CORRECT USE OF DISTRICT HEAT
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DISTRICT HEAT IS NEAT

District heating is a natural form of heating in densely-built areas. It keeps the environment clean and improves living comfort. District heating also conserves energy and the environment to a significant extent. The greatest savings come from combined production of district heat and electricity. This saves one-third of fuel compared with separate production of electricity and heat. It also combats climate change. District heating has also received recognition on the EU level for its energy efficiency.

District heating is reliable and flexible. The heat is produced in the economically most advantageous manner, taking environmental impacts into account. District heating fuels are natural gas, coal, peat, oil, wood and other renewable energy sources such as biogas. District heating also utilises the leftover heat from industrial processes.

District heating is the most popular form of heating in Finland. It is common in almost all towns and population centres. About 2.5 million Finns live in homes heated by district heat. District heating accounts for almost 50% of the total heating market. Almost 95% of apartment buildings and about half of terraced houses, as well as the bulk of public and commercial buildings, are connected to the district heating network. In the largest towns, the market share is more than 90%.

District heat is produced in combined heat and power (CHP) plants or in heating plants. Customers receive heat through the hot water circulating in the district heating network.

The temperature of district heating water varies between 65 and 115°C, depending on the weather. The temperature is at its lowest in summer when heat is only needed for hot service water. The temperature of water returning from customers to the production plants ranges between 25 and 50°C.
CORRECT USE OF DISTRICT HEAT SAVES HEAT AND MONEY

It is possible to save energy in a house with district heating without 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 remains comfortable and stable and there is always enough hot service water of the correct temperature.

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

Recommended indoor temperatures:
- home and office 20-22°C
- shops, workshops and industrial premises 18°C
- heated storerooms 12°C
- garages 5°C

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

HEAT MEASUREMENT

The thermal energy consumed in the building is measured. The components of the heat meter are a flow sensor, temperature sensors and a calculator. The flow sensor measures the volume of circulating district heating water. The temperature sensors constantly measure the temperatures of water going into and coming out of the building. The calculator calculates the thermal energy consumed. Consumption is shown in megawatt-hours (MWh). The heat supplier owns the metering equipment.

For example, the following data can be read from the heat meter:
- thermal energy
- volume of circulating district heating water
- momentary cooling of the district heating water
- momentary temperatures of the supply and return water of the district heating water
- momentary heat effect and water flow
The calculator calculates consumption according to the following formula:

\[ Q = V \cdot \Delta t \cdot 1.163 \]

Heat consumption (kWh) = volume of circulating district heating water (m\(^3\)) x temperature difference (cooling, °C) x specific factor of water 1.163.

1 MWh = 1,000 kWh (kilowatt-hours)

METER READINGS
The customer sends meter readings to the heat supplier according to instructions, or the heating company reads the meter remotely.

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

The reasons should be determined if cooling is under 25°C or if it differs considerably from values recorded earlier. The realised cooling of district heating water is often already calculated on the bill or consumption report sent by the heat supplier.

Monitor cooling on a regular basis!

MONITOR YOUR ENERGY CONSUMPTION
District heating companies provide their clients with follow-up reports on energy consumption at least once a year. In many locations, customers can monitor their consumption directly on the heat supplier’s website. The effect of the weather is taken into consideration with the heating degree-day in the comparison of annual consumption. The reports usually include adjustment for the weather. If current consumption differs considerably from the figures for previous years, it is advisable to inspect the adjustments and condition of the equipment.

Your heat supplier will provide additional information on your energy consumption and measurement.

Inform your energy or district heating company if you have carried out any saving measures in your house, if you stop heating for a longer period or if there are any other changes having an effect on energy consumption.

HEAT INDEX
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 heat calculations of buildings. 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. Local heating degree-days are calculated by the Finnish Meteorological Institute.

An example of calculating the heat index:

Housing Company Home Sweet Home (apartment building)

- total volume 7,000 m\(^3\)
- normalised energy consumption
  
  310 MWh = 310,000 kWh

Heat index: \[
\frac{310,000 \text{ kWh}}{7,000 \text{ m}^3} = 44.4 \text{ kWh/m}^3
\]

Normalising is only directed at the energy used for space heating; the heating of service water does not depend on the outdoor temperature. Energy and district heating companies provide information about the calculation of temperature adjustments. The heat supplier usually calculates the normalised consumption of a building and enters it on the heating bill or consumption report.

