Alloy Brush 360

		DIN	EN Nr.	UNS (ASTM)	AISI	LMSA
Designation	**NiBe2**			N03360	-	**A800**

Chemical composition (% weight)

Ni*	Be	Ti	Cu	Fe	Si
Remainder	1.85 - 2.05	0.4-0.6	0.25% max.	0.20% max.	0.20% max.

*Nickel plus additions Be + Ti + Cu > 99.5% min.

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 analysis indicated.

Main technical properties

The alloy Brush 360, NiBe2 (UNS N03360) beryllium nickel combines unique mechanical and physical high performances properties. The advantages include among others, a high ultimate tensile strength up to more than approximately 2000 N/mm^2, an excellent formability as well as a very high resistance to thermal stress relaxation up to temperatures exceeding 300°C. This alloy is recommended in all applications requiring particularly high spring properties at high temperatures. We find applications for Brush 360, NiBe2 (UNS N03360) in the connector industry at temperatures of use which can reach 300°C and sometimes 350°C, where all the copper alloys cannot be used at a higher temperature than 200°C. Due to its excellent resistance to temperature fluctuations, this alloy is also used for the production of components that are subjected to elevated temperatures for short intervals (up to 380°C). This alloy also maintains good spring properties in these conditions.
The fatigue strength is excellent; it can reach more than 700N/mm² for 10^6 (reverse bending R=-1), which is more than two times higher than that of CuBe2, alloy 25.

The precipitation hardening of this alloy Brush 360, NiBe2 (UNS N03360) is possible. During this treatment an increase of density appears (approximately 0.5%), which involves a dimensional shrinking of the material of about 0.2%. A decrease of the cold formability is induced by such a heat treatment, contrary to the mechanical resistance, which can rise from 300 to 500 N/mm², according to the temper and condition of heat treatment.
The surface preparation of the NiBe2 remains simple by mechanical or chemical processes.

Manufacturing range

		Thickness (mm)	Width (mm)	Length (mm)
Rolled products	Strips in coils [1)]	0.015 - 2.000	1.5 - 200.0	-
	Strips, sheets in [1)]	0.015 - 1.500	10.0 - 200.0	100 - 3000

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

Typical uses

Electronic components exposed to high temperatures and requiring good spring properties. Manufacture of thermostats, bellows, burn-in connectors and sockets, casings, diaphragms and membranes, etc.

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Mechanical properties of strips

Temper		Heat treatment	$Rp_{0.2}$ (N/mm^2)	Rm (N/mm^2)	A_{50mm} (%)	Hv (N/mm^2)	Bendability R/t (90°) T/L [1]
A	Soft annealed	-/-	270-490	650-900	>30	100-200	0/0
¼ H	¼ hard	-/-	440-860	750-1040	>15	150-295	0/0
½ H	½hard	-/-	790-1180	900-1210	>4	180-385	1.2/1.2
H	hard	-/-	1030-1310	1030-1310	>1	220-490	2.0/2.0

1) Minimal aptitude for bending with 90°. R=rayon of curve, t = the thickness of the band, T = transversal, perpendicularly to the axis of rolling, "good way" and L = longitudinal, parallel to the axis of rolling, "bad way".

Mill-hardened tempers

Temper	Heat treatment	$Rp_{0.2}$ (N/mm^2)	Rm (N/mm^2)	A_{50mm} (%)	Hv (N/mm^2)	Bendability R/t (90°) T/L [1]
MH2	Mill-hardened tempers. No further heat treatment is required.	680-870	1060-1240	>14	-	0/0
MH4		820-1070	1240-1420	>12	-	0.5/0.5
MH6		1030-1210	1370-1550	>10	-	1.0/1.2
MH8		1170-1420	1510-1690	>9	-	1.2/1.6
MH10		1370-1550	1650-1860	>8	-	1.5/2.2
MH12		1510-1700	1790-2000	>8	-	2.0/3.0

1) Minimal aptitude for bending with 90°. R=rayon of curve, t = the thickness of the band, T = transversal, perpendicularly to the axis of rolling, "good way" and L = longitudinal, parallel to the axis of rolling, "bad way".

Heat treatment at customer's plant

Temper		Heat treatment [2]	$Rp_{0.2}$ (N/mm^2)	Rm (N/mm^2)	A_{50mm} (%)	Hv (N/mm^2)
AT	Annealed + aged	3h à 500°C	>1030	>1480	>12	>340
¼ HT	¼ hard + aged	3h à 500°C	1400-1520	1650-1850	10-3	500-600
½ HT	½ hard + aged	2h à 500°C	1450-1550	1700-1800	10-3	500-570
HT	hard +aged	2h à 500°C	>1590	>1860	>8	>440

2) The age hardening is achieved by a simple heat treatment of 1.5h to 3h at a typical temperature of 500°C. In order to obtain specific mechanical properties, the heat treatment can be made apart from these conditions. A protective atmosphere is not required but is recommended for a clean and shiny surface.

