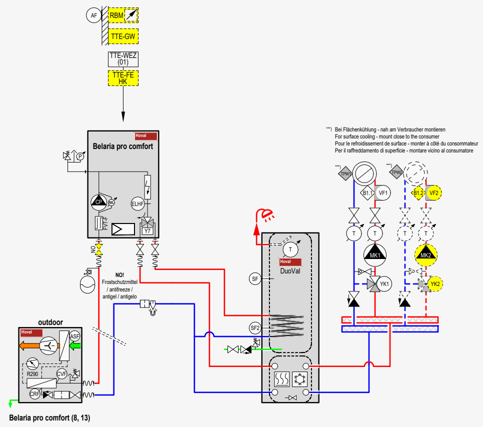
Compact storage tank for the following Hoval heat pumps

				
UltraSource® B comfort C (8,11)	Belaria® pro comfort (8,13)	Belaria® comfort ICM (8,13)	Daikin Altherma 3 H HT W (14,18)	UltraSource® T comfort (8,13)

Technical data

		E (100/300)	C (100/300)
Transport weight	kg	174	160
Tilting measure / Diameter / Height	mm	1970 / Ø 760 / 1800	
Thermal insulation polyurethane rigid foam, foam-lined	mm	80	
Thermal insulation λ	W/mK	0.024	
Fire protection class	-	B2	
Heat loss at 65 °C	W	76	
Buffer storage tank			
Volume	l	101	
Max. operating/test pressure	bar	3/4.5	
Min./max. operating temperature	°C	7/95	
Calorifier			
Volume	l	295	293
Max. operating/test pressure	bar	10/15	6/12
Max. operating temperature	°C	95	95
Heating coil (built-in)			
Heating surface	m^2	3.5	3.12
Heating water	l	21	19
Max. operating/test pressure	bar	10/15	10/15
Max. operating temperature	°C	95	95

DuoVal system with heat pump



CombiVal / MultiVal domestic water storage tank

Single and multiple coil solutions.

Domestic water storage tank for heating domestic water. A wide range of enamel and stainless steel calorifiers with single or multiple coils; different coil sizes for heating with oil/gas/biomass or heat pump/solar.

Broad range
Enamel and stainless steel calorifiers with a broad volume range. Single coil or multiple coil with different coil sizes.

Optimum protection
Water heater with enamel coating on the inside with protective anode or completely made of stainless steel. Cleaning flange and optional electric heating element.

Energy efficiency
Efficient thermal insulation by means of rigid polyurethane foam or polyester fibre fleece with patented aluminium sealing strip.

Patented flat section coil (stainless steel)
Maximum surface in minimum space for more standby volume and optimum transfer rate. Reduces limescale build-up.

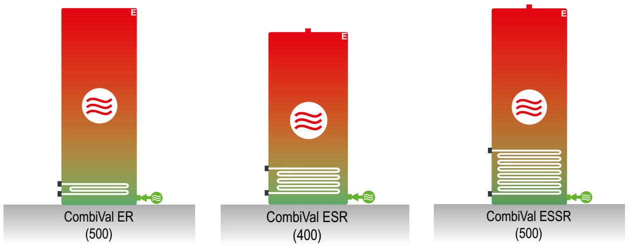
CombiVal E.. (200 - 1000) / CombiVal C.. (200 - 2000)
MultiVal E.. (300 - 1000) / MultiVal C.. (500 - 2000)

Single coil storage tank

CombiVal

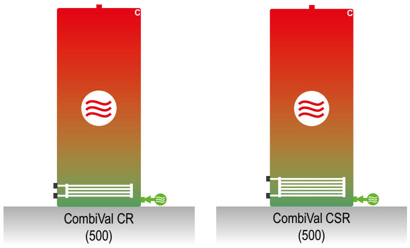
CombiVal enamelled

- Domestic water storage tank for heating domestic water
- Storage tank made from steel, enamelled on the inside
- With one built-in heat exchanger



CombiVal stainless steel

- Domestic water storage tank for heating domestic water
- Stainless steel storage tank
- With one built-in heat exchanger

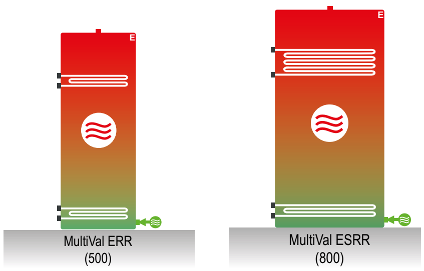


Multiple coil storage tank

MultiVal

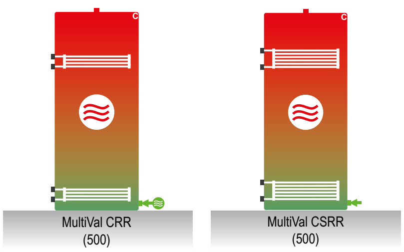
MultiVal enamelled

- Domestic water storage tank for heating domestic water
- Storage tank made from steel, enamelled on the inside
- With two built-in heat exchangers



MultiVal stainless steel

- Domestic water storage tank for heating domestic water
- Stainless steel storage tank
- With two built-in heat exchangers



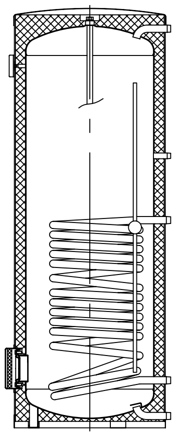
Enamelled storage tank
Structure.

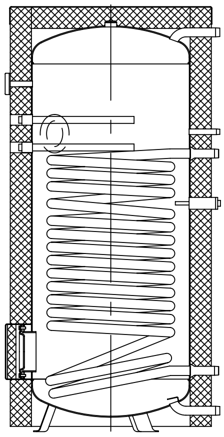
Enamelling
The interior of the calorifier is coated with enamel. Enamel is a glass coating which bonds to the steel in an enamelling furnace at approx. 870 °C. This glass coating is very stable, chemically speaking, and prevents corrosion.

CombiVal

Calorifier made of steel, enamelled on the inside, with one enamelled plain-tube heat exchangers which is permanently installed.

- Plain-tube heat exchanger, enamelled, permanently installed
- Magnesium protection anode built in
- Flange for electric heating element
- Thermal insulation made from polyurethane rigid foam, directly foam-lined on the calorifier
- Removable foil casing
- With thermometer and sensor duct

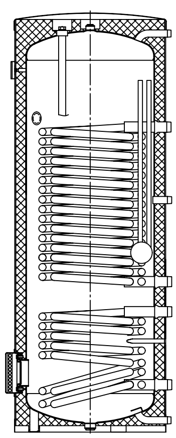

CombiVal ER (500)

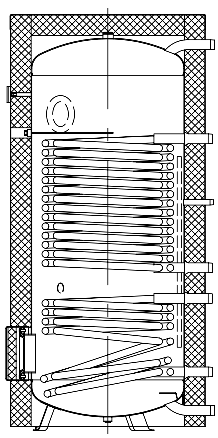

CombiVal ER (800)

MultiVal

Calorifier made of steel, enamelled on the inside, with 2 enamelled plain-tube heat exchangers which are permanently installed.

- 2 Heat exchanger
  - Bottom for alternative usage
  - Top for supplemental heating with oil, gas or wood-heated boilers
- Magnesium protection anode built in
- Flange for electric heating element
- Thermal insulation made from polyurethane rigid foam, directly foam-lined on the calorifier
- Removable foil casing
- With thermometer and sensor duct


MultiVal ESSR (500)


MultiVal ESSR (800)

Stainless steel storage tank

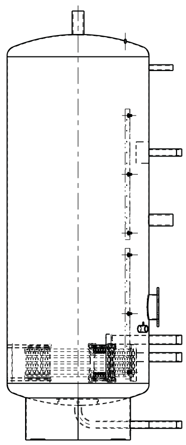
Structure.

Stainless steel

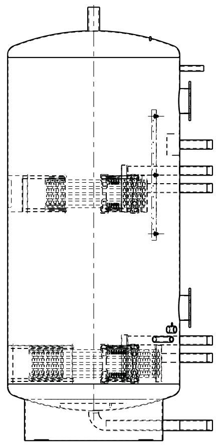
The stainless steel calorifiers are manufactured entirely from corrosion-resistant stainless steel. They meet the highest requirements in terms of hygiene and service life. Protection anodes are not necessary with stainless steel.

CombiVal / MultiVal

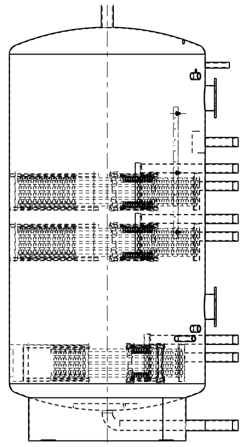
- Calorifier made of stainless steel
- Patented flat-section coil
- Thermal insulation made from polyester fleece with patented aluminium sealing bracket
- Removable polyurethane outer jacket
- Flange for electric heating element
- With thermometer and immersion sleeves



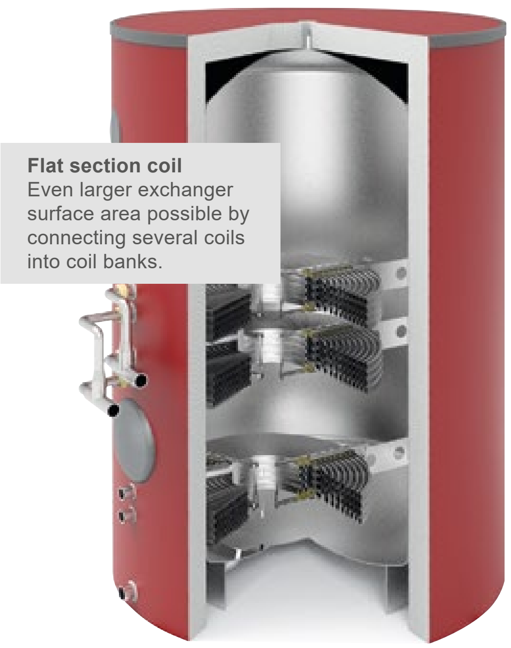
CombiVal CR (500)



MultiVal CRR (800)



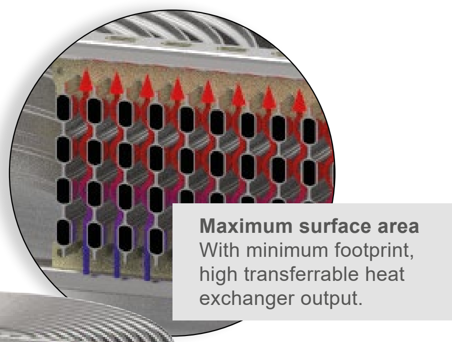
MultiVal CSRR (1000)

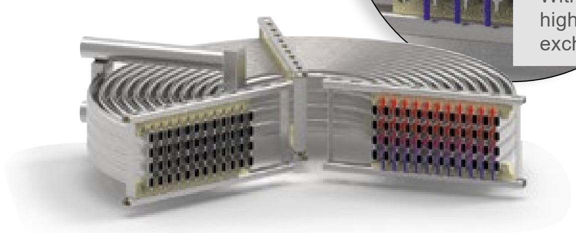


Properties and advantages of the new flat section coil register

Stainless steel storage tank and heat exchanger
Optimum output transfer by upright oval cross-section
Arrangement right at the bottom guarantees high exploitation of calorific value

- Reduces lime deposits
- Higher standby volume
- Absolute hygiene
- Optimum heat transfer rateübertragungsrate





CombiVal WPE
Heat pump calorifier.

Turnkey domestic water storage tank with built-in air/water heat pump for heating domestic hot water. Steel tank, enamel painted on the inside, with protection against corrosion and thermal insulation. Version with additional built-in standard heat exchanger also available.

Saves power as a result of heat pump technology
Approx. 66 % lower power consumption due to the use of state-of-the-art heat pump technology. Increase in energy efficiency.

Low operating costs
Reduced operating costs due to holiday program provided as standard. Ideal for use in combination with a photovoltaic solar plant.

Safe hot water hygiene based on automatic Legionella program
Periodic legionella program by increasing the temperature to 60 °C, supported by electric immersion heater.

Ready for connection
Simple installation due to equipment supplied ready for operation. User-friendly due to integrated control.

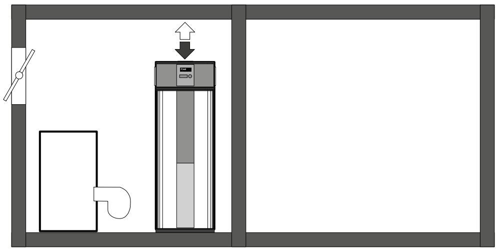
Volume: 270 litres
Heat output: 1.78 kW
Coefficient of performance COP: 3.6
Electric heating element: 2.0 kW

Installation examples

The pictures show different installation examples, which differ in the place of installation and the air guide.

