



The following sizes are generally available from stock in grades 304, 316 and 321. Low carbon grades 304L and 316L are also available on short mill lead times.

Stock lengths: 5 – 7 metre randoms

Certificates to DIN 50049 3.I.B.

A cutting service is available to provide your exact length requirements.

**STOCK SIZES**

Outside Diameter Inches (mm)	Wall Thickness Inches (mm)	Theoretical Inside Diameter Inches
1/32" OD (0.79mm)	x0.008" (0.20mm)	.015"
1/16" OD (1.63mm)	x0.006" (0.15mm) x0.010" (0.25mm) x0.016" (0.40mm) x0.020" (0.51mm) x0.022" (0.56mm)	.051" .043" .031" .022" .018"
3/32" OD (2.38mm)	x0.008" (0.20mm) x0.028" (0.71mm)	.078" .038"
1/8" OD (3.18mm)	x0.008" (0.20mm) x0.010" (0.25mm) x0.016" (0.40mm) x0.020" (0.51mm) x0.022" (0.56mm) x0.028" (0.71mm) x0.032" (0.81mm) x0.036" (0.91mm) x0.048" (1.22mm)	.109" .105" .093" .085" .081" .069" .061" .053" .029"
5/32" OD (3.97mm)	x0.010" (0.25mm) x0.016" (0.40mm) x0.022" (0.56mm) x0.028" (0.71mm)	.136" .124" .112" .100"
3/16" OD (4.76mm)	x0.010" (0.25mm) x0.016" (0.40mm) x0.020" (0.51mm) x0.022" (0.56mm) x0.028" (0.71mm) x0.036" (0.91mm) x0.048" (1.22mm)	.168" .156" .148" .144" .132" .118" .090"
<b>RS 682-898</b>		
.197" OD (5mm)	x0.020" (0.51mm)	.158"

Outside Diameter Inches (mm)	Wall Thickness Inches (mm)	Theoretical Inside Diameter Inches
.236" OD (6mm)	x0.020" (0.51mm) x0.039" (1.00mm) x0.059" (1.50mm)	.196" .157" .118"
1/4" OD (6.35mm)	x0.006" (0.15mm) x0.010" (0.25mm) x0.016" (0.40mm) x0.020" (0.51mm) x0.022" (0.56mm) x0.028" (0.71mm) x0.032" (0.81mm) x0.036" (0.91mm) x0.048" (1.22mm) x0.064" (1.63mm) x0.080" (2.03mm)	.238" .230" .218" .210" .206" .194" .186" .178" .154" .122" .090"
<b>RS 682-905</b>		
5/16" OD (7.94mm)	x0.022" (0.56mm) x0.028" (0.71mm) x0.032" (0.81mm) x0.036" (0.91mm) x0.048" (1.22mm) x0.064" (1.63mm)	.269" .257" .249" .241" .217" .185"
.315" OD (8mm)	x0.039" (1.00mm) x0.059" (1.50mm) x0.079" (2.00mm)	.236" .197" .158"
3/8" OD (9.53mm)	x0.022" (0.56mm) x0.028" (0.71mm) x0.032" (0.81mm) x0.036" (0.91mm) x0.048" (1.22mm) x0.064" (1.63mm) x0.080" (2.03mm) x0.125" (3.18mm)	.331" .319" .311" .303" .279" .247" .215" .125"
<b>RS 682-911</b>		
.394" OD (10mm)	x0.039" (1.00mm) x0.059" (1.50mm) x0.079" (2.00mm)	.315" .275" .236"

