

Kelvion



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Product Line: Box Cooler

EFFICIENT AND SPACE SAVING COOLING





EXPERTS IN HEAT EXCHANGE – SINCE 1920

Welcome to Kelvion! Where Heat Exchange is our Business. We are one of the leading global manufacturers of heat exchangers and have been providing solutions for almost every industrial application imaginable since the 1920s, specializing in customized solutions suitable for extreme environmental conditions - as of 2015 under the name of Kelvion.

With one of the most extensive selections of heat exchangers in the world, we are a well-known partner in many industries, including transportation, energy, oil and gas, the heavy industry, chemical and marine as well as sugar, food and beverage and the HVAC and refrigeration technology sector. Our products include Compact Fin Heat Exchangers, Plate Heat Exchangers, Single Tube Heat Exchangers, Transformer Cooling Systems, Cooling Towers and Shell & Tube Heat Exchangers.

Our many years of experience and in-depth expertise have made us specialists in this field. Our heat exchangers are designed specifically to meet the needs of the respective machine or equipment system, ensuring outstanding energy efficiency and reliability in any market segment. This gives our customers a cutting-edge over their competitors while also reducing operating costs over the long term.

As your heat exchange partner, we understand that outstanding and reliable after-sales services are critical for you, our customer, and we work alongside with you in close partnership supporting you throughout the full life cycle of your plant and equipment to ensure lasting business success.

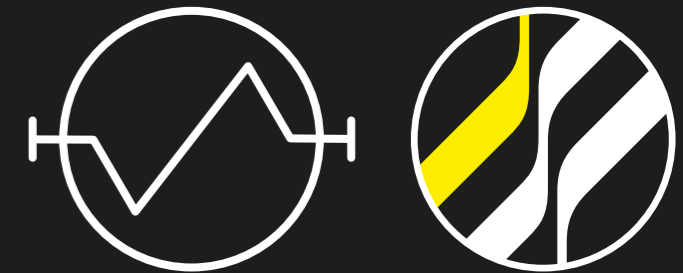
Kelvion – Experts in Heat Exchange.

KELVION – A TRIBUTE TO LORD KELVIN (1824 - 1907)

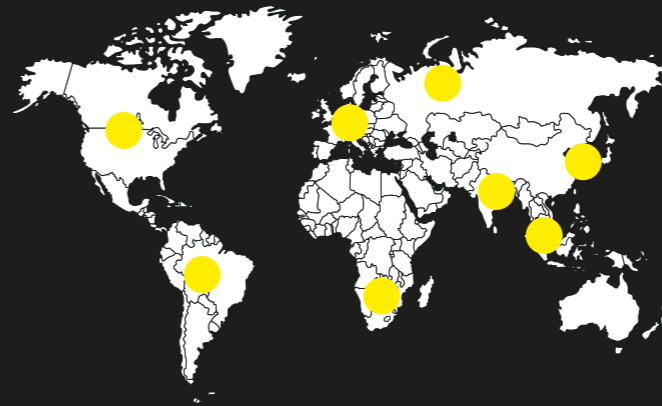


Lord Kelvin formulated the laws of thermodynamics and absolute units of temperature are stated in kelvin, in his honor.

OUR LOGO – INSPIRED FROM THE SCHEMATIC FOR HEAT EXCHANGER



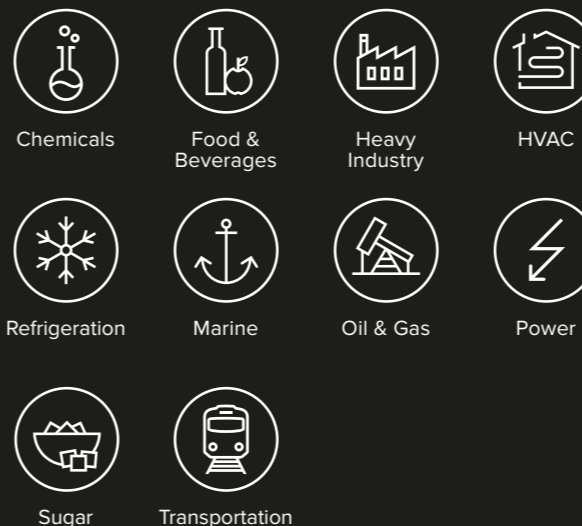
67 BRANCHES AND SALES PARTNERS WORLDWIDE



4,500 EMPLOYEES WORLDWIDE



YOUR MARKETS ARE OUR MARKETS



KELVION HAS A LONG HISTORY



POWERFUL AND RELIABLE MARINE COOLING



Marine engines and other on-board systems need to be kept cool during operation to keep ships running efficiently. At Kelvion we have decades of experience in providing robust heat exchangers capable of withstanding the rigors of operating in the high seas.

Our extensive range includes the box cooler. Optimally designed for maritime applications, it offers efficient, powerful cooling, reliably and over a long service life.

The box cooler comprises a U-tube bundle that is fitted in the sea chest on the side of a vessel, saving space in the engine room. The sea chest is equipped with inlet and outlet grids. Cooling sea water enters through the inlet grid and flows along the U-tube bundle to the outlet grid, thus cooling the

water inside the tubes. The cooling effect is achieved by the forced circulation of sea water when the vessel is moving or by natural convection when it is stationary.

Thus box coolers have the big advantage of not requiring a complete outboard water circuit, including sea water pump, sea water filter, valves, pipelines and further parts.

As sea water is used as the cooling medium, our box coolers are manufactured using anti-corrosive materials.

This heat exchanger type is virtually maintenance free and can be customized for all operating conditions and temperatures. For sailing areas where biological fouling could be an issue, we can provide special anti-fouling systems.



PERFECT SOLUTION FOR SMALL AND MEDIUM-SIZED VESSELS

Kelvion Box Coolers are ideal for small and medium sized vessels, including for example: tugboats, barges, fishing boats, carriers, dredgers, supply vessels, ferries, ice breakers, cargo freighters, tankers and reefers.

Box coolers can be used for a wide variety of temperature-reducing duties, from cooling the main engines, auxiliary engines and bow thrusters to air conditioning and hydraulic systems.

Our box coolers are available in different sizes, shapes and configurations, depending on the cooling capacity required.

One typical application for a box cooler is to dissipate the waste heat from diesel engines and other sources of heat, such as charge air coolers, lube oil and gear oil coolers.

Innovative technology

Kelvion's high-performing box coolers are the result of years of innovation and engineering excellence. That is why we are committed to improving and optimizing the mechanical design and thermal performance of our products, in order to meet the requirements of our customers, the market and classification societies around the world.

