Q1:

$$\frac{375\ KW}{I.p} = 90\%$$

$$\Rightarrow I_p = 415.67\ KW$$

$$415.67 = I_{mep} \times 8\ cylinders \times \frac{\pi}{4} \times 0.229^2 \times 0.3 \times 750 \times 0.5 \times \frac{10}{6}$$

$$I_{mep} = 6.659$$

$$6.659 = \text{working loop imep} - \text{pumping imep}$$

$$6.659 = imep - 0.345$$

$$\text{working imep} = 7\ bar$$

$$b.p = \eta \times I_p$$

$$I.p = imep \times 8 \times 0.5 \times \frac{\pi}{4} \times 0.229^2 \times 0.3 \times 750 \times \frac{10}{6}$$

$$I_p = I_{mep} \times 62.56$$

$$\text{mass of air} = \eta_v \times \rho_{air} \times V_{swept}$$

$$= \frac{102}{100} \times 1.225 \times \frac{\pi}{4} \times 0.229^2 \times 0.3$$

$$= 0.01564\ kg$$

Scanned by CamScanner

b.p = 490 Kw

at $\eta_v = 78\%$

$m_{air} = 0.011957$ Kg

$$Imep = \frac{6.659 \times 0.01564}{0.011957} = 8.7 \text{ bar}$$

b.p = 8.7 x 62.57 = 595 Kw

S.f.c without T.C:

$$\dot{m}a = 0.011957 \times \frac{\pi}{4} \times 0.229^2 \times 0.304 \times 8 \times 0.5$$

$$= 2.48 \times 10^{-3} \text{ Kg/s}$$

$$\dot{m}f = \frac{1}{25} \dot{m}a = 0.187 \text{ Kg/s}$$

$$S.f.c = \frac{0.187 \text{ Kg} \times 3600}{416.67}$$

With T.C:

$$\dot{m}f = 0.244 \text{ Kg/s}$$

$$sfc = \frac{0.244 \times 3600}{545} = 1.61 \text{ Kg/Kwhr}$$

Scanned by CamScanner

12 i

without super charger :

$$Va = \eta v \times Vi = 0.8 \times 3 \times 10^{-3} = 2.4 \times 10^{-3} m^3$$

$$\text{for all cylinders} = 2.4 \times 10^{-3} \times \frac{3580}{2}$$

$$= 4.3 \ m^3/min$$

with super charger.

$$Td = 1.7 \times 1.013 \times 10^2$$

$$= 172 \ kJ/m^3$$

$$= \frac{288}{0.75}\left(1.7\left(\frac{1.4-1}{1.4}\right)-1\right)$$

$$= 62.86 \ K$$

$$Td = 288 + 26.86$$

$$= 350.86 \ K$$

$$Vfa = \frac{pa}{Ta} \times \frac{To}{pa}$$

$$= \frac{172.2 \times 3 \times 10^{-3} \times 285}{350 \times 86 \times 1.003} = 4.786 \times 10^{-3} \ m^3$$

Scanned by CamScanner

D flowrate:

$\Rightarrow 7.32 - 4.2 = 3.126 \ m^3/min$

$DIp = 3.126 \times 12.9 = 40.325 \ KW$

$\Delta p = p_{c1} - p_i = 172.2 - 101.3$

$= 70.9 \ KW/m^3$

$= 6.204 \ KW$

$DIp = 40.325 + 6.204 = 46.53 \ KW$

$DB.p = Ip \times \eta_m$

$= 46.53 \times 0.8 = 37.22 \ KW$

$mf = \frac{101.3 \times 7.32}{0.25 \times 285} = 0.11496 \ Kg/s$

required power: $= mcp(\Delta T) \times \frac{1}{\eta_m}$

$= 0.149 \times 1.003 \times \frac{1}{0.8} \times \Delta T$

$= 11.87 \ KW$

$DB.p = 37.22 - 11.87 = 25.36 \ KW$

Scanned by CamScanner