Further information: [www.motiva.fi/kulutuksen-normitus](http://www.motiva.fi/kulutuksen-normitus) (only in Finnish)
HEATING DEGREE-DAY

Heating degree-day is obtained by adding up the difference between the daily indoor and outdoor temperatures for each month. The most commonly used heating degree-day is S17, which is calculated on the basis of the difference between the assumed 24-hour mean value of +17°C between the indoor and outdoor temperature. The monthly heating degree-day is the sum of the daily heating degree-days, and correspondingly the heating degree-day for the year is the sum of monthly heating degree-days. Days with an average temperature of more than +10°C in the spring and more than +12°C in the autumn are not taken into account in the calculation of the heating degree-day. Thus, it is assumed that the heating of buildings is stopped and started daily when the outdoor temperature exceeds or falls below the above-mentioned limits.

PRESSURE AND DIFFERENTIAL PRESSURE OF THE DISTRICT HEATING NETWORK

The pumps in the district heating production plant or district heating network circulate the district heating water in the customer’s district heating equipment. The pressure and the differential pressure in the network fluctuate constantly. They are generally higher in winter than in summer.

STRAINER

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

Inform the heat supplier immediately if you suspect that the strainer is blocked.

District heating equipment owned by the heat supplier

1. District heating supply pipe
2. District heating return pipe
3. Heat supplier’s main shut-off valves
4. Customer’s main shut-off valves
5. Flow sensor
6. Strainer
7. Calculator
8. Temperature sensors
CUSTOMER’S DISTRICT HEATING EQUIPMENT

The equipment in the substation 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 comprehensive deliveries, from energy or district heating suppliers. The district heating equipment is pressure equipment.

The substation is located 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.

HEAT EXCHANGERS

District heating water heats the water that flows through the heat exchangers, which is then used for the building’s space heating system and for hot service water. 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 distribution room is used for district heating equipment only. Its door is to be kept locked. The heat supplier shall have free access to the heat distribution room.

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.
BALANCING THE HEATING NETWORK

The balance of the heating network is the foundation of well-functioning heating. The basic adjustment of the heating network ensures that the temperature in each room remains at the determined level. When having correct temperatures, the need for airing is reduced and energy use becomes more efficient. An unbalanced space heating network wastes thermal energy because excessively hot water will have to be fed into the radiators of the whole building.

Balancing of the space heating network is professional work, and it pays to let an expert company to take care of its planning and implementation. The heating network is balanced by regulating the precontrol values of the radiator valves and, if necessary, possible balancing valves. The dimensioning of the heating pump is also inspected in connection with the balancing.

The radiators are functioning correctly when their upper parts are warm and the lower parts at almost room temperature. The radiators are warm only when the room temperature falls below the set value.
CONTROL DEVICES FOR THE HEATING NETWORK

The control devices in the substation regulate the water temperature in the radiator or floor heating network 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.

The control curve chosen 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 floor heating
- parallel shift of the control curve
- possibility 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 programs
- indicator for valve movement direction
- alarm functions

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.

FLOOR HEATING CONTROL

It is possible to have partial or full underfloor heating in a building. Underfloor heating always requires a separate control system. Excessively hot water must not enter the underfloor heating network. Supply water temperature that is too high may damage pipes, floor structures and coatings. A high floor surface temperature is also unhealthy and wastes energy. The water temperature leaving the floor heating circuit must not exceed 45°C under any circumstances. If the temperature rises above the permitted level, the pump stops and will only start again once the temperature has fallen.

SETTING OF THE CONTROL CURVE

The control devices of various manufacturers are different from one another. Computer-based regulation and control systems (DDC control) are house-specific and very different. The following instructions are of principle only:

The setting of the control curve usually takes place programmatically, 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.
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 has been selected correctly, but the rooms are too hot with all outdoor temperatures.  
**Remedy: the curve is parallel-shifted downwards.** (A temperature change of approximately three degrees in the supply water temperature changes the room temperature by about one degree.)

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

• Read the operating instructions of the control equipment carefully and follow the instructions.

• 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 seek for the correct curve. The control curve selected at the installation stage is directive 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 a few days before the room temperatures are normalised.

