



- Pipes, Tubes
- Pipe Fittings
- Flanges, Fasteners
- Sheets, Plates, Coils
- Flats, Bars
- Angles, Channels, Beams
- Ferrous & Non-Ferrous Metals



The Reliable Steel Source
Inspiring Customer's Confidence.

Technical Guide
Version 9.0

COMPANY PROFILE

Ratnadeep Steel & Engg. Co. an ISO Certified Company is a leading **Manufacturer, Supplier and Stockist of Ferrous and Non Ferrous metals** in form of **Pipes, Tubes, Plates, Sheets, Fittings, Bars, Flanges, Structures & Fasteners**. With over 25 years of experience in the industry, Ratnadeep is known for its wide range of products, high quality standards, and competitive prices.

Ratnadeep's products are used in a wide range of industries, including oil & gas, power generation, petrochemicals, pharmaceuticals, food & beverage, textiles, and machinery etc. The company also offers custom cutting and fabrication services to meet the specific needs of its customers.

Ratnadeep is committed to providing its customers with the best possible service and support. Its team of experienced professionals is always available to answer questions and help customers find the right products for their needs.

In short, Ratnadeep Steel & Engg. Co. is a trusted **One-stop shop for all your Ferrous and Non Ferrous metal needs**.

The following items we deal are in wide range of Sizes and Grades and are readily available with us in bulk quantities...

PIPES & TUBES PLATES, SHEETS & COILS

STAINLESS STEEL
INCOLOY 800, 825
INCOLOY ALLOY 20
SMO 254 (UNS S31254)
COPPER

PIPE FITTINGS STRUCTURES

CARBON STEEL
NICKEL ALLOY 200
HASTELLOY C22, C276
PHOSPHORUS BRONZE
BRASS

FLANGES FASTENERS

ALLOY STEEL
TITANIUM GR 2
DUPLEX & SUPER DUPLEX
BOILER QUALITY
17-4PH & 15-5PH

BARS COPPER JUMPERS

MILD STEEL & HOT DIP GI
INCONEL 600, 601, 625
GUN METAL
MONEL 400, K500
ALUMINIUM

We are approved suppliers to various government department & Public sectors all over the country & regularly supplying to them for a long time. We have got ready stock of the above items in various sizes as per National / International Standards & Specification & the same shall be supplied as per your requirements at very reasonable rates.

We can arrange any **Third-Party inspection agency from LRIS, BVIS, IBR, TUV, DNV, MECON, MDL, PDIL, LLOYDS etc.**

Hope, that we will get an opportunity to work with your esteemed organization and prove our excellence to build a long-term relation for the future.

Request you to please enlist our name in your approved Suppliers/Vendors list and send us your valuable purchase enquiries to enable us to quote our most competitive rates and terms.

QUALITY POLICY

At Ratnadeep Steel & Engg. Co., we are committed to providing high-quality products and services to our customers. Our quality policy is guided by principles that support our unique working culture, which incorporates respect, self-management, open communication, and continuous improvement.



Our quality assurance system starts with understanding our customers' requirements and continues until the customer is completely satisfied with the delivery of our products and services. We exercise stringent quality control measures to ensure the accurate dimensions and mechanical properties of our products.

Our quality assurance system assures each product to pass through the following processes and quality systems:

- **Material Control System**
- **Process Control System**
- **Machining and Dimensional Control**
- **Certification and Supplementary Test**
- **Finishing, Marking & Packing**

Our quality policy is built for a result-oriented work culture to fulfill our customers' needs in terms of cost, quality, and delivery. We are aiming towards zero losses by enhancing the effectiveness of people and plant equipment safely.

PRODUCT RANGE

PIPES & TUBES



Stainless Steel	: ASTM A 312 GR. TP 304, 304L, 304H, 309S, 309H, 310S, 310H, 316, 316L, 316Ti, 316H, 316LN, 317, 317L, 321, 321H, 347, 347H, 904L.
Carbon Steel	: ASTM A 53 GR. A & B, ASTM A 106, GR. A, B & C, API 5L GR.B, API 5L X 42, X46, X52, X56, X60, X65 & X70, X80 (PSL1 & PSL2)
Alloy Steel	: ASTM A 335 GR P1, P5, P9, P11, P12, P22, P91, P92 etc.
High Nickel Alloys	: Monel, Nickel, Inconel, Hastelloy, Copper Brass, Bronze, Titanium, Tantalum, Bismuth, Aluminium, High Speed Steel, Zinc, Lead etc.
Type	: Round, Square, Rectangular (Seamless, Welded, ERW & EFW)
Size	: 1/4" NB to 32"NB (Seamless & Welded)
Wall Thickness	: Sch.5S to Sch. XXS & as specified.
Size	: 1/4"OD to 6"OD
Wall Thickness	: 22SWG TO 10SWG

BUTTWELD FITTINGS



Stainless Steel	: ASTM A 403 GR. WP 304, 304L, 304H, 309S, 309H, 310S, 310H, 316, 316L, 316Ti, 316H, 316LN, 317, 317L, 321, 321H, 347, 347H, 904L.
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/WP92 etc.
Duplex & Super Duplex Steel	: UNS S31803, UNS S32750, UNS S32760, 904L, Alloy 20, 254 SMO
High Nickel Alloys	: Monel, Nickel, Inconel, Hastelloy, Copper Brass, Bronze, Titanium, Tantalum, Bismuth, Aluminium, High Speed Steel, Zinc, Lead etc.
Type	: Elbow, Tee, Reducer, Return Bends, Stub-Ends, Cap, Collar, Cross, Insert etc.
Size	: 1/4" NB to 32"NB (Seamless & Welded)
Wall Thickness	: Sch.5S to Sch. XXS & as specified.