# SEAMLESS TUBE

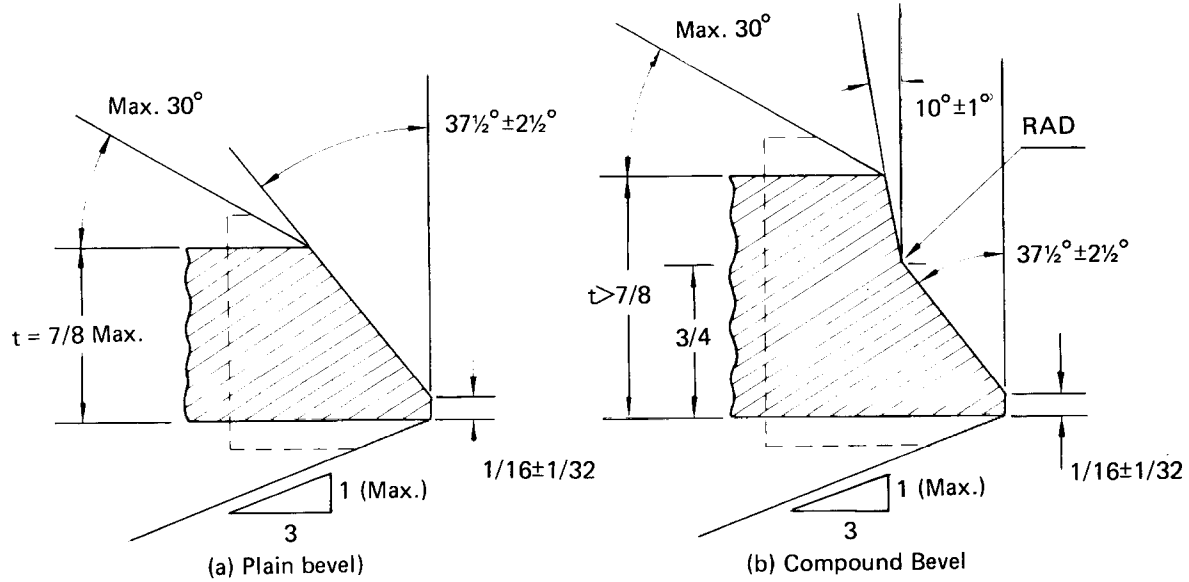


## Stainless Steel Seamless Tubes ASTM A213-89/ASTM A269-88 & ASTM A511-88

Outside Diameter Inches (mm)	Wall Thickness Inches (mm)	Theoretical Inside Diameter Inches
.405" OD (10.29mm)	(see Pipe Section 1/8" NB SCH 10 to SCH 40)	
7/16" OD (11.11mm)	x0.028" (0.71mm) x0.036" (0.91mm) x0.048" (1.22mm) x0.064" (1.63mm)	.382" .366" .342" .310"
.437" OD (12mm)	x0.039" (1.00mm) x0.059" (1.50mm) x0.079" (2.00mm)	.394" .355" .315"
1/2" OD (12.70mm)	x0.010" (0.25mm) x0.028" (0.71mm) x0.036" (0.91mm) x0.048" (1.22mm) RS 682-927 x0.064" (1.63mm)	.480" .444" .428" .404" .372"
.540" OD (13.72mm)	(see Pipe Section 1/4" NB SCH 10 to SCH 80)	
9/16" OD (14.29mm)	x0.032" (0.81mm) x0.048" (1.22mm) x0.064" (1.63mm)	.499" .467" .435"
.591" OD (15mm)	x0.059" (1.50mm)	.473"
5/8" OD (15.88mm)	x0.028" (0.71mm) x0.036" (0.91mm) x0.048" (1.22mm) RS 682-933 x0.064" (1.63mm)	.569" .553" .529" .497"
.675" OD (17.15mm)	(see Pipe Section 3/8" NB SCH 10 to SCH 80)	
11/16" OD (17.46mm)	x0.036" (0.91mm) x0.064" (1.63mm)	.616" .560"

Outside Diameter Inches (mm)	Wall Thickness Inches (mm)	Theoretical Inside Diameter Inches
3/4" OD (19.05mm)	x0.028" (0.71mm) x0.036" (0.91mm) x0.048" (1.22mm) RS 682-949 x0.064" (1.63mm)	.694" .678" .654" .622"
	x0.080" (2.03mm) x0.104" (2.64mm) x0.125" (3.18mm) x0.188" (4.78mm)	.590" .542" .500" .374"
.788" OD (20mm)	x0.039" (1.00mm) x0.059" (1.50mm) x0.079" (2.00mm)	.710" .670" .630"
13/16" OD (20.64mm)	x0.064" (1.63mm)	.684"
.840" OD (21.34mm)	(see Pipe Section 1/2" NB SCH 5 to SCH 160)	
7/8" OD (22.23mm)	x0.036" (0.91mm) x0.048" (1.22mm) x0.064" (1.63mm) x0.080" (2.03mm) x0.125" (3.18mm)	.803" .779" .747" .715" .625"
.975" OD (25mm)	x0.059" (1.50mm)	.867"
1" OD (25.40mm)	x0.028" (0.71mm) x0.036" (0.91mm) x0.048" (1.22mm) RS 682-955 x0.064" (1.63mm)	.944" .928" .904" .872"
	x0.080" (2.03mm) x0.104" (2.64mm) x0.125" (3.18mm) x0.188" (4.78mm) x0.250" (6.35mm)	.840" .792" .750" .624" .500"
1.050" OD (26.67mm)	(see Pipe Section 3/8" NB SCH 5 to SCH 160)	
1 1/8" OD (28.58mm)	x0.036" (0.91mm) x0.048" (1.22mm) x0.064" (1.63mm) x0.125" (3.18mm)	1.053" 1.029" .997" .875"

# Stainless Steel Butt-Welding Fittings Welding End Preparation



ANSI B16.9

(in inches)

Nominal Pipe Wall Thickness (t)	End Preparation
Less than 1/8	Cut square or slightly chamfer, at mfr.'s option
1/8 to 7/8 incl.	Plain bevel as in sketch "a" above
More than 7/8	Compound bevel as in sketch "b" above

- Notes: 1. End preparations are in accordance with ANSI B16.25 Paragraph 4.2  
 2. End preparations conforming to customer specifications will be specially manufactured upon consultation.



