Testing Critical Characteristics of Soft Ferrite Materials for Power Applications

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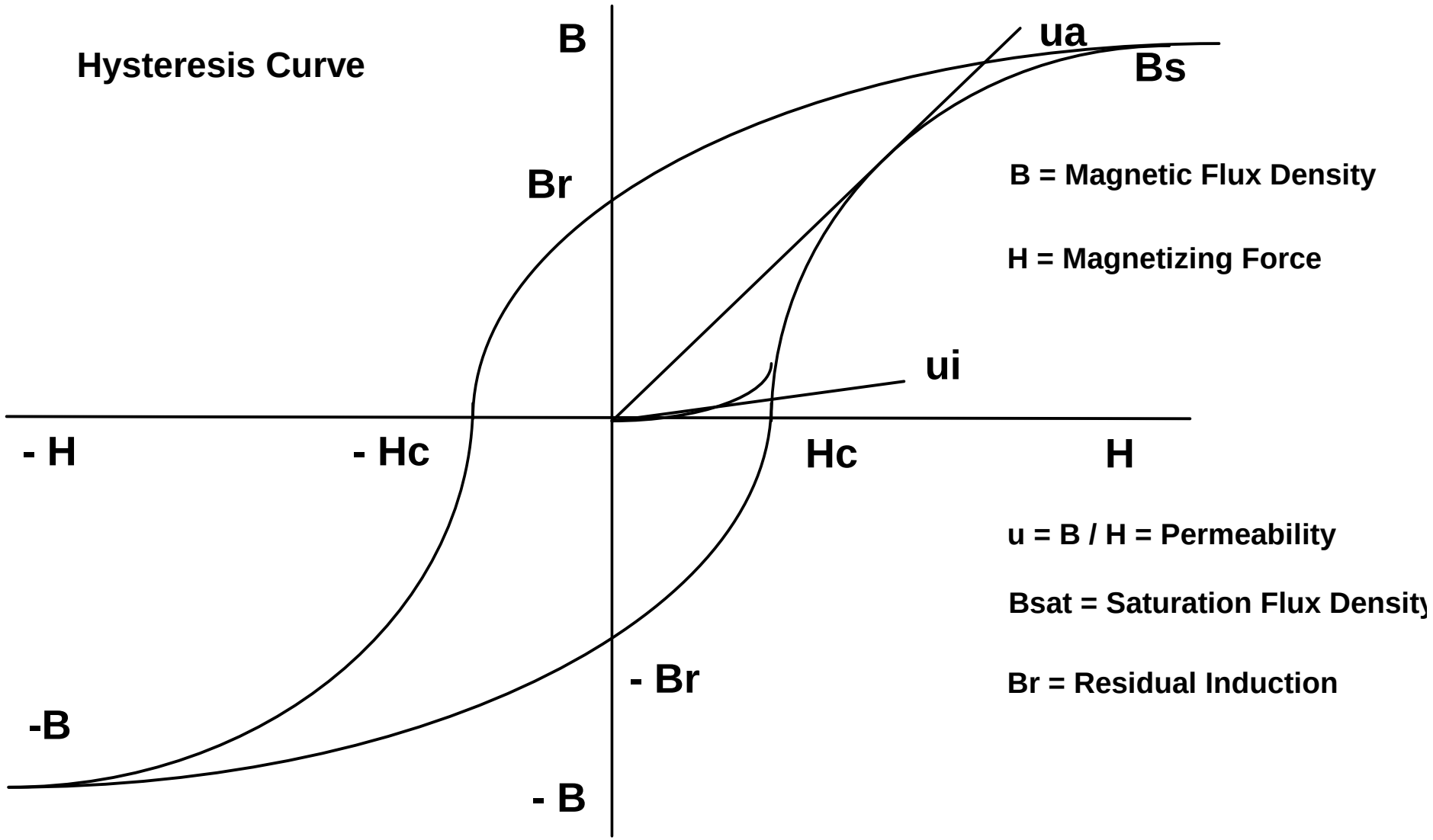
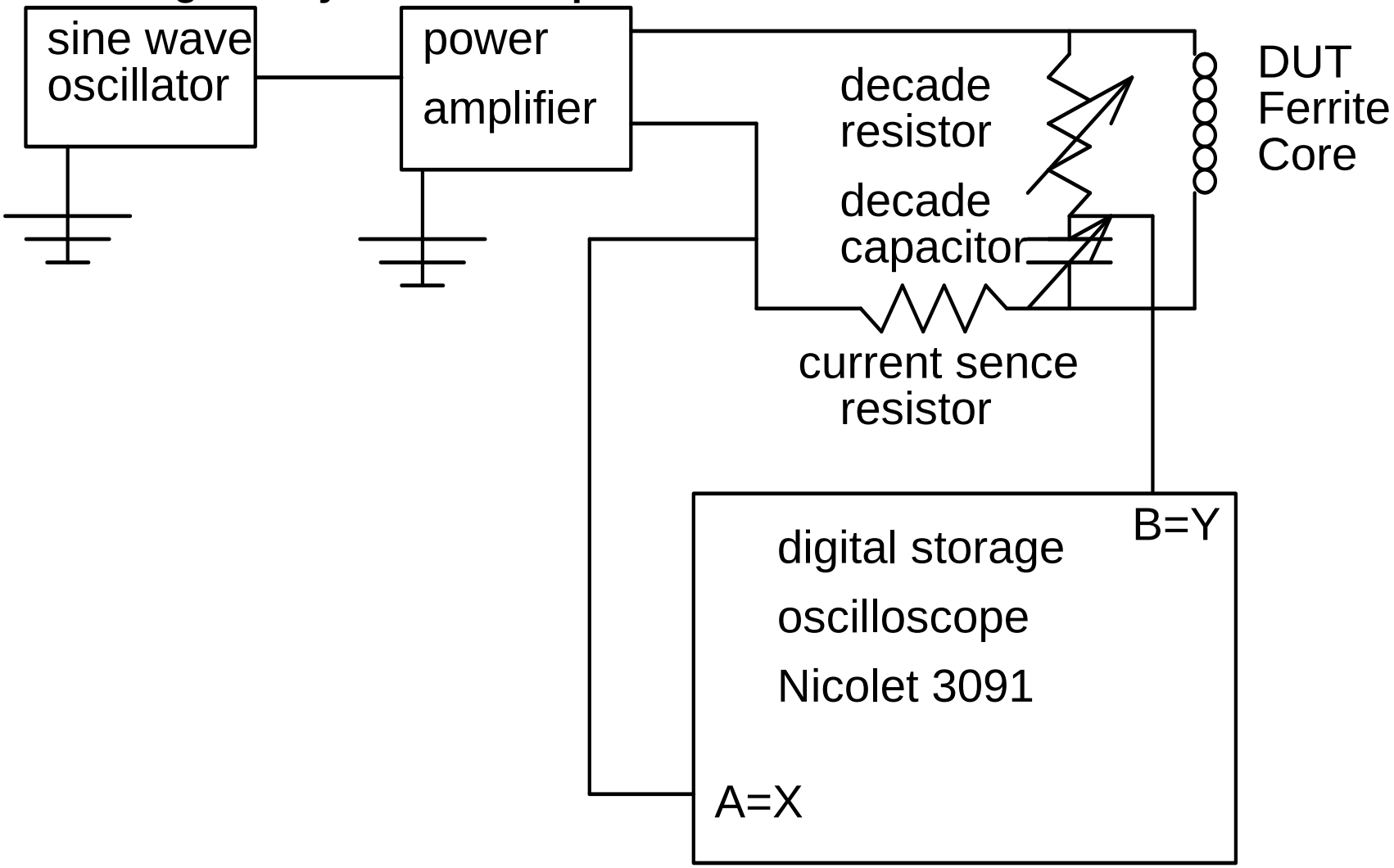
Critical Characteristics are those that affect the size or cost of the final magnetic component.

