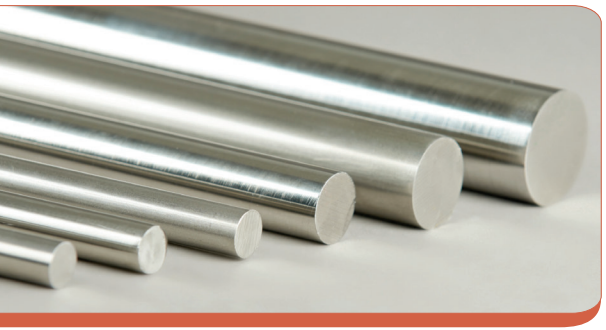
NICKEL ALLOYS



WHAT ARE NICKEL ALLOYS?

Nickel will alloy readily with most metals such as copper, chromium, iron and molybdenum. The addition of nickel alters the properties of the resulting alloys that can be used to produce desirable characteristics such as outstanding resistance to corrosion, increase high-temperature scaling, exceptional strength and many other unique properties.

Categories	Grades	UNS	Bars	Round Bar Size Range (in mm)	Condition
NICKEL ALLOYS	INCONEL 625	N06625	•	20.00 - 325.00	Solution Annealed
	INCONEL 718	N07718	•	25.40 - 152.40	Solution Annealed, Aged to MYS 120 KSI
	INCONEL 718 - 150 KSI	N07718	•	16.00 - 177.80	Solution Annealed, Aged as per AMS 5663 to MYS 150 KSI
	INCONEL 925	N09925	•	15.88 - 254.00	Solution Annealed, Aged to MYS 110 KSI
	ALLOY 20	N08020	•	12.00 - 152.40	Hot rolled, Annealed
	MONEL 400	N04400	•	15.88 - 152.40	Hot Rolled and Stress Released Cold Drawn MYS 35 KSI
	MONEL R405	N04405	•	22.23 - 57.15	Hot Rolled and Stress Released Cold Drawn MYS 50 KSI
	MONEL K500	N05500	•	15.88 - 190.00	Hot rolled, Annealed, Aged
	HASTELLOY C-276	N10276	•	15.87 - 95.25	Hot rolled, Annealed

INCONEL 625 (UNS N06625)

Alloy 625 is a Nickel-Chromium-Molybdenum alloy with high strength and toughness from Cryogenic Temperatures up to 1500°F. It has excellent resistance to a variety of corrosive environments but yet possesses excellent fabricability resulting in it commonly being used in sea-water applications and in the field of aerospace. Some common uses for these are Aircraft ducting and exhaust systems, bellows, multiphase flow meters and many more.

KEY PROPERTIES

Yield Strength	50 KSI Min
Tensile Strength	110 KSI Min
Elongation	20% Min
Reduction of Area	25% Min
Hardness	35 HRC Max

SPECIFICATIONS

ASTM B446/B564 /ASME SB446/
SB564 GRADE 1/2
NACE MR0175/ISO15156-3

CONDITION

Solution Annealed

Typical chemical composition, by % mass

Nickel	Chromium	Molybdenum	Iron	Niobium + Tantalum
Ni 58.00% Min	Cr 20.00 - 23.00%	Mo 8.00 - 10.00%	Fe 5.00% Max	Nb+Ta 3.15 - 4.15%
Cobalt	**Silicon**	**Manganese**	**Titanium**	**Silver**
Co 1.00% Max	Si 0.50% Max	Mn 0.50% Max	Ti 0.40% Max	Ag 0.40% Max
Carbon	**Sulphur**	**Phosporous**		
C 0.10% Max	S 0.015% Max	P 0.015% Max		

INCONEL 718 (UNS N07718)

Alloy 718 is a high strength, corrosion resistant Nickel-Chromium alloy used for cryogenic temperatures up to long term service at 1200°F. Its ability to be fabricated and combined with goo tensile, fatigue, creep and rupture strength has resulted in its use in a wide range of applications. It is widely used in oil & gas and in the field of aerospace such as for sheet metal parts for aircrafts, land-based gas turbine engines and cryogenic tankage.

