ABC
OF DISTRICT HEAT

CORRECT USE OF DISTRICT HEAT

Contents

District heating is local

District heating is local heating, and it is the most common heating method in Finland. Almost half of the heating and hot service water required by all buildings in the country is produced with district heat.

District heating means living comfort and wellbeing. It is a safe, secure and easy method of heating, which can save energy, money and time without having to make great investments. With correct and well-advised use of heating equipment, energy is saved without having to compromise over the requirements of healthy living.

When the equipment is in good condition, the room temperature stays at a comfortable and even level, and there is always plenty of hot service water at all seasons and times of day. The need for maintenance and repairs is also low.

The strength of district heat lies in the flexibility of the production system. District heat can be produced in a number of different ways and, if necessary, the production form or source of energy can be changed. No action is required from the customer in such an event.

In general, district heat is produced in combined heat and power plants or in heating plants. An increasing amount of renewable fuels, such as wood and forest chips, is used in the production of district heat. More traditional fuels include natural gas, coal and peat. Heat pumps and surplus heat are also utilised in district heating.

Customers receive heat through the hot water circulating in the district heating network.

Further information about district heat is available on www.kaukolampo.fi/en

An example of the distribution of heat consumption in an older building where heating accounts for 78% and service water 22%. The consumption distribution is house-specific.

Well-functioning equipment saves money and heat

Heating costs can be reduced without great investments. With correct use of heating equipment, energy is saved without having to compromise over the requirements of healthy living.

The difference in the temperature of district heating water coming into and going out of the building is called the cooling of district heating water. The higher the cooling of district heating water is, the better the district heating equipment of the building is working.

The equipment may have a fault if the cooling is below 25°C in the heating season or if it deviates considerably from previous values. Cooling can usually be monitored on the bill sent by the heat supplier or on the annual consumption report. If you suspect a fault in the equipment, contact a HVAC company or your heat supplier.

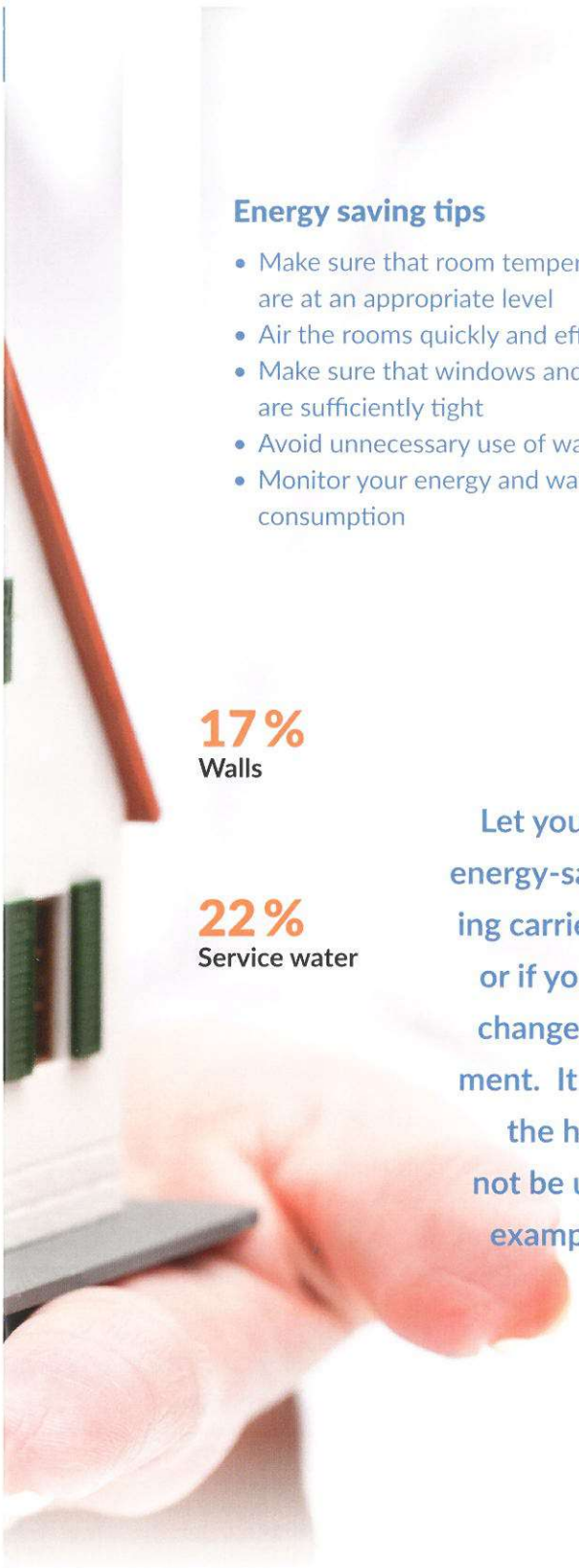
It is recommended that room temperatures are adjusted according to the use of the rooms.

Energy saving tips

- Make sure that room temperatures are at an appropriate level
- Air the rooms quickly and efficiently
- Make sure that windows and doors are sufficiently tight
- Avoid unnecessary use of water
- Monitor your energy and water consumption

17 %
Walls

22 %
Service water



Let your heat supplier know if energy-saving measures are being carried out in your property or if you are planning to make changes to the heating equipment. It is also worth notifying the heat supplier if heat will not be used for some time, for example, during renovations.

Recommended indoor temperatures:

- home and office 20–22°C
- shops, workshops and industrial premises 18°C
- heated storerooms 12°C
- garages 5°C

A drop of just one degree in room temperature means a saving of about five per cent in annual energy consumption.

It pays to monitor heat consumption

The thermal energy used by a property is metered, and billing is based on actual consumption. The heat supplier usually takes the consumption readings remotely. The heat supplier is also responsible for taking care of the operation of the metering centre.

