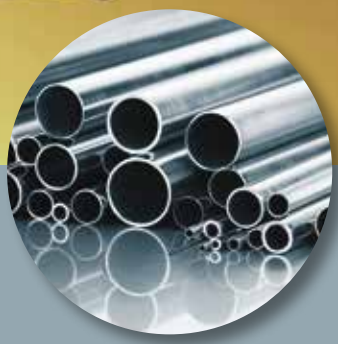
AMETEK®
SPECIALTY METAL PRODUCTS

finetubes

SuperiorTube



AEROSPACE

High Strength Tubing Solutions for Critical Aerospace Applications



TUBING EXCELLENCE

With over 70 years of engineering expertise in supplying high precision tubes, Fine Tubes and Superior Tube work closely with customers worldwide, developing high specification tubing solutions to help them solve their technical challenges. We manufacture high performance tubes in an ever expanding range of stainless steel and titanium alloys for supercritical aerospace applications.

TUBING INNOVATIONS

Fine Tubes and Superior Tube benefit from a world-class reputation for innovative and high quality tubing solutions geared towards the aerospace industry. Here are a few examples:

1950
North American X-15 rocket-powered aircraft uses Superior Tube's products in its ballistic control system.

1957
Fine Tubes starts to supply stainless steel tubing to Vickers Viscount Aircraft.

1965
Fine Tubes and Superior Tube collaborate to supply AM350 tubes for the Concorde programme.

1970
Superior Tube supplies the Ti 3Al-2.5V hydraulic line tubing used in the F-15 Eagle fighter.

1980
NASA Space Shuttle life support system relies on high pressure stainless steel tubing made by Superior Tube.

1999
Eurofighter uses Fine Tube's titanium tubing for hydraulic systems & EJ200 engine.

2006
Fine Tubes supplies Airbus A380 with Ti 3Al-2.5V tubing for 5,000 psi hydraulic systems.

2014
Fine Tubes supplies specialist tubing for the Solar Orbiter satellite to investigate the sun.



TUBING SOLUTIONS

AEROSPACE

Fine Tubes and Superior Tube have been supplying high quality tubular products to the civil aerospace, defence and space industries since inception. Our position in the aerospace industry has been achieved through the culmination of our long-term commitment to development and innovation.

With an international reputation for manufacturing high specification tubing in a wide range of advanced metals and lightweight alloys, we supply tubing for critical airframe and aircraft engine applications.

Starting with stainless steels, we have continually expanded our process capability and have developed a unique expertise in processing nickel alloys for high-temperature/high-strength applications and titanium alloys where a high strength-to-weight ratio is required.

Superior Tube and Fine Tubes continue to lead in meeting the exacting quality demands of the aerospace industry, ensuring that new design concepts today become the industry standards of tomorrow.

CIVIL

Our high strength tubing has been deployed in engines and airframes of major commercial aircraft programmes including Airbus and Boeing.

Critical to the safe operation of the aircraft, our 3,000 or 5,000 psi hydraulic tubes are used to actuate flight control surfaces and are crucial components in landing gear and brake systems.

We also supply heat resistant tubing for various systems within commercial aero engines, including fuel delivery, fire suppression, drain lines and bleed air systems.

DEFENCE

Superior Tube and Fine Tubes primarily supply hydraulic and aero engine tubing deployed in the engines and airframes of military aircraft. From developing the lightweight titanium tubing for the hydraulic systems of the Eurofighter to manufacturing high performance Waspaloy™ tubing for the afterburners of the F-15/F-16, we work closely with major defence aviation manufacturers globally.

SPACE

Our involvement in the space industry goes back to the 1960s, where we contributed to Telstar 1, the world's first communications satellite. Since then, Fine Tubes and Superior Tube have been developing and supplying high quality tubing solutions for various space exploration programmes, including NASA's Space Shuttle and Mars Exploration projects.

Our expertise in manufacturing high precision seamless tubing also fulfils the exacting requirements in terms of high quality and cleanliness levels needed for the critical Chemical Propulsion System of the highly anticipated Solar Orbiter satellite project.

