

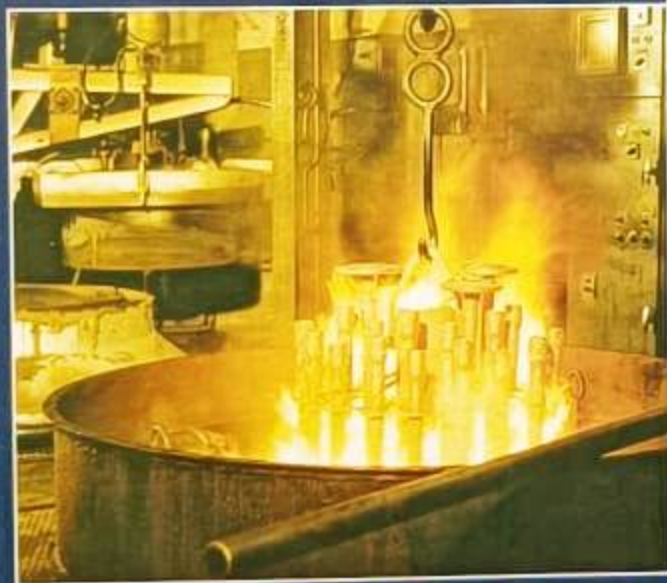
# CORROSION RESISTANT ALLOY

**ZIRCONIUM  
NICKEL ALLOYS  
HASTELLOYS**



- . PIPES
- . FITTINGS
- . FLANGES
- . PLATES
- . BARS
- . TUBINGS

**TITANIUM  
DUPLEX  
STAINLESS STEEL**



- . HEAT EXCHANGERS
- . VESSELS
- . REACTORS
- . TOWERS

**PT UNGGUL PRAKARSA PRISMA**

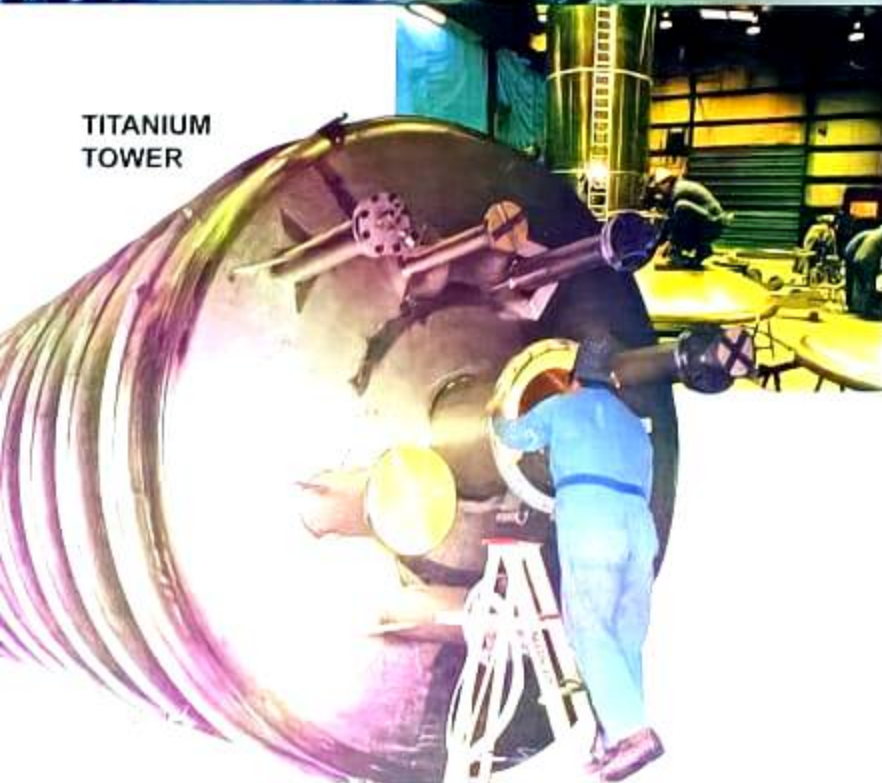
**THE ENGINEERING SUPPLY COMPANY**

TLP : 62-21-6007760,6280471-72,6011867-68

FAX : 62-21-6016573-6267903

Email : [upp@cbn.net.id](mailto:upp@cbn.net.id)

**PROCESS EQUIPMENT & CORROSION-RESISTANT METAL  
STAINLESS, CARBON, TITANIUM, ZIRCONIUM, HASTELLOY, TANTALUM, ETC**



PROCESS EQUIPMENT & CORROSION-RESISTANT METAL



# Selection Guide Corrosion-Resistant Alloys

(Other alloy compositions and product forms may be available. Inquire for details.)

