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BASIC HYDRAULICS AND PUMP PERFORMANCE

CALCULATING PUMP EFFICIENCY

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Parameters for monitoring pump performance

Maintaining pump performance requires monitoring of the following three parameters:

- Flow
- Pressure
- Power consumption

Pump efficiency can be calculated based on these parameters.

Calculating pump efficiency

Pump efficiency:

$$\eta = \frac{H \times Q}{367 \times P_1}$$

Here:

- Q is the flow in cubic meters per hour (m^3/h)
- H is the pump head, or pressure, in meters (m)
- P_1 is the motor power consumption in kilowatts (kW)

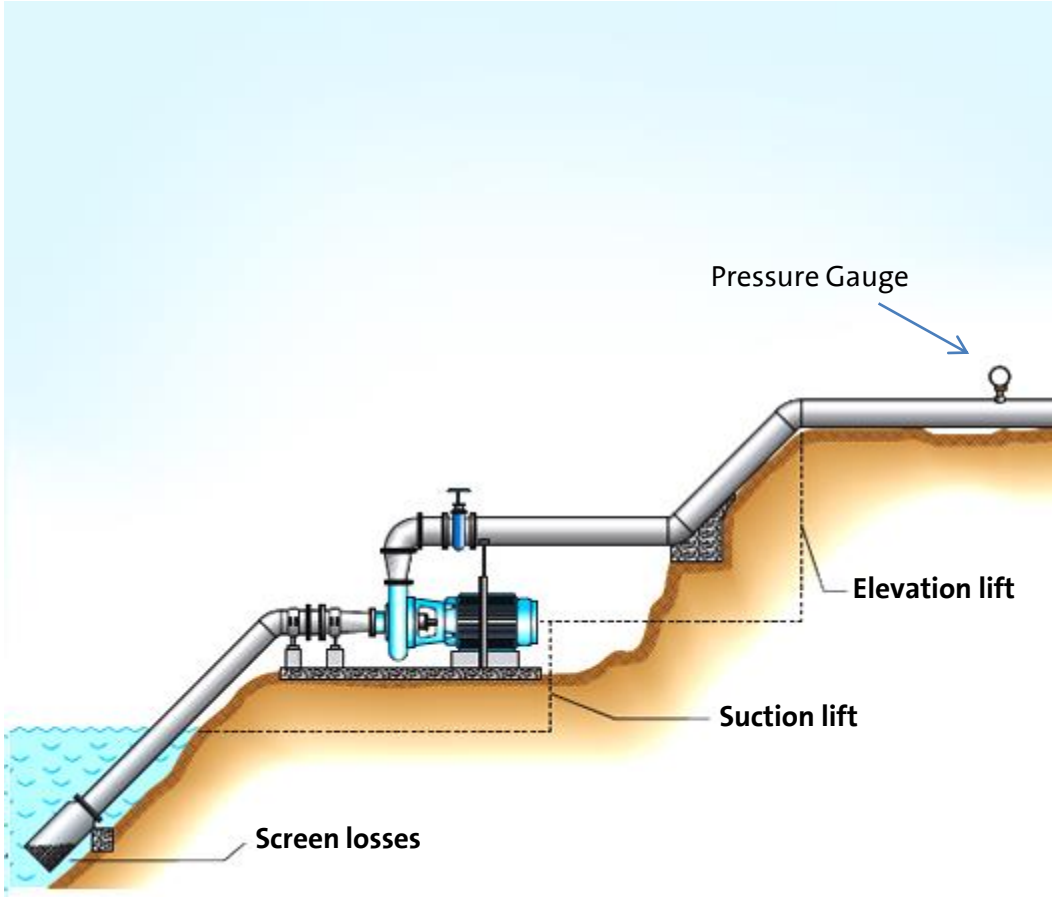
Note: *This formula calculates both motor and pump-end efficiency as one total number. It is also called wire-to-water efficiency as it calculates the power input to the motor in relation to the power output from the pump. Do not compare this with the pump literature because the literature is for pump efficiency only.*

Flow	Designation Q	Unit m^3/h	Cubic meters per hour
Head (pressure)	Designation H	Unit m	Meters
Energy	Designation P	Unit kW	Kilowatt

Monitoring pressure

When checking the pressure, if the pressure gauge is not installed directly at the pump discharge, add the elevation lift and friction loss from the discharge to the gauge.

You should always do this for deep-well pumps.



Monitoring performance parameters of pumps

If all the performance parameters—Flow, Pressure and Power consumption are recorded immediately after the pump has been installed, they may be used as benchmark data, and they can be checked at regular intervals.

Online monitoring equipment can also be used to trigger an alarm if some of the parameters change or exceed a preset limit.

