

Fuel & Lube Oil Cabinet



FUEL & LUBE OIL CABINET

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Calibration & Maintenance



FUEL & LUBE OIL CABINET

Calibration and Maintenance

Introduction

The Kittiwake equipment should provide accurate results for many years. The equipment should perform within its specifications considerably longer than the suggested calibration interval of 12 to 18 months, but it is important that confidence in the results is regularly established. Regularly returning the equipment to Kittiwake will ensure good calibration, but this can be expensive or inconvenient, especially when the equipment is operated in the remote areas for which it is designed. The following describes some general calibration strategies and provides detailed examples of how confidence can be established.

Calibration strategies

- The equipment is often operated in parallel with less frequent laboratory based oil analysis testing wear metals or other similar parameters.

- Periodically schedule the laboratory to recheck oil samples tested with the equipment.

- Keep known calibration samples of oil to retest on the equipment.

- Try to record and plot the results. The equipment provides very repeatable results and a lot of information when the results are plotted and trended with engine operation.

- Return the equipment to Kittiwake for calibration, or exchange parts with the nearest agent.

Storage and transportation

All equipment should be stored upright and in a secure position. Prevent exposure to extremes of temperature, humidity and vibration.

- Store reagents upright and away from heat or sources of ignition.

- Remove the reagents before sending back equipment for repair or calibration.

- Do not send reagents back to Kittiwake.

Electrical testing

- Always operate equipment with an IEC 320 connector and cable rated greater than 3 Amps, earthed, and of the correct polarity.
- Always operate with the correct fuse.
If fuse continually blows, do not exceed the rating, but contact your agent.
- There are no user serviceable parts within the equipment.
The unit must be returned to Kittiwake if it ceases to operate.

Safety testing

Test	Limit
Earth Bond Test:	< 0.1Ohm at 25Amps
Insulation Resistance:	>50M.Ohm at 500Volt DC
Flash Voltage Test:	< 5mA at 800VAC (equipment switched on)
Operation Test:	Correct operation; no error codes

Bunker Samplers



FUEL & LUBE OIL CABINET

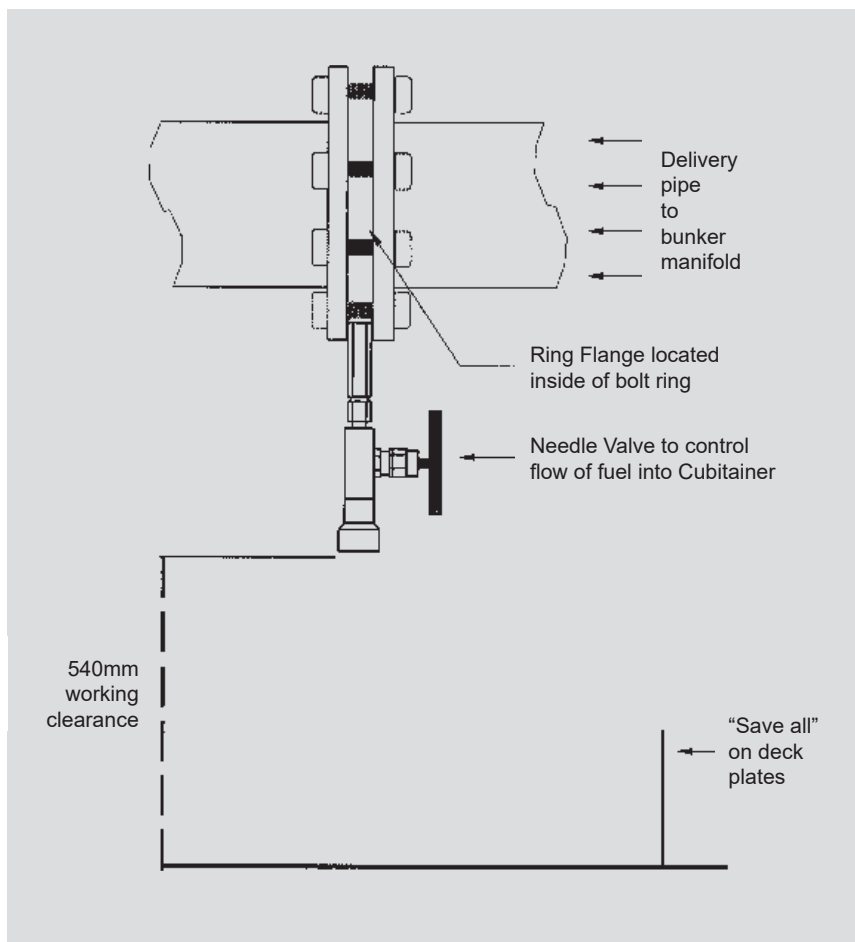
Bunker Samplers

Installation

The ISO fuel specification ISO 8217 refers to the place of custody transfer, which is normally at the vessel's manifold. In other words, at the vessel's end of the bunker delivery hose.

However, it is often more practical to use the sample taken by the supplier at the barge end of the hose.

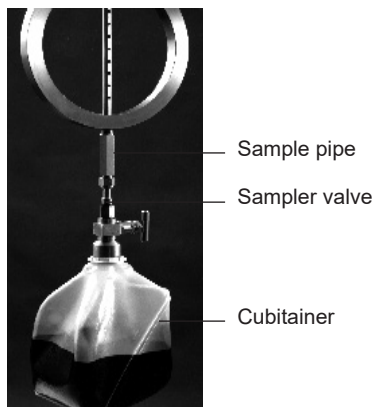
Provided that the sample is witnessed throughout the bunkering, then properly mixed and split, it doesn't matter which end of the delivery hose is used.



Operation

- The tube within the sampler should always be cleaned before use. This can be achieved by removing the tube and simply flushing with a clean distillate fuel.

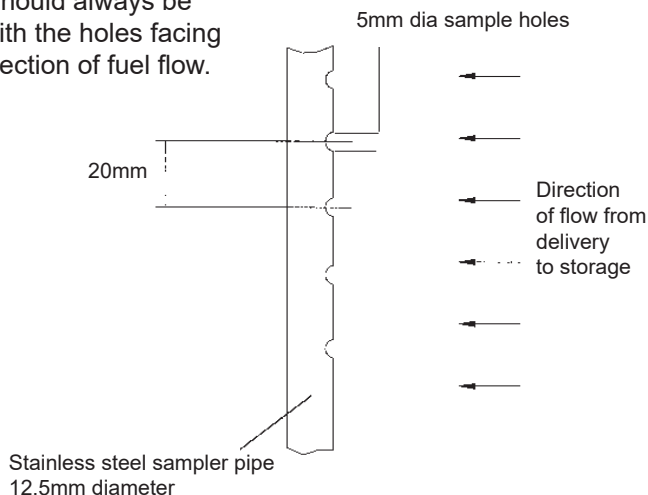
The use of low flash point solvents for cleaning the sampler is discouraged as contamination of the sample can lead to very expensive mistakes!



Sampler with attached Cubitainer.

