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MA3001
selection of spur gears

VG

Date:

No.

Power transmitted = 1.2 kW

Input speed = 2930 rpm

Output speed = $125 \pm 3\%$ rpm

= 121.25 to 128.75 rpm

all round clearance = 11.20 mm

speed ratio, $SR = \frac{\text{input speed}}{\text{output speed}} = \frac{2930}{125} = 23.44 = SR_1 \times SR_2 \times SR_3 \times SR_4$

assume uniform loading & less importance application.

service factor, $f_s = 1.0$, safety factor, $s_s = 1.0$

$$P_{tab} = P_{eff} \times s_s \times f_s$$

$$= 1.2 \times 1.0 \times 1.0$$

$$= 1.2 \text{ kW}$$

$$M_{tab} = M_{eff} \times s_s \times f_s$$

$$M_{eff} = \frac{P}{\omega} = T$$

$$M_{tab} = \frac{P}{\omega} \times 1.0 \times 1.0$$

assume all SR same for all gears,

$$SR = \sqrt[4]{23.44} \approx 2.20 \text{ (approx for each stage)}$$

use $z=05b$ (SR_1)

$$N_1 = 15T$$

$$T_1 = \frac{1.2 \times 10^3}{\frac{2\pi}{60} (2930)} = 3.91 \text{ Nm}$$

$$M_{tab} = T_1$$

$$m_1 = 1.25 \text{ mm} \checkmark$$

$$N_2 = 2.2 \times 15 = 33T$$

$$\therefore N_1 = 15T, m_1 = 1.25$$

$$\therefore N_2 = 32T$$

$$N_2 = 32T, m_2 = 1.25 \parallel$$

$$T_2 = T_1 \times \frac{N_1}{N_2}$$

$$= 3.91 \times \frac{15}{32} = 1.83 \text{ Nm}$$

$$@ N_2, T_2 \rightarrow m_2 = 1.25 \checkmark$$

use $z=05b$ (SR_2)

$$N_3 = 15T$$

$$T_3 = T_2 = 1.83 \text{ Nm}$$

$$m_3 = 1.5 \text{ mm} \checkmark$$

$$\therefore N_3 = 15T, m_3 = 1.5 \text{ mm}$$

$$N_4 = 2.2 \times 15 = 33T$$

$$N_4 = 33T, m_4 = 1.5 \text{ mm} \parallel$$

$$T_4 = 1.83 \times \frac{33}{33} = 1.83 \text{ Nm}$$

$$m_4 = 1.5 \text{ mm} \checkmark$$

Use Z-05b (SR₃)

$$N_5 = 16$$

$$T_5 = T_4 = 18.35 \text{ Nm}$$

$$m_5 = 2 \text{ mm} \checkmark$$

$$N_6 = 2.2 \times 15 = 33T$$

$$\therefore N_5 = 16T, m_5 = 2 \text{ mm}$$

$$\therefore N_6 = 35$$

$$N_6 = 35T, m_6 = 2 \text{ mm} //$$

$$T_6 = 18.35 \times \frac{35}{16} = 40.14 \text{ Nm}$$

$$m_6 = 2 \text{ mm} \checkmark$$

Use Z-05b (SR₄)

