

Hoval EnerVal

Heating and cooling – Saving energy for every requirement.

Efficient | Flexible | Versatile



Hoval | Responsibility for Energy and Environment

Storing hot water efficiently

If the energy does not simply come out of the ground.

The Earth, with the very high temperatures in its interior, holds a huge amount of energy. In some regions, some of this energy makes its way to the Earth's surface in the form of hot water or even steam. With this free hot water, people heat buildings or use the heat for industrial applications.

In a heating system, the required heat is obtained from valuable resources. This makes it all the more important to use this heat sparingly and responsibly. The required thermal output often represents a problem here. This means a compromise has to be struck.

With the Hoval EnerVal buffer storage tank family, you can store energy efficiently - without compromises.

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Hoval energy buffer storage tanks

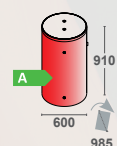
The range from 2023 onwards.

EnerVal (100 - 500)

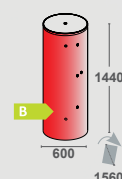
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- Operating pressure: **3 bar**
- Operating temperature: **5 - 95 °C**
- Application: **Heating** ● and **cooling** ●



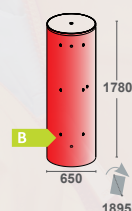
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Nominal content 117 l



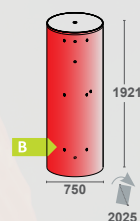
(200)
Nominal content 222 l



(300)
Nominal content 283 l



(500)
Nominal content 473 l



Energy buffer storage tank

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** ●



EnerVal G (800 - 6000)

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

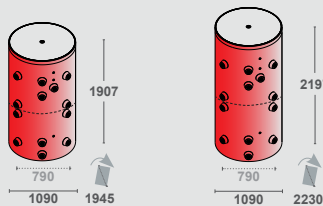


EnerVal G cool (800 - 6000)

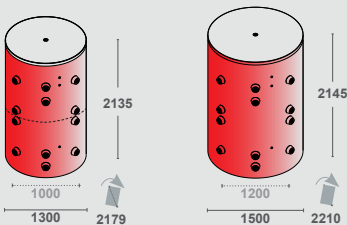
- Connection: **flange**
- Operating pressure: **6 bar**
- Operating temperature: **min. 5 °C**
- Application: **Cooling** ●
- Coating: **water-based varnish**



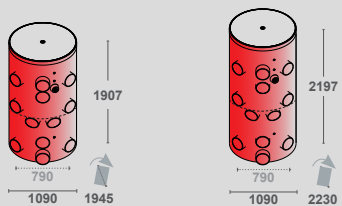
(800) Nominal content 781 l (1000) Nominal content 992 l



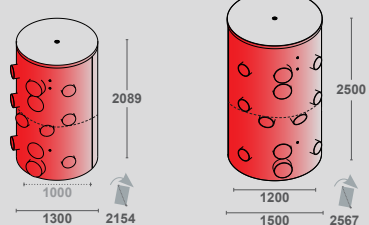
(1500) Nominal content 1416 l (2000) Nominal content 2032 l



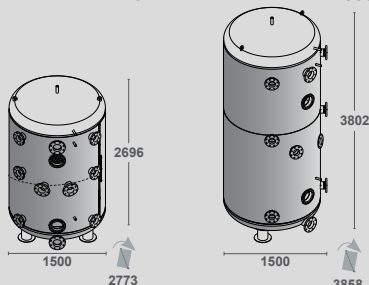
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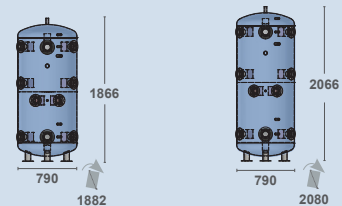
(1500) Nominal content 1384 l (2500) Nominal content 2419 l



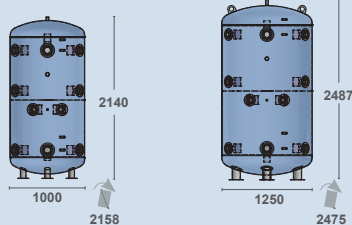
(4000) Nominal content 4021 l (6000) Nominal content 5897 l



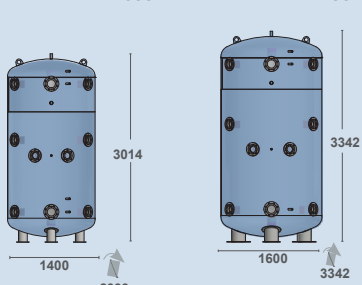
(800) Nominal content 793 l (1000) Nominal content 889 l



(1500) Nominal content 440 l (2500) Nominal content 2518 l



(4000) Nominal content 4035 l (6000) Nominal content 5849 l



Hoval EnerVal and EnerVal G

The storage tank for numerous requirements.



■ **EnerVal (100 - 500)**

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

(100)

A ➔

Nominal content **117 l**

All dimensions in mm

Deviations possible as a result of manufacturing tolerances.
Dimensions +/-10 mm
All supports length: 50 or 75 mm



Tilting measure

B ➔

Energy efficiency class

Delivery



Storage tank with insulation installed



Storage tank with insulation installed,
Insulation can be disassembled on site

790



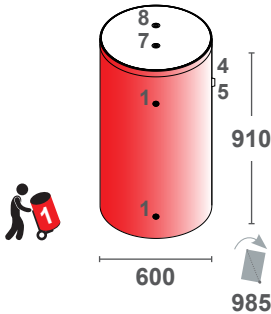
Storage tank and insulation separate
(two packages)



or



storage tank uninsulated,
insulation on site



Heating connection (charging)	1	2 x Rp 1½" (internal thread)
Electric heating element	—	
Removable cap for positioning the sensor in the sensor duct	4	Ø 60 mm
Sensor duct inner	5	Ø 11 mm
Heating return	7	1 x R 1" (external thread)
Heating flow	8	1 x R 1" (external thread)
Thermal insulation	Polyurethane (PU) hard foam, 50 mm	

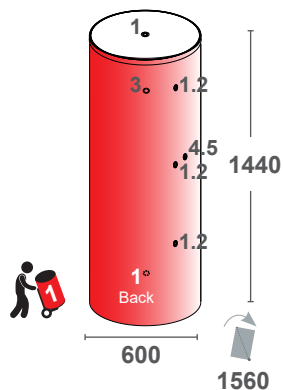
7+8 suitable
for direct installation
of an armature group.



(200)

B

Nominal content 222 l

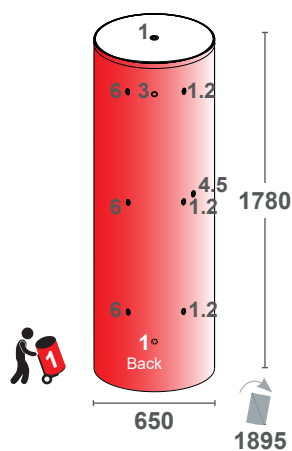


1	5 x Rp 1½" (internal thread)
2	3 x Rp 1½" (internal thread)
3	
4	Ø 60 mm
5	Ø 11 mm
Polyurethane (PU) hard foam, 50 mm	

(300)

B

Nominal content 283 l

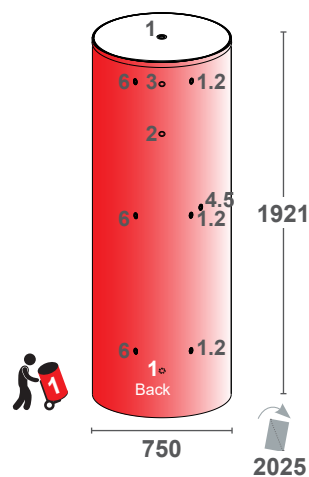


1	5 x Rp 1½" (internal thread)
2	3 x Rp 1½" (internal thread)
3	
4	Ø 60 mm
5	Ø 11 mm
6	3 x Rp 1½" (internal thread)
Polyurethane (PU) hard foam, 75 mm	

