

# Hysteresis Loss

When a magnetic material is subjected to cycle of magnetisation (i.e. it is magnetised first in one direction and then in the other), a power loss occurs due to molecular friction in the material i.e. the magnetic domains of the material resist being turned first in one direction and then in the other. Therefore, energy is required in the material to overcome this opposition. This loss being in the form of heat and is termed as *hysteresis loss*. The effect of hysteresis loss is the rise of temperature of the machine.

## How to mitigate?

By using materials of low coercivity.

## Formula

Power loss ( $P_h$ ) occurring because of the hysteresis,

$$P_h = K_h B_m^{1.6} fV$$

Where,  $K_h$  = hysteresis coefficient.

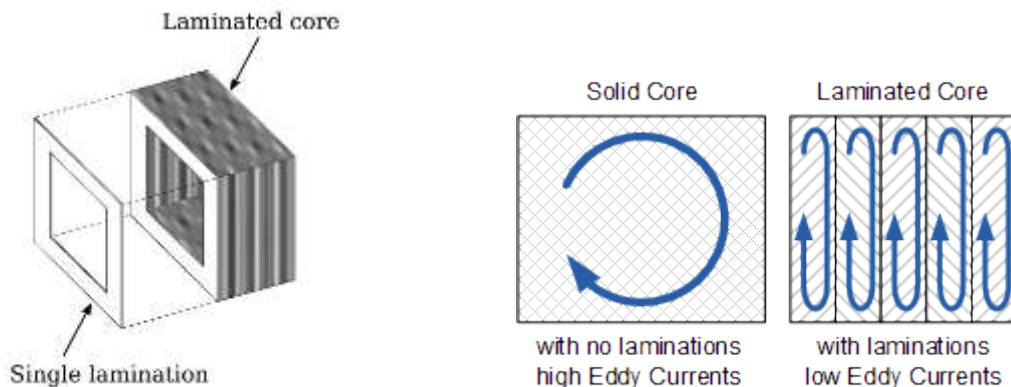
$B_m$  = Maximum value of flux density

$f$  = frequency

$V$  = Volume of the core/Magnetic material

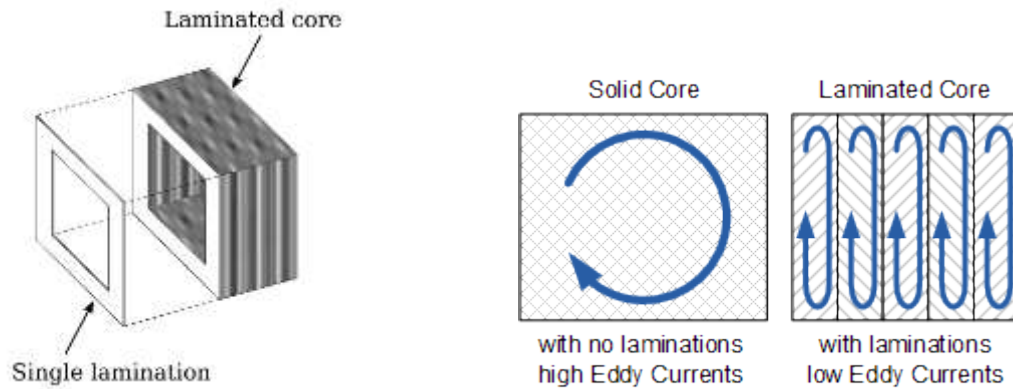
# Eddy Current Loss

When a magnetic material is subjected to a changing magnetic field, a voltage is induced in the material according to Faraday's law of electromagnetic induction. Since the material is conducting, the induced voltage circulates currents within the body of the magnetic material. These circulating currents are known as *eddy currents*. These eddy currents causes  $I^2R$  loss in the material, known as *eddy current loss*. The eddy current loss also results in the increase in temperature of the material.



## How to mitigate?

- By using laminated core.
- Pictures of laminated core are given in the following.



## Formula

$$\text{Eddy current power loss, } P_e = K_e B_{max}^2 f^2 t^2 V \text{ Watts}$$

Where,

- $K_e$  = Eddy current coefficient,
- $B_{max}$  = Maximum flux density,
- $f$  = frequency of magnetisation or flux,
- $t$  = thickness of lamination, and
- $V$  = Volume of magnetic material.