VERITAS PETROLEUM SERVICES

INSTRUCTION MANUAL

FUEL QUALITY TESTING

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Introduction

Thank you for choosing Veritas Petroleum Services (VPS) as your fuel management partner. VPS is committed to providing you with the best possible marine fuel management solutions.

VPS introduced the Fuel Quality Testing (FQT) service in 1981 to meet the needs of a maritime community seriously concerned about the quality of bunkers supplied in ports worldwide. Over the years, the problems encountered by ship-owners and operators in the procurement and use of marine fuels have not diminished.

VPS fulfills the requirements of an independent international testing service which is credible both to ship-owners and suppliers alike. Four wholly-owned and ISO 17025 accredited laboratories strategically located in Singapore, Rotterdam, Fujairah and Houston are operated so that fuel samples will reach the appropriate VPS laboratory in the shortest possible time. Assisted by use of the SampLogic, to avoid sample transportation delays, this in turn facilitates fast turnaround of test results and operational advice.

VPS has thus far tested more than 2 million marine fuel samples in our FQT programme. An extensive monitoring network makes it possible to spot fuel quality problems in bunkering ports around the world and the Bunker Alert service will immediate notify of the risk, exclusively to members of the VPS FQT programme.

The VPS FQT programme provides ship operators with sampling procedures in accordance with MARPOL Annex VI requirements inclusive of the required documentation. All VPS sampling equipment (sample bottles, seals, cubitainers and line samplers) are MARPOL compliant.

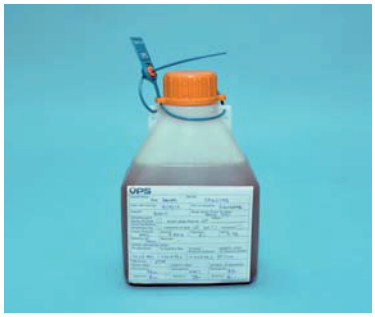
Whether you are already a member or you are new to the VPS testing programme, please go throught this instruction manual to fully enjoy the benefits offered by VPS. This manual is a simplified version of our Instruction Manual Part 1. Please go to https://www.v-p-s.com/brochures-downloads/ to view our detailed online instruction manuals (Part 1 and 2)

Overview of VPS Samples

The diagram below describes the purpose of each of the fuel oil samples to be taken routinely under the VPS Fuel Quality Testing (FQT) and Fuel System Check (FSC) programme, as well as the associated labels accompanying these samples.

Sample to laboratory

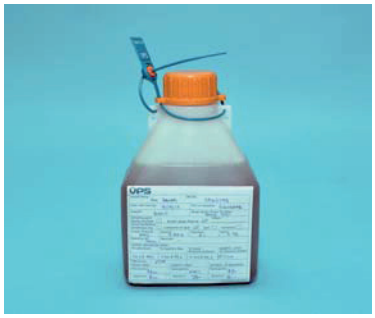
This sample is to be identified with the ***white*** FQT label and sealed with a security seal***. This sample should be sent immediately to a VPS laboratory for fuel quality testing.*** Dispatch for analysis to the appropriate VPS laboratory in accordance with the given instructions (see page 11).



Ship's retained sample

This sample is to be identified with the ***white*** FQT label and sealed with a security seal**.** This sample should be ***retained onboard.***

In the event of a dispute, the sample may be required to be sent to a laboratory for testing. In such cases witnessing of the breaking of the seal and testing is often required in the presence of the parties involved.



Sample to supplier

This sample is to be identified with the ***white*** FQT label and sealed with a security seal**.** This sample should be ***given to the supplier.***

If the supplier declines or discards the sample, make sure that this is recorded in the ship's log.

Fuel System Check (FSC) samples

The purpose of these samples is to verify the efficiency of the fuel treatment system. FSC samples are to be identified with the ***red*** FSC label and sealed with a security seal. The special FSC cardboard box can be used for shipment. Dispatch for analysis to the appropriate VPS laboratory in accordance with the given instructions (see page 11).

Please note that each sample should be duly filled (i.e. "FILL TO THIS LINE"), sealed and the respective labels attached.

Important notice for sampling

In order to obtain a representative sample of the fuel delivered to the ship, the sample has to be drawn continuously throughout the entire bunkering process. To achieve this, VPS strongly recommends the use of a VPS continuous drip line sampler together with clean VPS cubitainers.