SCREWED & FORGED FITTINGS



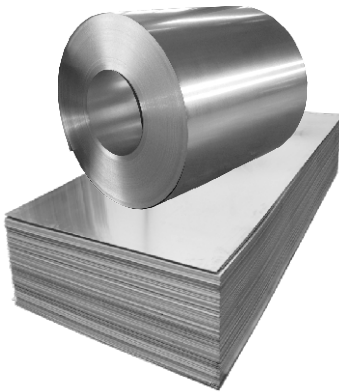
Stainless Steel	: ASTM A 182 F304, 304L, 304H, 309S, 309H, 310S, 310H, 316, 316L, 317, 317L, 321, 310, 347, 347H, 904L.
Carbon Steel	: ASTM A 105/A694 F42/46/52/56/60/65/70/A350 LF3/A350LF2
Alloy Steel	: ASTM A 182 F1/F5/F9/F11/F22/F91 etc.
Others	: Monel, Nickel, Inconel, Hastelloy, Copper Brass, Bronze, Titanium, Tantalum, Bismuth, Aluminium, High Speed Steel, Zinc, Lead etc.
Type	: Elbow, Tee, Union, Cross, Coupling, Plug, Swage Nipple, Welding Boss, Hexagon Nipple, Barrel Nipple, Hexagon Nut, Hose Nipple, Weldolet, Elbolet, Sockolet, Thredolet, Nipolet, Latrolet etc.
Size	: 1/4" NB to 4"NB (Socketweld & Threaded)
Class	: 3000#, 6000#, 9000#

PRODUCT RANGE

FLANGES



Stainless Steel	: ASTM A 182 F304, 304L, 304H, 316, 316L, 317, 317L, 321, 310, 347, 347H, 904L etc.
Carbon Steel	: ASTM A 105/A694 F42/46/52/56/60/65/70/A350LF3/A350LF2 etc.
Alloy Steel	: ASTM A 182 F1, F5, F11, F22, F91 etc.
Duplex Steel	: 2205 (Monel), 2507 (Super Duplex), UNS-31803, 32750, 32990
Others	: Monel, Nickel, Inconel, Hastelloy, Copper Brass, Bronze, Titanium, Tantalum, Bismuth, Aluminium, High Speed Steel, Zinc, Lead etc.
Type	: Weldneck, Slipon, Blind, Socket Weld, Lap Joint, Spectacle, Ring Joint, Orifice, Long Weldneck, Deck Flange etc.
Size	: 1/2" NB to 48"NB
Class	: 150#, 300#, 400#, 600#, 900#, 1500# & 2500# also as per National & International Standards



SHEET, PLATE & COILS

Stainless Steel	: ASTM A 240 GR. TP 304, 304L, 304H, 309S, 309H, 310S, 310H, 316, 316L, 316Ti, 316H, 316LN, 317, 317L, 321, 321H, 347, 348, 348H, 409, 416, 420, 430 etc.
Alloy Steel	: ASTM A387 Gr. 2, 5, 9, 11, 12 & 22, 91 in class 1 & 2 ASTM A204 Gr. A & B, DIN 17175 Gr. 15Mo3 & 16Mo3 with IBR Test Certificate.
Carbon Steel / Boiler Quality	: IS 2062 Gr. A, B & C, IS 2002 Gr. 1 & 2 ASTM A516 Gr. 60 & 70, ASTM A516 Gr. 60 & 70, A572 Gr. 50 etc.



RODS / BARS & WIRES

Material Grade	: Stainless Steel, Nickel Alloys, Carbon Steel, Alloy Steel, IBR Non IBR.
High Nickel Alloy	: Monel, Nickel, Inconel, Hastelloy, Copper Brass, Bronze, Titanium, Tantalum, Bismuth, Aluminium, High Speed Steel, Zinc, Lead etc.
Type	: Rods, Hex, Square, Wires, Billets etc.



COPPER BRAIDED WIRES & JUMPERS

Copper Flexible Connectors
Silicon Carbide & Molybdenum Disilicide
Heating Element Accessories
Aluminium Wire & SS Wire Braided Products.
Special Earthing Materials, Sheet Metal Components.

PIPES & TUBES



Stainless Steel	: ASTM A 312 GR. TP 304, 304L, 304H, 316, 316L, 317, 317L, 321, 310, 347, 904L etc.
Carbon Steel	: ASTM A 53 GR. B / A105 GR. B / API 5L GRADE B / API 5L GR. X42/46/52/56/60/65/70/S355J2H etc. (IBR & NON IBR)
Low Temperature, Carbon Steel	: A333 Gr.3 / Gr. 6 etc.
Alloy Steel	: ASTM A 335 GR P1, P5, P9, P11, P12, P22, P91, P92 etc.
M.S. ERW & Hot Dipped Galvanized (G.I) ERW Air Pre Heater & Corten Tubes	: Pipe as per IS1239 & IS3589, Gr. FC 330 & 410
High Nickel Alloys	: Monel, Nickel, Inconel, Hastelloy, Copper & Brass, Bronze, Titanium, Tantalum, Bismuth, Aluminium, High Speed Steel, Zinc, Lead etc.
Type	: Round, Square, Rectangular
Size	: 1/4" NB to 32"NB (Seamless) 1/2" NB to 108"NB (Welded)
Wall Thickness	: Sch.5S to Sch. XXS & Heavy Wall Pipe 22 SWG to 10 SWG

CARBON STEEL / ALLOY STEEL / STAINLESS STEEL

PIPE & TUBES SCHEDULE DIMENSIONS WALL THICKNESS, WT./MTR. (KG)

