KITTIWAKE
monitoring innovation

Monitoring Technologies Product Catalogue

Introduction

World Class Innovations in Condition Monitoring

Monitoring the condition of critical plant & machinery is central to implementing effective maintenance while rapid, informed decision-making is vital to avoiding costly down time and managing risk.

At Kittiwake, we pride ourselves on providing our customers with the right blend of technology, expertise and information, enabling you to manage risk, reduces downtime, optimize efficiencies and maximize profit.

Established in 1993, Kittiwake Developments has grown into a leading global provider of monitoring and testing technology solutions with offices in the UK, Germany, USA, and Asia. As an expert in machinery condition monitoring, fuel and lube oil analysis and marine water testing, we pride ourselves on our record of investment and commitment to developing our talented workforce to create innovative technology solutions that make a real difference to our customers' operations.To get an overview and more detailed information in particular systems or specialized measuring equipment we created a catalogue. Short introductions help to get access in each chapter. That makes it easy for customers to gain insight about products and services.

The Index at the end makes it possible to find keywords and their description, furthermore cross references in the catalogue.

We want to give this catalogue to interested parties and to customers who need to get more knowledge or adjusted information for products they already use and/or want to upgrade.

The Kittiwake-Team

Oil Test & Analysis Solutions

1. Onsite Oil Test & Solutions 5
2. Sampling Solutions 17
3. Independent Laboratory Oil Test 22
4. Online Oil Sensors 24

Machinery Condition

1. Onsite Wear Debris Analysis 28
2. Wear Debris Sensors 30
3. Diesel Performance Analyzer 32
4. Torque Meter 38
5. Acoustic Emission Solutions 39
6. Application Specific Solutions 51

Cylinder Drain Oil Management

1. Laboratory Oil Service 56
2. ANALEXAlert 57
3. LinerSCAN 58

Marine Water Test Solutions

1. Marine Potable Water Test Kits 64
2. Marine Sewage Water Test Kits 67
3. Cooling and Boiler Water Test Kits 68

Laboratory Devices

1. ANALEXpqL 72
2. ANALEXrpd 73
3. ANALEXrobot R19 74
4. FTIR Oil Analyser 75

Kittiwake Training

1. Basic Oil Seminar 79
2. Marine Potable Water Tests 80
3. Cylinder Drain Oil Management 81
4. Monitoring with Acoustic Emissions 82
5. Diesel Performance 83

Oil Test and Analysis Solutions

1. Onsite Oil Test & Solutions 5
2. Sampling Solutions 17
3. Independent Laboratory Oil Test 22
4. Online Oil Sensors..... 24

1. Onsite Oil Test & Solutions

Kittiwake's oil test kit range and oil analysis range provides a complete set of economically priced equipment, with a level of accuracy suited to routine analysis. Oil test kits provide you with a condition monitoring tool enabling you to make informed operational and maintenance decisions about your critical plant and equipment. Fuel and lubricating oils form a major cost element in the operation of almost all industrial machinery and engines. The ability to test on-site at the point of use enables engineers and facilities managers to conduct oil anlysis quickly and easily.

Supplied ready for use, in heavy duty aluminium or durable ABS cases, Kittiwake's multi- parameter test kits contain all of the necessary equipment and consumables for your oil condition monitoring needs.

Fuel and lubricating oil analysis equipment enables you to carry out a simple on-site condition based maintenance of your fuel and lubricating oils.

- Fast, accurate results for multiple oil parameters in an easy to use, portable kit.
- Laboratory grade results, available on-board or in the field.
- Regular monitoring to provide trends, helps to avoid expensive machinery and equipment failure.
- Make informed on-site maintenance decisions.
- Act before the onset of critical failure.
- Robust and reliable for use in harsh or remote environments
- Save time and money by knowing exactly when to change out oil

EasySHIP

Reagents - non hazardous - easy and quick to transport!

Testing on site using the calcium hydride method and a test vessel has long been used for effective and accurate results in the field. However, its volatile nature makes it expensive to ship and hazardous to use.