AEROSPACE APPLICATIONS:

- Aero engine tubes
- Convoluting tube-seals
- Ducting systems
- Hydraulic and pneumatic control systems
- Instrumentation
- Landing gear
- Pitot tubes
- Torque control rods
- Transmission tubes
- Waveguides



MANUFACTURING CAPABILITIES

ALLOYS

Fine Tubes and Superior Tube produce a wide range of custom-sized tubing in an ever expanding range of alloys – available in three different forms, i.e. seamless, welded or welded & redrawn (Weldrawn®) finish.

SEAMLESS, WELDED, WELDED & REDRAWN

Stainless Steel 304, 316, 321, 347, 15-5PH, 17-4PH, 21-6-9, FV607

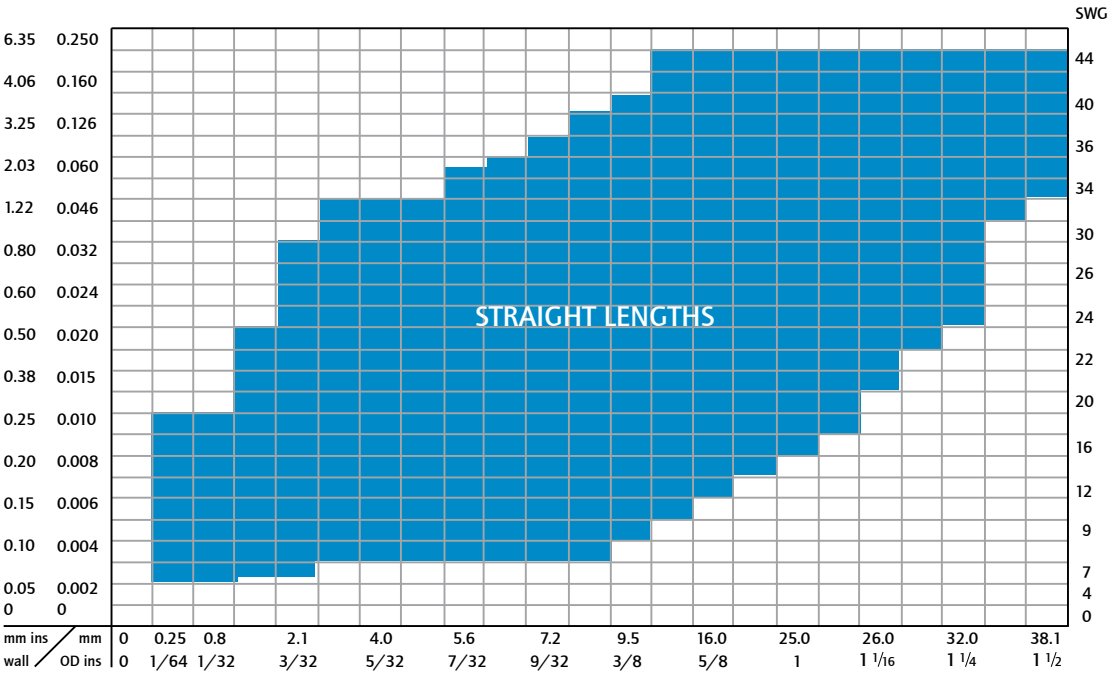
Nickel Waspaloy™, X-750, 75, 263, 600, 625, 718

SEAMLESS ONLY

Titanium Ti 3Al-2.5V (Grade 9), Ti 6Al-4V (Grade 5), Ti CP (Grade 1 and 2), Ti 4Al-2.5V

We also manufacture tubing in many other grades. Please contact us for more details.

SIZE RANGE



Our tubing sizes typical for aerospace applications range from 0.25 mm (0.010 in) to 38.10 mm (1.5 in) OD in seamless, welded and welded & redrawn.

