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Efficiency in Vertical Pumps

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In all industrial markets, customers are concerned with the efficiency of the pumps purchased. This is due, primarily to the cost of electrical power, but can also serve as a gauge for comparison of competing proposals. With this in mind, it is vital to understand what the customer means when he says "Efficiency" and how the pump factory defines efficiency.

To start, there are three common types of efficiency related to vertical pumps: Bowl Efficiency, Pump Efficiency and Wire-to-Water Efficiency. This paper is intended to define these terms and suggest when or how each should be utilized.

Bowl Efficiency – This term represents the efficiency of the hydraulic bowl assembly only. This value is given on the published curves and may be discounted due to special materials (i.e. 316SS castings) or features of the bowl assembly (i.e. hydraulic thrust balance). The Bowl Efficiency will always have the highest numerical value for any of the efficiency terms.

Pump Efficiency – This term represents the efficiency of the entire pump, including the bowl assembly, column assembly and discharge head assembly. As there are friction losses associated with the column and head, the resulting calculation for Pump Efficiency always will be numerically lower than Bowl Efficiency. The final percentage decrease will depend on the relationship between the sum of the friction losses and the TDH (total dynamic head) of the pump.

Wire-to-Water Efficiency – The numerical value for this efficiency is derived by multiplying the Pump Efficiency times the Motor Efficiency. This value represents the combined overall efficiency of the Pump and Motor package. Wire-to-Water will always be the lowest value for efficiency, as no machine can have efficiency greater than 1.00.

The challenge is to know when to use each of the values listed above. Few customer data sheets will differentiate between these three. As a customer, be sure to be specific when asking about efficiency. That way you will be comparing "apples to apples."

Service Solutions

It's All About the Pitch – And I'm Not Talking Baseball…

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Often we are asked to make minute adjustments on pumps and other machines which measure in the thousandths of an inch or tenths of a millimeter. An example would be adjusting the impeller clearance on a single stage end suction pump. Normally you would use a Dial Indicator or a set of Thickness Gages (Feelers) to make the adjustment. Sometimes you don't have access to those tools at the time but still need to make a reasonably accurate adjustment. How can you do that?

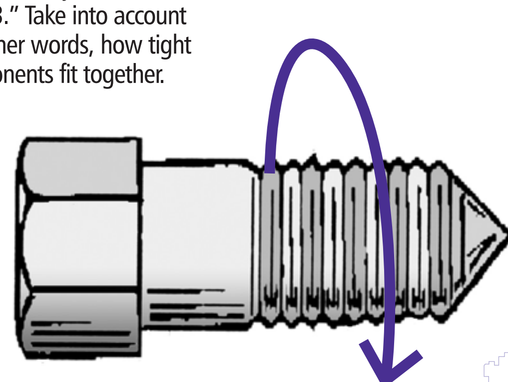
One method which is often over looked is using the adjustment screws or nuts themselves. Because these screws, nuts or caps are threaded and engage another threaded component the distance they move as they are turned can easily be determined. If you know how much they move as you rotate them then you can predict with reasonable accuracy what a clearance or pre-load would result based on the number of rotations of the screw or screws.

It's all about the Pitch. The Thread Pitch or the number of threads per inch (TPI). In the U.S. Thread Series the number of threads per inch is designated after the diameter of the fastener, i.e. ½" – 13 NC. The Pitch of that thread is 1 divided by the number of threads per inch, in this example 1/13 = 0.07692."

This means that for every turn of the screw, it will move .07692." One Half turn would be half that or about 0.038."

If the fastener happens to be a Hex Nut or Hex Head Capscrew we can get even more accurate adjustment. Since a Hex Fastener has six "flats," turning the fastener "one flat" would equal 1/6th of the total movement. I.e. 0.07692 / 6 0.013" per "flat."

Therefore, say you need to set the clearance between two surfaces to about 0.010" and the adjusting screw is threaded at 13 TPI. Bring the two surfaces so they are in slight contact, note the position of the fastener, rotate the fastener one flat from that position and you have set the clearance to about 0.013." Take into account the class of thread, in other words, how tight the two threaded components fit together.



Production threads and Class 2 threads have quite a bit of internal clearance where Class 3 and 5 have much less. Take the "play" out of the fastener before noting the position of the flat, this will provide more accuracy.

The Metric System makes this even easier because fasteners are designated in Diameter and Pitch. So a M14 X 2 fastener is 14 mm in diameter and the pitch is 2 mm. It moves 2 mm for every revolution. Therefore 2mm / 6 flats = 0.33 mm.

This procedure will never yield the accuracy of a good Dial Indicator or properly used Feeler Gages but it is the same principle used in a Micrometer. And, the Shop Manual for my 1967 Triumph Motorcycle suggests setting the intake and exhaust valves clearance this way. But, of course, that sounds like a thrashing machine when it's running too.