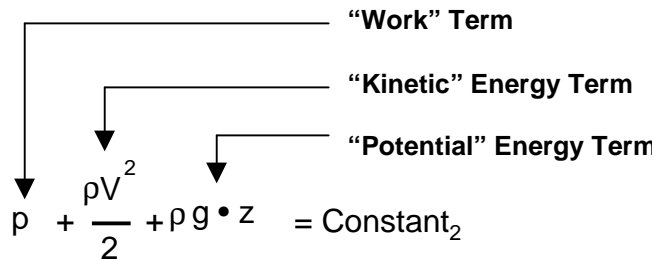


Bernoulli's Equation

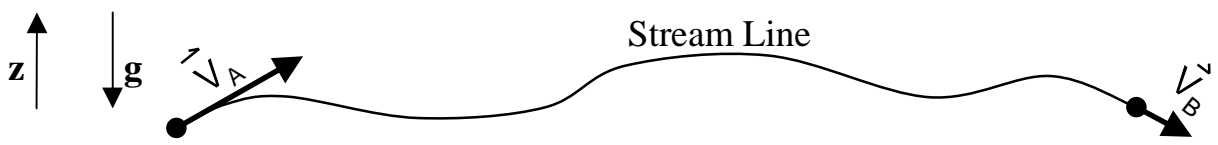
Stream Line:

Along a stream line, Bernoulli's equation states:

$$\frac{p}{\rho} + \frac{V^2}{2} + g \cdot z = \text{Constant}_1 \quad \text{OR} \quad p + \frac{\rho V^2}{2} + \rho g \cdot z = \text{Constant}_2$$



A stream line is a line which is everywhere tangent to a fluid particle's velocity. By default, this means a stream line is the path a fluid particle travels.



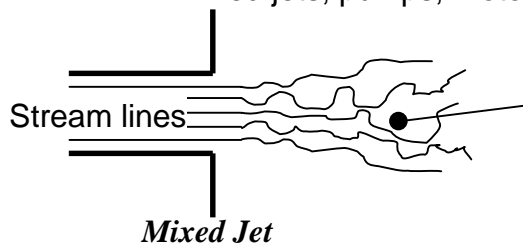
Bernoulli's equation can be applied between points A and B.

$$\frac{p_A}{\rho_A} + \frac{V_A^2}{2} + g \cdot z_A = \text{Constant}_3 = \frac{p_B}{\rho_B} + \frac{V_B^2}{2} + g \cdot z_B$$

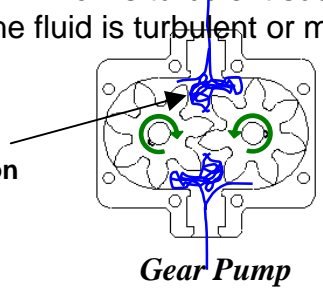
Fluid Flow Assumptions:

You should only use Bernoulli's equation when ALL of the following are true:

- Along a Streamline - Bernoulli's equation can only be used along a streamline, meaning only between points on the SAME streamline.
- Inviscid flow - Energy loss due to viscous affects is small
Bernoulli's equation can not be used through a region which is turbulent such as mixed jets, pumps, motors, and other areas where the fluid is turbulent or mixing.



Mixing =
Can't Use Bernoulli's Equation



- Stead State - The velocity of the flow, V_{Fluid} , is not a function of time.
- Incompressible - Most fluid flow applications can be considered incompressible. Incompressible means that the amount a fluid volume can be compressed is very small compared to the initial fluid volume. Gases can generally NOT be considered incompressible. For instance, when someone pumps up a bike tire, more and more air is compressed into the same volume. With liquids, VERY VERY high pressures (you are unlikely to see these as an engineer) are required to do this.

If Bernoulli's equation can be applied at points A & B on the same stream line:
This is a VERY POWERFUL TOOL for use in fluid mechanics WHEN USED CORRECTLY!!!!