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"Materials that Create Solutions"

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PRODUCT PORTFOLIO

PIPES | PIPE FITTINGS | FLANGES

Pioneering Fluid Control

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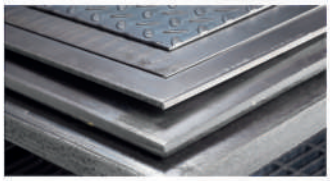
PIPES & TUBES

Stainless Steel: ASTM A312 TP 304 / 304L/304H/316/316L/317/317L/ 321/310/347/904L etc.
Carbon Steel: ASTM A53 GR. B/A 106 GR. B/API 5L GRADE B/A PI5L GR. X42 /46/56/60/65/70 A333 GR. 3/GR. 6 etc.
Alloy Steel: ASTM A335 GR. P1/P5/P9 /P11/P22/P91 etc.
Others: Monel, Nickel, Inconel, Hastalloy, Copper, Brass, Bronze, Titanium, Tantalum, Bismuth, Aluminium, High Speed Steel, Zinc, Lead, etc.
Types: Round, Square, Rectangular.
Size: Upto 24" NB. (Seamless & Welded)
Wall Thickness: Schedule 5S to Schedule XXS

SHEETS, PLATES, RODS

Materials: Stainless Steel, Nickel Alloys, Carbon Steel, Alloys Steel, Other Ferrous & Non-Ferrous Metals.

Types: Sheets, Plates, Strips, Round Bars, Wires, Channel, etc.



FLANGES

Stainless Steel: ASTM A182 F304 /304L/304H/316/316L/317/317L/ 321/310/347/904L, etc.
Carbon Steel: ASTM A105/A694 F42/ 46/52/56/60/65/70/A350 LF3/A350 LF2, etc.
Alloys Steel: ASTM A182 F1/F5/F9/ F11/F22/F91 etc.
Others: Monel, Nickel, Inconel, Hastalloy, Copper, Brass, Bronze, Titanium, Tantalum, Bismuth, Aluminium, High Speed Steel, Zinc, Lead, etc.
Types: Weldneck, Slipon, Blind, Socket Weld, Lap Joint, Spectacles, Ring Joint, Oriface, Long Weldneck, Deck Flange, etc.
Size: 1/2" NB to 24" NB.
Class: 150#, 300#, 400#, 900#, 1500# & 2500#.

FASTNERS

Stainless Steel: AISI 302, 304, 304L, 316, 316L, 310, 317, 317L, 321, 347, 410, 420, 904L etc.

Carbon Steel: Bare Condition, Galvanized, Phosphetised, Cadmium Plated, Hot Deep Galvanized, Blooded, Nickel Chrome Plated, etc.

Alloy Steel: 4.6, 5.6, 6.6, 8.8, 10.9 & 12.9 /'R', 'S', 'T' Conditions.

Non Ferrous Metal: Copper, Brass, Aluminium, Titanium, Nichrome, Al Bronze, Phosphorous Bronze, etc.

Types: Bolts, Nuts, Washers, Anchor Fasteners, Stud Bolts, Eye Bolt, Stud, Threaded Rod, Cotter Pin, Socket Screw, Fine Fasteners & Spares, Foundation Fasteners, etc.

BUTTWELD

Stainless Steel: ASTM A403 WP 304 / 304L/304H/316/316L/317/317L/ 321/310/347/904L etc.
Carbon Steel : ASTM A234 WPB/A420 WPL3/A420 WPL6/MSS-SP-75 WPHY 42/46/52/56/60/65/70
Alloy Steel: ASTM A234 WP1/WP5/ WP9/WP11/WP22/WP91 etc.
Others: Monel, Nickel, Inconel, Hastalloy, Copper, Brass, Bronze, Titanium, Tantalum, Bismuth, Aluminium, High Speed Steel, Zinc, Lead, etc.
Types: Elbow, Tee, Reducer, Return Bends, Stub-Ends, Cap, Collar, Cross, Insert etc.
Size: 1/4" NB to 32" NB. (Seamless & Welded)
Wall Thickness: Schedule 5S to Schedule XXS

FORGED FITTINGS

Stainless Steel: ASTM A182 F304/304L/ 304H/316/316L/317/317L/321/310/ 347/904L etc.
Carbon Steel: ASTM A105/A694 F42/46/ 52/56/60/65/70/A350 LF3/A350 LF2.
Alloy Steel: ASTM A182 F1/F5/F9/F11/ F22/F91 etc.
Others: Monel Nickel, Inconel, Hastalloy, Copper, Brass, Bronze, Titanium, Tantalum, Bismuth, Aluminium, High Speed Steel, Zinc, Lead, etc.
Types: Elbow, Tee, Union, Cross, Coupling, Cap, Bushing, Plug, Swage Nipple, Welding Boss, Hexagon Nipple, Barrel Nipple, Welding Nipple, Parraler Nipple, Street Elbow, Hexagon Nut, Hose Nipple, Bends Adapter, Insert, Weldolet, Elbowlet, Sockolet, Thredolet, Nipolet, Letrolet, etc.
Size: 1/4" NB to 4" NB. (Socketweld & Threaded)
Class: 150#, 3000#, 6000#, 9000#.

TUBES FITTINGS

Material Grade: Stainless Steel, Niekel Alloys, Carbon Steel, Alloy Steel, Monel, Nickel, Inconel, Hastalloy, Copper, Brass, Bronze, Titanium, Bismuth, Tantalum, Aluminium, High Speed Steel, Zinc, Lead etc.
Type: Nipples, Adaptors, Crosses, Union Ball Joints, Reducing Bushing, Reducers, Pipe Caps, Coupling, Pipe Plug, Hollow Hex Plug, Elbow, Reducing Union, 90 Deg. Union Elbow, Reducing 90 Deg. Union Elbow, Extender Leg 90 Deg. Union Elbow.

45 Deg. Union Elbow, Union, Tee, Female Connector, Male Connector, Manifold Tee, Locator, Union, Extended Run Leg Union Tee, Reducing tee, Tribow, Atw Weld Ring, Tube, Socket Weld to Pipe Butt Weld, Tube Butt Weld to Tube Socket Weld, Port Connector etc.

VALVES

Stainless Steel: AISI 304, 304L, 316, 316L, 310, 317, 317L, 321, 347, 904L etc.
Carbon Steel: A105,A216 GR. WCB, Cadmium Plated, Nickel, Chrome Plated, etc.
Non-Ferrous Metal: Copper, Brass, Titanium, Phosphorous Bronze etc.
Type: Ball Valve, Gate Valve, Check Valve, Needle Valve, Mini Valve, Guage Rott Valve, Globe Valve, Manifolds (2 way, 3 way, 5 way)

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Respected Customer,

Subject: Registration of our firm in your approved list of vendors

Dear Madam/Sir,

VALVE TECH INDUSTRIES PVT. LTD. - Global metals distributor specializing in the import & exports of specialty stainless, nickel alloys and custom fabrication jobs.

- One-Stop Source for Metal Products
- Domestic and International

VALVE TECH INDUSTRIES PVT. LTD. is a metal supplier of industrial metal products including stainless steel, carbon steel, nickel, alloys, aluminium, copper, brass and bronze in all ASTM grades. Our well-established and trusted relationship with the mill depots guarantees an uninterrupted supply to you of virtually any kind of metal products.

Over the past years, we have developed the skills needed to service the international community.

We carry this moment to present ourselves as one of the leading and largest importer, manufacture, stockists & supplier of various items which are mention below. It is urged by us to place your timely enquires to us in these particular items.

ENQUIRIES ARE HEREBY REQUISTED IN

Metal product include:

- Nickel Alloy bars, Sheets, Plate, Pipe and Tubing
- Titanium bars, Sheets, Plate, Pipe and Tubing
- Stainless Steel, Copper, Aluminium and Carbon Stel tubing and Pipes
- Stainless Steel, Copper, Brass Aluminium and Carbon Steel Sheets and Plates
- Stainless Steel, Copper, Brass, Aluminium and Carbon Steel Structural and Bars
- Wire Products, Welding wire and electrode in all Stainless and Nickel Grades
- Nuts, Bolts and Valves in many Stainless, Copper, Brass and Nickel Grades

We also supply :

- Flanges and fittings in Nickel Alloys, Stainless, Titanium and carbon steel,
- Forgings in all grades of Nickel Alloys, Stainless and Carbon Steel,
- Copper Range - HEX BRAND Copper cable lugs, inline connector 1.5 SQR mm to 1000 SQR mm, Copper bus bar, rod, flexible braid etc.

Our Stainless Steel products are used in first stage and second stage processing for a wide variety of ASME products including pressure vessels, furnaces, heat exchangers, boilers and more.

Test Certificate of the materials from Govt. approved lab. Can be provided. Guarantee Certificate of the materials can also be obtained from us the third party inspection is also allowed.

Above Items, where you shall definitely receive our ECONOMICAL OFFER with FLEXIBLE TERMS, that will benefit your order conditions.

As we are willing to all your business condition. Please do not hesitate in responding back to us by placing your timely enquires in our favour.

For **VALVE TECH INDUSTRIES PVT. LTD.**

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FORMULA OF CALCULATING WEIGHT

1) Weight of S.S. Pipes

OD (MM) W.T. (MM) X W.T. (MM) X 0.00756 = kg (per ft)
OD (MM) W.T. (MM) X W.T. (MM) X 0.0248 = kg (per mtr)

2) Weight of S.S. Round

Dia (MM) X Dia (MM) X 0.0019 kg (per ft)

3) Weight of S.S. Hexagonal Rod

Dia (MM) X Dia (MM) X 0.002072 = kg (per ft)

4) Weight of S.S. Square Rod

Diameter X Diameter X .0025 Weight per ft.

5) Weight of Stainless Steel Sheets

Length x Width x Thickness X 0.000008 = kg (per Sheet)
(mm) (mm) (mm)

6) Weight of S.S. Circle

Diameter X Diameter X Thickness x 0.0000063 = Weight per pc.
(mm) (mm) (mm)

7) Weight of S.S. Flat in mm per ft.

Length x Width x Thick x 0.000008 = per Pcs.

8) Weight of Copper Pipe

OD (MM) W.T. (MM) x W.T. X 0.0078 kg (per ft.)

9) Making of Pipe from Sheet or Plate

OD Thick X 3.14 Width of Cutting Sheet of Plate

10) Pressure Conversion :

kg/mm2 X 1422.3 = Psi = kg/cm2 X 14.223

11) 1 Feet	=	0.3048 meter
1 Mtr.	=	3.2808 ft.
1 Inch.	=	25.4 mm
1 Pound	=	0.454 (45359243) kgs.

APPLICATIONS :

- IRON & STEEL PLANTS
- PETRO CHEMICAL PLANTS
- ACID & CHEMICAL INDUSTRIES
- MINES
- AUTOMOBILE INDUSTRIES
- HEAVY MACHINERIES
- DISTILLERIES
- CEMENT PLANTS
- ELECTRIC & ELECTRONIC INDUSTRIES
- SPACE CENTRES
- FERTILIZER INDUSTRIES
- FOOD INDUSTRIES
- OIL & GAS INDUSTRIES
- PAPER & PULP INDUSTRIES
- PHARMACEUTICALS
- POWER SECTORS
- REFINERIES
- SUGAR MILLS
- TEXTILE INDUSTRIES

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CORROSION RESISTANT STEEL THAT WE OFFER

AISI 302
An austentic stainless steel, which because of its ability to attain high strength and ductility through moderate of severe cold working, can be used for automobile trims, conveyor belts, transportation cars such as railway coaches, metal fixtures for construction purposes, roof drainage products storm door frames and tableware

AISI 304
It is the most widely used austentic stainless steel. Popularly known as 18/8 stainless steel, it has excellent corrosion resistance and forming characteristics. Used in chemical, petrochemical and fertiliser industries, and as equipment in dairy, food processing, pharmaceutical industries, in hospital, households as kitchen ware, cryogenic vessels and as heat exchanger in air conditioning refrigeration, for machinery in paper, pulp and textile beverage sectors

AISI 304L
An austentic stainless steel similar to AISI 304 with less carbon (0.03%)is used in place of AISI 304 for improved resistance to intergranular corrosion it is used for parts and structures which cannot be heat treated for stress relieving after welding

AISI 309/AISI 309S
These are ausrentics stainless steels which are strong and tough. Because of their higher nickel and chromium content, these are used for application requiring high scaling resistance and corrosion resistance. They find their use for air heater, annealing boxes, bak oven equipment, boiler baffle pates, carburising boxes, chemical processing equipment, dryers, exhaust manifolds, furnace parts, gas turbine parts, heat exchangers, jet engine parts, oil burner parts, oven equipment, petroleum refining equipment, etc

AISI 310/AISI 310S
These are austentic types with higher chromium and nickel content then 309/309S. Because of their relatively high creep strength and mechanical properties at higher temperatures these steel find their applications for higher temperatures and severe service conditions. Used for air heaters, annealing boxes, ovens, carburising boxes, fire box sheets, furnace linings, furnace stacks and dampers, gas turbines parts, heat exchangers, kiln linings, nozzl diaphragm assemblies for turbo jet engines, oil burner parts paper mill equipment, oil refinery equipment, recuperators and so on.

AISI 316
An austenitic stainless steel with 2.0 to 3.0% Mo. which improves corrosion resistance and imparts hot strength characteristics. Used for applications requiring resistance to pitting corrosion and in halogen atmospheres. Typical applications: architectural trims, marine exteriors, chemical processing equipment, food processing equipment, petroleum refining equipment, pharmaceutical equipment, photographic equipment, pulp and paper processing equipment, textile finishing equipment, etc.

AISI 316L
An austentic stainless steel, is Modification of type AISI 316 (contains a maximum of 0.03 percent carbon) with reduced tendency towards carbide precipitation without addition of a stabilising element. Recommended for parts which cannot be heat treated after welding.

AISI 317/AISI 317L
There are austentic stainless steels which are modifications of type AISI 316/AISI 316 L and offerincreased chromius, nickel and molybdenum ranges for improved corrosion resistance. The steels were developed to resist attack of sulphurous and compounds. They resist Fitting in phosphoric and aceticacids. Application include paper pulp handling equipment, process equipment for producing photographic chemicals, bleaching solutions and handling sulphurous acetic, formic, citric and tartaric acids. They have the best corrosion resistance to body acids and blood and are recommended for surgincal bone applications.

AISI 321
An austentic stainless steels similar to AISI 304 but stabilised with titanium to avoid inter-grannularcorrosion. Type AISI 321 resists scaling and vibration fatigue. It is used for aircraft exhaust stacks and manifolds, pressure vessels, large mufflers for stationery diesel engines, carburettors, expansion bellows, stack liners, fire walls, etc.

