

Designation	DIN	EN	ASTM	AISI	LMSA
X2NiCoMo18-9-5	1.6358	-	-	-	E100

Chemical composition (Weight %)

Fe	C	Co	Ni	Mo	Ti	Al	Mn	Si	P	S
Balance	≤ 0.03	8.0-10.0	17.0-19.0	4.5-5.5	0.5-0.8	0.05-0.15	≤ 0.10	≤ 0.10	≤ 0.01	≤ 0.01

In order to achieve maximum homogeneity and consistent quality, the actual tolerances on both alloy components and impurities are significantly tighter and more precisely defined than the standard composition indicated.

Typical indicative chemical composition (Weight %)

Fe	Ni	Co	Mo	Ti
Balance	18.0	9.0	5.0	0.5

Main technological properties

This low carbon hardenable martensitic steel (maraging steel) allows an easy cold working of high spring property parts. The produced strips are delivered in soft, skin passed and cold rolled tempers. Durnico® has a high fatigue strength limit and the cutting edges, often critical in mechanical clock industry, for example, remain smooth. The hardening of parts (typically at 480°C 3h under vacuum or under inert atmosphere) results in a high degree of hardening without perceptible dimensional change.

After an annealing at high temperature (typically 800-1000°C) and a rapid cooling carried out during the production process, a soft annealed condition is achieved which corresponds to a soft martensite. In contrast to carbon steels, there is no distortion of the lattice by interstitial carbon atoms and the martensitic structure can be easily cold deformed. Moderate temperature tempering results in a high degree of hardening by precipitation of very stable Ni₃Ti or Fe₂Mo intermetallics. This hardening is obtained without any perceptible dimensional change. In the majority of cases this allows the finishing of parts in soft annealed metal without retouching after heat treatment. The work hardening only becomes significant for high rates (> 60%), but the effect of tempering on Durnico® is practically additive. Therefore, the higher tensile strengths are obtained by adding both contributions.

Lamineries MATTHEY SA produces two different Maraging steels: Durnico®, X2NiCoMo18-9-5, 1.6358 (Durimphy, NiMark 300) and Durinox, X2CrNiMo10-10-5, 1.6908 (Ultrafort). A slightly higher mechanical strength can be achieved with Durnico®. Corrosion resistance of Durinox exceeds that of Durnico®, though is slightly lower than that of stainless steel 1.4435, 316L.

Typical manufacturing range

		Thickness (mm)	Width (mm)	Length (mm)
Rolled products	Strips in coils ¹⁾	0.030 - 2.000	1.5 - 200.0	-
	Foil cut to length ¹⁾	0.030 - 1.500	10.0 - 200.0	100 - 3000

1) All our production possibilities are not presented here. Other dimensions or other product forms upon request. Certain combinations of thicknesses and widths are not possible.

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Mechanical properties of strips

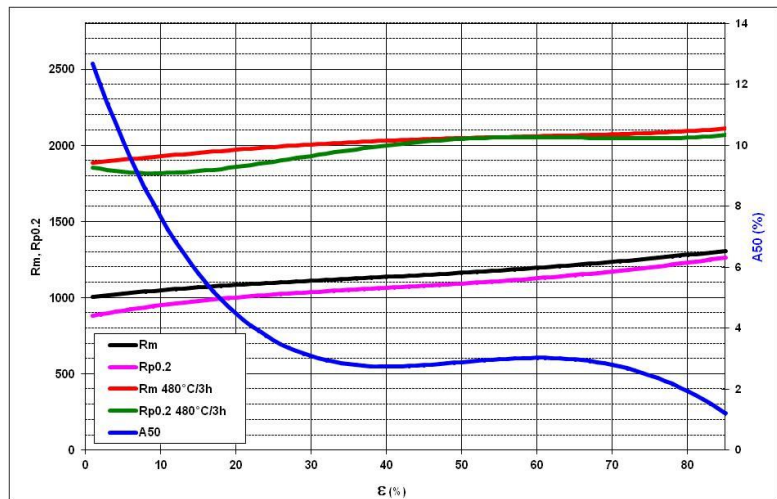
Temper	Heat Treatment	Rm (N/mm ²)	Hv (N/mm ²)
R1000	H310 soft	1000-1200	310-345
R1050	H310 skin passed	1050-1250	310-350
R1300	H360 hard	≥ 1200	≥ 360
After hardening (at the customer)			
R1800	H500 soft + hardened	1800-2100	540-630
R1900	H520 skin passed + hardened	1900-2100	550-640
R2200	H600 hard + hardened	≥ 2100	≥ 600

Typical uses

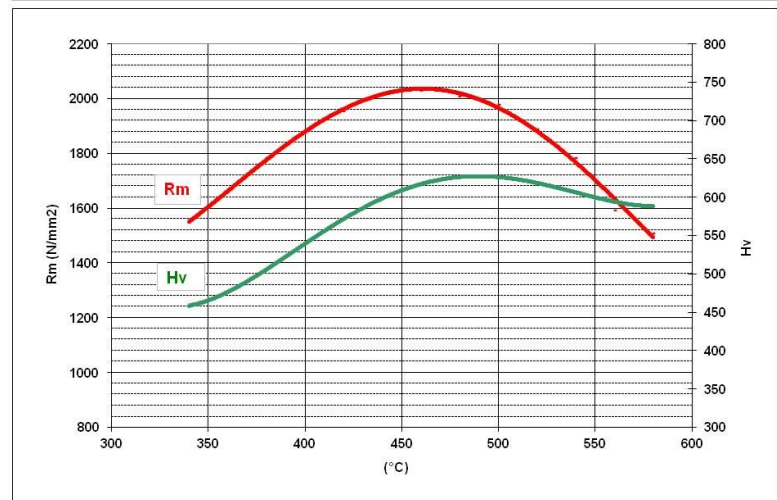
Springs, pallet forks, wheels, bridges, connectors, various parts subjected to high stresses, etc.

Strain-hardening curve.

Rm and Rp_{0.2} values before and after heat treatment.



Evolution of Hv and Rm of skin passed Durnico® according to the processing temperature (3 hours).



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Physical properties

Modulus of elasticity	kN/mm ²	195
Poisson ratio		0.3
Density	kg/dm ³	8.1
Melting point / Melting range	°C	1430-1460
Linear dilatation coefficient (x10 ⁻⁶)	/ °C	Hardened ¹⁾ : 9.5 (0-100°C)
Thermal conductivity at 20°C	W/m °K	Hardened ¹⁾ : 19.7
Specific heat at 20°C	J/kg K	Hardened ¹⁾ : 440
Electrical resistivity	μΩcm	Hardened ¹⁾ : 44
Electrical conductivity	MS/m	Hardened ¹⁾ : 2.28
Curie temperature	°C	Approx. 400

¹⁾ These values are given for standard tempering at 480°C on soft annealed metal. They can vary significantly with the tempering temperature.

Tolerances

Thickness	Thickness (mm)		Lamineries MATTHEY SA		
	≥	<	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

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

Upon request: our "LMSA Precision" and "LMSA Extreme" tolerances are also available.

Width

Our width tolerance is + 0.2 -0.0 mm (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
Our tolerance "standard" respects the EN Standard 1654 (Length of measurement 1000 mm).	3	6	12	-	6	-
Other tolerances upon request.	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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