

VERIFUEL – UNDERSTANDING MARINE FUEL

2020 FUELS Bill Stamatopoulos

Oct 2019



Myth Busters

- Myth No 1: VLSFOs will be Blended Fuels
- Fact: It's just that the blend recipe needs to change to meet the lower S limit
- Myth No 2: Compliance is a 2020 problem
- Fact: Preparation is the key to success. It is not a 2020 problem, it is a **2019** challenge because when we get to 2020 it is too late
- Myth No 3: There is no Specification for the VLSFOs
- *Fact:* Fuels will still be sold in accordance with ISO 8217:2017 addressing all of the technical issues apart from compatibility.





Myth Busters



Myth no 4: Cat fines will be a big problem for the VLSFOs

Fact: The max 1.00% S fuels contained more cat fines on average than the HSFOs. So far VLSFOs on average, contain same amount of cat fines as the HSFOs but the density and viscosity is lower, ie. relatively easier removal of cat fines (27/25 ppm)

Myth No 5: The 2018 fuel incident experienced with HSFO from Houston were a pre-warning for VLSFO issues.

Fact: Endemic marine fuel cases occur with regular intervals of some 3 years. In the 2018 case, all involved fuels were HSFOs. Since 2015, we tested a large number of ULSFO for ECAs. A small number of these low sulphur fuels had initial "teething" issues, but in the 5 years since the introduction of these fuels, there have been no endemic cases associated with ULSFO. With most endemic cases occurring with HSFOs, there is no reason to believe why VLSFO should have more compared with HSFO in 2020.



What may / will happen in 2020 ?



Key parameters for 0.50% sulphur marine Fuel Oil blending will be:

- **Stability** (Paraffinic vs Cracked blend components) **Pour Point**
- Acidity (Sweet crude sources with high AN DOBA)
 Viscosity (No minimum limit in ISO 8217, Table 2)
 CCAI (Difference between viscosity and density)



High boiling asphaltene-free material with good ignition properties, high flash point and higher viscosity & pour point than distillates.

The behaviour is defined by their paraffinic/waxy nature.



On VLSFO availability

- ✓ Singapore: as of 01 Mar 2019
- ✓ Fujairah: as of Feb 2019
- ✓ ARA: First bunkering performed in early Feb 2019
- China: available
- ✓ S. Korea: available
- Russia: tested their first samples in May 2018
- ✓ Spain and Portugal: tested their first samples in Dec 2018
- Taiwan, Japan, Greece, Aruba, Istanbul, Bonaire, Brazil, Curacao, UK, Skaw, Panama Canal, Gulf of Oman, Off Lome, Italy, India, Brazil.









Piraeus FO production from 2.1 down to 1.3 mil mts*

PORT	kMT	
Piraeus	1.800	
Thessaloniki	5	
Patra	180	*1,15 mil mts will be the estimated VLSFO production
Igoumenitsa	20	
Crete	250	2019 · 1.8 mil mts HSFO
Siros	130	2020: 170,000 mts HSFO
Kalimnos	90	
Various	220	2019: 460,000 mts LSMGO
Total	2.700	2020: 635,000 mts LSMGO





GROUP OF COMPANIES

Storage Moves Ahead of 2020



- Denmark: Terminal comprised of 11 storage tanks (74,000 cubic meters) leased
- **Rotterdam:** Began maintenance at its storage facility
- **Singapore:** Tankage is now tight. There was a lot of open capacity a few months ago and almost all of it now taken on a spot basis
- **Off shore:** Storage via ULCC carrier.
- * Vitol will finalize the construction of a new refinery in Malaysia (30.000 barrels per day) in May 2020 to help up with the upcoming demand







New VLSFOs basis testing

	Russia	Spore Rot,	Spore	Spore	Houston	Fujairah	Spore	Shanghai
	RMD 80	N. Orl.	RMG 380	RMG 380	RMD 80	RMG 180	RMG 180	
Density (kg/m³)	911.6	955.2	946.1	947.4	903.5	930.3	959.3	928.9
Viscosity (mm²/s)	35.4	72.0	139.6	337.7	34.5	126.1	162.1	198
Sulphur (%m/m)	0.48	0.45	0.45	0.45	0.30	0.30	0.34	0.31
TSA % (m/m)	0.02	0.02	0.01	0.06	0.01	0.01	0.01	0.04
Pour Point (°C)	24	15	<21	9	24	3	24	15
Al + Si (mg/kg)	5	30	35	34	8	15	16	15
CCAI	803	836	818	810	796	804	830	797





