



PLYMOUTH TUBE COMPANY
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PLYMOUTH TUBE CO USA[®]



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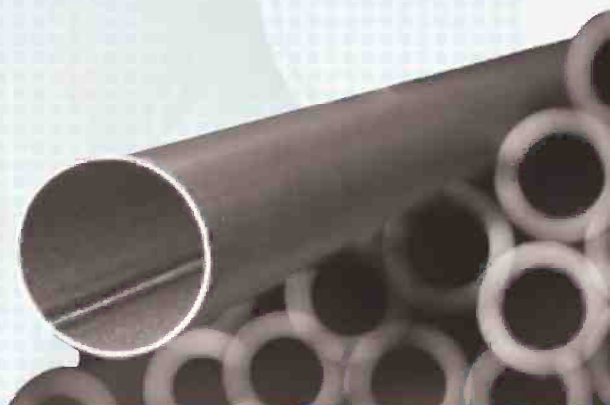
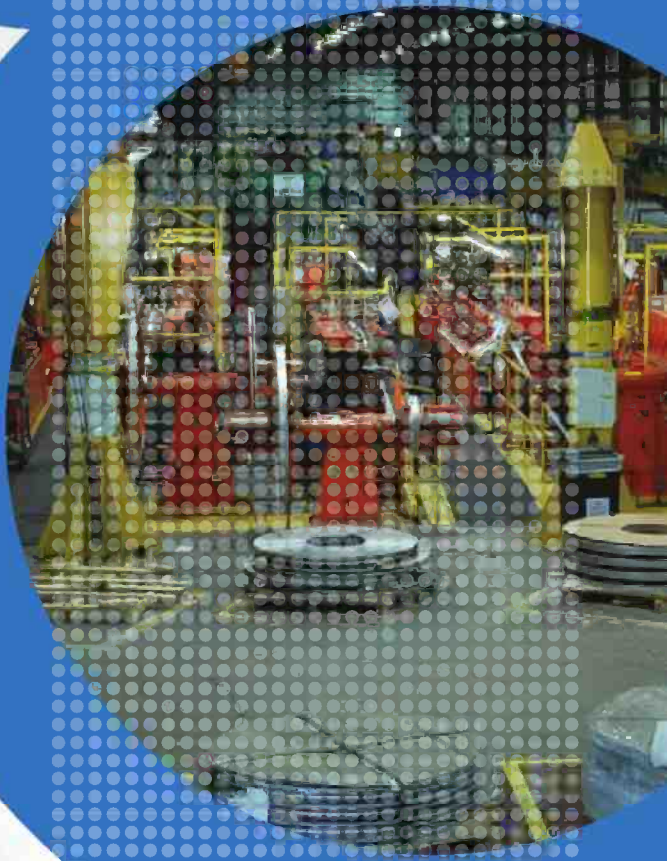
Plymouth Tube Company's facility in East Troy, WI is home to SEA-CURE®, a leader in super ferritic stainless steel tubing for the power generation and heat transfer markets since 1978. A privately held, family-owned business founded in 1924, Plymouth was the first tube company to produce stainless steel feedwater heater tubes. With over 20 years of commercial history, SEA-CURE® has an outstanding performance record and has supplied over 100 million feet (30 million meters) of SEA-CURE® tubing worldwide.

As an industry leader, Plymouth Tube is committed to its mission of **providing products and services that meet or exceed our customers' expectations.** Continuous improvement is fostered throughout Plymouth Tube's operation by Manufacturing Excellence. This philosophy empowers teams to create an organization that is effective, flexible, productive and powerful in producing products within the markets we serve. Our customers around the world rely on the superior quality, strength and precision of our products, including SEA-CURE®, to ensure safety, performance and reliability over decades of service.

Providing Customer Solutions

Many customers have struggled with Copper-Nickel, Titanium or super ferritic stainless steel tubing because of corrosion, pitting or other consequences of a corrosive environment. These can result in outages, failures and retubing, all of which cost money and time. At Plymouth Tube, our qualified Technical Managers provide our customers with complimentary analysis to determine the most reliable and cost efficient tubing solution for you. Not only will we analyze your water chemistry, but for condenser applications, we will also provide a comparison of the various alloys for back pressure, vibration potential, uplift and potential savings from material changes.

