Operational optimisation measures for companies: Heating

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Set thermostat valves correctly before the heating season

If the room temperature is too low or too high in only a few rooms at the start of the heating season, this will be due in most cases to individual thermostat valves that are either faulty or incorrectly adjusted.

Action

At the start of the heating season – usually in October – check whether all the thermostat valves are working, and that the right temperature is set.

Requirement

Radiators or underfloor heating are controlled by thermostat valves.

In buildings, every additional degree C increases the heating costs by 6 to 10 per cent.

What to do

Release and adjust a jammed valve:

1. Remove the thermostat head

- Relieve pressure on the thermostat: to do this, turn it to the highest level; this reduces the pressure on the valve pin.
- Remove the thermostat head (depending on the model: slacken the screw, or turn the clamping ring counterclockwise).

2. Release the valve pin

- If necessary, pre-treat the valve pin with penetrating oil solvent spray.
- Gently tap the pin with a rubber mallet until it can be moved (see overleaf). Caution: do not pull the pin out! If you can push the pin in with your finger and it then comes out again automatically, the valve is working again.

3. Fit and adjust the thermostat head

- Fit the thermostat head back in position.
- Set the temperature you want. When doing this, keep to the guidance values (see overleaf) for the relevant type of room usage.

Costs – effort

- Your own labour for one room with three thermostat valves: ¼ to 1 hour
- New thermostat head: approx. CHF 50
- Valve and thermostat head: approx. CHF 100
- If there is no way to disconnect the radiator from the water system, the entire heating system must be drained and refilled so you can install the new valves. In this case, it is best to replace all the valves in the building at the same time.

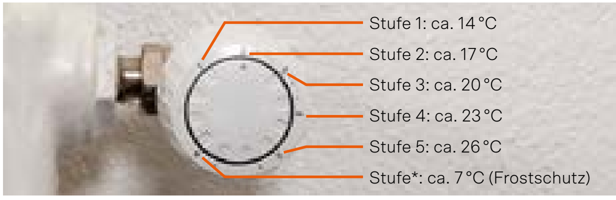
Please note!

Make sure that the same temperature is set on all thermostat valves in the same room. (Mechanical) thermostat valves from different manufacturers basically have the same structure. However, they differ as regards design (fixing, setting options) and scaling (temperatures). All manufacturers’ websites offer good, easily understandable instructions on operating their products.

Additional explanations

Temperature setting

You will see that the thermostat valves are only marked with numbers or bars, but no specific information is stated about the temperature settings. The scaling may differ slightly from one manufacturer to the next, but the principle is similar for all these devices. Here are some guidance values to show approximately which temperature is set in which position:



The "right" room temperature

The following temperatures are valid as guidelines for a pleasant indoor climate:

- Office, meeting room: 20 to 22 °C
- Workshop: 18 °C
- Warehouse, basement: 16 °C
- Areas where people circulate: 17 °C
- WC, showers: 20 to 23 °C

Ensure air circulation and prevent heat accumulations

As far as possible, do not cover or obstruct radiators, thermostat valves and perforated radiator covers with furniture, documents (including books, files, folders) or vases, etc., because this can cause heat to accumulate. Warm air must be able to circulate freely from the radiator into the room. The thermostat valve must not be located in an area where heat accumulates: otherwise, the measured temperature will be too high. If this is not possible, you must use a model with a remote sensor. The sensor is placed on the wall so it measures the effective room temperature.

Blocked valve pin

Example of a blocked valve pin (see the arrow) that can be released by gently tapping it with a rubber mallet. Under no circumstances should you pull the pin out manually.

Programmable thermostat valves

With programmable thermostat valves (known as "smart devices"), the room temperature can be set higher or lower at specified times. This makes it easy to heat single rooms individually.

"Island" systems

The time schedule is programmed directly on the thermostat valve. You can enter the schedule directly on the thermostat valve, or with your smart phone via Bluetooth.

Networked systems

In networked systems, the individual thermostat valves communicate wirelessly with a base station that can activate and control each radiator thermostat individually. The base station is connected to the internet and it can be controlled conveniently from a central unit (e.g. the technical building services office).

Additional information

- Smart heating: how to optimise your heating system

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Protect thermostat valves and limit the temperature

Settings on thermostat valves in public zones such as corridors, toilets or showers are often changed. Mechanical stress and the risk of theft are also higher in these areas.

Action
Protect the thermostat valves against changes, and use a theftproof design.

Requirement
Radiators or underfloor heating are controlled by thermostat valves.

In buildings, every additional degree C increases the heating costs by 6 to 10 per cent.

What to do
On some models, the thermostat head has to be removed to set limits; on others, the setting can be made with the thermostat head still installed (see the installation instructions).

1. Set the temperature limit

A: Restrict the temperature range
- The "lower limit" is defined by a pin or clip (usually coloured blue) (e.g. level 2, approx. 17 °C).
- The "upper limit" is defined by a second pin or clip (usually coloured red) (e.g. level 3, approx. 20 °C).

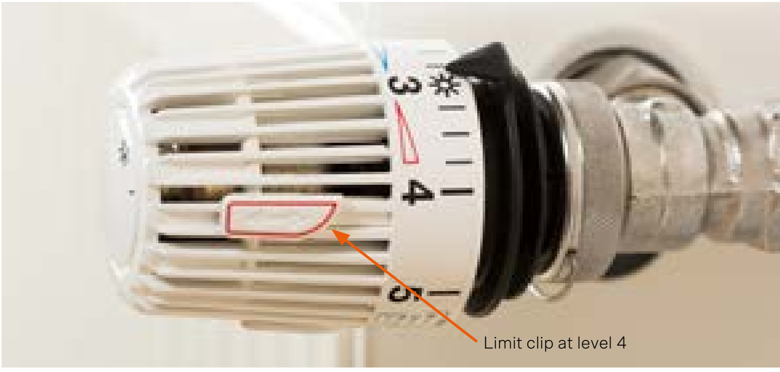
B: Block the temperature at a fixed value
- If you select the same temperature for both limit values, the thermostat head will be blocked. For example: if you set level 3 for the "lower limit" and level 3 for the "upper limit" as well, the head can no longer be rotated and the temperature is set to approx. 20 °C.

2. Cancel the temperature limit

Remove the pins or clips

3. Theft protection

Install any caps or protection that may be needed (These can be obtained from the heating installer)



Costs – effort
- Your own labour for one room with three thermostat valves: ¼ to 1 hour
- New thermostat head: approx. CHF 50 to 80
- Valve and thermostat head: approx. CHF 120
- The entire heating system must be drained and refilled so you can install the new valves. In this case, it is best to replace all the valves in the building at the same time.

Please note!
Make sure that the same temperature is set on all thermostat valves in the same room. (Mechanical) thermostat valves from different manufacturers basically have the same structure. However, they differ as regards design (fixing, setting options) and scaling (temperatures). All manufacturers' websites offer good, easily understandable instructions on operating their products.

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Additional explanations

Public building models

A "public building model" is more robust than a conventional thermostat valve. Also, the modifiable temperature can be restricted within a specified range (e.g. 18 to 20 °C), or set to a fixed value (e.g. 19 °C). This prevents anyone from making unwanted changes to the settings. Public building models of this sort require a special tool (such as a special screwdriver) or explicit specialist knowledge about releasing the lock.

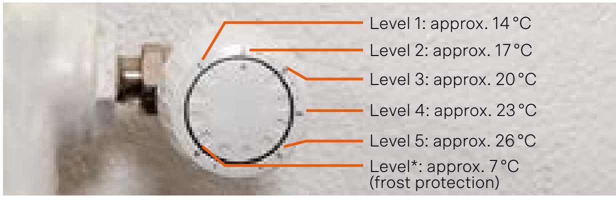
Important: The use of public building models in offices and meeting rooms has not proven successful in practice, because complaints have increased considerably. Install public building models in public zones such as corridors, staircases, toilets and showers.

Theft-proof models

Public building models have integrated theft protection. They are also vandal-proof, and they can withstand loads of up to 100 kg thanks to their better bending strength. "Public building caps" are available to protect various conventional thermostat valves and electronic actuators.

Temperature setting

You will see that the thermostat valves are only marked with numbers or bars, but no specific information is stated about the temperature settings. The scaling may differ slightly from one manufacturer to the next, but the principle is similar for all these devices. Here are some guidance values to show approximately which temperature is set in which position:



The "right" room temperature

The following temperatures are valid as guidelines for rooms/spaces accessible to the public:

- Warehouse, basement: 16 °C
- Areas where people circulate: 17 °C
- WC, showers: 20 to 23 °C

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Vent radiators in autumn

The heating is switched on. The thermostat valves have been checked. Nevertheless, only some areas of the radiators are becoming warm, bubbling noises can be heard and it is too cold in the room. In this case, there is probably air in the system and it has to be vented.

Action

Vent radiators in autumn if they are making noises (bubbling, gurgling or whistling, etc.) or they only heat up partially. In any case, radiators should be vented once every three years.

Requirement

The rooms are heated by radiators. You need a square socket wrench and a container (plastic cup) to collect the water.

