VPS ARTICLE

Distillate Fuels: The "Trouble-Free" Marine Fuel?

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Introduction to Distillate Fuels

With the recent implementation on 1st May 2025, of a new Emission Control Area (ECA) in the Mediterranean Sea, the question arises, will we see an increase in demand for marine gas oils/distillates? If so, will a higher demand result in a lower quality product? This article looks to address current marine distillate quality and the test parameters which can be employed to assist in determining fuel quality and the relevant fuel management considerations, required to mitigate any associated risks through the following:

1. Density
2. Viscosity
3. Flash Point
4. Cold-Flow Properties
5. Lubricity
6. FAME
7. Microbial Activity
8. Incompatibility

For decades global shipping has thought of distillate fuels, as problem-free fuels. Yet whilst High Sulphur Residual Fuels and Very Low Sulphur Fuels, offer certain fuel management challenges, marine distillate fuels, are not exempt, they simply have different considerations and challenges.

Within the ISO8217:2024 marine fuel standard, there are four grades of fossil marine distillates, DMA, DMB, DMX, DMZ, plus three Fatty Acid Methyl Esters (FAME) containing distillates, DFA, DFB and DFZ, to support decarbonization compliance.

Today, DMA is the most commonly used marine distillate. Suitable for most marine engines, DMA is known for its cleaner combustion, consistent performance, and ability to reduce emissions when compared to heavier, residual marine fuels. This type of fuel is also commonly referred to as, Low-Sulphur Marine Gas Oil (LSMGO).

DMA: This is the LSMGO Highlighted above. As per its classification, it's a standard marine distillate suitable for various marine engines.

DMB: The heaviest fuel among the distillates and is typically used in medium-speed marine engines.

DMX: Often referred to as a special light distillate, DMX is used primarily for emergency engines and equipment, plus some high-speed engines that require fuels with lower viscosity and density.

DMZ: This is a clean distillate intended for use with more sensitive engines.

Ultra Low Sulphur Fuel Oil (ULSFO) is another similar fuel type. Marine fuels like DMA are often integrated with specific additive blends, these are designed to address and counter challenges typical of marine environments, for instance, microbial growth in storage tanks. DMA's cetane number, which indicates the ignition quality of the fuel, usually surpasses 45, whilst

ULSFO's cetane number floats between 40 to 45. While there are premium diesel variants with a higher cetane number, the main objective of ULSFOs is to lower sulphur emissions.

The higher cost of DMA is another differentiating factor and can be swayed by marine-specific rules, the demand it witnesses in ports, and the overarching dynamics of the global marine fuel market. For ULSFO, its pricing hinges mainly on elements like crude oil prices, the capacity of refineries, transportation overheads, and the demand from the road transportation sector.

Marine Distillates (MGO) and ULSFOs account for 14.2% and 1.2% respectively, of all fuel samples sent to VPs for testing:

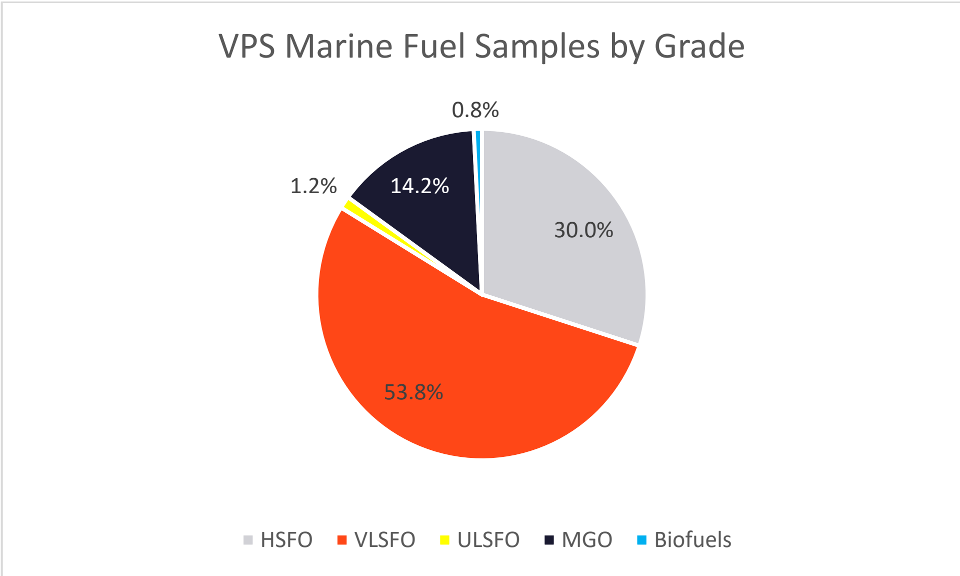


Figure 1 : VPS Sample Receipt by Fuel Grade

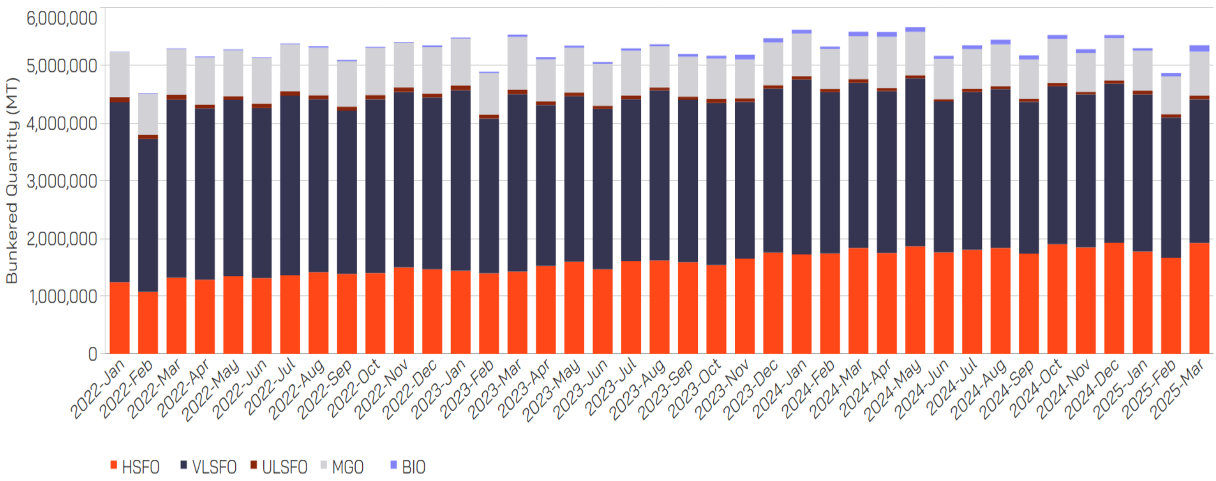


Figure 2 : Bunkered Quantities Tested by VPS per fuel type

Whilst distillate deliveries remained stable in Q1-2025 at around 800,000mt, ULSFO deliveries have risen 15% quarter-over-quarter.

Fuel Management Concerns relating to Marine Distillates

Minimising Financial Risks: Density Short-lifting - Fuel is delivered by volume but paid for by weight. Overstated density stated in a Bunker Delivery Note (BDN) results in operators paying for fuel that was not actually supplied. VPS data and vast experience indicates that short lifting of distillates significantly exceeds that of HSFO and VLSFO. This fact, together with the premium price of distillates can be a substantial drain on the operating budget of a company.