The VPS line sampler should be sealed to prevent tampering during the sampling operation. Please note that the use of a continuous drip or auto-sampler is required by resolution MEPC.182(59) "Guidelines for the Sampling of Fuel Oil for Determination of Compliance with the revised Annex VI of MARPOL".

VPS advocates Custody Transfer Sampling, which is also a requirement under the Singapore Code of Practice for Bunkering (SS600) and the TR48. The recommended location for Custody Transfer Sampling is at the ship's manifold. If for any reason the sample cannot be taken at the ship's manifold, such reasons should be recorded in the ship's log.

It should be noted that bunker sampling practices may vary from supplier to supplier, country to country and even port to port. In most ports, other than Singapore and Gibraltar which have their Code of Practice for Bunkering, the legal and binding commercial samples according to the supplier's Terms and Conditions are usually the samples taken by the supplier and the sampling point of these commercial samples may not be the vessel manifold.

It is therefore important to review both local requirements as well as the supplier's Terms and Conditions/Charter Party agreement to assess where the legal and binding commercial samples as per the supplier's Terms and Conditions/ Charter party agreement are to be taken during bunkering operations.

If these samples are not being taken at the ship's manifold, it is important to have a ship representative/surveyor witness the sampling and sealing of supplier's commercial samples even though another set of samples are being drawn from the ship's manifold by the vessel crew. It is also recommended to counter-seal the supplier's commercial samples but only in case the sampling has been witnessed and the samples are considered to be representative.

VPS line sampler

Obtaining a representative sample from each bunkering is an essential part of the fuel management procedure onboard the vessel. It requires the use of appropriate equipment which makes it possible to take a sample that is representative and acceptable for all parties involved. The reliability of test results from fuel quality analysis and fuel density used in calculations for quantity measurements are dependent on correct sampling procedures being followed.

Please ensure that the vessel is equipped with a MARPOL Annex VI compliant line sampler sampling device installed at the point of Custody Transfer, i.e. at the ship's bunker manifold. If the vessel is not fitted with a proper sampling device, it may not be possible to take a representative sample as required by MARPOL 73/78 Annex VI.

The VPS Line Sampler consists of a sampling probe assembly complete with needle valve, security cap. Teflon cap and metal cap. Sampling is carried out by the continuous drip method throughout the duration of the bunkering. Installation is extremely simple using the two fully threaded long bolts provided to secure the sample to the bunker manifold. The diameter of these two fully threaded long bolts is slightly smaller such that the sampler can be "permanently" fitted to the outer flange of the bunkering manifold. The remainder of the provided bolts is half threaded and are long enough to penetrate the bunkering manifold, the sampler as well as the bunker hose flange; hence there is no need to remove or install the sampler at each bunkering.

The needle valve is used to control the rate at which a continuous drip sample can be drawn. It also serves as a stop valve for the sampling. The anti-tamper security cap prevents unauthorized changes in the adjustment of the drip rate during sampling. The sample is collected in a disposable 10-litre or 5-litre cubitainer, which is screwed onto the sampler and threaded with the seal. The cubitainers watertight system prevents contamination from rainwater, dust and cargo such as bauxite, grain etc.

The VPS Line sampler has proven itself as a tamper-evident, reliable and cost effective sampling device for obtaining representative fuel samples. Please contact the nearest VPS office for more information.

Fuel Quality Test Sampling Kit

Each VPS sampling kit contains;

- ✓ 40 Sampling bottles with caps
- ✓ IATA approved shipping boxes
- ✓ Security seals with unique seal numbers
- ✓ Ziplock bags
- ✓ 4 x 60ml sampling bottles for compatibility checks

1 Fuel Quality Testing Program information pack containing :

- Air Courier Directory
- Instruction Manual
- Sample Detail Form
- Request to Witness Sampling Form
- Proforma Invoice
- Label for Sample Bottle
- Address Label for Laboratories
- Fuel System Check - Record Form
- Preprinted Airway Bills

Ordering of Sampling kits and cubitainers

When sampling supplies run low, please contact the nearest VPS office. Or go for online ordering of supplies to https://kts.vpsveritas.com/ . The following items can be ordered:

- Fuel Quality Test (FQT) Sampling kit
- 5-Litre Cubitainers (30pcs)
- 10-Litre Cubitainers (30pcs)

* *Please note that a DataAccess login ID and password are required for web ordering.*

Request To Witness Sampling Form

Invite the supplier's representative to witness the sampling procedures. Complete a 'Request to Witness Sampling' form and ensure that it is signed by both parties. Give the top copy to the supplier's representative. The blue copy is for the ship's files.

