Marine Technic a/s

Fuel / Lube oil test kit

Order code 1001052 for light fuel 1001054 for heavy fuel

Zematra bv

Steenspil 28
4661 TZ Halsteren
The Netherlands
Tel: +31 – (0)164-687770
Fax: +31 – (0)164-680512
E-mail: info@zematra.com
Website : www.zematra-marine.com

Version 1 / 2009

CONTENTS

CODE LIST

DISPOSABLE SPARES PACKED IN A SEPARATE CARTON

CODE	CONTENTS	NUMBER
O 100251	Syringes 1 ml	100
O 120405	Syringes 5 ml	100
O 120410	Syringes 10 ml	100
Optional		
1001132	Spare set of O-rings for reaction vessels	
1001124	Water Free Cleaning Spray	

CONTENTS OF THE TEST KIT

TEST	CODE	DESCRIPTION	NUMBER
DENSITY	L2000	Cardanic Device	1
	L2002	Stand Reducer	1
	A300210	Thermometer, ASTM 12C	1
	H806210	ASTM Hydrometers	4
	H806212	in steps of 50	
	H806214		
	H806216	Only by 1001054	
	AZ00080	Glass insert	1
	1001201	Density Heater Only by 1001054	1
POUR POINT	1070002	Conical tube	1
	2611021	Test tube with cork	1
	A300070	Thermometer 5C	1
	1001504	Coolant aerosol	1
WATER %	1001101	Reaction vessel complete	1
	1001103	Water Free Diluent, 1000 ml	1
	1001104	Water Test Solution, 50 ml	1
SALT	1001652	Quantab strips, box of 40	1
	2429417	Separation funnel	1
	1001603	Distilled water, 50 ml	1
	1101604	Reagens DG, 10 ml	1
	1001050/1001051	Glass vials	2
ALAKLINITY (TBN)	1002301	Reaction vessel complete	1
	1002311	TBN Test Solution, 500 ml	1
	A-159	Magnetic heater/stirrer	1
	5700427	Magnets	2
INSOLUBLES TEST	7380770	Filter paper A4	20
	7000771	Perforated template	1
VISCOSITY – fuel	1002052	Falling Sphere Viscometer	1
	1000064	Thermometer 20°C – 60°C	1
	1000068	Stainless steel ball 16.20 mm	1
	1000070	Mirror	1
	E920630	Electronic timer	1
	4110111	Beaker glass 600 ml	1
VISCOSITY- lube	1002040	Viscotool	1
COMPATIBILITY/ STABILITY	1002-055	Chromatographic paper (box 100)	1
	1001436	Holder for filter paper	1
	O3225221	Pair of tweezers	1
	5700427	Magnets 20x6 mm	2
	1001404	PTFE/Aluminum oven	1
	1001403	Reference spot sheet ASTM	1
	E910560	Digital thermometer	1
	4110204	Erlenmeyer 100 ml	1
SAFETY	7000153	Safety goggles	1

2. SAMPLING INSTRUCTIONS

A. Fuels

Accurate and verifiable analysis of (marine) fuels can only be achieved if a representative sample is obtained. It is vital that a truly representative sample is obtained but this can be very difficult particularly if the bunker stem is many thousands of tones. Additionally, it should be bore in mind that the total volume to be lifted in one lot can be originating from more than one source.

Zematra Portable Sampler

However, modern in line, continuous drip samplers, such as **Zematra In Line Sampler** can help ship owners overcome this problem.

A non representative sample can lead to inaccurate analytical results and incorrect information and advice being passed to ship owners and their staff. The method of operation of these samplers is relatively simple. A needle valve on the inter flange mounted sampler is used to control the drip rate during the sampling process. The sample is collected in a disposable five litre plastic container which is replaced for each bunker sampling operation. The container, which is fitted with a security seal, is removed from the sampler on completion of sampling.

The container is thoroughly shaken, to ensure a fully homogeneous sample, before the sample is decanted to one liter sample bottles. Each bottle must then be individually labeled, sealed and fitted with tamper proof seals. A sample seal number is then allocated to each sample which facilitates sample custody and provides an audit trail.

