

## 304/304L

(UNS S30400/S30403)

### Availability:

Seamless Pipe: 1/4" - 24"  
Weld Pipe: 1/2" - 36"  
Butt-Weld Fit: 1/2" - 36"  
Butt-Weld Fit SMLS: 1/2" - 36"  
Pressure Fittings: 1/4" - 4"  
150# Fittings/Nipples: 1/4" - 6"  
Valves: 1/2" - 24"  
Tubing: 1/4", 3/8", 1/2", 3/4", 1"  
Flanges: 1/2" - 36"  
Bar: 1/8" - 12"

### Specifications:

ASTM A312, A376, A358, A269  
A249, A403, A182, A351  
ASME SA312, SA376, SA358  
SA269, SA249, SA403  
SA182, SA351

### Description:

304 stainless is a low-carbon (0.08% max) version of basic 18-8, also known as 302. Type 302 has 18% chromium and 8% nickel. Type 304 has a slightly lower strength than 302 due to its lower carbon content. Type 304 is used in welding applications, because the low carbon permits some exposure in the carbide precipitation range of 800° F - 1500° F without the need for post-annealing operations. However, the severity of the corrosive environments may necessitate annealing after welding or the use of 304L. Type 304L has a carbon content of 0.03% or less.

### Typical Applications:

- Sanitary systems
- Dairy and food processing
- Heat exchangers, evaporators
- Feedwater heaters

### Tensile Requirements:

Tensile Strength      Yield Strength  
(KSI) = 70      (KSI) = 25

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cr	Mn	Ni	P	S	Si
MAX		MAX		MAX	MAX	MAX
0.035	18.0 - 20.0	2.0	8.0 - 13.0	0.045	0.030	1.00

## 310S/310H

(UNS S31008)

### Availability:

Seamless Pipe: 1/2" - 8"  
Weld Pipe: 8" - 12"  
Butt-Weld Fittings: 1/2" - 8"  
Bar: 1" - 8"

### Specifications:

ASTM A312, A403, A182  
ASME SA312, SA403, SA182

### Description:

Alloy 310S has excellent resistance to oxidation under constant temperatures up to 2000° F. Cyclic conditions reduce its oxidation resistance, and a maximum operating temperature of 1900° F is generally recommended if cycling is involved. Having a lower coefficient of expansion than most 300 stainless steels, 310S may be used in operations involving moderately severe thermal cycling, such as rapid air cooling. Its not usually recommended for liquid quenching. 310S is widely used in moderately carburizing atmospheres such as petro-chemical plants.

### Typical Applications:

- Heat exchanger and heat recuperator tubing
- Molten salt applications
- Sulfur-bearing gas atmospheres

### Tensile Requirements:

Tensile Strength      Yield Strength  
(KSI) = 75      (KSI) = 30

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cr	Mn	Mo	Ni	P	S	Si
MAX		MAX	MAX		MAX	MAX	MAX
0.08	24.0 - 26.0	2.0	0.75	19.0 - 22.0	0.045	0.03	1.00

## 316/316L

(UNS S31600/S31603)

### Availability:

Seamless Pipe: 1/4" - 24"  
Weld Pipe: 1/2" - 36"  
Butt-Weld Fit: 1/2" - 36"  
Butt-Weld Fit SMLS: 1/2" - 36"  
Flanges: 1/2" - 24"  
Pressure Fittings: 1/4" - 4"  
150# Fittings/Nipples: 1/4" - 6"  
Valves: 1/2" - 24"  
Tubing: 1/4", 3/8", 1/2", 3/4", 1"  
Bar: 1/8" - 8"

### Specifications:

ASTM A312, A376, A358, A269  
A249, A403, A182, A351  
A479, A276  
ASME SA312, SA376, SA358  
SA269, SA249, SA182  
SA276, SA403, SA479, SA351

### Description:

Type 316 is a molybdenum steel possessing improved resistance to pitting by solutions containing chlorides and other halides. In addition, it provides excellent tensile, creep and stress-rupture strengths at elevated temperatures. Type 316 is available in low carbon (316L) and high carbon (316H) alloys.

