Permenorm 5000 V5 / H2

TYPICAL ALLOY COMPOSITION (weight percent)

	Ni	Fe	additions
PERMENORM 5000 V5	47.5	balance	Mn, Si
PERMENORM 5000 H2	47.5	balance	Mn, Si

DESCRIPTION

PERMENORM 5000 exhibits the highest saturation polarization of 1.55 T in the NiFe system in combination with a high initial and maximum permeability.

In alloys with 45-50 % Ni the microstructure and thus the shape of the hysteresis loop can be altered over a wide range by selecting certain rolling or intermediate annealing steps. Therefore with materials of almost identical composition it is possible to have very different magnetic properties.

PERMENORM 5000 V5: Rotor Grade
PERMENORM 5000 V5 shows an almost isotropic relatively fine-grained structure after final heat treatment.

PERMENORM 5000 H2: Transformer Grade
PERMENORM 5000 H2 exhibits a very coarse-grained, anisotropic structure after final heat treatment. The cold rolled material can show a cubic texture which results in high permeability values in the rolling direction and to some extent in transverse direction after the final annealing.

FORMS OF SUPPLY

PERMENORM 5000 H2 is available as solid material (bar, rod, wire) or as cold rolled strip in thicknesses from 0.025 mm to 2.0 mm.
PERMENORM 5000 V5 is available as cold rolled strip in thicknesses from 0.05 mm to 2.0 mm.

APPLICATIONS

Inductive components and cores, strip wound cores, relay parts, measurement transducers, transformers, storage chokes, shielding, rotor and stator laminations, flux conductors and pole pieces in magnetic valves.

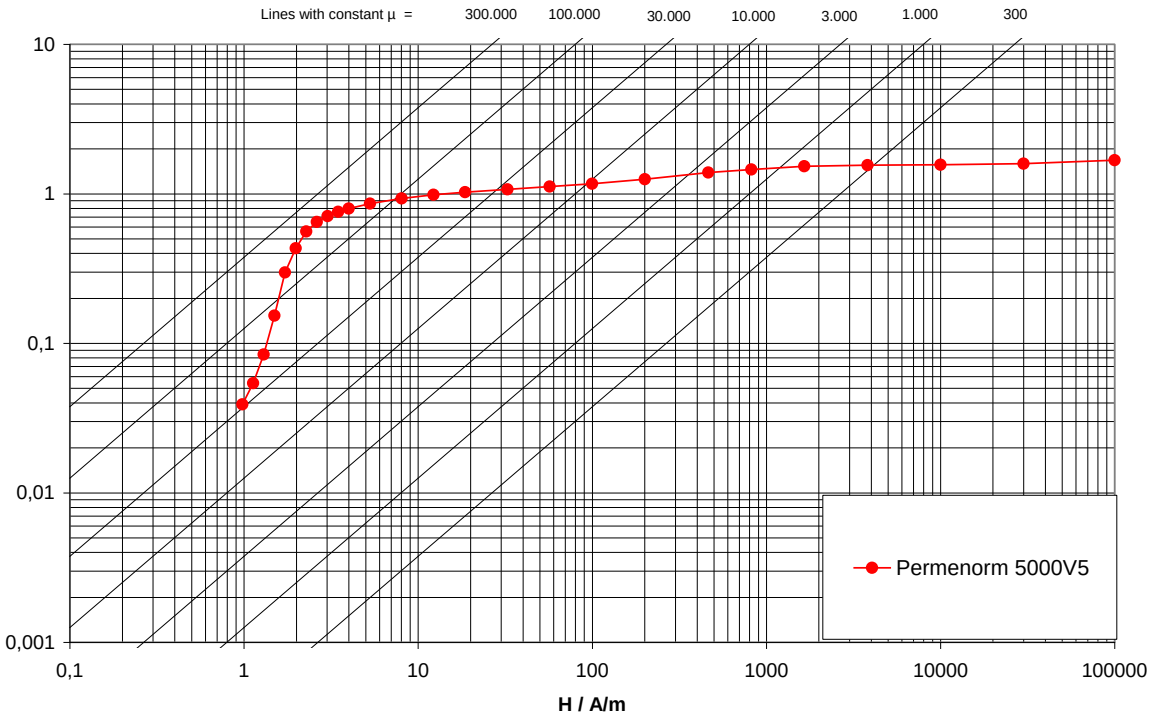
MAGNETIC PROPERTIES (typical values)

DC Magnetic Properties

Table 1: Static properties of stamped rings; strip thickness: 1 mm

Material	Permeability μ @ 0.4 A/m	Permeability μ_{max}	Coercivity (A/m)	Saturation polarization (T)
Permenorm 5000 H2	7000	120000	5	1.55
Permenorm 5000 V5	9000	135000	4	1.55

Figure 1: static properties; PERMENORM 5000 V5, measured on stamped rings; thickness 0.35mm



AC Magnetic Properties

Table 2: dynamic (50Hz) properties of solid material, measured on stamped rings,

Material	Permeability μ @ 0.4 A/m	Permeability μ_{max}	Losses @1T	Saturation polarization
Permenorm 5000 H2	12000	90000	p=0.25 W/kg at thickness 0.2 mm	1.55 T
Permenorm 5000 V5			p=0.42 W/kg at thickness 0.5 mm	1.55 T

Figure 2: Core Loss, PERMENORM 5000 V5, measured on stamped rings, thickness 0.35mm; measurement according ASTM 773-M01/IEC 60404-4