- Allow to drain thoroughly before reinstalling.

The tube should always be installed with the holes facing into the direction of fuel flow.



- When bunkering starts, place a container under the sampler, open the sampler valve fully and flush the sampler with fuel.

- Close the valve and attach a Cubitainer onto the Sampler.

Adjust the needle valve to give a slow and steady drip.

Time the fill rate to estimate that it will provide for sufficient sample over the expected delivery period. The sample value can be locked in this position to prevent tampering during delivery.



Sampler in use on a Bunker Barge.



Sampler with valve lock fitted to satisfy PSA guidelines.

- If the Cubitainer fills during the bunkering period, remove it and add a numbered tamper evident cap. Place an empty Cubitainer on the sampler and continue to draw a sample.

- Some delivery conditions can cause a vacuum in the line e.g. suddenly stopping the pumps on the barge. Close the sampler valve in these circumstances or the sample will be drawn back into the delivery line.

- On completion of the bunkering, remove and seal the Cubitainer, fully open the sampler valve and allow the sampler to drain.

Typical bunker suppliers terms state that the 'official' sample will be that taken by the supplier (barge operator). Failure to witness can void claim. Always get the barge operator to witness removal and sealing of the Cubitainer Sample Bottle. If this request is refused or if no witness is provided, then note this in the delivery log.

Kittiwake Cubitainers are available in kits with all ancillary consumables.

If a sample is required for on board testing only, then the sample can be drawn directly into a sample bottle instead of the cubitainer.

- Insert the full Cubitainer into the pourer box and thoroughly mix the contents.

- Select 3 or 4 clean sample bottles.
- Attach the pourer spout and gradually transfer the contents into the sample bottles filling each a little at a time. If more than one Cubitainer was used, then transfer a portion of each into the bottles.



- Complete the document labels and attach one to each sample bottle:
 1. Supplier's sample
 2. Vessel's sample
 3. On-site analysis sample
 4. Analysis service sample
(optional if on-site analysis indicates a potential problem)

Date: _____
 Grade: _____
 Lesson to: _____
 Delivery: Change / Repeat / Study / Other _____ Send HOSS _____
 Delivered by: _____ Name: _____
 Received by: _____ Name: _____

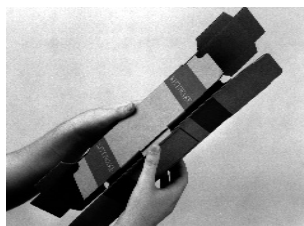
FOR THE COMBINED / JOINTED USE ... This is a certified copy made for you ... and has been supplied, where it is subject to acceptance, it will be subject to the same conditions as the original. The date of delivery is indicated in the serializing/packaging / version of the book. (copy)

Flat pack shipping containers

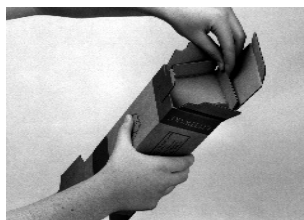
Flat pack shipping containers are provided for transportation of fuel samples. These are tested and approved for use in air transportation. It is **very** important that the correct packaging is used if sending a fuel sample for a laboratory analysis.

Flat pack shipping containers may be assembled in 4 steps as shown below:

- Fold up into a square tube.



- Assemble base and lock in tab.



- Insert sample bottle, sealed and labelled correctly.



- Close end, label case and store.
Ship to laboratory as appropriate.



Heated Viscometer



FUEL & LUBE OIL CABINET



Heated Viscometer

3



Heated Viscometer

Specifications

Operational fluid density:
 $870\text{kgm}^{-3} \leq \rho \leq 1000\text{kgm}^{-3}$

Range:

20 - 810 cSt at 50°C (ISO Fuel Grades RMA10 to RML55)

20 - 810 cSt at 40°C (lube oils SAE 5 through SAE 50)

Test time:

Heating from 25°C: 10minutes

Viscosity at 40°C: 3 minutes (unheated)

Repeat test: maximum 30 seconds

Calculations:

Viscosity at 50°C or 40°C (heated)

Viscosity at 40°C (unheated, corrected to 40°C)

Viscosity at 100°C (calculated)

Calculated Carbon Aromaticity Index (CCAI)

Density correction from 50°C to 15°C in vacuo

Variable Viscosity Index (for unheated mode)

Accuracy:

Typically with +/- 3%(20 - 450 cSt) or +/- 2 cSt

Power:

110 to 240 VAC 50/60Hz 200VA

Fuse Rating:

2.5A 20mm 250VAC HRC A/S (T) Ceramic

HEATED VISCOMETER

Viscosity Meter

Intended use

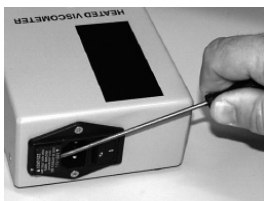
The Viscometer is designed to measure the viscosity of oil either room temperature or warmed to 40°C or 50°C, and with a density of between 870 kgm⁻³ and 1000 kgm⁻³ (inclusive).

Note: these instruction apply to Viscosity Meters with software version 2.xx

Setting the mains voltage

Before connecting the power supply to the mains check that the correct supply voltage is selected. Failure to do this may damage the instrument.

To change supply voltage



Remove fuse box using a screwdriver.



Select correct voltage supply.



Replace box, ensuring white arrows are aligned.

Connecting the power supply

- Connect the yellow power supply lead to the Viscosity Meter and lock into place using by rotating the outer collar.

- Connect the mains lead into the socket on the side of the power supply, checking the correct mains voltage is selected. Plug the other end of the lead into the mains supply.

- Turn on the mains power and then turn on the power supply using the switch next to the socket, the green light should come on and the Viscosity Meter display should illuminate.



Connect lead to
Viscosity Meter.

Green power
light

Fuse & voltage
selector

Lead to Viscosity
Meter



On/off
switch

Power socket

Location

The unit is designed to operate on a flat level surface such as a workbench. This is essential for accurate and reliable operation. Ensure that the Viscosity Meter can be rocked back and forward without obstruction in one clean movement.

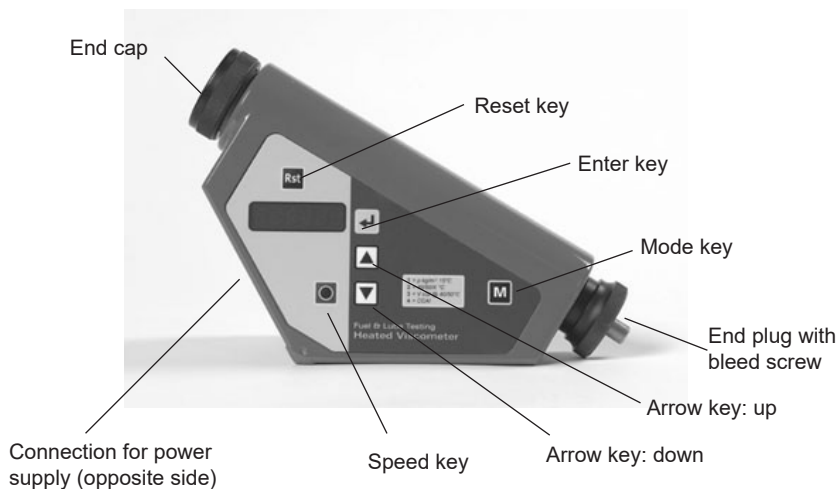
Make sure the power supply is located towards the rear of the workbench where the cable cannot be caught during operation.



