









BOX COOLERS (MARINE HULL):

- **INTRODUCTION TO BOX COOLERS**
- **DAVID BIENVENU ON SERVICE TECHNIQUES**

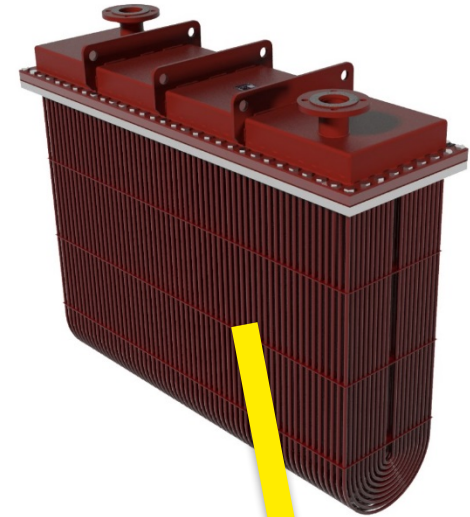
Box Coolers

The box cooler is an efficient water cooling system widely used on riverboats and sea-going vessels for over 60 years.



Box Cooler Overview

- U shaped tube bundle.
- Installed in a sea chest.
- This sea chest is sometimes called box.
Hence the name box cooler.
- Cooling water inside the tube bundle
is cooled down by seawater inside the
sea chest.

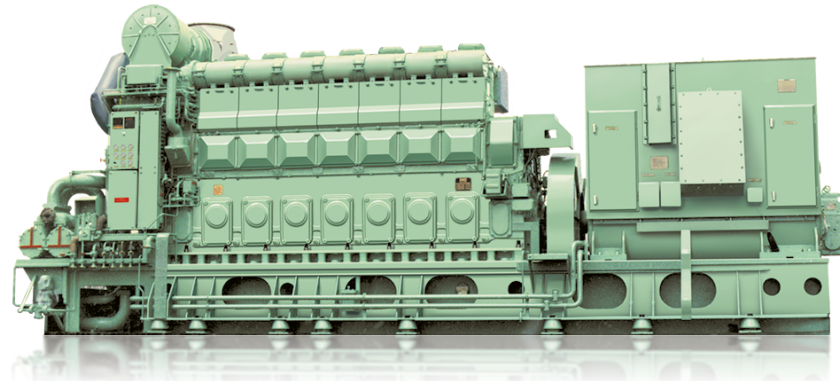


Box Cooler Animation



Box Cooler Applications

- **Main engines (main propulsion)**
- **Auxiliary engines**
- **Diesel generators**
- **Deck equipment**
- **Bow thrusters**
- **Air cooling systems**



Box Cooler Concept

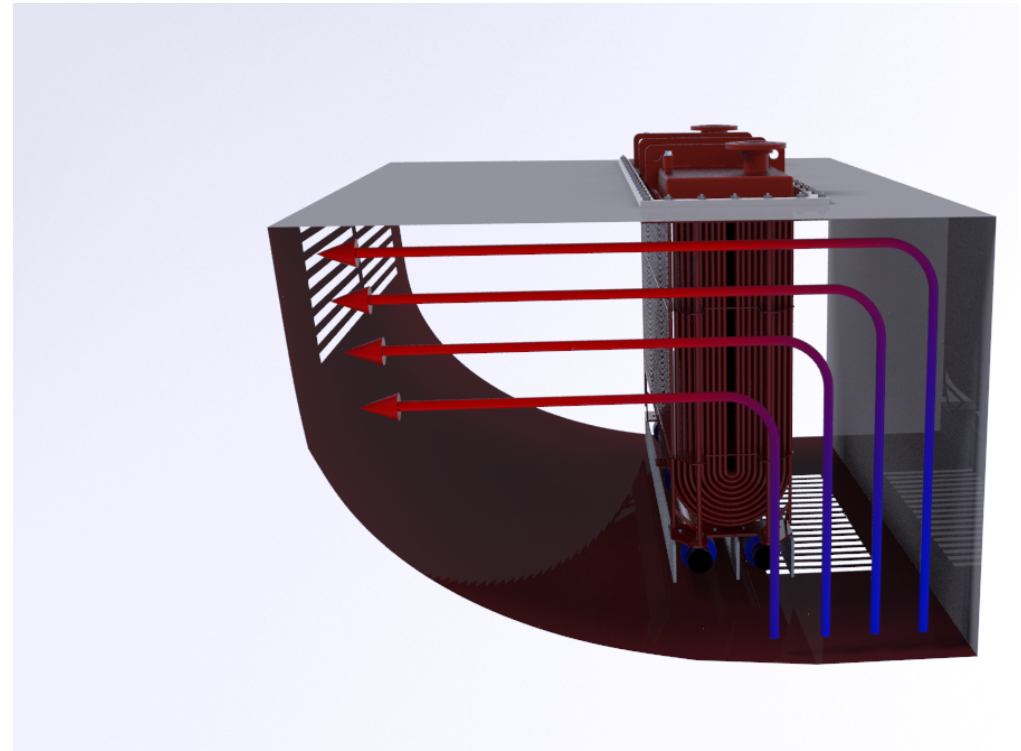
Cooling water is forced through an U-tube bundle which is placed in a sea chest with inlet and outlet grids.