BOX COOLERS ARE APPLICABLE IN VARIOUS VESSEL TYPES LIKE:



Tugboats



Barges



Fishing boats



Carrier vessels



Construction vessels



Offshore vessels

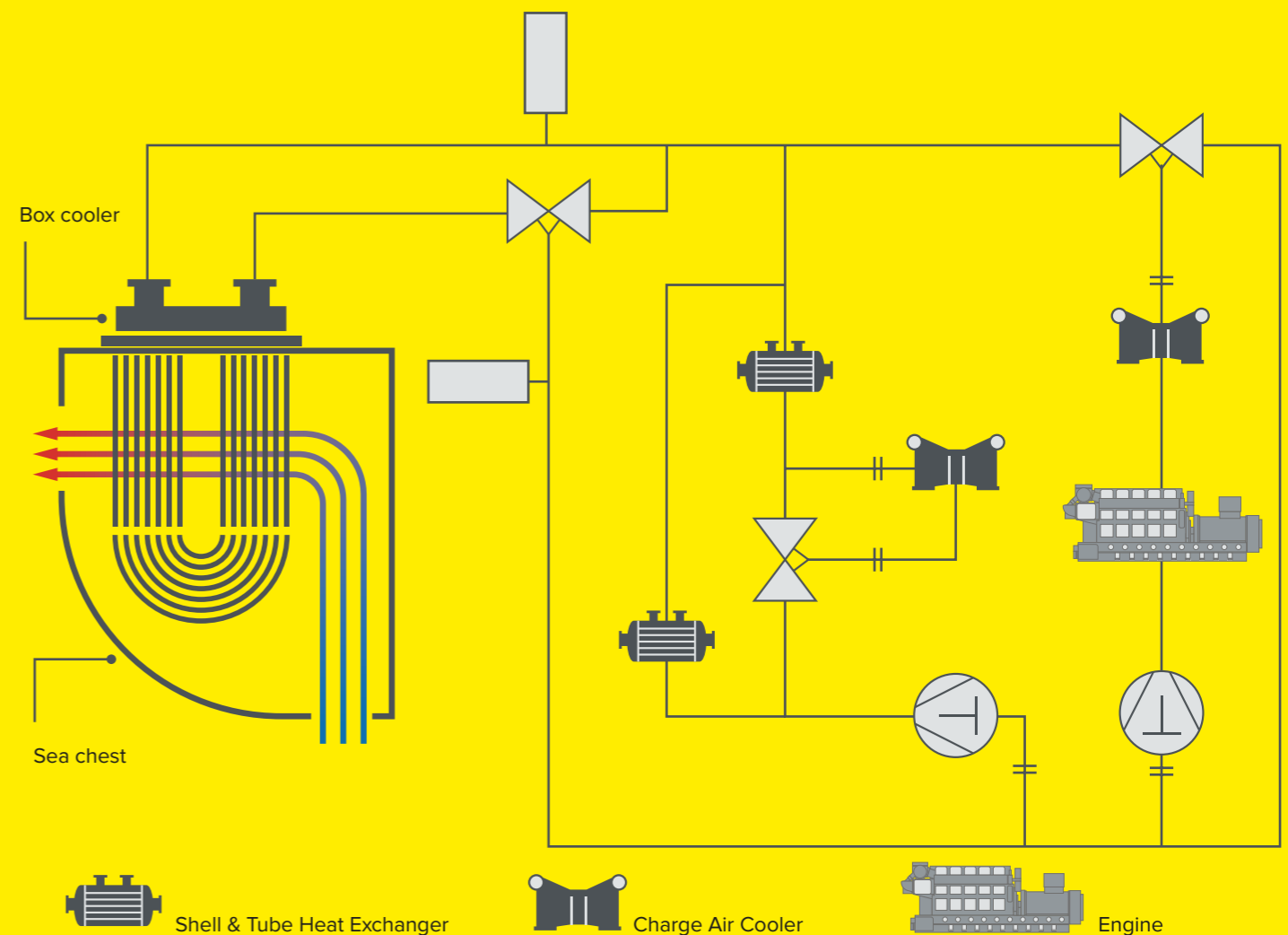
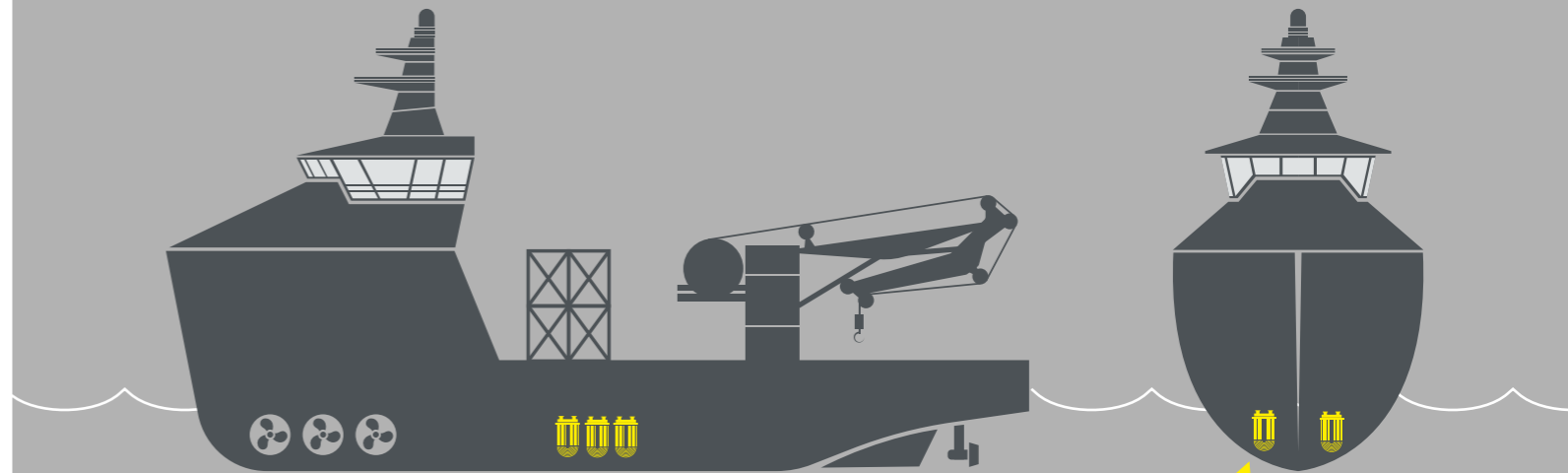


Small & medium cargo vessels



Small & medium tankers

BOX COOLER FUNCTION & PRINCIPLE



Box cooler advantages

OPTIMUM COOLING AT SEA IN ALL CONDITIONS

Our low-maintenance and space-saving box coolers, with their long service lives and high availability, have won customers around the globe.