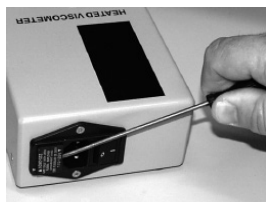
Controls and features

The instrument measures viscosity by timing the descent of a metal ball through the internal tube. The instrument is designed to easily 'TILT' from side to side allowing the ball to fall under gravity, measurements are taking in both direction to compensate for the workbench being slightly out of level.

There is an internal circuit that controls the heating of the oil to allow measurements to be taken on higher viscosity oil. The display will request a 'TILT' for measurement only when the temperature is stable to ensure accurate results. The processing circuitry compensates for the temperature of the oil and allows display of Centistokes adjusted to 40,50 or 100 °C. There is a calculator feature, which allows the reading to be adjusted for Density and Viscosity Index for improved accuracy and to display the CCAI.



To change fuse



Remove fuse box using a screwdriver.



Carefully remove and replace fuse.



Replace box, ensuring white arrows are aligned to correct voltage supply.

Cleaning after use

After a measurement is taken the inside of the measuring chamber must be clean of any residual oil, If any is left it could affect the accuracy of the next result. It is also essential to ensure there are no foreign bodies, grit, pieces of tissue etc. inside the tube, as they will affect the motion of the metal ball.

- Turn off the power supply and disconnect the yellow lead from the viscometer. Carefully open the end cap to empty the oil out of the tube.

CAUTION: *The oil may be hot (50°C).*

-
- Using the sieve supplied to catch the metal ball, tip the oil out into a container
-
- Using the rod supplied push a wad of clean tissue down the centre of the tube ensuring all remaining oil is cleaned out. Replace the metal ball into the tube and fit end caps for safe keeping.

General cleaning and maintenance

Make sure the power supply is disconnected from the mains. Wipe down the instrument with a clean dry soft cloth. Do not immerse in water, if necessary to remove stubborn marks use a cloth soaked in warm soapy water.

If the unit fails to power up disconnect the power lead and check the fuse is OK. We have supplied replacement fuses of the correct type in the spares pack. Do not use any other type of fuse.

There are no other user serviceable parts inside the unit, if the unit still does not operate return to the supplier for repair.

Note: If the equipment is used in a manner or for a purpose other than that described above then any safety protection may be impaired.

General operation

- Use Reset key to initialise operation.

- Use Mode key to select Viscometer functions.

- Use Arrow keys to change values.

- Speed key toggles on/off. Used for rapid slewing of values.

Filling with oil

- Support Viscometer vertically, slacken bleed valve, then pull out the sliding plug. Ensure Viscometer tube is clear, clean and contains the metal ball.

- Fill the tube with the oil sample to just above the V-plate. Slowly push in and rotate the plug with the valve open until all air is expelled. Do not use excess force.

- Loosely fit the bleed valve and place the Viscometer in an upright position. Leave to stand for 5mins

- Tighten the bleed valve and wipe off excess oil from the plug. Place Viscometer back on its base and connect the power cable. The Viscometer is now ready for use but do not tilt yet.

Note: If air is not fully expelled from the unit, it may affect results

Rst

M

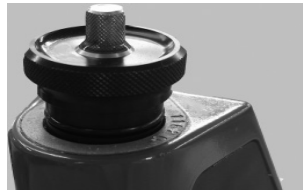
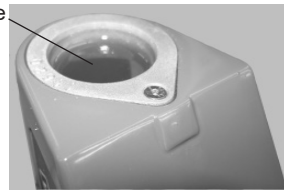


Slacken bleed valve
and remove end plug.



Fill the tube with oil to
just above the edge of
the V-plate.

V-plate



Slowly push in
and rotate the end cap
until all air is expelled.
Tighten the bleed valve.



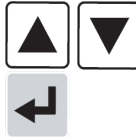
Taking a measurement

- Use Reset key to initialise operation.
- Use Arrow keys to toggle display and select the temperature required with the Return key.
- Temperature display flashes as Viscometer heats the oil. Degree [°] symbol flashes until the oil temperature stabilises.
- Tilt Viscometer when prompted. When oil temperature is stable, the display will show Viscosity at 40° or 50°C as selected.
- Wait for tilt prompt before taking repeat readings.
- Use Arrow keys to toggle display of cSt from 40° or 50° to 100°C.



Rst

2 00

Unheated Lube Oil
(correct up to 40°C)

2 00

Heated Lube Oil
(to 40°C)

2 40

Heated Fuel Oil
(to 50°C)

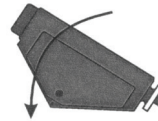
2 50

Display flashes

XX.X°

Temperature
stabilises

40.0°



t i i t

125.4cS



t i i t

indicator
cSt at 100°C

12.54cS

Improving accuracy in Heated Mode

- Take several readings over a longer period of time until readings stabilise.

Correct reading for Density:

The Mode 1 Density value (kg/m^3 at 15°C in vacuo) used by the Viscosity Meter will default at: 0.900 for $0^\circ - 40^\circ\text{C}$ operation and to 0.990 for 50°C Fuel Oil operation

-
- Select Mode 1.

Use Speed and Arrow keys to input the oil Density (i.e. Density at 15° in vacuo).

- Select Mode 5 to recalculate cSt. value and press return.

Improving accuracy in Unheated Mode with Multigrade or Synthetic Oils

- Follow 'Taking a measurement' on the previous page to obtain a reading in cSt. corrected to 40°C .
-

- Select Mode 1.
Use Speed and Arrow keys to input the oil Density (i.e. density at 15° in vacuo).
The Density of many Synthetic Oils is nearer to 1.0 than 0.9.
-

- Select Mode 5.
Enter the approximate Viscosity Index (VI).
The VI of Multigrade Oils will be higher than the default VI of 100.
-

- Press Return key in Mode 5 to recalculate cSt. corrected to 40°C .
-

M

1c .900

Density = 0.9



5 xxx

125.4cS

M

1c .900

Density = 0.9

1c .992

Density = 0.992

M

5 100

Viscosity Index = 100

5 126

Viscosity Index = 126



132.5cS

Correcting the Density from 50°C to 15°C in vacuo

The small [c] in Mode 1 [1c] indicates the reading is as 15°C in vacuo. Sometimes you may be given the reading at 50°C in air and this will need to be corrected.

- Select Mode 1 Density at 15°C in vacuo.
- Press Return to enter the reading at 50°C in air.
(This is indicated by the [u] for uncorrected [1u]).
Use the Speed and Arrow keys to enter the reading.
- Press Return and the uncorrected reading is automatically corrected to 15°C in vacuo. This value will then be used by the Viscosity Mkheter for all other calculations.

