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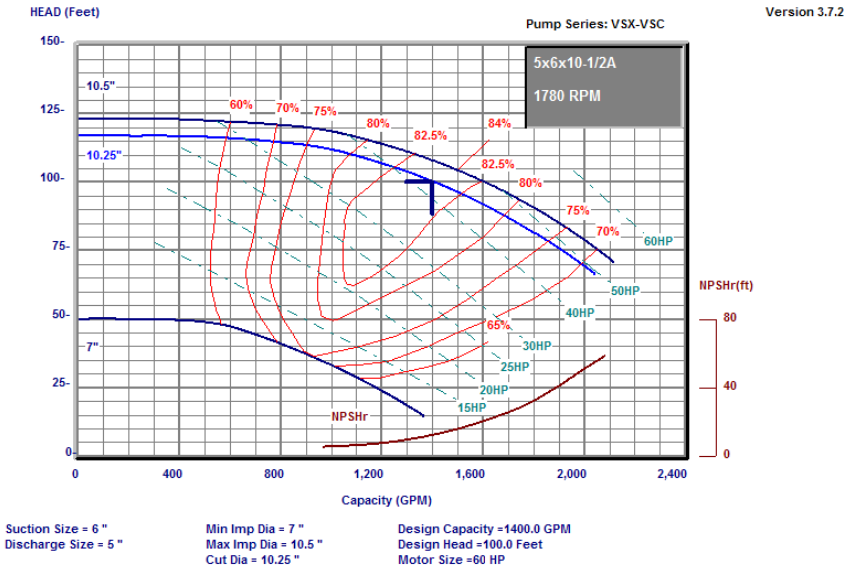
**August 9th 2010 ~ Monday Morning Minutes:**
by Norm Hall

# Heat Added to Chilled Water Systems Due to Pump Efficiency

We received an interesting question this week from a consultant engineer: "How much temperature increase will I get in the chilled water from the pump? My secondary chilled water pump has a capacity of 1400 GPM at 100 feet" Let's look at the answer.

ANSWER: Centrifugal pumps in hydronic systems do the work of moving gallons per minute of fluid against a differential head in feet. This work is defined as Brake Horsepower (BHP) also expressed in equation 1.

The maximum amount of horsepower available to heat the water is 1 minus the pump efficiency multiplied by the motor horsepower. Bell and Gossett refers to this as the Heating Horsepower (HHP) expressed in equation 2. 1 HP equals 42.44 BTU/Minute (equation 3) and BTU/minute is GPM times ΔT times 8.33 times specific gravity times specific heat (equation 4). The later two items are equal to 1 for water. Using all of this we arrive at a formula for ΔT shown as equation 5.




Bell & Gossett
ITT Industries

BHP= (GPM X Ft hd)/ (3960 X Eff) - Equation 1
HHP= BHP X (1-Eff) - Equation 2
1 HP= 42.44 BTU/M - Equation 3
BTU/M = GPM X ΔT X 8.33 X 1 X 1 - Equation 4

$$\frac{\Delta T = (42.44 \times HHP)}{(8.33 \times GPM) = (5.09 \times HHP)/GPM}$$ - Equation 5

Let's look at the example requested by the engineer. We selected a 60 HP pump using the ITT Bell and Gossett ESP-PLUS program.

The BHP, using equation 1, is (1400 X 100) / (3960 X .84) = 42.09 HP. At the design point we have an efficiency of 84% so HHP is 42.09 X .16 or 6.73 HP and ΔT is (5.09 X 6.73)/1400 or .02 degrees F. We can answer the question with the response, "Not very much"!