Installation in boiler room

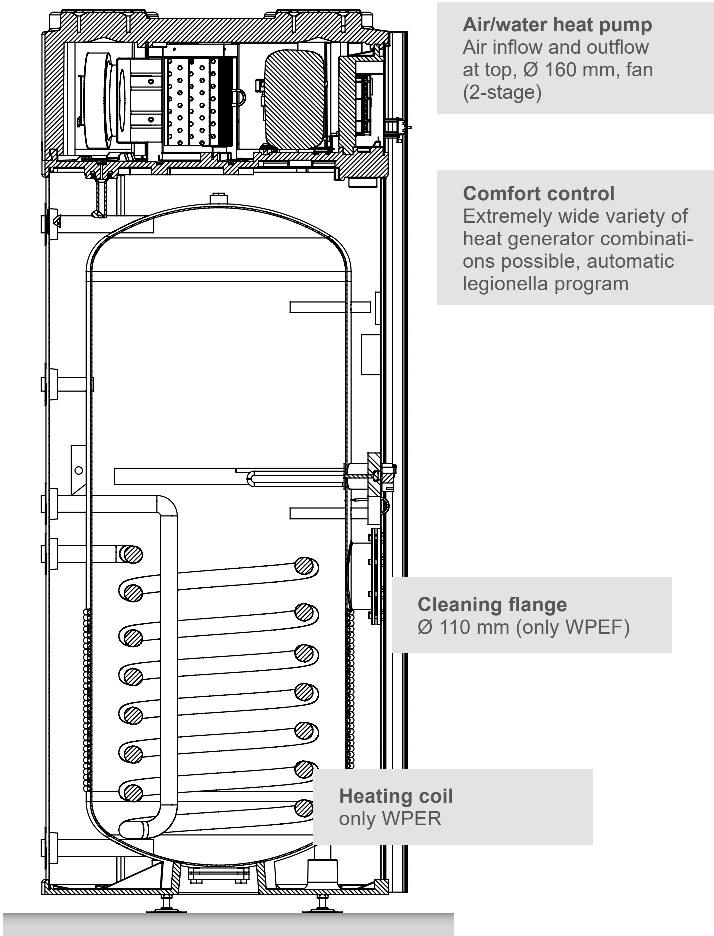
- Air guide: Inflow and outflow of air from the room
- Use of waste heat that can no longer be exploited



Installation in utility room

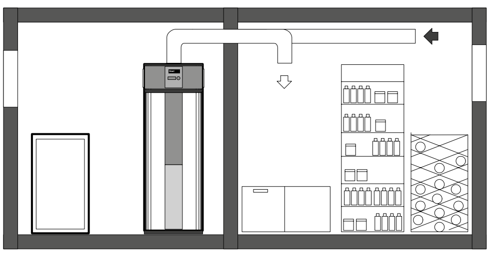
- Air guide: Inflow and outflow of air from the room
- Min. room volume 20 m³

Structure of CombiVal WPE



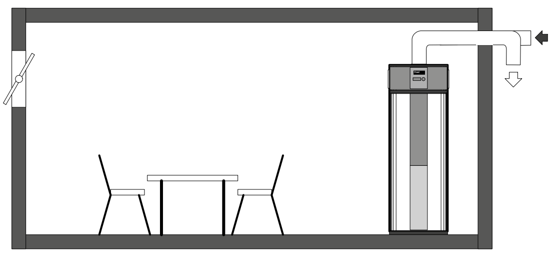
Installation in boiler room with heat pump

- Air guide: Inflow and outflow of air from the adjacent room
- Min. room volume 25 m³
- Use of waste heat that can no longer be exploited
- Cooling, dehumidification (wine cellar, storage room)



Installation in recreation room

- Air guide: Inflow and outflow of air either from the room or from outdoors
- Min. room volume 20 m³



VarioVal
The stratified storage tank saves up to 30 % energy.

Hygienic combination storage tank with stratification principle for heating domestic water and heating water. Steel storage tank for heating water with thermal insulation. A built-in steel heat exchanger for solar integration and an external fresh water module or integrated corrugated tube exchanger for direct heating of domestic water.

Maximum efficiency through stratification
The VarioVal stratifies the water according to its temperature. Only a small part of the water has to be heated up to the maximum temperature. This cuts heating costs.

Space-saving solution – for heating and domestic hot water
Only one VarioVal is required instead of two separate storage tanks for the heating water and the hot domestic water.
This saves a huge amount of space.

Hot water for the bathroom and kitchen – quickly and hygienically
The VarioVal provides immediate hot water on demand according to the hygienic continuous flow principle. Legionellae do not stand a chance.

The modular system for individual solutions
VarioVal means a basic stratified storage tank supplemented by various modules. It can be used to create customised energy-efficient solutions for various energy sources.

VarioVal RL (600):
VarioVal RLS (800-1000) with solar heat exchanger
VarioVal RHS (800-1000) with solar heat exchanger

Efficient stratification in temperature levels saves energy

The VarioVal stratified storage tank stores the heat of a boiler, a heat pump and/or a solar energy system as hot water. The water itself helps to cut energy costs. Cold water is heavier and sinks down, hot water is lighter and rises to the top. Temperature levels are created that are ideal for use in kitchens and bathrooms, for heating and for water flowing back from heating and hot water generation. Only part of the tank has to be heated to the maximum required temperature rather than the entire content of the tank. Fittings protect the temperature layers inside the tank. As a result, you can save up to 30 % in energy costs. This has been certified by an independent testing institute in Switzerland. The use of a stratified storage tank is often even more efficient than using a mixed tank with a higher energy efficiency class rating.

The "two-in-one" tank tucks in and saves space

The VarioVal supplies heating water as well as domestic water. It thus saves both the space that would have been taken up by a second storage tank and its heat losses. Installation engineers can mount the necessary fittings for the operation of the heating, the solar energy systems and the supply of hot water directly on the storage tank. This saves additional space on the wall.

Domestic hot water – quick and hygienic

The VarioVal uses a heat exchanger to heat the domestic water on demand to the required temperature quickly and hygienically. The size of the heat exchanger is optimised in line with the hot water requirement and the flow is continuous. Dangerous legionellae that proliferate primarily in standing water and at average temperatures do not stand a chance. Heating domestic water on demand is more efficient than storing hot water in a separate tank until it is needed. The domestic hot water used for bathing, for example, is absolutely hygienic and it is provided in an energy-efficient way.

Legionellae are bacteria that occur all over the world as a natural component in bodies of water. Only in very large numbers can they cause harm to human health in people with low immunity. Legionellae proliferate very quickly at water temperatures of 35 to 45 °C, in particular in standing water or "dead zones". Most important protection against legionellae: always keep domestic water flowing and store water at temperatures below 30 °C or above 50 °C (hardly any proliferation of legionellae).

TransTherm® aqua L
Buffer storage solution.

Turnkey station for heating domestic water using the buffer storage principle. With stainless steel plate heat exchangers, copper soldering. TopTronic E® system controller built in.
Range of application: high hot water requirements. Combination with CombiVal E or CombiVal C storage tank – for new buildings and renovations.

Hygienic water heating
Complete heating of the entire contents of the tank, automatic legionella protection through complete charging of the tank to a high temperature.

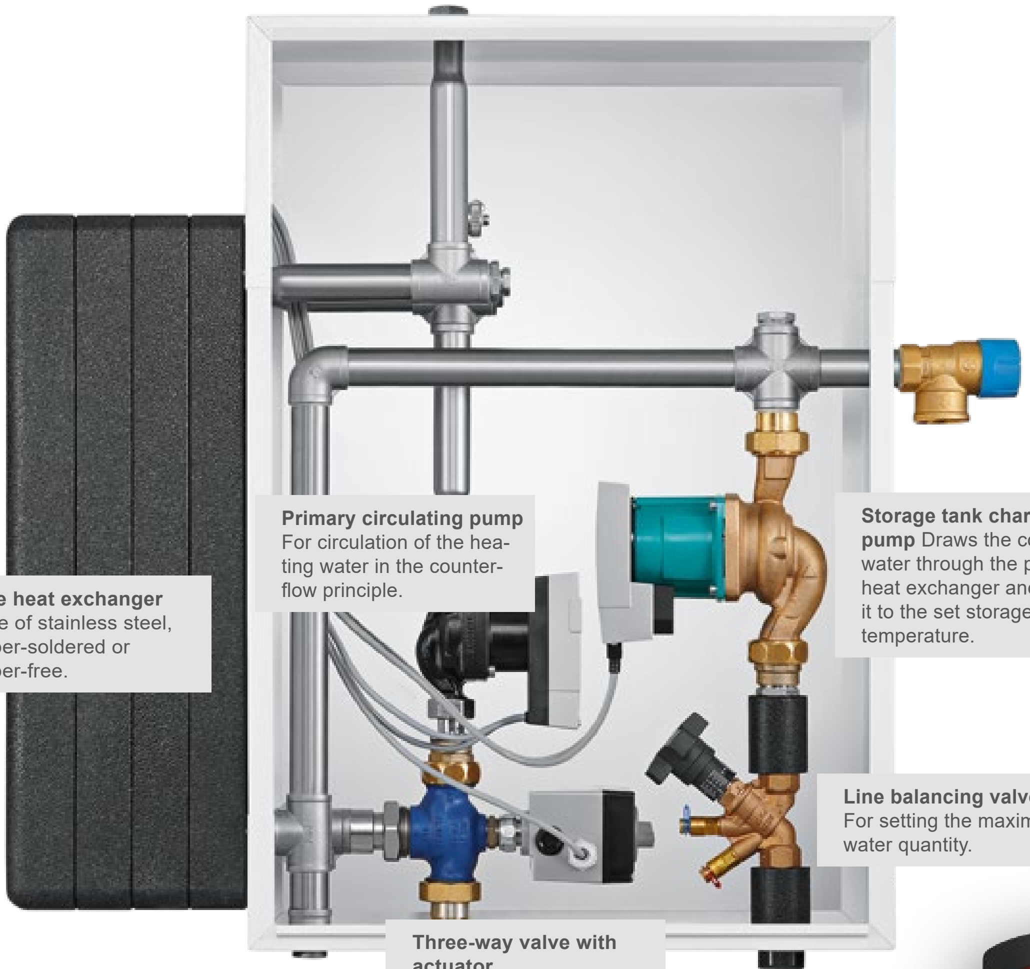
Compact construction
Compact unit with low space requirement mounted on steel frame, larger output values can be configured according to customer requirements.

High efficiency
High draw-off capacity with small storage tank charging output, high peak draw-off

Latest modular control
Simple, intuitive operating concept with touchscreen and clear graphical representation of the plant condition. Can be expanded at any time due to modular design.

Domestic hot water output 50 - 275 kW
CombiVal E charging tank: 300 - 2000 litres
CombiVal C charging tank: 200 - 2500 litres

TransTherm® aqua L in detail



Functional principle

In the buffer storage solution, the hot water storage tank (without integrated heat exchanger) is "charged" with heated domestic water (hot water) from top to bottom via a stratified charge pump, i.e. stratified. This is why it is also called a stratified charging storage tank (stratified charging principle).
The buffer storage solution has an external heat exchanger. The heat exchanger is arranged outside the storage tank.

The design of the heat exchanger is based, on the one hand, on the primary heating power available, the charging temperature/domestic water temperature and, on the other hand, on the time available for recharging the storage tank. If the output parameters for the charging heat exchanger and domestic water storage tank are optimum, the charging heat exchanger will be operated constantly at its calculated output irrespective of the draw-off capacity drawn off in the domestic water network.

TransTherm® aqua F

Fresh water module.

Turnkey station for heating domestic water using the continuous flow principle. With stainless steel plate heat exchangers, copper soldering. Built-in TopTronic® E system controller.
Centralised or decentralised domestic water heating with high hygiene standards, combined with an energy buffer tank. Flats, single family homes – for new buildings and renovations.

Hygienic water heating

Heating using the continuous flow principle, no storage of domestic water, therefore legionella risk greatly reduced.

Compact construction

Compact unit with low space requirement mounted on steel frame, larger output values can be configured according to customer requirements.

