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What is the best way for "pump efficiency estimation" without having vendor information?

Yasaman Birang
Process Engineer

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Marco

Marco Chiavelli
Engineering manager presso Datwyler - Pharma Packaging

Hello,
to estimate the efficiency of a centrifugal (?) pump i would do the following:
- measure the instantaneous flow with a flow meter on the delivery pipe
- measure the pressure on delivery pipe by a pressure gauge
- measure the absorbed current of the pump at that working point

with these 3 values you could estimate an overall efficiency, comprhensive of mechanical, hydraulic and electrical efficiency.

1) - with the current you can estimate the absorbed power (V*I*sqrt(3)*cos pi..... i guess!)

2) - the flow rate (m3/h) * pressure gauge (bar) / 367 = gives you the net needed power (in Watt) to pump that amount of water at that head.

The ratio of the 2) on 1) is the overall efficency.

I hope this could help

Regards
Marco

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Manvendra Kumar

Manvendra Kumar Garg
Sr. Process Engineer at Valdel E&C

u may considered 50 % efficicncy of pump

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Saeid R. Mofrad
Principal Process Engineer at Petrofac (P.E.)
Top Contributor

Pump efficiency is influenced by hydraulic effects, mechanical losses, and internal leakage. Each of these factors can be controlled to improve pump efficiency.

• Hydraulic losses may be caused by boundary layer effects, disruptions of the velocity profile, and flow separation. Boundary layer losses can be minimized by making pumps with clean, smooth, and uniform hydraulic passages. Mechanical grinding and polishing of hydraulic surfaces, or modern casting techniques, can be used to improve the surface finish, decrease vane thickness, and improve efficiency. Shell molds, ceramic cores, and special sands pro-duce castings with smoother and more uniform hydraulic passages. Separation of flow occurs when a pump is operated well away from the best efficiency point (BEP). The flow separation occurs because the incidence angle of the fluid entering the hydraulic passage is significantly different from the angle of the blade. Voided areas increase the amount of energy required to force the fluid through the passage.

• Mechanical losses in a pump are caused by viscous disc friction, bearing losses, seal or packing losses, and recirculation devices. If the clearance between the impeller and casing side-wall is too large, disc friction can increase, reducing efficiency. Bearings, thrust balancing devices, seals, and packing all contribute to frictional losses. Most modern bearing and seal designs generate full fluid film lubrication to minimize frictional losses and wear. Frequently, recirculation devices such as auxiliary impellers or pumping rings are used to provide cooling and lubrication to bearings and seals. Like the main impeller, these devices pump fluid and can have significant power requirements.

• Internal leakage occurs as the result of flow between the rotating and stationary parts of the pump, from the discharge of the impeller back to the suction. The rate of leak-age is a function of the clearances in the pump. Reducing the clearances will decrease the leakage but can result in reliability problems if mating materials are not properly selected. Some designs bleed off flows from the discharge to balance thrust, provide bearing lubrication, or to cool the seal.

The expected hydraulic efficiency of a pump design is a function of the pump size and type. Generally, the larger the pump, the higher the efficiency. As a rule of thumb, the efficiency of centrifugal pumps varies from about 20% for low capacity pumps (less than 10gpm) to a high of almost 90% for large capacity pumps (10,000 gpm). However, you can safely use 70% for pumps above 100 gpm as long as pump specific speed is more than 1500. For lower capacities and/or lower specific speed refer to below post.

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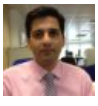

Saeid R. Mofrad
Principal Process Engineer at Petrofac (P.E.)
Top Contributor

To answer your question, there are few correlations and graphs to estimate the centrifugal pump efficiency.

* A quick estimate for centrifugal – pump efficiency paper by Alejandro Anaya Durand (Chemical Engineering, July 1989) presents a graph for a pump with differential head between 50ft to 300ft based on the following equations:

If 100 gpm < Q < 1000 gpm then E_1 = 80 - 0.2855H + 0.000378HQ - 0.000000238 HQ^2 + 0.000539 H^2 - 0.000000639 H^2 Q + 0.0000000004 H^2 Q^2

If Q < 100 gpm then E_2 = E_1– 0.35 (100 - Q)

Where Q and H are in gpm and ft, respectively. E_1 and E_2 are efficiencies in %.

* Centrifugal Pumps Handbook, Centrifugal Pump Efficiency Paper By David Cummings, refer to the graph in page 30 of the following link:

http://www.scribd.com/doc/39717682/Cenl-Pumps-Handbook

3) I have got another graph in my library but I am not able to find its reference. I will share it with you once I could find the reference.

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Emad

Emad El Gebesy
Maersk Oil Qatar, Engineering Services

hi, Yasaman.
once i had developed a visual basic program for centrifugal pump, the project was LNG, FEED. please send me on my mail to can send it to you or any one interested.

my mail is
emad.gebesy@worleyparsons.com

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Reza

Reza Modanloo
Senior Process Engineer /Open to new opportunities
Top Contributor

Dear Yasaman,
First of all pay attention that pump efficiency is a function of pump flowrate, when any increase in flowrate will decrease pump efficiency.
If Electromotor specifications are available, first calculate the electromotor power by following formula: P1= √3 V. I. CosΨ, then calculate the pump power by following formula P2= ΔP.Q where ΔP is pressure difference across the pump and Q is pump flowrate (both of them can be easily measured in site).finally you can easily calculate pump efficiency by following formula: Efficieny= P2/P1
GOOD LUCK

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