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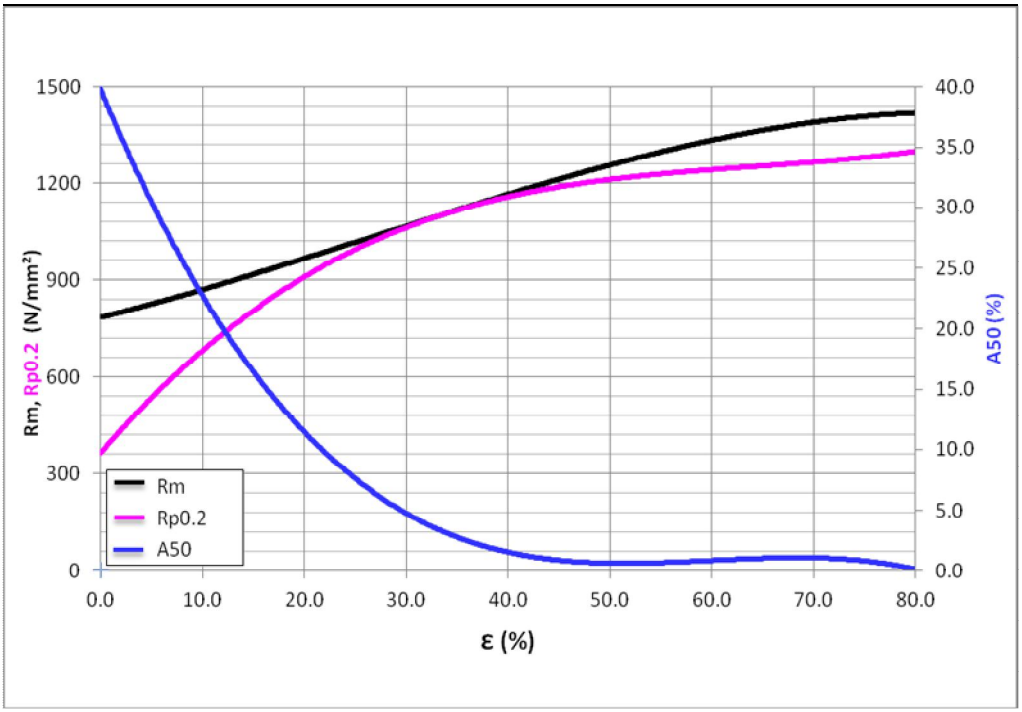
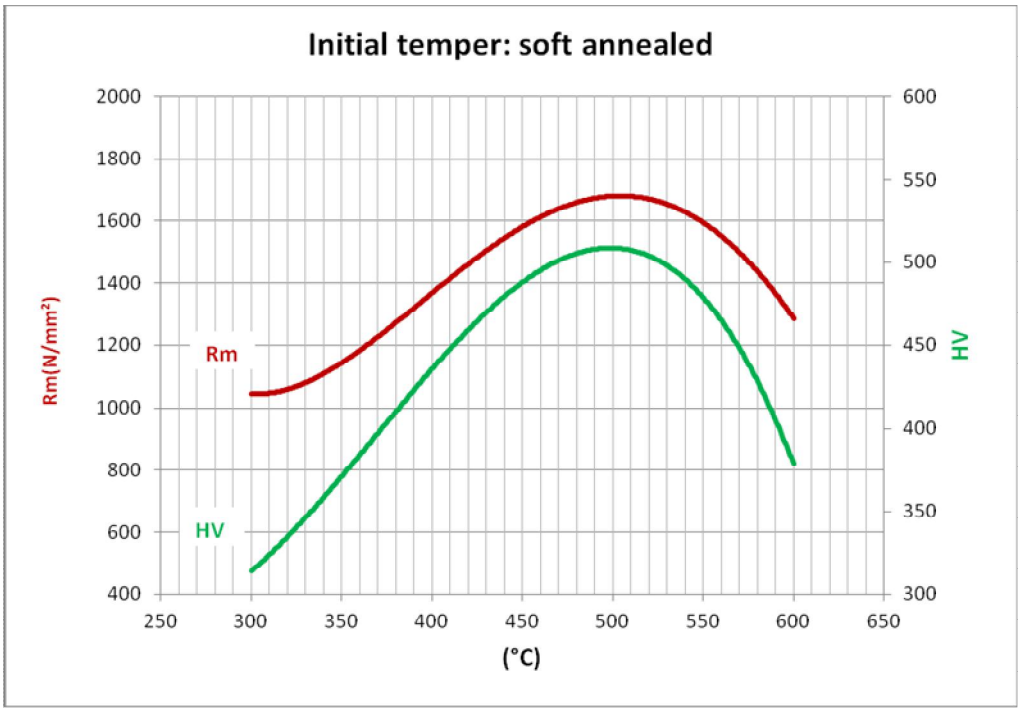
Strain-hardening curve. Rm, $Rp_{0.2}$ (N/mm^2) and A_{50} (%).



Evolution of Hv and Rm of Brush 360, NiBe2 according to the processing temperature (3 hours).

Initial temper: soft annealed.