(500)

B

Nominal content 473 l



1	5 x Rp 1½" (internal thread)	Heating connection (charging)
2	4 x Rp 1½" (internal thread)	Electric heating element
3		Thermometer and immersion sleeve (mounted)
4	Ø 60 mm	Removable cap for positioning the sensor in the sensor duct
5	Ø 11 mm	Sensor duct inner
6	3 x Rp 1½" (internal thread)	Heating connection
Polyurethane (PU) hard foam, 75 mm		Thermal insulation



■ EnerVal (800 - 2000)

Connection: **thread**

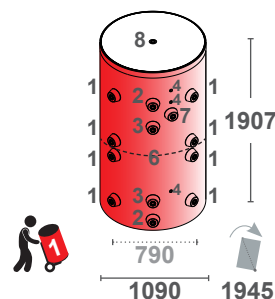
Operating pressure: **3 bar**

Operating temperature: **20 - 95 °C**

Application: **Heating** ●

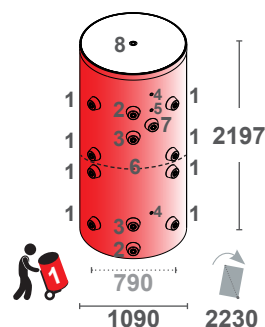
(800)

Nominal content **781 l**



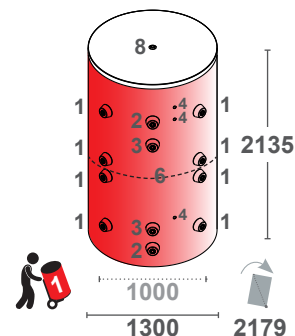
(1000)

Nominal content **922 l**



(1500)

Nominal content **1416 l**



Charging	1	8 x G 2" (internal thread)	1	8 x G 2" (internal thread)	1	8 x G 2" (internal thread)
Discharge	2	2 x G 2" (internal thread)	2	2 x G 2" (internal thread)	2	2 x G 2" (internal thread)
Electric heating element	3	2 x G 1½" (internal thread)	3	2 x G 1½" (internal thread)	3	2 x G 1½" (internal thread)
Sensor/thermometer	4	3 x G ½" (internal thread)	4	3 x G ½" (internal thread)	4	3 x G ½" (internal thread)
Terminal strip for contact sensor	5	2 x	5	2 x	5	2 x
Perforated partition plate	6	1 x	6	1 x	6	1 x
Circulation lance	7	1 x G 1" (internal thread)	7	1 x G 1" (internal thread)	7	
Evacuation of air	8	1 x G 1" (internal thread)	8	1 x G 1" (internal thread)	8	1 x G 1" (internal thread)
Thermal insulation	Polyester fabric, 150 mm		Polyester fabric, 150 mm		Polyester fabric, 150 mm	



■ EnerVal G (800 - 6000)

Connection: **flange**

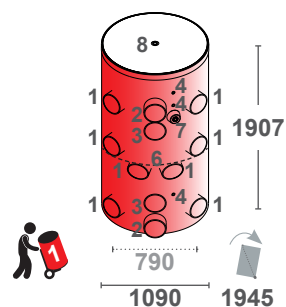
Operating pressure: **6 bar**

Operating temperature: **20 - 95 °C**

Application: **Heating** ●

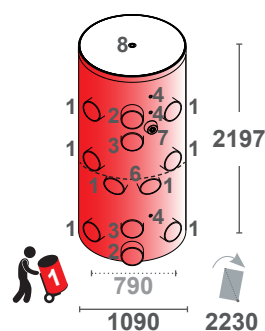
(800)

Nominal content **788 l**



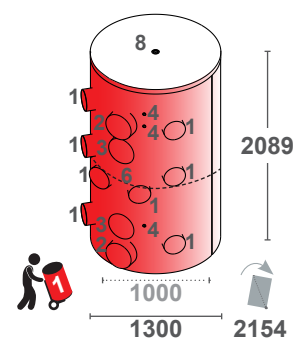
(1000)

Nominal content **928 l**



(1500)

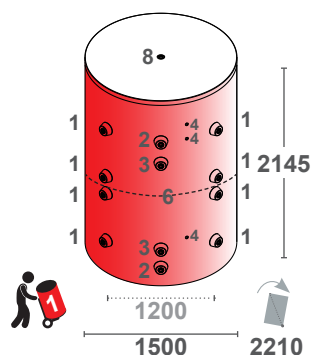
Nominal content **1384 l**



Charging	1	8 x DN 65	1	8 x DN 65	1	8 x DN 80
Discharge	2	2 x DN 80	2	2 x DN 80	2	2 x DN 100
Electric heating element	3	2 x DN 110	3	2 x DN 110	3	2 x DN 180
Sensor/thermometer	4	3 x G ½" (internal thread)	4	3 x G ½" (internal thread)	4	3 x G ½" (internal thread)
Terminal strip for contact sensor	5	2 x	5	2 x	5	2 x
Perforated partition plate	6	1 x	6	1 x	6	1 x
Circulation lance	7	1 x G 1" (internal thread)	7	1 x G 1" (internal thread)	7	
Evacuation of air	8	1 x G 1" (internal thread)	8	1 x G 1" (internal thread)	8	1 x G 1" (internal thread)
Thermal insulation	Polyester fabric, 150 mm		Polyester fabric, 150 mm		Polyester fabric, 150 mm	

(2000)

Nominal content 2032 l




1	8 x G 2" (internal thread)
2	2 x G 2" (internal thread)
3	2 x G 1½" (internal thread)
4	3 x G ½" (internal thread)
5	2 x
6	1 x
7	
8	1 x G 1" (internal thread)
Polyester fabric, 150 mm	

All dimensions in mm

Deviations possible as a result of manufacturing tolerances.


Dimensions +/-10 mm


All supports length: EnerVal - 150 mm
EnerVal G - 75 mm

 Tilting measure

Delivery

 Storage tank with insulation installed

 Storage tank with insulation installed,
Insulation can be disassembled on site
790

 Storage tank and insulation separate
(two packages)

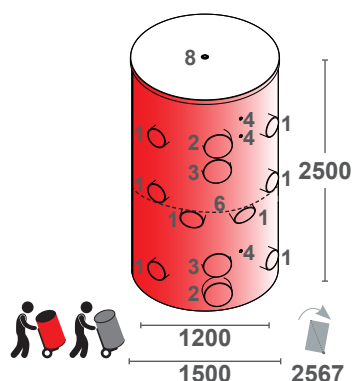
 or  storage tank uninsulated,
insulation on site

(4000)

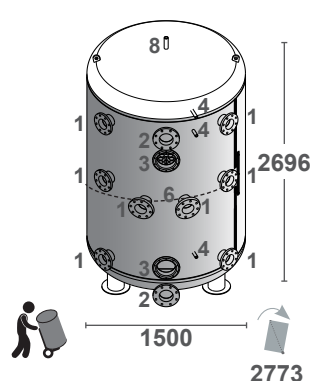
Nominal content 4021 l

(2500)

Nominal content 2419 l



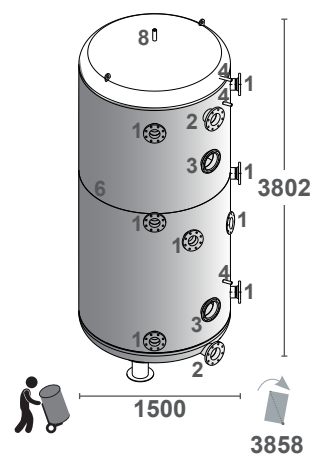
1	8 x DN 80
2	2 x DN 100
3	2 x DN 180
4	3 x G ½" (internal thread)
5	2 x
6	1 x
7	
8	1 x G 1" (internal thread)
Polyester fabric, 150 mm	



1	8 x DN 100
2	2 x DN125
3	2 x DN 180
4	3 x G ½" (internal thread)
5	2 x
6	1 x
7	
8	1 x G 1" (internal thread)
on site	

(6000)

Nominal content 5897 l



1	8 x DN 100	Charging
2	2 x DN125	Discharge
3	2 x DN 180	Electric heating element
4	3 x G ½" (internal thread)	Sensor/thermometer
6	2 x	Terminal strip for contact sensor
7	1 x	Perforated partition plate
		Circulation lance
9	1 x G 1" (internal thread)	Evacuation of air
on site		Thermal insulation

Hoval EnerVal G cool

The storage tank for low-temperature application.

