

# LEGIONELLA:

Seafarers Essential Information

# Introduction



Legionnaires' Disease is a potentially fatal form of pneumonia caused by the inhalation of Legionella bacteria. If infected, between 10-30% of people die unless treated at the earliest opportunity. [1]

When we hear about outbreaks of Legionnaires' Disease, they tend to be stories around hotels, hospitals and leisure centres. In reality, contamination can occur within any man-made water system, and the piping on your vessel is **no different**.

If an outbreak of Legionnaires' Disease was to occur on-board your vessel, you run the risk of being prosecuted by the authorities, and the reputational damage to your business could be significant.

What's more, you'll most likely have to cease trading until the issue has been resolved, resulting in further loss of earnings. **You could even lose a crew member in the process.**

With such high stakes, it's far better to take steps to avoid all potential Legionella and water safety risks before a contamination occurs, and the best way to do this is with accurate and rapid testing.

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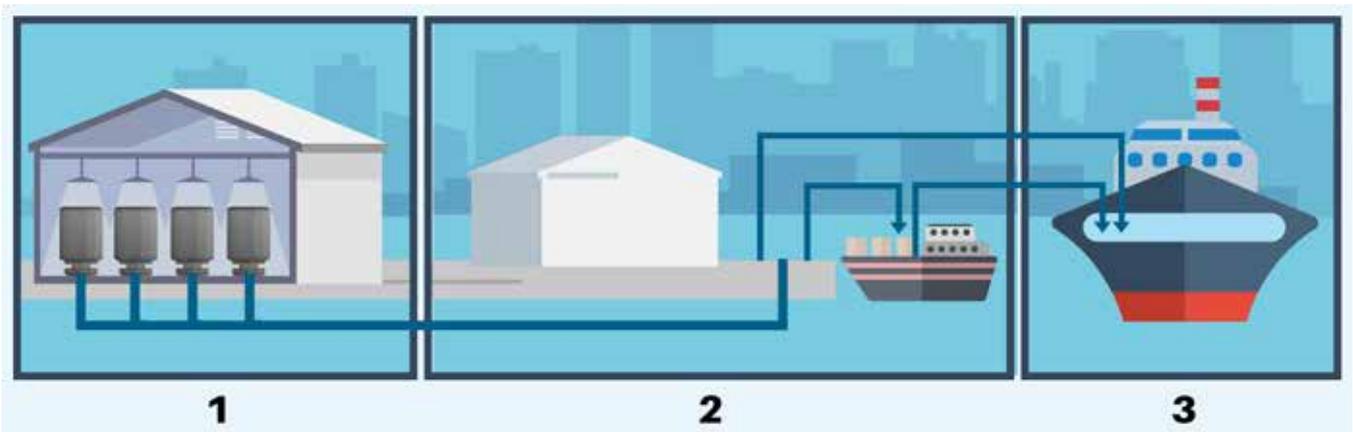
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# How Can Legionella Get On-board?

Legionella bacteria are widespread in natural water systems such as ponds, lakes and rivers, but it's rare for people to catch the disease from these sources [3]. In fact, Legionella doesn't really become a problem for people until it finds its way into purpose-built water systems such as cooling towers and spa pools.

The organisation of water supply on a vessel differs greatly to that on land, and the risk of contamination can arise from the following if the correct testing processes are not put in place [4]:



## 1. Water obtained from an unsafe source

Whilst ports and water suppliers should provide water of a quality in line with the recommendation in the WHO Guidelines for Drinking-Water Quality (more on page 9), this isn't always guaranteed.

If your vessel uses irregular ports where the quality and nature of source water is hard to determine, it's vital that you carry equipment for basic testing.



## 2. Loading and transfer to ship

Even if the water obtained at the port is safe, this does not mean it will remain safe during transferring onto the vessel. This process can include hydrants, hoses, water boats and water barges, which offer multiple opportunities for contaminants to make their way into the potable water system on your vessel.

In one incident, 690 people were affected by an outbreak of shigellosis when the potable water from a pier was connected to a ships' firefighting system (which contained seawater) so the crew could wash the decks. This emphasised the need to ensure that potable and non-potable water were passed through completely different piping systems, and that their fittings were incompatible with one another.

## 3. Storage of water on ships

The plumbing aboard ships consists of numerous piping systems carrying potable water, seawater, sewage, and fuel, fitted into a relatively confined space, making cross-contamination and back siphonage a greater risk.

