

Designation	PERMENORM® 5000 V5	UNS	AISI	LMSA
		-	-	F110

Chemical composition

Fe	Ni	Mn	Si
Balance	46.0 - 49.0	0.30 - 0.80	0.10 - 0.40

Values (Weight %). In order to achieve maximum homogeneity and consistent quality, the actual manufacturing tolerances are tighter and more precisely than the composition indicated.

Main technical properties and features

Permenorm® 5000 V5 alloy is a soft magnetic alloy containing approximately 46 % Ni and around 50 % iron. This alloy has a high initial and maximum permeability compared to alloys with a high nickel content. The high iron content has disadvantages. The dynamic properties (at higher magnetic field frequencies) are poorer than those of Mumetall®, and the coercive field strength and therefore the core losses are higher. Permenorm® 5000 V5 has a fine-grained structure after final annealing treatment.

The Lamineries MATTHEY produces the alloy Permenorm® 5000 V5, in precision cold-rolled product forms (strip and sheet).

Typical uses

Shields, measuring systems, telephone diaphragms, magnetic valves, rotor and stator laminations, shielding rotor, coil cores for stepping motors in quartz watches, relays. Often used in magnetic shielding for medium to high field strengths.

Typical manufacturing range

	Thickness (mm)	Width (mm)	Length (mm)
Rolled products Strip in coils ^[1]	0.010 - 1.000	1.5 - 200.0	-
Strip as sheets ^[1]	0.015 - 0.400	10.0 - 200.0	100 - 3000

[1] Not all our production possibilities are presented here. Other dimensions or product forms available upon request. Some combinations of thicknesses and widths are not possible.

Mechanical properties of strips

Temper	R _m (N/mm ²)	R _{p0.2} (N/mm ²)	A _{50mm} (%)	Hardness HV
R550 soft annealed	550 - 800	300 - 550	12 min.	160 - 250
R750 ½ hard	750 - 1050	550 - 900	-	230 - 330
R1000 hard	1000 - 1250	900 - 1200	-	320 - 400

Physical properties

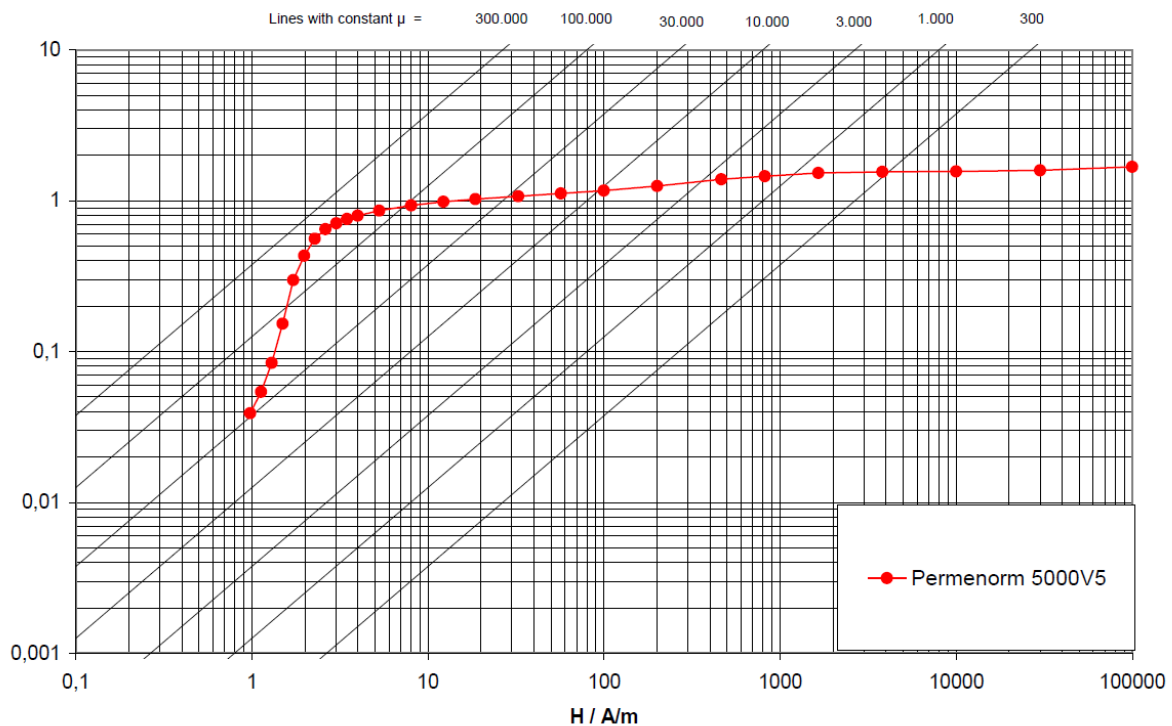
Modulus of elasticity	kN/mm ²	140
Density	g/cm ³	8.25
Linear dilatation coefficient	10 ⁻⁶ /°C	10
Thermal conductivity at 20°C	W/m °K	13 - 14
Electrical resistivity	μΩcm	45
Curie temperature	°C	440