Customers receive a heat consumption monitoring report from the heat supplier at least once a year. In many locations, customers can monitor their consumption directly on the heat supplier's website. Remotely read meters enable consumption monitoring even at the hourly level.

It is easy for customers to monitor the condition and controls of their heating equipment with the consumption information of the monitoring report. Temperature variations in different years are taken into account with the heating degree day. If current consumption deviates considerably from the consumption of corresponding months in previous years, the heating equipment should be inspected.

Your heat supplier can provide additional information on your property's energy consumption and metering.

Heating degree day and heat index

With the heating degree day, it is possible to compare individual heat consumption in different months or years and to compare it with the consumption of other, corresponding buildings. Variations in the outdoor temperature in different years are taken into account with the heating degree day.

The heat index is the heat consumption adjusted (normalised) with the heating degree day to the normal year per one building cubic metre a year (kWh/m^3/year). The heating degree day has been developed for heating calculations for properties, and it tells whether the month in question has been warmer or colder than a corresponding average month. Local heating degree days are calculated by the Finnish Meteorological Institute.

Further information: www.motiva.fi/kulutuksennormitus (only in Finnish)

Equipment

This graph is indicative, and the positioning of equipment within the entity varies depending on the make of the equipment.

HEAT SUPPLIER'S EQUIPMENT

The heat supplier is responsible for the district heating supply and return pipes, the metering centre, the shut-off valves and the strainer.

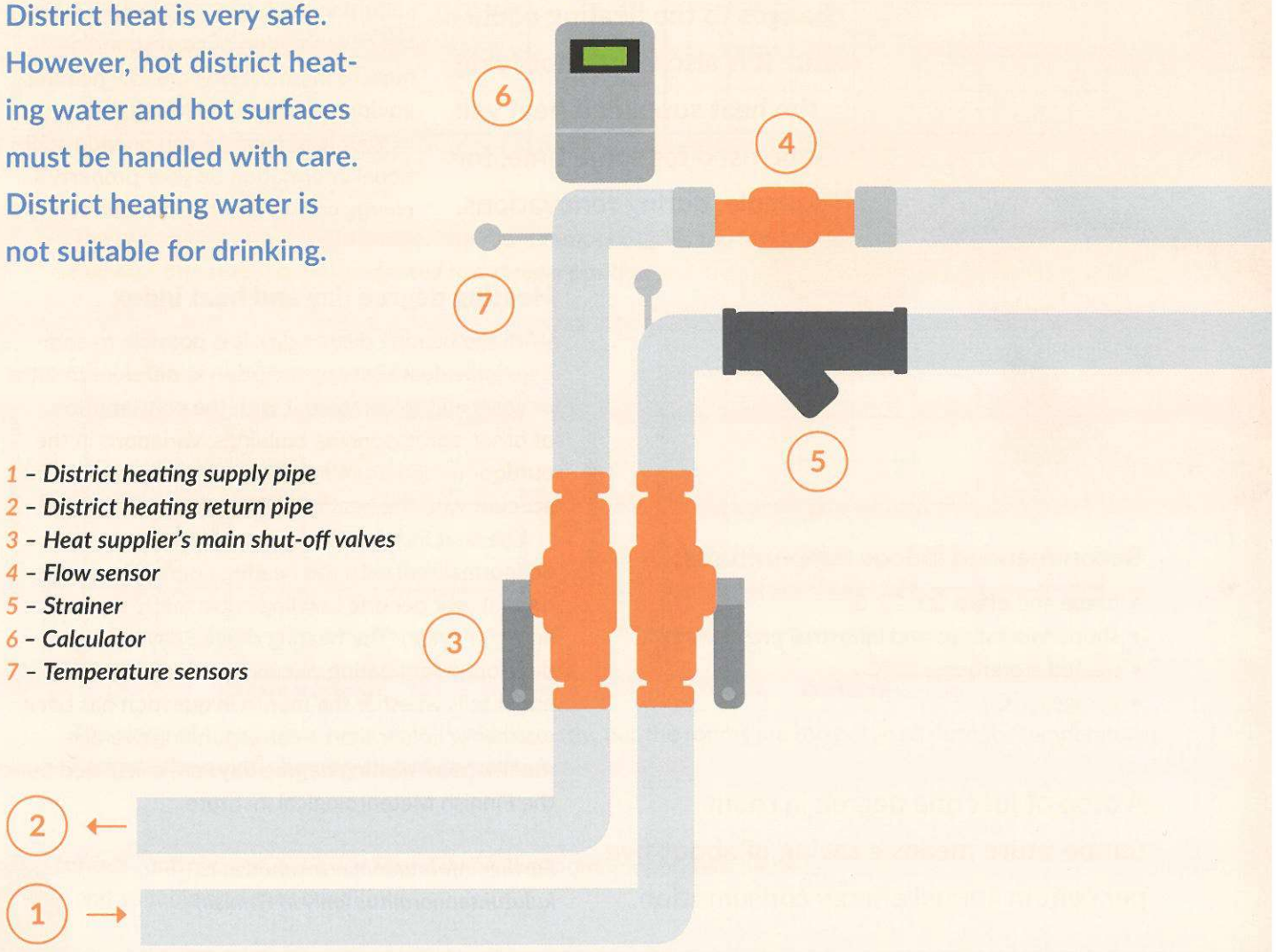
The pumps in the district heating production plant or district heating network keep the water circulating in the customer's substation. The pressure and pressure difference in the district heating network vary: they are usually higher in the winter than in the summer.

The heat meter consists of the flow sensor, two temperature sensors and the calculator. The flow sensor measures the volume of district heating water circulating through the equipment and the temperature sensors measure the temperature of water going into and coming out of the building. The calculator calculates the consumed thermal energy, and the consumption can be read as megawatt-hours (MWh).