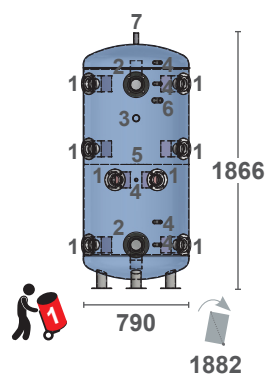


■ EnerVal G cool (800 - 6000)

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

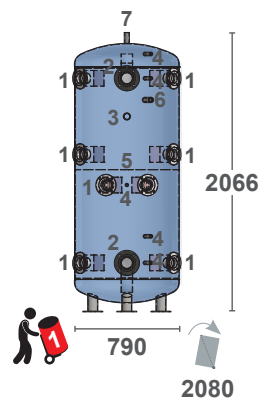
(800)

Nominal content 793 l



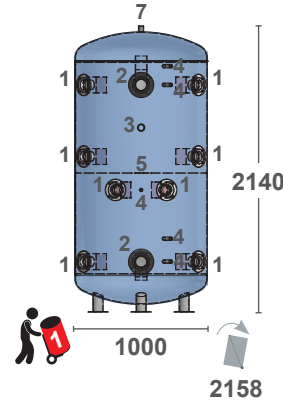
(1000)

Nominal content 889 l



(1500)

Nominal content 1440 l




Charging	1	8 x DN 65
Discharge	2	2 x DN 80
Electric heating element	3	1 x G 1½" (IG)
Sensor/thermometer	4	5 x G ½" (internal thread)
Perforated partition plate	5	1 x
Circulation lance	6	1 x G 1" (internal thread)
Evacuation of air	7	1 x G 1" (internal thread)
Cold insulation		synthetic rubber, 19 mm

1	8 x DN 65
2	2 x DN 80
3	1 x G 1½" (IG)
4	5 x G ½" (internal thread)
5	1 x
6	1 x G 1" (internal thread)
7	1 x G 1" (internal thread)
	synthetic rubber, 19 mm

1	8 x DN 80
2	2 x DN 100
3	-
4	5 x G ½" (internal thread)
5	1 x
6	-
7	1 x G 1" (internal thread)
	synthetic rubber, 19 mm

All dimensions in mm

Deviations possible as a result of manufacturing tolerances.
Dimensions +/-10 mm
All supports length: 75 mm

 Tilting measure

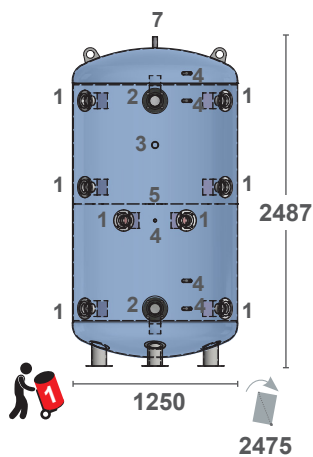
Delivery



Storage tank with insulation installed

(2500)

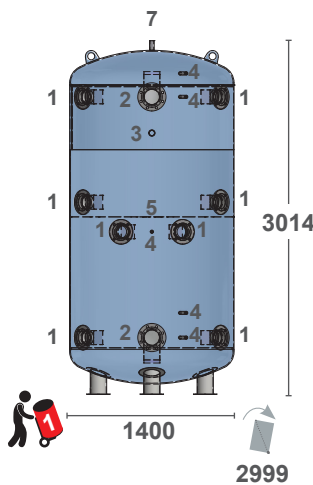
Nominal content 2518 l



1	8 x DN 80
2	2 x DN 100
3	-
4	5 x G 1/2" (internal thread)
5	1 x
6	-
7	1 x G 1" (internal thread)
synthetic rubber, 19 mm	

(4000)

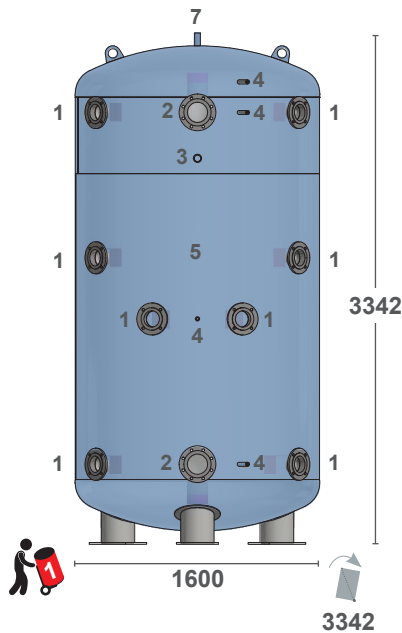
Nominal content 4035 l



1	8 x DN 100
2	2 x DN 125
3	-
4	5 x G 1/2" (internal thread)
5	1 x
6	-
7	1 x G 1" (internal thread)
synthetic rubber, 19 mm	

(6000)

Nominal content 5849 l



1	8 x DN 100	Charging
2	2 x DN 125	Discharge
3	-	Electric heating element
4	5 x G 1/2" (internal thread)	Sensor/thermometer
5	1 x	Perforated partition plate
6	-	Circulation lance
7	1 x G 1" (internal thread)	Evacuation of air
synthetic rubber, 19 mm		Cold insulation

Heat accumulator

Hoval EnerVal in comparison.

Type of heat accumulators

From sensible to thermochemical.

Heat accumulator

Heat accumulators are storage tanks for thermal energy (energy storage). A distinction is made between storage tanks for sensible heat, latent heat storage tanks and thermochemical heat accumulators. Heat storage tanks can be built in different sizes. They are available both as short-term and seasonal storage tanks and, depending on their design, can store and release low-temperature heat for space heating or high-temperature heat for industrial applications. In addition to the storage of thermal energy, the most important goal of heat accumulators is to decouple the generation and use of heat, in terms of time.

Types of heat accumulators

Sensible heat accumulators

They change their "sensible" temperature during the charging or discharging process, e.g. as a buffer storage tank. The heat capacity is one of the most important parameters for sensible heat storage tank materials. Since this type does not undergo phase transformations, it can be used over a wide temperature range, especially in the high temperature range.

Latent heat accumulators

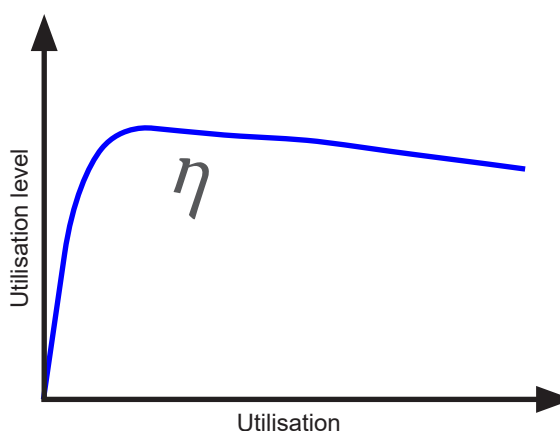
They do not change their "sensible" temperature during the charging or discharging process; instead, the heat storage medium changes its aggregate state. Usually, this is a transition from solid to liquid (or vice versa). The storage medium can be charged or discharged beyond its latent heat capacity, only then resulting in a temperature increase or decrease.

Thermochemical heat accumulator or sorption heat store

They store heat with the help of endothermic and exothermic reactions, e.g. with silica gel or zeolites. Thermochemical heat accumulators use the heat transformation of reversible chemical reactions: The heat transfer medium used changes its chemical composition when heat is added, and most of the added heat is released again during the externally triggered reconversion.

