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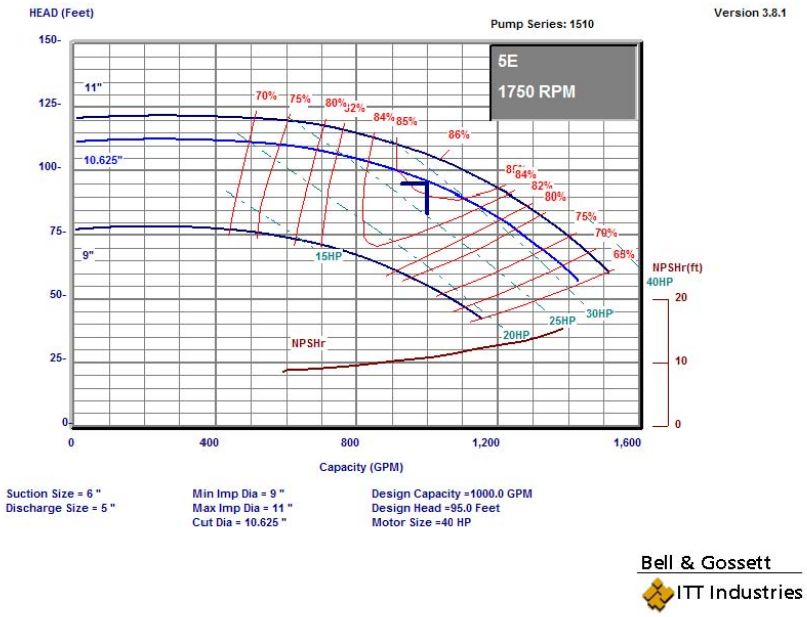
September 6th 2010 ~ Monday Morning Minutes:

Centrifugal Pumps and Pump Curves for HVAC and Plumbing Systems



Centrifugal pumps are the "heart" of hydronic heating, cooling, and plumbing systems. Over the next few weeks, the R. L. Deppmann Monday Morning Minutes features some basic and advanced pumping topics. Let's start with a quick review of the information contained on the pump curve.

For our example, we will use an ITT Bell and Gossett model 1510 end suction base mounted centrifugal pump model 5E with a nominal speed of 1750 RPM.

The horizontal axis is flow rate in GPM or gallons per minute of water. The vertical axis is feet of head. Actually, it is foot-pounds/pound but feet of head is the common term.

The duty point of 1000 GPM at 95 feet it has a 10-5/8" impeller. This pump is manufactured with impellers trimmed in 1/8" increments. If we showed all the impellers, you would not be able to read anything else on the curve.

There are efficiency curves, in red, which are determined by factory tests. This pump has an efficiency of 85.3% at the duty point. Note that as the duty point changes in a variable flow system, so does the efficiency.

The dashed lines from left to right are BHP or brake horsepower. BHP= (GPM X Ft. HD)/ (3960 X Pump Eff.). As the duty point changes and we move to the right and left on the 10.625" curve, the brake horsepower changes. At 500 GPM the pump requires 20 HP and at 1400 GPM it requires about 32 HP. If the pump was supplied with a 30 HP motor, it would be overloaded at 1400 GPM. Most engineers specify non-overloading selections and therefore this pump would be supplied with a 40 HP motor.

The last item is the most confusing item. $NPSH_r$ is net positive suction head required by the pump to keep the liquid from flashing in the impeller. It changes with flow and is read to the right. The $NPSH_r$ head is in feet but is an absolute number. For example, 34 feet of $NPSH_r$ would read 0 PSIG on a gauge. ***Next week we will examine pump selection.***