Regular venting of the heating system eliminates comfort problems, and energy consumption can be reduced by as much as 15 per cent.

What to do

1. Preparation

- Switch the heating on and turn the heating system up until it is quite warm.
- Switch the circulating pump off (air rises).
- Wait one hour.

2. Vent

- Switch the circulating pump back on.
- Set the thermostat valves to position 5.
- Start with the radiator in the lowest position (usually on the ground floor) and work your way up to the top floor.
- Using a square socket wrench, carefully open the venting valve. At the same time, hold a container under the valve to catch the water.
- Close the valve as soon as all the air has escaped and only water is coming out.

3. Check the pressure – top up the water as necessary

- Check the water pressure with the manometer (pressure gauge) in the central heating unit.
- If the pressure in the heating system is too low, top up the water (see overleaf).

Costs – effort

Your own labour depends on the size of the building. Calculate about 45 minutes' labour to vent 10 radiators.

Please note!

Water coming out of the radiator can be very hot – especially in old systems. It is best to wear gloves when you work.

Don't allow large amounts of water to escape from the venting valve, because you will then have to top up the water again. The water you remove is often black and smelly but – unlike fresh water – is already "degassed" (does not contain oxygen), so it protects the pipes against corrosion.

Additional explanations

Top up the water

The manometer (pressure gauge) in the heating room shows the pressure in the heating system. Check whether the (black) indicator on the manometer is within the setpoint range (green area). If the pressure is below the green area, it is too low, and the water has to be topped up.

Rule of thumb for pressure

For every 10 metres of a building's height, 1 bar of pressure is required. The inlet pressure for the expansion tank must be added to this figure. Pressure of about 2 bar is therefore required for a building with three or four floors.

Water hardness requirement

Please note that heating systems must not be filled with any quality of water you care to use. Boiler manufacturers have defined maximum water hardness requirements for this purpose. According to the Swiss Society of Engineers and Architects (SIA), these values are defined as follows:

Heat output	Max. hardness of filling water
less than 50 kW	max. 30 °fH
50 to 200 kW	max. 20 °fH
200 to 600 kW	max. 15 °fH
over 600 kW	max. 0,2 °fH

fH = French hardness
(degrees of water hardness in France, Switzerland, Italy)

Your local water utility will give you information on the water hardness at your building's location.

Additional information

– Fact sheet on the quality of water used to fill and top up heating and cooling systems, suisstec

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Set the heating curve correctly

On the basis of complaints from users about the room temperature, you suspect that the heating curve is not set correctly. Or: you have noticed that the room temperature remains high at night even though you have implemented a night-time temperature reduction.

Action

Set the heating curve and heating limit correctly on the heating controller for the heating system.

Setting the heating curve correctly will achieve savings of four to six per cent.

What to do

First, perform this action in cold weather (somewhat less than 0 °C) so the room temperature is set correctly for this outside temperature. Repeat the same step when the weather is warmer (a little over 10 °C).

1. Define temperatures and identify critical rooms

- Possibly in consultation with the users, define the setpoint for the room temperature (e.g. 22 °C for offices).
- Find out which rooms are difficult to heat. These include rooms facing the outside or facing north, the top floor and rooms in corner positions.

2. Determine and evaluate room temperatures

See page 4 (Check the interaction between the thermostat valves and the heating curve)

3. Correct the heating curve

Reduce the heating curve by 3 °C during the heating period (see page 2).

4. Adjust the heating limit

Reduce the heating limit by 1 °C during the transition period (see page 3).

5. Observe

Then observe the room temperature for two weeks in each room. Repeat steps 4 and/or 5 until the room temperature is no longer reached (complaints), and correct the set values as required.

6. Set the correct temperature and document it

- Set the correct temperature on the thermostat valves and the room temperature controllers.
- Record the new setpoint values in the logbook.

Costs – effort

- Your own labour: approx. one working day (depending on the size of the building)
- Simple thermometer: CHF 20 to 30
- USB data logger: approx. CHF 100

Please note!

- Keep a written record of the original setpoint values and every adjustment in the log book (journal).
- Inform users of the various rooms that the room temperature may be slightly higher in the next few days. Ask users not to adjust the thermostat valve and not to open windows. Users are welcome to document their own experiences.
- Check whether the outside temperature indicator in the heating control is correct. The temperature shown is often wrong (faulty outdoor sensor or solar radiation).
- Check whether the time setting on the heating control is adjusted correctly (e.g. winter time).

Additional explanations

Setting the heating curve

The heating curve (heating characteristic) describes the relationship between the outside temperature and the flow temperature of the heating system.

Diagnosis and action	Analogue controllers	Digital controllers

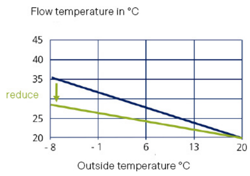
1. Room temperature is too high in cold weather (below 0 °C)

Reduce the flow temperature (FT/VT) by setting a flatter heating curve.

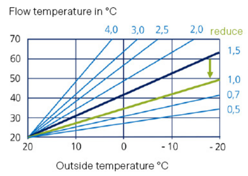
Rule of thumb for radiators: Reducing the heating curve by 5 °C decreases the room temperature by 2,5 °C.

Rule of thumb for underfloor heating: Reducing the heating curve by 2 °C decreases the room temperature by 2 °C.

e.g. set a flatter curve



e.g. select a 1,0 curve instead of 1,5.



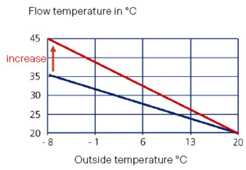
2. Room temperature is too low in cold weather (below 0 °C)

Increase the flow temperature (FT/VT) by setting a steeper heating curve.

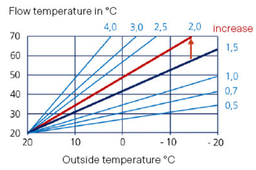
Rule of thumb for radiators: Increasing the heating curve by 5 °C increases the room temperature by 2,5 °C.

Rule of thumb for underfloor heating: Increasing the heating curve by 2 °C increases the room temperature by 2 °C.

e.g. set a steeper curve



e.g. select a 2.0 curve instead of 1.5.

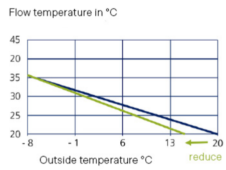


3. Room temperature is too high in warm weather (over 10 °C)

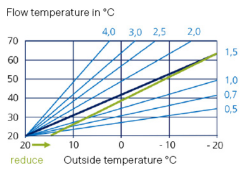
Reduce the flow temperature (FT/VT) by setting a steeper heating curve.

Rule of thumb: Reducing the heating curve by 3 °C decreases the room temperature by 1 °C.

e.g. set a steeper curve, or reduce the heating limit



e.g. reduce the heating limit

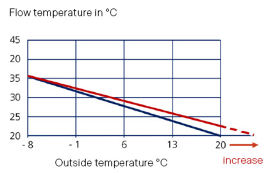


4. Room temperature is too low in warm weather (over 10 °C)

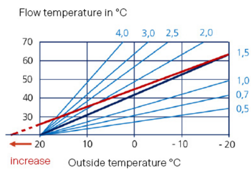
Increase the flow temperature (FT/VT) by setting a flatter heating curve.

Rule of thumb: Increasing the heating curve by 3 °C increases the room temperature by 1 °C.

e.g. set a flatter curve, or increase the heating limit



e.g. increase the heating limit



Additional explanations

Flow temperatures

The approximate setting for the flow temperatures is based on various guidance values, depending on the heating system, the age and type of the building, and the usage.

Heating system	Outside temperature	–8 °C	15 °C
Radiator heating		↓	↓
Built before 1980	Flow temperature	60–70 °C	25 °C
Built between 1980 and 2000	Flow temperature	50–60 °C	25 °C
Built between 2000 and 2010	Flow temperature	40–50 °C	25 °C
Built after 2010	Flow temperature	35–40 °C	20 °C
Underfloor heating			
Built before 1990	Flow temperature	35–50 °C	25 °C
Built between 1990 and 2010	Flow temperature	30–40 °C	25 °C
Built after 2010	Flow temperature	30–35 °C	20 °C

Lower flow temperatures can usually be set in buildings with many internal loads (e.g. equipment or lights that give off heat).

Automatic summer-winter switchover

Modern controllers are equipped with an automatic summer-winter switchover feature. Depending on the product, this feature is activated by functions such as “heating limit”, “summer limit” or “ECO”. The advantage of the automatic function is that the control automatically switches off the heating group or pump according to the outside temperature. In this case, it is no longer necessary to switch the heating groups off manually in spring or to switch them on in autumn. However, it is worth checking periodically to see whether this function is working as you want it to.

Setting the heating limit

The heating limit is defined as the outside temperature at which the heating controller switches the heating system off because the building no longer needs to be heated in order to provide the desired indoor temperature (e.g. 20 °C). Once this temperature is reached, the heat stored in the building, solar radiation and heat dissipated indoors (from lighting and computers, etc.) is sufficient to maintain the temperature. The heating limit is set so that the room temperature does not decrease in the transition period. Consequently, the heating limit is always set lower than the room temperature. These factors allow a lower heating limit to be set:

- better building insulation,
- more solid building construction,
- lower room temperature,
- smaller required air change,
- faster response by the heat delivery system.

