Phynox

Flat wire

Description	CoCr20Ni15Mo	Material number	ASTM	EN/DIN	UNS
		2.4711	F1058	CoCr20Ni15Mo	R30003, R30008

Chemical composition

Fe	Co	Cr	Ni	Mo	Mn	Si	C	P	S	Be	A*
Rest	39.0–41.0	19.0-21.0	15.0–18.0	6.5–7.5	1.50–2.50	≤ 0.12	≤ 0.15	≤ 0.015	≤ 0.015	≤ 0.001	≤ 1.0

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

Dimensions

The product can be supplied as flat wire in a thickness range of 0.05-2.50 mm and a width range of 0.20-10 mm, in various edge designs.

Delivery mode

- In coils
- On different spools

Physical properties

Young's modulus, E	20 ºC	215.00 [GPA]
Heat expansion coefficient	20 ºC – 200 ºC	12.5 [10^{-6}/K]
Density	-	8.3 [g/cm^3]
Heat conductivity	20 ºC	12.5 W/m K
Specific resistance	20 ºC	95 μΩcm
Specific heat capacity	20 ºC	450 J/kgK
Magnetic properties	-	Non-magnetic; for all practical applications, Phynox can be considered as non-magnetic over the entire temperature range.

Technical main features

Properties and applications

Phynox belongs to the class of cobalt alloys and has unique properties in terms of strength, toughness, ductility, and corrosion resistance. Furthermore, the material is biocompatible and therefore is used for implants for a long time. The alloy contains 40% cobalt, 20% chromium, 16% nickel and 7% molybdenum. This high-performance material is used wherever very high demands are made on corrosion resistance and where material fatigue must be excluded. Typical areas of application are in human and dental medicine, the chemical and the aerospace industries. In the watch industry, Phynox is a popular material for production of springs and axles.
Tensile strengths of over 2200 N/mm^2 (depending on the diameter) can be achieved with the appropriate heat treatment. Furthermore, Phynox has a high bending fatigue strength, enormous temperature resistance and it is non-magnetic.

Corosion resistance

Phynox is not or only very hardly attacked by organic as well as mineral acids at room temperature and outshines even the best stainless steels in terms of corrosion resistance. Because of this good resistance and the inactivity in connection with body fluid or tissue, it is often used for implants.

Heat treatment
Phynox can be hardened at a temperature of 520°C for 3h. This hardening process should always take place under a vacuum or in a furnace flooded with argon. The material discolors in the air, but this has no effect on its mechanical properties. The amount of hardness increase depends on the degree of strain hardening in the as-delivered condition. The tensile strength in the as-delivered condition should be defined in a way that the desired hardness can be achieved by heat treatment. This is how the material reaches its optimum state.

Weldability
Phynox can be welded well and is also solderable. However, it must be noted that only strain-hardened material can be hardened. Therefore, the welded areas should not be exposed to any major mechanical stress once the material has been hardened.

Strain hardening
The figure below shows a strain hardening curve for the material 2.4711. As the degree of deformation increases, the yield strength ratio approaches against 1.

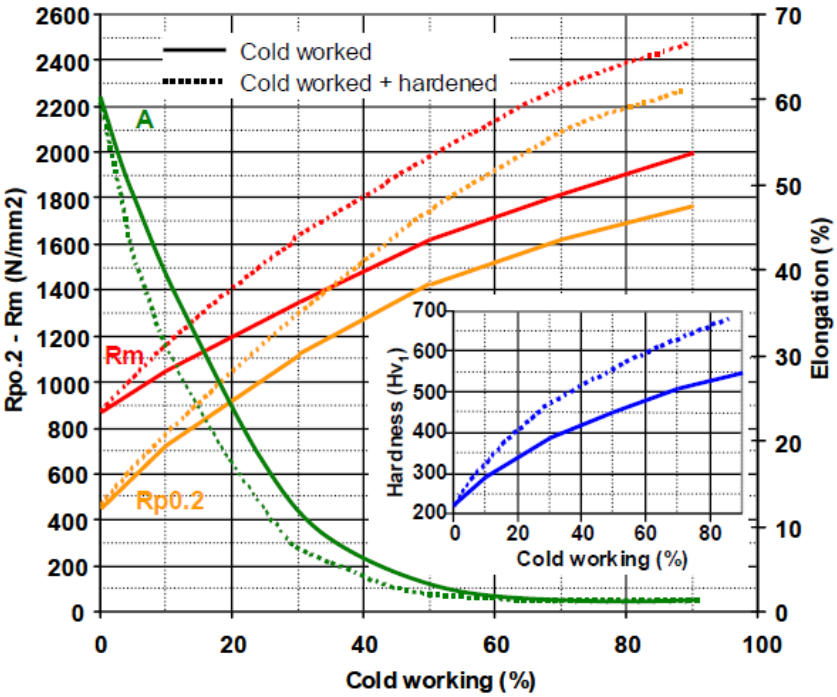

Figure: values for Rm, Rp0.2, A, und HV_1 before and after hardening (520 °C, 3h).

Surface Finish

Special surface qualities are available upon request.

Thermal treatment

Treatment	Temperature	Duration	Cooling
Annealing	1050 °C	0.5 h	Rapid cooling in air*, gas or water
Hardening	480 – 540 °C	2 – 5 h	Preferably under high vacuum 10-5 T or argon
Relaxation	< 250-300°C	1 – 2 h	-

* a treatment in the air causes a yellow oxide layer.

Protective atmosphere:
All thermal treatments should always be carried out in an H_2-free atmosphere as a precautionary measure.

Remarks:

- For cold rolled products, it is recommended to put them to stress-relieving annealing.
- In this case, the stress-relieving annealing should be done before machining.

Processing

Machining
The optimum cutting conditions for the material depend on machine tools, cutting tools used, chip dimensions, cooling lubricants, desired tolerances, as well as the surface roughness.

Machining	difficult
Cutting speed	slow, Vc ≈ 20-40 m/min
Feed	moderate to strong
Cooling-lubricant	individual choice

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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