



Best Practice	EFFICIENT FANS AND CONTROL	COOL-04																														
Application	Cooling System																															
SME sector	Industrial																															
SME Sub-sector	All																															
Technical description	Auxiliary units (pumps and fans) can consume between 20 and 50 percent of the compressor power. Common savings potentials are the usage of fan/motor with higher efficiency, reduction of operating hours and capacity control.																															
Recommendation for optimisation	Replacement of fans/motors Especially for smaller power ranges (under 1 kW) electronically commutated (EC) motors have better efficiency than asynchronous motors. There are new EC motors available which suffice the IE5 class (Ultra-Premium Efficiency). Since 2017 all motors in the power range of 0,75 to 375 kW must fulfil the efficiency requirements of at least IE3 (IE2, when coupled with a frequency converter).																															
	Efficiency classes for low power motors: minimum efficiency (in %) of 50 Hz electro motors (4 poles) as specified in IEC 60034-30-1																															
	<table><tr><td></td><td>120W</td><td>250W</td><td>550W</td><td>750W</td><td>1.5kW</td></tr><tr><td>IE4 (Super Premium Efficiency)</td><td>69,8</td><td>77,9</td><td>83,9</td><td>85,7</td><td>88,2</td></tr><tr><td>IE3 (Premium Efficiency)</td><td>64,8</td><td>73,5</td><td>80,8</td><td>82,5</td><td>85,3</td></tr><tr><td>IE2 (High Efficiency)</td><td>59,1</td><td>68,5</td><td>77,1</td><td>79,6</td><td>82,8</td></tr><tr><td>IE1 (Standard Efficiency)</td><td>50,0</td><td>61,5</td><td>70,0</td><td>72,1</td><td>77,2</td></tr></table>			120W	250W	550W	750W	1.5kW	IE4 (Super Premium Efficiency)	69,8	77,9	83,9	85,7	88,2	IE3 (Premium Efficiency)	64,8	73,5	80,8	82,5	85,3	IE2 (High Efficiency)	59,1	68,5	77,1	79,6	82,8	IE1 (Standard Efficiency)	50,0	61,5	70,0	72,1	77,2
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Reduction of operating hours <ul style="list-style-type: none">• Switch off fans, when cooled area is not in use or when no cooling is needed/required temperature is reached• Install door contact switch: if the door is open, cooling is being interrupted to avoid cold air seeping out• Switch off evaporator fans when defrosting (if electric or with hot gas) Electricity consumption decreases for the fan motor and the compressor due to lower cooling load.																																
Fan control – evaporator To control the air volume, flow the fans can be switched off, when the refrigerant flow stops. Another option is the use of multipolar motors (step-by-step coupling). High savings can be achieved with an infinitely variable thermostatic control which reduces the consumed power through rotation speed control.																																



	<p>Fan control - condenser</p> <p>Normally, the condenser fans switch off if the switch on again if the value rises. The order in which the fans are switched on should be in a way that the first fan (as seen from the perspective of the refrigerant influx) is the first to be switched on again. The condenser fans should be switched off if the pumps are switched off (except during cold weather to prevent icing).</p>			
Relevant technical considerations	<p>The key parameters for cooling systems in general are measured power, operating hours, COP, cooling load and ambient temperature. Other factors to be considered: production rate, operation time, main equipment and processes supplied by cooling plant.</p>			
Schemes and diagrams	<p style="text-align: center;">Sketch of a basic cooling system</p>			
Economics		Up to 15kW [EUR]	15-80 kW [EUR]	Over 80kW [EUR]
	Replacing existing fan with one equipped with an EC motor	1,000-5,000	over 5,000	over 5,000
Energy savings	<p>Different ways of power control result in different saving potentials:</p> <ul style="list-style-type: none"> • Replacement of AC motors with EC motors: about 30% • Interruption of cooling: reduction of electrical consumption due to the fan motor and the compressor due to the lower cooling load. • Use of multi-pole motors: 2 fans at half speed consume less energy than one at full load • Rotation speed control: average 20% reduction in consumption 			



Economic savings	20-30% (due to reduced energy consumption)
Average Payback Time	3-6 years
Emissions	Emissions depend on the characteristics of the refrigerant gas.
Environmental benefits	Environmental Benefits through the reduction of CO ₂ emissions.
Main NEBs (Multiple benefits)	<input checked="" type="checkbox"/> Environmental benefits <input type="checkbox"/> Increased productivity <input type="checkbox"/> Work environment/ Health/Safety <input type="checkbox"/> Increased competitiveness <input type="checkbox"/> Maintenance
Replicability	High Suitable measure for all cooling systems.
Related measures	<ul style="list-style-type: none"> • COOL-01: Cooling load reduction and free cooling • COOL-02: Compression control • COOL-03: Lower condensing temperature - Raise of evaporation temperature • COOL-05: Loss reduction • COOL-06: Heat recovery
References	<p>Kulterer, K., Mair, O., Horvath, C.: Leitfaden für Energieaudits in Kältesystemen, klimaaktiv energieeffiziente betriebe, Vienna 2017</p> <p>5869-200318_Massnahmeliste_Kaelte_(En).pdf</p>

This Best Practice was developed by the Impawatt Project (GA No. 785041) and adapted for the GEAR@SME Project (GA No. 894356)