The new EasySHIP reagent sachet has been developed with our customers shipping costs in mind. Now you can buy most Kittiwake Water in Oil Test Kits or reagent packs which are non hazardous for transport.

As well as savings on shipping, the EasySHIP method from Kittiwake is extremely simple and safe to handle. Our nonhazardous, single dose, pre- measured, no mess sachet requires no pre- work and no mixing before use.

Central Units for Tests

Console

Kittiwake provides three different levels of Oil Analysis/Test solutions:

- **Electronic Oil Analysis Solutions** (OTC), highest accuracy according to laboratory standards
- **DIGI Oil Test Solutions,** state of the art with high accuracy
- **ECON Oil Test Solutions,** simple analog devices with acceptable accuracy

The **Console** is the central control unit for the Oil Analysis range and the heart of Kittiwake on-site oil test solution range.

A unique inductive coupled power supply enables individual test cells to be powered via an electromagnetic link, thus eliminating the need for wires, batteries or connectors. An infrared data link connects the Unheated Viscometer to the side of the Console. Measurement data is transmitted via the link and up to 256 sets of readings can be stored in the memory. Results are displayed on an easy to read LCD screen and can be downloaded to a PC for further analysis and trending. The console features large key pad buttons for simple operation.

Specifications

Display:	8 digit LED
Keypad:	Membrane type with tactile buttons
Interfaces:	Measuring Cell socket with inductive power circuit and Infrared data link. Infrared data link for viscometer. RS232 port of data download to PC
Memory:	Capacity to store 256 readings in none volatile storage
Power:	110 to 2340 AC 50/60 Hz 20 VA

Digi Cell

The DIGI Test Cell is the heart of Kittiwake DIGI on site oil test solution range, providing simple, accurate results for Water in Oil and Total Base Number (TBN).

With an easy to read digital display providing instructions and results, a five year (10,000 tests) battery life and built in memory for recording previous test results, the Kittiwake DIGI Cell has become a favoured test method worldwide for on-site and on-board testing. Alternatively, Kittiwake ECON Test Cells offer simple, analogue results. Test cells are available individually for either Water in Oil or Base Number (BN). Alternatively, a DIGI Combined Test Cell is available that performs both test parameters in a single cell. Both types of cells have recently been upgraded to offer increased functionality and usability. All reagents and the test methods remain the same.

Specifications

Display:	Electronic with step by step test instructions
Keypad:	Membrane type with 3 simple buttons
Memory:	Previous test, plus five oils
Power:	Battery life 5 years (10.000 tests)

Water in Oil

Electronic Water in Oil Test Kit

Maintain and protect your equipment, whilst eliminating damage caused by water in your oil.

The Electronic Water in Oil Test Cell does provide highest on site accuracy for testing Water in Oil giving results after a few minutes.

DIGI Water in Oil Test Kit

The DIGI Water in Oil Test Kit provides state of the art, digital analysis and gives fast, accurate results for easy monitoring of trends.

ECON Water Test Cell

Alternatively, the ECON Water in Oil Test Kit contains a simple, analogue test cell together with all necessary reagents and equipment for an easy to use, economical test. Water can enter the oil from many sources including condensation, leakage and malfunction of oil treatment systems.

- Prevent corrosion, cavitation or failure of your machinery by detecting water in oil, before any damage occurs.
- Minimise instability of additive packages and damaging microbe growth by monitoring your oil.

EasySHIP Reagent B

EasySHIP Water in Oil Reagent Pack is supplied with all needed for further 50 Tests.