Below is the typical chemical composition for Alloy 718 that has been aged to MYS 120 KSI:

KEY PROPERTIES (120 KSI)

Yield Strength	120 KSI Min
Tensile Strength	150 KSI Min
Elongation	20% Min
Reduction of Area	25% Min
Hardness	40 HRC Max

SPECIFICATIONS

API 6A718 / 6ACRA
NACE MR0175/ISO15156-3

CONDITION

Solution Annealed, aged to MYS 120 KSI
Solution Annealed, aged to MYS 150 KSI

Typical chemical composition, by % mass

Nickel	Chromium	Molybdenum	Iron	Niobium + Tantalum
Ni 50.00 - 55.00%	Cr 17.00% - 21.00%	Mo 2.8% - 3.3%	Fe Balance	Nb+Ta 4.75 - 5.50%
Cobalt	**Silicon**	**Manganese**	**Titanium**	**Carbon**
Co 1.00% Max	Si 0.35% Max	Mn 0.35% Max	Ti 0.80 - 1.15%	C 0.045% Max
Sulphur	**Phosporous**			
S 0.01% Max	P 0.01% Max			

KEY PROPERTIES (110 KSI)

Yield Strength	110 KSI Min
Tensile Strength	140 KSI Min
Elongation	18% Min
Reduction of Area	25% Min
Hardness	48 HRC Max

SPECIFICATIONS

API 6ACRA
NACE MR0175/ISO15156-3

CONDITION

Solution Annealed, aged to MYS 110 KSI

Typical chemical composition, by % mass

Nickel	Chromium	Iron	Molybdenum
Ni 42.00 - 46.00%	Cr 19.50 - 22.50%	Fe 22.00% Min	Mo 2.5% - 3.5%
Copper	**Titanium**	**Aluminium**	**Manganese**
Cu 1.50 - 3.00%	Ti 1.90 - 2.40%	Al 0.10 - 0.50%	Mn 1.00% Max
Silicon	**Niobium & Tantalum**	**Carbon**	**Sulphur**
Si 0.50% Max	Nb+Ta 0.50% Max	C 0.03% Max	S 0.03% Max

INCONEL 925 (UNS N09925)

Alloy 925 is an age hardened Nickel-Iron-Chromium Alloy with additions of Molybdenum, Copper, Titanium and Aluminum. It has corrosion resistance similar to Alloy 825 but with higher strength obtained through age hardening. Alloy 925 is used in various applications requiring a combination of high strength and corrosion resistance. This is due to its properties of having good resistance to sulfide stress cracking and stress corrosion cracking in sour (H2S containing) crude oil and natural gas. It is commonly used for gas well components, valves and high strength requirement piping systems.

ALLOY 20 (UNS N08020)

Alloy 20 is a Nickel-Iron-Chromium austenitic alloy designed specifically to withstand sulfuric acid. Alloy 20 is an excellent option when chloride stress corrosion racking is an issue. It also has good resistance to pitting and crevice corrosion. Although originally designed for use in sulfuric acid related industries, Alloy 20 is now a popular choice for a wide variety of industries including the chemical, food, pharmaceutical, and plastics industries.