As with loading and transferring, the potable water system on-board a vessel must be protected against backflow when connected to non-potable systems. If backflow preventers are defective, contaminants are able to enter the distribution system when negative pressure arises.

# The Importance of Regular Testing

Once Legionella has made it onto your vessel, the right conditions can cause it to grow and spread.

Ships are considered particularly high-risk environments for the growth of Legionella for a variety of reasons [5]:

## Temperature



Legionella can proliferate in warm water between 25 °C and 50 °C.

The high temperatures around engine rooms on-board a vessel and when travelling through tropical regions can increase the risk and speed of Legionella growth.

## Flow Rates



Low flow rate or areas of stagnant water are well suited to bacteria growth.

With some ships periodically being taken into dry dock for maintenance and repair, the piping systems on-board may spend months at a time not in use.

This puts those who clean and maintain the water systems, as well as those who next use them, at risk.

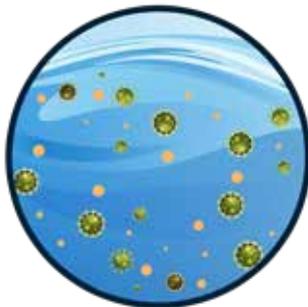
## Deposits



Rust, sludge, scale and biofilms (more on page 12) present within the piping system can support bacterial growth by providing a source of nutrients.

Again, if a water system is not used for weeks (if not months) at a time, this increases the risk of a deposit build up.

## Insufficient Residual Disinfection



Some ship operators believe that residual disinfection is enough to treat contaminated water. It is not.

Whilst it can provide a measure of safety by killing low levels of some pathogens, it can't always eliminate them completely. Low levels of residual disinfectant are not enough to prevent gross contamination [4].

With such a high risk of contamination, maintaining the quality of water on-board your vessel with regular testing is vital.

By carrying out regular testing, you are able to identify small amounts of Legionella bacteria before they become too great a threat. If you do not test regularly you run the risk of widespread contamination, which may result in your water system, and therefore your entire vessel, being out of action while it is disinfected.

### Did you know?

"A recent study conducted on Legionnaires' Disease outbreaks on vessels revealed that Legionella was detectable in potable water systems on 58% of 350 vessels in the study." - Centers for Disease Control and Prevention

# What Do the Rules Say?



## MLC 2006

The Maritime Labour Convention, 2006 provides comprehensive rights and protections at work for seafarers. Part of the regulation is aimed at maintaining high-quality drinking water on-board ships, to protect crew from waterborne health risks.

The regulations state that:

**“The shipowner and master must ensure that food and drinking water are provided on the ship which [...] do not contain anything which is likely to cause sickness or injury to health.” [7]**

There is no doubt that the inhalation of Legionella bacteria can cause injury to health, with approximately 50% of those infected showing signs of mental confusion, 30% having diarrhoea and vomiting, and 10% succumbing to the resulting disease. [1]

## WHO

The World Health Organization (WHO) currently provides guidance on Legionella risk assessment and management in three principal documents; Guidelines for Drinking-Water Quality, Guidelines for Safe Recreational Water Environments and Guide to Ship Sanitation.

The latter, which focuses on vessel's in particular, states that:

**“A ship operator’s role is to provide safe water to passengers and crew, fit for all intended purposes. Water on-board should be kept clean and free from pathogenic organisms and harmful chemicals.” [5]**

A pathogenic organism is an organism capable of causing disease in its host. *L. pneumophila*, a species of Legionella, not only causes Legionnaires' Disease but also a milder flu-like illness called Pontiac Fever.

By keeping the system on your vessel clean from potentially fatal bacteria, you can guarantee compliance with regulations, avoid unwanted delays, and preserve the health and safety of your crew on-board.

### Quick Fact

Whilst everyone is susceptible to infection, some people are at a higher risk [3]. These include:

- people over 45 years of age
- smokers and heavy drinkers
- people suffering from chronic respiratory or kidney disease
- diabetes, lung and heart disease
- anyone with an impaired immune system

If anyone on-board your vessel falls within one of these categories, it's even more important that you regularly test for Legionella.