Ordering Information

FG-K17767-KW:
Electronic Water in Oil Test Kit (Low Range)
Range: 0-6000 ppm
Accuracy: +/-100ppm
Test Time: 2 minutes
Reagents: non hazardous

FG-K17766-KW:
Electronic Water in Oil Test Kit (Standard Range)
Range: 0-1%
Accuracy: +/-0.1%
Test Time: 2 minutes
Reagents: non hazardous

FG-K1-101-KW:
DIGI Water in Oil Test Kit
Range: 0.02-1%, 200-10000 ppm, 0-10%, 0-20%
Accuracy: +/- 0.1% on 0-10% range
Test Time: 2 minutes
Reagents: non hazardous

FG-K17032-KW:
DIGI Water in Oil Test Kit (Low Range)
Range (LR): 0.02-1%, 100-3000ppm, 0-10%
Accuracy: +/-0.1% on 0-10% range
Test Time: 5 minutes
Reagents: non hazardous

FG-K13958-KW:
ECON Water in Oil Test Kit
Range: 0-1.2%
Accuracy: Typically 0.1 %
Test Time: 2 minutes
Reagents: hazardous, UN 1404

Spares
FG-K2-101-KW:
EasySHIP Water in Oil Reagent Pack

FG-K2-001-KW:
Water in Oil Reagent Pack
Reagents: hazardous, UN1404

AS-K1-104-KW:
Electronic Water Cell (0 - 2.5%)

AS-K1-105-KW:
Electronic Water Cell (0 - 6000 ppm)

AS-K13889-KW:
DIGI Water Cell

AS-K13890-KW:
DIGI Combined Cell (Water + BN)

Base Number (BN)

Electronic Base Number Test Kit

Measure your oil's alkaline reserve and ability to neutralise acids from combustion.

The Electronic BN Test Kit does provide highest on-site accuracy for testing BN giving results after a few minutes.


DIGI Cell

The DIGI BN Test Kit provides state of the art, digital analysis and gives fast, accurate results for in-depth monitoring of trends.


ECON BN Test Cell

The ECON BN Test Kit gives a rapid indication of BN depletion in lubricants.

- Avoid fouling within the engine and corrosion of engine components by monitoring the Base Number (BN) of your lubricating oils.
- Simple, economical monitoring of lubricants.

BN Reagent Pack

- Replacement reagents can be ordered at short notice.
- Reagents are ready in packs
- BN Reagent Pack available with all needed for 50 Tests

Ordering Information

FG-K25197-KW:
Electronic BN Test Kit
Range: 5-99 BN
Accuracy: Typically +/- 10% of new BN
Test Time: 2 minutes
Reagents: non hazardous

AS-K1-106
Electronic BN Test Cell

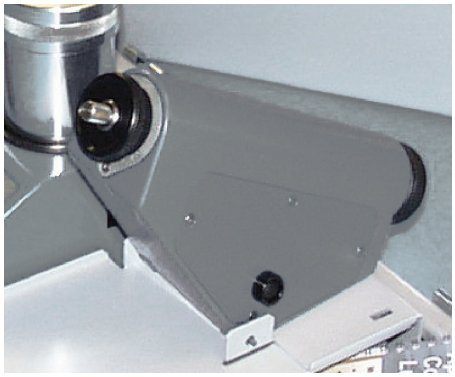
FG-K1-004-KW:
DIGI BN Test Kit
Range: 5-80 BN
Accuracy: Typically +/- 10% of new oil BN
Test Time: 2 minutes
Memory: Previous test, plus five oils
Reagents: non hazardous

FG-K13959-KW
ECON BN Test Kit
Range: 5 - 55 BN
Accuracy: Typically +/- 10% of new oil BN
Test Time: 2 minutes
Reagents: non hazardous

FG-K2-002-KW
Base Number Reagent Pack

Viscosity

Electronic Heated Viscometer


Electronic Unheated Viscometer


DIGI Viscotube

ECON Viscostick

Viscosity is widely regarded an oils most important characteristic. It is the viscosity that shows the oil's resistance to flow and the strength of the oil film between surfaces.