### Typical Applications:

- Nuclear, chemical processing, rubber, plastics, pulp/paper, pharmaceutical and textile industries
- Heat exchangers, condensers and evaporators

### Tensile Requirements:

Tensile Strength      Yield Strength  
(KSI) = 70      (KSI) = 25

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cr	Mn	Mo	Ni	P	S	Si
MAX		MAX			MAX	MAX	MAX
0.035	16.0 - 18.0	2.00	2.0 - 3.0	10.0 - 14.0	0.045	0.030	1.00

## 317L

(UNS S31703)

### Availability:

Weld Pipe: 1/2" - 12"  
Seamless Pipe: 1/2" - 8"  
Butt-Weld Fittings: 1/2" - 12"  
Flanges: 1/2" - 12"  
Bar: 1" - 8"

### Specifications:

ASTM A312, A403, A182  
ASME SA312, SA403, SA182

### Description:

Alloy 317L is a molybdenum-bearing, austenitic chromium nickel steel similar to type 316, except the alloy content in 317L is somewhat higher. It has superior corrosion resistance in special applications where it is desired to reduce contamination to a minimum. 317L was developed primarily to more effectively resist the attack of sulfurous acid compounds. However, its proven ability to combat corrosion has widened its use for many other industrial applications.

### Typical Applications:

- Flue gas desulfurization scrubber systems
- Chemical and petro-chemical processing
- Pulp and paper plants
- Food processing equipment
- Textile equipment

### Tensile Requirements:

Tensile Strength Yield Strength  
(KSI) = 75 (KSI) = 30

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cr	Mn	Mo	Ni	P	S	SI
MAX		MAX			MAX	MAX	MAX
0.035	18.0 - 20.0	2.0	3.0 - 4.0	11.0 - 15.0	0.04	0.03	1.00

## 321/321H

(UNS S32100/S32109)

### Availability:

Seamless Pipe: 1/2" - 16"  
Weld Pipe: 6" - 12"  
Butt-Weld Fittings: 1/2" - 12"  
Butt-Weld Flanges: 1/2" - 12"  
Flanges: 1/2" - 8"  
Bar: 1" - 12"

### Specifications:

ASTM A312, A403, A182,  
A479, A276  
ASME SA312, SA403, SA182  
SA479, SA276

### Description:

These titanium-bearing stainless steels are stabilized against carbide precipitation. They are designed for operation within the damaging temperature range where carbide precipitation develops. In this type of steel, the carbon combines preferentially with titanium to form a harmless titanium carbide, leaving the chromium in solution to maintain full corrosion resistance. Type 321 is basic type 304 modified by adding titanium in an amount at least 5 times the carbon-plus-nitrogen contents.

### Typical Applications:

- High temperature chemical process
- Heat exchanger tubes
- Refineries
- High temperatures steam service

### Tensile Requirements:

Tensile Strength Yield Strength  
(KSI) = 75 (KSI) = 30

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cr	Mn	Ni	P	S	SI	Ti
MAX		MAX		MAX	MAX	MAX	
0.08	17.0 - 19.0	2.0	9.0 - 12.0	0.045	0.030	1.00	Trace*

## 347/347H

(UNS S34700/S34709)

### Availability:

Seamless Pipe: 1/2" - 12"  
Weld Pipe: 8" - 12"  
Butt-Weld Fittings: 1/2" - 12"  
Butt-Weld Flanges: 1/2" - 12"  
Bar: 1" - 12"

### Specifications:

ASTM A312, A403, A182,  
A479, A276  
ASME SA312, SA403, SA182  
SA479, SA276

### Description:

These stainless alloys are austenitic chromium steels containing columbium. The addition of columbium produces a stabilized type of stainless that eliminates carbide precipitation, and consequently, intergranular corrosion. They are recommended for parts fabricated by welding, that cannot be subsequently annealed. They also are used for parts, that can be intermittently heated and cooled to temperatures between 800° and 1600° F.