Utilisation level

The utilisation level of a storage tank is determined from the ratio of the stored usable energy and the energy supplied to the storage tank. With conventional water storage tanks, the utilisation level decreases over time because heat is released into the surroundings. Dependencies: Surface of the storage tank, insulation material and thickness. Temperature difference between storage medium and the surroundings. This does not apply, or applies to a lesser extent, to thermochemical heat accumulators.



Hoval EnerVal

Saving energy compactly.

A buffer storage tank stores heating energy with water in a simple but very effective way. It compensates for differences between the generated and consumed heat output. In this way, it decouples the generation of heat from consumption either in terms of time or in terms of hydraulics.

Added value for your benefit:

- Increased efficiency
- Flexible integration into plants
- Flexible set-up
- Versatile area of application
- Increases the durability of the heat generator



A range for numerous requirements.

Steel buffer storage tank for storing heating water. EnerVal und EnerVal G (800 - 6000) with thermal insulation.

Area of application: Heating and cooling applications in single-family homes and blocks of flats, in commercial and industrial applications - for new construction and refurbishment.



Efficient

The EnerVal energy buffer storage tank connects the heat generator or – in the case of bivalent heating systems – two or more heat generators with the heat consumer. If the generator supplies more heat than is currently needed in the building, the EnerVal stores this temporarily. It acts as a "heat battery". This improves the operating behaviour and thus the efficiency and durability of the heat generator.

Inside, the EnerVal works on the principle of a stratified storage tank and is thus particularly efficient. Its high-quality thermal insulation reduces heat losses to the outside. Even the connections are secured by covers to cut heat losses. The inside of the covering is only broken out when the connector is used.

Flexible

With its numerous connections, the EnerVal energy buffer storage tank reveals its flexibility as a component of the overall system. It offers great freedom in the individual design of new plants. This is an important aspect for plants that require a large storage tank volume, but

where little space is available. Heat generators of any type and several heating circuits can be almost universally connected and conveniently installed.

Versatile

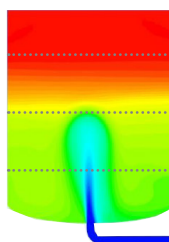
From small to large: the graduated range of the EnerVal includes numerous types. This means that there is a suitable storage tank for almost every heat generator. The EnerVal gives you a choice between two pressure levels and between a screw connection or flange connection. Whether heating or cooling, you are also sure to find the right EnerVal. The "small ones" can even be used for heating and cooling, they are the ideal space-saving solution for heat pumps with cooling function. You can also obtain these from Hoval in accordance with our motto: everything from a single source.

Greater energy efficiency due to installed parts and stratification

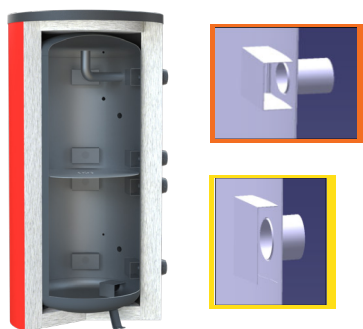
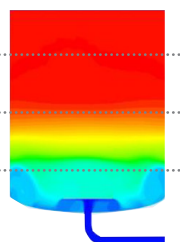
Inside the EnerVal, fixed installed parts before the connection nozzles ensure the ideal inflow and outflow velocity, and thus the best possible retention of temperature stratification in all operating states. Mixing of the storage tank contents and thus additional energy expenditure for reheating is avoided. The cross-section of the connections, another factor influencing the flow velocity, is ideally matched to the installed parts.

Inflow influences stratification

■ Without installed parts
Max. flow velocity
 $\leq 0.07 \text{ m/s}$

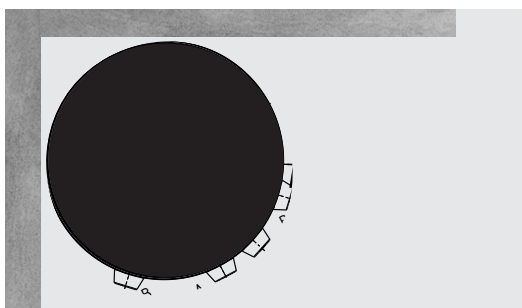


■ With baffle plate
Max. flow velocity
 $\leq 0.2 \text{ m/s}$



Space-saving corner set-up

On EnerVals larger than (800), the connections are located in the front area of the storage tank. Consequently, these types can be installed in a corner, to save space. This can be the right solution particularly when replacing a storage tank.



EnerVal buffer storage tanks - overview of variants



EnerVal

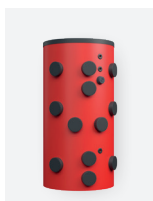
Connection: **thread**

Operating pressure **3 bar**

Operating temperature

(100-500) **5 - 95 °C**

(800 - 6000) **20 - 95 °C**



EnerVal G

Connection: **flange**

Operating pressure **6 bar**

Operating temperature **20 - 95 °C**



EnerVal G cool

Connection: **flange**

Operating pressure **6 bar**

Operating temperature **min. 5 °C**

Additional heat from electric heating element

An electric heating element is installed in the buffer storage tank for additional heating or emergency heating. It converts electricity directly into heat and is used when temperature fluctuations need to be compensated or additional heat is required. If the heat generator fails, it represents the "emergency heat supply".

An electric heating element powered by electricity from your own photovoltaic system is particularly ecological and economically efficient. When the heating element is operated, the self-consumption of photovoltaic electricity increases. In this way, you save heating costs and produce heat ecologically.

In order to use solar electricity, a regulated heating element with corresponding power electronics is better than an unregulated one. This is either switched off or operates at maximum power. If the solar power cannot deliver sufficient power, the heating element must either be operated with mains power or remain off. For the EnerVal, the Hoval range includes both regulated electric heating elements as an ideal supplement to a photovoltaic system and unregulated electric heating elements.



Buffer storage tank and domestic water

In combination with a separate fresh water module, the EnerVal energy buffer storage tank transfers the heat of the stored heating water to the domestic water using the continuous flow principle. The advantage: no need for storing hot domestic water. The domestic water is heated directly when being drawn off. The additional heat for the hot water is already taken into account when designing the storage tank volume.

If the available floor space is too small for one buffer storage tank and one domestic water storage tank, a combination storage tank may be the space-saving solution. A smaller hot water storage tank is inserted within a larger energy buffer storage tank and thus draws heat from the buffer storage tank through its walls.



Information about domestic water, fresh water modules and combination storage tanks
► See Domestic water systems factbook





Installed parts and inflow

For the ideal temperature stratification.

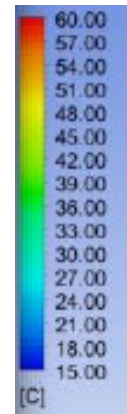
Inflow velocity

Where is it cold and where is it hot?

Stratified storage tank

EnerVal energy buffer storage tanks are designed as stratified storage tanks. Appropriate measures ensure that the strong temperature stratification is maintained. Hot water can always be drawn from the top of the EnerVal, even if it is not completely heated up. In the case of an unfavourable inflow, for example

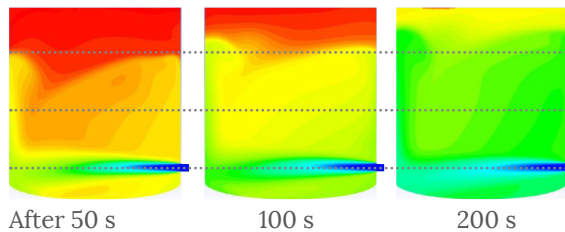
without installed parts, the cold return water and the hot supply water would intermix. Ideal inflow processes at the connections ensure stable stratification inside the EnerVal. The cross-section of the connections and fixed installed parts are decisive here.



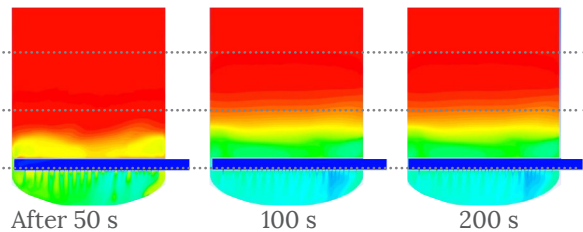
Installed parts influence the temperature distribution in the storage tank

Horizontal inflow?

