$$(\alpha h)^4 = \left(\sqrt{\frac{\text{copper width}}{\text{slot width}}} \times \text{solid cond. depth}\right)^4$$

is 0.097. The avg. loss factor is

$$K_{d\,av} = 1 + (\alpha h)^4 \left(\frac{m^2}{9}\right) \qquad m = \text{no. of layers}$$

$$= 1 + 0.097\left(\frac{5}{9}\right)$$

$= 1.27$ & the loss in the top layer

is $k_{d5} = 1 + 0.097\left(\frac{20}{3}\right) = 1.66$

Stray loss will be taken as 20%.

I^2R loss: $3 \times 219^2 \times 0.000102 = 14.7$ W

Eddy loss: $0.27 \times 14.7 = 3.0$ W

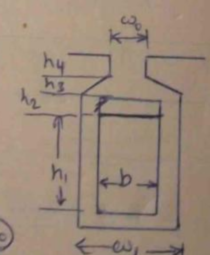
Stray loss: $0.2(14.7 + 3) = 3.5$

21.21 W

The IR drop is $219 \times .102 \times 1.27 = 28.4$ V

The effective resistance is $\dfrac{28.4 \times 100}{3300/\sqrt{3}} = 1.5\%$ or 0.015 pu

Leakage reactance



The specific slot permeance,

$$\lambda_s = \frac{h_1}{3w_s} + \frac{h_2}{w_s} + \frac{2h_3}{w_s + w_0} + \frac{h_4}{w_0} \quad (60)$$

$$= \frac{41.7}{3 \times 13.5} + \frac{4}{13.5} + \frac{2 \times 2.5}{13.5 + 3} + \frac{1.5}{3} = 2.13$$

slot leakage flux $\phi_s = 2\sqrt{2}\,\mu_0 J T_c L_s \lambda_s$ — (69)

$$= 2\sqrt{2}(4\pi \times 10^{-7})(5)(0.295)(2.13)$$

$$= 2.45 \text{ mWb.}$$

$$L_0 \lambda_0 = K_s Y^2 / \pi y_s \quad (63)$$

$$= 1 \times 0.298^2 / (\pi \times 0.0331) = 0.856$$

$$\phi_0 = 2\sqrt{2}\,\mu_0 J T_c L_0 \lambda_0 \quad (70)$$

$$= 2\sqrt{2} \times (4\pi \times 10^{-7}) \times 5 \times 219 \times 0.856 = 3.9 \text{ mWb.}$$

The total leakage flux is $\phi_s + \phi_0 = 6.35$ mWb.

Expressing this in terms of the main flux, $\frac{6.35}{57.6} = 0.11$ p.u

Stator core

For a core density of about 1.1 Wb/m², the depth h below the slot must accomodate half the flux; whence $h \simeq 10$ cm. The stator bore is $D = 180$cm, depth of two slot b is 10.6 cm, so that the outside diameter of the stator core may be

$$D_0 = 180 + 10.6 + 20 \simeq 220 \text{ cm} = 2.2 \text{ m}$$

Air gap

The ratio of the field mmf on open ckt for normal vtg. to the armature mmf at full load (ie the short ckt ratio) is 1.2. The armature mmf is

$$F_a = 1.35\, J\, T_{ph}\, K_{w1} / p \quad (85)$$

$$= 1.35 \times 219 \times 150 \times 0.955/10 = 4240 \text{ AT/pole}$$