## **NICKEL 200**

(UNS N02200, WNr 2.4060/2.4066)  
(Ni 99.6, C 0.04)

Commercially pure wrought nickel with good mechanical properties and corrosion-resistance. Used for chemical and process plant such as caustic soda and synthetic fiber production, and for food handling.

## **NICKEL 201**

(UNS N02201, WNr 2.4061/2.4068)  
(Ni 99.6, C 0.02 max)

Similar to Nickel 200 but with the carbon content controlled to prevent intergranular embrittlement at service temperatures above 315°C (600°F). Used for chemical and process plant.

## **DURANICKEL® ALLOY 301**

(UNS N03301)  
(Ni 94.0, Al 4.5, Ti 0.5)

An age-hardenable nickel grade combining the corrosion-resistance of Nickel 200 with greater strength and hardness. Used for extrusion dies in the plastics industry and in the chemical and process industries.

## **MONEL® ALLOY 400**

(UNS N04400, WNr 2.4360/2.4366)  
(Ni 65.1, Cu 32.0, Fe 1.6, Mn 1.1)

A Ni-Cu alloy with high strength and excellent resistance to a range of media including seawater, dilute hydrofluoric and sulphuric acids, and alkalis. Used in marine and offshore engineering, salt production, feedwater heater tubing and chemical and hydrocarbon processing.

## **MONEL® ALLOY K-500**

(UNS N05500, WNr 2.4375)  
(Ni 64.7, Cu 30.2, Al 2.7, Fe 1.0, Ti 0.6)

Similar to MONEL alloy 400 but age-hardenable for improved strength and hardness. Used for pump shafts, oil well tools, doctor blades, springs, fasteners and marine propeller shafts.

## **INCONEL® ALLOY 600**

(UNS N06600, WNr 2.4816)  
(Ni 76.0, Cr 15.0, Fe 8.0)

A Ni-Cr-Fe alloy, with good high-temperature strength oxidation-resistance, resistance to stress/corrosion cracking and caustic corrosion. Used for chemical and petrochemical processing, heat treatment applications, and in nuclear and automobile engineering.

## **INCONEL® ALLOY 22**

(UNS N06022, WNr 2.4602)  
(Ni 59.0, Cr 20.5, Mo 14.2, Fe 2.3, W 3.2)

An alloy with corrosion resistance in a wide range of reducing and oxidizing media, and resistance to localized corrosion and stress-corrosion cracking.

## **INCONEL® ALLOY 625**

(UNS N06625, WNr 2.4856)  
(Ni 61.0, Cr 21.5, Mo 9.0, Nb 3.6,  
Fe 2.5)

A Ni-Cr-Mo alloy with resistance to severely corrosive environments, particularly to pitting, crevice corrosion and high-temperature oxidation, and with high strength from cryogenic temperatures up to 815°C (1500°F). Used in aerospace engineering, gas turbines, chemical processing, oil and gas extraction, pollution control, and marine and nuclear engineering.

## **INCONEL® ALLOY 625LCF®**

(UNS N06626)  
(Ni 61.0, Cr 21.5, Mo 9.0, Nb 3.6, Fe 2.5)

Similar to INCONEL alloy 625 but with composition and processing controlled for optimum resistance to mechanical and thermal fatigue at up to 650°C (1200°F).

## **INCONEL® ALLOY 686**

(UNS N06686, WNr 2.4606)  
(Ni 58.0, Cr 20.5, Mo 16.3, W 3.8, Fe 1.0)

Offering optimum resistance to localized corrosion in acid chloride environments and excellent resistance to oxidizing, reducing and mixed acids. Used in a range of aggressively corrosive environments in pollution control, waste processing and process industry applications.