High efficiency

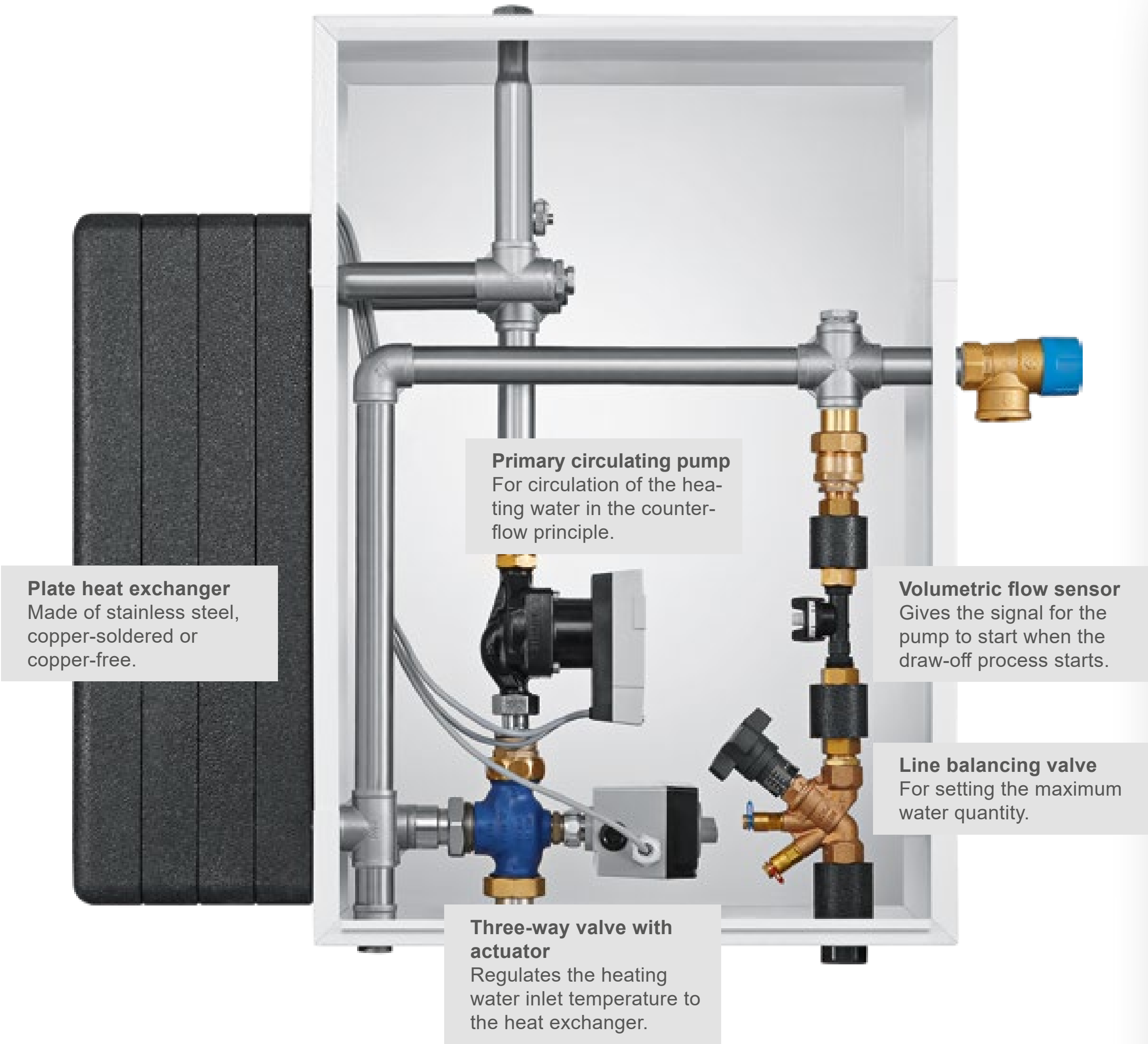
High draw-off capacity with small storage tank charging output, high peak draw-off.

Latest modular control

Simple, intuitive operating concept with touch-screen and clear graphical representation of the plant condition. Can be expanded at any time due to modular design.

Domestic hot water output: 50 - 275 kW in the casing
Domestic hot water output 350 - 700 kW on stand frame

TransTherm® aqua F in detail



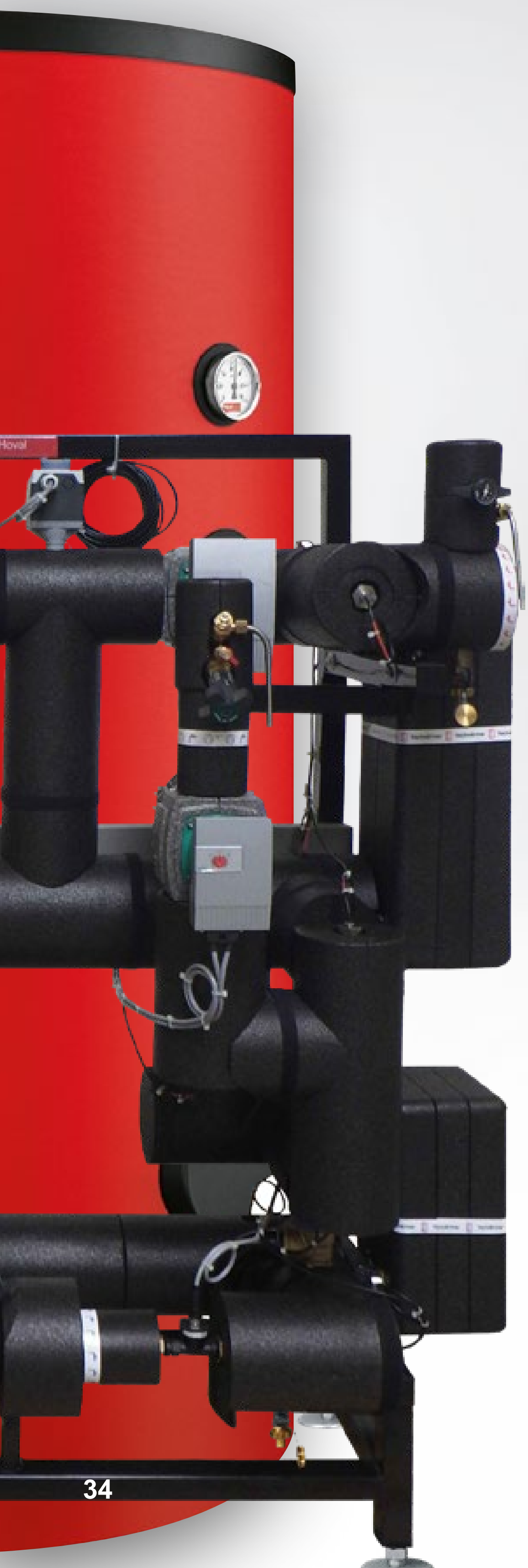
Functional principle

This type of domestic water heating is intended to avoid storing large quantities of heated water for long periods. The reason is that fresh and hygienically pure hot water should reach the draw-off points. Ultimately, however, the temperature, quality of the domestic water installation and the maintenance of the system are decisive with regard to achieving this objective.

Features of systems with fresh water stations

- Particularly hygienic water heating using the continuous flow principle, as no hot water storage is required.
- Rapid availability of hot water.
- Individual configuration of the nominal draw-off capacity possible.
- Large heating water cooling when there are draw-offs and thus low return temperatures can be achieved, i.e. ideal for heating with district heating and combination with condensing boiler technology and solar plants.
- Observe water hardness to avoid limescale build-up in the plate heat exchanger.

TransTherm® aqua FS
Fresh water module.



Domestic water heating in the continuous flow principle with 2 heat exchangers. Reduction in lime precipitation by controlling the heating charging temperature via a 3-way valve.
Startup-optimised domestic hot water charging with speed-controlled charging pump when domestic water is drawn off. Optimum return cooling by means of the preheater-supplementary heater principle.
The TransTherm® aqua FS fresh water module must be combined with two heating water buffer storage tanks. The autonomous fresh water module is set up on a stand frame and is floor-standing.

Hygienic water heating
Heating using the continuous flow principle, no storage of domestic water, therefore legionella risk greatly reduced.

Compact construction
Compact unit with low space requirement mounted on steel frame

High efficiency
High draw-off capacity with small storage tank charging output, high peak draw-off. Optimum utilisation of condensing boiler technology through low return temperatures.

Latest modular control
Simple, intuitive operating concept with touch-screen and clear graphical representation of the plant condition. Can be expanded at any time due to modular design.

Domestic hot water output 50 - 700 kW
on stand frame

TransTherm® aqua FS in detail

Functional principle

The TransTherm® aqua FS is a special extension of the TransTherm® aqua F fresh water module. The special feature of this fresh water module is that the return flow temperature can be further cooled down via a second heat exchanger.
This is controlled by the controller via the second mixer output YK1 with 0-10 volts by means of a preset setpoint temperature at the sensor RLF. To do this, it is necessary not to fully charge the buffer storage tank (1) located before it.

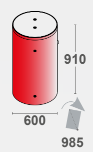
The middle zone of the buffer storage tank is used in this system to be able to regulate the desired flow temperature/draw-off temperature under certain conditions, depending on the valve position.
There is no CAN bus communication between the TransTherm® aqua FS and the buffer storage tanks installed before it. No set value is sent to the buffer storage tanks.
The buffer storage tanks must be constantly heated for constant operation.

EnerVal
Energy buffer storage tank.

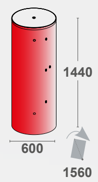
EnerVal (100 - 500)

- Connection: **thread**
- Operating pressure: **3 bar**
- Operating temperature: **5 - 95 °C**
- Application: **Heating** and **cooling**

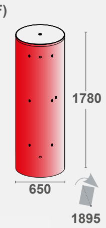
(100)
Nominal content 117 l
A
(A+→ F)



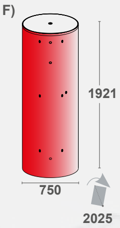
(200)
Nominal content 222 l
B
(A+→ F)



(300)
Nominal content 283 l
B
(A+→ F)



(500)
Nominal content 473 l
B
(A+→ F)



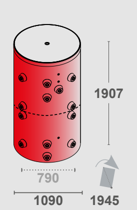
In a heating system, the buffer storage tank serves as a heat accumulator. This means the heat generation process is no longer tied to heat consumption, either in terms of time or in terms of hydraulics. As a component of system technology, it is very versatile.

Water is predominantly used as the medium for storing the heat. Its very high specific heat capacity makes it an excellent heat transfer medium. Due to its low viscosity and toxicological harmlessness, water is easy to handle. Both the input and the extraction of thermal energy are uncomplicated.

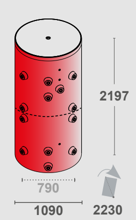
EnerVal (800 - 2000)

- Connection: **thread**
- Operating pressure: **3 bar**
- Operating temperature: **20 - 95 °C**
- Application: **Heating**

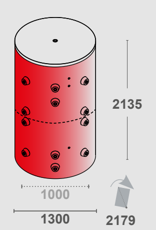
(800)
Nominal content 781 l



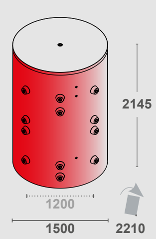
(1000)
Nominal content 992 l



(1500)
Nominal content 1416 l



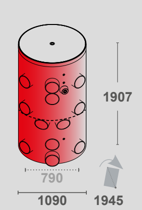
(2000)
Nominal content 2032 l



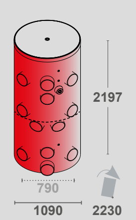
EnerVal G (800 - 6000)

- Connection: **flange**
- Operating pressure: **6 bar**
- Operating temperature: **20 - 95 °C**
- Application: **Heating**

(800)
Nominal content 788 l



(1000)
Nominal content 928 l



(1500)
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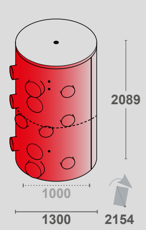
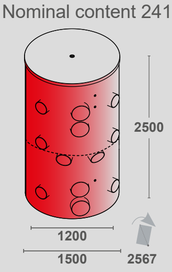
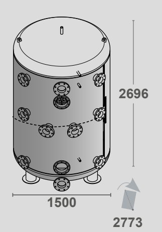


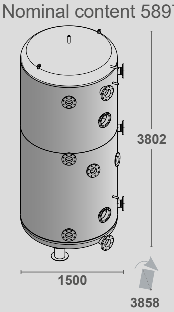
(2500)
Nominal content 2419 l



(4000)
Nominal content 4021 l



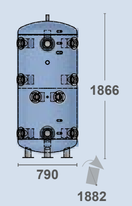
(6000)
Nominal content 5897 l



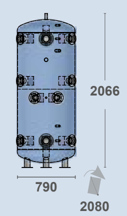
EnerVal G cool (800 - 6000)

- Connection: **flange**
- Operating pressure: **6 bar**
- Operating temperature: **min. 5 °C**
- Application: **Cooling**
- Coating: **water-based varnish**

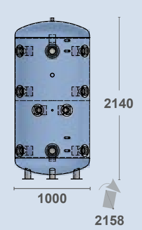
(800)
Nominal content 793 l



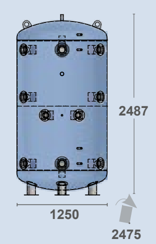
(1000)
Nominal content 889 l



(1500)
Nominal content 440 l



(2500)
Nominal content 2518 l



(4000)
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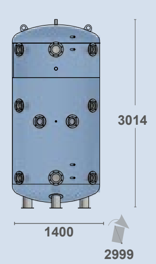
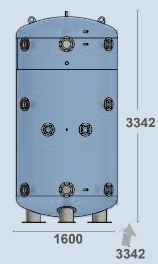


(6000)
Nominal content 5849 l



Heat generation
Overview.

