Consistency Applications - Velocity Compensation

The Effects of Total Force (Flow & Shear) on Consistency Probes

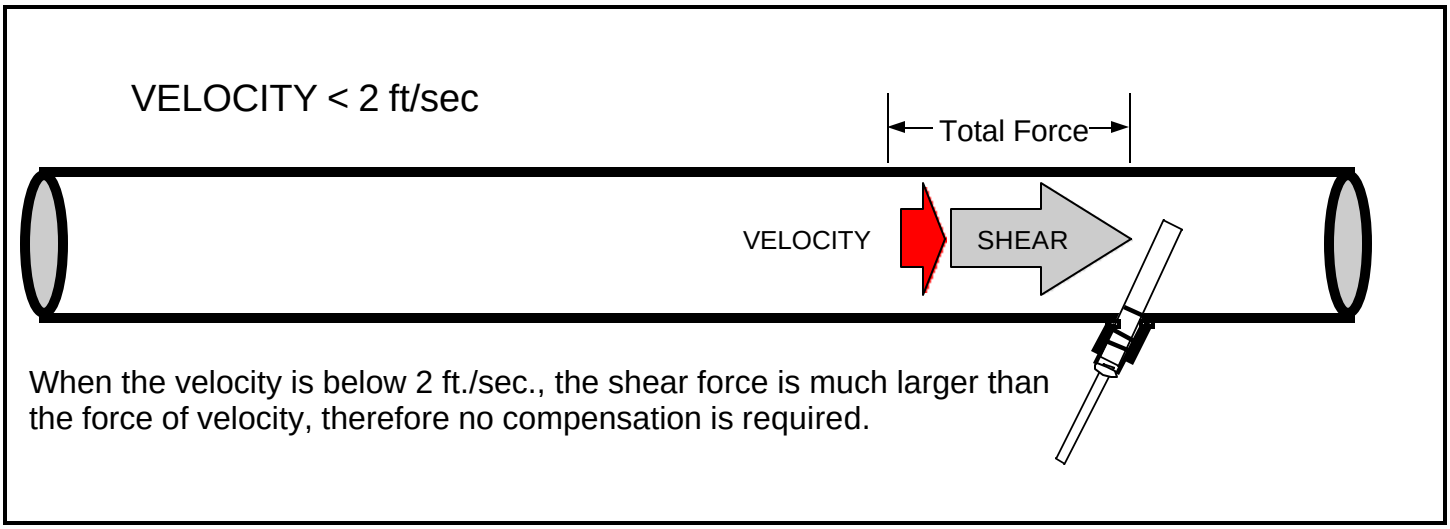
Application Summary

The measurement of consistency through the use of force sensitive elements is based on the capability of the probe to effectively measure the amount of total force placed on the wetted portion of the element while in-process. This total force acting on the probe is the sum of the shear force, that can be correlated to consistency, and the force due to the flow (or velocity) of the water in the stock.

The shear force is the amount of force it takes for the fibers to shear (un-tangle, or unbond in a slurry) across the surface area of the probe. This shear force is constant, regardless of the velocity, changing only with fiber concentration or fiber characteristics.