### Typical Applications:

- High temperature chemical process
- Heat exchanger tubes
- Refineries
- High temperature steam service

### Tensile Requirements:

Tensile Strength Yield Strength  
(KSI) = 75 (KSI) = 30

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Co	Cr	Mn	Ni	P	S	SI	Ta
MAX			MAX		MAX	MAX	MAX	
0.08	Trace*	17.0 - 19.0	2.0	9.0 - 13.0	0.045	0.030	1.00	Trace*



## 410

(UNS S41000)

### Availability:

Seamless Pipe: 1/2" - 8"

### Specifications:

ASTM A268, A815, A182

### Description:

410 is a martensitic stainless steel that is magnetic, resists corrosion in mild environments and has fairly good ductility. 410 pipe is used where abrasion and wear resistance is needed, combined with fair resistance to general corrosion and oxidation.

### Typical Applications:

- Pipeline transportation of fluids mixed with solids like coal, sand or gravel

### Tensile Requirements:

Tensile Strength      Yield Strength  
(KSI) = 70                      (KSI) = 30

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cr	Mn	Ni	P	S	Si
MAX		MAX		MAX	MAX	MAX
0.15	11.5 - 13.5	1.0	0.50	0.04	0.03	1.00

## 904L

(UNS N08904)

### Availability:

Seamless Pipe: 1/2" - 6"

### Specifications:

ASTM B677, B366  
ASME SB677, SB366

### Description:

904L is a high-alloy austenitic stainless steel with low carbon content. The grade is intended for use under severe corrosive conditions. It was originally developed to resist corrosion in dilute sulfuric acid and has been proven effective in this application over many years. Structurally, 904L is fully austenitic and is less sensitive to precipitation ferrite and sigma phases than conventional austenitic grades with high molybdenum content. 904L has a good resistance to general corrosion, particularly in sulfuric and phosphoric conditions.

### Typical Applications:

- Production and transport of sulfuric acid
- Metal pickling in sulfuric acid
- Production and concentrations of phosphoric acid
- Use in seawater, brackish water, condensers, heat exchangers and general pipe work
- Paper and allied industries
- Gas washing

### Tensile Requirements:

Tensile Strength      Yield Strength  
(KSI) = 70                      (KSI) = 25

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cr	Cu	Mn	Mo	Ni	P	S	Si
MAX			MAX			MAX	MAX	MAX
0.02	19.0 - 23.0	1.0 - 2.0	2.0	4.0 - 5.0	23.0 - 28.0	0.045	0.035	1.0

## Alloy 20

(UNS N08020)

### Availability:

Seamless Pipe: 1/2" - 8"  
Weld Pipe: 1/2" - 12"  
Butt-Weld Fittings: 1/2" - 12"  
Flanges: 1/2" - 12"  
Pressure Fittings: 1/2" - 2"  
150# Fittings: 1/4" - 2"  
Tubing: 1/4", 3/8", 1/2"  
Valves: 1/2" - 12"  
Bar: 1" - 8"

### Specifications:

ASTM B729, B464, B366,  
B473, B462  
ASME SB729, SB464, SB366,  
SB473, SB462

### Description:

Alloy 20 is one of the so-called "Super" stainless steels that was designed for maximum resistance to acid attack. Its nickel, chromium, molybdenum and copper content contribute to its overall resistance to chloride stress corrosion cracking and general pitting attack. Although the alloy was designed for use in applications involving sulfuric acid, it also can be used for processing pharmaceuticals, food, gasoline, solvents, plastics, explosives, synthetics fibers and many more products.

