finetubes / SuperiorTube / AMETEK SPECIALTY METAL PRODUCTS

MEDICAL TUBING

High precision, small diameter tubes engineered to last a lifetime.

Our high strength and lightweight specialty metal tubes are engineered for critical medical applications.

Key advantages include:

- Excellent strength-to-weight ratio
- Tightest tolerances
- Highest levels of microbiological corrosion resistance
- Customizable, high-quality surface finishes

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TUBING EXCELLENCE

With more than 85 years of engineering expertise in manufacturing high precision tubes, Fine Tubes and Superior Tube work closely with medical customers worldwide, to solve their technical and metallurgical challenges.

We develop high performance tubing solutions for critical cardiac and orthopedic applications in a range of titanium, stainless steel and specialty alloys.

TUBING INNOVATIONS

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

1936

Superior Tube manufactures hypodermic needle tubing for critical medical instruments including catheters and cystoscopies.

2002

Fine Tubes develops profiled implant tubing for medical applications.

1970

Superior Tube develops 316 stainless steel tubing for life-saving artificial kidney machines.

2003

Superior Tube's proprietary tube rolling process is used to produce titanium alloy tubing for artificial heart valve frames.

1980

Superior Tube produces precision needle tubing for the "Radiation Implanter" - a medical device for the treatment of cancerous tumours.

2004

Fine Tubes manufactures Ti 6Al-4V (Grade 5) tubing for femur and tibia bone nail implants.

1997

Superior Tube receives its first order for advanced L605™ (cobalt-chromium) alloy tubing related to coronary stents.

2009

Superior Tube receives an award for its role in the development and market introduction of innovative transaortic valve replacements.

TUBING SOLUTIONS

MEDICAL

For more than eight decades, design engineers have been relying on Fine Tubes and Superior Tube, two of the medical industry's most technologically advanced manufacturers of highly engineered, small-diameter, precision alloy tubing.

The demand for high performance stainless steel and titanium alloys that can offer excellent strength-to-weight ratios is constantly increasing. This, in combination with high levels of microbiological corrosion resistance and fatigue life properties, is the challenge that has been exceeded by our biocompatible medical materials.

We have the technical capability to achieve an OD surface finish down to 16µ in (0.4µ m) Ra or better with centre-less grinding and an ID surface finish down to 8µ in (0.2µ m) Ra or better with electropolishing.

From advanced alloy precision tubing development to every day inventory management challenges, we're ready to partner with you to help develop solutions for your unique requirements.

CRITICAL MEDICAL APPLICATIONS

Our high performance tubes are engineered for coronary/cardiac implants and orthopedics.

- Dental implants 
- Heart valves 
- Coronary and Vascular stents 
- Spinal cages 
- Lag screws 
- Trauma nails 

ADDITIONAL APPLICATIONS

- Dental handles / drills 
- Surgical instruments 
- HPLC columns for drug and food testing 

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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.