• If the building’s control centre includes extra functions, e.g optimisation, learn how to use them.

• If in doubt, ask the supplier of the control devices or the heat supplier for advice.
**TIMER**

The timer reduces the room temperature for the desired period of time.

**SERVICE WATER CONTROL DEVICES**

The temperature of service water is adjusted by means of a control valve on the district heating side. The temperature of the service water is 55°C. The temperature of the service water must not be reduced for the night with the timer.

Incorrectly dimensioned or poorly functioning control devices for service water may cause, for example, fluctuation in the service water temperature. The reason for the fault must always be established and repaired.

**DETECTING A LEAK IN THE HEAT EXCHANGER**

The heat exchanger for heating may have an internal leak if the safety valve in the heating network is leaking. A filling valve that has been left open may also be the reason for the leak.

It is more difficult to detect an internal leak in the heat exchanger for service water. The condition of heat exchangers for service water that are over 10 years of age should be checked about once a year. 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.

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

Read carefully the operating and maintenance instructions for the pumps.

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 the cold period, the pressure is higher than in spring or autumn.

The expansion equipment keeps the water in all radiators and the pressure even. The most common model of expansion vessel is the membrane expansion vessel located in the heat distribution room. The water expands as it becomes hotter, and water flows into the membrane expansion vessel. When cooling, the volume of water diminishes and water flows out of the membrane expansion vessel into the space heating network.

The size and initial pressure of the pressure vessel is dimensioned so that there is no need to add water to the closed space heating network equipped with a membrane expansion vessel. The pressure vessel is faulty or the filling valve is leaking if the pressure of the space heating network rises constantly and water is leaking through the safety 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. The reason for any constant need to add water must always be established.

Water is added to the space heating network through the filling valves.

SAFETY DEVICES

The safety valve of the space heating network protects the radiators and the expansion vessel even if the filling 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).

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 indicate the pressure and the difference in available pressure.

The thermometers indicate the service water temperature and the supply and return water temperature of the space heating network. When the space heating network is in balance, 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.
The temperature levels for the heating network are specific for each building. In conventional radiator heating, the supply water temperature is a maximum of 70°C. In old buildings, the water temperature need in the coldest periods may be up to 80°C.

In underfloor heating systems, the supply water temperature must not rise too high. Plastic pipes are normally used in floor heating. The temperature of water flowing in the pipes must be below 45°C.

**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 shut-off
- If the heating pumps are stopped, start them up on a weekly basis

**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

**Remember**

- to keep the heat distribution room tidy
- to monitor the functioning of the equipment in accordance with the operating instructions
- to learn to use the control devices, pumps, expansion and safety equipment and other technical devices in the correct manner
- to keep the shut-off valves of the pressure meters closed. (They are opened when the pressure is checked)
- to supply the readings of the heat meter in accordance with the heat supplier’s instructions, when necessary
- to monitor your heat consumption and cooling
- to ensure that any faults are repaired or to report them further
REPLACING THE CUSTOMER’S DISTRICT HEATING EQUIPMENT

The condition and functioning of customer equipment must be inspected on a regular basis. A full survey is recommended for the equipment after 15 years of service at the latest. Condition inspections and surveys are carried out by the inspectors of energy and district heating companies, heat contractors, 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. New equipment is dimensioned to equal the real heating need of the building, which saves acquisition costs. The contracted water flow/heat capacity is also checked at the same time.

Always contact your heat supplier before replacing any equipment.
IF THE HEATING DOES NOT WORK

MALFUNCTION?

FAULT IN THE HEAT SUPPLIER’S EQUIPMENT

- Supply water temperature of the circulating district heating water:
  - 65-120°C

- Disruption in the heat supplier’s heat delivers

- Pressure difference in the circulation of district heating water:
  - below 60 kPa

- Blocked strainer

CUSTOMERS OWN EQUIPMENT

- Are the control devices working?
  - Yes
  - No: The settings of the control devices may be incorrect

- 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

- Is the network pressure correct (a sufficient amount of water)?
  - Yes
  - No: There may be a leak in the system or a fault in the pressure vessel

MEASURES

- Stop the ventilation equipment
- Ask the heat supplier to clean it
- Switch the heating to manual operation if the fault remains
- Stop the ventilation equipment, if necessary
- Add more water to the network and check possible faults
- If necessary, contact an expert