Compared to other marine cooling systems, the box cooler boasts unique advantages. It has a much lower susceptibility to corrosion from sea water and is less sensitive to fouling caused by barnacles, molluscs, algae, sea weed and bacteria.

With the box cooler there is no need for a complete outboard water circuit, including sea water inlet pump, sea water filter, valves, pipelines and other parts which would all have to be manufactured with sea water-resistant materials. This, together with the cooler's low maintenance properties, means lower operational costs than with other solutions.

Cutting the ice

Compared to other cooling systems box coolers are also very suitable for sailing under icy conditions. In general there is no danger for damage due to freezing water. The so feared brash ice is not a problem for box cooling. Shortly after starting the engines the ice will melt in the sea chest. Should there be any danger of the water freezing in the tubes, of course attention needs to be paid and using of anti-freeze is recommended.

Beside icy conditions box cooler are the best choice for shallow, sandy and silt-polluted waters due to the smoother flow on the outside of the box cooler compared to a pumped and forced flow.

KEY BENEFITS AT A GLANCE

- ▶ Eliminates on-board sea water system
- ▶ Less susceptible to corrosion and fouling
- ▶ Can operate in icy conditions, silt or polluted waters
- ▶ Low maintenance
- ▶ Space-saving in the machine room
- ▶ Low operational costs



Product types and variations

VERSATILE TECHNOLOGY TO SUIT YOUR NEEDS



Rectangular box cooler



Round box cooler



Stepped box cooler

The cooling power of the Kelvion Box Cooler is matched by its versatility. Its simple design can be configured in different versions and shapes to suit the available space and cooling requirements.

A box cooler comprises a U-shaped tube bundle, mounted with a tube sheet and a waterbox to guide the water flow. The bundle is bolted with a gasket to the mounting ring, which fixes the cooler to the hull. The construction method allows the waterbox to be removed while the bundle is still fixed to the hull, thus preventing sea water entering the vessel while being in the water.

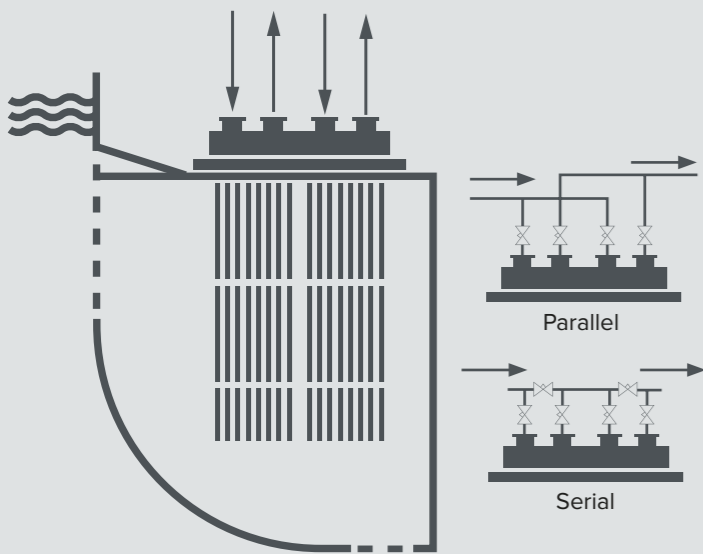
To cover a wide range of cooling duties and constructive boundary conditions, Kelvion Box Coolers are available in many variations in round and rectangular design.

The round shape is mainly for purposes with smaller cooling capacities. This type covers cooling surfaces between 2 - 21 m². The maximum possible diameter of the bundles is about 400 mm.

The rectangular form is used for larger cooling capacities and covers cooling surfaces between 9 to 120 m². The width of the box cooler bundle goes up to about 400 mm, while the maximum length is about 2000 mm.

As the space available for the box cooler is often limited in the sea chest, the bundle must follow the contours of the hull as closely as possible to generate the largest possible cooling surface. This is achieved by executing the box cooler with a stepped bundle in several sections, each with a different depth.

Independent of the design Kelvion Box Coolers are available with bundle depths between 400 and 1800 mm. Even bigger types are available on request.



DOUBLE CIRCUIT & REDUNDANCY ARRANGEMENTS

When cooling two separate water circuits or in case of required redundancy, it is possible to supply the box cooler with two compartments, so two circuits in one box cooler and thus limiting the space requirement.

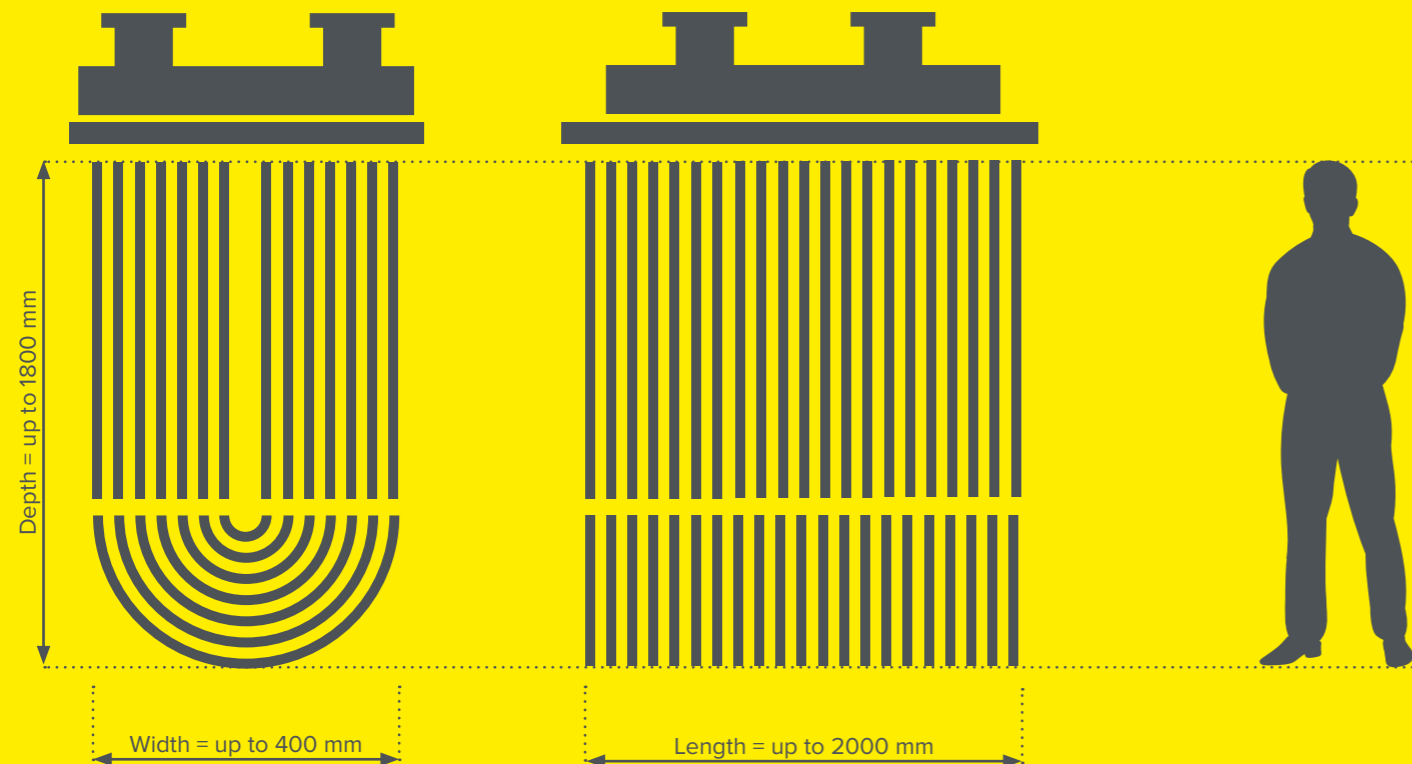
For the redundancy version the two compartments can be operated parallel or in series being equipped with additional pipe work and valves. The double circuit and the redundancy design can be applied to both round and rectangular box coolers.