New VLSFOs basis testing – ARA area

VLSFOs	RMG 380	RMG 180	RMG 180	RMG 380	RMD 80
Density (kg/m ³)	985.9	929.9	937.3	921.2	939.1
Viscosity (mm²/s)	165.5	132.4	34.3	130.0	76.8
Sulphur (%m/m)	0.47	0.38	0.47	0.49	0.47
TSA % (m/m)	0.06	0.17	0.03	0.02	0.06
Pour Point(°C)	<21	<21	27	27	<21
Al + Si (mg/kg)	17	8	47	7	12
NSE (MJ/kg)	41.00	41.89	41.70	41.97	41.65
CCAI	856	803	830	794	819





VLSFO Parameter Ranges (Jan to Aug, 2019)

Parameter		VLSFO				
Falametei	Average	Min	Max	Average		
Visc@50°C (cSt)	260.1	8.05	379.1	337.2		
Dens@15°C (kg/m ³)	949.5	884.1	985.9	982.6		
Sulphur (% m/m)	0.39	0.23	0.52	2.54		
Sediments (% m/m)	0.03	0.01	0.17	0.04		
Al+Si (mg/kg)	23	2	56	26 43,0		
Ash (% m/m)	0.022	<0.010	0.051	0.044		







VLSFO parameters ranges

Daramatar	Results May to August 2019					
Parameter	Average	Min	Max			
Visc@50°C (cSt)	151	4.21	372			
Dens@15°C (kg/m3)	947.3	881.7	985.6			
Sulphur (% m/m)	0.46	0.32	0.51			
Sediments (% m/m)	0.04	< 0.01	0.35			
Al+Si (mg/kg)	24	<2	49			
Ash (% m/m)	0.020	<0.010	0.033			



Hellenic Petroleum Refinery – RMG 380 8217:2017



VLSFOs	AVERAGE
Density (kg/m ³)	909.2
Viscosity (mm²/s)	22
Sulphur (%m/m)	0.48
TSA % (m/m)	0.04
Flash point (°C)	63.5
Al+Si (mg/kg)	9
MCR (% m/m)	4.4
Pour Point	<-18C



Singapore VLSFO









Suppliers preparing

VLSFOs –	Belfast	Civitavecchia	Piraeus	Reykjavik	Galway	
RMG 380	BDN: 0.58	BDN: 0.62	BDN: 0.52	BDN: 0.64	BDN: 0.67	
Density (kg/m³)	960.8	954.1	959.4	921.2	961.2	
Viscosity (mm²/s)	255.4	237.5	269.5	130.0	366	
Sulphur (%m/m)	0.54	0.57	0.56	0.64	0.58	
TSA % (m/m)	0.02	0.01	0.05	0.03	0.03	
Pour Point (°C)	<21	<21	<21	<21	<21	
Al + Si (mg/kg)	37	9	10	26	47	



PAS 23263 – Sep 2019



- ✓ ISO TC28/SC4/WG6 developed the Publically Available Specification (PAS 23263) for the interim period that will provide detailed guidance to fuel suppliers and users on key identified fuel aspects.
- ✓ The PAS 23263 shall be used in conjunction with ISO 8217:2017
- ✓ PAS 23263 reconfirms that ISO 8217:2017 also covers the new fuels and makes <u>specific quality</u> <u>considerations</u>:
 - □ Viscosity expected to vary widely.
 - □ Cold flow properties wider range of fuel formulations. Some 0,50 mass % S fuels can exhibit tendencies towards being of a waxier nature.
 - Compatibility Due to the expected higher variety in fuels composition post 2020, the risks for incompatibility between fuels might increase.





Preparing for 2020 fuels

- Make a risk assessment and mitigation plan
- ✓ Review existing fuel management plan
- Complete vessels' implementation plan
- Evaluate vessels' installations:
- Tanks (number, cleaning, segregation, heating capacity)
- Fuel treatment systems (separators, filters, heating options)
- ✓ Review and implement optimum cylinder oil arrangements
- ✓ Introduce new bunker or charter party clauses
- ✓ How to secure compliant fuel from supplier?
- ✓ Steam excess generation?