Customer Solutions



The Leading Corrosion-Resistant Alternative to Copper-Nickel and Titanium Tubing

SEA-CURE® is a high performance stainless steel that can be used as an alternative to Copper-Nickel and Titanium tubing, as well as other materials. It is one of the most cost-effective alloys in high chloride applications and where the potential for microbiological influenced corrosion (MIC) exists. Designed for seawater applications, SEA-CURE® has excellent corrosion resistance and good thermal conductivity that is used in feedwater heaters, heat exchangers, power plant condensers and other applications. It has been specifically designed for applications where chloride induced pitting, crevice and stress corrosion cracking may be encountered. SEA-CURE® also significantly increases the life of the tube leading to overall cost savings by eliminating repairs or replacements.

Chlorides, such as salt or brackish water, can decrease the life of a tube. Ammonia stress grooving & corrosion, corrosion cracking, erosion, pitting & under-deposit corrosion and sand corrosion are some types of Copper-Nickel or Titanium tube failures that can be eliminated with SEA-CURE®. If Copper-Nickel tubing is used, copper deposits can also slow down production as well as harmfully deposit into the environment.

At East Troy, the Mill processes ODs between .625" - 2" with a wall thickness of .016" - .083", depending on the OD to wall ratio. The Mill has capabilities for U-Bend and straight tubes up to 130'.

SEA-CURE® is designed to save you money and improve efficiency by preventing shut down for tube leaks, ensuring tube cleanliness, eliminating chemical treatment and reducing CO₂ costs. All original condenser installations are still using original tubes – that's over 90 million feet of SEA-CURE®!

SEA-CURE® is accepted by both Section III and Section VIII of the ASME Boiler Code. It can be ordered to ASTM A268 or ASME SA268 specifications as UNS S44660.





Vibration Resistance – Minimum Walls for Various Condenser Candidates for Similar Support Spacing

Alloy	Modulous	Wall
Admiralty	16 x 10 ⁶ psi	.049"
90/10 Cu/Ni	18.0	.043"
70/30 Cu/Ni	22.0	.034"
Type 439	29.0	.025"
Type 304 / Type 316	28.3	.026"
N08367	28.2	.027"
Ti Grade 2	14.9	.053"
SEA-CURE®	31.5	.023"

SEA-CURE® has a very high modulus of elasticity that makes it very resistant to vibration fatigue damage.

Cost Effective High Performance Solution

SEA-CURE® stainless steel outperforms other alloys in most applications and is the best economical choice as Copper-Nickel and Titanium prices increase or change dramatically.

Value Proposition of SEA-CURE® in Condenser Applications

Alloy Option Wall	90/10 Cu/Ni 18 BWG	Ti Gr 2 22 BWG	N08367 22 BWG	SEA-CURE® 22 BWG	SEA-CURE® 24 BWG
Estimated Tube Purchase Cost	\$2,430,000	\$2,300,000	\$2,850,000	\$2,000,000	\$1,800,000
Installation Charges	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000
Estimated Staking Cost	\$0	\$150,000	\$50,000	\$0	\$75,000
Anchoring Improvement	\$0	\$50,000	\$0	\$0	\$0
Tubesheet Coating for Galvanic	\$0	\$165,000	\$165,000	\$165,000	\$165,000
Fuel Cost Differences - 20 years	Base	(\$2,673,220)	(\$1,336,600)	(\$2,339,060)	(\$3,174,440)
Derate losses to fix tube leaks ^b	\$4,875,000	\$0	\$0	\$0	\$0
Chemical treatment \$100,000 /yr	\$2,000,000	\$0	\$0	\$0	\$0
Turbine/Boiler cleaning every 4 years	\$1,000,000	\$0	\$0	\$0	\$0
Estimated CO ₂ Cost Diff. -20 years	Base	(\$3,528,650)	(\$1,764,312)	(\$3,087,559)	(\$4,190,261)
20 year total cost basis	\$10,905,000	(\$2,936,870)	\$564,088	(\$2,661,619)	(\$4,724,701)
20 year savings vs. Cu/Ni	\$0	\$13,841,870	\$10,340,912	\$13,566,619	\$15,629,701