DESIGN DATA

The basic design conditions of the box cooler are:

- ▶ Design pressure: 3.33 bar g
- ▶ Test pressure: 5.00 bar g
- ▶ Design temperature: 94.9 °C

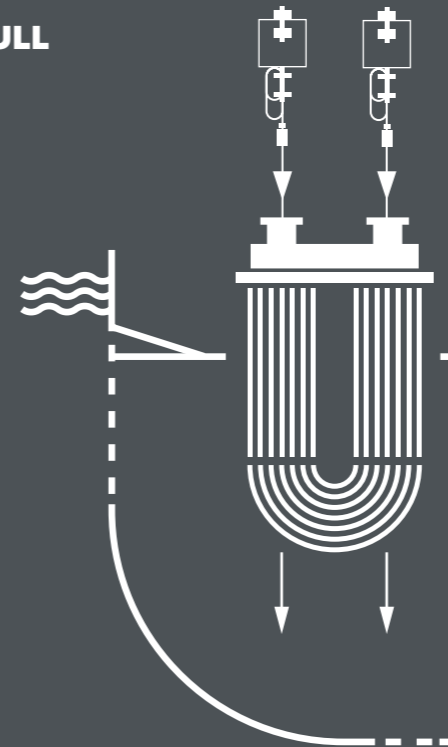
These figures are sometimes adapted to comply with the specific requirements of some classification societies and customers. All box coolers are hydraulically pressure tested in our factory and supplied with a pressure test certificate and/ or a classification society certificate.



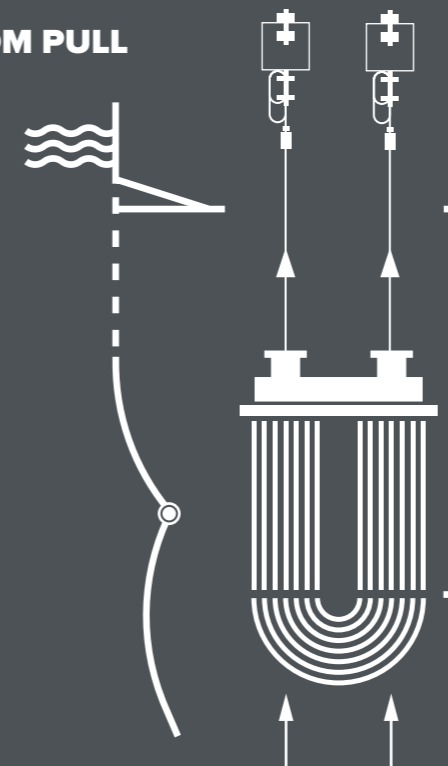
TYPE OF INSTALLATION

The box cooler can be installed in two ways, known as top pull and bottom pull. With top pull, the cooler is mounted downwards through the top deck into the sea chest. Bottom pull applies where there is insufficient space in the machine room above the cooler. In this case the box cooler is mounted through hatches in the sea chest from the underside of the hull. Depending on the version, the mounting rings of the box coolers are delivered accordingly.