### Typical Applications:

- Chemical and allied industries
- Food and dye production
- Heat exchangers
- SO<sub>2</sub> scrubbers and other severe environments
- Tanks
- Pickling racks
- Valves

### Tensile Requirements:

Tensile Strength      Yield Strength  
(KSI) = 80                      (KSI) = 35

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Nb + Ta	Cr	Cu	Fe	Mn	Mo	Ni	P	S	Si
MAX	8x Carbon				MAX			MAX	MAX	MAX
0.07	1.0	19.0 - 21.0	3.0 - 4.0	BAL	2.0	2.0 - 3.0	32.0 - 38.0	.045	.035	1.0

## Alloy 200

(UNS N02201t)

### Availability:

Seamless Pipe: 1/2" - 8"  
Weld Pipe: 8" - 12"  
Butt-Weld Fittings: 1/2" - 8"  
Flanges: 1/2" - 8"  
Pressure Fittings: 1/2" - 2"  
Bar: 1" - 6"

### Specifications:

ASTM B161, B162, B366, B160  
B564  
ASME SB161, SB162, SB366  
SB160, SB564

### Description:

Alloy 200 is an unalloyed wrought nickel. It offers excellent corrosion resistance, good mechanical, magnetic and magnetostrictive properties and useful thermal and electrical conductivities.

### Typical Applications:

- Food production (cool brines, fatty acids, & fruit juices)
- Vessels in which fluorine is generated and reacted with hydrocarbons
- Storing & transportation of phenol
- Manufacture handling of sodium hydroxide, production of viscose rayon & manufacture of soap
- Production of hydrochloride and chlorination of hydrocarbons

### Tensile Requirements:

Tensile Strength Yield Strength  
(KSI) = 50 5" < (KSI) = 10  
5" > (KSI) = 12

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cu	Mn	Ni	S	Si	Fe
MAX	MAX	MAX	MIN	MAX	MAX	MAX
0.02	0.25	0.35	99.0	0.01	0.35	0.40

## Alloy 400

(UNS N04400)

### Availability:

Seamless Pipe: 1/2" - 8"  
Weld Pipe: 8" - 12"  
Butt-Weld Fittings: 1/2" - 8"  
Flanges: 1/2" - 8"  
Pressure Fittings: 1/2" - 2"  
150# Fittings: 1/4" - 1"  
Tubing: 1/4", 3/8", 1/2"  
Bar: 1" - 8"

### Specifications:

ASTM B165, B127, B366, B164  
B564  
ASME SB165, SB127, SB366  
SB164, SB564

### Description:

Alloy 400 is used for its excellent combination of corrosion resistance, strength, ductility and weldability. The corrosion resistance in seawater is especially good under high velocity conditions. Alloy 400 also is generally not susceptible to stress corrosion cracking.

### Typical Applications:

- Feed-water and steam generator in power plants
- Brine heaters and evaporator bodies in salt plants
- Sulfuric and hydrofluoric acid alkylation plants
- Industrial heat exchangers
- Cladding for crude oil distillation columns
- Splash-zone sheathing in offshore structures
- Propeller and pump shafts for seawater service
- Monoethanolamine (MEA) reboiler tubes

### Tensile Requirements:

Tensile Strength Yield Strength  
(KSI) = 70 5" < (KSI) = 28  
5" > (KSI) = 25

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cu	Mn	Ni	S	Si	Fe
MAX		MAX	MIN	MAX	MAX	MAX
0.30	28.0 - 34.0	2.00	63.0	0.024	0.50	2.50

## Alloy 600

(UNS N06600)

### Availability:

Seamless Pipe: 1/2" - 8"  
Butt-Weld Fittings: 1/2" - 8"  
Flanges: 1/2" - 8"  
Bar: 1" - 8"

### Specifications:

ASTM B167, B366, B166, B564  
ASME SB167, SB366, SB564  
SB166

### Description:

Alloy 600 is a nickel-chromium-iron alloy used for applications which require resistance to corrosion and heat. The alloy also has excellent mechanical properties and presents the desirable combination of high strength and good workability under a wide range of temperatures.

