



Best Practice	OPTIMISED CONTROL OF PUMPS	PUMP-03
Application	Optimisation of Pumping Systems	
SME sector	Industrial	
SME Sub-sector	All	
Technical description	<p>In many cases, the flow rate is mechanically controlled: Throttling, By-pass.</p> <p>Such a situation leads to situations of inefficiency, caused by: too high pressure level, unnecessary flow and low efficiency of the pumps.</p>	
Recommendation for optimisation	<ul style="list-style-type: none"> • Optimization by throttling: in both situations, the presence of a valve allows to adjust the flow rate going to increase the pressure drops in the circuit. This mode of valve adjustment is inefficient: <ol style="list-style-type: none"> 1. The reduction of the flow rate following the characteristics of the pump generates an unnecessarily high pressure. 2. Pump efficiency is reduced from 80% to 60%. • Optimization by speed regulation (frequency converters): The proportional adjustment mode (very common in practice) follows a regulation line that allows you to vary the frequency of supply of the pump, to be able to vary the speed of rotation of the pumping system and consequently vary and adjust the flow rate. 	
Relevant technical considerations	<p>The choice and installation of a frequency converter is the responsibility of a specialist.</p> <p>The integration of a frequency converter must be done correctly. It is important not to pollute the electrical network with harmonics and not to cause problems with the engine.</p>	
Schemes and diagrams	<p>The following figure compares the situation of a pump (green curves) in a closed circuit (blue curves) and an open circuit with static height or back pressure (red curves).</p>	

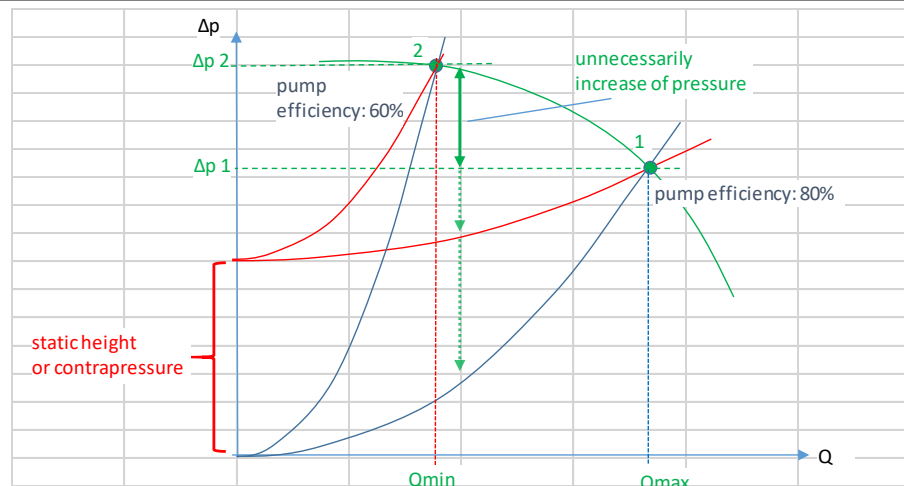


Fig. 1: effect of a throttling flow control (source: Planair SA)