SUPERCRITICAL TUBING • GRADE CHART

AEROSPACE

finetubes × SuperiorTube

ALLOY GROUP	ALLOY UNS No.	WNR	Chemical Analysis %											Density		Temper	Tensile Rm (min)		Yield Rp 0.2% (min)		Elong. % min	Hardness HV	Properties
			C	Mn	Ni	Cr	Fe	Mo	Ti	Nb	N	Al	Other	g/cm³	lb/in³		ksi	MPa	ksi	MPa			
STAINLESS STEEL	304L S30403	1.4306	0.035 max	2.0 max	8.0-11.0	18.0-20.0	bal							7.93	0.286	ANN	70	485	25	170	35	200 max	Lower carbon of 304 with good weldability.
	316L S31603	1.4404	0.035 max	2.0 max	10.0-13.0	16.0-18.0	bal	2.0-2.5						7.93	0.286	ANN	70	485	25	170	35	200 max	Better corrosion resistance than 304 in chloride Good weldability.
		1.4435						2.5-3															316L with minimum molybdenum content of 2.5%.
	321 S32100	1.4541	0.080 max	2.0 max	9.0-12.0	17.0-19.0	bal		5XC -0.600					7.93	0.286	ANN	75	515	30	205	35	200 max	Titanium stabilised grade with good weldability, improved resistance to weld decay attack & better mechanical properties at elevated temperatures.
	347 S34700	1.4546	0.080 max	2.0 max	9.0-12.0	17.0-19.0	bal			10XC -1.000				7.93	0.286	ANN	75	515	30	205	35	200 max	As for 321 but uses niobium as stabilising element.
	21-6-9 S21900		0.080 max	8.0-10.0	5.5-7.5	19.0-21.5	bal				0.15-0.40			8	0.289	CW	142-162	979-1117	120	827	16	250 min	Good corrosion resistance, high mechanical properties.
	FV607 S64607		0.12-0.16	0.5-1.2	0.4-0.9	10.0-11.7	bal	0.7-1.2			0.35 max		V 0.15-0.3	7.7	0.278	HT	130-152	900-1050	107	740	8	290-349	Martensitic grade showing good creep resistance.
	17-4PH S17400	1.4542	0.070 max	2.0 max	3.0-5.0	15.0-17.5	bal			0.15-0.45			Cu 3.0-5.0	7.9	0.286	HT	155	1070	145	1000	5	300 min	Capable of developing high mechanical properties by solution treatment & age hardening.
	15-5PH S15500		0.070 max	1.0 max	3.50-5.5	14.5-15.5	bal			0.15-0.45			Cu 2.5-4.5	7.8	0.282	HT	155	1070	145	1000	12	331-401	Capable of developing high mechanical properties by solution treatment and age hardening.
NICKEL ALLOYS	Alloy 75 N06075	2.4951	0.08-0.15	1.0 max	bal	18.0-21.0	5.0 max		0.20-0.60				Cu 0.5 max	8.37	0.303	ANN	100-120	690-830	46	300	30	230 max	High temperature oxidation resistance.
	Alloy 263 N07263		0.04-0.08	0.6 Ma	bal	19.0-21.0	0.7 max	5.6-6.1	1.9-2.4		0.3-0.6		Co 19.0-21.0	8.36	0.302	HT	140	970	90	620	39	250 min	High creep strength with good weldability.
	Alloy 600 N06600	2.4816	0.15 max	1.0 max	72.0 min	14.0-17.0	6.0-10.0						Cu 0.50 max	8.42	0.304	ANN	80	550	35	240	30	200 max	Very good combination of strength & oxidation resistance.
	Alloy 625 N06625	2.4856	0.10 max	0.5 max	bal	20.0-23.0	5.0 max	8.0-10.0	0.40 max	3.15-4.15		0.40 max		8.44	0.305	ANN	120	827	60	414	30	260 max	High strength, excellent fabricability. Superior resistance to a wide range of corrosive environments.
	Alloy 718 N07718	2.4668	0.08 max	0.4 max	50 .0-55.0	17.0-21.0	bal	2.80-3.30	0.65-1.15	4.75-5.50		0.20-0.80	Co 1.0 max	8.19	0.296	HT	185	1275	150	1034	12	331 min	Age hardenable, high-strength nickel alloy with excellent corrosion resistance and formability. Used at temperatures up to 700ºC.
	Alloy X750 N07750	2.4669	0.08 max	1.0 max	70.0 min	14.0-17.0	5.0-9.0		2.25-2.75	0.70-1.20		0.40-1.00		8.25	0.298	HT	160	1103	100	689	20	260-360	High temperature strength performance.
TITANIUM	CP Grade 1 R50250	3.7025	0.08 max				0.20 max		bal		0.03 max			4.48	0.162	ANN	80	552	70	482	15		The most ductile and softest titanium alloy. A good solution for cold forming and corrosive environments.
	CP Grade 2 R50400	3.7035	0.08 max				0.30 max		bal		0.03 max		O 0.25 max	4.51	0.163	ANN	50	345	40-65	275-450	20		Very high strength to weight ratio combined with excellent seawater corrosion resistance.
	Ti 3Al-2.5V Grade 9 R56320	3.7194	0.08 max				0.25 max		bal		0.03 max	2.5-3.50	V 2.0-2.5	4.48	0.162	CWSR	125	860	105	725	10		Cold worked 75 to 85% to result in moderately high strength and good ductility. Weldability on par with commercially pure grades and excellent torsion and corrosion resistance.
	Ti 6Al-4V Grade 5 ELI R56401	3.7165							bal			6.0	V 4.0	4.33	0.156	CWSR	159	1100	141	980	8		ELI grade, very high strength to weight ratio.
	Ti 4Al-2.5V R54250						1.5		bal			4.0	V 2.5			CWSR	146	1006	129	890	14		Very high strength to weight ratio with improved ductility.