Magnetic properties

Conditions	Thickness (mm)	Saturation polarization J_s (T)	Coercivity	Permeability (μ_{max})	μ_4 (Relative Permeability à 0.40 A/m)	Losses at 1T (W/kg)
Static	0.35 mm	1.55	0.04	135000	9000	-
Dynamic 50 Hz	0.35 mm	1.55	-	-	-	$P_{1.0}=0.42$ épaisseur 0.5mm

Heat treatment of finished parts

The optimum magnetic properties for the alloy Permenorm® 5000 V5 are obtained by high temperature heat treatment on the finished components. The treatment is initially designed to recrystallize the metal. The treated parts must be handled with care, to avoid all plastic deformation which will degrade the magnetic properties. A protective atmosphere is essential to avoid oxidation. The use of pure dry hydrogen is recommended. The parts to be treated must be degreased and cleaned before annealing. The inert powder (alumina or magnesia) often used to avoid direct contact between different parts must be perfectly anhydrous. A high temperature promotes both coarsening of the primary grains and purification of the metal (notably carbon elimination). The optimum heat treatment is 2-5 hours at 1150°C in pure dry hydrogen.



Static properties, Permenorm® 5000 V5, measured on stamped rings; thickness 0.35mm (Source Vaccumschmelze)

Tolerances (strip and foil)

Thickness	Thickness (mm)		Lamineries MATTHEY			
	≥	<	LMSA Standard	LMSA Precision	LMSA Extreme	
<p>The table shown is an outline of our typical thickness tolerances available. They are tighter than industry standards.</p> <p>Our "LMSA Precision" and "LMSA Extreme" tolerances are available upon request.</p>	-	0.025	-	-	± 0.001	
	0.025	0.050	± 0.003	± 0.002	± 0.0015	
	0.050	0.065	± 0.004	± 0.003	± 0.002	
	0.065	0.100	± 0.006	± 0.004	± 0.003	
	0.100	0.125	± 0.008	± 0.006	± 0.003	
	0.125	0.150	± 0.008	± 0.006	± 0.004	
	0.150	0.250	± 0.010	± 0.008	± 0.004	
	0.250	0.300	± 0.012	± 0.008	± 0.005	
	0.300	0.400	± 0.012	± 0.009	± 0.005	
	0.400	0.500	± 0.015	± 0.010	± 0.006	
	0.500	0.600	± 0.020	± 0.012	± 0.007	
	0.600	0.800	± 0.020	± 0.014	± 0.007	
	0.800	1.000	± 0.025	± 0.015	± 0.009	
	1.000	1.200	± 0.025	± 0.018	± 0.012	
	1.200	1.250	± 0.030	± 0.020	± 0.012	
1.250	1.500	± 0.035	± 0.025	± 0.014		
Width	Our width tolerances "Standard" is +0.2, -0.0 (or ± 0.1 mm upon request). They are available for slit widths < 125 mm and thicknesses < 1.00 mm. Special tolerances upon request.					
Camber	Width (mm)		Camber max. (mm/m)			
	>	≤	LMSA standard		LMSA extreme	
			≤ 0.5 mm	> 0.5 mm	≤ 0.5 mm	> 0.5 mm
	3	6	12	-	6	-
	6	10	8	10	4	5
10	20	4	6	2	3	
20	250	2	3	1	1.5	
Surface	Special surface qualities upon request					
Flatness	Special requirement on the longitudinal or transversal flatness upon request					

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