

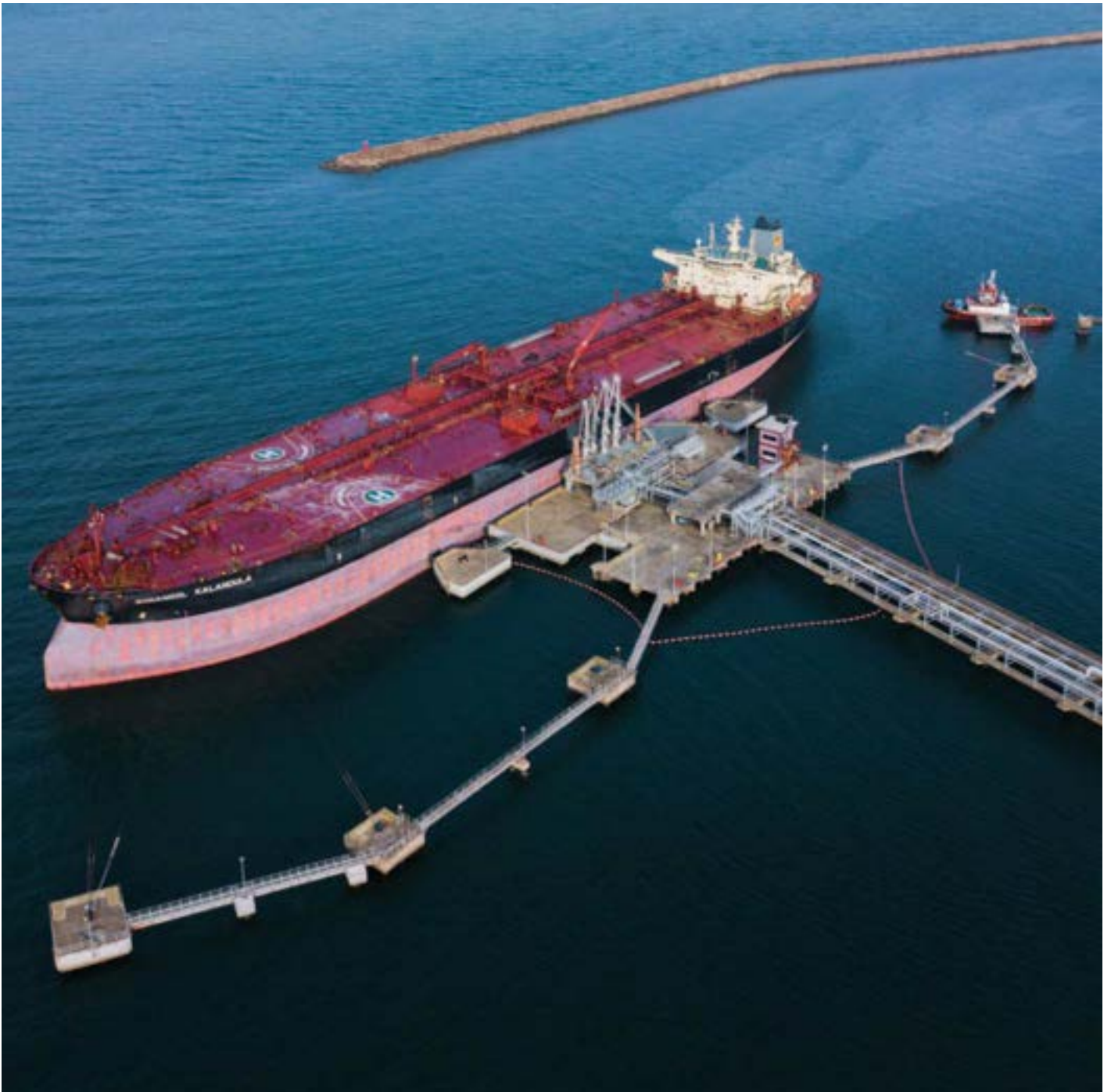


Star International

Worldwide marine and offshore services

Star fuel testing and treatment solutions

A turnkey fuel stewardship solution for shipping, cruise ferry and yacht operators



The Star marine fuel testing and treatment range provides a turnkey stewardship solution for users of marine diesel fuels and low sulphur alternatives. The range has been developed specifically for shipping operators requiring an effective means to measure and manage fuel quality, in port and at sea.