NOMINAL PIPE SIZE		SCHEDULE DESIGNATIONS 36.10 & 36.19 ANSI / ASME	WALL THICKNESS MM	WEIGHT KG / METER
OD INCH MM				
1/2 15 0.840 21.3		STD 40s XS 80 40s 160 10s	2.76 3.73 4.77	1.26 1.62 1.95
3/4 20 1.050 26.7		STD 40 40s XS 80 80s 160 10s XXS 80s	2.10 2.87 3.91 5.53 7.82	1.27 1.68 2.19 2.88 3.63
1 25 1.315 33.4		5s 10 10s STD 40 40s XS 80 80s 160 10s XXS 80s	1.65 2.76 3.37 4.54 6.35 9.09	1.29 2.09 2.50 3.23 4.23 5.45
1-1/4 32 1.660 42.2		5s 10 10s STD 40 40s XS 80 80s 160 10s XXS 80s	1.65 2.76 3.55 4.85 6.35 9.70	1.64 2.69 3.38 4.46 5.60 7.76
1-1/2 40 1.900 48.3		5s 10 10s STD 40 40s XS 80 80s 160 10s XXS 80s	1.65 2.76 3.68 5.08 7.13 10.16	1.89 3.10 4.04 5.40 7.23 9.54
2 50 2.375 60.3		5s 10 10s STD 40 40s XS 80 80s 160 10s XXS 80s	1.65 2.76 3.91 5.53 8.73 11.07	2.38 3.93 5.44 7.48 11.11 13.45
2-1/2 65 2.875 73.0		5s 10 10s STD 40 40s XS 80 80s 160 10s XXS 80s	2.10 3.04 5.15 7.01 9.52 14.0	3.68 5.26 8.63 11.41 14.91 20.40
3 80 3.55 88.9		5s 10 10s STD 40 40s XS 80 80s 160 10s XXS 80s	2.10 3.04 5.48 7.62 11.12 15.24	4.51 6.45 11.28 15.27 21.33 27.68
3-1/2 90 4.000 101.6		5s 10 10s STD 40 40s XS 80 80s 160 10s XXS 80s	2.10 3.04 5.74 8.07 10.7 16.15	5.17 7.40 13.57 18.62 24.03
4 100 4.500 114.3		5s 10 10s STD 40 40s XS 80 80s 120 10s 160 10s XXS 80s	2.10 3.04 6.02 8.56 11.12 13.48 17.12	5.83 8.36 16.07 22.32 28.30 33.53 41.02
5 125 5.563 141.3		5s 10 10s STD 40 40s XS 80 80s 120 10s 160 10s XXS 80s	2.76 3.40 6.55 9.52 12.70 15.87 19.05	9.45 11.57 21.77 30.95 40.27 49.10 57.42
6 150 6.625 168.3		5s 10 10s STD 40 40s XS 80 80s 120 10s 160 10s XXS 80s	2.76 3.40 7.11 10.97 14.27 18.26 21.94	11.30 13.83 28.26 42.56 54.21 67.55 79.18
8 200 8.625 219.1		5s 10 10s 20 10s 30 10s STD 40 40s 60 10s XS 80 80s 100 10s 120 10s 140 10s 160 10s XXS 80s	2.76 3.75 6.350 7.036 8.179 10.31 12.70 15.08 18.26 20.62 23.01 22.27	14.76 19.96 33.31 36.78 42.53 53.08 64.63 75.89 90.43 100.93 111.26 107.88

NOMINAL PIPE SIZE		SCHEDULE DESIGNATIONS ANSI / ASME	WALL THICKNESS MM	WEIGHT KG / METER
OD INCH MM				
10 250 10.750 273.1		5S 10S 20 10S 30 10S STD 40 40S XS 60 80S 80 10S 100 10S 120 10S 140 10S 160 10S XXS 10S	3.40 4.19 6.35 7.79 9.27 12.70 15.08 18.26 21.43 25.40 28.57	22.63 27.78 41.76 51.00 60.30 81.53 95.97 114.74 133.01 155.11 172.26
12 300 12.750 323.9		5s 10s 20 10s 30 10s STD 40s 40 40s XS 80s 60 10s 80 10s 100 10s 120 10s 140 10s 160 10s XXS 10s	3.96 4.57 6.35 8.38 9.52 10.31 12.70 14.27 17.47 21.43 25.40 28.57 33.32	31.25 35.99 49.71 65.20 73.83 79.73 97.44 108.97 132.02 159.86 186.93 208.06 238.74
14 350 14.000 355.6		10s 10 10s 20 10s STD 30 40s 40 40s XS 80s 60 10s 80 10s 100 10s 120 10s 140 10s 160 10s	4.77 6.35 7.92 9.52 11.12 12.70 15.08 19.05 23.82 27.78 31.75 35.71	41.31 54.68 67.94 81.28 94.50 107.38 126.68 158.10 194.92 224.62 253.55 281.71
16 400 16.000 406.4		10s 10 10s 20 10s STD 30 40s 40 40s XS 80s 60 40 80 40 100 40 120 40 140 40 160 40	4.77 6.35 7.92 9.52 12.70 16.66 21.43 26.18 30.96 36.52 40.48	47.29 62.64 77.87 93.21 123.29 160.13 203.50 245.53 286.65 333.14 365.33
18 450 18.000 457.2		10s 10 10s 20 10s STD 30 40s 40 40s XS 80s 60 10s 80 10s 100 10s 120 10s 140 10s 160 10s	4.77 6.35 7.92 9.52 11.12 12.70 14.27 19.05 23.82 29.36 34.92 39.67 45.23	53.27 70.59 87.79 105.15 122.37 139.20 155.91 205.82 254.61 309.78 363.67 408.49 459.56
20 500 20.000 508.0		10s 10 10s 20 40s XS 30 80s 40 10s 60 10s 80 10s 100 10s 120 10s 140 10s 160 10s	5.53 6.35 9.52 12.70 15.08 20.62 26.18 32.53 38.10 44.45 50.01	68.60 78.55 117.08 155.11 183.39 247.87 311.14 381.49 441.48 508.10 564.83
24 600 24.000 609.6		10 10s STD 20 40s XS 20 80s 30 10s 40 10s 60 10s 80 10s 100 10s 120 10s 140 10s 160 10s	6.35 9.52 12.70 14.27 17.47 24.61 30.96 38.88 46.02 52.37 59.53	94.46 140.94 186.93 209.56 255.16 355.05 441.80 547.28 639.63 719.68 807.58

**MS / GI ERW / EFW TUBE / PIPE CONFIRMING TO
IS:1239 PART 1 PLAIN END./ IS 3589 GR. 330/410/450 BEVELLED END**



MILD STEEL PIPES CONFIRMING TO IS : 1239 (PART 1) - 1979

Nominal Bore		Outside Diameter		Light		Medium		Heavy	
				Thickness	Weight	Thickness	Weight	Thickness	Weight
Inch	In mm	In	mm	mm	kg/mtr	mm	Kg/Mtr.	mm	Kg/Mtr.
1/8"	3 mm	0.406	10.32	1.80	0.361	2.00	0.407	2.65	0.493
1/4"	6 mm	0.532	13.49	1.80	0.517	2.35	0.650	2.90	0.769
3/8"	10 mm	0.872	17.10	1.80	0.674	2.35	0.852	2.90	1.02
1/2"	15 mm	0.844	21.43	2.00	0.952	2.65	1.122	3.25	1.45
3/4"	20 mm	1.094	27.20	2.35	1.410	2.65	1.580	3.25	1.90
1"	25 mm	1.312	33.80	2.65	2.010	3.25	2.440	4.05	2.97
1.1/4"	32 mm	1.656	42.90	2.65	2.580	3.25	3.140	4.05	3.84
1.1/2"	40 mm	1.906	48.40	2.90	3.250	3.25	3.610	4.05	4.43
2"	50 mm	2.375	60.30	2.90	4.110	3.65	5.100	4.47	6.17
2.1/2"	65 mm	3.004	76.20	3.25	5.840	3.65	6.610	4.47	7.90
3"	80 mm	3.500	88.90	3.25	6.810	4.05	8.470	4.85	10.1
4"	100 mm	4.500	114.30	3.65	9.890	4.50	12.10	5.40	14.4
5"	125 mm	5.500	139.70	-	-	4.85	16.20	5.40	17.8
6"	150 mm	6.500	165.10	-	-	4.85	19.20	5.40	21.2



