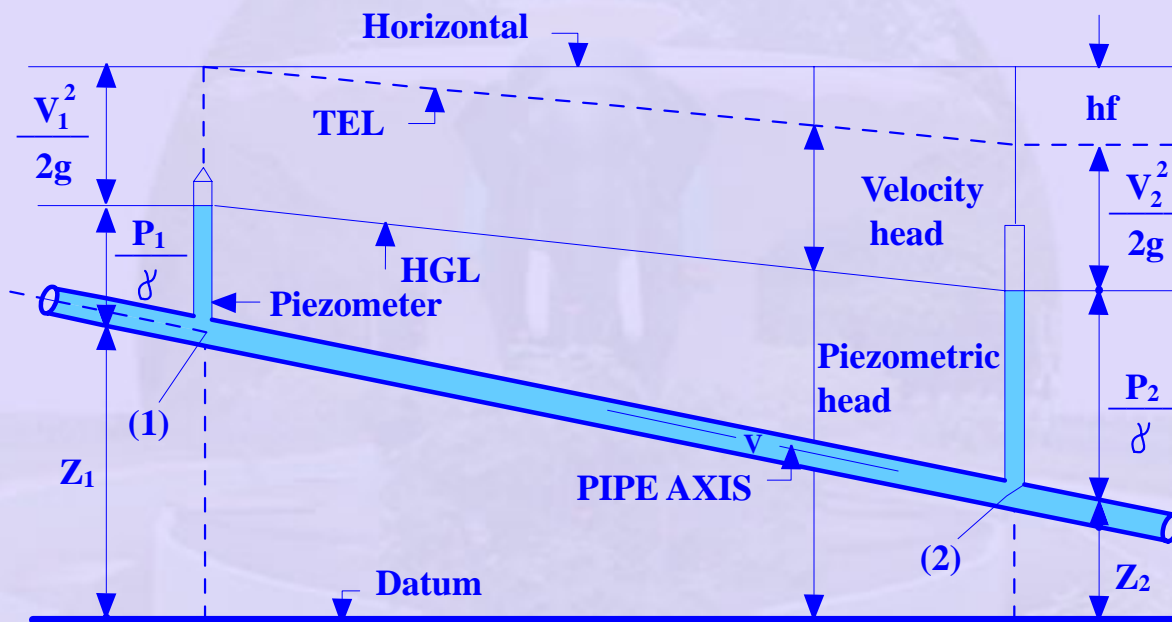


2.3 Difference between Pipe Flow and Free Surface Flow

OPEN CHANNEL FLOW	PIPE FLOW
Defines as a passage in which liquid flows with its upper surface exposed to atmosphere.	A pipe is a closed conduit which is used for carrying fluids under pressure.
The flow is due to gravity	The flow in a pipe is termed as pipe flow only when the fluid completely fills the cross section & there is no free surface of fluid.
Flow conditions are greatly influenced by slope of the channel.	Hydraulic grade line does not coincide with the water surface.
Hydraulic grade line coincides with the water surface	The maximum velocity occurs at a little distance below the water surface.
The maximum velocity occurs at a little distance below the water surface.	The maximum velocity occurring at the pipe centre.
The shape of the velocity profile is dependent on the channel roughness.	Velocity Distribution is symmetrical about the pipe axis.



2.3.1 Hydraulic Grade Line (HGL)

Definition: A curve drawn above the datum which has ordinates equal to the piezometric head at every point is called HGL or Hydraulic gradient.

The vertical intercept between the datum and pipe axis is the elevation head.

the datum and pressure gradient (HGL) is the piezometric head.

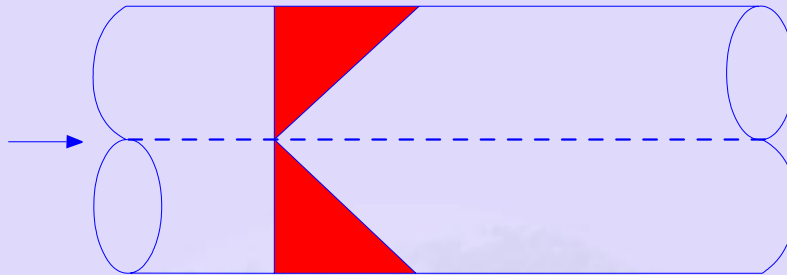
the pipe axis and the HGL is the pressure head.

HGL and TEL is the velocity head. Datum and TEL is the total head.

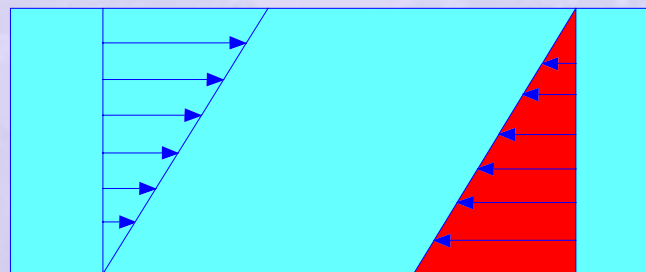
The TEL always falls on the direction of flow because of loss of head. The HGL may rise or falls depending on the pressure variation in the pipe.

In a pipe of uniform section the velocity head remains the same, if the rate of flow is constant. hence TEL and HGL are parallel if the pipe axis is horizontal.

HGL is always below the TEL. At point where pressure is equal to the atmospheric pressure, HGL meets the pipe axis.



Shear stress distribution in pipe flow



Velocity distribution Shear stress distribution