How to deplete non-compliant fuel before the carriage ban?

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VLSFO ULSFO MDO 0.50%

LSMGO 0.10%

SIP template

artic	culars of shi	ip	3	Fuel o	il capacity and segregation capability:
	1. N	Name of ship:		Followi	ng any required modifications as per Section 2:
	2. D	Distinctive number or letters:			
	3. II	MO Number:		3.1	Expected number of bunker tanks designated to store 0.50% sulphur compliant fuel oil:
lann	ning and pre	paration (before 1 January 2020)		3.2	Expected total storage capacity (m ³) for 0.50% sulphur compliant fuel oil:
	Risk assessment and mitigation plan			2.2	Europeted number of humber tenks designated to store 0.10% subhur
	1.1 F 1.2 L	Risk assessment (impact of new fuels): YES/NO Linked to onboard SMS YES/NO		3.3	compliant fuel oil:
	Fuel oil s	system modifications and tank cleaning (if needed)		3.4	Expected total storage capacity (m ³) for 0.10% sulphur compliant fuel oil:
	2.1 S	Schedule for meeting with manufacturers and/or classification societies:		3.5	Approximate total fuel oil content (m ³) in the fuel oil transfer, purification and delivery systems:
			4	Procu	rement of compliant fuel oil
				4.1	Details of fuel purchasing procedure to source compliant fuels, including procedures in cases where compliant fuel oil is not readily available:
	2.2 S	Structural Modifications (installation of fuel oil systems/tankage) required: YES/NO/NOT APPLICABLE			
	If YES, the	ien:			
	2.2.1 F	Fuel oil storage system:			
	Descriptio	on of modification:		4.2	Estimated date for bunkering compliant fuel oil, not later than 24:00hrs 31 December 2019:
				4.3	If fuel arranged by charterer, is there an intention to accept charter party contracts that do not have a specified obligation to provide compliant fuel oil after 1 June 2019 or other date to be identified: YES/NO

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SIP template

6

More than a manual..

5 Fuel oil changeover plan

- 5.1 Consider whether a ship-specific fuel changeover plan is to be made available. The plan should include measures to offload or consume any remaining non-compliant fuel oil. The plan should also demonstrate how the ship intends to ensure that all its combustion units will be using compliant fuel oil no later than 1 January 2020.
- 5.2 As per the ship-specific fuel changeover plan, the maximum time period required to changeover the ship's fuel oil system to use compliant fuel oil at all combustion units:
- 5.3 Expected date and approximate time of completion of the above-mentioned changeover procedure:
- 5.4 Consider availability of adequately trained officers and crew familiar with the ship's fuel system and fuel changeover procedures to carry out the fuel oil changeover procedure. If this cannot be confirmed, then consider whether there is a sufficient amount of time dedicated for ship-specific familiarization and training of new officers and crew.

Documentation and reporting

- 6.1 If there are modifications planned as per section 2, related documents including the shipboard fuel oil tank management plans and stability and trim booklets should be consequently updated.
- 6.2 The implementation plan could be kept on board and updated as applicable.
- 6.3 If when following the implementation plan the ship has to bunker and use non-compliant fuel oil due to unavailability of compliant fuel oil safe for use on board the ship, steps to limit the impact of using non-compliant fuel oil could be:

6.4 The ship should have a procedure for Fuel Oil Non-Availability Reporting (FONAR). The master and chief engineer should be conversant about when and how FONAR should be used and who it should be reported to.

Administrations and PSC authorities may take into account the SIP when verifying compliance with the 0.50% sulphur limit requirement.





FONAR – MEPC.320(74)

FUEL OIL NON-AVAILABILITY REPORT (FONAR)

Note:

1 This report is to be sent to the flag Administration and to the competent authorities in the relevant port(s) of destination in accordance with regulation 18.2.4 of MARPOL Annex VI. The report shall be sent as soon as it is determined that the ship/operator will be unable to procure compliant fuel oil and preferably before the ship leaves the port/terminal where compliant fuel cannot be obtained. A copy of the FONAR should be kept on board for inspection for at least 36 months.