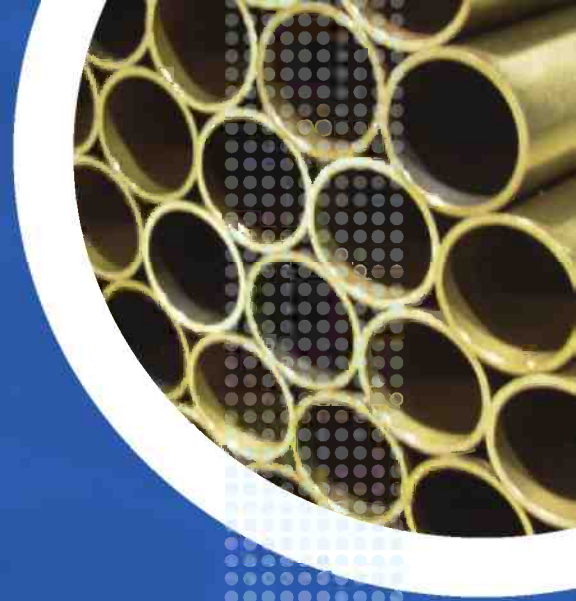
Blue numbers are negative and show savings Note^b 1/yr for 5 years, 2 / year after @ \$225,000 derate each

*Average Cost difference propositions are based on an averaged 2009 customer analysis.

Plymouth Tube expects the cost savings to continue, and improve, in the future.

SEA-CURE®/Titanium Comparison for Power Plant Condenser Applications

Attribute (Power Plant Condenser Applications)	SEA-CURE®	Titanium
Corrosion Resistance	SIMILAR	
Cracking Resistance	SIMILAR	
Thermal Properties	SIMILAR	
Mechanical Strength	HIGHER	<
Water Droplet Erosion Resistance	SUPERIOR	<
Vibration Tolerance	SUPERIOR	<
Temperature Tolerance	SIMILAR	
H2 Embrittlement	REVERSIBLE	PERMANENT
Price	LOWER	>
Delivery Time	FASTER	>



Examples of Common Re-Tubing Alternatives

Issues with Admiralty Brass Tubing

change to 304/316

- No Cu transport
- No erosion
- No ammonia grooving
- No Sulfide/H2S attack
- More vibration resistant
- Reduced thermal performance**
- May require tubesheet coating
- Risk of pitting or MIC

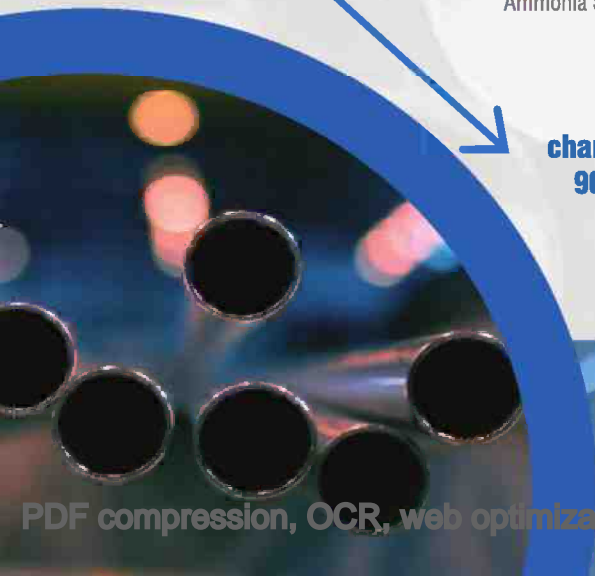
- Cu transport in cycle water
- Cu transport in cooling discharge
- Inlet end erosion
- Obstacle erosion
- Ammonia grooving
- Impingement damage to upper tubes
- Sulfide/H2S attack
- Ammonia SCC