Calculated Carbon Aromaticity Index (CCAI)

- Select Mode 1.
Use Speed and Arrow keys to enter the Density.
Use the Return key to toggle between Corrected and Uncorrected Density (see 'Correcting the Density').
- Select Mode 3 and display the last recorded Viscosity.
Alter this if necessary using the Speed and Arrow keys.
- Select Mode 4 to calculate CCAI for this Density and Viscosity.

M 1c .900



1u .970



1c .992

M



1c .992



1u .970

M

3 133



3 147

M

4 864

Water in Oil & BN



FUEL & LUBE OIL CABINET



DIGI+ Test Cell

Specifications

Range:

Water: 0.1 % to 20.0 %, 0.1 % to 10.0 %, 0.02 % to 1.00 %, 200 ppm to 10000 ppm, 100 ppm to 3000 ppm

BN: 1 to 150

Test time:

BN: 2 minutes

Water: 3 minutes

Water Range Resolution:

100 ppm to 10000 ppm, Typically ± 1000 ppm

> 1 %, Typically ± 1 %

± 5 BN or 10 % (whichever is greater)

Maximum Storage Time From Full Battery:

6 months (stored between -5°C to 35°C)

Tests Per Charge:

50 tests or 5 hours

Minimum Battery Charge Cycles:

500

Operation temperature range:

10 to 45°C

Weight:

200g



Hydrogen gas build-up risk.
Use in well-ventilated areas.
Dispose of test waste carefully.

Charging DIGI+



Charge fully with Micro-USB
cable before first use

Refit USB socket cover



Fully charged battery
run time: 50 tests

Note: Charge fully at least once every 6 months

Powering On

Use Left (L), Middle (M) or
Right (R) button to power on



Testing - Water (H₂O) - SPOT (single oil test) for DIGI+ Water and DIGI+ Combined



RANGE*

OK

START

Follow on-screen
instructions

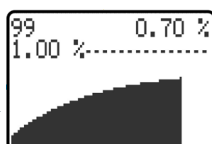


*Select the test range for the approximate amount of
water. If not known, select 0.1 % -
20.0 % to reduce risk of overpressure.



Note: Close and hand tighten only (1/8 turn max.)

3 SHAKE CELL FOR
3 MINUTES
TO ABORT TEST
PRESS 5
FOR 5 SECONDS



PRESS ANY KEY T
15.6 %

TESTING IS
COMPLETE

Check result
against limit for
the test point



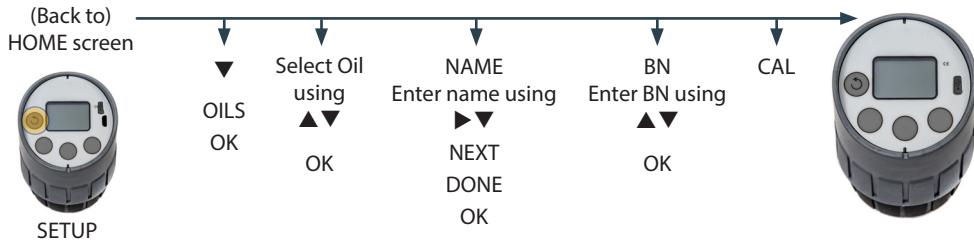
Testing - BN - SPOT (single oil test) for DIGI+ BN and DIGI+ Combined



BN compares the pressure generated from a used oil test to a new oil test. For each oil type, new oil is measured and saved as a calibration for future used oil tests.

Calibration

Cell must be calibrated for each of the oil types to be measured using a new sample of unused oil before used oil can be tested.

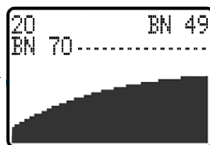


Measure Used Oil

Select Oil using $\blacktriangle \blacktriangledown$ OK → (Follow on-screen instructions)



3 SHAKE CELL FOR 2 MINUTES
TO ABORT TEST PRESS 5 FOR 5 SECONDS



PRESS ANY KEY TO
BN 50

TESTING IS COMPLETE

Check result against limit for the test point

Cleaning



Dispose of contents carefully and wipe with a lint-free cloth. Use a mild solvent if necessary, for example, isopropyl alcohol.

Powering Off



OR

AUTO-OFF after 5 minutes

DIGI+ Consumables, Spares & Contacts Information

View the Condition Monitoring product range: <https://ph.parker.com/gb/en/monitors>

Single Parameter Test Kits

Kits contain all necessary equipment for rapid test results in the field before operating

Order	Tests	Range
FG-K6-101-KW+ Water in Oil (DIGI+)	50	<ul style="list-style-type: none"> 0.02 % to 1 %, 1 % to 10 %, 1% to 20 % 200 ppm - 10000 ppm 100 ppm - 3000 ppm
FG-K6-004-KW+ Base Number (DIGI+)	50	1 to 150 BN
FG-K3-020-KW Viscosity (Lube oil)	-	Go/No Go Typically detects 5% - 10% distillate fuel dilution of an SAE 30 to 40 engine oil and increases in viscosity due to oil contamination
FG-K1-006-KW Insoluble contamination	100	Qualitative
FG-K1-005-KW Salt contamination	30	Qualitative
FG-K24743-KW Acid Number	50	0-6 AN Simple-to-use drop test. The result is shown by a colour change, providing easily interpretable results

Combination Test kits (includes the individual tests above)

Code	Name	Parameters
FG-K6-103-KW+	EasySHIP DIGI+ Basic Kit	W, V, I, S
FG-K6-107-KW+	EasySHIP DIGI+ Industrial Kit	W, V, I, BN
FG-K6-108-KW+	EasySHIP DIGI+ Field Kit	W, V, I, BN, AN
FG-K6-110-KW+	EasySHIP DIGI+ Combined Kit	W, V, I, BN, S

Consumables

Replacements can be ordered at short notice

Code	Name	# of tests
FG-K2-101-KW	EasySHIP Water in Oil Reagent pack	50
FG-K2-002-KW	BN Reagent Pack	50
FG-K2-003-KW	Insoluble test Reagent Pack	50

Reagents are packed in accordance with IATA/IMDG/IRD Air/Marine/Road Transportation codes and can be delivered to major ports world-wide

DIGI+ Consumables, Spares & Contacts Information

Spares

Accessories & Spares can be ordered at short notice

Code	Name	Description	Qty
ACCK06002	USB Dust Cover and Agitator Pack	Keeps DIGI+ USB socket clean. Agitator is used in water-in-oil test	10 & 3
ACCK06003	DIGI+ Combined Cell and accessories	Accessories include: Agitators (3), USB 1.5m lead & Quick Guide	1
FG-K16822-KW	Seal Kit	Replacement O-ring for DIGI+	1

