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From Sea to Shining Sea, Connectors Support Marine Applications

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Marine waters present some of the harshest and most unforgiving conditions for manufactured equipment. Choosing the right enclosures and connectors is a key element of keeping the pressure, temperature, and chemical elements of these environments at bay.

Almost 90% of global trade depends on ocean travel and, with a growing population, it still provides a key part of our food supply. However, the potential uses for the oceans go far beyond transport and food.

Energy providers are exploring deeper oceans in the search for oil and gas reserves. There is also considerable research being conducted into deep-sea mining.

The composition of the seafloor means that it might serve as a potential source for minerals including copper, gold, and zinc. The sea itself can also generate huge amounts of energy. Equipment that harnesses the movement of waves and tides can create clean, renewable energy.

At the same time, we are now more aware than ever of our impact on this huge but delicate ecosystem. The oceans and their inhabitants play a vital role in the regulation of atmospheric carbon dioxide levels.

The vast array of pollutants, from chemicals to microplastics is gaining awareness around the world for its devastating consequences. Governments and the scientific community are determined to understand how human activity changes the oceans, and to establish strategies to protect these vital resources.

Technology at Sea

With all these activities taking place in all parts of the ocean from the shallows of the coastlines to the deepest plains, it should come as no surprise that technology plays a key role at sea.

Mariners use sophisticated systems to provide everything from navigation and communication to energy generation and freshwater production. Scientists are conducting vital research to build our understanding of the subsea environment using some of the most advanced equipment available.

The increased use of technology at sea presents challenges. The marine environment creates some of the harshest and most unforgiving conditions into which manufactured equipment must travel. Designing equipment for use in the marine environment requires understanding the physical and chemical processes at work.

Connectors are often at the front line of this battle against the elements. Whether aboard ship or fixed in static locations, the number of electronic devices being deployed into marine applications is increasing.

Almost all of these devices require connections, whether to provide power, transmit signals or collect data. When designing for marine applications, it is vital to choose connectors that can endure for long periods in these demanding conditions.

Understanding the Environment

The marine environment represents a complex combination of hazards that have the potential to cause considerable damage to unprotected equipment. The first and most immediate problem is preventing the ingress of water.

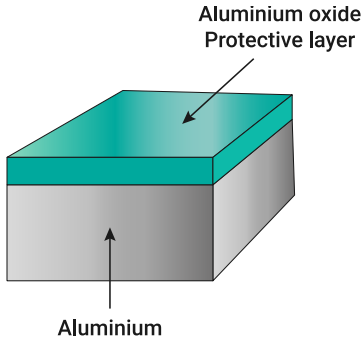
The sea is not a static environment. Water is constantly in motion from wind and wave action. Equipment intended for use at sea must be designed to withstand everything from pools of static water to spray that is thrown by strong winds, and even the pounding of waves over the bow.

The mechanical pounding that is the result of a ship making way in rough seas has the energy to rip equipment away from its mounting. This same energy can easily cause water to find its way inside an otherwise sealed enclosure.

Waterproof enclosures and connectors need seals that are capable of protecting against relentless mechanical impact, high-speed water being sprayed from all directions, and potential immersion for short periods. This requires not just a suitable seal design, but also considerable physical strength.

A second problem that must be overcome is the potential of water to cause damage in other ways. Most global trade routes travel through salt water. The properties of saltwater make it hazardous to certain materials, in particular metals.

The best-known effect is rust, which is the oxidization of the outer layer of iron. This happens when metal atoms lose electrons to form ions. The increased conductivity of salt water encourages these ions to be formed more easily and so speeds the process of oxidization.