### Typical Applications:

- Steam generators
- Chemical processing
- Food processing
- Superheaters
- Jet engines
- Electronic parts

### Tensile Requirements:

Tensile Strength Yield Strength  
(KSI) = 80 - 100 (KSI) = 30 - 50

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cr	Cu	Fe	Mn	N	S	Si
MAX		MAX		MAX	MIN	MAX	MAX
0.15	14.0 - 17.0	0.50	6.00 - 10.00	1.00	72.0	0.015	0.50



## Alloy 625

(UNS N06625)

### Availability:

Welded Pipe: 1/2" - 8"  
Butt-Weld Fittings: 1/2" - 8"  
Flanges: 1/2" - 8"  
Bar: 1" - 4 1/2"

### Specifications:

ASTM B443, B705, B366, B446  
B564

ASME SB443, SB705, SB366  
SB446, SB564

### Description:

Alloy 625 is a nickel-chromium alloy used for its high strength, excellent fabricability and outstanding corrosion resistance. Service temperatures range from cryogenic to 1800° F. Alloy 625 strength is derived from the stiffening effect of molybdenum so that 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.

### Typical Applications:

- Used for structures in contact with seawater and subject to high mechanical stress
- Flue gas scrubber components
- Chimney linings
- Superphosphoric acid production equipment
- Sour gas production tubes
- Offshore industry, marine equipment

### Tensile Requirements:

Tensile Strength Yield Strength  
(KSI) = 120 - 150 (KSI) = 60 - 95

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Grade 1 - Chemical Composition %

C	Cr	Fe	Ni	Al	Ti	Mo	Cb + Ta	Mn	Si	P	S	Co
MAX		MAX	MIN	MAX	MAX			MAX	MAX	MAX	MAX	MAX
0.10	20.0 - 23.0	5.0	58.0	0.40	0.40	8.00 - 10.00	3.15 - 4.15	0.50	0.50	0.015	0.015	1.0

## Alloy 800/800H/800HP

(UNS N08800/ N08810  
N08811)

### Availability:

Seamless Pipe: 1/2" - 8"  
Welded Pipe: 8" - 12"  
Butt-Weld Fittings: 1/2" - 8"  
Flanges: 1/2" - 8"  
Bar: 1" - 6"

### Specifications:

ASTM B407, B514, B366, B408  
B564

ASME SB407, SB514, SB366  
SB408, SB564

### Description:

Alloy 800 is widely used in equipment that must resist corrosion, have high strength or resist oxidation, carburization and other harmful effects of high-temperature exposure. Alloy 800HP is used for high temperature applications requiring optimum creep and rupture properties. The chromium in the alloy imparts resistance to oxidation and corrosion. The high nickel content maintains an austenitic structure so the alloy is ductile. The nickel also contributes resistance to scaling, general corrosion, and stress corrosion cracking.

### Typical Applications:

- Steam/hydrocarbon reforming for components
- Ethylene pyrolysis tubing in convection and radiant sections - resistance to carburization and good mechanical properties
- Ethylene dichloride cracking tubes
- Components of heat exchangers, piping systems
- Steam generators tubing in helium coolant

### Tensile Requirements:

Tensile Strength Yield Strength  
(KSI) = 65 (KSI) = 25

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cr	Fe	Ni	Al	Ti	Al/Ti	Si	Mn	Cu	S
		MIN								
.05 - .10	19.0 - 23.0	39.5	30.0 - 35.0	.15 - .60	.15 - .60	.85 - 1.20	1.00	1.5	0.75	0.015

## Alloy 825

(UNS N08825)

### Availability:

Seamless Pipe: 1/2" - 8"  
Welded Pipe: 8" - 12"  
Butt-Weld Fittings: 1/2" - 8"  
Flanges: 1/2" - 8"  
Bar: 1" - 6"

### Specifications:

ASTM B443, B705, B366, B425  
B564

ASME SB443, SB705, SB366  
SB925, SB564

### Description:

Alloy 825 is a nickel-iron-chromium alloy with additions of molybdenum, copper and titanium. The alloy's chemical composition provides exceptional resistance to many corrosive environments. The nickel content is sufficient for resistance to chloride-ion stress corrosion cracking. The nickel, combined with molybdenum and copper, also gives outstanding resistance to reducing environments, such as those containing sulfuric and phosphoric acid. The molybdenum also aids resistance to pitting and crevice corrosion.

