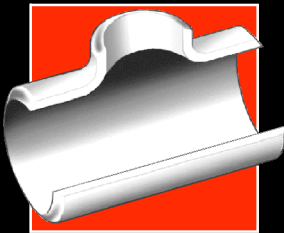


Section 5

Pipe and Tube Sizes

This Section contains pipe and tube dimensions and weights, and information on specific applications. (Pipe threads and surface finishes are covered in Section 10. Weld bevels are covered in Section 6.)



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Pipe Sizes - ANSI/ASME

This subsection summarises pipe dimensions and weights (per unit length) as defined in ANSI/ASME specifications.

ANSI/ASME Pipe Specifications

ANSI/ASME pipe specifications B36.19M-1985 and B36.10M-1995 are summarised on pages 5-3 to 5-6.

- **B36.19M-1985.** (Reaffirmed 1994.) This applies specifically to stainless steel pipe, but has a restricted range of pipe sizes.
The schedule numbers for pipe ordered to this specification are suffixed with the letter 'S'.
- **B36.10M-1995.** This applies to wrought steel pipe and may be used for pipe sizes not specified in B36.19M.
- **Weights** quoted, from both the B36.10M and B36.19M specifications, assume plain ends and carbon steel (not stainless steel).

The quoted weights are calculated using the formula:

$$W_{pe} = 0.02466(OD-t)t$$

where

W_{pe} = Nominal plain end mass rounded to the nearest 0.1 kg/m assuming carbon steel

OD = Outside diameter

t = Wall thickness, nominal

- **Weights for austenitic and duplex steel pipe.**
Multiply the quoted weight (W_{pe}) by 1.014.
- **Weights for ferritic and martensitic steel pipe.**
Multiply the quoted weight (W_{pe}) by 0.985.

Tolerances

Pipe tolerances are specified in the ASTM pipe standards summarised in Section 2.

Nominal Pipe Sizes (NPS)

The size of all pipe is identified by the nominal pipe size (NPS).

- **Description.** The manufacture of pipe in the nominal sizes of $\frac{1}{8}$ to 12 inches, inclusive is based on a standardised outside diameter (OD). Although the original relationship between nominal sizes, outside diameter and wall thickness no longer exists, these nominal sizes and standard ODs continue in use.

Pipe in nominal sizes of 14 inches and larger have an OD corresponding to the nominal size.

- **Metric Equivalents.** Refer to page 5-9 for the metric equivalents of nominal pipe sizes as defined by ISO specifications.

Wall Thicknesses

- **Standard, XS and XXS.** The wall thickness designations 'Standard', 'Extra-Strong' (XS) and 'Double Extra-Strong' (XXS) have been used for many years.
- **Schedule Numbers** were subsequently added as a convenient designation for use in ordering pipe. 'Standard' and Schedule 40 are identical for nominal pipe sizes up to 10 inches, inclusive.

All larger sizes of 'Standard' have $\frac{3}{8}$ inch wall thickness. 'Extra-Strong' and 'Schedule 80' are identical for nominal pipe sizes up to 8 inches, inclusive. All larger sizes of 'Extra-Strong' have $\frac{1}{2}$ inch wall thickness.

- **Stainless Steel Pipe.** Schedule numbers for pipe ordered to the stainless steel pipe specification B36.19M-1985 are suffixed with the letter 'S'.

Pressure Ratings

Refer to page 5-29 for pressure rating calculations and pressure/temperature tables.

Pipe Sizes - ANSI/ASME B36.19M-1985

Dimensions and weights per metre - stainless steel pipe

Nominal Pipe Size	OD		Schedule 5S ¹			Schedule 10S ¹			Schedule 40S			Schedule 80S		
														
	in	mm	in	mm	kg/m	in	mm	kg/m	in	mm	kg/m	in	mm	kg/m
1/8	0.405	10.3	-	-	-	0.049	1.24	0.28	0.068	1.73	0.37	0.095	2.41	0.47
1/4	0.540	13.7	-	-	-	0.065	1.65	0.49	0.088	2.24	0.63	0.119	3.02	0.80
3/8	0.675	17.1	-	-	-	0.065	1.65	0.63	0.091	2.31	0.84	0.126	3.20	1.10
1/2	0.840	21.3	0.065	1.65	0.80	0.083	2.11	1.00	0.109	2.77	1.27	0.147	3.73	1.62
3/4	1.050	26.7	0.065	1.65	1.03	0.083	2.11	1.28	0.113	2.87	1.69	0.154	3.91	2.20
1	1.315	33.4	0.065	1.65	1.30	0.109	2.77	2.09	0.133	3.38	2.50	0.179	4.55	3.24
1 1/4	1.660	42.2	0.065	1.65	1.65	0.109	2.77	2.70	0.140	3.56	3.39	0.191	4.85	4.47
1 1/2	1.900	48.3	0.065	1.65	1.91	0.109	2.77	3.11	0.145	3.68	4.05	0.200	5.08	5.41
2	2.375	60.3	0.065	1.65	2.40	0.109	2.77	3.93	0.154	3.91	5.44	0.218	5.54	7.48
2 1/2	2.875	73.0	0.083	2.11	3.69	0.120	3.05	5.26	0.203	5.16	8.63	0.276	7.01	11.41
3	3.500	88.9	0.083	2.11	4.51	0.120	3.05	6.45	0.216	5.49	11.29	0.300	7.62	15.27
3 1/2	4.000	101.6	0.083	2.11	5.18	0.120	3.05	7.40	0.226	5.74	13.57	0.318	8.08	18.63
4	4.500	114.3	0.083	2.11	5.84	0.120	3.05	8.36	0.237	6.02	16.07	0.337	8.56	22.32
5	5.563	141.3	0.109	2.77	9.47	0.134	3.40	11.57	0.258	6.55	21.77	0.375	9.53	30.97
6	6.625	168.3	0.109	2.77	11.32	0.134	3.40	13.84	0.280	7.11	28.26	0.432	10.97	42.56
8	8.625	219.1	0.109	2.77	14.79	0.148	3.76	19.96	0.322	8.18	42.55	0.500	12.70	64.64
10	10.750	273.1	0.134	3.40	22.63	0.165	4.19	27.78	0.365	9.27	60.31	0.500 ²	12.70 ²	96.01 ²
12	12.750	323.9	0.156	3.96	31.25	0.180	4.57	36.00	0.375 ²	9.53 ²	73.88 ²	0.500 ²	12.70 ²	132.08 ²
14	14.000	355.6	0.156	3.96	34.36	0.188 ²	4.78 ²	41.30 ²	-	-	-	-	-	-
16	16.000	406.4	0.165	4.19	41.56	0.188 ²	4.78 ²	47.29 ²	-	-	-	-	-	-
18	18.000	457	0.165	4.19	46.81	0.188 ²	4.78 ²	53.26 ²	-	-	-	-	-	-
20	20.000	508	0.188	4.78	59.25	0.218 ²	5.54 ²	68.61 ²	-	-	-	-	-	-
22	22.000	559	0.188	4.78	65.24	0.218 ²	5.54 ²	75.53 ²	-	-	-	-	-	-
24	24.000	610	0.218	5.54	82.47	0.250	6.35	94.45	-	-	-	-	-	-
30	30.000	762	0.250	6.35	118.31	0.312	7.92	147.36	-	-	-	-	-	-

Notes

- Schedules 5S and 10S wall thicknesses do not permit threading in accordance with ANSI/ASME B1.20.1.
- These dimensions and weights do not conform to ANSI/ASME B36.10M.
 - The suffix 'S' after the schedule number indicates that the pipe dimensions and weight are in compliance with this stainless steel pipe specification, ANSI/ASME B36.19M-1985, and not the more general ANSI/ASME B36.10M-1995 specification.
 - Although this specification is applicable to stainless steel, quoted weights are for carbon steel pipe and should be multiplied by 1.014 for austenitic and duplex steels, or by 0.985 for ferritic and martensitic steels.

Pipe Sizes - ANSI/ASME B36.10M-1995

Dimensions and weights per metre - steel pipe

Nominal Pipe Size	OD		Schedule 10			Schedule 20			Schedule 30			Schedule 40		
														
	in	mm	in	mm	kg/m	in	mm	kg/m	in	mm	kg/m	in	mm	kg/m
1/8	0.405	10.3	-	-	-	-	-	-	0.057	1.45	0.32	0.068	1.73	0.37
1/4	0.540	13.7	-	-	-	-	-	-	0.073	1.85	0.54	0.088	2.24	0.63
3/8	0.675	17.1	-	-	-	-	-	-	0.073	1.85	0.70	0.091	2.31	0.84
1/2	0.840	21.3	-	-	-	-	-	-	0.095	2.41	1.12	0.109	2.77	1.27
3/4	1.050	26.7	-	-	-	-	-	-	0.095	2.41	1.44	0.113	2.87	1.69
1	1.315	33.4	-	-	-	-	-	-	0.114	2.90	2.18	0.133	3.38	2.50
1 1/4	1.660	42.2	-	-	-	-	-	-	0.117	2.97	2.87	0.140	3.56	3.39
1 1/2	1.900	48.3	-	-	-	-	-	-	0.125	3.18	3.53	0.145	3.68	4.05
2	2.375	60.3	-	-	-	-	-	-	0.125	3.18	4.48	0.154	3.91	5.44
2 1/2	2.875	73.0	-	-	-	-	-	-	0.188	4.78	8.04	0.203	5.16	8.63
3	3.500	88.9	-	-	-	-	-	-	0.188	4.78	9.92	0.216	5.49	11.29
3 1/2	4.000	101.6	-	-	-	-	-	-	0.188	4.78	11.41	0.226	5.74	13.57
4	4.500	114.3	-	-	-	-	-	-	0.188	4.78	12.91	0.237	6.02	16.07
5	5.563	141.3	-	-	-	-	-	-	-	-	-	0.258	6.55	21.77
6	6.625	168.3	-	-	-	-	-	-	-	-	-	0.280	7.11	28.26
8	8.625	219.1	-	-	-	0.250	6.35	33.31	0.277	7.04	36.81	0.322	8.18	42.55
10	10.750	273.0	-	-	-	0.250	6.35	41.77	0.307	7.80	51.03	0.365	9.27	60.31
12	12.750	323.8	-	-	-	0.250	6.35	49.73	0.330	8.38	65.20	0.406	10.31	79.73
14	14.000	355.6	0.250	6.35	54.69	0.312	7.92	67.90	0.375	9.53	81.33	0.438	11.13	94.55
16	16.000	406.4	0.250	6.35	62.64	0.312	7.92	77.83	0.375	9.53	93.27	0.500	12.70	123.30
18	18.000	457	0.250	6.35	70.57	0.312	7.92	87.71	0.438	11.13	122.38	0.562	14.27	155.80
20	20.000	508	0.250	6.35	78.55	0.375	9.53	117.15	0.500	12.70	155.12	0.594	15.09	183.42
22	22.000	559	0.250	6.35	86.54	0.375	9.53	129.13	0.500	12.70	171.09	-	-	-
24	24.000	610	0.250	6.35	94.53	0.375	9.53	141.12	0.562	14.27	209.64	0.688	17.48	255.41
26	26.000	660	0.312	7.92	127.36	0.500	12.70	202.72	-	-	-	-	-	-
28	28.000	711	0.312	7.92	137.32	0.500	12.70	218.69	0.625	15.88	271.21	-	-	-
30	30.000	762	0.312	7.92	147.28	0.500	12.70	234.67	0.625	15.88	292.18	-	-	-
32	32.000	813	0.312	7.92	157.24	0.500	12.70	250.64	0.625	15.88	312.15	0.688	17.48	342.91
34	34.000	864	0.312	7.92	167.20	0.500	12.70	266.61	0.625	15.88	332.12	0.688	17.48	364.90
36	36.000	914	0.312	7.92	176.96	0.500	12.70	282.27	0.625	15.88	351.70	0.750	19.05	420.42
38	38.000	965	-	-	-	-	-	-	-	-	-	-	-	-
40	40.000	1016	-	-	-	-	-	-	-	-	-	-	-	-
42	42.000	1067	-	-	-	-	-	-	-	-	-	-	-	-
44	44.000	1118	-	-	-	-	-	-	-	-	-	-	-	-
46	46.000	1168	-	-	-	-	-	-	-	-	-	-	-	-
48	48.000	1219	-	-	-	-	-	-	-	-	-	-	-	-

Notes

- This specification is applicable to all steel pipe including stainless steel. Quoted weights are for carbon steel pipe and should be multiplied by 1.014 for austenitic and duplex steels, or by 0.985 for ferritic and martensitic steels.

