ROBAN Special Alloy - Product Catalogue

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Scope

Rod, bar, wire, plate, sheet, strip, pipe, tube, fitting, forging and billet in:
Stainless steels: 904L, 2205, 2507, 254 SMO, 17-4PH, 17-7PH, 15-7PH
Corrosion resistant alloys: Monel 400, K-500, Nickel 200, 201, Hastelloy B-3, C-4, C-22, C-276, C-2000, G-30, G-35, N
High temperature alloys: Hastelloy B, S, X, Haynes 188, 230, 556, Inconel 617, 625, 718, X750

Custom-made products are available by request.

Certification

Mill test report issued with every order (independent inspection on request)
Third-party inspection release by SGS, BV, TUV, Lloyd's or Intertek
PED 2014/68/EU documentation where the application requires it

Grade index

17-4PH

Equivalent designations: Type 630, UNS S17400, DIN W. Nr. 1.4542
Density: 7.75 g/cm3 | Melting range: 1404-1440C
Product forms and standards:
Rod, bar and shape: A 564, A 484
Plate, sheet and strip: A 693, A 480
Forging: A 705, A 484
Chemical composition (%): Fe balance, Cr 15-17.5, Ni 3-5, Cu 3-5, C --0.07, Mn --1, Si --1, P --0.04, S --0.03, Nb+Ta 0.15-0.45
Features: 17-4PH is a chromium-nickel-copper precipitation hardening martensitic stainless steel that combines oxidation and corrosion resistance comparable to 304 in most environments with high strength and hardness. It is the most widely used of all the precipitation hardening stainless steels, and is more cost effective than many high nickel non-ferrous alloys in some applications. 17-4PH cannot be used at temperatures above 300C and at cryogenic temperatures. It is magnetic.
Applications: Aerospace industry, biomedical hand tools, chemical and food processing equipment, nuclear waste processing and storage, general metalworking, and paper mill equipment.

17-7PH

Equivalent designations: Type 631, UNS S17700, DIN W. Nr. 1.4568
Density: 7.81 g/cm3 | Melting range: 1404-1440C
Product forms and standards:
Rod, bar and shape: A 564, A 484
Plate, sheet and strip: A 693, A 480
Forging: A 705, A 484
Chemical composition (%): Fe balance, Cr 16-18, Ni 6.5-7.75, C --0.09, Mn --1, Si --1, P --0.04, S --0.03, Al 0.75-1.5
Features: 17-7PH is a precipitation hardening martensitic stainless steel that combines high strength and

hardness with good corrosion resistance. Its corrosion resistance in conditions TH 1050 and RH 950 is generally superior to standard hardenable chromium types 400 series stainless steels, but is not as good as chromium-nickel type 304. Corrosion resistance in condition CH 900 is similar to type 304 in most environments. Like other martensitic steels, it is subject to cracking when exposed under stress in environments containing hydrogen sulfide. Such applications should be avoided.
Applications: Aerospace industry, chemical and food processing equipment, petroleum refining equipment, and general metalworking.

15-7PH

Equivalent designations: Type 632, UNS S15700, DIN W. Nr. 1.4532
Density: 7.81 g/cm3 | Melting range: 1415-1450C
Product forms and standards:
Rod, bar and shape: A 564, A 484
Plate, sheet and strip: A 693, A 480
Forging: A 705, A 484
Chemical composition (%): Fe balance, Cr 14-16, Ni 6.5-7.75, Mo 2-3, C --0.09, Mn --1, Si --1, P --0.04, S --0.03, Al 0.75-1.5
Features: 15-7PH is a semi-austenitic precipitation hardening stainless steel that provides high strength and hardness and good corrosion resistance. Its general corrosion resistance level in conditions TH 1050 and RH 950 is superior to standard hardenable chromium types 400 series stainless steels, but is not as good as chromium-nickel type 304.
Applications: Diaphragms, welded and brazed honeycomb panels, aircraft bulkheads, springs, and retaining rings.

2205

Equivalent designations: UNS S32205, DIN W. Nr. 1.4462
Density: 7.69 g/cm3 | Melting range: 1385-1443C
Product forms and standards:
Rod, bar and shape: A 276, A 484
Plate, sheet and strip: A 240, A 480
Seamless and welded pipe: A 790, A 999
Seamless and welded tubing: A 789, A 1016
Fitting: A 815, A 960
Forged or rolled pipe flange and forged fitting: A 182, A 961
Billet and bar for forging: A 314, A 484
Chemical composition (%): Fe balance, Cr 22-23, Ni 4.5-6.5, Mo 3-3.5, C --0.03, Mn --2, Si --1, P --0.03, S --0.02, N 0.14-0.2
Features: 2205 is a duplex stainless steel with nearly equal proportions of austenite and ferrite when properly heat treated. This microstructure makes it much more resistant to stress corrosion cracking than stainless steel 304 and 316L. 2205's higher chromium, molybdenum and nitrogen contents give it significantly improved pitting and crevice corrosion resistance in the presence of chlorides. Its yield strength is about twice that of austenitic stainless steels. It is highly suitable for applications in environments containing chlorides and hydrogen sulfide such as marine applications and oil and gas production.
Applications: Oil and gas industry piping, tubing and heat exchangers; pulp and paper industry bleaching equipment, liquor tanks and digesters; cargo tanks for ships and trucks; chemical processing industry pressure vessels, tanks, piping and heat exchangers; and food processing equipment.

