FLOWKS

FLOWKS VALVE INC.

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FLOWKS

How Quality Lasts!

Oil&Gas&Power&Cryogenics

Ni Al BRONZE

INCONEL

MONEL

HASTELLOY

NICKEL ALLOY

DUPLEX

SUPER DUPLEXI

TITANIUM

ZIRCONIUM

ALLOY VALVE

FLOWKS

About US

Flowks Valve is a manufacturer specializing in all kinds of industrial valves. After years of experience in supplying valves for distributors and projects, Flowks Valve has been recognized as a skilled and responsible supplier. The reputation relies on our strict inspection procedure from CAD design, material purchasing, machining, assembling, hydraulic & air testing to packing & delivery. Each step is carried out by our experienced and dedicated craftsmen.
We offer various types of valves with different materials, including special materials like Monel, Inconel, duplex, copper, bronze, etc. We follow different standards such as API, ANSI, DIN, BS and JIS.
We are capable of supplying valves with special testings and treatments like radiographic examnation (RT), ultrasonic examnation (UT), liquid penetrant test (LPT), magnetic particle test (MPT), low temperature impact test and PMI. Special coating like FCC and TCC is also avaialble.

Our valves are widely used in different industries. We provide OEM service.
If you find anything interesting, please do not hesitate to contact us.
What you will get is quality products with competitive prices.
Look forward to having a chance to serve your esteemed company.

PRODUCT CONTENTS

Application

Flowks serves numerous domestic and foreign projects. We have good ability and experience in providing valves for severe services, designing valves for special applications, quick delivery of spare parts for replacement, etc.

Our valves are widely used in different industries.

- ***Onshore Oil & Gas***
- ***Fine Chemicals***
- ***LNG-Liquefied Natural Gas***
- ***Water & Waste Water Treatment***
- ***Metallurgy Industry***
- ***Power Plant***
- ***Marine Weapon***
- ***Pulp & Paper***
- ***Offshore Oil & Gas***


Ship Building


Power Plant


Oil Production

LNG


Offshore Oil & Gas


Petro-chemical

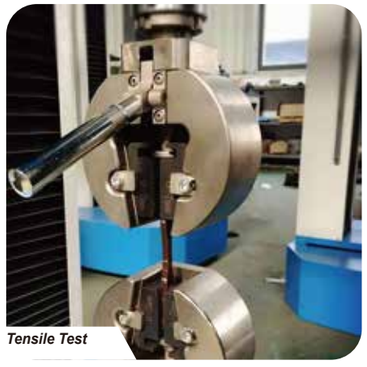
Testing

Modern and advanced testing tools with strict and scientific management, assures that each valve can be in full compliance with customer requirements.


PMI


Metallographic Test


Salt Spray Test


Tensile Test


Impact Test


Hardness Test

Ultrasonic Test (UT)


Liquid Penetrant Test (LPT)


Radiographic Test (RT)


FLOWS
150
BIOUNITOR
3636


3-150
BIOUNITOR
T60S

Ball Valve-Floating Ball Valve

Type: floating, trunnion mounted, top entry, three way, four way, multi-way, etc.
Body Material: brass, bronze, copper alloy steel, aluminium bronze, etc.
Trim Material: aluminium bronze, MONEL, etc.
Size: ½″ to 36″
Pressure: class 150 to class 600
Working Condition: ship, onshore, offshore, high-salt condition.
Structure: can be bolted body or screwed body. Bolting material can be exotic alloy steel like MONEL or Inconel

Ball Valve-Trunnion Mounted Ball Valve

Type: floating, trunnion mounted, top entry, three way, four way, multi-way, etc.
Body Material: brass, bronze, copper alloy steel, aluminium bronze, etc.
Trim Material: aluminium bronze, MONEL, etc.
Size: ½″ to 36″
Pressure: class 150 to class 600
Working Condition: ship, onshore, offshore, high-salt condition.
Structure: can be bolted body or screwed body. Bolting material can be exotic alloy steel like MONEL or Inconel

Forged Steel Gate Valve/Globe Valve

Type: forging body, BB, screwed bonnet, flanged/BW/SW/NPT ends
Body Material: brass, bronze, copper alloy steel, aluminium bronze, etc.
Trim Material: aluminium bronze, MONEL, stem material can be MONEL and Inconel.
Size: ½″ to 3″
Pressure: class 150 to class 600
Working Condition: ship, onshore, offshore, high-salt condition.
Structure: can be bolted body or screwed body. Bolting material can be exotic alloy steel like MONEL or Inconel

Forged Steel Check Valve

Type: forging body, BB, screwed bonnet, flanged/BW/SW/NPT ends, swing and piston type
Body Material: brass, bronze, copper alloy steel, aluminium bronze, etc.
Trim Material: aluminium bronze, MONEL
Size: ½″ to 3″
Pressure: class 150 to class 600
Working Condition: ship, onshore, offshore, high-salt condition.
Structure: can be bolted body or screwed body. Bolting material can be exotic alloy steel like MONEL or Inconel

Cast Steel Gate Valve

Type: casting body, BB, screwed bonnet, flanged ends, flexible wedge
Body Material: brass, bronze, copper alloy steel, aluminium bronze, etc.
Trim Material: aluminium bronze, MONEL, stem material can be MONEL and Inconel.
Size: 2″ to 36″
Pressure: class 150 to class 600
Working Condition: ship, onshore, offshore, high-salt condition.
Structure: can be bolted body or screwed body. Bolting material can be exotic alloy steel like MONEL or Inconel

Cast Steel Globe Valve

Type: casting body, BB, screwed bonnet, flanged ends, flexible wedge
Body Material: brass, bronze, copper alloy steel, aluminium bronze, etc.
Trim Material: aluminium bronze, MONEL, stem material can be MONEL and Inconel.
Size: 2″ to 36″
Pressure: class 150 to class 600
Working Condition: ship, onshore, offshore, high-salt condition.
Structure: can be bolted body or screwed body. Bolting material can be exotic alloy steel like MONEL or Inconel

Butterfly Valve-Offset Butterfly Valve

Type: wafer, lug, concentric, double offset, triple offset
Body Material: brass, bronze, copper alloy steel, aluminium bronze, etc.
Trim Material: aluminium bronze, MONEL, stem material can be MONEL and Inconel.
Size: 2″ to 40″
Pressure: class 150 to class 600
Working Condition: ship, onshore, offshore, high-salt condition.

Butterfly Valve-Concentric Butterfly Valve

Type: wafer, lug, concentric, double offset, triple offset
Body Material: brass, bronze, copper alloy steel, aluminium bronze, etc.
Trim Material: aluminium bronze, MONEL, stem material can be MONEL and Inconel.
Size: 2″ to 40″
Pressure: class 150 to class 600
Working Condition: ship, onshore, offshore, high-salt condition, waste-water treatment.

Wafer Check Valve

Type: wafer, lug, flanged, dual plate
Body Material: brass, bronze, copper alloy steel, aluminium bronze, etc.
Trim Material: aluminium bronze, MONEL, stem material can be MONEL and Inconel.
Size: 2″ to 36″
Pressure: class 150 to class 600
Working Condition: ship, onshore, offshore, high-salt condition, waste-water treatment.

Cast Steel Swing Check Valve

Type: casting body, BB, screwed bonnet, flanged ends
Body Material: brass, bronze, copper alloy steel, aluminium bronze, etc.
Trim Material: aluminium bronze, MONEL
Size: 2″ to 36″
Pressure: class 150 to class 600
Working Condition: ship, onshore, offshore, high-salt condition.
Structure: can be bolted body or screwed body. Bolting material can be exotic alloy steel like MONEL or Inconel

Cast Steel Plug Valve

Type: casting body, BB, screwed bonnet, flanged ends
Body Material: brass, bronze, copper alloy steel, aluminium bronze, etc.
Trim Material: aluminium bronze, MONEL, stem material can be MONEL and Inconel.
Size: 2″ to 36″
Pressure: class 150 to class 600
Working Condition: ship, onshore, offshore, high-salt condition.
Structure: can be bolted body or screwed body. Bolting material can be exotic alloy steel like MONEL or Inconel

1-Consult us for valves which are not listed in this catalogue.
2-Customized design is available based on different working conditions.
3-We have experience in this industry for decades of years, we are capable to provide the best solution with economic price and short delivery time.