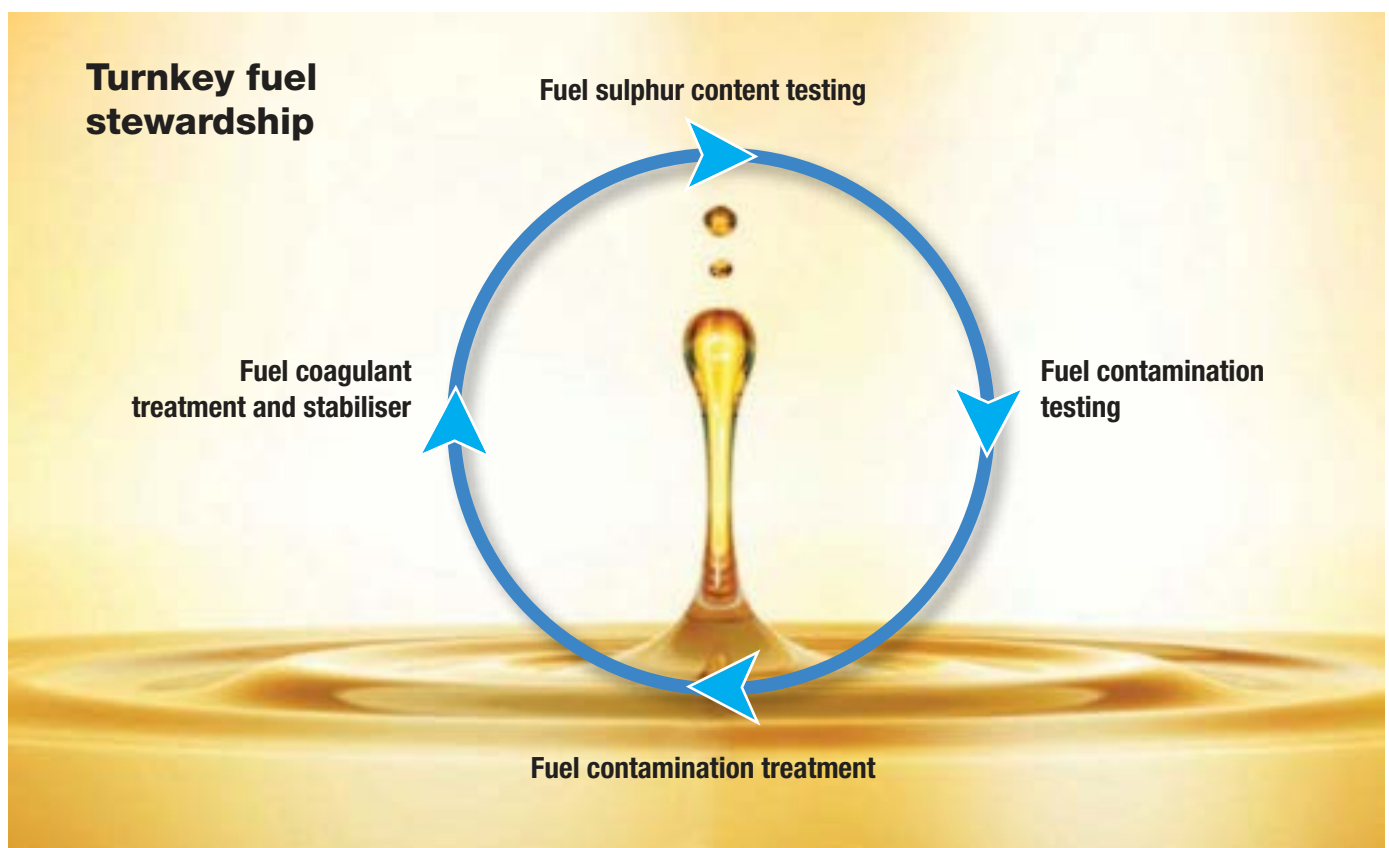
The Star Mariner fuel stewardship range has been developed in response to the International Maritime Association's (IMO's) 2020 regulations. It supports operators in meeting regulatory requirements and in safeguarding assets from the risks associated with using low sulphur, Fatty Acid Methyl Ester (FAME) based alternative fuels.