AISI 347
An austentic stainless steel similar to AISI 321 but stabilised by Columbium which does not appresiably reduce the overall corrosion resistance. Recommended in the range of 240° to 900° C for parts fabricated by welding and which cannot be subsequently annealed. Applications include airplane exhaust stacks, welded tanks for chemicals, heat resistors, jet engine parts, expansion bellows, etc.

AISI 409
It is the lowest alloyed straight Chromium ferritic stainless steel. It replaces carbon steels and low alloysteels where some amount of heat or corrosion resistance and higher strenght are required and where appearance is secondary. It is used for finds in heater tubes, transformer and capacitor cases, dry fertiliser spreaders, automotive exhaust systems including mufflers, resonators, silencers, pipes and emission control units, high pressure agricultural spray tanks, culverts, shipping containers and farms equipments.

AISI 410/410S
AISI 410 is the most commonly used 12% Chromium martensitic stainless steel. Excellent combination of toughness and strength can be developed through proper heat treatment. This steel has better corrosion resistance in the hardened condition. It is a good choice when good formability and high strength are required and the end use demands resistance to mildly corrosive environment. It is used for furnace parts and burners operating below 650° C micrometer parts, tray supports, caps and vaporisers in petroleum fractionating towers, lining for reaction chambers, coal screens, fishing tackles, keys, lamp brackets, rules and tapes, wall screens, steam turbine buckets, blades, buckets covers, pump parts, petrochemicals equipment and press plates. Type AISI 410 S is low carbon modification of AISI 410.

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STAINLESS STEEL - PLATE, SHEET AND STRIP

ALLOYING ELEMENTS IN STAINLESS STEEL

Stainless Steel is a steel to which alloying elements are added to enhance different mechanical, physical and corrosion resistant properties. Listed below is a summary of the effects of the most important alloying elements.

Carbon

In most stainless steel carbon (C) is kept to low levels, typically, 0.08% C max, or to lower levels of 0.03% C max in the low carbon "L" grades and other stainless steels which are utilised mainly for the manufacture of welded fabricated components in thicker section. However, in the martensitic stainless steels C is the alloying elements specifically added, in amounts varying from 0.15% - 1.2% C, in order to render these steels heat treatable by quenching and tempering to develop high strength and hardness levels.

Chromium

Chromium (Cr.) is the alloying element which renders stainless steel "stainless". A minimum of±11% Cr. is needed, at which level a continuous, stable and inert (passive) chromium oxide film forms on the surface. This is stainless steel's natural built-in resistance to corrosion, both wet (aqueous) and dry (gaseous). Higher levels of Cr. (up to ± 26% Cr. max) increase the corrosion resistance.

Nickel

Nickel (Ni), if added to stainless steel in sufficient quantity, develops a fully austenitic crystal structure, hence austenitic crystal structure, hence austenitic stainless steels as typified by grade 304 (18% Cr. 8% Ni). They are the most utilised stainless steels. Lower levels of Ni, insufficient to develop a fully austenitic crystal structure result in a duplex (mixed) crystal structure of ferritic and austenitic of the duplex stainless steels.

Molybdenum

Molybdenum (Mo) enhances the properties (passivity) of the passive film, and thereby renders those stainless steels which contain it more corrosion resistant. More the content of Mo more aggressive the corrosive conditions that can be handled.

Titanium

(Ti) is a stabilising alloying element, ie it is a strong carbide, thus preventing the formation of cr carbides. Thus intergranular corrosion, which occurs in the region adjacent to the weld in a welded component, is prevented.

Manganese

Manganese (Mn) is similar to Ni in that it has the ability to promote the formation of an austenitic crystal structure. In the 200 series austenitic stainless steels Mn. is used to partially replace Ni. Mn is also increased to slightly higher levels than normal in the free machining grades of stainless steel to which Sulphur (S) or Selenium (Se) have been added.

Sulphur

Sulphur (S) is normally kept to very low levels typically 0.03% S max. If increased to ± 0.2% S the machinability of the steel is improved, but the fabricational properties, mechanical properties and corrosion resistance is impaired.

Selenium

Selenium (Se) has effects similar to Sulphur in improving the machinability, specifically the surface finish which can be obtained on machined components.

Niobium & Tantalum

Niobium (Nb) and Tantalum (Ta) are stabilising elements with effects similar to Ti. They are used together for stabilised grades which are seldom used, the Ti stablised grades being preferred. However, for the wire used for the manufacture of stabilised welding consumable (both electrodes and filler wire), Nb is the stabilising element used as Ti tends to be lost in transfer across the arc.

Nitrogen

Nitrogen (N) is alloying element which promotes the formation of an austenitic crystal structure, and is used to complement Ni in the "N" grades of austenitic stainless steel. The yield strength of such grades at sub-zero temperature is vastly improved. Also used in the so called "second generation" duplex stainless steels to increase the austenitic fraction of the crystal structure, thereby improving the weldability.

Silicon

Silicon (Si) is added to improve the scaling resistance of austenitic heat resistant stainless steels. In castings higher Si content increases the fluidity of the molten metal thereby improving the "castability".

APPLICABLE TECHNICAL SPECIFICATIONS

ASTM A240

Standard specification for Heat-Resisting Chromium and chromium, - Nickel Stainless Steel plate, Sheet and Strip for Pressure Vessels. This specification covers chromium, chromium - nickel and chromium - manganese nickel stainless and heat resisting steel plate, sheet and strip for pressure vessels.

ASTM A480 M

Standard Specification for General Requirements for Flat Rolled Stainless and Heat Resisting Steel, Plate, Sheet and Strip This specification covers a group of general requirements which unless otherwise specified in the purchase order or in an individual specification, shall apply to rolled steel plate, sheet and strip, under each of the following specifications issued by ASTM: Spec. A167, A176, A177, A420 and A412.

Definitions:

Plate material 5mm and over in thickness and 250mm and over in width. Sheet material 5mm in thickness and 600mm and over in width. Strip-cold-rolled material under 5 mm in thickness and under 600mm in width.

ASTM A 167

Standard Specifications for Stainless and Heat Resisting Chromium - Nickel Steel Plate, Sheet and Strip. This specification covers stainless and Heat - Resisting Chromium - Nickel Steel Plate, Sheet and Strip. Material furnished under this specification shall conform to the applicable requirements of the current edition of ASTM Spec. A480.

ASTM 176

Standard specification for stainless and heat-resisting Chromium-Nickel Steel Plate, Sheet and Strip. This specification covers stainleess and heat resisting chromium, steel plate, sheet and strip available in a wide variety of surface finishes (See section to follow giving description of surface finishes) Materials furnished under this specification shall conform to the applicable requirements of the current edition of ASTM spec A480.

ASTM A666-91

Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar. This specification covers a austenitic stainless steels in the annealed and normally required cold worked conditions for various structural, architectural, pressure vessel, magnetic, cryogenic and heat resisting applications. (This revision of Specification A666 replaces prior Specification A412 and A177.) In addition to the requirements of this specification, all requirements of the current edition of Spec. A480 shall apply.

BS 1449: Part 2

Specification for Stainless and Heat Resisting Steel Plate, Sheet and Strip. Includes flat rolled stainless and heat-resisting steel products in coil and cut length form, including plate 3 mm - 10mm thick, wide strip sheet from 0.3mm to less than 3mm thick and narrow strip from 0.5 to less than 3mm.

DIN 17440/17441: Stainless steels Quality Specifications.

This standard comprises the common stainless steels, which have a wide field of application as hot or cold formed products. It applies to hot (17440) or cold (17441) formed plates, bars, wires, seamless and welded tubes and to forgings.

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Typical Mechanical Properties of Stainless Steel Pipe/Tube

Grade	Tensile Strength. min. Ksi (Mpa)	Yield Point min. Ksi (Mpa)	Mechanical Properties, min				Hardness Test. Max	
			Elongation, (G.L.: 2 in or 50 mm)					
			Full Section Specimen	Strip Specimen		Round Specimen	Brinell	Rockwell
				t>6/16 in	t>5/16 in			
TP 304	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TP 304 H	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TP 304 L	70(485)	25(170)	35	35	56t+17.50	28	192	B90
TP 304 N	80(550)	35(240)	35	35	56t+17.50	28	192	B90
TP 304 LN	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TP 309	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TP 310	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TP 316	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TP 316 H	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TP 316 L	70(485)	25(170)	35	35	56t+17.50	28	192	B90
TP 316 N	80(550)	35(240)	35	35	56t+17.50	28	192	B90
TP 306 LN	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TP 317	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TP 321	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TP 321 H	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TF 347	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TP 347 H	75(515)	30(205)	35	35	56t+17.50	28	192	B90
TP 405	60(414)	30(207)	20	20	*2	28	207	B95
TP 410	60(414)	30(207)	20	20	*2	-	207	B95
TP 429	60(414)	35(241)	20	20	*2	-	190	B90
TP 430	60(414)	35(241)	20	20	*2	-	190	B90
TP 443	70(483)	40(276)	18	18	*2	-	207	B95
TP 446	70(483)	40(276)	20	20	*2	-	207	B95
TP 329	90(621)	70(483)	20	20	*2	-	271	C28
TP 409	60(414)	30(207)	20	20	*2	-	207	B95
TP XM-8	60(414)	30(207)	20	20	*2	-	190	B90
TP 316 TI	75(515)	30(205)	35	35	56t+17.50	28	192	B90

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CHEMICAL COMPOSITION OF STAINLESS STEEL / MECHANICAL PROPERTIES

Grade Design-ation	C%	MN%	SI%	S%	P%	CR%	NI%	MO%	TI%	UTS	YS	%EL	R.A.%
AISI	MAX	MAX	MAX	MAX	MAX					Kg/ mm² min	(0.2% Offset) Kg/mm² min	Min	
302	0.15	2.00	0.75	0.030	0.045	17.00	8.00			53	21	40	50
						19.00	10.00						
304	0.08	2.00	0.75	0.030	0.045	18.00	8.00			53	21	40	50
						20.00	12.00						
304L	0.03	2.00	0.75	0.030	0.045	18.00	8.00			53	21	40	50
						20.00	12.00						
309	0.20	2.00	0.75	0.030	0.045	22.00	12.00			53	21	40	50
						24.00	15.00						
309S	0.08	2.00	0.75	0.030	0.045	22.00	12.00			53	21	40	50
						24.00	15.00						
310	0.25	2.00	0.75	0.030	0.045	24.00	19.00			53	21	40	50
						26.00	22.00						
310S	0.08	2.00	0.75	0.030	0.045	24.00	19.00			53	21	40	50
						26.00	22.00						
316	0.08	2.00	0.75	0.030	0.045	16.00	10.00	2.00		53	21	40	50
						18.00	14.00	3.00					
316L	0.03	2.00	0.75	0.030	0.045	16.00	10.00	2.00		53	21	40	50
						18.00	14.00	3.00					
316Ti	0.08	2.00	0.75	0.030	0.045	16.00	10.00	2.00	5xC				
						18.00	14.00	3.00	min				
317	0.08	2.00	0.75	0.030	0.045	16.00	10.00	3.00					
						18.00	14.00	4.00					
321	0.08	2.00	0.75	0.030	0.045	17.00	9.00		5xC	53	21	40	50
						19.00	12.00		min				
347	0.08	2.00	0.75	0.030	0.045	17.00	9.00	NS+	To				
						19.00	13.00	10xC	min				
410	0.15	1.00	0.75	0.030	0.040	11.50				49	28	20	50
						13.50							
420	0.15	1.00	0.75	0.030	0.040	12.00				49	28	20	45
						14.00							
430	0.12	1.00	0.75	0.030	0.040	16.00				49	28	20	45
						18.00							
431	0.20	1.00	0.75	0.030	0.040	15.00				49	28	20	45
						17.00							

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CHEMICAL COMPOSITION OF STAINLESS STEEL / MECHANICAL PROPERTIES

NOM. BORE	OUTSIDE DIAMETER		SCHEDULE 5		SCHEDULE 10		SCHEDULE 40		SCHEDULE 80		SCHEDULE 160	
MM	INCH	M/M	WALL THICKNESS	WEIGHT (Kg/m)	WALL THICKNESS	WEIGHT (Kg/m)	WALL THICKNESS	WEIGHT (Kg/m)	WALL THICKNESS	WEIGHT (Kg/m)	WALL THICKNESS	WEIGHT (Kg/m)
3	1/8"	10.3	-	-	1.24	0.278	1.73	0.365	2.41	0.469	-	-
6	1/4"	13.7	-	-	1.65	0.491	2.24	0.633	3.02	0.497	-	-
10	3/8"	17.2	-	-	1.62	0.631	2.31	0.845	3.20	1.10	-	-
15	1/2"	21.3	1.65	0.801	2.11	0.999	2.77	1.27	3.75	1.62	4.75	1.94
20	3/4"	26.7	1.65	1.02	2.11	1.28	2.87	1.68	3.91	2.20	5.54	2.89
25	1"	33.4	1.65	1.29	2.77	2.09	3.38	2.50	4.55	3.24	6.35	4.24
32	1 1/4"	42.2	1.65	1.65	2.77	2.69	3.56	3.38	4.85	4.46	6.35	5.61
40	1 1/2"	48.30	1.65	1.90	2.77	3.11	3.68	4.05	5.08	5.41	7.14	7.25
50	2"	60.3	1.65	3.34	2.77	3.92	3.91	5.44	5.54	7.48	9.41	11.1
65	2 1/2"	73.0	2.11	3.69	3.05	5.26	5.16	8.63	7.01	11.4	9.53	14.9
80	3"	88.9	2.11	4.51	3.05	6.45	5.49	11.3	7.62	15.3	11.1	21.3
90	3 1/2"	101.6	2.11	5.18	3.05	7.41	5.74	13.6	8.08	18.6	-	-
100	4"	114.3	2.11	5.94	3.05	8.38	6.02	16.1	8.56	22.3	13.8	33.6
125	5"	141.3	2.77	9.34	3.40	11.6	6.55	21.8	9.53	31.0	-	49.2
150	6"	168.3	2.77	11.3	3.40	13.8	7.11	29.1	11.0	42.7	18.2	67.8
200	8"	219.1	2.77	14.8	3.76	20.0	8.18	42.8	12.7	64.6	23.0	111.2
250	10"	273.05	3.40	23.0	4.19	28.3	9.27	61.40	-	-	-	-
300	12"	323.85	3.96	31.80	4.57	36.60	9.52	71.10	-	-	-	-
350	14"	355.60	3.96	34.90	4.73	42.10	9.52	82.42	-	-	-	-
400	16"	406.44	4.19	42.30	4.78	48.20	9.52	94.52	-	-	-	-
450	18"	457.20	4.19	47.60	4.78	54.30	9.52	106.61	-	-	-	-
500	20"	508.00	4.78	60.40	5.54	69.90	9.52	118.71	-	-	-	-
550	22"	558.80	4.78	66.15	5.54	76.58	9.52	130.80	-	-	-	-
600	24"	609.60	5.54	83.63	6.35	95.77	9.52	142.91	-	-	-	-

