

# MARINE FUEL QUALITY TESTING



***TRIBOCARE***  
***MARINE LABORATORIES***

## ***INTRODUCTION***

Tribocare is a new generation testing organization using the latest analytical techniques to examine the quality of your products.

We offer our services worldwide, with great emphasis and experience to the marine sector.

Our laboratories are strategically located to meet with fast and thorough service our global client's demands.

They are established in the **Sharjah emirate of the United Arab Emirates** and in **Singapore** which are well connected to the East and West.

We guarantee first-class service at reasonable cost with quick turnaround time.



Our core services are:

- ❖ **Marine Fuel Quality Testing**
- ❖ **Investigative Analysis on Problematic Fuels**
- ❖ **Bunker Quantity Surveys**
- ❖ **Marine Lubricants Used Oil Analysis – Condition Monitoring**
- ❖ **Research and Development Testing on Marine Lubricants**
- ❖ **Cylinder Scavenge Drain Oil Analysis – CLO feed rate optimization**
- ❖ **Potable Water Testing,**
- ❖ **Ballast Water Effluent Compliance Analysis**
- ❖ **Sewage and Graywater Analysis,**
- ❖ **Bilge Water Separator Effluent Analysis**
- ❖ **Scuba Air Quality Testing**
- ❖ **Fire Foam Testing**

## **MARINE FUEL TESTING**

*Fuels analysis is a very important aspect of machinery maintenance. Testing fuel for suitability before use is essential. Even though fuel related machinery problems are caused by only a small percentage of all the fuels which are supplied, the importance of regular fuel testing should not be underestimated.*

*Fuel analysis can identify potential causes for fuel filter plugging, smoke, loss of power, poor injection performance, malfunctioning throttle position sensors and sticking valves.*

*Other than creating operational problems, fuels of unknown quality may lead to commercial losses or violation of statutory requirements.*

*By not following local or global environmental regulations may result in penalties such as vessel detentions and fines.*

*Our laboratories test to international industry and regulatory standards, including ISO 8217, Marpol Annex VI, SolasCh.II-2, Reg. 4 and other specifications.*

*Our capabilities include:*

***Asphaltenes, Ash, Carbon Residue***

***Compatibility/Stability***

***Cold Flow Properties***

***Density, Flashpoint***

***Sulfur Content, Lubricity***

***Microbes Contamination***

***Pour Point***

***Total Sediment Potential (TSP)***

***Viscosity, Water Content***

***ISO 8217 Bunker Fuel Testing***

***Bunker Fuel Chemical Contamination Screening***



*And more...*

## **RESIDUE AND HEAVY FUEL OIL**

*Before using a certain fuel in your engine, the fuel quality should be established by analysing a small sample in a reliable and well-reputed laboratory. This will help to optimize consumption, ensure regulatory compliance and select an appropriate purification process to improve the fuel oil quality. Furthermore, it contributes to preventing engine downtime and avoiding expensive dry-docking of the vessel.*

*When choosing a laboratory the selection should be based on expertise, the quality of data*

*analysis and recommendations as well as the analysis speed, all of which at reasonable cost. Here in TRIBOCARE we fulfil all these requirements.*

*TRIBOCARE is fully equipped with state-of-the-art premium brand instruments to test bunker fuel samples in accordance with ISO 8217. In addition, we have the means to carry out screening tests to check the fuel for chemical contaminants and impurities.*

*We are committed to providing accurate results, always within 48 hours and at reasonable cost.*



## **LOW AND ULTRA-LOW SULPHUR GASOIL**

*Marine diesel engines are categorized as low-speed, medium-speed and high-speed. These three engine types require different fuels. Low-speed engines can be fuelled with residual fuels containing high Sulphur levels whereas medium-speed engine fuel requirements vary according to the engine design. Highspeed engines are sensitive to the fuel*

*quality and run on clear distillate fuel with low Sulphur content.*

*The application of diesel with less than 500 ppm Sulphur can cause wear to the pump in engines of earlier generations due to the reduced lubrication properties of low and ultra-low Sulphur fuels. The ISO 8217 standard specifies a lubricity limit for distillate fuels with less than 500 ppm Sulphur.*