2507

Equivalent designations: UNS S32750, DIN W. Nr. 1.4410
Density: 7.75 g/cm3 | Melting range: 1396-1450C
Product forms and standards:
Rod, bar and shape: A 276, A 484
Plate, sheet and strip: A 240, A 480
Seamless and welded pipe: A 790, A 999
Seamless and welded tubing: A 789, A 1016
Fitting: A 815, A 960
Forged or rolled pipe flange and forged fitting: A 182, A 961
Billet and bar for forging: A 314, A 484
Chemical composition (%): Fe balance, Cr 24-26, Ni 6-8, Mo 3-5, C --0.03, Mn --1.2, Si --0.8, P --0.035, S --0.02, Cu --0.5, N 0.24-0.32
Features: 2507 is a super duplex stainless steel with higher alloy content, thus making it superior to 2205 in corrosion resistance and strength. It has excellent resistance to uniform, pitting, crevice corrosion and chloride stress corrosion cracking. In dilute sulfuric acid contaminated with chloride ions, 2507 has better corrosion resistance than 904L, which is specially designed to resist pure sulfuric acid. Because 2507's low carbon content greatly lowers the risk of carbide precipitation at the grain boundaries during heat treatment, it is highly resistant to carbide-related intergranular corrosion. 2507 is not suitable for applications which require long exposure to temperatures above 300C because of the increased risk of a reduction in toughness. Its yield strength is about twice that of conventional austenitic stainless steels.
Applications: Chemical processing industry piping, vessels and heat exchangers; desalination plant seawater piping; oil and gas industry equipment; power plant flue gas desulfurization systems, scrubber systems and absorber towers; and chemical tankers.

254 SMO

Equivalent designations: UNS S31254, DIN W. Nr. 1.4547
Density: 7.94 g/cm3 | Melting range: 1320-1390C
Product forms and standards:
Rod, bar and shape: A 276, A 484
Plate, sheet and strip: A 240, A 480
Seamless and welded pipe: A 312, A 999
Welded pipe: A 814, A 999
Seamless and welded tubing: A 269, A 1016
Fitting: A 403, A 960
Forged or rolled pipe flange and forged fitting: A 182, A 961
Forging: A 473, A 484
Chemical composition (%): Fe balance, Cr 19.5-20.5, Ni 17.5-18.5, Mo 6-6.5, C --0.02, Mn --1, Si --0.8, P --0.03, S --0.01, Cu 0.5-1, N 0.18-0.22
Features: 254 SMO is a high performance austenitic stainless steel. Its high alloying elements content imparts excellent resistance to uniform, pitting and crevice corrosion, and stress corrosion cracking. It was originally developed to withstand the corrosion of acids, especially in the presence of halide ions, such as hydrochloric acid, hydrofluoric acid, phosphoric acid, and sulphuric acid contaminated with chlorides. In certain environments it is an alternative to more expensive nickel alloys and titanium alloys.
Applications: Chemical processing equipment, pulp and paper industry bleaching equipment, desalination plant seawater piping, food and beverage industry, pharmaceuticals, and hydrometallurgy.

Invar 36

Equivalent designations: UNS K93600, W. Nr. 1.3912
Density: 8.11 g/cm3 | Melting range: 1430C
Product forms and standards:
Sheet and strip: B 388, B 753
Chemical composition (%): Fe balance, Ni 35-37, C --0.15, Mn --0.6, Si --0.4, P --0.025, S --0.025, Co --0.5, Cr --0.25
Features: Invar 36 is a 36% nickel-iron alloy notable for its uniquely low coefficient of thermal expansion which is roughly one-tenth that of carbon steel in the range from room temperature to around 200C. It also retains good strength and toughness at cryogenic temperatures. It can be hot and cold formed and machined using processes similar to austenitic stainless steels.
Applications: Invar 36 is useful for applications where high dimensional stability is required such as standards of length, precision optical and laser system, cryogenic components. It is also used in conjunction with high expansion alloys in applications in bimetallic thermostats.

Hastelloy B

Equivalent designations: UNS N10001
Density: 9.24 g/cm3 | Melting range: 1330-1380C
Product forms and standards:
Rod: B 335
Plate, sheet and strip: B 333, B 906
Seamless pipe and tube: B 622
Welded pipe: B 619, B 775
Welded tube: B 626, B 751
Welding fitting: B 366
Chemical composition (%): Ni balance, Mo 26-30, Fe 4-6, Co --2.5, Cr --1, C --0.05, Mn --1, Si --1, P --0.04, S --0.03, V 0.2-0.4
Features: Hastelloy B has excellent resistance to reducing environments like sulfuric acid at moderate concentrations and other nonoxidizing acids. It also resists stress corrosion cracking induced by chlorides. Hastelloy B has poor resistance to oxidizing environments, therefore, it should not be used where ferric or cupric salts are present as these salts may cause rapid corrosion failure.
Applications: Equipment handling reducing chemical environments; and chemical process industry involving hydrochloric, sulfuric, phosphoric and acetic acids.

Hastelloy B-2

Equivalent designations: UNS N10665, DIN W. Nr. 2.4617
Density: 9.22 g/cm3 | Melting range: 1330-1380C
Product forms and standards:
Rod: B 335
Plate, sheet and strip: B 333, B 906
Seamless pipe and tube: B 622
Welded pipe: B 619, B 775
Welded tube: B 626, B 751
Welding fitting: B 366
Forged or rolled pipe flange and forged fitting: B 462
Billet and bar for reforging: B 472
Forging: B 564

Chemical composition (%): Ni balance, Mo 26-30, Fe --2, Cr --1, Co --1, C --0.02, Mn --1, Si --0.1, P --0.04, S --0.03

Features: Hastelloy B-2 has outstanding resistance to hydrochloric acid at all concentrations and temperatures. It also has significant resistance to reducing environments like sulfuric, phosphoric, acetic acids and other nonoxidizing media. Hastelloy B-2 has excellent resistance to pitting corrosion, stress corrosion cracking, and knife line and weld heat-affected zone attack. Hastelloy B-2 has poor resistance to oxidizing environments, therefore, it should not be used where ferric or cupric salts are present as these salts may cause rapid corrosion failure.

Applications: Equipment handling reducing chemical environments; and chemical process industry involving hydrochloric, sulfuric, phosphoric and acetic acids.