Ball Valve-Floating Ball Valve

Type: floating, trunnion mounted, top entry, three way, four way, multi-way, etc.
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: ½" to 36"
Pressure: class 150 to class 2500
Working Condition: high temperature, high acid base, severe condition.

Check Valve-Swing Check Valve

Type: BB, screwed bonnet
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: 2" to 36"
Pressure: class 150 to class 600
Working Condition: high temperature, high acid base, severe conditions.

Diaphragm Valve

Type: BB, screwed bonnet, a customized valve.
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: ½" to 24"
Pressure: class 150 to class 300
Working Condition: high temperature, high acid base, severe conditions.

Check Valve-Wafer Check Valve

Type: wafer, flanged, wafer lug
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: 2" to 48"
Pressure: class 150 to class 2500
Working Condition: high temperature, high acid base, severe conditions.

Ball Valve-Forged Steel Ball Valve

Type: floating, trunnion mounted, top entry, three way, four way, multi-way, etc.
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: ½" to 36"
Pressure: class 150 to class 2500
Working Condition: high temperature, high acid base, severe conditions.

Double Block and Bleed Valve-DBB

Type: DBB, SBB, integral, monoflange
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: ½" to 24"
Pressure: class 150 to class 2500
Working Condition: high temperature, high acid base, severe conditions.

Ball Valve-Y Type Three Way Ball Valve

Type: floating, trunnion mounted, top entry, three way, four way, multi-way, etc.
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: ½" to 24"
Pressure: class 150 to class 2500
Working Condition: high temperature, high acid base, severe conditions.

Butterfly Valve-Triple Offset Butterfly Valve

Type: offset, wafer, lug
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: ½" to 48"
Pressure: class 150 to class 900
Working Condition: high temperature, high acid base, severe conditions.

Ball Valve-Discharge Ball Valve

Type: discharge ball valve
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: ½" to 24"
Pressure: class 150 to class 300
Working Condition: high temperature, high acid base, severe conditions.

Discharge Valve

Type: discharge valve
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: ½" to 24"
Pressure: class 150 to class 600
Working Condition: high temperature, high acid base, severe conditions.

Sight Glass

Type: BB, screwed bonnet
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: ½" to 24"
Pressure: class 150 to class 300
Working Condition: high temperature, high acid base, severe conditions.

Strainer

Type: T type, Y type, basket, conical
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: ½" to 24"
Pressure: class 150 to class 2500
Working Condition: high temperature, high acid base, severe conditions.

Regulating Valve

Type: BB, screwed bonnet
Body Material: Titanium. Nickel, Inconel, MONEL, Hastelloy, Duplex, Zirconium, Tantalum, 904L, 20 Alloy
Size: ½" to 24"
Pressure: class 150 to class 2500
Working Condition: high temperature, high acid base, severe conditions.

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Titanium and Titanium Alloy Forgings and Bar(ASTM B381 And ASTM B348).

Element		Forgings ASTM B381						Bar ASTM B348					
		Gr.F2	Gr.F3	Gr.F5	Gr.F6	Gr.F7	Gr.F12	Gr.2	Gr.3	Gr.5	Gr.6	Gr.7	Gr.12
N	Nitrogen, max	0.03	0.05	0.05	0.03	0.03	0.03	0.03	0.05	0.05	0.03	0.03	0.03
C	Carbon, max	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
H	Hydrogen, max	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
Fe	Iron, max	0.30	0.30	0.40	0.50	0.30	0.30	0.30	0.30	0.40	0.50	0.30	0.30
O	Oxygen, max	0.25	0.35	0.20	0.20	0.25	0.25	0.25	0.35	0.20	0.20	0.25	0.25
Al	Aluminum	...	...	5.5-6.75	4.0-6.0	...	...	...	...	5.5-6.75	4.0-6.0	...	...
V	Vanadium	...	...	3.5-4.5	...	...	...	...	...	3.5-4.5	...	...	...
Sn	Tin	...	...	...	2.0-3.0	...	...	...	...	...	2.0-3.0	...	...
Ru	Ruthenium	...	...	...	...	...	...	...	...	...	...	...	...
Pd	Palladium	...	...	...	...	0.12-0.25	...	...	...	...	...	0.12-0.25	...
Co	Cobalt	...	...	...	...	...	...	...	...	...	...	...	...
Mo	Molybdenum	...	...	...	...	...	0.2-0.4	...	...	...	...	...	0.2-0.4
Cr	Chromium	...	...	...	...	...	...	...	...	...	...	...	...
Ni	Nickel	...	...	...	...	...	0.6-0.9	...	...	...	...	...	0.6-0.9
Nb	Niobium	...	...	...	...	...	...	...	...	...	...	...	...
Zr	Zirconium	...	...	...	...	...	...	...	...	...	...	...	...
Si	Silicon	...	...	...	...	...	...	...	...	...	...	...	...
Residuals max each		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
max total Titanium		0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Ti	Titanium	balance	balance	balance	balance	balance	balance	balance	balance	balance	balance	balance	balance
Mechanical Requirements	TS(min)	345	450	895	828	345	483	345	450	895	828	345	483
	YS(min)	275	380	828	795	275	345	275	380	828	795	275	345
	El(min)	20	18	10	10	20	18	20	18	10	10	20	18
	HB(max)	30	30	25	25	30	25	30	30	25	25	30	25

Titanium and Titanium Alloy Castings (ASTM B367).

ASTM B367		Composition, Weight %								
Element		C-2	C-3	C-5	C-6	Ti-Pd7B	Ti-Pd8A	Ti-Pd16	Ti-Pd17	Ti-Pd18
N	Nitrogen, max	0.05	0.05	0.05	0.05	0.05	0.05	0.03	0.03	0.05
C	Carbon, max	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
H	Hydrogen, max	0.015	0.015	0.015	0.015	0.015	0.015	0.0150	0.0150	0.0150
Fe	Iron, max	0.20	0.25	0.40	0.50	0.20	0.25	0.30	0.20	0.25
O	Oxygen, max	0.40	0.40	0.25	0.20	0.40	0.40	0.18	0.25	0.15
Al	Aluminum	...	...	5.5-6.75	4.00--6.00	...	...	...	...	2.5-3.5
V	Vanadium	...	...	3.5-4.5	...	...	...	...	...	2.0-3.0
Sn	Tin	...	...	...	2.0-3.0	...	...	...	...	...
Pd	Palladium	...	...	...	...	0.12 min	0.12 min	0.04-0.08	0.04-0.08	0.04-0.08
Residuals max each		0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
max total Titanium		0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Mechanical Requirements	TS(min)	345	450	895	795	345	450	345	240	620
	YS(min)	275	380	825	725	275	380	275	170	483
	El(min)	15	12	6	8	15	12	15	20	15
	HB(max)	210	235	365	335	210	235	210	235	365

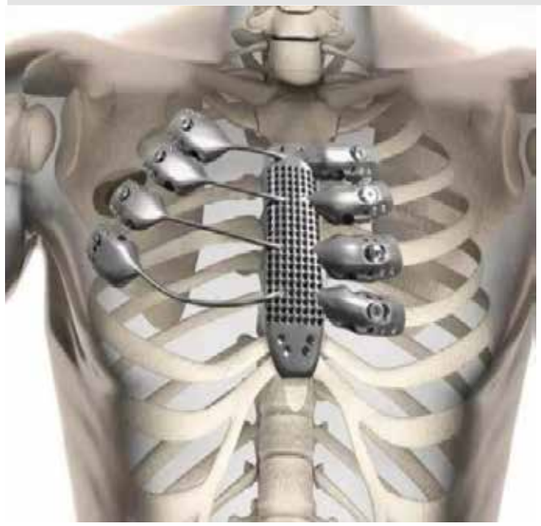
Titanium alloys are metals that contain a mixture of titanium and other chemical elements. Such alloys have very high tensile strength and toughness (even at extreme temperatures). They are light in weight, have extraordinary corrosion resistance and the ability to withstand extreme temperatures. However, the high cost of both raw materials and processing limit their use to military applications, aircraft, spacecraft, bicycles, medical devices, jewelry, highly stressed components such as connecting rods on expensive sports cars and some premium sports equipment and consumer electronics.