Setting a lower heating limit reduces the operating period for the heating and allows more savings in the transition period

Guidance values for the heating limit

These values relate to a room temperature of 20 °C.

- Non-insulated old buildings erected before 1977: 15–17 °C
- Buildings erected between 1977 and 1995: 14–16 °C
- Buildings erected between 1995 and 2010: 12–15 °C
- Minergie buildings: 9–14 °C
- “Passive houses”, Minergie-P buildings: 8–10 °C

It is best to make and check changes to the heating limit settings in autumn, at daytime outside temperatures of about 12 to 18 °C and without solar radiation insofar as possible.

Additional explanations

Room temperature control concepts

The heating curve plays an important part in these control systems:

1. Pure flow temperature control
The flow temperature setting determines the room temperature. Changes to the heating curve are noticed immediately in the rooms. For the same reason, users immediately notice incorrectly adjusted heating curves as well (it is either too hot or too cold).

2. Thermostat valve or single room controls
External influences can be taken into account optimally if a local control system (thermostat valves, single-room controllers) is used for the fine adjustment of the temperature in the rooms. For example, these devices switch off the radiator in the room as soon as the sun heats the room on its own. But in this case too, the flow temperature for the heating boiler or heating groups is adjusted via the heating curve.

- **If the heating curve has been set too low**
  If the heating curve is set too low, the required room temperature will not be reached. This leads to complaints, and the heating curve must be "lifted up" as appropriate.
- **If the heating curve has been set too high**
  If the heating curve is set too high, the local control system limits the room temperature so as to avoid overheating the rooms (provided the control system is set correctly). Users do not notice this – everyone is satisfied. But because the flow temperature is too high, there are increased heat losses in the generating and distribution system. Also, the effect of the night reduction is diminished, or there may even be no night reduction at all – because, although the heating controller reduces the flow temperature, it may still be high enough to keep the room at the daytime temperature setpoint. So with this system, an incorrectly set heating curve "covertly" leads to unwanted energy losses and energy costs.

Check the interaction between the thermostat valves and the heating curve

If the temperature in the rooms does not fall at night even though a night reduction has been programmed, the reason could be that the flow temperature is set too high.
- Set all the thermostat valves in these rooms to the maximum temperature (position 5) or dismantle them completely.
- If you have a room temperature controller or manual valves, set them to the highest level.
- Use a thermometer or USB logger to measure the room temperature for two to three days. The correct temperature is determined inside the room, at a height of approx. 1.5 m and without any disruptive influences (solar radiation, heat dissipated by printers, etc.).
- Use the recorded data to check whether the temperature in the rooms corresponds to the setpoint values.

Individual rooms are too cold

If the heating curve has to be increased significantly on account of only a few rooms, the problem can be solved in those rooms:
- Check the flow rate. Is the entire surface of the radiator warm? Are the valves fully open?
- Vent the radiator
- Remove anything blocking the radiator (curtain, furniture)
- (Possibly) remove sludge from underfloor heating pipes
- (Possibly) increase the circulating pump pressure

Minimum flow temperature

If a minimum flow temperature (base temperature) can be set on the controller, it must be checked and set as follows for outside temperatures starting from 20 °C:
- Underfloor heating: 20 °C
- Radiators: 22 to 23 °C

Additional information

- Energy manual for caretakers

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Reduce the flow temperature outside of usage periods

If the flow temperature of your heating system is the same outside of usage hours (at night and weekends) as during the day, heat losses are being increased unnecessarily.

Action

Reduce the flow temperature for the heating system or individual heating circuits outside of usage periods.

Requirement

The building has little insulation, and has a heat generator with power reserves. (For details, see the section on "Determining the potential for reduction" overleaf.)

In old buildings, a night-time temperature reduction can save between 5 and 10 per cent of the energy consumption.

What to do

1. Define the rooms and times

Define the rooms where the temperature should be reduced, and the times when the reduction should occur. This can relate to the entire heating system or only to individual heating groups.

2. Reduce the flow temperature

It is best to optimise the heating at a night-time outside temperature in the region of 0 °C:

- On the heating controller, reduce the flow temperature by a maximum of 2 °C for the defined reduction period.
- Document the changes in the logbook.
- Observe the changes for at least three days. Are the room temperatures maintained when operation finishes and begins (closing and opening times)? Are there condensation problems because the air humidity is too high (see overleaf)?

3. Repeat step 2

Repeat step 2 until you can no longer maintain the temperatures, or until condensation problems occur. At this point, increase the flow temperature again by the value of the most recent reduction (i.e. reverse the last step).

Costs – effort

Your own labour: 2 to 3 hours

Please note!

- For heating systems in very well insulated new buildings and heat pumps designed for maximum efficiency, it makes little sense to reduce the flow temperature temporarily (see overleaf).
- It is also possible to reduce the temperature of the relevant heating groups in one part of the building only (e.g. in the factory hall).
- During holidays (e.g. over Christmas and New Year), the temperature of the entire heating system should be reduced insofar as possible. To do this, select the "Constant night" setting on the heating controller. Please note: After doing this, expect a longer heat-up phase of one to two days.

Additional explanations

Determining the potential for reduction

Poorly insulated buildings (e.g. old buildings that have not been refurbished) lose large amounts of energy through the building envelope during the night. The greater the difference between indoor and outside temperatures, the greater these energy losses will be. When the room temperature falls, the temperature difference also decreases. It is best to determine the potential for the reduction on a night when the outside temperature is 0 °C.

- Measure the room temperature in the evening (e.g. at 5 pm).
- Check whether all the windows are closed.
- Switch the heating off completely.
- Measure the room temperature next morning (e.g. at 7 am).

If the room temperature has fallen by more than 3 °C during the night, a night reduction is worthwhile.

Take response times into account

On account of the heating system's inertia and long response time, the flow temperature can already be reduced 1 to 3 hours before the end of operation (closing time). However, it must also be increased again 1 to 3 hours before operation begins (opening time). The response times of heat delivery systems with radiators are 1 to 1½ hours – considerably shorter than the response times for underfloor heating, which are 2 to 3 hours.

Do not reduce the temperature below 16 °C

In rooms where the setpoint temperature is 20 °C, do not reduce the room temperature below 16 °C during the night. At lower temperatures, there is an increased risk of damp spots and mould. Observe the windows. Condensation water on the edges is a sign of high air humidity (see the fact sheet on ventilation: 02 Airflows).

Take the type of heating system into account

Fossil-fuel and wood-fired heating systems

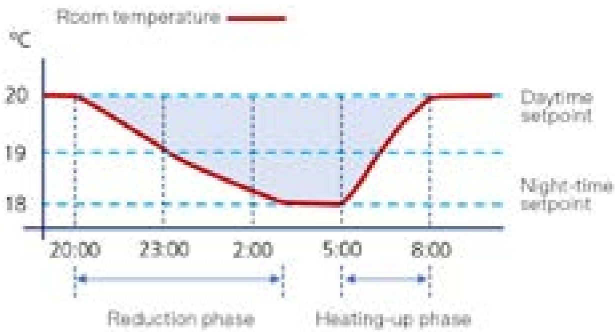
Gas and oil-fired boilers as well as pellet and woodchip boilers are highly suitable for night-time temperature reduction. These are high-performance systems that deliver higher flow temperatures in the heat-up phase again without major losses of efficiency.

Heat pumps (with underfloor heating systems)

It is often necessary to examine whether a night reduction makes sense for heat pump heating systems with underfloor heating. If the flow temperature is increased in the morning to reach the room temperature setpoint, the heat pump runs at a less efficient operating point. This can cancel out the energy savings achieved by the reduction, or can even cause additional costs.

The effect of reducing the temperature at night

The effect of night reduction is proven. If the room temperature is lower at night, the heat losses from the building are also reduced. In the illustration below, the heating is turned down at 8 pm after the end of the operating period, and is turned back up at 5 am, so the room temperature has reached the setpoint again when operations resume at 8 am. This saves around 3.5 per cent of the overall energy consumption (area coloured blue).



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11.2021

Minimise the cooling of buildings through the lift shaft

During winter, it's always cool in a lift and in the areas in front of the lift doors on upper floors. Employees often complain about draughts near the lift. These are indications of an uncontrolled flow of cold air through the lift shaft.

Action

Set the temperature control for the shaft ventilation correctly. If the openings in the shaft overhead are not yet equipped with ventilation dampers, consider retrofitting them.

Requirement

Your building has a lift shaft (with or without extraction dampers).

An open 12-metre-high lift shaft causes annual heat losses of 15'000 kWh or more

What to do

Lift shaft without ventilation dampers

Check out the option of retrofitting ventilation dampers (insulated versions) to ensure tight sealing of the openings in the shaft overhead.