## **INCONEL® ALLOY 690**

(UNS N06690, WNr 2.4642)  
(Ni 61.5, Cr 29.0, Fe 9.0)

An alloy with excellent resistance to high-temperature corrosion in applications such as nuclear steam generators, coal gasification, and sulphuric, nitric and nitric/hydrofluoric acid processing.

## **INCONEL® ALLOY 718**

(UNS N07718, WNr 2.4668)  
(Ni 54.0, Fe 18.5, Cr 18.0, Nb 5.0,  
Mo 3.0, Ti 1.0)

An age-hardenable alloy combining high strength up to 700°C (1300°F) with corrosion-resistance and excellent weldability. Used in aerospace, gas turbines, oil and gas extraction and nuclear engineering.

## **INCONEL® ALLOY 725™**

(UNS N07725)  
(Ni 57.0, Cr 21.0, Mo 8.0, Fe 7.5, Nb 3.5,  
Ti 1.5, Al 0.3)

An alloy with corrosion-resistance comparable with that of INCONEL alloy 625 but with higher strength obtainable by age-hardening.

## **INCONEL® ALLOY C-276**

(UNS N10276, WNr 2.4819)  
(Ni 57.0, Mo 16.0, Cr 16.0, Fe 5.0, W 4.0)

An alloy with excellent resistance to reducing and mildly oxidizing environments. Resistant to localized attack and stress-corrosion cracking. Used extensively in pollution control applications and throughout the chemical and process industries.

## **INCONEL® ALLOY G-3**

(UNS N06985, WNr 2.4619)  
(Ni 44.0, Cr 22.0, Fe 19.5, Mo 7.0,  
Cu 2.0)

An alloy that is readily weldable and resistant to intergranular corrosion in the welded condition. Used for gas well downhole tubulars, and handling phosphoric and sulphuric acids.

## **INCOLOY® ALLOY 864™**

(UNS S35135)  
(Fe 39.0, Ni 34.0, Cr 21.0, Mo 4.2, Si 0.8,  
Ti 0.6)

An alloy with excellent fatigue resistance, thermal stability and resistance to hot salt corrosion, pitting and chloride stress-corrosion cracking. Developed for automotive exhaust system flexible couplings, EGR tubes, manifolds and tailpipes.

## **INCOLOY® ALLOY 800**

(UNS N08800, WNr 1.4876)  
(Fe 46.0, Ni 32.5, Cr 21.0, C 0.05)

An alloy with high strength and corrosion-resistance used in chemical, petrochemical and food processing, in nuclear engineering, and for the sheathing of electric heating elements. Applications generally at temperatures below 650°C (1200°F).

**P.T UNGGUL PRAKARSA PRISMA**

## Corrosion-Resistant Alloys — continued

(Other alloy compositions and product forms may be available. Inquire for details.)

### **INCOLOY® ALLOY 925™**

(UNS N09925)  
(Ni 44.0, Fe 28.0, Cr 21.0, Mo 3.0, Ti 2.1,  
Cu 1.8, Al 0.3)

Offering corrosion-resistance comparable with that of INCOLOY alloy 825 but with higher strength obtained by age-hardening. Used in the oil and gas and marine industries for applications calling for high strength and resistance to general corrosion and pitting.

### **INCOLOY® ALLOY 020**

(UNS N08020, WNr 2.4660)  
(Fe 37.0, Ni 35.0, Cr 20.0, Cu 3.5,  
Mo 2.5, Nb 0.6)

An alloy with resistance to general corrosion, pitting and crevice corrosion in media containing chlorides and sulphuric, phosphoric and nitric acids. Used in chemical and process plant.

### **INCOLOY® ALLOY 25-6MO**

(UNS N08925/N08926, WNr 1.4529)  
(Fe 45.0, Ni 25.0, Cr 20.0, Mo 6.5,  
Cu 0.9, N 0.20)

An austenitic 6% Mo alloy resistant to pitting and crevice corrosion in media containing chlorides and other halides. Applications include handling sulphuric and phosphoric acids, chemical plant, marine and offshore engineering, pulp and paper production, pollution control and nuclear service water piping.

### **INCOLOY® ALLOY 028**

(UNS N08028, WNr 1.4563)

A corrosion-resistant austenitic stainless steel used for downhole tubing in oil and gas extraction operations.