Star International's range of fuel stewardship products allow operators to validate fuel composition and quality and provides treatment additives to tackle any contamination identified.

The range includes the following on-board solutions:

- **Star XRF onboard sulphur tester**
An on-board analyser that confirms sulphur content in fuel within a range of 0.1% – 5.0%, allowing validation of fuel for vessels operating within and outside of designated Emission Control Areas (ECAs).

- **Star FUELSTAT contamination test kit**
An on-board testing solution that detects *Hormoconis resiniae* (diesel bug), bacteria, fungi and yeast contaminants in as little as 10 minutes.
- **Star Mariner fuel treatment additives**
A range of fuel treatment additives that are effective with Marine Gas Oils (MGOs) and low sulphur alternatives, acting to neutralise and prevent contamination, improve shelf life and counter temperature induced coagulation.
- **On-board fuel testing and treatment**
Used in conjunction with the fuel stewardship product range, operators can benefit from an all-encompassing solution to fuel management, covering on-board storage and use.



Marine fuel contamination and the benefits of proactive fuel stewardship

Fuel contamination is a persistent problem for shipping operators and can be enhanced at every stage of fuel production, distribution, storage and in the fuel systems of end users.

Contaminants including *microbiocidal* growth, *Hormoconis resiniae* (diesel bug), fungi, yeasts and water can all infiltrate fuel, potentially rendering the supply useless if left untreated.

Common symptoms of fuel contamination include:

- Clogged fuel filters / shorter fuel filter life
- Failing fuel pumps
- Partial / complete injector failure
- Abnormal / accelerated piston ring wear
- Fuel tank erosion
- Increased fuel consumption
- Loss of engine power
- Increased exhaust smoking
- Engine failure

A proactive fuel stewardship strategy enables operators to accurately monitor the composition and quality of diesel oil. On-board testing identifies any problems at the point of refuelling and at sea, meaning contamination risks can be minimised and suppliers held to account.

Unnecessary downtime and damage to hardware can be minimised and potentially costly fines resulting from regulatory non-conformities avoided.