Pipe Sizes - ANSI/ASME B36.10M-1995

Dimensions and weights per metre - steel pipe

Nominal Pipe Size	OD		Standard (STD)			Schedule 60			Extra Strong (XS)			Schedule 80		
														
	in	mm	in	mm	kg/m	in	mm	kg/m	in	mm	kg/m	in	mm	kg/m
1/8	0.405	10.3	0.068	1.73	0.37	-	-	-	0.095	2.41	0.47	0.095	2.41	0.47
1/4	0.540	13.7	0.088	2.24	0.63	-	-	-	0.119	3.02	0.80	0.119	3.02	0.80
3/8	0.675	17.1	0.091	2.31	0.84	-	-	-	0.126	3.20	1.10	0.126	3.20	1.10
1/2	0.840	21.3	0.109	2.77	1.27	-	-	-	0.147	3.73	1.62	0.147	3.73	1.62
3/4	1.050	26.7	0.113	2.87	1.69	-	-	-	0.154	3.91	2.20	0.154	3.91	2.20
1	1.315	33.4	0.133	3.38	2.50	-	-	-	0.179	4.55	3.24	0.179	4.55	3.24
1 1/4	1.660	42.2	0.140	3.56	3.39	-	-	-	0.191	4.85	4.47	0.191	4.85	4.47
1 1/2	1.900	48.3	0.145	3.68	4.05	-	-	-	0.200	5.08	5.41	0.200	5.08	5.41
2	2.375	60.3	0.154	3.91	5.44	-	-	-	0.218	5.54	7.48	0.218	5.54	7.48
2 1/2	2.875	73.0	0.203	5.16	8.63	-	-	-	0.276	7.01	11.41	0.276	7.01	11.41
3	3.500	88.9	0.216	5.49	11.29	-	-	-	0.300	7.62	15.27	0.300	7.62	15.27
3 1/2	4.000	101.6	0.226	5.74	13.57	-	-	-	0.318	8.08	18.63	0.318	8.08	18.63
4	4.500	114.3	0.237	6.02	16.07	-	-	-	0.337	8.56	22.32	0.337	8.56	22.32
5	5.563	141.3	0.258	6.55	21.77	-	-	-	0.375	9.53	30.97	0.375	9.53	30.97
6	6.625	168.3	0.280	7.11	28.26	-	-	-	0.432	10.97	42.56	0.432	10.97	42.56
8	8.625	219.1	0.322	8.18	42.55	0.406	10.31	53.08	0.500	12.70	64.64	0.500	12.70	64.64
10	10.750	273.0	0.365	9.27	60.31	0.500	12.70	81.55	0.500	12.70	81.55	0.594	15.09	96.01
12	12.750	323.8	0.375	9.53	73.88	0.562	14.27	108.96	0.500	12.70	97.46	0.688	17.48	132.08
14	14.000	355.6	0.375	9.53	81.33	0.594	15.09	126.71	0.500	12.70	107.39	0.750	19.05	158.10
16	16.000	406.4	0.375	9.53	93.27	0.656	16.66	160.12	0.500	12.70	123.30	0.844	21.44	203.53
18	18.000	457	0.375	9.53	105.16	0.750	19.05	205.74	0.500	12.70	139.15	0.938	23.83	254.55
20	20.000	508	0.375	9.53	117.15	0.812	20.62	247.83	0.500	12.70	155.12	1.031	26.19	311.17
22	22.000	559	0.375	9.53	129.13	0.875	22.23	294.25	0.500	12.70	171.09	1.125	28.58	373.83
24	24.000	610	0.375	9.53	141.12	0.969	24.61	355.26	0.500	12.70	187.06	1.219	30.96	442.08
26	26.000	660	0.375	9.53	152.87	-	-	-	0.500	12.70	202.72	-	-	-
28	28.000	711	0.375	9.53	164.85	-	-	-	0.500	12.70	218.69	-	-	-
30	30.000	762	0.375	9.53	176.84	-	-	-	0.500	12.70	234.67	-	-	-
32	32.000	813	0.375	9.53	188.82	-	-	-	0.500	12.70	250.64	-	-	-
34	34.000	864	0.375	9.53	200.31	-	-	-	0.500	12.70	266.61	-	-	-
36	36.000	914	0.375	9.53	212.56	-	-	-	0.500	12.70	282.27	-	-	-
38	38.000	965	0.375	9.53	224.54	-	-	-	0.500	12.70	298.24	-	-	-
40	40.000	1016	0.375	9.53	236.53	-	-	-	0.500	12.70	314.22	-	-	-
42	42.000	1067	0.375	9.53	248.52	-	-	-	0.500	12.70	330.19	-	-	-
44	44.000	1118	0.375	9.53	260.50	-	-	-	0.500	12.70	346.16	-	-	-
46	46.000	1168	0.375	9.53	272.25	-	-	-	0.500	12.70	351.82	-	-	-
48	48.000	1219	0.375	9.53	284.24	-	-	-	0.500	12.70	377.79	-	-	-

Notes

- This specification is applicable to all steel pipe including stainless steel. Quoted weights are for carbon steel pipe and should be multiplied by 1.014 for austenitic and duplex steels, or by 0.985 for ferritic and martensitic steels.

Pipe Sizes - ANSI/ASME B36.10M-1995

Dimensions and weights per metre - steel pipe

Nominal Pipe Size	OD		Schedule 100			Schedule 120			Schedule 140			Schedule 160		
														
	in	mm	in	mm	kg/m	in	mm	kg/m	in	mm	kg/m	in	mm	kg/m
1/2	0.840	21.3	-	-	-	-	-	-	-	-	-	0.188	4.78	1.95
3/4	1.050	26.7	-	-	-	-	-	-	-	-	-	0.219	5.56	2.90
1	1.315	33.4	-	-	-	-	-	-	-	-	-	0.250	6.35	4.24
1 1/4	1.660	42.2	-	-	-	-	-	-	-	-	-	0.250	6.35	5.61
1 1/2	1.900	48.3	-	-	-	-	-	-	-	-	-	0.281	7.14	7.25
2	2.375	60.3	-	-	-	-	-	-	-	-	-	0.344	8.74	11.11
2 1/2	2.875	73.0	-	-	-	-	-	-	-	-	-	0.375	9.53	14.92
3	3.500	88.9	-	-	-	-	-	-	-	-	-	0.438	11.13	21.35
3 1/2	4.000	101.6	-	-	-	-	-	-	-	-	-	-	-	-
4	4.500	114.3	-	-	-	0.438	11.13	28.32	-	-	-	0.531	13.49	33.54
5	5.563	141.3	-	-	-	0.500	12.70	40.28	-	-	-	0.625	15.88	49.11
6	6.625	168.3	-	-	-	0.562	14.27	54.20	-	-	-	0.719	18.26	67.56
8	8.625	219.1	0.594	15.09	75.92	0.719	18.26	90.44	0.812	20.62	100.92	0.906	23.01	111.27
10	10.750	273.0	0.719	18.26	114.75	0.844	21.44	133.06	1.000	25.40	155.15	1.125	28.58	172.33
12	12.750	323.8	0.844	21.44	159.91	1.000	25.40	186.97	1.125	28.58	208.14	1.312	33.32	238.76
14	14.000	355.6	0.938	23.83	194.96	1.094	27.79	224.65	1.250	31.75	253.56	1.406	35.71	281.70
16	16.000	406.4	1.031	26.19	245.56	1.219	30.96	286.64	1.438	36.53	333.19	1.594	40.49	365.35
18	18.000	457	1.156	29.36	309.62	1.375	34.93	363.56	1.562	39.67	408.26	1.781	45.24	459.37
20	20.000	508	1.281	32.54	381.53	1.500	38.10	441.49	1.750	44.45	508.11	1.969	50.01	564.81
22	22.000	559	1.375	34.93	451.42	1.625	41.28	527.02	1.875	47.63	600.63	2.125	53.98	672.26
24	24.000	610	1.531	38.89	547.71	1.812	46.02	640.03	2.062	52.37	720.15	2.344	59.54	808.22

Nominal Pipe Size	OD		Double Extra Strong (XXS)		
					
	in	mm	in	mm	kg/m
1/2	0.840	21.3	0.294	7.47	2.55
3/4	1.050	26.7	0.308	7.82	3.64
1	1.315	33.4	0.358	9.09	5.45
1 1/4	1.660	42.2	0.382	9.70	7.77
1 1/2	1.900	48.3	0.400	10.15	9.56
2	2.375	60.3	0.436	11.07	13.44
2 1/2	2.875	73.0	0.552	14.02	20.39
3	3.500	88.9	0.600	15.24	27.68

Nominal Pipe Size	OD		Double Extra Strong (XXS) continued		
					
	in	mm	in	mm	kg/m
Continued:					
3 1/2	4.000	101.6	-	-	-
4	4.500	114.3	0.674	17.12	41.03
5	5.563	141.3	0.750	19.05	57.43
6	6.625	168.3	0.864	21.95	79.22
8	8.625	219.1	0.875	22.23	107.92
10	10.750	273.0	1.000	25.40	155.15
12	12.750	323.8	1.000	25.40	186.97

Note

- This specification is applicable to all steel pipe including stainless steel. Quoted weights are for carbon steel pipe and should be multiplied by 1.014 for austenitic and duplex steels, or by 0.985 for ferritic and martensitic steels.

Standard and Birmingham Wire Gauges

Pipe and tube wall thicknesses may be specified in terms of the Standard Wire Gauge (SWG) or the Birmingham Wire Gauge (BWG). A table of equivalent wall thicknesses is provided below. See pages 5-25 and 5-26 also.

Conversion of SWG and BWG number to wall thickness

Standard Wire Gauge (formerly Imperial Wire Gauge) SWG		
SWG	Wall Thickness	
	in	mm
0 SWG	0.324	8.23
1 SWG	0.300	7.62
2 SWG	0.276	7.01
3 SWG	0.252	6.40
4 SWG	0.232	5.89
5 SWG	0.212	5.38
6 SWG	0.192	4.88
7 SWG	0.176	4.47
8 SWG	0.160	4.06
9 SWG	0.144	3.66
10 SWG	0.128	3.25
11 SWG	0.116	2.95
12 SWG	0.104	2.64
13 SWG	0.092	2.34
14 SWG	0.080	2.03
15 SWG	0.072	1.83
16 SWG	0.064	1.63
17 SWG	0.056	1.42
18 SWG	0.048	1.22
19 SWG	0.040	1.02
20 SWG	0.036	0.91
21 SWG	0.032	0.81
22 SWG	0.028	0.71
23 SWG	0.024	0.61
24 SWG	0.0220	0.56
25 SWG	0.0200	0.51
26 SWG	0.0180	0.46
27 SWG	0.0164	0.42
28 SWG	0.0148	0.38
29 SWG	0.0136	0.35
30 SWG	0.0124	0.31
31 SWG	0.0116	0.29
32 SWG	0.0108	0.27
33 SWG	0.0100	0.25
34 SWG	0.0092	0.23
35 SWG	0.0084	0.21
36 SWG	0.0076	0.19
37 SWG	0.0068	0.17
38 SWG	0.0060	0.15
39 SWG	0.0052	0.13
40 SWG	0.0048	0.12

Birmingham Wire Gauge BWG		
BWG	Wall Thickness	
	in	mm
0 BWG	0.340	8.64
1 BWG	0.300	7.62
2 BWG	0.284	7.21
3 BWG	0.259	6.58
4 BWG	0.238	6.05
5 BWG	0.220	5.59
6 BWG	0.203	5.16
7 BWG	0.180	4.57
8 BWG	0.165	4.19
9 BWG	0.148	3.76
10 BWG	0.134	3.40
11 BWG	0.120	3.05
12 BWG	0.109	2.77
13 BWG	0.095	2.41
14 BWG	0.083	2.11
15 BWG	0.072	1.83
16 BWG	0.065	1.65
17 BWG	0.058	1.47
18 BWG	0.049	1.24
19 BWG	0.042	1.07
20 BWG	0.035	0.89
21 BWG	0.032	0.81
22 BWG	0.028	0.71
23 BWG	0.025	0.64
24 BWG	0.022	0.56
25 BWG	0.020	0.51
26 BWG	0.018	0.46
27 BWG	0.016	0.41
28 BWG	0.014	0.36
29 BWG	0.013	0.33
30 BWG	0.012	0.30
31 BWG	0.010	0.25
32 BWG	0.009	0.23
33 BWG	0.008	0.20
34 BWG	0.007	0.18
35 BWG	0.005	0.13
36 BWG	0.004	0.10

Tube Sizes - ISO

This subsection considers the ISO standards applicable to stainless steel tubes (ISO standards do not distinguish between pipe and tube). ISO 1127 and ISO 1129 specifically address stainless steel tube, and are based on the more general ISO 4200. The accuracy of tube dimensions may be selected from pre-defined tolerance values specified in ISO 5252. The tables on the following pages present tube size and weight information based on these ISO standards.

ISO 4200 - Plain End Steel Tubes, Welded and Seamless

This specification applies to plain ended, welded and seamless steel tube in general. Tube sizes suitable for threading are not identified (see page 5-9). The tubes are defined in terms of two 'Groups' and three 'Series' as follows:

- **Two groups of tube** are covered:
 - Group 1:** Tubes for general purpose use (see page 5-10 and following).
 - Group 2:** Precision tubes (see page 5-15 and 5-16).
- **An ISO Series number** is used to classify the tube outside diameters as follows:
 - Series 1:** Series for which all accessories needed for the construction of piping systems are standardised.
 - Series 2:** Series for which not all accessories are standardised.
 - Series 3:** Series for special application for which very few accessories exist.

ISO 1127 and ISO 1129 Tube Specifications

The ISO specifications that specifically address stainless steel tube are:

- **ISO 1127-1980(E)** 'Stainless steel tubes - Dimensions, tolerances and conventional masses per unit length.' This standard contains a subset of dimensions from ISO 4200. The ISO 1127 sizes are shown in **bold** type in the tables on page 5-10 and following.
Tolerances D1 to D4 and T1 to T5, as defined in ISO 5252 (see below), may be specified.
- **ISO 1129-1992(E)** 'Steel tubes for boilers, superheaters and heat exchangers - Dimensions, tolerances and conventional masses per unit length.' This standard contains a subset of dimensions from ISO 4200. It is more limited in sizes than ISO 1127 and has a smaller, higher quality, range of tolerances. The ISO 1129 sizes for stainless steel tubes are shown in underlined type in the tables on page 5-10 and following.
Tolerances D2 to D4 and T2 to T5, as defined in ISO 5252 (see below), may be specified.

Tolerances - ISO 5252

Both ISO 1127 and 1129 refer to the range of tolerances on outside diameter and wall thickness defined in ISO 5252. They are as follows:

- **Outside Diameter Tolerances:**
 - D1 $\pm 1.5\%$ with a minimum of ± 0.75 mm
 - D2 $\pm 1.0\%$ with a minimum of ± 0.5 mm
 - D3 $\pm 0.75\%$ with a minimum of ± 0.3 mm
 - D4 $\pm 0.5\%$ with a minimum of ± 0.1 mm
- **Wall Thickness Tolerances:**
 - T1 $\pm 15\%$ with a minimum of ± 0.6 mm
 - T2 $\pm 12.5\%$ with a minimum of ± 0.4 mm
 - T3 $\pm 10\%$ with a minimum of ± 0.2 mm
 - T4 $\pm 7.5\%$ with a minimum of ± 0.15 mm
 - T5 $\pm 5\%$ with a minimum of ± 0.1 mm

T1 to T5 include eccentricity.

Ordering Information

ISO tubes should be ordered using a standard set of parameters defined in ISO 404 (summarised in Section 10).

Tube Sizes - ISO

ISO Quality Standards

The following ISO standards (not fully covered in this manual) define the technical delivery conditions, similar to those in the ASTM pipe and tube standards (see Section 2 and Section 3), that may be specified for ISO tubes. (Information on chemical compositions from these standards is included in Section 1.)

- **ISO 2604/II** 'Steel Products for Pressure Purposes - Quality Requirements - Part II : Wrought seamless tubes'.
- **ISO 2604/IV** 'Steel Products for Pressure Purposes - Quality Requirements - Part V : Longitudinally welded austenitic stainless steel tubes'.

DN Nominal Sizes - ISO 6708

ISO 6708:1995(E) defines the DN series of nominal sizes as an alphanumeric designation of size for components of a pipework system, which is used for reference purposes. It comprises the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimetres, of the bore (ID) or outside diameter (OD) of the end connections. The following table lists DN sizes based on outside diameter.

