EN.svgE RGY

High Precision Tubing Solutions for Demanding Power Applications

NUCLEAR • CONVENTIONAL • SOLAR
TUBING EXCELLENCE

With over 70 years of engineering expertise in supplying high precision tubes, Superior Tube and Fine Tubes 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, nickel, titanium and zirconium alloys for supercritical and ultra-supercritical nuclear, thermal and solar power applications.

TUBING INNOVATIONS

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

1940
Superior Tube supplies tubing for the Manhattan Project, where mankind first learned to control the energy of the atom.

1954
Superior Tube manufactures zirconium reactor tubes for the first nuclear-powered submarine, the USS Nautilus.

1957
Superior Tube supplies cladding to Shippingport Atomic Power Station, the first plant to produce electricity for a civilian population.

1960
Superior Tube produces fuel cladding for Argonne National Laboratory's Experimental Breeder Reactor-II.

1970
Fine Tubes develops 20-25Nb nuclear fuel cladding and supplies for the UK's first generation of Advanced Gas Reactors.

2000
The Tennessee Valley Authority's Watts Bar nuclear reactor facility uses Zirconium Zr4 tubing from Superior Tube.

2008
Fine Tubes supplies CERN with cooling tubes for the Large Hadron Collider experiment.

2012
Fine Tubes manufactures high-performance tubing for the Gemasolar thermosolar plant in Spain.
TUBING SOLUTIONS

NUCLEAR POWER

Our involvement with the nuclear industry goes back as far as the 1930s. Since then, Superior Tube and Fine Tubes have been developing and supplying high-quality tubing solutions for in-core reactor components, where tubing is critical to the safe operation of nuclear reactors that have to withstand extreme temperatures, pressures and radiation.

From developing tubing solutions to be used as fuel cans for the U.K.'s AGR program, we have continued to evolve our product range in support of PWR, PHWR, LWR, BWR and FBR reactor technologies.

Fine Tubes and Superior Tube have worked closely with the world's prominent nuclear reactor suppliers to develop tubular solutions for both new builds and maintenance projects globally, including the United Kingdom, United States, Canada, France, India and China.

NUCLEAR APPLICATIONS:
• Control and Instrumentation
• Control Rod Drive Mechanism
• Fuel Rods or Cladding Tubes
• Flux Thimble Guide Tubes
• Heat Exchangers
• Steam Generators
• Turbine Island Condensers

THERMAL POWER

Superior Tube and Fine Tubes supply hollow conductors or cooling tubes for water-cooled or helium/hydrogen-cooled turbine generators used in 660 MW or above supercritical thermal power plants, as well as 1000 MW or above ultra-supercritical coal-fired power plants.

As leading tube manufacturers, we also have the capability to supply welded or welded & redrawn tubes for low-pressure and high-pressure heaters manufactured in our fully automated multi mill.

THERMAL APPLICATIONS:
• Control and Instrumentation
• Steam Turbine Generators
• Super Heaters
• Condensers

SOLAR POWER

Fine Tubes and Superior Tube manufacture tubing solutions for use in CSP (Concentrated Solar Power) technology in solar tower or solar thermal power plants.

Our expertise in processing exotic alloys for high-performance tubing satisfied the need of mission-critical heat exchangers at the heart of the solar process of Gemasolar, the award-winning commercial solar power plant near Seville in Spain. In collaboration with SENER, we have developed and produced the corrosion-resistant heating exchanger tubes for the steam generators as well as the high-performance tubing that make up the receiver of the Gemasolar central tower containing molten salt.

SOLAR APPLICATIONS:
• Control and Instrumentation
• Heat Collectors
• Heat Exchangers
• Super Heaters
• Condensers
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 303Se, 304, 304L, 316, 316L, Vacuum Melted 316L, 321 and 347
Duplex S31803, Super Duplex S32750 and S32760
Nickel 200, 201, 211, 230, Monel 400, 600, 625, 690, 718, 750, 800, 825

SEAMLESS ONLY
Titanium Ti CP (Grade2)
Zirconium Zircaloy2, Zircaloy4

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

SUPPLIED FORMS
Straight lengths: Maximum 65 ft (20 m)
Coils: Up to 200 lb (100 kg) or up to 32,808 ft (10,000 m) length with orbital joints
Forms: Straight or 'U' bent
Surface Finish: 16 micro inch Ra (ID 0.4 micron Ra) (as drawn)
4 micro inch Ra (ID 0.1 micron Ra) (electropolished)

The exceptional performance of our high-performance tubing is a reflection of our years of experience with specialty alloys and our state-of-the-art manufacturing processes. Each manufacturing run is custom designed, precision fabricated and finished to exacting specifications.