Lift shaft with ventilation dampers

Check the values set on the thermostat control for the ventilation dampers:

- Temperature at which the ventilation dampers open (e.g. 35 °C)
- Temperature at which the ventilation dampers are closed (e.g. below 30 °C)
- The exact temperature values depend on the product and are specified by the manufacturer.

Costs – effort

- Costs of materials for the ventilation dampers are approx. CHF 1500 to CHF 2500
- Installation costs: approx. CHF 3000
- Total costs (materials and installation): about CHF 5000

Please note!

- Where the lift shaft adjoins an unheated room or the outdoor climate, the shaft should be heat insulated.
- Ventilation dampers can only be in the "open" or "closed" positions.
- It is advisable to include maintenance of the dampers in the lift maintenance.

Additional explanations

Shaft supply and exhaust ventilation

Many lift shafts pass from an unheated basement through heated storeys into an unheated attic storey, or into the lift superstructure. Cold outside air flows into the shaft through basement windows that are not airtight or are open, is heated by the shaft walls and rises (chimney effect). This creates a suction effect that also draws in warm air from heated rooms through lift doors that are not airtight, resulting in draughts that present a comfort problem. Finally, the heated air flows to the outside through ventilation openings in the shaft overhead.

Retrofitted exterior lift systems

Lift installations are often built onto the outside of a building at a later stage. In this case, the lift and shaft doors penetrate the existing perimeter insulation.

Conventional lift doors are hardly airtight, and they do not meet the thermal insulation and air-tightness requirements for modern buildings. The problem can be solved by inserting an unheated anteroom between the lift door and the heated rooms. The access door to the anteroom can then ensure that the thermal insulation and air-tightness requirements are met.

Safety is key

It is mandatory to comply with local fire protection regulations when retrofitting ventilation dampers.

Emergency exit hatch

It must be easy for the fire service to gain access to the emergency exit hatch from inside and outside. When the emergency exit hatch is in the open position, it must also be kept open by a retaining device that can easily be released.

Note

Until 2015, every lift shaft had to be equipped with an opening for smoke extraction.

However, buildings are becoming increasingly airtight. For this reason, a smoke extraction outlet on the roof will only function poorly if no fresh air can flow into the basement. When the fire protection regulations (BSV) were revised in 2015, the general requirement for an extraction damper was therefore removed (with the exception of fire service lifts).

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11.2021

Reduce the water volume used in washbasins and showers

Taking a shower with a conventional shower head flushes up to 18 litres of hot water down the drain every minute. That's far more than a comfortable shower requires! Also: the volume of water that flows into a washbasin is often more than is really needed.

Action

Take a shower instead of a bath. And don't make the shower too long or too hot. Restrict the water volume for the washbasin and shower, or reduce the outflow with a flow restrictor or a water-saving shower head.

Requirement

Suitable adjustment of the tap or fitting must be possible so that the water volume flowing through it can be restricted.

A water saver or a water-saving shower head will pay for itself after less than one year of use

What to do

1. Determine the water volume

Determine the water volume for the washbasin and shower by filling a one-litre measuring vessel with the taps fully open and measuring the time until the litre measuring vessel is full.

2. Evaluate the measured values

Calculate the water volume for the tap or fitting (litres/minute) based on the measured time (60 divided by the number of seconds for 1 litre). Compare the actual situation to the target situation.

Application	Current status			Target status	
	Filling time	Water volume	Efficiency	Water volume	Efficiency
Washbasin	8 seconds	7,5 litres/min.	Class B	3–5 litres/min.	Class A
Showers	6 seconds	10 litres/min.	Class C	6–8 litres/min.	Class B

3. Optimise the water volume

Reduce the water volume:

- A: by restricting the water volume for the tap or installing a water saver (flow restrictor).
- B: by replacing the shower head with a water-saving model.

4. Document and observe

Note the new values in the logbook. Pay attention to complaints and correct the set values as necessary.

Costs – effort

- Your own labour (measuring and setting the water volume): approx. half an hour per tap or fitting
- Costs of water savers: CHF 10 to CHF 20 per tap/fitting
- Costs of a water-saving shower head: CHF 30 to CHF 60 per shower head

Please note!

In janitorial rooms and kitchens (tea kitchens), it does not make much sense to restrict the water volume because this merely extends the time needed to fill a cleaning bucket or electric kettle with water. What are known as "Ecoboosters" provide a good solution in rooms of this sort. They supply 5 litres per minute in normal operating mode; in boost mode, however, they deliver the full rate of 17 litres per minute (Ecoboosters can be purchased from specialised trade outlets, hardware stores and retail outlets).

Additional explanations

Reduce the water volume in the tap

In good-quality water taps and fittings, the water volume and often also the (maximum) water temperature in the tap can be restricted This is the best and cheapest way of cutting hot water consumption so you can save costs and energy. The manufacturer's installation instructions describe whether and how the water volume in the tap/fitting can be restricted. You will find the instructions on the internet (on the manufacturer's site: search for the model).

What to do:
- Close the outflow to prevent small objects from sliding into it.
- Remove the handle. Depending on the type of tap, you will need an Allen key or a screwdriver to do this. The screw is usually concealed beneath a circular cover.
- The "cartridge" is located under the handle. The cartridge can be used to adjust the water volume and (in some cases) also the tap's maximum temperature. Depending on the model, the water volume can be changed with an adjusting ring or a setscrew.
- Re-assemble the tap.

Retrofitting water savers

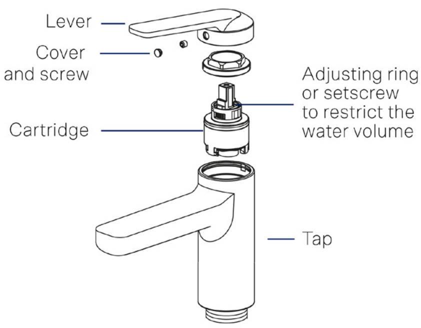

Illustration: KWC (adapted slightly)

Another simple way to reduce the water volume is by replacing the existing spray controller (aerator, mixing nozzle, Perlator) with a water-saving model (water saver, flow restrictor, water-saving inserts).

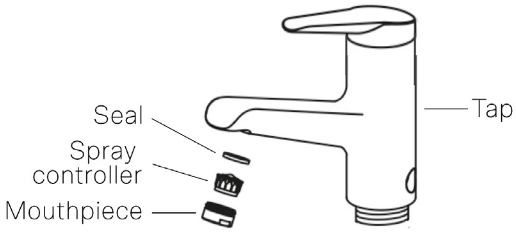

Illustration: KWC (adapted slightly)

Energy label

Good water-saving inserts and shower heads are marked with the energy label. The less water a shower head delivers, the less energy is consumed. So: low flow rates are indicators of high energy efficiency. Hand shower heads in efficiency class A (< 6 litres/minute) have very low flow rates and are mainly suitable for showering in private settings.

Temperature fluctuations

If the installation is inadequate, very severe restriction of the shower head's water volume can cause unpleasant temperature fluctuations. The water is too hot or too cold, and the temperature cannot be adjusted correctly. If this phenomenon occurs, replace the shower head with a model that delivers more water (a higher flow rate reduces pressure losses). Notify your building management when you install water-saving inserts. If the temperature fluctuations persist, you must call in a specialist (possibly for a hydronic balancing procedure).

Additional information

- Enjoy water – save energy with no compromises on comfort
- Efficient hot water supplies for new residential buildings. An overview for building owners
- The energy label for sanitary products
- SVGW (Swiss Gas and Water Industry Association) Fact Sheet: "Pressure and temperature fluctuations"

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11.2021

Adapt the burner output to the actual requirements

Optimal burner output reduces the emissions from your heating and cuts fuel consumption by up to 3 percent.

Action

Determine the burner output that you actually need and adjust the output to the effective demand.

Requirement

You have an old oil or gas burner with output of over 20 kilowatts, but it cannot yet adapt (modulate) its actual output to the demand. Also: this action is only possible for non-condensing boilers and systems without an economiser (for utilisation of waste heat from the flue gas).

What to do

- Read the annual operating hours on the meter. If the burner runtimes are less than the guidance values (see overleaf), this indicates that the burner output is too high.
- The burner's output will also be too high after the building envelope has been insulated.

To reduce the output from oil burners, you can use a smaller nozzle or reduce the throughput. On gas burners, you have to reduce the throughput.

- Have the burner output checked and reset by a specialist.
- After the burner output has been adjusted, the combustion has to be re-regulated and inspected in compliance with the Ordinance on Air Pollution Control (OAPC).

Costs – effort

- If you have the burner output adjusted as part of the annual service, the additional service cost should be between CHF 500 and CHF 1000.

Please note!

- The burner output (thermal output) can only be changed within a certain range. When doing this, follow the instructions from the burner and boiler manufacturer.
- The heating system must always be able to meet the maximum demand for heating power in winter.
- After adjusting the burner output, the burner runtime should also be checked and optimised.

Additional explanations

Minimum operating hours for the burner

For heating systems with a heat generator whose output is more than 20 kilowatts, there are guidance values for the burner's minimum annual operating hours. Failure to reach these values indicates that the burner output is too high.

