

Stainless
Steel
Tubular
Products

aalco[®]

Disclaimer

This Data is indicative only and as such is not to be relied upon in place of the full specification. In particular, mechanical property requirements vary widely with temper, product and product dimensions. All information is based on our present knowledge and is given in good faith. No liability will be accepted by the Company in respect of any action taken by any third party in reliance thereon.

Please note that the Issue date shown below is no guarantee of accuracy or whether the information herein is up to date or is from the most recent references available at that date.

The information provided in this publication has been drawn from various recognised sources, including EN Standards, recognised industry references (printed & online) and manufacturers' data. No guarantee is given that the information is from the latest issue of those sources or about the accuracy of those sources.

Material supplied by the Company may vary significantly from this data, but will conform to all relevant and applicable standards.

As the products detailed may be used for a wide variety of purposes and as the Company has no control over their use; the Company specifically excludes all conditions or warranties expressed or implied by statute or otherwise as to dimensions, properties and/or fitness for any particular purpose, whether expressed or implied.

Advice given by the Company to any third party is given for that party's assistance only and without liability on the part of the Company. All transactions are subject to the Company's current Conditions of Sale. The extent of the Company's liabilities to any customer is clearly set out in those Conditions; a copy of which is available on request.

Weights

All weights shown in this publication are for guidance only. They are calculated using nominal dimensions and scientifically recognised densities. Please note that in practice, the actual weight can vary significantly from the theoretical weight due to variations in manufacturing tolerances and compositions.

Copyright 2015: All Rights reserved: Aalco Metals Limited. No part of this publication may be reproduced, sorted in a retrieval system or transmitted in any form or by any means, electronic, mechanical, recording or otherwise without the prior written consent of the proprietor.

Aalco is a registered trade mark of Aalco Metals Limited.

Issue No. 2 – Nov 2015

Aalco is the UK's largest independent multi-metals stockholder. Customers from every sector of the UK manufacturing and engineering industries, whether small local businesses or large multinational corporations, benefit from a cost-effective single source for all their metals requirements.

Aalco – delivering customer service and investing in capability:

- ◊ An inventory that includes aluminium, stainless steel, copper, brass, bronze and nickel alloys in all semi-finished forms
- ◊ Comprehensive processing services providing items cut and/or finished to customer requirements
- ◊ Eighteen locations bringing local service to every corner of the UK
- ◊ Ongoing investment in technology and logistics to ensure on-time delivery

No order is too large or too small and Aalco offers a responsive and competitive service for supplying anything from single item orders to major JIT contracts, tailoring this service to individual needs.

Whatever your requirement, in whatever quantity, your local Aalco service centre is ready and willing to satisfy your needs. For a quotation, for further information, more extensive technical information, advice on product selection or to place an order, please contact your local Aalco service centre or refer to the web site www.aalco.co.uk.

Service

The most comprehensive stock range; the highest investment in processing equipment; local service centres nationwide; helpful, friendly, knowledgeable staff and the industry's biggest fleet of delivery vehicles – it all adds up to unbeatable service.

Aalco has maintained market leadership over many years through an absolute dedication to customer service – a service level that is continuously monitored and improved through key performance indicators.

That's why, for reliable, on-time delivery of exactly what you want, when and where you need it, whether it's a small one-off item or a complex JIT contract, Aalco is the essential first choice.