# TOLERANCE TABLES

## ASTM A312-A530 & A269-A450

### Stainless Steel ASTM A312-A530

#### Permissible variations in outside diameter

Nominal Pipe Size, in.	Permissible variations in outside diameter			
	Over		Under	
	in.	mm	in.	mm
1/8 to 1 1/2, incl	1/64 (0.015)	0.40	1/32 (0.031)	0.79
Over 1 1/2 to 4, incl	1/32 (0.031)	0.79	1/32 (0.031)	0.79
Over 4 to 8, incl	1/16 (0.062)	1.59	1/32 (0.031)	0.79
Over 8 to 18, incl	3/32 (0.093)	2.38	1/32 (0.031)	0.79
Over 18 to 26, incl	1/8 (0.125)	3.18	1/32 (0.031)	0.79
Over 26 to 34, incl	5/32 (0.156)	3.79	1/32 (0.031)	0.79
Over 34 to 48, incl	3/16 (0.187)	4.76	1/32 (0.031)	0.79

#### Permissible variations in wall thickness

Seamless and welded – The minimum wall thickness at any point shall not be more than 12.5% under the nominal wall thickness specified.

### Stainless Steel ASTM A269-A450

#### Permissible variations in dimensions

Group	Size, outside diameter, in.	Permissible variations in outside diameter, in. (mm)	Permissible variations in wall thickness, <sup>a</sup> percent	Ovality shall be double the permissible variations in outside diameter when wall thickness is	Permissible variations in cut length, in (mm) <sup>b</sup>	
					Over	Under
1	Up to 1/2	±0.005 (0.13)	±15	..	1/8 (3.2)	0
2	1/2 to 1 1/2, excl	±0.005 (0.13)	±10	less than 0.065 in. (1.65 mm)	1/8 (3.2)	0
3	1 1/2 to 3 1/2, excl	±0.010 (0.25)	±10	less than 0.095 in. (2.42 mm)	3/16 (4.8)	0
4	3 1/2 to 5 1/2, excl	±0.015 (0.38)	±10	less than 0.150 in. (3.81 mm)	3/16 (4.8)	0
5	5 1/2 to 8, excl	±0.030 (0.76)	±10	..	3/16 (4.8)	0

<sup>a</sup>When tubes as ordered require wall thickness 3/4 in. (19.0 mm) or over, or an inside diameter 60 percent or less of the outside diameter, a wider variation in wall thickness is required. On such sizes a variation in wall thickness of 12.5 percent over or under will be permitted.

For tubes less than 1/2 in. (12.7 mm) in inside diameter which cannot be successfully drawn over a mandrel, the wall thickness may vary ± 15 percent from that specified.

<sup>b</sup>These tolerances apply to cut lengths up to and including 24 ft (7.3 m). For lengths over 24 ft an additional over tolerance of 1/8 in. (3.2 mm) for each 10 ft (3.0 m) or fraction thereof shall be permissible, up to a maximum tolerance of 1/2 in. (12.7 mm).

# Stainless Steel Standards and Qualities



**Chemical Composition requirements** of Austenitic Stainless Steel grades shown throughout this brochure, in accordance with the A.S.T.M. (American Society for Testing and Materials).

Grade	Uns. Spec.	C Carbon	Mn Manganese (Max)	P Phosphorus (Max)	S Sulphur (Max)	Si Silicon (Max)	Ni Nickel	Cr Chromium	Mo Molybdenum	Ti Titanium
TP304	S30400	0.08 (Max)	2.00	0.040	0.030	0.75	8.00 - 11.00	18.00 - 20.00	—	—
TP304H	S30409	0.04 - 0.10	2.00	0.040	0.030	0.75	8.00 - 11.00	18.00 - 20.00	—	—
TP304L	S30403	0.035 (Max) <i>B</i>	2.00	0.040	0.030	0.75	8.00 - 13.00	18.00 - 20.00	—	—
TP316	S31600	0.08 (Max)	2.00	0.040	0.030	0.75	11.00 - 14.00	16.00 - 18.00	2.00 - 3.00	
TP316H	S31609	0.04 - 0.10	2.00	0.040	0.030	0.75	11.00 - 14.00	16.00 - 18.00	2.00 - 3.00	
TP316L	S31603	0.035 (Max) <i>B</i>	2.00	0.040	0.030	0.75	10.00 - 15.00	16.00 - 18.00	2.00 - 3.00	
TP321	S32100	0.08 (Max)	2.00	0.040	0.030	0.75	9.00 - 13.00	17.00 - 20.00	—	5 x C Min 0.60% max

*B* — For small diameter or thin walls or both, where many drawing passes are required during manufacture, a maximum carbon of .040% is permitted in grades TP304L and TP316L.

