TERMS AND DEFINITIONS

1. Initial permeability μ **i**
   The limiting value of the amplitude permeability when the field strength is vanishingly small.
   $$\mu i = \lim_{H \to 0} \mu a$$

2. Effective permeability μ **e**
   The permeability obtained by the self-inductance of magnetic core in a closed magnetic circuit where the flux leakage can be ignored.
   $$\mu e = \frac{L}{\mu_0 N^2} \cdot C_1$$
   L: Self-inductance of coil
   μ_0: Permeability of vacuum magnetic constant
   N: Number of winding turns
   C_1: Core constant

3. Amplitude permeability μ **a**
   The relative permeability obtained from the peak value of the flux density and the peak value of the applied field strength, at a stated amplitude of either, when the field strength is varying periodically with time with an average of zero, and the material is initially in a specified neutralized state.

4. Permeability of vacuum magnetic constant μ_0
   The permeability in vacuum.
   $\mu_0 = 4\pi x10\ exp\text{-}7(H/m)$

5. Saturation magnetic flux density **Bs**
   The maximum intrinsic induction possible in a material.

6. Maximum magnetic flux density in a hysteresis loop **Bm (mT)**
   The flux density at high field strength.

7. Remanent magnetic flux density **Br (mT)**
   The value of the remanent flux density when the material is brought from saturation by a monotonically changing field.

8. Coercivity **Hc (A/m)**
   The magnetic field strength for which the flux density is zero.

9. Apparent permeability μ **app**

The ratio of the inductance, L of a measuring coil when assembled in a specified position on a given core, to the inductance, L_0 of the same coil measured without the core.

$$\mu\ app= \frac{L}{L_0}$$

10. Inductance factor **AL**

The inductance of a coil of specified geometry, placed on a given core in a specified position, divided by the square of the number of winding turns.

$$AL= \frac{L}{N2}$$

N: Number of winding turns on the specified measuring coil
L: Inductance of the measuring coil when placed on the core

11. Loss factor **tan δ**

The sum of the hysteresis loss factor, eddy current loss factor and residual loss factor.

$$\tan\delta = \frac{Rm}{\omega L} = \frac{Reff - Rw}{\omega L}$$

Rm: Loss resistance of magnetic core alone
ω: Angular velocity
L: Self inductance of core with coil)
Reff: Resistance of core and coil
Rw: Resistance of coil

12. Relative loss factor **tanδ/μ i**

The ratio of loss factor to AC initial permeability.

$$\frac{\tan\delta}{\mu i} = \frac{\mu''}{(\mu')^2}$$

Note: The following formula applies when the gap of magnetic circuit is small.

$$\frac{\tan\delta}{\mu i} = \frac{\tan\delta}{\mu e}$$

13. Core loss **Pc (W)**
The power absorbed by a magnetic core and dissipated as heat, when the core is subjected to an alternating magnetic field which results in a measurable temperature rise.

14. Core loss volume density) **Pcv (kW/m³)**
Core loss per unit volume of a magnetic core.

15. Quality factor **Q**
The reciprocal of the tangent of the loss angle.

16. Temperature coefficient of initial permeability $\alpha\mu i$
The fractional change of permeability per 1℃ in a temperature range from T_1 to T_2.

$$\alpha\mu i = \frac{\mu i_2 - \mu i_1}{\mu i_1} \cdot \frac{1}{T_2 - T_1}$$

μi_1: Permeability at temperature T_1
μi_2: Permeability at temperature T_2

17. Relative temperature coefficient of initial permeability $\alpha\mu ir$
The temperature coefficient per unit permeability.

$$\alpha\mu ir = \frac{\alpha\mu i}{\mu i_1}$$

18. Curie temperature **Tc (°C)**
The temperature below which a material is ferromagnetic or ferrimagnetic and above which it is paramagnetic.

19. Resistivity **ρ (Ω·m)**
The electrical resistance per unit length and cross-sectional area of a magnetic core.

20. Density **d (kg/m³)**
The density of magnetic core is calculated from its volume and weight.

$$d = \frac{W}{V}$$

21. Core factors

C_1 : For a core of given geometry, the summation of the quotients of the elements of the magnetic path length L measured along the assumed mean magnetic path by the corresponding cross-sectional area A of the magnetic path elements.

$$C_1 = \Sigma \frac{L}{A}$$

C_2 : For a core of given geometry, the summation of the quotients of the elements of the magnetic path length L measured along the assumed mean magnetic path by the square of the corresponding cross-sectional area A of the magnetic path elements.

$$C_2 = \Sigma \frac{L}{A^2}$$

22. Effective dimensions of a magnetic circuit

For a magnetic core of given geometry, the magnetic path length, the cross-sectional area and the volume that a hypothetical toroidal core of the same material properties and of radially thin uniform cross-section should posses to be magnetically equivalent to the given core, within the limit of the Rayleigh region.

Effective cross-sectional area **Ae**

$$Ae = \frac{C_1}{C_2}$$

Effective magnetic path length **Le**

$$Le = \frac{C_1^2}{C_2}$$

Effective volume **Ve**

$$Ve = Ae \cdot Le = \frac{C_1^3}{C_2^2}$$