Hastelloy B-3

Equivalent designations: UNS N10675, DIN W. Nr. 2.4600

Density: 9.22 g/cm3 | Melting range: 1370-1418C

Product forms and standards:

Rod: B 335

Plate, sheet and strip: B 333, B 906

Seamless pipe and tube: B 622

Welded pipe: B 619, B 775

Welded tube: B 626, B 751

Welding fitting: B 366

Forged or rolled pipe flange and forged fitting: B 462

Billet and bar for reforging: B 472

Forging: B 564

Chemical composition (%): Ni 65--, Mo 27-32, Ni+Mo 94-98, Cr 1-3, Fe 1-3, W --3, Co --3, C --0.01, Mn --3, Si --0.1, P --0.03, S --0.01, Al --0.5, Ti --0.2, Cu --0.2, Nb --0.2, Ta --0.2, V --0.2, Zr --0.1

Features: Hastelloy B-3 has outstanding resistance to hydrochloric acid at all concentrations and temperatures. It also resists sulfuric, phosphoric, formic, acetic acids and other nonoxidizing media. It has excellent resistance to pitting corrosion, stress corrosion cracking, and knife line and weld heat-affected zone attack. Hastelloy B-3 has greater thermal stability than Hastelloy B-2.

Applications: Hastelloy B-3 is suitable for the applications where Hastelloy B-2 is required. Like Hastelloy B-2, Hastelloy B-3 should not be used in the presence of ferric or cupric salts as these salts may cause rapid corrosion attack.

Hastelloy C-4

Equivalent designations: UNS N06455, DIN W. Nr. 2.4610

Density: 8.64 g/cm3 | Melting range: 1350-1380C

Product forms and standards:

Rod: B 574

Plate, sheet and strip: B 575

Seamless pipe and tube: B 622

Welded pipe: B 619, B 775

Welded tube: B 626, B 751

Welding fitting: B 366

Chemical composition (%): Ni balance, Cr 14-18, Mo 14-17, Fe --3, Co --2, C --0.015, Mn --1, Si --0.08, P --0.04, S --0.03, Ti --0.7

Features: Hastelloy C-4 has outstanding high-temperature stability, and has excellent resistance to

stress-corrosion cracking and oxidizing atmospheres up to 1040C. It has exceptional resistance to a wide variety of chemical process environments, including hot contaminated mineral acids, solvents, chlorine and chlorine contaminated media (organic and inorganic), formic and acetic acids, acetic anhydride, and seawater and brine solutions.
Applications: Chemical processing involving wet chlorine, hypochloric acid, hydrochloric acid, acetic acid and acetic anhydride; flue gas scrubber systems; pickling operations; and electro-galvanizing.

Hastelloy C-22

Equivalent designations: UNS N06022, DIN W. Nr. 2.4602
Density: 8.69 g/cm3 | Melting range: 1325-1370C
Product forms and standards:
Rod: B 574
Plate, sheet and strip: B 575
Seamless pipe and tube: B 622
Welded pipe: B 619, B 775
Welded tube: B 626, B 751
Welding fitting: B 366
Forged or rolled pipe flange and forged fitting: B 462
Billet and bar for reforging: B 472
Forging: B 564
Chemical composition (%): Ni balance, Cr 20-22.5, Mo 12.5-14.5, Fe 2-6, W 2.5-3.5, Co --2.5, C --0.015, Mn --0.5, Si --0.08, P --0.02, S --0.02, V --0.35
Features: Hastelloy C-22 is a versatile Ni-Cr-Mo-W alloy with better comprehensive corrosion resistance performance than other Ni-Cr-Mo alloys, including Hastelloy C-276, Hastelloy C-4 and Inconel 625. Hastelloy C-22 has outstanding resistance to pitting, crevice corrosion and stress corrosion cracking. It has excellent resistance to oxidizing aqueous media including wet chlorine and mixtures containing nitric acid or oxidizing acids with chloride ions. It also offers optimum resistance to environments where reducing and oxidizing conditions are encountered in process streams. So it can be used where "upset" conditions are likely to occur or in multi-purpose plants. Hastelloy C-22 has exceptional resistance to a wide variety of chemical process environments, including strong oxidizers such as ferric and cupric chlorides, chlorine, hot contaminated solutions (organic and inorganic), formic and acetic acids, acetic anhydride, and seawater and brine solutions. It resists the formation of grain boundary precipitates in the weld heat-affected zone, thus making it suitable for most chemical process applications in the as-welded condition.
Applications: Chemical processing involving acetic acid, acetic anhydride and complex acid mixture; pickling operations; cellophane manufacture; chlorination systems; electro-galvanizing rolls, expansion bellows; flue gas scrubber systems; geothermal wells; HF furnace scrubbers; incineration scrubbers; nuclear fuel reprocessing; pesticide production; phosphoric acid production; heat exchangers; selective leaching systems; sulfur dioxide cooling towers; sulphonation systems; and weld overlay.

Hastelloy C-276

Equivalent designations: UNS N10276, DIN W. Nr. 2.4819
Density: 8.87 g/cm3 | Melting range: 1325-1370C
Product forms and standards:
Rod: B 574
Plate, sheet and strip: B 575
Seamless pipe and tube: B 622
Welded pipe: B 619, B 775

Welded tube: B 626, B 751
Welding fitting: B 366
Forged or rolled pipe flange and forged fitting: B 462
Billet and bar for reforging: B 472
Forging: B 564
Chemical composition (%): Ni balance, Cr 14.5-16.5, Mo 15-17, Fe 4-7, W 3-4.5, Co --2.5, C --0.01, Mn --1, Si --0.08, P --0.04, S --0.03, V --0.35
Features: Hastelloy C-276 has excellent resistance to localized corrosion, stress corrosion cracking, and to both oxidizing and reducing media, thus making it suitable for a wide variety of chemical process environments, including ferric and cupric chlorides, hot contaminated media (organic and inorganic), formic and acetic acids, seawater and brine solutions. It is one of the few materials that withstands the corrosive effects of wet chlorine gas, hypochlorite and chlorine dioxide.
Applications: Chemical processing, waste treatment, pollution control, pulp and paper production, and marine engineering.

