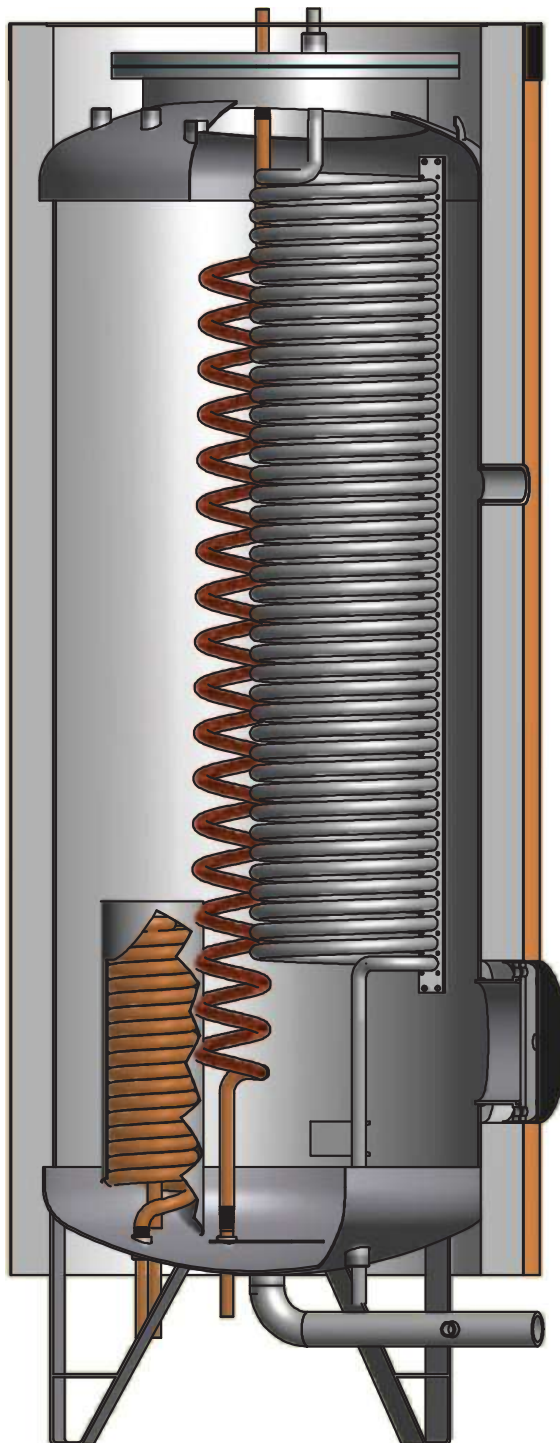




**Cooling. Heating.
Innovation.**

DK-Energy Storage Tank



**COMBINED
WHOLE
BUILDING
SOLUTIONS**

**INDIRECT HEATING
OF DRINKING WATER IN
FLOW LINE SYSTEM**

**WARMING OF
HEATING AND
DRINKING WATER IN ONE
TANK PLUS OPTIONS TO
REHEAT WITH FURTHER
SOURCES OF AVAILABLE
HEAT**

CONSTRUCTION OF THE DK ENERGY STORAGE TANK

The structure of the energy storage tank is very straightforward: Taking our well established standard **DK-Heat Recovery Tank for heating purposes** and add to this a premium quality **stainless steel spiral tube heat exchanger**.

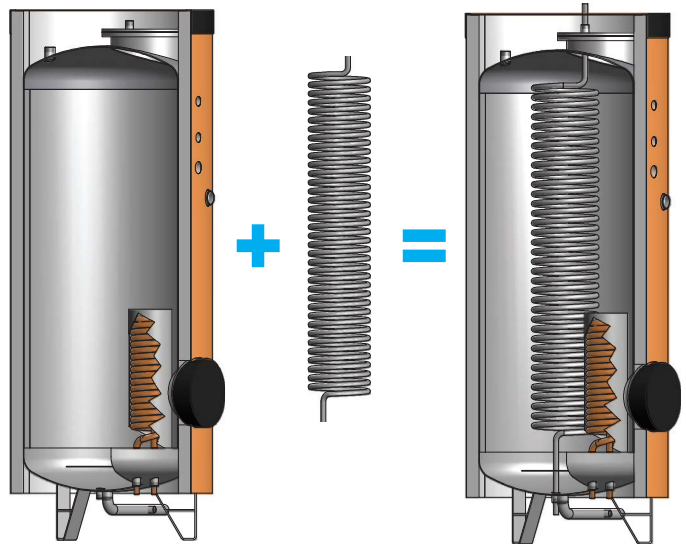
The heating water in a raw heating tank is heated with either internal or external single-walled heat exchangers. The drinking water flows through the spiral tube. **Twin wall heat exchangers are fitted** as standard: to comply with European EN 1717 to protect drinking water.

To heat the drinking water DK relies on a spiral tube. The main reason for choosing this type of heat exchanger is that the pressure loss as compared to a corrugated pipe is significantly lower (about 30%).