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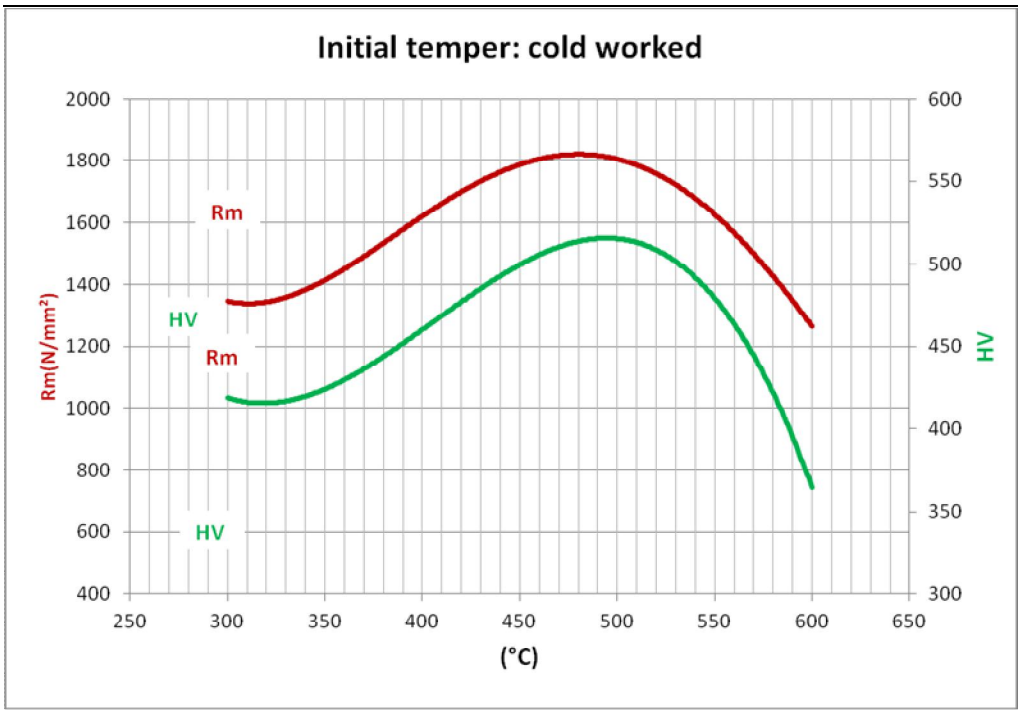
Evolution of Hv and Rm of Brush 360, NiBe2 according to the processing temperature (3 hours).

Initial temper: cold worked



Physical properties

Modulus of elasticity, E	kN/mm^2	195 - 210 (before and after hardening, respectively)
Poisson ratio		0.30
Density (specific gravity)	kg/dm^3	8.25 - 8.27 (before and after hardening, respectively)
Melting range	°C	1195 – 1325
Coefficient of thermal expansion lin.(20-300°C)	/ °C	0,0000145
Thermal conductivity at 20°C	W/m °K	48
Electrical resistivity	µΩcm	43 - 28.7 (before and after hardening, respectively)
Electrical conductivity	MS/m	2 - 4 (before and after hardening, respectively)
Electrical conductivity	% IACS	4 - 6 (before and after hardening, respectively)
Magnetic properties		Ferromagnetic

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Tolerances

Thickness

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

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

Thickness (mm)		EN Standard		Lamineries MATTHEY SA		
≥	<	10140 Precision	10258 Precision	LMSA Standard	LMSA Precision	LMSA Extrem
	0.025	-	-	-	-	± 0.001
0.025	0.050	-	-	± 0.003	± 0.002	± 0.0015
0.050	0.065	-	± 0.003	± 0.003	± 0.0025	± 0.002
0.065	0.100	-	± 0.004	± 0.004	± 0.0035	± 0.003
0.100	0.125	± 0.005	± 0.006	± 0.005	± 0.004	± 0.003
0.125	0.150	± 0.005	± 0.006	± 0.005	± 0.005	± 0.004
0.150	0.250	± 0.010	± 0.008	± 0.008	± 0.006	± 0.004
0.250	0.300	± 0.010	± 0.009	± 0.009	± 0.007	± 0.005
0.300	0.400	± 0.010	± 0.010	± 0.010	± 0.007	± 0.005
0.400	0.500	± 0.015	± 0.012	± 0.012	± 0.008	± 0.006
0.500	0.600	± 0.015	± 0.014	± 0.014	± 0.010	± 0.007
0.600	0.800	± 0.015	± 0.015	± 0.015	± 0.010	± 0.007
0.800	1.000	± 0.015	± 0.018	± 0.018	± 0.012	± 0.009
1.000	1.200	± 0.020	± 0.020	± 0.020	± 0.015	± 0.0012
1.200	1.250	± 0.020	± 0.020	± 0.020	± 0.015	± 0.0012
1.25	1.500	± 0.020	± 0.020	± 0.020	± 0.015	± 0.0014

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

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

Width (mm)		Camber max. (mm/m)			
		LMSA standard		LMSA extremes	
>	≤	≤ 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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