# Choosing Your Test Kit

Testing water samples on a vessel can be challenging, and the traditional lab-based testing that is often recommended to shipowners poses some problems:

- Depending on where in the world your vessel is, access to the laboratory can be limited and the reliability of labs in certain countries can be questionable
- The 10-14 day wait for lab-based results runs the risk of further contamination
- Relying solely on the culture test is not enough. Doing so can lead to false negative results and underestimated counts of Legionella bacteria

The good news is that **new and innovative technology has meant that you no longer need to rely on lab-based testing**. Portable Legionella test kits enable you to monitor water systems on-board without having to wait days for results.

But with so many kits out there, it's hard to know which one to choose.

So let's break it down into three 'must haves':

## 1. Rapid Results

The symptoms of Legionnaires' Disease do not always appear until up to 14 days after exposure to the bacteria. You cannot afford to wait until a crew member shows signs of the disease to start testing your water system, as the likelihood of contamination will have increased dramatically from initial exposure.

Rather than waiting days for traditional lab-based testing, you need an on-site Legionella test that can detect the bacteria before it has a chance to infect your crew. The fastest Legionella test kit on the market can give you a positive or negative result within 35 minutes, leaving you with enough time to carry out further testing on both the system and your crew.

## 2. Accuracy and Sensitivity

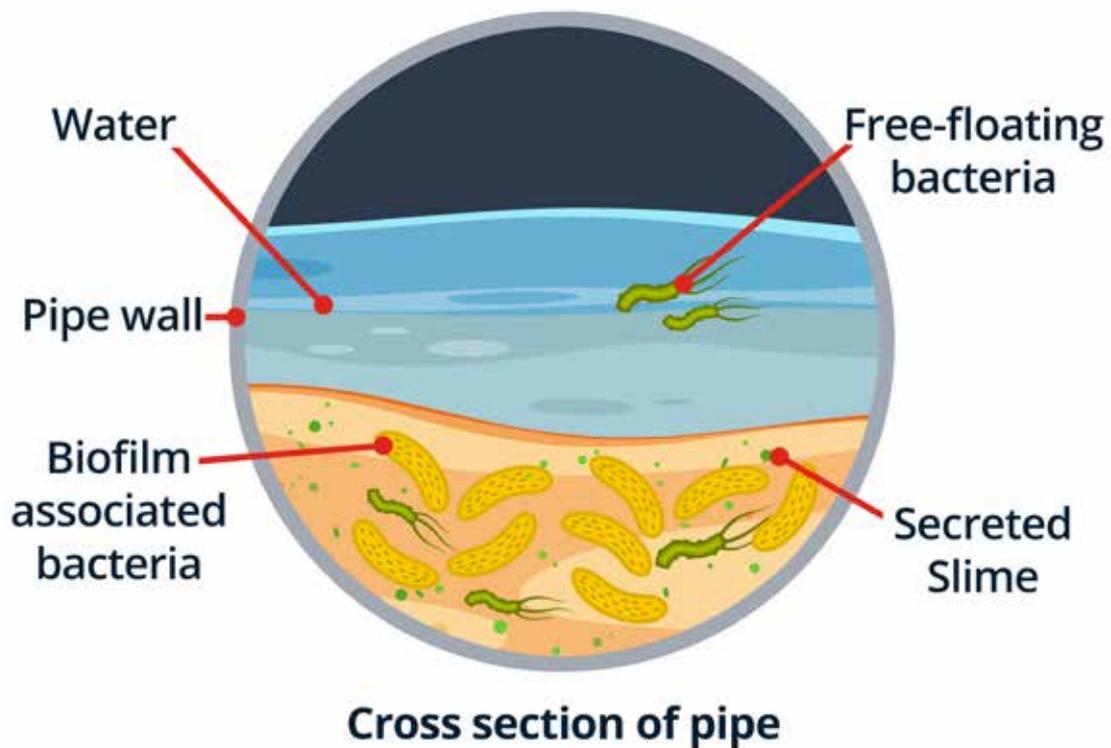
The levels of Legionella bacteria present on your vessel will determine what action needs to be taken [8]:

Legionella bacteria (colony forming unit per litre)	Recommended Actions
< 100 CFU/L	No action required
100 - 1000 CFU/L	Either: <ul style="list-style-type: none"> <li>• If the minority of samples are positive, the system should be resampled. If similar results are found again, a review of the control measures and risk assessment should be carried out to identify any remedial actions necessary, or</li> <li>• If the majority of samples are positive, the system may be colonised, albeit at a low level. An immediate review of the control measures and risk assessment should be carried out to identify any other remedial action required. Disinfection of the system should be considered</li> </ul>
> 1000 CFU/L	The system should be resampled, and an immediate review of the control measures and risk assessment carried out to identify any remedial actions, including possible disinfection of the system.  Retesting should take place a few days after disinfection and at frequent intervals afterwards until a satisfactory level of control is achieved.