One sample should be sent to a shore based testing laboratory, whilst one sample should be given to the ship and shore representatives. Any remaining samples which are not required elsewhere should be retained on board ship in a safe place such that they can be used as evidence if any bunker related problems arise.

SAMPLING INSTRUCTIONS

B. Lubricants

Figure 1

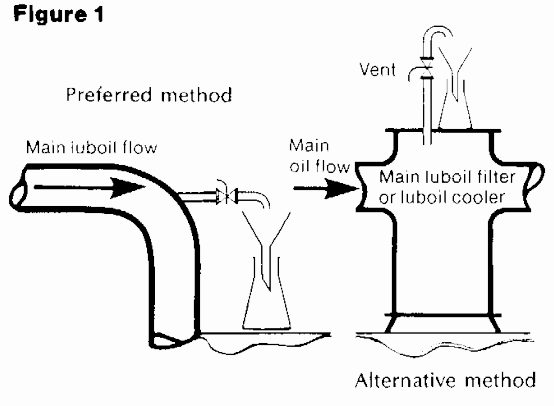
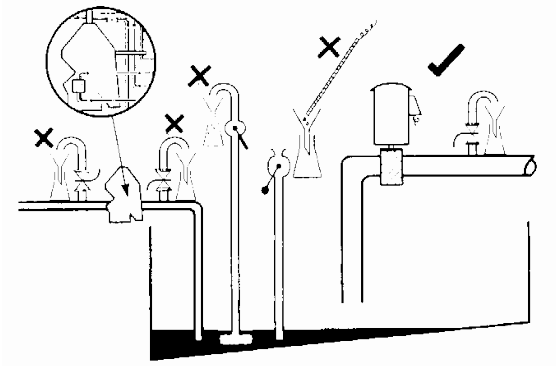


Figure 2. Luboil sump - sample to be taken from discharge side of luboil pump



GOOD SAMPLING

- Draw samples from a connection that comes directly out of the main oil supply to the engine *(See figure 1)*.
- Always sample from the same point.
- Ensure total quantity of oil in circulation is approximately the same at each sampling.
- Sample only when the oil is up to its operating temperature with the engine running.
- Thoroughly purge the sample connection until cold “dead” oil has been completely cleared and hot oil is flowing.
- Draw samples into a clean container of about 1 liter size.
- Draw samples over a period – about 10 minutes for larger engines, 5 minutes for smaller engines.

AVOID *(see figure 2)*

- Sampling from places where the oil may be stagnant or have little or no flow such as: sumps
- auxiliary smaller pipelines
- purifier suction lines or discharge lines drain cocks of filters, coolers, etc.
- Sampling while engine is stopped

3. DENSITY - Fuels

Necessary equipment:

Cardanic Device and Stand Reducer for light fuel and the thermostatic controlled heater column for heavy fuel
Thermometer, ASTM 12C
Hydrometers, type L50SP, kg/ltr at 15 °C
Range 850-1000 in steps of 50.
For heavy fuel range 850-1050.
Glass insert

Note: For digital measurement (*DENDI*) refer to separate instruction manual.

Procedure for light fuel *(figure 1)*:

1. Fill the glass tube with oil to be tested to approx. 2 cm under the top of the glass tube.
2. Insert the appropriate hydrometer and the thermometer and let it settle.
3. Read the hydrometer and convert the found density at the tested temperature to that at 15°C using the graph, Petroleum Tables 53B or the Shell Bunker Calculator on floppy disk

Figure 1

Procedure for heavy fuel *(figure 2)*:

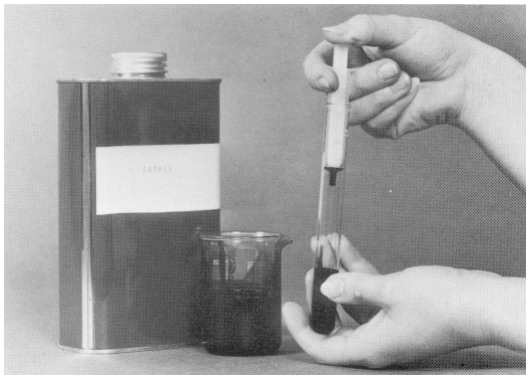
1. Fill the heater tube with that amount of water which is needed to surround the glass tube completely.
2. Turn on the heater element which will automatically reach the adjusted temperature of 50 °C.
3. After the oil has reached the set temperature insert the appropriate hydrometer and let it settle.
4. Read the hydrometer and convert the found density at 50 °C to the density at 15 °C using the graph, Petroleum Tables 53B or the Shell Bunker Calculator program on floppy disk.

Figure 2

4. POUR POINT- FUELS

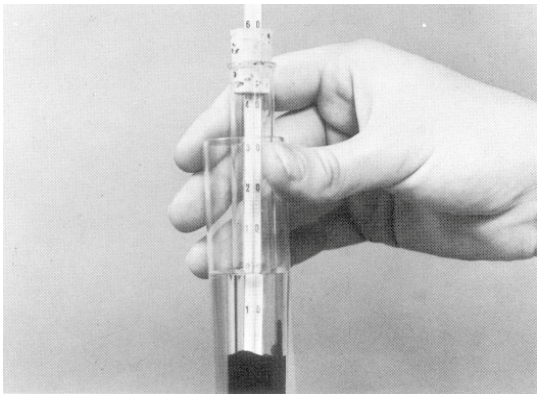
Necessary equipment:

Conical tube, test tube with cork, 5 ml syringes, Thermometer 5C and coolant aerosol.



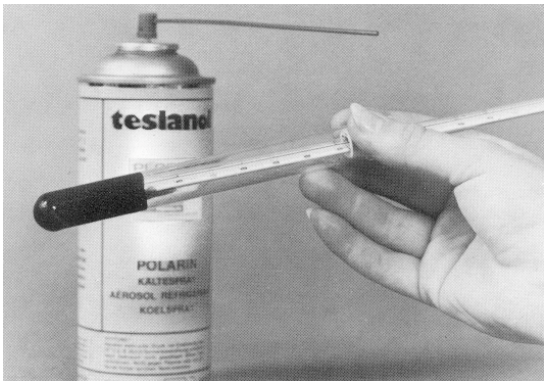
Procedure

1. Using a syringe right into the test tube put 5 ml of the warmed oil into this tube.
   Make sure the oil does not obscure the sides of the tube.



2. Fit the thermometer and cork ensuring that the thermometer is centralized and does not touch the bottom. Place the assembly in the conical tube.

3. Spray a 2 sec. burst of coolant into the conical tube. Remove the assembly without disturbing the thermometer and tilt the tube gently until a slight movement of the oil is seen. Replace the tube and repeat at 3° C intervals.



4. The temperature at which the oil does not move when tilted for 3 sec. is rounded up 3°C and noted as **Temperature A.**

5. Half fill the conical tube with warm water approx. 10 °C above temperature “A”. Repeat tilting until the oil flows again and note as **Temperature B.**

6. The average Pour Point is expressed as the average of the two temperatures **A** and **B.**

5. VISCOSITY - Fuels

Necessary equipment:

Falling Sphere viscometer
Thermometer 20°C till –60°C
Stainless steel ball 16.20 mm
Mirror
Electronic timer
Beaker glass 600 ml
Heater-Stirrer
Bunker Calculator (optional)

Procedure:

1. Heat the oil-sample till approximately 50º C and shake well.
2. Remove the metal mask from one end and fill the tube for approx. ¾ with oil to be tested and add the stainless steel ball.
3. Top up with oil, place the glass window, ensure that no air is trapped and screw on the top nut securely.
4. Put the meter into the beaker and let it settle for some minutes to stabilize the temperature.
5. Turn the viscometer upside down, place it on the mirror and start the electronic timer. Allow the ball falling to the bottom.
6. Upon reaching the bottom, which can be detected in the mirror, stop the electronic timer. Note the time and the temperature during this exercise.
7. Repeat steps 6 and 7 two or three times.