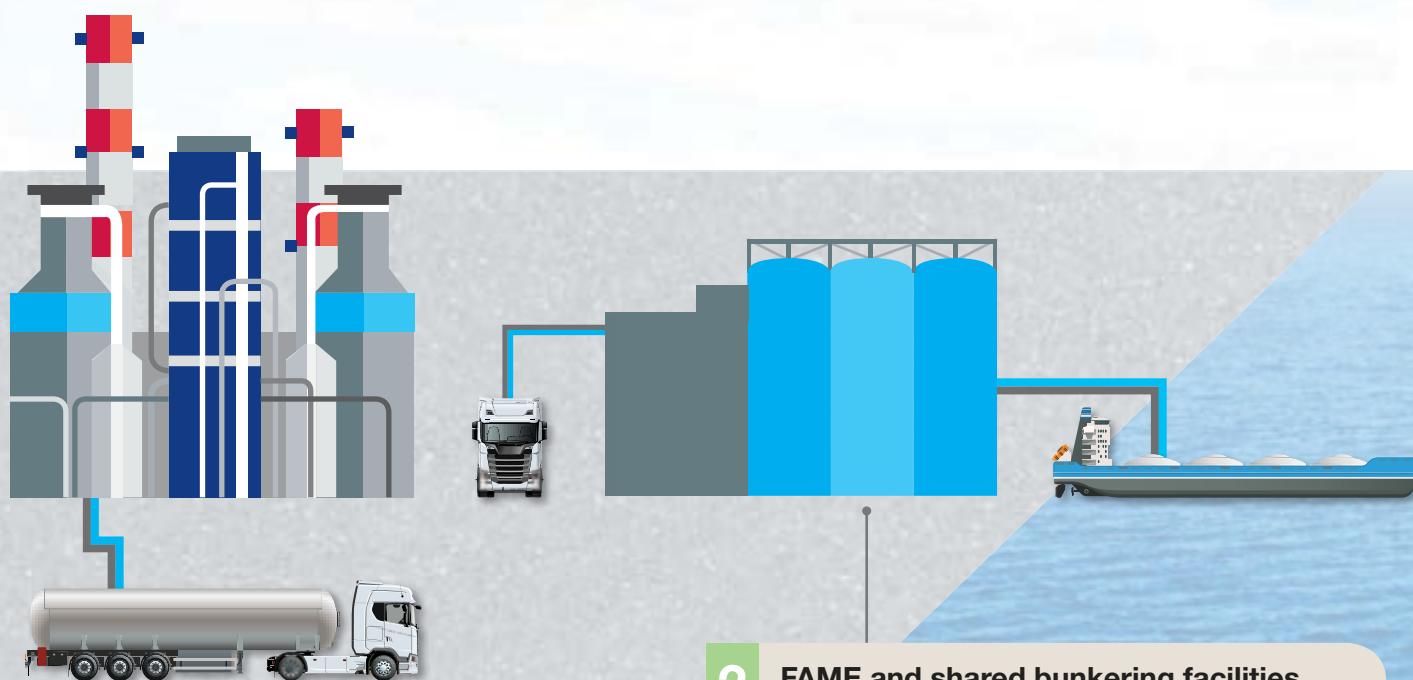


In January 2020, new regulations were introduced by the International Maritime Organisation (IMO) to dramatically reduce the permitted sulphur content in marine fuels from 3.5% to 0.5%. The IMO 2020 limit applies to fuel oil used on ships operating outside designated ECA's and is intended to reduce environmental impacts resulting from exhaust emissions.

In order to adhere to IMO 2020, many fuel producers are turning to blended fuel oils containing Fatty Acid Methyl Ester (FAME) to create compliant biofuel alternatives. While this option does achieve a lower sulphur content, the use of FAME fuels also increases the risk of free water, creates favourable conditions for the development of microbial contamination and lowers the lubricity of the fuel.

Even for operators that choose to circumvent the sulphur limit using technologies such as exhaust scrubbers, there are still a host of cross contamination threats present throughout the supply chain, meaning that a proactive approach to fuel stewardship is required.

Risks of contamination in the fuel supply chain



1 FAME and shared transport infrastructure

Once a fuel leaves the refinery, it becomes part of a supply chain that carries numerous types of fuel. Residues from different fuel types can mix during transport and potentially spread contamination.

2 FAME and shared bunkering facilities

Bunkering facilities, as with transport infrastructure, are used for numerous types of fuel, meaning the potential for FAME and FAME free fuels to cross contaminate is present.

Cross contamination in bunkering facilities is a particular threat in markets including Europe and the USA, where fuels of up to 7% fame can be supplied without being labeled as a biofuel.

“The implementation of this regulation by the IMO will have far-reaching implications throughout the marine fuel supply chain, from refining, through distribution, bunkering, handling and storage on-board the ship.”

- Joint Industry Guidance: The supply and use of 0.50% sulphur marine fuel, 2019

3 Contamination on-board ship

Fuel contamination can take place on-board at the point of refuelling or while fuel is being stored in tanks prior to use.



4 On-board storage

In addition to increased risk of contamination, FAME based fuels also require proactive stewardship once on-board to counter issues associated with temperature induced coagulation, reduced lubricity and a reduced shelf life.



Ensure IMO compliance with the XRF sulphur tester

The XRF on-board sulphur tester is a high precision D4294 sulphur content analyser that allows marine operators to confirm the sulphur content of fuel. This on-board solution enables fast, accurate analysis and provides the data required to ensure compliance with IMO regulations.

The XRF onboard sulphur tester delivers fast and precise sulphur testing with a limit of detection as low as 0.1%, meaning it is effective for confirming fuels used within and outside of Emission Control Areas (ECA's).

Key benefits:

- **Recognised sulphur analysis method**
Providing lab quality results
- **Wide analytical range**
Confirms sulphur content from 0.01% to 5%
- **Easy to use**
Minimum sample preparation
- **Robust and compact**
Designed for the marine environment
- **Portable**
Testing can be completed anywhere
- **Recognised testing methodology**
Complies with ASTM D4294, ISO 8754, and IP 336

The XRF on-board sulphur tester provides laboratory quality results and relies on methodologies that are approved for marine fuel testing. The unit is compliant with ISO 8754 and ASTM D4294 regulations.