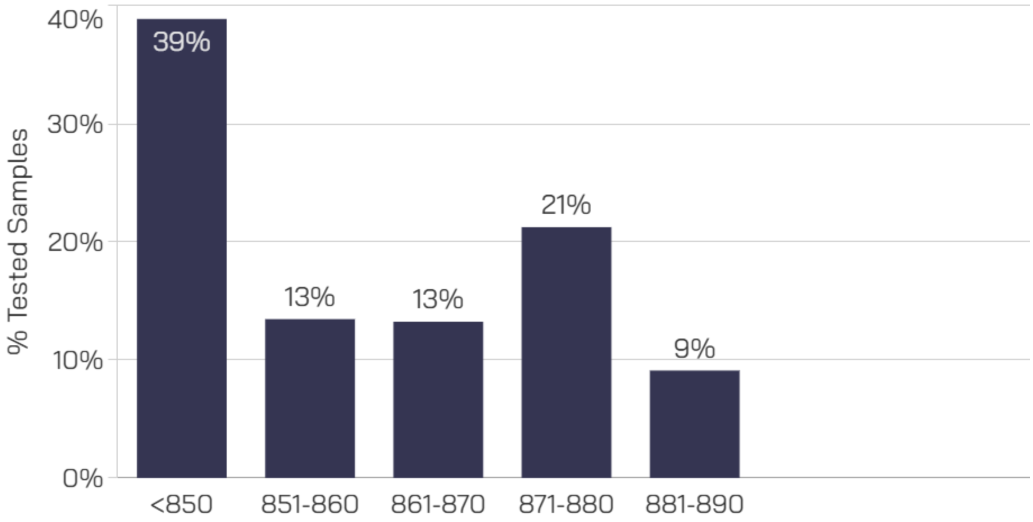


Figure 3: Tested MGO Density Levels Q1-2025

Currently 39% of MGO samples tested by VPS, fall below 850Kg/m^3, where the ISO8217:2024 specification limit is 890Kg/m^3. The BDN values are predominantly higher, indicating such overstatements, result in lost fuel for the vessel.

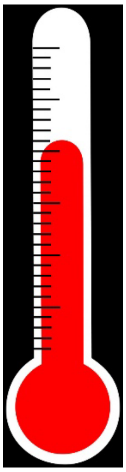
Mitigating Operational Risks: Low Viscosity - Marine fuel delivery systems and engines are generally designed for operating on higher viscosity HSFO and VLSFO. The low viscosity of distillate fuels may result in insufficient injection pressure which could challenge engine start-up, manoeuvring, or low load operation.

Even without heating the fuel, a warm engine room can easily heat the fuel to e.g. 50°C. A fuel bunkered as 2cSt at 40°C, will have a viscosity of 1.7cSt at 50°C, below the required minimum 2cSt that is recommended by major engine, boiler and pump manufacturers.

Currently 99.1% of all MGO samples tested by VPS in Q1-2025, have a viscosity >2.0 CSt and less than 6.00 CSt.

Ensuring Compliance with Statutory Regulations: Low Flash Point - Flash point is the temperature at which the vapours of a fuel ignite when a test flame is applied. It is considered to be a useful indicator of the fire hazard associated with the storage of marine fuels. The Safety of Life at Sea (SOLAS) convention and ship classification society rules, require all fuels to have a flash point of more than 60°C, with the exception of Emergency Equipment (eg lifeboat engines). Yet, the Flash Point of marine distillates is an on-going issue. In 2024, the Flash Point cases relating to MGO fuels, accounted for 22% of the Bunker Alerts issued by VPS.

Poor Cold-Flow Properties: Poor cold flow properties, indicated through pour point (PP), cold filter plugging point (CFPP) and cloud point (CP), can lead paraffinic wax precipitation from the fuel. This wax can then lead to clogged filters and pipe lines and in the worst case, complete solidification of the fuels in vessel tanks if not heated sufficiently.



- **Cloud Point** - temperature at which the distillate fuel becomes slightly opaque in appearance - wax crystals begin to come out of solution.
- **Cold Filter Plugging Point** - is defined as the highest temperature at which a given volume of fuel will fail to pass through a standardized filtration device in a specified time, when cooled under specified conditions.
- **Pour Point** - is stated as being the lowest temperature at which oil ceases to flow upon cooling.

In Q1-2025 the average Pour Point of MGO dropped to -7°C:

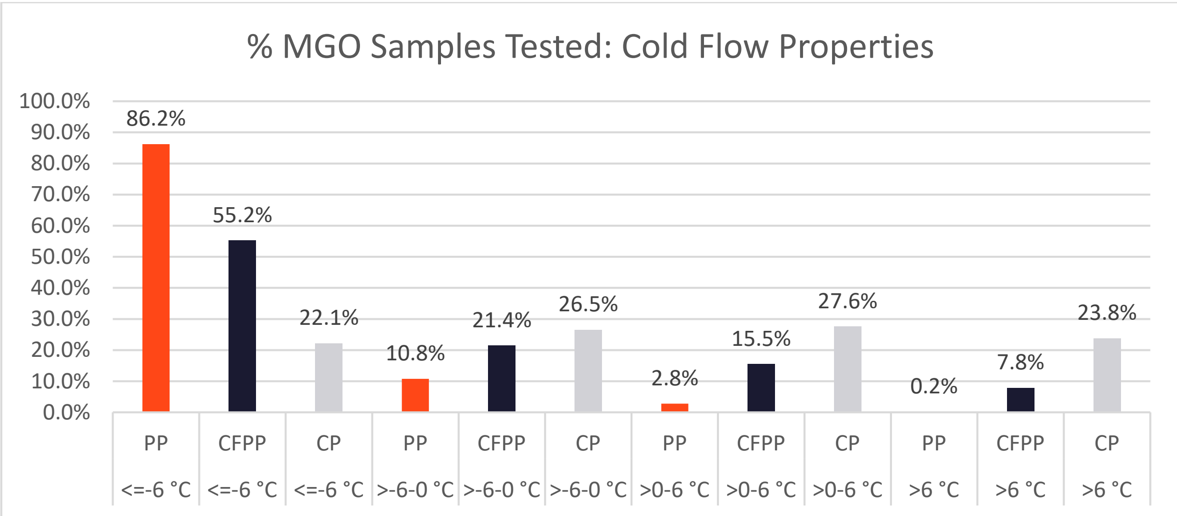


Figure 4: MGO Cold-Flow Test Data Q1-2025

Insufficient Fuel Lubricity: Marine engine fuel pumps are self-lubricated. If the lubricity of the distillate is poor, high wear may be caused usually within a short period of time. The risk of encountering poor lubricity is higher when sulphur is below 0.05% (500ppm). Therefore, in such cases testing the fuel for its lubricity level is a key requirement. This is undertaken via laboratory test method ISO12156-1, with a specification limit of 526µm Corrected Wear Scar Diameter.

Many people believe it is sulphur which actually provides the distillate with its natural lubricity. This is incorrect. The process to remove sulphur from fuel is termed, “hydrodesulphurization” and it is this process to remove sulphur which also removes polyaromatics present, which do provide the natural lubricity to fuels.

Fatty Acid Methyl Esters (FAME): It now seems ironic that prior to ISO8217:2010, FAME was seen as a contaminant if found within marine fuels. Then the 2010 revision, allowed “de-minimus” levels of FAME to be present in marine fuels. The ISO8217:2017 went a step further by including three new distillate grades, DFA, DFB and DFZ, with a FAME limit of 7% in each. Now the ISO8217:2024 allows up to 100% FAME in relation to marine biofuel blends.

Although FAME has good ignition, combustion and lubricity properties, as well as providing a reduction in GHG emissions, it can reduce oxidation stability and increase the risk of microbial growth. The risks increase if the fuel is to be stored for a prolonged period of time, e.g. more than 3 months.

Microbial Contamination: Bacteria, **y**east and **f**ungi can live and thrive in distillate fuel tanks in the presence of water and elevated temperatures. Such conditions provide an ideal environment for microbial growth. Such microbes, if allowed to grow can lead to operational issues such as clogged filters/nozzles and corrosion in fuel tanks and pipework. This situation can be further complicated by the presence of Fatty Acid Methyl Esters (FAME), which can provide a further source of nutrients for bugs to feed upon. To monitor this microbial activity it is recommended to carryout BYF-testing. Good onboard house-keeping, ensuring a water-free environment will reduce the risks of bug-growth. However, should the situation deteriorate, then biocides can be used to kill the microbes.

Figure 5: Damage caused by the presence of microbes

Incompatibility Issues: Loss of propulsion and/or fuel incompatibility during fuel change-over from HSFO or VLSFO to a distillate fuel when entering an emission control area (ECA) is another problem that ship operators should be aware of. Changing between residual-based fuels and distillate fuels can inevitably result in mixing in the fuel system. The result may be incompatible mixtures and in the worst case, a loss of propulsion.

MGO Off-Specifications: In Q1-2025, 7.3% of MGO samples tested were off-specification for at least one test parameter. The Top 4 off-specification parameters were Pour Point (39%), FAME (23%), Flash Point (14%) and Lubricity (7%). In terms of Off-specification Distillates by region, 22% of samples tested from Singapore were off-specification, with 7.3% of those from Europe, 7% off-specification samples from North America and 4.7% of samples from Asia Pacific.