Hastelloy C-2000

Equivalent designations: UNS N06200, DIN W. Nr. 2.4675
Density: 8.50 g/cm3 | Melting range: 1328-1358C
Product forms and standards:
Rod: B 574
Plate, sheet and strip: B 575
Seamless pipe and tube: B 622
Welded pipe: B 619, B 775
Welded tube: B 626, B 751
Welding fitting: B 366
Forged or rolled pipe flange and forged fitting: B 462
Billet and bar for reforging: B 472
Forging: B 564
Chemical composition (%): Ni balance, Cr 22-24, Mo 15-17, Fe --3, Co --2, C --0.01, Mn --0.5, Si --0.08, P --0.025, S --0.01, Cu 1.3-1.9, Al --0.5
Features: Hastelloy C-2000 is a versatile corrosion resistant alloy with excellent resistance to uniform corrosion in oxidizing or reducing environments. It resists all acids, especially hydrochloric, sulfuric and hydrofluoric acids, at wide temperature ranges, and also resists pitting corrosion, crevice corrosion and stress corrosion cracking induced by chlorides and other halide solutions.
Applications: Chemical process industry reactors, heat exchangers, columns and piping; pharmaceutical industry reactors and dryers; and flue gas desulfurization system components.

Hastelloy G-30

Equivalent designations: UNS N06030, DIN W. Nr. 2.4603
Density: 8.22 g/cm3 | Melting range: 1370-1400C
Product forms and standards:
Rod: B 581
Plate, sheet and strip: B 582
Seamless pipe and tube: B 622
Welded pipe: B 619, B 775
Welded tube: B 626, B 751
Welding fitting: B 366

Forged or rolled pipe flange and forged fitting: B 462
Billet and bar for reforging: B 472
Chemical composition (%): Ni balance, Cr 28-31.5, Fe 13-17, Mo 4-6, W 1.5-4, Co --5, C --0.03, Mn --1.5, Si --0.8, P --0.04, S --0.02, Cu 1-2.4, Nb+Ta 0.3-1.5
Features: Hastelloy G-30 is a high chromium nickel-base alloy which has superior corrosion resistance over most other nickel and iron-base alloys in commercial phosphoric acid as well as many complex environments containing highly oxidizing acids such as nitric/hydrochloric, nitric/hydrofluoric and sulfuric acids. It resists the formation of grain boundary precipitates in the heat-affected zone, making it suitable for use in most chemical process environments in the as-welded condition.
Applications: Chemical processing involving phosphoric acid, sulfuric acid and nitric acid; nuclear fuel reprocessing; nuclear waste processing; pickling operations; petrochemical; fertilizer manufacture; pesticide manufacture; and gold ore extraction.

Hastelloy G-35

Equivalent designations: UNS N06035, DIN W. Nr. 2.4643
Density: 8.18 g/cm3 | Melting range: 1332-1361C
Product forms and standards:
Rod: B 574
Plate, sheet and strip: B 575
Seamless pipe and tube: B 622
Welded pipe: B 619, B 775
Welded tube: B 626, B 751
Welding fitting: B 366
Forged or rolled pipe flange and forged fitting: B 462
Billet and bar for reforging: B 472
Forging: B 564
Chemical composition (%): Ni balance, Cr 32.25-34.25, Mo 7.6-9, Fe --2, Co --1, W --0.6, C --0.05, Mn --0.5, Si --0.6, P --0.03, S --0.015, Al --0.4, Cu --0.3, V --0.2
Features: Hastelloy G-35 is an upgrade version of Hastelloy G-30. It has extraordinary resistance in the wet process phosphoric acid production environment, which is widely used in fertilizer production. Its performance in this environment is far superior to Hastelloy G-30 and stainless steels. It can also resist localized corrosion and chloride-induced stress corrosion cracking in chlorides containing media. Because of its high chromium content, Hastelloy G-35 is extremely resistant to other oxidizing acids, such as nitric acid and mixtures containing nitric acid. As a result of its appreciable molybdenum content, it possesses moderate resistance to reducing acids, and unlike other nickel-chromium-molybdenum alloys, it is very resistant to caustic dealloying in hot sodium hydroxide.
Applications: Wet process phosphoric acid production evaporators, pickling equipment using nitric acid and hydrofluoric acid, caustic neutralizing systems, and chemical process industry systems involving nitric acid and chlorides.

Hastelloy N

Equivalent designations: UNS N10003
Density: 8.78 g/cm3 | Melting range: 1300-1400C
Product forms and standards:
Rod: B 573
Plate, sheet and strip: B 434, B 906
Welding fitting: B 366

Chemical composition (%): Ni balance, Mo 15-18, Cr 6-8, Fe --5, C 0.04-0.08, Mn --1, Si --1, P --0.015, S --0.02, W --0.5, Co --0.2, V --0.5, Al+Ti --0.5, Cu --0.35, B --0.01
Features: Hastelloy N has excellent oxidation resistance to hot fluoride salts in the temperature range of 704 to 871C. It has good oxidation resistance in air. It also has good fabricability and good resistance to aging and embrittlement.
Applications: Containers for molten fluoride salts.

Hastelloy S

Equivalent designations: UNS N06635
Density: 8.75 g/cm3 | Melting range: 1335-1380C
Product form and specification confirmed against ASTM/EN on enquiry
Chemical composition (%): Ni balance, Cr 14.5-17, Mo 14-16.5, Fe --3, Co --2, W --1, C --0.02, Mn 0.3-1, Si 0.2-0.75, P --0.02, S --0.015, Al 0.1-0.5, Cu --0.35, La 0.01-0.1, B --0.015
Features: Hastelloy S has excellent thermal stability, low thermal expansion and excellent oxidation resistance at 1093C. It has good high temperature and thermal fatigue strength. It retains its strength and ductility after aging at temperatures of 427 to 871C. Hastelloy S is particularly suitable for cyclical heating conditions where components must be capable of retaining their strength, ductility and metallurgical integrity after long time exposure.
Applications: Industrial furnaces, and gas turbine engine seal rings.

