NET POSITIVE SUCTION HEAD (NPSH)

Fig. 3.29. shows a centrifugal pump drawing liquid from a sump open to a atmosphere.

Let, hs = Vertical distance between the centre line of the pump and the free liquid surface of the sump,

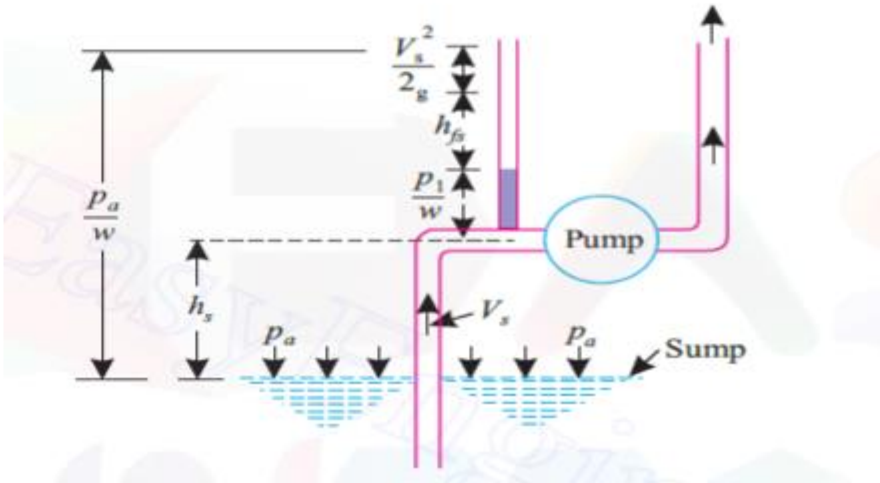
V_s = Velocity of liquid in the suction pipe,

h_{fs} = Losses in the suction pipe upto the pump inlet (1),

p_1 = Absolute static pressure at pump inlet,

p_a = Absolute atmospheric pressure, and

p_v = Vapour pressure of the liquid for a given temperature.



Pressure balance at pump section.

Now the pump will work without cavitation, if p_1 is *greater than* p_v by an amount equal to that required by the liquid for the increase in velocity head when entering the impeller; if this amount be denoted by H_{sv}, we can write

$$\frac{p_1}{w} = \frac{p_v}{w} + H_{sv} \quad ...(i)$$

Also,

$$\frac{p_1}{w} = \frac{p_a}{w} - \left(h_s + h_{fs} + \frac{V_s^2}{2g}\right) \quad ...(ii)$$

From (*i*) and (*ii*), we have:

$$H_{sv} = \frac{p_a}{w} - \left(h_s + h_{fs} + \frac{V_s^2}{2g}\right) - \frac{p_v}{w}$$

or,

$$H_{sv} = H_a - H_s - H_v \quad ...(3.30)$$

$$\left(H_a = \frac{p_a}{w}, \text{ and, } H_v = \frac{p_v}{w}\right)$$

where, H_s = Total suction head $= \left(h_s + h_{fs} + \frac{V_s^2}{2g}\right)$

This value of H_{sv} is frequently called the *net positive suction head* (NPSH). Thus the net positive suction head may *be defined "as the difference between the net inlet head and the head corresponding to the vapour pressure of the liquid"*. NPSH may also be defined as "*the net head (in metres of liquid) that is required to make the liquid flow through the suction pipe from the sump to the impeller.*"

This *term has significance only when cavitating liquids are handled.*

NPSH is a parameter (diamensional) that *can be used to check cavitation in pump*. The term *NPSH* is a frequently used in *pump industry*. The minimum *NPSH* depends upon the pump design, its speed and the discharge.

From eqn. (*ii*), the **limiting value of suction lift** (h_s) is given by:

$$h_s = \left(\frac{p_a - p_v}{w}\right) - h_{fs} - \frac{V_s^2}{2g}, \text{ when } p_1 = p_v \qquad ...(3.31)$$

Suction height is usually limited from 7 to 8 metres. The permissible suction lift would be less at elevated pump elevation since atmospheric pressure diminishes with altitude. The suction lift should in no case be more than that given by eqn. (3.31), otherwise due to reduction in pressure, rapid vaporization of the liquid may occur, which may ultimately lead to cavitation.