Heating	With hot water	Without hot water
Single-stage burner	2200 h/a	2000 h/a
Two-stage burner	First stage = 3200 h/a Second stage = 300 h/a	First stage = 1700 h/a Second stage = 300 h/a

Check the exhaust gas temperature

Reducing the burner output will also lower the temperature of the exhaust gas. If this temperature is below 160 °C for brick-lined chimneys (see the burner service report), the exhaust gas temperature must be measured at the chimney outlet after optimisation. It must not fall below 70 °C or there is a risk of soot forming. You can also reduce this risk by slightly opening the fresh air vent at the base of the chimney. For example: you can fix the fresh air vent with a spacer or a screwed joint so that it is always slightly open. The inflow of fresh air will then dry the chimney out and, at the same time, will prevent an unwanted inflow of fresh air through the boiler that would cool it down.

Keep the boiler room clean

All combustion requires air. If this air is contaminated with dust, combustion will be impaired. This will increase pollutant emissions and energy consumption. The burner will also be more liable to malfunctions. Therefore: clean the boiler room at the start of the heating season and also during the heating period whenever necessary (e.g. after construction work).

Check the flame pattern

Look through the inspection window into the combustion chamber at regular intervals. If the flame tips are red, sooty and in contact with the boiler wall, or if the flame pattern is uneven and not symmetrical (perhaps with spark showers), it may mean that combustion is not optimal. In this case, the combustion must be checked and correctly adjusted by a specialist. Periodic cleaning of the boiler and regular adjustment of the combustion can reduce fuel consumption by up to 3%.

Additional information

- Operational optimisation for energy efficiency: operating buildings more efficiently, technical book, 2021
- Replacement of heating systems in larger apartment buildings and condominiums, brochure, 2021
- "Renewable heating" incentive consulting, range of advisory services
- Gas and oil heating systems, dimensioning aid, information sheet, 2017

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Illustration: 123rf.com

10/2022

Insulation of heating and hot water pipes prevents major heat losses

Make sure that all hot pipes are properly wrapped up! That's because large quantities of valuable heat are lost from uninsulated heating and hot water pipes and fittings (manual and slide valves, pumps, etc.).

Action

Insulate all heating and hot water pipes that pass through unheated rooms and spaces. Industrial facilities must also insulate steam pipes (> 90 °C) in heated rooms.

Requirement

To search for heat losses from heating pipes, the outdoor temperature needs to be below 5 °C.

What to do

- Check pipes in unheated rooms (basements, garages, staircases, etc.) by feeling them with your hand. This will enable you to find hot pipes that are losing heat unnecessarily.
- Also check whether the existing pipe insulation is incomplete or defective. Was the insulation:
  - Not added after a repair?
  - Cut open to take a measurement?
  - Mechanically damaged?
- Have hot pipes insulated by an insulation specialist. If you insulate the pipes yourself, measure their diameter and purchase the right insulating shells from a DIY/hardware store.

Costs – effort

- Pipe insulation (shells) with a length of 1 metre and a 90° bend cost CHF 10 to CHF 25 each, depending on their size. There are also additional small items such as PE adhesive tape and aluminium end sleeves.
- Your own labour per metre is about 10 to 20 minutes – depending on how many bends and branches need insulation.
- With heat insulation, CHF 6 to CHF 10 can be saved on energy costs per metre of pipe and per year.

Please note!

- With a little manual dexterity, you can make a good job of insulating straight pipes yourself. However, pipe systems with angled joints, many branches and various fittings are more complex. In these cases, consider calling in an insulation specialist.
- Insulating steam pipes is a challenging task that should be undertaken by an expert.

Additional explanations

Insulation thicknesses

Cantonal energy legislation defines the insulation thicknesses for heat-conducting pipes (from 30 °C to 90 °C) in new buildings (see the specimen regulations of the cantons in the energy sector). These depend on the pipe material and its diameter (see the table).

Inside pipe diameter		**Outside pipe diameter**		**Minimum insulation thickness**[1]	
		As the inner pipe diameter is standardised, the outer diameter can vary slightly depending on the material.		Thermal conductivity (λ) λ > 0,03 to ≤ 0,05 W/(m·K) (e.g. synthetic rubber, cellular glass or mineral wool)	Thermal conductivity (λ) λ ≤ 0,03 W/(m·K) (e.g. polyurethane (PUR) or polyisocyanurate (PIR))
DN	**inches**	**mm (approx.)**		**mm**	**mm**
10	⅜	16	(16–19)	40	30
15	½	20	(20–24)	40	30
20	¾	26	(25–29)	50	40
25	1	33	(30–35)	50	40
32	5/4	42	(36–43)	50	40
40	1 ½	47	(44–49)	60	50
50	2	59	(50–62)	60	50

1 Assistance with execution, EN-103, Heating and hot water systems, EnDK (Conference of Cantonal Energy Directors), May 2020 edition

Insulation of pumps and fittings

Special moulded shells are available to insulate pumps and fittings. These must be obtained from specialised trade outlets. Alternatively, have the work carried out by an insulation specialist.

Special case: insulation of steam pipes

Steam pipes with temperatures of over 90 °C are still to be found in many industrial premises. Even in heated rooms, these still need to be insulated. Because of the high temperatures, not all insulation materials are suitable for insulating steam pipes. It is therefore worthwhile to have steam pipes insulated by a specialist.

Repair defective heat insulation.

Additional information

- Technical insulation in building technology suissetec, 2020
- Assistance with execution, EN-103 Heating and hot water systems, EnDK (Conference of Cantonal Energy Directors)
- You can find insulation specialists on the Isolsuisse website

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Illustrations: zweiweg

10/2022

Eliminate concealed heat losses on decommissioned technical installations

When built-in technical elements such as ventilation ducts, pipes or chimneys are taken out of service, valuable heat is lost between the warm and cold zones unless these elements are dismantled and the openings in the walls are insulated.

Action

You can avoid hidden heat losses by consistently removing old ventilation ducts, pipes or chimneys, and then insulating the openings in the walls.

Requirement

Your building and its technical installations already have quite a few years “under their belt” and have undergone a number of conversions or refurbishments.

What to do

- Check whether your building has technical installations leading from a warm zone into a cold zone that are no longer in use. Be sure to check technical rooms and production areas in particular:
  - Old ventilation grilles and ducts
  - Inactive supply lines/pipes (heating, hot water, pneumatic delivery systems, compressed air, etc.)
  - Unused sanitary venting ducts and wastewater pipes
  - Venting ducts and filler pipes on old oil tanks, air intake openings on disused oil or gas heating equipment
  - Disused chimneys
- Dismantle the technical installations.
- Seal or insulate the openings.

Costs – effort

- You need about half a day’s labour to dismantle, insulate and seal one opening. You also need suitable insulating material for tamping as well as materials for sealing (mortar or a plate).
- Large openings and those between two fire sections are best sealed by a specialist.

Please note!

- If a wall separates two fire sections, a professional, regulation-compliant fire-resistant seal must be installed after demolition.
- An unwanted flow of cold air into a room through an opening can give rise to comfort problems. These can be improved by insulating and sealing the opening.

Additional explanations

Fresh air openings in the heating basement

After an oil or gas heating system has been replaced by a heat pump, the fresh air opening that leads into the heating room can be closed. When the oil heating system is dismantled, the filler pipe and the oil tank vent are also superfluous. They can be dismantled and sealed.

If your oil or gas heating is still in operation, check the fresh air intake opening at intervals and adjust it correctly.
Guidance value for the fresh air opening:

- Forced-air burners, oil and gas
  Opening area [cm²] = power [kW] x 6
- Atmospheric burners, oil and gas
  Opening area [cm²] = power [kW] x 8,6

Disused chimneys

After an oil or gas heating system has been replaced by a heat pump, the chimney is no longer used in most cases. The exception are chimneys used simultaneously by a wood-burning appliance (storage stoves, fireplace stoves, pellet stoves, etc.). Unused chimneys form a “cold air column” in the warm building. Resultant heat losses can be reduced by applying good insulation to the chimney outlet using a diffusion-open material. Any moisture must be able to escape. At the same time, all openings to the chimney (pipes, dampers) in the building must be tightly sealed. If a roof renovation is scheduled, the chimney should be removed as far as the underside of the roof. The entire roof can then be insulated.

In all cases, it is worth discussing insulation and dismantling with the chimney builder in advance to clarify aspects relating to building physics and structural engineering (moisture, dismantling, etc.).

Ventilation ducts

Pay particular attention to disused ventilation ducts. They are often installed close to the ceiling and usually have large cross-sections. Inactive duct networks can have extensive branches and quite often pass through heated rooms. They can cause substantial heat losses.

Pay attention to air humidity

Fresh air can flow through openings into the basement or technical rooms: this will dehumidify the indoor air in winter. If the opening is sealed, the relative air humidity in the room can increase. Monitor the situation and if the room air humidity increases too much (e.g. above 60% r.h.), reduce the humidity by ventilating the rooms regularly.