TOP PULL



BOTTOM PULL



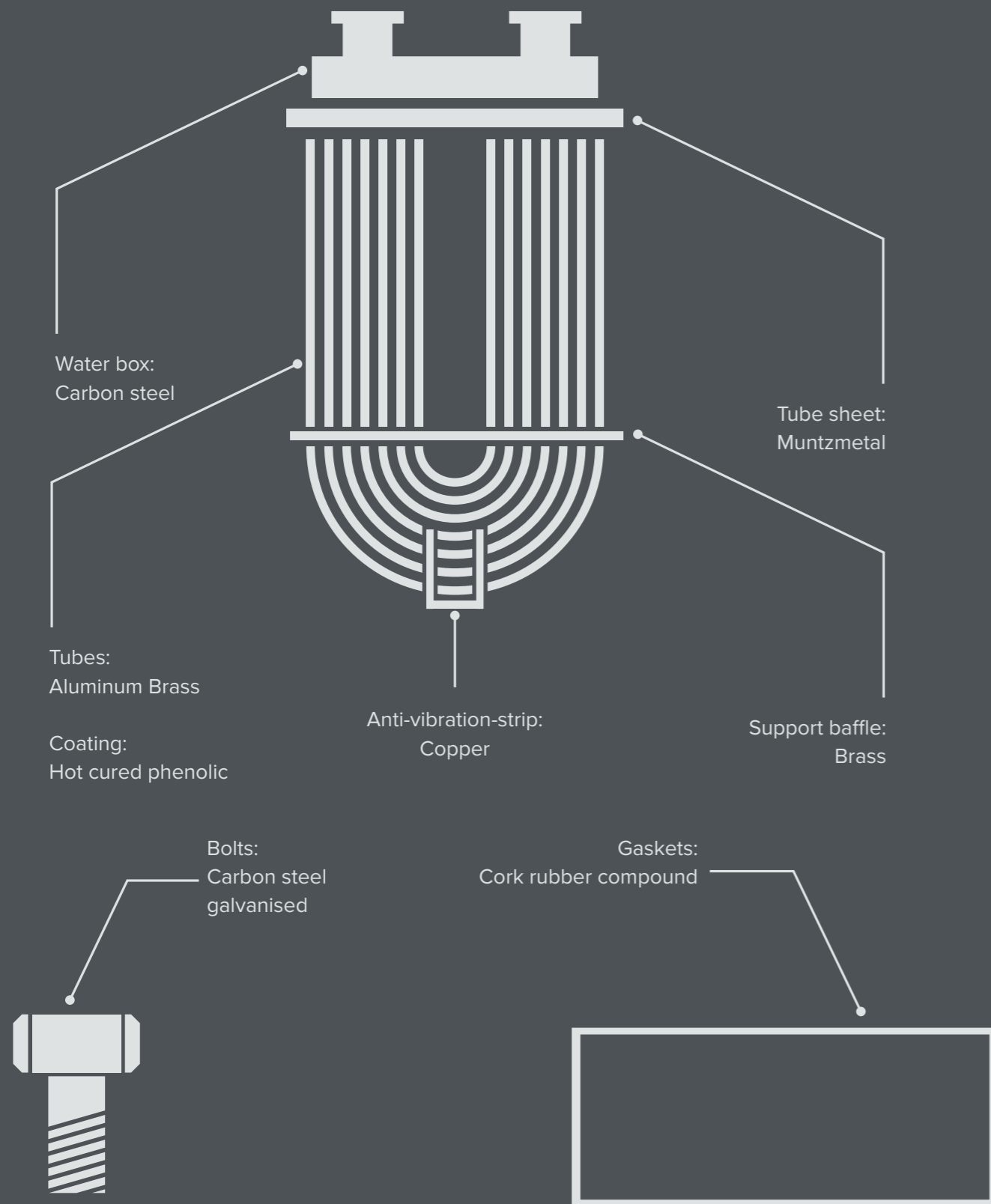
CLASSIFICATIONS

Abbr.	Classification society	Country
ABS	American Bureau of Shipping	USA
BV	Bureau Veritas	France
CCS	China Classification Society	China
CR	China Corporation Register	Taiwan
DNV	Det Norske Veritas	Norway
GL	Germanischer Lloyd	Germany
IRS	Indian Register of Shipping	India
KR	Korean Register of Shipping	Korea
LRS	Lloyds Register of Shipping	UK
MROS	Maritime Register of Shipping	Russia
NK	Nippon Kaiji Kyokai	Japan
NSI	Nederlandse Scheepvaart Inspectie	Netherlands
RINA	Registro Italiano Navale	Italy
RRR	Russian River Register	Russia
USCG	Unites States Coast Guard	USA

POSITION OF BOX COOLER IN SEA CHEST

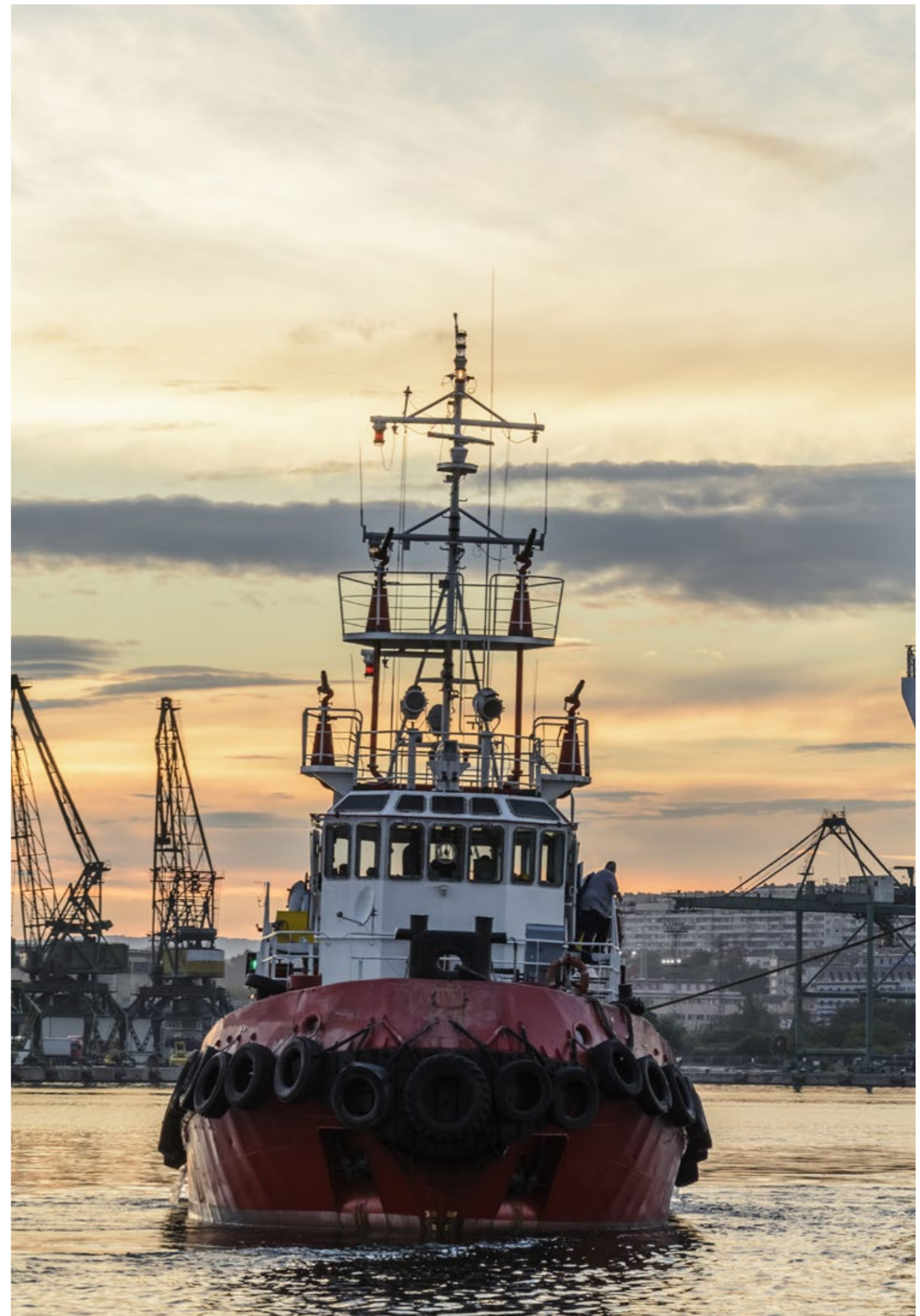
The correct positioning is crucial for the thermal performance of the box coolers and must be projected carefully. In general there can be chosen between longitudinal and transversal positioning. Also placing several box coolers in one sea chest and on one vessel is common practice, but also this must be designed accurately. Kelvion has the professional knowledge to work out the optimal solution together with the designer.

