



**reflex 'buffer tank'
for hot and cold water storage**



reflex 'buffer tank'

An investment in the future

Fossil fuels are becoming more scarce every year and energy costs are constantly on the rise. We have to rethink energy policy. One possible option would be to shift our focus to forward-looking energy generation processes, such as co-generation of heat and power or heat pumps.

reflex 'buffer tanks' could play a role in reaching these goals. By separating energy generation and supply, slow boilers, for example, could be optimally operated without having to accept restrictions in use.

The strengths of reflex 'buffer tanks' really become evident when they are used in conjunction with solar energy systems, block-type thermal power stations and cold water systems.



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Forward-looking energy strategies – but not without reflex 'buffer tanks'!

reflex 'buffer tanks' are the ideal complement for:

- ▶ Heat pump systems
Operation of the heat pump is cost-effective regardless of current heating requirements.
- ▶ Solar energy systems
The abundance of solar energy is stored and available to you for a longer period of time even if the sun isn't shining.
- ▶ Solid-fuel boiler
Efficient boiler operation is guaranteed for slow combustion.
- ▶ Block-type thermal power stations
The waste heat produced from electricity generation is stored and available to be supplied for thermal load peaks.
- ▶ Heating and cooling systems
To cover and protect against demand peaks.



reflex 'PHF buffer tank'

reflex 'PH buffer tank'

reflex 'buffer tank' Effective and flexible

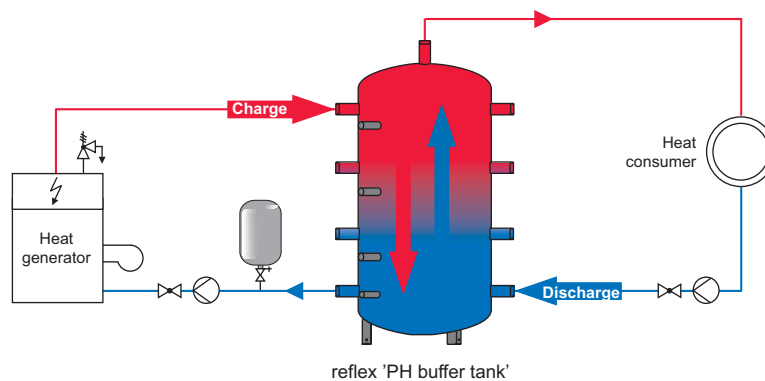
Functional principle – simple yet extremely effective!

reflex 'buffer tanks' work on the principle of layered storage and have a similar function to "thermobatteries".

A buffer tank can separate heat generation and heat consumption from one another not just chronologically but also hydraulically. This makes it possible to optimally adjust heat generation and heat consumption.

Three upper connections for the charge and discharge lines and two lower connections for return lines from the heat consumer or to the heat generator make a variety of different combinations and connections possible.

Of course, this functional principle can also be applied to the cold water systems.



The devil is in the detail – not a problem for reflex 'buffer tanks'!

- ▶ Tank is available in 6 sizes between 300 and 2000 liters
- ▶ 8 side connections, 1 connection on the top for versatile connection options
- ▶ 4 sockets to integrate sensors
- ▶ Its many connections make it ideal for subsequent enhancement
- ▶ 'PHF' with flange as inspection opening and to integrate an auxiliary heater
- ▶ 'PHW' with large heating surface, e.g. to incorporate a solar energy system
- ▶ High-quality 90 mm thermal insulation lowers operating costs and reduces the standby-losses to a minimum
- ▶ Foil coat available in 4 colors, to ensure that your buffer tank fits in nicely with your heating system



reflex 'buffer tank'
with insulation



"I have the flexibility I need with the reflex 'buffer tank' – there is a large selection of sizes, types and colors available and lots of options for connections."

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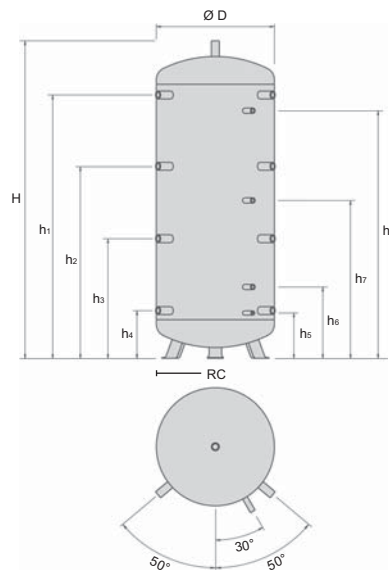


reflex 'buffer tank'