Choosing a test kit that can achieve a sensitivity of 100 cfu/l is vital, as it allows you to detect low levels of Legionella bacteria before they have the chance to contaminate your entire water distribution system, the cost of which can be huge.

### 3. Water and Biofilm Testing

We now understand that some Legionellosis outbreaks are linked to the existence of biofilms [9], so it's vital that you choose a test kit that can test both water samples and biofilm samples.



A biofilm is formed when layers of microorganisms, typically bacteria, adhere to one another. Together they form a tough protective layer on a surface that encloses colonies of bacteria.

They can occur and bond to a range of man-made and naturally occurring surfaces, such as rocks and metalwork, with an obvious example on-board ships being the slimy layer that forms inside a drainage pipe [10].

Once established, these biofilms act as a very robust, safe space for bacteria to thrive, making the risk of further contamination throughout your water system even greater.

By purchasing a test kit that tests for both, you are ensuring maximum protection from the risk of contamination.

# Summary

The risk of Legionella bacteria contaminating the water supply on your vessel can arise when **unsafe source water makes it into your distribution system**. This can occur:

- At the port if the source water is not tested correctly
- During loading if cross contamination occurs
- Once on-board during storage or distribution if unsafe water from other systems reaches your potable water system

Once Legionella has made it onto your vessel, the following conditions within your water system can cause it to grow:

- High temperature – particularly around engine rooms
- Low flow or areas of stagnate water
- Heavy deposit build up

The best way to ensure your water supply is free from Legionella bacteria is with **thorough and regular testing**. When choosing your testing method, it's vital that your kit:

- Is accurate and sensitive
- Delivers rapid results
- Tests both water and biofilm

By testing your vessel with a reliable Legionella kit, you can prevent Legionella bacteria from contaminating your water system. This means that you:

- Protect your crew from the potentially fatal Legionnaires' Disease
- Adhere to the rules laid out by MLC 2006 and WHO
- Avoid having to pay huge sums to disinfect your entire water system

## In short...

If this bacterium makes it onto your vessel, the consequences for your crew, your reputation and your finances could be huge. Therefore, it's vital that you ensure your vessels have **reliable test kits on-board that can detect low levels of bacteria quickly...**

# Martek Marine's LegionellaMAX Test

The LegionellaMAX Test Kit is the most advanced, accurate and versatile technology for the rapid detection of Legionella bacteria.

## What can be tested?

This test kit is designed to test for Legionella in both water and biofilms in risk areas identified by the Centers for Disease Control and Prevention, such as showers, industrial and domestic water systems, spas and bathtubs.

## How does it work?

The LegionellaMAX Test Kit uses an immunochromatographic assay to detect the presence of cell surface antigens from Legionella bacteria in a sample. The presence of antigen causes the "Test Line" to turn red in colour.

The kit contains all the items required to perform 4 tests (2 water samples plus 2 biofilm tests). The filtration step concentrates the Legionella bacteria to achieve a sensitivity level of 0.1 CFU/ ML in water samples, and a sensitivity of 0.2 CFU/ ML in biofilms.

The pre-filled syringe containing recovery buffer and the pre-filled vials means there's no need to measure or dilute solutions. This makes it extremely simple to use.

**1**

Collect water  
sample

**2**

Perform 2  
simple tests

**3**

Results within  
35 minutes

# About Martek Marine



We exist to revolutionise ship safety, performance and crew welfare.

Martek Marine is a 'best-in-world' marine disruptive technologies provider. With a focus on three core pillars, ship safety, performance and crew welfare, Martek Marine has supplied over 30,000 ship sets across the globe since 1999.