People

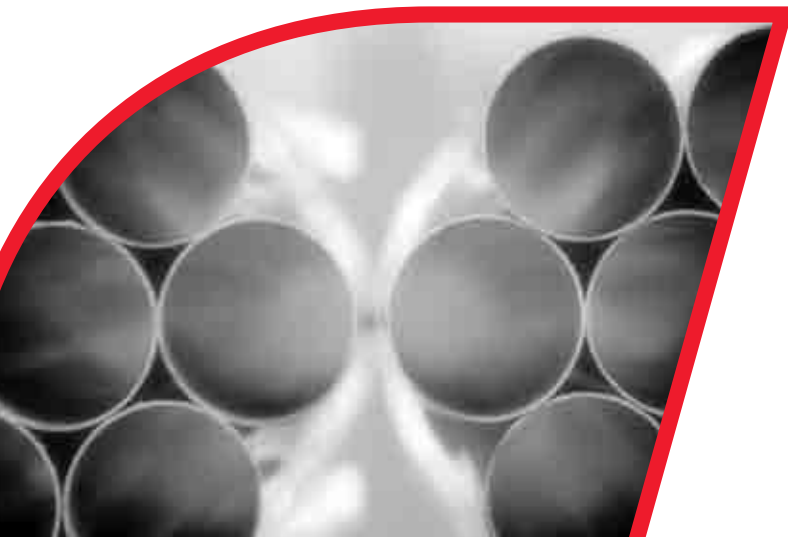
Exceptional customer service starts with people. Aalco develops and retains high quality personnel using a variety of 'in house' courses which cover both skills training, product knowledge and teamwork.

Every Aalco service centre has a dedicated team of people working together to provide an unbeatable service to customers in their region. Customers can expect to receive a quick and informed response to any enquiries for material or for information.

Quality

Aalco takes great care when selecting manufacturing sources for its products and every mill we use is measured against a series of predetermined quality control requirements. All products supplied by Aalco conform to the relevant BS or international standards. Certification can be supplied on request.

Aalco service centres operate a quality manual designed to ISO9001/2008 requirements. Many vendor approvals and bespoke quality control systems are operated through individual Aalco service centres.





Tube

Seamless to ASTM A269, imperial sizes from 1/8" O/D x 24swg to 4" O/D x 1/4" wall in grade 316L

Seamless to ASTM A269, grades 304L & 316L, in metric sizes 6mm O/D x 0.5mm wall to 38mm O/D x 4mm wall

Decorative – Round, Square, Rectangular

Structural – Square and Rectangular up to 250mm

Hygienic (see below)

Welded Metric Nominal Internal Diameter (see below)

Pipe

Seamless and Welded to ASTM A312 from 1/8" to 24" in grades 304L & 316L

Flanges

ASTM A182 / ANSI B16.5

BS 10 Table E, Grade 316L

BS 4504 / EN 1092 Raised Face, 16 Bar

Backing Flanges in Aluminium and Coated Mild Steel

Fittings

Butt Weld Fittings, Seamless and Welded, to ASTM A403 in grades 304L & 316L including elbows, tees & reducers

BSP Screwed Fittings, grade 316 from 1/8" to 3"

Hygienic fittings (see below)

Welded Metric Nominal Internal Diameter (see below)

Hygienic Tube and Fittings

Grades 304L & 316L 3/4" O/D to 4" O/D:

Tube – As Welded & Descaled, Annealed & Polished or Bright Annealed

Bends, Fitted Bends, Tees, Reducers, Clamps & Tube Hangers

Unions – RJT, IDF & DIN

Metric – Welded Nominal Internal Diameter (ND)

From 18mm O/D x 1.5mm wall to 910mm O/D x 5mm wall

Grades 1.4432 (316L High Molybdenum) & 1.4307 (304L)

Tube, Elbows, Tees, Reducers, Collars, End Caps, Tube Clamps & Clips

Backing Flanges in Aluminium & Coated Mild Steel

Further information is provided by these publications, available either from your local Service Centre or at www.aalco.co.uk



Product Guide

Technical information on applications, uses and specifications for stainless

steel, aluminium, copper, brass and bronze.

Stocklist



in stainless steel, aluminium, copper, brass and bronze.

A guide to the Aalco standard stock range



Metric

A guide to the range of light-walled nominal diameter metric stainless steel tubular products used

in water treatment, pulp & paper and other industries.



