

LIQUID SHEAR

WHY CARE ABOUT SHEAR?

When handling two-phase slurries like massecuite, liquid shear could cause the mother liquor to be separated from the sugar crystals before reaching the centrifugal, reducing conversion efficiency.

WHAT TYPE OF PUMP HAS THE LEAST SHEAR?

Many types of positive displacement pumps claim low shear, but there is no quantitative data validating which type has the least shear. Viking internal gear pumps, when selected and operated to minimize shear, are among the lowest-shear options available, and are used extensively on shear-sensitive liquids including:

- Emulsions (e.g. chocolate and mayonnaise)
- Suspensions (e.g. microspheres in carrier liquids)
- Polymers (e.g. latex, synthetic rubber and long chain polyelectrolytes)

WHAT IS SHEAR?

Shear is the relative motion between adjacent layers of moving liquid, and shear rate is the rate of relative motion between adjacent layers of a moving liquid. Shear rate is calculated by dividing the maximum velocity of the liquid by the distance, normal to the liquid flow, between the point of zero velocity and of the maximum velocity.

Shear Rate = Velocity / Distance = (Length / Time) / Length = Time⁻¹. Using seconds as the unit of time, Time⁻¹ becomes seconds⁻¹. Shear rate is normally expressed in units of reciprocal seconds, sec⁻¹. Shear rates for all Viking pumps can be calculated using Technical Reference TR-114.

HOW DO I MINIMIZE SHEAR?

In a pump, shear rate is a function of:

- The radial clearances between the I.D. of the casing and the O.D. of the rotor
- The rotor diameter
- The rotor RPM

Shear can be minimized by selecting a pump with extra clearances, and running it very slowly. For most shear-sensitive liquids Viking recommends a rotor rim speed of <300 feet/minute. Your Viking distributor can help select the best combination of pump rotor diameter and speed to achieve your required flow rate while keeping shear rate to the absolute minimum.

WHAT ABOUT SYRUPS AND MOLLASSES?

These liquids are not shear-sensitive, so maximum pump speed is only limited based on viscosity and to avoid heat generation which could cause caramelization of sugars at the bushings or seal faces. Rotor rim speeds of 800 ft/min or less have been proven effective.