LARGE DIAMETER ERW PIPES CONFIRMING TO IS 3589

Wall Thickness in mm	Nominal Bore 7" NB 193.7 mm OD	Nominal Bore 8" NB 219.1 mm OD	Nominal Bore 10" NB 273 mm OD	Nominal Bore 12" NB 323.7 mm OD	Nominal Bore 14" NB 355.6 mm OD	Nominal Bore 16" NB 406.4 mm OD	Nominal Bore 18" NB 457 mm OD	Nominal Bore 20" NB 508 mm OD
kg/mtr	kg/mtr	kg/mtr	kg/mtr	kg/mtr	kg/mtr	kg/mtr	kg/mtr	kg/mtr
4.85	22.59	25.62	32.07	38.13	-	-	-	-
5.60	26.00	29.28	36.93	43.93	48.11	-	-	-
6.00	27.88	31.53	39.50	47.02	51.49	61.00	69.00	-
6.35	29.34	33.28	41.73	49.67	54.43	62.35	70.50	78.50
7.01	32.27	36.76	46.43	55.45	61.82	69.04	-	-
7.94	-	41.00	50.95	61.85	67.98	77.92	87.80	-
8.18	-	42.56	53.42	65.12	-	-	-	-
9.53	-	51.50	60.24	73.75	81.21	93.13	105.00	117.00
12.70	-	-	-	-	107.28	123.30	139.00	155.00

STANDARD TYPES OF STAINLESS STEEL GAUGE PIPES

Standard Types Of Stainless Steel Gauge Pipes

Size	O.D in mm	10G (3.25) (0.120")	12G (2.64) (0.104")	14G (2.03) (0.080")	16G (1.65) (0.065")	186G (1.21) (0.049")	20G (0.91) (0.035")	22G (0.71) (0.028")
1/4	6.35	0.075	0.070	0.065	0.058	0.046	0.037	0.030
5/16"	7.93	0.114	0.105	0.089	0.079	0.060	0.048	0.038
3/8"	9.52	0.152	0.135	0.113	0.097	0.080	0.058	0.046
1/2"	12.7	0.226	0.200	0.157	0.134	0.105	0.079	0.063
5/8"	15.87	0.310	0.264	0.212	0.174	0.134	0.103	0.081
3/4"	19.05	0.386	0.326	0.256	0.215	0.161	0.124	0.097
7/8"	22.25	0.465	0.390	0.310	0.252	0.192	0.145	0.113
1"	25.4	0.541	0.450	0.351	0.294	0.218	0.167	0.131
1 1/4"	31.750	0.696	0.580	0.448	0.375	0.275	0.200	0.162
1 1/2"	38.1	0.851	0.700	0.542	0.452	0.332	0.250	0.196
1 3/4"	44.45	1.020	0.832	0.646	0.530	0.390	0.294	0.230
2"	50.8	1.161	0.960	0.733	0.607	0.447	0.336	0.263
2 1/4"	57.15	1.315	1.085	0.828	0.687	0.504	-	-
2 1/2"	63.5	1.472	1.210	0.924	0.792	0.562	All Schedule size pipes are available in (+-) Tolerance Thickness Length as requirement and gauges pipes & tubes also available in various outside diameter & thickness & length as requirement Finishing : Aluminium, Bright, Polished, Matt, EP as requirement.	
2 3/4"	69.85	1.630	1.338	1.022	0.847	0.619		
3"	76.2	1.782	1.460	1.115	0.924	0.676		
3 1/2"	88.9	2.092	1.718	1.306	1.082	0.791		
4"	101.6	2.403	1.971	1.497	1.239	0.905		
4 1/2"	114.3	2.713	2.224	1.608	1.397	1.020		
5"	127.0	3.023	2.477	1.879	1.554	1.134		
5 1/2"	139.7	3.336	2.730	2.070	1.713	1.250		
6"	152.4	3.654	2.983	2.261	1.875	1.364		