Handrail

A guide to the Aalco range of stainless steel handrail/balustrade systems

comprising tube and slotted tube plus associated fittings.

Tube specifications

ASTM Standards covered in this section	
ASTM Tube – General Requirements	
A450/A450M	General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes
A370	Mechanical Testing of Steel Products
A213/A213M	Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater and Heat Exchanger and Condenser Tubes
A249/A249M	Welded Austenitic Steel Boiler, Superheater, Heat Exchanger and Condenser Tubes
A268/A268M	Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service
A269	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A270	Seamless and Welded Austenitic Stainless Steel Sanitary Tubing
A511	Seamless Stainless Steel Mechanical Tubing
A554	Welded Stainless Steel Mechanical Tubing
A632	Seamless and Welded Austenitic Stainless Steel Tubing (small diameter) for General Service
A778	Welded, Unannealed Austenitic Stainless Steel Tubular Products
A789/A789M	Seamless and Welded Ferritic/Austenitic (Duplex) Stainless Steel Tubing for General Service
A791/A791M	Welded, Unannealed Ferritic Stainless Steel Tubing
A803/A803M	Welded Ferritic Stainless Steel Feedwater Heater Tubes

Markings on the tube

The full identification should be continuously marked down the whole length, including:

- ◊ Size – Outside Diameter (O/D) and Wall Thickness
- ◊ Specification
- ◊ Grade
- ◊ Method of Manufacture (Seamless or Welded)
- ◊ Heat Number
- ◊ Manufacturer's Name or Symbol

Hygienic Tubing

Please see separate section on page 6-1.

Metric ND Tubing

Please see separate section on page 7-1.

Tube size ranges

An extensive size range is available. Non-standard tube sizes may be subject to mill quantity restrictions and extended delivery times.

Below is a guide to the sizes readily available on an ex-stock basis:

- ◊ Hypodermic tube from 0.4mm to 5mm O/D with wall thickness 0.05mm to 0.4mm
- ◊ Instrumentation tube in straight lengths or continuous coils of up to 1,000 metres long: O/Ds 6mm, 8 mm, 10 mm and 12mm with heavy wall thicknesses, typically 0.5mm, 1mm, 1.5mm or 2mm
- ◊ Metric sizes from 6mm O/D to 610mm O/D with wall thickness 1mm to 6mm
- ◊ Imperial sizes from 1/8" O/D to 6" O/D with wall thickness from 24swg to 10swg
- ◊ Hygienic/Sanitary Tube
 - Imperial sizes to ASTM A270: 1/2", 1", 1 1/2", 2", 2 1/2", 3" & 4" O/D with 16swg wall and 4" O/D with 14swg wall
 - Metric sizes to DIN 11850: 1", 1 1/2", 2", 2 1/2" & 3" O/D with 1.5mm wall and 4" O/D with 2mm wall
- ◊ Welded Tubes for the water industry from 18mm O/D x 1.5mm wall to 910mm O/D x 5mm wall
- ◊ Welded Tube for automotive exhaust systems, mostly in grade 409 – A limited size range from 35mm to 63 mm O/D with wall thickness 1.2mm to 2mm
- ◊ Decorative and structural tubes (welded)
 - Round in metric and imperial O/D sizes from 6mm O/D x 1.0mm wall to 100mm O/D x 3mm wall and 1/8" O/D x 24swg to 4" O/D x 1/4" wall
 - Square in metric and imperial O/D sizes from 12.7 mm O/D x 1.5mm wall to 250mm x 250 x 10mm wall
 - Rectangular in metric sizes from 20mm x 10mm x 1.2mm wall to 300mm x 200mm x 10mm wall
 - Other items include Oval, Handrail and Textured Finish – Most common oval size is 60mm x 33mm x 2.0mm wall
 - Note that most decorative tubes are supplied with a polished finish

ASTM Tube

Tube Sizes - General Purpose Seamless Tube

The following table lists tube sizes commonly manufactured to ASTM A269 or ASTM A511. The tables are based on manufacturer's information.