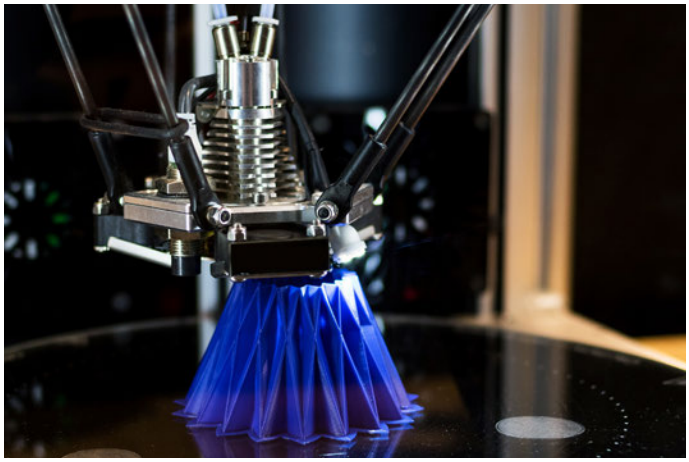
Oxidization and Sea Water

In some metals, oxidization works to our advantage. For example, the oxidized layer of aluminium that forms on the surface of the metal can protect the material beneath it. However, another characteristic of salt water is that it is corrosive, which can cause damage to this protective layer.

If the corrosive action of saltwater strips away the layer of aluminium oxide, the aluminium beneath is exposed and the oxidization process begins again. Over time, the material will slowly be corroded away.

The increased conductivity of salt water can have one more harmful effect. Many connector bodies and enclosures need to be conductive to provide electrical shielding. If two dissimilar conductive metals are in contact in the presence of a conductive solution such as salt water, a chemical process will occur which will cause one of the metals to corrode whilst the other will be unaffected. This is called galvanic corrosion and can be highly destructive. Designers must be vigilant to prevent this unwanted effect.

As a final note to prove how unforgiving the marine environment can be, seawater also contains bacteria that consumes iron and produces rust as a result.

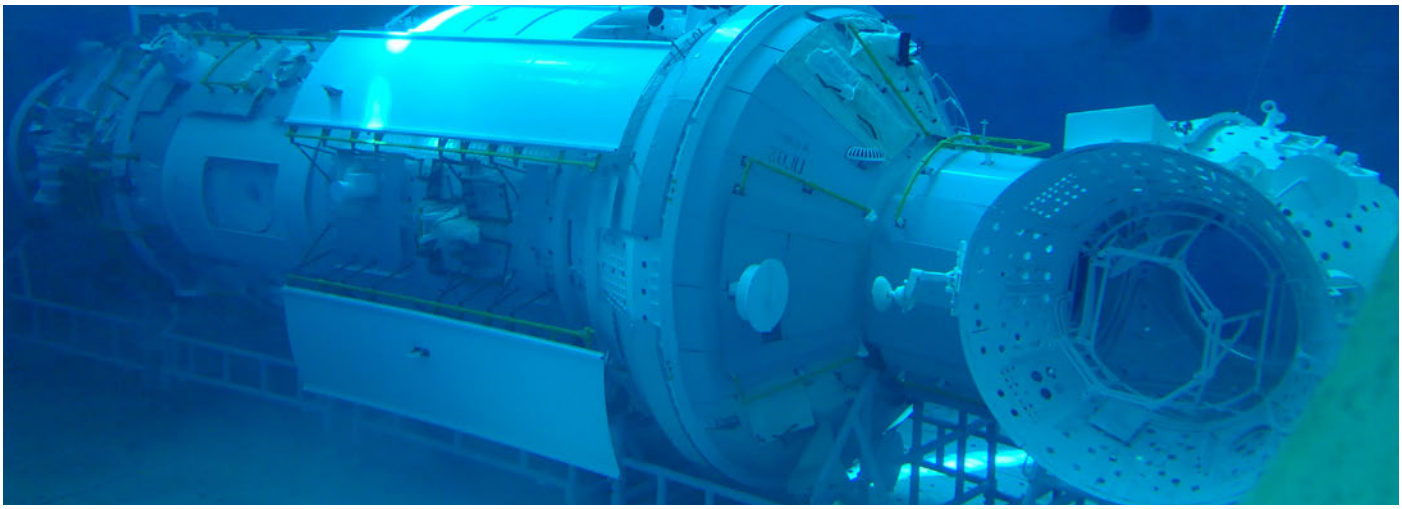


Making the Change from Metal

With metal at such risk in saltwater conditions, one option is to replace metal with plastic in deck-top applications. Plastic is immune from both oxidization and galvanic corrosion, making it a realistic alternative for marine equipment.