## Analytical Protocols

RESIDUAL FUELS TESTING PARAMETERS			
S/N	Parameters	Units	Test Methods
1.	Kinematic Viscosity@50°C	mm <sup>2</sup> /s	ISO 3104/ASTM D 445
2.	Density@15°C	kg/m <sup>3</sup>	ISO 12185
3.	Sulphur Content	mass%	ISO 8754
4.	Flash Point	°C	ISO 2719 (Proc. A/B) modified
5.	Acid Number	mg KOH/g	ASTM D 664
6.	Total sediment Accelerated	mass%	ISO 10307-2
7.	Micro Carbon residue	mass%	ISO 10370
8.	Pour Point	°C	ISO 3016
9.	Water	vol %	ISO 3733/ASTM D 6304 Proc
10.	Ash	mass %	ISO 6245 modified
11.	Vanadium (V), Iron (Fe), Nickel (Ni)	mg/kg	IP 501
13.	Magnesium (Mg), Potassium (K)	mg/kg	IP 501 modified
14.	Sodium (Na), Calcium (Ca)	mg/kg	IP 501
15.	Zinc (Zn), Phosphorus (P)	mg/kg	IP 501
16.	Aluminium (Al), Silicon (Si)	mg/kg	IP 501
CALCULATED VALUES			
22.	CCAI	-	ISO 8217, Annex B
23.	Net/ Gross Specific Energy	MJ/kg	ISO 8217 Annex E
25.	Aluminium + Silicon	mg/kg	IP 501
26.	Injection Temperatures	°C	For Injection Viscosities of 8/10/11/12/13/15/18 & 20



MARINE DISTILLATE FUELS TESTING PARAMETERS						
S/N	Parameters	Units	Test Methods	DMA	DMB	DMZ
1.	Appearance	-	ISO 8217, 7.6	✓	✓	✓
2.	Kinematic Viscosity@40°C	mm <sup>2</sup> /s	ISO 3104/ASTM D 445	✓	✓	✓
3.	Density@15°C	kg/m <sup>3</sup>	ISO 12185	✓	✓	✓
4.	Sulphur Content	mass%	ISO 8754	✓	✓	✓
5.	Flash Point	°C	ISO 2719 (Proc. A/B)	✓	✓	✓
6.	Acid Number	mg KOH/g	ASTM D 664	✓	✓	✓
7.	Micro Carbon residue on 10% volume distillation residue	mass%	ISO 10370	✓	-	✓
8.	Total Sediment Existent	mass%	ISO 10307-1	-	✓	-
9.	Micro Carbon residue	mass%	ISO 10370	-	✓	-
10.	Pour Point	°C	ISO 3016	✓	✓	✓
11.	Water	vol %	ISO 3733/ASTM D 6304 C	If the distillate's sample appearance is hazy.		
12.	Ash	mass %	ISO 6245 modified	✓	✓	✓
13.	Vanadium (V)	mg/kg	IP 501	If the ash content in the sample is above 0.01%		
14.	Iron (Fe), Nickel (Ni)	mg/kg	IP 501			
15.	Magnesium (Mg)	mg/kg	IP 501 modified			
16.	Potassium (K)	mg/kg	IP 501 modified			
17.	Sodium (Na)	mg/kg	IP 501			
18.	Calcium (Ca)	mg/kg	IP 501			
19.	Zinc (Zn), Phosphorus (P)	mg/kg	IP 501			
20.	Aluminium (Al), Silicon (Si)	mg/kg	IP 501			
21.	10% / 50% / 90% recovered temperatures	°C	ASTM D86	✓	✓	✓
22.	Lubricity	-	ISO 12156-1	If the Sulphur Content is <500 ppm		
CALCULATED VALUES						
23.	Cetane Index	-	ISO 4264	✓	✓	✓
24.	Net Specific Energy	MJ/kg	ISO 8217 Annex E	✓	✓	✓
25.	Gross Specific Energy	MJ/kg	ISO 8217 Annex E	✓	✓	✓

## **Advanced Fuel Testing**

*There have been numerous occasions where operational problems were observed by the use of Marine Fuels complying with the ISO8217 standard. These fuels blocked filters, damaged the fuel pumps or even the engines, and exhibited poor burn quality.*

*In Tribocare, we have the knowledge and the means to protect our customers from those fuels prior to use, as well as assist them in defining the root cause of the problem and proceed to the required actions after facing the problems.*

*Besides ISO8217 routine testing we are offering the following advanced testing as well:*

### **HEADSPACE GC-MS ANALYSIS FOR CHEMICAL CONTAMINANTS**

*GC-MS headspace screening is a high-end forensic, yet rapid technique, to identify the presence of known common chemical contaminants, before the fuel is actually burnt and this adds an additional level of damage prevention and asset protection to the vessel.*