change to SEA-CURE®

- No Cu transport
- No erosion or impingement damage
- No ammonia grooving
- No Sulfide/H2S attack
- More vibration resistant**
- Improved thermal performance**
- Usually requires tubesheet coating
- NO risk of pitting or MIC

change to 90/10

- Reduced thermal performance**
- Improved vibration resistance
- Cu transport in cycle water
- Cu transport in cooling discharge
- Reduced inlet end erosion
- Obstacle erosion
- Reduced Ammonia grooving
- Impingement damage to upper tubes
- Sulfide/H2S attack





State of the Art Process

SEA-CURE® has many attractive physical properties:

- High Mechanical Strength
- High Stiffness – high elastic modulus and less vibration prevent fatigue failures.
- High Hardness – provides further resistance to sand erosion.
- Low Thermal Expansion – similar to those of carbon steel and lower than those of austenitic stainless steel or copper alloys.
- Good Thermal Conductivity – similar to titanium and higher than the austenitic stainless steels or high nickel alloys.
- Excellent Corrosion Resistance – alleviates problems caused by high pressure and aggressive cooling water.

The Choice of Utility Engineers and Fabricators

Engineers and fabricators choose SEA-CURE® as their choice for electric power plant condensers & BOP exchangers, various heat exchangers in chemical, petro-chemical & refining applications, desalination heat exchangers and flue gas handling systems (such as secondary heat exchangers in high efficiency furnaces).

The American Gas Association has approved SEA-CURE® for flue gas condensate applications. SEA-CURE® is also successful in petro-chemical, desalination, food processing, petroleum, ship heat exchanger and home high efficiency furnace applications.

The addition of nickel in SEA-CURE® produces a tough crack-resistant base metal and weld that can be reduced to over a 15% wall reduction.

SEA-CURE® is not affected by high water velocities caused by tube blockage or mechanical design, nor by steam impingement. Compared to Type 316 it has only 25% of the weight loss in an eroding environment.

SEA-CURE® stainless steel has better resistance to general corrosion over a broader range of conditions than the austenitic stainless steels. SEA-CURE® was designed to withstand all types of corrosive elements that make it similar to Titanium.



Guidelines

Plymouth Tube recommends certain processes to maximize the benefit of SEA-CURE® tubing. Due to the specialized heat treatment SEA-CURE® receives to achieve superior corrosion rates, we do not recommend the reannealing of SEA-CURE® unless specialized equipment is available. SEA-CURE® is also less suitable for stretch forming operations than austenitic grades. Also, to attain good weld corrosion resistance and toughness, careful welding conditions are used with SEA-CURE®, such as the gas tungsten arc welding (GTA) process. Speak with a Plymouth Tube Technical Manager to discuss how SEA-CURE® best lives up to its potential.

Quality Assurance

SEA-CURE® tubing is cut to length, end finished, cleaned and air dried. Felt plugs are blown through the tube's inside diameter to confirm that it is clean and dry. Our products are carefully packaged and secured to prevent damage during shipping. Custom packaging is available upon request.

All Plymouth Tube products undergo rigorous and comprehensive on site laboratory testing including eddy current, ultrasonic, air under water (250 kPa min for SEA-CURE®), hydrostatic, liquid penetrant, flatten, flare, flange, reverse bend, reverse flatten, tensile, hardness, various corrosion, residual chloride and straight & U-Bend (if applicable) residual stress testing.

Your Tubing Specialist

At Plymouth Tube, you are more than just a customer, you are a partner for which we work together to engage ideas for efficient and productive solutions for your power generation and heat transfer tubing needs. We work with you to determine the best tubing solution for your specific needs. Innovation and continuous improvement of our manufacturing process are some of the main drivers that differentiate us from other manufacturers. We implement the theory of lean manufacturing and routinely work to improve our process with Kaizen inspired events. We realize that by getting to know our customers and inquiring about which issues they encounter assists us in producing tubing that exceeds expectations.





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