Imperial dimensions and weights per metre

OD	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	
in	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		0.200	0.254	0.323	0.383		0.507				
7/16					0.234		0.390							
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	Wall thickness, mm						
	0.5	1.0	1.5	2.0	2.5	3.0	4.0
mm	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	0.369	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	3.42
40				1.91			
42				2.01			
50				2.42			

Notes

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

ASTM Tube

Tube Sizes - Heat Exchanger Tube

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.

- For a full list of Standard Wire Gauge (SWG) and Birmingham Wire Gauge (BWG) dimensions please refer to charts on page 8.2 of this databook.

Heat exchanger tube - principal SWG sizes

Outside Diameter			Standard Wire Gauge (SWG)							
			22 (0.711mm)	20 (0.914mm)	18 (1.218mm)	16 (1.625mm)	14 (2.032mm)	12 (2.641mm)	11 (2.946mm)	10 (3.251mm)
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.

Heat exchanger tube - principal BWG sizes

Outside Diameter			Birmingham Wire Gauge (BWG)								
			20 (0.889mm)	18 (1.245mm)	16 (1.651mm)	15 (1.829mm)	14 (2.108mm)	13 (2.413mm)	12 (2.769mm)	11 (3.048mm)	10 (3.403mm)
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

- 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.

ASTM Tube

Tube Sizes - Instrumentation Tubing and Capillary Tubing

Instrumentation and hydraulic control tubing

OD	Wall thickness, mm			
	0.5	1.0	1.5	2.0
mm	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	0.369	0.503
14			0.462	0.604
15		0.352	0.510	0.654

Notes

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

Capillary or hypodermic tubing - typical sizes

Outside Diameter		Wall thickness
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

Notes

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

Tube Sizes - 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 A554, Welded Stainless Steel Mechanical Tubing.

Square structural and decorative tube - typical sizes

Square size: Outside Dimensions		Wall thickness, mm									
		1.0	1.2	1.5	2.0	3.0	4.0	5.0	6.0	8.0	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	2.20					
25.40	1		0.97	1.10							
30.00			1.10	1.37	1.84	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	21.6	
120.00						11.8	14.7	18.0			36.0
150.00						14.0	18.6	23.0	31.2	34.3	41.7
200.00						19.1	24.8	30.8	35.0	47.3	57.6
250.00								37.1		59.9	73.5

Notes

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

ASTM Tube

Tube Sizes - 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	3.0	4.0	5.0	6.0	8.0	10.0
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						
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				4.98	7.53					
120 x 60				5.64	8.12	11.1	13.8			
120 x 80					9.53	12.4	15.4	17.3		
150 x 50					9.53					
150 x 80					10.7					
150 x 100					11.7	15.4	18.8	22.6	27.9	
200 x 100					14.06	18.5	22.6	27.1	34.3	41.7
200 x 150								31.6	41.3	
250 x 150								36.9	47.3	
300 x 100									47.3	

Notes

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

Tube Sizes - 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)						
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	1.50	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
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		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

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

ASTM Tube

Chemical Compositions and Dimensional Tolerances

Chemical compositions

See ASTM A240/240M on page 1-6 of this Databook.

Standard tolerances for welded and seamless cold finished tube (ASTM A450/A450M)

(OD)		Variations in OD ¹				Variation in t_{min} ²	
		Under		Over		Under	Over
in	mm	in	mm	in	mm	%	%
<1	<25.4	0.004	0.1	0.004	0.1	0	20
1	25.4	0.006	0.15	0.006	0.1	0	20
>1 to 1½	>25.4 to 38.1	0.006	0.15	0.006	0.15	0	20
>1½ to <2	>38.1 to <50.8	0.008	0.2	0.008	0.2	0	22
2	50.8	0.008	0.2	0.008	0.2	0	22
>2 to 2½	>50.8 to 63.5	0.010	0.25	0.010	0.25	0	22
>2½ to 3	>63.5 to 76.2	0.012	0.3	0.012	0.3	0	22
>3 to 4	>76.2 to 101.6	0.015	0.38	0.015	0.38	0	22

