A core of magnetic material of a volume = 100 cm^3 was tested at 50Hz. Thickness of lamination = 1 mm

$B_{max} = 1\,T$

Eddy current loss = Hysteresis loss = 50W

At $B_{max} = 0.8\,T$ Total loss becomes 66 W with same frequency

Find the total loss at 60Hz, $B_{max} = 0.9\,T$ and thickness = 0.8 mm. volume = 50cm^3

Solution: $P_h = K_h V B_{max}^n f = K_h' B_{max}^n f$

$P_e = K_e V B_{max}^2 f^2 t^2 = K_e' B_{max}^2 f^2 t^2$

$50 = K_h' \times 1^n \times 50$ $\quad K_h' = 1$

$50 = K_e' \times 1^2 \times 50^2 \times 1^2$ $\quad K_e' = 0.02$

$66 = 1 \times 0.8^n \times 50 + 0.02 \times 0.8^2 \times 50^2$

$66 = 50 \times 0.8^n + 32$

$0.8^n = 0.68$

$n \log 0.8 = \log 0.68$

$n = 1.72$

At 60Hz, $B_{max} = 0.9$, $t = 0.8$

$P = 1 \times 0.9^{1.72} \times 60 + 0.02 \times 0.9^2 \times 60^2 \times 0.8^2$

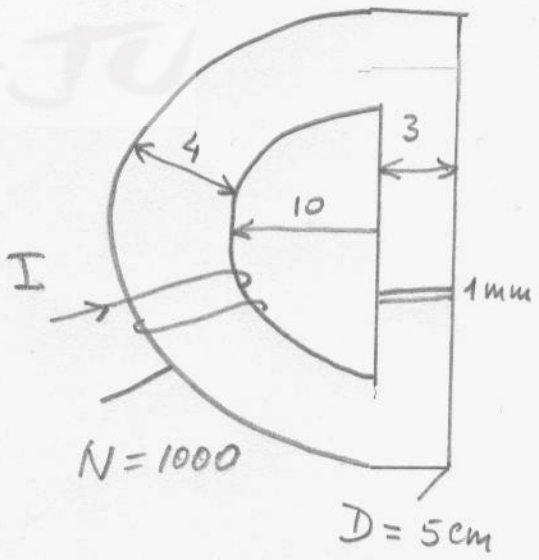
$= 50.05 + 37.32 = 87.37\,W$ for 100 cm^3

$P \propto V \quad \therefore P = \frac{87.37}{2} = 43.68$ for 50cm^3

Given $B_g = 1\ T$

Fringing Factor = 1.05

Given B-H curve



Find I

$B_g = 1T \qquad A_g = 3 \times 5 \times 10^{-4} \times 1.05$

$\phi = BA = 1.575\ mWb$

$$B_v = \frac{1.575 \times 10^{-3}}{3 \times 5 \times 10^{-4}} = 1.05\ T$$

From graph $H_v = 900\ At/m$

$$H_g = \frac{B_g}{\mu_0} = \frac{1}{4\pi \times 10^{-7}} = \frac{10^7}{4\pi} = 796\,000$$

$$B_c = \frac{1.575 \times 10^{-3}}{4 \times 5 \times 10^{-4}} = 0.7875\ T$$

From graph $H_c = 700\ At/m$

$$l_v = \frac{20 + 2 + 2}{100} = 0.24$$

$$l_c = \frac{12\pi + 1.5 + 1.5}{100} = 0.407$$

$$NI = H_c l_c + H_v l_v + H_g l_g$$

$$1000 I = 700 \times 0.407 + 900 \times 0.24 + 796000 \times 10^{-3}$$

$$I = 1.28\ A$$

A dc motor with 9 slots, 4 poles, simplex, double layer wave, retrogressive winding

Draw developed winding diagram