MATERIALS AND COATINGS



All parts of the box cooler which are in contact with sea water are made of seawater resistant materials to prevent corrosion. The tubes are of aluminum brass, the tube sheets are made of Muntzmetal. Additionally all surfaces in contact with the outboard water are coated with several layers of a hot cured phenolic resin

to generate a galvanic insulation and prevent the sea chest against galvanic corrosion. Additionally the coating creates a dampening bond between the U-tubes, support baffles and anti-vibration-strips that avoids scuffing and rattling of the tubes. Beside this it lowers the risk of under deposit corrosion on the box cooler.



ICAF – IMPRESSED CURRENT ANTI-FOULING SYSTEM

There may be some sailing and operational conditions where biological fouling could be an issue. Unwanted organisms, such as barnacles, mussels, algae, seaweed, bacteria and grasses, can restrict the flow and lower the thermal performance of the box cooler.

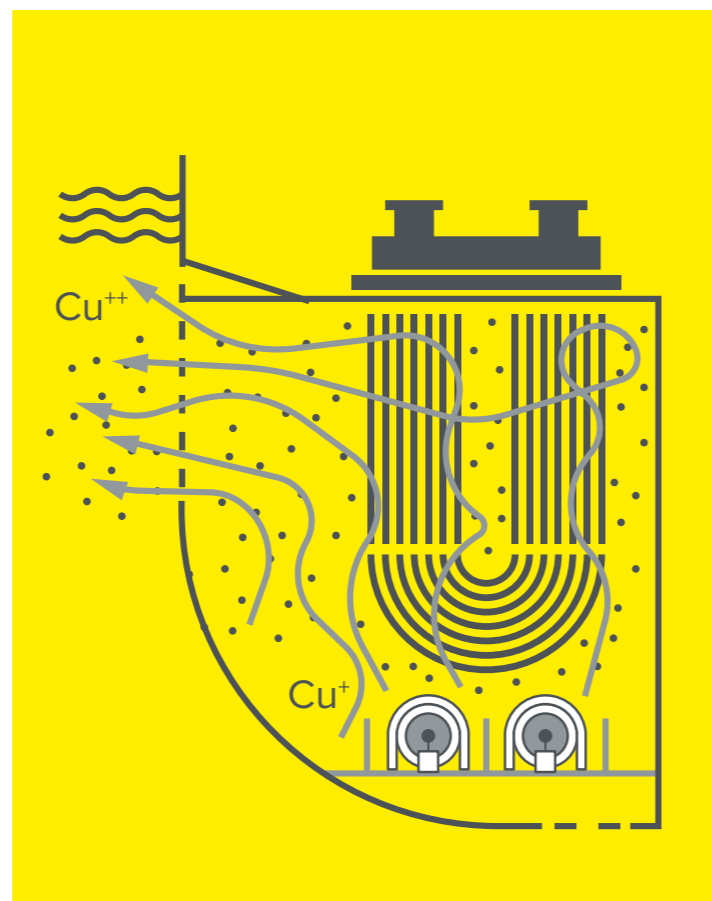
There are several possibilities to prevent the biological fouling. Kelvin focuses mainly on the so called ICAF-Systems. The Impressed Current Anti-Fouling system (ICAF) is a very effective way of preventing biological fouling. Anodes of pure copper are mounted under the box cooler in the sea chest. A constant current is applied between the anodes and the hull (mass), which causes copper to dissolve in the seawater. These Cu^+ ions create a continuous toxic environment preventing the settling of deposits.

The toxicity is only active during a limited time as the Cu^+ ions fall back to the stable Cu^{++} . So this will not harm the environment.

We will advise whether a box cooler should be fitted with an ICAF system. Where the thermal performance has already deteriorated as a result of marine deposits, the ICAF system can be retro-fitted. There are two methods for installing the ICAF system:

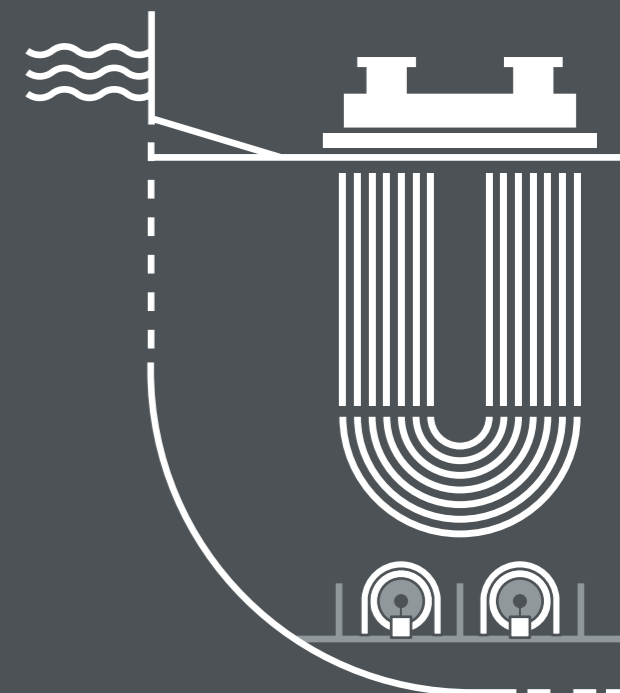
- ▶ Separate ICAF-System
- ▶ Integrated ICAF-System

Beside the ICAF system also Ultrasonic Anti-Fouling systems (USAF) are available, but here a case by case evaluation must be done.