2 This report should be used to provide evidence if a ship is unable to obtain fuel oil compliant with the provisions stipulated in regulations 14.1 or 14.4 of MARPOL Annex VI.

3 Before filing a FONAR, the following should be observed by the ship/operator:

3.1 A fuel oil non-availability report is not an exemption. According to regulation 18.2 of MARPOL Annex VI, it is the responsibility of the Party of the destination port, through its competent authority, to scrutinize the information provided and take action, as appropriate.

3.2 In the case of insufficiently supported and/or repeated claims of non-availability, the Party may require additional documentation and substantiation of fuel oil non-availability claims. The ship/operator may also be subject to more extensive inspections or examinations while in port.

3.3 Ships/operators are expected to take into account logistical conditions and/or terminal/port policies when planning bunkering, including but not limited to having to change berth or anchor within a port or terminal in order to obtain compliant fuel.

3.4 Ships/operators are expected to prepare as far as reasonably practicable to be able to operate on compliant fuel oils. This could include, but is not limited to, fuel oils with different viscosity and different sulphur content not exceeding regulatory requirements (requiring different lube oils) as well as requiring heating and/or other treatment on board.

Keep on-board for 3 years

> FONAR is not an exemption

Other compliant fuels are expected to be considered





FONAR template – MEPC.320(74)

3 Evidence of attempts to purchase compliant fuel oil

3.1 Provide a description of actions taken to attempt to achieve compliance prior to entering "country X" waters (and ECA, if applicable), including a description of all attempts that were made to locate alternative sources of compliant fuel oil, and a description of the reason why compliant fuel oil was not available:

3.2 Name and email address of suppliers contacted, address and phone number and date of contact (dd-mm-yyyy):

Please attach copies of communication with suppliers (e.g. emails to and from suppliers)

4 In case of fuel oil supply disruption only

4.1 Name of port at which ship was scheduled to receive compliant fuel oil:

5 Operation constraints, if applicable

5.1 If non-compliant fuel has been bunkered due to concerns that the quality of the compliant fuel available would cause operational or safety problems on board the ships, the concerns should be thoroughly documented.

5.2 Describe any operational constraints that prevented use of compliant fuel oil available at port:

5.3 Specify steps taken, or to be taken, to resolve these operational constraints that will enable compilant fuel use:

6 Plans to obtain compliant fuel oil

6.1 Describe availability of compliant fuel oil at the first port-of-call in "country X", and plans to obtain it:

6.2 If compliant fuel oil is not available at the first port-of-call in "country X", list the lowest sulphur content of available fuel oil(s) or the lowest sulphur content of available fuel oil at the next port-of-call:

Provide evidence of attempts to find compliant fuel

Provide plans to find compliant fuel



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Case 1: Ship received compliant fuel oil as per BDN but subsequently received a fuel test report indicating non-compliance (and if after 01 Mar 2020 also in violation of the HSFO carriage ban)

Issue notification to: Flag State / Bunker Port Authority / Supplier

The representative fuel sample as taken by the vessel and tested by Bureau Veritas VeriFuel indicates that the sulphur content in the fuel is above 0.50% m/m or 0.10% m/m (for ECAs) and above the declared sulphur content on the bunker delivery note.

We hereby lodge a protest to the supplier to reserve rights for any future consequences on this matter. We hereby also notify the relevant Authorities in accordance with the requirements of MEPC.181 (59) "Guidelines for Port State Control under the Revised MARPOL Annex VI".

The Authorities are hereby requested to consider initiating actions as specified in the Revised MARPOL Annex VI.





Case 2: MARPOL sample is the supplier's responsibility and its seal number should be reflected on the BDN. What if suppliers deliver a MARPOL sample to the vessel that was not witnessed?

Some operators decided as a standard operating procedure to always issue notification to: Flag State / Bunker Port Authority / Supplier

The MARPOL Annex VI sample(s) was/were not taken at receiving ship's manifold as per MEPC.182 (59).

We hereby lodge a protest to the supplier to reserve rights for any future consequences on this matter. We hereby also notify the relevant Authorities in accordance with the requirements of MEPC.181 (59) "Guidelines for Port State Control under the Revised MARPOL Annex VI".