### Typical Applications:

- Components for heating coils, tanks, crates
- Fuel element dissolvers (Sulfuric & nitric acids, caustic hydroxide)
- Sea water cooled heat exchangers; offshore product piping system tubes and components
- Pipelines carrying wet sulphur dioxide gas & pulp digesters in the paper making process
- Heat exchangers, evaporators, scrubbers

### Tensile Requirements:

Tensile Strength Yield Strength  
(KSI) = 85 (KSI) = 35

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cr	Fe	Ni	Al	Ti	Cu	Mo	Si	S
MAX		MAX		MAX			MAX	MAX	MAX
0.05	19.5 - 23.5	22.0	38.0 - 46.0	0.2	0.6 - 1.2	1.5 - 3.0	2.5 - 3.5	0.50	0.03



## C-276

(UNS N10276)

### Availability:

Welded Pipe: 1/2" - 12"  
Seamless Pipe: 1/2" - 4"  
Butt-Weld Fittings: 1/2" - 12"  
Flanges: 1/2" - 12"  
Valves: 1/2" - 8"  
Bar: 1" - 9"

### Specifications:

ASTM B619, B366, B564, B574  
ASME SB619, SB366, SB564, SB574

### Description:

Alloy C-276 is an improved wrought version of Alloy C. It has the same excellent corrosion resistance with greatly improved fabricability. It can be hot-worked and cold-formed by conventional procedures. It can be joined by welding methods and resists the formation of grain boundary precipitates in the weld-affected zone. Thus, it is suitable for most chemical process applications in the as-welded conditions. It resists stress-corrosion cracking and is resistant to oxidation at temperatures up to 1900° F.

### Typical Applications:

- Chemical processing
- Pollution control
- Pulp and paper
- Other severe environments and/or conditions

### Tensile Requirements:

Tensile Strength (KSI) = 110      Yield Strength (KSI) = 52.6

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Co	Cr	Fe	Mn	Mo	Ni	P	S	Si	V	W
MAX	MAX			MAX			MAX	MAX	MAX	MAX	
0.01	2.5	14.5 - 16.5	4.0 - 7.0	1.0	15.0 - 17.0	BAL	.04	.03	0.08	0.35	3.0 - 4.5

## Duplex 2205

(UNS S31803/S32205)

### Availability:

Seamless Pipe: 1/2" - 8"  
Weld Pipe: 1/2" - 12"  
Butt-Weld Fittings: 1/2" - 12"  
Flanges: 1/2" - 12"  
Bar: 1" - 8"

### Specifications:

ASTM B790, B815, B182, ASME SB790, SB815, SB182,

### Description:

Avesta Sheffield 2205 is a ferritic-austenitic stainless steel which combines many of the beneficial properties of both ferritic and austenitic steels. As a result of high chromium and molybdenum contents, the steel has very good pitting and uniform corrosion resistance, as well as high mechanical strength. 2205 has good weldability and can be welded using most of the techniques for stainless steels. Due to the balanced composition, when welded correctly, the heat-affected zone contains sufficient austenite to avoid risk of localized corrosion.

### Typical Applications:

- Heat exchangers, tube & pipe for gas & oil
- Heat exchangers and pipes in desalination plants
- Pressure vessels, pipes, & tanks for various chemicals and chlorides
- Rotors, fans, shafts and press rolls where high corrosion fatigue is needed

### Tensile Requirements:

Tensile Strength (KSI) = 95      Yield Strength (KSI) = 65

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cb	Fe	Mn	MO	N	Ni	P	S	SI
MAX			MAX				MAX	MAX	MAX
0.030	22.0 - 23.0	BAL	2.0	3.00 - 3.50	0.14 - 0.20	4.50 - 6.50	0.030	0.020	1.0

## 254SMO®

(UNS S31254)

### Availability:

Weld Pipe: 1/2" - 12"  
Seamless Pipe: 1/2" - 8"  
Butt-Weld Fittings: 3/4" - 12"  
Flanges: 3/4" - 12"  
Bar: 1" - 8"

### Specifications:

ASTM A312, A403, A182, ASME SA312, SA403, SA182

### Description:

254SMO is an austenitic steel designed for maximum resistance to pitting and crevice corrosion. With high levels of chromium, molybdenum and nitrogen, 254SMO is especially suited for high chloride environments such as brackish water, seawater, pulp mill bleach plants and other high-chloride process streams. In new construction, 254SMO has been found in many cases to be technically adequate and much less costly substitute for nickel-based alloys and titanium. 254SMO is readily fabricated and welded.