ISO Nominal Pipe Sizes (DN) - Preferred DN sizes

DN	Outside Diameter (OD)	Equivalent NPS
Dimensionless	mm	Dimensionless
10	17.2	$\frac{3}{8}$
15	21.3	$\frac{1}{2}$
20	26.9	$\frac{3}{4}$
25	33.7	1
32	42.4	$1\frac{1}{4}$
40	48.3	$1\frac{1}{2}$
50	60.3	2
65	76.1	$2\frac{1}{2}$
80	88.9	3
100	114.3	4
125	139.7	-
150	168.3	6
200	219.1	8

DN	Outside Diameter (OD)	Equivalent NPS
Dimensionless	mm	Dimensionless
250	273	10
300	323.9	12
350	355.6	14
400	406.4	16
450	457	18
500	508	20
600	610	24
700	711	28
750	762	32
800	813	34
900	914	36
1000	1016	40
1200	1220	48

Tubes Suitable for Threading According to ISO 7598

DN	Equivalent NPS	Outside Diameter (OD)	Wall Thickness	Weight
Dimensionless	Dimensionless	mm	mm	kg/m
10	$\frac{3}{8}$	17.2	2.3	0.858
15	$\frac{1}{2}$	21.3	2.6	1.217
20	$\frac{3}{4}$	26.9	2.6	1.582
25	1	33.7	3.2	2.444
32	$1\frac{1}{4}$	42.4	3.2	3.141
40	$1\frac{1}{2}$	48.3	3.2	3.614
50	2	60.3	3.6	5.111
65	$2\frac{1}{2}$	76.1	3.6	6.535

General Purpose Tube Sizes - ISO

Dimensions and weights per metre (based on ISO 4200 Group 1 - tubes for general purpose use)

OD ¹  mm	ISO Series	 Wall thickness ¹ , mm														Continuation		
		0.5	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.3	2.6	2.9	3.2	3.6			
		 Weight ^{1,2} , kg/m (weights are true for austenitic steel)																
6	2	-	-	-	0.125	0.144	These outside diameters (6, 8, 10 mm) are as specified in ISO 4200 group 2 - precision tubes (see page 5-15)											
8	2	-	-	-	0.176	0.204												
10	2	-	-	-	0.225	0.264												
10.2	1	0.121	0.144	0.188	0.230	0.270	0.308	0.344	0.379	0.410	0.455	0.495	-	-	-	Refer to page 5-11 for wall thicknesses 4.00 to 16 mm Refer to page 5-12 for wall thicknesses 17.5 to 65 mm		
12	2	0.144	0.171	0.224	0.275	0.325	0.372	0.416	0.460	0.500	0.559	0.612	0.661	0.705	-			
12.7	2	0.153	0.182	0.238	0.293	0.345	0.396	0.445	0.491	0.536	0.599	0.658	0.711	0.761	-			
13.5	1	0.163	0.194	0.254	0.313	0.369	0.424	0.477	0.527	0.576	0.645	0.710	0.769	0.825	0.892			
14	3	0.169	0.201	0.264	0.326	0.385	0.442	0.496	0.550	0.601	0.674	0.742	0.806	0.865	0.937			
16	2	0.194	0.231	0.304	0.376	0.445	0.512	0.577	0.640	0.701	0.789	0.872	0.951	1.03	1.12			
17.2	1	0.209	0.249	0.329	0.406	0.481	0.554	0.625	0.694	0.761	0.858	0.950	1.04	1.12	1.23			
18	3	0.219	0.261	0.345	0.425	0.504	0.582	0.657	0.730	0.801	0.904	1.00	1.10	1.19	1.30			
19	2	0.232	0.276	0.365	0.451	0.535	0.617	0.697	0.775	0.851	0.961	1.07	1.17	1.27	1.39			
20	2	0.244	0.291	0.385	0.476	0.564	0.652	0.737	0.820	0.901	1.02	1.14	1.24	1.35	1.48			
21.3	1	0.260	0.311	0.411	0.509	0.604	0.698	0.789	0.879	0.966	1.10	1.22	1.34	1.45	1.59			
22	3	0.269	0.321	0.425	0.526	0.625	0.722	0.817	0.910	1.00	1.14	1.26	1.39	1.50	1.65			
25	2	0.307	0.367	0.485	0.601	0.715	0.827	0.937	1.05	1.15	1.31	1.46	1.60	1.75	1.93			
25.4	3	0.312	0.373	0.493	0.611	0.727	0.841	0.953	1.06	1.17	1.33	1.48	1.63	1.78	1.97			
26.9	1	0.331	0.395	0.523	0.649	0.772	0.894	1.01	1.13	1.25	1.42	1.58	1.75	1.90	2.10			
30	3	0.369	0.442	0.585	0.726	0.865	1.00	1.14	1.27	1.40	1.59	1.79	1.97	2.14	2.38			
31.8	2	0.392	0.469	0.621	0.771	0.920	1.07	1.21	1.35	1.49	1.70	1.90	2.10	2.29	2.54			
32	2	0.394	0.472	0.625	0.776	0.925	1.07	1.22	1.36	1.50	1.71	1.92	2.11	2.30	2.56			
33.7	1	0.416	0.497	0.659	0.818	0.976	1.13	1.29	1.44	1.58	1.81	2.02	2.23	2.45	2.71			
35	3	0.432	0.517	0.685	0.851	1.02	1.18	1.34	1.50	1.65	1.88	2.11	2.33	2.55	2.83			
38	2	0.469	0.562	0.745	0.926	1.11	1.28	1.46	1.63	1.81	2.05	2.30	2.55	2.79	3.10			
40	2	0.495	0.592	0.785	0.977	1.17	1.35	1.54	1.72	1.90	2.17	2.44	2.69	2.94	3.28			
42.4	1	0.525	0.628	0.833	1.04	1.24	1.44	1.63	1.83	2.02	2.30	2.59	2.86	3.14	3.49			
44.5	3	0.551	0.660	0.875	1.09	1.30	1.51	1.72	1.92	2.13	2.43	2.73	3.02	3.31	3.68			
48.3	1	-	0.717	0.951	1.18	1.42	1.64	1.87	2.10	2.31	2.65	2.97	3.30	3.61	4.03			
51	2	-	0.757	1.01	1.25	1.49	1.74	1.98	2.22	2.46	2.80	3.15	3.49	3.83	4.27			
54	3	-	0.802	1.07	1.33	1.59	1.84	2.10	2.35	2.60	2.97	3.35	3.70	4.07	4.54			
57	2	-	0.847	1.13	1.40	1.68	1.95	2.22	2.49	2.75	3.15	3.54	3.93	4.31	4.81			
60.3	1	-	0.897	1.19	1.48	1.78	2.06	2.35	2.64	2.92	3.34	3.76	4.17	4.58	5.11			
63.5	2	-	0.945	1.26	1.56	1.87	2.18	2.48	2.78	3.08	3.52	3.96	4.39	4.83	5.40			
70	2	-	-	1.39	1.73	2.07	2.40	2.74	3.07	3.40	3.90	4.38	4.87	5.35	5.99			
73	3	-	-	1.45	1.80	2.16	2.51	2.86	3.21	3.56	4.07	4.58	5.09	5.59	6.26			
76.1	1	-	-	1.51	1.88	2.25	2.62	2.98	3.35	3.70	4.25	4.78	5.32	5.84	6.54			
82.5	3	-	-	1.64	2.04	2.44	2.84	3.24	3.64	4.03	4.62	5.20	5.78	6.35	7.11			
88.9	1	-	-	1.76	2.20	2.64	3.07	3.49	3.93	4.35	4.98	5.61	6.24	6.86	7.68			
101.6	2	-	-	-	-	3.02	3.51	4.01	4.50	4.98	5.71	6.45	7.17	7.89	8.83			
108	3	-	-	-	-	3.21	3.74	4.26	4.79	5.31	6.09	6.86	7.63	8.40	9.41			
114.3	1	-	-	-	-	3.40	3.96	4.52	5.07	5.62	6.45	7.27	8.09	8.90	9.98			
127	2	-	-	-	-	-	-	5.02	5.64	6.26	7.18	8.10	9.01	9.92	11.1			
133	2	-	-	-	-	-	-	5.26	5.91	6.56	7.53	8.49	9.45	10.4	11.7			
139.7	1	-	-	-	-	-	-	5.53	6.22	6.89	7.91	8.92	9.93	11.0	12.3			
Refer to page 5-12 for outside diameters greater than 139.7 mm																		

Notes

- Bold type** indicates that the OD, wall thickness or weight is specified in ISO 1127:1992(E) 'Stainless steel tubes'. Underlined type indicates that the OD, wall thickness or weight is specified in the austenitic, ferritic and martensitic stainless steel tube tables of ISO 1129 'Steel tubes for boilers, superheaters and heat exchangers'.
- For ferritic and martensitic steel multiply the quoted austenitic steel weight by 0.97.

General Purpose Tube Sizes - ISO

Dimensions and weights per metre (based on ISO 4200 Group 1 - tubes for general purpose use)

 OD ¹ mm	ISO Series	Continuation	 Wall thickness ¹ , mm														Continuation
			4.0	4.5	5.0	5.4	5.6	6.3	7.1	8.0	8.8	10.0	11.0	12.5	14.2	16	
			 Weight ^{1,2} , kg/m (weights are true for austenitic steel)														
10.2	1	Refer to page 5-10 for wall thicknesses 0.5 to 3.6 mm	-	-	-	-	-	-	-	-	-	-	-	-	-	Refer to page 5-12 for wall thicknesses 17.5 to 65 mm	
12	2		-	-	-	-	-	-	-	-	-	-	-	-	-		
12.7	2		-	-	-	-	-	-	-	-	-	-	-	-	-		
13.5	1		-	-	-	-	-	-	-	-	-	-	-	-	-		
14	3		-	-	-	-	-	-	-	-	-	-	-	-	-		
16	2		1.20	-	-	-	-	-	-	-	-	-	-	-	-		
17.2	1		1.32	1.43	-	-	-	-	-	-	-	-	-	-	-		
18	3		1.40	1.52	-	-	-	-	-	-	-	-	-	-	-		
19	2		1.50	1.63	1.75	-	-	-	-	-	-	-	-	-	-		
20	2		1.60	1.75	1.88	-	-	-	-	-	-	-	-	-	-		
21.3	1		1.74	1.89	2.04	2.15	-	-	-	-	-	-	-	-	-		
22	3		1.81	1.97	2.13	2.24	-	-	-	-	-	-	-	-	-		
25	2		2.10	2.31	2.50	2.65	2.72	2.95	-	-	-	-	-	-	-		
25.4	3		2.14	2.35	2.55	2.70	2.78	3.01	-	-	-	-	-	-	-		
26.9	1		2.29	2.52	2.74	2.91	2.99	3.25	3.52	3.79	-	-	-	-	-		
30	3		2.60	2.87	3.13	3.33	3.42	3.74	4.07	4.41	-	-	-	-	-		
31.8	2		2.78	3.08	3.35	3.57	3.67	4.02	4.39	4.77	-	-	-	-	-		
32	2		2.80	3.10	3.38	3.60	3.70	4.05	4.43	4.81	-	-	-	-	-		
33.7	1		2.97	3.29	3.59	3.83	3.94	4.32	4.73	5.15	5.49	-	-	-	-		
35	3		3.11	3.43	3.76	4.00	4.12	4.53	4.96	5.41	5.77	-	-	-	-		
38	2		3.40	3.78	4.13	4.41	4.54	5.00	5.49	6.01	6.43	7.01	-	-	-		
40	2		3.60	4.00	4.38	4.68	4.82	5.32	5.85	6.41	6.87	7.51	-	-	-		
42.4	1		3.85	4.27	4.68	5.00	5.16	5.69	6.28	6.89	7.40	8.11	-	-	-		
44.5	3		4.06	4.51	4.94	5.29	5.45	6.03	6.65	7.31	7.87	8.64	9.23	10.0	-		
48.3	1		4.44	4.93	5.42	5.80	5.99	6.63	7.32	8.07	8.70	9.59	10.3	11.2	-		
51	2		4.71	5.24	5.76	6.17	6.36	7.04	7.81	8.61	9.30	10.3	11.0	12.0	-		
54	3		5.00	5.57	6.13	6.57	6.78	7.52	8.33	9.22	9.96	11.1	11.8	13.0	14.2		
57	2		5.31	5.92	6.51	6.98	7.21	8.00	8.87	9.82	10.7	11.8	12.7	13.9	15.2		
60.3	1		5.63	6.28	6.92	7.42	7.66	8.52	9.46	10.5	11.4	12.6	13.6	15.0	16.4		
63.5	2		5.96	6.65	7.32	7.86	8.12	9.02	10.0	11.1	12.1	13.4	14.5	16.0	17.5		
70	2		6.61	7.38	8.13	8.73	9.02	10.0	11.2	12.4	13.5	15.0	16.2	18.0	19.8		
73	3		6.91	7.72	8.51	9.14	9.45	10.5	11.7	13.0	14.1	15.8	17.1	18.9	20.9		
76.1	1		7.22	8.07	8.90	9.56	9.89	11.0	12.3	13.6	14.8	16.5	17.9	19.9	22.0		
82.5	3		7.86	8.79	9.70	10.4	10.8	12.0	13.4	14.9	16.2	18.2	19.7	21.9	24.3		
88.9	1		8.51	9.51	10.5	11.3	11.7	13.0	14.5	16.2	17.7	19.8	21.5	23.9	26.6		
101.6	2		9.77	11.0	12.1	13.0	13.5	15.0	16.7	18.8	20.4	22.9	25.0	27.9	31.1		
108	3		10.42	11.7	12.9	13.9	14.4	16.0	17.9	20.0	21.9	24.5	26.7	29.9	33.4		
114.3	1		11.1	12.4	13.7	14.7	15.2	17.1	19.1	21.3	23.2	26.1	28.5	31.9	35.6		
127	2		12.3	13.8	15.3	16.4	17.0	19.0	21.3	23.8	26.0	29.3	31.9	35.8	40.1		
133	2		12.9	14.5	16.0	17.3	17.9	20.0	22.4	25.0	27.4	30.8	33.6	37.7	42.2		
139.7	1		13.6	15.2	16.8	18.2	18.8	21.0	23.5	26.4	28.8	32.5	35.4	39.8	44.6		
Refer to page 5-13 for outside diameters 139.7 to 2540 mm																	

Notes

- Bold type** indicates that the OD, wall thickness or weight is specified in ISO 1127:1992(E) 'Stainless steel tubes'. Underlined type indicates that the OD, wall thickness or weight is specified in the austenitic, ferritic and martensitic stainless steel tube tables of ISO 1129 'Steel tubes for boilers, superheaters and heat exchangers'.
- For ferritic and martensitic steel multiply the quoted austenitic steel weight by 0.97.

