MOLYBDENUM POWDER METALLURGY PRODUCTS

Number PD-7046
Issue 2-08.25.2015

MP35N Alloy (UNS R30035)

Description of Product This specification covers flat-rolled plate, sheet and foil made from MP35N Cobalt – 35Nickel – 20Chromium – 10Molybdenum Alloy

Chemical Characteristics[1)]
(Mass fraction in % [cg/g]; ppm [µg/g])

The chemical composition of the vacuum melted starting ingots shall conform to the following limits:

Ni	min	-	33.0	%	max	-	37.0	%
Cr	min	-	19.0	%	max	-	21.0	%
Mo	min	-	9.0	%	max	-	10.5	%
C	max	-	0.025	%				
Mn	max.		0.15	%				
Si	max	-	0.15	%				
P	max	-	0.015	%				
S	max	-	0.010	%				
Fe	max	-	1.0	%				
Ti	max	-	1.0	%				
B	max	-	0.015	%				
Cobalt	Balance							

Condition Plate, sheet, and foil will be supplied in the annealed, cold-rolled, or cold-rolled + aged condition.

Mechanical Properties Tensile properties of plate and sheet shall be determined in accordance with Test Methods ASTM E8/E8M while tensile properties for foil shall be determined in accordance with Test Method ASTM E345.

Product forms in the annealed condition shall meet the mechanical property requirements in Table 1. Sheet product in the 48% cold-rolled condition shall meet the requirements listed in Table 1. Other product forms in the cold-rolled condition or in cold-rolled + aged condition shall be specified and agreed upon in the purchase order.

Hardness values, when desired, can be measured using Rockwell hardness B (HRB), Rockwell hardness C (HRC) or Vickers hardness (HVN). Test methods ASTM E18 and E384 will be used. Hardness limits shall be specified and agreed upon in the purchase order.

1) Information on testing methods on request.

Table 1 - Mechanical Properties

Condition	Ultimate Tensile Strength[2], min, MPa (psi)	Yield Strength (0.2% offset[2], min, MPa, (psi)	Elongation, min, % in 50mm or 2in.	Rockwell Hardness, min
Annealed[3]	792 (115,000)	310 (45,000)	45	87 HRB
48% Cold-Rolled	1357 (197,000)	1343 (195,000)	3	43 HRC

[2] Tensile and yield requirements apply to tests taken longitudinally to the rolling direction.

[3] 0.5 mm (0.0197in.) sheet, vacuum annealed at 1022°C (1875°F), 2h at temperature.

Finishes for Plate Types of finish available for plate are ground finish produced by surface grinding or continuous belt sanding and dull finish produced by chemical descaling.

Finishes for Sheet & Foil Types of finish available for sheet and foil are dull cold-rolled, bright cold-rolled or as specified in the purchase order.

Edges for Plate Rolled edge or approximate square edge produced by bandsaw or abrasive saw cutting.

Edges for Sheet & Foil For sizes greater than 1.5mm (0.060in) in thickness, an approximate square edge produced by abrasive sawing; For sizes under 1.5mm (0.060in) an edge produced by slitting or shearing.

Dimensional Characteristics

MP35N FLAT ROLLED PRODUCT SIZES

Product	Thickness inches	mm	Width in.	mm
Hot Rolled Plate	.187–2.00	4.75-50.8	24 max.	610
Hot Rolled Sheet	.040–.186	1.02-4.74	24 max.	610
Cold Rolled Plate	.187–.500	4.75-12.7	24 max.	610
Cold Rolled Sheet	.005–.186	.127-4.74	24 max.	610
Cold Rolled Foil	.002–.0049	.0508-.124	12 max.	305

Inquire regarding Length

WIDTH TOLERANCE

Thickness Inches	mm	½-6 in.	12.7-152 mm	6-12 in.	152-305 mm	12-24 in.	305-610 mm
.002 to .010	.0508-0.254	± .005	± 0.127	± .010	± 0.254	± .031	± 0.787
over .010 to .020	0.254-0.508	± .010	± 0.254	± .010	± 0.254	± .031	± 0.787
over .020 to .035	0.508-0.889	± .015	± 0.381	± .015	± 0.381	± .031	± 0.787
over .035 to .060	0.889-1.524	± .031	± 0.787	± .031	± 0.787	± .031	± 0.787
over .060 to .1875	1.524-4.763	± .062	± 1.57	± .062	± 1.57	± .062	± 1.570
over .187 to .500	4.763-12.70	± .062	± 1.57	± .062	± 1.57	± .062	± 1.570