Support Resources

- Quick Test Guide
- Information Guide
- How-to Videos
- Safety Data Sheets
- Example DIGI_CFG.csv file
- DIGI Utility (Set-up Software)
- CE Declaration
- UKCA Declaration



www.parker.com/DIGIPLUS-resource

Contacts

Enter your supplier contact details below:

Supplier Name:

Supplier Telephone Number / Address / Reference:

Notes:

For DIGI+ manufacturer contact details as well as contact details for local and global suppliers, please visit: www.parker.com

Insolubles Loading

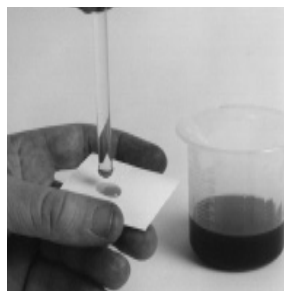


FUEL & LUBE OIL CABINET

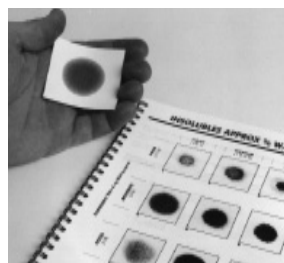
Insolubles Loading

- Place a clean filter paper on a level surface.
- Shake the oil sample bottle to mix the contents and pour a small volume into the beaker.
- Dip the acetate rod into the oil and allow the first drop to return to the beaker.

Place the second drop onto the paper and set aside for 24 hours.



- Compare the dried spot with the examples given on the next page.



Insolubles

This is indicated by the shade of the spot.

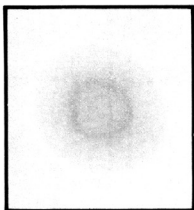
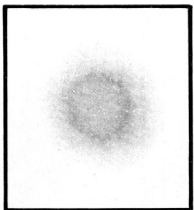
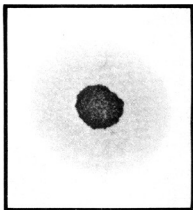
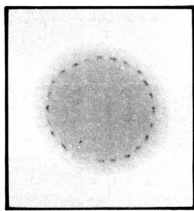
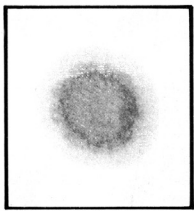
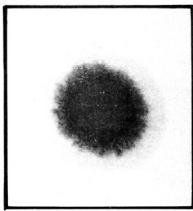
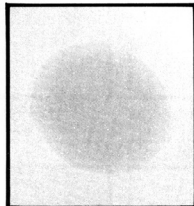
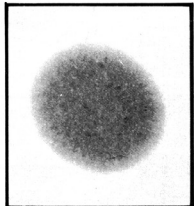
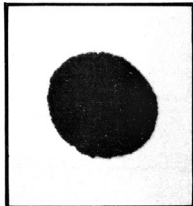
A very dark spot indicates a heavy insolubles loading.

If the dispersency is very low, only the centre of the spot will be dark.

Dispersency

This is indicated by the colour change from the centre to the outside of the spot. A distinct colour change indicates reduced dispersency.

NB: If the insolubles are very high or dispersency is low, immediately send a sample of the oil for detailed analysis.

Insolubles % w/w approx			
	light ($< 0,1$)	medium ($1 - 2$)	heavy (> 2)
poor (< 1)			
moderate ($1 - 2$)			
good (> 5)			

Density Meter



FUEL & LUBE OIL CABINET

Density Meter



Specifications

Range:	800 to 1010kg/m ³ at 15°C (ISO 8217 Fuel Grades DMA to RML55)
Test time:	Heating from 15°C: 10 minutes Repeat test: maximum 30 seconds Cleaning: 1 minute
Test temperature:	Selectable 50°C or 70°C
Calculations:	Density at 15°C in vacuo, centiPoise to centiStokes Calculated Carbon Aromaticity Index (CCAI)
Accuracy:	Typically with ±0.1% (800 - 1010kg/m ³)
Power:	110 to 250VAC Autoselected 50/60 Hz 200VA
Fuse rating:	2.5A 20mm 250VAC HRC A/S (T) Ceramic

Density Meter

Intended use

The Density Meter is designed to measure the Density of fuel or lubrication oil either at 50°C or 70 °C.

CAUTION: The Density Meter must not be used for heating any other liquids such as water, cleaning fluids, or any fuels with a low flash point temperature (e.g. gasoline).

Note: These instructions apply to density meters with software version 2.xx

Setting the Mains Voltage

The meter auto selects the heating and power supply to match the supplied



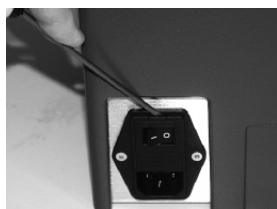
240ac

Connecting the Power Supply

- Connect the mains lead into the socket on the rear of the Density Meter. Plug the other end of the lead into the mains supply.
- Turn on the mains power and then turn on the power supply using the switch next to the socket, density meter display should illuminate showing the mains voltage detected.



To change fuse



Open lid using screwdriver.



Carefully remove fuses.



Replace and secure lid.

Location

The unit is designed to operate on a flat level surface such as a workbench. The unit when operating contains hot oil heated up to 70 °C. It is essential for safe operation that it is on a stable surface with the power cable running backwards from the unit where it cannot be accidentally snagged.

Controls and features

The instrument measures density using a hydrometer dropped in warmed oil. Most oil can be measured at 50 °C but for very viscous oils the units can be set to warm to 70 °C .

There is a calculator feature, which allows the reading to be adjusted to show Density at 15°C in a vacuum. If the viscosity is known in Centistokes or Centipoise the calculator will display the CCAI.



Cleaning after use

- After a measurement is taken, turn off the power supply and disconnect the mains lead from the Density Meter.
- Carefully pour the oil into a container using the pouring spout.

CAUTION: The oil will be hot (up to 70 °C). Pour out the contents carefully. Using the rod supplied use a wad of clean tissue down the centre of the tube ensuring all remaining oil is cleaned out.

General cleaning

Make sure the power supply is disconnected from the mains. Wipe down the instrument with a clean dry soft cloth. Do not immerse in water, if necessary to remove stubborn marks use a cloth soaked in warm soapy water.

Maintenance

If the unit fails to power up disconnect the power lead and check the fuse is OK. We have supplied replacement fuses of the correct type in the spares pack. Do not use any other type of fuse.

There are no other user serviceable parts inside the unit, if the unit still does not operate return to the supplier for repair.

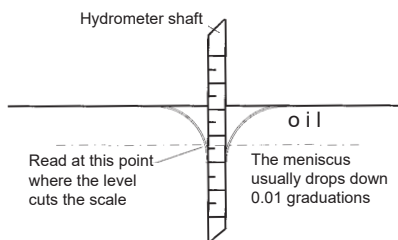
Note: If the equipment is used in a manner or for a purpose other than that described above then any safety protection may be impaired.