### Typical Applications:

- Seawater handling equipment
- Pulp mill bleach systems
- Tall oil distillation columns and equipment
- Chemical processing equipment
- Food processing equipment
- Desalination equipment
- Flue gas desulfurization scrubbers

### Tensile Requirements:

Tensile Strength (KSI) = 94      Yield Strength (KSI) = 44

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Cr	Cu	Mn	Mo	N	Ni	P	Si	S
MAX			MAX				MAX	MAX	MAX
0.02	19.5 - 20.5	0.5 - 1.0	1.0	6.0 - 6.5	0.18 - 0.22	17.5 - 18.5	0.03	0.80	0.010

## 6061-T6 Aluminum

(UNS A96061)

### Availability:

Seamless: 1/2" - 12"  
Butt-Weld Fittings: 1/2" - 12"  
Flanges: 1/2" - 12"

### Specifications:

ASTM B221, B361, B247

### Description:

Aluminum has been proven to be the economical choice for a wide variety of applications. Its cost-effectiveness and lightweight characteristics make it a popular grade material in petroleum and petrochemical industries. The ability of aluminum to conduct heat rapidly makes it an ideal material for heat transfer processes, cryogenic applications and similar uses. Its resistance to corrosion often results in longer service life and reduced maintenance.

### Typical Applications:

- General fluid transmission and process piping
- Portable and temporary piping
- Hydraulic pressure lines
- Heat transfer and cryogenic processes
- Structural, ornamental and architectural uses

### Tensile Requirements:

Tensile Strength	Yield Strength
38,000 PSI	35,000 PSI

### Chemical Composition %

Al	Cr	Cu	Fe	Mg	Si	Zn
			MAX		MAX	MAX
Remainder	0.04 - 0.35	0.15 - 0.40	0.7	0.8 - 1.2	0.40 - 0.8	0.25

## P11

(P11, WP11, F11)  
(1 - 1/4% Cr • 1/2% Mo)

### Availability:

Seamless Pipe: 1/2" - 24"  
Butt-Weld Fittings: 1/2" - 24" Cl. 1  
Flanges: 1/2" - 24"  
Pressure Fittings: 1/8" - 4"

### Specifications:

ASTM/ASME A335, A182, A234

### Description:

"Low alloy" refers to steel with an alloy composition of 1 to 1 1/2% chromium and molybdenum. The small amount of chromium and molybdenum differentiates the alloy from carbon steel. Alloy elements strengthen the product for use in temperatures and pressures that would cripple carbon steel. Typical temperatures applications range from -20° to 1050° F.

### Typical Applications:

- Extraction steam lines
- Crude distillation units

### Tensile Requirements:

Tensile Strength	Yield Strength
(KSI) = 60	(KSI) = 30

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Mn	P	S	Si	Cr	Mo
		MAX	MAX			
.05 - .15	.30 - .60	0.030	0.030	.50 - 1.00	1.00 - 1.50	.44 - .60

## P22

(P22, WP22, F22)  
(2 - 1/4% Cr • 1% Mo)

### Availability:

Seamless Pipe: 1/2" - 24"  
Butt-Weld Fittings: 1/2" - 24"  
Flanges: 1/2" - 24"  
Pressure Fittings: 1/8" - 4"

### Specifications:

ASTM/ASME A335, A182, A234

### Description:

Used primarily for their stress/rupture properties, P22 can be held at high temperatures with high pressure and can also have a strong resistance to rupturing. In addition, 2 1/4% chrome can be used for elevated temperatures, creep and corrosion resistance process and service. Typical temperatures applications range from -20° to 1100° F.