Hastelloy X

Equivalent designations: UNS N06002, DIN W. Nr. 2.4665
Density: 8.23 g/cm3 | Melting range: 1260-1355C
Product forms and standards:
Rod: B 572
Plate, sheet and strip: B 435, B 906
Seamless pipe and tube: B 622
Welded pipe: B 619, B 775
Welded tube: B 626, B 751
Welding fitting: B 366
Billet and bar for reforging: B 472
Chemical composition (%): Ni balance, Cr 20.5-23, Fe 17-20, Mo 8-10, Co 0.5-2.5, W 0.2-1, C 0.05-0.15, Mn --1, Si --1, P --0.04, S --0.03
Features: Hastelloy X is a nickel-chromium-iron-molybdenum alloy with an exceptional combination of high temperature strength, oxidation resistance and fabricability. It shows good ductility after prolonged exposure at temperatures up to 870C for 16000 hours. It also has excellent resistance to stress corrosion cracking in petrochemical applications.
Applications: Gas turbine engine combustion zone components, industrial furnaces, chemical process industry.

Haynes 188

Equivalent designations: UNS R30188
Density: 8.98 g/cm3 | Melting range: 1315-1410C
Product form and specification confirmed against ASTM/EN on enquiry
Chemical composition (%): Co balance, Ni 20-24, Cr 20-24, W 13-16, Fe --3, C 0.05-0.15, Mn --1.25, Si 0.2-0.5, P --0.02, S --0.015, La 0.02-0.12, B --0.015
Features: Haynes 188 combines excellent high temperature strength with very good resistance to oxidizing environments up to 1095C for prolonged exposure, and excellent resistance to sulfate deposit hot corrosion.

It also has excellent resistance to molten chloride salts, and good resistance to gaseous sulfidation.
Applications: Military and commercial gas turbine engine combustion cans, transition ducts and after-burner components.

Haynes 230

Equivalent designations: UNS N06230, DIN W. Nr. 2.4733
Density: 8.97 g/cm3 | Melting range: 1301-1371C
Product forms and standards:
Rod: B 572
Plate, sheet and strip: B 435, B 906
Seamless pipe and tube: B 622
Welded pipe: B 619, B 775
Welded tube: B 626, B 751
Welding fitting: B 366
Billet and bar for reforging: B 472
Forging: B 564
Chemical composition (%): Ni balance, Cr 20-24, W 13-15, Mo 1-3, Co --5, Fe --3, C 0.05-0.15, Mn 0.3-1, Si 0.25-0.75, P --0.03, S --0.015, Al 0.2-0.5, La 0.005-0.05, B --0.015
Features: Haynes 230 combines excellent high temperature strength, outstanding resistance to oxidizing environments up to 1149C for prolonged exposure, premier resistance to nitriding environments, and excellent long term thermal stability. It has low thermal expansion than most high temperature alloys, and good resistance to grain coarsening with prolonged exposure to high temperatures.
Applications: Gas turbine engine combustion cans, transition ducts, after-burners, flameholders and thermocouple sheaths; high temperature heat exchangers; and industrial furnace heat resistant components.

Haynes 556

Equivalent designations: UNS R30556
Density: 8.23 g/cm3 | Melting range: 1330-1415C
Product forms and standards:
Rod: B 572
Plate, sheet and strip: B 435, B 906
Seamless pipe and tube: B 622
Welded pipe: B 619, B 775
Welded tube: B 626, B 751
Welding fitting: B 366
Billet and bar for reforging: B 472
Chemical composition (%): Fe --0.04, Cr --0.015, Ni 0.1-0.5, Co 0.3-1.25, Mo --0.3, W 0.005-0.1, C 0.001-0.1, Mn 0.1-0.3, Si --0.02
Features: Haynes 556 combines effective resistance to sulfidizing, carburizing and chlorine-bearing environments at high temperatures with good oxidation resistance, fabricability and excellent high temperature strength. It also resists to corrosion by molten zinc, molten chloride salts and other salts.
Applications: Industrial waste incinerators, rotary calciners and kilns, hot-dip galvanizing equipment, aerospace industry high temperature components.

Inconel 600

Equivalent designations: UNS N06600, DIN W. Nr. 2.4816
Density: 8.47 g/cm3 | Melting range: 1354-1413C

Product forms and standards:
Rod, bar and wire: B 166
Plate, sheet and strip: B 168, B 906
Seamless pipe and tube: B 167, B 829
Welded pipe: B 517, B 775
Welded tube: B 516, B 751
Welding fitting: B 366
Billet and bar for reforging: B 472
Forging: B 564
Chemical composition (%): Ni 72--, Cr 14-17, Fe 6-10, C --0.15, Mn --1, Si --0.5, S --0.015, Cu --0.5
Features: Inconel 600 has good resistance to corrosion and high temperature, and has high strength and good fabricability. It resists chloride-ion-incurred stress corrosion cracking, sulfur compounds and oxidizing conditions at high temperatures.
Applications: Chemical process industry, heat treating fixtures, airframe components and nuclear reactors.

Inconel 601

Equivalent designations: UNS N06601, DIN W. Nr. 2.4851
Density: 8.11 g/cm3 | Melting range: 1360-1411C
Product forms and standards:
Rod, bar and wire: B 166
Plate, sheet and strip: B 168, B 906
Seamless pipe and tube: B 167, B 829
Welded pipe: B 775
Welded tube: B 751
Chemical composition (%): Ni 58-63, Cr 21-25, Fe balance, C --0.1, Mn --1, Si --0.5, S --0.015, Al 1-1.7, Cu --1
Features: Inconel 601 has good resistance to heat and corrosion, especially outstanding to oxidation at elevated temperatures up to 1200C. It also has high strength, good fabricability and good resistance to aqueous corrosion.
Applications: Chemical process industry, waste incinerators, power generation equipment, heat treating equipment, and gas turbine engine components.

Inconel 617

Equivalent designations: UNS N06617, DIN W. Nr. 2.4663A
Density: 8.36 g/cm3 | Melting range: 1330-1375C
Product forms and standards:
Rod, bar and wire: B 166
Plate, sheet and strip: B 168, B 906
Seamless pipe and tube: B 167, B 829
Billet and bar for reforging: B 472
Forging: B 564
Chemical composition (%): Ni 44.5--, Cr 20-24, Co 10-15, Mo 8-10, Fe --3, C 0.05-0.15, Mn --1, Si --1, S --0.015, Al 0.8-1.5, Ti --0.6, Cu --0.5, B --0.006
Features: Inconel 617 has excellent resistance to oxidation and carburization at high temperatures. It also resists a wide range of corrosive aqueous environments. Inconel 617 has high strength and maintains much of its strength at elevated temperatures.
Applications: Gas turbine engine combustion cans and ducts, heat treating equipment, petrochemical

processing, power plant equipment, and catalyst-grid supports in nitric acid production.