General Purpose Tube Sizes - ISO

Dimensions and weights per metre (based on ISO 4200 Group 1 - tubes for general purpose use)

OD ¹  mm	ISO Series	Continuation	 Wall thickness ¹ , mm													
			17.5	20	22.2	25.0	28.0	30.0	32.0	36.0	40.0	45.0	50.0	55.0	60.0	65.0
			 Weight ^{1,2} , kg/m (weights are true for austenitic steel)													
<u>57</u>	2	Refer to page 5-10 for wall thicknesses 0.5 to 3.6 mm Refer to page 5-11 for wall thicknesses 4.0 to 16 mm	-	-	-	-	-	-	-	-	-	-	-	-	-	
<u>60.3</u>	1		-	-	-	-	-	-	-	-	-	-	-	-	-	
<u>63.5</u>	2		-	-	-	-	-	-	-	-	-	-	-	-	-	
<u>70</u>	2		23.0	-	-	-	-	-	-	-	-	-	-	-	-	
73	3		24.3	-	-	-	-	-	-	-	-	-	-	-	-	
<u>76.1</u>	1		25.7	28.1	-	-	-	-	-	-	-	-	-	-	-	
<u>82.5</u>	3		28.5	31.3	33.5	-	-	-	-	-	-	-	-	-	-	
<u>88.9</u>	1		31.3	34.5	37.1	40.0	-	-	-	-	-	-	-	-	-	
<u>101.6</u>	2		36.9	40.9	44.1	47.9	51.6	-	-	-	-	-	-	-	-	
108	3		39.7	44.1	47.7	52.0	56.1	58.6	-	-	-	-	-	-	-	
<u>114.3</u>	1		42.4	47.2	51.2	55.9	60.5	63.3	65.9	-	-	-	-	-	-	
127	2		48.0	53.6	58.3	63.8	69.4	72.9	76.1	82.0	-	-	-	-	-	
133	2		50.6	56.6	61.6	67.6	73.6	77.4	80.9	87.4	93.1	-	-	-	-	
<u>139.7</u>	1		53.5	59.9	65.3	71.8	78.3	82.4	86.3	93.5	99.9	-	-	-	-	
Refer to page 5-14 for outside diameters greater than 139.7 mm																

 OD ¹ mm	ISO Series	 Wall thickness ¹ , mm														Continuation
		0.5	0.6	0.8	1.0	1.2	1.4	1.60	1.8	2.0	2.3	2.6	2.9	3.2	3.6	
		 Weight ^{1,2} , kg/m (weights are true for austenitic steel)														
Refer to page 5-10 for outside diameters less than 141.3 mm																
141.3	3	-	-	-	-	-	-	5.60	6.29	6.98	8.00	9.03	10.0	11.1	12.4	Refer to page 5-11 for wall thicknesses 4.0 to 16 mm Refer to page 5-14 for wall thicknesses 17.5 to 66 mm
152.4	3	-	-	-	-	-	-	6.04	6.79	7.53	8.64	9.75	10.9	12.0	13.4	
159	3	-	-	-	-	-	-	6.31	7.08	7.86	9.02	10.2	11.3	12.5	14.0	
168.3	1	-	-	-	-	-	-	6.68	7.50	8.32	9.56	10.8	12.0	13.2	14.8	
177.8	3	-	-	-	-	-	-	-	7.93	8.80	10.1	11.4	12.7	14.0	15.7	
193.7	3	-	-	-	-	-	-	-	8.65	9.60	11.0	12.4	13.9	15.3	17.1	
219.1	1	-	-	-	-	-	-	-	9.79	10.9	12.5	14.1	15.7	17.3	19.4	
244.5	3	-	-	-	-	-	-	-	-	12.1	13.9	15.7	17.5	19.3	21.7	
273	1	-	-	-	-	-	-	-	-	13.6	15.6	17.6	19.6	21.6	24.3	
323.9	1	-	-	-	-	-	-	-	-	16.1	-	20.9	23.3	25.7	28.9	
355.6	1	-	-	-	-	-	-	-	-	17.7	-	22.9	25.6	28.2	31.7	
406.4	1	-	-	-	-	-	-	-	-	20.2	-	26.3	29.3	32.3	36.3	
457	1	-	-	-	-	-	-	-	-	22.7	-	-	-	36.3	40.9	
508	1	-	-	-	-	-	-	-	-	25.4	-	-	-	40.4	45.5	
559	3	-	-	-	-	-	-	-	-	-	-	-	-	44.5	50.1	
610	1	-	-	-	-	-	-	-	-	-	-	-	-	48.6	54.7	
660	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Refer to page 5-13 and 5-14 for outside diameters greater than 660 mm																

Notes

- Bold type** indicates that the OD, wall thickness or weight is specified in ISO 1127:1992(E) 'Stainless steel tubes'.
Underlined type indicates that the OD, wall thickness or weight is specified in the austenitic, ferritic and martensitic stainless steel tube tables of ISO 1129 'Steel tubes for boilers, superheaters and heat exchangers'.
Italic type indicates additional sizes (not ISO) specified in DIN 2463 Part 1 (see page 5-17).
- For ferritic and martensitic steel multiply the quoted austenitic steel weight by 0.97.

General Purpose Tube Sizes - ISO

Dimensions and weights per metre (based on ISO 4200 Group 1 - tubes for general purpose use)

 OD ¹ mm	ISO Series	Continuation	 Wall thickness ¹ , mm														Continuation
			4.0	4.5	5.0	5.4	5.6	6.3	7.1	8.0	8.8	10.0	11.0	12.5	14.2	16	
			 Weight ^{1,2} , kg/m (weights are true for austenitic steel)														
Refer to page 5-11 for outside diameters less than 141.3 mm																	
141.3	3	Refer to page 5-12 for wall thicknesses 0.5 to 3.6 mm	13.8	15.4	17.1	18.4	19.0	21.3	23.9	26.7	29.2	32.9	35.9	40.3	45.2	50.2	Refer to page 5-14 for wall thicknesses 17.5 to 65 mm
152.4	3		14.9	16.7	18.5	19.9	20.6	23.0	25.8	28.9	31.6	35.7	38.9	43.8	49.1	54.6	
159	3		15.5	17.4	19.3	20.8	21.5	24.1	27.0	30.2	33.1	37.3	40.8	45.9	51.5	57.3	
168.3	1		16.4	18.5	20.4	22.0	22.8	25.6	28.6	32.1	35.1	39.6	43.3	48.8	54.8	61.0	
177.8	3		17.4	19.5	21.6	23.3	24.1	27.1	30.3	34.0	37.2	42.0	45.9	51.7	58.2	64.8	
193.7	3		19.0	21.3	23.6	25.5	26.4	29.6	33.2	37.2	40.7	46.0	50.3	56.7	63.8	71.2	
219.1	1		21.5	24.2	26.8	28.9	29.9	33.6	37.7	42.2	46.3	52.4	57.3	64.7	72.9	81.4	
244.5	3		24.1	27.0	30.0	32.3	33.5	37.6	42.2	47.4	51.9	58.7	64.3	72.6	81.9	91.5	
273	1		26.9	30.3	33.6	36.2	37.5	42.0	47.3	53.1	58.2	65.9	72.2	81.5	92.0	103	
323.9	1		32.1	35.9	39.9	43.1	44.6	50.1	56.3	63.3	69.4	78.6	86.2	97.4	110	123	
355.6	1		35.2	39.6	43.8	47.3	49.1	55.1	62.0	69.6	76.4	86.5	94.9	108	121	136	
406.4	1		40.3	45.3	50.2	54.2	56.2	63.1	71.0	79.8	87.6	99.3	109	123	139	156	
457	1		45.4	51.0	56.5	61.1	63.3	71.1	80.0	89.9	98.8	112	123	139	157	177	
508	1		50.5	56.7	62.9	68.0	70.4	79.1	89.0	100	110	125	137	155	176	197	
559	3		55.6	62.5	69.4	74.9	77.6	87.2	98.1	110	121	137	151	171	194	218	
610	1		60.7	68.2	75.7	81.7	84.8	95.2	107	121	132	150	165	187	212	238	
660	3		65.7	73.9	82.0	88.5	91.8	103	116	131	143	163	179	203	230	258	
711	1		70.8	79.6	88.4	95.4	98.9	111	125	141	155	176	193	219	248	278	
762	2		75.9	85.3	94.8	102	106	119	134	151	166	188	207	235	266	299	
813	1		81.0	91.1	101	109	113	127	143	161	177	201	221	251	284	319	
864	3		86.1	96.8	108	116	120	135	152	171	188	214	235	267	302	340	
914	1		91.1	102	114	123	127	143	161	181	199	226	249	282	320	360	
1016	1		101	114	127	137	142	159	179	202	222	252	277	314	356	401	
1067	1		-	-	133	144	149	167	188	212	233	265	291	330	374	421	
1118	1		-	-	139	150	156	175	197	222	244	277	305	346	392	441	
1168	2		-	-	146	157	163	183	206	232	255	290	319	362	410	462	
1219	1		-	-	152	164	170	191	215	243	267	303	333	378	428	482	
1321	2		-	-	-	-	184	207	234	263	289	328	361	410	465	523	
1422	1		-	-	-	-	199	223	252	283	311	354	389	441	501	563	
1524	2		-	-	-	-	-	239	270	304	334	379	417	473	537	604	
1626	1		-	-	-	-	-	255	288	324	356	405	445	505	573	645	
1727	2		-	-	-	-	-	-	306	344	379	430	473	537	609	685	
1829	1		-	-	-	-	-	-	324	365	401	455	501	569	645	726	
1930	2		-	-	-	-	-	-	-	385	423	481	529	600	681	767	
2032	1		-	-	-	-	-	-	-	405	446	506	557	632	717	808	
2134	2		-	-	-	-	-	-	-	-	468	532	585	664	754	849	
2235	1		-	-	-	-	-	-	-	-	491	557	613	696	790	889	
2337	2		-	-	-	-	-	-	-	-	-	583	641	728	826	930	
2438	2		-	-	-	-	-	-	-	-	-	608	668	759	862	970	
2540	1		-	-	-	-	-	-	-	-	-	633	697	791	898	1011	

Notes

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- For ferritic and martensitic steel multiply the quoted austenitic steel weight by 0.97.

General Purpose Tube Sizes - ISO

Dimensions and weights per metre (based on ISO 4200 Group 1 - tubes for general purpose use)

 OD ¹ mm	ISO Series	Continuation	 Wall thickness ¹ , mm													
			17.5	20.0	22.2	25.0	28.0	30.0	32.0	36.0	40.0	45.0	50.0	55.0	60.0	65.0
			 Weight ^{1,2} , kg/m (weights are true for austenitic steel)													
Refer to page 5-12 for outside diameters less than 141.3 mm																
141.3	3	Refer to page 5-12 for wall thicknesses 0.5 to 3.6 mm Refer to page 5-13 for wall thicknesses 4.0 to 16 mm	54.2	60.7	66.2	72.8	79.4	83.6	87.6	94.9	101	-	-	-	-	-
152.4	3		59.1	66.3	72.4	79.7	87.2	91.9	96.5	105	113	121	-	-	-	-
159	3		62.0	69.6	76.0	83.9	91.8	96.9	102	111	119	128	-	-	-	-
168.3	1		66.1	74.3	81.2	89.7	98.4	104	109	119	128	139	148	-	-	-
177.8	3		70.2	79.0	86.5	95.6	105	111	117	128	138	150	160	-	-	-
193.7	3		77.2	87.0	95.3	106	116	123	130	142	154	168	180	191	201	-
219.1	1		88.3	99.7	109	121	134	142	150	165	179	196	212	226	239	251
244.5	3		99.47	112	124	137	152	161	170	188	205	225	243	261	277	292
273	1		112	127	139	155	172	183	193	214	233	257	279	300	320	339
323.9	1		134	152	168	187	207	221	234	260	284	314	343	370	396	421
355.6	1		148	168	185	207	230	245	259	288	316	350	383	414	444	473
406.4	1		170	193	214	239	265	283	300	334	367	407	446	484	520	556
457	1		193	219	242	270	301	321	341	379	418	464	510	554	596	638
508	1		215	244	270	302	337	359	381	425	469	522	573	624	673	721
559	3		237	270	298	334	372	397	422	471	520	579	637	694	750	804
610	1		260	295	327	366	408	436	463	517	571	637	701	764	826	887
660	3		282	320	355	397	443	473	503	562	621	693	764	833	901	968
711	1		304	346	383	429	479	512	544	608	672	750	828	903	978	1051
762	2		326	372	411	461	515	550	585	654	723	808	891	974	1055	1134
813	1		349	397	440	493	550	588	626	700	774	865	955	1044	1131	1217
864	3		371	423	468	525	586	626	667	746	825	923	1019	1114	1208	1300
914	1		393	448	496	556	621	664	707	791	875	979	1082	1183	1283	1382
1016	1		438	499	552	620	693	741	788	883	978	1094	1209	1323	1436	1548
1067	1		460	524	581	652	728	779	829	929	1029	1152	1273	1394	1513	1631
1118	1		482	550	609	684	764	817	870	975	1080	1209	1337	1464	1589	1714
1168	2		504	575	637	715	799	855	910	1020	1130	1265	1400	1533	1665	1795
1219	1		526	600	665	747	835	893	951	1066	1181	1323	1463	1603	1741	1878
1321	2		571	652	722	811	906	970	1033	1158	1283	1438	1591	1743	1894	2044
1422	1		615	702	778	874	977	1046	1114	1249	1384	1552	1718	1883	2046	2209
1524	2		660	753	835	938	1049	1122	1195	1341	1486	1666	1845	2023	2199	2375
1626	1		705	804	891	1002	1120	1199	1277	1433	1588	1781	1973	2163	2353	2541
1727	2		749	855	948	1065	1191	1275	1358	1524	1690	1895	2099	2303	2504	2705
1829	1		794	906	1004	1129	1263	1351	1440	1616	1792	2010	2227	2443	2658	2871
1930	2		838	956	1060	1192	1333	1427	1521	1707	1893	2124	2354	2582	2809	3035
2032	1		883	1008	1117	1256	1405	1504	1602	1799	1995	2239	2481	2723	2963	3201
2134	2		927	1059	1174	1320	1476	1580	1684	1891	2097	2354	2609	2863	3116	3367
2235	1		972	1109	1230	1383	1547	1656	1765	1982	2198	2468	2735	3002	3268	3532
2337	2		1016	1160	1287	1447	1619	1733	1847	2074	2301	2582	2863	3143	3421	3698
2438	2		1061	1211	1343	1510	1690	1809	1928	2165	2402	2696	2990	3282	3572	3862
2540	1		1105	1262	1400	1574	1761	1885	2009	2257	2504	2811	3117	3422	3726	4028

Notes

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Underlined type indicates that the OD, wall thickness or weight is specified in the austenitic, ferritic and martensitic stainless steel tube tables of **ISO 1129 'Steel tubes for boilers, superheaters and heat exchangers'**.
- For ferritic and martensitic steel multiply the quoted austenitic steel weight by 0.97.