Small outside diameter tubes  $\leq \frac{1}{2}$ " OD (12.70mm)

Thin wall tubes  $\leq 0.049$  inch (1.25mm)

**Please note:**

ASTM Standards in Tubular products **are not** directly comparable with B.S. (British Standard) specifications, however, ASTM standards can be considered as possible alternatives.

Check with your local branch as to chemical and mechanical variations.



## Stainless Steel Standards and Qualities

**Tensile requirements** of Austenitic Stainless Steel grades shown throughout this brochure, in accordance with the A.S.T.M. (American Society for Testing and Materials).

<b>Grade</b>	<b>UNS Designation</b>	<b>Tensile Strength Min. Ksi [MPa]</b>	<b>Yield Strength Min. Ksi [MPa]</b>	<b>Elongation in 2 inches or 50mm Min, % (Longitudinal)</b>
TP304	S30400	75 [515]	30 [205]	35
TP304H	S30409	75 [515]	30 [205]	35
TP304L	S30403	70 [485]	25 [170]	35
TP316	S31600	75 [515]	30 [205]	35
TP316H	S31609	75 [515]	30 [205]	35
TP316L	S31603	70 [485]	25 [170]	35
TP321	S32100	75 [515]	30 [205]	35

**Please note:**

On seamless stainless steel tubing as per ASTM A269, chemical analysis only is shown on certificates unless material is dual-certified to ASTM A213 at time of manufacture by the manufacturer. Ask your local branch to check the material test certificates should mechanical results be required.

# Table of Stainless Steel Hardness and Tensile Strength



BRINELL hardness: HB = sphere mm 10 - test load kg 3000 - time required 30" ● ROCKWELL hardness: HRC = diamond cone 120° - test load kg 150  
● ROCKWELL hardness: HRB = sphere 1/16" - test load kg 100

VICKERS hardness: HV = diamond pyramid 136° - test load kg 30 ● SHORE hardness: Sh = american ange D o C.

Tensile strength kgt/mm <sup>2</sup> R	Brinell d impression	Hardness		Rockwell hardness		Shore hardness	
		Brinell HB	Vickers HV	HRC	HRB	Sh D	Sh C
74	4.07	220	236	18.5			
	4.09	218	234	18.1	97		
73	4.11	216	232	17.6			
72	4.12	214	229	16.9			
	4.14	212	227	16.4	96		
71	4.16	210	15.9				
70	4.18	208	223	15.4	95		
	4.20	206	221	15			
69	4.22	204	219				
68	4.24	202	217		94		
	4.26	200	214				
67	4.28	198	212		93		
	4.30	196	210				
66	4.33	194	208		92		
65	4.35	192	206				
	4.37	190	204		91		
64	4.39	188	202				
63	4.41	186	200		90		
	4.44	184	198				
62	4.46	182	196		89		
61	4.48	180	194				
	4.51	178	192		88		
60	4.53	176	190				
59	4.56	174			87		
	4.58	172					
58	4.61	170			86		
	4.64	168					
57	4.66	166			85		
56	4.68	164					
	4.71	162			84		
55	4.74	160					
54	4.77	158			83		
	4.79	156					
53	4.82	154			82		

**A comprehensive service  
is available on request for  
testing of materials.**

**Either physical or chemical  
properties can be analysed  
to your requirements.**

**Material Test Certificates  
are supplied on request for  
all ASTM Standard products.**

Tensile strength kgt/mm <sup>2</sup> R	Brinell d impression	Hardness		Rockwell hardness		Shore hardness	
		Brinell HB	Vickers HV	HRC	HRB	Sh D	Sh C
52	4.85	152					
	4.87	150			81		
51	4.91	148			80		
50	4.94	146			79		
	4.97	144					
49	5.00	142			78		
48	5.03	140			77		
	5.07	138					
47	5.10	136			76		
	5.14	134			75		
46	5.17	132			74		
45	5.21	130					
	5.25	128			73		
44	5.29	126			72		
43	5.33	124			71		
	5.36	122			70		
42	5.40	120			69		
	5.45	118			68		
41	5.49	116			67		
40	5.54	114			66		
	5.58	112			64.5		
39	5.62	110			63.5		
38	5.67	108			62		
	5.72	106			60.5		
37	5.77	104			59		
	5.82	102			58		
36	5.88	100			56.5		
35	5.93	98			55		
	5.99	96			53		
34	6.05	94			51		
33	6.10	92			49		
	6.15	90			47		



# Theoretical Internal Bursting Pressures of Stainless Steel Tubing

## Theoretical Internal Bursting Pressures of Tubing

Theoretical Bursting Pressure, in pounds for stainless tubes. Based on Barlow's Formula:  $P = \frac{2ST}{D}$

P = Bursting pressure in psi. D = Outside diameter of tube in inches. S = Fiber stress of 75,000 psi ultimate for bursting pressure. T = Wall thickness.