If the supplier declines to attend the witnessing of sampling, please note this in the ship's log-book. Such a record can serve as contemporaneous evidence should a fuel quality dispute later arise. Please ensure that full details such as barge, cargo officer, supplier, time, date and circumstances are recorded.

Bunkering Completion

A bunkering is considered completed when the supplying barge has transferred the stipulated bunker quantity to the receiver vessel. Once the bunkering process is completed, break the seal of the security cap of the needle valve and shut the needle valve by carefully turning it in the clockwise direction.

Unscrew the cubitainer from the drain probe and close it with the cap provided. A drip tray should always be kept under the sampler connections to collect oil drips and prevent spillage.

Sample Preparation

Cap the cubitainer and shake the content vigorously for about 10 minutes to mix the sample thoroughly. When bunkering in colder climates ensure that the sample collected in the cubitainer is warm enough to allow for shaking.

Fill three (3)* sample bottles 1/3 at a time. Make several passes to fill up the bottles equally, capping and re-shaking the cubitainer before each filling. This is to ensure that the sample is evenly distributed and the content in each bottle is representative.

In some cases, other parties may require samples for testing (e.g. both the owner and the charterer may be on the testing programme) and will require separate samples to be sent. In such cases additional samples should be taken as required. Fill the bottles to the mark "FILL TO THIS LINE."

Sealing the Bottles

Close the sampling bottles tightly using the screw caps provided. Seal all the bottles and record all seal numbers on the Sample Details Form. To prevent tampering, it is important to pull the seal tail completely though the seal tag. ***Do not cut the tail.***

Record the seal numbers in the ship's log book. In addition, it is strongly advised to request the supplier to record all sample seal numbers on the BDN** for cross-reference purposes.

Complete the required fuel quality testing sample (white) bottle labels. Sign these labels in the presence of and jointly with the supplier's representative and attach a label to each bottle.

Do not under any circumstances sign any blank labels.

Do not accept any samples which has been prepared and/or offered in advance of the bunkering operation. Any sample offered in advance is not representative for the fuel as bunkered.

* *The Singapore Standard SS600 and the TR48 for Bunkering requires four samples to be drawn with similar distribution to the involved parties as indicated, but with an additional MARPOL sample to be kept onboard the vessel. A fifth sample shall also be prepared for the bunker surveyor if a bunker quantity survey is carried out during the fuel delivery (see page 24).*

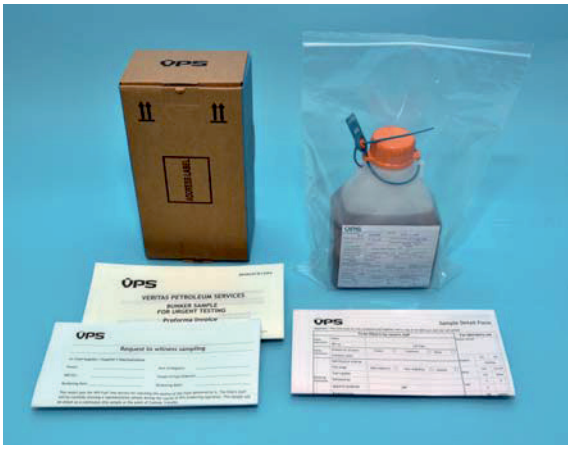
** *The Singapore Standard SS600 and the TR48 for Bunkering requires the seal numbers to be recorded on the BDN to verify the authenticity and to be SS600 compliant (see page 24).*

Sample Detail Form

It is important that all information related to the bunkering is recorded on the Sample Detail Form. This information is essential for the correct processing of the sample and will also be used for future reference. Please enclose the top copy in the shipping box with the sample forwarded to the laboratory. The pink copy is for the ship's file.

Laboratory Sample

Put the bottle of sample to be sent for testing into the ziplock bag to prevent any spillage during transport. Gently squeeze the ziplock bag to minimize any air content prior to sealing.



Pack the bottle in the FQT shipping box together with the completely filled in Sample Detail Form and ensure a copy of the bunker delivery note (BDN) is also included.

Attach the appropriate address label to the shipping box as instructed in the VPS Air Courier Directory and dispatch the sample to the nearest VPS Laboratory. Always include the Safety Data Sheet (SDS)* and the Pro Forma Invoice. See page 7 for more information on how to send the sample.