In this system of indirect drinking water heating only small amounts of heated water are stored.

Therefore, a **simpler protection against Legionella** is provided.

Through additional connections for the heating circuit, it is also possible to provide heating power from drinking water to the heating circuit. A primary object of the systems is to achieve the highest possible temperature level at the drinking water exit. **Four DK-concepts can offer the Holistic solution.**

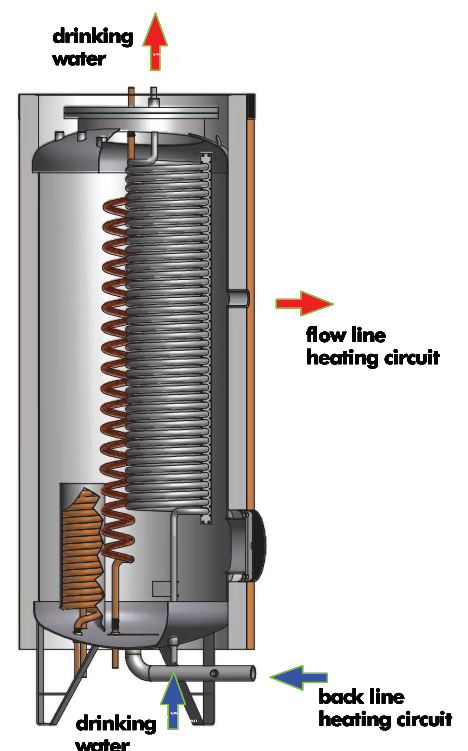


HEATING AND DRINKING WATER HEATING Using only the waste heat energy from refrigeration systems

The unique concept of this system lies in the unique arrangement of the heat exchangers.

The performance of internal heat exchanger of the refrigeration system is available **across the entire length of the tank**. The heating water return is located in the lower part of the tank and the heating flow is positioned at two-thirds of the tank height. Thus, the upper third of the tank will not be traversed by the heating circle and may be heated from the refrigeration units using the de-superheating capacity to achieve a higher level of water temperature.

Employing this method and construction it is possible, even at moderate condensing temperatures, to ensure heating water heating in the low temperature range and drinking water heating in the high temperature range.





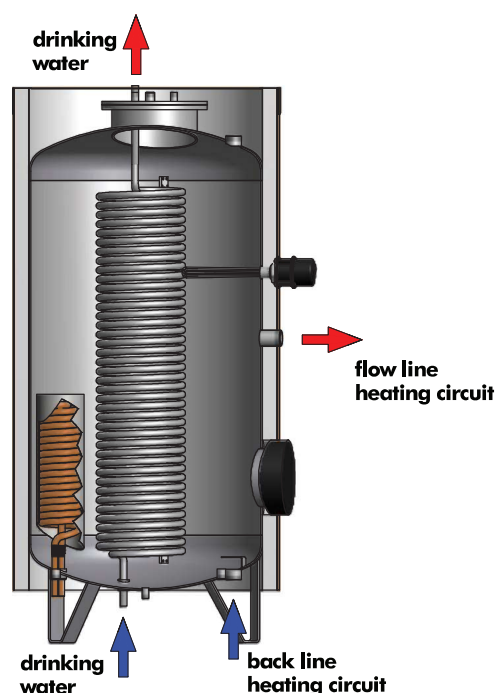
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WASTE HEAT USE IN COMBINATION WITH AN ELECTRIC BOOST HEATER

The waste heat from the refrigeration system is, is the prime energy source for heating the heating and drinking water. DK systems for serving applications that require higher water temperatures can be offered complete with a factory fitted electric heater, complete with safety over heat projection control. This system is ideal for smaller projects, such as the Petrol Station Forecourt Shop application: In November 2010, DK supplied a DK-Energy Storage Tank to the clients refrigeration contractor. The waste heat from the refrigeration system ($Q_o = 4.95 \text{ kW}/Q_c = 8.1 \text{ kW}$), was used to heat the admin offices and staff rooms (81 sq. m.) of the petrol station. In addition, drinking for the snack bar is simultaneously heated in a continuous process with a stainless steel spiral tube heat exchanger. The specialist refrigeration contractor took measurements five months before (November 2010 - March 2011).