Technical data

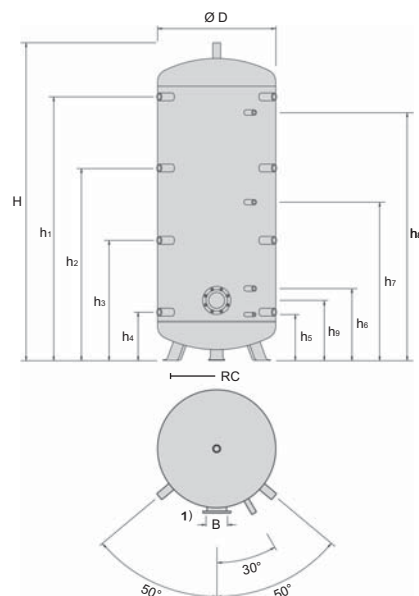
reflex 'PH buffer tank'

- ▶ For hot and cold water storage
- ▶ Storage tank made of high-grade steel S235JRG2 (RSt 37-2)
- ▶ Untreated on the inside, exterior finishing
- ▶ Perm. excess op. press. 3 bar
- ▶ Perm. operating temperature 95 °C



reflex 'PHF buffer tank'

- ▶ For hot and cold water storage
- ▶ Storage tank made of high-grade steel S235JRG2 (RSt 37-2)
- ▶ Untreated on the inside, exterior finishing with opening for cleaning and inspection
- ▶ Perm. excess op. press. 3 bar
- ▶ Perm. operating temperature 95 °C

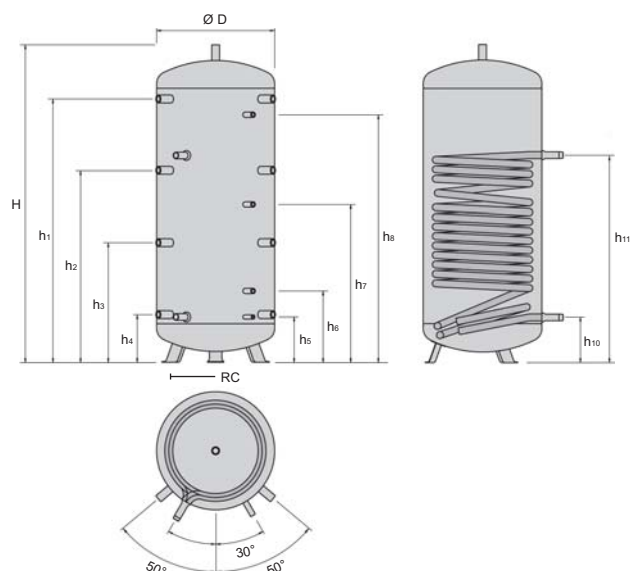


reflex 'PHW buffer tank'

- ▶ For hot and cold water storage
- ▶ Storage tank made of high-grade steel S235JRG2 (RSt 37-2)
- ▶ Untreated on the inside, exterior finishing
- ▶ With additional heating surface
- ▶ Perm. excess operating pressure

Storage	3 bar
Heating surface	16 bar
- ▶ Perm. operating temperature

Storage	95 °C
Heating surface	110 °C



reflex 'buffer tank'

Technical data / accessories

Tank type	PH, PHF ¹⁾ , PHW	300	500	800	1000	1500	2000
Nominal capacity	Liters	300	500	750	1000	1470	2000
Diameter Ø D	mm	597	597	750	850	1000	1200
Diameter Ø D1 ²⁾	mm	777	777	930	1030	1180	1380
Height H	mm / internal thread 1½	1320	1950	2000	2043	2120	2122
Diagonal height	mm	1335	1960	2015	2065	2145	2155
Reference circle RC	mm	520	520	680	772	875	1020
h ₁	mm / internal thread 1½	1033	1655	1661	1681	1716	1680
h ₂	mm / internal thread 1½	760	1181	1208	1228	1258	1245
h ₃	mm / internal thread 1½	490	701	748	768	798	805
h ₄	mm / internal thread 1½	225	225	291	311	341	365
h ₅	mm / internal thread ½	210	210	276	296	341	365
h ₆	mm / internal thread ½	380	375	441	461	551	575
h ₇	mm / internal thread ½	670	945	991	1011	1096	1100
h ₈	mm / internal thread ½	960	1515	1561	1581	1566	1630
h ₉ ¹⁾	Pitch circle B mm	150	150	150	150	150	150
	mm	265	265	365	386	421	445
h ₁₀	Internal thread	1	1	1¼	1¼	1¼	1¼
	mm	210	210	275	296	335	365
h ₁₁	Internal thread	1	1	1¼	1¼	1¼	1¼
	mm	705	955	1301	1322	1363	1393
Heating surface	m ² PHW	1.34	1.88	3.72	4.48	4.48	4.48
Weight	kg PH	51	61	112	130	167	244
	kg PHF	54	64	115	133	170	247
	kg PHW	74	89	185	216	253	330
Article no.	PH	7783000	7783100	7783200	7783300	7783400	7783500
	PHF	7783600	7783800	7784000	7784200	7784400	7784600
	PHW	7783700	7783900	7784100	7784300	7784500	7784700

