IRON POWDER CORE LOSS CHARACTERISTICS

The Iron Powder Q-curves section of this booklet can be very useful for designing high-Q, low power inductors and transformers, but additional consideration must be given to higher power applications.

Excessive temperature rise due to Iron Powder core loss at high frequencies will occur before saturation and is usually the primary limiting factor in the operation of an Iron Powder core inductor at high frequency.

The following charts show core loss information in milliwatts per cubic centimeter of core material as a function of peak AC flux density for various frequencies. The Faraday Law is used to calculate the peak AC flux density. The effective cross-sectional area and volume for each core size can be found on previous pages of this booklet.

The following formula provides a reasonable approximation for the temperature rise of a core in free standing air.

Temperature Rise (°C) =

$$\left[\frac{\text{Total Power Dissipation (Milliwatts)}}{\text{Available Surface Area (cm}^2\text{)}}\right]^{.833}$$

The surface area of a toroid increases at approximately a squared rate with the outside diameter, while the volume increases at approximately a cubed rate. The result is that a small diameter core can dissipate more power per unit volume than a larger diameter core for the same temperature rise.

Each of the three following graphs show core loss results in milliwatts per cubic centimeter as a function of frequency and AC flux density. These can be useful in projecting losses for frequencies not shown.