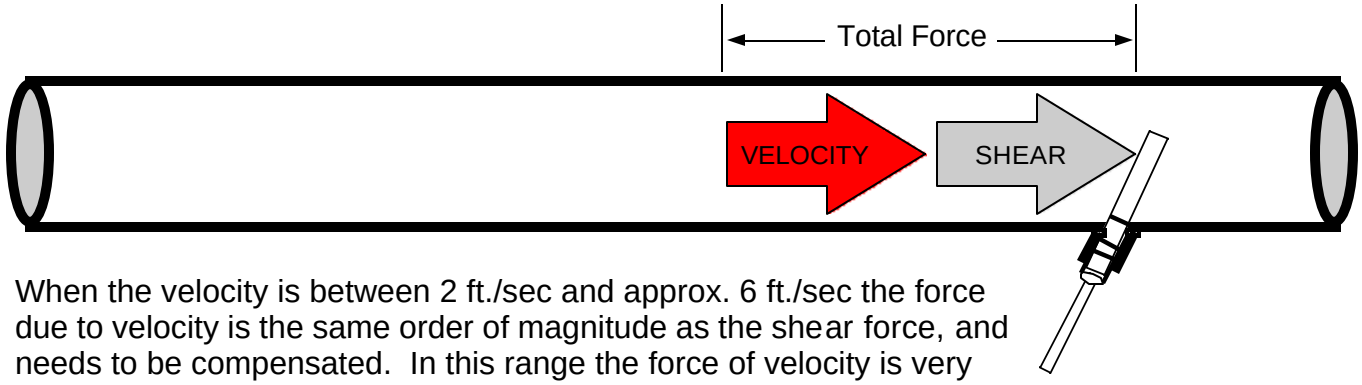
The force related to flow velocity is different and has a significant impact on the total force acting on the consistency element. As the velocity increases, the flow-related force is proportional to the square of the velocity of the stock, consequently increasing its impact on the total force measurement.

This can be illustrated by the following diagrams.



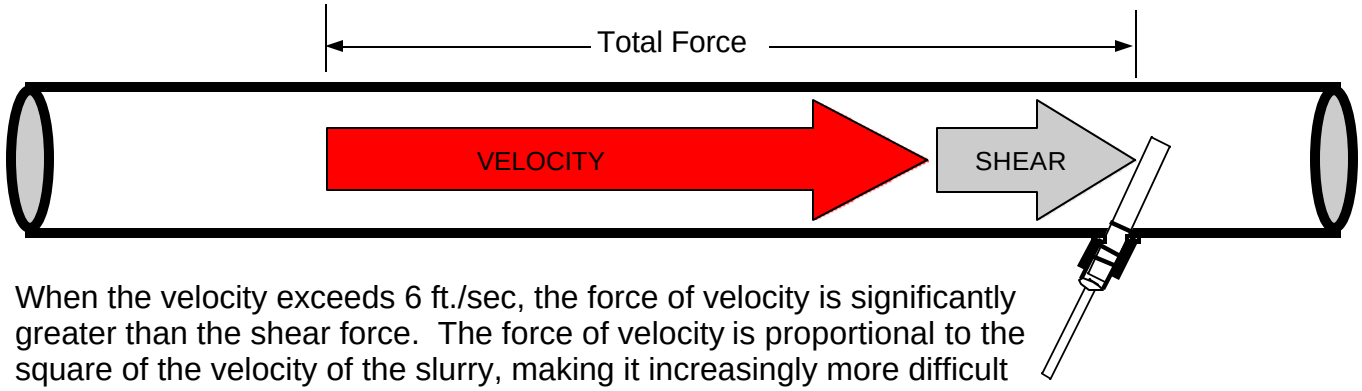
When the velocity is below 2 ft./sec., the shear force is much larger than the force of velocity, therefore no compensation is required.

VELOCITY < 6.0 ft/sec



When the velocity is between 2 ft./sec and approx. 6 ft./sec the force due to velocity is the same order of magnitude as the shear force, and needs to be compensated. In this range the force of velocity is very predictable and reproducible, and can be compensated accordingly, removing it from the shear force measurement.

VELOCITY > 6.0 ft/sec



When the velocity exceeds 6 ft./sec, the force of velocity is significantly greater than the shear force. The force of velocity is proportional to the square of the velocity of the slurry, making it increasingly more difficult to compensate, overwhelming the shear force measurement.

Example - Dilution Control Application

When dilution is added to a stock line to *lower the consistency*, as in any standard application, the *increased flow, or velocity,* increases the amount of total force applied to the consistency element. With out proper velocity compensation, the consistency element will "see" this increased force as HIGHER consistency, when in actuality, the overall consistency has been lowered through the additional dilution water.

This is why TECO applies our sensors in velocity ranges below 6 ft./sec where we can effectively compensate for velocity changes without negatively effecting our accuracy levels.

Thompson Equipment Company, Inc.
125 Industrial Ave.
New Orleans, LA 70121

Phone: 504-833-6381
Fax: 504-831-4664
www.teco-inc.com