### **6MO SUPER AUSTENITIC STAINLESS STEEL**

(UNS N08367, ASTM A240/480)  
(Ni 24.0, Cr 21.0, Mo 6.5, N 0.2, Bal Fe)

Excellent resistance to pitting and crevice corrosion in Chloride solutions. Used for Sea Water heat exchangers Oil, Gas and Chemical equipment.

### **DUPLEX STAINLESS STEEL 31803**

UNS S31803, ASTM A182/240  
(Ni 5.5, Cr 22.5, Mo3.0, N 0.17)

Austenitic/Ferritic duplex stainless steel. High strength and good resistance to Chloride stress cracking. Used for chemical, paper pulp and food equipment. Oilfield piping, heat exchanger pipework and equipment.

### **SUPER DUPLEX STAINLESS STEEL 32760**

UNS S32760, ASTM A240  
(Ni 7.0, Cr 25.0, Mo 3.5, N 0.25)

Superior Austenitic/Ferritic duplex stainless steel with a pren min of 40. Oil and Gas, Chemical and Petrochemical Process Pipework and equipment.

## Heat Resistant Alloys

(Other alloy compositions and product forms may be available. Inquire for details.)

### **INCONEL® ALLOY 600**

(UNS N06600, WNr 2.4816)  
(Ni 76.0, Cr 15.0, Fe 8.0)

A Ni-Cr-Fe alloy with good high-temperature strength and oxidation-resistance, and resistance to stress-corrosion cracking and caustic corrosion. Used for chemical and petrochemical processing, heat treatment applications, and in nuclear and automobile engineering.

### **INCONEL® ALLOY 601**

(UNS N06601, WNr 2.4851)  
(Ni 60.5, Cr 23.0, Fe 14.4, Al 1.4)

An alloy with outstanding high-temperature strength and oxidation-resistance. Used in a range of thermal processing applications.

### **INCONEL® ALLOY 617**

(UNS N06617, WNr 2.4663)  
(Ni 52.0, Cr 22.0, Co 12.5, Mo 9.5, Fe 1.5,  
Al 1.2)

An alloy with an exceptional combination of high-temperature strength, stability and oxidation-resistance. Also resistant to carburizing gases and a range of aqueous environments, it is used in petrochemical and thermal processing, nitric acid production and gas turbine engineering.

### **INCONEL® ALLOY 625**

(UNS N06625, WNr 2.4856)  
(Ni 61.0, Cr 21.5, Mo 9.0, Nb 3.6, Fe 2.5)

A Ni-Cr-Mo alloy with resistance to a range of severely corrosive environments, particularly to pitting, crevice corrosion and high-temperature oxidation, and with high strength from cryogenic temperatures up to 815°C (1500°F). Used in aerospace engineering, gas turbines, chemical processing, oil and gas extraction, pollution control, and marine and nuclear engineering.

### **INCONEL® ALLOY 625LCP®**

(UNS N06626)  
(Ni 61.0, Cr 21.5, Mo 9.0, Nb 3.6, Fe 2.5)

Similar to INCONEL alloy 625 but with composition and processing controlled for optimum resistance to mechanical and thermal fatigue at up to 650°C (1200°F).

### **INCONEL® ALLOY 690**

(UNS N06690, WNr 2.4642)  
(Ni 61.5, Cr 29.0, Fe 9.0)

An alloy with excellent resistance to high-temperature corrosion in applications such as nuclear steam generators, coal gasification and sulphuric, nitric and nitric/hydrofluoric acid processing.

### **INCONEL® ALLOY 718**

(UNS N07718, WNr 2.4668)  
(Ni 54.0, Fe 18.5, Cr 18.0, Nb 5.0,  
Mo 3.0, Ti 1.0)

An age-hardenable alloy combining high strength up to 700°C (1300°F) with corrosion-resistance and excellent weldability. Used in aerospace, gas turbines, oil and gas extraction, and nuclear engineering.

### **INCONEL® ALLOY X-750**

(UNS N07750, WNr 2.4669)  
(Ni 73.0, Cr 15.5, Fe 7.0, Ti 2.5, Nb 1.0,  
Al 0.7)

An age-hardenable Ni-Cr-Fe alloy with high tensile and creep-rupture properties up to 700°C (1300°F). Applications include gas turbine engineering, tooling, fasteners, springs, and automotive components.