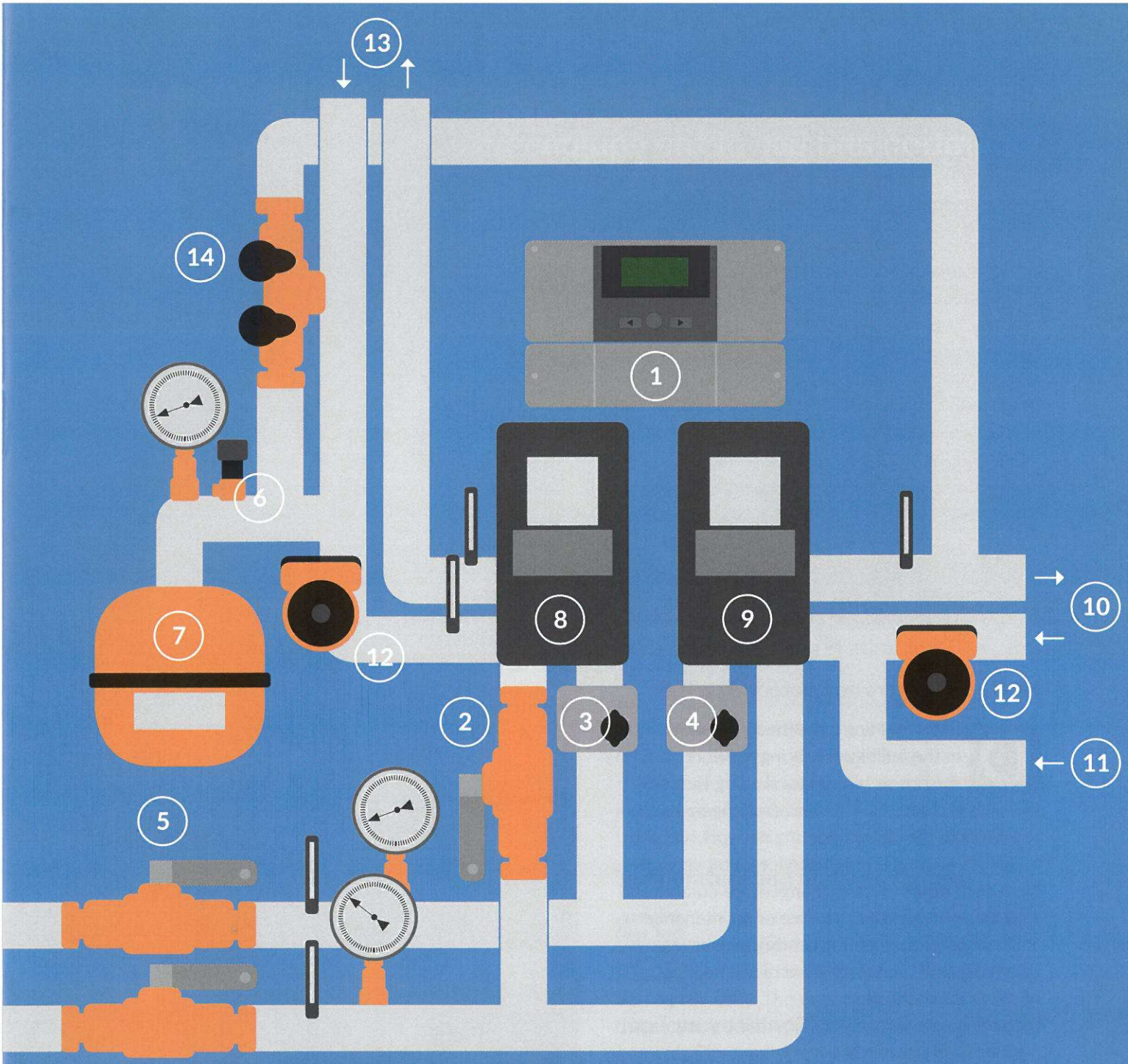
The strainer filters the largest impurities of the water in the district heating network. Low temperature of the hot service water is the first sign of a blockage. If the strainer is badly blocked, the heat supply may also be affected. When the strainer is blocked, the pressure meters in the district heating pipes show almost the same readings.

Contact the heat supplier if you suspect a blockage in the strainer.

District heat is very safe. However, hot district heating water and hot surfaces must be handled with care. District heating water is not suitable for drinking.



1 – District heating supply pipe
2 – District heating return pipe
3 – Heat supplier's main shut-off valves
4 – Flow sensor
5 – Strainer
6 – Calculator
7 – Temperature sensors



CUSTOMER'S DISTRICT HEATING EQUIPMENT

The substation is a factory-made entity, which includes the heat exchangers for heating and service water and, possibly, a heat exchanger for air conditioning, control devices, pumps, expansion and safety equipment, thermometers and manometers, and shut-off valves. Customers acquire their district heating equipment and the related installation work from heating contractors or as turnkey deliveries from energy or district heating suppliers. The substation is pressure equipment.

The substation is installed in the heat distribution room. A sufficient amount of space should be reserved for the substation and the supplier's equipment for maintenance purposes. The connection diagram for the equipment is displayed on the wall of the heat distribution room.

The heat distribution room is used for district heating equipment only, and its door is to be kept locked. The heat supplier must have free access to the heat distribution room whenever necessary.

1 – Regulator
2 – Summer shut-off
3 – Control valve for heating
4 – Control valve for service water
5 – Customer's main shut-off valves
6 – Safety valve
7 – Expansion vessel
8 – Heat exchanger for heating
9 – Heat exchanger for service water
10 – Hot service water
11 – Cold water
12 – Pump
13 – Radiator network
14 – Topping-up valve

Operation and use of the equipment

Heat exchangers and detecting a leak

District heating water heats the water in the building's heating network and the hot service water flowing through the heat exchangers. The heat exchangers keep the water in the district heating network and the building's heating and hot service water separate from each other. Heat exchangers are durable and they do not need much service or maintenance.

The heat exchanger for heating may have an internal leak if the safety valve of the heating network is leaking. A topping-up valve that has been left open may also be the reason for the safety valve to leak.