The mill pressures used when hydrotesting are usually based on fiber stress of 20,000 psi (26.7% of burst pressures listed below) unless specifications require other pressures.

Specifications and code rulings assign maximum stresses in use which are dependent on factors such as inspection requirements, temperatures encountered, service life expected and alloy.

### WALL THICKNESS - INCHES & B.W.G.

O.D. Inches	.020 25	.022 24	.025 23	.028 22	.032 21	.036 20	.042 19	.049 18	.058 17	.065 16	.072 15	.083 14	.095 13	.109 12	.120 11	.134 10	.148 9	.165 8
1/8	24,000	26,400	30,000	33,600	38,400	42,000	50,400	58,800										
1/4	12,000	13,200	15,000	16,800	19,200	21,000	25,200	29,400	34,800	39,000								
3/8	8,000	8,800	10,000	11,200	12,800	14,000	16,800	19,600	23,200	26,000								
1/2	6,000	6,600	7,500	8,400	9,600	10,500	12,600	14,700	17,400	19,500	21,600	24,900	28,500					
5/8	4,800	5,300	6,000	6,725	7,675	8,400	10,075	11,750	13,925	15,600	17,275	19,925	22,800					
3/4	4,000	4,400	5,000	5,600	6,400	7,000	8,400	9,800	11,600	13,000	14,400	16,600	19,000	21,800				
7/8	3,425	3,750	4,300	4,800	5,475	6,000	7,200	8,400	9,950	11,150	12,350	14,225	16,275	18,675				
1	3,000	3,300	3,750	4,200	4,800	5,250	6,300	7,350	8,700	9,750	10,800	12,450	14,250	16,350	18,000	20,100	22,200	
1 1/8			3,325	3,750	4,275	4,650	5,600	6,550	7,750	8,650	9,600	11,050	12,650	14,550	16,000	17,875	19,725	
1 1/4			3,000	3,350	3,850	4,200	5,050	5,875	6,950	7,800	8,650	9,950	11,400	13,075	14,400	16,075	17,750	
1 3/8			2,725	3,050	3,500	3,825	4,575	5,350	6,325	7,100	7,850	9,050	10,350	11,900	13,100	14,625	16,150	
1 1/2			2,500	2,800	3,200	3,500	4,200	4,900	5,800	6,500	7,200	8,300	9,500	10,900	12,000	13,400	14,800	
1 5/8			2,300	2,575	2,950	3,225	3,875	4,525	5,350	6,000	6,650	7,650	8,775	10,050	11,075	12,375	13,650	
1 3/4			2,150	2,400	2,750	3,000	3,600	4,200	4,975	5,575	6,175	7,125	8,150	9,350	10,275	11,475	12,675	
1 7/8						2,800	3,350	3,925	4,650	5,200	5,750	6,650	7,600	8,725	9,600	10,725	11,850	
2						2,625	3,150	3,675	4,350	4,875	5,400	6,225	7,125	8,175	9,000	10,050	11,100	
2 1/8						2,475	2,975	3,450	4,100	4,600	5,075	5,850	6,700	7,700	8,475	9,450	10,450	
2 1/4							2,800	3,275	3,875	4,350	4,800	5,550	6,350	7,275	8,000	8,975	9,875	
2 3/8							2,650	3,100	3,675	4,100	4,550	5,250	6,000	6,900	7,575	8,475	9,350	10,425
2 1/2							2,525	2,950	3,475	3,900	4,325	4,975	5,700	6,550	7,200	8,050	8,875	9,900
2 5/8							2,400	2,800	3,325	3,725	4,125	4,750	5,425	6,225	6,850	7,650	8,450	9,425
2 3/4								2,675	3,150	3,550	3,925	4,525	5,175	5,950	6,550	7,300	8,075	9,000
2 7/8								2,550	3,025	3,400	3,750	4,325	4,950	5,675	6,250	7,000	7,725	8,600
3								2,450	2,900	3,250	3,600	4,150	4,750	5,450	6,000	6,700	7,400	8,250
3 1/8								2,350	2,775	3,125	3,450	3,975	4,550	5,225	5,550	6,425	7,100	7,925
3 1/4								2,250	2,675	3,000	3,325	3,825	4,375	5,025	5,525	6,175	6,825	7,600
3 3/8								2,175	2,575	2,875	3,200	3,675	4,225	4,850	5,325	5,950	6,575	7,325
3 1/2								2,100	2,475	2,775	3,075	3,550	4,075	4,675	5,150	5,750	6,350	7,075
3 5/8								2,025	2,400	2,675	2,975	3,425	3,925	4,500	4,950	5,550	6,100	6,825