### **INCONEL® ALLOY 751**

(UNS N07751, WNr 2.4694)  
(Ni 73.0, Cr 15.0, Fe 7.0, Ti 2.5, Al 1.1,  
Nb 1.0)

Similar to INCONEL alloy X-750 but with higher aluminum for greater age-hardening. Used for high-temperature applications such as internal combustion engine exhaust valves.

### **INCOLOY® ALLOY 330**

(UNS N08330, WNr 1.4333)  
(Fe 44.0, Ni 35.5, Cr 18.5, Si 1.1)

An alloy with good resistance to oxidation and carburization, for thermal processing and heat treatment applications.

## High Temperature Petrochemical Furnace Tube Materials

Grade	Specifications		Nominal Chemical Composition (%)						
	ASTM	DIN 17006	C	Cr	Ni	Mn max	Si max	Other	
25-35NbW	A297 Mod	G-X 45 NiCrWNb 35 25	0.45	25.0	35.0	1.50	2.00	Nb 1.00 W 3.75	
This modified HP alloy is modified with tungsten and niobium for high carburization and oxidation resistance. It is especially well suited for hot legs of ethylene cracking coils. Service limit: 1150°C (2100°F)									
28-48WCo	—	G-NiCr28WCo	0.50	28.0	48.0	1.50	2.00	W 5.00 Co 3.00	
The high nickel content of this alloy combined with additions of tungsten and cobalt produce good high temperature strength and carburization resistance. Applications of this alloy include radiant and convection tube supports and hangers. Service limit: 1180°C (2155°F)									
30-50W	—	G-NiCr 28 W	0.50	28.0	48.0	1.50	2.00	W 4.00	
A nickel base alloy with tungsten addition that provides exceptional strength. This material also has good resistance to carburization and oxidation. It is used in furnace designs where higher temperatures are required. Service limit: 1165°C (2130°F)									
35-45 Micro-Alloy 35-45MA	—	G-X 40 NiCrNbSiTi 45 35	0.40	35.0	45.0	2.00	2.25	Nb + Ti 1.00	
Similar to MTek™ 30-50W in high temperature strength and carburization resistance, but without the welding difficulties of a high tungsten alloy. This micro-alloy offers improved aged ductility, plus resistance to metal dusting. It is quite suitable for components operating in hot zones of pyrolysis coils and components of reformer outlet manifolds. Service limit: 1150°C (2100°F)									
50-50Nb	—	G-NiCr 50 Nb	<0.10	50.0	balance	—	—	2.5 max	
A nickel base high temperature corrosion resistant specialty alloy that resists fuel-ash corrosion, specifically sulfur and vanadium attack. Service limit: 950°C (1740°F)									

## HEAT RESISTANT ALLOYS

Wisconsin Centrifugal offers the petrochemical engineer a broad selection of alloys for high temperature and corrosive service applications. A condensed listing of some of the most frequently specified alloys is shown, as well as descriptions of six Wiscalloys developed or optimized by WC research for temperature and service extremes.

### Wiscalloy 25-35 Nb

A niobium strengthened modification of the HP alloy. Its excellent high-temperature properties make it especially suited for reformer catalyst tubing. The alloy can also be modified for use in ethylene pyrolysis furnaces.

### Wiscalloy 20-32 Nb

A low carbon, niobium strengthened alloy with excellent rupture ductility and thermal shock resistance. This alloy retains much of its ductility after prolonged thermal exposure and repeated cycling and is recommended for applications such as manifolds, headers and transfer lines.

### Wiscalloy 30-50 W

A high carbon nickel base alloy, structurally controlled to provide exceptional strength and resistance to oxidation at temperatures up to 2200°F. WC produces this alloy for advanced furnace tube designs, operating at higher temperatures and pressures.

### Wiscalloy 24-24 Nb

A cast heat resistant alloy, containing niobium which exhibits good mechanical properties at temperatures in the range of 1400 - 1800°F. Recommended for petrochemical reformer tubing and structural components.