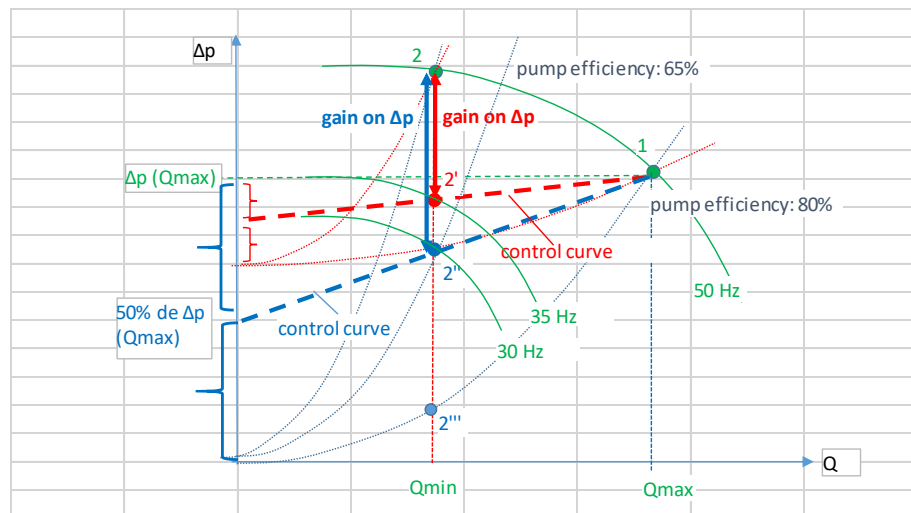


Fig. 2: speed regulation (source: Planair SA)

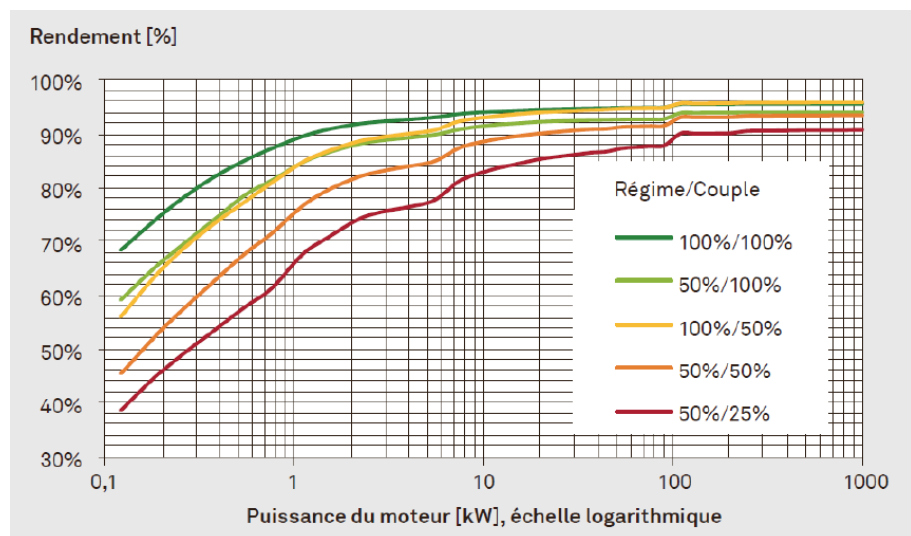


Fig. 3: efficiency of frequency converters



Economics	Unit costs of variable frequency drives vary between 350 and 1,500 EUR.
Energy savings	<p>The advantage of an optimization based on a frequency converter can be very high (up to 75% energy savings).</p> <p>In this case, the law of affinity can be applied (the ratio of flow and energy is almost cubic).</p>
Economic savings	Economic savings are closely linked to the reduction of electricity used
Average Payback Time	3 years
Emissions	<p>0,7kgCO₂/kWh_{el}</p> <p>The emission alone is indirectly caused by the electricity involved.</p>
Environmental benefits	Reduced CO ₂ emissions due to lower energy needs.
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
Related measures	<ul style="list-style-type: none"> • PUMP-01: Reduction of running time for pumps - Switch off motors when not needed
Case study	<p>Installation of frequency converter (Switzerland, 2019)</p> <ul style="list-style-type: none"> • Initial Situation: in a packaging board factory, a group of two pumps supplies water to a boiler. The supply is partially controlled by a 3 way-valve which returns the excess to the tank. When the water level in the boiler reaches the high threshold. This means that a significant part of the flow rate permanently returns to the tank and that the pressure is too high (due to network losses). Moreover, the pumps stop and start very frequently (every 3 minutes). Except for the boiler start on Monday morning, the pump is incorrectly sized. The global efficiency is very low. • Description of the optimisation: integration of a new pumps with VSD. The pump speed is controlled by the level of water in the boiler. No return to the tank. When the flow rate is under the minimal flow (according to pump specifications) the pump stops.



	<ul style="list-style-type: none">• Implementation costs: 17,000 EUR• Payback Time: 3.2 years
References	Nicolas MACABREY, Planair, 2019

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