



*Mixing Solutions
As Unique As Your Needs*

Viscosity—How it is Related to Agitator Design and Performance

*Viscosity plays a very important role in agitator design.
Read further to learn practical guidelines*

How does Viscosity affect my cost?

Anyone who's spent time in the lab testing the physical properties of materials soon finds out that people are generally very poor judges of the viscosity of liquids. We have tested liquids reported to be "about like motor oil" and found values from 10 cps to above 30,000. Motor oil (say SAE 30 at room temperature) is actually about 150 cps. When the analogy is with really thick liquids, molasses for example, the results are even worse.

Why is this important to you? An accurate value for the viscosity of the material you want to mix will determine the best impeller geometry, the optimum number of impellers and their spacing, how much power is required and many other details an applications engineer needs to come up with the best designed agitator for your process.



A simple example illustrates what can happen if the reported viscosity is wrong. A 36 inch standard HiFlow™ impeller at 100 RPM requires about 1 HP at 10 cps (and slightly more at 150 cps), but at 30,000 cps it requires more than 7 HP. Moreover, the low viscosity cases require a baffled vessel, but baffles would never be used at the higher viscosity. A bad value for the viscosity can result in a greatly oversized or undersized mixer installed in the wrong vessel. Bottom line is that it may not work or it may be way more mixer than you really need.

GUARANTEE

ProQuip, Inc. accepts full responsibility for furnishing suitable equipment which shall be fit for the purpose which it is required, and for its successful operation under the conditions for which it was specified

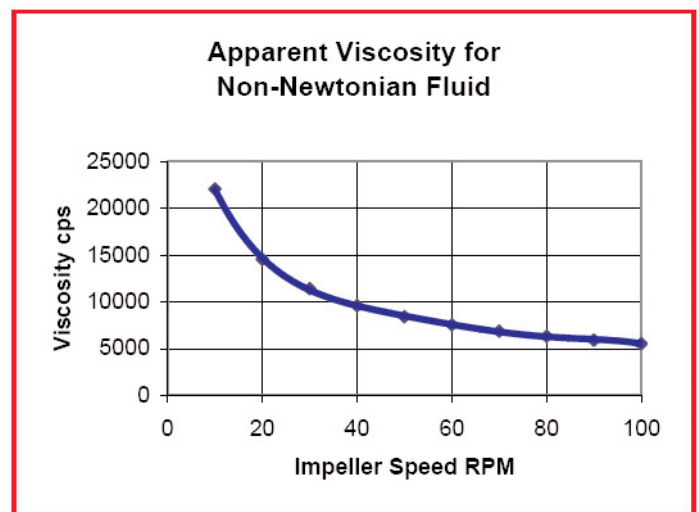
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How does Viscosity affect my process?

The process performance of the mixer is also strongly influenced by viscosity. In the case above the blend time goes up by a factor of about 500. You wanted 20 minutes (and would get it for a viscosity about like motor oil), but you got one week (because it's really 30,000 cps). [Note that an application engineer would not recommend the system in our illustration if he knew the material was 30,000 cps, and that the actual blend time would be a lot longer than a week because the 1 HP motor would trip out].

What is non-Newtonian?

There isn't enough space in a short memo to get into a detailed discussion of "non-Newtonian" liquids, but it is important to know that most "thick" liquids are usually non-Newtonian. They don't have a fixed value of viscosity in centipoises. They have an "apparent viscosity" that almost always goes down in value as they are stirred faster. You know you have one of these when the mixing impeller "cuts a hole in the batch." The liquid moves vigorously right around the impeller but is "dead" farther out in the tank. Polymers, adhesives, high solids slurries and many other "thick" liquids are typically non-Newtonian. To design a mixer for a non-Newtonian fluid we must have at least three viscosity measurements at different "shear rates" (roughly speaking, stirring speeds).



How can ProQuip help?

What should you do if you need a new mixer or want to trouble shoot an existing installation? If you have any doubts about viscosity, send us 600 milliliters of the material in question. We will do a viscosity test for you and it's free. But remember to send an MSDS for us to review before you ship any hazardous material.