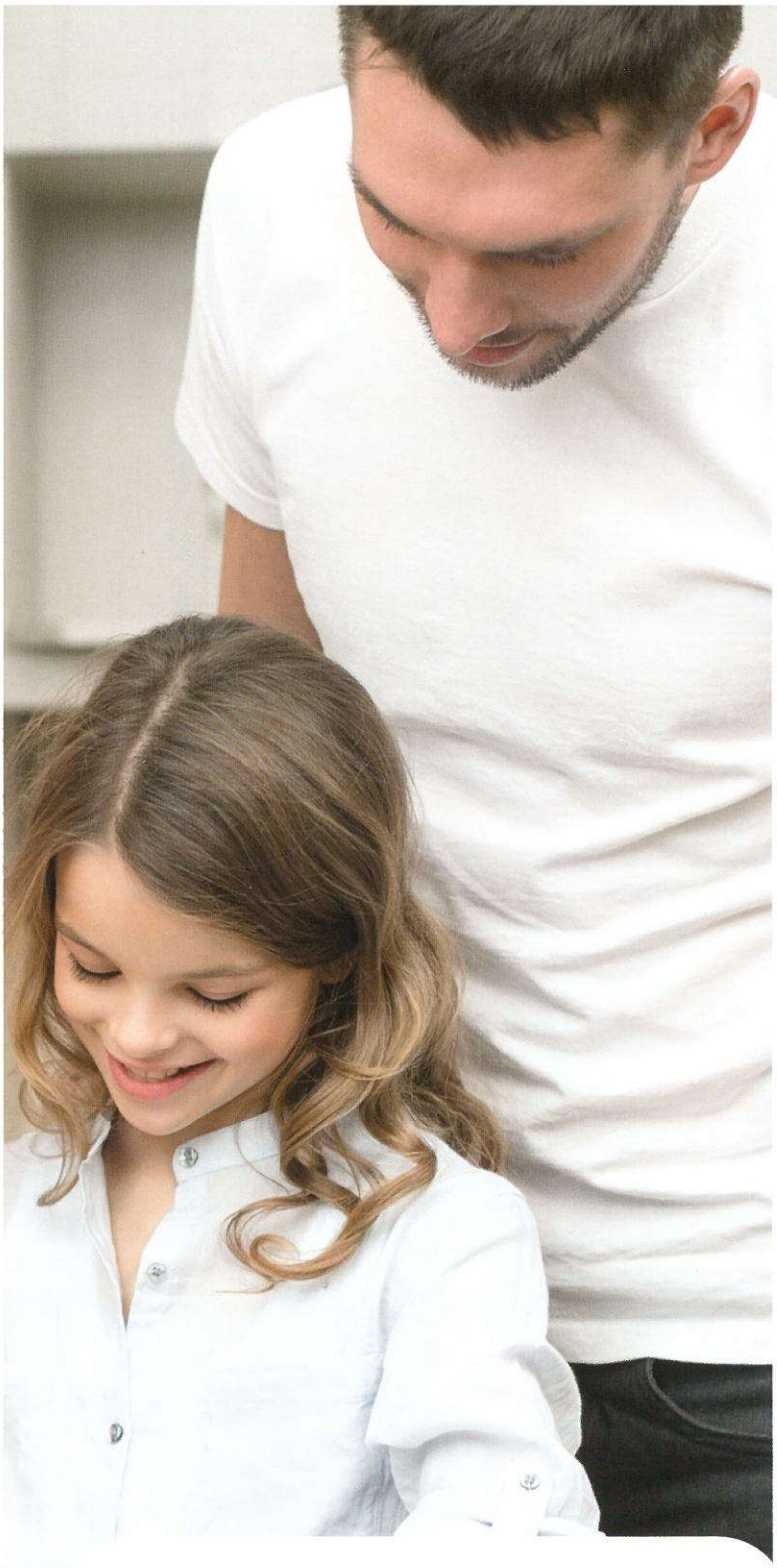
Contact your heat supplier and heat contractor immediately if you suspect a leak in the heat exchanger.

It is more difficult to detect an internal leak in the heat exchanger for service water. A leak in the heat exchanger for service water can be detected as an increase in water and energy consumption and fluctuations in the service water temperature.

Many energy and district heating companies add a colouring agent in the district heating water, which helps to detect a leak. There is a leak in the heat exchanger if the hot service water has a greenish colour.

Pumps

The heating pump circulates the water in the building's space heating network. The circulating pump for service water keeps the temperature of the entire service water network at the correct and even temperature, which prevents unnecessary hot water consumption. The service water pump is kept running at all times.



Safety devices

The safety valve of the space heating network protects the radiators and the expansion vessel even if the topping-up valve is left open or there is an internal leak in the heat exchanger, in which case the pressure of the district heating water will have an effect on the space heating network. In such a case, the safety valve opens and leaks water.

The safety valve in the service water network prevents a pressure increase of over 1.0 MPa (10 bar).

Pressure of the heating network and operation of the membrane expansion vessel

The pressure in the space heating network increases when the temperature rises. During sub-zero temperatures, the pressure is higher than in the spring or autumn.

The expansion vessel keeps the water in all heat distribution devices (radiators and underfloor heating) and the pressure at a stable level. The pressure vessel is faulty or the topping-up valve is leaking if the pressure of the space heating network rises constantly and water is leaking through the safety valve.

From time to time, check the pressure level of the heating network and only add water if necessary. Water is added through the topping-up valve. It is not necessary to add water to the space heating network if the radiators are bled and there are no leaks in the network. Variations in pressure are normal as the pressure changes in relation to the network temperature.

The reason for any constant need to add water must always be established.

Temperature and pressure meters

The customer's district heating equipment has pressure and temperature meters for checking that the equipment is functioning correctly. The pressure meters indicate the pressures of the heating and water system network. The pressure meters for district heating show the pressure and the difference in available pressure.