CARBON STEEL, ALLOY STEEL, LOW TEMP, PIPE & TUBES SPECIFICATION

CHEMICAL ANALYSIS									MECHANICAL PROPERTIES			SPECIFIC REQUIREMENT
									TENSILE STRENGTH	YIELD TRESS	ELONGA-TION	
SPECIFICATION	WT	C%	Mn %	P % MAX	S% MAX	Si%	Cr%	Mo%	Mpa	Mpa	50mm MIN	
ASTM A 53/A	AW	0.25MAX	0.95MAX	0.050	0.060	-	-	-	330MIN	205MIN	36	Cr Mo Cu Ni Va 40 15 40 40 08 Five elements not to exceed 1%
ASTM A 53/B	AW	0.30MAX	1.20MAX	0.050	0.060	-	-	-	415MIN	240MIN	29/5	
ASTM A 106/A	AW	0.25MAX	0.27-0.93	0.035	0.025	0.10MIN	0.40MAX	0.15MAX	330MIN	205MIN	35/2	
ASTM A 106/B	AW	0.35MAX	0.29-1.06	0.035	0.025	0.10MIN	0.40MAX	0.15MAX	415 MIN	240MIN	30/22	
ASTM A 106/C	AW	0.35MAX	0.29-1.06	0.035	0.025	0.10MIN	0.40MAX	0.15MAX	485MIN	275MIN	30/22	
ASTM A 179	MW	0.06-018	0.27-0.63	0.035	0.035	-	-	-	325MIN	180MIN	35.0	Hardness 72 HRB Max
ASTM A 214	MW	0.18MAX	0.27-0.63	0.035	0.035	-	-	-	385MIN	180MIN	35.0	Hardness 72 HRB Max
ASTM A 192	MW	0.06-0.18	0.27-0.63	0.035	0.035	0.25MAX	-	-	325MIN	180MIN	35.0	Hardness 77 HRB Max
ASTM A 209/T1	MW	0.10-0.20	0.30-0.80	0.025	0.025	0.10-0.50	-	0.44-0.65	380MIN	205MIN	30/22	Hardness 80 HRB Max
ASTM A 209/T1a	MW	0.15-0.25	0.30-0.80	0.025	0.025	0.10-0.50	-	0.44-0.65	365MIN	195MIN	30/22	Hardness 81 HRB Max
ASTM A 209/T1b	MW	0.14MAX	0.30-0.80	0.025	0.025	0.10MIN	-	0.44-0.65	415MIN	220MIN	30/22	Hardness 77 HRB Max
ASTM A 210/A-1	MW	0.27max	0.93max	0.048	0.035	0.10MIN	-	-	415MIN	255MIN	30/22	Hardness 79 HRB Max
ASTM A 210/C	MW	0.35MAX	0.29-1.06	0.048	0.035	0.10MIN	-	-	485MIN	275MIN	30/22	Hardness 89 HRB Max
ASTM A 213/T2	MW	0.10/0.20	0.30-0.61	0.025	0.025	0.10-0.30	0.50-0.81	0.44-0.65	415MIN	205MIN	30/22	Hardness 85 HRB Max
ASTM A 213/T5	MW	0.15MAX	0.30-0.60	0.025	0.025	0.50MAX	4.00-6.00	0.44-0.65	415MIN	205MIN	30/22	Hardness 85 HRB Max
ASTM A 213/T11	MW	0.15MAX	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	0.44-0.65	415MIN	205MIN	30/22	Hardness 85 HRB Max
ASTM A 213/T12	MW	0.15MAX	0.30-0.61	0.025	0.025	0.50MAX	0.80-1.25	0.44-0.65	415MIN	205MIN	30/22	Hardness 85 HRB Max
ASTM A 213/T22	MW	0.15MAX	0.30-0.60	0.025	0.025	0.50MAX	1.90-2.60	0.87-1.13	415MIN	205MIN	30/22	Hardness 85 HRB Max
ASTM A 333/3	AW	0.19MAX	0.31-1.64	0.025	0.025	0.18-0.37	Ni	3.18-3.82	380MIN	205MIN	35/25	IMPACT AS -50F FOR 40X10/18/1490 MRB -50F40X10/18/14 90 HRB MAX
ASTM A 333/6	AW	0.30MAX	0.29-1.06	0.025	0.025	0.10MIN	-	-	415MIN	240MIN	30/22	
ASTM A 334/3	AW	0.19MAX	0.31-1.64	0.025	0.025	0.18-0.37	Ni	3.18-3.82	380MIN	205MIN	35/28	
ASTM A 334/6	MW	0.30MAX	0.9-1.06	0.025	0.025	0.10MIN	-	-	415MIN	240MIN	30/22	
ASTM A 335/P1	AW	0.10-0.20	0.30-0.80	0.025	0.025	0.10-0.50	-	0.40-0.65	380MIN	205MIN	30/22	
ASTM A 335/P2	AW	0.10-0.20	0.30-0.61	0.025	0.025	0.10-0.30	0.50-0.81	0.40-0.65	380MIN	205MIN	30/22	
ASTM A 335/P5	AW	0.15MAX	0.30-0.60	0.025	0.025	0.50-1.00	4.00-6.00	0.40-0.65	415MIN	205MIN	30/22	
ASTM A 335/P11	AW	0.15MAX	0.30-0.61	0.025	0.025	0.50MAX	0.80-1.25	0.40-0.65	415MIN	205MIN	50/22	
ASTM A 335/P12	AW	0.15MAX	0.30-0.60	0.025	0.025	0.50MAX	1.90-2.60	0.87-1.13	415MIN	205MIN	30/22	
ASTM A 335/P22	AW	0.15MAX	0.30-0.60	0.025	0.025	0.50MAX	1.90-2.60	0.87-1.13	415MIN	205MIN	30/22	
BS/3059/1/33		0.15Max	0.30-0.70	0.050	0.050	-	-	-	324-441	186MIN	25	
BS/3059/2/33		0.15MAX	0.40-0.70	0.050	0.050	0.10-0.35	-	-	324-441	186MIN	21	
BS/3059/245		0.12-0.18	0.90-1.20	0.035	0.035	0.10-0.35	-	-	441-560	245MIN	22	
DIN/17175/ST35.8		0.17MAX	0.40MIN	0.040	0.040	0.35MAX	-	-	340-441	235MIN	25	
DIN/17175/ST45.8		0.22MAX	0.45MIN	0.040	0.040	0.10-0.35	-	-	441-540	255 MIN	25	
DIN/17175/15MO3		0.12-0.20	0.50-0.80	0.040	0.040	0.10-0.35	-	0.25-0.35	441-540	284MIN	21	
DIN/17175/13CrMO44		0.10-0.18	0.40-0.60	0.040	0.040	0.10-0.35	0.70-1.60	0.40-0.50	441-570	294MIN	22	
DIN/17175/10CrM910		0.15MAX	0.40-0.60	0.040	0.040	0.15-0.50	2.0-2.5	0.9-1.10	441-570	249MIN	22	
ASTM A 199/T5	MW	0.50-0.15	0.30-0.60	0.025	0.025	0.50MAX	4.00-6.00	0.45-0.65	415MIN	170MIN	30/22	HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX HARDNESS 85 HRB MAX
ASTM A 199/T11	MW	0.05-0.15	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	0.44-0.65	415MIN	170MIN	30/22	
ASTM A 199/T22	MW	0.05-0.15	0.30-0.60	0.025	0.025	0.50MAX	1.90-2.60	0.87-1.13	415MIN	170MIN	30/22	
ASTM A 199/T4	MW	0.15MAX	0.30-0.60	0.025	0.025	0.50-1.00	2.15-2.85	0.44-0.65	415MIN	170MIN	30/22	
ASTM A 199/T7	MW	0.15MAX	0.30-0.60	0.025	0.025	0.50-1.00	6.00-8.00	0.45-0.65	415MIN	170MIN	30/22	
ASTM A 200/T5	MW	0.15MAX	0.30-0.60	0.025	0.025	0.50-1.00	4.00-6.00	0.45-0.65	415MIN	170MIN	30/22	
ASTM A 200/T11	MW	0.05-0.15	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	0.44-0.65	415MIN	170MIN	30/22	
ASTM A 200/T22	MW	0.05-0.15	0.30-0.60	0.030	0.030	0.50MAX	1.90-2.60	0.87-1.13	415MIN	170MIN	30/22	
ASTM A 200/T4	MW	0.05-0.15	0.30-0.60	0.030	0.030	0.50-1.00	2.15-2.85	0.44-0.65	415MIN	170MIN	30/22	
ASTM A 200/T7	MW	0.15MAX	0.30-0.60	0.030	0.030	0.50-1.00	6.00-8.00	0.45-0.65	415MIN	170MIN	30/22	
ASTM A 199/T9	MW	0.15MAX	0.30-0.60	0.030	0.030	0.25-1.00	8.00-10.0	0.90-1.10	415MIN	170MIN	30/22	
ASTM A335/P9	MW	0.15MAX	0.30-0.60	0.025	0.025	0.25-1.00	8.00-10.00	0.09-1.10	415MIN	172MIN	30/22	
ASTM A178A	MW	0.06-0.18	0.30-0.60	0.035	0.035	-	-	-	325MIN	160MIN	35	
ASTM A178C	MW	0.35MAX	0.27-0.63	0.035	0.035	-	-	-	415MIN	170MIN	30	
ASTM A178B	MW	0.27MAX	0.80 MAX	0.030	0.015	0.10MIN	-	-	485MIN	275MIN	30	