### **GC-MS COMPREHENSIVE ANALYSIS**

*In order to provide highly accurate quantitative analysis at potentially low detection limits, GCMS Direct-injection is the ultimate forensic tool in specific chemical identification. Used specifically in post-burn fuel quality investigation, this technique requires a high degree of analytical chemistry expertise and experience, but can provide detailed evidence in fuel quality disputes.*

### **ASPHALTENE CONTENT ANALYSIS**

*High asphaltene content fuels have the greater tendency to form sludge especially when blended with incompatible hydrocarbons. If the paraffinic nature of the hydrocarbon medium increases then the asphaltene separation may occur.*

## **SEPARABILITY NUMBER**

Separability number (SN), also referred to as reserve stability number (RSN), indicates the resistance of a residual fuel oil to form sludge. Separability number determines the extent an oil phase separates from the colloiddally aggregated asphaltenes upon the addition of a paraffinic solvent. High separability number is an indication of asphaltene aggregation resulting a poor stability reserve of the oil. Separability number is an excellent accompaniment to the routinely hot filtration methods. It can identify potentially troublesome fuels (unstable) even when the HFT method is indicating a low sediment content. Conversely, it may indicate that a high sediment fuel is in fact quite stable and unlikely to form sludge. This information in combination, is extremely useful from an operational perspective, as it will indicate in advance if and what mitigation steps are appropriate.

## **FAME CONTENT (ASTM D7963)**

Clause 5.1 of ISO 8217:2017 mentions "The DMA, DMZ, DMB and RM grades shall not include FAME other than a "de minimis" level. In the context of this

document, "de minimis" means an amount that does not render the fuel unacceptable for use in marine applications that are not designed or suited to handling fuels containing FAME." By analyzing acc to the ASTM D7963 we can identify the presence of FAMES in the fuels. The presence of significant concentration of biofuel and water in the fuel can facilitate microbial growth which can lead to sludging and thereby filter clogging.

## **CATFINES SIZE DISTRIBUTION**

Studies have indicated that not only the cat fines concentration but also the size of the cat fines plays a part in the wear process. Evaluating the size of Catfines has proven useful, especially, in trouble shooting cases. It can be used in conjunction with Purifier Testing.

## **OTHER**

Based in the description of the operational problems faced, additional tests like acidity, Toluene-Xylene Equivalents or others can be proposed and performed by Tribocare, in order to find the root of the complications.

## Benefits of Engaging in Tribocare's Fuel Testing Program



Our Fuel Testing Services, are designed in such a way, that allows our Clients to have the minimum possible engagement in the whole procedure, thereby liberating valuable time to tend other matters.

We achieve this by, undertaking all the administrative works, such as providing sampling kits directly to the vessels, arranging sample transportations even from the most

difficult ports in the world, chasing the agents to send the samples timely and guaranteeing minimum time of sample delivery in our labs.

The analysis results are reported within 24 hours of samples receipt in our laboratories and we give specific guidance on how to use the fuel according to the testing results.

We offer as well 24/7 technical support to keep you in a perfect piece of mind.

### Our Program offers:

- Testing and Interpretation of the results.
- Vessel-specific Onboard Fuel Treatment Advising based on the provided Ship Information form
- Provision of Sampling Kits
- Free Transportation of the Kits directly to the Vessel or designated Client's Stock Point
- Global Transportation arrangements of the Samples back to the lab.
- Password protected data with free access to our online portal via Computer or Phone Apps
- 24/7 Technical Support
- Guidance on Claims Handling, regarding testing procedures
- Guidance on Regulations



## United Arab Emirates

A2-74 SAIF Zone  
Sharjah  
United Arab Emirates  
+ 971 6 5528799  
[admin@tribocare.com](mailto:admin@tribocare.com)

## Singapore

32, Pandan Road,  
Singapore 609279  
+65 62642840  
[singapore@tribocare.com](mailto:singapore@tribocare.com)



## Greece/Cyprus

Patriarchou Grigoriou 23,  
Nea Erythraia, 14671, Athens  
+30 6943000835  
[grsales@tribocare.com](mailto:grsales@tribocare.com)

## Germany

Kornkamp 32  
D-22926 Ahrensburg  
+49 4102 6075  
[lassen@tribocare.com](mailto:lassen@tribocare.com)

## Hong Kong

Room 1201, 12/F, AT Tower  
180 Electric Road, North Point, Hong Kong  
Ph +852 5702 7694 , +852 9155 3632  
Fax: +852 2838 2602  
[info@jcmarine.hk](mailto:info@jcmarine.hk)