The thermometers display the service water temperature and the supply and return water temperature of the space heating network. If the heating network is balanced, the return temperature is clearly lower than the supply temperature. There are also thermometers in the district heating supply and return pipe. The difference in their readings is the momentary cooling temperature in the district heating water.

There is a thermometer with an alarm in the service water. It raises the alarm if the temperature rises above 65°C. Check the control valve and find out the reason for the alarm.

Heating network in a building and its balancing

The balance of the building's heating network is the basis of well-functioning and energy-efficient heating. The basic adjustment of the heating network ensures that the temperature remains even in all rooms. When the temperature is at an appropriate level, the need for airing is reduced and the efficiency of energy use is improved. If the heating network is unbalanced, the ambient temperatures in different rooms and/or apartments may vary to a great extent. An unbalanced space heating network wastes thermal energy because excessively hot water will have to be fed into the heating network of the whole building.

The heating network is balanced by regulating the precontrol values of the thermostat valves and, if necessary, possible butterfly valves. The dimensioning of the heating pump is also inspected in connection with the balancing. It is worth asking HVAC companies about the balancing of a heating network.

Control devices for the heating network

The control devices in the heat distribution room regulate the water temperature in the radiator or underfloor heating network, e.g. according to the outdoor temperature.

When the regulation system is tuned and functioning correctly, the water temperature entering the heating network automatically remains at the correct level throughout the year. This guarantees correct indoor temperature and increases living comfort.

The control curve selected at the control centre is specific for each building. Unnecessary increase of the control curve should be avoided.

The functions and equipment of the control centre include:

- setting of the control curve for determining the temperature of the water entering the radiators or underfloor heating
- parallel shift of the control curve
- option to reduce indoor temperature
- program selector switch (for example, clock control, day or night program, manual operation, mechanical controls)
- timer for 24-hour or weekly programmes
- indicator for valve movement direction
- alarm functions.

Radiators are functioning correctly when their upper part is warm and the lower part is almost at room temperature. The radiators are warm only when the room temperature falls below the set value. Normal ambient temperature in living areas is 20–22°C.

Underfloor heating control

It is possible to have partial or full water-circulating underfloor heating in a building. Underfloor heating always requires a separate control system. In underfloor heating solutions, the surface transferring heat is extensive and therefore the temperature of the water circulating in the underfloor heating pipes can be kept at a fairly low level, at 25–45°C. The temperature is affected by the material of the underfloor heating pipes, the type of flooring and the structure of the intermediate floor. Excessively hot water must not be allowed into the underfloor heating network as it may damage the pipes, floor structures and surfaces. A high floor surface temperature is also unpleasant and wastes energy. The temperature entering the underfloor heating circuit must not exceed the manufacturer's maximum permitted temperature for its materials under any circumstances. The underfloor heating circuit often has an overheat protection thermostat. If the temperature rises above the permitted level, the pump stops and will only start again once the temperature has fallen.

Room-specific control

The thermostatic radiator valve prevents excessive heating of the room. Room-specific thermostatic valves take into account the extra heat from the sun, electric appliances, lighting and people.

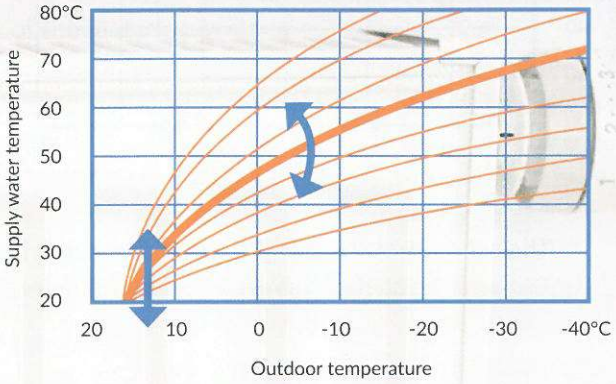
Service water control devices

The temperature of service water is adjusted by means of a control valve on the district heating side. In old buildings, the temperature of hot service water should be at least 50°C, and in new buildings and in houses that have undergone pipe renovation it should be 55°C throughout the water system. However, hot service water must never exceed 65°C.

If the temperature of service water fluctuates, the reason for the fault must be determined.

Setting of the control curve

The control devices regulate the water temperature in the radiator or underfloor heating network, e.g. according to the outdoor temperature. The control devices of various manufacturers are different from one another. The following instructions are indicative only:



Shifting of the control curve up or down

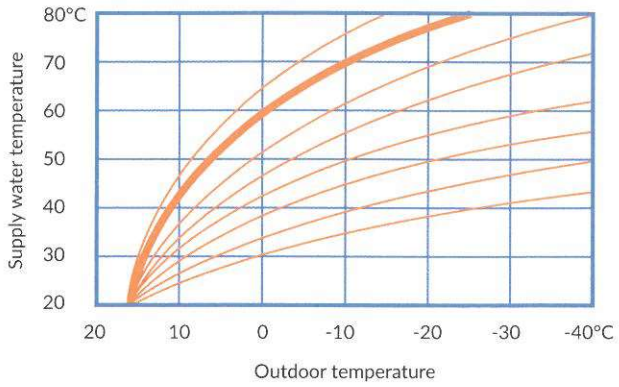
Setting of the control curve

The control curve is usually set according to the programme, in which case the user determines the set values of the supply water temperature for various outdoor temperatures. The supplier of the control system provides detailed instructions on the setting of the control curve.