The analyser uses intuitive software and can be operated by crew on-board ship with minimal training.

The robust stability has been tested through continuous measurement of standard NIST fuel oil sample 1619b (0.698%) within the temperature range of 10°C to 30°C.

With corrected net counts, the calibration covers the whole range of marine applications with one linear curve, ensuring robust calibration with precise sulphur analysis.

Product code 00960220



Dynamic range	Sulphur 50ppm – 5wt%
Applications	Hydrocarbons including; crude oil, mineral oil, diesel, gasoline, marine fuel, jet fuel, kerosene, lubricants
Method compliance	ASTM D4294, ISO 8754 and IP 336
Measure time	30 - 900 seconds
Calibration	- 30 different calibration curves - Linear (automatic custom calibration available)
Sample volume	Cap: 7 – 10ml / bottle: 25ml
Connections	USB, ethernet
Data output	Printout, USB and ethernet to PC
Dimensions	3 cm x 30 cm x 26 cm
Weight	7.2 Kg
Power supply	10-240 VAC \pm 10%, 50-60 Hz
Battery power	Wh > 4 hours continuous
Operating temperature	5°C - 40°C
Operating humidity	30 - 85%



Test for microbial fuel contamination with Star FUELSTAT

Star FUELSTAT is a field test that quickly and accurately detects contamination in marine diesel fuels, identifying the nature of a contamination and its severity at the point of refuelling or at sea in as little as ten minutes.

Star FUELSTAT detects *Hormoconis resiniae* (diesel bug), bacteria, fungi, and yeast contaminants in as little as ten minutes. It offers a reliable and economical microbial testing solution, drastically reducing the cost of testing when compared to lab-based methods.

Testing can be completed in three simple stages and requires no formal training, meaning crew can determine and act on any contamination, safeguarding a vessel's fuel supply.

For digital reporting, the Star FUELSTAT Result app can be used. This is available as a free tool for iOS and Android platforms, offering instant verification of results and data transfer via SMS or email, whilst simultaneously sending a report to a secure portal for access and download at any time, from anywhere in the world.

Product code 00960218

Key benefits:

- **Fast and accurate results**
Verified contamination reporting in ten minutes
- **Results verified on site**
No laboratory required
- **Economical**
No additional equipment, transport or laboratory fees
- **Reduced risk of cross contamination**
No sterile testing conditions or specialist expertise required
- **Identification of specific microbes harmful to fuel**
Detects diesel bug, bacteria, fungi and yeasts, and the severity of contamination
- **Versatile**
Tests both fuel and free water
- **Recyclable**
Can be safely disposed
- **Internationally recognised test method**
Fully compliant to ASTM D8070
- **Star FUELSTAT Result**
A Smartphone app which enables fast, transparent and auditable reporting within minutes, anywhere in the world via a secure portal

Star FUELSTAT - A proven fuel testing solution



Results in as little as ten minutes

Star FUELSTAT is a proven testing solution that is already established in the aviation and oil production sectors where it is used by more than ten oil majors and 400 airlines worldwide. In both sectors it has yielded cost and time savings of 50% over lab-based alternatives and saved in excess of 1 million hours of labour, by enabling personnel on site to complete fuel testing with no laboratory support or associated waiting times.

Star International has partnered with Conidia Bioscience Ltd to offer Star FUELSTAT to the maritime sector, supplying shipping, ferry, cruise and yacht operators with a technology which is revolutionising on-site contaminant testing.

The Star FUELSTAT solution

As simple as 1-2-3

Test. Result. Report.

1



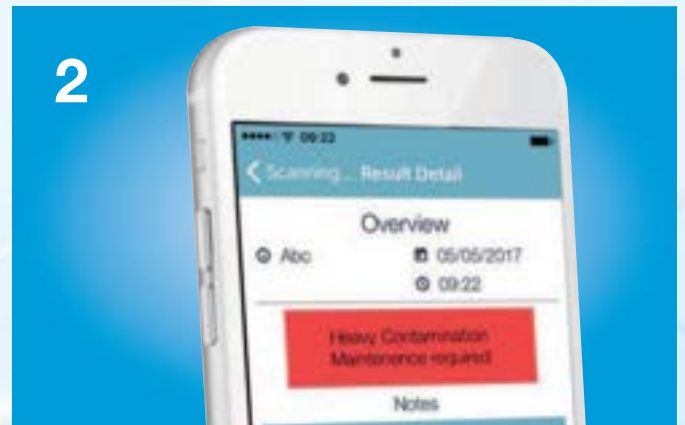
Star FUELSTAT test

- Accurate results anywhere. Testing process can be learned in minutes and carried out by anyone
- Immediate decisions can be made without delay
- Results in as little as ten minutes