Sample for Supplier

Hand one bottle over to the supplier's representative. If the supplier declines or discards the sample, make sure that this is recorded in the ship's log with full details such as the name of the responsible person, barge, supplier name, time, date, incident, seal number of the sample. This information is essential in the event of a quantity or quality dispute at a later stage.

* *The SDS is a SOLAS and IATA requirement and should be provided by the supplier for each type of fuel loaded to the vessel. The SDS is a mandatory document required by the airlines to ascertain whether or not the fuel sample can be considered as "not restricted cargo" with flash point above 60.5°C.*

Ship's Retained Sample

It is important to retain one bottle of sample onboard in a secure location, because in most cases this may be the only sample left which represents the fuel delivered to the ship.

MARPOL Annex VI Sample

MARPOL Annex VI refers to MEPC.182(59) "Guidelines for the Sampling of Fuel Oil for Determination of Compliance with the revised Annex VI of MARPOL" which states that a sample of the fuel delivered to the ship should be obtained at the receiving ship's inlet bunker manifold and should be drawn continuously throughout the bunker delivery period.

This MARPOL sample has to be retained under the ship's control until the fuel oil is substantially consumed, but in any case for a period of not less than **12 months** from the time of delivery.

It is the supplier's obligation to provide a representative MARPOL sample, continuously drawn throughout the entire bunkering process. The sample is to be sealed and signed by the supplier's representative and the master or officer in charge of the bunker operation on completion of the bunkering operation.

In the event that the supplier does not fulfill the obligation to provide a MARPOL sample or in case it is not taken as per the guidelines in MEPC.182(59) the following actions should be taken:

- Inform the supplier about the fact that the sample is non-compliant, referring to MEPC.182(59), and propose to prepare the official MARPOL sample from the cubitainer as used for the three routine bunker samples taken at ship manifold. The sample has to be sealed and clearly marked as MARPOL sample. It is recommended that the seal number of the MARPOL samples is registered on the BDN for cross-reference. If this is accepted by the supplier a Notification is not necessary.

- If the supplier does not accept to take the MARPOL sample from ship manifold, a Notification highlighting the non-compliance with MARPOL Annex VI requirements should be issued. The Notification is to be forwarded to the relevant Port State and the Ship's Flag State. For assistance in issuing the Note of Protest, please refer to VPS' instruction manual part 2 "MARPOL Annex VI & Regulatory Guidelines".

- In addition to the Notification and in the absence of a properly taken MARPOL sample provided by the supplier the crew may optionally prepare a SHIP's MARPOL sample from the cubitainer as used for the three routine bunker samples taken at the ship's manifold. This additional fourth sample should be sealed and clearly identified as SHIP's MARPOL sample on a white label and documented as such for retention on board. The supplier's sample should be countersigned with the appropriate reservations

- If there are technical reasons as to why a sample cannot be taken at the receiving ship's manifold (e.g. vacuum problems and/or extreme weather conditions), then such reasons should be recorded in the ship's log book and the sample taken elsewhere. For example at the barge manifold.

Dispatch of Samples using SampLogic

Bunker fuel samples should be dispatched to the laboratory for testing as soon as possible after the bunkering operation is completed. Agreements have been made by VPS with major air courier companies worldwide to ensure priority handling.

To ensure timely analysis and reporting of the fuel sample analysis results, VPS encourage utilizing the SampLogic to activate fuel sample collection. SampLogic helps to reduce time required to prepare shipping documents and provides real-time tracking of the fuel samples.

The SampLogic offers the following benefits:

- A single point of contact to activate sample collection. All sample collection requests submitted will be transmitted electronically to VPS appointed courier service provider. There is no longer a need to call the courier service providers to arrange for sample collection.
- To make sure the samples are delivered to the VPS laboratories with no delays, it is essential to get the shipping document right. SampLogic uses the booking details to generate the shipping document which are required to accompany the fuel samples.
- Sample collection request submitted to SampLogic will be issued a tracking number which allow you to monitor the status of your sample at any time.

Getting Started with Samplogic:

To request for sample collection, please go to https://samplogic.vpsveritas.com

Upon receipt of your request, Samplogic will send the shipping document (Proforma Invoice, Airway Bill and an example of an approved SDS) to the email addresses provided.

