

Hydraulic and gas engineers often deal with fluids flowing from one level to another. In low speed gas flow systems or water supply systems it may be appropriate for the engineer to use levels or heads expressed in m Fluid, particularly as manometers are commonly used to register pressures as a displacement of fluid column. It has therefore become common practice in many branches of engineering to use the terms total head and velocity head in preference to total pressure and velocity pressure.

If you are used to using this approach you can follow this practice within Fluid Flow. However in order to explain the pressure definitions used within Fluid Flow we need to consider the momentum and energy equations in terms of pressure because density may not always be constant.

The energy per unit mass of flowing fluid at any point in a fluid network can be expressed by considering the following component terms (simplified equation in non differential form used for physical interpretation only);

$$E = p + 0.5 \rho v^2 + \rho g z$$

where the terms are defined as follows;

$\rho g z$ is called the hydrostatic pressure. It is not actually a pressure but does represent the change in pressure possible due to potential energy variations in the fluid as a result of elevation changes. It is not necessary to show this term alone in the results table because we have entered this data as elevation for each node.

p represents the **static pressure**. This is the pressure that acts equally in all directions at the point in the fluid and is present irrespective if the fluid is flowing or if the fluid is at rest.

$0.5 \rho v^2$ is called the **velocity pressure** or dynamic pressure or kinematic pressure. This term represents the kinetic energy within the flowing fluid.

In flowing fluids it is more useful to consider the sum of the static and velocity pressures ($p + 0.5 \rho v^2$), which is called the **stagnation pressure**. In many fluid flow texts the terms stagnation pressure and total pressure are used to mean the same. Within the context of the Fluid Flow application **total pressure** refers to the summation of the three terms in the above equation. i.e. ($p + 0.5 \rho v^2 + \rho g z$). Stagnation pressure is the pressure a flowing gas will rise to if brought to rest isentropically, converting the kinetic energy to enthalpy.

Sometimes the term **piezometric pressure** or hydraulic head is useful and this is the summation of the hydrostatic and static pressure terms i.e. ($p + \rho g z$).

Other pressure terms that are used within the application are:

gauge pressure - this is the pressure above or below local atmospheric pressure.

absolute pressure - the pressure above absolute zero. This is equal to the sum of the local atmospheric pressure and the gauge pressure.

atmospheric pressure - also called barometric pressure. This is equal to the local pressure measured with a barometer. FluidFlow uses a value of 101325 Pa. This value can be globally changed from the [Options][Calculation] menu.

vapour pressure - the pressure exerted on a fluid when a liquid is in equilibrium with its own vapour.

booster pressure rise - the pressure generated by a booster. This is equal to the difference in total pressure across the booster.

non-recoverable pressure loss - this is the total pressure loss. This loss represents energy conversion that cannot be recovered.

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