

$$V = IR \quad (1)$$

$$H \cdot dl = NI \quad (1)$$

where

$$dl = l_c$$

$$B = \mu_0 \mu_r H \quad (2)$$

where $\mu_0 = 4\pi \times 10^{-7}$ and $\mu_r = 1.05$ for air.
For steel, μ_r is in the range of 2000 to 6000.

$$\frac{B}{\mu_0 \mu_r} = H \quad (3)$$

$$\frac{B}{\mu_0 \mu_r} \cdot l_c = NI \quad (4)$$

$$B = \frac{\Phi}{A_c} \quad (5)$$

$$\frac{\Phi}{\mu_0 \mu_r A_c} \cdot l_c = NI \quad (6)$$

where

$$\frac{l_c}{\mu_0 \mu_r A_c} = R_{\text{rel}}$$

$$\Phi R_{\text{rel}} = NI \quad (7)$$

$$NI = \Phi R_{\text{rel}}$$

where

NI = Magnetomotive Force (MMF),

Φ = Flux,

R_{rel} = Reluctance of the Magnetic Circuit.