Interpretation:

1. Average the falling times.
2. Average the temperatures.
3. The factor to be used for the range of 0 to 600 centipoises (cP) is equal to 1.0 centipoises for the ball used with the average falling time. The falling time is therefore equal to the viscosity of the oil in cP.
4. Multiply the average falling time by the calibration factor.
5. Convert the Density from 15 C to the Density at the found average test temperature by using the Tables or Bunker Calculator.
6. Convert the measured Dynamic viscosity in cP into Kinematic viscosity in cSt by dividing the result by the density of the oil as obtained in step 5.
7. Kinematic viscosity at standard reference temperature (50 °C, 80 °C or 100 °C) can be obtained by using the Graph (Viscosity at Different Temperatures) or Bunker Calculator.

6. VISCOSITY - Lubricants

Necessary equipment: Viscotool and syringes, 5ml

Optional Equipment: Water Free Cleaning Spray (*order code 1001124*).

Procedure:

- Fill 5 ml of representative sample into the reservoir for used oil by using a clean syringe.
- Fill 5 ml of fresh oil into the reservoir for fresh oil by using a clean syringe.
- Make sure both oils have the same temperature, i.e. ambient temperature.

Tilt the VISCOTOOL until it rests on the base opposite the reservoirs. Keep in position till the fresh oil (reference oil) has reached the mark and turn the VISCOTOOL in the horizontal position.

Interpretation:
Viscosity is too high if stopped before the mark of the fresh oil. This can be caused by insoluble material or contamination with (very viscous) residual fuel.

Viscosity is too low if stopped after the mark of fresh oil, due to contamination with a lighter product. This can be caused by contamination with fuel.

Note: Electro-cleaning solvents might attack the material.

7. WATER CONTENT – Fuels and Lubricants

Necessary equipment: Reaction vessel with manometer and valve, Water Free Diluent, Water Test Solution, heater/stirrer and syringes.

Procedure:

1. Shake the sample thoroughly to obtain a homogeneous mixture. Immediately add 5 ml of oil to the reaction vessel using a 5 ml syringe.

2. Add 5 ml Water Free Diluent using a 5 ml syringe. Also add a magnet.

3. Close the reaction vessel, swirl carefully and open the valve by turning the notched wheel to "O".

4. Shake the bottle with the Water Test Solution thoroughly to obtain a homogeneous mixture. (Note the ball inside the bottle is moving). Take 1 ml Water Test Solution with the 1 ml syringe and inject to the reaction vessel.

5. Remove the syringe and immediately close the valve by turning the notched wheel to "S" (clockwise) assuring the pressure is zero.

6. Place the reaction vessel on the magnetic stirrer and switch the stirrer on and make sure the heater is turned off and the plate is cold. Read the manometer after 10-12 minutes.
7. Clean the reaction vessel with Zematra Water Free Cleaning Spray

NOTE

If the water content of the sample is above 1,24% volume, open the cover, reduce the sample and repeat the test with a smaller amount of oil. Calculate the results as follows: Water % vol. = meter reading x 5/ sample volume taken in ml.

8. NATURE OF WATER - Fuels and Lubricants

Necessary equipment: separating funnel, distilled water, reagent DG, water-free diluent, 10 ml syringes, Quantab strips, vial, and a holder for the separating funnel.

Procedure with sufficient free water

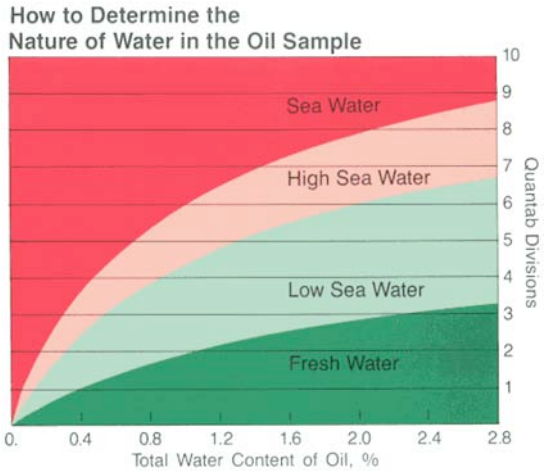
4. Drain the oil from the water phase as much as possible.
5. Pour the water with the remaining oil into the separating funnel.
6. Follow procedure from step 5 under emulsified oil.