The position of the opening is critical

The extent of heat losses depends on the temperature difference between the rooms and the size and position of the opening. The greatest heat losses are caused by large openings located close to the ceiling (or, even worse, in it) that lead from a heated room into the open air. Small openings near the floor that lead from a heated room into an unheated one are rather less problematic in terms of energy efficiency. However, they can cause loss of comfort in the heated room (cold floor). Example: an opening measuring 20 cm x 20 cm that leads directly from the indoor to the outdoor climate at floor level causes heat losses of about 300 kWh over one year. The same opening at a height of 2,2 m results in five to ten times more heat losses.

Additional information

- Heat losses through functional openings in building envelopes
  SFOE (Federal Office of Energy)/HSLU (Lucerne University of Applied Sciences and Arts) 2013

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Illustration: zweiweg

10/2022

Reduce the circulating pump's flow rate

Circulating pumps for heating often pump too much water, so they consume electrical energy unnecessarily. If you set the volume flow correctly, you'll not only save electricity but also avoid annoying whistling noises.

Action

At an outside temperature of 0 °C, the difference between the heating group's flow and return temperatures should be higher than 5 K. If the difference is less, the volume flow (flow rate) is too high and it can be reduced.

Requirement

The heating system must be equipped with multi-level or speed-controlled pumps. Two thermometers are also needed: one in the flow and one in the return.

If you can reduce the volume flow from level 3 to level 1, you will save around CHF 250 per year.[1]

What to do

1. Determine the difference between the flow and return temperatures

- Measure the difference between the flow and return temperatures.
- Compare the values to the recommended values (see the graph, overleaf).
- If the temperature difference is currently less than the recommended value, the volume flow is too high and it can be reduced.

2. Reduce the flow rate

Reduce the volume flow (see overleaf).

- Pumps with a step switch: 1 level less
- Speed-controlled pumps: reduce the volume flow by approx. 20 per cent

1 Applies to a pump with power consumption of 400 watts at the first level and 800 watts at the third level.

3. Check the temperature differences again

After half an hour, repeat steps 1 and 2 until the temperature difference corresponds to the recommendations.

4. Document the new settings

- Note down the new values in the logbook.
- If there are complaints that it is too cold in the rooms, go back one step and increase the volume flow again.

Costs – effort

Your own labour for one central heating unit with multiple pump groups (including follow-up inspection): approx. 4 hours

Please note!

- Ideally, the optimisation should be carried out when the outside temperature is about 0 °C, because the differences are more clearly visible at this temperature.
- Accurate thermometers are required to determine (small) temperature differences – so check whether the two thermometers are measuring correctly. If there are any discrepancies, calibrate the thermometers or replace them.
- Heating systems respond relatively slowly to changes, so they cannot be adjusted for optimal operation in a matter of minutes or hours.

Setting the volume flow

A: Pumps with multiple speed levels

With a step switch, the operating mode is set permanently (uncontrolled pump). The higher the speed level, the more water is pumped.

- Reduce the volume flow by selecting a lower speed level on the switch.

Additional explanations

B: Speed-controlled pumps with various setting options

On newer pumps, the volume flow can be adjusted with the help of various functions (e.g. automatic, via proportional pressure curve, or via constant pressure control). These pumps are usually delivered with the "automatic" factory setting. With this setting, the pump adjusts automatically in the specified delivery range. This process requires some time – so let the pump run for at least one week before you check the pump setting and select a different operating mode, if necessary.

Setting for two-pipe heating systems

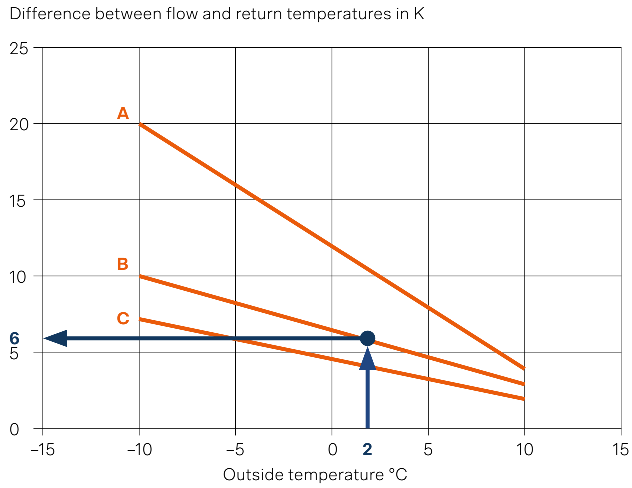
- "Automatic" mode: this mode adapts the pump's delivery rate to the actual heat demand in the system.
- Proportional pressure control mode: the delivery head increases in proportion to the volume flow. This is suitable for systems with high pressure losses in the distributor pipes (two-pipe heating systems with thermostat valves, primary circuits, cooling systems). Not suitable for underfloor heating.

Settings for underfloor and one-pipe heating systems

- "Automatic" mode: this mode adapts the pump's delivery rate to the actual heat demand in the system.
- Constant pressure control mode: the flow rate is adjusted to the current heat demand and the delivery head is always kept constant. Select the lowest curve at which the pump still provides the required delivery pressure.

Temperature difference as an indicator

The optimal difference between flow and return temperatures depends on the type of heat delivery system (underfloor heating, low-temperature radiator, high-temperature radiator) and on the outside temperature. The graph shows guidance values for the optimal temperature difference for the systems just mentioned.



A: Radiators with a flow temperature > 60 °C
B: Low-temperature radiators < 50 °C
C: Underfloor heating

Example: With an outside temperature of 2 °C, the optimal difference between the flow and return temperatures for a heating system with low-temperature radiators is 6 K.

Improved efficiency for the heat generator

As well as cutting the costs of electricity for the circulating pump, an optimal temperature difference boosts the efficiency of heat pumps and condensing boilers.

Additional information

- Dimensioning aid for circulating pumps
- Circulating pumps in heating systems, suissetec
- Use underfloor heating the right way, suissetec

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11.2021

Defrost the right way and your costs will melt away!

Ice forming on the evaporator is a reliable indicator of how well the defrosting function is working. If an uneven layer of ice forms and the ice is thicker in some places, the defrosting process should be checked and optimised as necessary.

Action

If the defrosting function is adjusted correctly, the air-to-water heat pump will consume less energy.

Requirement

Ideally, the defrosting process should be checked and optimised when the outside temperature is around freezing point (minus 2 °C to plus 5 °C).

With optimally adjusted defrosting, you will save between CHF 500 and 1000 per year (depending on the size of the system).

What to do

The goal is to find the minimum defrosting temperature at which there is no longer any ice on the evaporator after the defrosting process. The best way to do this:

1. Determine the temperature of the evaporator fins

Initiate the defrosting process (the evaporator must be iced up). At the point in time when all the ice has melted away, measure the temperature on the fins.

2. Set the defrosting temperature and time

Set the temperature you measured (see step 1) as the new defrosting temperature on the defrosting thermostat. You must also set the maximum defrosting period (e.g. 25 minutes[1]). By doing this, you make sure that the defrosting process ends if the temperature is not reached.

3. Enter the drip-off time

Check the drip-off time and set it so that the remaining water can drip off the fan before the compressor and the fan switch on again (e.g. 3 minutes).

4. Restart the heat pump

Costs – effort

A service technician needs about 1 to 2 hours for the optimisation, which will cost between CHF 300 and 400.

Please note!

- The defrosting process is permanently programmed in the heat pump. Setting the defrosting temperatures correctly requires a certain amount of experience. Also, some controls are user-friendly while others are rather more complex to operate. In case of doubt, you can also have the service technician change the defrosting temperature.
- Check the defrosting function once every 3 to 5 years.

1 The time depends on the device and location.

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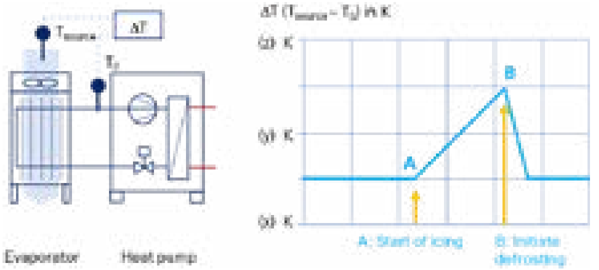
Additional explanations

Optimum between icing and defrosting

An iced-up evaporator makes the heat transfer much worse, so the heat pump's seasonal performance factor also deteriorates. But if defrosting is performed too often, the energy consumed by defrosting will increase and the heat pump's seasonal performance factor will decrease. This makes it important to find the right setting that ensures the optimum balance between "icing" and "defrosting".



Different defrosting intervals

There are three ways of triggering the defrosting process:

1. Defrosting based on a fixed time interval

Example: At outside temperatures below 5 °C, defrosting takes place after 1 hour of operating time for a fixed period of 10 minutes – even if the evaporator is not frozen. This principle is simple, safe and reliable. On the other hand, it is poor in terms of energy efficiency because defrosting takes place even when it is not necessary.

2. Defrosting based on a fixed defrosting interval

Example: Defrosting takes place after 1 hour of operating time, but the defrosting process is not geared to a fixed time; instead, it only lasts as long as necessary. This variant is more energy-efficient than defrosting based on a fixed interval.

