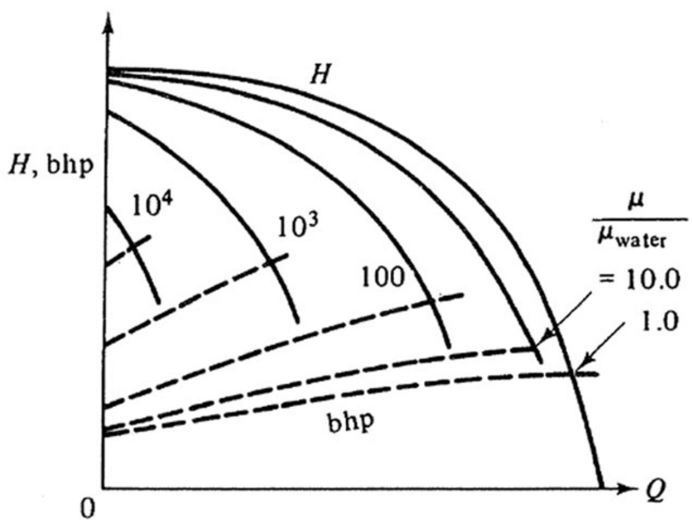
from experience

Viscous Fluid Impact on Centrifugal Pumping

The *October 2018 edition of From Experience* emphasized the importance of knowing the properties of the fluid being pumped; in particular, how to apply fluid viscosity test data for a given flow rate and pressure drop in the piping system. Fluid viscosity also must be considered when selecting and sizing the pumping technology. Centrifugal pumps are designed and tested for water flow, a fluid with a viscosity of approximately 1 centipoise (cP). By definition, fluids with higher viscosity exhibit higher shear stress for a given shear rate. This shear stress results in several known effects on centrifugal pumping:

- Increased brake horsepower
- Reduced head
- Reduced capacity
- Decreased pump efficiency
-

The illustration below shows the impact of shear stress on the centrifugal pump curve.



SOURCE: https://www.pumpsandsystems.com/topics/pumps/reciprocating-pumps/reciprocating-pumps-vs-multi-stage-centrifugal-pumps?page=2

Most pump sizing programs, or pump manufacturers can estimate the result of the fluid viscosity on the centrifugal pump sizing, and compensate for the aforementioned factors, with large pumps and motor horsepower.

Centrifugal pumps are generally selected for fluids with viscosity below 100 cP, with compensation made in the sizing for the effects described above. For fluids above 100 cP however, a comparison of centrifugal and Positive Displacement (PD) pumps should be made to confirm which technology provides the more efficient pumping solution.

PD pumps will exhibit “slip” for low viscosity fluids (below 200 cP), and require slightly more power as a result. For viscous fluids above 200 cP, PD pump power and performance is very predictable and will likely be the more efficient pumping technology.

experience in brief

Centrifugal Pump Affinity Rules may be applied to estimate the pump speed and/or impeller diameter change required to compensate for increased brake horsepower requirements when pumping viscous fluids:

$$\frac{BHP_1}{BHP_2} = \frac{D_1^3}{D_2^3} = \frac{S_1^3}{S_2^3}$$

Where:

BHP = Brake Horsepower
D = Impeller diameter inches
S = Speed in rpm

continuing education

Hixson associates regularly participate in continuing professional education events across the country. To learn more about the events listed below, e-mail Hixson at: info@hixson-inc.com

“Water Management Best Practices”
A Hixson *Food Plant of the Future* Webinar
Save the Date!
May 2, 2019

Electrical Distribution Principles and Applications
Madison, WI
November 6-8, 2018

Direct Comments/Questions to:
Warren Green, Manager
Process Engineering
wgreen@hixson-inc.com
Phone: 513.241.1230
Fax: 513.241.1287
www.hixson-inc.com

Free webinar series! Go to www.hixson-inc.com/insights/foodplant-of-the-future/ to register or access the archives of Hixson’s webinars.

A knowledge-sharing publication from:
HIXSON
ARCHITECTURE ENGINEERING INTERIORS