Brake Power(B.P) = 300 kW

<u>Given</u>: B.P at max. rated speed (N_{max}) ⟹ B.P is maximum for each cycle

$$\therefore B.P_{max} = 300\,kW$$

$$bmep = 700\,kPa - 900\,kPa$$

$$bmep_{at\ B.P_{max}} = 700\,kPa$$

W.K.T

<u>Formula</u>

$$\boxed{bmep_{at\ P_{max}} = \frac{P_{max}\, n_R}{N_{max}\, V_d}} \quad (1)$$

$n_R = 2$ for 4-stroke engines

<u>Given</u>: max. mean piston speed $\bar{S}_{p_{max}} = 12\,m/s$

W.K.T,

<u>Formula</u>: $\bar{S}_{p_{max}} = 2 L N_{max}$

$$\therefore \boxed{N_{max} = \frac{\bar{S}_{p_{max}}}{2L}} \quad (2)$$

Substitute (2) in (1),

Also,

W.K.T,

<u>Formula</u>:

$$\boxed{V_d = \left(n \times \frac{\pi}{4} B^2 \times L\right) dm^3} \quad (3)$$

(n: No. of cylinders; B: Bore; L: Stroke)

Sub (3) in (1), gives

$$bmep_{at\ P_{max}} = \frac{P_{max}\, n_R}{\left(\frac{\bar{S}_p}{2L}\right) \times \left(n \times \frac{\pi}{4} B^2 \times L\right)} = \frac{P_{max}\, n_R}{\left(\frac{\bar{S}_p}{2}\right) \times \left(n \times \frac{\pi}{4} B^2\right)}$$

$$\Rightarrow 700\text{kPa} = \frac{300\text{kW} \times 2}{\frac{12}{2} \times \frac{\pi}{4} \times (B^2 \times n)} \times 10^3$$

$$\therefore B^2 \times n = \left[\frac{300\text{kW} \times 2}{\frac{6 \times \pi}{4} \times 700\text{kPa}}\right] \times 10^3 = 181.98 \text{ dm}$$

~~Assuming~~ $\therefore$ $B^2 \times n = 181.98 \text{ dm}^2$ (4)

W.K.T,

Formula:

$$bmep_{at\ T_{max}} = \frac{6.28 \times T_{max} \times n_R}{V_d} = \frac{6.28 \times T_{max} \times n_R}{(n \times B^2) \times \frac{\pi}{4} \times L}$$

NOTE: Since the question first asks for me to calculate L (i.e stroke) & only after that should I calculate T_{max}, I first have to solve the eq (4) i.e $B^2 \times n = 181.98 \text{ dm}^2$

Assuming, number of cylinders = 6

$\Rightarrow B^2 = 30.33 \text{ dm}^2 \Rightarrow B = 5.507 \text{ dm}$

$\Rightarrow B = 550.7 \text{ mm}$

Now !!

I have no other option but to assume L = B, as no other equation for finding L exists.

What do I do?

If I assume $L = \frac{B}{2}$, I get a realistic rpm of 1300.