3. Demand-actuated defrosting

The defrosting intervals and times are variable, and are automatically adapted to the effective demand. A self-learning control system triggers defrosting at fixed intervals at the beginning of the heating period. In this case, the surface temperature of the evaporator is measured continuously and the duration until the evaporator is completely "ice-free" is determined. The next defrosting process is shortened or extended accordingly. This is a complex solution in terms of control technology, but it is definitely the most energy-efficient option.

The main defrosting methods

A: Reverse-cycle defrosting (for 80 per cent of systems)

With this method, the refrigeration circuit is reversed. The evaporator becomes a condenser and the heat causes the ice to melt. Defrosting settings:

A: Fixed time control: operating time of 1 hour, followed by defrosting for 10 minutes.

B: Time control with variable end: operating time of 1 hour, followed by defrosting for as long as necessary. Or: both operating time and defrosting are continuously redefined by the control (demand-led). Correct adjustment of the defrosting is somewhat more complex and time-consuming.

B: Hot gas bypass defrosting

The hot gas is fed to the evaporator directly downstream of the compressor, and it defrosts the evaporator. The operating time for hot gas bypass defrosting processes is 10 to 15 per cent of (overall) operating time, which is rather long. No heating operation is possible during this period (reduced output).

C: Natural defrosting (up to 5 °C)

Natural defrosting works up to an outside temperature of 5 °C. To do this, the heat pump is switched off and the fans continue to run. The ice melts away due to the "warm" ambient air. This is a highly energy-efficient solution.

D: Electrical defrosting

The evaporator is defrosted with an electrical insert. Simple – but not energy-efficient.

Additional information

– Guideline with measures to optimise refrigeration systems
– Heat pumps: planning – optimisation – operation – maintenance

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Clean evaporators on heat pumps regularly

Evaporators on air-to-water heat pumps become soiled over time. The constantly increasing film of dirt on the fins diminishes the heat transfer. This leads to higher energy consumption and higher operating costs.

Action

Clean the evaporator every 2 years. Cleaning intervals depend on the location, and they may be considerably shorter or longer depending on the degree of soiling.

Requirement

A squeaking or whirring fan that causes louder noises than usual indicates that the evaporator is soiled.

Systems with a heavily soiled evaporator consume up to 45 per cent more energy.

What to do

The evaporator becomes soiled by dust, pollen, leaves or exhaust gases from the ambient air. Therefore, clean it as follows:

- Study the manufacturer’s operating manual (safety, cleaning instructions)
- Switch the heat pump off and disconnect it from the power grid (switch it off via a circuit breaker, or remove the fuses)
- Remove the cover
- Clean the evaporator from both sides.
- Be careful not to damage the fins as you do this (also see overleaf).
- Clean the housing, grid(s) and fan
- Fit the cover back in position
- Switch on the evaporator and the fan
- Perform the listening check again.
- If the fan is still squeaking or whirring, contact the service specialist for the heat pump.

Costs – effort

- Your own labour: approx. 2 hours per evaporator
- Cost of fin comb: approx. CHF 25, available from refrigeration and air conditioning equipment wholesalers

Please note!

- It is best to clean the heat exchangers in autumn, before the heating season, when the trees have already shed their leaves.
- If you clean earlier in the year, it is best to do so after pollen is released into the air – in June.

Additional explanations

Cleaning methods

High-pressure water cleaner: When using a high-pressure water cleaner, make sure that the water is always sprayed straight onto the evaporator so the fins are not deformed.

Compressed air or vacuum cleaner: Wherever dirt does not stick, an industrial vacuum cleaner or compressed air can be used for cleaning. Rule when using compressed air: Always blow the air straight onto the evaporator to avoid bending the fins out of shape. Please note: When used indoors, compressed air blows the dry dust into the room.

It is essential to observe the manufacturer's instructions for all cleaning methods that involve high pressures. The instructions usually state the maximum pressure, the minimum distance to be kept from the air or water jet (e.g. 200 mm), and the working direction (e.g. perpendicular to the pipe register, maximum deviation ±5 °).[1]

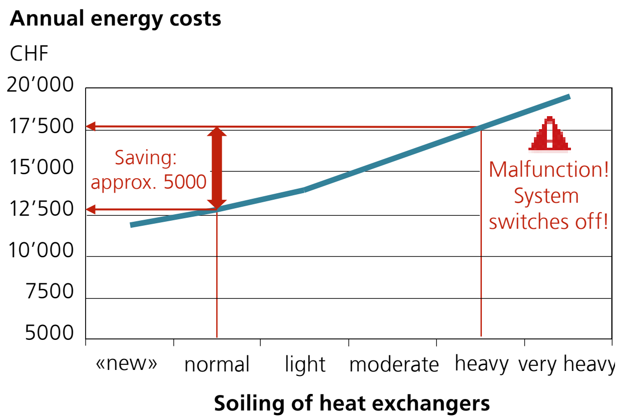
Severely deformed fins

If the fins on the heat exchanger are severely deformed, full flowthrough will be impeded. The exchanger's "power" diminishes and energy efficiency suffers. Deformations are caused by mechanical damage, for example by spraying the fins obliquely with the high-pressure cleaner. If more than one quarter of the fins are deformed, you should re-align them. To do this, use the devices known as "fin combs". If you do not have any, or if the fins are very severely deformed, you can do this by hand. Align one fin at a time, using long-nose pliers and a 2-mm screwdriver.[1]

Sources
1 Guideline with measures to optimise refrigeration systems
2 Research Council for Refrigeration Technology of the German Mechanical Engineering Industry Association (VDMA), Study FKT 37/97, Saving Energy through Maintenance, 2016
3 Guide to refrigeration: maintenance and energy

When an increase in consumpti on goes unnoticed

Cleaning the evaporator improves heat transfer between the ambient air and the refrigerant. This increases the efficiency of the heat pump system because without cleaning, the energy consumption increases continuously – but you do not notice this happening. A study by the German Mechanical Engineering Industry Association (VDMA)[2] shows that if refrigeration systems (which, of course, include heat pumps) are not maintained for two years, they exhibit a 25 to 45 per cent increase in energy consumption.[3] Air-to-water heat pumps are likely to become soiled rather less quickly than refrigeration systems, because the evaporator is cleaned slightly during every defrosting process. This washes out some of the dust or pollen. However, leaves and grease remain behind and form deposits, so the evaporator gradually becomes clogged and energy efficiency also decreases significantly.



Annual energy costs of a system with (evaporator) power of 210 kW with different degrees of soiling of heat exchangers.

Additional information

- Guideline with measures to optimise refrigeration systems
- Guide to refrigeration: maintenance and energy
- Heat pumps: planning – optimisation – operation – maintenance

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11.2021

Energy data – the key to tracking down savings potential

A faulty controller, a change to a setting or a major leak in the compressed air system: these are everyday occurrences that often cause increased energy consumption. If the error or fault is only discovered late in the day, the costs can quickly mount up.

Action

Evaluate the operational and consumption data recorded by your building management system at regular intervals to avoid "energy leaks".

Requirement

Your building has a building management system.

If you track down possible potential for saving energy at an early stage, you will easily save 5 to 10 percent of your energy costs.

What to do

1. Compare energy consumption data

Regularly compare the recorded energy consumption data with the data for the previous period (see "Please note"). If consumption increases abruptly for no obvious reason, analyse the cause.

2. Analyse the recorded data

Each week or month, compare the other recorded data (statistics and trend curves) with the data for the previous period. If there are any irregularities, investigate their cause. (Also see page 2: Reasons for discrepancies)

3. Check the displayed data

Check the displayed values at regular intervals

- Are the current values (temperatures, pressures, etc.) plausible?
- Are the setpoints (e.g. temperatures) maintained?

Costs – effort

Your own labour: approx. 1 to 3 working days per year, depending on intensity

Please note!

- Like all other data, energy consumption data should be compared to the previous year's figures at least once a year or, better, every quarter (for small businesses), once a month (medium-sized businesses) or even once a week.
- The values should be plausibility-checked both in summer and in winter.

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Additional explanations

Purchased at high cost – but inadequately used
Quite often, costly building management systems are only used to generate alarms in case of malfunctions. Of course, alarms are important and they are the basis for short response times. But modern building management systems can do far more than this.

Thanks to graphic displays, they allow targeted monitoring and optimisation of complex technical systems and control processes. This eliminates the requirement for specialists to measure temperatures, consumption figures or system pressures in a plant. Also, for example, reduced temperatures at night and outside of usage times can be monitored with no need for the responsible individual to be on the premises.

Some typical "mistakes"
"Operating with no benefit" is the most obvious mistake that can be identified in many systems by evaluating the data from the building management system. This category includes, for instance, systems and machines that operate at night although the entire workforce is at home and the plant should be inactive: air compressors are a classic example of this.