■ Without installed parts
Max. flow velocity ≤ 0.1 m/s

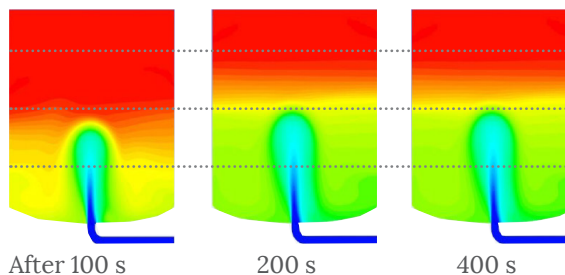


■ With charging pipe
Max. flow velocity ≤ 0.1 m/s

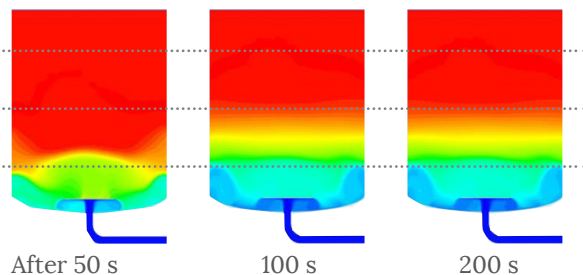


Vertical inflow?

■ Without installed parts
Max. flow velocity ≤ 0.07 m/s



■ With baffle plate
Max. flow velocity ≤ 0.2 m/s



Deflection of the inflow

The fixed installed parts in the EnerVal.

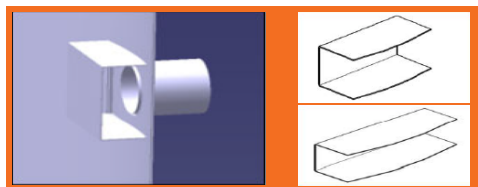
Inside the EnerVal, fixed installed parts before the connection nozzles ensure the ideal inflow and outflow velocity, and thus the best possible retention of temperature stratification in all operating states. Mixing of the storage tank contents and thus additional energy

expenditure for reheating is avoided. The cross-section of the connections, another factor influencing the flow velocity, is ideally matched to the installed parts.



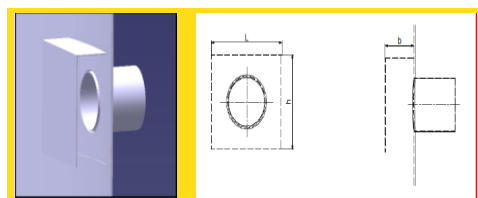
1 Flow deflection firmly installed on the jacket plate

Flow velocity ≤ 0.2 m/s



2 Flow deflection firmly installed on the dished bottom

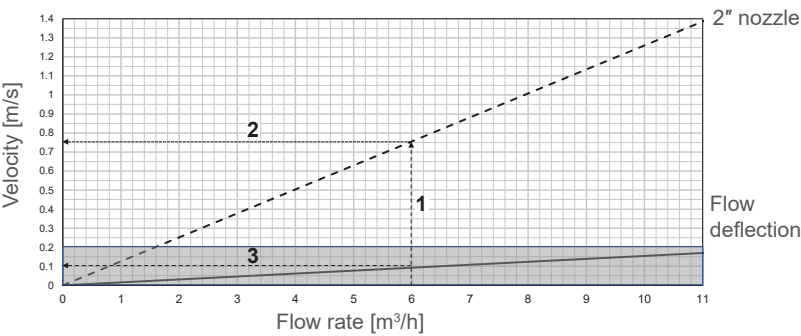
Flow velocity ≤ 0.2 m/s



Inflow velocity

The influence of the deflection.

EnerVal (800 - 2000)

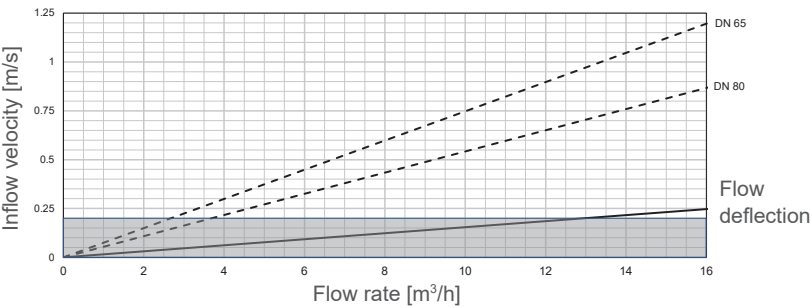


Reading example

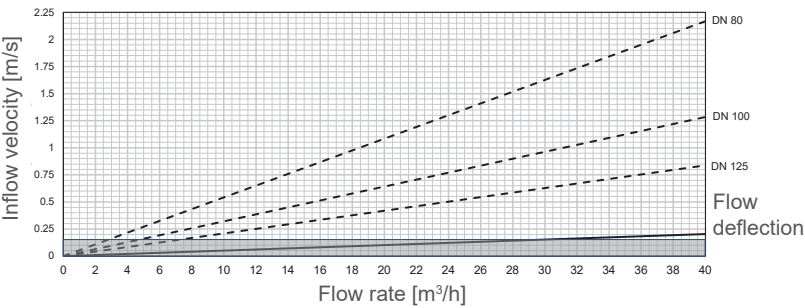
- 1 = Flow rate
- 2 = Velocity in the connection nozzles
- 3 = Inflow velocity with flow deflection in the EnerVal

EnerVal G und EnerVal G cool

Types (800, 1000)

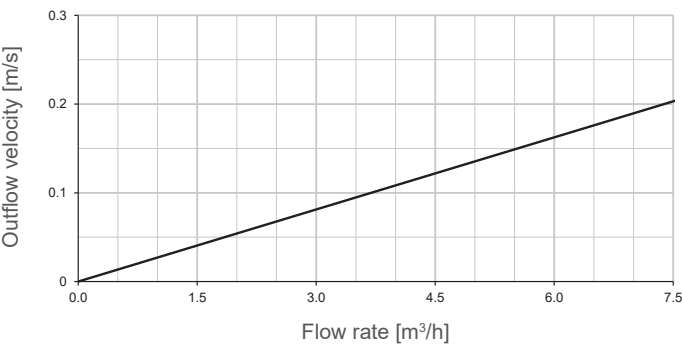


Types (1500 - 6000)



EnerVal (200 - 500)

Face velocity
flow lance DN 40



Flow lance accessory
for EnerVal (200-500)





EnerVal in the system
The function of the buffer storage tank.

Belaria twin AR

Energy buffer storage tank and heating circuit

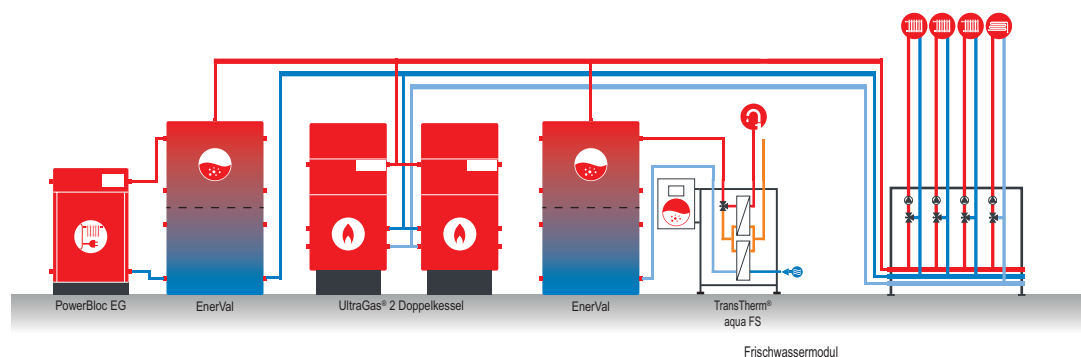
In the heating circuit, the buffer storage tank is placed between the heat generator/base load heat generator and the heat consumers. It is controlled via the heat generator with its system control. Most centrally operated heating plants work with water as the heat transfer medium. Thus, the energy buffer storage tank is a large container through which the heating water flows.