Inconel 625

Equivalent designations: UNS N06625, DIN W. Nr. 2.4856
Density: 8.44 g/cm3 | Melting range: 1290-1350C
Product forms and standards:
Rod and bar: B 446
Plate, sheet and strip: B 443, B 906
Seamless pipe and tube: B 444, B 829
Welded pipe: B 705, B 775
Welded tube: B 704, B 751
Welding fitting: B 366
Billet and bar for reforging: B 472
Forging: B 564
Chemical composition (%): Ni 58--, Cr 20-23, Mo 8-10, Fe --5, C --0.1, Mn --0.5, Si --0.5, P --0.015, S --0.015, Co --1, Nb+Ta 3.15-4.15, Al --0.4, Ti --0.4
Features: Inconel 625 has excellent strength at temperatures up to 816C. At higher temperatures, its strength is generally lower than that of other solid solution strengthened alloys. Inconel 625 has good oxidation resistance at temperatures up to 980C and shows good resistance to aqueous corrosion, but is relatively moderate compared to other more capable corrosion resistant alloys.
Applications: Chemical process industry and sea water application. Inconel 625 is used in short term applications at temperatures up to 816C. For long term service, it is best restricted to a maximum of 593C, because long term exposure above 593C will result in significant embrittlement.

Inconel 718

Equivalent designations: UNS N07718, DIN W. Nr. 2.4668
Density: 8.23 g/cm3 | Melting range: 1260-1335C
Product forms and standards:
Rod, bar and forging: B 637
Plate, sheet and strip: B 670, B 906
Seamless pipe and tube: B 983
Chemical composition (%): Ni 50-55, Fe balance, Cr 17-21, Mo 2.8-3.3, C --0.08, Mn --0.35, Si --0.35, P --0.015, S --0.015, Co --1, Nb+Ta 4.75-5.5, Ti 0.65-1.15, Al 0.2-0.8, Cu --0.3, B --0.006
Features: Inconel 718 is an age-hardenable nickel-chromium alloy that combines corrosion resistance with high strength and good fabricability. It has high creep-rupture strength at temperatures up to 700C. Its excellent relaxation resistance contributes to its application in springs.
Applications: Gas turbine engines, rocket motors, nuclear reactors and spacecraft.

Inconel X750

Equivalent designations: UNS N07750, DIN W. Nr. 2.4669
Density: 8.28 g/cm3 | Melting range: 1393-1427C
Product forms and standards:
Rod, bar and forging: B 637
Chemical composition (%): Ni 70--, Cr 14-17, Fe 5-9, C --0.08, Mn --1, Si --0.5, S --0.01, Ti 2.25-2.75, Nb+Ta 0.7-1.2, Al 0.4-1, Co --1, Cu --0.5
Features: Inconel X750 is an age-hardenable nickel-chromium alloy. It has good corrosion and oxidation resistance and high strength at temperatures up to 700C. It also has good properties down to cryogenic

temperatures. Its corrosion resistance performance is similar to Inconel 600.
Applications: Gas turbine engines, rocket motors, heat treating fixtures, nuclear reactors, pressure vessels and airframes.

Incoloy A-286

Equivalent designations: UNS S66286, DIN W. Nr. 1.4980
Density: 7.94 g/cm3 | Melting range: 1370-1430C
Product forms and standards:
Bar and forging: A 638, A 484
Chemical composition (%): Fe balance, Ni 24-27, Cr 13.5-16, C --0.08, Si --1, Mn --2, P --0.04, S --0.03, Ti 1.9-2.35, Mo 1-1.5, V 0.1-0.5, Al --0.35, B 0.001-0.01
Features: Incoloy A-286 is an age-hardenable alloy which can withstand oxidation and retain good strength at temperatures up to about 700C. It can be readily formed by standard processes for stainless steels and nickel alloys.
Applications: Aircraft and industrial gas turbine components that are subject to high levels of heat and stress at service temperatures up to 700C such as turbine wheels and blades, frames, superchargers and afterburner parts. It is also used in fasteners of automotive engines.

Incoloy 020

Equivalent designations: UNS N08020
Density: 8.08 g/cm3 | Melting range: 1357-1430C
Product forms and standards:
Rod, bar and wire: B 473
Plate, sheet and strip: A 240, A 480, B 463, B 906
Seamless pipe and tube: B 729, B 829
Welded pipe: B 464, B 775
Welded tube: B 468, B 751
Welding fitting: B 366
Forged or rolled pipe flange and forged fitting: B 462
Billet and bar for reforging: B 472
Chemical composition (%): Fe balance, Ni 32-38, Cr 19-21, Cu 3-4, Mo 2-3, C --0.07, Mn --2, Si --1, P --0.045, S --0.035, Nb+Ta --1
Features: Incoloy 020 has excellent resistance in chemicals containing sulfuric acid, and has good resistance to environments containing chlorides, phosphoric acid and nitric acid. It contains niobium for stabilization against sensitization and resultant intergranular corrosion. It also has good mechanical properties and fabricability.
Applications: Chemical, food, pharmaceutical and plastics industries, heat exchangers, mixing tanks, pickling equipment, synthetic rubber manufacturing equipment, pumps, valves and piping.