1) The 'EFHR Electrical screw-in heater' may be installed in the 'PHF buffer tank'
The 'RWT Ribbed-tube heat exchanger' may be installed in the 'PHF buffer tank'

2) Ø D1 incl. thermal insulation, please order separately

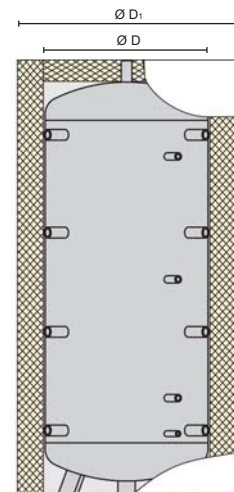
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reflex 'PW thermal insulation'

- ▶ For thermal insulation of 'PH, PHF, PHW buffer tanks'
- ▶ Made of 90 mm CFC-free flexible foam
- ▶ As a separate accessory for assembly at the installation location

▶ **Important:**
A 'PWF foil coat' is also necessary

Type	PW 300	PW 500	PW 800	PW 1000	PW 1500	PW 2000
Article no.	9119301	9119302	9119303	9119304	9119305	9119306



reflex 'PWF foil coat'

- ▶ PVC-foil cover for 'PW thermal insulation'
- ▶ PVC-foil in 4 colors available to match the heat generator

Type	PW 300	PW 500	PW 800	PW 1000	PW 1500	PW 2000
Article no. White	9119311	9119312	9119313	9119314	9119315	9119316
Orange	9119321	9119322	9119323	9119324	9119325	9119326
Blue	9119331	9119332	9119333	9119334	9119335	9119336
Silver	9119341	9119342	9119343	9119344	9119345	9119346

Flange cap

- ▶ When using 'PW thermal insulation' in conjunction with 'PHF buffer tank'

Article no. 7755800

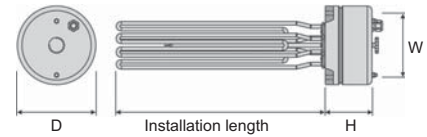


reflex 'buffer tank'

Accessories

reflex 'EFHR Electrical screw-in heater'

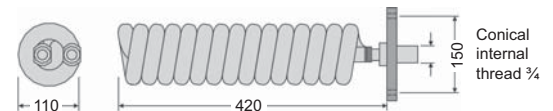
- ▶ As electrical heating for reflex 'PH buffer tank', also suitable for continuous operation
- ▶ 3 power settings, switchable
- ▶ With temperature control up to 95 °C
- ▶ Safety temperature limiter 120 °C
- ▶ Electrical connection on-site
- ▶ Easy installation in the cleaning opening
- ▶ Incl. counterflange and seal



Type	Article no.	Tank size liters	Output kW	Voltage V	Installation length mm	W mm	H mm	D mm
EFHR 4.0	9116314	300 - 2000	4.0 / 2.7 / 2.0	400	295	150	110	185
EFHR 6.0	9116315	300 - 2000	6.0 / 4.0 / 3.0	400	395	150	110	185
EFHR 8.0	9116316	300 - 2000	8.0 / 5.5 / 4.0	400	495	150	110	185
EFHR 10.0	9116317	300 - 2000	10.0 / 6.7 / 5.0	400	495	150	110	185

reflex 'RWT 1 Ribbed-tube heat exchanger'

- ▶ For 'PHF buffer tanks' to connect to an additional heat generator, e.g. a fireplace or a solar energy system
Suitable for heating water, district heating water, solar fluid
- ▶ Easy installation in the cleaning opening
- ▶ Made of ribbed copper pipe
- ▶ Incl. counterflange and seal
- ▶ Electrically insulated connections for galvanic separation
- ▶ Perm. excess op. press. 10 bar
- ▶ Perm. operating temperature 90 °C



Type	Article no.	Tank size liters	D1 mm	Installation length mm	W mm	Output* kW	Surface m ²
RWT 1	7755900	300 - 2000	110	420	150	9.0	1.1

* Output for heating water supply 80 °C with 0.65 m³/h, heating water from 50 °C to 70 °C

Selection

Because some of the tank dimensions are very complex depending on the characteristics of the heat consumer and heat generator, we only provide general information here.

The dimensions should thus always be defined in consultation with the planner or the boiler manufacturer.