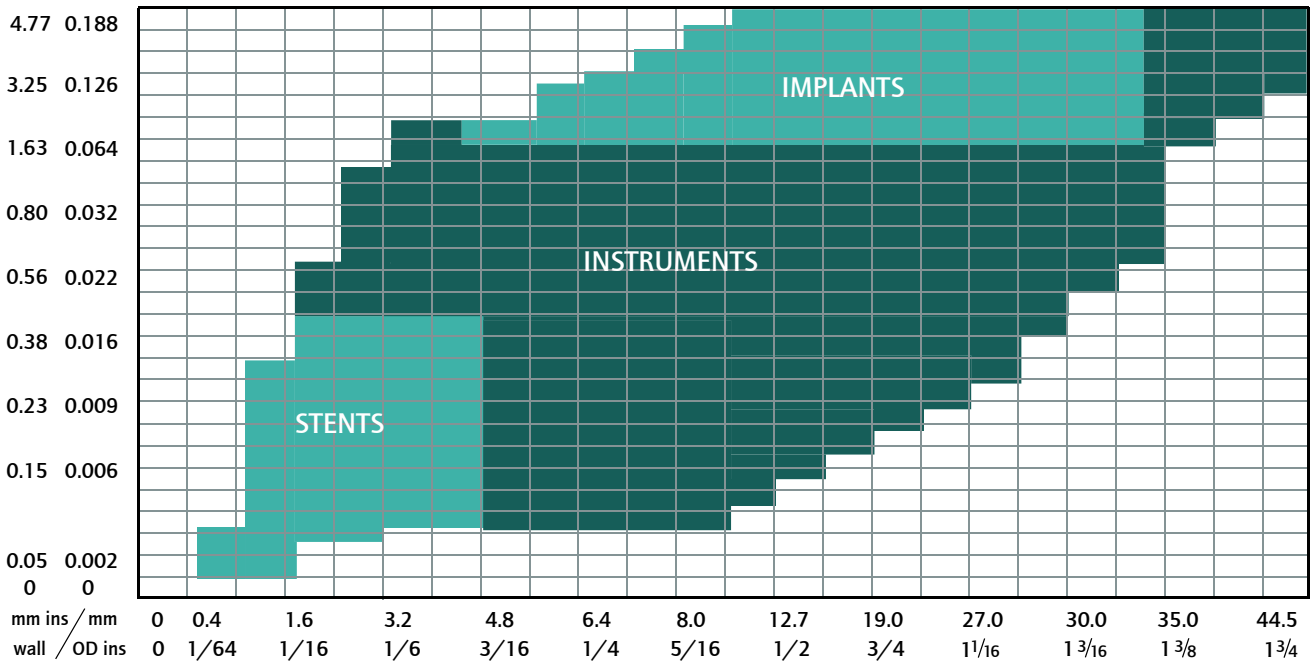
SEAMLESS, WELDED, WELDED & REDRAWN				
STAINLESS STEEL				
304L	316L	316LVM	17-4PH®	17-7PH®

TITANIUM			
Ti CP (Grade 1 and Grade 2)	Ti 6Al-4V (Grade 5)	Ti 3Al-2.5V (Grade 9)	Ti 6Al-4V ELI (Grade 23)

SPECIALTY		
L605™	MP35N®	Nitronic® 50

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

SIZE RANGE



Size range for medical products is based upon manufacture of cold drawn tubing from 0.012 in (0.30 mm) to 1 5/8" (45 mm) OD. Tolerances: OD and ID up to 0.0005 in (0.0127 mm) are achievable.

SUPERCRITICAL TUBING • GRADE CHART

MEDICAL

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	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	Standard AOD melt austenitic stainless steel grade.
		1.4435						2.5-3															316L with minimum molybdenum content of 2.5%.
	316LVM S31673	1.4441	0.030 max	2.0 max	11.0-14.0	17.0-19.0	bal	2.0-3.0						7.93	0.286	ANN	70	485	25	170	35	200 max	Vacuum remelt or ESR to achieve highest microcleanliness levels and structural homogeneity.
	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.
	17-7 PH® S17700	1.4568	0.09	1.0	6.50-7.75	16.00-18.00	bal						Al .75/1.5	7.81	0.282	ANN	140	965	35	241	20	222 max	Precipitation hardening grade often used for surgical instruments.
SPECIALTY	L-605™ R30605	2.4964	.05-0.15	1.0-2.0	9.0-11.0	19.0-21.0	3.0						W14.0/16.0	9.10	0.330	ANN	160	1104	95	655	35	266 max	Cobalt chrome alloy ideal for implantable applications.
	MP35N® LTi R30035		0.03 max	0.2 max	33.0-37.0	19.0-21.0	1.0 max	9.0-10.5	1.0 max				Co bal	8.43	0.304	HT	220	1514	200	1380	10	528 max	Nickel cobalt alloy with very high strength, toughness and outstanding corrosion resistance.
	Nitronic® 50 S20910	1.3964	0.060 max	4.0-6.0	11.5-13.5	20.5-23.5	bal	1.5-3.0		0.1-0.3	0.2-0.4		V 0.1-0.3	7.880	0.285	ANN	100	690	55	380	35	285 max	Nitrogen strengthened austenitic grade with exceptional strength in the cold-worked condition.
														7.450	0.270	CW	170	1170	150	1034	20	528 max	
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 corrosion resistance.
	Ti 6Al-4V Grade 5 R56400	3.7165	0.10 max				0.40 max		bal		0.05 max	5.5-6.75	V 3.5-4.5	4.43	0.160	ANN	50	345	40	275	20		Stronger than commercially pure titanium with the same stiffness and thermal properties excluding thermal conductivity. Excellent combination of corrosion resistance, weld and fabricability.
	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 23 ELI R56401	3.7165							bal			6.0	V 4.0	4.33	0.156	CWSR	159	1100	141	980	8		Improved ductility and fracture toughness with some reduction in strength.