Selection matrix

Calculating the value based only on the amount of investment costs is not sensible. Although this would be clear and simple, it would not be sustainable at all, since the plant is built for a useful life of 20 to 30 years and the operating costs over this period are usually much more important. In addition, the ecological compatibility of the plant is taken into account, e.g. through a system with a high proportion of renewable energy.

Drawing off

Hot water should be available at the desired temperature and in the desired quantity (without any long delay).

Standards

Compliance with standards and regulations. Compliance with country-specific standards and specifications

Operation

Economic and ecological operation. Operation should be cost-effective, energy-saving and environmentally friendly.

Hygiene

In order to avoid a massive increase of legionella in the domestic water installation, domestic water heating systems with low storage tank volumes and storage tank outlet temperatures ≤ 60 °C should be preferred.

Design

Careful planning and exact design (working safety). Excessively large boilers must be avoided. Sophisticated planning for switching and control.

Availability

Domestic hot water circulation systems are installed to ensure that hot water is always available at every hot water draw-off point despite centralised heat supply. This not only increases comfort, but also avoids increased water consumption.

System

Selection of the system according to requirements, adjustment and adaptation to heat generation. Domestic water systems should be reliable and easy to operate.

Domestic water / heat generator – matrix

System comparisons.

Selection matrix

The table below lists and explains the main evaluation criteria. For a systematic evaluation, the criteria should also be weighted according to individual priorities.

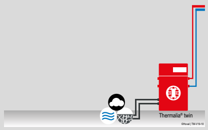
In the table, the requirements for a system are weighted, which means that, for example in the case of a heat pump system, the requirements for maintaining temperatures and hygienic operation are high.

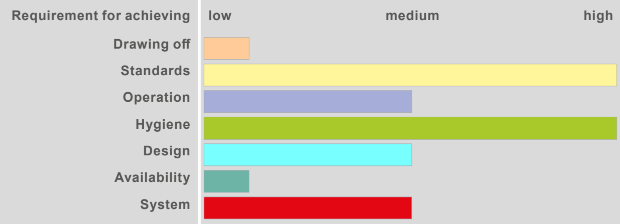
Storage tank

Monovalent

Low temperature

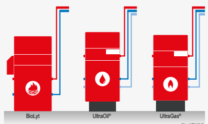
Heat pump

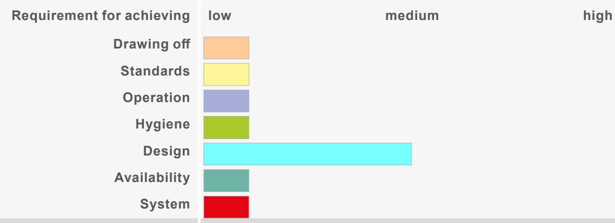




High temperature

Pellets / oil / gas

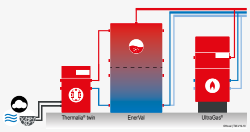


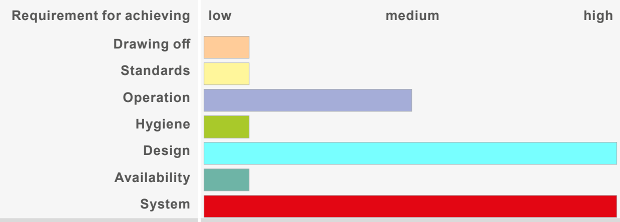


Bivalent

Low temperature

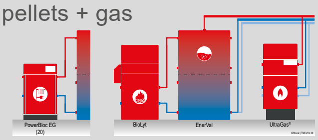
Heat pump + gas

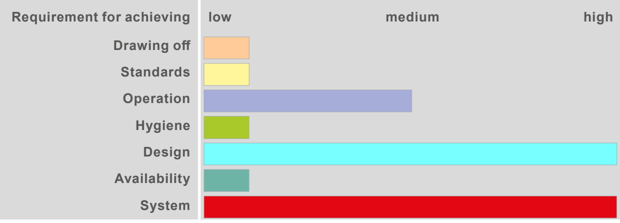




High temperature

CHP plant / pellets + gas





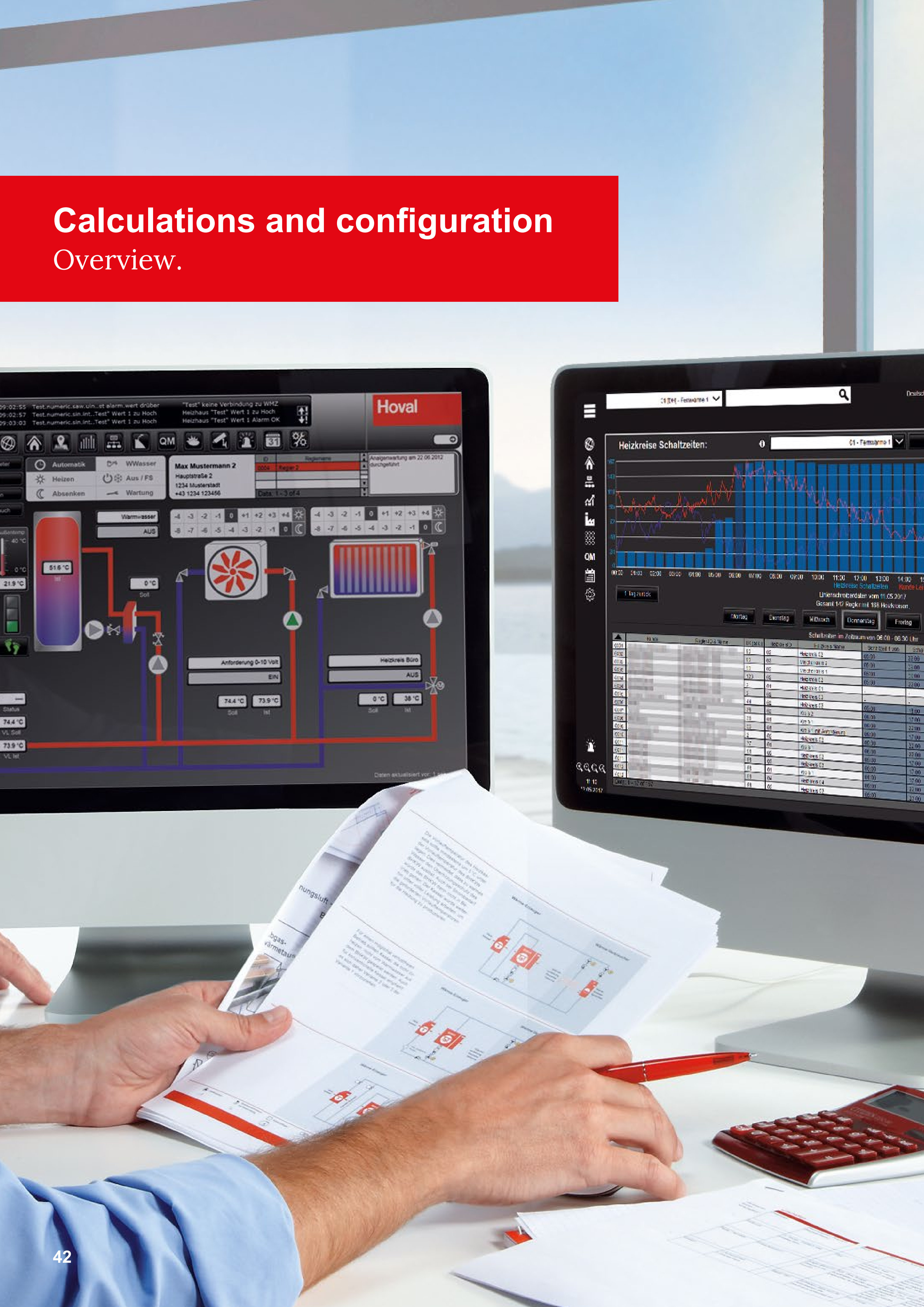
Hoval

Buffer storage solution

Combination storage tank

Fresh water system

Calculations and configuration
Overview.



Content

Planning for the demand case.

Hot water that is available at practically all times and in any desired quantity, has become expected as a matter of course nowadays. However, in order to be able to meet the demand for "any desired quantity", a careful analysis of requirements must be carried out to determine the size of a hot water storage tank or fresh water station. The reliability of this demand analysis increases, the more input data can be stated and the more accurate the data is.
The extensive, modern and contemporary product range with the corresponding control system from Hoval basically covers all water heating requirements. Basically, it is possible to choose between vertical and horizontal storage tanks, regardless of whether a storage tank system or a buffer storage solution is planned. Fresh water stations and the necessary buffer storage tanks are available in different sizes. This fact is an important point in the preliminary selection.

The following points must be considered:

- What floorspace is available?
- Which dimensions have to be considered for transporting the system into the building?
- How tall is the room?

In addition, the aim should be to understand precisely what water heating system is to be planned as thoroughly as possible.

Calculation and calculation methods

Division of the calculation methods.

	Determination of demand			
	N number		DHW VS	∑ line
Building types				
	central	decentralised		
Residential building				
Single-family home	✓	O	✓	O
Block of flats ≤ 12 RUs	✓	O	✓	O
Block of flats ≥ 12 RUs	✓	O	✓	O
Non-residential building	×		✓	O
Operations building	×		✓	O
Office buildings	×		✓	O
Hotel	×		✓	O
Educational facility	×		✓	O
Healthcare facility	×		✓	O
Multi-purpose hall/sports facility	×		✓	O
Hypermarket	×		✓	O
Warehouse/wholesale/logistics	×		✓	O
Manufacturing hall	×		✓	O
Special building	×		✓	O
Data centre	×		✓	O
Power station	×		✓	O

Legend	
Standard	✓
possible	O
Not possible	×

Central domestic water heating				Decentralised domestic water heating		
Storage tank	Storage tank charging	Volumetric flow		Storage tank	Storage tank charging	Volumetric flow
✓	○	○		○	×	✓
✓	✓	○		○	×	✓
○	✓	○		○	×	✓
				○	×	✓
○	○	✓		○	×	✓
×	×	○		○	×	✓
○	✓	○		○	×	✓
×	×	✓		○	×	✓
×	○	✓		○	×	✓
×	×	✓		○	×	✓
×	×	×		○	×	✓
×	○	✓		○	×	✓
×	×	✓		○	×	✓
○	○	✓		○	×	✓
×	×	✓		○	×	✓
×	×	✓		○	×	✓

Calculation basis

DIN 4708 as calculation aid for residential buildings.

Scope of validity of DIN 4708

DIN 4708 is the basis for determining a demand index N for residential buildings with mixed occupancy, with the objective enabling a storage tank selection. Buildings with mixed occupancy are occupied by people who have different occupations, a different daily routine and thus need hot water at various times. This results in a long demand period with relatively small demand peaks.
In other words, the basis for the scope of validity of DIN 4708 is the low probability of a simultaneous peak demand by the building inhabitants. On the other hand, company-owned apartments, hotels, retirement homes and other apartment buildings do not fall within the scope of DIN 4708.

Standard flat

DIN 4708 defines a "standard flat" and assigns it the demand index N = 1. The demand index indicates that the domestic hot water requirement of the calculated building corresponds to N times the demand of a standard flat.
The standard flat comprises 4 rooms, in which on average of 3 – 4 persons live. It has a normal bathtub NB 1 as the draw-off point to be calculated. According to the standard values for the draw-off point requirement, this results in an energy demand for water heating of:
3.5 × 5820 Wh = 20,370 Wh

Draw-off period

The basic theory of DIN 4708 assumes a draw-off period which slowly increases at the beginning, reaches its maximum approximately in the middle and slowly decreases again towards the end (Gaussian bell curve).
The draw-off period is divided for calculation purposes into 5 draw-off times and 4 pause times, in which case the third draw-off is the largest and always lasts 10 minutes.
All other times as well as the associated draw-offs are defined in DIN 4708 for all demand indexes from N = 1 to N = 300.
The amount of the third draw-off can be used for configuring the necessary peak draw-off capacity of a fresh water station.

Storage tank selection

3 requirements must be met to select a storage via the demand or performance index:

- The performance index NL of the storage tank must be at least as large as the demand index N.
- The boiler output must be at least as great as the continuous hot water output at 10 / 45 °C stated together with the performance index.
- If the boiler is intended for both heating and water heating, a boiler supplement is required for the water heating.

Fresh water station with buffer storage tank

The fresh water station must provide the peak draw-off capacity that results from the determined demand index. The required buffer storage tank volume depends on the available heat generator output, the buffer storage tank temperature and the return temperature of the fresh water station.

