

### 6.17.1 Occurrence (Water Hammer)

If the velocity of water flowing in a pipe is suddenly diminished, the energy given up by the water will be divided between compressing the water itself, stretching the pipe walls and frictional resistance to wave propagation. This pressure rise or water hammer is manifest as series of shocks, sounding like hammer blows, which may have sufficient magnitude to rupture the pipe or damage connected equipment.

It may be caused by the nearly instantaneous or too rapid closing of a valve in the line, or by an equivalent stoppage of flow such as would take place with the sudden failure of electricity supply to a motor driven pump. The shock pressure is not concentrated to the valve and if rupture occurs, it may take place near the valve simply because it acts there first. The reverses and surges back and forth through the pipe, getting weaker on each successive reversal. The velocity of the wave is that of acoustic wave in an elastic medium, the elasticity of the pressure due to water hammer is additive to the normal hydrostatic pressure in the pipe and depends on the elastic properties of the liquid and pipe and on the magnitude and rapidity of change in velocity. Complete stoppage of flow is not necessary to produce water hammer, as any sudden changes in velocity will create it to a greater or lesser degree depending on the conditions.