Procedure emulsified oil

1. Using a syringe add 10 ml diluent to the separating funnel. Shake the oil sample thoroughly and pour 10 ml of oil into the separating funnel.
2. Close the funnel with the stopper and shake well.
3. Remove the stopper and add 10 ml distilled water and max. 4 drops of demulsifier DG.
4. Close the funnel and shake carefully for approximately one minute.
5. Place the separating funnel in the holder and allow the water to separate. The separating time depends on the type of oil. Normally 15-20 minutes will be sufficient.
6. Drain the water from the separating funnel into the small glass vial. **Be careful that no oil is drained.**
7. Place lower end of the Quantab strip into the water. Allow water to saturate the strip completely. Determine the height of the white column in Quantab units between 2 and 30 minutes after the signal string begins to turn blue.

Interpretation

a. Note the reading in Quantab units at the tip of the white column to the nearest one-tenth unit.
b. Convert Quantab units to percent sodium or ppm chloride ion using the calibration table.



9. ALKALINITY (TBN)

Necessary equipment: Reaction vessel with manometer and valve, Water Free Diluent, TBN Test Solution and syringes.

Procedure:

1. Open the reaction vessel by unscrewing the lid. Add 5 ml Water Free Diluent using a syringe.

2. Add 10 ml oil sample to the reaction vessel using a syringe. **Also add a magnet.** Close the reaction vessel tightly. Open the valve in the lid of the reaction vessel by turning the notched lid directly under the manometer to "O".

3. Shake the bottle with TBN Solution and fill a syringe with 10 ml of TBN Test Solution. Place the syringe in the opening of the notched lid and empty the syringe.

4. Remove the syringe and **immediately close the valve by turning the notched lid to "S" (clockwise)** making sure the pressure is zero when starting the reaction.

5. Place the reaction vessel on the magnetic stirrer and switch the stirrer on and make sure the heater is turned off and the plate is cold. Read the pressure after 15 minutes and revert to the TBN graph. Clean the reaction vessel with Zematra Water Free Cleaning Spray.

10. INSOLUBLES SPOT TEST

Necessary equipment: 20 pcs DC Filter paper A4 (sheet); 1 pc perforated base board; 1 pc map for insoluble test papers; reference spots

PROCEDURE:

1. Take a small sample of oil and shake well.
2. Place an A4 filter paper sheet on the perforated base board.
3. Put one drop of the oil on the filter paper, using a paperclip either copper wire.
4. Put next to this drop, one drop of fresh oil (comparison).
5. Let both drops dry.

INTERPRETATION:

ALWAYS NOTE: TYPE OF OIL AND HOURS IN USE

A. JUDGEMENT OF DISPERSANCY (see reference spots)

1. The dispersancy of the oil is *good* should the “colour” of the blotter show an even change from the centre to the edge. The oil is still fit for further service. *However, we advise you in no case to exceed the oil change period set by the engine manufacturer.*

2. The dispersancy is moderate should a lighter edge with a clearly visible colour change have developed around a dark kernel. In such a case the oil is fit for further service for only a short period, following the date of oil sampling.

3. Dispersancy is non-existent should the dirt deposit be concentrated in a small dark blotter that has not grown to a bigger diameter than that of the original oil drop. *The oil is no longer fit for service and should be changed immediately.*

B. JUDGEMENT OF CONTAMINATION (see reference spots)

1. Contamination of crankcase oils with combustion deposits usually causes blotters of diesel engine oils to look “darker” than those of petrol engine oils. In a diesel engine this phenomenon is mainly caused by soot which has no other detrimental effect on the oil but an increase in viscosity simultaneously with a steep increase in its dispersancy.