As a rule, the draw-off for the supply flow should be from the highest connection on the storage tank. The return flow is connected at the lowest point. The flow feed enters in the upper connection area, the return feed to the consumers is in the lower connection area. If several consumers with different temperature levels are connected, the feed can be made separately at different heights. Since the density of water within a given volume depends on the temperature, thermal stratification occurs in the buffer storage tank. Hot water is "lighter" than cold water, and rises to the top.

Tasks of a buffer storage tank

By separating heat generation and heat distribution, the heat generator can be operated efficiently regardless of the household's heat demand. Its efficiency increases while the cycle rate decreases: the heat generator does not have to be constantly switched on and off, which has a positive effect on its service life. Renewable energy sources can also be integrated into the heating system very effectively, or even several heat generators can be easily combined in one heating plant. The efficiency of the heating system is higher, the energy consumption and thus also the heating costs are lower.

In addition, significantly higher loads can also be supplied from the buffer storage tank at short notice. If a buffer storage tank is charged by a heat generator with 100 kW for one hour, it stores a heat quantity of 100 kWh. This makes it possible to cover short-term load peaks which are higher than the output of the basic heat generator, e.g. 200 kW for 30 minutes, without the peak load boiler coming into operation or even being necessary. The hydraulic conditions must allow for the higher flow rates due to the higher output.



Hydraulic integration

The interconnections make the difference!

Hydraulics

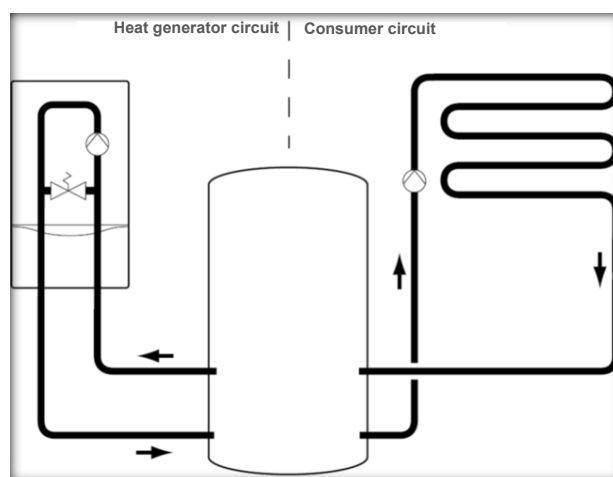
A simple buffer storage tank receives the cooled water from the return flow from the consumers, and feeds them with the stored hot water from the heat generators when the heat is needed. Since this is done almost in parallel via two circuits, the buffer storage tank can absorb heat from the heat generators without heat having to be taken from the consumers at the same time.

Hydraulic isolation

Base load heat generators are often subject to special operating conditions such as minimum return flow temperatures or minimum flow rates. To comply with these requirements, the base load heat generators are operated with their own pumps and control equipment. These pumps must be hydraulically decoupled to ensure that they do not have a negative effect

on the rest of the system hydraulics.

This ensures that the flow rates in the heat generator circuit are within the operating conditions to be complied with and that they do not influence the distribution circuits. The buffer storage tank also performs this function of a hydraulic switch.



Note!

The following schematics explain the basic connection options. Real plants must be configured.

Information about hydraulic schematics

► See Hoval system technology

One or more buffer storage tank(s)

Plants are increasingly frequently being equipped with buffer storage tanks, whether for heat pumps, wood boilers, CHP plants or solar plants. The hydraulic integration of a buffer storage tank must fulfil several aspects. In addition to the aforementioned requirements, it should also be easy to implement in existing plants and fulfil the tasks of a buffer storage tank as effectively as possible.

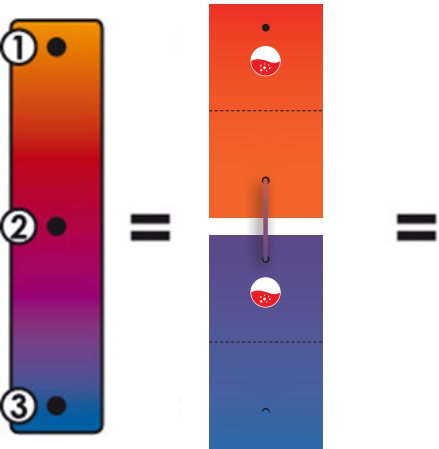
It is not uncommon for the necessary storage tank volume to have to be divided into several smaller containers, because only these can be fitted through the doors or stairwells.

It is generally known that the efficiency of heat storage depends to a large extent on the stratification in the storage tank. And for the purposes of stratification, a slim and tall storage tank is definitely better than a small and wide one with a large diameter.

If the decision has been made in favour of several storage tanks, these can be connected hydraulically in series (cascade connection) or also in parallel (if necessary with hydraulic balancing). The heat loss is higher than when using a single larger storage tank, because the overall surface area is larger.

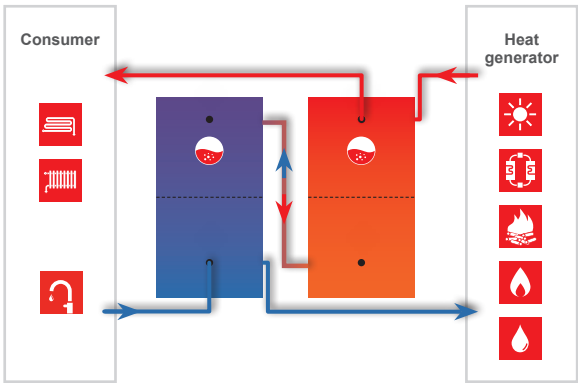
Serial integration (in series)

The picture shows a series connection of two buffer storage tanks. It is clear to see that with this connection, the total volume is distributed over the height between several containers. While in the parallel connection, all containers contain the same temperatures, in the series connection there are containers with different temperatures.



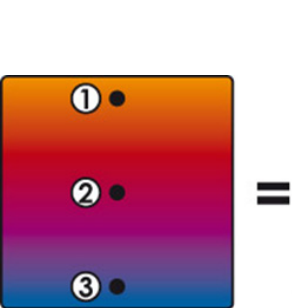
Important for the series connection:

- The number of containers in series corresponds to the number of storage zones, which is directly related to the number of connections.
- The series connection is certainly an advantage for the stratification in the buffer storage tank.
- Also, the buffer storage tanks do not have to be at the same height.
- The interconnecting pipes do not need to be horizontal, straight or of particularly large cross-section.



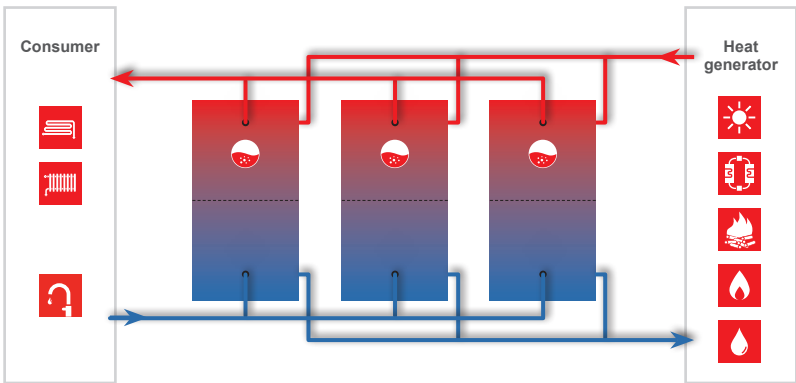
Parallel integration

The picture shows a parallel connection of three buffer storage tanks. It is quite clear that with the parallel connection, the total volume is distributed over the cross-section between several containers. It can also be seen that the number of containers can be increased as desired.