Precision Tube Sizes - ISO

Dimensions and weights per metre (based on ISO 4200 Group 2 - precision tubes)

 OD mm	ISO Series	 Wall thickness ¹ , mm														Continuation
		0.5	(0.8)	1	(1.2)	1.5	(1.8)	2	(2.2)	2.5	(2.8)	3	(3.5)	4	(4.5)	
		 Weight ² , kg/m (conventional weights)														
4	2	0.043	0.063	0.074	0.083	-	-	-	-	-	-	-	-	-	-	
5	2	0.056	0.083	0.099	0.112	-	-	-	-	-	-	-	-	-	-	
6	2	0.068	0.103	0.123	0.142	0.166	0.186	0.197	-	-	-	-	-	-	-	
8	2	0.092	0.142	0.173	0.201	0.240	0.275	0.296	0.315	0.339	-	-	-	-	-	
10	2	0.117	0.182	0.222	0.260	0.314	0.364	0.395	0.423	0.462	-	-	-	-	-	
12	2	0.142	0.221	0.271	0.320	0.388	0.453	0.493	0.532	0.586	0.635	0.666	-	-	-	
12.7	2	0.150	0.235	0.289	0.340	0.414	0.484	0.528	0.570	0.629	0.684	0.718	-	-	-	
14	3	0.166	0.260	0.321	0.379	0.462	0.542	0.592	0.640	0.709	0.773	0.814	0.906	-	-	
16	2	0.191	0.300	0.370	0.438	0.536	0.630	0.691	0.749	0.832	0.911	0.962	1.08	1.18	-	
18	3	0.216	0.339	0.419	0.497	0.610	0.719	0.789	0.857	0.956	1.05	1.11	1.25	1.38	1.50	
20	2	0.240	0.379	0.469	0.556	0.684	0.808	0.888	0.966	1.08	1.19	1.26	1.42	1.58	1.72	
22	3	0.265	0.418	0.518	0.616	0.758	0.897	0.986	1.07	1.20	1.33	1.41	1.60	1.78	1.94	
25	2	0.302	0.477	0.592	0.704	0.869	1.03	1.13	1.24	1.39	1.53	1.63	1.86	2.07	2.28	
28	3	0.339	0.537	0.666	0.793	0.980	1.16	1.28	1.40	1.57	1.74	1.85	2.11	2.37	2.61	
30	3	0.364	0.576	0.715	0.852	1.05	1.25	1.38	1.51	1.70	1.88	2.00	2.29	2.56	2.83	
32	2	0.388	0.616	0.765	0.911	1.13	1.34	1.48	1.62	1.82	2.02	2.15	2.46	2.76	3.05	
35	3	0.425	0.675	0.838	1.00	1.24	1.47	1.63	1.78	2.00	2.22	2.37	2.72	3.06	3.38	
38	2	0.462	0.734	0.912	1.09	1.35	1.61	1.78	1.94	2.19	2.43	2.59	2.98	3.35	3.72	
40	2	0.487	0.773	0.962	1.15	1.42	1.70	1.87	2.05	2.31	2.57	2.74	3.15	3.55	3.94	
45	3	-	0.872	1.09	1.30	1.61	1.92	2.12	2.32	2.62	2.91	3.11	3.58	4.04	4.49	
50	2	-	0.971	1.21	1.44	1.79	2.14	2.37	2.59	2.93	3.26	3.48	4.01	4.54	5.05	
55	3	-	1.07	1.33	1.59	1.98	2.36	2.61	2.86	3.24	3.60	3.85	4.45	5.03	5.60	
60	2	-	1.17	1.46	1.74	2.16	2.58	2.86	3.14	3.55	3.95	4.22	4.88	5.52	6.16	
70	2	-	1.36	1.70	2.04	2.53	3.03	3.35	3.68	4.16	4.64	4.96	5.74	6.51	7.27	
80	2	-	1.56	1.95	2.33	2.90	3.47	3.85	4.22	4.78	5.33	5.70	6.60	7.50	8.38	
90	3	-	-	-	2.63	3.27	3.92	4.34	4.76	5.39	6.02	6.44	7.47	8.48	9.49	
100	2	-	-	-	2.92	3.64	4.36	4.83	5.31	6.01	6.71	7.18	8.33	9.47	10.6	
110	3	-	-	-	3.22	4.01	4.80	5.33	5.85	6.63	7.40	7.92	9.19	10.5	11.7	
120	2	-	-	-	-	-	5.25	5.82	6.39	7.24	8.09	8.66	10.1	11.4	12.8	
140	3	-	-	-	-	-	6.13	6.81	7.48	8.48	9.47	10.1	11.8	13.4	15.0	
160	2	-	-	-	-	-	7.02	7.79	8.56	9.71	10.9	11.6	13.5	15.4	17.3	
180	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
200	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
220	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
240	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
260	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Refer to page 5-16 for wall thicknesses 5 to 25 mm

Refer to page 5-16 for wall thicknesses 5 to 25 mm

Notes

- 1 Thicknesses in parentheses should be avoided where possible
- 2 Conventional weights (carbon steel) are quoted.
For austenitic stainless steels multiply the quoted weight by 1.014.
For ferritic and martensitic steels multiply the quoted weight by 0.985.

Precision Tube Sizes - ISO

Dimensions and weights per metre (based on ISO 4200 Group 2 - precision tubes)

 OD mm	ISO Series	Continuation	 Wall thickness ¹ , mm														
			5	(5.5)	6	(7)	8	(9)	10	(11)	12.5	(14)	16	(18)	20	(22)	25
			 Weight ² , kg/m (conventional weights)														
4	2	Refer to page 5-15 for wall thicknesses 0.5 to 4.5 mm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
8	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
10	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
12	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
12.7	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
14	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
16	2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
18	3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
20	2		1.85	-	-	-	-	-	-	-	-	-	-	-	-	-	
22	3		2.10	-	-	-	-	-	-	-	-	-	-	-	-	-	
25	2		2.47	2.64	2.81	-	-	-	-	-	-	-	-	-	-	-	
28	3		2.84	3.05	3.26	3.63	3.95	-	-	-	-	-	-	-	-	-	
30	3		3.08	3.32	3.55	3.97	4.34	-	-	-	-	-	-	-	-	-	
32	2		3.33	3.59	3.85	4.32	4.74	-	-	-	-	-	-	-	-	-	
35	3		3.70	4.00	4.29	4.83	5.33	-	-	-	-	-	-	-	-	-	
38	2		4.07	4.41	4.74	5.35	5.92	6.44	6.91	-	-	-	-	-	-	-	
40	2		4.32	4.68	5.03	5.70	6.31	6.88	7.40	-	-	-	-	-	-	-	
45	3		4.93	5.36	5.77	6.56	7.30	7.99	8.63	9.22	10.0	-	-	-	-	-	
50	2		5.55	6.04	6.51	7.42	8.29	9.10	9.86	10.6	11.6	-	-	-	-	-	
55	3		6.17	6.71	7.25	8.29	9.27	10.2	11.1	11.9	13.1	14.2	-	-	-	-	
60	2		6.78	7.39	7.99	9.15	10.3	11.3	12.3	13.3	14.6	15.9	17.4	-	-	-	
70	2		8.01	8.75	9.47	10.9	12.2	13.5	14.8	16.0	17.7	19.3	21.3	-	-	-	
80	2		9.25	10.1	10.9	12.6	14.2	15.8	17.3	18.7	20.8	22.8	25.3	27.5	-	-	
90	3		10.5	11.5	12.4	14.3	16.2	18.0	19.7	21.4	23.9	26.2	29.2	32.0	34.5	36.9	
100	2	11.7	12.8	13.9	16.1	18.2	20.2	22.2	24.1	27.0	29.7	31.1	36.4	39.5	42.3		
110	3	12.9	14.2	15.4	17.8	20.1	22.4	24.7	26.9	30.1	33.1	37.1	40.8	44.4	47.7		
120	2	14.2	15.5	16.9	19.5	22.1	24.6	27.1	29.6	33.1	36.6	41.0	45.3	49.3	53.2		
140	3	16.6	18.2	19.8	23.0	26.0	29.1	32.1	35.0	39.3	43.5	48.9	54.2	59.2	64.0		
160	2	19.1	21.0	22.8	26.4	30.0	33.5	37.0	40.4	45.5	50.4	56.8	63.0	69.1	74.9		
180	3	21.6	23.7	25.7	29.9	33.9	38.0	41.9	45.8	51.6	57.3	64.7	71.9	78.9	85.7		
200	2	-	-	28.7	33.3	37.9	42.4	46.9	51.3	57.8	64.2	72.6	80.8	88.8	96.6		
220	3	-	-	-	36.8	41.8	46.8	51.8	56.7	64.0	71.1	80.5	89.7	98.6	107		
240	3	-	-	-	40.2	45.8	51.3	56.7	62.1	70.1	78.0	88.4	98.6	109	118		
260	3	-	-	-	43.7	49.7	55.7	61.7	67.5	76.3	84.9	96.3	107	118	129		

Notes

- 1 Thicknesses in parentheses should be avoided where possible
- 2 Conventional weights (carbon steel) are quoted.
For austenitic stainless steels multiply the quoted weight by 1.014.
For ferritic and martensitic steels multiply the quoted weight by 0.985.

Pipe and Tube - DIN

The DIN standards for stainless steel pipe and tube dimensions and weights are described below, together with a list of applicable DIN technical delivery standards.

DIN Pipe and Tube Specifications

- **DIN 2462 Part 1** 'Seamless stainless steel tubes, Dimensions and masses per unit length'. This standard covers austenitic, ferritic and martensitic stainless steel tubes and defines dimensions, weights and tolerances.
- **DIN 2463 Part 1** 'Welded austenitic stainless steel pipes and tubes'. This standard covers welded austenitic stainless steel tubes and defines dimensions, weights and tolerances.

DIN Tube Sizes

DIN 2462 and DIN 2463 tubes comply with the dimensions and weights per metre specified in ISO 1127 (see pages 5-8 to 5-14). DIN 2462 covers seamless tube from 6 mm to 406.4 mm OD and from 1 mm to 14.2 mm wall thickness. DIN 2463 covers welded tube from 6 mm to 1016 mm OD and from 1 mm to 8.8 mm wall thickness.

Tolerances - DIN 2462 and DIN 2463

DIN 2462 and 2463 specify the following ISO 5252 defined tolerances (see page 5-8):

Tolerances specified in DIN 2462 and DIN 2463

DIN Standard and Manufacturing Process	Outside Diameter (OD)	Outside Diameter Tolerance (ISO 5252)	Wall Thickness (t)	Wall Thickness Tolerance (ISO 5252)	Deviation from Straight per 1 m Length	
DIN 2462 Cold Worked	≤219.1 mm	D2	All	T3	2 mm max for OD >17.2 to 114.3 mm, 2.5 mm max for OD >114.3 mm	
		D3 ¹ or D4 ¹		T4 ¹		
DIN 2462 Hot Worked	44.5 to 219.1 mm	D1	All	T1		
		D2		T2		
	>219.1 to 610 mm	D1		<0.05 x OD		+22.5%, -15%
				0.05 x OD to 0.09 x OD		T1
				>0.09 x OD	T2	
DIN 2463 Welded	≤168.3 mm	D2	All	T3	2 mm max for OD >17.2 to 114.3 mm, 2.5 mm max for OD >114.3	
		D3 ¹ or D4 ¹		T4 ¹		
	>168.3 mm	±1.0% max, ±3 mm				T3

Notes

- 1 May be specified in special cases.
- Additional cut length tolerances are as follows:
 For OD ≤ 40 mm, tolerance = $\pm 1, -0$ mm (≤ 1 m); $\pm 2, -0$ mm (≤ 2 m); $\pm 3, -0$ mm (≤ 3 m); $\pm 4, -0$ mm (≤ 4 m); $\pm 5, -0$ mm (≤ 8 m).
 For OD >40 mm to 168 mm, tolerance = $\pm 5, -0$ mm (≤ 6 m); $\pm 3, -0$ mm (>6 m).
 For OD >168 mm, tolerance = $\pm 10, -0$ mm

DIN Technical Delivery Standards

The following DIN standards (not covered in this manual) define the technical delivery conditions, similar to those in the ASTM pipe and tube standards (see Section 2 and 3), that may be specified for DIN 2462 and DIN 2463 tubes.

- **DIN 17455** 'General purpose welded circular stainless steel tubes'.
- **DIN 17456** General purpose seamless circular stainless steel tubes'.
- **DIN 17457** 'Welded circular austenitic stainless steel tubes subject to special requirements'.
- **DIN 17458** 'Seamless circular austenitic stainless steel tubes subject to special requirements'.

Tube Sizes - Metric / Inside Diameter

The following table lists metric tube sizes specified on inside diameter. The table is based on ISO 4200 pipe sizes and weights, with manufacturers' data added (shown in *italics*) for additional common sizes. Commonly available sizes are shown in **bold**.

Dimensions and weights per metre (based on ISO 4200 sizes and manufacturer's data)

Inside Diameter ID  mm	Wall thickness, mm							
	1.0	1.5	2.0	2.5	3.0	4.0	5.0	6.0
	 Weight, kg/m (conventional weights)							
4	0.123							
6	0.173		0.395		0.666			
8	0.222		0.493		0.814	1.18		
10	0.271	0.430	0.592		0.962	1.38	1.85	
12	0.321	0.507	0.691		1.11	1.58	2.10	
13		0.536		0.956				2.81
14	0.370		0.789		1.26	1.78		
15	0.400	0.610	0.851	1.08			2.47	
16	0.419		0.888		1.41			3.26
17		0.684		1.20		2.07		
18	0.469		0.986				2.84	3.55
19		0.758			1.63			
20	0.518	0.807		1.39		2.37	3.08	3.85
21			1.13					
22		0.869			1.85	2.56	3.33	
23	0.592			1.57				4.29
25		0.980		1.70			3.70	
26	0.666		1.38		2.15		4.07	4.74
27		1.05		1.82		3.06		
28	0.715		1.48					5.03
29		1.13			2.37			
30	0.765	1.18		2.00		3.35	4.32	
31			1.63					
32		1.24			2.59	3.55		
33	0.838			2.19				5.77
34			1.78		2.74			
35		1.35		2.13			4.93	
36	0.912		1.87					
37		1.42				4.04		
38	0.962							6.51
40		1.56		2.62			5.55	
40.5			2.13					
43	1.09							7.25
47		1.79	2.46			5.03		
48	1.21	1.86						7.99
50		1.93	2.60	3.24			6.78	

Continued on next page

Notes

- Commonly available sizes are shown in **bold**.
- Information based on manufacturers' data is shown in *italics*.
- Conventional weights are quoted.
For austenitic stainless steels multiply the quoted weight by 1.014.
For ferritic and martensitic steels multiply the quoted weight by 0.985.

