2-(1)

Step I :→ Thickness of cylinder wall :-
The cylinder wall is subjected to gas pressure and piston side thrust. There may be bending of the wall due to piston side thrust.

$$t = \frac{p_{max} D}{2\sigma_t} + K$$

(2) following empirical relations may also be used to find various thickness.

i) The thickness of cylinder wall

$$t = 0.04 D + 1.6 \text{ mm}$$

ii) Thickness of the fgy lines = 0.030 to 0.035D

iii) Thickness of water jacket wall
$= 0.032 D + 1.6$ mm

Step II : Cylinder Diameter or Bore and length :→

(1) The input of a cylinder can be given as.

$$IP = \frac{p_m L A_n}{60}$$

(3) output power can also be written in the term of brake power as

$$BP = \frac{2\pi NT}{60}$$

(4) Mechanical efficiency is given as,

$$\eta_m = \frac{\text{Brake Power (BP)}}{\text{Indicated power (IP)}}$$

Step III Cylinder flange and Studs :→

(1) Mathematically,

$$\pi/4 D^2 P_{max} = n_s \times \pi/4 d_c^2 \sigma_t$$

$$P_{max} D^2 = n_s d_c^2 \sigma_t$$

$$d_c = D \sqrt{\frac{P_{max}}{n_s \sigma_t}}$$

Step (iv) :- Cylinder Head :→

(1) The thickness of cylinder head may be obtained as,

$$t_h = 0.316 D \sqrt{\frac{P_{max}}{\sigma_c}}$$