### Wiscalloy 25-35 W

A tungsten containing HP alloy for highly stressed applications approaching 2100°F. Its strength and carburization resistance make it very suitable for ethylene pyrolysis furnaces.

### Wiscalloy CE20N

This alloy yields a superior combination of stress corrosion resistance, mechanical properties and thermal stability to 1000°F. Controlled ferrite content provides excellent resistance to stress corrosion cracking in hydrocracker piping. WC produces this alloy in pipe, flanges and fittings up to 24" pipe size.

ALLOY		CHEMICAL COMPOSITION					
Wiscalloy Type	ACI †	CARBON	CHROMIUM	NICKEL	MANG. MAX.	SILICON MAX.	OTHERS
25 - 20	HK - 40	.35 - .45	23 - 27	19 - 22	1.50	.50 - 2.00	
25 - 35	HP	.35 - .75	24 - 28	33 - 37	2.00	2.50	
24 - 24 Nb		.25 - .35	23 - 25	23 - 25	1.00	1.50	Controlled Niobium
25 - 35 Nb	HP Modified	.35 - .55	23 - 27	32 - 37	1.50	2.00	Controlled Niobium
25 - 35 W	HP Modified	.40 - .60	25 - 28	34 - 38	1.50	2.00	Controlled Tungsten
20 - 32 Nb		.06 - .12	18 - 21	30 - 34	1.50	1.00	Controlled Niobium
30 - 50 W		.50 - .60	26 - 30	45 - 50	1.50	2.00	Controlled Tungsten
CE20N	CE20N	.20 Max	23 - 26	8 - 11	1.50	1.50	Controlled Ferrite

# Heat resistant Alloys — continued

(Other alloy compositions and product forms may be available. Inquire for details.)

## INCOLOY® ALLOY 800

(UNS N08800, WNr 1.4876)  
(Fe 46.0, Ni 32.5, Cr 21.0, C 0.05)

An alloy with high strength and corrosion-resistance used for applications in chemical and petrochemical processing, and for the sheathing of electric heating elements.

## INCOLOY® ALLOY 800H

(UNS N08810, WNr 1.4958 & 1.4876)  
(Fe 46.0, Ni 32.5, Cr 21.0, Al+Ti 0.3-1.2, C 0.08)

Similar to INCOLOY alloy 800 but with improved creep and stress-rupture properties for applications above 650°C (1200°F). Resistant to high-temperature oxidation, carburization and nitridation, it is widely used in petrochemical and thermal processing.

## INCOLOY® ALLOY 800HT®

(UNS N08811, WNr 1.4959 & 1.4876)  
(Fe 46.0, Ni 32.5, Cr 21.0, Al+Ti 0.85-1.2, C 0.08)

Similar to INCOLOY alloy 800H but with even more precisely controlled composition and higher ASME design stress allowables.

## INCOLOY® ALLOY A-286

(UNS S66286, WNr 1.4980)  
(Fe 56.5, Ni 25.5, Cr 15.0, Ti 2.1, Mo 1.25)

An age-hardenable Fe-Ni-Cr alloy with good strength and oxidation-resistance at up to 700°C (1300°F).

## INCOLOY® ALLOY DS

(WNr 1.4862)  
(Fe 41.0, Ni 37.0, Cr 18.0, Si 2.3, Mn 1.0)

A thermal processing alloy with good high-temperature strength and resistance to oxidation and carburization.

## NIMONIC® ALLOY 75

(UNS N06075, WNr 2.4630/2.4951)  
(Ni 76.0, Cr 20.0, Fe 4.0)

An alloy with good high-temperature strength and outstanding resistance to oxidation. Used for thermal processing and gas turbine applications.

## NIMONIC® ALLOY 80A

(UNS N07080, WNr 2.4631/2.4952)  
(Ni 76.0, Cr 19.5, Ti 2.4, Al 1.4)

An age-hardenable alloy for use at up to 815°C (1500°F). Used in gas and steam turbines, nuclear engineering, for hot working tools, and for the exhaust valves of internal combustion engines.

## NIMONIC® ALLOY 90

(UNS N07090, WNr 2.4632/2.4969)  
(Ni 60.0, Cr 19.5, Co 16.0, Ti 2.5, Al 1.5)

An age-hardenable alloy for use at up to 925°C (1700°F). Used for hot-working tools, high-temperature springs and gas turbine components.