Important for the parallel connection:

- All containers are on the same height.
- All the respective interconnections are at the same height.
- The interconnecting pipes run precisely horizontally.
- The interconnecting pipes are as short as possible, without bends, and have large cross-sections.
- The connecting pipes always emerge vertically into the interconnecting pipes.



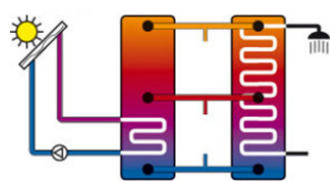
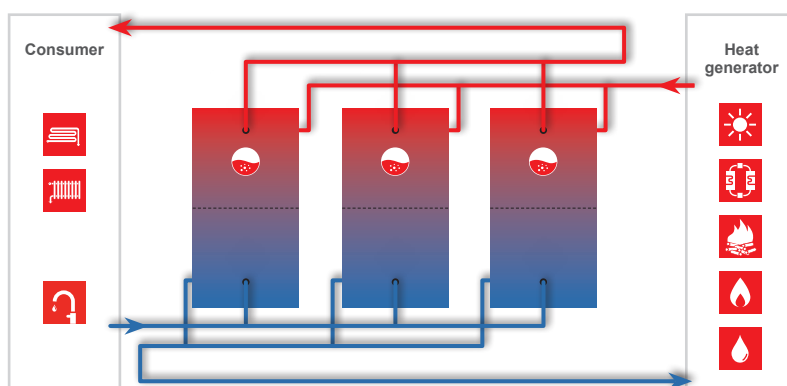
Tichelmann system

The Tichelmann system depends on the fact that the water flowing through or the cooling or heat transfer medium must cover the same length of pipe everywhere. The lengths of the flow and return lines are considered together and the same pressure losses occur at each consumer, so that the mass flow is evenly distributed. Of course, it is also important that the outputs or resistance values in all heating surfaces is approximately the same.

The Tichelmann principle is a simple way of balancing a system hydraulically. Based on equal arrangement of supply and return lines, it is easy to construct. It does not require any additional regulation and has no moving parts

that can cause defects or malfunctions. This increases the operational safety of the plant.

One disadvantage of the Tichelmann circuit, however, is the need for additional piping. Once installed, the system can no longer be fine-tuned afterwards.

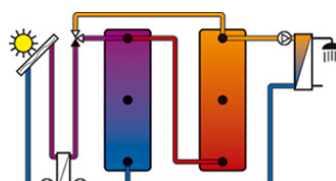


Summary I

There is also a serious disadvantage with the series connection:

- No gravity compensation is possible between the individual buffer storage tanks!

If, for example, a buffer storage tank with an internal solar heat exchanger and one with an internal domestic water coil are to be combined, this is only possible via gravity compensation, which requires a parallel connection. With a series connection, the solar heat would never get to the domestic water in summer.



Summary II

If, on the other hand, a solar charging module and a fresh water module are used, as shown in the picture, a series connection can be employed, because the modules ensure the heat transport between the individual buffer storage tanks with their pumps.

However, it must be ensured that the charging module also charges the upper or hotter buffer storage tank in summer (differential temperature switching valve). If this is ensured, the series connection can fully exploit its advantages over the parallel connection.

Bivalent plants

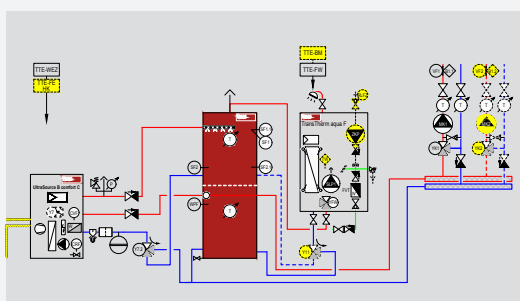
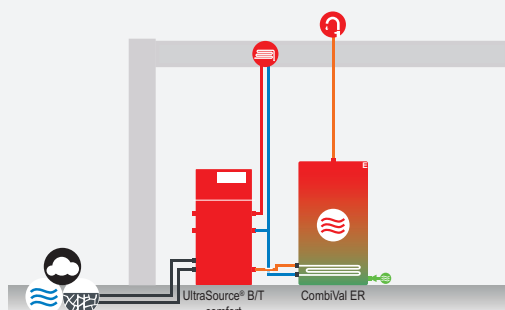
Bivalent plants – consisting of a base load heat generator with buffer storage tank and a peak load boiler – can reduce heat generator costs. From the point of view of hydraulics that are robust and easy to plan, the serial integration of the buffer storage tank is also particularly suitable economically.

The aim of an economically sensible dimensioning of bivalent systems must therefore be for as much of the heating work as possible to be carried out with the smallest possible base load heat generator. The different general conditions of the planned base-load heat generators must be taken into account here.

Efficiency through the right hydraulic integration – system technology from Hoval

Fossil or regenerative energy source, simple or complex? In addition to an extensive range of products, Hoval also offers a large selection of matching solutions with a detailed hydraulic schematic. This is usually supplemented by electrical connection diagrams and parameter settings for the TopTronic® E system control.

How to save time during planning and installation. And if help is needed, Hoval is there to provide advice and service. Everything from a single source: fitting, function-tested and efficient.



Storing heat

It all depends on the storage capacity.



Capacity (amount of heat that can be stored)

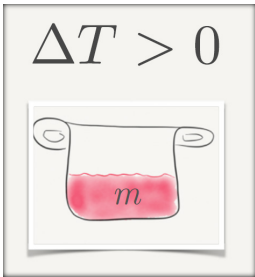
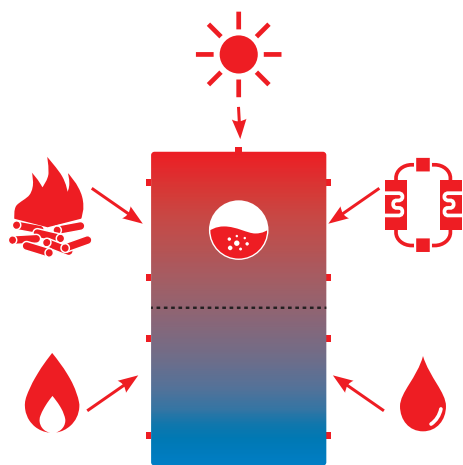
The amount of heat that can be stored in a buffer storage tank depends not only on the storage tank volume, but also on the temperature range, i.e. the difference between the maximum and minimum temperature in the storage tank.

For example, a storage tank for a solar plant with heating support can be heated to a maximum of 90 °C, and 30 °C can be assumed to be the minimum temperature if this is the required flow temperature of the heating system. (Heat below this temperature level can no longer be used in the system.)

Capacity of a storage tank

$$\Delta Q = m \cdot c \cdot \Delta T \quad [\text{J}]$$

ΔQ = Heat quantity [J]
 m = Buffer volume [kg]
 c = Specific heat capacity
 $\left[\frac{\text{J}}{\text{kg K}} \right]$
 ΔT = Temperature range [K]



Amount of heat that can be stored

Sample calculations

■ Amount of heat that can be stored (heat capacity)

for a buffer storage tank with a storage tank volume of 400 litres

$$\Delta Q = m \cdot c \cdot \Delta T \quad [\text{J}]$$

■ Storage tank temperature 90 °C

$$Q = 400 \text{ kg} \cdot 4,190 \frac{\text{kJ}}{\text{kg K}} \cdot (90 \text{ °C} - 30 \text{ °C})$$

$$Q = 400 \text{ kg} \cdot 4,190 \frac{\text{kJ}}{\text{kg K}} \cdot 60 \text{ K}$$

$$Q = 101 \text{ MJ} = 28 \text{ kWh}$$

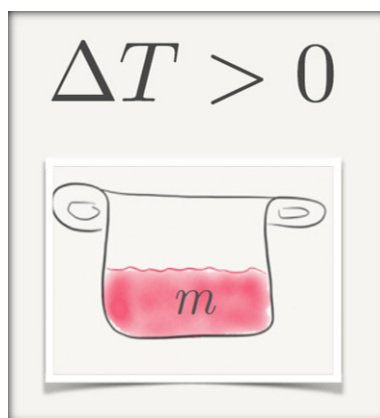
■ Storage tank temperature 60 °C

$$Q = 400 \text{ kg} \cdot 4,190 \frac{\text{kJ}}{\text{kg K}} \cdot (60 \text{ °C} - 30 \text{ °C})$$

$$Q = 400 \text{ kg} \cdot 4,190 \frac{\text{kJ}}{\text{kg K}} \cdot 30 \text{ K}$$

$$Q = 50 \text{ MJ} = 14 \text{ kWh}$$

If the same storage tank were only heated to 60 °C with a heat pump, only half as much energy could be stored, i.e. 14 kWh.