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PERMISSIBLE RAW MATERIAL ACCORDANCE WITH ASTM A403

Grade	Type of Material	Permissible Raw Materials			
		Pipe	Plate	Bar	Forging
304.	304 (18-8)	A 312, grade TP 304	A 240, type 304	A 479, type 304	A 182, type F 304
304H.	304H (18-8), carbon 0.04 TO 0.10 percent	A 312, grade TP 304H	A 240, type 304H	A 479, type 304H	A 182, type F 304 H
304L.	304 L (18-8), carbon 0.035 percent., max	A 312, grade TP 304L	A 240, type 304L	A 479, type 304L	A 182, type F 304L
309.		A 312, grade TP 309	A 240, type 309S	A 479, type 309S	
310.	310 (25-20)	A 312, grade TP 310	A 240, type 310S	A 479, type 310S	A 182, type F 310
347.	347 (18-8, Cb Plus Ta)	A 312, grade TP 347	A 240, type 347	A 479, type 347	A 182, type F 347
316..	316 (18-8, Mo)	A 312, grade TP 316	A 240, type 316	A 479, type 316	A 182, type F 316
316H..	316 H (18-8 Mo), carbon 0.04 to 0.10 percent	A 312, grade TP 316H	A 240, type 316H	A 479, type 316	A 182, type F 316H
316L.....	316L (18-8 Mo), carbon 0.035 percent., max	A 312, grade TP 316L	A 240, type 316L	A 479, type 316L	
317.	317(18-8, Mo)	A 312, grade TP 317	A 240, type 317	A 479, type 317	
321.	321 (18-8, Ti)	A 312, grade TP 321	A 240, type 321	A 479, type 321	A 182, type F 321
321H.	321H (18-8<Ti) carbon 0.04 to 0.10 percent	A 312, grade TP 321	A 240, type 321 H	A 479, type 321	A 182, type F 321H
348.	348(18-8, Cb)	A 312, grade TP 348	A 240, type 348	A 479, type 348	A 182, type F 348
347H.	347H (18-8, Cb+Ta) carbon 0.04 to 0.10 percent	A 312, grade TP 347H	A 240, type 347	A 479, type 347	A 182, type F 347H

SCHEDULES - WALL THICKNESS (ANSIB 36.19.1970)

INCHES														METRIC												
N.B.	10	20	30	40	60	80	100	120	140	160	STD	XS	XXS	N.B.	10	20	30	40	60	80	100	120	140	160	STD	XS	XXS
1/2				.109		.147				.188	.109	.147	.294	15				2.77		3.73				4.78	2.77	3.73	7.47
3/4				.113		.154				.219	.113	.154	.308	20				2.87		3.91				5.56	2.87	3.91	7.82
1				.133		.179				.250	.133	.179	.358	25				3.38		4.55				6.35	3.38	4.55	9.09
11/4				.140		.191				.250	.140	.191	.382	32				3.56		4.85				6.35	3.38	4.85	9.70
11/2				.145		.200				.281	.145	.200	.400	40				3.68		5.08				7.14	3.68	5.08	10.16
2				.154		.218				.343	.154	.218	.436	50				3.91		5.54				8.71	3.91	5.54	11.07
21/2				.203		.276				.375	.230	.276	.552	65				5.16		7.01				9.53	5.61	7.01	14.02
3				.216		.300				.438	.216	.300	.600	80				5.49		7.62				11.13	5.49	7.62	15.24
31/2				.226		.318					226	.318		90				5.74		8.08					5.74	8.08	16.15
4				.237		.337		.438		.531	.237	.337	.674	100				6.02		8.56		11.13		13.49	6.02	8.56	17.12
5				.258		.375		.500		.625	.258	.375	.750	125				6.55		9.53		12.70		15.88	6.55	9.53	10.05
6				.280		.432		.562		.718	.280	.432	.864	150				7.11		10.97		14.27		18.24	7.21	10.97	21.95
8		.250	.277	.322	.406	.500	.593	.718	.812	.906	.322	.500	.875	200		6.35	7.04	8.18	10.31	12.70	15.06	18.24	20.62	23.01	8.18	12.70	22.23
10		.250	.307	.365	.500	.593	.718	.843	1.00	1.125	.365	.500	1.000	250		6.35	7.80	9.27	12.70	15.06	18.24	21.14	25.40	28.58	9.27	12.70	24.40
12		.250	.330	.406	.562	.687	.843	1.000	1.125	1.312	.375	.500	1.000	300		6.35	8.38	10.31	14.27	17.45	21.41	25.40	28.58	33.32	9.53	12.70	25.40
14	.250	.375	.375		.593	.750	.937	1.093	1.250	1.406	.375	.500		350	6.35	7.92	9.52		15.06	19.05	23.80	27.76	31.75	35.71	9.53	12.70	
16	.250	.375	.375	.500	.656	.843	1.031	1.218	1.438	1.593	.375	.500		400	6.35	7.92	9.52	12.70	16.66	21.41	26.19	30.94	36.53	40.46	9.53	12.70	
18	.250	.375	.438	.562	.750	.937	1.156	1.375	1.562	1.781	.375	.500		450	6.35	7.92	11.13	14.27	19.05	23.80	9.36	34.93	39.67	45.24	9.53	12.70	
20	.250	.375	.500	.593	.812	1.031	1.281	1.500	1.70	1.968	.375	.500		500	6.35	9.53	12.70	15.06	20.62	26.19	32.54	38.10	44.45	49.99	9.53	12.70	
22	.250	.375	.500		.875	1.125	1.375	1.625	1.875	2.125	.375	.500		550	6.35	9.52	12.70		22.23	28.58	34.93	41.28	47.63	53.98	9.53	12.70	
24	.250	.375	.687	.587	.968	1.218	1.531	1.812	2.062	2.343	.375	.500		600	6.35	9.52	14.27	17.45	24.59	30.94	38.89	46.02	52.37	59.51	9.53	12.70	

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CHEMICAL AND MECHANICAL PROPERITES OF CARBON STEEL AND ALLOY STEEL PIPES

Available Ex-stock with Test Certificate and IBR Test Certificates in from IIIA/IIIB
Available Ex-stock with LRS Certificate ASTM A 333/6 & ASTM 335 P-11

# Carbon steel seamless Pipes	ASTM A 106 Grade B	#Low Temperature seamless Pipes	ASTM A ### Grade 6
# Carbon steel seamless boiler tubes	BS/3059/68/Part/I CDS ST-33	# Low Temperature seamless Tubes	ASTM <A 334 Grade 1
Seamless boiler tubes	BS/3059/68/Part/HFS St-33	* Heat Exchanger Tubes	ASTM A 179
* ERW boiler tubes	ASTM 210 A -1/DIN 17175/ST 35-8	* API Line Pipes	API 5L Grade B
* CDW boiler tubes	BS/3059/68/Part/I ERW ST-33	*MSERW Pipes	IS 1239 Part I-1979
*Alloy steel seamless Pipes	BS/3059/68/Part/ CEW ST-33	*Hot Deep Galvanised Pipes	IS 1239 Part I-1979
*Alloy steel seamless Tubes	ASTM 335 P-1, P-5, P-11, P-22	Big diameter ERW Pipes	IS 3589
	ASTM 213 T-11, T-22 ASTM 209 T-1	* M/S. Square Rectangular Section	ISS 4923/ASTM-A 500
	DIN 17175 Grade 3 15 Mo3	*M.S. General Engineering Tubes	BSS/1775, IS 3074
			ISS 4711, ISS 3601

POPULAR STANDARDS AND SPECIFICATIONS

	CHEMICAL ANALYSIS											MECHANICAL PROPERTIES				
												TENSILE STRENGTH	IMPACT TEST	YIELD STRESS	ELONGATION %	HARDNESS
	SPECIFICATION	C%	Mn%	P%Max	S%Min	S%	Cr%	Cr% Max	Mo%	NI% Max	Va% Max	MP a	0.50F 40X10	MP a	50 mm Min Transverse	--
1	ASTMA53/A	0.25MAX	0.95MAX	0.050	0.060	--	--	--	--	--	--	331MIN	--	207MIN	36	--
2	ASTMA53/B	0.30MAX	12.QMAX	0.050	0.060	--	--	--	--	--	--	413MIN	--	240MIN	29.5	--
3	ASTMA106/A	0.25MAX	0.27-0.93	0.025	0.025	0.10MIN	0.40MAX	0.40	0.15MAX	0.40	0.80	330MIN	--	205MIN	25/20	--
4	ASTMA106/B	0.30MAX	0.29-1.06	0.025	0.025	0.10MIN	0.40MAX	0.40	0.15MAX	0.40	0.80	415MIN	--	240MIN	16.5/12	--
5	ASTMA106/C	0.35MAX	0.29-1.06	0.025	0.025	0.10MIN	0.40MAX	0.40	0.15MAX	0.40	0.80	485MIN	--	275MIN	16.5/12	--
6	ASTMA179	0.06-0.18	0.27-0.63	0.048	0.048	-	--	--	--	--	--	325MIN	--	180MIN	35.0	72HRBMAX
7	ASTMA192	0.06-0.18	0.27-0.63	0.048	0.048	0.25MAX	--	--	--	--	--	325MIN	--	180MIN	35.0	77HRBMAX
8	ASTMA209/T1	0.10-0.20	0.30-0.80	0.045	0.045	0.10-0.50	--	--	0.44-0.65	--	--	380MIN	--	205MIN	30/22	80HRBMAX
9	ASTMA209/T1a	0.15-0.25	0.30-0.80	0.045	0.045	0.10-0.50	--	--	0.44-0.65	--	--	365MIN	--	195MIN	30/22	81HRBMAX
10	10 ASTMA209/T1B	0.14MAX	0.30-0.80	0.045	0.045	0.10-0.50	--	--	0.44-0.65	--	--	415MIN	--	220MIN	30/22	77HRBMAX
11	ASTMA210A-1	0.27MAX	0.93MAX	0.048	0.048	0.10MIN	--	--	--	--	--	415MIN	--	225MIN	30/22	79HRBMAX
12	ASTMA210/C	0.35MAX	0.29-1.06	0.048	0.048	0.10MIN	--	--	--	--	--	485MIN	--	275MIN	30/22	89HRBMAX
13	ASTMA213/T2	0.10-0.20	0.30-0.61	0.045	0.045	0.10-0.30	C.50-0.81	--	0.44-0.65	--	--	415MIN	--	205MIN	30/22	85HRBMAX
14	ASTMA213/T5	0.15MAX	0.30-0.60	0.030	0.030	0.050MAX	4.00-6.00	--	0.45-0.65	--	--	415MIN	--	205MIN	30/22	85HRBMAX
15	ASTMA213/T11	0.15MAX	0.30-0.60	0.030	0.030	0.50-1.00	1.00-1.50	--	0.44-0.65	--	--	415MIN	--	205MIN	30/22	85HRBMAX
16	ASTMA213/T12	0.15MAX	0.30-0.16	0.045	0.045	0.50MAX	0.80-1.25	--	0.44-0.65	--	--	415MIN	--	205MIN	30/22	85HRBMAX
17	ASTMA213/T22	0.15MAX	0.30-0.60	0.030	0.030	0.50MAX	1.90-2.60	--	0.87-1.13	--	--	415MIN	--	205MIN	30/22	85HRBMAX
18	ASTMA333/1	0.30MAX	0.40-1.06	0.025	0.025		--	--	--	--	--	380MIN	J14	205MIN	25/20	--
19	ASTMA333/6	0.30MAX	0.29-1.06	0.025	0.025	0.10MIN	--	--	--	--	--	415MIN	J14	240MIN	16.5/12	--
20	ASTMA334/1	0.30MAX	0.40-1.06	0.025	0.025		--	--	--	--	--	380MIN	J14	205MIN	35/28	85HRBMAX
21	ASTMA334/6	0.30MAX	0.29-1.06	0.025	0.025	0.10MIN	--	--	--	--	--	415MIN	J14	240MIN	30/22	90HRBMAX
22	ASTMA335/P1	0.10-0.20	0.30-0.80	0.025	0.025	0.10-0.50	--	--	0.44-0.65	--	--	380MIN	--	205MIN	20	--
23	ASTMA335/P-2	0.10-0.20	0.30-0.61	0.025	0.025	0.10-0.30	0.50-0.81	--	0.44-0.65	--	--	380MIN	--	205MIN	20	--
24	ASTMA335/P5	0.15MAX	0.30-0.60	0.025	0.025	0.50MAX	4.00-0.60	--	0.45-0.65	--	--	415MIN	--	205MIN	20	--
25	ASTMA335/P11	0.15MAX	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	--	0.44-0.65	--	--	415MIN	--	205MIN	20	--
26	ASTMA335/P12	0.15MAX	0.30-0.61	0.025	0.025	0.50MAX	0.80-1.25	--	0.44-0.65	--	--	415MIN	--	205MIN	20	--
27	ASTMA335/P22	0.15MAX	0.30-0.61	0.025	0.025	0.30MAX	1.90-2.60	--	0.87-1.13	--	--	415MIN	--	205MIN	20	
28	BS/3059/1/33	0.15MAX	0.30-0.70	0.050	0.050	-	--	--	--	--	--	324-441	--	186MIN	25	--
29	BS/3059/2/33	0.15MAX	0.40-0.70	0.050	0.050	0.10-0.35	--	--	--	--	--	324-441	--	186MIN	21	--
30	BS/3059/2/45	0.12-0.18	0.90-1.20	0.040	0.035	0.10-0.35	--	--	--	--	--	441-560	--	245MIN	22	--
31	BS/3059/2/620	0.10-015	0.40-0.70	0.040	0.040	0.10-0.35	0.70-1.10	--	0.45-0.65	--	--	441-618	--	235MIN	22	--
32	DIN/17175/ST35/8	0.17MAX	0.40MIN	0.040	0.040	0.35MAX	--	--	--	--	--	340-441	--	235MIN	25	
33	DIN/17175/ST45/8	0.22MAX	0.45MIN	0.040	0.040	0.10-0.35	--	--	--	--	--	441-540	--	235MIN	25	--
34	DIN/17175/15M03	0.12-0.20	0.50-0.80	0.040	0.040	0.15-0.35	--	--	0.25-0.35	--	--	441-540	--	284MIN	21	--
35	DIN/1715/13	--	--	--	--	--	--	--	--	--	--		--			--
	CrM044	0.10-0.18	0.40-0.70	0.040	0.040	0.15-0.35	0.70-1.00	--	0.40-0.50	--	--	441-570	--	294min	22	--
36	SAE52100	0.98-1.10	0.20-0.45	0.25	0.25	0.10-0.35	1.30-1.60	--	0.10MIN	--	--	--	--	--	--	--