► Usable heat energy $Q_{\Delta\vartheta}$ [kWh]

$$Q_{\Delta\vartheta} = V_{St} \cdot \rho \cdot c_p \cdot \eta \cdot \Delta\vartheta \text{ [kJ]}$$

$$1 \text{ kWh} = \frac{1 \text{ kJ} \cdot \text{h}}{3600\text{s}}$$

with $Q_{\Delta\vartheta}$ = Usable heat quantity for charge or discharge process in [kJ] or [kWh], dependent on the temperature difference $\Delta\vartheta$ between tank supply and return

V_{St} = Tank capacity in [Liter]

ρ = Density of the heat carrying medium [kg/l], for water use simply use 1 kg/l

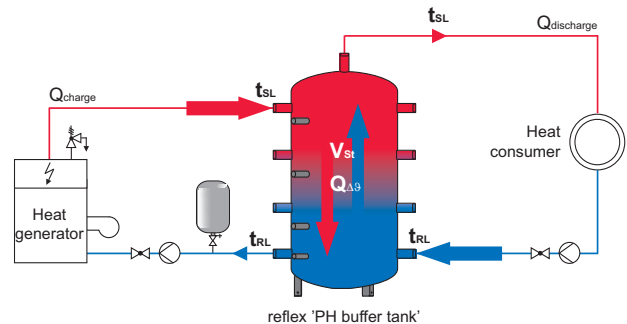
c_p = Specific heat capacity of the heat carrying medium, for water 4.19 kJ/(kg*K)

η = Level of tank utilization [-], at maximum capacity $\eta=0.9$

$\Delta\vartheta$ = Difference between tank supply and return temperature

$$\Delta\vartheta = t_{sL} - t_{rL} \text{ in [K]}$$

Nominal capacity buffer tank	Q_{20} kWh	Q_{30} kWh	Q_{40} kWh	Q_{50} kWh
300	6	9	13	16
500	10	16	21	26
800	17	25	33	42
1000	21	31	42	52
1500	31	47	63	78
2000	42	63	84	105



► Usable heat output \dot{Q} [kW]

$$\dot{Q} = \frac{Q_{\Delta\vartheta}}{\Delta t} = \frac{V_{St} \cdot \rho \cdot c_p \cdot \eta \cdot \Delta\vartheta}{\Delta t}$$

with \dot{Q} = Charge or discharge output in [kW]

Δt = Charge or discharge time in [s]

► Buffer tank in solar energy systems with low to medium solar radiation

$$V_{St} = A_{LA} \cdot \frac{v_{St}}{a_{LA}} = A_{LA} \cdot \frac{70}{10 \dots 20}$$

with V_{St} = Tank capacity in [liters]

A_{LA} = Living area in [m²]

v_{St} = Specific tank volume per m² of collector surface in [l/m²]
guideline value: 60 ... 80 l/m² (70 l/m² here)

a_{LA} = Specific living area per m² of collector surface in [m²]
guideline value: 10 ... 20 m²/m²

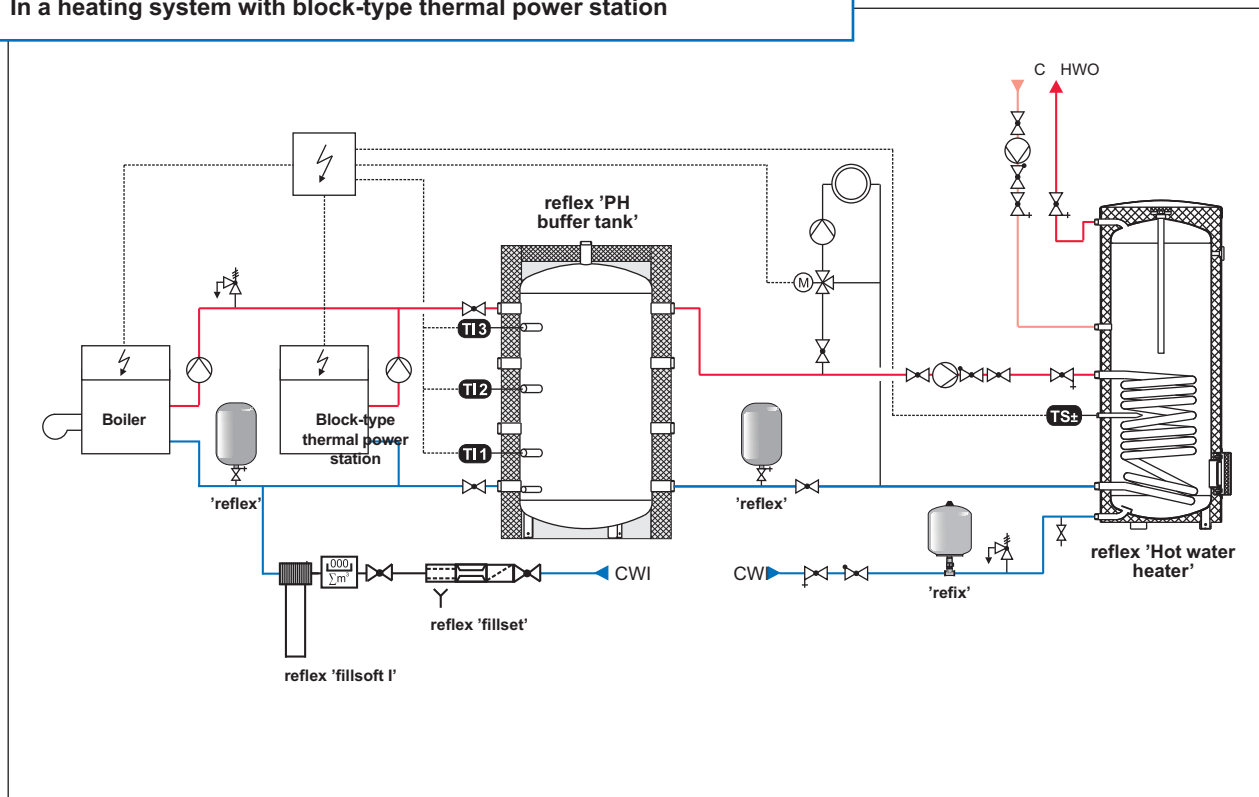
Living area m ²	Collector surface m ²	Buffer tank liters
70	7 - 14	490 - 980
100	10 - 20	700 - 1400
150	15 - 30	1050 - 2100
200	20 - 40	1400 - 2800
250	25 - 50	1750 - 3500
300	30 - 60	2100 - 4200
350	35 - 70	2450 - 4900
400	40 - 80	2800 - 5600
450	45 - 90	3150 - 6300
500	50 - 100	3500 - 7000