O.D. Inches	.049 18	.058 17	.065 16	.072 15	.083 14	.095 13	.109 12	.120 11	.134 10	.148 9	.165 8	.180 7	.203 6	.220 5	.238 4	.259 3	.284 2	.300 1
3 3/4	1,950	2,325	2,600	2,875	3,325	3,800	4,350	4,800	5,350	5,900	6,600	7,200	8,125	8,800				
3 7/8	1,900	2,250	2,500	2,775	3,200	3,675	4,200	4,650	5,175	5,725	6,375	6,975	7,850	8,500				
4	1,825	2,175	2,425	2,700	3,100	4,075	4,090	4,500	5,025	5,550	6,175	6,750	7,600	8,250				
4 1/4	1,725	2,050	2,300	2,550	2,925	3,350	3,850	4,225	4,725	5,225	5,825	6,350	7,150	7,750				
4 1/2	1,625	1,925	2,150	2,400	2,750	3,150	3,625	4,000	4,450	4,925	5,500	6,000	6,750	7,325	7,925			
4 3/4	1,550	1,825	2,050	2,275	2,625	3,000	3,450	3,775	4,225	4,675	5,200	5,675	6,400	6,950	7,500			
5	1,475	1,750	1,950	2,150	2,500	2,850	3,275	3,600	4,025	4,450	4,950	5,400	6,100	6,600	7,150			
5 1/4	1,400	1,650	1,850	2,050	2,375	2,700	3,100	3,425	3,825	4,225	4,700	5,150	5,800	6,275	6,800			
5 1/2	1,325	1,575	1,775	1,950	2,250	2,600	2,975	3,275	3,650	4,025	4,500	4,900	5,550	6,000	6,500	7,050		
5 3/4	1,275	1,500	1,700	1,875	2,150	2,475	2,850	3,125	3,500	3,850	4,300	4,700	5,300	5,725	6,200	6,750		
6	1,220	1,450	1,625	1,800	2,075	2,375	2,325	3,000	3,350	3,700	4,125	4,500	5,075	5,500	5,950	6,475	7,100	
8	925	1,100	1,225	1,350	1,550	1,775	2,050	2,250	2,525	2,775	3,100	3,375	3,800	4,125	4,475	4,850	5,325	5,625
10	750	875	975	1,075	1,250	1,425	1,625	1,800	2,000	2,225	2,475	2,700	3,050	3,300	3,575	3,875	4,250	4,500
12	625	725	825	900	1,050	1,200	1,375	1,500	1,675	1,850	2,075	2,250	2,550	2,750	2,975	3,250	3,550	3,750
14	525	625	700	775	900	1,025	1,175	1,300	1,450	1,600	1,775	1,925	2,175	2,350	2,550	2,775	3,050	3,225
16	450	550	600	675	775	900	1,025	1,125	1,250	1,400	1,550	1,700	1,900	2,050	2,225	2,425	2,675	2,825
18	400	475	550	600	700	800	900	1,000	1,125	1,250	1,375	1,500	1,700	1,850	1,975	2,150	2,350	2,500
20	375	450	500	550	625	725	825	900	1,000	1,100	1,250	1,350	1,525	1,650	1,775	1,950	2,125	2,250
24	300	375	400	450	525	600	675	750	850	925	1,025	1,125	1,250	1,375	1,475	1,625	1,775	1,875
30	250	300	325	350	425	475	550	600	675	750	825	900	1,025	1,100	1,200	1,300	1,425	1,500



