



**Nace MR0175**  
**ASTM F562 / ISO 5832-6 / BS 7252-6 Surgical Implant Applications**

UNS  
R30035

AISI  
-

LMSA  
E400

**Chemical composition (Weight %)**

Co	Ni	Cr	Mo	Fe	Ti	Mn	Si	C	P	B	S
Bal.	33.0-37.0	19.0-21.0	9.0-10.5	≤ 1.0	≤ 1.0	≤ 0.15	≤ 0.15	≤ 0.025	≤ 0.015	≤ 0.015	≤ 0.010

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 chemical composition (Weight %)**

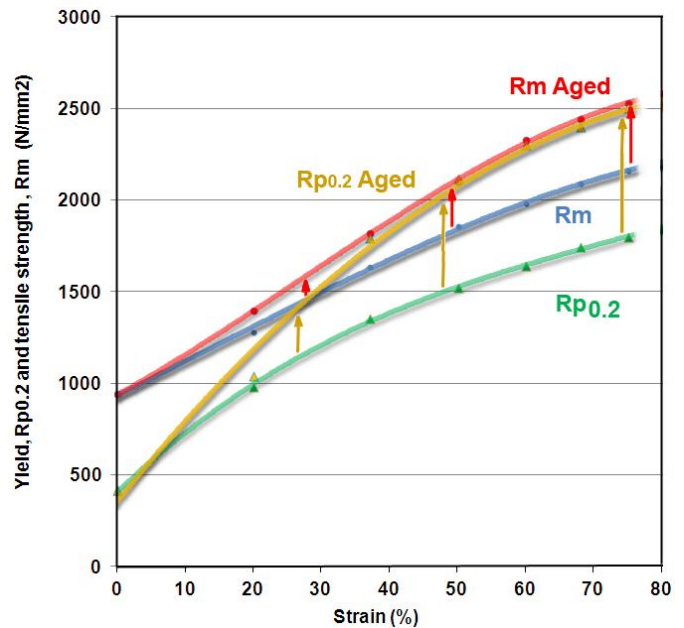
Ni	Co	Cr	Mo	Fe	Ti
35.0	33.5	20.5	9.5	0.5	0.01

**Main technical properties and features**

Lamineries MATTHEY SA produces the Alloy MP35N® in precision cold-rolled product forms (strip and sheet). This alloy is produced by vacuum induction melting (VIM), followed by vacuum arc remelting (VAR). MP35N® alloy is a multi-phase nickel-cobalt based alloy with a unique range of properties - ultra high strength, toughness, corrosion resistance, biocompatibility and moreover MP35N® is nonmagnetic.

MP35N® alloy is included in NACE MR0175 to a maximum hardness of Rockwell 35 HRC (maximum hardness of Rockwell 51 HRC in specific cold reduced plus aged conditions). This material requirement lists sulfide stress cracking resistant materials for exposure to sour environments, such as in gas and oil well service. MP35N® is suitable for medical implants and orthodontic/prosthetic applications and also respects ASTM F562 / ISO 5832-6 / BS 7252-6 for Surgical Implant Applications. MP35N® resists corrosion in most mineral acid, hydrogen sulfide and seawater environments whilst exhibiting excellent resistance to stress corrosion cracking and hydrogen embrittlement, even at high strength levels. MP35N® alloy is an extremely noble metal. This can result in galvanic corrosion when electrically coupled with more active metals such as carbon steel and stainless steels.

The annealing temperature of MP35N® is between 1040-1150°C in a protective or neutral atmosphere. The strength levels developed by MP35N® alloy are primarily the result of mechanical working, such as cold rolling for sheet and strip products. Both strength and hardness increase in a nearly linear manner with the percentage of cold work. As expected, ductility decreases with higher cold work. However, even with large amounts of deformation, an excellent ductility is retained. After cold working, MP35N alloy can be aged at different temperatures for increased strength. The alloy will respond to aging only if already cold work strengthened. No increase in strength will result from aging annealed material. For optimum mechanical properties, cold rolled MP35N® should be aged at 550-600°C for 4 hours, then air cooled. The effect of the cold rolling, followed by an hardening at 550°C during 4h is shown on the strength-strain curve.



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### Typical manufacturing range

		Thickness (mm)	Width (mm)	Length (mm)
<b>Rolled products</b>	Strip in coils <sup>1)</sup>	0.010 – 0.400	1.5 - 200.0	-
	Strip as sheets <sup>1)</sup>	0.015 – 0.400	10.0 - 200.0	100 - 3000

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

### Mechanical properties of strips

Temper		Heat Treatment	R <sub>p0.2</sub> (N/mm <sup>2</sup> )	R <sub>m</sub> (N/mm <sup>2</sup> )	A <sub>50mm</sub> 1) (%)	HV
R790	soft annealed	-/-	240-450	790-1000	≥ 30	200-300
R900	¼ hard	-/-	450-800	900-1150	≥ 15	260-360
R1000	½ hard	-/-	700-1150	1000-1250	≥ 10	290-390
R1200	hard	-/-	≥ 1000	≥ 1200	≥ 2	≥ 360

1) Available for thicknesses ≥ 0.300 mm

### Physical properties

Modulus of elasticity	KN/mm <sup>2</sup>	220-240 (annealed-cold rolled and aged)
Poisson ratio		0.29
Density	kg/dm <sup>3</sup>	8.43
Melting point / Melting range	°C	1315-1450
Linear dilatation coefficient (20-300°C)	10 <sup>-6</sup> / °C	12.8 (20-100°C), 13.7 (20-200°C), 14.8 (20-320°C)
Thermal conductivity at 20°C	W/m °K	11.3
Electrical resistivity	μΩcm	103
Electrical conductivity	MS/m	0.97
Specific heat at 20°C	J/(kg K)	502
Magnetic properties		Non-magnetic in soft and cold worked tempers
Permeability		μ = 1.00092 (annealed - T 25°C)

### Typical uses

Because of its unique combination of properties, MP35N® alloy has been used in a wide variety of applications. MP35N alloy has been used in fasteners, springs, nonmagnetic electrical components and instrument parts in medical, seawater, oil and gas, chemical and food processing environments and aerospace. MP35N can be effectively used at cryogenic temperatures without embrittlement and maintains its properties at temperatures up to 320°C. It is also suitable for medical implants and orthodontic/prosthetic devices.

### Tolerances

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Thickness	Thickness (mm)		Lamineries MATTHEY SA		
	≥	<	LMSA Standard	LMSA Precision	LMSA Extreme
		0.025	-	-	± 0.001
<p>The table shown is an outline of our typical thickness tolerances available, which are tighter than industry standards.</p> <p>Our "Precision" and "Extreme" tolerances are available upon request.</p>	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 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
<p>Our tolerance "standard" respects the EN Standard 1654 (Length of measurement 1000 mm). Other tolerances upon request.</p>	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 longitudinal or transversal flatness requirements upon request

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