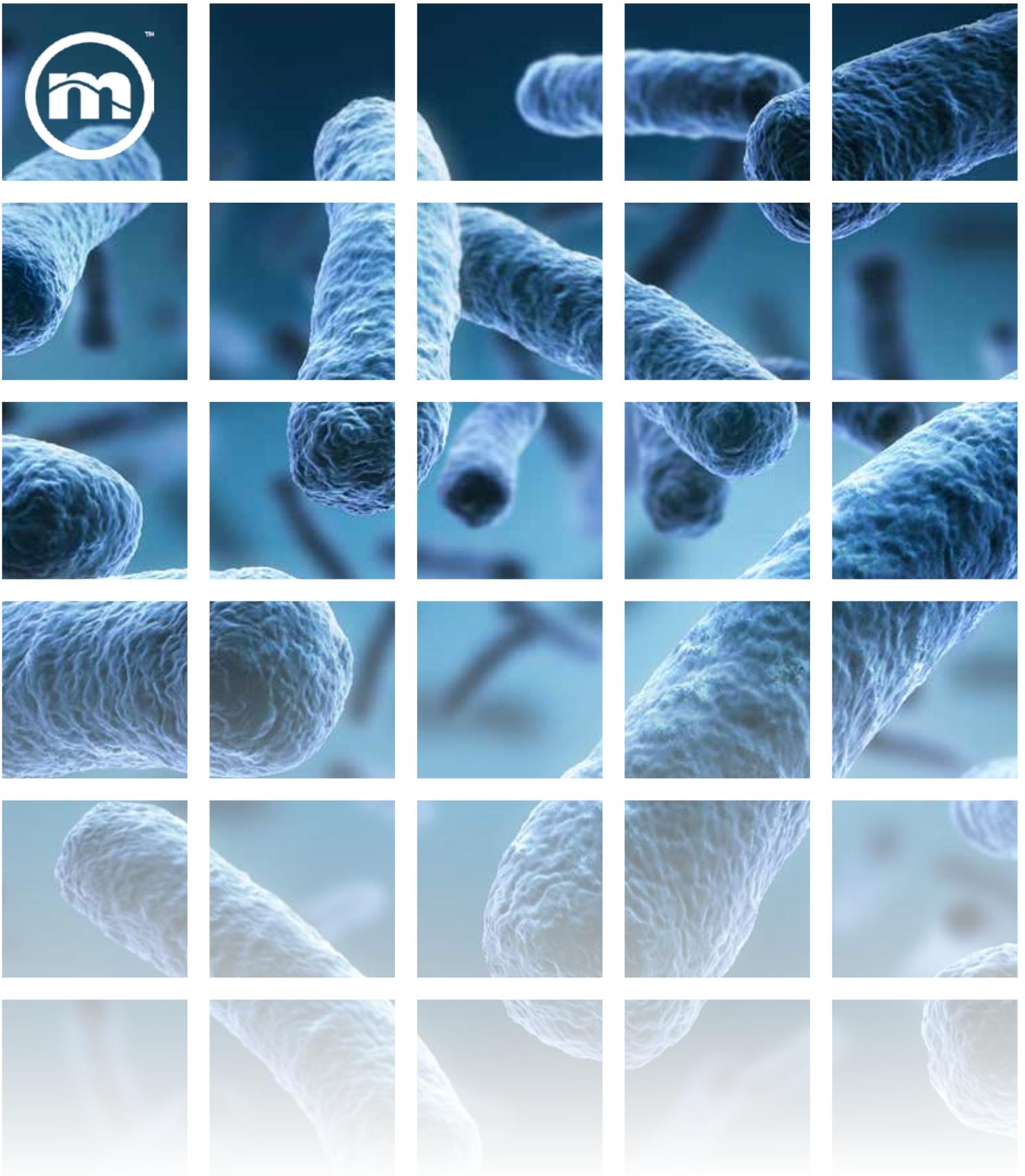
Martek's ground-breaking technology offers simple compliance with all safety, environmental and navigational marine regulations, protecting assets, life and the environment in the global maritime industry.

From 24-hour worldwide dispatch for calibration gases, to lifesaving marine AED's, and from gas detection to bridge watch alarm systems, Martek Marine ensure all aspects of safety and performance are covered to the highest standard.

With 20 years pedigree, in-house expert knowledge and international renown for an exceptional customer experience, Martek Marine continues to steam ahead at the forefront of innovation.

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Martek Marine  
Adwick Park, Manvers,  
Rotherham, South Yorkshire,  
S63 5AB, UK

[www.martek-marine.com](http://www.martek-marine.com)  
[info@martek-marine.com](mailto:info@martek-marine.com)  
UK Office: +44 (0)1709 599 222  
Singapore Office: +65 6408 3334