Inquire regarding tolerances for width less than ½ in. / 12.7mm tolerances

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THICKNESS TOLERANCE

Thickness inches	mm	Up to 12 in. Wide	305 mm	12 – 24 in. Wide	305-610 mm
.002 to .005	.0508-0.127	± .0006	± 0.0152	N/A	N/A
over .005 to .008	0.127-0.203	± .0007	± 0.0178	± .0009	± 0.0229
over .008 to .010	0.203-0.254	± .0008	± 0.0203	± .0010	± 0.0254
over .010 to .018	0.254-0.457	± .0010	± 0.0254	± .0012	± 0.0305
over .018 to .035	0.457-0.889	± .0017	± 0.0432	± .0020	± 0.0508
over .035 to .1875	0.889-4.760	± 5%	N/A	± 6%	N/A

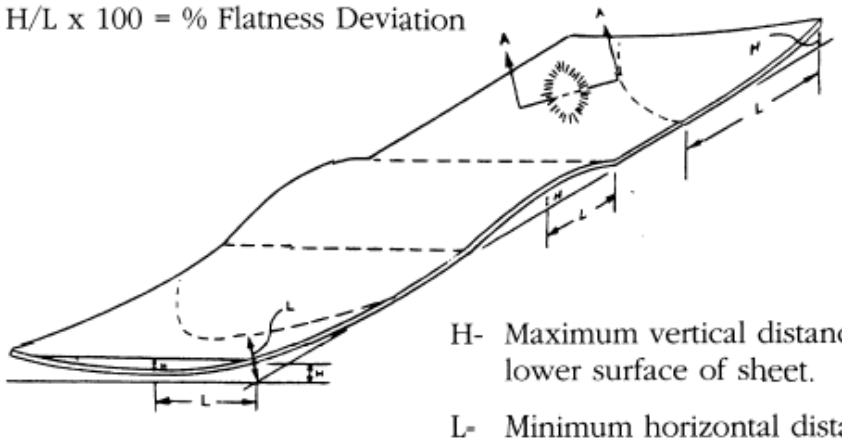
Length Tolerance For specified lengths, the tolerance for all sizes is + .0625 - 0 inch per foot of length. Edge Straightness-Maximum camber is .0625 inch per foot of length.

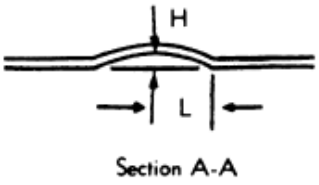
Flatness Tolerance

THICKNESS (INCHES)		FLATNESS DEVIATION (% MAXIMUM)
	0.187 to 0.500	3
Over	0.500 to 1.000	5
Over	1.000 to 1.500	6

The total deviation from flatness is determined by the following formula:

H/L x 100 = % Flatness Deviation





Section A-A

H- Maximum vertical distance between flat surface and lower surface of sheet.

L- Minimum horizontal distance between highest point on sheet and point contact with flat surface.

Hazards identification in Advertising (REGULATION (EC) No 1272/2008 Article 48)
none.

Identification The material will be identified with appropriate specification number, ingot or lot number, and nomial size. Shipping containers will be marked with the name of the customer and the purchase order number.

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Rejection

H.C. Starck must receive written notification of rejected material with the resaon for rejection. The right is reserved to inspect rejected material at customer plant for claim validation. The material may be returned only after proper authorization.

Applicable Standards

ASTM E8/E8M Test Method for Tension Testing of Metallic Materials
ASTM E18 Test Method for Rockwell Hardness of Metallic Materials
ASTM E345 Test Methods of Tension Testing of Metallic Foil
ASTM E384 Test Method for Knoop and Vickers Hardness of Materials
ASTM F562 Specification for Wrought 35Cobalt–35Nickel–20Chromium–10 Molybdenum Alloy for Surgical Implant Applications (UNS R30035)
ASTM F688 Specification for Wrought 35Cobalt–35Nickel–20Chromium–10 Molybdenum Alloy Plate, Sheet and Foil for Surgical Implants (UNS R30035)

H.C. Starck Inc.
45 Industrial Place
Newton, MA 02461-1951 / USA
Phone +1 (617) 630-5800, Fax +1 (617) 630-5879

H.C.Starck
High Performance Metal Solutions

info@hcstarcksolutions.com www.hcstarcksolutions.com