Incoloy 800

Equivalent designations: UNS N08800, DIN W. Nr. 1.4876
Density: 7.94 g/cm3 | Melting range: 1357-1385C
Product forms and standards:
Rod and bar: B 408
Plate, sheet and strip: A 240, A 480, B 409, B 906
Seamless pipe and tube: B 407, B 829
Welded pipe: B 514, B 775

Welded tube: B 515, B 751
Welding fitting: B 366
Forging: B 564
Chemical composition (%): Fe 39.5--, Ni 30-35, Cr 19-23, C --0.1, Mn --1.5, Si --1, S --0.015, Cu --0.75, Al 0.15-0.6, Ti 0.15-0.6
Features: Incoloy 800 has good rupture and creep strength and excellent resistance to oxidation, carburization and sulfidation at temperatures up to 816C. It also resists general corrosion by many aqueous media. For applications requiring higher stress rupture and creep properties, especially at temperatures above 816C, Incoloy 800H and 800HT are recommended. Incoloy 800 is readily formed, welded and machined.
Applications: Chemical and petrochemical process piping, heat exchangers, furnace components, carburizing equipment, heating-element sheathing, and nuclear power steam-generator tubing.

Incoloy 800H

Equivalent designations: UNS N08810, DIN W. Nr. 1.4958
Density: 7.94 g/cm3 | Melting range: 1357-1385C
Product forms and standards:
Rod and bar: B 408
Plate, sheet and strip: A 240, A 480, B 409, B 906
Seamless pipe and tube: B 407, B 829
Welded pipe: B 514, B 775
Welded tube: B 515, B 751
Welding fitting: B 366
Forging: B 564
Chemical composition (%): Fe 39.5--, Ni 30-35, Cr 19-23, C 0.05-0.1, Mn --1.5, Si --1, S --0.015, Cu --0.75, Al 0.15-0.6, Ti 0.15-0.6
Features: Incoloy 800H has a restricted carbon content range of 0.05 to 0.10%, which is in the upper portion of that of Incoloy 800, and is annealed at 1149 to 1177C (Incoloy 800 is annealed at 983 to 1038C). These differences impart it to have higher stress rupture and creep properties than Incoloy 800.
Applications: Chemical and petrochemical process piping, high temperature heat exchangers, furnace components, carburizing equipment, heating-element sheathing, and nuclear power steam superheating tubing.

Incoloy 800HT

Equivalent designations: UNS N08811, DIN W. Nr. 1.4959
Density: 7.94 g/cm3 | Melting range: 1357-1385C
Product forms and standards:
Rod and bar: B 408
Plate, sheet and strip: A 240, A 480, B 409, B 906
Seamless pipe and tube: B 407, B 829
Welded pipe: B 514, B 775
Welded tube: B 515, B 751
Welding fitting: B 366
Forging: B 564
Chemical composition (%): Fe 39.5--, Ni 30-35, Cr 19-23, C 0.06-0.1, Mn --1.5, Si --1, S --0.015, Cu --0.75, Al 0.15-0.6, Ti 0.15-0.6, Al+Ti 0.85-1.2
Features: Incoloy 800HT ensures higher stress rupture and creep properties compared to Incoloy 800H as a result of restricting the carbon content further in the range of 0.06 to 0.10% (Incoloy 800H is 0.05 to 0.10%), and the aluminum plus titanium content at 0.85 to 1.20% (Incoloy 800H is 0.30 to 1.20%).

Applications: Chemical and petrochemical process piping, high temperature heat exchangers, furnace components, carburizing equipment, heating-element sheathing, and nuclear power steam superheating tubing.

Incoloy 825

Equivalent designations: UNS N08825, DIN W. Nr. 2.4858
Density: 8.14 g/cm3 | Melting range: 1370-1400C
Product forms and standards:
Rod and bar: B 425
Plate, sheet and strip: B 424, B 906
Seamless pipe and tube: B 423, B 829
Welded pipe: B 705, B 775
Welded tube: B 704, B 751
Welding fitting: B 366
Forging: B 564
Chemical composition (%): Ni 38-46, Fe 22--, Cr 19.5-23.5, C --0.05, Mn --1, Si --0.5, S --0.03, Mo 2.5-3.5, Cu 1.5-3, Ti 0.6-1.2, Al --0.2
Features: Incoloy 825 has excellent resistance to chloride-ion-induced stress corrosion cracking, reducing environments containing phosphoric and sulfuric acids, oxidizing environments containing nitric acid and nitrates, and pitting, crevice corrosion and intergranular corrosion. It has good mechanical properties at cryogenic temperatures to moderately high temperatures up to 538C.
Applications: Chemical process industry, acid production, pickling equipment, pollution control equipment.

Incoloy 925

Equivalent designations: UNS N09925
Density: 8.08 g/cm3 | Melting range: 1311-1366C
Product forms and standards:
Rod, bar and wire: B 805
Rod, bar and forging: B 637
Plate, sheet and strip: B 872
Seamless pipe and tube: B 983
Chemical composition (%): Ni 42-46, Fe 22--, Cr 19.5-22.5, C --0.03, Mn --1, Si --0.5, P --0.03, S --0.03, Mo 2.5-3.5, Cu 1.5-3, Ti 1.9-2.4, Al 0.1-0.5, Nb --0.5
Features: Incoloy 925 is a precipitation-hardenable nickel-iron-chromium alloy. It combines high strength with Incoloy 825's excellent corrosion resistance. Incoloy 925 is particularly resistant to sulfide-induced stress cracking and stress-corrosion cracking.
Applications: Down-hole and surface well components for sour (containing hydrogen sulfide) crude oil and natural gas production.

926

Equivalent designations: UNS N08926, DIN W. Nr. 1.4529
Density: 8.1 g/cm3 | Melting range: 1320-1390C
Product forms and standards:
Rod, bar and wire: B 649
Plate, sheet and strip: A 240, A 480, B 625, B 906
Seamless pipe and tube: B 677, B 829
Welded pipe: B 673, B 775
Welded tube: B 674, B 751

Welding fitting: B 366
Billet and bar for reforging: B 472
Chemical composition (%): Fe balance, Ni 24-26, Cr 19-21, Mo 6-7, C --0.02, Mn --2, Si --0.5, P --0.03, S --0.01, Cu 0.5-1.5, N 0.15-0.25
Features: Alloy 926 has excellent resistance to pitting and crevice corrosion in media containing halides and hydrogen sulfide. It also has outstanding resistance to chloride-induced stress corrosion cracking, and resists to both oxidizing and reducing environments.
Applications: Sour (containing hydrogen sulfide) crude oil and natural gas well components, flue gas desulfurization system components, marine engineering piping, and corrosive chemicals containers.