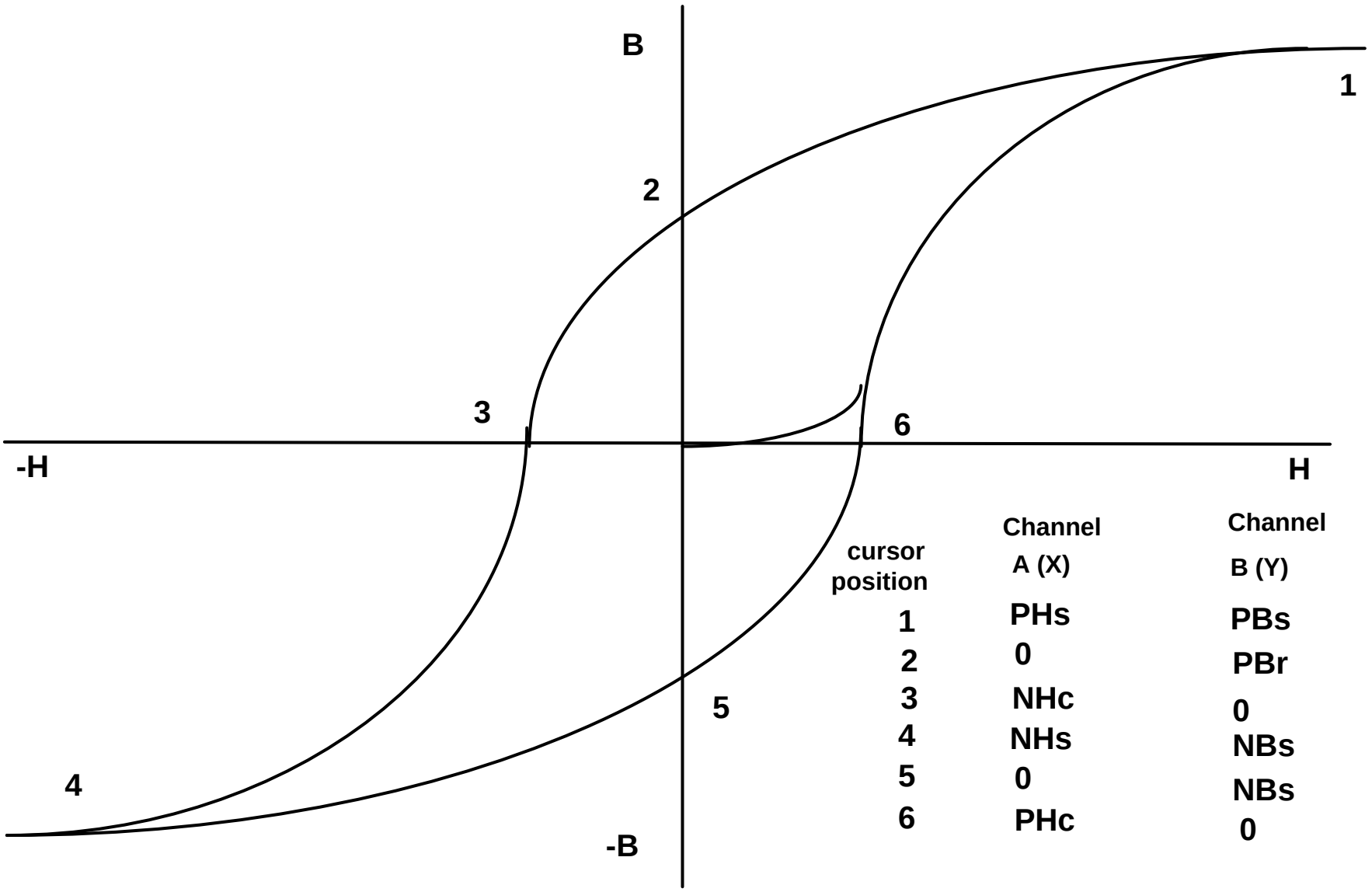
Bsat is typically the core size constraint for lower frequency transformers and output chokes.