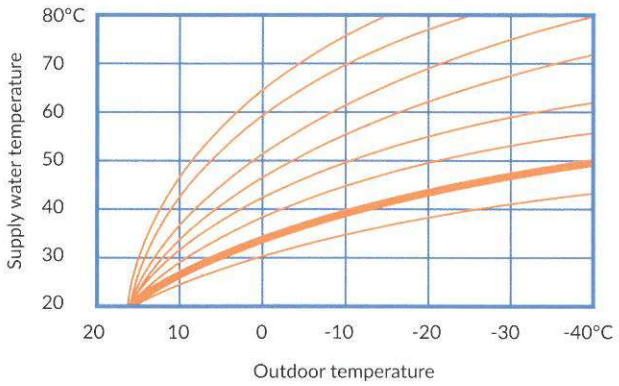
- Read the instructions for the control carefully.
- A correctly set control curve guarantees the desired room temperature in all normal weather conditions.
- The control curve is building-specific, and you may have to search for the correct curve. The control curve selected at the installation stage is indicative only.
- Write down the changes made to the set values of the control devices in different weather conditions.
- When adjusting the control values, it will take 2–3 days before the room temperatures stabilise.
- If in doubt, ask the supplier of the control devices or the heat supplier for advice.

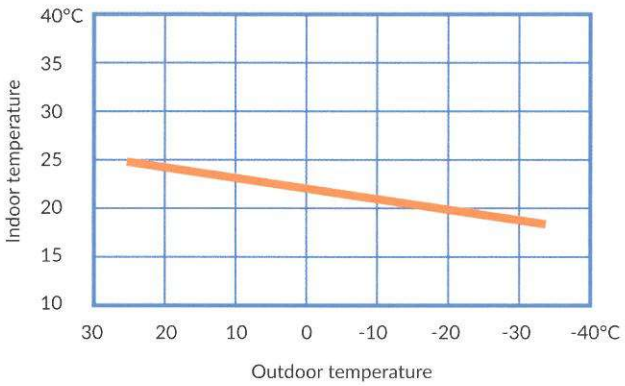
Functioning and correctly set devices guarantee a pleasant living environment without any heat losses.

Impact of the control curve selection on room temperature

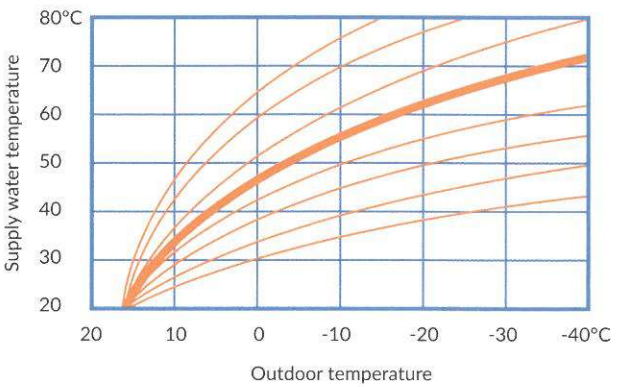


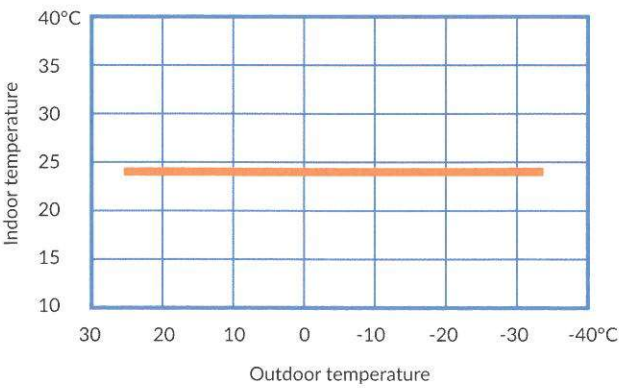
The set control curve is too steep. The room temperature is too high in cold weather.
Remedy: ***the control curve is adjusted to a more gently sloping position***





The set control curve is too gentle. The room temperature is too low in very cold weather.
Remedy: ***the control curve is adjusted to a steeper position***





The slope of the control curve is selected correctly, but the rooms are too hot in all outdoor temperatures.
Remedy: ***the curve is parallel-shifted downwards.***

The correct control curve has been found when the room temperature remains stable and suitable under all conditions.

Instructions for users of district heating equipment

The temperature levels for the heating network are specific for each building. In conventional radiator heating, the maximum supply water temperature is 70°C. In old buildings, the water temperature may need to be up to 80°C in the coldest temperatures.

In underfloor heating systems, the supply water temperature must not rise too high. Underfloor heating pipes are often made of plastic and it is recommended that the temperature of water flowing in the pipes is usually kept below 40 degrees.

Outdoor temperature below -15°C

- Cancel the night-time temperature drop or ensure that the automatic functions take care of it automatically
- Ensure that there is no danger of freezing in the radiators of the ventilation devices

Summer

- Ensure that the control valve is closed and remains closed or, if necessary, close the summer shutoff

Spring and autumn

- Ensure correct control values
- Select suitable night temperatures with the timer and parallel shift
- Check the clocks in the control device when switching between winter time and summer time
- Check the pressure of the space heating network when the heating period starts
- Check the temperature of the hot service water