Although "commercially pure" titanium has acceptable mechanical properties and has been used for orthopedic and dental implants, for most applications titanium is alloyed with small amounts of aluminium and vanadium, typically 6% and 4% respectively, by weight. This mixture has a solid solubility which varies dramatically with temperature, allowing it to undergo precipitation strengthening. This heat treatment process is carried out after the alloy has been worked into its final shape but before it is put to use, allowing much easier fabrication of a high-strength product.

Titanium alloys are generally classified into four main categories:
Alpha alloys which contain neutral alloying elements (such as tin) and/ or alpha stabilisers (such as aluminium or oxygen) only. These are not heat treatable. Examples include: Ti-5Al-2Sn-ELI, Ti-8Al-1Mo-1V.

Near-alpha alloys contain small amount of ductile beta-phase. Besides alpha-phase stabilisers, near-alpha alloys are alloyed with 1–2% of beta phase stabilizers such as molybdenum, silicon or vanadium. Examples include:-
Ti-6Al-2Sn-4Zr-2Mo, Ti-5Al-5Sn-2Zr-2Mo, IMI 685, Ti 1100.

Alpha and beta alloys, which are metastable and generally include some combination of both alpha and beta stabilisers, and which can be heat treated. Examples include: Ti-6Al-4V, Ti-6Al-4V-ELI, Ti-6Al-6V-2Sn, Ti-6Al-7Nb.
Beta and near beta alloys, which are metastable and which contain sufficient beta stabilisers (such as molybdenum, silicon and vanadium) to allow them to maintain the beta phase when quenched, and which can also be solution treated and aged to improve strength. Examples include: Ti-10V-2Fe-3Al, Ti–29Nb–13Ta–4.6Zr,[3] Ti-13V-11Cr-3Al, Ti-8Mo-8V-2Fe-3Al, Beta C, Ti-15-3.



Aluminium bronze is a type of bronze in which aluminium is the main alloying metal added to copper, in contrast to standard bronze (copper and tin) or brass (copper and zinc). A variety of aluminium bronzes of differing compositions have found industrial use, with most ranging from 5% to 11% aluminium by weight, the remaining mass being copper: other alloying agents such as iron, nickel, manganese, and silicon are also sometimes added to aluminium bronzes.

Composition Bronze or Ounce Metal Castings (ASTM B61 And ASTM B62).

Chemical Requirements	Chemical Requirements										Mechanical Requirements			
	Cu	Sn	Pb	Zn	Ni incl Co	Fe	Sb	S	P	Al	` Si	TS(min)	YS(min)	El(min)
No.C83600-B62	84.0-86.0	4.0-6.0	4.0-6.0	4.0-6.0	1.0	0.30	0.25	0.08	0.05	0.005	0.005	205	95	20
No.C92200-B61	86.0-90.0	5.5-6.5	1.0-2.0	3.0-5.0	1.0	0.25	0.25	0.05	0.05	0.005	0.005	235	110	24

Aluminum-Bronze Sand Castings (ASTM B148).

Copper Alloy UNS No.	Chemical Requirements								Mechanical Requirements				
	Cu	Al	Fe	Mn	Ni	Si	Pb		TS(min)	YS(min)	El(min)	RE(min)	HB
C95200	86.0 min	8.5-9.5	2.5-4.0	...	...	...	...		450	170	20	...	110
C95300	86.0 min	9.0-11.0	0.8-1.5	...	...	...	...		450	170	20	...	110
C95400	83.0 min	10.0-11.5	3.0-5.0	0.50 max	1.5 max	...	...		515	205	12	...	150
C95410	83.0 min	10.0-11.5	3.0-5.0	0.50 max	1.5-2.5	...	...		515	205	12	...	150
C95500	78.0 min	10.0-11.5	3.0-5.0	3.5 max	3.0-5.5	...	...		620	275	6	...	190
C95520	74.5 min	10.5-11.5	4.0-5.5	1.5 max	4.2-6.0	1.5 max	0.03 max		...	...	...	...	...
C95600	88.0 min	6.0-8.0	...	...	0.25 ma	1.8-3.2	...		415	195	10	...	...
C95700	71.0 min	7.0-8.5	2.0-4.0	11.0-14.0	1.5-3.0	0.10 max	0.03 max		620	275	20	...	...
C95800	79.0 min	8.5-9.5	3.5-4.5	0.8-1.5	4.0-5.0	0.10 max	0.03 max		585	240	15	...	...
C95820	77.5 min	9.0-10.0	4.0-5.0	1.5 max	4.5-5.8	0.10 max	0.02 max		...	...	...	...	...
C95900	remainder	12.0-13.5	3.0-5.0	1.5 max	0.5 max	...	...		...	...	...	...	...

Aluminum Bronze Rod, Bar, and Shapes (ASTM B150).

Chemical Requirements	Chemical Requirements										Mechanical Requirements			
	C61300	C61400	C61900	C62300	C62400	C63000	C63020	C63200	C64200	C64210	TS(min)	YS(min)	El(min)	HB
Aluminum	6.0-7.5	6.0-8.0	8.5-10.0	8.5-10.0	10.0-11.5	9.0-11.0	10.0-11.0	8.7-9.5	6.3-7.6	6.3-7.0				
Copper, inclsilver	remainder	remainder	remainder	remainder	remainder	remainder	74.5 min	remainder	remainder	remainder				
Iron	2.0-3.0	1.5-3.5	3.0-4.5	2.0-4.0	2.0-4.5	2.0-4.0	4.0-5.5	3.5-4.3	0.30 max	0.30 max				
Nickel, incl cobalt	0.15 max	...	...	1.0 max	...	4.0-5.5	4.2-6.0	4.0-4.8	0.25 max	0.25 max				
Manganese	0.20 max	1.0 max	...	0.50 max	0.30 max	1.5 max	1.5 max	1.2-2.0	0.10 max	0.10 max				
Silicon	0.10 max	...	...	0.25 max	0.25 max	0.25 max	. . .	0.10 max	1.5-2.2	1.5-2.0				
Tin	0.20-0.50	...	0.6 max	0.6 max	0.20 max	0.20 max	0.25 max	...	0.20 max	0.20 max				
Zinc, max	0.10	0.20	0.8	...	...	0.30	0.30	...	0.50	0.50				
Lead, max	0.01	0.01	0.02	...	...	...	0.03	0.02	0.05	0.05				
Arsenic, max	...	...	...	...	...	...	...	...	0.15	0.15				
Phosphorus,max	0.015	0.015	...	...	...	...	...	...	...	...				
Other elements														

The mechanical property of aluminium bronze differs from shapes and diameters, see details in ASTM B150/M150.

Aluminium bronzes are most valued for their higher strength and corrosion resistance as compared to other bronze alloys. These alloys are tarnish-resistant and show low rates of corrosion in atmospheric conditions, low oxidation rates at high temperatures, and low reactivity with sulfurous compounds and other exhaust products of combustion. They are also resistant to corrosion in sea water. Aluminium bronzes' resistance to corrosion results from the aluminium in the alloys, which reacts with atmospheric oxygen to form a thin, tough surface layer of alumina (aluminium oxide) which acts as a barrier to corrosion of the copper-rich alloy. The addition of tin can improve corrosion resistance.

Application:

Aluminium bronzes are most commonly used in applications where their resistance to corrosion makes them preferable to other engineering materials. These applications include plain bearings and landing gear components on aircraft, guitar strings, valve components, engine components (especially for seagoing ships), underwater fastenings in naval architecture, and ship propellers. Aluminium bronze is also used to fulfil the ATEX directive for Zones 1, 2, 21, and 22. The attractive gold-toned coloration of aluminium bronzes has also led to their use in jewellery.

Aluminium bronzes are in the highest demand from the following industries and areas:

General sea water-related service

Water supply

Oil and petrochemical industries (i.e. tools for use in non-sparking environments)

Specialised anti-corrosive applications

Certain structural retrofit building applications

Castings Nickel and Nickel Alloy.(ASTM A494/ A494M).