Boiler supplement for water heating according to DIN 4708-2

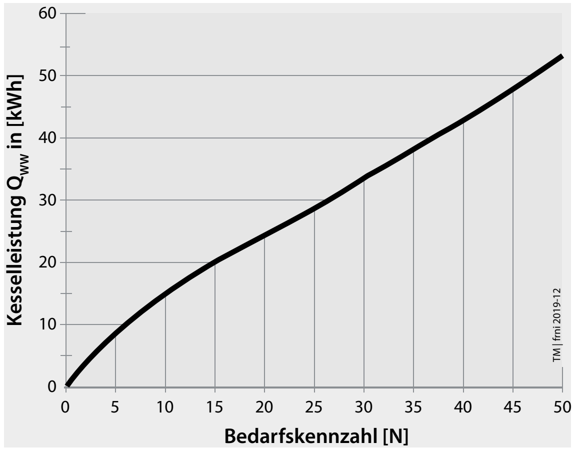
Required output for building heating and water heating. Whenever a system for water heating is planned, it is necessary to check whether an increase in the boiler capacity (boiler supplement) is advisable. In the last 2 decades, regulations have reduced the permissible specific values for heat losses in new buildings at regular intervals. The result is very low building heating requirements, which would actually only require very small boiler capacities – if the boilers were not also used for water heating. Constant hot water comfort often requires a relatively large boiler capacity.

Calculation basis
Cumulative line process / peak volumetric flow.

Boiler supplement

The decision on the amount of a boiler supplement results from 3 requirements in DIN 4708-2 for the dimensions of the water heating system:

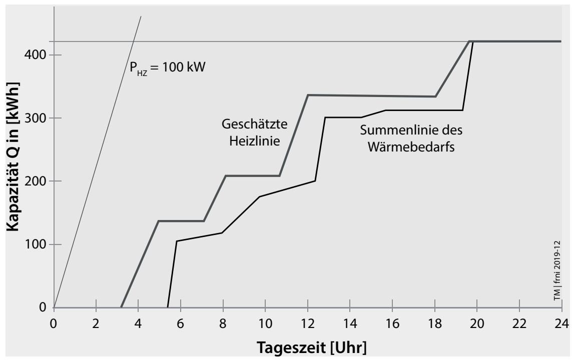
- The calculated performance index NL of the selected storage tank must be at least as large as the calculated demand index N.
- The boiler capacity Q_K must be at least as high as the continuous output Q_D required to achieve the performance index NL.
- The boiler output Q_K must be at least as high as the sum of the heat demand of the building $Q_{N\ build}$, and a boiler supplement Q_{WW} for water heating. The amount of the demand index N is taken as an estimated value for the boiler supplement (in kW). A calculation value for the amount of the boiler supplement Q_{WW} is shown in the figure on the right.



Cumulative line process

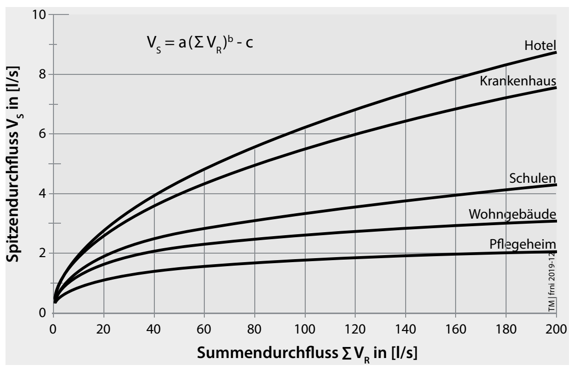
If it is known at which times specific amounts of heat will be required by individual consumers from a water heating system, then the heat demand characteristic curve can be represented as a cumulative line in a heat diagram (according to Faltin).
The heat quantities are entered over time, the gradient therefore corresponds to the current heat output.
The demand characteristic line provides important benchmarks:

- Total heat demand in kWh at the end of the demand period.
- Maximum heat output demand in kW at the steepest gradient.



Peak volumetric flow

The conversion of the total volumetric flows into the peak volumetric flows takes into account the simultaneity behaviour of the consumers within the building under consideration, and is essential for a correct calculation of the entire system. DIN 1988-3 contains various diagrams and tables which, depending on the type of building and a corresponding simultaneity factor, allow the total volumetric flows to be converted into a peak volumetric flow.



Design example

Comparison between the system solutions.

Design example

Example of residential building.

Initial situation.
Residential building: 25 flats
NL = 25
Q_H = 75 kW

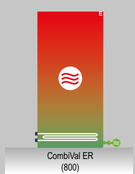
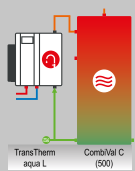
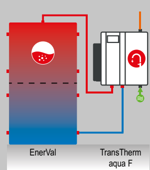
Design example for residential building

Taking the example of a residential building with 25 flats, the configuration is to be shown for the individual principles:

- Storage tank solution
- TransTherm® aqua L buffer storage solution
- Fresh water system TransTherm® aqua F

Sequence of the design example

The table below shows a comparison of the individual steps for selecting components and the output supplement for the heat generator.

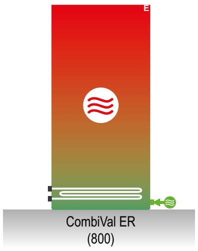
	 Storage tank	 Charging system	 Fresh water
Step 1	NL number	NL number	Water volumetric flow
Step 2	Tank size	Tank size	Module
Step 3	-	Module	Buffer tank
Step 4	Output supplement	Output supplement	Output supplement

Design example

Register storage tank.

1. Coil calorifier

- Configuration according to catalogue data
- Performance figure NL = 25
- Selection of the domestic hot water temperature
- Selection of the charging temperature



Configuration of tank size

- Table in the catalogue
- Performance figure NL = 25
- Domestic hot water temperature 45 °C, configuration for comfort
- Charging temperature = 70 °C

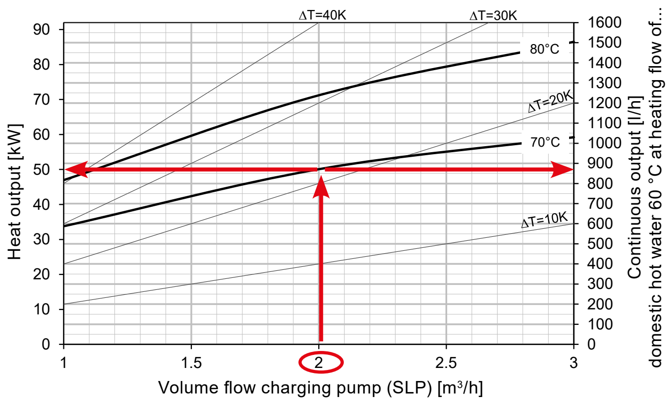
Selection of the next larger storage tank: 400 l

	Comfort [1]			Standard [2]		
T >	60°C	70°C	80°C	60°C	70°C	80°C
NL v						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13	300					
14						
15				300		
16						
17						
18						
19						
20						
21	400	300				
22						
23						
24						
25						
26				400	300	
27						
28						
29			300			
30	500	400				
31						

for diagram of 400 l storage tank

- Assumption: charging volumetric flow of 2 m³/h
- Intersection with curve T1 = 70 °C
- Results in an output of approx. 66 kW
- Boiler supplement*$_{\text{rule of thumb}}$ = QH + 50 % of calorifier connected load
- Gives: 75 kW + 50/2 kW a **boiler output: 100 kW**
- **Continuous output of approx. 870 l/h**

Domestic hot water continuous output at 60 °C



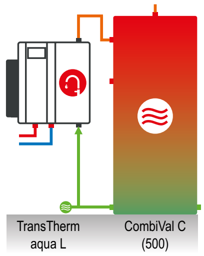
* For correct derivation see page 44

Design example

Buffer storage solution.

2. Charging system

- Configuration according to catalogue data
- Boiler supplement = Q_H + 50 % of charging system connected load



Configuration of storage tank charging module

- Table in the catalogue
- Tank size: 400 l
- Performance figure NL = 25
- Results in a module size:

  TransTherm® aqua L (1-10)

■ **Technical data**
Performance data

TransTherm aqua L (1-10 to 1-50)
Temperature primary 70 °C flow/30 °C return

Domestic water heating

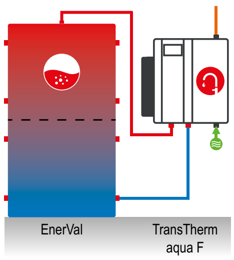
			Cold water 10 °C Domestic water 60 °C					
		TransTherm aqua L	(10)	(16)	(20)	(30)	(40)	(50)
		kW	50	90	115	175	230	275
		m³/h	0.86	1.54	1.97	3.00	3.94	4.71
		l/min	14.3	25.7	32.9	50.0	65.7	78.6
		l/s	0.2	0.4	0.5	0.8	1.1	1.3
Tank size l								
200	**$\dot{V}$s**	**l/10 min**	343	457	529	-	-	-
	Hourly output	l/h at 60 °C	1057	1743	2171	-	-	-
	NL index		13	22	29	-	-	-
300	**$\dot{V}$s**	**l/10 min**	443	557	629	800	-	-
	Hourly output	l/h at 60 °C	1157	1843	2271	3300	-	-
	NL index		21	31	39	57	-	-
400	**$\dot{V}$s**	**l/10 min**	543	657	729	900	-	-
	Hourly output	l/h at 60 °C	1257	1943	2371	3400	-	-
	NL index		23	41	49	69	-	-
500	**$\dot{V}$s**	**l/10 min**	643	757	829	1000	1157	-
	Hourly output	l/h at 60 °C	1357	2043	2471	3500	4443	-
	NL index		25	44	56	80	100	-
800	**$\dot{V}$s**	**l/10 min**	943	1057	1129	1300	1457	-
	Hourly output	l/h at 60 °C	1657	2343	2771	3800	4743	-
	NL index		33	52	64	94	123	-
1000	**$\dot{V}$s**	**l/10 min**	1143	1257	1329	1500	1657	1786
	Hourly output	l/h at 60 °C	1857	2543	2971	4000	4943	5714

Design example

Fresh water system.

3. Fresh water system

- Peak volumetric flow V_S according to DIN 1988-300 (data for 45 °C domestic hot water)
- Conversion to 60 °C
- Design of heating water buffer storage tank
- Boiler supplement according to table



Calculation and peak volumetric flow according to DIN 1988-300

Calculation with Excel

Reading of the values for V_S at 60 °C

Table Calculation flow rate of common drinking water extraction points

Type of extraction point	dimension	Calculation flow rate (VR)	Tapping points	Σ VR
	DN	l/s	number	l/s
Discharge valves without aerators	15	0.30	0	0.00
	20	0.50	0	0.00
	25	1.00	0	0.00
Discharge valves with aerators	10	0.15	0	0.00
	15	0.15	0	0.00
Mixing valves for				
shower tub	15	0.15	25	3.75
bathtub	15	0.15	0	0.00
kitchen sink	15	0.07	25	1.75
washbasin	15	0.07	25	1.75
bidet	15	0.07	0	0.00
Household machines				
Washing machine	15	[illegible]	0	0.00
Dishwasher	15	[illegible]	0	0.00
WC bowls and urinals				
Filler valve for closets	15	0.13	0	0.00
Flushing valves for urinals	15	0.30	0	0.00
Flushing valves for WCs	20	1.00	0	0.00
Calculation flow rate (VR)			Σ VR	7.25

Table Constants for peak flow

Building type	Constant a	Constant b	Constant c
Residential building	1.48	0.19	0.94
Ward in hospital	0.75	0.44	0.18
Hotel	0.70	0.48	0.13
School	0.91	0.31	0.38
Administrative buildings	0.91	0.31	0.38
Retirement home	1.48	0.19	0.94
Nursing home	1.40	0.14	0.92

Calculation of peak flow VS 1 $\dot{V}_S = a\left(\sum \dot{V}_R\right)^b - c$

Building type	VS bei 45°C l/s	VS bei 45°C l/min	VS bei 45°C l/h	VS bei 60°C l/s	VS bei 60°C l/min	VS bei 60°C l/h
Residential building	1.216	72.98	4378.98	0.85	51.09	3065.29
Ward in hospital	1.613	96.79	5807.24	1.13	67.75	4065.07
Hotel	1.682	100.90	6053.73	1.18	70.63	4237.61
School	1.302	78.10	4686.09	0.91	54.67	3280.26
Administrative buildings	1.302	78.10	4686.09	0.91	54.67	3280.26
Retirement home	1.216	72.98	4378.98	0.85	51.09	3065.29
Nursing home	0.922	55.65	3338.86	0.65	38.95	2337.20

Configuration of fresh water module

- Table in the catalogue
- Domestic water 60/10 °C
- Conversion from l/h to m³/h
- V secondary approx. 3 m³/h
- Gives **TransTherm® aqua F (6-30)**

■ **Technical data**
Performance data

TransTherm aqua F (6-10 to 6-50)

