

Solutions for navy heat exchanger applications

Heat exchangers used in Navy applications are faced with several specific operational issues along with dedicated controls from world class classification societies such as DNVGL, Bureau Veritas, RINA and others. Despite such tight requirements, reliable solutions do exist.

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⌘ Steel coated channel in seawater service

Use of aluminium bronze to face sea water corrosion issues

Aluminium bronze is a family of copper-based alloys including aluminium, nickel, iron and manganese in various proportions to meet strength properties, corrosion resistance, machinability or reparability requirements. Among the properties we find:

- High mechanical strength
- Lower density than steel
- Non sparking
- Low magnetic permeability (of $<1.03\mu$ in selected grades)
- High seawater corrosion resistance
- Resistance to biofouling

A main advantage of aluminium bronze is its protective oxide surface film which has the ability to self-repair, outperforming all steel-coated applications in the long run as well as most stainless steel solutions.

Detailed information on the various international standards and properties of NAB alloys can be found in the "Guide to Nickel Aluminium Bronze for Engineers" published by the Copper Development Association.

About the company

Inoxyda is a sand casting foundry entirely dedicated to aluminium bronze solutions for all components in contact with seawater (pumps, valves, heat exchangers and propulsion systems). The company's large size manufacturing capacities and international certifications enable it to export 60% of its production.



⌘ ASTM C95800 Casted Aluminium Bronze Channel



⌘ ASTM C63000 Forged Aluminium Bronze Tubeshheet



⌘ INOXYDA 3P Covers for Chemical Industry

Manufacturing & reparability

Nickel Aluminium Bronze (NAB) alloys are available in various states enabling construction:

- Welded assembly; the most commonly used until recently, and based on standard plates and bars.
- Casted design, which reduces the risk of corrosion in weld seams.
- Forged design for some very specific Navy applications requiring very high strength, for example, in submarine applications.

Quality controls & Navy classification societies

Regardless of which aluminium bronze grade is used in association with the various manufacturing solutions, all components will need to follow strict quality controls, on one hand, linked to company certifications such as:

- ISO 9001
- PED (Pressure Equipment Directive 2014/68/EU)
- Classification Societies (DNVGL, Bureau Veritas, RINA...)

And on the other hand, process related controls which can include:

- Inspection and test plans
- Dye penetrant test
- Pressure test
- Ultrasonic thickness measurement
- X-rays (in particular for high pressure applications)

And last but not least, a third-party inspection is required.

Summary

Sea water or brackish environments are a real challenge for all heat exchangers, often leading to corrosion issues and unexpected downtime due to leakage and/or fouling, further leading to unexpected maintenance costs. Due to its properties, nickel aluminium bronze is an option to be considered in comparison to other coated or stainless steel solutions despite its higher alloy cost. Remember that you can expect to regain 60% of the raw material cost when you scrap it, thus further improving your TCO. Meeting both ASME and Ship Classification requirements is also possible, especially at Inoxyda who has extensive knowledge of all aluminium bronze grades used in the shipbuilding industry and holds the necessary certifications. For more technical information or a detailed feasibility study, contact Inoxyda (www.inoxyda-foundries.com)