CHEMICAL COMPOSITION OF STAINLESS STEEL

Stainless Steel is essentially a low carbon steel which contains chromium at 10% or more by weight. It is this addition of chromium that gives the steel its unique stainless corrosion resisting Properties. The corrosion resistance and other useful properties of the steel are enhanced by increased chromium content and the addition of other elements such as molybdenum, nickel and nitrogen

Chemical Composition of Stainless Steel											Nearest Equivalent Specification		
AISI Grade	UNS NO.	EN	BS	C Max	Mn Max	P Max	S Max	Si Max	Cr	Ni	Mo	Cu	I.S.

Austenitic

201	S20100	-	-	0.15	5.5/7.5	0.06	0.03	1	16.0/18.0	3.5/5.5	-	-	-
202	S20200	-	-	0.15	7.5/10	0.06	0.03	1	17.0/19.0	4.0/6.0	-	-	-
301	S30100	-	301S21	0.15	2.0max	0.045	0.040	1.0	16.0/18.0	6.0/8.0	-	-	10Cr17Ni7
302	S30200	-	-	0.15	2.0	0.045	0.030	1.0	17.0/19.0	8.0/10.0	-	-	07Cr18Ni9
303	S30300	-	303S31	0.15	2.0	0.045	0.15 min	1.0	17.0/19.0	8.0/10.0	-	-	15Cr18Ni9
304	S30400	1.4301	-	0.08	2.0	0.045	0.030	1.0	18.0/20.0	8.0/10.0	-	-	04Cr18Ni10
304L	S30403	1.4307	304S11	0.030	2.0	0.045	0.030	1.0	18.0/20.0	8.0/12.0	-	-	02Cr18Ni11
304LN	S30453	1.4306	304S61	0.030	2.0	0.045	0.030	0.75	18.0/20.0	8.0/11.0	-	-	-
304H	S30409	-	-	0.05	2.0	0.045	0.03	1	18.0/20.0	8.5/9.5	-	-	-
309	S30900	-	309S16	0.20	2.0max	0.045	0.030	1.0	22.0/24.0	12.0/15.0	-	-	20Cr24Ni12
309S	S30908	1.4833	-	0.08	2.0	0.045	0.030	1.0	22.0/24.0	12.0/15.0	-	-	-
310H	S31009	-	-	0.25	2.0	0.045	0.030	1.50	24.0/26.0	19.0/22.0	-	-	10Cr25Ni12
310S	S31008	1.4845	-	0.08	2.0	0.045	0.030	1.50	24.0/26.0	19.0/22.0	-	-	-
316	S31600	-	316S31	0.08	2.0	0.045	0.030	1.0	16.0/18.0	10.0/14.0	2.0/3.0	-	04Cr17Ni12Mo2
316L	S31603	1.4404	316S11	0.030	2.0	0.045	0.030	1.0	16.0/18.0	10.0/14.0	2.0/3.0	-	03Cr17Ni12Mo2
316LN	S31653	-	316S61	0.030	2.0	0.045	0.030	0.75	16.0/18.0	10.0/14.0	2.0/3.0	-	-
316Ti	S31635	1.4571	320S31	0.080	2.0	0.045	0.030	1.0	16.0/18.0	10.0/14.0	2.0/3.0	-	-
317	S31700	-	-	0.08	2.0	0.045	0.030	1.0	18.0/20.0	11.0/15.0	3.0/4.0	-	-
317L	S31703	-	317S12	0.030	2.0	0.045	0.030	1.0	18.0/20.0	11.0/15.0	3.0/4.0	-	-
317LN	S31753	-	-	0.03	2.0	0.045	0.03	1	18.0/20.0	11.0/15.0	3.0/4.0	-	-
321	S32100	1.4541	321S31	0.08	2.0	0.045	0.030	1.0	17.0/19.0	9.0/12.0	-	-	04Cr18Ni10Ti20
347	S34700	-	347S31	0.08	2.0	0.045	0.030	1.0	17.0/19.0	9.0/12.0	-	-	04Cr18Ni10Nb-40
904L	N08904	1.4539	-	0.02	2.0	0.045	0.035	1	19.0/23.0	23.0/28.0	4.0-5.0	-	-

Ferritic

410	S41000	-	410S21	0.15	1.00	0.040	0.030	1.0	11.50-13.50	0.75	...	...	...
410S	S41008	1.4000	403S17	0.08	1.00	0.040	0.030	1.0	11.50-13.50	0.60	...	...	...
429 ^o	S42900	-	-	0.12	1.00	0.040	0.030	1.0	14.00-16.00	...	...	...	...
430	S43000	1.4016	430S17	0.12	1.00	0.040	0.030	1.0	16.00-18.00	0.75	...	...	...
439	S43035	-	-	0.07	1.00	0.040	0.030	1.0	17.00-19.00	0.050	...	0.04	...
444	S44400	-	-	0.025	1.00	0.040	0.030	1.0	17.5-19.5	1.00	1.75-2.50	0.035	...
446	-	-	-	0.25	1.50	0.040	0.030	0.50	11.40/13.00	-	-	-	-
409L	-	-	-	≤ 0.030	≤ 1.00	≤ 1.00	-	-	-	10.50~11.75	~	-	-

Duplex & Super Duplex

---	S31803	1.4462	-	0.030	2.00	0.030	0.020	1.0	21.0-23.0	4.5-6.5	2.5-3.5	—	0.08-0.20
255 ^o	S32550	-	-	0.040	1.50	0.040	0.030	1.0	24.0-27.0	4.5-6.5	2.9-3.9	1.50-2.50	0.10-0.25
2507	S32750	1.441	-	0.030	1.20	0.035	0.020	0.8	24.0-26.0	6.0-8.0	3.0-5.0	0.50	0.24-0.32
---	S32760	-	-	0.030	1.00	0.030	0.010	1.0	24.0-26.0	6.0-8.0	3.0-4.0	0.50-1.00	0.20-0.30

