CHEMPUMP
A DIVISION OF TEIKOKU USA INC.

ENGINEERING DATA SHEET

Effect of Specific Gravities on Chempump Selection		
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04/01/99	**06/25/93**	**4E**

Pumping a liquid with a high specific gravity has an effect on the performance of canned motor pumps. When pumping high specific gravity fluids, the motor load increased directly proportionally to the specific gravity of the liquid. As the motor load increases, the speed of the motor decreases, resulting in a reduction in the output of the pump.

To compensate for the reduction in motor speed when pumping a liquid with a high specific gravity, the impeller diameter may have to be increased.

There are two methods which can be used for proper Chempump model selection when fluids with specific gravities other than 1.0 are to be handled. These are as follows:

A. Equivalent Head Method

When pumping fluids with specific gravities other than 1.0, the pump model selected (from motor load line) should be sufficient to handle the load equivalent in feet of water. For example, if the head required is 100 feet and the fluid specific gravity is 1.5, the load equivalent in feet would be 150 feet. This means that although the impeller diameter would be sized on the basis of the rated capacity at 100 feet, the motor load line would be selected on the basis of a point plotted on the curve at the rated capacity and 150 feet TDH.

Although almost always sufficient for estimating purposes, this method becomes less accurate as the variance from a specific gravity of 1.0 becomes greater. The accuracy of this method is further compromised in cases where the unit efficiency is different at the head rating point. For fluids with 1.2 or greater specific gravities, the watt draw method should be used to determine the motor size and model required. Even for specific gravities less than 1.2, the watt draw method should be applied in order to confirm the selection made by the equivalent load method.

B. Watt Draw Method

As explained in Engineering Data Sheet 2E, the motor load line is plotted on Chempump performance curves from data recorded by testing and then by use of the following formula:

$$\text{TDH} = \frac{\text{(watts) (overall eff.)}}{0.189\ \text{(GPM) (sp.gr.)}}$$

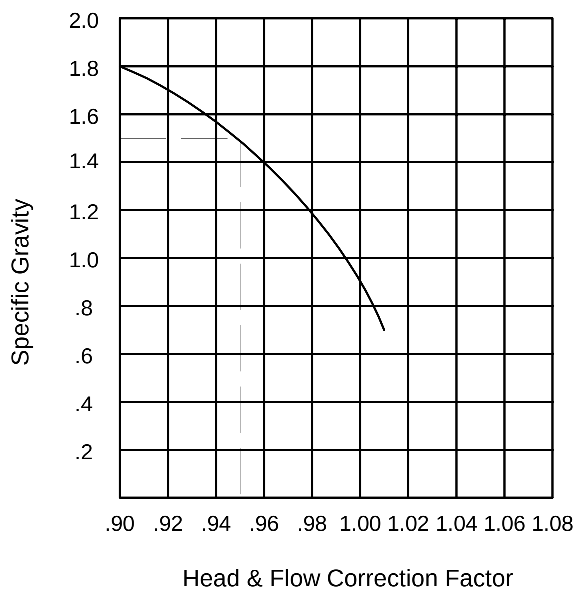
In the above formula, the specific gravity used is 1.0, the watts used are the full load watts for the motor size involved, and the overall efficiency used is taken from test recordings. Several capacity (GPM) ratings, spaced at equal intervals over the entire pumping range of the unit are selected and through use of this formula, the related pump head (TDH) is determined. Each of these calculated capacity-load points is then plotted on the pump curve and a line is drawn through these points which represents the motor load line.

By stating the above formula in a different manner, such as:

$$\text{Watts} = \frac{(.189)\ (\text{GPM})\ (\text{TDH})\ (\text{Sp.Gr.})}{\text{Overall Efficiency}}$$

the relationship between specific gravity and watts (a measure of the work out put of a motor) can be seen. Through use of this formula when handling fluids with specific gravities other than 1.0 and up to 2.0, the motor size can be quite accurately determined. (For specific gravities above 2.0, special calculations must be made.) The calculation of kilowatts required should be made at the design point and also at runout. The KW required should never exceed the full load watt rating of the motor. This will insure non-overloading performance. Full load kilowatt ratings are noted on the Chempump performance curve.

Since specific gravity may have an effect on the hydraulic performance characteristics of the pump, the impeller size actually required should be determined as outlined below.



Instructions to select impeller diameter for various specific gravities.

(1) Select head and flow correction factor from chart on left. Enter chart at required specific gravity at point of intersection with curve and read factor at bottom of page. (For sp. gr. 1.5 factor is .95 -- see chart.)

(2) Calculate equivalent water flow and head:

$$\text{Equivalent head} = \frac{\text{Required head}}{\text{Correction factor}}$$

$$\text{Equivalent flow} = \frac{\text{Required GPM}}{\text{Correction factor}}$$

(3) Using equivalent water head and GPM, impeller is selected from standard curve.

Specific gravity of the pumped fluid has a dual effect on the performance of the pump and motor. If the motor is loaded due to a fluid with high specific gravity the speed of the motor will decrease (slip). Thus a specific gravity greater than 1.0 will load the motor directly proportion to the specific gravity of the liquid. Conversely when specific gravity is less than 1.0 the motor load will not be as great.

If the fluid also has a viscosity greater than 30 cps, the effect of viscosity must also be considered for proper pump and motor selection. Please refer to EDS 5E to determine the effect of viscosity on Chempump selection.

Example:

Select a pump to product 20 GMP @ 150 TDH, pumping a fluid with a specific gravity of 1.7 and viscosity of 1 cps.

Head and flow connection factor (from chart) is .92.

$$\text{Equivalent head} = \frac{150}{.92} = 163$$

$$\text{Equivalent flow} = \frac{20}{.92} = 21.7$$

From Performance Curve A-70058, a 6¼" impeller should be selected.

Motor Selection

$$KW_{(DES)} = \frac{.189 \times 20 \times 150 \times 1.7}{.25 \times 1000} = 3.86$$

$$KW_{(EOC)} = \frac{.189 \times 50 \times 137 \times 1.7}{.41 \times 1000} = 5.37$$

The correct pump selection is a GB-5K with a 6¼" impeller.