Outboard water is circulating around the tubes.

Cooling effect is obtained by a forced seawater circulation due to speed of the vessel.

**Natural circulation applies for non-sailing condition.
Seawater is warmed up and rises.**

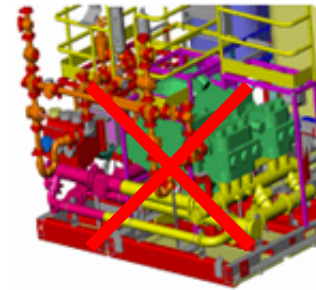
Thermosyphon principle



Box Cooler Advantages

Elimination of outboard water circuit on board

- No Pump
- No Piping
- No Valves
- No Filters

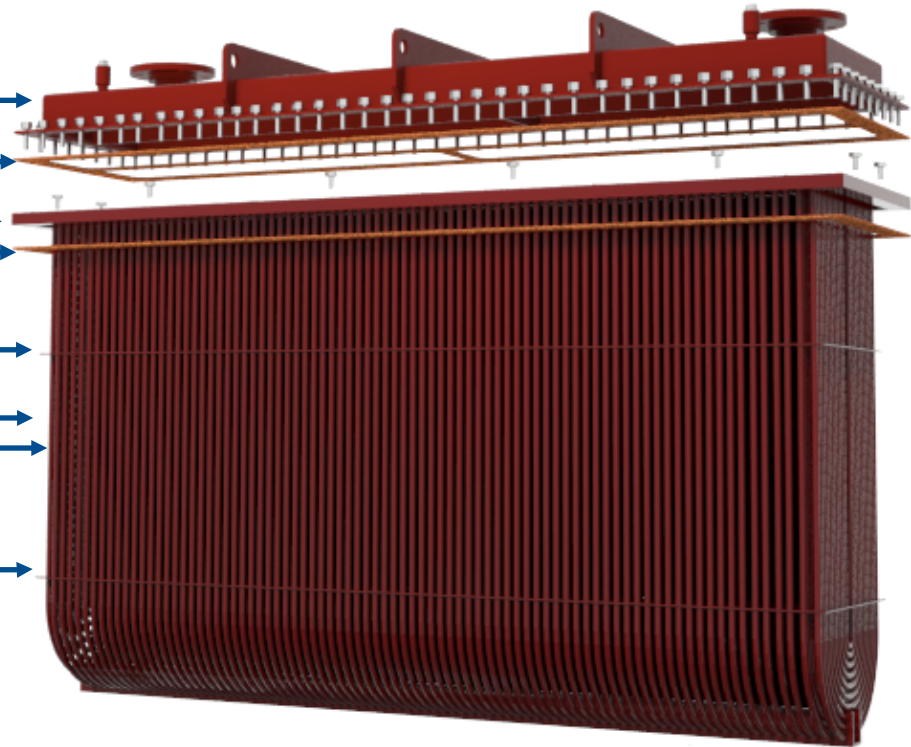


- Saves room on ship
- Low operational cost

Box coolers are much less susceptible to corrosion and fouling, compared with any other solution

Box Cooler Components

- Tubes
- Tube sheet
- Support sheets
- Coating
- Waterbox
- Gaskets
- Mounting ring



Box Cooler

Protection Against Corrosion

- **All materials of box cooler in contact with seawater are seawater resistant material**
- **Hot-cured phenolic resin based coating very commonly used**