2. In view of the *nature of contaminants* from the combustion deposits one may for instance declare a petrol engine oil unfit for further service when the blotter becomes a dark-grey colour, while in the case of a diesel engine oil perhaps this will not be done before the blotter is completely black in the kernel, changing to dark-grey at the edge.

3. As said before contamination with (diesel) combustion deposits will increase the viscosity of the oil. Consequently in the case of a very “black” blotter spot, further investigation as to the real value of the viscosity of the used oil should take place. *This can be determined with the Visgage.* The oil should be rejected if the upper SAE-limit of the oil under observation has been exceeded.

4. In the case of *heavier contamination with fuel oils* the viscosity of the crankcase oil will decrease steeply. Again real value of the viscosity can be determined with the Visgage. By means of the determination of the *flash point* a few items can be checked. It is also true that the oil should be rejected, when (in this case) the lower SAE-limit of the oil has been reached.

11. COMPATIBILITY AND STABILITY

Necessary equipment: Chromatographic filter paper, oven, holder for filter paper, pair of tweezers, magnets, Erlenmeyer of 100 mL. digital thermometer and the ASTM D4740 reference spot sheet.

PROCEDURE:

STABILITY (on fuels received)

1. Pour approx. 60 mL. of the fuel into the 100 mL. Erlenmeyer and add one magnet.
2. Turn on the heater to 100 °C and place the Erlenmeyer on the heater. Proper temperature will be reached after approx. 15 minutes.
3. Remove the Erlenmeyer from the heater and place the oven on the heater. Put the Erlenmeyer into the oven back to heat up again. Temperature can be measured by putting the sensor of the digital thermometer in the small hole of the oven.
4. If needed adjust the temperature to 100 °C.
5. As soon as the oil has reached a stable temperature of approx. 100 °C remove the Erlenmeyer from of the oven.
6. Let one drop of the fuel fall on the filter paper by using a pin.
7. By using the pair of tweezers. Place the filter paper on the filter holder and place the holder in the oven. Allow the spot to dry for approx. 20 minutes.
8. Compare the spot with the spots on the reference spot chart.

COMPATIBILITY (different, new fuel and remainder of stock)

1. Pour equal quantities of the fuels to be mixed into the Erlenmeyer. (say 30 ml of each) and add one magnet.
2. Follow the steps 2 – 8 from the **STABILITY** procedure.

INTERPRETATION:

1. Reference spot 1; Homogenous spot no inner ring.
2. Reference spot 2: Faint or poorly inner ring.
3. Reference spot 3; Well defined inner ring, only slighter darker than the background.
4. Reference spot 4; Well defined inner ring, thicker than the ring in reference spot 3. Somewhat darker than the background.
5. Reference spot 5; Very dark solid or nearly solid area in the centre. This central area is much darker than the background.

Spot 1 is compatible and spot 5 is incompatible.

Don’t touch the oven mantle when in operation. Although the exterior of the oven is made of Teflon, it can be hot. Wait until cooled down before removing the oven.

12. SAFETY GUIDE

Some solvents used in this kit have low flash points,
Therefore:

DO NOT USE NAKED LIGHTS
NEITHER SMOKE DURING TESTING

ENSURE GOOD VENTILATION

Never use water for cleaning up spills of Water Test Solution. If required Water Free Cleaning Spray or the diluent used in the water test and TBN test can be used for cleaning

CLEANING

It is recommended to clean the equipment with Water Free Cleaning spray. Be careful with Water Test Solution. This reagent is based on calcium hydride and reacts firmly with water. The gas produced during the reaction with water is highly flammable

REPLACEMENT ORDERS

Any materials required for replacement:

Re-order to :

Zematra bv
Steenspil 28
4661 TZ Halsteren
The Netherlands
Tel: 0031 – (0)164-687770
Fax: 0031 – (0)164-680512
E-mail: info@zematra.com

Please specify order codes as mentioned on page 3