Replacing the customer's district heating equipment

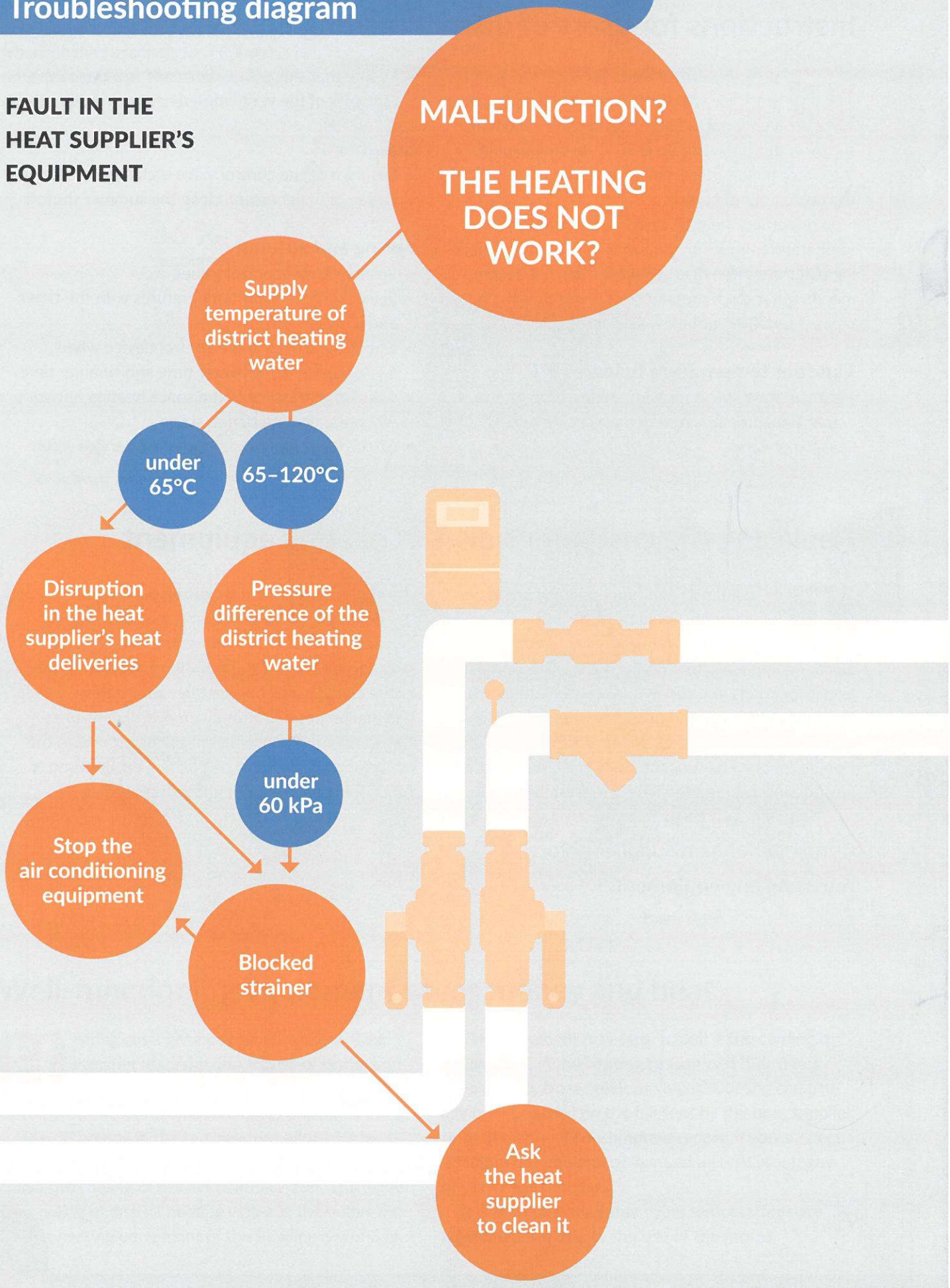
The condition and functioning of customer equipment should be inspected on a regular basis. A full survey is recommended for equipment after 20 years of service. Condition inspections and surveys are carried out by the surveyors of energy and district heating companies, equipment manufacturers and heating and ventilation designers. The functioning of the equipment and any possible replacement needs are established in the survey of the district heating equipment.

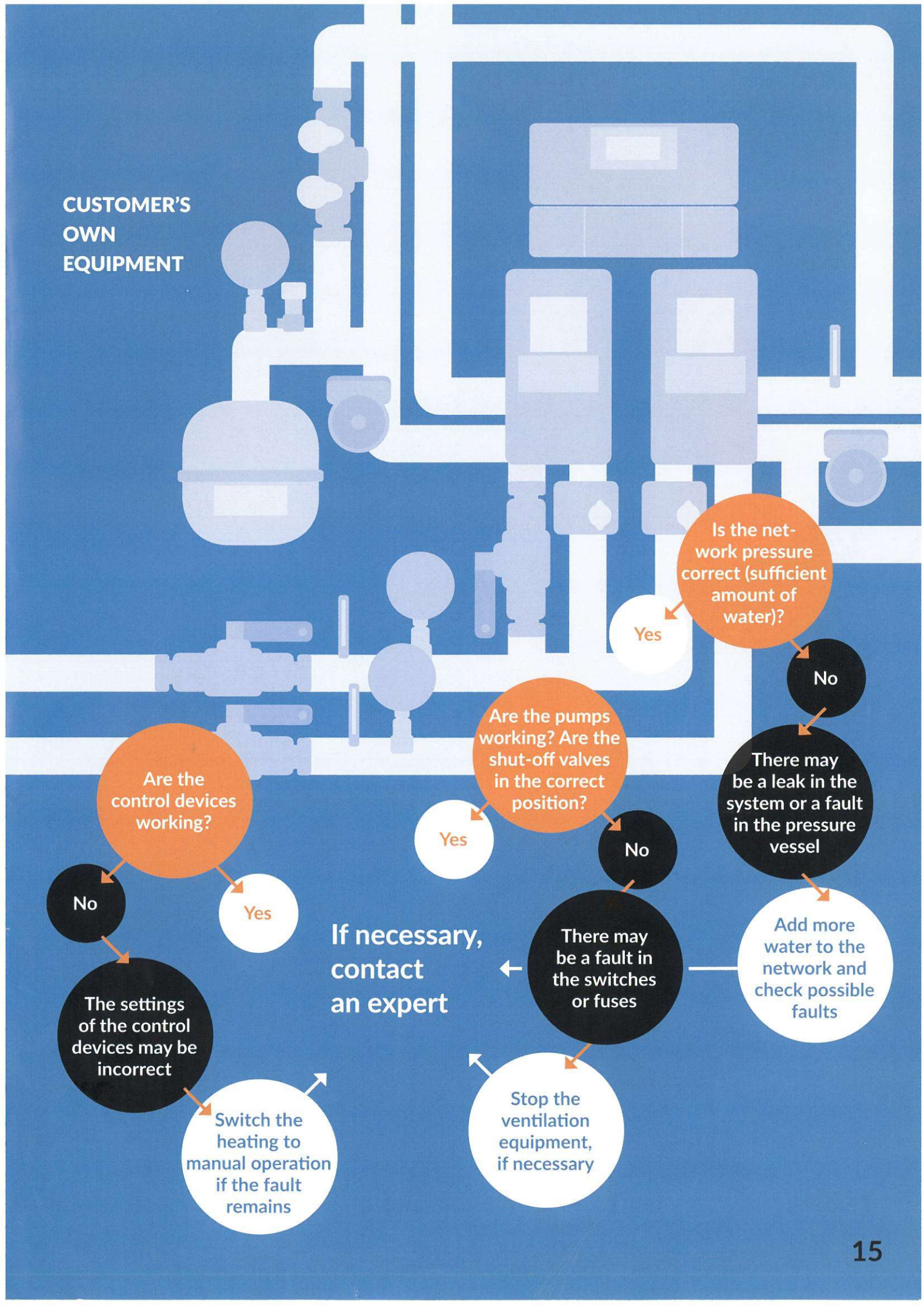
The extent of replacement is always assessed separately in each case. When the equipment is over 15 years old, it is usually worth replacing the entire substation if one part becomes faulty. Old equipment has often been overdimensioned. Dimensioning the equipment to correspond to the actual heating need of the building ensures better functioning and reduces unnecessary costs.