Biofouling Worldwide



■ *Most severe*

■ *Less severe*

■ *Least severe*

Box Cooler Biofouling



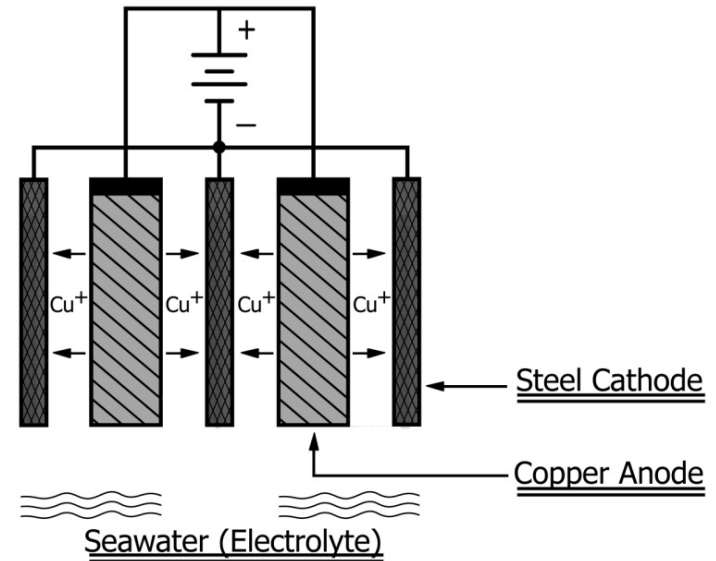
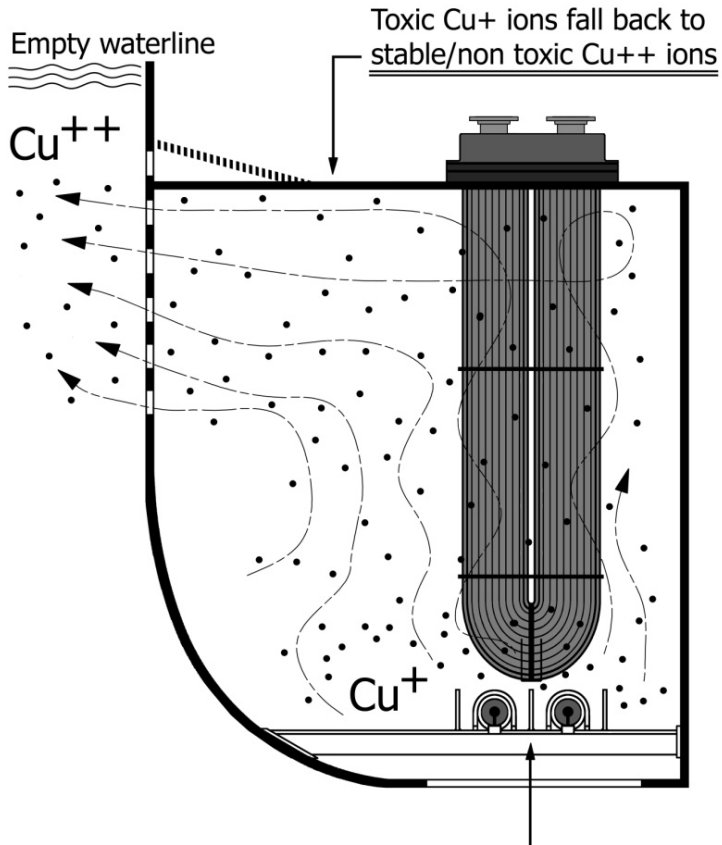
Two ways to address BioFouling:

ICAF: Impressed Current Anti Fouling

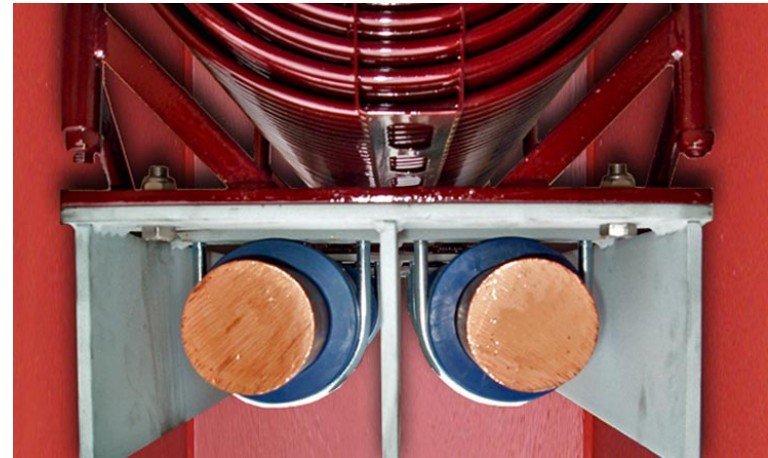
USAF: Ultra Sonic Anti Fouling

ICAF (Impressed Current Anti Fouling)

Principle of ICAF system



ICAF (Impressed Current Anti Fouling)



USAF (Ultra Sonic Anti Fouling)

Ultrasonic antifouling is a technology that helps reduce fouling on underwater structures, through using small-scale acoustic cavitation to destroy, denature and discourage attachment of algae and other single-celled organisms.



USAF (Ultra Sonic Anti Fouling) How does it work?

A transducer distributes high-frequency ultrasound that:

Removes the slimy layer (biofilm), preventing the attachment of micro-organism (rust, scale, barnacles, etc...) and preventing the development of bacteria

Destroys algae

Destroys larvae

Destroys one-cellular organisms => harmless for water plants.