KEY PROPERTIES

Yield Strength	35 KSI Min
Tensile Strength	80 KSI Min
Elongation	30% Min
Reduction of Area	50% Min
Hardness	32 HRC Max

SPECIFICATIONS

ASTM B473/ASME SB473
NACE MR0175/ISO15156-3

CONDITION

Hot Rolled, Annealed

Typical chemical composition, by % mass

Nickel	Chromium	Copper	Molybdenum	Manganese
Ni 32.00 - 38.00%	Cr 19.00 - 21.00%	Cu 3.00 - 4.00%	Mo 2.00 - 3.00%	Mn 2.00% Max
Silicon	**Niobium + Tantalum**	**Carbon**	**Phosporous**	**Sulphur**
Si 1.00% Max	Nb+Ta 8 X C - 1.00%	C 0.07% Max	P 0.045% Max	S 0.035% Max
Iron				
Fe Balance				

NICKEL ALLOYS

KEY PROPERTIES (Annealed)

Yield Strength	40 KSI Min
Tensile Strength	80 KSI Min
Elongation	30% Min
Hardness	35 HRC Max

SPECIFICATIONS

ASTM B473/ASME SB473
NACE MR0175/ISO 15156-3

CONDITION

Stress Released Cold Drawn MYS 35 KSI

Typical chemical composition, by % mass

Nickel	Copper	Iron	Manganese
Ni 63.00% Min	Cu 28.00 - 34.00%	Fe 2.00% Max	Mn 2.00% Max
Silicon	**Carbon**	**Sulphur**	
Si 0.50% Max	C 0.30% Max	S 0.024% Max	

MONEL 400 (UNS N04400)

Monel 400 is a nickel-copper alloy that can be hardened only by cold working, it has high strength and toughness over a wide range of temperature usage while providing excellent resistance to corrosion. Monel 400 is widely used in the marine and chemical processing industries.

MONEL K500 (UNS N05500)

Monel K500 is a precipitation-hardenable Nickel-Copper alloy that combines the excellent corrosion resistance characteristics of Monel 400 with the added advantage of greater strength and hardness. These amplified properties, strength and hardness, are obtained by adding aluminum and titanium to the nickel-copper base and by age hardening. Typical applications for Monel K500 products are oil well drill collars and instruments, pump shafts and impellers, non-magnetic housings, safety lifts and valves for oil and gas production.

KEY PROPERTIES (Annealed)

Yield Strength	90 KSI Min
Tensile Strength	140 KSI Min
Elongation	20% Min
Reduction of Area	25% Min
Hardness	35 HRC Max

SPECIFICATIONS

ATM B865

CONDITION

Hot rolled / Annealed, aged harden

Typical chemical composition, by % mass

Nickel	Copper	Aluminum	Iron	Manganese
Ni 63.00% Min	Cu 27.00 - 33.00%	Al 2.30 - 3.15%	Fe 2.00% Max	Mn 1.50% Max
Titanium	**Silicon**	**Carbon**	**Sulphur**	
Ti 0.35 - 0.85%	Si 0.50% Max	C 0.18% Max	S 0.010% Max	

HASTELLOY C-276 (UNS N10276)

Hastelloy C-276 is a Nickel-Molybdenum-Chromium Alloy with the addition of Tungsten. It has excellent corrosion resistance in a wide range of corrosive media and is especially resistant to pitting and crevice corrosion. It is resistant to the formation of grain boundary precipitates in the weld heat-affected zone, thus making it suitable for most chemical process application in an as welded condition.

KEY PROPERTIES (Annealed)

Yield Strength	41 KSI Min
Tensile Strength	100 KSI Min
Elongation	40% Min
Hardness	35 HRC Max

SPECIFICATIONS

ASTM B564/B574
ASME SB564/SB574
NACE MR0175/ISO15156-3

CONDITION

Hot rolled / Annealed

Typical chemical composition, by % mass

Nickel	Molybdenum	Chromium	Iron	Tungsten
Ni Balance	Mo 15.00 - 17.00%	Cr 14.50% - 16.50%	Fe 4.00 - 7.00%	W 3.00 - 4.50%
Cobalt	**Manganese**	**Vanadium**	**Silicon**	**Phosphorous**
Co 2.50% Max	Mn 1.00% Max	V 0.35% Max	Si 0.08% Max	P 0.04% Max
Sulphur	**Carbon**			
S 0.03% Max	C 0.01% Max			

METAL CUTTING SERVICE