$$N_7 = 16$$

$$T_7 = T_6 = 40.14$$

$$m_7 = 2.5 \text{ mm} \checkmark$$

$$\therefore N_7 = 16T, m_7 = 2.5 \text{ mm}$$

$$N_8 = 2.2 \times 16 = 35.2T$$

$$N_8 = 36T, m_8 = 2.5 \text{ mm} //$$

$$\therefore N_8 = 36$$

$$T_8 = 40.14 \times \frac{36}{16} = 90.315$$

$$m = 2.5 \text{ mm} \checkmark$$

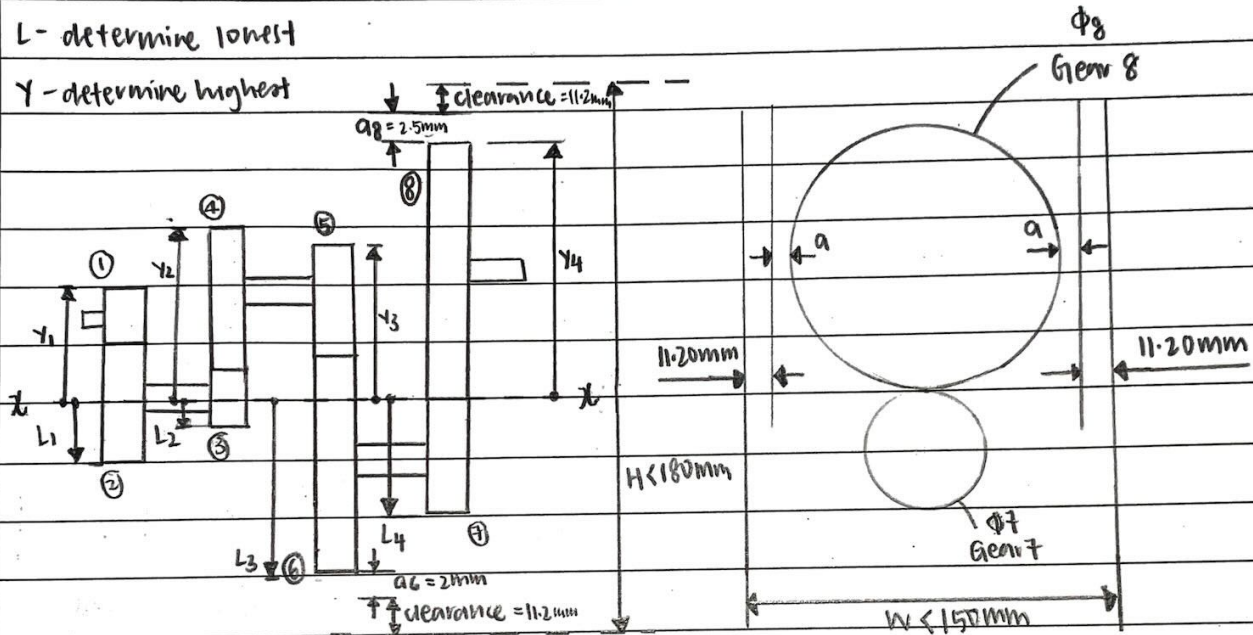
output speed = $125 \pm 3 \text{ rpm}$ - Satisfied ??

Gear	Teeth	Module	Pitch ϕ	Centre Dist
N ₁	15	1.25	18.75	29.375
N ₂	32	1.25	40	
N ₃	15	1.5	22.5	36.0
N ₄	33	1.5	49.5	
N ₅	16	2	32	51.0
N ₆	35	2	70	
N ₇	16	2.5	40	65.0
N ₈	36	2.5	90	

$$\begin{aligned}
 H &= \text{clearance} + a_6 + \frac{D_6}{2} + \frac{D_7}{2} + D_8 + a_8 + \text{clearance} \\
 &= 11.2 + 2 + \frac{30}{2} + \frac{40}{2} + 90 + 2.5 + 11.2 \\
 &= 171.9 \text{ mm} < 180 \text{ mm}
 \end{aligned}$$

L - determine lowest

Y - determine highest



lowest $\rightarrow L_3$ //

highest $\rightarrow Y_4$ //

$$H = \text{clearance} + a_6 + \frac{D_6}{2} + \frac{D_7}{2} + D_8 + a_8 + \text{clearance} = 117.4 \text{ mm} < 150 \text{ mm} //$$

$$= 171.9 \text{ mm} < 180 \text{ mm} //$$

$$\text{width, } w = \text{largest gear} + 2a + 2c$$

$$= 90 + 2(2.5) + 2(11.20)$$