Star FUELSTAT result

- Reduces risk of misinterpretation
- Immediate visual verification of results
- No need for additional equipment other than a smartphone

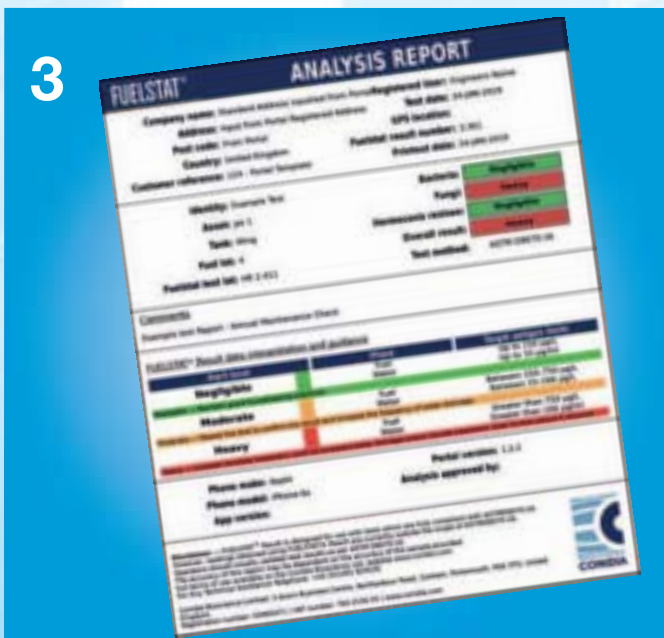
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Star FUELSTAT report

- Traceability of testing
- Identification of contamination sources and hotspots
- Proof of test, proof of result, proof of method

3



Protect fuel integrity with Star Mariner fuel additives

The Star Mariner range of fuel additives are designed to support fuel stewardship activities by protecting the integrity of fuel on-board ship.

Suitable for a range of commercial vessels, the Star Mariner range offers versatile treatment solutions that can be applied to all types of fuel and low sulphur alternatives.

Star Mariner Eliminator

Star Mariner Eliminator is a biocide that eradicates and prevents microbial contamination of fuel, also known as 'diesel bug' (*Hormoconis resinæ*).

Key benefits include:

- Prevention of fuel degradation and damage to fuel filters caused by contamination from microbes, fungi and algae,
- Prevention of poor starting caused by microbial fuel contamination, and
- Maintenance of optimum fuel efficiency.

Product codes	5 litres	00920038
	20 litres	00920049
	205 litres	00920005



Star Mariner Neptune

Star Mariner Neptune is a water dispersant and fuel systems cleaner, designed specifically to remove water from fuel, while also improving lubricity and cleaning injectors.

Key benefits include:

- Effective dispersal of water within fuel and minimisation of potential injector corrosion,
- Adds “lubricity” to low sulphur content fuel, reducing wear in fuel pumps and injectors and prolonging component life,
- Protection of fuel against manifestation of microbial growth (diesel bug) in fuel storage tanks, and
- Protection and cleaning of injectors and injector tips, ensuring optimum fuel atomisation and a complete fuel burn.

Product codes	20 litres	00920040
	205 litres	00920003



Star Mariner fuel additives

Star Mariner MGO 31-A5 Fuel Stabiliser

Star Mariner MGO 31-A5 fuel stabiliser has been formulated to prolong the shelf life of diesel fuel when stored long term. Star Mariner MGO 31-A5 is formulated to maintain diesel fuel quality and usability.

Key benefits include:

- Stabilisation of fuel, preventing deterioration, separation and oxidisation for up to 18 months after application,
- Effective when combined with biodiesel fuel containing up to 50% Fatty Acid Methyl Ester (FAME) content,
- Protection against microbial growth (diesel bug), and
- Effective dispersal of water contamination, protecting injectors from wear and damage.