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Highlights of ASTM Specifications for Stainless Steel Tubes and Pipes

Specification	Allowable Outside Diameter Variations in mm			Allowable Wall Thickness Variations		Exact Length Tolerances in mm		Testing Product Analysis
ASTM A-270 Seamless & Welded Sanitary Tubing	Diameter 25.4 38.1 50.8 63.5 76.2 101.6	Over .05 .05 .05 .05 .08 .08	Under .20 .20 .28 .28 .30 .38	Over% +12.5 +12.5 +12.5 +12.5 +12.5 +12.5	Under % -12.5 -12.5 -12.5 -12.5 -12.5 -12.5	Over 3.2 3.2 3.2 3.2 3.2 3.2	Under 0 0 0 0 0 0	Reverse Flattening Test 100% Hydrostatic Test External Polish on all tubes Refer to ASTM A-270
ASTM A-249 Welded Boiler, Superheater, Heat Exchanger and Condenser Tubes	Under 25.4 24.4-38.1 incl. 38.1-50.8 excl. 50.8-63.5 excl. 63.5-76.2 excl. 76.2-101.6 incl.	0.1016 0.1524 0.2032 0.254 0.3048 0.381	0.1016 0.1524 0.2032 0.2540 0.3048 0.3810	+10 +10 +10 +10 +10 +10 Minimum Wall tubes +18% 0 available on request	-10 -10 -10 -10 -10 -10	3.175 3.175 3.176 4.76 4.76 4.76	0 0 0 0 0 0	Tension Test Flattening Test Flare Test/Flange Test *Reverse Bend Test Hardness Test 100% Hydrostatic Test *Reverse Flattening Test Refer to ASTM A-450 *Wherever applicable
ASTM A-312 Seamless & Welded Pipe	13.7-48.3 incl. 48.3-114.3 incl. 114.3-220. incl.	0.40 0.79 1.60	0.79 0.79 0.79	Minimum Wall 12.5% under nominal wall specified		6.4 6.4 6.4 (Normally Random lengths ordered)	0 0 0	Tension Test Flattening Test 100% Hydrostatic Test Refer to ASTM A-530
ASTM A-269 Scamles & Welded Service	Upto 12.7 12.7-38.1 38.1-88.9 excl. 88.9-139.7 excl. 139.7-203.2 excl.	0.13 0.13 0.25 0.38 0.76	0.13 0.13 0.25 0.38 0.76	+15 +10 +10 +10 +10	-15 -10 -10 -10 -10	3.2 3.2 4.8 4.8 4.8	0 0 0 0 0	Flare Test Flange Test (welded only) Hardness Test Reverse Flattening Test (Welded only) 100% Hydrostatic Test Refer to ASTM A-269
ASTM A-213 Seamless Boiler, Superheater and Heat Exchange Tubes	Under 25.4 25.4-38.1 incl. 38.1-50.8 excl. 50.8-63.5 excl. 63.5-76.2 excl. 76.2-101.6 incl.	0.1016 0.1524 0.2032 0.2540 0.3048 0.3810	0.1016 0.1524 0.2032 0.2540 0.3048 0.3810	+20 +20 +22 +22 +22 +22	-0 -0 -0 -0 -0 -0	3.175 3.175 3.176 3.76 4.76 4.76	0 0 0 0 0 0	Tension Test Flattening Test Flare Test Hardness Test 100% Hydrostatic Test Refer to ASTM A-450
ASTM A-268 Seamless & Welded Ferritic Stainless Steel tubes	Under 12.7 12.7-38.1 excl. 38.1-88.9 excl. 88.9-168.3 excl.	0.13 0.13 0.25 0.38	0.13 0.13 0.25 0.38	+15 +10 +10 +10	-15 -10 -10 -10	3.2 3.2 4.8 4.8	0 0 0 0	Tension Test, Flare Test Flange Test (ERW only) Hardness Test Reverse Flattening Test 100% hydrostatic test
ASTM A-358 for welded big Diameter Pipes	For all size	+0.5%	-0.5%	No LIMIT	-0.3 mm	Customer's Specification		Transvers tension test, Transverse guided bend test, Hydrostatic test, radiographic examination (as specified) dye penetrant (optional).
ASTM A-688 For welded Feed Water heater 'U' Tubes	Under 25.4 mm	.1016	.1016	+20 +10	-0(for Min wall thk) --10 (for Avg Wall thk)	3 to 13	0	Tension, Hardness, Corrosion, Reversebend, Flange, Flattening, Hydrostatic Test, Pneumatic Test, Non Destructive Test.

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STAINLESS STEEL

TYPICAL PHYSICAL PROPERTIES OF WROUGHT STAINLESS STEELS, ANNEALED CONDITION

Type	UNS designation	Density Mg/m³	lb/in.³	Elastic Modulus Gpa	10° psi	Mean Coefficient of thermal expansion um/m.C 0°C to 100	315	538	uin./in"F 100	315	538
						32°F to : 212	600	1000	212	600	1000
201	S20100	7.8	0.28	197	28.6	15.7	17.5	18.4	8.7	9.7	10.2
202	S20200	7.8	0.28			17.5	18.4	19.2	9.7	10.2	10.7
205	S20500	7.8	0.28	197	28.6		17.9	19.1		9.9	10.6
301	S30100	8.0	0.29	193	28.0	17.0	17.2	18.2	9.4	9.6	10.1
302	S30200	8.0	0.29	193	28.0	17.2	17.8	18.4	9.6	9.9	10.2
302B	S30215	8.0	0.29	193	28.0	16.2	18.0	19.4	9.0	10.0	10.8
303	S30300	8.0	0.29	193	28.0	17.2	17.8	18.4	9.6	9.9	10.2
304	S30400	8.0	0.29	193	28.0	17.2	17.8	18.4	9.6	9.9	10.2
304L	S30403	8.0	0.29								
S30430	S30430	8.0	0.29	193	28.0	17.2	17.8		9.6	9.9	
304N	S30451	8.0	0.29	196	28.5						
305	S30500	8.0	0.29	193	28.0	17.2	17.8	18.4	9.6	9.9	10.2
308	S30800	8.0	0.29	193	28.0	17.2	17.8	18.4	9.6	9.9	10.2
309	S30900	8.0	0.29	200	29.0	17.2	16.6	17.2	8.3	9.2	9.6
310	S31000	8.0	0.29	200	29.0	15.0	16.2	17.0	8.8	9.0	9.4
314	S31400	7.8	0.28	200	29.0		15.1			8.4	
316	S31600	8.0	0.29	193	28.0	15.9	16.2	17.5	8.8	9.0	9.7
316L	S31603	8.0	0.29								
316N	S31651	8.0	0.29	196	28.5						
317	S31700	8.0	0.29	193	28.0	15.9	16.2	17.5	8.8	9.0	9.7
317L	S31703	8.0	0.29	200	29.0	16.5		18.1	9.2		10.1
321	S32100	8.0	0.29	193	28.0	16.6	17.2	18.6	9.2	9.6	10.3
329	S32900	7.8	0.28								
330	No8330	8.0	0.29	196	28.5	14.4	16.0	16.7	8.0	8.9	9.3
347	S34700	8.0	0.29	193	28.0	16.6	17.2	18.6	9.2	9.6	10.3
384	S38400	8.0	0.29	193	28.0	17.2	17.8	18.4	9.6	9.9	10.2
405	S40500	7.8	0.28	200	29.0	10.8	11.6	12.1	6.0	6.4	6.7
409	S40900	7.8	0.28			11.7			6.5		
410	S41000	7.8	0.28	200	29.0	9.9	11.4	11.6	5.5	6.3	6.4
414	S41400	7.8	0.28	200	29.0	10.4	11.0	12.1	5.8	6.1	6.7
416	S41600	7.8	0.28	200	29.0	9.9	11.0	11.6	5.5	6.1	6.4
420	S42000	7.8	0.28	200	29.0	10.3	10.8	11.7	5.7	6.0	6.5
422	S42200	7.8	0.28			11.2	11.4	11.9	6.2	6.3	6.6
429	S42900	7.8	0.28	200	29.0	10.3			5.7		
430	S43000	7.8	0.28	200	29.0	10.4	11.0	11.4	5.8	6.1	6.3
430F	S43020	7.8	0.28	200	29.0	10.4	11.0	11.4	5.8	6.1	6.3
431	S43100	7.8	0.28	200	29.0	10.2	12.1		5.7	6.7	
434	S43400	7.8	0.28	200	29.0	10.4	11.0	11.4	5.8	6.1	6.3
436	S43600	7.8	0.28	200	29.0	9.3			5.2		
440A	S44002	7.8	0.28	200	29.0	10.2			5.7		
440C	S44004	7.8	0.28	200	29.0	10.2			5.7		
444	S44400	7.8	0.28	200	29.0	10.0	10.6	11.4	5.6	5.9	6.3
446	S44600	7.5	0.27	200	29.0	10.4	10.8	11.2	5.8	6.0	6.2
PH 13-8 Mo	S13800	7.8	0.28	203	29.4	10.6	11.2	11.9	5.9	6.2	6.6
15-5 PH	S15500	7.8	0.28	196	28.5	10.8	11.4		6.0	6.3	
17-4 PH	S17400	7.8	0.28	196	28.5	10.8	11.6		6.0	6.4	
17-7 PH	S17700	7.8	0.28	204	29.5	11.0	11.6		6.1	6.4	

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STAINLESS STEEL

MECHANICAL PROPERTIES OF WROUGHT STAINLESS STEEL

Type	UNS Designation	Condition	Tensile Strength Mpa	% Proof Strength Mpa	Elongation % in 50 mm	Hardness Brinell	ASTM Specification
201	S20100	Annealed	655	260	40	217	A666
202	S20200	Annealed	620	260	40	255	A666
205	S20500	Annealed	790	450	40	217	A666
301	S30100	Annealed	515	205	40	201	A167
302	S30200	Annealed	515	205	40	201	A167
302B	S30215	Annealed	515	205	40	217	A167
303	S30300	Annealed	585	240	50	–	A581
304	S30400	Annealed	518	205	40	201	A240
304L	S30403	Annealed	485	170	40	202	A240
304N	S30403	Annealed	550	240	30	201	A240
305	S30500	Annealed	515	205	40	183	A240
308	S30800	Annealed	515	205	40	183	A167
309	S30900	Annealed	515	205	40	217	A167
310	S31000	Annealed	515	205	40	217	A167
314	S31400	Annealed	515	205	40	–	A276
316	S31600	Annealed	515	205	40	217	A240
316L	S31603	Annealed	485	205	40	217	A240
316N	S31651	Annealed	550	240	35	217	A240
317	S31700	Annealed	515	205	35	217	A240
317L	S31703	Annealed	515	205	40	217	A240
321	S32100	Annealed	515	205	40	217	A240
329	S32900	Annealed	724	550	25	–	-
330	N08330	Annealed	480	210	30	75	B536
347	S34700	Annealed	515	205	40	201	A240
384	S38400	Annealed	415	–	–	–	A493
405	S40500	Annealed	415	170	20	179	A176
409	S40900	Annealed	380	205	22	179	A176
410	S41000	Annealed	450	205	22	217	A176
414	S41400	Annealed	1030*	–	–	–	A580
416	S41600	Annealed	585	–	–	–	A581
420	S42000	Annealed	860*	–	–	–	A580
422	S42200	Tempered	965	760	13	–	A565
429	S42900	Annealed	450	205	22	183	A176
430	S43000	Annealed	450	205	22	183	A176
430F	S43020	Annealed	585	–	–	–	A581
431	S43100	Annealed	965*	–	—	–	A580
434	S43400	Annealed	530	365	23	155	–
436	S43600	Annealed	530	365	23	155	–
440A	S44002	Annealed	725	415	20	205	A276
440C	S44004	Annealed	760	450	14	223	A276
444	S44400	Annealed	415	275	20	217	A176
446	S44600	Annealed	515	275	20	217	A176
PH13-8Mo	S13800	H1000	1380	1310	6	410	–
15-5PH	S15500	H1025	1070	1000	12	331	–
17-4PH	S17400	H1025	1070	1000	12	331	–
17-7OH	S17700	Th1050	1240	1030	3	366	–

All properties minimum specified as per code * Annealed and cold finished.

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STAINLESS STEEL

ANCILLARY PROPERTIES

Other ancillary properties of corrosion resistant steel, Stainless & Mild Steel

Over and above the usual mechanical properties of Tensile Stress, Proof Stress, Elongation, other ancillary properties of STAINLESS STEEL are often required. These are given in the table below:-

NOTE: These are typical properties, and do often vary depending on the reference: The values given below should therefore not be used as guaranteed or minimum values.