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
Tubing sizes typical for power applications range from 0.1181 in (3 mm) to 2 in (50.8 mm) OD in seamless, welded, welded & redrawn. Other sizes are available on request, starting from 0.0098 in (0.25 mm) OD.

TUBING QUALITY

- RCC-M
- Nadcap (Heat Treatment)
- Nadcap (NDT)
- Nadcap (Welding)
- TUV AD-2000 info sheet W0/TRD 100
- 97/23/EC (PED) - TüV
- ISO 9001/AS EN 9100
- 10CFR50 Appendix B
- ASME NQA1
- ANSI/NCSL-Z-540
- ISO 10012
- ISO 14001

Tubing supply is based on the technical requirements of ASME III.
<table>
<thead>
<tr>
<th>ALLOY</th>
<th>UNS No.</th>
<th>Chemical Analysis %</th>
<th>Density</th>
<th>Tensile Rm (min)</th>
<th>Yield Rp 0.2% (min)</th>
<th>Elong. % min</th>
<th>Hardness HV</th>
<th>Properties</th>
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<tr>
<td></td>
<td></td>
<td>C</td>
<td>Mn</td>
<td>Ni</td>
<td>Cr</td>
<td>Fe</td>
<td>Mo</td>
<td>Ti</td>
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</table>

**Notes:**
- Density is given in g/cm³ and lb/in³.
- Tensile Rm (min) and Yield Rp 0.2% (min) are in ksi and Mpa.
- Elong. % min is the minimum elongation at failure.
- Hardness HV is the Vickers hardness number.
- Properties are provided for each alloy, including their applications and characteristics.
- Zirconium is suitable for high-chloride and seawater environments.
- Superaustenitic stainless steels offer improved resistance to pitting and crevice corrosion.
- Titanium stabilized grades are known for their resistance to weld decay attack and improved mechanical properties at elevated temperatures.
<table>
<thead>
<tr>
<th>Alloy Group</th>
<th>UNS No.</th>
<th>Chemical Analysis (%)</th>
<th>Density</th>
<th>Tensile Rm (min)</th>
<th>Yield Rp 0.2% (min)</th>
<th>Elong. % min</th>
<th>Hardness</th>
<th>Properties</th>
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<td></td>
<td>WNR</td>
<td>C Mn Ni Cr Fe Mo Ti Nb Al Other</td>
<td>g/cm³</td>
<td>lb/in³</td>
<td>ksi</td>
<td>mpa</td>
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<td>0.10-0.40</td>
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<td>0.08-0.15 max</td>
<td>1.0 max</td>
<td>bal</td>
<td>18.0-21.0</td>
<td>5.0 max</td>
<td>0.20-0.60</td>
<td>Co 0.5 max</td>
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<td>2.4065</td>
<td>0.15 max</td>
<td>0.4 max</td>
<td>bal</td>
<td>19.0-21.0</td>
<td>0.7 max</td>
<td>5.6-6.1</td>
<td>19.2-4</td>
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<td>Cu 0.25 max</td>
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<td>72.0 min</td>
<td>14.0-17.0</td>
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<td>10.0</td>
<td>Cu 0.50 max</td>
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<td>0.05 max</td>
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<td>0.4 max</td>
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<td>170-210</td>
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<td>2.80-3.30</td>
<td>0.65-1.15</td>
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<td>70.0 min</td>
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<td>0.15 max</td>
<td>1.5 max</td>
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<td>39.5 min</td>
<td>0.15-0.60</td>
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<td>0.05-0.10 max</td>
<td>1.5 max</td>
<td>30.0-35.0</td>
<td>19.0-23.0</td>
<td>39.5 min</td>
<td>0.15-0.60</td>
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<td>1.5 max</td>
<td>30.0-35.0</td>
<td>19.0-23.0</td>
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</table>
GLOBAL PRESENCE

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

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

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.

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

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