Monel 400

Equivalent designations: UNS N04400, DIN W. Nr. 2.4360, 2.4361
Density: 8.80 g/cm3 | Melting range: 1300-1350C
Product forms and standards:
Rod, bar and wire: B 164
Plate, sheet and strip: B 127, B 906
Seamless pipe and tube: B 165, B 829
Welded pipe: B 725, B 775
Welded tube: B 730, B 751
Welding fitting: B 366
Forging: B 564
Chemical composition (%): Ni 63--, Cu 28-34, Fe --2.5, C --0.3, Mn --2, Si --0.5, S --0.024
Features: Monel 400 has excellent resistance to corrosion by many reducing media such as sulfuric and hydrochloric acids. It is generally more resistant to corrosion by oxidizing media than higher copper alloys. Monel 400 resists pitting and stress corrosion cracking in most fresh and industrial waters. It has good resistance in flowing seawater, but under stagnant conditions, pitting and crevice corrosion is induced. Monel 400 is probably the most resistant to hydrofluoric acid in all concentrations up to the boiling point, of all engineering alloys. Monel 400 is notable for its toughness, it does not show embrittlement tendency at cryogenic temperatures. It is work hardenable.
Applications: Chemical process equipment, crude oil stills, gasoline and fresh water tanks, marine engineering equipment, valves, pumps and fasteners.

Monel 401

Equivalent designations: UNS N04401
Density: 8.91 g/cm3 | Melting range: 1280C
Product form and specification confirmed against ASTM/EN on enquiry
Chemical composition (%): Ni 40-45, Cu balance, Fe --0.75, C --0.1, Mn --2.25, Si --0.25, S --0.015, Co --0.25
Features: Monel 401 has a very low temperature coefficient of resistance and medium-range electrical resistivity. It is used in specialized electrical and electronic applications.
Applications: Wire-wound precision resistors and bi-metal contacts.

Monel 404

Equivalent designations: UNS N04404, DIN W. Nr. 2.4867
Density: 8.91 g/cm3 | Melting range: 1300-1350C
Product form and specification confirmed against ASTM/EN on enquiry
Chemical composition (%): Ni 52-57, Cu balance, Fe --0.5, C --0.15, Mn --0.1, Si --0.1, S --0.024, Al --0.05

Features: Monel 404 has low magnetic permeability and low Curie temperature. Because its low magnetic permeability is not significantly affected by processing and fabrication, it is particularly suitable for electronic parts.
Applications: Specialized electrical and electronic applications.

Monel K-500

Equivalent designations: UNS N05500, DIN W. Nr. 2.4375
Density: 8.44 g/cm3 | Melting range: 1315-1350C
Product forms and standards:
Rod, bar, wire and forging: B 865
Chemical composition (%): Ni 63--, Cu 27-33, Fe --2, C --0.18, Mn --1.5, Si --0.5, S --0.01, Al 2.3-3.15, Ti 0.35-0.85
Features: Monel K-500 combines Monel 400's excellent corrosion resistance with greater strength and hardness as a result of adding aluminum and titanium and proper heat treatment to cause precipitation hardening. It is nonmagnetic at temperatures as low as -101C. Monel K-500 has excellent dimensional stability which is very useful in high precision devices. Like Monel 400, it does not undergo ductile-to-brittle transition at cryogenic temperatures as low as that of liquid hydrogen. Its tensile and yield strengths increase while ductility and toughness are only slightly impaired.
Applications: Chemical process pump and valve components; paper production pulp processing doctor blades and scrapers; marine engineering chains, cables, fasteners and springs; electronic components; and oil and gas production non-magnetic housings, pump shafts and impellers.

Nickel 200

Equivalent designations: UNS N02200, DIN W. Nr. 2.4060, 2.4066
Density: 8.89 g/cm3 | Melting range: 1435-1446C
Product forms and standards:
Rod and bar: B 160
Plate, sheet and strip: B 162, B 906
Seamless pipe and tube: B 161, B 829
Welded pipe: B 725, B 775
Welded tube: B 730, B 751
Welding fitting: B 366
Forging: B 564
Chemical composition (%): Ni 99--, Fe --0.4, C --0.15, Mn --0.35, Si --0.35, S --0.01, Cu --0.25
Features: Nickel 200 is commercially pure wrought nickel. It is highly resistant to various reducing chemicals. It can also be used in oxidizing conditions that cause the formation of a passive oxide film, for instance its unexcelled resistance to caustic alkalis. Nickel 200 is limited to service at temperatures below 315C, because at higher temperatures it suffers from graphitization which results in severely compromised properties. In that circumstance, Nickel 201 is used instead. It has a high Curie temperature and good magnetostrictive properties. Its thermal and electrical conductivities are higher than nickel alloys.
Applications: Useful for applications where maintaining product purity is considered such as handling of caustic alkalis, foods and synthetic fibers; electrical and electronic parts; aerospace and missile components; and chemical storage and shipping tanks.

Nickel 201

Equivalent designations: UNS N02201, DIN W. Nr. 2.4061, 2.4068

Density: 8.89 g/cm3 | Melting range: 1435-1446C
Product forms and standards:
Rod and bar: B 160
Plate, sheet and strip: B 162, B 906
Seamless pipe and tube: B 161, B 829
Welded pipe: B 725, B 775
Welded tube: B 730, B 751
Welding fitting: B 366
Chemical composition (%): Ni 99--, Fe --0.4, C --0.02, Mn --0.35, Si --0.35, S --0.01, Cu --0.25
Features: Nickel 201 is the low-carbon version of Nickel 200. Because of its low carbon content, Nickel 201 is not subject to embrittlement by intergranularly precipitated carbon or graphite when exposed to temperatures of 315 to 760C for prolonged time if carbonaceous materials are not in contact with it. Therefore, it is a substitute for Nickel 200 in applications above 315C. However it does suffer from intergranular embrittlement by sulfur compounds at temperatures above 315C. Sodium peroxide can be used to change them to sulfates to counteract their effect.
Applications: Electronic components, caustic evaporators, combustion boats and plater bars.

Contact

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