One Day Course on Pumps

By : Engr. Wong Choon Yoong, *M.I.E.M., P.Eng.*

On 12 July 2006, The Institution of Engineers Malaysia Mechanical Engineering Technical Division organised a one day course on pumps, where the event was made successful by 70 participants. With us were Mr. C. S. Choong and Ms. Ivynne Ong, both are with Pumpfield Corporation, dealer for Calgon range of water pumps. Mr. Choong, started the course with the review on how to select centrifugal pumps. All the data such as pumping head, capacity, water temperature and also suction condition have to be taken into consideration to ensure system stability in the long run.

The good engineering practice in relation to pump, always linked us back to the idea where a pump of good efficiency must be selected. Sounds familiar, truly, it is. We have seen a lot of specifications requesting for pumps with 85% efficiency. It is achievable on certain range of application, but does everyone know that the pump efficiency actually varies across a range from 15 – 90 %? How does this affect the pump performance? This is related to the motor selection and power consumption and is derived from,

Input kW (power that contribute to the bill)

$$= \frac{\text{WkW}}{\text{Overall efficiency}}$$

where the WkW (water kilowatt) is

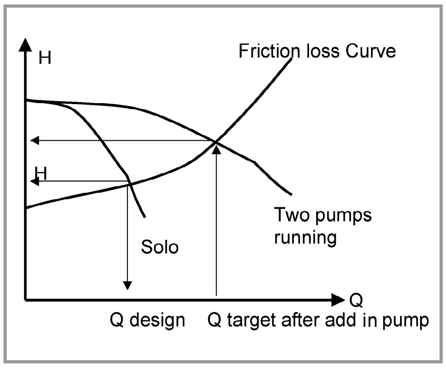
$$= \frac{\text{H (m) x Q (m}^3\text{/Hr)}}{367}$$

and overall efficiency is

= Pump Efficiency x Motor Efficiency

Up to this point, a pump with generally lower efficiency would affect the overall efficiency of the machine, and incur higher power consumption.

Till here, we were introduced by Mr. Choong to yet another assumption in centrifugal pump design, "higher safety margin is better". This is however not the case, when it comes to centrifugal pump head sizing. As we know, the Q and H is in inverse proportional, therefore, actual pump operating at a lower pumping head will increase the flow, and this will increase the power which is required to drive the pump. This is exactly what happens when we oversize the pumping head by placing a too high safety margin.



At the second session of the course, Ivynne shared her thoughts on system design and related information. We know about pumps running in parallel will generate double flow. However, in a system where upgrading is considered, this doubling of flow is determine by a lot of other factors. Look at the following diagram. With the increment of Q, or pumping capacity, the system head, or the required pumping head will increase too. This will shift the pump operation towards the left hand side of the curve, high head and low flow. Therefore, it is not necessary that the flow will double when we add in one more pump of the similar capacity. In a system upgrading, the major factors to be considered shall be, the pipe size and the condition (old pipe will have a lower coefficient value, therefore higher losses), existing motor kW and the starter panel. If any of these factors are neglected, we may end up spending more, but getting less.

At the end of the session, we were briefed on the now very commonly discussed variable system, and how it assist in energy saving. Look at the formula.

$$\frac{N1}{N2} = \left(\frac{Q1}{Q2}\right)$$

$$\frac{N1}{N2} = \left(\frac{H1}{H2}\right)^2$$

$$\frac{N1}{N2} = \left(\frac{P1}{P2}\right)^2$$

and $N = \frac{120\ (\text{frequency})}{\text{No of poles}}$

Local frequency without external control over it, shall be 50 Hz. With the use of a frequency converter, or more known as the inverter, the frequency can be controlled to match the demand on site, via a pressure transmitter, giving 4 – 20 mA signal. Is it by varying of the frequency, thus varying the rpm, which is N? Notice the mathematical relations! Whenever we reduce the rpm by 2 times, we can reduce the power requirement by 8 times. This is the basic principle of the variable speed system. ■