- Measuring oil viscosity provides early detection of contamination, fuel ingress and shear thinning.
- Suitable for hydraulic oils, diesel engine oils, enclosed gears and fuel oils (heated viscometer only).
- Monitoring viscosity gives an early warning for a range of common problems like fuel dilution
- Calculate the SAE range, as well as viscosity (unheated viscometer only).
- Estimate the combustion performance (CCAI) of fuel oil. The Kittiwake DIGI Viscotube uses the falling ball technique to measure the viscosity of an oil.

Two types of electronic Viscometer are available from Kittiwake - Heated and Unheated.

The heated viscometer measures at the actual temperature required while the unheated viscometer measures at room temperature and then automatically corrects to the reported temperature.

Both instruments are designed to 'Tilt' from side to side in both directions, allowing the ball to fall under gravity and the viscosity of the oil calculated automatically.

The DIGI Viscotube is provided with viscosity calculation software and a Digital Thermometer for accurate results.

The ECON Viscostick gives a simple go / no-go result. Typically it will detect 5-10% distillate fuel dilution of an SAE 30 to 40 engine oil as well as increases in viscosity due to oil contamination.

Ordering Information

FG-K1-200-KW:
Electronic Heated Viscometer

Range:	20-810 cSt @ 40°C
Display:	8 Digit LED
Keypard:	Membrane type with tactile buttons
Power:	110 to 240 AC 50/60 Hz
Accuracy:	Typically with +/- 3% (20-450 cSt) or +/- 2 cSt
Test Time:	Heating from 25°C, 10 minutes Viscosity at 40°C, 3 minutes Repeat test: maximum 30 seconds
Reagents:	N/A

AS-K1-103:
Electronic Unheated Viscometer
(Only available with an Oil Test Center)

Range:	20-500 cSt @ 40°C, Calculated Viscosity at 40°C, 50°C and 100°C. Calculated SAE Range: 15-500cSt at 40°C, 50°C or 100°C
Accuracy:	+/- 2% (15-320 cSt) or +/- 2 cSt
Test Time:	1 minute
Reagents:	N/A

FG-K14828-KW:
DIGI Viscotube

Range:	20-600 cSt @ 40°C, using three sizes of ball
No. of Tests:	Unlimited
Test Time:	1 - 10 minutes
Reagents:	N/A

FG-K3-020-KW:
ECON Viscostick

Range:	Go/ no go
Application:	Lubricating oils, viscous hydraulics
No. of Tests:	Unlimited
Test Time:	1 minute
Reagents:	N/A

Total Acid Number (TAN)

Electronic TAN Cell

Total Acid Number or TAN is a measure of both the weak organic and strong inorganic acids present within oil.

The Electronic TAN Test Kit does provide highest on site accuracy for testing TAN giving results after a few minutes.

- Prevent damage from oil oxidation by monitoring TAN levels.
- Highly accurate test results with separate reagent packs for 0-3 and 0-6 TAN.

Ordering Information

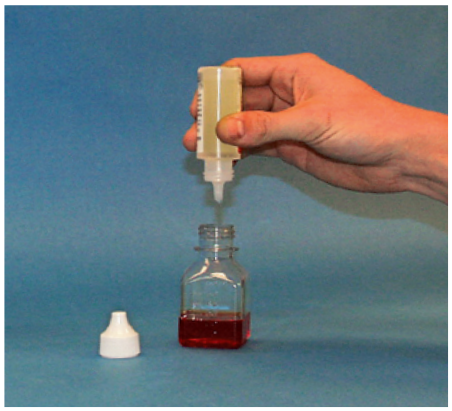
FG-K25196-KW:
Electronic Total Acid Number (TAN) Test Kit

Range:	0-3, 0-6 TAN
Accuracy:	+/-0.2 TAN
Test Time:	2 minutes
Reagents:	UN1993, UN1170

AS-K1-108
Electronic TAN Test Cell

FG-K2-005-KW:
Total Acid Number Reagent Pack 0-3

FG-K2-006-KW:
Total Acid Number Reagent Pack 0-6



ECON TAN Drop Test Kit

The ECON TAN Drop Test gives a rapid indication of TAN increase in lubricants.