All fuel samples need to be accompanied by a Proforma Invoice, AWB and SDS. You are required to print out the shipping document and submit along with the fuel sample together with a SDS.

A courier will also be contacted and send to the address you advise the collect the sample and deliver it to the VPS laboratory.

Dispatch using the Air Courier Directory (ACD)

If use of the SampLogic is not possible please refer to the Air Courier Directory provided with the sampling kit for shipping instructions to the appropriate laboratory. It is essential that the service center of the nominated courier is contacted for immediate collection of samples. If the nominated courier is not used, the transportation of the sample will likely be delayed and extra delivery costs incurred.

Fuel System Check samples (FSC)

Although the delivered fuel meets the ordered specification, it is imperative that the fuel treatment plant is operating at maximum efficiency. ISO 8217 specifies the required properties of fuels at the time and place of custody transfer. It is presumed that there will be adequate treatment before use. Samples taken from the fuel system when a fuel is in use will help indicate the efficiency of the treatment plant and thus assist the ship's staff in taking preventive action, if needed.

Periodic sampling from the fuel treatment system will also identify problems such as water ingress from ballast systems, leaking heating coils and cargo contamination. A good fuel management system would include Fuel System Check (FSC) samples and analysis at least once each quarter.

The purpose of the Fuel System Check (FSC) programme is to monitor and evaluate the effectiveness of the fuel oil treatment plant. The ship staff draws samples periodically, if operational problems are experienced or as triggered by the VPS fuel oil analysis reports in connection with poor quality bunker deliveries. Upon receipt in one of VPS' labs, the samples are analyzed, the results assessed and reported by VPS.

In addition, VPS offers catalytic fines (Al+Si) size distribution screening as a value-added service to complement the FSC programme.

Experience gained by VPS and its customers since the introduction of the Fuel Quality Testing programme in 1981, combined with studies and research, confirms that fuel treatment systems are not always operating at optimum efficiency. Contamination may occur in the ship's fuel system and tanks for example due to defective steam heating coils, seawater/cargo ingress resulting from badly located or damaged vent pipes or from settled cat fines and/or water being mixed into the fuel from the tank bottoms.

Efficient separator operation is essential for the removal of heavy fuel oil contaminants such as water and cat fines. With the FSC programme, inefficient operation, malfunctions and defects in the separators can be identified.

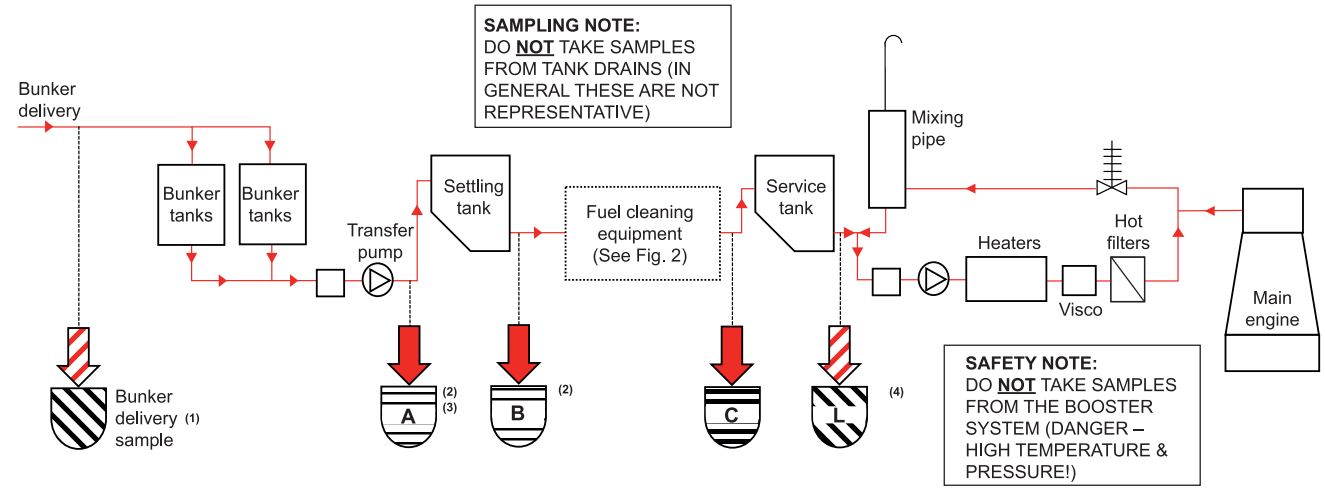
Major marine engine manufacturers recommend less than 15 mg/kg aluminium+silicon (Al+Si) at the engine inlet. Hence, assuming a delivered fuel contains 60 mg/kg Al+Si, the fuel treatment plant has to operate at an efficiency level capable of removing 75% of these highly abrasive particles in order to meet the engine manufacturers' requirements.