Core Loss is typically the core size constraint for high frequency transformers.



Measuring The Hysteresis Loop





cursor position	Channel A (X)	Channel B (Y)
1	PHs	PBs
2	0	PBr
3	NHc	0
4	NHs	NBs
5	0	NBs
6	PHc	0

Drive Volts Peak = (H) (Le) / (4) (π) (N)

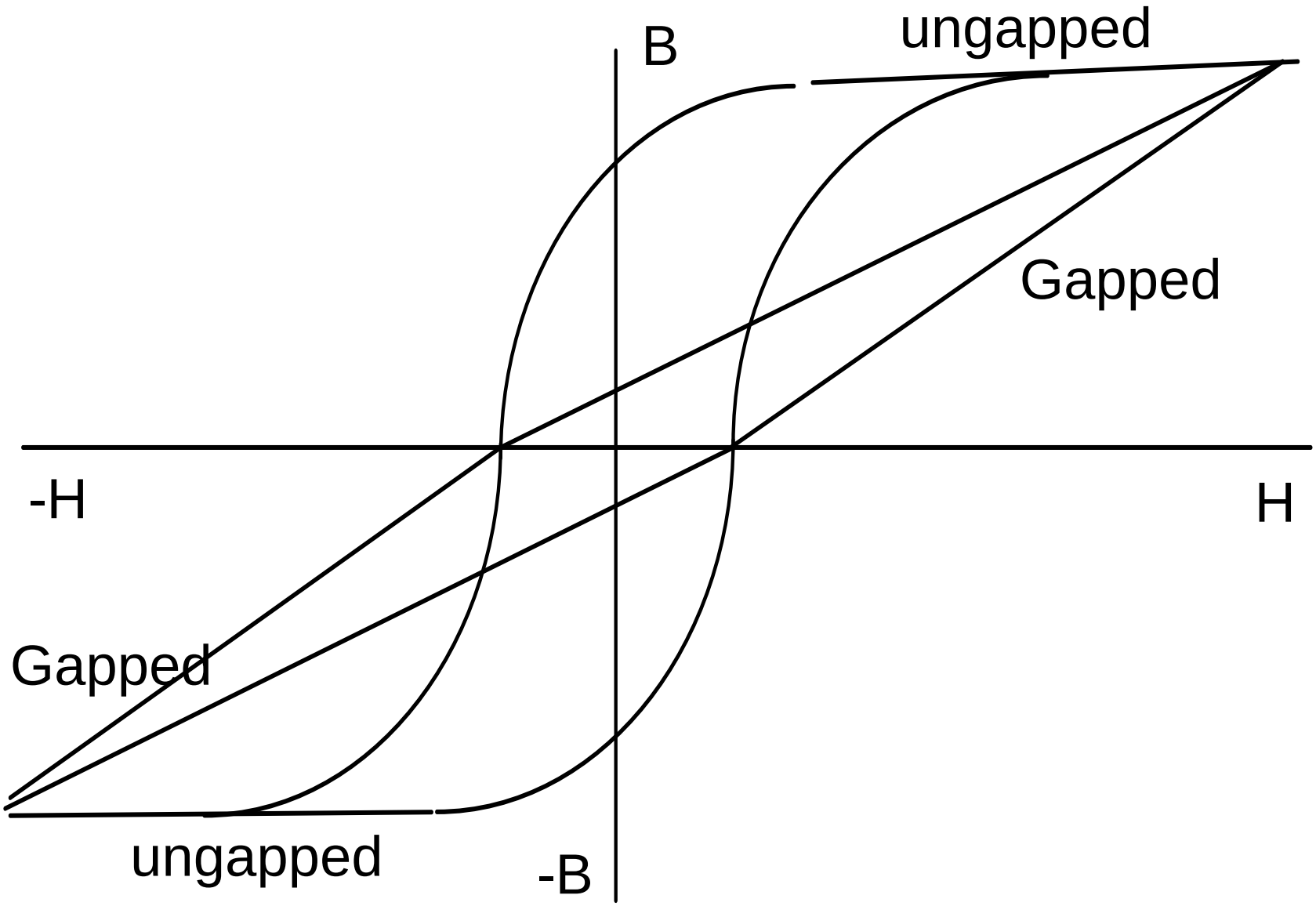
Bs = (R) (C) ((PBs + NBs) / 2) (10^8) / (N) (Ae)