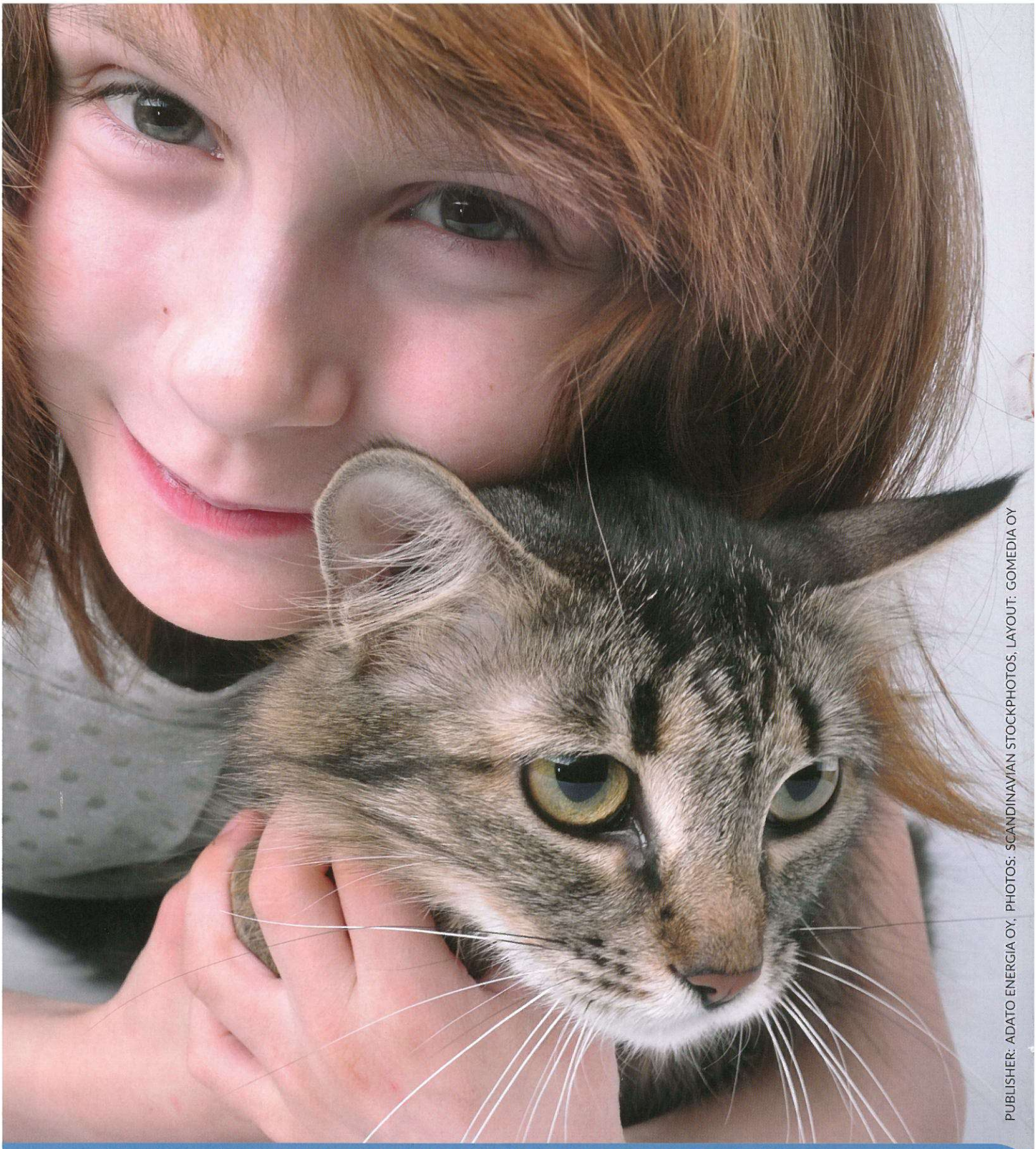
Contact your heat supplier before replacing any equipment.

Troubleshooting diagram

FAULT IN THE HEAT SUPPLIER'S EQUIPMENT




CUSTOMER'S OWN EQUIPMENT
Is the network pressure correct (sufficient amount of water)?
Yes
No
There may be a leak in the system or a fault in the pressure vessel
Add more water to the network and check possible faults
Are the pumps working? Are the shut-off valves in the correct position?
Yes
No
There may be a fault in the switches or fuses
Stop the ventilation equipment, if necessary
Are the control devices working?
Yes
No
The settings of the control devices may be incorrect
Switch the heating to manual operation if the fault remains
If necessary, contact an expert



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