Sampling and Distribution

For analysis results to be useful, sampling must be carefully carried out at key locations throughout the fuel oil system. Samples for FSC should be taken in connection with poor quality bunker deliveries or if operational problems are experienced. Figure 1 "Sampling Positions and Sample Identification Letters" shows the recommended locations from which FSC samples are to be drawn.

In order to secure representative samples, it is recommended that the sampling locations are fitted with sampling cocks or valves. A connecting pipe may extend to a convenient position for sample collection. A facility should be provided to allow for the flushing of the connection back to the system or to a waste tank. Samples should NOT be drawn from tank drains. A recommended set of Fuel System Check samples consists of one sample taken from each of the following locations (see fig. 1):

FIG. 1 Sampling Positions & Sample Identification Letters



Notes

(1) Bunker delivery samples are submitted under the "VPS FQT Program" and are not a part of "Fuel System Check". Shown here only for clarity.

(2) Normal set of "Fuel System Check" samples consists of "A", "B" and "C". For a breakdown of sample after each component of the fuel cleaning equipment see Fig. 2.

(3) Record on the sample label & form the identification of the bunker tank that transfer pump is drawing from.

(4) Samples of position "L" (after the Service Tank) may be submitted as an alternative to samples taken after the fuel cleaning equipment. Note however the sample should NOT be taken from the Service Tank drain.

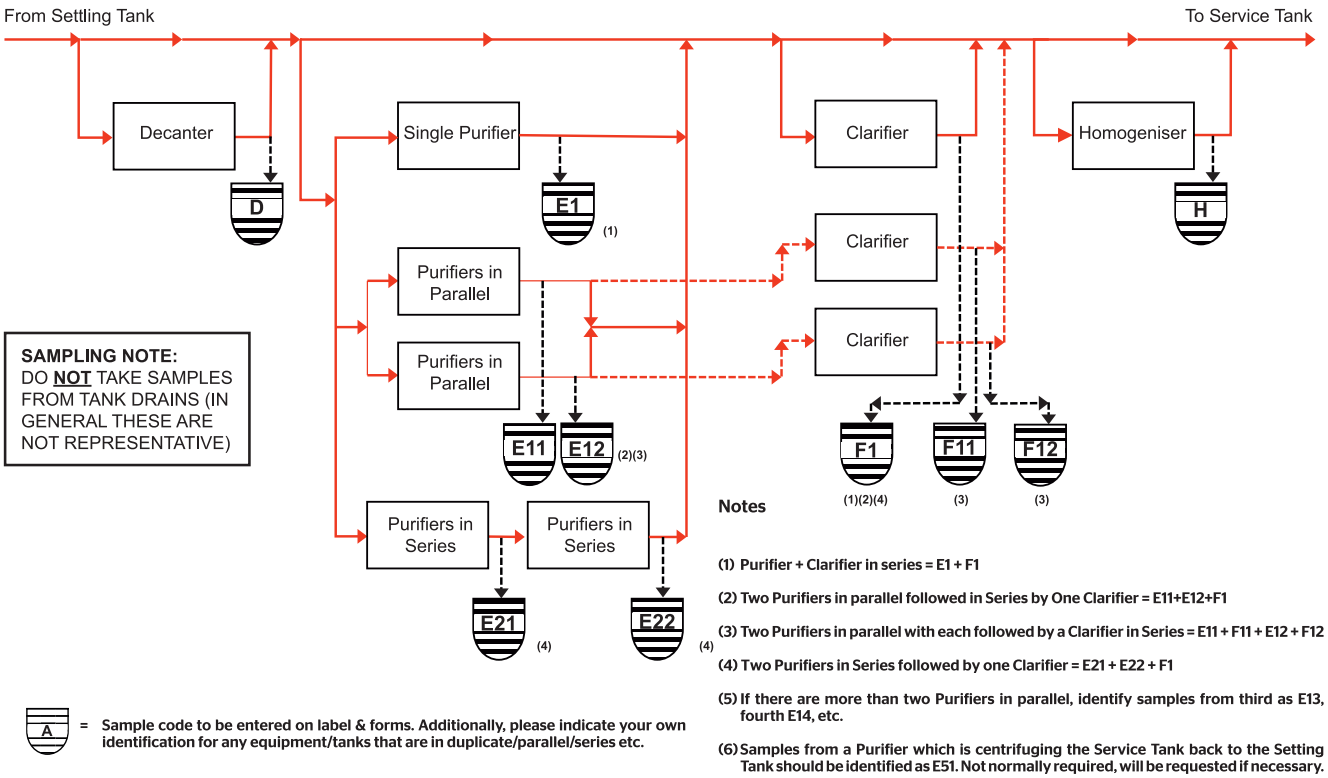
- **Sampling position**
- **Sample code to be entered on label & forms. Additionally please indicate your own identification for any equipment/tanks that are in duplicate/parallel/series etc.**