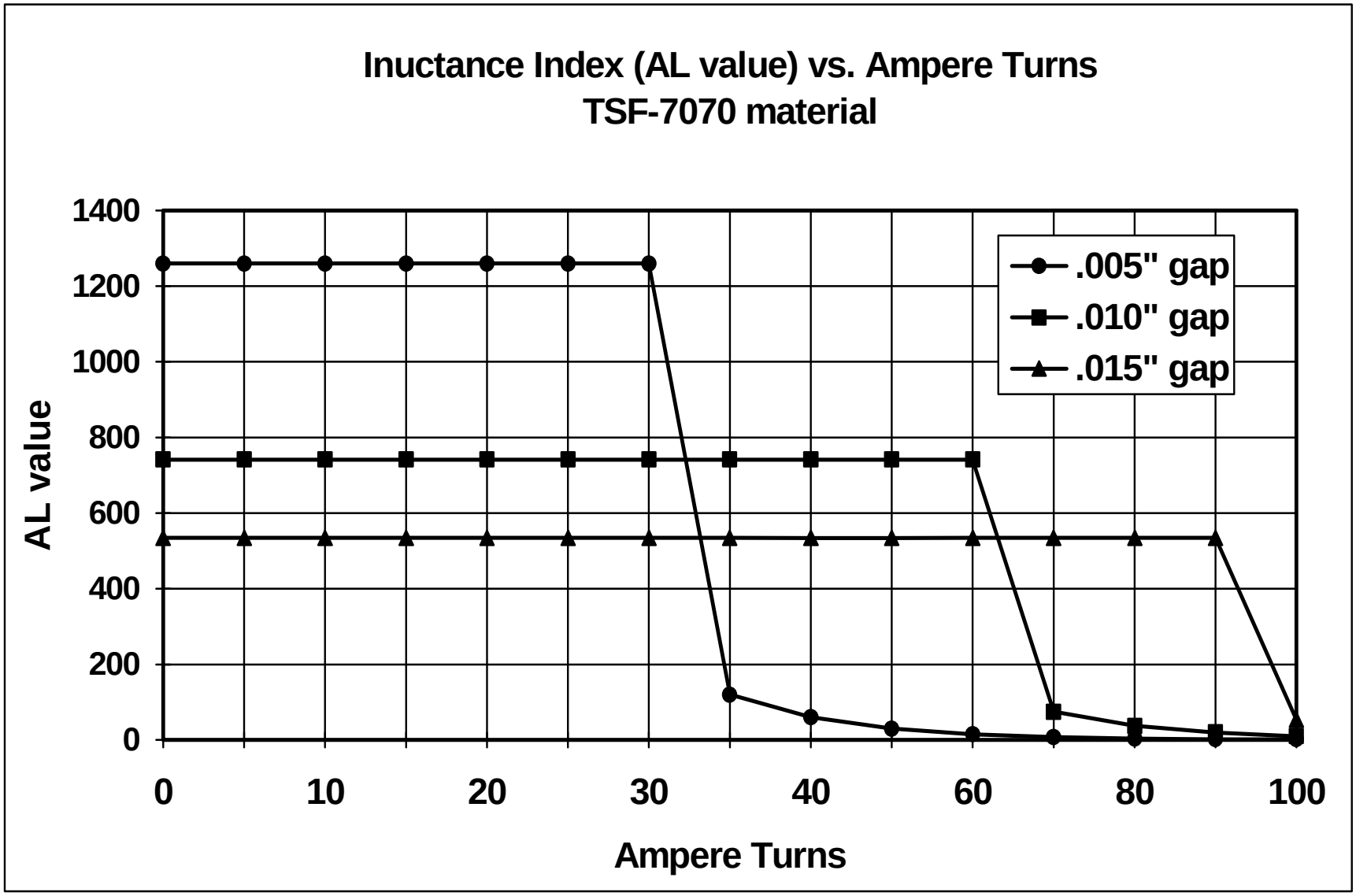
Br = (R) (C) ((PBr + NBr) / 2) (10^8) / (N) (Ae)

Hc = (.4) (π) (N) ((PHc + NHc) / 2) / Le

Hs = (.4) (π) (N) ((PHs + NHs) / 2) / Le

H = Magnetizing force in oersteds
B = Flux density in gauss
R= Resistance value of decade resistor in ohms
C = Capacitance value of decade capacitor in farads
N = Number of turns
Ae = Cross-sectional area in cm^3
Le = Magnetic path length in cm