reflex 'buffer tank'

Sample installations

reflex 'PH buffer tank'

In a heating system with block-type thermal power station



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TS± The temperature sensor to be installed on site starts and stops the charge process depending on the switching hysteresis installed on the boiler.

TI 1 With a system-specific, higher-level regulation system, it is possible to link the regulation systems of the block-type thermal power station, boiler and consumer to one another. The charge level of the tank can be optimally recorded and routed to the regulation system by the **TI 1**, **TI 2** and **TI 3** sensors to be installed on the buffer tank on site.
TI 2
TI 3 If you have concrete questions about integrating the buffer tank into the hydraulic and regulation systems, please ask the specialists at the manufacturers of the regulation system and boiler.

Notes for the installer

- ▶ The reflex 'PH buffer tank' assumes the function of a hydraulic 'gateway' and separates energy generation and consumption.
- ▶ The upper third of the reflex 'buffer tank' should always be kept at $\geq 70^\circ\text{C}$ for potable water supply.
- ▶ The dimensions of the reflex 'buffer tank' are defined, e.g. according to the minimum operating time of the block-type thermal power stations and/ or the coverage of demand peaks.
- ▶ The volume of the reflex 'buffer tank' must absolutely be taken into account when determining the system volume to define dimensions for water supply or softening in accordance with VDI 2035 Bl.