			Heating water temperature flow 65 °C (6-..)						70 °C (6-..)					
Domestic water secondary	**TransTherm aqua F**		(10)	(16)	(20)	(30)	(40)	(50)	(10)	(16)	(20)	(30)	(40)	(50)
60/5 °C	T return primary	°C	30	30	30	30	30	30	30	30	30	[illegible]	30	30
	V̇ primary	**m³/h**	**1.08**	**1.88**	**2.5**	**3.73**	**4.84**	**5.77**	**1.32**	**2.09**	**2.59**	[illegible]	**4.82**	**5.72**
	Q max.	kW	43	75	100	149	193	230	60	95	118	171	219	260
	V̇ secondary	**m³/h**	**0.67**	**1.17**	**1.55**	**2.33**	**3.01**	**3.59**	**0.94**	**1.48**	**1.84**	[illegible]	**3.42**	**4.06**
60/10 °C	T return primary	°C	30	30	30	30	30	30	30	30	30	[illegible]	30	30
	V̇ primary	**m³/h**	**0.8**	**1.5**	**2.01**	**3.16**	**4.34**	**5.39**	**1.08**	**1.94**	**2.48**	[illegible]	**4.95**	**5.92**
	Q max.	kW	32	60	80	126	173	215	50	90	115	[illegible]	230	275
	V̇ secondary	**m³/h**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**3.01**	**3.95**	**4.73**
60/15 °C	T return primary	°C	30	30	30	30	30	30	30	30	30	[illegible]	30	30
	V̇ primary	**m³/h**	**0.55**	**1.05**	**1.38**	**2.13**	**3.08**	**3.96**	**0.97**	**1.8**	**2.37**	**3.73**	**4.84**	**5.72**
	Q max.	kW	22	42	55	85	123	158	44	82	108	170	220	260
	V̇ secondary	**m³/h**	**0.42**	**0.8**	**1.05**	**1.63**	**2.35**	**3.02**	**0.84**	**1.57**	**2.08**	**3.24**	**4.21**	**4.98**

Calculation of the required buffer volume

In order to provide the required energy for domestic water heating, a fresh water station is generally connected to a heating water puffer tank. The volume of the heating water buffer tank is determined by the domestic hot water requirement of the installation, the storage temperature in the heating water buffer tank and the user behaviour.

$$V_P = \dot{V}_S \cdot t \cdot \left(\frac{T_P}{T_{WW}}\right) \cdot s_n$$

V_P	Required minimum volume of the heating water buffer storage tank	
$\dot{V}_S$	Calculated peak flow of the fresh water module	
t	Time for which the peak flow is required. The value can be gear towards for the temperature spread between the heating water buffer storage tank and domestic water.	
$\left(\frac{T_P}{T_{WW}}\right)$	For the temperature spread between the buffer storage tank and DHW	
	0.5	for a high temperature spread (e.g. 90/45 °C)
	0.7	for a medium temperature spread (e.g. 70/45 °C)
	1	for a low temperature spread (e.g. 55/45 °C)
s_n	Safety factor for observing user behaviour	
	1	normal non-draw-off times
	2	short non-draw-off times
	3...4	very short non-draw-off times

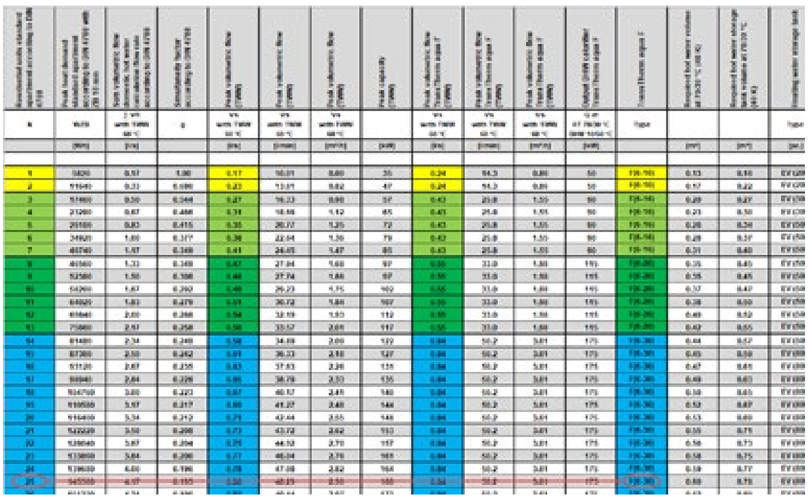
V_P	$\dot{V}_S$	t	$\left(\frac{T_P}{T_{WW}}\right)$	s_n
(litr)	(l/min)	(min)		
1533	51.1	10.0	1.0	3.0

Input

Result

Buffer storage tank and domestic hot water configuration

- Supplement from table: charging output heating water buffer storage tank
- Complete table in the appendix



Appendix
Descriptions, tables, definitions.

Content

Water hardness
Description and conversion.

The requirements of European standard EN 14868 must be met.

In particular, the following specifications must be complied with:

- The maximum temperature on the domestic water side is 60 °C, whereby the total hardness of the water must not exceed 14 °dH (2.5 mmol/l).
- The domestic water temperature of 50-55 (60) °C restricts limescale and lime precipitation.
- If, for hygiene reasons, hot water temperatures of over 60 °C are required, measures must be implemented to prevent the formation of deposits (calcification). Stagnation of water and unfavourable temperatures (below 55 °C) can result in bacteria (e.g. legionella) multiplying. However, a hot water temperature of 70 °C must never be exceeded.
- The pH-value of the domestic water must be between 7 and 9 (tap water has: 6.0–8.5!)

pH value = degree to which a liquid tends to be "acid" or "alkaline"

pH value	7 = neutral water
pH value <	7 = acidic water
pH value >	7 = alkaline water

Carbonic hardness (temporary hardness).

Calcium and magnesium compound with carbonic acid (carbonate)
Carbonic hardness is not thermo-stable, and precipitates out of the water as boiler scale in the hot water temperature range.

Non-carbonic hardness (permanent hardness).

All compounds such as chloride, sulphate, nitrate, non-calcium and magnesium compounds. As the temperature rises, the solubility increases and there is no precipitation in the hot water temperature range (depending on water and temperature = gypsum boiler scale or on evaporation = residues).

Designation of the limescale in the precipitation temperature range:

- above 100 °C = boiler scale in steam boilers, electric heating rods – Calcium carbonate + calcium sulphate (gypsum) and silicate
- below 100 °C = boiler scale with hot water, electric heating rods – Calcium carbonate (limescale)

Carbonate	= carbonic acid salts
Sulphate	= sulphuric acid salts

Due to the risk of corrosion, the sum of the chloride, nitrate and sulphate content of the domestic water must not exceed a total of 100 mg/l. The maximum free chloride concentration is 0.5 mg/l.

Due to the risk of deposits forming, the mineral content of the tap water must not exceed 250 mg/l. The maximum conductance is 500 µS/cm.
If the sulphate (SO_4^{2-}) content exceeds the carbonate (HCO^{3-}) content, copper-soldered heat exchangers must not be used.

Loss of output in % due to lime deposits

Subdivisions and conversion of degrees of hardness

The total hardness of water can be referred to in degrees:

- 1 degree of German hardness (1 °dH)
- 1 °dH = 10 mg calcium oxide (CaO) / 1 litre or corresponding to 7.2 mg (Ca) / 1 litre water

Designation	Hardness in °fH	mmol/l
very soft	0 - 7	0 - 0.7
soft	7 - 15	0.7 - 1.5
medium-hard	15 - 25	1.5 - 2.5
quite hard	25 - 32	2.5 - 3.2
hard	32 - 42	3.2 - 4.2
very hard	> 42	> 4.2

Hardness range	Millimoles of calcium carbonate per litre	°dH
soft	less than 1.5	less than 8.4
medium	1.5 - 2.5	8.4 - 14
hard	> 2.5	> 14

Conversion	Unit	°dH	°e	°fH	ppm	mval/l	mmol/l
1 degree of German hardness	1 °dH	1	1.253	1.78	17.8	0.357	0.178
1 degree of English hardness (Clark degree)	1 °eH	0.798	1	1.43	14.3	0.258	0.142
1 degree of French hardness	1 °fH	0.560	0.702	1	10	0.2	0.1
ppm $CaCO_3$ (American hardness)	1 ppm	0.056	0.070	0.1	1	0.02	0.01
mval/l Earth alkali ions	1 mval/l	2.8	3.51	20.04	50	1	0.5
mmol/l Earth alkali ions	1 mmol/l	5.6	7.02	40.08	100	2	1

Average domestic hot water requirement

various consumers (standard values).

Consumer	DHW demand [l]	Reference parameter	DHW Outlet temperature [°C]	Heat quantity demand [Wh]
Showers				
Sportsperson	35	per shower	40	1220
Factory work, low level of dirt	40	per shower	40	1395
Factory work, high level of dirt	55	per shower	40	1920
Bathing				
Normal bathtubs	120	per bath	45	4885
Large bathtubs	200	per bath	45	8140
Hydrotherapy bathtubs	300	per bath	45	12210
High-volume bathtubs	300	per bath	45	12210
Single-family home				
Simple standard	30	per person per day	60	1745
Medium standard	40	per person per day	60	2325
Elevated standard	50	per person per day	60	2910
Block of flats				
Social housing scheme	25	per person per day	60	1455
General housing scheme	35	per person per day	60	2035
High standard housing scheme	45	per person per day	60	2620
Hotel / apartment blocks				
Straightforward	30	per bed per day	60	1745
2nd class	50	per bed per day	60	2910
1st class	70	per bed per day	60	2620
University hall of residence				
Annual average	37	per person per day	60	2150
Winter peak demand period	46	per person per day	60	2675
Retirement home				
Annual average	36	per person per day	60	2090
Winter peak demand period	40	per person per day	60	2320
Commercial / industry				
With longer peak draw-off	36 - 42	per shower	60	1465 - 1710
With short-term peaks	30 - 36	per shower	60	1220 - 1465
Estimated value for any cleaning location	50	per person per day	60	1745
Schools				
Without showers	5 - 15	per student per day	45	205 - 610
With showers	30 - 50	per student per day	45	1220 - 2035
Barracks	30 - 50	per person per day	45	1220 - 2035
Swimming pools				
Public	60	per user	40	2095
Private	30	per user	40	1050
Standard	20 - 30	per user	60	1160 - 1745
Well equipped	30 - 50	per user	60	1745 - 2610

Consumer	DHW demand [l]	Reference parameter	DHW Outlet temperature [°C]	Heat quantity demand [Wh]
Saunas				
Public	100	per user	40	3490
Private	50	per user	40	1745
Fitness centre	40	per user	60	2325
Medicinal spas	200 - 400	per patient per day	45	8140 - 16280
Hospitals				
With simple medical facilities	50	per bed per day	60	2910
With average medical facilities	70	per bed per day	60	4070
With elaborate medical facilities	90	per bed per day	60	5235
Annual average	38	per bed per day	60	2030
Winter peak demand period	42	per bed per day	60	2440
Office buildings	10 - 40	per person per day	45	410 - 1630
Department stores	10 - 40	per employee per day	45	410 - 1630
Restaurant / catering establishment				
For preparation	4	per meal	60 - 65	235 - 255
Time-staggered	4	per meal	60 - 65	235 - 265
Bakeries				
Dough preparation	40	per m² baking area per day	60	2325
Cleaning the establishment	1	per m² baking area	60	60
Physical hygiene (showering and washing hands)	40	per employee per day	60	2325
Butchers				
Cooking, cleaning machinery and appliances	60	per pig per week	60	3490
Cleaning the establishment	2	per m² floorspace	60	120
Physical hygiene (showering and washing hands)	40	per employee per day	60	2325
Slaughterhouses				
Tripe tubs (content 100 l)	400	per hour	60	23255
Scalding tubs (content 500 l)	50	per hour	60	2910
Pig scalding tubs (content 200 l)	200	per hour	60	11630
Dairies	1 - 1.5	per 1 l milk	75	75 - 115
Laundries	250 - 300	per 100 kg laundry	75	18900 - 22680
Hairdressing salons				
Barber shop	55 - 90	per workplace per day	45	2240 - 3660
Ladies hairdresser	150 - 200	per workplace per day		6100 - 8140
Cleaning the establishment	1	per m² floorspace	45	40

Requirements and directives
Listing.