Product codes	20 litres	00920051
	205 litres	00920052

Star Mariner MGO Antigel

Star Mariner MGO Antigel is an anticoagulant and anti-waxing agent formulated to maintain the cold flow properties of winter grade MGOs and low sulphur alternative fuels.

Key benefits include:

- Maintenance of optimum Cold Filter Plugging Point (CFPP) properties down to -24 degrees centigrade*,
- Protection against fuel filter plugging at temperatures below the fuel cloud point, and
- Reliable operation of marine diesel engines in severe, cold weather conditions.

* Final CFPP figure may vary, as it is based on the MGO's CFPP prior to treatment

Product codes	20 litres	00920043
	205 litres	00920036



Star Mariner Oceanic

Star Mariner Oceanic is an HFO sludge and soot dispersant that cleans fuel systems and improves fuel efficiency.

Key benefits include:

- A reduction in fuel sludge content of up to 70%
- Reduced sludge disposal costs,
- Reduced sludge formation in fuel storage tanks, and economisers,
- The dispersal of asphaltenes and other HFO components to improve fuel efficiency, and
- A more efficient and complete fuel burn and reduced fuel consumption.

Product codes	25 litres	00920037
	205 litres	00920050



On-board fuel testing and treatment services

Ensure fuel quality and safeguard storage systems with a complete service that includes fuel sample analysis; fuel polishing and conditioning; and fuel tank and system cleaning.

Fuel sampling and analysis

Fuel analysis provides quantitative proof of the quality of the fuel, together with the nature and severity of any contamination.

Our fuel sampling and analysis service can be applied to all fuels commonly used for marine applications and covers low and ultra-low sulphur alternatives, together with lubricating and heavy oils.

Analysis is completed to ISO 4406 EN590 and ASTM standards and can inform an effective treatment regime to protect fuel integrity throughout the product lifecycle.

Key benefits include:

- Confirm the quality of fuel in storage or verify supplies at the point of on-boarding.
- Identify a range of contaminants and their severity.
- Inform an effective treatment regime for fuel on-board ship, with benchmarking provided from the initial sample.

Fuel polishing and conditioning

A fuel polishing and conditioning service that uses unique filtration and chemical technology to decontaminate and recover spoilt fuel supplies.

Fuel polishing is the most effective means available to salvage contaminated fuel, and works by removing contaminants including moisture, bacteria, sediment, sludge and particles from the fuel mix.

Our service uses a unique filtration system that can be integrated permanently into a vessel's fuel system, or linked from the quayside to condition on-board fuel supplies whilst in port or dry dock. Filtration can be achieved from 10 microns, down to 0.5 microns, with treated fuel returned to the vessel within BS EN fuel standards.

Key benefits include:

- Salvage contaminated fuel on-board and in bunkering facilities.
- Avoid costly waste disposal charges and costs related to replacing contaminated fuel.
- Extend the shelf life of fuel in ship's storage tanks.
- Minimise fuel system downtime, maintenance costs and component wear.
- Realise improved fuel efficiency.

Tank and fuel system cleaning

Fuel tank cleaning is an essential element of a robust approach to fuel stewardship and offers a proven means to purge on-board fuel systems of any impurities that can transfer to the fuel supply.

Our fuel tank cleaning service is bespoke to an individual fuel system and can draw on manual and automated approaches to provide a safe and thorough cleanse of a vessel's fuel storage and handling facilities.

Key benefits include:

- Minimise the chances of fuel developing contamination issues post bunkering.
- Improve system efficiency and reliability.
- Minimise component wear and reduce the frequency of system filter replacements.
- Extend the operational lifespan of tanks and fuel handling systems.





Key products and services:

- Marine chemicals
- Refrigeration and air conditioning
- Firefighting equipment and services
- Marine safety equipment
- LSA liferaft service and repair
- EndoSan wide-spectrum disinfectant
- Marine fuel testing and treatment
- Instrument calibration
- Marine gas detectors
- First aid and medical gases
- Jet washers
- Lorry loader and quayside services
- Narwhal Rigid Inflatable boats
- Welding equipment and services

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