Standard tolerances for seamless hot finished tube (ASTM A450/A450M)

Outside Diameter (OD)		Wall Thickness (t)		Variations in OD ¹				Variation in t_{min} ²	
				Under		Over		Under	Over
in	mm	in	mm	in	mm	in	mm	%	%
≤4	≤101.6	≤0.095	≤2.4	1/32	0.8	1/64	0.4	0	40
≤4	≤101.6	>0.095 to 0.150	>2.4 to 3.8	1/32	0.8	1/64	0.4	0	35
≤4	≤101.6	>0.150 to 0.180	>3.8 to 4.6	1/32	0.8	1/64	0.4	0	33
≤4	≤101.6	>0.180	>4.6	1/32	0.8	1/64	0.4	0	28
>4 to 7½	>101.6 to 190.5	>0.095	>2.4	3/64	1.2	1/64	0.4	-	-
>4 to 7½	>101.6 to 190.5	>0.095 to 0.150	>2.4 to 3.8	3/64	1.2	1/64	0.4	0	35
>4 to 7½	>101.6 to 190.5	>0.150 to 0.180	>3.8 to 4.6	3/64	1.2	1/64	0.4	0	33
>4 to 7½	>101.6 to 190.5	>0.180	>4.6	3/64	1.2	1/64	0.4	0	28
>7½ to 9	>190.5 to 228.6	≤0.095	≤2.4	1/16	1.6	1/64	0.4	-	-
>7½ to 9	>190.5 to 228.6	>0.095 to 0.150	>2.4 to 3.8	1/16	1.6	1/64	0.4	0	35
>7½ to 9	>190.5 to 228.6	>0.150 to 0.180	>3.8 to 4.6	1/16	1.6	1/64	0.4	0	33
>7½ to 9	>190.5 to 228.6	>0.180	>4.6	1/16	1.6	1/64	0.4	0	28

Notes

1 Includes ovality tolerance except for thin wall tube.

2 t_{min} = minimum wall thickness.

- ◊ **Standard Cut Lengths.** Alternatives are: Random As agreed with the purchaser.
Specified Cut lengths as specified, with end finish specified also.
- ◊ **Length tolerances.** No tube shall be shorter than specified. Over length tolerances of tubes (before bending) are as follows: Seamless, hot finished tube: All sizes: 3/16 in (5mm) max.
Seamless, cold finished and welded tube: <2 in (50.8mm) OD: 1/8 in (3mm) max.
≥2 in (50.8mm) OD: 3/16 in (5mm) max.

These apply to lengths <24 ft (7.3 m) and are increased by 1/8 in (3mm) for each additional 10 ft (3 m).

Seamless ferritic and austenitic alloy-steel boiler, superheater and heat exchanger tubes

This specification covers minimum wall thickness seamless ferritic and austenitic steel, boiler and superheater tubes and austenitic steel heat exchanger tubes.

Finish

- Finish. Austenitic grades are pickled free of scale. Bright annealed tube need not be pickled. Ferritic cold drawn tubes shall be free of scale, but slight oxidation is allowed. Ferritic hot formed tubes shall be free of loose scale.

