LAMINERIES MATTHEY
NOTZ group advanced metal solutions

MUMETALL®

		UNS	AISI	LMSA
Designation	**MUMETALL®**	-	-	**F105**

Chemical composition

Fe	Ni	Mo	Cu
Balance	75.0 - 78.0	2.50 - 4.50	3.00 - 6.00

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

Mumetall® is a soft magnetic alloy casted by the company VACUUMSCHMELZE, containing approximately 76 % Ni, 5 % molybdenum and 5 % copper. The presence of molybdenum and copper increases the magnetic permeability. The high nickel content allows the use of this material without the need of a corrosion resistant coating. This alloy has a saturation polarization of about 0.8 Tesla, the highest technically feasible permeability, and a very low coercive force, the material saturates at low magnetic fields. This gives it low hysteresis losses when used in AC magnetic circuits.

Mumetall® alloy has good ductility and is easy to cold work, allowing it to be easily formed into thin sheets needed for magnetic shields. The high permeability of this alloy provides a low reluctance path to the magnetic flux, which explains its use in magnetic shields against static or slowly varying magnetic fields. Magnetic shields made from high permeability alloys such as Mumetall®, do inhibit the magnetic fields, but offers the path for the magnetic field lines surrounding the shielding region. This creates a field depletion in the shielded area.

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

Typical uses

The main applications are relays (for ground fault circuit breakers and railway signaling, for example), stepper motors for watches, safety caps for gas equipments, shielding, magnetic sensors (current, angular position, displacement) and aeronautical engineering (hyper-frequency oscillators), AC magnetic circuits.

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/mm²)	$Rp_{0.2}$ (N/mm²)	A_{50mm} (%)	Hardness HV
R480	soft annealed	480 - 650	150 - 350	25 min.	90 - 170
R650	½ hard	650 - 900	400 - 750	3 min.	170 - 290
R900	hard	900 - 1200	850 min.	-	290 - 380

Physical properties

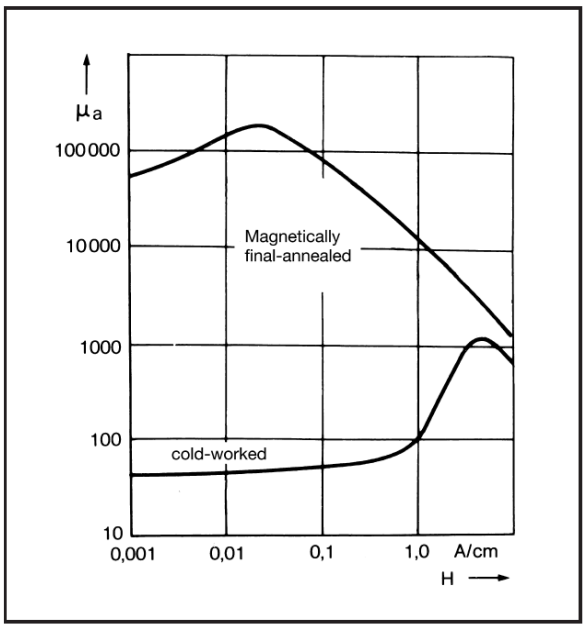
Modulus of elasticity	kN/mm^2	200
Density	g/cm^3	8.7
Melting point	°C	1450
Linear dilatation coefficient	10^{-6}·/ ºC	13.5
Thermal conductivity at 20°C	W/m °K	17 - 19
Electrical resistivity	μΩcm	55
Specific heat	J/(kg. K)	460
Curie temperature	ºC	400
Saturation induction at 20ºC	Tesla	0.8

Magnetic properties

Conditions	Thickness (mm)	Saturation polarization J_s (T)	Coercivity	Permeability (μ_{max})	μ_4 (Relative Permeability à 0.40 A/m)	Losses À 1T (W/kg)
Static	1.00	0.80	0.015	250000	60000	-
Dynamic (50 Hz)	0.20	0.80	-	150000	60000	$P_{0.5}$=0.025

Heat treatment of finished parts

The optimum magnetic properties for the Alloy Mumetall® 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, in order 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 1000 - 1100ºC in pure dry hydrogen.



Effect of final heat treatment on MUMETALL® (Source Vacuumschmelze)

Tolerances (strip and foil)

Thickness

The table shown is an outline of our typical thickness tolerances available. They are tighter than industry standards.

Our "LMSA Precision" and "LMSA Extreme" tolerances are available upon request.

Thickness (mm)		Lamineries MATTHEY		
≥	<	LMSA Standard	LMSA Precision	LMSA Extreme
-	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

Our tolerance "LMSA Standard" respects the EN Standard 1654 (Length of measurement 1000 mm).
Other tolerances upon request.

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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