Heating

- Carefully fill Density Meter tube with oil up to the fill line about 10mm from the top.
- Switch ON, press reset. (Unit displays revision and supply voltage). Select heating temperature using UP and DOWN arrows.
- Press Return to start heating.
- Centigrade digit "°" flashes as the Density Meter heats the oil. Stir the oil occasionally as it heats up with the stirring rod provided. When the temperature stabilises at 50°C the meter is ready for operation, (this takes about 10 minutes).
- The meter will display the uncorrected [u] hydrometer reading in Mode 1. Stir the oil thoroughly and gently insert the hydrometer (select an appropriate range for this). Imparting a gentle spin will help it reach a steady level.

Testing

- Read the hydrometer at the meniscus. Use Arrow and Speed keys in Mode 1 to enter the uncorrected [1u] Hydrometer reading at 50°C.



- Press Return. Display now shows the Density corrected to 15° [1c] in a vacuum kg/m^3 in vacuo.

Rst	▲	
	▼	
↙		38.6°
		39.0°
Do not use the hydrometer for stirring the oil. Be careful with the hydrometers: they are made of glass and will break!		19.3°
		50.0°



1U .980

3 ranges of hydrometers are available:
 0.80 - 1.01 Wide range but less discrimination
 0.85 - 0.95 Lighter fuels DMA - RMH
 0.90 - 1.01 Heavier fuels RMD - RML



1U .978



1C .999

Calculating CCAI (Calculated Carbon Aromaticity Index)

- Advance to Mode 2. (Not available with 70° heating).
-
- The default viscosity is 280, or the last reading entered.
Use Arrow and Speed keys to enter an Oil Viscosity.
This is normally entered in centiStokes at 50°C for Fuel Oils.
-
- Advance to Mode 3. (Not available with 70° heating).
CCAI value is displayed automatically, using the entered Density and Viscosity values.
-
- Use Mode key to cycle modes and repeat calculations.

Conversion to centiStokes from centiPoise

- Holding down Speed key in Mode 2 allows entry of Viscosity in centiPoise [P].
-
- Press Return to display value converted from cP to cSt using the Density entered in Mode 2.

NB: Corrected Density [1c] can be altered for calculating cSt from cP.



M

2 280



2 273



M

3 864

M



'P' indicates
centiPoise option

2P 273



Viscosity corrected to
centiStokes

2 279

Compatibility Test



FUEL & LUBE OIL CABINET

Compatibility Test



Specifications

Range:	As per ASTM D4740
Test time:	20 minutes (unattended)
Accuracy:	Variation of 1 rating in 20 repeat tests
Power:	110 to 250VAC Autoselected 50/60Hz 150VA
Fuse rating	2.5A 20mm 250VAC HBS A/S (T) Ceramic

Compatibility Test

Intended use

The Compatibility oven is use to pre-heat a sample and then dry sample test paper prior to analysis. It contains chamber heated to 100 °C. It must not be used for heating any other materials.

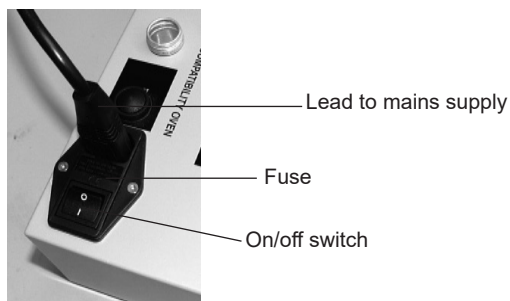
Note: these instruction apply to compatibility ovens with software version 1.xx

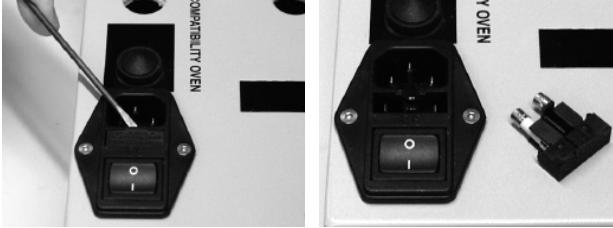
Setting the mains voltage

The meter auto selects the heating and power supply to match the supplied mains voltage.

Connecting the power supply

- Connect the mains lead into the socket on the side of the power supply.
- Turn on the mains power and then turn on the power supply using the switch next to the socket, the timer display should illuminate.





Remove fusebox using a screwdriver

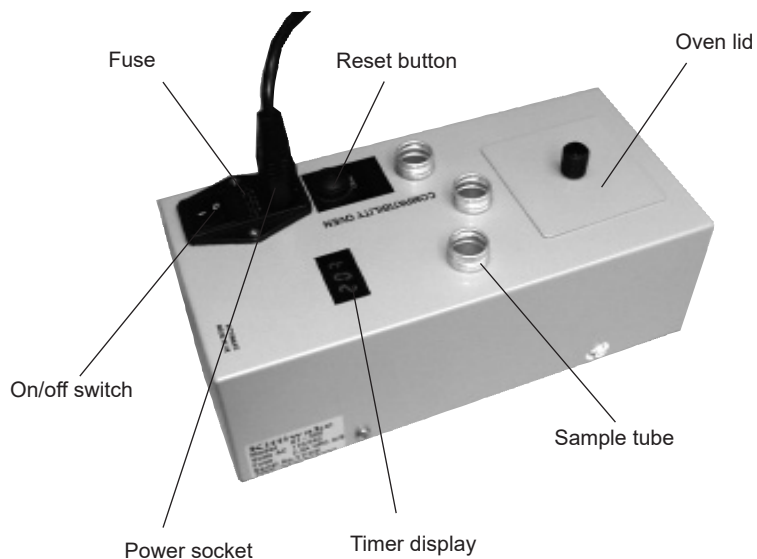
Location

The unit is designed to operate on a flat level surface such as a workbench. The unit when operating contains hot oil heated up to 100 °C It is essential for safe operation that it is on a stable surface with the power cable running backwards from the unit where it cannot be accidentally snagged.



Controls and features

The instrument is designed to prepare oil sample for performing a visual oil compatability analysis. It automatically controls the oven temperature to 100 °C and has a timer features to allow the preparation time to be measured.



Cleaning after use

- After a measurement is taken, turn off the power supply and disconnect the mains lead from the Compatibility oven.

CAUTION The oil samples and oven will be hot (up to 100 °C). Handle with care.

- When cool remove the sample tubes and dispose of oil and tube.

General cleaning

Make sure the power supply is disconnected from the mains. Wipe down the instrument with a clean dry soft cloth. Do not immerse in water, if necessary to remove stubborn marks use a cloth soaked in warm soapy water.

Maintenance

If the unit fails to power up disconnect the power lead and check the fuse is OK. We have supplied replacement fuses of the correct type in the spares pack. Do not use any other type of fuse.

There are no other user serviceable parts inside the unit, if the unit still does not operate return to the supplier for repair.

Note: If the equipment is used in a manner or for a purpose other than that described above then any safety protection may be impaired

Stability of Fuel Oil

- Obtain a representative sample.
Shake thoroughly just before testing.
Heat in hot water if necessary to aid pouring.

