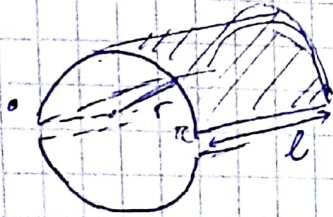


# - WEEK 5 Assignment - "Winding Design"

$$B = 0.6 \sin \omega t$$



$$\begin{aligned} \Phi &= \int_0^{\omega t} 0.6 \sin(\omega t) \cdot r \cdot l \cdot d(\omega t) \\ &= 2r \cdot l \cdot 0.6 = 1.2rl \\ &= \underline{1.92 \text{ mWb}} \end{aligned}$$

16mm  
100mm

$$I_{\text{peak}} = 2\pi f \cdot k_w \cdot N_{ph} \cdot \Phi$$

$\downarrow$  2462       $\downarrow$   $f = \frac{1500 \cdot 2}{120} = 25$        $\downarrow$   $k_d \cdot N_{ph} = 112.54$        $\downarrow$   $1.92 \cdot 10^{-3}$

$$k_d \cdot N_{ph} = 112.54$$

$$\frac{\sin(q \cdot \frac{\alpha}{2})}{q \cdot \sin(\frac{\alpha}{2})}$$

$q$ : # slots per pole per phase

$$\Rightarrow \frac{1/2}{q \cdot \sin(\frac{\alpha}{2})} \cdot \text{layer} \cdot q \cdot \text{cond} \cdot \frac{1}{2} = 112.54$$

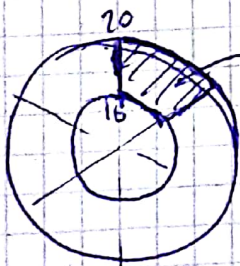
1/2 for 30h 2 pole

2 cond = 112.54 · sin(α/2)

let  $\alpha = 10^\circ$ ;  $6q = \frac{360}{10} = 36$        $q = 6$        $N_{ph} = 2 \cdot 6 \cdot 5 \cdot 2 = 120$

cond = 5

$\Rightarrow k_d \cdot N_{ph} = 114$



$$\begin{aligned} A &= 75.16 \text{ mm}^2 \\ A_{\text{eff}} &= 52.78 \text{ mm}^2 \\ N_{ph} &= 120 \end{aligned}$$

$$\phi_{\text{cable}} = 0.748 \text{ mm} \rightarrow 20 \text{ AWG} \rightarrow \text{area: } 0.518 \text{ mm}^2$$

~~20 AWG cable area = 0.518 mm²~~       $I = 2.07 \text{ A}$

$$P = 149.2 \text{ W}$$

resistivity:  $33.31 \text{ m}\Omega/\text{cm}$

$$\begin{aligned} \text{length} &= 120 \times (2 \cdot 100 + \pi \cdot 18) \\ &= 30786 \text{ mm} = 30.786 \text{ m} \end{aligned}$$

$$R_{\text{phase}} = 1.025 \Omega$$

$$P_{\text{cu}} = 3 \cdot (2.07)^2 \cdot 1.025 = 13.2 \text{ W}$$

$$\eta = \frac{P_{\text{out}}}{P_{\text{out}} + P_{\text{loss}}} = \underline{92\%}$$