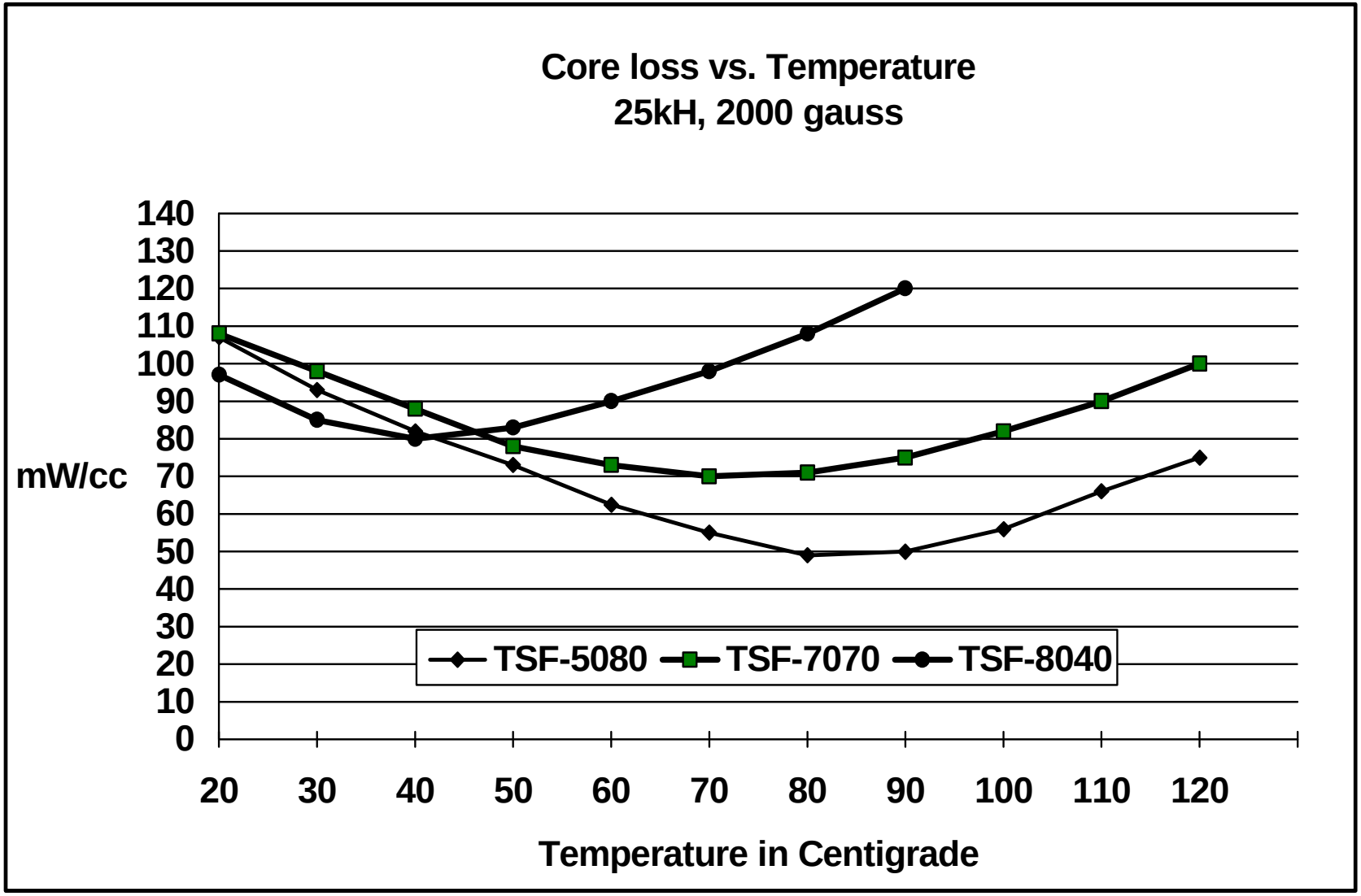
Wayn Kerr's 3245 Inductance Analyzer with their 3220 DC bias unit is used to measure inductance vs ampere turns.

