How to Create a Pump Curve, Part 6

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We were talking about efficiency last month and I want to point out that when it comes to submersibles, the rated flow of the pump is usually the most efficient point on the curve. We have always suggested you stay within 5% of the best efficiency point (BEP) of a curve. With a submersible, about 20% of the rated flow equals 5% of the BEP.

You will notice we have more lines on the chart [on this page]. You can see we added Break Horsepower (BHP) lines to our curve from last month. Where the BHP line crosses the curve, is the horsepower (HP) required at that point. There is a BHP formula that requires the efficiency to calculate. It looks like this on a calculator:

BHP = GPM x TDH x SG ÷ 3960 ÷ Eff.

What does everything mean?

BHP - Break Horsepower

GPM - Gallons Per Minute

TDH - Total Dynamic Head (all the losses in our system added up at the flow rate we are looking for.)

SG - Specific Gravity (water has an SG of one, and since one times any number is that number, it is often omitted.)

3960 - The results of one HP of work (33,000 foot-pounds per minute) divided by the weight of one gallon* of water (8.334 pounds*).

Eff. - Efficiency. Read last month's article.

To do an example, let's pick a point on the curve with an efficiency point on it, say 80% to the left of the BEP. Our flow rate is about 720 GPM and the head is 123.

So our problem looks like this:

720 x 123 ÷ 3960 ÷ .8 = 27.95 HP

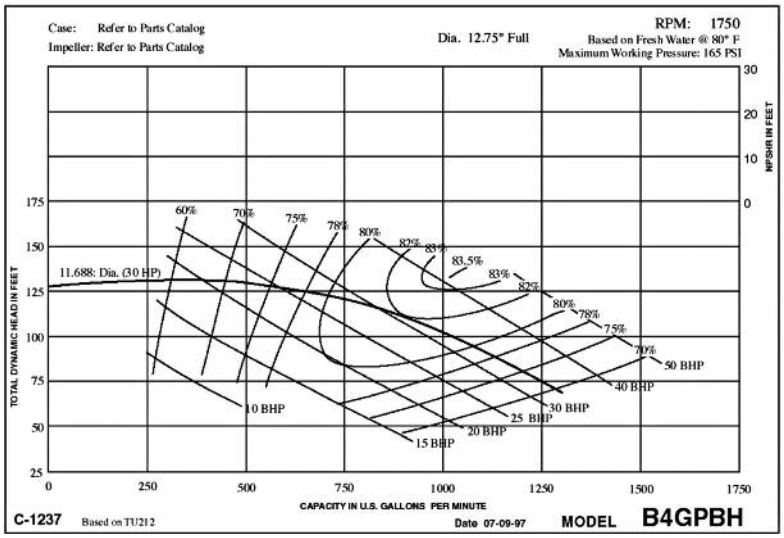
and if we interpolate between the 25 and 30 BHP lines, it does look like 28 BHP.

Also important to note is the BEP is quite often to the right of the name plate horsepower. This pump being a 30 HP pump is flowing about 800 GPM at that HP. The BEP of this 30 HP curve is at about 900 GPM. This means the BEP is in the service factor (SF) of the motor and this is true most of the time. The question comes up though, did we overload the pump at the right side? Looks like 1300 GPM x 70TDH ÷ 3960 ÷ .7 = 32.8 BHP, almost 33 HP.

So did we overload the motor? Well, the SF of most motors is 1.15. So if we take 30 x 1.15 = 34.5. I like to say, "Not in my lab." Of course, we all realize in south Texas in the summer the heat eats away at our SF, hence the 5% on either side of the BEP.

*(1 gallon ≈ 3.78 liters)
(1 pound ≈ .45 kilograms)

Next month, still more lines (ahhh).



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