

# Monel 400 | Alloy 400 | W.Nr. 2.4360 Chemical Compositions- Data Sheet

NC Alloys is Certified to ISO 9001



## Alloy 400

- belongs to the group of nickel-copper alloys with advantageous mechanical and corrosion-chemical properties. The material exhibits good strength and toughness, and is approved in pressure vessel construction up to an operating temperature of 425 °C.
- exhibits good resistance in hydrofluoric acid, non-oxidizing, diluted acids, alkalis and salt solutions, organic acids and dry gases such as oxygen, chlorine, hydrogen chloride, sulfur oxide and carbon dioxide. The precipitation-hardenable variant, alloy K-500, also provides high strength at comparable corrosion resistance properties.
- has proven particularly useful in flowing sea water, whereby the corrosion resistance to sea water in the splash water zone is significant. An essential benefit in the application of alloy 400 is its low susceptibility to stress-crack corrosion. Under the influence of oxidizing constituents such as iron or copper salts, the use of this material is not recommended.

## Application

- Offshore engineering, e.g. condensers, piping, claddings and fittings
- Plants/equipment of the chemical and petrochemical process industry, e.g. centrifuges in a salt processing plant
- Plants/equipment and components of ships, e.g. valves, fire extinguishing systems, pumps and ship screw shafts
- Energy engineering, e.g. piping, high-pressure feedwater heaters and coolers
- Environmental engineering, e.g. evaporation plants and crystallizers in wastewater engineering

## Specifications

DIN Designation	NiCu30Fe
DIN Material Number	2.4360
VdTÜV Datasheet	263
UNS	N04400
DIN	17743, 17750, 17751, 17752, 17753, 17754
ASTM	B 127, B 163, B 164, B 165, B 564
ASME	SB 127, SB 163, SB 164, SB 165, SB 564
SAE	AMS 4675, AMS 4544, AMS 7233
BS	3072/NA13, 3073/NA13, 3074/NA13, 3075/NA13

## Delivery Forms

Sheet	hot or cold rolled, heat treated, pickled or de-scaled
Plates	hot rolled, heat treated pickled or de-scaled
Strip	hot or cold rolled, heat treated, pickled or de-scaled
Pipe	seamless or longitudinally welded, heat treated, pickled or de-scaled
Bar	hot rolled or forged, cold rolled, heat treated, pickled or de-scaled
Wire	rolled or drawn, heat treated, pickled or de-scaled
Forging	heat treated, machined on request
Welding filler metal	welding bar, wire electrode coated bar electrode

Do you require other delivery forms or finishes? We will be glad to discuss your needs with you over the phone.

Please get further information under:

<https://www.ncalloys.com/alloys/monel/monel-400/>

### Processing instructions

Alloy 400 alloy is cold and hot formable. For degrees of deformation  $\geq 5\%$ , the hot-forming temperature is 1200 to 1000 °C; for degrees of deformation  $<5\%$  1000 to 800 °C. Stress-relief annealing or annealing is required after cold forming with degrees of deformation  $> 5\%$ , and annealing is required after hot forming. The sulfur-free furnace can be adjusted to maintain a slightly reducing or neutral atmosphere. If the absence of sulfur cannot be guaranteed, slightly oxidizing annealing is necessary. Measures should be taken to avoid alternating between oxidizing and reducing conditions.

### Heat treatment

Annealing: 800 – 900 °C

Stress-relief annealing: 550 – 650 °C

Duration depending on thickness of semi-finished product.

Cooling: air

### Welding

The welding of alloy 400 is preferably carried out on like materials using GATW and GMAW gas metal arc welding processes and the fusion arc welding process. Owing to the tendency to hot crack susceptibility, the semi-finished products should be processed in a stress-free, metallic bright condition and be free of dirt. Care must be taken to apply a low amount of heat during welding. Preheating or secondary heat treatment is generally unnecessary.

### Chemical Composition\*

	C	Si	Mn	S
Max.	0.16	0.50	2.00	0.020
	Cu	Fe	Al	Ni
Min.	28.0	1.00	-	63.00
Max.	34.0	2.50	0.50	-

\* weight %

### Physical Properties

Melting temperature range	1300-1350 [°C]
Density*	8830 [kg · m <sup>-3</sup> ]
Modulus of elasticity* (approximately)	188 [GPa]
Specific heat*	430 [J · kg <sup>-1</sup> · K <sup>-1</sup> ]
Thermal conductivity*	21.5 [W · m <sup>-1</sup> · K <sup>-1</sup> ]
Coefficient of thermal expansion 20 - 95°C	13.0 x 10 <sup>-6</sup> [K <sup>-1</sup> ]
Specific electrical resistivity*	0.48 [ $\Omega$ · mm <sup>2</sup> · m <sup>-1</sup> ]

\* at room temperature

### Mechanical Properties at Room Temperature

Semi-finished product form	Sheet	Sheet
	soft annealed	stress-relief annealed
R <sub>p0.2</sub> min [MPa]	175	400
R <sub>m</sub> [MPa]	450-600	580-780
A <sub>min</sub> [%]	30	18

### Mechanical Properties at Elevated Temperatures\*

Semi-finished product form	Strength parameter	Temperature °C			
		100	200	300	400
Sheet $\leq$ 50 mm thickness	R <sub>p0.2</sub> [MPa]	150	135	130	130
Pipe $\leq$ 25 mm thickness, soft annealed	R <sub>m</sub> [MPa]	420	390	380	370

\* minimum values

### Welding Filler Metal

	DIN EN ISO	Alloy Designation
Bar (GWAT)	18274	Ni 4060
Wire (GMAW)	18274	Ni 4060
Coated bar electrode (MMA)	14172	Ni 4060

We will be glad to provide you with information and instructions on machining and processing and on the selection of suitable welding filler metal. Please do not hesitate to call us.

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For further information about our products and locations, please refer to our image brochure or consult our website at [www.ncalloys.com](http://www.ncalloys.com).

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