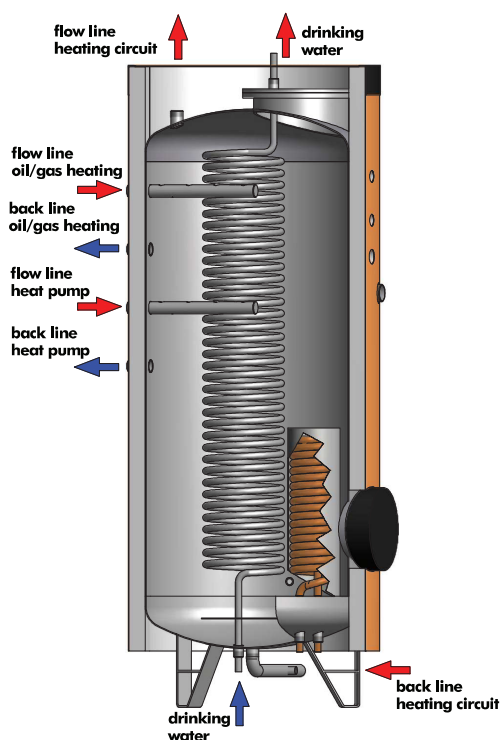
The data obtained proved that the DK-Heat Recovery was sufficient to ensure almost all the entire heating of the staffrooms and hot water for the petrol station – without support from a second heat source.

During this exceptionally cold winter, the power consumption of the installed electric heater was 90 kW for the entire winter period. The electric heater with an output of 6 kW had been in operation merely 15 hours in total during the whole winter.



WASTE HEAT (INTERNAL HEAT EXCHANGERS) USE IN COMBINATION WITH A HEAT PUMP / GAS BOILER

For larger scale projects and heating systems requiring higher flow temperatures. DK offer internal or external heat exchangers to provide the complete heating requirement to the upper third of the DK Heat Store Tank tank with a heat pump heat exchanger and/or Gas/LPG/Oil fired boiler systems. The core heat source of the tank is the responsible use of waste heat energy from refrigeration plant & equipment – in this case by internal heat exchangers. The benefits of heating with internal heat exchangers as opposed to external heat exchangers can be seen in the fact that no additional pumps are needed. This reduces the investment as well as operating & maintenance costs. The internal heat exchanger offers unparalleled direct and continuous heat transfer performance at all periods of refrigeration plant operation





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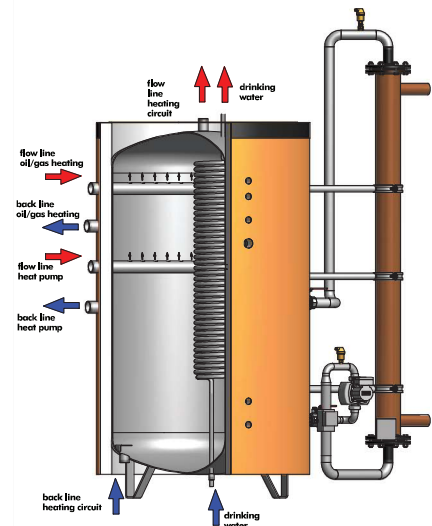
WASTE HEAT (EXTERNAL HEAT EXCHANGERS) USE IN COMBINATION WITH A HEAT PUMP / GAS BOILER

An alternative method to the above previous described system, is the employment of the DK externally (to the tank) heat exchanger.

This method is usually required for large pressure lines, and also offers the opportunity to install heat and flow rate metering between the heat exchanger and tank – giving delivery of true and real-time data of performance and efficiency of waste heat utilization & carbon reduction/savings.

In addition, this system allows for easy separation of responsibilities between the various refrigeration and plumbing contractors.

This separation and clarity often proves beneficial for supermarket projects – clearly defining the work responsibilities between the client, main contractor and the specialist installers.



INSTALLATION NOTE

In the examples shown, most heat exchangers and supplementary heaters are installed within the DK-Combined Heat Recovery Tank.

These heaters are provided for safe and for sufficient heating of the rooms, but they are also required for heating circuits with higher flow temperatures than t_c .

In all systems with additional requirement heating to higher flow temperature – whether using heat pump, PWW or electric – it is important to ensure adequate duty of the heating circuit to ensure return temperatures below t_c .

Otherwise it is impossible to harvest the waste heat energy from the refrigeration systems.

The following is a typical example of a Super Market application

Design condition condensing temperature of the refrigeration systems in winter mode: max. t_c $+37^\circ\text{C}$ to be connected heating circuits:

- 1.) Smoke removal / ventilation system / static heating floors flow line $+55$ / return flow $+35^\circ\text{C}$
Heat output of the above 3 heating circuits: 40%
- 2.) Floor heating flow line $+33$ / return flow $+28^\circ\text{C}$
Heating power of the heating circuit described above: 60%

This resulted in an average return temperature calculated from $+30.8^\circ\text{C}$, and thus a delta „t“ from 6.2 K to t_c $+37^\circ\text{C}$

OTHER POSSIBILITIES

Assuming there is no drinking water to be heated and therefore no spiral tube heat exchanger is needed, the DK-Heat Recovery offers these systems as true holistic & sustainable building heating solutions.

Please talk to our Design Team in the “contact us” section and we will find an optimal solution for your business - together

DK-Kälteanlagen GmbH

Hollefeldstraße 30 · 48282 Emsdetten · Tel.: 0049 2572 / 9314 - 0 · Fax 0049 2572 / 9314 - 20
www.dk-kaelteanlagen.de · Info@dk-kaelteanlagen.de