GOOD PRACTICES IN SME

Pump regulation

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Why is investing in a frequency converter in a motor-pump system cost-effective?

There is a maximal efficiency to pumps, meaning that the pump chosen for the installation should be selected so that it operates at its optimal point, or maximal performance. The biggest gains can be achieved by changing the way the pump is regulated. The graph below shows a comparison between three of the most common methods for regulating low specific speed pumps (centrifugal and propeller). It shows that that if there is a need to lower the flow in the pump, bypass regulation will increase the energy consumption, throttling regulation decreases energy consumption linearly, while variable speed regulation decreases the energy consumption significantly. The difference in power draw Δ*P* is cost-effective when considering the advantages of changing from the common throttling regulation to variable speed regulation using a frequency converter.

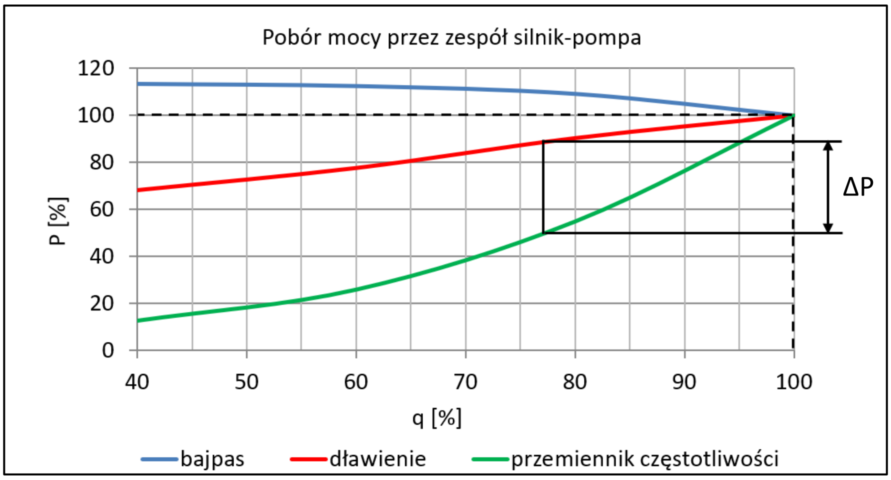

Fig. 1 Relationship between energy consumption by the motor-pump in relation to its regulation method Title: Energy consumption of the motor pump system, Legend: Blue – bypass , Red – throttle, Green – frequency converter

Changing the method of regulation should be done after first conducting a minimally yearlong analysis of operation. Still it can be confidently ascertained that if flow regulation is varied by 8-10% from the optimal point, then using variable speed regulation will generate significant benefits, at an attractive payback time at that – from 0,5 to 1,5 years. By large variations in flow intensity changing the method of regulation from throttling to variable speed regulation can lower the energy consumption by as much as 50%.

Source: Podręcznik do samooceny zużycia energii dla MŚP, Jacek Szymczyk, 2020

fot. 1 epompa: pompa wirowa

How to estimate savings of replacing throttling regulation with a variable speed regulation?

To estimate the savings created by replacing a throttling regulator with a variable speed regulator we can use the formula:

$$\Delta k = (\Delta P_1 \times t_1 + \Delta P_2 \times t_2 + \cdots + \Delta P_n \times t_n) \times k$$

Δk – annual savings$[\frac{PLN}{year}]$

ΔP_1 – difference between the energy consumed by a throttling regulated pump and a variable speed regulated pump for an output Q_1 [kW]

t_1 – work hours of the pump at output Q_1 [h/year]

k – price of electric energy $[\frac{PLN}{kWh}]$

What would be the savings when replacing a throttle regulator with a variable speed regulator if the pump often operates at 90% output?

Savings [PLN/year], which can be achieved by replacing a throttle regulator with a variable speed regulator when the pump often operates at 90% output assuming the price of energy at 0,55 PLN/kWh:

	Energy consumed by the pump at its optimum [kW]							
Work hours at 90% output [h/year]	10	20	30	40	50	60	75	90
500	468 PLN	935 PLN	1 403 PLN	1 870 PLN	2 338 PLN	2 805 PLN	3 506 PLN	4 208 PLN
1000	935 PLN	1 870 PLN	2 805 PLN	3 740 PLN	4 675 PLN	5 610 PLN	7 013 PLN	8 415 PLN
1500	1 403 PLN	2 805 PLN	4 208 PLN	5 610 PLN	7 013 PLN	8 415 PLN	10 519 PLN	12 623 PLN
2000	1 870 PLN	3 740 PLN	5 610 PLN	7 480 PLN	9 350 PLN	11 220 PLN	14 025 PLN	16 830 PLN
2500	2 338 PLN	4 675 PLN	7 013 PLN	9 350 PLN	11 688 PLN	14 025 PLN	17 531 PLN	21 038 PLN
3000	2 805 PLN	5 610 PLN	8 415 PLN	11 220 PLN	14 025 PLN	16 830 PLN	21 038 PLN	25 245 PLN
3500	3 273 PLN	6 545 PLN	9 818 PLN	13 090 PLN	16 363 PLN	19 635 PLN	24 544 PLN	29 453 PLN
4000	3 740 PLN	7 480 PLN	11 220 PLN	14 960 PLN	18 700 PLN	22 440 PLN	28 050 PLN	33 660 PLN
4500	4 208 PLN	8 415 PLN	12 623 PLN	16 830 PLN	21 038 PLN	25 245 PLN	31 556 PLN	37 868 PLN
5000	4 675 PLN	9 350 PLN	14 025 PLN	18 700 PLN	23 375 PLN	28 050 PLN	35 063 PLN	42 075 PLN

Source: KAPE