### Typical Applications:

- Main steam and hot reheat systems
- Process heater tubing

### Tensile Requirements:

Tensile Strength	Yield Strength
(KSI) = 60	(KSI) = 30

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Mn	P	S	Si	Cr	Mo
		MAX	MAX			
.05 - .15	.30 - .60	0.040	0.040	0.50	1.90 - 2.60	.87 - 1.13



## P5

(P5, WP5, F5)  
(5% Cr • 1/2% Mo)

### Availability:

Seamless Pipe: 1/2" - 24"  
Butt-Weld Fittings: 1/2" - 24"  
Flanges: 1/2" - 24"  
Pressure Fittings: 1/8" - 4"

### Specifications:

ASTM/ASME A335, A182, A2344

### Description:

P5 is a chromium alloy used for its strong resistance to hot sulfide corrosion cracking. 5% chromium material has a higher minimum mechanical properties than 1 1/4% and 2 1/4% chromium, which makes the material ideal for high temperature and pressure applications. In addition, 5% chromium can be used for elevated temperatures and corrosion resistant process and service. Typical temperatures applications range from -20° to 1200° F.

### Typical Applications:

- Petrochemical and refinery installations
- Delayed cokers
- Hydrocrackers
- Cat reformer
- Heater drain systems

### Tensile Requirements:

Tensile Strength (KSI) = 60      Yield Strength (KSI) = 30

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Mn	P	S	Si	Cr	Mo
MAX		MAX		MAX		
0.15	.30 - .60	0.030	0.030	0.50	4.00 - 6.00	.44 - .60

## P9

(P9, WP9, F9)  
(9% Cr • 1% Mo)

### Availability:

Seamless Pipe: 1/2" - 24"  
Butt-Weld Fittings: 1/2" - 24"  
Flanges: 1/2" - 24"  
Pressure Fittings: 1/8" - 4"

### Specifications:

ASTM/ASME A335, A182, A234

### Description:

Used primarily for Nace applications where sour environments under high temperature and pressure are expected. Chromium of 9% gives corrosion resistance similar to 400 series stainless steel, but provides higher tensile properties at hotter temperatures than 405 or 410 stainless. In addition, 9% chromium can be used for elevated temperatures and corrosion resistant process. Typical temperatures applications range from -20° to 1200° F.

### Typical Applications:

- Fluid cat crackers
- Crude distillation units

### Tensile Requirements:

Tensile Strength (KSI) = 60      Yield Strength (KSI) = 30

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Mn	P	S	Si	Cr	Mo
MAX		MAX	MAX			
0.15	.30 - .60	0.030	0.030	.25 - 1.00	8.00 - 10.00	.90 - 1.10

## P91

### Availability:

Seamless Pipe: 1/2" - 24"  
Butt-Weld Fittings: 1/2" - 24"  
Flanges: 1/2" - 24"  
Pressure Fittings: 1/8" - 4"

### Specifications:

ASTM/ASME A335, A182, A234

### Description:

P91 is basic P9 modified by the addition of small amounts of vanadium and columbium/niobium, which greatly improves the creep strength and allows operation at higher pressure and temperature. P91 gives more flexibility and cost savings than P22 by reducing the wall thickness thanks to the improved creep properties and resistance against high-pressure hydrogen. P91 is preferred over P22 and P5 in sulfur-rich atmosphere furnaces

### Typical Applications:

- Boilers, superheaters up to 1050° F steam temperature
- Distillation and cracking units
- Petrochemical and refinery installations

### Tensile Requirements:

Tensile Strength (KSI) = 85      Yield Strength (KSI) = 60

KSI can be converted to MPA (Megapascals) by multiplying by 6.895.

### Chemical Composition %

C	Mn	P	S	Si	Cr	Mo	V	Cb(Nb)	N	Al	Ni
		MAX	MAX							MAX	MAX
.08 - .12	.30 - .60	.02	.01	.20 - .50	8.00 - 9.50	.85 - 1.05	.18 - .25	.06 - .10	.03 - .07	.040	.40