MECHANICAL PROPERTIES OF S.S. PIPES

Table-2 Annealing Requirements

A312/A 312M

Table-3 Tensile Requirements

Grade or UNS Designation	Solution Treating Temperature	Cooling Requirements
All Grades not individually listed below	1900° (1040°C)	rapid°
TP321H, TP347H, TP348H		
Cold Rolled	2000°F (1100°C)	
Hot Rolled only	1925°F (1050°C)	
TP304H, TP316H,		
Cold Rolled	1900°F (1040°C)	
Hot rolled only	1900°F (1040°C)	
TP309H, TP309HCb, TP310H	1900°F (1040°C)	
TP310HCb		
S30815	1920°F (1050°C)	rapid°
s31272	1920°F (1050°C)	rapid°
S31254	2100°F (1050°C)	rapid°
S24565	2050-2140°F (1120-1170°C)	rapid°
S35315	2010°F (1100°C)	rapid°
N08367	2010°F (1100°C)	rapid°
N08904	2010°F (1100°C)	rapid°

Grade	UNS Designation	Tensile Strength, min Ksi (MPa)	Yield Strength, Min Ksi (MPa)
TP304L	S30403	70 (485)	25 (170)
TP316L	S31603	70 (485)	25 (170)
TP304	S30400	75 (515)	30 (205)
TP304h	S30409	75 (515)	30 (205)
TP309Cb	S30940	75 (515)	30 (205)
TP309H	S30909	75 (515)	30 (205)
TP309HCb	S30941	75 (515)	30 (205)
TP309s	S30908	75 (515)	30 (205)
TP310Cb	S31040	75 (515)	30 (205)
TP310H	S31009	75 (515)	30 (205)
TP310HCb	S31041	75 (515)	30 (205)
TP310s	S31008	75 (515)	30 (205)
	S31272	65 (450)	29 (200)
TP316	S31600	75 (515)	30 (205)
TP316H	S31609	75 (515)	30 (205)
TP317	S31700	75 (515)	30 (205)
TP317L	S31703	75 (515)	30 (205)
TP321	S32100		
Welded		75 (515)	30 (205)
Seamless			
≤ 3/8 in.		75 (515)	30 (205)
> 3/8 in.		70 (485)	25 (170)
TP321H	S32109		
Welded		75 (515)	30 (205)
Seamless			
< 3/8 in.		75 (515)	30 (205)
> 3/8 in.		70 (485)	25 (170)
TP347	S34700	75 (515)	30 (205)
TP347H	S34700	75 (515)	30 (205)
TP347LN	S34751	75 (515)	30 (205)
TP348	S34800	75 (515)	30 (205)
TP348H	S34809	75 (515)	30 (205)
TPXM-10	S21900	90 (620)	50 (345)
TPXM-11	S21904	90 (620)	50 (345)
TPXM-15	S38100	75 (515)	30 (205)
TPXM-29	S24000	100 (690)	55 (380)
TPXM-19	S20910	100 (690)	55 (380)
TP304N	S30451	80 (550)	35 (240)
TP316N	S31651	80 (550)	35 (240)
TP304LN	S31653	75 (515)	30 (205)
-	S31254	94 (650)	44 (300)
-	S30615	90 (620)	40 (275)
-	S30815	87 (600)	45 (310)
-	S30600	75 (540)	35 (240)
-	S31725	75 (515)	30 (205)
-	S31726	80 (550)	35 (240)
-	S31050		
T<0.25 in.		84 (580)	39 (270)
T>0.25 in.		78 (540)	37 (255)
-	s32615	80 (550)	32 (220)
-	S33228	73 (500)	27 (185)
-	S24565	115 (795)	60 (415)
-	S30415	87 (600)	42 (290)
-	S32654	109 (750)	62 (430)
-	S35315	94 (650)	39 (270)
-	N08367:		
t<0.187		100 (690)	45 (310)
t>0.187		95 (655)	45 (310)
-	N08904	71 (490)	31 (215)

Elongation in 2 in or 50mm (or 4D), min, % Longitudinal Transverse

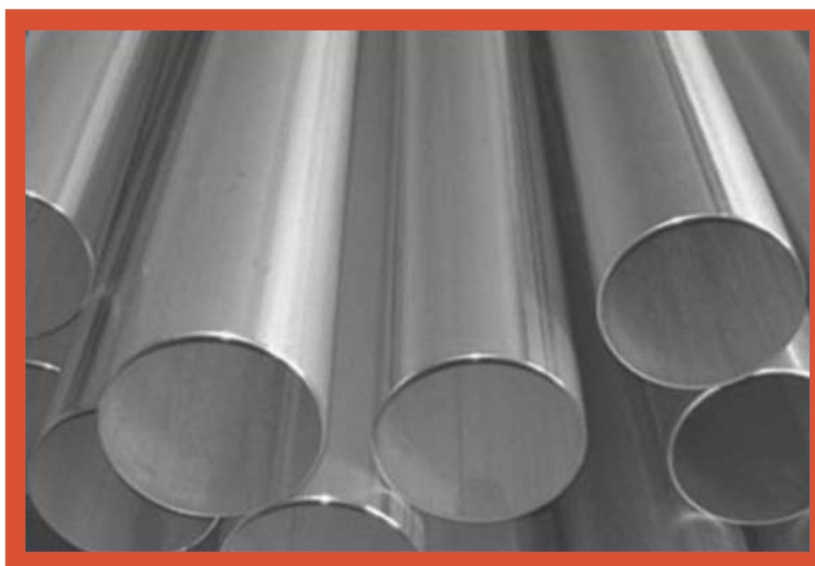
All Grades except S31050 and S32615 35 25 S32615, S31050 25 - N08367

Prior to the issuance of A312/A 312 M -88a, the tensile and yield strength values were 76 (515) and 30 (205) respectively, for nominal wall greater than 3/8 in. (9.5mm)