- Pour a sample of oil into a beaker.
Transfer about 10ml of oil from the beaker into a sample tube
(to a height of about 30mm).
NB: For equipment setup see 'Timer' section.

- With the unit fully heated to 100°C, place the tube in one of the
preheat holes. Press Reset and allow the timer to count to 20
(takes 20 minutes).

- Stir the oil for 5 seconds with an acetate rod.
Remove the rod without touching the side of the tube.
Allow the first drop to fall back in and the second drop to fall onto the
centre of the test paper.

- Place the paper in the removable tray section
and replace in the oven.
Press Reset and allow the timer to count to 20.
During this time the spot will develop and dry.

- Remove the paper and compare the spot against the Spot Reference
Chart (see following pages).



Unit
fully heated

f 0 0

f 2 0



Timer reset to
0 minutes

f 0 0

f 2 0

Compatibility of Fuel Oils

- Repeat the sample preparation procedure used in the 'Stability of Fuel Oil' method (on the previous page), using one tube for each fuel to be tested (fuel A and B).

- With the unit fully heated, place the tubes into two of the preheat holes. Press Reset and allow the timer to count to 5.

- Carefully syringe samples of fuel A and B into a third sample tube in the same ratio as the oils are to be mixed in the bunker tank. Stir to mix well.

- Place the third tube (containing the mixture) in the remaining preheat hole. Press Reset and allow the timer to count to 15.

- Stir the oil for 5 seconds.
Remove the rod without touching the side of the tube.
Allow the first drop of oil to fall back and the second drop to fall onto the centre of the test paper.
A spot may also be made of fuel A and B at this stage, if required.

- Place the paper(s) on the removable tray section. Replace in the oven. Reset and allow the timer to count to 20. Both the mixture and each individual fuel can be tested for stability.

- Remove the paper(s) using the tweezers and compare the spot against the Spot Reference Chart on the next page.



Unit fully
heated

t	0	0
t	0	5



Mixture

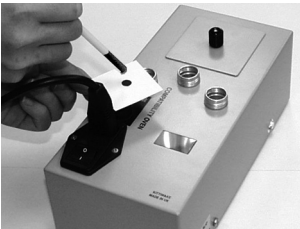


Fuel A



Fuel B

t	0	0
t	1	5

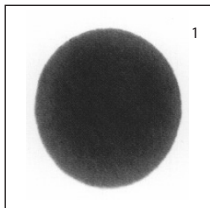


t	0	0
t	2	0

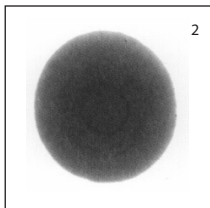


Spot Reference Chart

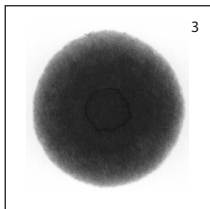
When the dried sample is removed from the oven, it can be compared against the spot reference chart. Differences in colour, overall darkness, spot size and appearance of outer edges should be ignored. Only the characteristics of the centre ring should be examined when determining compatibility rating.



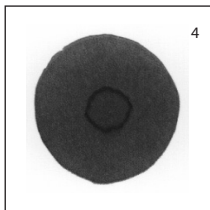
Compatible / stable.



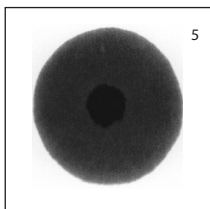
Will deposit some sludge; handle carefully;
consider chemical additives; do not overheat;
increase purifier; blow down frequency.



As for 2 but increased sludge potential.



Incompatible / unstable.



Incompatible / unstable.

ASTM: D 2781 also used in
revised standard ASTM 4740-94.
With acknowledgement to ASTM.

Theory of Operation

Measure stability of pre-blended oils on delivery and storage:

- Test each new bunker fuel.
-
- Check after purifier.
-
- Check effectiveness of fuel additives used to improve fuel stability.

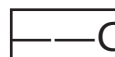
Measure compatibility of two component oils:

- Test when fuels are mixed on transfer or bunkering.

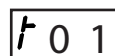
Timer

The equipment is provided with a small display that will indicate as follows:

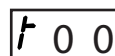
- Equipment in heating mode, not yet up to temperature.



- Equipment heated to 100°C and ready for use, when timer starts to count in 0 - 99. The timer counts in minutes.



- The timer can be reset by pressing the Reset button.



Salt/Fresh Water Test



FUEL & LUBE OIL CABINET

Salt/Fresh Water Test

This Test is designed to determine if the water contamination in a Fuel or Lube Oil sample is from a Fresh or Salt Water source. As a guide 1% sea water contamination is associated with 100ppm Salt and can easily be detected with this test. Note that Salt will continue to contaminate Lube Oil, even when the original water contamination has been evaporated.

- Add 2ml of Reagent H to the test tube.

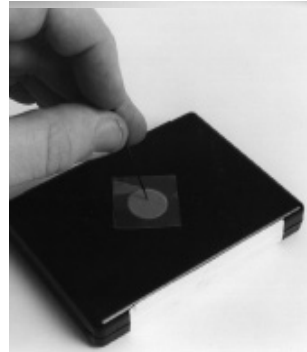
Shake the oil sample and draw off 5ml using the syringe provided. Add this to the test tube, replace the cap and shake vigorously.

Place the tube upright in **hot** water and allow to stand for 1 hour until the water settles out of the oil sample.



- Take one test pad from the box and replace the lid. Handle the test pads by the edges to avoid contaminating the surfaces with sweat.

Puncture an area 10mm in diameter 10 to 15 times with the pin provided.



- Flush the pipette with Reagent H. Place the tip in the water layer in the test tube.

Squeeze the bulb gently and draw off a sample of the water into the pipette.

Remove the pipette, wipe off any oil and return a few drops of water to the test tube.

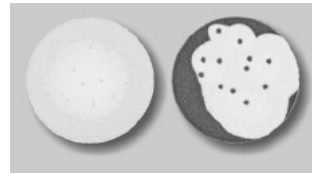
- Place the next drop of water onto the prepared test pad.
Allow the pad to stand for 5 minutes.



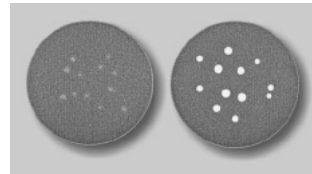
- Examine the pad:

If a large yellow patch appears, the contamination is **Salt Water**.

If there is no yellow colour, or only a very faint yellow patch appears, the contamination is **Fresh Water**.



Salt Water.



Fresh Water.

- A positive result should always be checked by testing another pad.

Pour Point Test



FUEL & LUBE OIL CABINET

Pour Point Test

This test is designed to provide a guideline figure for the pour point of residual fuel oils, specifically fuel oil grade RMA – RMK of ISO 8217 1996. Results are for guidance only but carry sufficient accuracy to identify future difficulties in storage and handling of fuels with unusually high pour point. Never store fuel at or below the tested pour point.



