Pump ED 101

VFD Pump Selection - - Why Hertz Instead of RPM?

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I get several emails each month asking why my VFD sizing programs (Hertz, Hertz VHS, HPSA, and PPSA) show the resulting curves in Hz rather than RPM. Maybe my analog brain works differently, but frequency is more meaningful to me than is speed.

Have you ever considered why the head / capacity curves in a typical pump manufacturer's catalog shows head in feet rather than PSI? It was not done to make it more difficult for those of us whose primary application is constant pressure, where PSI is the typical unit of measure. Neither was it done to make it easier for those of us in the wastewater industry who tend to work in feet. It was done purely for sake of simplicity.

The head, measured in feet, produced by a centrifugal pump is independent of the specific gravity of the liquid being pumped. If a particular pump can produce 231 feet of head while pumping water (specific gravity = 1), it will produce that same head while pumping a liquid with a specific gravity of 1.2. The difference is that the gauge pressure in PSI would differ for the two. Water at 231 feet would show a gauge pressure of 100 PSI while the higher weight liquid would show a gauge pressure of 120 PSI. If those manufacturer's curves were published in PSI, there would have to be a separate set for each liquid that might be pumped!

A similar situation exists when we review various pumps for operation in a VFD application. First, manufacturers do not always use the same speed reference for their family curves. Some show synchronous speed (3600, 1800, or 1200 RPM) while others use the slip speed of the motor used during testing. Depending upon the manufacturer and motor design (the typical pump motor is Design B) the actual operating speed will be 2 – 5% lower than that of synchronous speed.

When reviewing a pump curve under VFD control, we really do not need to be concerned about these differences. Secondly, what we care about when evaluating a curve is its operable range of speed. This range is usually expressed as a

percentage and it is much easier for me to comprehend 40hz/60hz (4/6 or 2/3) than 1167rpm/1750rpm. I can do the first one in my head but need a calculator for the second!

Occasionally, we do need to know the actual pump speed. For example, most VFD software requires that we set the maximum, minimum, sleep, and wake speeds in RPM. The Affinity Law calculator in Hertz displays the actual RPM from 30 to 60 hz. Just enter the motor operating RPM in cell B22 to view them.

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