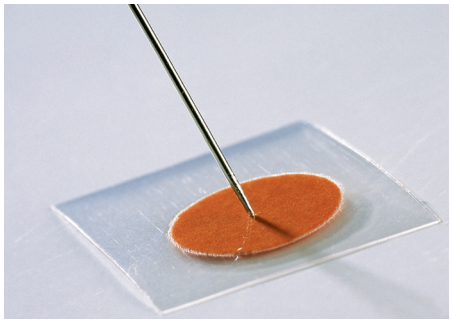
- Test kit is supplied with up to fifty tests, enabling you monitor TAN level trends.
- Simple to use drop test - the result is shown by a colour change, providing you with easy to interpret results, suitable for use by nontechnical personnel.

Ordering Information

FG-K24743-KW:
ECON TAN Drop Test Kit

Range:	0-6 TAN
Accuracy:	+/-0.3 TAN
Test Time:	2 minutes
No. of Tests:	25
Reagents:	UN1993, UN 1170
Reagent Pack:	FG-K24743-KW

Salt Water Contamination



ECON Salt Test

Eliminate rapid corrosion in lube oil, fuel or hydraulic systems by checking for the presence of salt.

- Provides rapid indication of the presence of salt, even if all the water has been evaporated.
- Fast and easy to use.

Ordering Information

FG-K1-005-KW:
ECON Salt Water Contamination Test Kit

Range:	Go/ no go
Application:	Lubricating oil, fuel, water
Test Time:	1 hour (unattended)
No. of Tests:	25
Reagents:	Non hazardous
Reagent Pack:	FG-K1-005-K

Insolubles

Insolubles Test Cell

Insolubles Meter

Insolubles Test Kit

Insolubles are a build up of combustion related debris and oxidation products within the oil.

Regular monitoring of insolubles helps to prevent lacquer formation on hot surfaces, sticking of piston rings, wear of cylinder liner and bearing surfaces.

Highly accurate results - two test modes are available: % insolubles w/w by IP316 or % insolubles by Mobil Soot Index.

High insolubles will cause lacquer formation on hot surfaces, sticking of piston rings and wear of cylinder liner and bearing surfaces. The detergent property of the oil will also decrease, speeding further deterioration.

- Detect insolubles from diesel engine combustion products such as fuel ash, carbon, partially oxidised fuel, oil oxidation products and spent lubricant additive.
- Simple and quick to use, the Insolubles tests available give you actionable results, helping prevent engine damage.

Ordering Information

FG-K25194-KW:
Electronic Insolubles Test Kit

Range:	0-3.5% w/w, 0-1.75%
Accuracy:	+/-0.1 w/w
Test Time:	1 minute
Reagents:	non hazardous
Reagent Pack:	FG-K2-003-KW

AS-K1-107
Electronic Insolubles Test Cell

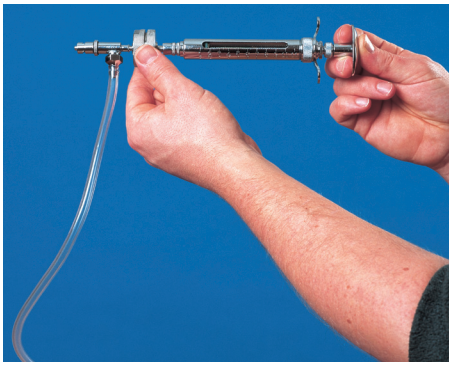
FG-K17105-KW:
DIGI Insolubles Test Kit

Range:	0-2.5%
Accuracy:	Typically +/-0.1%
Test Time:	< 2 minutes
No. of Tests:	50 Tests
Reagents:	non hazardous
Reagent Pack:	FG-K2-003-KW

FG-K1-006-KW
ECON Kit Insolubles Test Kit

Range:	Good/Poor
Test Time:	one hour (unattended)
Reagent:	non hazardous
Reagent Pack:	FG-K1-006-KW

Hydraulic Particles (Patch Test)



Patch Test

Monitoring your hydraulic and gearbox oils is a necessary part of any preventative maintenance program.

