

NICKEL & NICKEL ALLOYS



Technical Information

Nickel is a very versatile metal, and although very useful in its commercially pure forms, it is its ability to alloy with a range of metals which has brought it to the forefront of modern metallurgy.

A range of highly alloyed materials has developed to provide high strength and excellent corrosion resistance, particularly at elevated temperatures, to meet specific requirements in many different types environment.



NICKEL & ALLOYS GRADE DESIGNATIONS AND CHEMICAL COMPOSITIONS (% BY WEIGHT)

Chemical Compositions													
DIN	ASTM ALLOY	Ni	Cr	Fe (max)	Co (max)	Mo	Cu (max)	C (max)	Mn (max)	Si (max)	S (max)	P	Others
COMMERCIAL PURE NICKELS													
2.4066	200	99.0 min	-	0.40	-	-	0.25	0.15	0.35	0.35	0.01	-	Mg 0.2 max.
2.4068	201	99.0 min	-	0.40	-	-	0.25	0.02	0.35	0.35	0.01	-	Mg 0.2 max.
NICKEL-COPPER ALLOY													
2.4360	400	63.0 min	-	2.50	-	-	28.0 to 34.0	0.30	2.0	0.50	0.025	-	-
NICKEL-CHROMIUM & NICKEL-CHROMIUM-IRON ALLOYS													
2.4816	600	72.0 min	14.0 to 17.0	6.0 to 10.0	-	-	0.5	0.15	1.00	0.50	0.015	-	-
2.4851	601	58.0 to 63.0	21.0 to 25.0	Balance	-	-	1.0	0.10	1.00	0.50	-	-	Al 1.00 to 1.70
2.4856	625	58.0 min	20.0 to 23.0	5.0	1.0	8.0 to 10.0	-	0.10	0.50	0.50	-	-	Nb + Ta 3.15 to 4.15 Ti 0.40 max Al 0.40 max
2.4668	718	50.0 to 55.0	17.0 to 21.0	Balance	1.0	2.80 to 3.30	0.30	0.08	0.35	0.35	-	-	Nb + Ta 4.75 to 5.50 Ti 0.65 to 1.15 B 0.006 max Al 0.20 to 0.80
2.4669	X 750	70.0 min	14.0 to 17.0	5.0 to 9.0	1.0	-	0.50	0.08	1.00	0.50	-	-	Nb + Ta 0.70 to 1.20 Ti 2.25 to 2.75 Al 0.40 to 1.00
2.4819	C 276	Balance	14.5 to 16.5	4.0 to 7.0	2.5	15.0 to 17.0	-	0.01	1.00	0.08	-	-	W 3.00 to 4.50 V 0.35 max
2.4665	X	Balance	20.5 to 23.0	17.0 to 20.0	0.50 to 2.50	8.0 to 10.0	0.50	0.05 to 0.15	1.00	1.00	-	-	W 0.20 to 1.00 Ti 0.15 max B 0.008 max Al 0.50 max

NICKEL & ALLOYS GRADE DESIGNATIONS AND CHEMICAL COMPOSITIONS (% BY WEIGHT)

Chemical Compositions													
DIN	ASTM ALLOY	Ni	Cr	Fe (max)	Co (max)	Mo	Cu (max)	C (max)	Mn (max)	Si (max)	S (max)	P	Others
IRON-NICKEL-CHROMIUM ALLOYS													
2.4876	800	30.0 to 35.0	19.0 to 23.0	39.5 min	-	-	-	0.10	1.50	1.00	-	-	Ti 0.15 to 0.60 Al 0.15 to 0.60
2.4858	825	38.0 to 46.0	19.5 to 23.5	22.0 min	-	2.50 to 3.50	-	0.05	1.00	0.50	-	-	Ti 0.60 to 1.20 Al 0.20 max
GLASS SEALING ALLOY (CONTROLLED EXPANSION)													
2.3381	29/18	28.0 to 30.0	0.20 max	52.0 to 54.0	16.0 to 18.0	0.20	0.20	0.04	0.50	0.20	-	-	Al + Mg + Zr + Ti 0.20 max