Tensile and hardness requirements

Grade	UNS	Tensile Strength min		Yield Strength min		¹ Elongation in 2 in (50 mm) or 4D, min	Brinell Hardness HB max	Vickers Hardness HV max	Rockwell Hardness HRB or C scale/max
		ksi	MPa	ksi	MPa				
18Cr-2Mo		60	415	40	275	201	217	230	B96
TP201	S20100	95	655	38	260	35	219	230	B95
TP202	S20200	90	620	45	310	35	219	230	B95
TP304	S30400	75	515	30	205	35	192	200	B90
TP304H	S30409	75	515	30	205	35	192	200	B90
TP304N	S30451	80	550	35	240	35	192	200	B90
TP304L	S30403	70	485	25	170	35	192	200	B90
TP304LN	S30453	75	515	30	205	35	192	200	B90
TP309Cb	S30940	75	515	30	205	35	192	200	B90
TP309H	S30909	75	515	30	205	35	192	200	B90
TP309HCb	S30941	75	515	30	205	35	192	200	B90
TP309S	S30908	75	515	30	205	35	192	200	B90
TP310Cb	S31040	75	515	30	205	35	192	200	B90
TP310H	S31009	75	515	30	205	35	192	200	B90
TP310HCb	S31041	75	515	30	205	35	192	200	B90
TP310HCbN	S31042	95	655	43	295	30	256	- ³	B100
TP310S	S31008	75	515	30	205	35	192	200	B90
	S31272	65	450	29	200	35	217	- ³	B95
TP316	S31600	75	515	30	205	35	192	200	B90
TP316H	S31609	75	515	30	205	35	192	200	B90
TP316L	S31603	70	485	25	170	35	192	200	B90
TP316N	S31651	80	550	35	240	35	192	200	B90
TP316LN	S31653	75	515	30	205	35	192	200	B90
TP317	S31700	75	515	30	205	35	192	200	B90
TP317L	S31703	75	515	30	205	35	192	200	B90
TP321	S32100	75	515	30	205	35	192	200	B90
TP321H	S32109	75	515	30	205	35	192	200	B90
TP347	S34700	75	515	30	205	35	192	200	B90
TP347H	S34709	75	515	30	205	35	192	200	B90
TP347LN	S34751	75	515	30	205	35	192	200	B90
TP347HFG		80	550	30	205	35	192	200	B90
TP348	S34800	75	515	30	205	35	192	200	B90
TP348H	S34809	75	515	30	205	35	192	200	B90
XM-15	S38100	75	515	30	205	35	192	200	B90
XM-19	S20910	100	690	55	380	35	250	265	C25
	S30615	90	620	40	275	35	192	200	B90
	S30815	87	600	45	310	40	217	- ³	B95
	S31050	84 (78 ²)	580 (540 ²)	39 (37 ²)	270 (255 ²)	25	217	- ³	B95
	S33228	73	500	27	185	30	192	200	B90
	S21500	78	540	33	230	35	192	200	B90
	S31725	75	515	30	205	35	192	200	B90
	S31726	80	550	35	240	35	192	200	B90
	S32615	80	550	32	220	25	192	200	B90
	S25700	78	540	35	240	50	192	200	B90

Notes

- Elongation for wall thickness $t = \frac{5}{16}$ in (8mm); For wall thickness $t < \frac{5}{16}$ in (8mm): Elongation % = $32t + 10.00$ (= $1.25t + 10.00$) for 18Cr-2Mo. Calculated elongation values should be rounded to the nearest whole number.
- Values if wall thickness $t > 0.25$ in
- No Vickers hardness provided.

ASTM Tube

Tube Specifications - ASTM A249/A249M

Welded austenitic steel boiler, superheater, heat exchanger and condenser tubes

This specification covers nominal wall thickness austenitic steel welded tubes for use as boiler, superheater, heat exchanger, condenser, or hygienic tubes. Minimum wall thickness tube may be also specified.