Specifications

Range:	0° - 50°C Fuel Oils ISO 8217 Grade RMA - RMK
Accuracy:	Typically $\pm 6^{\circ}\text{C}$
Thermometer:	Electronic with 0.1°C resolution

Pour Point Test

- Warm the fuel oil sample without stirring to between 40 and 50°C. (Alternatively, take a pre-heated fuel sample directly from the Density Meter or Heated Viscometer.)



Sources of Warm Oil

- Pour 50ml of the sample into a 100ml beaker and either
 - place the beaker in a domestic refrigerator or
 - place the beaker in a bath of crushed ice.

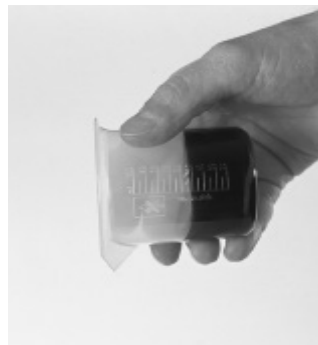
The pour point of most residual fuels is above 0°C, thus for these products there is no need to determine a pour point below this temperature.



Place the beaker in a bath of crushed ice.

- Inspect the beaker at approximately 5 minute intervals. (Use a watch or the counter on the compatibility tester to judge 5 minutes.)

Examine the beaker by holding in a horizontal position as shown. This process should be completed within a few seconds and the oil returned to the cooling medium (refrigerator or ice bath).



- The pour point is reached when the oil surface stays in the vertical position when tilted for a period of 5 seconds and does not sag in the beaker.



Must stay vertical at Pour Point

- At this point, insert the thermometer and take the temperature of the oil in the beaker. This should be completed within 10 seconds.

Note: Please refer to manufacturers instructions for operation of the thermometer.



Insert the thermometer and take the temperature of the oil in the beaker.

- The pour point is defined as 3°C higher than the temperature at which the fuel in the sample beaker will not flow when tilted for a period not exceeding 5 seconds.

**Pour Point =
Temperature for
no flow + 3°C .**



Health and Safety



FUEL & LUBE OIL CABINET

Health and Safety Information

Operation of Fuel and Lube Oil Test Equipment

Ensure that:

- The operator is thoroughly familiar with all aspects of the instruction manual.
- The equipment is connected to the correct power supply.
- The equipment is placed on a firm, horizontal surface during use and that it is prevented from sliding.
- The working area is well ventilated and illuminated.
- The equipment is not subjected to damp or liquid spray (e.g. on deck).
- The equipment is never used in a hazardous environment.
- Never smoke while using the equipment or handling any of the Reagents.

Over Pressure Protection

Digi Cell

The Water and TBN Cell has been safety tested to more than 20 times working pressure. However it is essential that the operator does not exceed the recommended volumes of reagents or test oils in each cell.

The Water and TBN Cell is designed to vent excess pressure and prevent spray before the cap can be fully removed. If the cell is operated beyond its design pressure then simply slacken the cap to release the pressure. Hold the cell upright when slackening the cap to prevent any liquid from being sprayed out as the pressure escapes.

Viscometer

The end plug and bleed valve assembly in the Viscometer are designed to slide. If cold oil is left in the Viscometer and allowed to expand, there is danger of an hydraulic lock but damage is prevented by allowing the end plug to be pushed out.

Always therefore clean out the Viscometer after use and never store the Viscometer with the tube full of oil.

Chemicals

Care has been taken to ensure the safety of reagents used, but it is imperative that the operator is thoroughly familiar with the individual Health and Safety Data Sheets before handling or use of any reagent.

Liquid Reagents S and TBN:

Have a flash point above 66°C.

Reagent B:

Will react with oxygen and especially water to liberate hydrogen gas. It is subject to IATA, IMDG transport restrictions.

CAUTION: Never store the equipment without checking that all reagents are sealed tightly and cannot leak. Remove all Reagents before returning the equipment to the manufacturer.

Guide to interpreting Health & Safety Data Sheets

Most reports are split into a number of sections, each covering just one aspect of the product and as the same report format is used for many different chemicals, not every entry is appropriate information for Kittiwake Products. The information may not be reproduced in this order but almost all of the information will appear in all Health and Safety Data Sheets. The main purpose of this guide is to provide a glossary to most of the specialist terms and acronyms found in Health and Safety Data Sheets prepared to the standards of USA, Canada and the EU. They may also be useful in assessing data sheets prepared in other regions.

Product name:	Including Synonyms and government identification codes.
Summary of hazards:	Usually written in understandable but precise terms.
Hazardous ingredients:	Individual components which have their own particular hazards.
Physical data:	Colour, density, smell, boiling etc.
Fire and explosion Hazard data:	This describes the flash point, auto ignition temperature and flammability in air. The procedure for fire fighting is covered as are the particular fire and explosion hazards.
Reactivity data:	How product will react when in contact with other materials.
Health hazard information:	Specific health risks covering all methods of exposure to the product.
Emergency first aid:	Detailed advice on first aid measures and guidance on treatment for doctors.
Precautionary measures:	How to avoid the health and fire/explosion hazards.
Spill and leak procedures:	How to deal with spillages of the product and how to clean up same.

For copies of Health and Safety Data Sheets, please visit our website at www.kittiwake.com

Other Information



FUEL & LUBE OIL CABINET

Independent Laboratory Report

**Saybolt**

A CAFE LABORATORIES COMPANY

FAST TO THE POINT.

CALIBRATION CERTIFICATE

Report No: 102/10159-0/08

ROLLING BALL VISCOSIMETER

Manufacturer/производитель: Kittiwake
 Instrument no./серийный номер: 2865
 Ref. Oils/тестируемые образцы: Fuel oils/топливо марок

Ref. viscosimeter	Ref. Viscosity Лабораторная вязкость (cSt)	Measured Visc. Полученная вязкость (cSt)	Deviation Разница (cSt)	Acceptable deviation допустимая разница (cSt)
CF-150-570A	30.39	30.4	0.01	+ 2.52
CF-360-66	180.3	181.9	1.6	+ 8.5
CF-350-73	372.4	374.3	1.9	+ 17.5
CF 400 4178	723.4	732.6	9.2	+ 34.0

DENSITY METER

Manufacturer/Model/ производитель/модель: Kittiwake / AS-K1-301
 Instrument no./серийный номер: 3092
 Ref. Oils/тестируемые образцы: Diesel oil (low vise), Fuel Oil (High Visc)
 дизельное топливо, тяжелое топливо
 Ref. Densimeter: DMA 45 S1, No.: 252638

Ref. density Лабораторная (g/ml)	Measured Dens. Полученная (g/ml)	Deviation Разница (g/ml)	Acceptable deviation допустимая разница (g/ml)
0.8367	0.837	0.0003	± 0.001
0.9713	0.972	0.0007	± 0.001

Saybolt Denmark A/S, 24-1-2008

Jan Aclimann



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 E-mail: saybolt.danmark@cafe.com

All our activities are carried
 out under our general terms
 and conditions
 Reg nr 3/5 217-96