VPS Additional Protection Service (APS): For a number of years VPS have recognized some of the short-comings of various revisions of ISO8217, in not providing sufficient protection to vessels, crew and the environment. For this reason VPS introduced the Additional Protection Service (APS) which offer ISO8217 testing plus some key additional tests, to support greater protection and provide more information about the fuel ship owners and operators are purchasing. This service includes a test slate for marine distillates:

	Distillates
Full ISO 8217 scope	X
Cold Flow properties (CP & CFPP)	X
Lubricity (when S is </= 0.05%m/m)	X
Fame	X
BYF	X

VPS also provide APS-Bio packages, which cover biofuels, including MGO/FAME blends.

Summary

It is fair to say, despite some opposing opinions, that marine distillates can exhibit challenging fuel management issues. Like all fuels, distillates have their pro's and their con's, but if the con's are known and understood, then the associated risks can be minimized. Testing of distillates is a major part of this fuel management process in reducing the potential risks associated with poor quality distillate fuels.

As the drive to decarbonize shipping continues, the reduction of GHG along with sulphur oxides (SOx), nitrogen oxides, (NOx) and particulate matter (PM) will continue. So, just as the Mediterranean Sea have now implemented a new ECA, other regional ECAs will come into force.

Going forward at this time, the sulphur limit to enter and operate within an ECA will continue to be 0.10%, This will inevitably lead to an increase in demand for MGO fuels and ULSFOs for vessels sailing within these waters. We may also see an increase in demand for FAME/MGO biofuel blends in order not only achieve the sulphur requirements, but also to simultaneously reduce the CO_2 and GHG emissions within the ECAs.

On average, the world fleet spends an estimated 6% of time at sea within the Mediterranean ECA, based on 2024 data, with cruise and passenger vessels among the most exposed vessel types, each spending around 20% of time at sea within the ECA boundaries.

Already within the Mediterranean Sea, we have seen an increase in marine distillate bunkerings. May-25 is already showing an increase in distillate tonnage deliveries of +35% over May-24 and a comparison between January-25 and May-25 suggests distillate tonnage to increase by 2.5 times. The off-specification of distillates is currently running at 3.1% within the Mediterranean Sea.

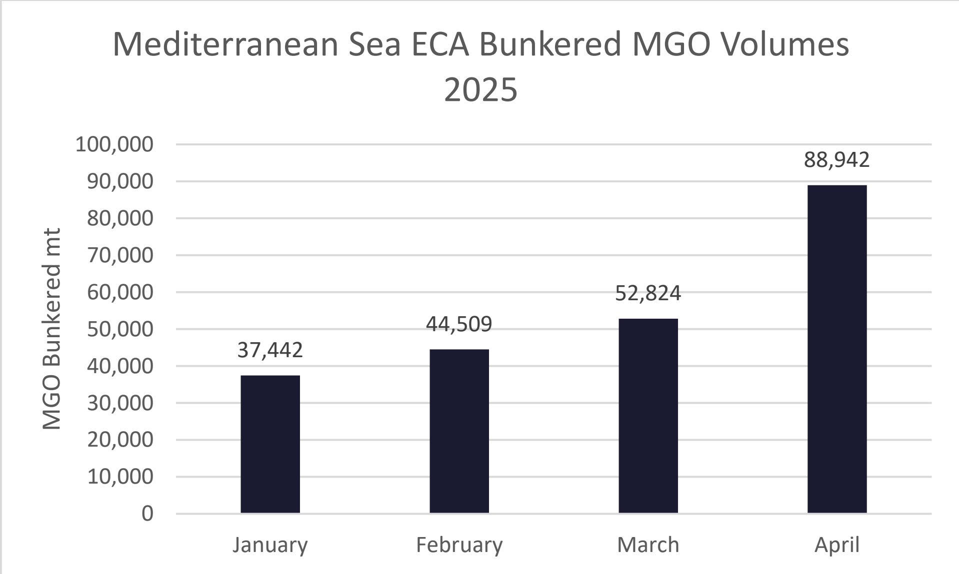


Figure 6: MGO Bunkered Volumes 2025 – Mediterranean Sea ECA

With developments and advances in marine fuels progressing at an ever increasing rate, it is more important than ever for vessel owners and operators to work closely with a Fuel Management partner, such as VPS, to ensure protection and compliance in this fast-changing world.

For further information and support regarding your marine distillates fuel management, please contact:
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