Installation and equipment of heating and domestic hot water heating system	
Regulation	**Designation**
DIN-EN 1717	Protection against pollution of potable water installations and general requirements of devices to prevent pollution by backflow
DIN 1988-100	TRWI – part 100: Protection of domestic water, preservation of domestic water, DVGW technical rules
DIN 1988-200	TRWI – part 200: Planning and execution, components, apparatus, materials
DIN 1988-300	TRWI – part 200: Determination of pipe diameters
DIN 4701	Rules for calculating the heat requirement of buildings; basic rules for calculation
DIN 4708	Central heat-water-installations; terms and calculation-basis (storage tank configuration with demand and output index, pp. 36 ff.)
DIN 4747-1	Heating plants for district heating – Part 1: Safety requirements for domestic substations, stations and domestic systems to be connected to hot-water district heating networks
DIN 4751-1	Medium Temperature Hot Water Systems (MTHWS) with a boiler flow temperature up to 120 °C – Specification for open systems and sealed systems with pressurisation by gravity using a column of water or by safety valves – Safety equipment
DIN 4751-2	Medium Temperature Hot Water Systems (MTHWS) with a boiler flow temperature up to 120 °C; specification for sealed systems using thermostatic control; safety equipment
DIN 4751-3	Medium Temperature Hot Water Systems (MTHWS) with a boiler flow temperature up to 95 °C and forced flow boilers with rated output up to 50 kW; specification for sealed systems using thermostatic control; safety equipment
DIN 4752	High temperature water central heating systems with flow temperatures higher than 110 °C (protection against pressures over 0.5 atü) – Equipment and installation
DIN 4753	Water heaters, water heating installations and storage water heaters for domestic water
DIN EN 12897	Water supply – Specification for indirectly heated unvented (closed) storage water heaters
DIN 18032-1	Sports halls – Halls and rooms for sports and multi-purpose use – Part 1: Planning principles
DIN 18380	German construction contract procedures (VOB) – Part C: General technical specifications in construction contracts (ATV) – Installation of central heating systems and hot water supply systems
DIN 18381	German construction contract procedures (VOB) – Part C: General technical specifications in construction contracts (ATV) – Installation of gas, water and drainage pipework inside buildings
DIN 18421	German construction contract procedures (VOB) – Part C: General technical specifications in construction contracts (ATV) – Insulation of service installations
-	AVB[2]; (tender template for building works); water
DVGW W551	Drinking water heating and drinking water piping systems – Technical measures to reduce Legionella growth – Design, construction, operation and rehabilitation of drinking water installations
DVGW W553	Dimensioning of circulation-systems in central drinking water heating systems
EN 806	Specifications for installations inside buildings conveying water for human consumption
TRD 701	Technical rules for steam boilers: steam boiler systems with group II steam generators
97/23/EG	European Pressure Equipment Directive (PED)
VDI 2035	Prevention of damage in water heating installations
VDI 2089	Building services in swimming baths – Indoor pools
VDI 6001	Reconstruction of tap-water installations – Water intended for human consumption
VDI 6002	Solar heating for potable water
VDI 6003	Water heating systems – Comfort criteria and performance levels for planning, evaluation and implementation
VDI 6023	Hygiene in potable water installations

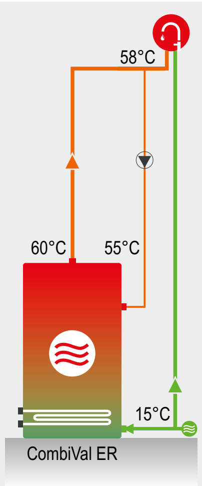
Buffer storage tank and domestic hot water configuration TransTherm® aqua F.

Quick configuration using NL number

Residential units standard apartment according to DIN 4708 N	Peak heat demand standard apartment according to DIN 4708 with preparation 10 min Preparation [Wh]	Sum flow rate domestic hot water calculation flow rate according to DIN 4708 ∑ VR at DHW 60 °C [l/s]	Simultaneity factor according to DIN 4708 g	Peak flow rate (DHW) $\dot{V}s$ at DHW 60 °C [l/s]	Peak flow rate (DHW) $\dot{V}s$ at DHW 60 °C [l/min]	Peak flow rate (DHW) $\dot{V}s$ at DHW 60 °C [m³/h]	Peak output (DHW) [kW]	Peak flow rate TransTherm® aqua F (DHW) $\dot{V}s$ at DHW 60 °C [l/s]	Peak flow rate TransTherm® aqua F (DHW) $\dot{V}s$ at DHW 60 °C [l/min]	Peak flow rate TransTherm® aqua F (DHW) $\dot{V}s$ at DHW 60 °C [m³/h]	DHW calorifier output TransTherm® aqua F Q at HT 70/30 °C DHW 10/60 °C [kW]	TransTherm® aqua F Type	Required hot water volume at 70/30 °C (40 K) [m³]	Required hot water buffer storage tank volume at 70/30 °C (40 K) [m³]	Hot water buffer storage tank 1 EnerVal Type	Required recharging capacity Time: 20 min 70/30 °C (40 K) [kW]	Required recharging capacity Time: 30 min 70/30 °C (40 K) [kW]	Required recharging capacity Time: 60 min 70/30 °C (40 K) [kW]
1	5820	0.17	1.00	0.17	10.01	0.60	35	0.24	14.3	0.86	50	(6-10)	0.13	0.16	(200)	23	15	8
2	11640	0.33	0.680	0.23	13.61	0.82	47	0.24	14.3	0.86	50	(6-10)	0.17	0.22	(200)	31	21	10
3	17460	0.50	0.544	0.27	16.33	0.98	57	0.43	25.8	1.55	90	(6-16)	0.20	0.27	(300)	37	25	12
4	23280	0.67	0.466	0.31	18.66	1.12	65	0.43	25.8	1.55	90	(6-16)	0.23	0.30	(300)	42	28	14
5	29100	0.83	0.415	0.35	20.77	1.25	72	0.43	25.8	1.55	90	(6-16)	0.26	0.34	(500)	47	31	16
6	34920	1.00	0.377	0.38	22.64	1.36	79	0.43	25.8	1.55	90	(6-16)	0.28	0.37	(500)	51	34	17
7	40740	1.17	0.349	0.41	24.45	1.47	85	0.43	25.8	1.55	90	(6-16)	0.31	0.40	(500)	55	37	18
8	46560	1.33	0.349	0.47	27.94	1.68	97	0.55	33.0	1.98	115	(6-20)	0.35	0.45	(500)	63	42	21
9	52380	1.50	0.308	0.46	27.74	1.66	97	0.55	33.0	1.98	115	(6-20)	0.35	0.45	(500)	63	42	21
10	58200	1.67	0.292	0.49	29.23	1.75	102	0.55	33.0	1.98	115	(6-20)	0.37	0.47	(500)	66	44	22
11	64020	1.83	0.279	0.51	30.72	1.84	107	0.55	33.0	1.98	115	(6-20)	0.38	0.50	(500)	70	46	23
12	69840	2.00	0.268	0.54	32.19	1.93	112	0.55	33.0	1.98	115	(6-20)	0.40	0.52	(500)	73	49	24
13	75660	2.17	0.258	0.56	33.57	2.01	117	0.55	33.0	1.98	115	(6-20)	0.42	0.55	(500)	76	51	25
14	81480	2.34	0.249	0.58	34.89	2.09	122	0.84	50.2	3.01	175	(6-30)	0.44	0.57	(500)	79	53	26
15	87300	2.50	0.242	0.61	36.33	2.18	127	0.84	50.2	3.01	175	(6-30)	0.45	0.59	(800)	82	55	27
16	93120	2.67	0.235	0.63	37.63	2.26	131	0.84	50.2	3.01	175	(6-30)	0.47	0.61	(800)	85	57	28
17	98940	2.84	0.228	0.65	38.79	2.33	135	0.84	50.2	3.01	175	(6-30)	0.49	0.63	(800)	88	59	29
18	104760	3.00	0.223	0.67	40.17	2.41	140	0.84	50.2	3.01	175	(6-30)	0.50	0.65	(800)	91	61	30
19	110580	3.17	0.217	0.69	41.27	2.48	144	0.84	50.2	3.01	175	(6-30)	0.52	0.67	(800)	94	62	31
20	116400	3.34	0.212	0.71	42.44	2.55	148	0.84	50.2	3.01	175	(6-30)	0.53	0.69	(800)	96	64	32
21	122220	3.50	0.208	0.73	43.72	2.62	153	0.84	50.2	3.01	175	(6-30)	0.55	0.71	(800)	99	66	33
22	128040	3.67	0.204	0.75	44.92	2.70	157	0.84	50.2	3.01	175	(6-30)	0.56	0.73	(800)	102	68	34
23	133860	3.84	0.200	0.77	46.04	2.76	161	0.84	50.2	3.01	175	(6-30)	0.58	0.75	(800)	104	70	35
24	139680	4.00	0.196	0.78	47.08	2.82	164	0.84	50.2	3.01	175	(6-30)	0.59	0.77	(800)	107	71	36
25	145500	4.17	0.193	0.80	48.29	2.90	168	0.84	50.2	3.01	175	(6-30)	0.60	0.78	(800)	110	73	37
26	151320	4.34	0.190	0.82	49.44	2.97	173	0.84	50.2	3.01	175	(6-30)	0.62	0.80	(800)	112	75	37
27	157140	4.50	0.187	0.84	50.53	3.03	176	0.84	50.2	3.01	175	(6-30)	0.63	0.82	(800)	115	76	38
28	162960	4.67	0.184	0.86	51.56	3.09	180	0.84	50.2	3.01	175	(6-30)	0.64	0.84	(800)	117	78	39
29	168780	4.84	0.181	0.88	52.54	3.15	183	1.10	65.8	3.95	230	(6-40)	0.66	0.85	(800)	119	79	40
30	174600	5.00	0.179	0.90	53.75	3.22	188	1.10	65.8	3.95	230	(6-40)	0.67	0.87	(1000)	122	81	41
31	180420	5.17	0.176	0.91	54.61	3.28	191	1.10	65.8	3.95	230	(6-40)	0.68	0.89	(1000)	124	83	41
32	186240	5.34	0.174	0.93	55.73	3.34	194	1.10	65.8	3.95	230	(6-40)	0.70	0.91	(1000)	126	84	42
33	192060	5.50	0.172	0.95	56.81	3.41	198	1.10	65.8	3.95	230	(6-40)	0.71	0.92	(1000)	129	86	43
34	197880	5.67	0.170	0.96	57.85	3.47	202	1.10	65.8	3.95	230	(6-40)	0.72	0.94	(1000)	131	87	44
35	203700	5.84	0.168	0.98	58.85	3.53	205	1.10	65.8	3.95	230	(6-40)	0.74	0.96	(1000)	133	89	44
36	209520	6.01	0.166	1.00	59.81	3.59	209	1.10	65.8	3.95	230	(6-40)	0.75	0.97	(1000)	136	90	45
37	215340	6.17	0.164	1.01	60.73	3.64	212	1.10	65.8	3.95	230	(6-40)	0.76	0.99	(1000)	138	92	46
38	221160	6.34	0.163	1.03	61.99	3.72	216	1.10	65.8	3.95	230	(6-40)	0.78	1.01	(1000)	141	94	47
39	226980	6.51	0.161	1.05	62.84	3.77	219	1.10	65.8	3.95	230	(6-40)	0.79	1.02	(1000)	143	95	48
40	232800	6.67	0.159	1.06	63.65	3.82	222	1.10	65.8	3.95	230	(6-40)	0.80	1.03	(1000)	144	96	48
41	238620	6.84	0.158	1.08	64.84	3.89	226	1.10	65.8	3.95	230	(6-40)	0.81	1.05	(1000)	147	98	49
42	244440	7.01	0.156	1.09	65.58	3.93	229	1.10	65.8	3.95	230	(6-40)	0.82	1.07	(1000)	149	99	50
43	250260	7.17	0.155	1.11	66.71	4.00	233	1.10	65.8	3.95	230	(6-40)	0.83	1.08	(1000)	151	101	50
44	256080	7.34	0.154	1.13	67.82	4.07	237	1.31	78.8	4.73	275	(6-50)	0.85	1.10	(1500)	154	103	51
45	261900	7.51	0.152	1.14	68.46	4.11	239	1.31	78.8	4.73	275	(6-50)	0.86	1.11	(1500)	155	104	52
46	267720	7.67	0.151	1.16	69.52	4.17	243	1.31	78.8	4.73	275	(6-50)	0.87	1.13	(1500)	158	105	53
47	273540	7.84	0.150	1.18	70.56	4.23	246	1.31	78.8	4.73	275	(6-50)	0.88	1.15	(1500)	160	107	53
48	279360	8.01	0.149	1.19	71.58	4.29	250	1.31	78.8	4.73	275	(6-50)	0.89	1.16	(1500)	162	108	54
49	285180	8.17	0.148	1.21	72.58	4.35	253	1.31	78.8	4.73	275	(6-50)	0.91	1.18	(1500)	165	110	55
50	291000	8.34	0.146	1.22	73.06	4.38	255	1.31	78.8	4.73	275	(6-50)	0.91	1.19	(1500)	166	110	55

Circulation and hot water temperature

Description.