→ 'fillsoft' brochure

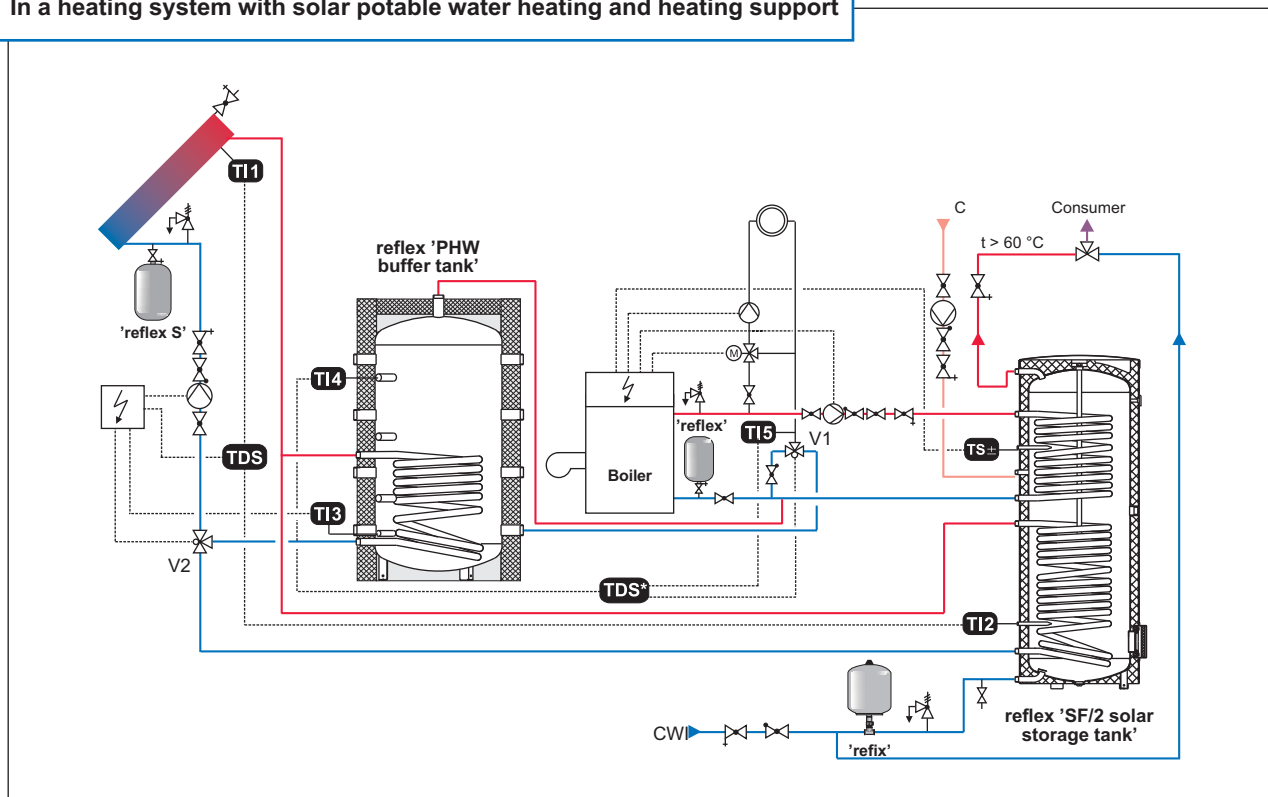
Sample selection

- ▶ Heating system
'PH buffer tank' 40-80 liter/kW heating capacity
- ▶ Block-type thermal power station with single-family house:
 $P_{el} < 5\text{ kW} \rightarrow$ 'PH buffer tank' 300 - 500 liters
 $P_{el} < 30\text{ kW} \rightarrow$ 'PH buffer tank' 500 -1000 liters

The circuits must be adjusted to suit local conditions.

reflex 'PH buffer tank'

In a heating system with solar potable water heating and heating support



TS± The temperature sensor to be installed on site starts and stops the charge process depending on the switching hysteresis installed on the boiler.

TDS The tank is charged by the solar energy system depending on a preset, minimum temperature difference **TDS** between the **TI1** and **TI2** sensors installed on site. When the required tank temperature is reached, the **TI2** sensor switches to buffer charging with Valve V2.

TI4 > **TI5**
The boiler return is guided to the buffer tank and the return temperature increased through the discharge of the tank.

TI3 The sensor switches the solar energy system off after the maximum energy storage tank temperature has been reached.

TDS* The return line monitor compares the boiler return **TI5** to the buffer tank **TI4** and switches Valve V1.

TI4 ≤ **TI5**
The boiler return goes directly into the boiler.

Notes for the installer

- ▶ In addition to the priority potable water heating, the solar yield can be increased with the help of a reflex 'PHW buffer tank' by increasing return.
- ▶ To optimize the solar yields from the heating support, a **TDS*** return line monitor is installed in the boiler return that monitors the buffer tank discharge.