For further details on our grades visit: www.finetubes.co.uk/products/tube-grades www.superiortube.com/products/our-grades

AMETEK® SPECIALTY METAL PRODUCTS



TUBING QUALITY

TUBING QUALITY CERTIFICATIONS

- ISO 9001
- AS EN 9100
- Nadcap (Heat Treatment)
- Nadcap (NDT)
- Nadcap (Welding)
- TUV AD-2000 Merkblatt W0-TRD 100
- 97-23-EC (PED) - TüV
- ISO 10012
- ISO 14001
- RCC-M

CUSTOMER APPROVALS

- Airbus
- BAE Systems
- Boeing (commercial and military)
- Bombardier
- Embraer
- GE Aviation
- Gulfstream
- Hawker Beechcraft
- Liebherr
- Lockheed Martin
- Messier-Dowty
- Raytheon
- Rolls-Royce
- SNECMA-SAFRAN
- UTC
- Westland

MANUFACTURING STANDARDS

TITANIUM 3Al-2.5V

ABS 5004
ABS 5141
ABS 5918
AMS 4943
AMS 4944
AMS 4945
AMS 4946
MBBN 6001-4
MSRR 8673

TITANIUM 6Al-4V

FT2312 SEAMLESS

TITANIUM C.P.

AMS 4942
BAEM 4044
MSRR 8609

STAINLESS STEEL 21-6-9

ABM 7-3058
AMS 5561
ASN-A3288-NSA384510
BACM 157
BMS7-185
DAN 41
SO7-2210

OTHER STAINLESS STEELS

AMS-5566	Alloy 304
AMS-5643	Alloy 17-4PH
AMS-5659	Alloy 15-5PH
AMS-T-6845	Alloy 304
BS2T66	Alloy 347
BST68	Alloy 347
BST72	Alloy 347
LN 9398	Alloys 304-321-347
MIL-T-8808	Alloys 321-347
MSRR 6524	Alloy 347

NICKEL ALLOYS/NIMONICS

AMS 5580	Alloy 600
AMS 5581	Alloy 625
AMS 5582	Alloy X750
AMS 5589	Alloy 718
BSHR 403	HTA75 (Alloy 75)
BSHR 404	Alloy 263
MSRR 6513	FV607
MSRR 7006	Alloy 75
MSRR7037	Alloy C263

GLOBAL PRESENCE

Through the partnership between U.K.-based Fine Tubes and U.S.-based Superior Tube, both companies can offer increased capabilities, leading to significantly reduced lead times, an extended product portfolio, increased global reach and outstanding customer service.

Fine Tubes and Superior Tube are collectively a unit of AMETEK, Inc., a leading global manufacturer of electronic instruments and electromechanical devices.

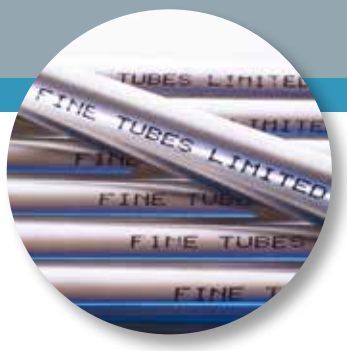
In addition to tube mills in the United Kingdom and the United States, we have sales offices in Germany, France, India and the United States, as well as an extensive network of partners in Asia, Europe and the Middle East.

Our tubing experts deliver high precision tubing to customers in over 35 countries worldwide.

GLOBAL SALES OFFICES AND AGENTS NETWORK

HIGH PRECISION TUBES FOR DEMANDING ENVIRONMENTS

AEROSPACE



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