

*Checklist for cooling systems*

# Manage your Cooling

Commerce and Industry

**Use the Danish Energy  
Saving Trust's checklist**

– and get a specialist to perform an energy audit of your cooling system

**Go'Energi**

Danish Energy  
Saving Trust

What to check	How to do it
<b>Cooling needs</b>	
Check purpose of system	Check whether the cooling needs, temperature requirements, process conditions or other factors have changed since the system was built or renovated.
	Check whether any new large processes or areas have been added or connected to the cooling system.
Minimising cooling needs	Check the media temperature requirements out in the process. This can often result in raising the inlet temperature. Check the temperature control of brine- or water-based systems, and avoid too low an inlet temperature.
	Check whether it is possible to use free cooling, e.g. for process cooling, oil cooling, air conditioning, and in server rooms. Consider whether cooling can be partly or wholly provided by free cooling, possibly fresh air cooling.
	Alternatively, check whether cooling processes are, or can be, divided into different media temperatures so that the suction pressure matches the cooling output and cooling needs, thereby minimising energy consumption. The difference between the evaporator temperature and the media temperature should not be greater than 4-6 °C.
	Check the ambient temperature in chillers, freezers, server rooms, and rooms with air conditioners. Check whether the ambient temperature is too low. Check the possibility of increasing ambient temperature at night.
	Check whether solar awnings are fitted to minimise the thermal impact on buildings and exterior pipework.
Check if requirements vary	Check whether cooling needs vary during day/year, and whether the system takes account of temperature variations and set point adjustments. Check the options for variable cooling volumes, timer controls and variable thresholds for temperature, brine and cooling water flow, set point adjustments, and summer and winter operation.
<b>System efficiency</b>	
System capacity	Check that screw compressors do not operate at a part load of less than 70%. Consider the possibility of variable speed control, so unloading of screw compressors is unnecessary (often may require external oil pump, etc.).
	Check that compressors do not start and stop continually as a result of overcapacity, or whether a smaller reciprocating compressor can replace the part load on a screw compressor.
	Check whether the system operates with capacity adjustable compressors, pumps, ventilators, etc.
	Check free cooling capacity. This can often be insufficient in relation to demand.
	Check the interaction between cooling and free cooling. The use of free cooling is often not optimal.
Cooling loop	Check that the buffer tank is large enough in the secondary cooling system to optimise the compressor operation.
	Check that the buffer tank supplies brine or cooling water at a stable temperature.
	Check that the buffer tank operates correctly as a coolant storage tank, not as a mixing tank for the inlet and outlet pipes. You can do this by checking the supply pipe temperature from the chiller before the tank and compare it with the supply pipe temperature to the consumer unit after the buffer tank. A rise of 2-3 °C in the brine or cooling water flow rate indicates that the liquid is being mixed, and the buffer tank is not functioning.
Cooling and refrigeration coils	Check that cooling coils do not ice up unnecessarily, and also de-ice correctly so that the whole coil is ice free after each de-icing.
	Check whether the distance between the fins is too small if de-icing is frequently required.
	Allow enough time after de-icing for all moisture droplets to disappear so the evaporator and cooling coils are completely dry.
	Check the temperature difference across the evaporator coil. The optimal difference across the evaporator is 8 °C.
Condensing system	Check whether the system operates with a fixed or variable condenser temperature (possibly dew point control with evaporative condenser). A high condensing temperature reduces the cooling capacity and results in excessive electricity consumption: a temperature rise of 1 °C increases electricity consumption by 3%.
	Check that the condensing temperature of evaporative condensers equates to dew point temperature + approx. 8 °C. The condensing temperature of air-cooled evaporators should equate to air temperature + approx. 10 °C.
	Check that the airflow to and (especially) from condensers is unobstructed, with no reverse flow of warm air.
	Check whether there is direct sunlight on the air-cooled evaporator coil. Direct sunlight increases the condensing temperature and increases electricity consumption unnecessarily.
Efficiency of electric motors	Check if energy saving components are fitted such as energy efficient fans and motors on the pumps and open compressors, and check that the control system runs the system very efficiently. Consider switching to better components or switching to a compressor unit with high overall efficiency.
	Check the ventilator motors, and recommend a possible switch to EC fan motors if the ventilators are required to run for long periods at low output.