Sample selection

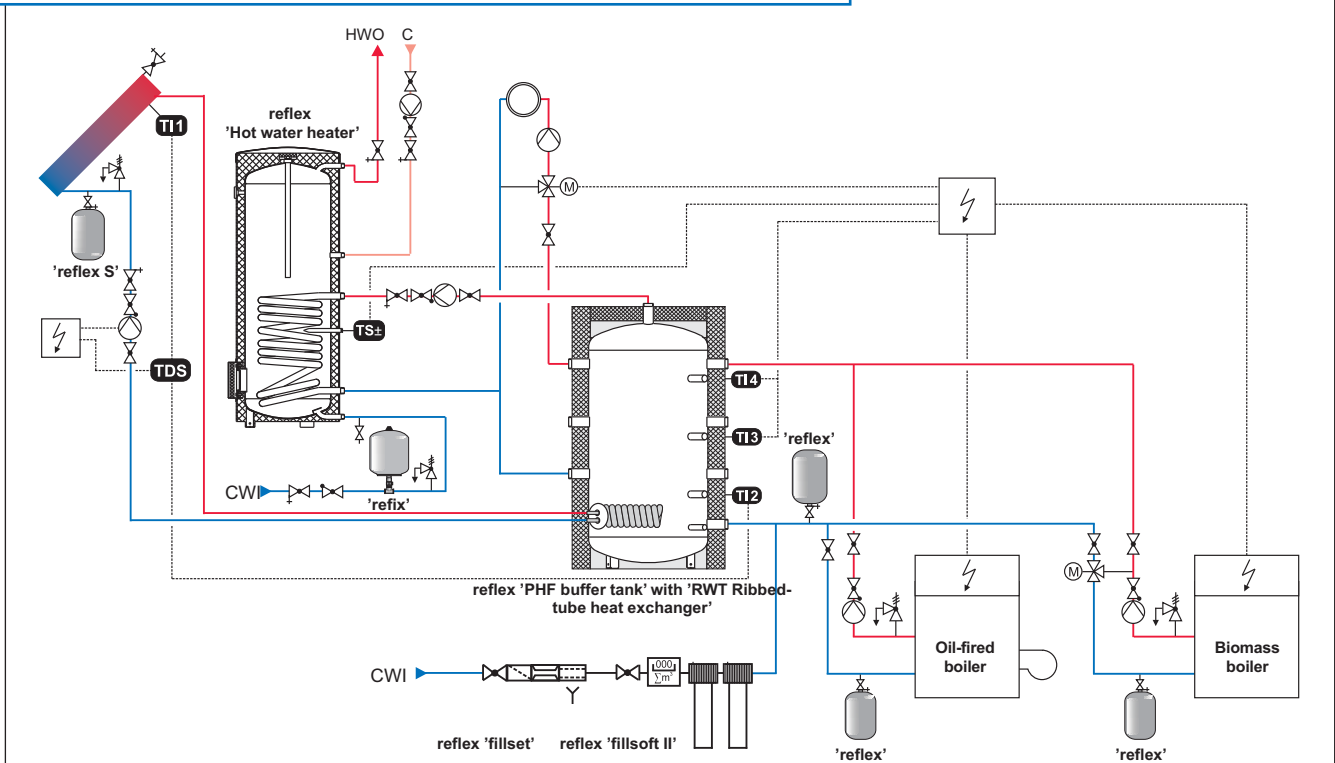
- ▶ Potable water heating:
Collector surface 1 - 1.5 m²/person
Solar potable water heater 60 - 80 liter/m² collector
- ▶ Heating support:
Collector surface 1...2 m²/10 m² additional living area
'PHW buffer tank' 60 - 80 liter/m² collector
(for systems with low to medium solar radiation)

reflex

reflex 'buffer tank'

Sample installations

reflex 'PHF buffer tank' with reflex 'RWT Ribbed-tube heat exchanger' in a heating system with two boilers and solar energy system



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- TS±** The temperature sensor to be installed on site starts and stops the charge process depending on the switching hysteresis installed on the boiler.
- TDS** The tank is charged by the solar energy system depending on a preset, minimum temperature difference **TDS** between the **T11** and **T12** sensors installed on site. When the required storage tank temperature is reached, the **T12** sensor switches off the solar pump.

- T1 2** With a system-specific, higher-level regulation system, it is possible to link the regulation systems of the biomass and oil-fired boilers and consumer to one another. The charge level of the tank can be optimally recorded and routed to the regulation system by the **T1 2**, **T1 3** and **T1 4** sensors to be installed on the buffer tank on site.
- T1 3**
- T1 4** If you have concrete questions about integrating the buffer tank into the hydraulic and regulation systems, please ask the specialists at the manufacturers of the regulation system and boiler.

Notes for the installer

- ▶ The 'PHF buffer tank' makes it possible to subsequently integrate a solar system with the help of the reflex 'RWT Ribbed-tube heat exchanger'.
- ▶ To guarantee a secure supply of potable water, the upper third of the buffer tanks should always be kept at the appropriate temperature.
- ▶ The 'PHF buffer tank' ensures a minimum operating time of the wood boiler and the dimensions must be defined for this requirement (observe minimum tank size for any requirements!).
- ▶ By enlarging the volume of the system with a reflex 'buffer tank', water can be supplied in accordance with VDI 2035 Bl.1 may be required particularly for multi-boiler systems.

→ 'fillsoft' brochure

Sample selection

- ▶ Coverage of a temporary demand peak:
Available boiler output 100 kW,
Demand peak 150 kW in 15 min,
SL/RL 80/50 °C (→ p. 7) from:

$$V_{st} = \frac{(Q_{max} - Q_K) \cdot t}{\rho \cdot c_p \cdot \eta \cdot \Delta\theta}$$

