Differential Joints or Circumferential Joint

(i) $t = \frac{P_i D_i}{2\sigma_t m} + 1$

$= 2.1$ Nm.

(ii) $d = 6\sqrt{t}$

$= 28$ Nm.

(iii) $n = \left(\frac{P}{d}\right)^2 \cdot \frac{P}{t}$

$= \left(\frac{2400}{28}\right)^2 \cdot \frac{1}{\sqrt{6}}$

$= 132$ rivets.

(iv) Pitch of Rivets :-

Assume Joint be double Riveted lap Joints.

No. of Rows = 2.

n_1 = no. of Rivets per Row $= \frac{n}{2} = 66.$

Pitch, $P_i = \frac{\pi (D_i + t)}{n_1} = \frac{\pi (2400 + 21)}{66}$

$= 115.2$ Nm

$P_{max.} = Ct + 41.2t$

$= 2.62(21) + 41.28$

$= 96.3.$

$\therefore P = 96$ Nm

Assuming Zig-Zag Riveting :-

$P_t = 0.33(P) + 0.67 d.$

$= .33(96) + 0.67(28)$

$= 50.44$ Nm.

$m = 1.5(d)$

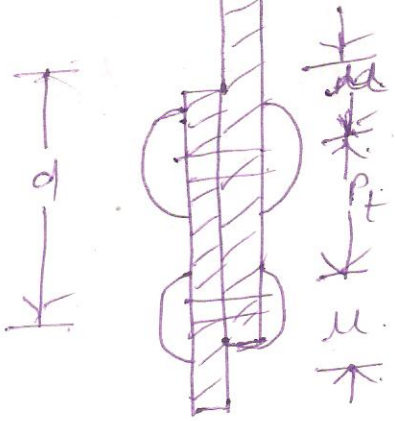
$= 42$ Nm

overlap, q

$p_t + 2u$

$= 50.44 + 2(42)$

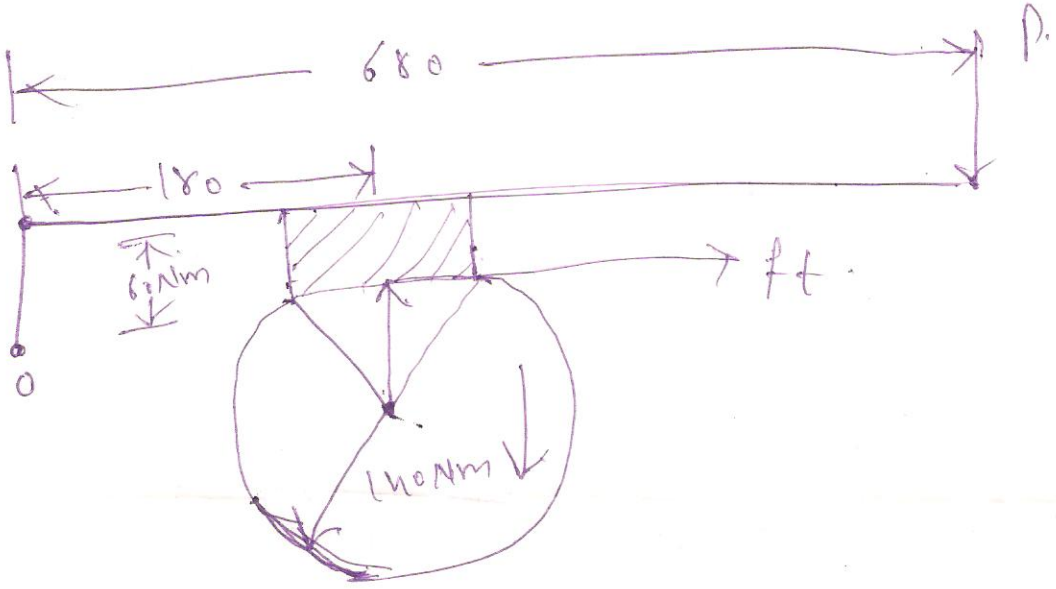
$= 134\ mm$



$$n_i = \frac{p-d}{p} = \frac{96-28}{96}$$

$$= 70.83\%$$

A=4



Given

$T = 15\ N\text{-}m$

$\mu = 0.3$

$P_{max} = 1N/mm^2$

$w = d$.

$T = ft \times r$

$15 = \mu RN \cdot \frac{140}{1000}$

$\frac{15}{0.3 \times 0.14} = RN$

$RN = 357.143\ N$

Taking N @ 0:

$P \times .680 + ft \times .06 = RA \times .180$

$P \times .68 + (0.3 \times 357.143) \times .06 = 357.143 \times .18$

$P \times .68 = 64.28 - 6.43$

$$P = 85.07\ N$$

(II) Block Design :-

$$P_B = \frac{RN}{A}$$

$$\frac{1N}{Nm2} \Rightarrow \frac{357.143\ N}{w(2r\sin\theta)}$$

Here θ is Not Given but, we may use $w = l$

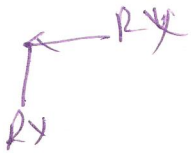
$$w = l$$

$$w = 2r\sin\theta$$

$$\therefore w = 2 \times 140 \times \sin 20. \qquad \text{Let } 20^\circ = 40^\circ$$

$$= 255Nm.$$

(III) Resultant Hinge Pin Reaction :-



$$RY = -P + RN$$
$$= 85 + 357$$
$$= 272N$$

$$RX \Rightarrow f_t = \mu RN$$
$$= 0.3 \times 357$$
$$= 107N.$$

(IV) Heat Generation Rate :-

$$N = 50\ r.p.m$$

$$H.G.R = f_t \times V$$
$$= \frac{107 \times \pi \times .28 \times 50}{60}$$
$$= 78.4\ J/sec.$$

A=6

KNUCKLE JOINT

$P = 150\ KN = 150 \times 10^3.$

$\sigma_t = 80\ mpa.$

$t = 60mpa$

$\sigma_c = 150\ mpa.$

(I) Dia of Rod (D) :-

$$D = \sqrt{\frac{4P}{\pi\sigma_t}} = \sqrt{\frac{4 \times 150 \times 10^3}{\pi(80)}}$$

$$= 48.86\ mm$$

(ii) $D_1 = 1.1D$
$= 53.75$ Nm

(iii) $a = .75 \times 48.86 = 36.64$ Nm
$b = 1.25 \times 48.86 = 61.08$ Nm.

(iv) Pin Dia :-

$$d = \sqrt{\frac{2P}{\pi t}} = \sqrt{\frac{2 \times 150 \times 10^3}{\pi \times 60}}$$
$$= 39.9 \text{ Nm}$$

$$d = 3\sqrt{\frac{32}{\pi b} \times \frac{P}{2}\left[\frac{b}{4} + \frac{a}{3}\right]}$$

$$= 3\sqrt{\frac{32}{\pi(80)} \times \frac{150 \times 10^3}{2}\left(\frac{61}{4} + \frac{36}{3}\right)}$$

$$= 63.8 \text{ Nm}$$

$\therefore d = 63.8$ Nm
$d_0 = 2 \times d = 127.7$ Nm
$d_1 = 1.1d = 95.7$ Nm.

(v) CHECK

$$\sigma_t = \frac{P}{b(d_0 - d)}$$
$$= \frac{150 \times 10^3}{61(127.7 - 63.8)}$$
$$= 38.48 \text{ MPa}$$

$\therefore$ Safe

$$\sigma_c = \frac{P}{bd}$$
$$= \frac{150 \times 10^3}{61 \times 63.8}$$
$$= 38.54 \text{ mpa}$$

$\therefore$ Safe