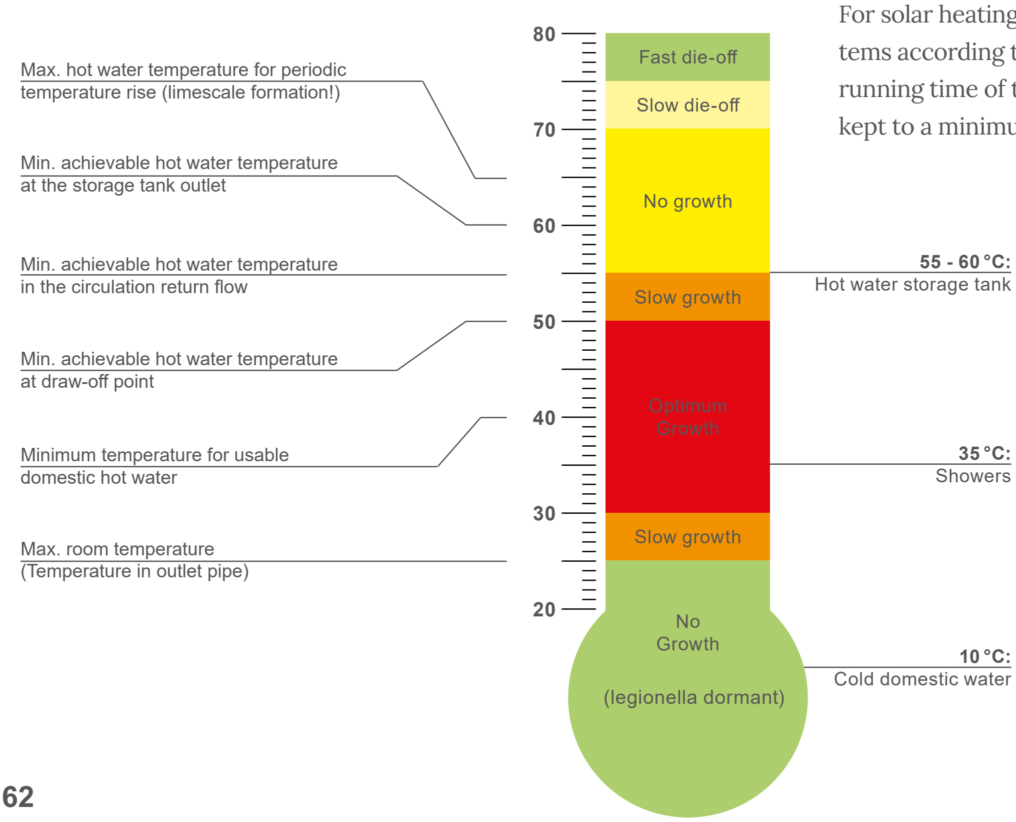
Circulation pipe

A branch back to the hot water tank is installed in the hot-water pipe as close as possible to the draw-off points. The hot water circulates within this circuit. When a hot water tap is opened, hot water is immediately available for the user. For larger buildings (blocks of flats, hotels, etc.) the installation of circulation pipes is also interesting from the point of view of water loss. At more remote draw-off points, it not only takes a very long time for hot water to arrive without a circulation pipe, but a great deal of water also flows away unused.
Storage tanks usually have their own circulation connection. If no separate connection is available, the circulation can also be integrated via the cold water inlet.
Integration via the cold water inlet is recommended for large circulation volumetric flow, because in this way water flows through the entire storage tank on the circulation side (fewer recharging operations). For fresh water stations, the circulation pipe is connected to the cold water inlet.

Circulation losses must be taken into account in the configuration. Under these operating conditions, the heat exchanger in the storage tank of a charging system or fresh water station can only transfer a small part of the nominal output.

Time control

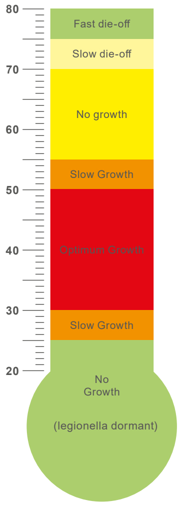
According to the Energy Saving Ordinance (EnEV), circulation systems must be equipped with automatic devices to switch off the circulation pumps (max. 8 h in 24 h according to DVGW regulations W 551) and must be insulated against heat loss in accordance with the recognised rules of technology. The temperature difference between hot water outlet and circulation inlet must not be greater than 5 K.
The circulation pipes must be dimensioned in accordance with DIN 1988-300 or DVGW worksheet W 553. In systems with pipe contents > 3 l between the outlet of the hot water storage tank and the draw-off point as well as large systems according to DVGW worksheet W 551, circulation systems are prescribed.
For solar heating of storage tanks in small systems according to DVGW worksheet W 551, the running time of the circulation pump must be kept to a minimum.



Methods of water treatment

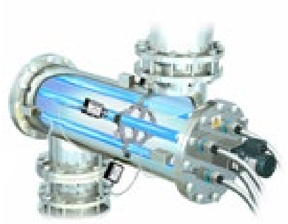
Description.

In the **Thermal disinfection**, the water in the pipe network is permanently heated to over 60 °C. At this temperature the germs die off and the spread of legionella is stopped. Disadvantage: for dependable elimination of germs, the minimum temperature must be maintained permanently. And this is often difficult with many pipe systems.
The principle of thermal disinfection is simple: legionella cannot multiply at temperatures of 55 °C and upward. For this reason, each draw-off point is flushed with water heated to over 70 °C. At this temperature the germs die off. The problem: to ensure that the legionella are killed, the draw-off points must be flushed with hot water for at least three minutes. In the case of large buildings and installations, this can only be done in stages (sections). And: most domestic water heaters are not designed for this continuous operation and cannot reach the required temperatures.

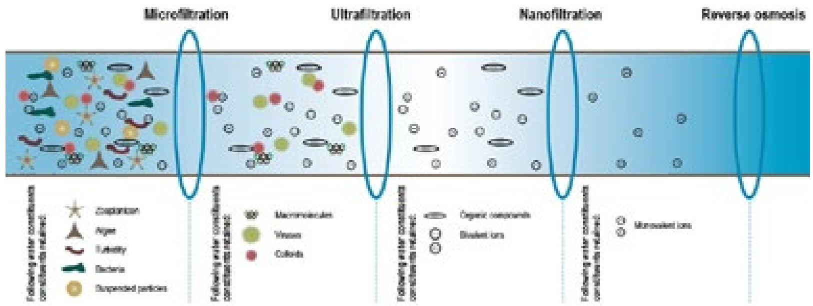


The **Chemical disinfection** works with chlorine-free chlorine dioxide systems. The process is very efficient, effective even at low concentrations and absolutely harmless.
By breaking down the biofilm in the system, the legionella are killed safely and without the formation of odours. However, improper use of chemicals can result in undesirable by-products. With the chemical disinfection method, the process must therefore be documented in detail by professionals. You should therefore call in expert help.

Another method is the **Installation of ultrafiltration systems**. Special filters prevent the spread of pathogens and other harmful substances.
Installing an ultrafiltration system in the domestic water system guarantees the successive decomposition of the biofilm completely without chemicals. The consistent treatment of the domestic water removes nutrients from the biofilm and, depending on the installation location, dead biomass can also be removed. The system reliably removes viruses, bacteria and parasites such as legionella, Escherichia Coli and even Noroviruses from the water supply system, leaving important healthy minerals in the domestic water.



The use of **Irradiation systems with UV light** is an environmentally friendly, chemical-free alternative and can be employed in support of other measures.
Irradiation systems with UV light are an environmentally friendly alternative method for killing germs and pathogens locally in flowing water. The high dosage of UV radiation damages the cell nucleus of microorganisms and prevents cell division. Germs such as legionella die off. Thanks to the absence of chemicals, the health of the users is not affected at any time, and the taste and smell of the water remains unchanged.



Flow rule

Mixed installation in domestic water systems.

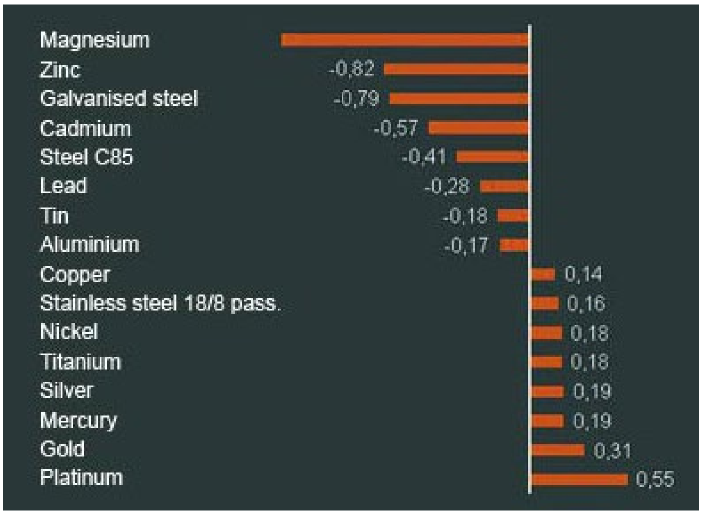
What actually is the flow rule?

Source: ikz.de/medien/ikz-praxis

The term flow rule is used in connection with what is called a mixed installation in domestic water systems. Different materials are used in one system. This concerns pipes, fittings and tanks.

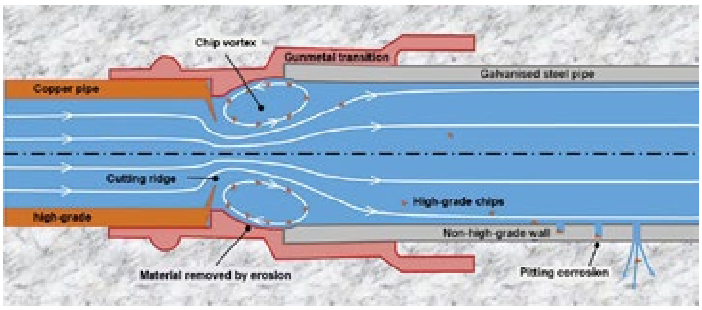
In domestic water installations, attention must be paid to the flow rule so that the less noble metal (steel and zinc) is not broken down by the more noble metals (copper and copper alloys such as brass or gunmetal) – in the worst case leading to complete destruction.

According to the flow rule, the domestic water must first flow through components made of less noble metals and then through components made of more noble metals. Problems arise if this rule is not observed and the more noble pipe is installed before the less noble one. Then more noble metal particles can be washed into the less noble pipe, settle at one point and "eat" through the pipe wall on contact. This "pitting" can create hairline holes that are difficult to detect but can cause serious damage over time.



The basic principle is: the more noble material degrades the less noble. And the higher the voltage difference, the stronger the process.

Another problem arises if work is carried out without proper care, and the pipe ends are not deburred when cutting the pipe. Then the water speed increases at this narrow point and a vortex is formed behind it, which tears chips out of the cutting burr. These swirl around in the vortex and, like the grains on a cutting disc, can grind through the pipe wall.



Two rules must therefore be strictly observed:

1. The flow rule: In domestic water installations with two or more metals, the less noble material must be used before the noble material in the flow direction.
2. Always deburr pipe ends cleanly.

Metal corrosion

Magnesium anode / impressed current anode.

The picture shows how a magnesium or sacrificial anode in a domestic hot water heater degrades over time.
Left: a new sacrificial anode.
Centre: an anode which has already been in operation for some time, but still has about 60% left.
Right: an anode that has done its job and is completely disintegrated (and the storage tank will definitely already have been attacked by corrosion).

Magnesium anode

The service life of the magnesium protection anode is about five years. However, it should be inspected once a year if possible. The condition of the magnesium protection anode can be determined by measuring the protection current when the anode is installed. Disconnect the earth cable from the storage tank and measure the protection current with an ammeter.
If the protection current is less than 0.3 mA, the anode must be removed and checked for degradation.

Impressed current anode

Mainly insoluble titanium mixed oxide anodes are used as impressed current anodes; these are installed isolated in the tank. A potentiostat supplies the anode with impressed current. Water tanks made of steel can also be protected by impressed current anodes to prevent corrosion. In contrast to magnesium protection anodes (sacrificial anodes), this method does not require regular inspection and does not need to be replaced, as they are only consumed in very small quantities. In contrast to the sacrificial anode, the anode material is not consumed. The operating costs are negligible at a power consumption of 2-4 W.

Magnesium / impressed current anode not at the same time

The Correx anode compensates residual currents of materials with different voltages, thus preventing corrosion.
If a magnesium anode is installed at the same time, the protection is not guaranteed.
The magnesium anode is not degraded because it is protected by the Correx anode. The magnesium anode thus loses its effect completely and the Correx anode is only partially functional.

Notes

Hoval

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Hoval is one of the leading international companies for heating and indoor climate solutions. Drawing on more than 75 years of experience and benefiting from a close-knit team culture, the Hoval Group delivers exciting solutions and develops technically superior products. This leadership role requires a sense of responsibility for energy and the environment, which is expressed in an intelligent combination of different heating technologies and customised indoor climate solutions.

Hoval also provides personal consultations and comprehensive customer service. With around 2500 employees in 15 companies around the world, Hoval sees itself not as a conglomerate, but as a large family that thinks and acts globally.
Hoval heating and indoor climate solutions are currently exported to more than 50 countries.

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