# Metric Dimensions and Weights of Stainless Steel Pipe



**Bold: Wall thickness in millimetres**

*Italic: Weight per metre in kilograms*

PIPE SIZE	O.D. IN M.M.	5S	10S	10	20	30	40	STD 40S	60	80	E.H. 80S	100	120	140	160	DBLE E.H.
1/8	10.29		1.25 .28				1.73 .37	1.73 .37		2.41 .48	2.41 .48					
1/4	13.72		1.65 .48				2.24 .64	2.24 .64		3.02 .81	3.02 .81					
3/8	17.15		1.65 .64				2.31 .86	2.31 .86		3.20 1.12	3.20 1.12					
1/2	21.34	1.65 .81	2.11 1.01				2.77 1.29	2.77 1.29		3.73 1.64	3.73 1.64				4.78 1.98	7.47 2.65
3/4	26.67	1.65 1.03	2.11 1.30				2.87 1.71	2.87 1.71		3.91 2.23	3.91 2.23				5.56 2.94	7.82 3.69
1	33.40	1.65 1.31	2.77 2.12				3.38 2.54	3.38 2.54		4.55 3.28	4.55 3.28				6.35 4.30	9.09 5.75
1 1/4	42.16	1.65 1.67	2.77 2.73				3.56 3.43	3.56 3.43		4.85 4.53	4.85 4.53				6.35 5.69	9.70 7.88
1 1/2	48.26	1.65 1.93	2.77 3.15				3.68 4.11	3.68 4.11		5.08 5.49	5.08 5.49				7.14 7.34	10.16 9.69
2	60.33	1.65 2.42	2.77 3.98				3.91 5.52	3.91 5.52		5.54 7.59	5.54 7.59				8.74 11.28	11.07 13.65
2 1/2	73.03	2.11 3.74	3.05 5.34				5.16 8.76	5.16 8.76		7.01 11.58	7.01 11.58				9.53 15.14	14.02 20.70
3	88.90	2.11 4.58	3.05 6.54				5.49 11.45	5.49 11.45		7.62 15.50	7.62 15.50				11.13 21.65	15.24 28.09
3 1/2	101.60	2.11 5.25	3.05 7.52				5.74 13.77	5.74 13.77		8.08 18.90	8.08 18.90					
4	114.30	2.11 5.92	3.05 8.48				6.02 16.31	6.02 16.31		8.56 22.65	8.56 22.65		11.13 28.32		13.49 34.02	17.12 41.63
5	141.30	2.77 9.50	3.40 11.74				6.55 22.10	6.55 22.10		9.52 31.41	9.52 31.41		12.70 40.28		15.88 49.83	19.05 58.28
6	168.28	2.77 11.47	3.40 14.04				7.11 28.68	7.11 28.68		10.97 43.19	10.97 43.19		14.27 54.20		18.26 68.56	21.95 80.36
8	219.08	2.77 14.99	3.76 20.25		6.35 33.31	7.04 36.81	8.18 43.16	8.18 43.16	10.31 53.08	12.70 65.59	12.70 65.59	15.09 75.92	18.26 90.44	20.62 100.92	23.01 112.90	22.23 109.48
10	273.05	3.40 22.97	4.19 28.20		6.35 41.77	7.78 51.03	9.27 61.20	9.27 61.20	12.70 81.55	15.09 97.40	12.70 81.55	18.26 114.75	21.44 133.06	25.40 155.15	28.58 174.82	25.40 157.41
12	323.85	3.96 31.72	4.57 36.53		6.35 49.73	8.38 65.20	10.31 80.91	9.53 74.92	14.28 108.96	17.48 133.98	12.70 97.46	21.44 159.91	25.40 186.97	28.58 208.14	33.32 242.28	25.40 189.70
14	355.60	3.96 34.87	4.78 41.92	6.35 55.56	7.93 67.90	9.53 81.33	11.09 95.90	9.53 81.33	15.09 126.71	19.05 160.44	12.70 107.39	23.83 194.96	27.79 224.65	31.75 253.56	35.71 285.88	
16	406.40	4.19 42.18	4.78 47.99	6.35 63.57	7.93 77.83	9.53 93.27	12.70 125.12	9.53 93.27	16.66 160.12	21.44 206.52	12.70 123.30	26.19 245.56	30.96 286.64	36.53 333.19	40.49 370.73	
18	457.20	4.19 47.15	4.78 54.06	6.35 71.64	7.93 87.71	11.13 122.38	14.28 158.22	9.53 105.16	19.05 205.74	23.83 258.38	12.70 139.15	29.36 309.62	34.93 363.56	39.67 408.26	45.24 466.35	
20	508.00	4.77 60.13	5.53 69.62	6.35 79.71	9.53 117.15	12.70 155.12	15.09 186.10	9.53 117.15	20.63 247.83	26.19 315.74	12.70 155.12	32.54 381.53	38.10 441.49	44.45 508.11	50.01 573.18	
22	558.80	4.77 66.20	5.53 76.66	6.35 87.79	9.53 129.13	12.70 171.09		9.53 129.13	22.23 294.25	28.58 379.14	12.70 171.09	34.93 451.42	41.28 527.02	47.63 600.63	53.98 681.82	
24	609.60	5.53 83.70	6.35 95.86	6.35 95.86	9.53 141.12	14.28 209.64	17.48 258.94	9.53 141.12	24.61 355.26	30.96 448.34	12.70 187.06	38.89 547.71	46.02 640.03	52.37 720.15	59.54 819.55	

## DECIMAL EQUIVALENTS OF B.W. GAUGES

B.W.G. OR FRACTION	DECIMAL	B.W.G. OR FRACTION	DECIMAL	B.W.G. OR FRACTION	DECIMAL	B.W.G. OR FRACTION	DECIMAL
36	.004	20	.035	9	.148	11/32	.344
35	.005	19	.042	5/32	.156	3/8	.375
34	.007	3/64	.047	8	.165	00	.380
33	.008	18	.049	11/64	.172	000	.425
32	.009	17	.058	7	.180	7/16	.438
31	.010	1/16	.063	3/16	.188	0000	.454
30	.012	16	.065	13/64	.203	1/2	.500
29	.013	15	.072	6	.203	17/32	.531
28	.014	5/64	.078	7/32	.219	9/16	.563
1/64	.016	14	.083	5	.220	19/32	.594
27	.016	3/32	.094	4	.238	5/8	.625
26	.018	13	.095	1/4	.250	11/16	.688
25	.020	7/64	.109	3	.259	3/4	.750
24	.022	12	.109	9/32	.281	13/16	.813
23	.025	11	.120	2	.284	7/8	.875
22	.028	1/8	.125	1	.300	15/16	.938
1/32	.031	10	.134	5/16	.313	1	1.000
21	.032	9/64	.141	0	.340	2	2.000