ASTM A494 Copper Alloy UNS No.	Chemical Requirements									Mechanical Requirements			
	C max	Mn max	Si max	P max	S max	Cu	Fe max	Ni	Nb	TS(min)	YS(min)	El(min)	HB
M35-1 UNS.N24135	0.35	1.50	1.25	0.03	0.03	26.0-33.0	3.50	balance	0.5 max	450	170	25.0	
M35-2 UNS.N04020	0.35	1.50	2.00	0.03	0.03	26.0-33.0	3.50	balance	0.5 max	450	205	25.0	
M30H UNS.N24030	0.30	1.50	2.7-3.7	0.03	0.03	27.0-33.0	3.50	balance	...	690	415	10.0	
M25S UNS.N24025	0.25	1.50	3.5-4.5	0.03	0.03	27.0-33.0	3.50	balance	...	...	...	...	
M30C UNS.N24130	0.30	1.50	1.0-2.0	0.03	0.03	26.0-33.0	3.50	balance	1.0-3.0	450	225	25.0	

Nickel Alloy Forgings,Rod, Bar, and Wire,ASTM B564 / B164 / B865 / B127

Copper Alloy UNS No.	Chemical Requirements									Mechanical Requirements			
	Ni min	Cu	Fe max	Mn max	C max	Si max	S max	Al	Ti	TS(min)	YS(min)	El(min)	HB
ASTM B564 UNS.N4400	63.0	28.0-34.0	2.5	2.00	0.30	0.50	0.024			xxx	xxx	xxx	
ASTM B164 UNS.N04400	63.0	28.0-34.0	2.5	2.00	0.30	0.50	0.024			xxx	xxx	xxx	
ASTM B164 UNS.N04405	63.0	28.0-34.0	2.5	2.00	0.30	0.50	0.025-0.060			xxx	xxx	xxx	
ASTM B865 UNS.N05500	63.0	27.0-33.0	2.0	1.50	0.18	0.50	0.010	2.30-3.15	0.35-0.85	xxx	xxx	xxx	
ASTM B127 UNS N04400	63.0	28.0-34.0	2.5	2.00	0.30	0.50	0.024			xxx	xxx	xxx	

Specification for Nickel Rod and Bar (ASTM B160).

ASTM B160	Chemical Requirements								Mechanical Requirements				
	Ni	Cu	Fe max	Mn max	C max	Si max	S max		TS(min)	YS(min)	El(min)	RA	HB
Copper Alloy UNS No.	Nickel	Copper	Iron	Manganese	Carbon	Silicon	Sulfur						
Nickel N02200	99.00	0.25	0.40	0.350	0.150	0.350	0.010		415	105	35		
Low-Carbon Nickel N02201	99.00	0.25	0.40	0.350	0.020	0.350	0.010		345	70	40		

Ni-Cr-Mo-Nb Alloy (UNS N06625),Ni-Cr-Mo-Si Alloy (UNS N06219),Ni-Cr-Mo-W Alloy (UNS N06650).

ASTM A446	Chemical Requirements														Mechanical Requirements		
	C max	Mn max	Si max	P max	S max	Cr	Nb+Ta	Nb	Co max	Mo	Fe max	Al max	Ti	Cu	Ni	TS(min)	YS(min)	EL(min)
UNS No.	Carbon	Manganese	Silicon	phosphorus	Sulfur	Chromium		Columbium	Cobalt	Molybdenum	Iron	Aluminum	Titanium	Copper	Nickel	ksi	ksi	ksi
N06625	0.10	0.50	0.50	0.015	0.015	20.0-23.0	3.15-4.15	...	1.0	8.0 min	5.0	0.40	0.40	...	58.0	100	40	30
N06219	0.05	0.50	0.70-1.10	0.020	0.010	18.0-22.0	...	...	1.0	7.0-9.0	2.0-4.0	0.50	0.50	0.50	balance	96	39	50
N06650	0.03	0.50	0.50	0.020	0.010	19.0-21.0	0.05-0.5	0.50-2.50	1.0	9.5-12.5	12.0-16.0	0.05-0.50	0.05-0.20(N)	0.30	balance	116	58	45

Nickel Alloy Bar and Wire(ASTM B473).

ASTM B473	Chemical Requirements												Mechanical Requirements		
	C max	Mn max	Si max	P max	S max	Mo	Fe max	Ni	Cr	Cu	Nb+Ta	N	TS(min)	YS(min)	EL(min)
UNS No.	Carbon	Manganese	Silicon	phosphorus	Sulfur	Molybdenum	Iron	Nickel	Chromium	Copper		Nitrogen			
N08026	0.030	1.00	0.50	0.030	0.030	5.00-5.70	remainder	33.0-37.2	22.0-26.0	2.00-4.00	...	0.10-0.16			
N08020	0.070	2.00	1.00	0.045	0.035	2.00-3.00	remainder	32.0-38.0	19.0-21.0	3.00-4.00	Cx8-1.00	...			
N08024	0.030	1.00	0.50	0.035	0.035	3.50-5.00	remainder	35.0-40.0	22.5-25.0	0.50-1.50	0.15-0.35	...			

Monel is a group of nickel alloys, primarily composed of nickel (from 52 to 67%) and copper, with small amounts of iron, manganese, carbon, and silicon. (Alloys with copper contents 60% or more are called cupronickel.)

Stronger than pure nickel, Monel alloys are resistant to corrosion by many agents, including rapidly flowing seawater. They can be fabricated readily by hot- and cold-working, machining, and welding.

Monel is a solid-solution binary alloy. As nickel and copper are mutually soluble in all proportions, it is a single-phase alloy. Compared to steel, Monel is very difficult to machine as it work-hardens very quickly. It needs to be turned and

worked at slow speeds and low feed rates. It is resistant to corrosion and acids, and some alloys can withstand a fire in pure oxygen. It is commonly used in applications with highly corrosive conditions. Small additions of aluminium and titanium form an alloy (K-500) with the same corrosion resistance but with much greater strength due to gamma prime formation on aging. Monel is typically much more expensive than stainless steel.

Monel alloy 400 has a specific gravity of 8.80,a melting range of 1300–1350 °C, an electrical conductivity of approximately 34% IACS, and (in the annealed state) a hardness of 65 Rockwell B.Monel alloy 400 is notable for its toughness, which is maintained over a considerable range of temperatures.

Monel alloy 400 has excellent mechanical properties at subzero temperatures. Strength and hardness increase with only slight impairment of ductility or impact resistance. The alloy does not undergo a ductile-to-brittle transition even when cooled to the temperature of liquid hydrogen. This is in marked contrast to many ferrous materials which are brittle at low temperatures despite their increased strength.

Application

Aerospace, Oil Production and Refining, Marine, Musical Instruments

Inconel is a registered trademark of Special Metals for a family of austenitic nickel-chromium-based superalloys.

Inconel alloys are oxidation-corrosion-resistant materials well suited for service in extreme environments subjected to pressure and heat. When heated, Inconel forms a thick, stable, passivating oxide layer protecting the surface from further attack. Inconel retains strength over a wide temperature range, attractive for high temperature applications where aluminum and steel would succumb to creep as a result of thermally induced crystal vacancies. Inconel's high temperature strength is developed by solid solution strengthening or precipitation hardening, depending on the alloy.

Inconel alloys are typically used in high temperature applications. Common trade names for

Inconel Alloy 625 include: Inconel 625, Chronin 625, Altemp 625, Haynes 625, Nickelvac 625 and Nicrofer 6020.

Forged or Rolled Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High- Temperature Service(ASTM B462).