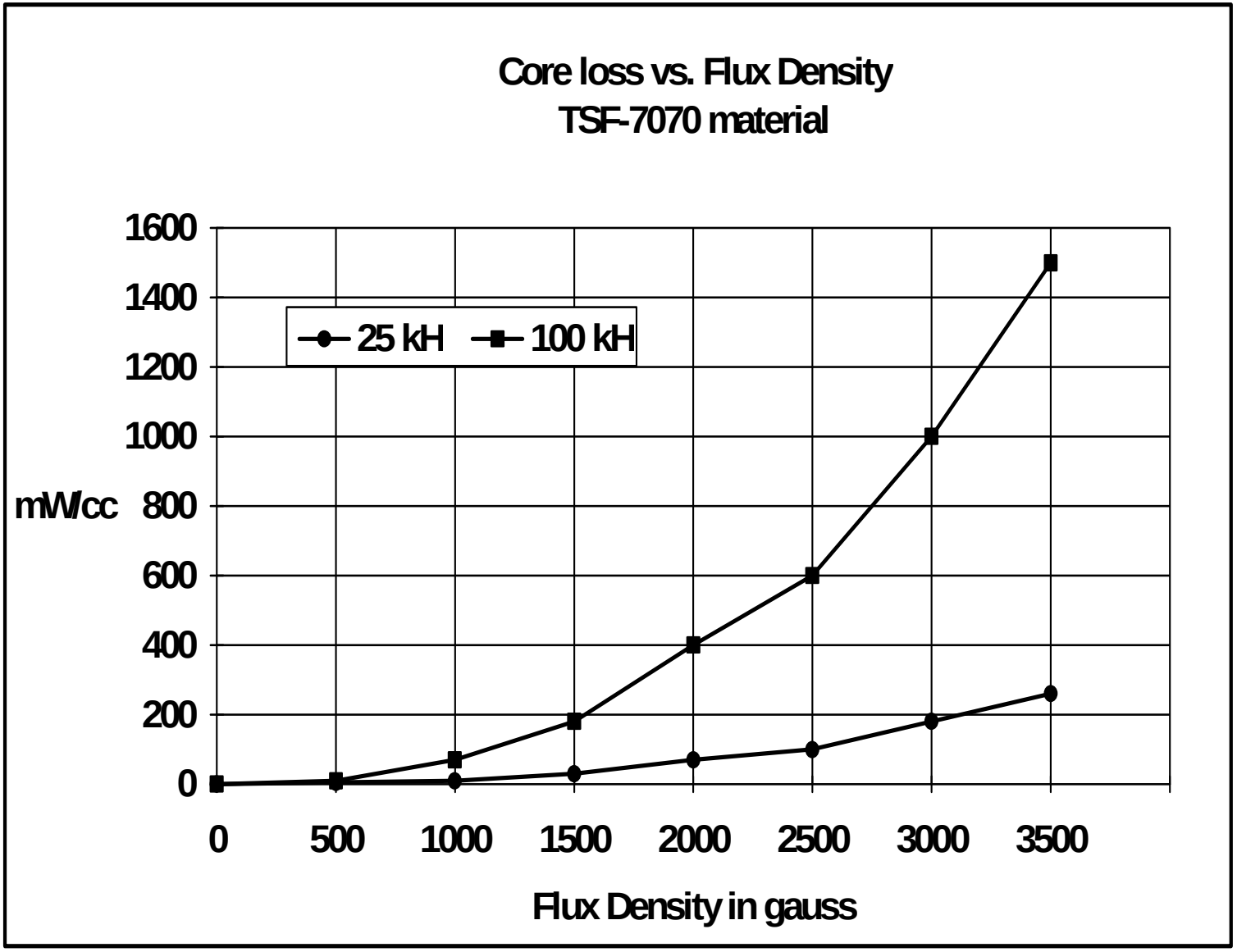
Each 3220 DC bias unit provides 20 amps and up to five can be connected in parallel to deliver a maximum of 100 amps.

Core Loss -

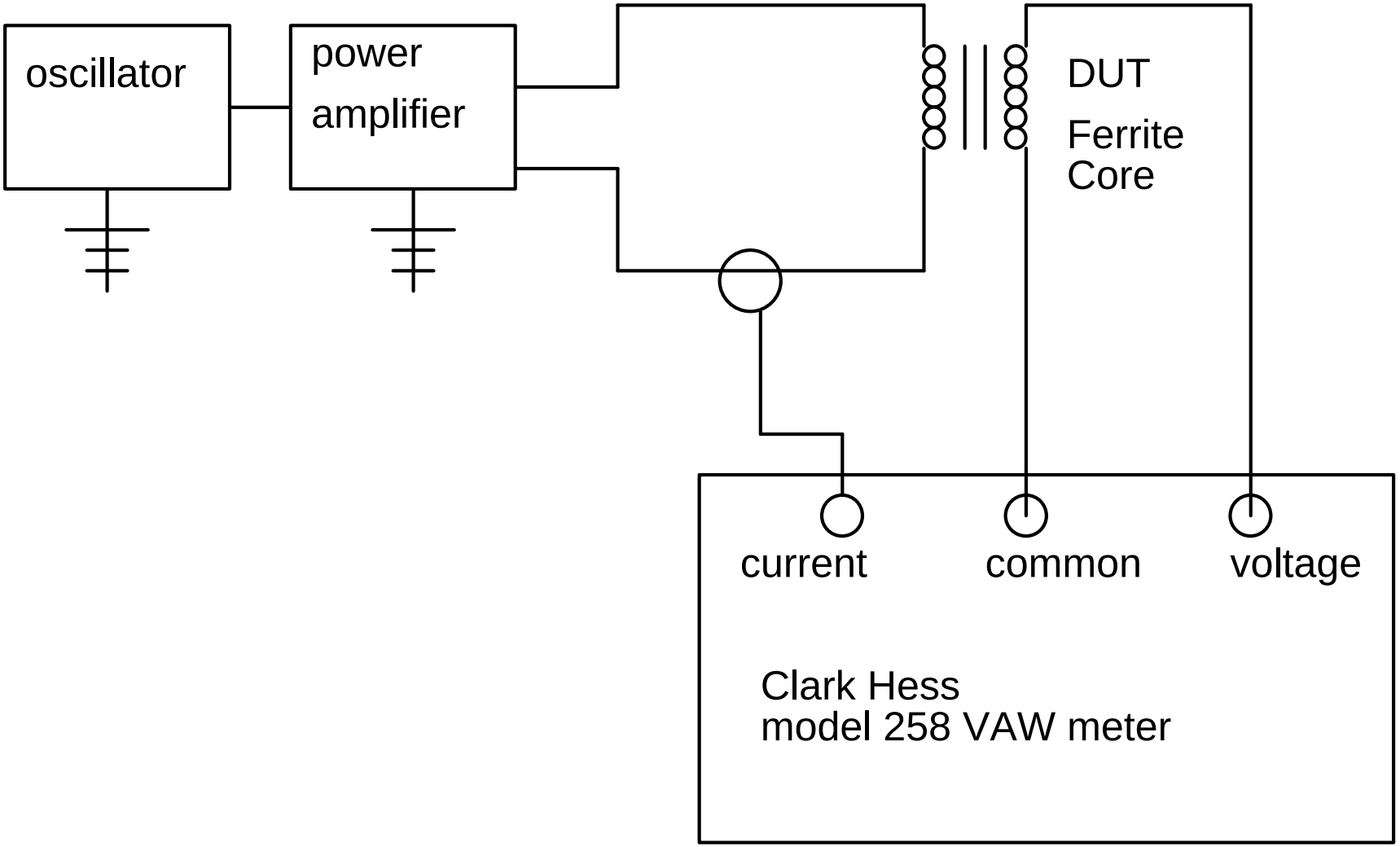
A measure of the efficiency of a material at high levels of magnetizing force.