Property & Units		Mild Steel	304	310	316	321	430	3CR12
Density : kg/m^3		7870	7900	7900	8000	7900	7800	7700
Modulus of Elasticity	Tension	200	195	205	195	195	200	207
Gpa	Torsion	65	85	70	70	72	65	-
Specific Heat Capacity	J/Kg°C	455	503	503	503	503	460	460
Thermal Conductivity W/m°C	at 100°C	73	15.7	13.4	14.5	15.7	21	23
	at 300°C	70	17.4	15.2	16.4	-	23	-
	at 500°C	65	21.2	18.9	20.0	21.2	24	25
Mean Co-Efficient of Thermal Expansion µm/m°C	0°100°C	12.5	17.0	15.5	16.5	17.0	10.4	10.8
	0°300°C	13.0	17.75	16.5	17.5	17.8	11.0	11.3
	0°500°C	13.8	18.5	17.25	18.25	18.25	11.3	12.5
Resistivity µΩm		0.16	0.70	0.80	0.75	0.70	0.60	0.57
Recommended Maximum service Temperature (Oxidising Conditions)	Continuous	500°C	925°C	1150°C	925°C	950°C	750°C	600°C
	Intermittent	600°C	850°C	1035°C	870°C	850°C	850°C	700°C
Endurance Limit Mpa		-	241	217	269	262	276	-
Relative Magnetic Permeability		200/3800	1.02	1.02	1.02	1.02	600/1100	approx 200/1000
Melting Range °C		1500/1520	1500/1520	1500/1520	1500/1520	1500/1520	1500/1520	1430/1510

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STAINLESS STEEL - SPECIAL ALLOYS

SPECIAL AND HIGH NICKEL ALLOYS
TYPES OF SPECIAL AND HIGH NICKEL ALLOYS

Alloy	Typical Trade Name	Major Applications	Nominal Composition; % Main Elements				
			Ni+ (Co)	Fe	Cr	Mo	Other
Pure Nickel	Nickel 200 (201) ® VDM Nickel 99.2 ® VDM LC Nickel 99.2 ®	Manufacture of caustic soda; electronic components; food processing equipment (201) & LC for temperatures above 315°C.	99.3				C:0.1 max. C:0.02max.in 201 & LC
Nickel Copper	Monel alloy 400 ® Nicorros ®	Resistant to sea-water and steam at elevated temperatures and to salt and caustic solutions. Feedwater heaters, heat exchangers. Marine fixture valves and pumps.	63 min.	1.5			Cu:31.5
	Monel alloy K-500 ® Nicorros®	Precipitation hardening alloy. Pump shafts, propeller shafts, oil well drill collars. Valve trim and fasteners.	63 min.	1.0			Cu:31.5 Al:22.7
Corrosion Resistant Nickel Base-Alloys	Hastelloy ® alloy B-2 Nimofer ® 6928	Sulphuric, hydrochloric and phosphoric acids. Good resistance to stress corrosion cracking and pitting.	Bal.	2.0 max.	1.0 max.	28.0	C:0.01 max. Co:1.0 max.
	Alloy 59 Nicrofer ® 5923hMo	Outstanding resistance to a wide range of corrosive media under oxidising and reducing conditions. Excellent resistance to pitting and crevice corrosion as well as chloride induced stress corrosion cracking.	Bal.	1.5 max.	23.0	16.0	C:0.01 max.
	Hastelloy ® alloy C-276 Nicrofer ® 5716hMoW	Excellent resistance in both oxidising and reducing acids with high chloride contamination. Also in chlorine-contaminated hydrocarbons.	Bal.	5.5	15.5	16.0	C:0.01 max. W:4.0 Co:2.5 max.
	Hastelloy ® alloy C-4 Nicrofer ® 6616hMoW	Highly resistant to stress corrosion cracking, Bal. pitting and intergranular corrosion in as Welded condition. High temperature stability in the 650-1050°C range.	Bal.	3.0 max.	16.0	15.5	C:0.01 max. Co:2.0
	Inconel ® 625 Nicrofer ® 6020hMoW Haynes ® alloy G25	Chemical and pollution control equipment. Nuclear reactors. Scrubber equipment for coalfired boilers. Organic and mineral acids. Phosphoric acid industry.	Bal.	5.0 max.	21.5	9.0	Co:1.0 max. Cb+Ta:3.7 Ti:0.40 max.
	Hastelloy® alloy C-22	Outstanding resistance to localised corrosion, stress corrosion cracking and general corrosion in oxidising and reducing chemicals. Best alloy to use as a universal weld filler metal to resist corrosion of weldments.	Bal.	3.0	22.0	13.0	Co:1.0 max. W:3.0 max. Co:2.5 max. V:0.35 max.
	Hastelloy® alloy G-30	Has many advantages over other metallic andnon-metallic materials in handling phosphoric, sulphuric and nitric acids and in fluoride environments and oxidising acid mixtures.	Bal.	15.0	29.5	5.5	C:0.03 max. cu:2.0 W:2.5 max. Co:2.0 max. Cb:0.8

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STAINLESS STEEL - SPECIAL ALLOYS

SPECIAL AND HIGH NICKEL ALLOYS
TYPES/NOMINAL PROPERTIES AND SPECIFICATIONS

	Mechanical Properties at Room Temperature (Annealed Condition)			Physical Properties at Room Temperature				Specifications			
Alloy	Tensile Strength Mpa	Yield Strength Mpa 0.2% offset	Elong (%)	Density g/cm3	Thermal Conductivity at 20°C (W-mK)	Coef. of Exp. (10-6/K) 20-300°C	Modulus of Elasticity Gpa	ASTM (B) ASTE (SB)	UNS No.	BS	Werks off No.
Nickel	370 min.	100 min.	40 min.	8.9	74 (LC) 76	14.5	196	161 162 163	NO2200 NO221 (LC)	3072 3074 NAII (LC)	2.4066 2.4068 (LC)
400	485 min.	195 min.	35 min	8.8	21.5	13	188	127 163 165	NO4400	3072 3074 NA13	2.4360
K-500	880 min. (in soln. ann., P.H.)	590 min.	15	8.5	17.0	12.9	185		NO5500	3072 3074 NA18	2.4375
B-2	955	526	53	9.2	11.1	10.3 (20-400°C)	217	622 333 335 626 619 366	NI0665		2.4617
59	710 min.	350 min.	45 min.	8.8	9.4	12.5	205	622 575	NO6059		2.4605
C-276	792	356	61	839	10.0	12.3	200	626 622 575 360 574 564	NI0276		2.4819
C-4	801	421	54	8.6	10.1	12.6	211	626 622 575 366 574 619	NO6455		2.4610

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TYPICAL/NOMINAL PROPERTIES AND SPECIFICATIONS

	Mechanical Properties at Room Temperature (Annealed Condition)			Physical Properties at Room Temperature				Specifications			
Alloy	Tensile Strength Mpa	Yield Strength Mpa 0.2% offset	Elong (%)	Density g/cm3	Thermal Conductivity at 20°C (W-mK)	Coef. of Exp. (10-6/K) 20-300°C	Modulus of Elasticity Gpa	ASTM (B) ASTE (SB)	UNS No.	BS	Werks off No.
625	910	468	47	8.44	9.8	13.6	205	444 443 446	NO6625		2.4856
C-22	800	407	62	8.69	10.1	12.6	206	366 574 575 619 622 626	NO6022		2.4611
G-30	690	310	65	8.22	10.2	14.4	202	366 581 582 619 622 626	NO6030		2.4603
825	655	345	40	8.1	11.0	15.3	195	163 423 424 425	NO8825	3072 3074 3074 NA16	2.4858
20	590 min.	275 min.	30 min.	8.1	13.5	16.5	200	463 464 468	NO8020		2.4660
31	690	320	50	8.1	12	15.1	195	709 668	NO8031		1.4562
28	500 min.	210 min.	40 min.	8.1	14	15.2	185	668	NO8028		1.4563

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STAINLESS STEEL - SPECIAL ALLOYS

SPECIAL AND HIGH NICKEL ALLOYS
TYPICAL/NOMINAL PROPERTIES AND SPECIFICATIONS

Alloy	Typical Trade Name	Major Applications	Nominal Composition; % Main Elements				
			Ni+ (Co)	Fe	Cr	Mo	Other
Corrosion-Resistant Nickel Base-Alloys	Incoloy 825 Nicrofer®4221	Picking tank heaters and hooks, Resistant to stress corrosion cracking in sulphuric and phosphoric acids. Nuclear waste evaporators.	42.0	30.0	21.5	3.0	C:0.05 Co:2.0 max. Ti:1.0 AI:0.02 max.
	Alloy 200 Carpenter® 20Cb3 Nicrofer® 3620 Nb	Applications in sulphuric and phosphoric acids	36	Bal.	20.0	2.5	C:0.05 Co:4.0 max. Cb:min.8x%C max.1.0
	Alloy 31 Nicrofer® 3127hMo	Outstanding resistance to crevice, pitting and stress corrosion cracking. Excellent resistance to a variety of corrosive media including contaminated mineral and organic acids.	31	Bal.	27.0	6.5	Cu:1.2
	Sanicro® 28 Nicrofer® 3127LC	Outstanding resistance to crevice corrosion pitting corrosion and stress corrosion cracking. Applications in sulphuric and phosphoric acids particularly those contaminated by chlorides and fluorides.	31	Bal.	27.0	3/-4	C:0.02 max. Cu:0.8-1.5

CHEMICAL COMPOSITION OF WROUGHT ALUMINIUM & ALUMINIUM ALLOYS

Designation New Old	Aluminium	Copper	Mangnesium	Silicon	Iron	Manga _nese	Zinc	Tl and/or other grain Refining Elements	Chromi --um	Remarks
19000 E1C	99.0 min	0.1		0.5	0.6	0.1				Ti+V -0.007; Total impurities = 1.00
19500 E1B 19501 E1E	99.5 min	0.05		0.3	0.4	0.05				Ti+V=0.007; Total impurities = 0.50
52000 NE4	Remainder	0.1	1.7-2.6	0.6	0.5	0.5	0.2	0.2	0.25	Cr+Mn = 0.5
53000 NE4	Remainder	0.1	2.8-4.0	0.6	0.5	0.5	0.2	0.2	0.25	Cr+Mn = 0.5
63400 HE9	Remainder	0.1	0.4-0.9	0.3-0.7	0.6	0.3	0.2	0.2	0.1	
63401 E91E	Remainder	005	0.4-0.9	0.3-0.7	0.5	0.03	0.1	0.1	0.03	Others 0.03 each total 0.1
64430 HE30	Remainder	0.1	0.4-1.2	0.6-1.3	0.60	0.4-1.0	0.1	0.2	0.25	
65032 HE20	Remainder	0.15-0.4	0.7-1.2	0.4-0.8	0.7	0.2-0.8	0.2	0.2	0.15-0.35	Either Mn or Cr shall be Present
6061	Remainder	0.15-0.4	0.8-1.2	0.4-0.8	0.7	0.15	0.25	0.15	0.04-0.35	Others each 0.05 total 0.15
6005	Remainder	0.10	0.4-0.6	0.6-0.9	0.35	0.10	0.10	0.10	0.10	Others each 0.05 total 0.15
6060	Remainder	0.1	0.35-0.6	0.3-0.6	0.1-0.3	0.1	0.15	0.1	0.5	Others each 0.05 total 0.15
6066	Remainder	0.7-1.2	0.8-1.4	0.9-1.8	0.5	0.6-1.1	0.25	0.2	0.4	Others each 0.05 total 0.15
64423	Remainder	0.5-1.0	0.5-1.3	0.7-1.3	0.8	1.0				
6082	Remainder	0.10	0.6-1.2	0.7-1.3	0.50	0.40-1.0	0.20	0.10	0.25	

Note: 1. Titanium and / or other grain refining elements and / or Chromium may be present at the option of the supplier provided the total content does not exceed 0.3 percent.
2. Composition limits are in percent maximum unless shown otherwise.

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STAINLESS STEEL-FITTINGS

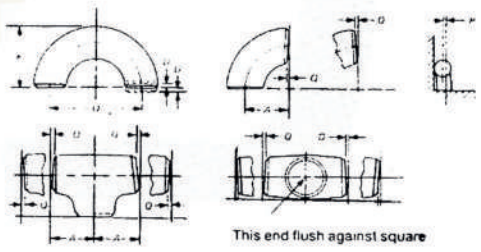
MATERIAL GRADES

Werkstoff Number	DIN	Chemical Composition					UNS	AISI
		C	Cr	Ni	Mo	Various		
1.4301	X5 Cr Ni 18 10	0.07	17-19	8.5 - 10.5	--	--	S30400	304
1.4306	X2 Cr Ni 19 11	0.03	18-20	10 - 12.5	--	--	S30403	304L
1.4541	X6 Cr Ni Ti 18 10	0.08	17-19	9 - 12	--	Ti	S32100	321
1.4550	X6 Cr Ni Nb 18 10	0.08	17-19	9 - 12	--	Nb	S34700	347
1.4401	X5 Cr Ni Mo 17 122	0.07	16.5 18.5	10.5 - 13.5	2 - 2.5	--	S31600	316
1.4404	X2 Cr Ni Mo 17 132	0.03	16.5-18.5	11 - 14	2 - 2.5	--	S31603	316L
1.4435	X2 Cr Ni Mo 18 143	0.03	17-18.5	12.5-15	2.5 - 3	--	S31606	316L
1.4436	X2 Cr Ni Mo 17 133	0.07	16.5 18.5	11-14	2.5 - 3	--	S31600	316
1.4571	X6 Cr Ni Mo Ti 97 122	0.08	16.5 18.5	10.5 -13.5	2 - 2.5	Ti	--	316Ti
1.4529	X2 Ni Cr Mo Cu 25 206	0.02	20-21	24.5 - 25.5	6 - 6.8	Cu, N	S31254	--
1.4539	X2 Ni Cr Mo Cu 25 205	0.02	20-21	24.5 - 25.5	4.5 - 8	Cu, N	NO8904	--
1.4462	X2 Cr Ni Mo N 22 53	0.03	21-23	4.5 - 6.5	2.5 - 3.5	N	S81803	--
2.4360	Ni Cu 30 Fe	0.15	--	63	--	Cu 28-34 Al, Mn, Fe	NO4400	Alloy 400
2.4816	Ni Cr 15 Fe	0.08	15 - 17	72 - 76	--	Ti, Al, Fe	NO6600	Alloy 600
2.4896	Ni Co 22 Mo 9 Nb	0.025	21-23	61 - 65	8.5 - 9.5	Nb, Fe	NO6625	Alloy 625
1.4876	X 10 Ni Gr Al Ti 32 20	0.07	19-21.5	30-32	--	Si, Al, Ti	NO8800	Alloy 800
2.4858	Ni Cr 21 Mo	0.02	20 - 22	38-42	2.5 - 3	Cu, Ti	NO8825	Alloy 825

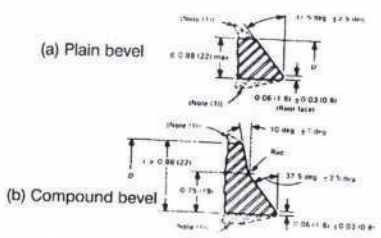
TOLERANCES AND END PREPARATION

Nominal Pipe Size (NPS)	Outside Diameter at Bevel (1) D	Inside Diameter at End (2) (3)	Wall Thickness (2) t	Center-to End Dimension A,B,C,M	Overall Length F.H.	Overall Length E	Center-to-Center Dimension 0	Back-to-Face Dimension K	Alignment of Ends U	Outside Diameter of Lap G	Thickness of Lap T	Fillet Radius of ap R
½ to 2½	+0.06 -0.03	0.03	Not less than 87.5% of nominal thickness	0.06	0.06	0.12	0.25	0.25	0.03	+0 -0.03	+0.06 -0	+0 -0.03
3 to 3½	0.06	0.06		0.06	0.06	0.12	0.25	0.25	0.03	+0 -0.03	+0.06 -0	+0 -0.03
4	+0.06	0.06		0.06	0.06	0.12	0.25	0.25	0.03	+0 -0.03	+0.06 -0	+0 -0.06
5 to 8	+0.09 -0.06	0.06		0.06	0.06 0.09	0.25	0.25	0.25	0.03	+0 -0.03	+0.06 -0	+0 0.06
10 to 18	+0.16 -0.12	0.12		0.09	0.25	0.25	0.25	0.38	0.25	+0 -0.06	+0.06 -0	+0 -0.06
20 to 24	-0.25 -0.19	0.19		0.09	0.09	0.25	0.38	0.25	0.06	+0 -0.06	+0.06 -0	+0 -0.06
26 to 30	+0.25 0.19	0.19		0.12	0.19	0.38	--	--	--	--	--	--
32 to 48	+0.25 0.19	0.19		0.19	0.19	0.38	--	--	--	--	--	--

Nominal	Angularity Tol.	
Pipe Size (NPS)	Off Angle Q	Off Plane P
1/2 to 4	0.03	0.06
5 to 8	0.06	0.12
10 to 12	0.09	0.19
14 0 16	0.09	0.25
18 to 24	0.12	0.38
26 to 30	0.19	0.38
32 to 42	0.19	0.50
44 to 48	0.19	0.75



GENERAL NOTES: (1) Dimensions are in inches. (2) Tolerances are equal plus and minus except as noted.
NOTES: (1) Out-of-round is the sum of absolute values of plus and minus tolerance. (2) The inside diameter at ends and the nominal wall thickness are to be specified by the purchaser. (3) Unless otherwise specified by the purchaser, these tolerances apply to the nominal inside diameter, which equals the difference between the nominal outside diameter and twice the nominal wallthickness.