What to check	How to do it
Heat recovery	Check whether any existing heat recovery works optimally – or whether heat from superheating or any oil cooling can be used for room heating purposes, etc.
<b>Automatic control</b>	
Automatic control and adjustment	Check whether adaptive cooling control is fitted.
	Check whether the cooling control operates with variable suction and condensing pressure using a frequency converter and several compressor stages in the adaptive cooling system.
BMS (Building Monitoring System)	Check that electricity meters are fitted to the compressors and cooling system, and that energy meters are fitted to the brine systems, and that they interface with and report to the BMS.
	Check that the system controls the ventilation fans, carries out de-icing, and automatically adjusts the cooling temperature based on demand.
	Check that your BMS measures and records energy consumption in the frequency converter and compressor system and from electricity meters. Possibly expand it to include measuring the amount of cooling used.
Measuring points	Check that measurements and signals from the system are displayed correctly on the BMS screen and also that they operate as required. Typically, these include temperature, humidity, media flow, motor power, signals from the temperature and flow monitors, and other alarms.
<b>Operation and maintenance</b>	
Heat exchangers	Check that the air-cooled condensers and dry coolers are free from scale deposits and leaves, and that the condensing pressure can be reduced by adjusting the ventilator, etc.
	Check whether there is excessive moisture in the refrigerant circuit by looking at the sight glass in the liquid line.
	Check whether there are noncondensable gases in the condenser (noticeable by artificially high condenser pressure), especially whether there is air in the system, and whether the automatic air purger works. Also check that any vacuum bleed on the brine system functions correctly.
	Check that evaporator exchangers are not fouled, and that there is no scale build-up on heating and cooling coils.
Insulation	Check that the insulation in the cold store, on the pipe system and the valves, etc. is both sufficient and intact. Keep an eye on the formation of condensate and ice. Check that pipes are properly insulated with pipe straps.
Corrosion	Check for any corrosion. This is often a sign of poor insulation and condensation problems.
	Check drains and outlets from the cold store, evaporator coils and refrigeration equipment because a blocked drain results in humidity and de-icing problems.
Leaks and draughts	Check the door seals to the cold store because draughts cause the temperature to rise.
	Check that air curtains operate as they should because a draught through a chiller curtain causes the temperature to rise and leads to de-icing problems on the evaporator coils.
Behaviour	Check that automatic doors in chiller and freezer rooms close quickly to prevent the temperature from rising.
	Check stacking in chiller and freezer rooms and refrigerators to ensure optimum refrigeration and air distribution.
	Check that the supply of brine to the production machinery stops when the machine is stopped.
	Check that the refrigeration and freezer coils are de-iced correctly to minimise electricity consumption.
<b>Energy control</b>	
System efficiency	Check that optimal energy control of the system is established in order to maintain a constant low condensing temperature, ensure a high evaporator temperature, and avoid part loading of the compressor.
	Check that electricity meters are fitted to the cooling system, and energy meters are fitted to the brine systems. In smaller systems, you should at least monitor the electricity consumption. In large systems you can calculate the efficiency (COP) online via metered media flow (the relationship between the measured cooling output and the total electricity consumption used by the compressors, pumps and fans).
<b>Links to other resources (in Danish unless otherwise indicated)</b>	
Websites	GoEnergi.dk/butik-koeling www.sparemotor.dk www.spareventilator.dk www.danskeenergi.dk
Publications	The Pressure Equipment Directive (97/23/EC) The Danish Working Environment Authority. Executive Order No. 100 on the use of Pressure equipment DS/EN 378-1, -2 og -3: Kølesystemer og varmepumper

**To be completed by specialist****Ventilation check carried out at:**

Company: \_\_\_\_\_ Date: \_\_\_\_\_

Unit (unit no.) referred to: \_\_\_\_\_

Estimated energy consumption: \_\_\_\_\_

**Observations :**

Efficiency measurement if any: \_\_\_\_\_

Other: \_\_\_\_\_

**Recommended measures in order of priority are shown below:****Priority 1:** Estimated payback period: 0-1 year**Priority 2:** Estimated payback period: 1-5 years**Priority 3:** Estimated payback period: over 5 years

Priority	Recommended measures

**Conclusion/Next step:**

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**Carried out by Company/Name:** \_\_\_\_\_ Appendix enclosed. Attach the appendix separately if there is insufficient space on this page.