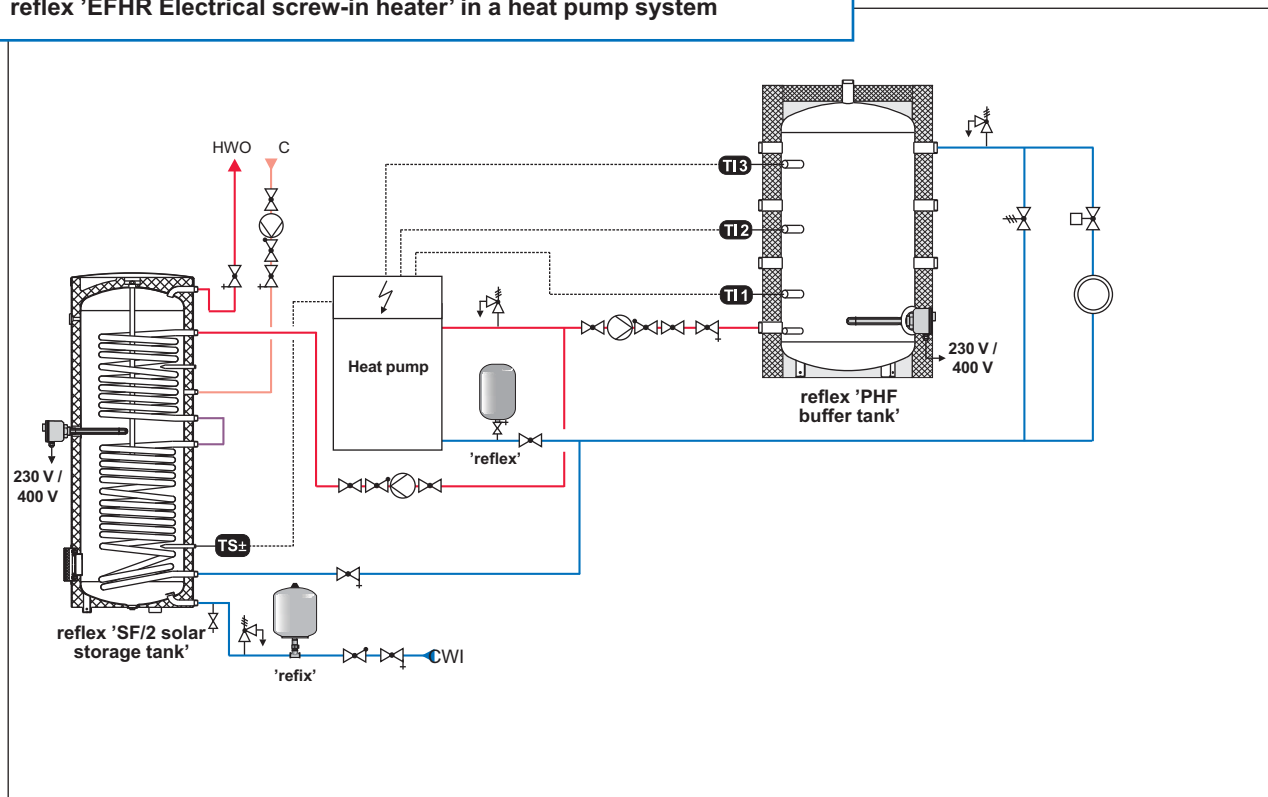
$$V_{st} = \frac{(150 - 100) \text{ kW} \cdot 15 \text{ min} \cdot 60 \text{ s/min}}{1 \text{ kg/l} \cdot 4,19 \text{ kJ/(kg} \cdot \text{k)} \cdot 30 \text{ K} \cdot 0,9}$$

$$= 398 \text{ liters}$$

selected: 'PHF buffer tank' 500 liters

The circuits must be adjusted to suit local conditions.

reflex 'PH buffer tank' with reflex 'EFHR Electrical screw-in heater' in a heat pump system



TS± The temperature sensor to be installed on site starts and stops the charge process depending on the switching hysteresis installed on the boiler.

TI 1 The charge condition of the storage tank can be optimally recorded and routed to the heat pump by the **TI 1**, **TI 2** and **TI 3** sensors to be installed on site.
TI 2
TI 3 If you have concrete questions about integrating the buffer tank into the hydraulic and regulation systems, please ask the specialists at the boiler manufacturer.

Notes for the installer

- ▶ The 'PHF buffer tank' ensures a minimum operating time of the heat pumps if the heating valves are closed and is integrated into a serial circuit between the boiler and consumer.
- ▶ When using a 'EFHR Electrical screw-in heater' to cover demand peaks, the 'PHF buffer tank' is integrated in the supply.
- ▶ Without a 'EFHR Electrical screw-in heater', the 'PHF buffer tank' is placed in the return and only charged when the heat pump is running.
- ▶ To increase the heating surface for potable water, the heating coils of a solar tank can be connected in a series.

Sample selection

- ▶ Minimum operating time of a heat pump (delay time):

$$V_{St} = \frac{1}{10} \text{ h} \cdot \text{Minimum hot water throughput [m}^3/\text{h]}$$

$$V_{St} = \frac{1}{10} \text{ h} \cdot V_{\text{heat pump min}} \text{ [m}^3/\text{h]}$$



Reflex –

We want the environment to benefit from our progress

Real progress is only achieved when man takes care of natural resources. Therefore, we favour materials and production technology which offer maximum environmental compatibility. Taking care of and assuming responsibility for the environment has been and will always be one of the principles of Reflex.



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