Tensile and hardness requirements

Grade	UNS	Tensile Strength min		Yield Strength min		Elongation in 2 in (50 mm) or 4D, min	Rockwell Hardness HRB or C
		ksi	MPa	ksi	MPa	%	scale/max
TP201	S20100	95	655	38	260	35	B95
TP202	S20200	90	620	38	260	35	B95
TP304	S30400	75	515	30	205	35	B90
TP304H	S30409	75	515	30	205	35	B90
TP304N	S30451	80	550	35	240	35	B90
TP304L	S30403	70	485	25	170	35	B90
TP304LN	S30453	75	515	30	205	35	B90
TP305	S30500	75	515	30	205	35	B90
TP309Cb	S30940	75	515	30	205	35	B90
TP309H	S30909	75	515	30	205	35	B90
TP309HCb	S30941	75	515	30	205	35	B90
TP309S	S30908	75	515	20	205	35	B90
TP310Cb	S31040	75	515	30	205	35	B90
TP310H	S31009	75	515	30	205	35	B90
TP310HCb	S31041	75	515	30	205	35	B90
TP310S	S31008	75	515	30	205	35	B90
TP316	S31600	75	515	30	205	35	B90
TP316H	S31609	75	515	30	205	35	B90
TP316L	S31603	70	485	25	170	35	B90
TP316N	S31651	80	550	35	240	35	B90
TP316LN	S31653	75	515	30	205	35	B90
TP317	S31700	75	515	30	205	35	B90
TP317L	S31703	75	515	30	205	35	B90
TP321	S32100	75	515	30	205	35	B90
TP321H	S32109	75	515	30	205	35	B90
TP347	S34700	75	515	30	205	35	B90
TP347H	S34709	75	515	30	205	35	B90
TP348	S34800	75	515	30	205	35	B90
TP348H	S34809	75	515	30	205	35	B90
TPXM-15	S38100	75	515	30	205	35	B90
TPXM-19	S20910	100	690	55	380	35	C25
TPXM-29	S24000	100	690	55	380	35	B100
	S30615	90	620	40	275	35	B95
	S31050	84 (78 ¹)	580 (540 ¹)	39 (37 ¹)	270 (255 ¹)	25	B95
	S31254	94	650	44	300	35	B96
	S30815	87	600	45	310	35	B95
	S31725	75	515	30	205	35	B90
	S31726	80	550	35	240	35	B90
	S24565	115	795	60	415	35	B100
	S33228	73	500	27	185	30	B90
	S30415	87	600	42	290	35	B96
	S32654	109	750	62	430	35	B100
	N08367	100 (95 ²)	690 (655 ²)	45 (45 ²)	310 (310 ²)	30	B100
	N08904	71	490	31	215	35	B90
	N08926	94	650	43	295	35	B100

Notes

- 1 Values if wall thickness $t > 0.25$ in
- 2 Values if wall thickness $t > 0.187$ in
- Refer to mandatory testing exceptions also.

Seamless and welded austenitic stainless steel tubing for general service

This specification covers nominal wall thickness austenitic stainless steel tubing for general corrosion resisting and low or high temperature service.

Tolerances

- Cut Length.** No tube may be shorter than specified. For tube $<1\frac{1}{2}$ in (38.1mm) cut length may be up to $\frac{1}{8}$ in (3 mm) longer than specified. For tube $\geq 1\frac{1}{2}$ in (38.1mm) cut length may be up to $\frac{3}{16}$ in (4.8mm) longer than specified. These tolerances are increased by $\frac{1}{8}$ in (3mm) for every 10 ft (3 m) over 24 ft (7.3 m), up to a maximum tolerance of $\frac{1}{2}$ in (13mm).