The Authorities are hereby requested to consider initiating actions as specified in the Revised MARPOL Annex VI.



Preparing our Crews for 2020 fuels



BE ALERTED

BUNKER FROM BUNKER MIGHT BE VERY DIFFERENT





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Huge variations in viscosity, density and cold flow properties

PRODUCTS	Α	В	С	D	E
Density (kg/m³)	950.4	942.3			
Viscosity (cSt)	327.8	232			
Pour Point (°C)	<21	9			
Min Storage temp (°C) for 80 cSt or lower					
Temp (°C) separator					
Temp (°C) for 12.5 cSt injection viscosity					





Huge variations in viscosity, density and cold flow properties

PRODUCTS	Α	В	С	D	E
Density (kg/m³)	950.4	942.3	955.2	911.6	920.5
Viscosity (cSt)	327.8	232	72.0	35.4	13
Pour Point (°C)	<21	9	15	24	<21
Min Storage temp (°C) for 80 cSt or lower	40	35	30	34	30
Temp (°C) separator	98	98	98	60	40
Temp (°C) for 12.5 cSt injection viscosity	133	126	100	82	51



Set the viscosity controller to AUTO VISCOSITY MODE

Preparing our Crews for 2020 fuels



- Optimum fuel management: receiving different viscosities (ex.187 cSt in port A, 23 cSt in port B). Most of the staff are used to 380 or 500 cSt fuel that does not differ too much from one delivery to another. <u>Things change</u>
- ✓ Compatibility: Segregating each fuel by avoid <u>mixing</u>, unless compatibility is guaranteed by supplier or by VeriFuel
- Cold flow properties: <u>Might vary (if tanks, fuel lines and filters</u> <u>can be heated, cold flow properties aren't an issue)</u>
- ✓ <u>Do not burn</u> the fuel until the analysis is available, if possible
- ✓ Study Certificate of Quality (CoQ) carefully before bunker operation. Key message: <u>know your fuel.</u>





Tank And Change Over Verification



- 1. Take a sample (preferably at the transfer pump) from the bunker tank (storage tank) that requires verification.
- Use your vessel specific change over program/calculator to figure out how long it will take to make the <u>complete</u> change-over from previous fuel to the VLSFO fuel
- 3. Take a sample as close to the engine inlet when changeover is complete (refer to step 2)
- 4. Record the time when step 3 takes place
- 5. Wait an hour or longer before taking another sample as close to the engine inlet (this is to validate the first engine inlet result)
- 6. Record the time when step 5 takes place.







Please complete the form electronically and click 'Send to Bureau Veritas' or email to verifuelforms@bureauveritas.com and verifuelsamples@samplelogistics.com

Vessel IMO number	9876543	Vessel name	Saga 1			
Order number (optional)		Fuel tank in use		Stb 1		
Fuel in use from	27-Aug-19	Number of fuel system samples taken?				3 🗸
Sampling location	Sampling time	Sampling date			Seal number	
Transfer pump	10:00 AM	27-Aug-19	27-Aug-19		123456	
Engine Inlet 🔹	07:00 PM	27-Aug-19	27-Aug-19		123457	
Engine Inlet	09:00 PM	27-Aug-19			123458	
Reason for taking Fuel System Samples		Routine o	Routine check			
Quantity bunkered (of fuel in use)		500	MT	•		
Separator configuration		Single	Single			
Separator inlet temperature		98	°C	•		
Separator inlet flow rate		2	m3/hr 🔽			
Vessel location during Fuel System sampling		At sea (sa	At sea (sailing)			
Sea state during Fuel System samplin	Ig	Modera	Moderate			
Sample pick-up details	Additional c	omments				



IMPORTANT TO FILL OUT IN ORDER TO AVOID DELAYS IN

VeriFuel Understanding Marine Fuel

Conclusions

- A challenging new environment ahead for all of us
 - Be aware: things change
 - Training: study, learn, ask
 - Do not be afraid to ask
 - Do not be afraid to report immediately, initial "teething" issues
 - ✓ Know your fuel
 - Cooperation with your fuel management partner
 - With proper preparation, planning and training, the technical challenges can be managed.





Thank you for your attention bill.stamatopoulos@gr.bureauveritas.com



Move Forward with Confidence