WELDING BEVELS AND ROOT FACE

Nominal Wall Thickness t	End Preparation
Less than x [Note (2)]	Cut square or slightly chamfer, at manufacturer's option.
x to 0.88 include. (22) [Note (2)]	Plain bevels as in sketch (a) above.
More than 0.88 (22)	Compound bevel as in sketch (b) above.

GERERAL NOTES: (1) Dimensions in parentheses are in millimeters. (2) Other dimensions are in inches.
NOTES: (1) See Section 8 and Fig. 2 for transition contours (2) x=0.19(5) for carbon steel or ferritic alloy steel and 0.12(4) for austenitic alloy steel.

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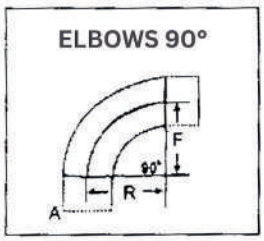
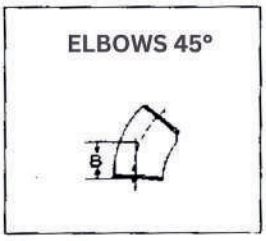
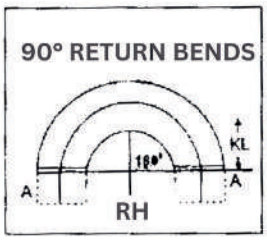
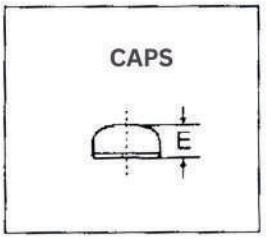
STAINLESS STEEL-FITTINGS

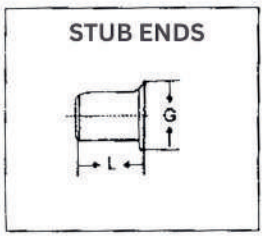
BUTT WELD FITTING

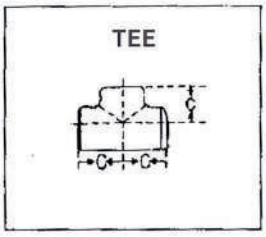


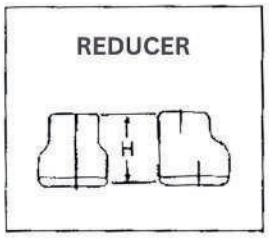


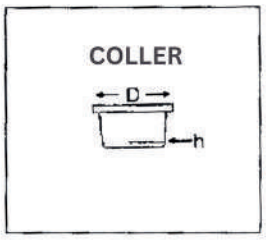












All Dimension are in mm

NOM. BORE	PIPE O.D	WALL THICKNESS RADIUS								A	B	C	E	G	L		H	D	h
		5S	10S	40S	80S	1D	1.5D	2D	3D						SHORT	LONG			
1/2"	21.34	0.65	2.11	2.77	3.73	12.7	19.05	25.4	38.1	12.7	15.9	25.4	25.4	34.9	50.8	76.2	50.8	45	8
1/4"	26.67	0.65	2.11	2.87	3.19	19.05	23.57	38.10	57.15	19.05	11.1	28.6	25.4	42.8	50.8	76.2	50.8	50	8
1"	33.40	0.65	2.77	3.38	4.55	25.4	38.1	50.8	76.2	25.4	22.2	38.1	38.1	50.8	50.8	101.6	50.8	60	10
11/4"	42.16	0.65	2.77	3.56	4.85	31.75	47.6	63.5	95.25	31.75	25.0	47.6	38.1	63.5	50.8	101.6	50.8	70	12
11/2"	48.26	0.65	2.77	3.68	5.08	38.1	57.15	76.2	114.3	38.1	28.6	57.2	38.1	73.0	50.8	101.6	63.5	80	12
2"	60.32	0.65	2.77	3.91	5.54	50.8	76.2	101.6	152.4	50.8	34.0	63.5	38.1	92.0	63.5	152.4	76.2	94	16
21/2"	73.02	2.11	3.05	5.16	7.01	63.5	95.25	127.0	190.5	63.5	44.0	75.2	38.1	104.8	63.5	152.4	88.9	110	16
3"	88.90	2.11	3.05	5.49	7.65	76.2	114.23	152.4	228.6	76.2	50.8	85.7	50.8	127.0	63.5	152.4	88.9	130	18
3 1/2"	101.60	2.11	3.05	5.74	8.08	88.9	133.35	177.8	266.7	88.9	57.2	95.3	63.5	139.7	76.2	152.4	101.6	140	18
4"	114.30	2.11	3.05	6.02	8.56	101.5	152.4	203.2	304.8	101.5	63.5	104.8	63.5	157.2	76.2	152.4	101.6	158	20
5"	141.30	2.77	3.40	7.55	9.52	127.0	190.5	254.0	381.0	127.0	82.6	123.8	76.2	185.7	76.2	203.2	127.0	188	25
6"	168.27	2.77	3.40	7.11	10.97	152.4	228.6	304.8	457.2	152.4	95.3	153.8	88.9	215.9	88.9	203.2	152.4	268	30
8"	219.07	2.77	3.76	8.18	12.7	203.2	304.8	406.4	609.6	203.2	127.0	190.5	101.6	270.0	101.6	203.2	152.4	268	30
10"	273.05	3.40	4.19	9.27	12.7	254.0	381.0	508.0	762.0	254.0	158.7	215.9	127.0	324.0	127.0	254.0	177.8	330	5
12"	323.85	3.96	4.75	9.52	12.7	304.0	457.2	609.6	914.4	304.0	190.5	254.0	152.4	381.0	152.4	254.0	203.2	400	40
14"	355.60	3.96	4.76	9.52	12.7	355.3	533.4	711.2	1066.8	355.3	22.2	280.0	165.1	412.8	152.4	305.0	330.2		
16"	406.40	4.19	4.76	9.52	12.7	446.1	609.6	812.8	1219.2	446.1	254.0	301.8	177.8	470.0	152.4	305.0	355.6		
18"	457.20	4.19	4.76	9.52	12.7	457.2	685.8	814.4	1371.6	457.1	285.7	343.0	203.2	533.4	152.4	305.0	381.0		
20"	508.00	4.76	5.54	9.52	12.7	508.0	762.0	901.6	1524.0	508.0	317.6	381.0	228.6	584.2	152.4	305.0	508.0		

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STAINLESS STEEL - FLANGES

SPECIFICATION COVERING THE MANUFACTURE AND DIMENSIONS OF FLANGES

ASTM Specifications
ASTM specifications regulate approved raw materials from which flanges can be made and the specifications for stainless flanges are:

ASTMA 182:
Forged or Rolled Alloy Steel pipe Flanges & Fittings for High Temperature service.

ANSI and MSS Specifications
The standards govern the dimensions and tolerances to which fittings are manufactured.

ANSI B. 16.5:
Steel Pipe Flanges and Flanged Fittings (½ to 24" Nom. Dia.)

MSS SP. 6:
Flanges Facings

MSS SP. 25:
Marking of Flanges

MSS SP. 39:
Bolts & Nuts for Flanges

MSS Sp. 44:
Large Diameter Pipeline Flanges (Over 24" Dia.)

API-605:
Large Diameter Flanges for Petroleum Usage (Over 24" Dia.)

The ASME Code is not a standard as such but section VIII provides the procedure for calculating the dimensions for all pressure vessel flanges.

ANSI B.31.10:
Code for pressure piping

ANSI B.31.3:
Petroleum Refinery Piping

ANSI B. 31.4:
Oil Transportation Piping

ANSI B. 31.5:
Refrigeration Piping Systems

ANSI B.31.7:
Nuclear Power Piping

ANSI B.31.8:
Gas transmission and Distribution Piping Systems

ANSI B.36.10:
Standard for Wrought Steel Pipe.

ANSI B.36.19:
Standard for Stainless Steel Pipe

ANSI B.16.10:
Valve Dimension Face & End

ANSI B.16.11
Forged Fittings Socket Weld & Threaded.

APPROXIMATE FLANGE RATING

APPROX. PRESSURE RATING IN BAR	10	15	20	25	40	64	100	150
ANSI B16-5 in lb/squin	150lb		300lb	400lb	600lb	900lb		
BS 4504	10/-	16/-		25/-	40/-	64/-	100/-	160/-
DIN2519/2526/2527/2573	PN10	PN16		PN25	PN40	PN64	PN100	PN160
SABS 1123	1000/-	1500/-		2500/-	4000/-	6400/-	10000/-	16000/-

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STAINLESS STEEL / CARBON STEEL - FLANGES

WELDING NECK FLANGE

SLIP-ON FORGE FLANGE

SOCKET WELDING FLANGE

SLIP-ON PLATE FLANGE

LAP JOINT FLANGE

BLIND FLANGE

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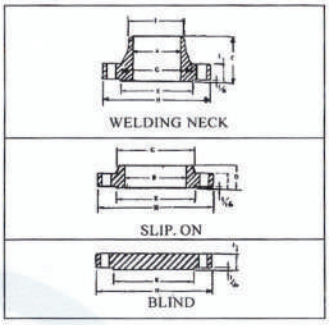
STAINLESS STEEL - FLANGES

150 LB. FLANGES STANDARD ANSI B16.5

1. All dimensions are in inches.
2. Material most commonly used, forged steel SA 181.
   Available also in stainless steel, alloy steel and non- ferrous metal.
3. The 1/16 in. raised face is included in dimensions C, D and J.
4. The lengths of stud bolts do not include the height of crown.
5. Bolt holes are 1/8 in. larger than bolt diameters.
6. Flanges bored to dimensions shown unless otherwise specified.
7. Flanges for pipes sizes 22, 26, 28 and 30 are not covered by ANSI B16.5.



Nominal Pipe Size	Diameter of Bore		Length Through Hub		Diametre of Hub at point of Welding	Diameter of Hub at Base	Outside Diameter of Flange	Thickness of Flange	Outside Diameter of Raised Face	No. of Holes	Diam. of Bolts	Length of Bolts		Ring Joint	Outside Dia.
												Bolt Circle	1/16 Raised Face		
	A	B	C	D	E	G	H	J	K						L
½	.62	.88	21/16	7/8	.84	1½	3¼	9/16	13/8	4	½	25/8	2½	3	
¾	.82	1.09	2½	1	1.05	17/8	45/8	5/8	111/16	4	5/8	3¼	2¼	3¼	
1	1.05	1.36	27/16	11/16	1.32	21/8	47/8	11/16	2	4	5/8	3½	3	3½	21/8
1¼	1.38	1.70	29/16	11/16	1.66	2½	5¼	3/4	2½	4	5/8	37/8	3	3½	2½
1½	1.61	1.95	211/16	13/16	1.90	2¾	61/8	12/16	27/8	4	3/4	4½	3½	4	2¾
2	2.07	2.44	234	15/16	2.38	35/16	6½	7/8	35/8	8	5/8	5	3¼	4½	35/16
2½	2.47	2.94	3	1½	2.88	15/16	7½	1	412	8	3/4	57/8	3¼	4½	315/16
3	3.07	3.57	31/8	111/16	3.50	45/8	8¼	11/8	5	8	3/4	65/8	4	4¾	45/8
3½	3.55	4.07	133/16	13/4	4.00	5¼	81/9	13/16	5½	8	¾	7¼	4¼	5	5¼
4	4.03	4.57	33/8	17/8	4.50	5¾	10	1¼	63/16	8	¾	77/8	4¼	5	5¾
5	5.05	5.66	37/8	2	5.56	7	11	13/8	73/16	8	¾	9¼	4½	5¼	7
6	6.07	6.72	37/8	21/16	6.63	811/8	12½	17/16	8½	12	¾	105/8	4¾	5½	81/8
8	7.98	8.72	43/8	27/16	8.63	10¼	15	15/8	105/8	12	7/8	13	5¼	6	10¼
10	10.02	10.88	45/8	25/8	10.75	125/8	17½	17/8	12¾	16	1	15¼	6	6¾	125/8
12	12.00	12.88	51/8	27/8	12.75	14¾	20½	2	15	16	11/8	17¾	6½	7¼	14¾
14	13.25	14.14	55/8	3	14.00	16¾	23	2½	16¼	20	39¼	20¼	6¾	7½	16¾
16	15.25	16.16	5¾	3¼	16.00	19	22½	2¼	18½	20	1¼	22½	7¼	8	19
18	17.25	18.18	6¼	3½	18.00	21	28	21	21	24	1¼	24¾	7½	8¼	21
20	19.25	20.20	63/8	3¾	20.00	231/8	30½	2½	23	24	1¼	27	8	8¾	231/8
22	21.25	22.22	6½	4	22.00	25¼	33	25/8	25¼	24	1½	29¼	8¾	9¾	
24	23.25	24.25	65/8	43/16	24.00	275/8	36	2¾	27¼	24	1¼	32	9	10	275/8
26	To be	26.25	7¼	7¼	26¼	283/8	381/7	31/8	29½	28	15/8	34½	10	11	29½
28	speci	28.25	7¾	7¾	28¼	30½	40¾	33/8	31½	28	15/8	37	10½	11½	31½
30	fied	30.25	8¾	8¼	30¼	329/16	43	35/8	33¾	28	1+	39¼	11¼	12¼	33¾

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DIMENSION OF PIPE FLANGES AS PER TABLE BS - 10

