NOTZ METALL SERVICE CENTER
NOTZ group advanced metal solutions

1.4021
1.4028
1.4034

		EN-Norm	AFNOR	AISI	DIN
Description	**Strip steel rust-resistant, hardenable according to EN 10088-2**	1.4021	Z20C13	420	1.4021
		1.4028	Z33C13	420F	1.4028
		1.4034	Z44C14/Z38C13	420	1.4034

Chemical analysis

Material	C	Si max.	Mn max.	P max.	S max.	Cr	Ni	Mo	PREN
1.4021	0.16 - 0.25	1.0	1.5	0.040	0.015	12.0 - 14.0	-	-	13
1.4028	0.26 - 0.35	1.0	1.5	0.040	0.015	12.0 - 14.0	-	-	13
1.4034	0.43 - 0.50	1.0	1.0	0.040	0.015	12.5 - 14.5	-	-	14

Chemical analysis according to the European standard EN in mass percentages. / *Other

Usage

Martensitic stainless grades are hardenable chromium steels that are usually processed in the soft state and then hardened for use as finished parts. With increasing carbon content, the steel becomes more brittle in processing, but higher strengths can be achieved after hardening. The steel is fully magnetic. This steel is used for cutting tools, knives, instruments, tweezers, machine parts and accessories with increased strength.

Resistance to corrosion
They have good corrosion resistance in moderate, non-chlorinated media such as soaps, solvents and organic acids and also have good resistance to water and water vapour. Martensitic steels should not be used in the soft annealed or highly tempered, quenched and tempered, condition if corrosion resistance is important. The best corrosion resistance is achieved in the hardened and tempered condition, in combination with a finely ground or polished surface.

Weldability
Martensitic stainless steels should generally not be welded.
Taking into account the special welding parameters, 1.4021 can be welded.

Thermal treatment
The soft annealing of these steels takes place at a temperature of 750°C - 850°C with subsequent slow furnace cooling.
The martensitic stainless steels with a carbon content up to about 0.4% are mainly used in the quenched and tempered condition and those with a C content above 0.4% in the hardened and tempered condition.
Hardening takes place at 950°C - 1'080°, quenched in oil or air. Tempering takes place above 600°C to 700°C and tempering at 100°C to 250°C depending on the desired hardness.

Heat resistance
The quenched and tempered steels can be used up to 550°C for short periods. However, in order to prevent the precipitation of undesirable phases, the range between 400°C and 600°C should generally be avoided. Using hardened martensitic steels at higher temperatures does not make sense (tempering temperature).

Mechanical Properties

Finish	Tensile strength	Hardness	0.2% yield strength	elongation at break
+A annealed	MPa (N/mm2)	HV approx. Values	MPa (N/mm²)	A 80 mm lengthwise
1.4021	max 700	max 225	-	min 15%
1.4028	max 740	max 235	-	min 15%
1.4034	max 780	max 245	-	min 12%

* higher tensil strength on request

The conversion of tensile strength into HV hardness is always subject to inaccuracies and only gives approximate values. In case of doubt, the test method stated in the product specification applies; tensile strength is to be preferred.

Physical properties at room temperature according to EN 10088-1

density	7.7 - 7.71 kg / dm³
Specific heat	439 - 460 J / (kg*K)
thermal conductivity	24.6 - 30 W / (m*K)
Coefficient of thermal expansion	10.1 - 10.2 (10^{-6}/K^{-1})
Electrical resistivity	1.4021, 0.60 (Ohm*mm²) / m 1.4028, 0.65 (Ohm*mm²) / m 1.4034, 0.55 (Ohm*mm²) / m
E-modules in GPa	215

magnetisability: available
Polishing ability: good
structure: martensitic

Surface Finish

Execution	Cleaning	Diameter
drawn	chemically purged	Ø 0.020 – 3.499 mm
surface ground	chemically purged	Ø 3.500 – 4.000 mm

Diameter

Diameter
Ø 0.02 – 4.00 mm
The product can be supplied as a round material (in round shape) or in customer-specific geometries or shapes.

Delivery mode

- as a ring
- on assorted spools
- straightened
- Axles

Diameter tolerances

Diameter mm	Tolerance %	Tolerance µ
0.020 – 0.249	-	± 1.0
0.250 – 0.399	-	± 1.5
0.400 – 1.500	-	± 2.0
1.500 – 4.000	-	± 2.5

Cleanliness
According to ISO 5832/7, AFNOR NF S90-4

non metallic inclusions			
Typ A	Typ B	Typ C	Typ D
sulfides	aluminates	silicates	globular oxides
1	3	1	1

Aging
Phynox cannot be hardened in the annealed state. A previous cold deformation is required to activate the hardening reaction of the material. Basically, the higher the degree of cold deformation, the higher the increase in strength.

Heat treatments

Treatment	Temperature	Duration	Cooling
Annealing	1050 °C	0.5 h	Cooling in the air*, gas or water
Aging	480 – 540 °C	2 – 5 h	Preferably in a 10^{-5} T vacuum or under argon protective atmosphere.
Stress relieving	< 250-300°C	1 – 2 h	-

* A treatment in air oxidizes the surface by forming a yellowish oxide layer.

Protective atmospheres
As a precautionary measure, all thermal treatments should always be carried out in an H_2-free atmosphere.

Remark
- A stress relieving treatment of the cold deformed products is recommended.
- A stress relieving treatment of the cold deformed products to uniformize their internal stresses before machining is recommended.

Physical properties

Young's Modulus	20 ºC	215.00 GPA
Poisson ratio	20 ºC – 200 ºC	0.3
Density	-	8.3 g/cm^3
Coefficient of thermal expansion	20 ºC	12.50 W/m °K
Specific electric resistance	20 ºC	0.10 μΩcm
Specific heat	20 ºC	450.020 J/kgK
Melting point	-	1450 – 1460 °C
Magnetic properties	-	Nonmagnetic For all practical purposes, Phynox in nonmagnetic through all temperature range.

Processing

Machining
The optimal cutting conditions for the material depend on the machine tools, the cutting tools used, the chip dimensions, lubricant-cooling fluid, the desired tolerances, as well as the surface roughness.

Machinability	difficult
Cutting speed	low, Vc ≈ 20-40 m/min
Feed	moderate to high
Lubricant-cooling	individual choice

Polishing
- In the cold worked condition, the polishing is easier.
- Phynox is suitable for the "Haut de gamme" polishing of the watch industry.

Note

All information provided in this data sheet is based on the best knowledge and the latest state of the art, but without guarantee. The use of materials should always be discussed with our sales specialists or our materials laboratory on a product- and application-specific basis.

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