SEPARATE ICAF-SYSTEM

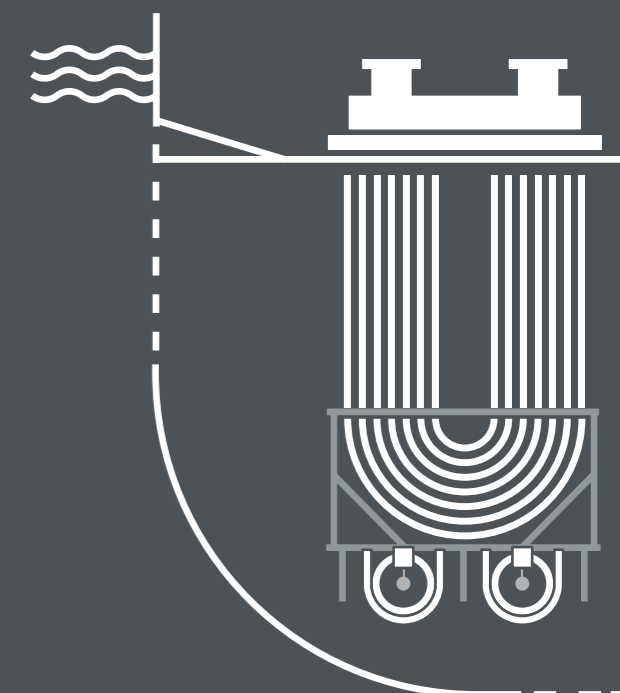
The anodes and cathodes are mounted on an angle steel frame, welded to the sea chest under the box cooler.



INTEGRATED ICAF-SYSTEM

The integrated ICAF system involves mounting the anodes in an anode assembly or anode rack, which is fixed with tie rods to the bottom of the box cooler, so it is an integral part of the equipment. The anode rack fits within the outer dimensions of the tube bundle, so that the box cooler can be fitted through the mounting ring in the sea chest. This option requires sufficient height above the mounting ring for lifting the box cooler. Under normal conditions, the anode rack must never be separated from the box cooler.

The integrated ICAF system requires less space than the separate ICAF version and has the added advantage of not requiring an installation to mount the anodes, cabling and cable feed in the sea chest.

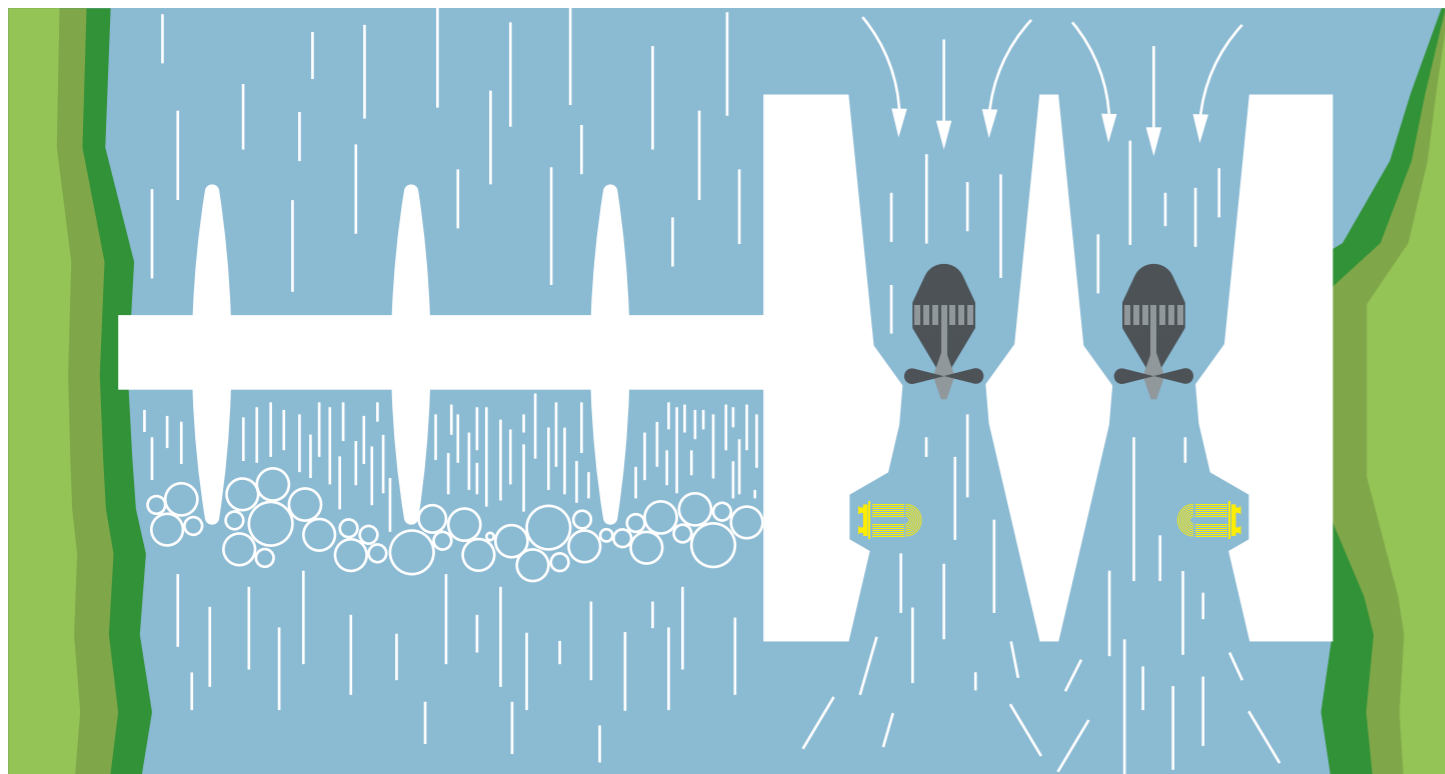


ADVANTAGES

- ▶ No installation required to mount the anodes, the cabling and cable feed in the sea chest
- ▶ Less space requirement

Special product types

POWERBOX – EFFICIENT COOLING FOR HYDRO POWER PLANTS



Our PowerBox is a passive cooling system for run-of-river hydro power plants – another application using the advantages of the box cooler. It is installed in the plant's main water flow channel, totally submerged in the river water, which means that a heat exchanger shell and pumps are obsolete. The water simply surrounds the U-tube bundle and a forced flow on the outside is automatic, due to the water velocity in the channel.

KEY BENEFITS

- ▶ Low maintenance
- ▶ Low operating costs
- ▶ Stainless steel waterbox
- ▶ Design pressure up to 10 bar

OUR SERVICE IN THREE WORDS: PEACE OF MIND



START-UP SERVICES

We ensure that our products are delivered safely and are fully validated to give a robust and reliable performance over as long a life cycle as possible.

- ▶ Commissioning on installation works for box coolers



SPARE PARTS AND SPARE PARTS SOLUTIONS

Even the best equipment shows signs of wear over time. We use only the highest quality spare parts, designed to match the excellence of the originals. This ensures that the optimum interaction between components is maintained. By safeguarding the original design we offer maximum security of your investment.

