Head and friction loss and the balance of energy

J. Chaurette, June 8, 2018 www.pumpfundamentals.com

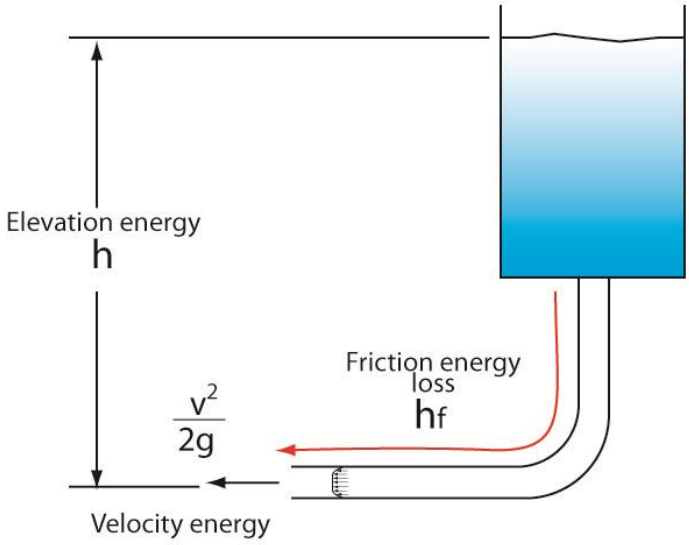
How do you compare static head to friction loss? How are these two things even comparable, they both seem to belong to different worlds.

In fact, they are both forms of energy. Static head is a form of potential or elevation energy. When we do a balance of energy we compare different forms of energy. The balance part comes in when you say all the energy forms have to be accounted for, there can be nothing left over, this is the principle of conservation of energy.

How is head an energy term? The unit of head is feet; however, its derivation comes from specific energy whose unit is energy per lb of liquid or lb-ft/lb or ft.

How is friction loss energy? Friction loss is determined by measuring the pressure difference of a moving liquid in a pipe between one location and a point further downstream. Pressure or pressure difference is a form of energy and can be expressed with the same units as head or lb-ft/lb.

Energy balance of the flow from a gravity tank



Available energy * h Input elevation energy

Friction energy h_f Friction loss

Usable energy $\frac{v^2}{2g}$ Output velocity energy

The balance of energy

$$h - h_f = \frac{v^2}{2g}$$

Friction loss depends on
- velocity
- diameter
- viscosity
- pipe roughness
- pipe length

The entrance loss of the pipe to the tank has been neglected as well as the friction loss due to any fittings on the pipe.

* Is the static head h energy? It is actually specific energy or energy per unit weight, the unit of h is (lb-ft/lb) or ft.