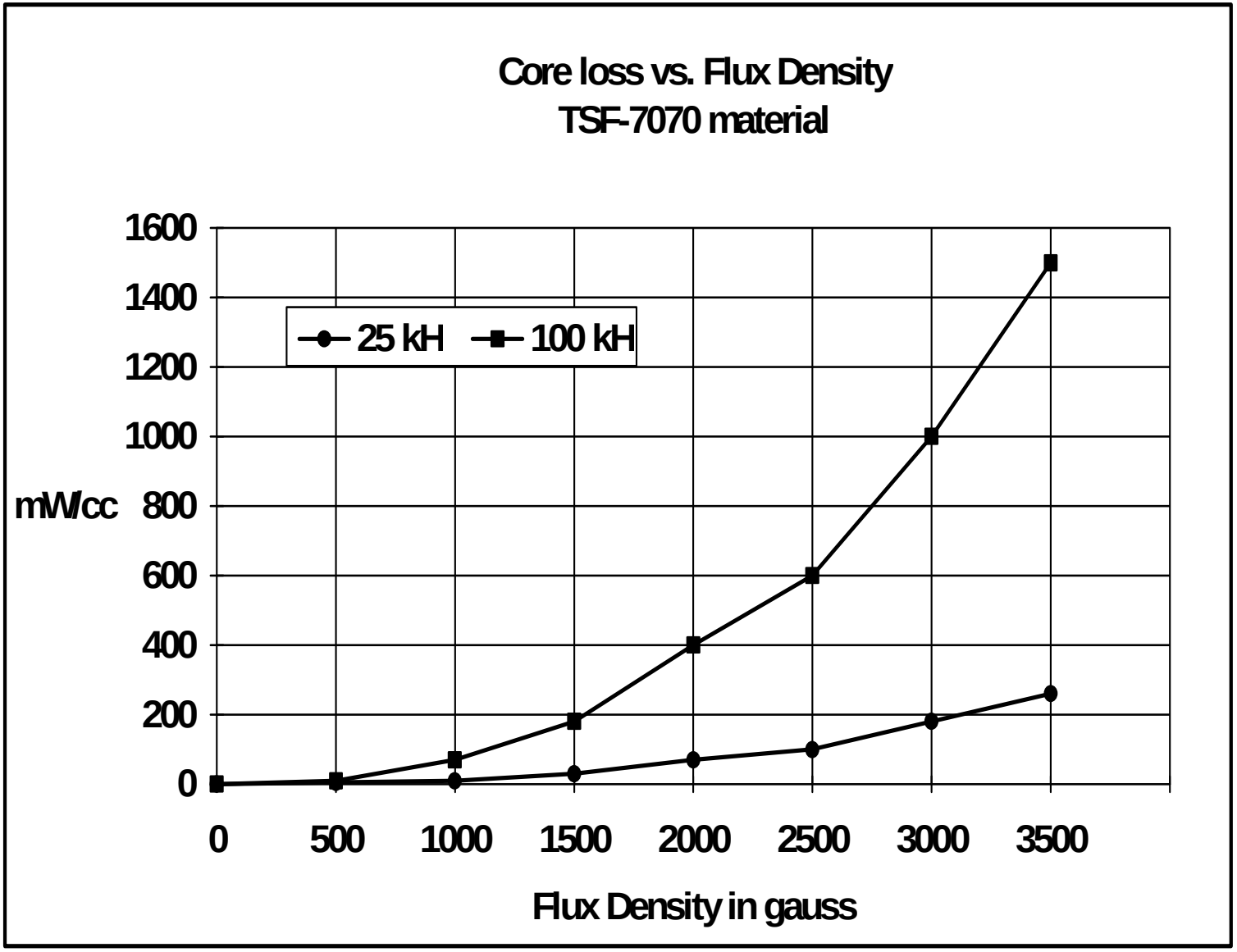
Dissipated electrical power which turns into heat inside a core when a magnetic field which varies with time is applied on the core.