Cross-sectional tolerances

Outside Diameter (OD)		Wall Thickness (t)		Variations in OD				Variation in t	
in	mm	in	mm	Under		Over		Under	Over
				in	mm	in	mm	%	%
$<1\frac{1}{2}$	<12.7	All	All	0.005	0.13	0.005	0.13	15	15
$1\frac{1}{2}$ to $<1\frac{1}{2}$	12.7 to <38.1	≥ 0.065	≥ 1.6	0.005	0.13	0.005	0.13	10	10
$1\frac{1}{2}$ to $<1\frac{1}{2}$	12.7 to <38.1	$<0.065^1$	$<1.6^1$	0.005	0.13	0.005	0.13	10	10
$1\frac{1}{2}$ to $<3\frac{1}{2}$	38.1 to <88.9	≥ 0.095	≥ 2.4	0.010	0.25	0.010	0.25	10	10
$1\frac{1}{2}$ to $<3\frac{1}{2}$	38.1 to <88.9	$<0.095^1$	$<2.4^1$	0.010	0.25	0.010	0.25	10	10
$3\frac{1}{2}$ to $<5\frac{1}{2}$	88.9 to <139.7	≥ 0.150	≥ 3.8	0.015	0.38	0.015	0.38	10	10
$3\frac{1}{2}$ to $<5\frac{1}{2}$	88.9 to <139.7	$<0.150^1$	$<3.8^1$	0.015	0.38	0.015	0.38	10	10
$5\frac{1}{2}$ to ≤ 8	139.1 to ≤ 203.2	≥ 0.150	≥ 3.8	0.030	0.76	0.030	0.76	10	10
$5\frac{1}{2}$ to ≤ 8	139.1 to ≤ 203.2	$<0.150^1$	$<3.8^1$	0.030	0.76	0.030	0.76	10	10

Notes

1 Thin walled tubes. Therefore ovality tolerance increases, but mean OD at a cross section must be within permissible variation.

Finish

- Finish.** Tubes to be pickled, free of scale. Where bright annealed, pickling is not necessary.



www.aalco.co.uk

ABERDEEN

Tel 01224 854810
Fax 01224 871982
e-mail aberdeen@aalco.co.uk

AYLESBURY

Tel 01296 461700
Fax 01296 339923
e-mail aylesbury@aalco.co.uk

BELFAST

Tel 02890 838 838
Fax 02890 837 837
e-mail belfast@aalco.co.uk

BIRMINGHAM

Tel 0121 585 3600
Fax 0121 585 6864
e-mail birmingham@aalco.co.uk

CHEPSTOW

Tel 01291 638 638
Fax 01291 638 600
e-mail chepstow@aalco.co.uk

DYFED

Tel 01269 842044
Fax 01269 845276
e-mail dyfed@aalco.co.uk

ESSEX

Tel 01268 884200
Fax 01268 884220
e-mail essex@aalco.co.uk

GLASGOW

Tel 0141 646 3200
Fax 0141 646 3260
e-mail glasgow@aalco.co.uk

HULL

Tel 01482 626262
Fax 01482 626263
e-mail hull@aalco.co.uk

LEEDS

Tel 0113 276 3300
Fax 0113 276 0382
e-mail leeds@aalco.co.uk

LIVERPOOL

Tel 0151 207 3551
Fax 0151 207 2657
e-mail liverpool@aalco.co.uk

MANCHESTER

Tel 01204 863456
Fax 01204 863430
e-mail manchester@aalco.co.uk

NEWCASTLE

Tel 0191 491 1133
Fax 0191 491 1177
e-mail newcastle@aalco.co.uk

NORWICH

Tel 01603 787878
Fax 01603 789999
e-mail norwich@aalco.co.uk

NOTTINGHAM

Tel 0115 988 2600
Fax 0115 988 2636
e-mail nottingham@aalco.co.uk

SOUTHAMPTON

Tel 023 8087 5200
Fax 023 8087 5275
e-mail southampton@aalco.co.uk

STOKE

Tel 01782 375700
Fax 01782 375701
e-mail stoke@aalco.co.uk

SWANLEY

Tel 01322 610900
Fax 01322 610910
e-mail swanley@aalco.co.uk



Also available in Ireland

DUBLIN

Tel +353 1 6298 600
Fax +353 1 6299 200
e-mail: dublin@amari-dublin.com

CORK

Tel +353 21 4310 520
Fax +353 21 4310 519
e-mail: cork@amari-cork.com