TOLERANCE : ASTM SPECIFICATION FOR TUBING & PIPING

Specification	Allowable Outside Diameter Variation in mm			Allowable Wall Thickness Variation		Exact Length Tolerance in mm		Testing
ASTM-A213 Seamless Boiler Superheater and Heat Exchanger Tubes	Nominal Diameter 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	Over .1016 .1524 .2032 .254 .3048 .381	Under .1016 .1524 .2032 .254 .3048 .381	%Over +20 +22 +22 +2 +22 +22	%Under -0 -0 -0 -0 -0 -0	Over 3.175 3.175 3.176 4.46 4.76 4.76	Under 0 0 0 0 0 0	Tension Test Flattening Test Flare Test Hardness Test 100% Hydrostatic test Refer to ASTM A-450
ASTM-A249 Welded Boiler Superheater , Heat Exchanger And Condenser T ubes	Under 25.4 25.4 - 38.1 incl 38.1-50.8 Excl 50.0-63.5 excl 63.5-76.2 excl 76.2-101.6 incl	.1016 .1524 .2032 .254 .3848 .381	.1016 .1524 .2032 .254 .3048 .381	+10 +10 +10 +10 +10 +10	-10 -10 -10 -10 -10 -10	3.175 3.175 3.175 4.76 4.76 4.76	0 0 0 0 0 0	Tension Test Flattening Test Flare Test Reverse Bend Test Hardness Test 100% Hydrostatic Test *Reverse flattening Test Refer to ASTM A-450 *Wherever applicable
ASTM-A269 Seamless & W elded Tubing for General Service	Upto 12.7 12.7- 38.1 excl 38.3 - 88.9 excl 88.9 -139.7 excl 139.7-203.2 excl	.13 .13 .25 .38 .76	.13 .13 .25 .38 .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-A269
ASTM-A270 Seamless & Welded Sanitary Tubing	25.4 38.1 50.8 60.5 76.2 101.6	.05 .05 .05 .05 .08 .08	.20 .20 .28 .28 .30 .38	+12.5 +12.5 +12.5 +12.5 +12.5 +12.5	-12.5 -12.5 -12.5 -12.5 -12.5 -12.5	3.2 3.2 3.2 3.2 4.8 4.8	0 0 0 0 0 0	Reverse flattening Test 100% Hydrostatic Test External polish on all tubes Refer to ASTM A-270
ASTM-A312 Seamless & Welded pipe	3.175-38.1 Incl 38.1-1016 Incl 101.6-203.2 Incl	.79 .4 1.59	.79 .79 .79	12.5% under Minimum Wall Nominal Wall Specified		6.4 6.4 6.4 (Normally Random Lengths ordered) 6.0	0 0 0	Tension Test Flattening Test 100% Hydrostatic Test Refer to ASTM A-530
ASTM A-358 Welded Pipe	219.06-750mm or 0.01 Inch							Refer to ASTM A-530



SPECIAL PRODUCTS

C TYPE/FLANGE COPPER EARTHING JUMPERS

Material : Copper **Bending Degree :** 90 Deg
Size : 2-inch to 14 inch **Surface Finish :** Natural
Design : Customized



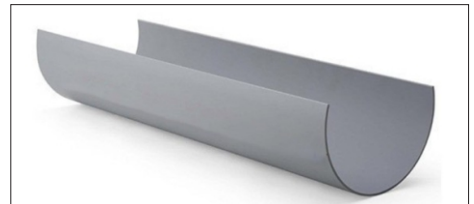
COPPER WIRE BRAIDED STRIPS & BRAIDED ROPES



WIRE MESH / BARBED WIRE / CHAIN LINK



HALF ROUND PIPE AS PER CUSTOMER REQUIREMENT



PHOSPHORUS BRONZE BAR GUN METAL BAR, BRASS BAR COPPER BAR



COPPER NICKEL PIPE & PIPE FITTINGS



BOILER TUBES AIR PRE HEATER TUBES



ALUMINUM PIPES, PLATES & BARS



APPLICATION INDUSTRIES



THIRD PARTY INSPECTION AGENCY & CONSULTANTS



FORMULAE OF CALCULATING WEIGHT

- WEIGHT OF STAINLESS STEEL / CARBON STEEL PIPES & TUBES
 $OD\ (mm) - W.T.\ (mm) \times W.T.\ (mm) \times 0.02466 = KG/MTR$
- WEIGHT OF COPPER PIPES & TUBES
 $O.D.\ (mm) - W.T.\ (mm) \times W.T.\ (mm) \times 0.0285 = KG/MTR$
- WEIGHT OF ALUMINIUM PIPES & TUBES
 $O.D.\ (mm) - W.T.\ (mm) \times W.T.\ (mm) \times 0.0082 = KG/MTR$
- WEIGHT OF LEAD PIPES & TUBES
 $O.D.\ (mm) - W.T.\ (mm) \times W.T.\ (mm) \times 0.0345 = KG/MTR$
- SHEET WIDTH REQD FOR ROLLED & WELDED PIPES
 $O.D.\ (mm) - Thk.\ (mm) \times 3.14 = SHEET\ WIDTH\ (mm)$
- WEIGHT FOR SQUARE / RECTANGLE PIPES
 $Length\ From\ 4\ Angle\ (OD)/3.14 - Thk.\ (mm) \times Thk.\ (mm) \times 0.00756 = KG/PER\ FEET$
- WEIGHT OF STAINLESS STEEL CIRCLE & BLANKS
 $O.D.\ (mm) \times O.D.\ (mm) \times Thk.\ (mm) / 160 / 1000 = KG/PCS.$
- WEIGHT OF STAINLESS STEEL SHEETS & PLATES
 $Length\ (mtr) \times Width\ (mtr) \times Thk.\ (mm) \times 8 = KG/SHEET$
- WEIGHT OF CARBON STEEL SHEETS & PLATES
 $Length\ (mtr) \times Width\ (mtr) \times Thk.\ (mm) \times 7.85 = KG/SHEET$
- WEIGHT OF ALUMINIUM SHEETS & PLATES
 $Length\ (mtr) \times Width\ (mtr) \times Thk.\ (mm) \times 2.66 = KG/SHEET$
- WEIGHT OF LEAD SHEETS & PLATES
 $Length\ (mtr) \times Width\ (mtr) \times Thk.\ (mm) \times 11.2 = KG/SHEET$
- WEIGHT OF STAINLESS STEEL ROUNDS / ROUND BAR
 $Dia.\ (mm) \times Dia.\ (mm) \times 0.00623 = KG/MTR$
- WEIGHT OF STAINLESS STEEL HEXAGONAL RODS
 $Dia.\ (mm) \times Dia.\ (mm) \times 0.00679 = KG/MTR$
- WEIGHT OF STAINLESS STEEL SQUARE RODS
 $Dia.\ (mm) \times Dia.\ (mm) \times 0.00787 = KG/MTR$



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