Design of Flash Mixer

For design of flash mixer , following are assumptions

Detention time (D. T.) = 20 to 60 sec.

Velocity gradient = 300 to 600 sec^{-1}

Height of tank = 1 to 3 mt. = 2.5 mt

Tangential velocity = 3 m/sec at the tip

Relative velocity = $3/4$ of the Tangential velocity

Diameter of impeller to the diameter of tank ratio = 0.2 to 0.4 mt.

Here , Q = 15 Mld = 625 m^3/hr = $\frac{625}{60\ X\ 60}$ = 0.1736 m^3/Sec

Step 1] To Find volume of flash mixer ;

V = Q x Detention time

= 0.1736 x 40

= 7 m^3

Step 2] To Find Area and diameter of flash mixer ;

Let the depth of Flash mixer = 2.5 mt

A = $\frac{V}{h}$ = $\frac{7}{2.5}$ = 2.8 m^2

We Have ; Area = $\frac{\pi}{4}$ x d^2

2.8 = $\frac{\pi}{4}$ x d^2

d = 1.89 mt. = 2 mt.

Step 3] To Find Actual volume of flash mixer ;

Volume = Area x height

= $\frac{\pi}{4}$ x 2^2 x 2.5

= 7.854 m^3

Step 4] Power required :

We have G = $\frac{\sqrt{P}}{\mu\ x\ C}$

Where P – Input power

G – Velocity Gradient as function of input power

= 450 sec^{-1}

μ - Absolute viscosity of water

= 0.8 x 10^{-3} poise

C - Capacity or volume of water in Flash Mixer

= 7.854 m^3

∴ P = 1272.34 Watt

Step 5] To Design Blades and Impeller ;

Diameter of Impeller = 0.4 x Diameter of flash mixer

= 0.4 x 2

= 0.8 mt.

Assuming speed of Impeller = 100 r.p.m.

∴ Velocity at tip of Impeller = $\frac{2\pi r n}{60}$

Where, r – Radius of Impeller = $^{0.8}/_{2}$ = 0.4 mt

n – Number of Revolutions = 100

$$V_i = \frac{2\pi \times 0.4 \times 100}{60}$$

= 6.50 $^{m}/_{sec}$