Tube Sizes - Metric / Inside Diameter

Dimensions and weights per metre (based on ISO 4200 sizes and manufacturer's data)

Inside Diameter ID  mm	Wall thickness, mm							
	1.0	1.5	2.0	2.5	3.0	4.0	5.0	6.0
	 Weight, kg/m (conventional weights)							
Continued from previous page								
53	1.33		2.75		3.85			
65		2.50	3.35	4.16				
66			3.40					
75				4.78				
80		3.06	4.10				10.5	
100		3.81	5.11	6.41			12.9	
125		4.75	6.36		9.61			
150		5.69	7.61		11.5		19.1	
200		7.56	10.1	12.7	15.2			
250			12.6	15.8	19.0			
300			15.1	18.9	22.7			
350				22.1	26.5			
400					30.3			
450					34.0			
500					37.8	50.5	63.4	76.2
550								
600					45.3	60.5	76.0	91.3
700					52.8	70.5	88.5	106
800					60.3	80.5	101	121
900					68.1	90.8	114	137
1000					75.6	101	126	152
1200					90.7	121	151	182

Notes

- Commonly available sizes are shown in **bold**.
- Information based on manufacturers' data is shown in *italics*.
- Conventional weights are quoted.
For austenitic stainless steels multiply the quoted weight by 1.014.
For ferritic and martensitic steels multiply the quoted weight by 0.985.

General Purpose Seamless Tube

The following table lists tube sizes commonly manufactured to ASTM A 269 or ASTM A 511. The tables are based on manufacturer's information.

Imperial dimensions and weights per metre

OD  in	Wall thickness, in												
	0.020	0.022	0.028	0.035	0.036	0.048	0.064	0.080	0.104	0.125	0.188	0.250	0.375
	Weight, kg/m (conventional weights)												
1/8	0.034	0.037	0.044		0.052								
3/16		0.059	0.072		0.088	0.109							
1/4	0.075	0.081	0.101		0.125	0.157	0.193						
5/16			0.129		0.161	0.206	0.258						
3/8			0.157		1.20	0.254	0.323	0.383		0.507			
7/16					0.234		0.525						
1/2			0.214	0.264	0.273	0.352	0.452	0.545		0.760			
5/8					0.344	0.449	0.582	0.714		1.01			
3/4					0.417	0.546	0.712	0.869	1.09	1.27	1.71		
7/8						0.643	0.841	1.03		1.52			
1					0.563	0.741	0.971	1.19	1.51	1.77	2.48	3.04	3.80
1 1/8						0.838	1.10						
1 1/4						0.944	1.23	1.52		2.28			
1 3/8					0.781		1.36						
1 1/2					0.854		1.49	1.84		2.79	4.00	5.07	
1 5/8							1.62						
1 3/4						1.32	1.75			3.29			
2							2.01			3.80		7.09	
2 1/4										4.31		8.11	
2 1/2							2.53			4.81		9.12	
2 3/4							2.79						
3							3.05	3.79		5.83		11.1	
3 1/2												13.2	
4										7.85		15.2	
5												19.4	
6												23.5	

Metric dimensions and weights per metre

OD  mm	Wall thickness, mm					
	0.5	1.0	1.5	2.0	2.5	3.0
	Weight, kg/m (conventional weights)					
6	0.069	0.126	0.170			
8		0.176	0.245			
10		0.226	0.321	0.403		
12		0.277	0.396	0.503		
14			0.462	0.604		
15		0.352	0.510	0.654		
16			0.547	0.705		
18			0.623			
20			0.698	0.888		1.28
22			0.774	1.02		
25			0.887	1.16	1.43	1.66
28			1.00	1.31		
30				1.41		2.04
36				1.66		
38						2.64
40				1.91		3.42
42				2.01		
50				2.42		

Note

- Conventional weights are quoted in both tables above.
- For austenitic stainless steels multiply the quoted weight by 1.014.
- For ferritic and martensitic steels multiply the quoted weight by 0.985.

Structural and Decorative Tubing

Significant quantities of stainless steel tubing are used for structural and decorative (ornamental) applications. Most of the tubing used in these applications is HF welded, although some TIG welded is also used.

Structural tubing may be specified to ASTM A 554, Welded Stainless Steel Mechanical Tubing (see page 3-38).

Square structural and decorative tube - typical sizes

Square size: Outside Dimensions		Wall thickness, mm									
		1.0	1.2	1.5	2.0	2.5	3.0	4.0	5.0	6.0	10.0
mm	in	 Weight, kg/m (austenitic stainless steel)									
10.00		0.34									
12.70	1/2	0.37	0.44	0.55							
15.00			0.53	0.65							
20.00		0.60	0.71	0.88	1.19						
22.00			0.79								
25.00			0.92	1.14	1.49	1.92	2.20				
25.40	1		0.97	1.10							
30.00			1.10	1.37	1.84	2.32	2.72				
32.00	1 1/4		1.20	1.47							
35.00				1.62	2.15						
38.00	1 1/2		1.37	1.75	2.31		3.51				
40.00			1.49	1.85	2.45		3.75	4.80			
50.00				2.32	3.08		4.65	5.96	7.41		
60.00				2.80	3.71		5.49	7.22	8.90		
70.00					4.38		6.53	8.45	10.6		
80.00					4.98		7.53	9.81	12.3		
100.00	4				6.40		9.53	12.4	15.3	17.5	
120.00							11.8	14.7	18.0		36.0
150.00							14.0	18.6	23.0	31.2	
200.00							19.1	24.8	30.8	35.0	
250.00									37.1		

Note

- This table is based on manufacturer's data.
- For ferritic and martensitic steel multiply the quoted austenitic steel weight by 0.97.

Structural and Decorative Tubing

Rectangular structural and decorative tube - typical sizes

Size: Outside Dimensions	Wall thickness, mm								
	1.0	1.2	1.5	2.0	2.5	3.0	4.0	5.0	6.0
mm	 Weight, kg/m (austenitic stainless steel)								
20 x 10	0.30	0.35	0.44						
25 x 10			0.59						
25 x 15		0.72	0.90						
30 x 10		0.71	0.90						
30 x 15		0.82	0.76						
30 x 20		0.92	1.14	1.49					
40 x 15		1.01	1.25						
40 x 20		1.10	1.37	1.84					
40 x 30			1.61	2.13					
50 x 25		1.41	1.75	2.31	3.75				
50 x 30			1.85			3.61			
50 x 40						4.08			
60 x 20			1.85	2.45					
60 x 30				2.80		4.13			
60 x 40			2.32	3.08		4.65	5.60		
70 x 40				3.40					
80 x 40			2.80	3.71		5.49	7.22	8.94	
80 x 60				4.38		6.53			
100 x 40			3.29			6.53			
100 x 50				4.68		6.95	9.09	11.3	
100 x 60				4.98		7.53	9.81	12.3	
120 x 40				5.00		7.43			
120 x 60				5.64		8.12			
120 x 80						9.53			17.3
150 x 50						9.53			
150 x 80						10.7			
150 x 100						11.7	15.4	18.8	22.6
200 x 100						11.1	18.5	22.6	27.1

Note

- This table is based on manufacturer's data.
- For ferritic and martensitic steel multiply the quoted austenitic steel weight by 0.97.

Structural and Decorative Tubing

Round structural and decorative tube - typical sizes

Outside Diameter (OD)		Wall thickness, mm						
		1.0	1.2	1.5	2.0	2.5	3.0	4.0
mm	in	 Weight, kg/m (austenitic stainless steel)						
6.00		0.13	0.14	0.17	0.20	-	-	-
8.00		0.18	0.20	0.24	0.30	-	-	-
9.53	3/8	0.21	0.25	0.30	0.38	-	-	-
10.00		0.23	0.26	0.32	0.40	0.47	-	-
12.00		0.28	0.32	0.39	0.50	0.59	0.68	-
12.70	1/2	0.29	0.35	0.42	0.54	0.64	0.73	-
14.00		0.33	0.39	0.47	0.60	0.72	0.83	-
15.00		0.35	0.42	0.51	0.65	0.78	0.90	-
15.88	5/8	0.37	0.44	0.54	0.70	0.84	0.97	-
16.00		0.38	0.45	0.55	0.70	0.85	0.98	1.20
18.00		0.43	0.51	0.62	0.80	0.97	1.13	1.40
19.05	3/4	0.45	0.54	0.66	0.85	1.04	1.21	1.51
20.00		0.48	0.57	0.70	0.90	1.10	1.28	1.60
22.00		0.53	0.63	0.77	1.00	1.22	1.43	1.80
22.22	7/8	0.53	0.63	0.78	1.01	1.23	1.44	1.83
23.00		0.55	0.66	0.81	1.05	1.28	1.502	1.90
25.00		0.60	0.72	0.88	1.15	1.41	1.65	2.10
25.40	1	0.61	0.73	0.90	1.17	1.43	1.68	2.14
28.00		0.68	0.81	1.00	1.30	1.60	1.88	2.40
28.57	1 1/8	0.69	0.82	1.02	1.33	1.63	1.92	2.46
30.00		0.73	0.87	1.07	1.40	1.72	2.03	2.60
31.75	1 1/4	0.77	0.92	1.14	1.49	1.83	2.16	2.78
32.00		0.78	0.92	1.15	1.50	1.85	2.18	2.80
34.00		0.83	0.99	1.22	1.60	1.97	2.33	3.00
35.00		0.85	1.02	1.26	1.65	2.03	2.40	3.10
36.00		0.88	1.05	1.30	1.70	2.10	2.48	3.20
38.00		0.93	1.11	1.37	1.80	2.22	2.63	3.41
38.10	1 1/2	0.93	1.11	1.37	1.81	2.23	2.64	3.42
40.00		0.98	1.17	1.45	1.90	2.35	2.78	3.61
42.00		1.03	1.23	1.52	2.00	2.47	2.93	3.81
44.45	1 3/4	1.09	1.30	1.61	2.13	2.63	3.11	4.05
45.00		1.10	1.32	1.63	2.15	2.66	3.15	4.11
48.30		1.18	1.42	1.76	2.32	2.87	3.40	4.44
50.00		1.23	1.47	1.82	2.40	2.97	3.53	4.61
50.80	2	1.25	1.49	1.85	2.44	3.02	3.59	4.69
51.00		1.25	1.50	1.86	2.45	3.04	3.61	4.71
53.00		1.30	1.56	1.93	2.55	3.16	3.76	4.91
54.00		1.33	1.59	1.97	2.60	3.22	3.83	5.01
55.00		1.35	1.62	2.01	2.65	3.29	3.91	5.11
58.00		1.43	1.71	2.12	2.80	3.47	4.13	5.40
60.00		1.48	1.77	2.20	2.90	3.60	4.30	5.60
63.50	2 1/2	1.56	1.87	2.33	3.08	3.82	4.50	6.00
65.00	2	1.60	1.92	2.38	3.15	3.90	4.70	6.10
70.00		1.73	2.07	2.57	3.41	4.20	5.00	6.60
76.10	3	1.88	2.25	2.80	3.70	4.60	5.50	7.20
80.00		1.98	2.37	2.95	3.90	4.90	5.80	7.60
85.00		2.10	2.52	3.10	4.20	5.20	6.20	8.10
101.60	4	-	3.02	3.80	5.00	6.20	7.40	9.80

Notes

- Commonly available sizes are shown **bold**
- For ferritic and martensitic steel multiply the quoted austenitic steel weight by 0.97.

Pipe and Tube for Specific Applications

This subsection describes the pipe and tubing used in common applications.

Automotive Exhaust Tubing

Significant quantities of welded tube are used in automotive exhaust systems. This is due to the increased temperature of exhaust emissions, necessitated by the inclusion of catalytic converters. Within silencers the tubes used are perforated.

- **Materials.** Typical grades for exhaust tubing are 409, 304, 304L and 321. Special ferritic grades 441, 439 and 444, and others, may be specified.
- **Sizes.** Exhaust tubing is produced in an extensive range of metric and imperial sizes. Outside diameters in the range from 12.7 mm to 127 mm and wall thickness in the range 1.0 mm to 3.0 mm are typical.
- **Cut lengths.** As specified down to a minimum of 35 mm. Square cut or mitre cut may be specified.
- **Patterns.** Plain tube or standard continuous perforated patterns may be specified.
- **Special requirements** such as special sizes or perforation patterns may be specified.

Automotive exhaust tube - typical sizes

Outside Diameter (OD)		Wall thickness, mm				
		1.0	1.2	1.5	1.8	2.0
mm	in	 Weight, kg/m (ferritic stainless steel)				
30		-	0.84	1.04	-	-
32	1¼	0.75	0.90	1.11	-	-
35	1⅜	-	0.98	1.22	-	-
38	1½	0.90	1.07	1.33	-	-
40		-	1.13	1.40	-	-
41.3		0.98	1.17	1.47	1.75	1.94
42		1.00	1.18	1.48	1.77	1.95
44.5	1¾	-	1.26	1.57	1.88	2.09
45		-	1.27	1.58	1.89	2.09
48		-	1.37	1.69	2.01	2.23
50		1.43	1.78	2.10	2.33	-
50.8	2	-	1.46	1.80	2.15	2.36
54.00	2⅛	-	1.56	1.92	2.26	-
60		-	1.73	2.14	2.51	2.82

Pulp and Paper Industry Tubing

The pulp and paper industry uses tube and associated fittings with fixed inside diameter. This tube is also used by other process industries and the water industry.

Refer to page 5-18 for a table of metric tube sizes based on inside diameter. Refer to page 6-36 for a summary of fitting types and sizes.

Hygienic Tubing

Refer to Section 9 for details of hygienic tubing and fittings.

Pipe and Tube for Specific Applications

Chemical and Petrochemical Pipe and Tube

This heading covers a broad spectrum of industries including chemical, petrochemical, offshore, process, power generation, nuclear, mining and mineral/metal processing, pulp and paper.