NICKEL & NICKEL ALLOYS MECHANICAL PROPERTIES

Mechanical Properties at room temperature in the Annealed Condition					
DIN	ASTM Alloy	Proof strength 0,2% min. (N/mm ²)	Tensile strength (N/mm ²)	Elong. % min. (50 mm Gauge length)	Hardness max. (VPN)
COMMERCIALLY PURE NICKELS					
2.4066	200	105	380	40	125
2.4068	201	85	350	30	125
NICKEL-COPPER ALLOY					
2.4360	400	195	480	35	125
NICKEL-CHROMIUM & NICKEL-CHROMIUM-IRON ALLOYS					
2.4816	600	240	550	30	230
2.4851	601	230	790	40	230
2.4856	625	415	825	30	250
2.4668	718 *	415	825	30	270
2.4669	X750 *	280	700	40	250
2.4819	C276	280	690	40	230
2.4665	X	310	720	30	230
IRON-NICKEL-CHROMIUM ALLOY					
2.4876	800	210	520	30	200
2.4858	825	240	550	30	200
GLASS SEALING ALLOY (CONTROLLED EXPANSION)					
2.3381	29/18	300	500	25	200

* Precipitation Hardenable Alloys

Nickel-Chromium & Nickel-Chromium-Iron Alloys

This group of alloys led the way to higher strength and resistance to elevated temperatures. Initially developed for use in the chemical processing industry where carburising environments and elevated temperatures were too severe for stainless steels.

Iron-Nickel-Chromium Alloys (800 Series)

Offering good oxidation resistance, these alloys have found extensive use in the petrochemical processing industry. The 800 series offer excellent strength at high temperature.

Controlled Expansion Alloys

A range of alloys developed for use in conjunction with the lightning industry where glass to metal seals are very important, they exhibit good thermal conductivity.

DIN	Alloy	Service Properties	Applications
2.4066	200	Commercially pure nickel with good mechanical properties and excellent corrosion resistance.	BURSTING DISCS, BATTERY TAGS, EXPLOSION PANELS, CONTACTS
2.4068	201	Low carbon version, generally specified for temperatures above 315°C, is not subject to embrittlement due to low carbon content.	ELECTRONIC PARTS, AEROSPACE COMPONENTS, BURSTING DISCS, BATTERY TAGS
2.4360	400	High strength and excellent corrosion resistance, particularly in sea water.	MARINE ENGINEERING, CHEMICAL PROCESS PLANT, BELLOWS, HEAT EXCHANGERS
2.4816	600	A nickel-chromium alloy which resists oxidation up to 1,200°C.	FLEXIBLE TUBING, FURNANCE EQUIPMENT, INSULATION BLANKET, CHEMICAL AND FOOD PROCESSING
2.4851	601	Lower nickel content than Alloy 600, with aluminium and silicon additions for improved oxidation resistance.	FURNACE EQUIPMENT, PETROCHEMICAL PROCESS EQUIPMENT
2.4856	625	High temperature, high strength alloy, tougher than Alloy 600 and higher oxidation resistance.	BELLOWS, HEAT EXCHANGERS, SEALS, GASKETS, MARINE BRANDING
2.4668	718	Age hardenable, high strength alloy. Titanium and niobium additions overcome strain age cracking problems in welding.	HIGH TEMPERATURE SPRINGS, BELLOWS, SEALS
2.4668	X750	Age hardenable. Excellent relaxation resistance.	HIGH TEMPERATURE SPRINGS, DIAPHRAGMS, GAS TURBINES, JET ENGINES
2.4819	C276	High resistance to oxidising and reducing atmospheres. Very resistant to acid chlorides.	CHEMICAL PROCESSING PLANT, MARINE ENGINEERING, DIAPHRAGMS
2.4665	X	Additional amounts of chromium and iron provide strength and resistance to corrosion and oxidation up to 1,170°C.	AEROSPACE COMPONENTS, HONEYCOMB SEALS
2.4876	800	Excellent strengths at elevated temperatures.	PETROCHEMICAL PROCESS TUBING, HEAT EXCHANGERS, FURNACE EQUIPMENT
2.4858	825	Additional molybdenum for increased corrosion resistance over Alloy 800. Resistant to oxidising and reducing acids, particularly sulphuric.	TUBING, PIPEWORK IN PETROCHEMICAL INDUSTRY, SEALS, GASKETS
2.3381	29/18	Controlled expansion alloy whose co-efficient of expansion decreases with rising temperature and matches the expansion rate of glass.	GLASS TO METAL SEALING APPLICATIONS AND CERAMICS