ASTM B462													
Copper Alloy UNS No.	C max	Mn max	P max	S max	Si max	Ni	Cr	C max	Mo	Cu	Nb+Ta	N	Fe max
	Carbon	Manganese	phosphorus	Sulfur	Silicon	Nickel	Chromium	Carbon	Molybdenum	Copper		Nitrogen	Iron
UNS N08026	0.03	1.00	0.030	0.030	0.50	33.00-37.20	22.00-26.00	0.03	5.00-6.70	2.00-4.00	…	0.10-0.16	balance
UNS N08020	0.07	2.00	0.045	0.035	1.00	32.00-38.00	19.00-21.00	0.07	2.00-3.00	3.00-4.00	cX8-1.00	…	balance
UNS N08024	0.03	1.00	0.035	0.035	0.50	35.00-40.00	22.50-25.00	0.03	3.50-5.00	0.50-1.50	0.15-0.35	…	balance
UNS N08367	0.030	2.00	0.040	0.030	1.00	23.5-25.50	20.00-22.00	0.030	6.00-7.00	0.75max	…	0.18-0.25	balance
UNS R20033	0.015	2.00	0.020	0.010	0.50	30.0-33.0	31.0-35.0	0.015	0.50-2.0	0.30-1.20	…	0.35-0.60	balance
UNS N06030	0.03	1.50	0.040	0.020	0.80	balance	28.0-31.5	0.03	4.0-6.0	1.0-2.4	0.30-1.50	…	13.0-17.0
UNS N06022	0.015	0.50	0.020	0.020	0.08	balance	20.0-22.5	0.015	12.5-14.5	…	…	…	2.0-6.0
UNS N06200	0.010	0.50	0.025	0.010	0.08	balance	22.0-24.0	0.010	15.0-17.0	1.3-1.9	…	…	3.0max
UNS N10276	0.010	1.00	0.040	0.030	0.08	balance	14.5-16.5	0.010	15.0-17.0	…	…	…	4.0-7.0
UNS N10665	0.02	1.00	0.040	0.030	0.10	balance	1.0max	0.02	26.0-30.0	…	…	…	2.0max
UNS N10675	0.01	3.00	0.030	0.010	0.10	balance	1.0-3.0	0.01	27.0-32.0	0.20	…	…	1.0-3.0
UNS N06059	0.010	0.50	0.015	0.010	0.100	balance	22.0-24.0	0.010	15.0-16.5	0.50max	…	…	1.5max
UNS N06686	0.010	0.750	0.040	0.020	0.080	balance	19.0-23.0	0.010	15.0-17.0	…	…	…	5.0max
UNS N08031	0.015	2.000	0.020	0.010	0.300	30.0-32.0	26.0-28.0	0.015	6.0-7.0	1.0-1.4	…	0.15-0.25	balance
UNS N06045	0.05-0.12	1.000	0.020	0.010	2.5-3.0	45.0min	26.0-29.0	0.05-0.12	…	0.3max	…	…	21.0-25.0
UNS N06025	0.15-0.25	0.150	0.020	0.010	0.500	balance	24.0-26.0	0.15-0.25	…	0.1max	…	…	8.0-11.0
UNS N10629	0.010	1.500	0.040	0.010	0.050	balance	0.5-1.5	0.010	26.0-30.0	0.500	…	…	1.0-6.0
UNS N06035	0.050	0.500	0.030	0.015	0.600	balance	32.25-34.25	0.050	7.60-9.00	0.30max	…	…	2.00max

ASTM B462	Chemical Requirements									Mechanical Requirements			
Copper Alloy UNS No.	Co	W	V	Ti	Zr	Nb	Ta	Ni +Mo	Al max	TS(min)	YS(min)	EL(min)	RA(min)
	Cobalt	Tungsten	Vanadium	Titanium	Zirconium	Columbium	Tantalum		Aluminum				
UNS N08026	…	…	…	…	…	…	…	…	…	551	241	30	50
UNS N08020	…	…	…	…	…	…	…	…	…	551	241	30	50
UNS N08024	…	…	…	…	…	…	…	…	…	551	241	30	50
UNS N08367	…	…	…	…	…	…	…	…	…	655	310	30	50
UNS R20033	…	…	…	…	…	…	…	…	…	750	380	40	…
UNS N06030	5.0	1.5-4.0	…	…	…	…	…	…		586	241	30	…
UNS N06022	2.5	2.5-3.5	0.35	…	…	…	…	…		690	310	45	…
UNS N06200	2.0	…	…	…	…	…	…	…	0.5	690	283	45	…
UNS N10276	2.5	3.0-4.5	0.35	…	…	…	…	…	…	690	283	40	…
UNS N10665	1.0	…	…	…	…	…	…	…	…	760	350	40	…
UNS N10675	3.0	3.0max	0.2	0.2	0.1	0.20max	0.20max	94.0-98.0	0.5	760	350	40	…
UNS N06059	0.3	…	…	…	…	…	…	…	0.1-0.4	690	310	45	…
UNS N06686	…	3.0-4.4	…	0.02-0.25	…	…	…	…	…	690	310	45	…
UNS N08031	…	…	…	…	…	…	…	…	…	650	276	40	…
UNS N06045	…	…	…	…	…	…	0.03-0.09(Ce)	…	…	620	241	35	…
UNS N06025	…	…	…	0.1-0.2	0.01-0.10	…	0.05-0.12(Y)	…	1.8-2.4	680	270	30	…
UNS N10629	2.5	…	…	…	…	…	…	…	0.1-0.5	760	350	40	…
UNS N06035	1.00	0.60max	0.2	…	…	…	…	…	0.4	586	241	30	…

Inconel Alloy 600 include: NA14, N06600, BS3076, 2.4816, NCr15Fe (FR), NiCr15Fe (EU) and NiCr15Fe8 (DE).

Inconel 718 include: Nicrofer 5219, Superimphy 718, Haynes 718, Pyromet 718, Supermet 718, and Udimet 718.

INCONEL® nickel-chromium alloy 625 (UNS N06625/W.Nr. 2.4856) is used for its high strength, excellent fabricability (including joining), and out- standing corrosion resistance. Service temperatures range from cryogenic to 1800°F (982°C).

Strength of INCONEL alloy 625 is derived from the stiffening effect of molybdenum and niobium on its nickel-chromium matrix; thus precipitation- hardening treatments are not required. This combination of elements also is responsible for superior resistance to a wide range of corrosive environments of unusual severity as well as to high-temperature effects such as oxidation and carburization.

The properties of INCONEL alloy 625 that make it an excellent choice for sea-water applications are freedom from local attack (pitting and crevice corrosion), high corrosion-fatigue strength, high tensile strength, and resistance to chloride-ion stress-corrosion cracking. It is used as wire rope for mooring cables, propeller blades for motor patrol gunboats, submarine auxiliary propulsion motors, submarine quick- disconnect fittings, exhaust ducts for boats, sheath-ing for undersea communication cables, submarine transducer controls, and steam-line bellows. Po- tential applications are springs, seals, bellows for sub- merged controls, electrical cable connectors, fasteners, flexure devices, and oceano-graphic instrument components.

INCONEL® alloy 718 (UNS N07718/W.Nr. 2.4668) is a high-strength, corrosion-resistant nickel chromium material used at -423° to 1300°F.

The age-hardenable alloy can be readily fabricated, even into complex parts. Its welding characteristics, especially its resistance to postweld cracking, are outstanding.

The ease and economy with which INCONEL alloy 718 can be fabricated, combined with good tensile, fatigue, creep, and rupture strength, have resulted in its use in a wide range of applications. Examples of these are components for liquid fueled rockets, rings, casings and various formed sheet metal parts for aircraft and land-based gas turbine engines, and cryogenic tankage. It is also used for fasteners and instrumentation parts.