- **Materials and Manufacture.** Applicable ASTM standards for pipe and tubing specify the materials and manufacturing requirements (including testing) as suitable for particular applications.
- **Sizes.** ANSI/ASME pipe sizes (see page 5-2) or ISO sizes (see page 5-8) are most commonly specified for these applications. Fittings and flanges, etc, are available for corresponding tube sizes.
- **Tolerances and Cut lengths.** These are specified in the applicable ASTM or ISO specifications.
- **Other requirements** such as bevelled or threaded ends may be specified. Weld bevels are covered in Section 6 and pipe threads are covered in Section 1.
- **Heat Exchanger and Condenser Tubes.** Stainless steel tubes used for heat exchangers and condensers may be specified using BWG or SWG wall thicknesses. Typical sizes are detailed in the following two tables. Refer to the underlined sizes on page 5-10 and following for stainless steel 'Steel tubes for boilers, superheaters and heat exchangers' as specified in ISO 1129.

Heat exchanger tube - principal SWG sizes

Outside Diameter			Standard Wire Gauge (SWG)							
			22 (0.711 mm)	20 (0.914 mm)	18 (1.218 mm)	16 (1.625 mm)	14 (2.032 mm)	12 (2.641 mm)	11 (2.946 mm)	10 (3.251 mm)
in	mm		 Weight, kg/m (average wall ¹)							
1/4	0.250	6.350	-	0.124	0.157	0.192	-	-	-	-
5/16	0.313	7.950	-	0.161	0.205	0.257	-	-	-	-
3/8	0.375	9.525	-	0.197	0.253	0.321	0.381	-	-	-
1/2	0.500	12.700	0.213	0.270	0.350	0.451	0.543	0.665	0.720	-
5/8	0.625	15.875	0.270	0.342	0.447	0.580	0.704	0.875	0.954	-
3/4	0.750	19.050	-	0.415	0.544	0.709	0.866	1.09	1.19	1.29
7/8	0.875	22.225	0.383	0.488	0.641	0.838	1.03	1.30	1.42	1.55
1	1.000	25.400	0.440	0.560	0.738	0.967	1.19	1.51	1.66	1.80
1 1/4	1.250	31.750	0.553	0.706	0.931	1.23	1.51	1.93	2.13	2.32
1 1/2	1.500	38.100	0.666	0.851	1.13	1.48	1.84	2.35	2.59	2.84
1 3/4	1.750	44.450	0.779	0.996	1.32	1.74	2.16	2.77	3.06	3.35
2	2.000	50.800	0.892	1.14	1.51	2.00	2.48	3.19	3.53	3.87
2 1/2	2.500	63.500	-	-	1.90	2.52	3.13	4.03	4.47	4.91
3	3.000	76.200	-	-	2.29	3.03	3.77	4.87	5.40	5.94
3 1/2	3.500	88.900	-	-	2.67	3.55	4.42	5.70	6.34	6.97
4	4.000	101.60	-	-	3.06	4.07	5.07	6.54	7.28	8.01

Notes

- 1 Conventional weights are quoted, assuming the tube is specified as average wall.
Add 10% to the weight for minimum wall tube.
Multiply quoted weights by 1.014 for austenitic and duplex steels, by 0.985 for ferritic and martensitic steels.
- Refer to page 5-7 for a full list of SWG numbers and equivalent wall thicknesses.

Pipe and Tube for Specific Applications

Heat exchanger tube - principal BWG sizes

Outside Diameter			Birmingham Wire Gauge (BWG)								
			20 (0.889 mm)	18 (1.245 mm)	16 (1.651 mm)	15 (1.829 mm)	14 (2.108 mm)	13 (2.413 mm)	12 (2.769 mm)	11 (3.048 mm)	10 (3.403 mm)
in	mm	 Weight, kg/m (average wall ¹)									
1/4	0.250	6.350	0.12	0.16	0.19	-	-	-	-	-	-
5/16	0.313	7.950	0.15	0.21	0.25	0.28	-	-	-	-	-
3/8	0.375	9.525	0.19	0.25	0.31	0.34	0.39	-	-	-	-
1/2	0.500	12.700	0.25	0.34	0.45	0.49	0.55	0.61	0.68	0.72	-
5/8	0.625	15.875	0.33	0.45	0.58	0.64	0.71	0.80	0.89	0.97	-
3/4	0.750	19.050	0.40	0.55	0.72	0.77	0.88	0.98	1.12	1.20	1.31
7/8	0.875	22.225	0.46	0.64	0.83	0.92	1.04	1.18	1.32	1.44	1.58
1	1.000	25.400	0.54	0.74	0.97	1.06	1.21	1.37	1.55	1.68	1.92
1 1/8	1.125	28.575	0.61	0.83	1.10	1.21	1.37	1.56	1.76	1.92	2.11
1 1/4	1.250	31.750	0.68	0.94	1.23	1.35	1.53	1.76	1.96	2.16	2.40
1 3/8	1.375	34.925	0.74	1.03	1.35	1.49	1.70	1.93	2.19	2.40	2.65
1 1/2	1.500	38.100	0.82	1.13	1.49	1.64	1.87	2.17	2.40	2.63	2.92
1 3/4	1.750	44.450	0.97	1.32	1.74	1.92	2.20	2.50	2.84	3.10	3.44
2	2.000	50.800	-	1.52	1.99	2.20	2.53	2.89	3.27	3.59	3.97
2 1/4	2.250	57.150	-	1.73	2.26	2.48	2.87	3.26	3.70	4.06	4.51
2 3/8	2.375	60.325	-	1.81	2.38	2.63	3.02	3.44	3.93	4.30	4.78
2 1/2	2.500	63.500	-	1.91	2.52	2.78	3.18	3.66	4.14	4.54	5.04
2 7/8	2.875	73.025	-	2.20	2.90	3.20	3.68	4.20	4.79	5.25	5.83
3	3.000	76.200	-	2.31	3.04	3.35	3.85	4.39	5.00	5.49	6.10
3 1/2	3.500	88.900	-	2.69	3.56	3.93	4.51	5.15	5.86	6.44	7.17
4	4.000	101.60	-	-	4.11	4.54	5.21	5.95	6.80	7.47	8.30

Notes

- Conventional weights are quoted, assuming the tube is specified as average wall.
Add 10% to the weight for minimum wall tube.
Multiply quoted weights by 1.014 for austenitic and duplex steels, by 0.985 for ferritic and martensitic steels.
- Refer to page 5-7 for a full list of BWG numbers and equivalent wall thicknesses.

Pipe and Tube for Specific Applications

Instrumentation and Hydraulic Control Tubing

This heading covers seamless small bore instrumentation tubing, hydraulic cylinder tubing, and associated compression fittings, valves, manifolds, orifice plates and enclosures.

- **Materials and Manufacture.** Typical grades for instrumentation tubing are 316, 304 and 321. The tube is manufactured using a seamless, cold drawn process to ASTM A 269 (page 3-26) or A 213 (average wall) (see page 3-10).
- **Sizes.** Tubing is produced in metric and imperial sizes as shown in the table below.
Metric sizes in the range 6 mm to 70 mm OD and 1.0 mm to 5.0 mm wall thickness, are typical.
- Imperial sizes are typically as listed for the heat exchanger tubes, with SWG numbers used to specify wall thickness (see page 5-25).
- **Cut lengths.** Tubing may be supplied in random lengths, cut lengths or continuous coils.
- **Capillary Tubing.** Tubes with outside diameters smaller than 6 mm are also available and are referred to as 'capillary tubing' or 'hypodermic tubing'. The following table lists typical sizes.

Instrumentation tubing

Refer to page 5-20 for tables of seamless tube sizes commonly used for instrumentation applications.

Capillary or hypodermic tubing - typical sizes

Outside Diameter 		Wall Thicknesses 
in	mm	mm
1/32	0.79	0.20
0.040	1.02	0.20
0.049	1.25	0.20
0.050	1.27	0.20
1/16	1.63	0.15 / 0.20 / 0.25 / 0.30 / 0.40 / 0.51 / 0.56
0.072	1.83	0.23
0.083	2.11	0.25
3/32	2.38	0.15 / 0.20 / 0.30 / 0.40 / 0.51 / 0.91
0.118	3.00	0.30 / 0.50 / 0.70 / 0.90
1/8	3.18	0.20 / 0.25 / 0.51 / 0.81 / 0.91 / 1.22
0.138	3.51	0.40
5/32	3.97	0.25 / 0.40 / 0.56 / 0.71 / 0.91
0.157	4.00	0.70 / 0.90 / 1.00
0.177	4.50	0.50
3/16	4.76	0.13 / 0.20 / 0.25 / 0.40 / 0.46 / 0.51 / 0.56 / 0.71 / 0.81 / 0.91 / 1.22 / 1.63
0.197	5.00	0.50 / 0.75 / 1.00 / 1.50

Note

- When this tubing is used with compression fittings there is a maximum hardness requirement.

Pressure Ratings

Pressure Ratings for Pipes, Tubes and Fittings

Wall Thickness Calculations for Straight Pipe Under Internal Pressure

The following equations and tables are based on those provided in the Process Piping Specification, ASME B31.3a-1996, ASME Code for Pressure Piping (see Notes for references to source paragraphs and tables in this specification).

Firstly, any one of the following four equations may be used to calculate the 'pressure design wall thickness' (t) of a straight pipe subject to internal pressure.

The equations assume $t < D/6$ (for pipe with $t \geq D/6$ or $P/SE > 0.385$ additional factors need to be considered).

The four alternative equations are:

$$t = \frac{PD}{2(SE + PY)}$$

$$t = \frac{PD}{2SE}$$

$$t = \frac{D}{2} \left(1 - \sqrt{\frac{SE - P}{SE + P}} \right)$$

$$t = \frac{P(d + 2c)}{2[SE - P(1 - Y)]}$$

where:

- t = Pressure design thickness
- d = Inside diameter of pipe. For pressure design calculation, the inside diameter of the pipe is the maximum value allowable under the purchase specification.
- P = Internal design pressure.
- D = Outside diameter pipe as listed in tables of standards or specifications or as measured.
- E = Quality factor. See the table "Basic quality factors 'E' for longitudinal weld joints in stainless steel pipes, tubes and fittings" on page 5-29.

- S = Stress value for material from the table "Basic allowable stresses 'S' in tension for stainless steels" on page 5-30.
- Y = Coefficient from table "Values of coefficient 'Y' for $t < D/6$ " on page 5-29.

Secondly, the minimum required wall thickness t_m of straight sections of pipe is determined in accordance with the following equation.

$$t_m = t + c$$

where:

- t_m = Minimum required thickness, including mechanical, corrosion and erosion allowances.
- c = The sum of the mechanical allowances (thread or groove depth) plus corrosion and erosion allowances. For threaded components, the nominal thread depth (dimension h of ASME B1.20.1, or equivalent) shall apply. For machined surfaces or grooves where the tolerance is not specified, the tolerance shall be assumed to be 0.5 mm (0.02 in) in addition to the specified depth of the cut.

The actual minimum thickness for the pipe selected, considering manufacturer's tolerance, shall not be less than t_m .

Units of Measure for Calculations

It is important to use compatible units for pressure calculations. ASTM and ASME/ANSI specifications are based upon imperial sizes.

Pipe bends

The equations above may also be used for pipe bends provided the requirement for minimum wall thickness (t_m) is met.

Further Information

Additional pressure rating information is contained in Section 7 and 8 of this manual.

Refer to ASME B31.3a-1996 paragraph 304 for further details relating to pressure rating and wall thickness calculations applicable to elbows, branch connections, closures, flanges, reducers and other components.

Pressure Ratings

Values of coefficient 'Y' for $t < D/6$

Materials	Temperature, °F (°C)					
	<900 (≤482)	950 (510)	1000 (538)	1050 (566)	1100 (593)	≥1150 (≥621)
	Y					
Ferritic Steels	0.4	0.5	0.7	0.7	0.7	0.7
Austenitic Steels	0.4	0.4	0.4	0.4	0.5	0.7
Cast Iron	0.0	-	-	-	-	-

Note

- The above table and the equations are based on paragraph 304.1 of ASME B31.3a-1996
- The value for Y may be interpolated for intermediate temperatures. For $t > D/6$:

$$Y = \frac{d + 2c}{D + d + 2c}$$

Basic quality factors 'E' for longitudinal weld joints in stainless steel pipes, tubes and fittings

Spec No.	Class (or Type)	Description	E	Notes
A 182	-	Forgings and Fittings	1.00	-
A 268	-	Seamless Tube	1.00	-
	-	Electric Fusion Welded Tube, Double Butt Seam	0.85	-
	-	Electric Fusion Welded Tube, Single Butt Seam	0.80	-
A 269	-	Seamless Tube	1.00	-
	-	Electric Fusion Welded Tube, Double Butt Seam	0.85	-
	-	Electric Fusion Welded Tube, Single Butt Seam	0.80	-
A 312	-	Seamless Pipe	1.00	-
	-	Electric Fusion Welded Pipe, Double Butt Seam	0.85	-
	-	Electric Fusion Welded Pipe, Single Butt Seam	0.80	-
A 358	1, 3, 4	Electric Fusion Welded Pipe, 100% radiographed	1.00	-
	5	Electric Fusion Welded Pipe, Spot radiographed	0.90	-
	2	Electric Fusion Welded Pipe, Double Butt Seam	0.85	-
A 376	-	Seamless Pipe	1.00	-
A 403	-	Seamless Fittings	1.00	-
	-	Welded Fitting, 100% radiographed	1.00	1
	-	Welded Fitting, Double Butt Seam	0.85	-
	-	Welded Fitting, Single Butt Seam	0.80	-
A 409	-	Electric Fusion Welded Pipe, Double Butt Seam	0.85	-
	-	Electric Fusion Welded Pipe, Single Butt Seam	0.80	-
A 430	-	Seamless Pipe	1.00	-
A 789	-	Seamless	1.00	-
	-	Electric Fusion Welded Pipe, 100% radiographed	1.00	-
	-	Electric Fusion Welded Tube, Double Butt Seam	0.85	-
	-	Electric Fusion Welded Tube, Single Butt Seam	0.80	-
A 790	-	Seamless	1.00	-
	-	Electric Fusion Welded Pipe, 100% radiographed	1.00	-
	-	Electric Fusion Welded Pipe, Double Butt Seam	0.85	-
	-	Electric Fusion Welded Pipe, Single Butt Seam	0.80	-

Note

- This table is based on Table A-1B of ASME B31.3a-1996
- 1 An E factor of 1.00 may be applied only if all welds, including welds in the base material, have passed 100% radiographic examination. Substitution of ultrasonic examination for radiography is not permitted for the purpose of obtaining an E of 1.00.