Core Loss Measurement



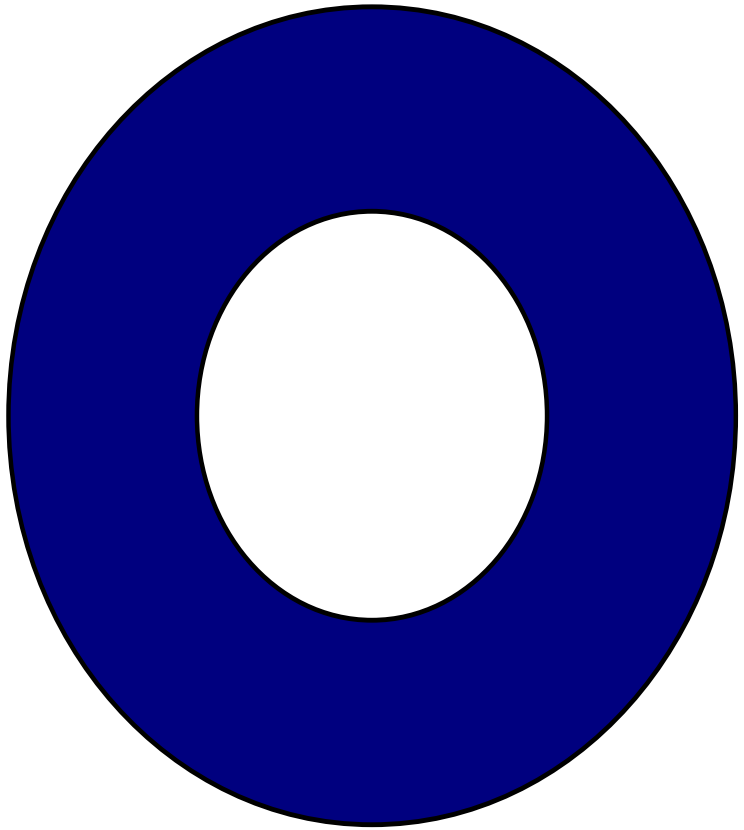


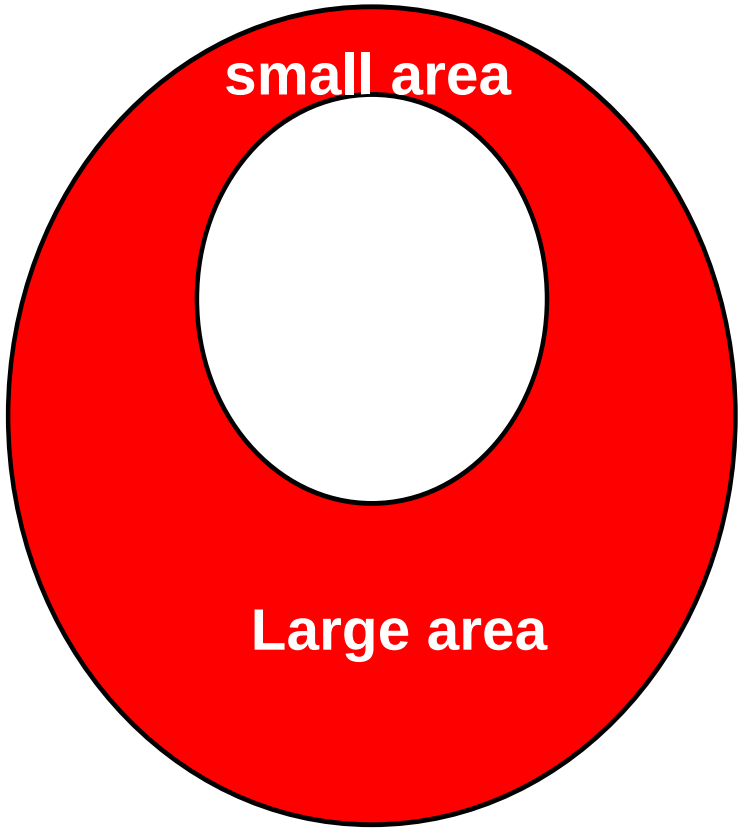
Core Loss Measurement

1. Set Oscillator frequency
2. Increase the oscillator amplitude until the desired voltage ($E = B(4.44) FNAe(10^{-8})$ is measured on the VAW meter.
3. Switch and read power in watts from the VAW meter

Cautions

- **Temperature measurements require long test leads that introduce impedance especially at high frequencies.**
- **Applied clamping pressure causes mechanical stresses that affect changes in magnetic parameters of soft ferrite materials.**
- **Cores with flux paths that have non-uniform cross sectional areas are difficult to model.**





uniform cross sectional area