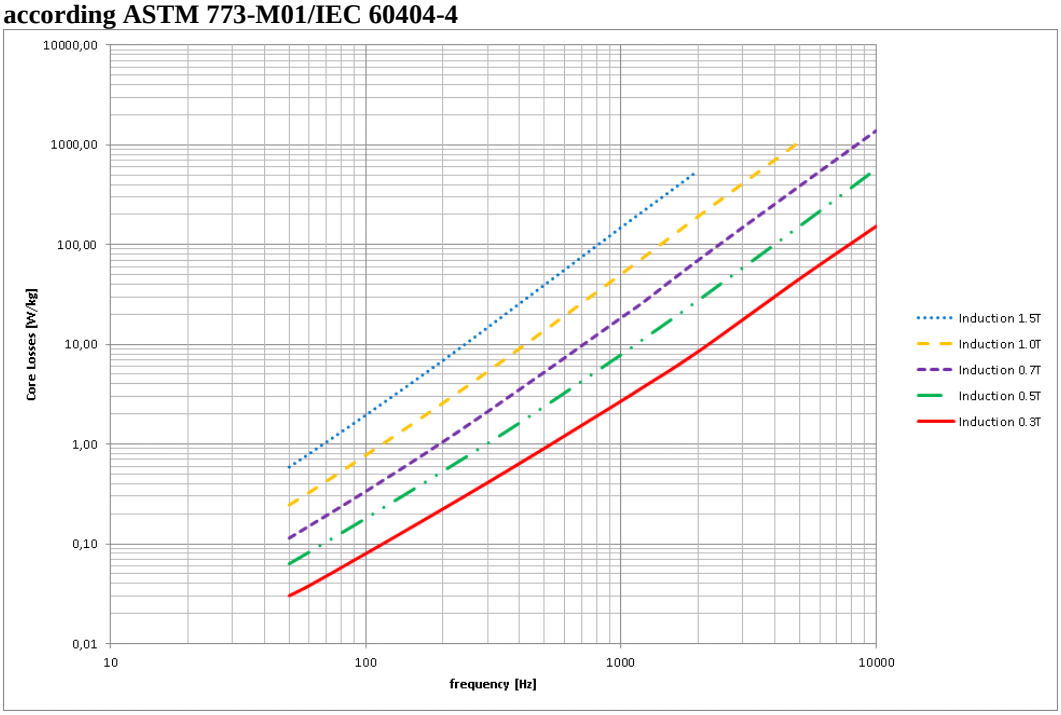
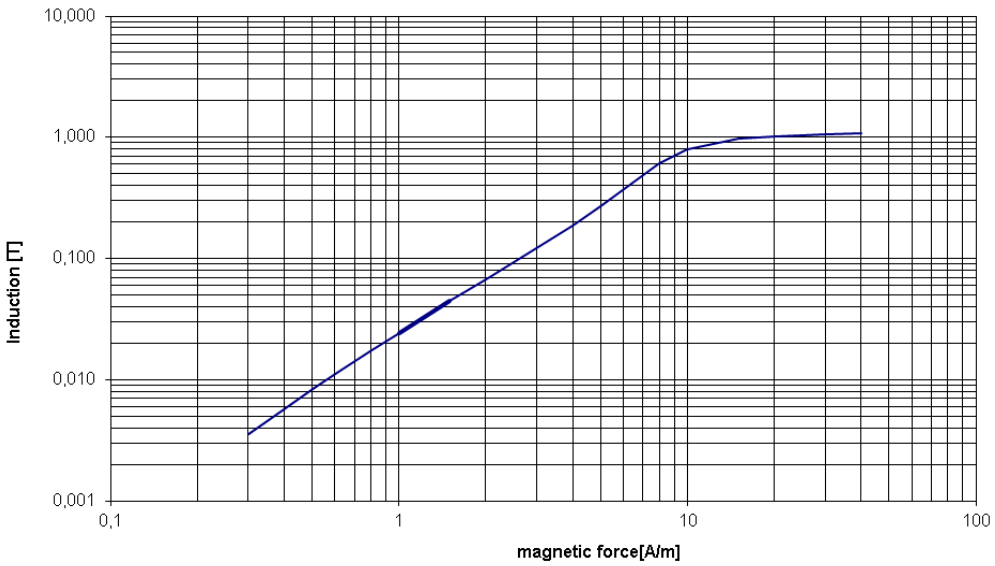


Figure 3: dynamic properties (50Hz), measured on stamped rings; thickness 0.35mm



Physical properties (typical values)

Table 3: typical values of physical properties

Physical properties	
Mass density	8.25 g/cm³
Electrical resistivity	0.45 Ohm mm²/ m
Thermal conductivity	13 - 14 W/m/K
Curie temperature	440°C
Coefficent of Thermal Expansion (20..200°C)	$8.85 \cdot 10^{-6}$/K*

*) after final magnetic annealing

Mechanical properties (typical values)

Table 4: typical values of physical properties

Mechanical properties in cold-rolled condition	
Tensile strength	850 - 1100 N/mm²
Young´s modulus	195 kN/mm²
Vickers hardness HV	220 – 300

HEAT TREATMENT

For optimum magnetic properties PERMENORM 5000 should be annealed in an oxygen-free, dry hydrogen atmosphere with a dew point below -40°C, at a temperature above 1000°C. Recommended parameters for stationary annealing are 5 h 1150°C.