Pressure Ratings

Basic allowable stresses 'S' in tension for stainless steels

ASTM Spec No.	Grade	Min Temp °F (for °C see Notes)	Metal Temperature, °F (°C)										Notes
			Min Temp to 100 (37.8)	300 (149)	500 (260)	700 (371)	850 (454)	1000 (538)	1150 (621)	1300 (704)	1400 (760)	1500 (816)	
			Basic Allowable Stress, S ksi										
A 312	TP321	-325	16.7	16.7	16.1	14.6	14.0	13.5	5.0	1.7	0.8	0.3	1, 2
A 376	TP321	-325	16.7	16.7	16.1	14.6	14.0	13.5	5.0	1.7	0.8	0.3	1, 2
A 269	TP304L	-425	16.7	16.7	14.8	13.5	12.8	7.8	4.0	2.1	1.1	0.9	2, 3
A 312	TP304L	-425	16.7	16.7	14.8	13.5	12.8	7.8	4.0	2.1	1.1	0.9	-
A 358	304L	-425	16.7	16.7	14.8	13.5	12.8	7.8	4.0	2.1	1.1	0.9	2
A 269	TP316L	-325	16.7	16.7	14.4	12.9	12.1	11.2	8.8	3.5	1.8	1.0	2, 3
A 312	TP316L	-325	16.7	16.7	14.4	12.9	12.1	11.2	8.8	3.5	1.8	1.0	-
A 358	316L	-325	16.7	16.7	14.4	12.9	12.1	11.2	8.8	3.5	1.8	1.0	2
A 312	TP321	-325	16.7	16.7	16.1	14.6	14.0	13.5	6.9	3.2	1.9	1.1	1, 2, 4
A 376	TP321	-325	16.7	16.7	16.1	14.6	14.0	13.5	6.9	3.2	1.9	1.1	1, 2, 4
A 312	TP321H	-325	16.7	16.7	16.1	14.6	14.0	13.5	6.9	3.2	1.9	1.1	1, 2
A 376	TP321H	-325	16.7	16.7	16.1	14.6	14.0	13.5	6.9	3.2	1.9	1.1	-
A 268	TP409	-20	20.0	-	-	-	-	-	-	-	-	-	6
A 268	TP430Ti	-20	20.0	-	-	-	-	-	-	-	-	-	6, 7
A 376	16-8-2H	-325	20.0	-	-	-	-	-	-	-	-	-	5, 6, 8
A 268	TP405	-20	20.0	17.7	17.2	16.2	10.4	4.0	-	-	-	-	6
A 268	TP410	-20	20.0	17.7	17.2	16.2	10.4	6.4	1.8	-	-	-	6
A 268	TP430	-20	20.0	19.6	19.0	17.6	10.4	6.5	2.4	-	-	-	6, 7
A 312	TP317L	-325	20.0	20.0	17.7	16.2	15.2	-	-	-	-	-	-
A 312	TP310	-325	20.0	20.0	20.0	18.3	14.6	11.0	3.6	0.8	0.4	0.2	4, 6, 10
A 358	310S	-325	20.0	20.0	20.0	18.3	14.6	11.0	3.6	0.8	0.4	0.2	2, 4, 5, 6
A 409	TP310	-325	20.0	20.0	20.0	18.3	14.6	11.0	3.6	0.8	0.4	0.2	2, 4, 5, 6, 10
A 312	TP321	-325	20.0	20.0	19.3	17.5	16.7	16.2	5.0	1.7	0.8	0.3	1
A 358	321	-325	20.0	20.0	19.3	17.5	16.7	16.2	5.0	1.7	0.8	0.3	1, 2
A 376	TP321	-325	20.0	20.0	19.3	17.5	16.7	16.2	5.0	1.7	0.8	0.3	1, 2
A 409	TP321	-325	20.0	20.0	19.3	17.5	16.7	16.2	5.0	1.7	0.8	0.3	1, 2
A 312	TP309	-325	20.0	20.0	20.0	18.3	14.6	10.5	5.0	2.3	1.3	0.7	4, 6, 10
A 358	309S	-325	20.0	20.0	20.0	18.3	14.6	10.5	5.0	2.3	1.3	0.7	4, 5, 6, 2
A 409	TP309	-325	20.0	20.0	20.0	18.3	14.6	10.5	5.0	2.3	1.3	0.7	2, 4, 5, 6, 10
A 312	TP347	-425	20.0	20.0	19.9	18.6	18.2	18.0	6.1	2.2	1.2	0.8	-
A 358	347	-425	20.0	20.0	19.9	18.6	18.2	18.0	6.1	2.2	1.2	0.8	1, 2
A 376	TP347	-425	20.0	20.0	19.9	18.6	18.2	18.0	6.1	2.2	1.2	0.8	1, 2
A 409	TP347	-425	20.0	20.0	19.9	18.6	18.2	18.0	6.1	2.2	1.2	0.8	1, 2
A 312	TP348	-325	20.0	20.0	19.9	18.6	18.2	18.0	6.1	2.2	1.2	0.8	-
A 358	348	-325	20.0	20.0	19.9	18.6	18.2	18.0	6.1	2.2	1.2	0.8	1, 2
A 376	TP348	-325	20.0	20.0	19.9	18.6	18.2	18.0	6.1	2.2	1.2	0.8	1, 2
A 409	TP348	-325	20.0	20.0	19.9	18.6	18.2	18.0	6.1	2.2	1.2	0.8	1, 2
A 312	TP310	-325	20.0	20.0	20.0	18.3	14.6	11.0	7.3	3.5	1.6	0.8	4, 6, 10, 11
A 358	310S	-325	20.0	20.0	20.0	18.3	14.6	11.0	7.3	3.5	1.6	0.8	2, 4, 5, 6, 11

Pressure Ratings

Basic allowable stresses 'S' in tension for stainless steels (Continued)

ASTM Spec No.	Grade	Min Temp °F (for °C see Notes)	Metal Temperature, °F (°C)										Notes
			Min Temp to 100 (37.8)	300 (149)	500 (260)	700 (371)	850 (454)	1000 (538)	1150 (621)	1300 (704)	1400 (760)	1500 (816)	
			Basic Allowable Stress, S ksi										
A 430	FP321	-325	20.0	20.0	19.3	17.5	16.7	16.2	6.9	3.2	1.9	1.1	1, 2
A 312	TP321	-325	20.0	20.0	19.3	17.5	16.7	16.2	6.9	3.2	1.9	1.1	1, 4
A 358	321	-325	20.0	20.0	19.3	17.5	16.7	16.2	6.9	3.2	1.9	1.1	1, 2, 4
A 376	TP321	-325	20.0	20.0	19.3	17.5	16.7	16.2	6.9	3.2	1.9	1.1	1, 2, 4
A 409	TP321	-325	20.0	20.0	19.3	17.5	16.7	16.2	6.9	3.2	1.9	1.1	1, 2, 4
A 430	FP321H	-325	20.0	20.0	19.3	17.5	16.7	16.2	6.9	3.2	1.9	1.1	1, 2
A 376	TP321H	-325	20.0	20.0	19.3	17.5	16.7	16.2	6.9	3.2	1.9	1.1	1, 2
A 312	TP321H	-325	20.0	20.0	19.3	17.5	16.7	16.2	6.9	3.2	1.9	1.1	-
A 430	FP316	-425	20.0	20.0	17.9	16.3	15.7	15.3	9.8	4.1	2.3	1.3	2, 5, 8,
A 430	FP316H	-325	20.0	20.0	17.9	16.3	15.7	15.3	9.8	4.1	2.3	1.3	2, 5, 8,
A 269	TP316	-425	20.0	20.0	17.9	16.3	15.7	15.3	9.8	4.1	2.3	1.3	2, 3, 4, 5, 8
A 312	TP316	-425	20.0	20.0	17.9	16.3	15.7	15.3	9.8	4.1	2.3	1.3	4, 8
A 358	316	-425	20.0	20.0	17.9	16.3	15.7	15.3	9.8	4.1	2.3	1.3	2, 4, 5, 8
A 376	TP316	-425	20.0	20.0	17.9	16.3	15.7	15.3	9.8	4.1	2.3	1.3	2, 4, 5, 8
A 409	TP316	-425	20.0	20.0	17.9	16.3	15.7	15.3	9.8	4.1	2.3	1.3	2, 4, 5, 8
A 312	TP317	-325	20.0	20.0	17.9	16.3	15.7	15.3	9.8	4.1	2.3	1.3	4, 8
A 409	TP317	-325	20.0	20.0	17.9	16.3	15.7	15.3	9.8	4.1	2.3	1.3	2, 4, 5, 8
A 376	TP316H	-325	20.0	20.0	17.9	16.3	15.7	15.3	9.8	4.1	2.3	1.3	2, 5, 8
A 312	TP316H	-325	20.0	20.0	17.9	16.3	15.7	15.3	9.8	4.1	2.3	1.3	8
A 430	FP347	-425	20.0	20.0	18.6	18.2	18.2	18.0	10.5	4.4	2.5	1.3	1, 2
A 430	FP347H	-325	20.0	20.0	18.6	18.2	18.2	18.0	10.5	4.4	2.5	1.3	1, 2
A 376	TP347H	-325	20.0	20.0	19.9	18.6	18.2	18.0	10.5	4.4	2.5	1.3	1, 2
A 312	TP347	-425	20.0	20.0	19.9	18.6	18.2	18.0	10.5	4.4	2.5	1.3	4
A 358	347	-425	20.0	20.0	19.9	18.6	18.2	18.0	10.5	4.4	2.5	1.3	1, 2, 4
A 376	TP347	-425	20.0	20.0	19.9	18.6	18.2	18.0	10.5	4.4	2.5	1.3	1, 2, 4
A 409	TP347	-425	20.0	20.0	19.9	18.6	18.2	18.0	10.5	4.4	2.5	1.3	1, 2, 4
A 312	TP348	-325	20.0	20.0	19.9	18.6	18.2	18.0	10.5	4.4	2.5	1.3	4
A 358	348	-325	20.0	20.0	19.9	18.6	18.2	18.0	10.5	4.4	2.5	1.3	1, 2, 4
A 376	TP348	-325	20.0	20.0	19.9	18.6	18.2	18.0	10.5	4.4	2.5	1.3	1, 2, 4
A 409	TP348	-325	20.0	20.0	19.9	18.6	18.2	18.0	10.5	4.4	2.5	1.3	1, 2, 4
A 312	TP347H	-325	20.0	20.0	19.9	18.6	18.2	18.0	10.5	4.4	2.5	1.3	-
A 312	TP348H	-325	20.0	20.0	19.9	18.6	18.2	18.0	10.5	4.4	2.5	1.3	-
A 430	FP304	-425	20.0	20.0	17.5	16.0	14.9	13.8	7.7	3.7	2.3	1.4	2, 5, 8
A 430	FP304H	-325	20.0	20.0	17.5	16.0	14.9	13.8	7.7	3.7	2.3	1.4	2, 5, 8
A 269	TP304	-425	20.0	20.0	17.5	16.0	14.9	13.8	7.7	3.7	2.3	1.4	2, 3, 4, 5, 8
A 312	TP304	-425	20.0	20.0	17.5	16.0	14.9	13.8	7.7	3.7	2.3	1.4	4, 8
A 358	304	-425	20.0	20.0	17.5	16.0	14.9	13.8	7.7	3.7	2.3	1.4	2, 4, 5
A 376	TP304	-425	20.0	20.0	17.5	16.0	14.9	13.8	7.7	3.7	2.3	1.4	2, 4, 5, 8
A 376	TP304H	-325	20.0	20.0	17.5	16.0	14.9	13.8	7.7	3.7	2.3	1.4	2, 5, 8
A 409	TP304	-425	20.0	20.0	17.5	16.0	14.9	13.8	7.7	3.7	2.3	1.4	2, 4, 5, 8

Pressure Ratings

Basic allowable stresses 'S' in tension for stainless steels (Continued)

ASTM Spec No.	Grade	Min Temp °F (for °C see Notes)	Metal Temperature, °F (°C)										Notes
			Min Temp to 100 (37.8)	300 (149)	500 (260)	700 (371)	850 (454)	1000 (538)	1150 (621)	1300 (704)	1400 (760)	1500 (816)	
			Basic Allowable Stress, S ksi										
A 312	TP304H	-325	20.0	20.0	17.5	16.0	14.9	13.8	7.7	3.7	2.3	1.4	8
A 268	TP443	-20	23.3	21.4	19.4	17.5	15.1	4.5	-	-	-	-	6
A 268	TP446	-20	23.3	21.4	19.4	17.5	15.1	4.5	-	-	-	-	6
A 789	S32304	-60	29.0	26.3	24.9	-	-	-	-	-	-	-	9
A 790	S32304	-60	29.0	26.3	24.9	-	-	-	-	-	-	-	9
A 789	S31803	-60	30.0	28.9	27.2	-	-	-	-	-	-	-	9
A 790	S31803	-60	30.0	28.9	27.2	-	-	-	-	-	-	-	9
A 789	S32900	-20	30.0	-	-	-	-	-	-	-	-	-	9
A 790	S32900	-20	30.0	-	-	-	-	-	-	-	-	-	9
A 789	S32750	-20	38.7	33.1	31.4	-	-	-	-	-	-	-	9
A 790	S32750	-20	38.7	33.1	31.4	-	-	-	-	-	-	-	9

Notes

- This table is based on Table A-1A of ASME B31.3a-1996.
- For specified minimum tensile and yield strengths refer to the individual ASTM specifications in Section 2 and 3.
- Minimum temperatures in °C: -20 °F = -29 °C, -60 °F = -51 °C, -325 °F = -199 °C, -425 °F = -254 °C.
- 1 For temperatures above 538 °C (1000 °F), these stress values may be used only if the material has been heat treated at a temperature of 1093 °C (2000°F) minimum.
- 2 When the material has not been solution heat treated, the minimum temperature shall be -29 °C (-20 °F) unless the material is impact tested.
- 3 Must be verified by tensile test.
- 4 For temperatures above 538 °C (1000 °F), these stress values apply only when the carbon content is 0.04% or higher.
- 5 For temperatures above 538 °C (1000 °F), these stress values may be used only if the material has been heat treated by heating to a minimum temperature of 1038 °C (1900 °F) and quenching in water or rapidly cooling by other means.
- 6 This steel is intended for use at high temperatures; it may have low ductility and/or low impact properties at room temperature after being used at higher temperatures.
- 7 If the chemical composition of this Grade is such as to render it hardenable, qualification under P-No. 6 is required.
- 8 Increasingly tends to precipitate intergranular carbides as the carbon content increases above 0.03%.
- 9 This steel may develop embrittlement after service at approximately 316 °C (600 °F) and higher temperature.
- 10 This material when used below -29 °C (-20 °F) shall be impact tested if the carbon content is above 0.10%.
- 11 The stress values above 538 °C (1000 °F) shall be used only when the micrograin size, is No. 6 or less (coarser grain). Otherwise, the lower stress values listed for the same material, specification, and grade shall be used.