Reasons for deviation in parameters

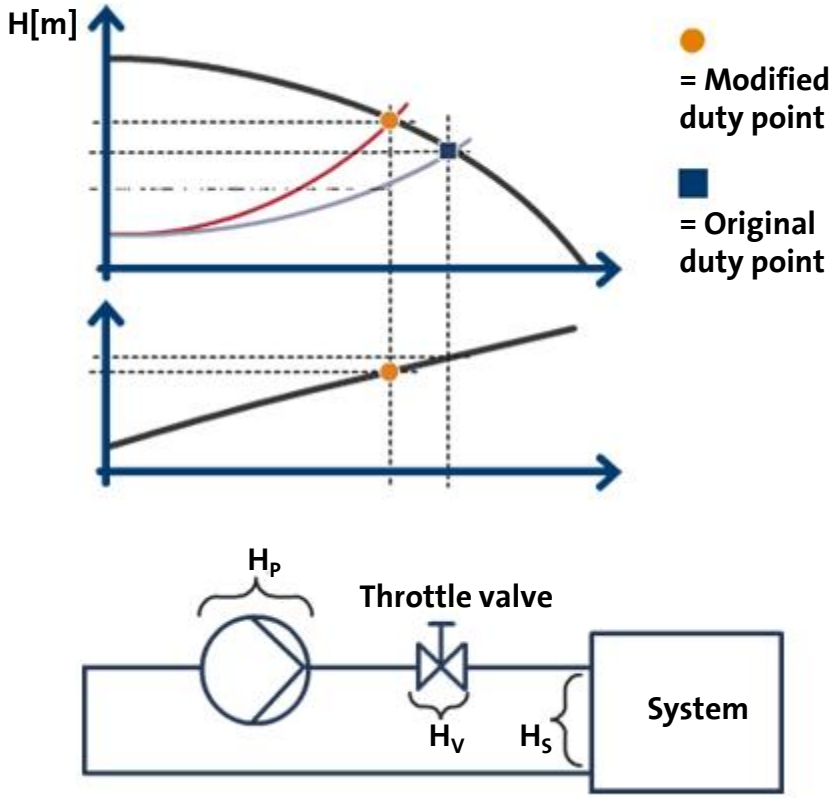
The parameters may deviate from the preset conditions when:

- The pump's operating conditions have changed.
- The flow or pressure requirements have changed.
- The pump is loosing efficiency.

Change in the pump's operating conditions

If the water table in a well drops and the pump has to deliver a higher head, the duty point actually moves to the left on the pump curve and deliver less flow.

It could also be caused by a valve in the system, which is throttling more than the usual. If possible, change the parameters back to the pump's previous operating conditions. If that is not possible, consider installing another pump.



Change in water or pressure requirements

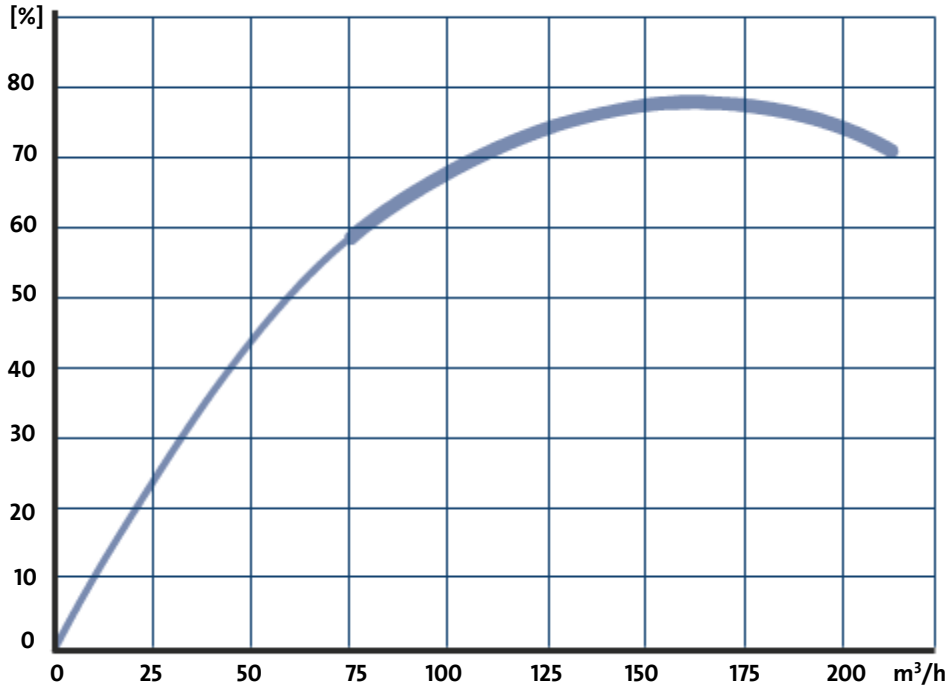
You must consider changing the pump if:

- Another irrigation zone has been added or taken out.
- The flow requirements have changed significantly.
- The irrigation system has been changed to a less water consuming application.

Loss of pump efficiency

If a pump is losing efficiency, it needs to be repaired or replaced. Loss of efficiency in pumps can occur because of the following factors:

- Cavitation
- Increase in friction loss from deposits in water that settle on the surface of pump and pipe
- Wear from sand and other materials in water
- Bad power supply



Operation outside bold line limits (75 m³/h and 215 m³/h) is not recommended.

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