# Glossary of Stainless Steel Tubing Terms

**Age hardening**—An aging process that increases hardness and strength. Ordinarily ductility decreases. Age hardening usually follows rapid cooling or cold working.

**Annealing**—The heating and cooling of steel to remove stresses, alter physical, mechanical and metallurgical properties, increase corrosion resistance, or to thermally treat steel prior to age hardening. Some scaling results from an oxide anneal.

**Bright annealing**—Annealing in a controlled atmosphere (e.g., cracked ammonia, hydrogen or vacuum) to prevent formation of dark, adherent oxides.

**Carbide**—A compound of carbon with one or more elements, such as chromium, columbium, tantalum or titanium. Depending on the type of stainless or heat-resisting steel and the heat treatment, the composition and quantity of carbides present affect properties of the steel. Chromium carbide at grain boundaries of austenitic stainless steels cause poor corrosion resistance. This carbide may result from welding or from improper annealing or quenching.

**Carbon pickup or carburizing**—Diffusion of carbon in the surface of steel when it is heated in the presence of a carbonaceous compound. This condition may result from poor cleaning of the steel surfaces or from exposure to a carburizing atmosphere.

**As-welded**—Tubular products not subject to thermal treatment after welding.

**Cold drawing**—Drawing tubular products through a hardened steel or tungsten carbide die while at room temperature. Cold drawing is usually done with a supporting inside mandrel (drawn over mandrel). The purpose of cold drawing is to reduce the O.D. or wall, or both, to produce smooth surface finishes, obtain closer tolerances and to promote weld area recrystallization during subsequent annealing.

**Concentricity**—As applied to tubular products, the centre of the inside diameter is consistent with the centre of the outside diameter.

**Descaling (acid)**—See pickling.

**Descaling (molten salt)**—Subjecting oxide annealed austenitic and high alloy steel to an oxidizing or reducing salt bath to produce more readily a scale-free surface when pickled in a subsequent step.

**Eccentricity**—As applied to tubular products, the centre of the inside diameter differs from the centre of the outside diameter indicating wall variation.

**Full finished**—Refers to tubular products in which the weld has been processed to produce uniform strength and

dimensions, and subsequently annealed to obtain proper corrosion resistance.

**Grain size**—Measurement of the areas or volumes of grains in a polycrystalline material. Grain sizes are reported in terms of number of grains per unit of area or volume, average diameter, or as a grain size number derived from area measurements.

**Inclusions**—Nonmetallic materials, usually oxides, sulfides and silicates, within a metal matrix.

**Manipulation tests**—Deformation of full sections or sector specimens to evaluate quality. Various tests are crush, flare, bend, flare and flange, flatten, reverse flatten, reverse bend and Van Stone flange. To produce face or root bend specimens, sector samples and guided fixtures are used.

**Mechanical properties**—Properties that reveal elastic or inelastic behaviour where force is applied. Examples are elastic and proportional limits, modulus of elasticity, yield strength, ultimate strength, elongation, hardness, impact strength, creep strength, and stress rupture strength.

**Ovality**—The difference between the maximum and minimum diameters of a tubular section.

**Passivating**—Exposure of stainless steel to a dilute solution of nitric or other oxidizing acid to remove free iron from the surfaces and improve corrosion resistance.

**Physical properties**—Properties, other than mechanical ones, relating to the physics of the alloy. Examples are density, heat conductivity, thermal expansion and electrical conductivity.

**Pipe**—A tubular product made to dimensions specified by American Standards Association.

**Pickling**—Chemical or electrochemical removal of surface oxides.

**Pressure test**—Subjecting tubular products to a specified hydraulic or pneumatic internal pressure to detect defects and weakness in the tube wall.

**Sinking (or sink drawing)**—A cold finishing operation to obtain exactly the desired diameter and/or to improve mechanical properties. This operation is performed by pulling a tube through a die without using an interior tool (mandrel).

**Straightness tolerance (or camber)**—Maximum deviation, or bow, within a specified length. Usual method to determine straightness deviation is to use a straight edge and dial indicator or a flat plate and feeler gauges.

**Swaging**—A method of cold working tubing in which reduction is accomplished by hammer-like blows delivered rapidly against the outside surface of the tube. An inside mandrel is usually used.