



PLYMOUTH TUBE CO USA[®]



Plymouth Tube Company

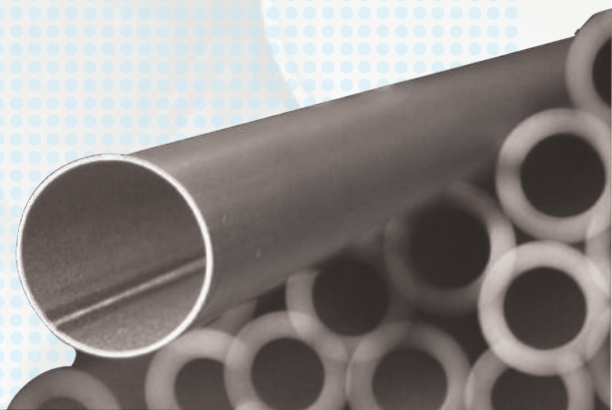
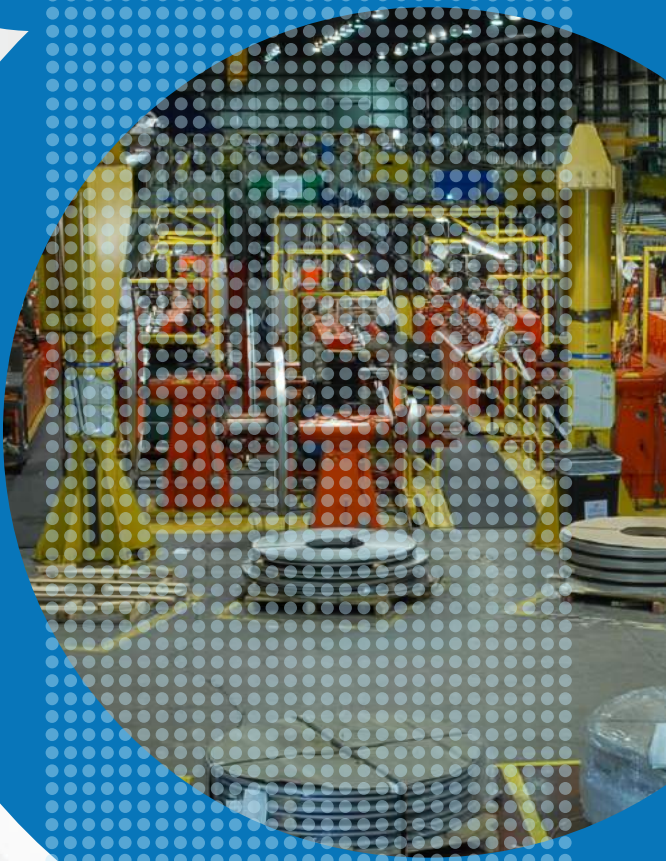
Plymouth Tube Company's facility in West Monroe, LA is home to SEA-CURE®, a leader in super-ferritic stainless steel tubing for the power generation and heat transfer markets since 1979. A privately held, family-owned business founded in 1924, Plymouth was the first tube company to produce stainless steel feedwater heater tubes. With over 40 years of commercial history, SEA-CURE has an outstanding performance record and has supplied over 145 million feet (45 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 alloys, 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 Alloys 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 steam surface condensers, specialty heat exchangers in numerous industries, and other applications needing the combination of high corrosion resistance and higher mechanical properties. 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.

High 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 lower efficiency and restrict capacity as well as harmfully deposit into the environment.

At West Monroe, the Mill processes ODs between .375"-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 carbon emissions. All original condenser installations are still using the original tubes or until the plant was shut down – that's over 129 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 or 26-3-3.

A photograph of a large industrial building with a dark metal exterior and a white roll-up door. The sign "PLYMOUTH TUBE CO." is visible above the door.

PLYMOUTH TUBE CO.





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

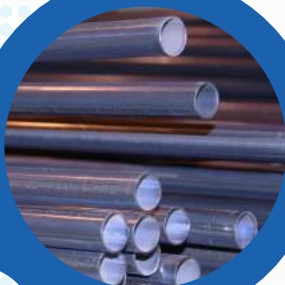
Alloy	Modulous	Wall
Admiralty	16 x 10 ⁶ psi	.049"
90/10 Cu/Ni	18.0	.043"
70/30 Cu/Ni	22.0	.034"
Type 439	29.0	.025"
Type 304 / Type 316	28.3	.026"
N08367	28.2	.027"
Ti Grade 2	14.9	.053"
SEA-CURE	31.5	.023"

* As determined by the Peake method

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

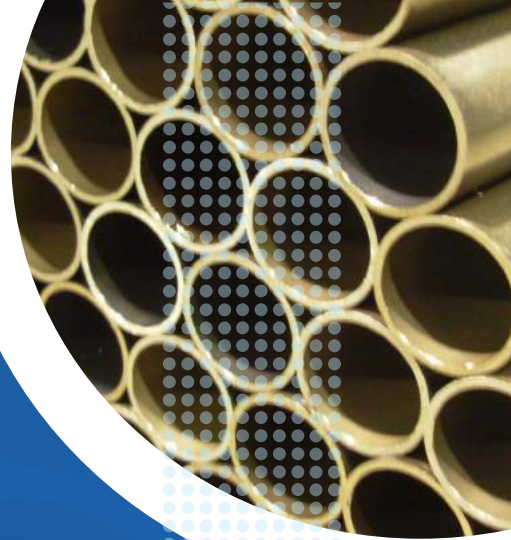
Cost Effective High Performance Solution

SEA-CURE can financially benefit the utility by the combination of improvements in thermal performance from a combination of higher thermal stainless steel conductivity and the ability to use thinner walls, and better reliability due to its high strength, erosion resistant, high corrosion resistance, and resistance to upset conditions.



SEA-CURE/Titanium Comparison for Power Plant Condenser Applications

Attribute (Power Plant Condenser Applications)	SEA-CURE	Titanium
Corrosion Resistance	SIMILAR	
Scratch Resistance	SUPERIOR	
Thermal Properties	SIMILAR	
Mechanical Strength	HIGHER	<
Water Droplet Erosion Resistance	SUPERIOR	<
Vibration Tolerance	SUPERIOR	<
Temperature Tolerance	SIMILAR	
H2 Embrittlement	REVERSIBLE	PERMANENT
Notch Toughness	SUPERIOR	<
Foreign Material Damage	SUPERIOR	<
Collapsing Resistance	SUPERIOR	<
Fatigue Cracking Resistance	SUPERIOR	<



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

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 boasts superior physical characteristics:

- 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, petrochemical & 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. It was chosen as the only material for the Department of Energy's Strategic Petroleum Reserve crude coolers.

The addition of nickel in SEA-CURE produces a tough crack-resistant base and weld metal and is the only super-ferritic stainless available in wall thicknesses up to .083" (2.1 mm). SEA-CURE is not affected by high water velocities caused by tube blockage or mechanical design, nor by steam impingement. Testing done at Laque labs at Wrightsville Beach, NC have shown resistance to 100 feet per second (30 meters per second).

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.



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.



Quality Assurance

SEA-CURE tubing is tested using air-under-water testing and eddy current testing. The outside diameter of 100% of each tube length is measured by a two plane laser micrometer. A rigorous visual inspection is performed just prior to boxing. Tubing can be cut-to-length or U-bent depending on the customer requirements. Custom packaging is available upon request. Plymouth Tube is ISO-9000 qualified and tubing can be certified in accordance with EN 10204/ ISO 10474 3.1. An optional 3.2 certificate is available upon request.

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.





www.seacuresolutions.com



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