Calculation of the energy buffer storage tank

If no other criteria for dimensioning of the tank are available, the buffer storage tank should be able to buffer at least one hour of CHP module run time.

It follows that the minimum size of the heat buffer storage tank for a CHP plant should be calculated so that the charging time of the buffer storage tank corresponds to one hour at max. thermal output of the CHP module(s). Recommended size of the heat buffer storage tank for a CHP plant module at a temperature spread of 20 K and one hour module run time.

■ Size of the heat buffer storage tank with a CHP plant

$$m = \frac{Q \cdot t \cdot 3600}{c \cdot \Delta T} \quad [\text{kg}]$$

m = Buffer volume [kg]

Q = Nominal heat output [W]

t = Bridging time [h]


c = Specific heat capacity

$$\left[\frac{\text{J}}{\text{kg K}} \right]$$

ΔT = Temperature difference [K]

Table for calculating the buffer storage tank volume

► See separate Excel spreadsheet



m =	$\frac{Q \cdot t \cdot 3600}{c \cdot \Delta T}$	
m =	Puffervolumen	(kg)
Q =	Nennwärmeleistung	(W)
t =	Überbrückungszeit	(h)
c =	Spez. Wärmekapazität	(J/kg K)
ΔT =	Temperaturdifferenz	(K)

A quick guide to terminology

Interrelations.

Specific heat capacity c

The specific heat capacity c indicates how much heat is required to heat a body with a mass of 1 kg by 1 K. The specific heat capacity c relates the heat quantity Q to the **mass m** of the substance (in kg).

$$c = \frac{\Delta Q}{m \cdot \Delta T} \quad \left[\frac{\text{J}}{\text{kg K}} \right]$$

Heat capacity C

This is also referred to as the energy storage density. It describes the maximum amount of heat that can be stored in a gaseous, liquid or solid substance under given conditions.

$$C = \frac{\Delta Q}{\Delta T} \quad \left[\frac{\text{J}}{\text{K}} \right]$$

Heat capacity of gases and liquids

It is typically measured at a constant **volume**.

At constant **pressure**, the volume increases and has to perform mechanical work against the cylinder pressure.

This means the heat capacity is higher, at constant pressure.

For gases and liquids

- Constant volume

$$V = \text{const}$$

$$C_v = \frac{\Delta Q}{\Delta T} \quad \left[\frac{\text{J}}{\text{K}} \right]$$

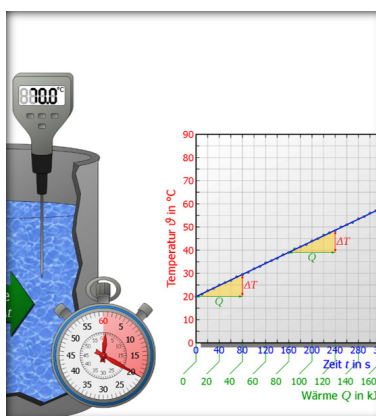
- Constant external pressure

$$p = \text{const}$$

$$C_p = \frac{\Delta Q}{\Delta T} \quad \left[\frac{\text{J}}{\text{K}} \right]$$

Specific heat capacity c - heat capacity C

$$c = \frac{C}{m} \quad \left[\frac{\text{J}}{\text{kg K}} \right]$$



Charging and discharging time

The time required to add or remove a certain amount of energy from the storage tank.

Maximum operating temperature

The maximum temperature of the storage tank.

Storage cycles that can be performed

The storage period is the time between the charging and discharging procedures. The duration of a storage cycle is composed of the total of charging, standstill and discharging times.

Minimising heat losses

Retaining stored energy.

Heat losses from buffer storage tanks

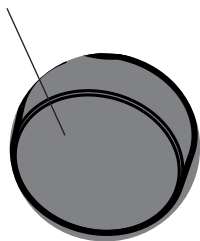
A heated buffer storage tank continuously loses a certain amount of heat. The amount of heat loses depends on the temperature difference between storage tank content and the surroundings. Heat conduction to the outside can be minimised by thermal insulation – while avoiding thermal bridges.

Energy buffer storage tanks of a few hundred litres that are not optimally insulated can lose quite a lot of kilowatt hours of heat per day in a boiler room. With high-quality and careful insulation, only a few kWh are lost – depending, of course, on the temperature difference between the storage tank contents and the surroundings.

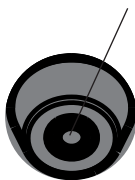
Connections

Critical points in thermal insulation are connections that penetrate the insulation layer, especially if these are in the upper, usually warmer, area. Caps can minimise heat losses here. The caps of the EnerVal are manufactured in such a way that the connection nozzles can be broken out when the connection is used. Unused connections are still fully insulated by the caps.

Insulated flange hood



Insulating cap - the opening for the connection nozzle can be broken out when the connection is used.



Cooling instead of heating

A brief look at the differences.



Buffer storage tank in cooling application

With suitable thermal insulation, a buffer storage tank can be used for both heating and cooling. In combination with a heat generator with cooling function, the stored water of the buffer storage tank is used for cooling when the cooling function is active. The following storage tanks are suitable for the cooling application.



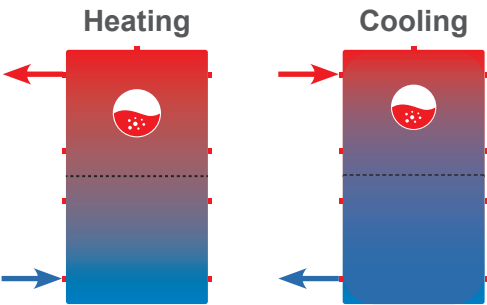
EnerVal (100 - 500)
 Connection: **thread**
 Operating pressure **3 bar**
 Operating temperature **5 - 95 °C**
 Application: **Heating** ● **and cooling** ●



EnerVal G cool
 Connection: **flange**
 Operating pressure **6 bar**
 Operating temperature **min. 5 °C**
 Application: **Cooling** ●

Connections when heating and cooling

In addition to the thermal insulation, the integration of the buffer storage tank is decisive for the cooling application. The return flow becomes the supply flow and the supply flow becomes the return flow. When the cooling function is active, the basic stratification in the storage tank is retained – hot at the top, cold at the bottom.



Information about
 Hoval heat pumps with cooling function
 ► See product brochures



Hoval quality.
You can count on us.

Hoval

As a specialist in heating and climate technology, Hoval is your experienced partner for system solutions. For example, you can heat water with the sun's energy and your rooms with oil, gas, wood or a heat pump. Hoval ties together the various technologies and also integrates room ventilation into the system. So you can save energy while looking after the environment and your costs – and still enjoy the same level of comfort.

Hoval is one of the leading international companies for indoor climate solutions. More than 75 years of experience continuously motivate us to design innovative system solutions. We manufacture complete systems for heating, cooling and ventilation to more than 50 countries.

We take our responsibility for the environment seriously. Energy efficiency is at the heart of the heating and ventilation systems we design and develop.

Responsibility for energy and environment

Your Hoval partner

Germany

Hoval GmbH
85609 Aschheim-Dornach
hoval.de

Austria

Hoval Gesellschaft m.b.H.
4614 Marchtrenk
hoval.at

Switzerland

Hoval AG
8706 Feldmeilen
hoval.ch

2023 - 04 | Subject to modifications