Click for more details on our grades **FINE TUBES** www.finetubes.co.uk/products/grade-comparison **SUPERIOR TUBE** www.superiortube.com/products/our-grades

TUBING QUALITY

INTEGRITY ASSURANCE

The quality control process at Fine Tubes and Superior Tube is critical in respect of consistently achieving the highest level of specification requirements.

Reduction control through pilgering and drawing is specific to each product dimension and specification requirements. This is the driver for tolerance control, OD and ID surface finish control, inclusion levels and final grain size.

- OD surface roughness typically better than 30µ in (0.75µ m) Ra.
- ID surface roughness typically better than 59µ in (1.5µ m) Ra.

Rigorous process control ensures that grain sizes typically achieve levels finer than ASTM 8 per ASTM E112.

Testing capabilities include non-destructive ultrasonic, eddy current and hydrostatic testing.

TUBE ADVANTAGES

High levels of ID and OD surface finish, tolerance and ovality controls yield a product which is a cost competitive alternative to the gun drilled technology. At the same time, it can offer additional benefits of consistency and small inside diameters over typical lengths of 10 ft (3 m).

- OD surface roughness can be further refined by centre-less grinding down to 16µ in (0.4µ m) Ra or better.
- ID surface roughness can be further refined by drawing down to 16µ in (0.4µ m), then electro-polished to achieve 8µ in (0.2µ m) Ra or better

ID defect levels: UT tested to levels down to 50 microns (0.0020 in/0.05 mm).

Fatigue life: Control of texture combined with extra low levels of interstitial impurities leads to higher fatigue performance than equivalent drilled bars.

Tolerances: In-house control to ISO 286-2 h8.

OUTSIDE DIAMETER		TOLERANCE +/-	
inches	mm	inches	mm
0.23 - 0.39	6 - 10	0.00086	0.022
> 0.39 - 0.70	>10 - 18	0.00011	0.027
> 0.70 - 1.81	>18 - 30	0.0013	0.033

ID/OD ratio: Tube production can be controlled over full length to maintain small IDs from 0.3 to 0.15 of OD.

TUBING QUALITY STANDARDS

- ASTM F136-Ti6-4 ELI
- ASTM F138-316L-316LVM
- ASTM F1314-22Cr-13Ni-5Mn
- BS ISO 5832-9
- ISO-DIS 25832-1

PRODUCTION FACILITIES

- Pilger mills
- Multi-roll rolling mills
- Draw benches
- Tube welding mills - In-line weld mills
- Controlled atmosphere heat treatment
- Bright annealing/hydrogen furnace
- Vacuum annealing
- Pickling & passivation plant
- NDT ultrasonic & eddy current testing
- Hydrostatic testing
- Radiographic examination
- Electropolishing capabilities
- Full chemical and physical laboratory analysis

ABOUT AMETEK SPECIALTY METAL PRODUCTS

AMETEK Specialty Metal Products (SMP) is a business unit of AMETEK, Inc. a leading global manufacturer of electronic instruments and electromechanical devices with annualized sales of approximately $5.5 billion.

The Specialty Metal Products business unit consists of five businesses and operating facilities in the United States and the United Kingdom.

These businesses are proven experts in the manufacture of advanced metallurgical products including roll bonded clad plate, precision metal strip, ultra-thin foil, shaped wire, engineered components, thermal management materials, water atomized powders and precision tube.

Our high performance metal products are used around the world for critical applications in a range of industries including aerospace, automotive, defense, electronics, industrial, medical, nuclear, oil and gas, and space and satellites.

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