Nickel-Iron-Chromium Alloy Rod and Bar. (ASTM B408)

ASTM B408	Chemical Requirements											
Copper Alloy	Ni	Cr	Fe	Mn max	C	Cu max	Si	S	Al max	Ti	Nb	Mo
UNS No.	Nickel	Chromium	Iron	Manganese	Carbon	Copper	Silicon	Sulfur	Aluminum	Titanium	Columbium	Molybdenum
N08120	35.0-39.0	23.0-27.0	remainder	1.50	0.02-0.10	0.500	1.000	0.030	0.400	0.2max	0.4-0.9	2.5max
N08800	30.0-35.0	19.0-23.0	39.5min	1.50	0.10max	0.750	1.000	0.015	0.15-0.60	0.15-0.60	…	…
N08810	30.0-35.0	19.0-23.0	39.5min	1.50	0.05-0.10	0.750	1.000	0.015	0.15-0.60	0.15-0.60	…	…
N08811	30.0-35.0	19.0-23.0	39.5min	1.50	0.06-0.10	0.750	1.000	0.015	0.15-0.60	0.15-0.60	…	…
N08890	40.0-45.0	23.5-28.5	remainder	1.50	0.06-0.14	0.750	1.0-2.0	0.015	0.05-0.60	0.15-0.60	…	1.0-2.0

ASTM B408	Chemical Requirements							Mechanical Requirements				
Copper Alloy	Nb	Ta	P max	W	Co	N	B	TS	YS	EL	RA	HB
UNS No.	Niobium	Tantalum	phosphorus	Tungsten	Cobalt	Nitrogen	Boron					
N08120	…	…	0.04	2.50	3.00	0.15-0.30	0.01	621	276	30		
N08800	…	…	…	…	…	…	…	515	205	30		
N08810	…	…	…	…	…	…	…	450	170	30		
N08811	…	…	…	…	…	…	…	450	170	30		
N08890	0.2-1.0	0.1-0.6	…	…	…	…	…	520	205	35		

Ni-Cr-Fe Alloys (UNS N06600, N06601, N06603, N06690, N06693, N06025, and N06045) and Ni- Cr-Co-Mo Alloy (UNS N06617) Rod, Bar, and Wire

ASTM A166	Chemical Requirements											
Copper Alloy	Ni	Cr	Co	Mo	Fe max	Mn max	Al max	C	Cu max	Si	S	Ti
UNS No.	Nickel	Chromium	Cobalt	Molybdenum	Iron	Manganese	Aluminum	Carbon	Copper	Silicon	Sulfur	Titanium
UNS N06600	72.0min	14.0–17.0	…	…	6.0–10.0	1.0max	…	0.15max	0.50	0.50	0.015	…
UNS N06601	58.0-63.0	21.0–25.0	…	…	balance	1.0max	1.0-1.7	0.10max	1.00	0.50	0.015	…
UNS N06617	44.5min	20.0–24.0	10.0–15.0	8.0–10.0	3.0max	1.0max	0.8-1.5	0.05-0.15	0.50	1.00	0.015	0.6
UNS N06690	58.0min	27.0–31.0	…	…	7.0–11.0	0.5max	…	0.05max	0.50	0.50	0.015	…
UNS N06693	balance	27.0–31.0	…	…	2.5–6.0	1.0max	2.5-4.0	0.15max	0.50	0.50	0.010	…
UNS N06025	balance	24.0-26.0	…	…	8.0–11.0	1.5max	1.8-2.4	0.15-0.25	0.10	0.50	0.010	…
UNS N06045	45.0min	26.0-29.0	…	…	21.0-25.0	1.0max	…	0.05-0.12	0.30	2.5-3.0	0.010	…
UNS N06603	balance	24.0-26.0	…	…	8.0-11.0	1.5max	2.4-3.0	0.20-0.40	0.50	0.50	0.010	…

ASTM A166	Chemical Requirements							Mechanical Requirements				
Copper Alloy	P max	Zr	Y	B	N	Nb	Ce	TS	YS	EL	RA	HB
UNS No.	phosphorus	Zirconium	Yttrium	Boron	Nitrogen	Niobium	Cerium	see details in ASTM A166.				
UNS N06600	…	…	…	…	…	…	…					
UNS N06601	…	…	…	…	…	…	…					
UNS N06617	…	…	…	0.006	…	…	…					
UNS N06690	…	…	…	…	…	…	…					
UNS N06693	…	…	…	…	…	0.5-2.5	…					
UNS N06025	0.02	0.01-0.10	0.05-0.12	…	…	…	…					
UNS N06045	0.02	…	…	…	…	…	0.03-0.09					
UNS N06603	0.02	0.01-0.10	0.01-0.15	…	…	…	…					

INCONEL® alloy X-750 (UNS N07750/W. Nr. 2.4669) is a precipitation-hardenable nickel-chromium alloy used for its corrosion and oxidation resistance and high strength at temperatures to 1300°F. Although much of the effect of precipitation hardening is lost with increasing temperature over 1300°F, heat-treated material has useful strength up to 1800°F. Alloy X-750 also has excellent properties down to cryogenic termperatures.

FLOWKS

Depending on the application and the properties desired, various heat treatments are employed. For service above 1100°F, particularly where loads are to be sustained for long times, optimum properties are achieved by solution treating (2100°F) plus stabilization treating (1550°F) plus precipitation treating (1300°F). For service below 1100°F, the alloy may be strengthened by precipitation treating after hot or cold working or by precipitation treating after equalizing or solution treating. A furnace-cooling treatment is also used to develop optimum properties for some applications.

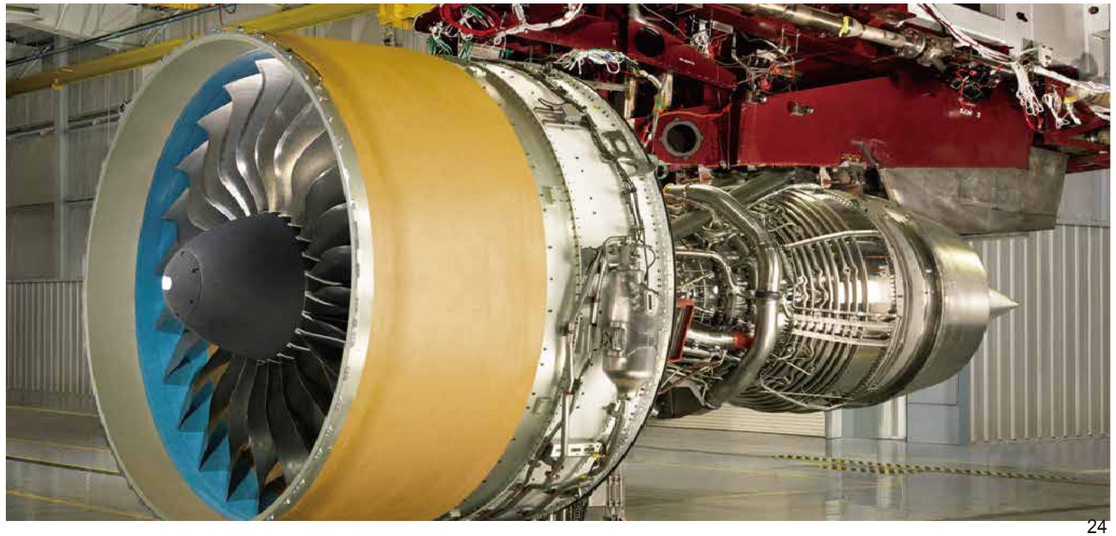
Incoloy refers to a range of superalloys produced by the Special Metals Corporation group of companies. They are mostly nickel-based, and designed for excellent corrosion resistance as well as strength at high temperatures; there are specific alloys for resistance to particular chemical attacks (e.g. alloy 020 is designed to be resistant to sulphuric acid, DS to be used in heat-treating furnaces with reactive atmospheres and many heat cycles)

INCOLOY alloys belong to the category of super austenitic stainless steels. These alloys have nickel-chromium-iron as the base metals, with additives such as molybdenum, copper, nitrogen and silicon. These alloys are known for their excellent strength at elevated temperatures and good corrosion resistance in a variety of corrosive environments.

INCOLOY alloy 800 is an alloy of nickel, iron and chromium. The alloy is capable of remaining stable and maintaining its austenitic structure even after long time exposures to high temperatures. Other characteristics of the alloy are good strength, and high resistance to oxidizing, reducing and aqueous environments

İNCOLOY alloy 800 is used in the following applications:

- •Heat exchangers
- • Carburising equipment
- • Heating elements
- • Sheathing and nuclear steam generator tubing.



Ni-Cr-Mo-Co Alloys. (UNS N06625 and UNS N06852) and Ni-Cr- Mo-Si Alloy (UNS N06219) Pipe and Tube(ASTM A444).

