Power = 7.5 kW D = .558 m

⇒ Input torque = 25.81 ft. lbf

= 25.81 × 0.3048 × 4.44822

= 34.9936 N-m

≃ 35 N-m

⇒ Power = T × ω

7500 = 35 × ω ⇒ ω = 214.286

⇒ $\omega = \frac{2\pi \times N}{60}$ ⇒ $N = \frac{\omega \times 60}{2\pi}$

N = 2047.315 rpm

⇒ ~~$V = \frac{\pi D N}{60}$ ⇒ $V = \pi \times 0.558 \times$~~

Presure Angle 20°

Module estimation on beam strength

$$m = \left[\frac{60 \times 10^6}{\pi} \left\{ \frac{Kw \cdot C_s \cdot f_s}{2n * C_v * \left(\frac{b}{m}\right) * \left(\frac{S_{ut}}{3}\right)} \right\}\right]^{1/3}$$

$C_s = 1.5$ $f_s = 1.5$ $Y = 0.308$

$C_v = \frac{3}{3+V} = \frac{3}{8}$ (assuming V = 5 m/sec.)

$$m = \left\{ \frac{60\times10^6}{\pi} \times \frac{7.5 \times 1.5 \times 1.5}{18 \times 2048 \times 3/8 \times \frac{1200}{3} \times 0.303} \right\}^{1/3}$$

$$\boxed{m = 2.66\ mm}$$

↘ On the basis of beam stren

* Module estimation on the basis of wear strength

$$m = \left[\frac{60\times10^6}{\pi} \left\{ \frac{(kw) \times Cs \times fs}{z^2 * n_p * Cv * \frac{b}{m} * Q \times K} \right\} \right]^{1/3}$$

$$K = .156\left(\frac{BHN}{100}\right)^2$$

$$= .156 \times \left(\frac{254}{100}\right)^2$$

$$Q = \frac{2z_g}{z_g - z_p}$$

$$= 2.92$$

$$m = \left[60\times10^6 \left\{ \frac{7.5 \times 1.5 \times 1.5}{18 \times 18 \times 2048 \times 3/8 \times 10 \times 2.92 \times (2.54)^2} \right\} \right]^{1/3}$$

$m = 2.52$ So, let's Assume $\boxed{m = 3}$

New $P_t = \frac{2 \times M_t}{d} \Rightarrow P_t = \frac{2 \times 35 \times 1000\ N\text{-}mm}{54\ mm}$

$$P_t = 1296.4\ N$$

$$V = \frac{\pi \times d \times N}{60\times10^3} = \frac{3.14 \times 18 \times 3 \times 2048}{60 \times 10^3}$$

$$= 5.787\ m/sec.$$

$$C_v = \frac{3}{3 + 5.79} = 0.341$$

$$P_{eff} = \frac{C_s}{C_v} \times P_t = \frac{1.5 \times 1296.4}{0.341}$$

$$= 5702.64\ N$$

$$Q_b = m b \sigma_b Y = 3 \times 30 \times 400 \times 0.308$$

$$= 11088$$

Here $Q_b > P_{eff}$

$$\frac{Q_b}{P_{eff}} = 1.94 = \beta_s$$

So, Module is 3mm.