### SPECIFICATIONS

### DESCRIPTION

### USES

<b>Aluminum Bronze</b>	C952, 954, 955, 958 including heat treated grades	12 alloys from 125 to 375 BHN hardness; heat treated grades for high strength. Tough; corrosion and wear resistant.	Bushing, bearings, gears. Pump, marine and aircraft parts.
<b>Gear Bronze</b>	SAE 65 family; C907, 908, 916, 929	5 standard alloys plus special alloys to engineer's specification	Worm gears, steel mill nuts.
<b>Bearing Bronze</b>	SAE 40, 64, 67, 660 etc. C836, 932, 937, 939	12 alloys—all popular tin, tin/lead and high lead.	Bearings, bushings, sleeves, liners.
<b>Manganese Bronze</b>	SAE 43, 430A & 430B C862, 863, 865	3 alloys high strength & hardness.	Steel mill nuts, ordnance parts, worm gears.
<b>Chrome Nickel Stainless</b>	CF8, CF3M, CF8M, CG8M, CE20N Nitronic 50 <sup>1</sup> Nitronic 60 <sup>1</sup>	"300" Series, general corrosion resistant alloys. Corrosion resistance and high strength. Wear and galling resistance.	Nuclear, chemical and food processing. Valve and pump trim. Deck equipment, pumps, valves. Pump wear rings, valve trim.
<b>Straight Chrome Stainless</b>	CA15, CA40, CA6NM, M-152	"400" Series, general corrosion resistant alloys.	Nuclear, chemical and food processing.
<b>Age Strengthened Stainless</b>	15-5PH, 17-4PH	High strength stainless steel. More corrosion resistant than 400 series.	Cylinders, hollow shafts, marine.
<b>Super Austenitic Stainless</b>	AL6XN <sup>2</sup> 254 SMO <sup>3</sup>	Corrosion resistance approaching nickel alloys, especially in chloride service.	Process piping exposed to corrosive flue gas and solutions.
<b>Duplex &amp; Super Duplex Stainless</b>	Wiscalloy 2205, Ferralium Alloy 255 <sup>2</sup> , SD 40 <sup>3</sup> Escaloy 45D <sup>4</sup>	Excellent seawater corrosion resistance combined with nearly twice the strength of common stainless grades.	Offshore piping systems, couplings. Centrifuge, dewatering equipment. Pump, valve trim, pulp digesters.
<b>Heat Resistant Stainless</b>	HD, HF, HH, HP, HT, HK-40 etc. Wiscalloy 20-32Nb, 25-35Nb, 30-50W	Standard and special modifications for high temperature strength and oxidation resistance.	Furnace tubes, manifolds, steel mill furnace rolls.
<b>Nickel Alloys</b>	Wiscalloy B, C, X Hastelloy S <sup>3</sup> Wiscalloy 625 Nickel-Copper Comp. A, D, E	Family of alloys for extreme heat and corrosion services. Exceptional corrosion resistance in marine service. High temperature strength. Acid and alkaline resistant. Weldable grades.	Gas turbine parts. Chemical process equipment. Ships seals, sleeves & housings. Pump trim, turbine cases. Marine pumps, valves etc.
<b>Cupro-Nickel</b>	70Cu-30Ni, 90Cu-10Ni	Seawater corrosion resistance.	Marine sleeves, piping components.
<b>Centri-Vac Alloys</b>	IN718, IN909, IN939, IN100 MAR-M-509, RENE 77, Waspalloy	Nickel, cobalt, iron based vacuum grade materials cast to net shapes.	Jet engine turbine cases, housings, shrouds, rings.
<b>Cobalt Alloys</b>	Wiscalloy 6, 21, 31	Non-galling, heat and thermal shock resistance.	Bearing and hot work sleeves and housings.
<b>Tool Steel</b>	A2, A6, D2, D5, H13	Non-deforming, wear/abrasion resistant.	Forming rolls, dies, slitter blades.
<b>Alloys Steel</b>	4100, 4300, 8600 series	Alloys for general structural use.	Cylinders, rolls, hollow shafts.

