



Cooling Cruise Ships Starts with Clad

Johnson Controls is a global diversified technology and multi industrial leader serving a wide range of customers in more than 150 countries. Johnson Controls' water-cooled marine chillers are used on cruise ships all over the world.



EXECUTIVE SUMMARY

Chillers keep cruise ships air conditioned for the comfort of the passengers and crew by transferring the heat out of the ship and into the ocean. Cool fresh water circulates to air handling units and the heat that it absorbs is transferred by refrigeration compressors to the condensers, shell and tube heat exchangers. This heat is then removed from the ship by circulating seawater through the condenser. Explosion clad material is used to protect the condensers in cooling systems that are prone to corrosion by seawater.

CHALLENGES

Shell and tube condensers are normally manufactured from steel and copper alloy. But seawater is quite corrosive towards these materials. Corrosion not only impacts the efficiency of the equipment, but increases maintenance costs and decreases the life of the system. Reliability, tight deadlines, energy consumption and environmental impact are important considerations for marine HVAC systems designers.



We see that this is the best material to protect our heat exchangers when the cooling media are corrosive or highly corrosive – meaning brackish water, river water or sea water.”

– Alain Jouannic
Marine Business Engineer
Johnson Controls

“The longevity is much better compared to technical solutions with epoxy coating, tarset coating or ceramic coating.”

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SOLUTIONS

To improve the life and reliability of heat exchangers in seawater applications the copper tubes are replaced with titanium or copper-nickel tubes. Likewise, the steel heat exchanger tube sheets must be protected. Explosion clad titanium or copper-nickel protects the tube sheet from corrosion while retaining the mechanical properties of the carbon steel.

Explosion cladding is used to bond two dissimilar metals while retaining – and sometimes even enhancing – the mechanical, electrical and corrosion properties of both. The cladding is selected not only to have good corrosion resistance but also to be anodic to the core alloy.

Alain Jouannic, Marine Business Engineer at Johnson Controls, values copper nickel explosion clad steel tube sheets. It is the best compromise in terms of performance, reliability and maintenance.

Leveraging the mechanical properties of clad tube sheets allows robust solutions for Johnson Controls. Starting with high quality materials that offer corrosion resistance solutions, end users are provided with large pieces of equipment with longer life cycles.

RESULTS

The performance and the reliability of the marine chillers for HVAC delivered by Johnson Controls' Nantes factory in France have enabled them to become one of the top suppliers and preferred partner for their end customers in the shipbuilding industry. NobelClad's explosion clad tube sheets meets Johnson Controls' stringent requirements for quality and reliability.

“Our experience shows that the composite steel with copper nickel explosion clad is the best technical and economical compromise.” says Alain Jouannic. “The longevity is much better compared to technical solutions with epoxy coating, tarset coating or ceramic coating.”

Johnson Controls has been working with NobelClad since 2000.