Table D : For Working Steam Pressure upto 50 lbs per sq. inch

Nominal Pipe size	O.D. of Pipe	Dia.of Flange	Dia. of Bolt Circle	No. of Bolt	Dia. of Bolt	Thickness
1/2"	21.3	95.3	66.7	4	12.7	4.8
3/4"	26.7	101.6	73.0	4	12.7	4.8
1"	33.4	114.3	82.6	4	12.7	4.8
1 1/4"	42.2	120.7	87.6	4	12.7	6.4
1 1/2"	48.3	133.4	98.4	4	12.7	6.4
2"	60.3	152.4	114.3	4	15.9	7.9
2 1/2"	73.0	165.1	127.0	4	15.9	7.9
3"	88.9	184.2	146.1	4	15.9	9.5
3 1/2"	101.6	203.2	165.1	4	15.9	9.5
4"	114.3	215.9	177.8	4	15.9	9.5
5"	141.3	254.0	209.6	8	15.9	12.7
6"	168.3	279.4	228.6	8	15.9	12.7
7"	190.5	304.8	260.4	8	15.9	12.7
8"	219.1	336.6	292.1	8	15.9	12.7
9"	244.5	368.3	323.9	8	15.9	15.9
10"	273.0	406.4	355.6	8	19.1	15.9
12"	323.9	457.2	406.4	12	19.1	15.9
14"	355.6	527.1	469.9	12	22.2	19.1
16"	406.4	577.9	520.7	12	22.2	19.1
18"	457.2	641.4	584.2	12.	22.2	22.2
20"	508.0	704.9	641.4	16	22.5	25.4
24"	609.6	825.5	755.7	16	25.4	28.6

Table E: For Working Steam Pressure 50 lbs upto 100 lbs per sq. inch

Nominal Pipe size	Dia.of Flange	Dia. of Bolt Circle	No. of Bolt	Dia. of Bolt	Thickness
1/2"	95.3	66.7	4	12.7	6.4
3/4"	101.6	73.0	4	12.7	6.4
1"	114.3	82.6	4	12.7	7.1
1 1/4"	120.7	87.3	4	12.7	7.9
1 1/2"	133.4	98.4	4	12.7	8.7
2"	152.4	114.3	4	15.9	9.5
2 1/2"	165.1	127.0	4	15.9	10.3
3"	184.2	146.1	4	15.9	11.1
3 1/2"	203.2	165.1	8	15.9	11.9
4"	215.9	177.8	8	15.9	12.7
5"	254.0	209.6	8	15.9	14.3
6"	279.4	228.6	8	19.1	17.5
7"	304.8	260.4	8	19.1	19.1
8"	336.6	292.1	8	19.1	19.1
9"	368.3	323.9	12	19.1	20.6
10"	406.4	355.6	12	19.1	22.2
12"	457.2	406.4	12	22.2	25.4
14"	527.2	469.9	12	22.2	25.4
16"	577.9	520.7	12	22.2	25.4
18"	641.4	584.2	16	22.2	28.6
20"	704.9	647.4	16	22.2	31.8
24"	825.5	755.7	16	25.4	38.1

Table F: For Working Steam Pressure above 100 lbs and upto 150 lbs per sq.inch

Nominal Pipe size	O.D. of Pipe	Dia.of Flange	Dia. of Bolt Circle	No. of Bolt	Dia. of Bolt	Thickness
1/2"	21.3	95.3	66.7	4	12.7	9.5
3/4"	26.7	101.6	73.0	4	12.7	9.5
1"	33.4	120.7	87.3	4	15.9	9.5
1 1/4"	42.2	133.4	98.4	4	15.9	12.7
1 1/2"	48.3	139.7	104.8	4	15.9	12.7
2"	60.3	165.1	127.0	4	15.9	15.9
2 1/2"	73.0	184.2	146.1	8	15.9	15.9
3"	88.9	203.2	165.1	8	15.9	15.9
3 1/2"	101.6	215.9	177.8	8	15.9	19.1
4"	114.3	228.6	190.5	8	15.9	19.1
5"	141.3	279.4	235.0	8	19.1	22.2
6"	168.3	304.8	260.4	12	19.1	22.2
7"	190.5	336.6	292.1	12	19.1	22
8"	219.1	368.3	323.9	12	19.1	25.4
9"	244.5	406.4	355.6	12	22.2	25.4
10"	273.0	431.8	381.0	12	22.2	25.4
12"	323.9	489.0	438.2	16	22.2	28.6
14"	355.6	552.5	495.3	16	25.4	31.8
16"	406.4	609.6	552.5	20	25.4	31.8
18"	457.2	673.1	609.6	20	28.6	34.9
20"	508.0	736.6	673.1	24	28.6	38.1
24"	609.6	850.9	781.1	24	31.8	41.3

Table H: For Working Steam Pressure above 150 lbs and upto 250 lbs per sq. inch

Nominal Pipe size	Dia.of Flange	Dia. of Bolt Circle	No. of Bolt	Dia. of Bolt	Thickness
1/2"	114.3	82.6	4	15.9	12.7
3/4"	114.6	82.6	4	15.9	12.7
1"	120.78	87.3	4	15.9	14.3
1 1/4"	133.4	98.4	4	15.9	17.5
1 1/2"	139.7	104.8	4	15.9	17.5
2"	165.1	127.0	4	15.9	19.1
2 1/2"	184.2	146.1	8	15.9	19.1
3"	203.2	165.1	8	15.9	22.2
3 1/2"	215.9	177.8	8	15.9	22.2
4"	228.6	190.5	8	15.9	25.4
5"	279.4	235.0	8	19.1	28.6
6"	304.8	260.4	12	19.1	28.6
7"	336.6	292.1	12	19.1	31.8
8"	368.3	323.9	12	19.1	31.8
9"	406.4	355.6	12	22.2	34.9
10"	431.8	381.0	12	22.2	34.9
12"	489.0	438.2	16	22.2	38.1
14"	552.5	495.3	16	25.4	41.3
16"	609.6	552.5	20	25.4	44.5
18"	673.1	609.6	20	28.6	47.6
20"	736.6	781.1	24	31.8	57.2
24"	850.9	673.1	25	28.6	50.8

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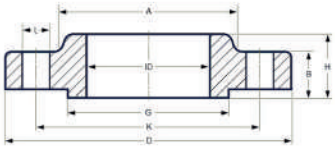
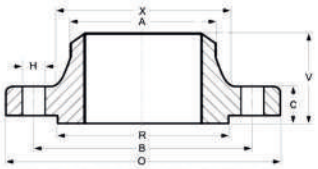
FORGED FLANGES TO ANSI B 16.5 (ASA 150 / 300 LBS)



SLIP-ON FLANGE



WELDING NECK FLANGE

BLIND FLANGE

150 LBS

Nominal Pipe Size (MM)	(INCH.)	Flange Dia O	Dia of Bolt Circle A	Dia of Bolt Holes D	No. of Holes	Thk. of Flange C	Dia of Hub E	Length through Hub S/O & S/W Y	Length through Hub W/N Y	Length through Hub L/J Y	Dia of Bore S/O & S/W B	Dia of Bore L/J B	Dia of R/F R	Depth of Socket F
15	1/2	88.9	60.3	15.9	4	11.1	30.2	15.9	47.6	15.9	22.3	22.9	34.9	9.5
20	3/4	98.4	69.8	15.9	4	12.7	38.1	15.9	52.4	15.9	27.7	28.2	42.9	11.1
25	1	107.9	79.4	15.9	4	14.3	49.2	17.5	55.6	17.5	34.5	35.0	50.8	12.7
32	1 1/4	117.5	88.9	15.9	4	15.9	58.7	20.6	57.1	20.6	43.2	43.7	63.5	14.3
40	1 1/2	127.0	98.4	15.9	4	17.5	65.1	22.2	61.9	22.2	49.5	50.0	73.0	15.9
50	2	152.4	120.6	19.0	4	19.0	77.8	25.4	63.5	25.4	62.0	62.5	92.1	17.5
65	2 1/2	177.8	139.7	19.0	4	22.2	90.5	28.6	69.8	28.6	74.7	75.4	104.8	19.0
80	3	190.5	152.4	19.0	4	23.8	107.9	30.2	69.8	30.2	90.7	91.4	127.0	20.6
100	4	228.6	190.5	19.0	8	23.8	134.9	33.3	76.2	33.3	116.1	116.8	157.2	23.8
125	5	254.0	215.9	22.2	8	23.8	163.5	36.5	88.9	36.5	143.8	144.5	185.7	23.8
150	6	406.4	361.9	22.2	8	25.4	192.1	39.7	88.9	39.7	170.7	171.4	215.9	27.0
200	8	279.4	241.3	22.2	8	28.6	246.1	44.4	101.6	44.4	221.5	222.2	269.9	31.7
250	10	342.9	298.4	25.4	12	30.2	304.8	49.2	101.6	49.2	276.3	277.4	323.8	33.3
300	12	482.6	431.8	25.4	12	31.8	365.1	55.6	114.3	55.6	327.1	328.2	381.0	39.7
350	14	533.4	476.2	28.6	12	34.9	400.0	57.1	127.0	79.4	359.1	360.2	412.7	41.3
400	16	596.9	539.7	28.6	16	36.5	457.2	63.5	127.0	87.3	410.5	411.2	469.9	44.4
450	18	635.0	577.8	31.	16	39.7	504.8	68.3	139.7	96.8	461.8	462.3	533.4	49.2
500	20	698.5	635.0	31.7	20	42.9	558.8	73.0	144.5	103.2	513.1	514.3	584.2	54.0
600	24	812.8	749.3	34.9	20	47.6	663.6	82.5	152.4	111.1	615.9	615.9	692.1	63.5

300 LBS

Nominal Pipe Size (MM)	(INCH.)	Flange Dia O	Dia of Bolt Circle A	Dia of Bolt Holes D	No. of Holes	Thk. of Flange C	Dia of Hub E	Length through Hub S/O & S/W Y	Length through Hub W/N Y	Length through Hub L/J Y	Dia of Bore S/O & S/W B	Dia of Bore L/J B	Dia of R/F R	Depth of Socket F
15	1/2	95.2	66.7	15.9	4	14.3	38.1	22.2	52.4	22.2	22.3	22.9	34.9	9.5
20	3/4	117.5	82.5	19.0	4	15.9	47.6	25.4	57.1	25.4	27.7	28.2	42.9	11.1
25	1	123.8	88.9	19.0	4	17.5	54.0	27.0	61.9	27.0	34.5	35.0	50.8	12.7
32	1 1/4	133.3	98.4	19.0	4	19.0	63.5	27.0	65.1	27.0	43.2	43.7	63.5	14.3
40	1 1/2	155.6	114.3	22.2	4	20.6	69.8	30.2	68.3	30.2	49.5	50.0	73.0	15.9
50	2	165.1	12.0	19.0	8	22.2	84.1	33.3	69.8	33.3	62.0	62.5	92.1	17.5
65	2 1/2	190.5	149.2	22.2	8	25.4	100.0	38.1	76.2	38.1	74.7	75.4	104.8	19.0
80	3	209.5	168.3	22.2	8	28.6	117.5	42.9	79.4	42.9	90.7	91.4	127.0	20.6
100	4	254.0	200.0	22.2	8	31.8	146.0	47.6	85.7	47.6	116.1	116.8	157.2	23.8
125	5	279.4	234.9	22.2	8	34.9	177.8	50.8	98.4	50.8	143.8	144.5	185.7	--
150	6	317.5	269.9	22.2	12	36.5	206.4	52.4	98.4	52.4	170.7	171.4	215.9	--
200	8	381.0	330.2	25.4	12	41.3	260.3	61.9	111.1	61.9	221.5	222.2	269.9	--
250	10	444.5	387.3	28.6	16	47.6	320.7	66.7	117.5	95.2	276.3	277.4	323.8	--
300	12	520.7	450.8	31.7	16	50.8	374.6	73.0	130.2	101.6	327.1	328.2	381.0	--
350	14	584.2	514.3	31.7	20	54.0	425.4	76.2	142.9	111.1	359.1	360.2	412.7	--
400	16	647.7	571.5	34.9	20	57.2	482.6	82.5	146.0	120.6	410.5	411.2	469.9	--
450	18	711.2	628.5	34.9	24	60.3	533.4	88.9	158.7	130.2	461.8	462.3	533.4	--
500	20	774.7	685.8	34.9	24	63.5	587.4	95.2	161.9	139.7	513.1	514.3	584.2	--
600	24	914.4	812.8	41.3	24	69.8	701.7	106.4	168.3	152.4	615.9	615.9	692.1	--

All Dimensions are in Millimeters Flanges except Lap Joint will be furnished with (1.6) Raised Face, which is included in "Thickness (C)" and Length through Hub (Y)"
• 600, 900, 1500, 2500 class flanges are also available on request.