# TITANIUM FACTS

## KEY PHYSICAL PROPERTIES

	Gr. 2 TITANIUM (SB 265)	Stainless Steel (SA 240-304)	Carbon Steel (SA 516) Gr. 70	Nickel (SB 162)	Cupro Nickel (SB 171)
Density (lbs./cu. in.)	163	0.287	.283	0.327	0.323
Melting Point (°F)	3035	2600	2500	2650	2200
Yield Point (ksi)	40	30	38	15	20
Coefficient of Expansion (10 <sup>-6</sup> in/in/°F)	4.65	8.55	5.57	6.77	8.5
Specific Heat (BTU/lb/°F)	.13	.12	.10	.11	.09
Thermal Conductivity (BTU/hr/ft <sup>2</sup> -F)	12.52	8.7	23.9	38.8	18
Modulus of Elasticity (10 <sup>6</sup> psi)	16.7	28	29	30	22

## GRADES OF TITANIUM

<b>GRADE 1</b>	Low strength commercially pure titanium for maximum formability
<b>GRADE 2</b>	Moderate strength commercially pure titanium for best combination of strength, weldability and formability
<b>GRADE 3</b>	High strength commercially pure titanium where less formability can be tolerated
<b>GRADE 5</b>	High strength titanium alloy containing 6% aluminum and 4% vanadium for use when strength is critical
<b>GRADE 7</b>	Similar to Grade 2 in strength, formability and weldability, but contains 0.15% palladium for improved corrosion resistance in reducing media and where crevices exist
<b>GRADE 12</b>	An alloy containing 0.8% nickel and 0.3% molybdenum for use at moderately elevated temperatures and in mild reducing environments and where crevices exist corrosion resistance in reducing media and where crevices exist

## COST COMPARISON FOR VARIOUS METALS

Material	Plate	Tubing Cost	Heat Exchanger	Vessel
Tantalum	50.0	30.0	27.0	38.0
Alloy B-2 (Hastelloy)	3.27	6.0	3.0	2.77
Zirconium	3.63	4.68	2.4	2.4
Alloy 200 (Nickel)	2.30	2.37	2.3	1.7
Titanium (Gr. 12)	1.10	1.18	1.2	1.1
Cupro Nickel	1.22	1.05	1.2	1.2
<b>TITANIUM (Gr. 2)</b>	<b>1.0</b>	<b>1.0</b>	<b>1.0</b>	<b>1.1</b>
2205 (Duplex S.S.)	.75	1.10	1.15	.95
Stainless Steel (316L)	.65	.75	.88	.80

**titanium SHEET** - grades 1 to 7, 9, 11 to 21, 23 to 32  
ASTM/ASME B / SB 265

**titanium PLATE** - grades 1 to 7, 9, 11 to 21, 23 to 32  
STRIP, SHEET AND PLATES  
ASTM / ASME B / SB 265

**titanium BAR** - grades 1 to 7, 9, 11 to 21, 23 to 25, 28 to 34  
ASTM / ASME B / SB 348  
Round Bar  
Threaded Rod  
Flat Bar and Angle

**titanium FASTENERS & titanium WELDING WIRE**

**CUSTOM FABRICATION** include  
Shear, Plasma, Saw, Brake  
Rolls, Welding, etc

**titanium TUBE** - gr 1, 2, 3, 7, 9, 11 to 21, 23, 24  
ASTM / ASME B / SB 338

**titanium PIPE** - grades 1, 2, 3, 7, 9, 10, 11, 12  
ASTM / ASME B / SB 337  
Sch 10S, Sch 40S, Sch 80S

**titanium FITTINGS** - grades 1, 2, 3, 7, 9, 11 to 21  
ASTM / ASME B / SB 363 BUTT WELD  
Stub Ends, Tees, Conc Reducer  
Reducers, 90 Deg Elbows, 45 Deg Elbows  
ASTM / ASME B / SB 348 BAR STOCK  
Class 3000#

**titanium FLANGES** - gr 1 to 7, 9, 11 to 21, 23 to 25  
ASTM / ASME B / SB 381 F2, Grade 2

**titanium NIPPLE** - grades 1, 2, 3, 7, 9, 10, 11, 12  
ASTM / ASME B / SB 337