Modern engineering polymers are strong enough to withstand the mechanical stress caused by the impact of waves. However, any equipment mounted above deck is exposed to sunlight as well as salt water. Direct sunlight contains ultraviolet (UV) radiation which can affect certain types of plastic.

UV radiation interferes with the bonds within the molecular structure of polymers. These weaknesses allow the polymer to interact with oxygen to weaken its structure. As a result, the plastic can look chalky or discoloured, and may be sufficiently weakened to allow the component to fail under harsh conditions.



As a result, selecting a connector for deck-top applications within the marine environment will require a thorough understanding of the conditions and how they will affect the materials that have been chosen.

The exploration and use of the seafloor means that modern equipment is also being deployed into undersea applications. The underwater environment presents a completely different set of challenges for components and enclosures. The pressure on equipment that is submerged grows quickly.

At 10 metres, the water pressure has risen from 1 atmosphere to 2 and will rise by another atmosphere for every additional 10 metres deeper. In addition, temperatures at great depths are low, typically around 4°C at depths of 200 metres and below. Therefore, the equipment needs to be pressure and temperature-resistant.

Solutions from Bulgin

Connectors intended for use in marine environments, whether aboard ship or shore-based installations, need to be designed with these extreme conditions in mind. Circular connectors offer the best combination of mechanical strength and secure mating. The coupling mechanisms of the Buccaneer circular connector series allows the use of compression seals which is essential when subjected to wind and waves. The circular O-ring that provides the mating seal is squeezed by the coupling mechanism, providing secure protection against moisture ingress.

The shells of the connectors are manufactured from high-impact, UV-stable polymers that deliver themechanical strength required to resist the pounding action of waves. The use of plastic removes the risk of corrosion and galvanic action. For applications in which electromagnetic interference (EMI) is a concern, plastic housings can be replaced with high-quality stainless steel, which combines high strength, resistance to rust, and excellent shielding.

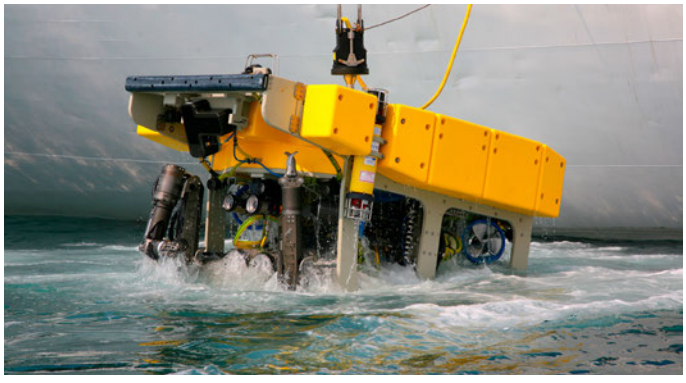
When terminating a cable-mounted connector for use in marine environments, the cable gland of flex cable-mounted connectors must provide the same level of sealing as the rest of the connector. Bulgin Buccaneer connectors are fitted with large cable seals which are available in a range of options that fit a wide selection of cable diameters to ensure the best possible seal.

Safety is Vital

The Bulgin Buccaneer circular connector series has a long history of superior performance in the marine environment. Designed originally for use in the leisure boating and yacht industry, the Buccaneer series is now a tried and trusted connector solution used in almost every segment of the marine industry, from offshore oil and gas production to commercial shipping and even the latest autonomous vessels.

The latest ROV (remotely operated vehicle) tether connector is designed for use in underwater applications, taking the Bulgin product range into one of the most unforgiving environments.

Designing the latest equipment for service at sea required engineers to understand the challenges of the environment and their effects on equipment. When selecting connectors, Bulgin has a range of solutions that can deliver power, data even in the toughest conditions.



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