Other frequent mistakes:
- Rooms are heated and cooled at the same time
- Heating pumps operate in summer
- The ventilation system cools during winter
- The heat recovery unit doesn't work
- No night-time temperature reduction is set
- Free cooling is installed but is not operating

Possible reasons for discrepancies
Energy consumption discrepancies that are revealed by the data from the building management system can have various causes and do not always have to indicate a problem:
- Changes to production volumes
- Conversions, extensions or demolitions
- Increased or reduced employee numbers
- Different numbers of heating degree days depending on climate conditions
- Incorrectly calibrated probes/sensors
- The building management system does not display the correct values
- Changes to operating times or settings such as temperatures, pressures, etc.
- Refurbishment or extension of supply systems such as heating, refrigeration/cooling, hot water, compressed air or ventilation (e.g. installation of new chilled beams).

Additional information
- Energy efficiency in functional buildings, Building Network Initiative (GNI)

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Keep heat inside buildings by closing doors and gates

Heat escapes continuously through open doors and gates – a costly state of affairs that can often be prevented. The solution? It all comes down to well-informed and attentive employees.

Action

By consistently closing external doors/gates as well as doors inside a building, you can take action against energy wastage.

Requirement

This action can be put into practice anywhere and is simple to implement.

What to do

Doors and gates that open to the outside

- On sliding doors, activate winter mode (so the door does not open fully)
- Close industrial doors and gates again immediately after goods have been loaded or unloaded
- Instruct employees to enter the building through the doors, not through the gates
- Close under-used public entrances
- Only open roller doors/gates to the necessary height

Doors and gates inside the building

Make sure that doors between heated and unheated zones are always closed in winter.

- Doors from offices or sales areas into corridors
- All doors that open onto staircases
- Doors from porches into warm areas
- Doors from a heated ground floor into an unheated basement
- Doors from a heated upper floor into an unheated attic storey
- Steam bath and sauna doors

Costs – effort

- You need about one hour to instruct the employees. You also need to inspect the premises from time to time and address “lapses” (open doors and gates) as necessary.
- By setting a sliding door to winter opening mode, heat losses through the door can be reduced by 30% (see next page).

Please note!

- If a door or gate is constantly open, investigate the reason. There may be an operational cause that you can easily rectify. Perhaps the door opens too slowly, so forklift drivers cannot complete their work in the time allowed. Simple technical solutions can often provide a remedy in cases such as these. Increase the door’s closing speed, for example, or do not open it to the full height.

Additional explanations

Only open doors and gates as far as necessary

There is a linear relationship between heat losses through an open door or gate and the door width, but these losses increase disproportionately in relation to the door height. It follows that doors and gates should not be opened any higher than is absolutely necessary. The minimum required opening dimension for a door in areas used by people is 2,10 metres.

In winter, screens or panels can be used to reduce the door height to the optimum dimension of 2,10 metres. In customer areas, where the visual impression is important, use an invisible glass panel for this purpose. Most automatic sliding doors have a "winter opening" mode that reduces their opening width. A width of 1 metre has proven suitable – this allows a twin pram with a width of 80 centimetres to pass through easily.

The example of a chemist's shop with a sliding door (1,40 metres wide and 2,20 metres high) shows how much energy-saving potential is available. The door is open for an average of 42 minutes per day. In the winter half of the year, heat losses through the door can be reduced by 30% if the door is only opened to a width of 1 metre in winter opening mode.

Retrofit sensors on revolving doors

Revolving doors prevent warm indoor air from flowing freely to the outside. But every time they revolve, they "scoop" warm air outwards and cold air inwards. To prevent unnecessary heat losses, the revolving door can be equipped with a sensor. When this is done, the door will only revolve when a person is present in the revolving area.

Retrofit door closers

If doors always remain open despite every effort to inform people, a door closer can provide an elegant solution. A simple door closer costs about CHF 50. Anyone who is technically skilled can install the closer themselves on most doors (except for glass doors and special metal doors).

Heated air curtain

Check your heated air curtain regularly to make sure it does not "leak". Check whether there is an opening between the blower assembly and the building envelope (outer wall) through which warm air can escape to the outside. In these cases, heat losses can be prevented by a lateral screen or panel that seals the opening. The air from the heated air curtain flows out at 30 °C to 35 °C and mixes with the cold outside air. If the indoor temperature becomes too high in warm seasons (or when the door is closed and the heated air curtain is active), you should ask your supplier to determine whether the temperature at which the heated air for the curtain is blown out can be adjusted to the effective temperature (outside temperature).

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Illustrations: zweiweg

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Reduce heat losses through open (industrial) doors and gates

It still often happens that a door or gate is left open while the forklift unloads a truck and transports the goods into the hall. A modern control is the remedy for this problem. It will optimise door opening and minimise heat losses.

Action

Keeping doors and gates open for short periods will minimise heat losses and improve comfort by helping to prevent temperature drops and draughts.

Requirement

You have modern high-speed doors or a sensor-actuated door control (e.g. with a laser scanner).

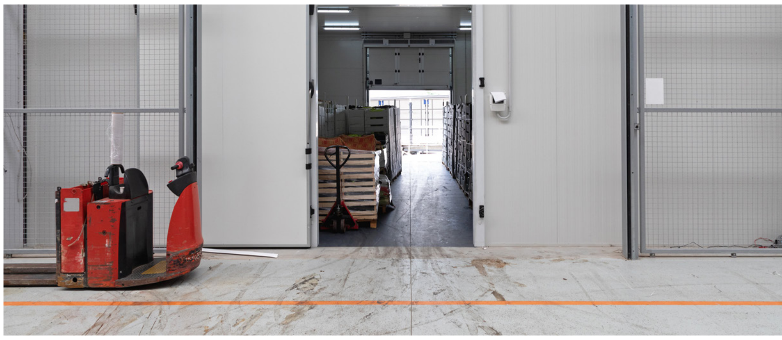
What to do

Intermittent operating mode for high-speed doors

- Check whether your high-speed doors (high-speed spiral doors or foil-coated roller doors) remain open all the time while goods are loaded and unloaded.
- Check whether you can reduce the opening time on the control (e.g. to 15 seconds) so that the door closes after every operation and only opens again when required.

Optimise door opening

- On sensor-controlled doors, check whether the opening height matches the actual requirement. The height of a standard forklift vehicle is about 2,2 metres – so even if the door is 4 metres high, an opening height of 2,5 metres is sufficient.
- Discuss heights with your employees based on their experience and practice, and adjust the door opening height accordingly.



Costs – effort

- To check and adjust one door, you will need between half an hour and one hour.
- Switching over from continuous to intermittent operation reduces heat losses through the door by 10% to 30%, depending on the application and the building.
- Reducing the opening height by 1,5 metres (from 4 metres to 2,5 metres) reduces heat losses through the door by 40% to 60%.

Please note!

- Safety requirements must be met at all times!
- There is no optimal period for doors to remain open. You need a solution that is tailored to your usage (your process).

Additional explanations

Avoid draughts

If two doors opposite each other are open at the same time, heat losses will increase noticeably and comfort will be impaired due to the draught. In situations of this sort involving draughts, the heat demand is 6% to 11% more than when the two doors are not open at the same time.

Slow- and fast-running doors

According to a German study, three types of door – sectional doors, roller doors and high-speed spiral doors – have a market share of over 90% in the industrial construction sector. Sectional doors and roller doors with slats close at an average speed of around 0,25 m/s and are classed as "slow-running" or "low-speed" doors. Fast-running doors include high-speed spiral doors and foil-coated roller doors. Their average speed of about 0,7 m/s makes them around three times faster than slow-running doors.

With their higher speed, fast-running doors can react more rapidly to effective demand. Their opening times are significantly shorter, so the heat losses in winter are correspondingly lower.

For doors that only open infrequently, however, the opening speed is of secondary importance. Good thermal insulation of the doors is the important factor here. In such cases, a less important part is played by heat losses through slow-closing doors whose opening and closing process often takes longer than the time for which the door is open.

Unload trucks inside the building

If your hall is large enough, you can drive trucks into it for loading and unloading. The doors/gates are only opened when the vehicles pass through them, after which they are closed again. This allows you to reduce heat losses through open doors by 70% to 80%, depending on the type of door. Drawbacks of this measure are the additional space required for the trucks and the exhaust gases from them that pollute the indoor air.

Situation analysis

It may well be worthwhile to commission an expert opinion from a door and drive technology specialist (for example: experts working for the supplier) on your doors and the work processes related to them. They can show you actions that you can take immediately:

- Which doors/gates include the necessary safety elements so that their opening time or height can be adjusted without any further interventions?

You will also learn which further actions are suitable in your case:

- Where are refurbishments, additions (such as air curtains and airlocks) or possibly replacements due within a suitable period?

Additional information

- Different door systems in industrial buildings, taking account of energy, building climate control and economic aspects, Technical University of Munich (TUM), Chair for Building Technology and Climate Responsive Design, 2013
- Gates – doors – windows
  FCOS (Federal Coordination Commission for Occupational Safety) information brochure
- Doors and gates
  Specialist documentation on safety, Swiss Council for Accident Prevention (BFU)
- You can find specialists in door/gate and drive technology at: Interest group for gate systems, drive systems and door systems (IGTAT)

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