- ▶ Genuine and comprehensive spare part kits
- ▶ Special materials for extreme demands
- ▶ Delivery of all related box cooler parts
- ▶ ICAF system spares



REPAIRS AND OVERHAULS

We understand that unscheduled downtime can be disastrous. That is why our trained engineers are ready to respond quickly in an emergency. We will review and repair components while keeping any disruption to a minimum. Any overhaul work is carried out in our service centers and conforms to the highest quality standards.

- ▶ Complete overhaul, repair or new production
- ▶ Professional repair in workshop
- ▶ Replacement or re-tubing of tube stacks
- ▶ Renewal of the external coating/ Re-coating
- ▶ Service agreements / Frame contracts
- ▶ Assistance to assembly and disassembly, shipping and transport



TESTING AND MONITORING

Having an understanding of the condition of the equipment allows you to secure reliable production, improve safety and energy efficiency and increase equipment lifetime. It can also help you to prevent breakdowns and prepare for the future.

- ▶ Leakage and pressure test
- ▶ Endoscopic analysis
- ▶ Analysis of cooling water
- ▶ Survey of complete cooling system



INSPECTIONS AND MAINTENANCE

Through regular inspections and maintenance, we help you to reduce costs, extend the lifetime of all your Kelvion products and to achieve a reliable performance. This also helps you with budget planning.

- ▶ Cleaning of inner and outer side via chemical, ultrasonic and thermal cleaning
- ▶ Extensive damage assessment and elimination
- ▶ Flow measurement on site
- ▶ Endoscopic analysis
- ▶ Supervising on seachest maintenance, including advise on sacrificial anodes



UPGRADES AND REPLACEMENTS

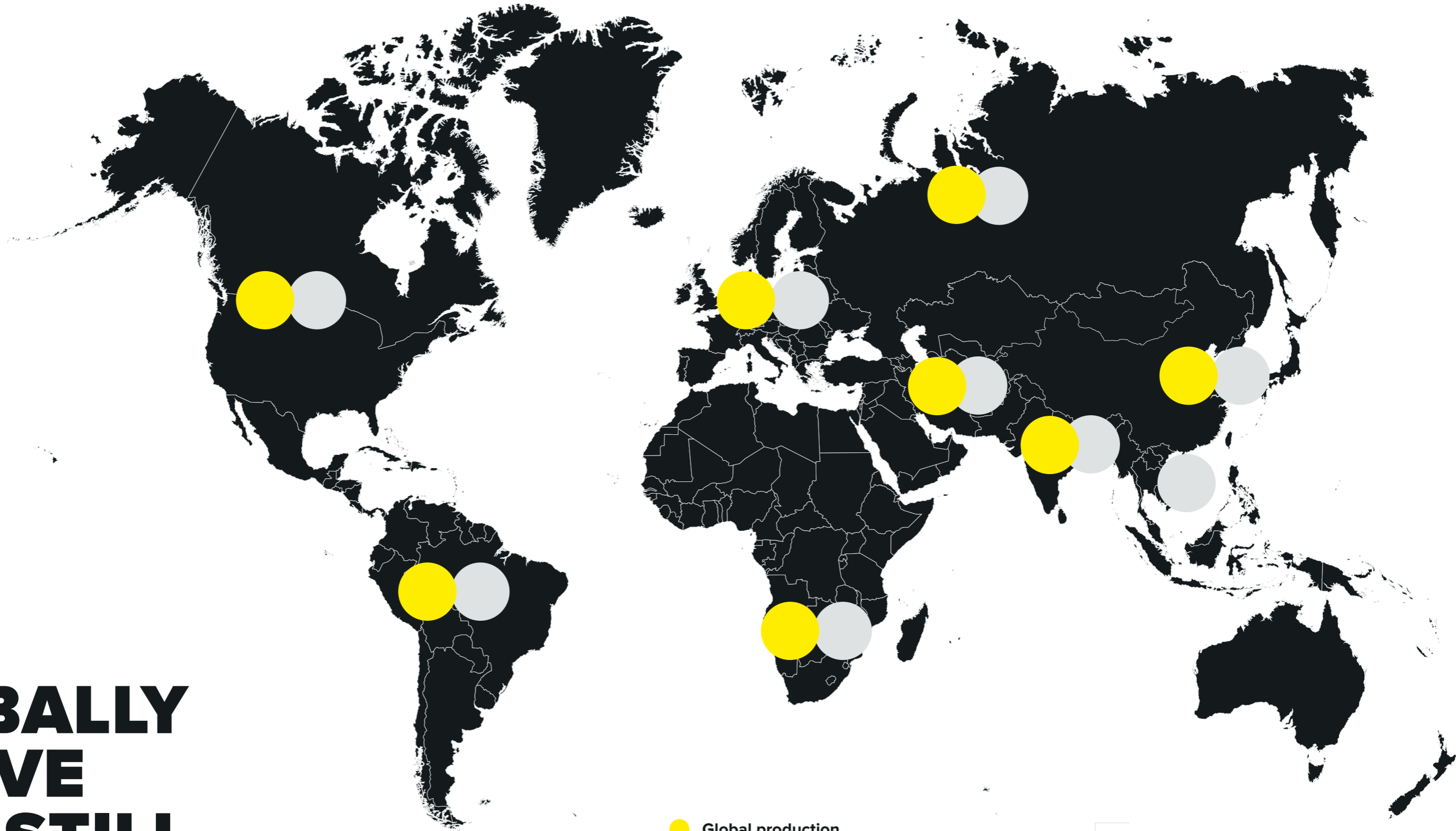
We replace components to keep our heat exchangers running smoothly and to prevent downtime. Where parts have become obsolete, we will suggest an upgrade.

- ▶ Analysis and assessment of performance bottle-necks
- ▶ High availability of parts for older units
- ▶ Fast and efficient service processing



CONSULTING AND TRAINING

Would you like a consultancy service that takes into account the special features of your process and where you feel that finding the right solutions are more important than closing the deal quickly? Then you will feel right at home with Kelvion. We will work closely with you to develop the exact solution that is best tailored to your needs.



GLOBALLY ACTIVE AND STILL CLOSE BY

- Global production footprint
- Global sales and service

No matter where your market is, regardless of country, we are never far away. We are always happy to answer any questions you may have and meet your requirements. Even the largest, most successful project begins with an initial, profitable conversation. We look forward to hearing from you.