ASTM A444	Chemical Requirements															Mechanical Requirements		
UNS No.	C max	Mn max	Si max	P max	S max	Cr	Nb+Ta	Nb	Co max	Mo	Fe max	Al max	Ti	Cu	Ni	TS(min)	YS(min)	EL(min)
	Carbon	Manganese	Silicon	phosphorus	Sulfur	Chromium		Columbium	Cobalt	Molybdenum	Iron	Aluminum	Titanium	Copper	Nickel			
N06852	0.05	0.50	0.50	0.015	0.015	20.0-23.0	…	0.51-1.00	…	8.0-10.0	15.0-20.0	0.40max	0.40max	…	balance	586	241	30
N06625	0.10	0.50	0.50	0.015	0.015	20.0-23.0	3.15-4.15	…	1.0max	10.0max	5.0max	0.40max	0.40max	…	58.0min	690	276	30
N06219	0.05	0.50	0.70-1.10	0.020	0.010	18.0-22.0	…	…	1.0max	7.0-9.0	2.0-4.0	0.50max	0.50max	0.50max	balance	660	270	30

Precipitation-Hardening Nickel Alloy Bars, Forgings, and Forging Stock for High-Temperature Service.(ASTM B637)

ASTM B637													
Copper Alloy UNS No.	C	Mn	Si	P	S	Cr	Co	Mo	Nb+Ta	Ti	Al	Zr	B
	Carbon	Manganese	Silicon	phosphorus	Sulfur	Chromium	Cobalt	Molybdenum		Titanium	Aluminum	Zirconium	Boron
UNS N07022	0.010	0.50	0.08	0.025	0.015	20.0–21.4	1.00	15.5–17.4	…	…	0.500	…	0.006
UNS N07208	0.04–0.08	0.30	0.15	0.015	0.015	18.5–20.5	9.0–11.0	8.0–9.0	…	1.90–2.30	1.38–1.65	0.02	0.003-0.010
UNS N07252	0.10–0.20	0.50	0.50	0.015	0.015	18.00-20.00	9.00–11.00	9.00–10.50	…	2.25–2.75	0.75–1.25	…	0.003-0.010
UNS N07001	0.03–0.10	1.00	0.75	0.030	0.030	18.00-21.00	12.00–15.00	3.50–5.00	…	2.75–3.25	1.20–1.60	0.02-0.12	0.003-0.010
UNS N07500	0.150	0.75	0.75	0.015	0.015	15.00-20.00	13.00–20.00	3.00–5.00	…	2.50–3.25	2.50–3.25	…	0.003-0.010
UNS N07750	0.08	1.00	0.50	…	0.010	14.00-17.00	1.00	…	0.70–1.20	2.25–2.75	0.40–1.00	…	…
UNS N07718	0.08	0.35	0.35	0.015	0.015	17.0–21.0	1.00	2.80–3.30	4.75–5.50	0.65–1.15	0.20–0.80	…	0.006
UNS N07080	0.10	1.00	1.00	…	0.015	18.00-21.00	…	…	…	1.80-2.70	0.50-1.80	…	…
UNS N07752	0.020-0.060	1.00	0.50	0.008	0.003	14.50-17.00	0.050	…	0.70-1.20	2.25-2.75	0.40-1.00	0.05	0.007
UNS N09925	0.03	1.00	0.50	0.030	0.030	19.5-22.5	…	2.5-3.5	0.5(only Nb)	1.9-2.40	0.1-0.5	…	…
UNS N07725	0.03	0.35	0.20	0.015	0.010	19.00-22.50	…	7.00-9.50	2.75-4.00	1.00-1.70	0.350	…	…

ASTM B637	Chemical Requirements								Mechanical Requirements				
Copper Alloy UNS No.	Fe	Cu	Ni	Ta	Nb	Cr	W	V	TS(min)	YS(min)	EL(min)	RA(min)	HB
	Iron	Copper	Nickel	Tantalum	Columbium	Chromium	Tungsten	Vanadium					
UNS N07022	1.80	0.50	balance	0.20	…	20.0–21.4	0.80	…	1000	552	15	14	228
UNS N07208	1.50	0.10	balance	0.10	0.20	18.5–20.5	0.50	…	1034	620	20	14	250
UNS N07252	5.00	…	balance	…	…	18.00-20.00	…	…	1100	620	20	18	310
UNS N07001	2.00	0.50	balance	…	…	18.00-21.00	…	…	1100	760	15	18	310
UNS N07500	4.00	0.15	balance	…	…	15.00-20.00	…	…	1200	725	15	15	310
UNS N07750	5.00-9.00	0.50	70.00min	…	…	14.00-17.00	…	…	1170	790	18	18	302 ~ 363
UNS N07718	balance	0.30	50.0-55.0	…	…	17.0–21.0	…	…	1275	1034	6	8	≥331
UNS N07080	3.00	…	balance	…	…	18.00-21.00	…	…	930	620	20	…	…
UNS N07752	5.00-9.00	0.5	70.00min	…	…	14.50-17.00	…	0.1	965	585	20	20	…
UNS N09925	22.00	1.5-3.0	42.0-46.0	…	…	19.5-22.5	…	…	965	758	18	25	≤38Rc
UNS N07725	balance	…	55.0-59.0	…	…	19.00-22.50	…	…	1034	827	20	35	≤43Rc

The Corrosion-Resistant HASTELLOY alloys are widely used by the chemical processing industries. The need for reliable performance leads to their acceptance and growth in the areas of energy, health and environmental, oil and gas, pharmaceutical and flue gas desulfurization industries. The attributes of HASTELLOY alloys include high resistance to uniform attack, outstanding localized corrosion resistance, excellent stress corrosion cracking resistance, and ease of welding and fabrication.

Hastelloy Alloy possesses outstanding resistance to non-oxidizing acids, such as hydrochloric acid and sulfuric acid. The advantages of Hastelloy B-3 alloy over previous B-family alloys are enhanced thermal stability and improved fabrication characteristics.

The most versatile of the HASTELLOY alloys are the "C-type" alloys.

Alloy C-276 a Versatile, corrosion resistant alloy. Very good resistance to reducing, and mildly oxidizing corrosives. Excellent stress corrosion cracking resistance with very good resistance to localized attack.

C-2000 alloy combines outstanding resistance to oxidizing media with superior resistance to non-oxidizing environments and represents a true performance breakthrough for chemical process equipment applications.

C-22 alloy is particularly resistant to pitting and crevice corrosion; it has been used extensively to protect against the most corrosive FGD systems and the most sophisticated pharmaceutical reaction vessels.

The name 'duplex' for this family of stainless steels derives from the microstructure of the alloys which comprises approximately 50/50 mixture of austenite and delta-ferrite. They are designed to provide better corrosion resistance, particularly chloride stress corrosion and chloride pitting corrosion, and higher strength than standard austenitic stainless steels such as Type 304 or 316. The main differences in composition, when compared with an austenitic stainless steel is that the duplex steels have a higher chromium content, 20 - 28%; higher molybdenum, up to 5%; lower nickel, up to 9% and 0.05 - 0.5% nitrogen. Both the low nickel content and the high strength (enabling thinner sections to be used) give significant cost benefits. They are therefore used extensively in the offshore oil and gas industry for pipework systems, manifolds, risers, etc and in the petrochemical industry in the form of pipelines and pressure vessels. In addition to the improved corrosion resistance compared with the 300 series stainless steels duplex steels also

Castings Nickel and Nickel Alloy. (ASTM A494/ A494M).