A) Transfer Pump Discharge
B) Before Separator(s)
C) After Separator(s)
L) After Service Tank (Before Fuel Heaters)
M) Before Main Engine - See Safety Note

To obtain an indication of the fuel treatment efficiency, it is necessary to submit as a minimum before and after separator samples and forward these to the appropriate laboratory for analysis.

Note: Additional samples may be drawn before or after individual components of the fuel treatment system. For a detailed breakdown of sampling locations and corresponding identification letters, please refer to fig.2

FIG. 2 Sampling Positions & Sample Identification Letters for Fuel Cleaning Equipment



FSC Sampling Procedure

In order to make the assessment of the analysis results to be as meaningful as possible, the samples should be drawn within a short period of time and when the fuel from the last bunkering has displaced the fuel oil from the previous delivery.

Before/after separator sampling should take place in between the de-sludging cycles. For instance, if discharge interval is set to two hours, the samples should be taken one hour after a discharge. First the separator inlet sample is taken, and immediately after that, the sample of the cleaned oil at the separator outlet should be taken.

For safety reasons it is NOT recommended to take samples from the booster system. Safety precautions should be taken if such samples need to be drawn because the fuel oil at this point has an elevated temperature and is kept under relatively high pressure.

The recommended sampling procedure for taking FSC samples is as follows:

1. The sample bottles from the FQT sampling kit should be used
2. Mark each sample container clearly e.g. by an ink marker before sampling to prevent confusion of which samples are drawn from where
3. Ensure the lines are thoroughly flushed before drawing the sample
4. The samples may be filled directly into the sample bottles, except for samples taken from the booster system, where it is recommended to use a closed container that can withstand the elevated temperature
5. The bottle cap should be firmly fastened after the sample has cooled to avoid leakage
6. Ensure that each sample is identified with the ***red*** FSC label. Seal all the bottles and record all seal numbers on the FSC form.
7. Complete the FSC Sample Record Form as provided in the binder. The original should be sent with the samples, together with other relevant documentation. The copy is for the ship's file. Please use multiple forms if needed

All sampling equipment should be clean and in good order. Oil, sludge, water and/or cleaning solvents from previous samplings can cause erroneous analysis results. Please refer to the safety considerations on page 6 during sampling.

Forwarding of Samples

Put each sample in a ziplock bag and pack the FSC samples in the FSC shipping box. Alternatively, if only one FSC sample is taken (not recommended), or if more than three FSC samples are being forwarded to the laboratory, the single FQT shipping boxes provided for the bunker delivery samples may be used. See page 11 for more information on how to send the sample(s).

Density, sulphur and vanadium are included in FSC reporting and used as “fingerprint parameters” in order to confirm that the samples represent the same fuel and which bunker fuel oil, the samples corresponds to.

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Veritas Petroleum Services (VPS) delivers testing, inspection and advisory solutions that help our customers achieve measurable improvements to fuel management, fuel cost, operational efficiency and compliance with marine fuel regulatory requirements.

In close collaboration with the industry, we introduced the first commercial bunker fuel testing and bunker quantity surveys for ships in 1981 and 1987, respectively. Today, customers remain at the heart of our business as we continue to expand our business.

We operate a global network of customer service offices supported round-the-clock by technical experts and four specialised and wholly-owned fuel testing laboratories strategically located in Rotterdam, Singapore, Houston and Fujairah. Our bunker quantity surveys are available at more than 200 key bunkering ports worldwide.

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