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600 lbs	Common sizes to 600 lbs flanges							WELDING-NECK 600 lbs		SLIP-ON 600 lbs		LAP-JOINT 600 lbs		
Size	Outside Diameter D	Thickness E	Raised Face Dia. F	Hub. Dia. B	FLANGE DRILLING			Diameter d1	Height H	Height H	Diameter A	Height H	Diameter A	Radius R
					No. of Bolt	Dia. of Bolt	Pitch Circle Dia. C							
1/2	95	14.3	34.9	38	4	16	67	21.3	52.4	22.2	22.4	22.2	22.9	3.1
3/4	117.5	15.9	42.9	48	4	19	83	26.7	57.2	25.4	27.7	25.4	28.2	3.1
1	124	17.5	50.8	54	4	19	89	33.4	61.9	27.0	34.5	27.0	35.1	3.1
1 1/4	133.5	20.6	63.5	63	4	19	98.5	42.2	66.7	28.6	40.2	28.6	43.7	4.7
1 ½	156	22.2	73	70	4	23	114.5	48.3	69.9	31.8	49.5	31.8	50	6.3
2	165	25.4	92.1	84	8	19	127	60.3	73.0	36.5	62	36.5	62.5	7.9
2½	190.5	28.6	104.8	100	8	23	149	73	79.4	41.3	74.7	41.3	75.4	7.9
3	209.5	31.8	127	117	8	23	168.5	88.9	82.5	46.0	90.7	46.0	91.5	9.5
3½	229	34.9	139.7	133	8	25	184	101.6	85.7	49.2	103.4	49.2	104.2	9.5
4	273	38.1	157.2	152	8	25	216	114.3	101.6	54.0	116.1	54.0	116.9	11.1
5	330	44.5	185.7	189	8	29	267	141.3	114.3	60.3	143.8	60.3	144.5	11.1
6	355.5	47.6	215.9	222	12	29	292	168.3	117.5	66.7	170.7	66.7	171.5	12.7
8	419	55.6	269.9	273	12	32	349	219.1	133.4	76.2	221.5	76.2	222.3	12.7
10	508	63.5	323.9	343	16	35.	432	273.0	152.4	165.1	276.4	111.1	277.4	12.7
12	559	66.7	381	400	20	35	489	323.9	155.6	85.7	327.2	117.5	323.2	12.7
14	603	69.5	412.8	432	20	38	527	355.6	165.1	93.7	359.2	127.0	360.2	12.7
16	686	76.2	469.9	495	20	42	603.5	406.4	177.8	106.4	410.5	139.7	411.2	12.7
18	743	82.5	533.4	546	20	45	654	457.2	184.2	177.5	461.8	152.4	462.3	12.7
20	813	88.9	584.2	610	24	45	724	508	190.5	127.0	513.1	165.1	514.4	12.7
24	940	101.6	692.2	718	24	51	838	609.6	203.2	139.37	616	184.2	616	12.7

1500 lbs	Common sizes to 1500 lbs flanges							WELDING-NECK 1500 lbs		SLIP-ON 1500 lbs		LAP-JOINT 1500 lbs		
NB								d1	H	H	A	H	A	R
1/2	121	22.2	34.9	38	4	22.2	82.5	21.3	60.3	31.8	22.4	31.8	22.9	3.1
3/4	130	25.4	42.9	44.5	4	22.2	89	26.7	69.9	34.9	27.7	34.9	28.2	3.1
1	149	28.6	50.8	25.5	4	25.4	101.5	33.4	73.0	41.3	34.5	41.3	35.1	3.1
1 1/4	159	28.6	63.5	63.5	4	25.4	111	42.2	73.0	41.3	43.2	41.3	43.7	4.7
1 ½	178	31.8	73	70	4	29	124	48.3	82.5	44.5	49.5	44.5	50	6.3
2	216	38.1	92.1	105	8	25.4	165	60.3	101.6	57.2	62	57.2	62.5	7.9
2½	244.5	41.3	104.8	124	8	29	190.5	73	104.8	63.5	74.7	63.5	75.4	7.9
3	266.5	47.6	127	133.5	8	32	203	88.9	117.5	73.0	90.7	73.0	91.5	9.5
4	311	54.0	157.2.	162	8	35	241.5	114.3	123.8	90.5	116.1	90.5	116.9	11.1
5	374.5	73.0	185.7	197	8	42	292	141.3	155.6	104.8	143.8	104.8	144.5	11.1
6	394	82.5	215.9	229	12	38	317.5	168.3	171.5	119.1	170.7	119.1	171.5	12.7

2500 lbs	Common sizes to 2500 lbs flanges							WELDING-NECK 2500 lbs		SLIP-ON 2500 lbs		LAP-JOINT 2500 lbs		
NB								d1	H	H	A	H	A	R
1/2	133.5	30.2	34.9	43	4	22.2	89	21.3	73.0	39.7	22.4	39.7	22.9	3.1
3/4	140	31.8	42.9	51	4	22.2	95	26.7	79.4	42.9	27.7	42.9	28.2	3.1
1	159	34.9	50.8	57	4	25.4	108	33.4	88.9	47.6	34.5	47.6	35.1	3.1
1 1/4	184	38.1	63.5	73	4	29	130	42.2	95.3	52.4	43.2	52.4	43.7	4.7
1 ½	203	44.5	73	79.5	4	32	146	48.3	111.1	60.3	49.5	60.3	50.0	6.3
2	235	50.8	92.1	95	8	29	171.5	60.3	127.0	69.9	62	69.9	62.5	7.9
2½	267	57.2	104.8	114.5	8	32	197	73	142.9	79.4	74.7	79.4	75.4	7.9
3	305	66.7	127.0	133.5	8	35	228.5	88.9	168.3	92.1	90.7	92.1	91.5	9.5
4	356	76.2	157.2	165	8	42	273	114.3	190.5	108.0	116.1	108.0	116.9	11.1
5	419	92.1	185.7	203	8	48	324	141.3	228.6	130.2	143.8	130.2	144.5	11.1
6	483	108.0	215.9	235	8	54	368.5	168.3	273.0	152.4	170.7	152.4	171.5	12.7

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ND 10

Nominal Pipe Size (in mm)	Flange Diameter mm	Flange thickness	Raised Face		number of holes	diameter of holes mm	p.c.d. mm
			diameter mm	height mm			
15	95	14	45	2	4	14	65
20	105	16	58	2	4	14	75
25	115	16	68	2	4	14	85
32	140	18	78	2	4	16	100
40	150	18	88	3	4	18	110
50	165	20	102	3	4	18	125
65	185	20	122	3	4	18	145
80	200	22	138	3	4	18	160
100	220	22	158	3	8	18	180
125	250	24	188	3	8	18	210
150	285	24	212	3	8	23	240
200	340	26	268	3	8	23	295
250	395	28	320	3	12	23	350
300	445	28	370	4	12	23	400

ND-16

Nominal Pipe Size (in mm)	Flange Diameter mm	Flange thickness	Raised Face (cast iron only)		number of holes	diameter of holes mm	p.c.d. mm
			diameter mm	height mm			
15	95	14	45	2	4	14	65
20	105	15	58	2	4	14	75
25	115	16	68	2	4	14	85
32	140	16	78	2	4	18	100
40	150	16	88	3	4	18	110
50	165	18	102	3	4	18	125
65	185	18	122	3	4	18	145
80	200	20	138	3	4	18	160
100	220	20	158	3	8	18	180
125	250	22	188	3	8	18	210
150	285	22	212	3	8	23	240
200	340	24	268	3	8	23	295
250	405	26	320	3	12	27	355
300	460	28	370	4	12	27	410

ND 40

Nominal Pipe Size (in mm)	Flange Diameter mm	Flange thickness	Raised Face (cast iron only)		number of holes	diameter of holes mm	p.c.d. mm
			diameter mm	height mm			
15	95	16	45	2	4	14	65
20	105	18	58	2	4	14	75
25	115	18	68	2	4	14	85
32	140	18	78	2	4	18	100
40	150	18	88	3	4	18	110
50	165	20	102	3	4	18	125
65	185	22	122	3	4	18	145
80	200	24	138	3	8	18	160
100	235	24	158	3	8	23	180
125	270	26	188	3	8	27	220
150	300	28	218	3	8	27	250
200	375	34	285	3	12	30	320
250	450	38	345	3	12	33	385
300	515	42	410	4	16	33	450

IS-1538

Nominal Pipe Size (in mm)	Diameter of Flange	P.C.D.	Holes		Thickness
			Number	Diameter	
mm	mm	mm	mm	mm	mm
80	200	150	4	19	21
100	220	180	8	19	22
125	250	210	8	19	22.5
150	285	250	8	23	23
200	340	295	8	23	24.5
250	395	350	12	23	26
300	445	400	12	23	27.5

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DIMENSION OF TOLERANCE IN INSPECTION

BUTT WELD FITTINGS TO ANSI 16.9 AND 16.28

All Dimension are in inch

ALL FITTINGS				Q	R	90° and 45° Elbow and Tees	Reducer F	180° Returns			Caps
Nominal Pipe Size	Outside Diameter of Bevel	Inside Diameter of End	Wall Thickness T	ANGULARITY Off Angle Q	ANGULARITY Off Plane P	Centre to End Dimention A.B.C.	Over all Length	Centre to Centre Dimention O	Back Face Dimention K	Alignment of Ends U	Over all Length E
½ to 2	+1/16-1/32	+1/32	Not Less than 87.5% of Normal Thickness	1/32	1/16	+1/16	+1/16	±1/4	±1/4	+1/32	±1/8
3 to 3½	±1/16	±1/16		1/32	1/16	+1/16	+1/16	±1/4	+1/4	±1/32	+1/8
4	+1/16	+1/16		1/32	1/16	+1/16	+1/16	±1/4	±1/4	+1/32	±1/8
5 to 8	±3/32-1/16	±1/16		1/16	1/8	+1/16	±1/16	+1/4	±1/4	+1/32	+1/4
10 to 12	+5/32-1/8	±1/8		3/32	3/16	+1/32	+3/32	±3/8	±1/4	+1/16	±1/4
14 to 16	+5/32-1/8	±1/8		3/32	1/4	±1/32	+3/32	±3/8	±1/4	+1/16	±1/4
18	+5/32-1/8	±1/8		1/8	1/4	+1/32	±3/32	±3/8	±1/4	+1/16	±1/4
20 to 24	+1/4-3/16	+3/16		1/8	3/8	+3/32	+3/32	±3/8	+1/4	+1/16	±1/4
30	+1/4-3/16	±3/16				±1/8	±3/16				±3/8
36	±1/4-3/16	±3/16				+3/16	±3/16				±3/8

SOCKET WELD FITTING TO ASA B 16.11 AND BS 3799

Nominal Bore	Elbows, tees crosses	Coupling	Half Coupling	All Fitting				
	Centre to bottom of socket	Bottom to Bottom of socket	Bottom to socket to opposite face	Bore diameter of socket	Bore diameter of fitting	Fitting wall thickness	Concentricity of bores	Coincidence of axes
1/4 & 3/8	±0.03	±0.06	±0.03	±0.10	±0.015	Not Less than nominal pipe wall Thickness	Socket and fitting bores within ±0.030	0.062 in 12 inch
1/2 & 3/4	±0.06	±0.12	±0.6					
1 to 2	±0.08	±0.16	±0.8					

SCREWED FITTINGS TO ASA B 16.11 AND BS 3799

Nominal Bore	Elbows, tees crosses		Street Elbows		Coupling half coupling		Bushing - plugs				Unions		
	Centre to End	Diameter of bead	Centre to female end	Diameter of bead	Centre to male end	Overall Length	Diameter	Height of head	Length under head	Across flat	Overall Length	Overall Length	Across flat
1/2 & 3/4	±0.031	±0.062 -0.031	±0.031	±0.062 -0.031	±0.062	±0.062	±0.062 -0	±0.031	±0.062	+0 -0.031	±0.062	±0.062	+0 -0.031
1 to 3	±0.062	±0.093 -0.062	±0.062	±0.093 -0.062	±0.093	±0.125	±0.093 -0	±0.062	±0.093	+0 -0.062	±0.093	±0.125	+0 -0.062

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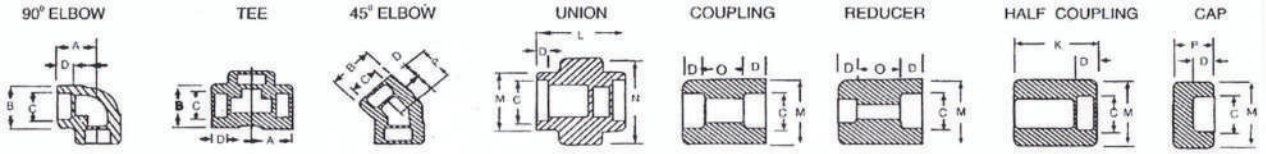
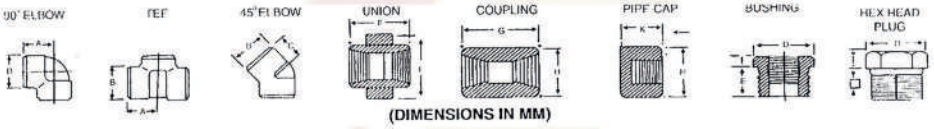
SOCKET WELD FITTING TO ANSI B-16.11



NOM BORE	PIPE O.D.	3000 LBS.									COMMON FACTORS					6000 LBS.			
		A max.	B max.	K	J	L	M	N	P	Q	C min.	D mi.	O min.	O max.	A	B	M	K	N
1/8"	10.3	22	18.5	26	16	40	17.3	32	15	10	10.7	10	5	8	22	22	20	25	46
1/4"	13.7	22	22	26	18	43	21.2	32	15	10	14.1	10	5	8	27	25	24	25	51
3/8"	17.2	25	25	26	19	48	25.4	36	16.5	10	17.6	10	3	9	27	28	28	26	60
1/2"	21.3	27	32	30	21	51	31	41	16.5	10	21.7	10	6	13	31	34	34	31	72
3/4"	26.7	34	38	36	24	57	37	50	19.5	13	27	13	6	13	37	42	41	35	80
1"	33.4	37	46	40	25	64	45.2	60	22.5	13	33.8	13	9	17	42	50	50	40	94
1 14"	42.2	42	56	40	29	70	55	70	22.5	13	42.6	13	9	17	47	59	58	41	100
1 1/2"	48.3	47	62	40	30	79	61.4	78	24	13	48.7	13	9	17	53	67	66	43	122
2"	60.3	56	75	52	37	89	75	95	29	13	61.2	16	15	23	59	84	83	55	
2 1/2"	73.02	60	92	52	48	114	91.3	125	32	16	73.8	16	14	24		102		56	
3"	89.00	76	110	52	51	127	108.8	140	35	16	89.8	16	14	24		121		58	
4"	114.50	88	137	58		150	136.9		42	19	115.5	19	14	24		152		64	

FORGED SCREWED FITTING TO ANSI B-16.11 3000/6000 LBS. THREADED TO ASA B 2.1



(DIMENSIONS IN MM)

NOM BORE	PIPE O.D.	3000 LBS.							COMMON FACTORS					6000 LBS.					
		A	B	C	G	H	K	D	E	F	I	J	L	A	B	C	G	H	K
1/8"	10.3	21	22	17	32	16	19	11	10	40	--	6	--	25	25	19	32	22	--
1/4"	13.7	25	25	19	35	19	25	16	11	43	3	6	32	29	33	22	35	25	27
3/8"	17.2	29	33	22	38	22	25	17.5	13	48	4	8	38	33	38	25	38	32	27
1/2"	21.3	33	38	25	48	29	32	22	15	51	5	8	46	38	46	29	48	38	33
3/4"	26.7	38	46	29	51	35	37	27	16	57	6	10	51	44	56	33	51	44	38
1"	33.4	44	56	33	60	44	41	35	19	64	6	10	60	51	62	35	60	57	43
1 14"	42.2	51	62	35	67	57	44	44.5	21	70	7	14	72	60	75	43	67	64	64
1 1/2"	48.3	60	75	43	79	64	44	51	21	79	8	16	80	64	84	44	79	76	48
2"	60.3	64	84	45	86	76	48	63.5	22	88	9	17	94	83	102	52	86	92	51
2 1/2"	73.02	83	102	52	92	92	60	76	27	118	10	21	122	95	121	64	92	108	64
3"	89.00	95	121	64	108	108	65	89	29	121	10	65	140	106	146	79	108	127	68
4"	114.50	114	152	79	121	140	68	117.5	32	150	13	25	180	114	152	79	121	159	75

DIMENSIONS AND OTHERS SPECIFICATIONS AS PER CUSTOMERS REQUIREMENTS ARE AVAILABLE ON REQUEST

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