ASTM A494 Copper Alloy UNS		Chemical Requirements												Mechanical Requirements		
		C max	Mn max	Si max	P max	S max	Mo	Fe max	Ni	Cr	Nb	W	V	TS(min)	YS(min)	EL(min)
Grade	UNS No.	Carbon	Manganese	Silicon	phosphorus	Sulfur	Molybdenum	Iron	Nickel	Chromium	Columbium	Tungsten	Vanadium			
CZ100	N02100	1.00	1.50	2.00	0.030	0.030	…	3.00	95.000	…	…	…	1.25(Cu)	345	125	10
N12MV	N30012	0.12	1.00	1.00	0.040	0.030	26.0-30.0	4.0-6.0	balance	1.000	…	…	0.20-0.60	525	275	6
N7M	N30007	0.07	1.00	1.00	0.040	0.300	30.0-33.0	3.00	balance	1.000	…	…	…	525	275	20
CY40	N06040	0.40	1.50	3.00	0.030	0.030	…	11.00	balance	14.0-17.0	…	…	…	485	195	30
CW12MW	N30002	0.12	1.00	1.00	0.040	0.030	16.0-18.0	4.5-7.5	balance	15.5-17.5	…	…	0.20-0.40	495	275	4
CW6M	N30107	0.07	1.00	1.00	0.040	0.030	17.0-20.0	3.00	balance	17.0-20.0	…	3.75-5.25	…	495	275	25
CW2M	N26455	0.02	1.00	0.80	0.030	0.030	15.0-17.5	2.00	balance	15.0-17.5	…	…	…	495	275	20
CW6MC	N26625	0.06	1.00	1.00	0.015	0.015	8.0-10.0	5.00	balance	20.0-23.0	3.15-4.50	1.000	…	485	275	25
CY5SnBiM	N26055	0.05	1.50	0.50	0.030	0.030	2.0-3.5	2.00	balance	11.0-14.0	…	3.0-5.0(Bi)	3.0-5.0(Sn)	…	…	…
CX2MW	N26022	0.02	1.00	0.80	0.025	0.025	12.5-14.5	2.0-6.0	balance	20.0-22.5	…	…	0.350	550	310	30
CU5MCuC	N08826	0.05	1.00	1.00	0.030	0.030	2.5-3.5	balance	38.0-44.0	19.5-23.5	0.060-1.20	2.5-3.5	1.50-3.50(Cu)	520	240	20
CX2M	N26059	0.02	1.00	0.50	0.020	0.020	15.0-16.5	1.50	balance	22.0-24.0	…	…	…	495	270	40

Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service. (ASTM A182)

ASTM A182		Chemical Requirements											Mechanical Requirements			
		C max	Mn max	Si max	P max	S max	Mo	N	Ni	Cr	Cu	Other	TS(min)	YS(min)	EL(min)	HB
Grade	UNS No.	Carbon	Manganese	Silicon	phosphorus	Sulfur	Molybdenum	Nitrogen	Nickel	Chromium	Copper	Elements	Mpa	Mpa	%	%
A182 F20	N08020	0.070	2.00	1.00	0.045	0.035	2.00–3.00	...	32.0–38.0	19.0–21.0	3.0–4.0	Nb8xCmin–1	550	240	30	50
A182 F44	254SMO	0.020	1.00	0.80	0.030	0.010	6.0–6.5	0.18–0.22	17.5–18.5	19.5–20.5	0.50–1.00	…	650	300	35	50
A182 F51	S31803	0.030	2.00	1.00	0.030	0.020	2.5–3.5	0.08–0.20	4.5–6.5	21.0–23.0	…	…	620	450	25	45
A182 F53	S32750	0.030	1.20	0.80	0.035	0.020	3.0–5.0	0.24–0.32	6.0–8.0	24.0–26.0	0.50	…	800	550	15	…
A182 F55	S32760	0.030	1.00	1.00	0.030	0.010	3.0–4.0	0.20–0.30	6.0–8.0	24.0–26.0	0.50–1.00	W 0.50–1.00	109-130ksi	550	25	45
A182 904L	NO8904	0.020	2.00	1.00	0.040	0.030	4.0–5.0	0.10	23.0–28.0	19.0–23.0	1.00–2.00	…	490	215	35	…

Castings, Austenitic-Ferritic （Duplex） Stainless Steel, for Pressure-Containing Parts. (ASTM A995)

ASTM A995		Chemical Requirements											Mechanical Requirements			
		C	Mn	Si	P	S	Cr	Ni	Mo	Cu	W	N	TS(min)	YS(min)	EL(min)	HB
Grade	ACI	Carbon	Manganese	Silicon	phosphorus	Sulfur	Chromium	Nickel	Molybdenum	Copper	Tungsten	Nitrogen	Mpa	Mpa	%	…
1B	CD4MCuN	0.040	1.00	1.00	0.040	0.040	24.5–26.5	4.7–6.0	1.7–2.3	2.7–3.3	…	0.10–0.25	690	485	16	…
2A	CE8MN	0.080	1.00	1.50	0.040	0.04	22.5-25.5	8.0-11.0	3.0-4.5	…	…	0.10-0.30	655	450	25	…
3A	CD6MN	0.060	1.00	1.00	0.040	0.04	24.0-27.0	4.0-6.0	1.75-2.5	…	…	0.15-0.25	655	450	25	…
4A	CD3MN	0.030	1.50	1.00	0.040	0.02	21.0-23.5	4.5-6.5	2.5-3.5	1.00max	…	0.10-0.30	620	415	25	…
5A	CE3MN	0.030	1.50	1.00	0.040	0.04	24.0-26.0	6.0-8.0	4.0-5.0	…	…	0.10-0.30	690	515	18	…
6A	CD3MWCuN	0.030	1.00	1.00	0.030	0.03	24.0-26.0	6.5-8.5	3.0-4.0	0.5-1.0	0.5-1.0	0.20-0.30	690	450	25	…

have higher strength. These are called duplex (or austenitic-ferritic) grades because their metallurgical structure consists of two phases, austenite (face-centered cubic lattice) and ferrite (body centered cubic lattice) in roughly equal proportions.
They are used for their good mechanical properties in the as-cast (and therefore as-welded condition) and/or their excellent corrosion resistance properties (particularly to stress corrosion cracking).

Duplex stainless steels are called “duplex” because they have a two-phase microstructure consisting of grains of ferritic and austenitic stainless steel. The picture shows the yellow austenitic phase as “islands” surrounded by the blue ferritic phase. When duplex stainless steel is melted it solidifies from the liquid phase to a completely ferritic structure. As the material cools to room temperature,

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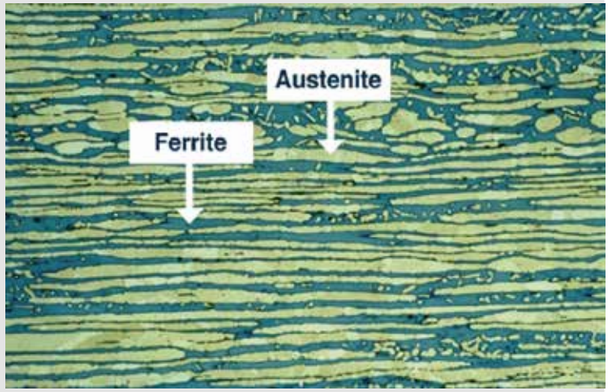
about half of the ferritic grains transform to austenitic grains (“islands”). The result is a microstructure of roughly 50% austenite and 50% ferrite.Duplex stainless steels have a two-phase microstructure of austenite and ferrite grains.The duplex structure gives this family of stainless steels a combination of attractive properties:



Strength: Duplex stainless steels are about twice as strong as regular austenitic or ferritic stainless steels.

Toughness and ductility: Duplex stainless steels have significantly better toughness and ductility than ferritic grades; however, they do not reach the excellent values of austenitic grades.

Corrosion resistance: As with all stainless steels, corrosion resistance depends mostly on the composition of the stainless steel. For chloride pitting and crevice corrosion resistance, their chromium, molybdenum and nitrogen content are most important. Duplex stainless steel grades have a range of corrosion resistance, similar to the range for austenitic stainless steels, i.e from Type 304 or 316 (e.g. LDX 2101©) to 6% molybdenum (e.g. SAF 2507©) stainless steels.

Stress corrosion cracking resistance: Duplex stainless steels show very good stress corrosion cracking (SCC) resistance, a property they have “inherited” from the ferritic side. SCC can be a problem under certain circumstances (chlorides, humidity, elevated temperature) for standard austenitics such as Types 304 and 316.

Cost: Duplex stainless steels have lower nickel and molybdenum contents than their austenitic counterparts of similar corrosion resistance. Due to the lower alloying content, duplex stainless steels can be lower in cost, especially in times of high alloy surcharges. Additionally, it may often be possible to reduce the section thickness of duplex stainless steel, due to its increased yield strength compared to austenitic stainless steel. The combination can lead to significant cost and weight savings compared to a solution in austenitic stainless steels.

Toughness and ductility: Duplex stainless steels have significantly better toughness and ductility than ferritic grades; however, they do not reach the excellent values of austenitic grades.