One of the most valuable indicators of machinery condition is oil cleanliness. The presence of particulate contamination in hydraulic or gearbox oils can be catastrophic. Monitoring fluid cleanliness levels assists in identifying abnormal conditions and preventing potential machinery damage.

Ordering Information

FG-K14368-KW:
Hydraulic Particles Test Kit

Range:	Good/Poor
Application:	Hydraulic oil, gearbox lubricants
No. of Tests:	100
Test Time:	5 minutes
Reagents:	non hazardous
Reagent Pack:	BI-K14366

Flash Point Tester

Flash Point Tester

An automated closed cup instrument using a small sample size and 1 or 2 minute standard test time.

The flammability of a material determines its safety classification and the regulations under which it must be handled, stored and transported. Can also be used to help detect fuel dilution.

Note: A standard butane (lighter) refill cartridge is required for operation.

The Electronic Flash Point Tester is a compact, bench top / portable, Closed Cup Flash Point Tester designed to carry out 'flash / no flash' tests or to determine flash point values up to 300°C using either Ramp or Rapid Equilibrium methods.

The operating principle is that a cup containing the sample to be tested is electrically heated to a user set test temperature. At the set temperature, a shutter in the lid is opened and a test flame is dipped into the vapour space above the sample. It can be determined if a sample has a flash point above or below the test temperature by detecting whether a flash has occurred or not.

The device features also a user-friendly ramp function to automatically increment the temperature for repeated tests until a flash is observed, or the end of the search range is reached, allowing rapid determination of unknown samples.

Ordering Information

FG-K16909-KW

Electronic Flash Point Tester

Temp Range:	ambient temperature +5 to 300 °C
Sample Size:	2-4 ml
Test Time:	OK in 2 minutes
Temp Running:	2° C/min.
Test Method:	Closed Cup
Resolution:	0.5°C
Accuracy:	0.5°C
Flash Detection:	Automatic
Voltage:	110-250 V
Frequency:	50/60 Hz
Power:	200 W
Weight:	43 kg

Cloud Point Detector

Cloud Point Detector

When ambient temperature drops below a certain level, wax crystals can form in the oil. This temperature is the 'cloud point'.

Kittiwake's Cloud Point Detector measures the temperature at which these wax crystals form, helping to screen the oil and prevent potential problems such as blocked fuel filters and lines.

- Prevent wax crystals forming in the fuel, which can block filters and starve the engine.
- Particularly useful for any industry operating in climates with low ambient temperatures.
- Highly accurate, electronic instrument available in extended and standard temperature ranges.

Ordering Information

FG-K12663-KW:

Cloud Point Detector (Standard)

Range:	-5°C to + 20°C Diesel
Sample Size:	0.5 ml
Average Test Time:	< 8 minutes
Keypad:	Membrane type with tactile buttons
Display:	124 x 64 graphics LCD with LED backlight
Power:	100-250 VAC 50/60 Hz

FG-K16954-KW:

Cloud Point Detector (Extended Range)

Range:	User selectable: +25°C to + 0°C, +15°C to - 10°C, +5°C to - 20°C
Sample Size:	0.5 ml
Average Test Time:	< 8 minutes
Keypad:	Membrane type with tactile buttons
Display:	124 x 64 graphics LCD with LED backlight
Power:	100-250 VAC 50/60 Hz

Density Meter


Density Meter

The Kittiwake Density Meter is suitable for both distillate and residual fuel oils.

Measuring the density of fuel using hydrometers, the Density Meter can be used to confirm the quantity and grade of fuel delivered.

The Density Meter is supplied complete with three hydrometers and consumables. The Density Meter is available standalone or as part of an Oil Analysis Suite.

- Ensure the correct weight of fuel has been delivered.
- Density is calculated electronically, giving fast, accurate results and estimating the combustion performance (CCAI), and correct viscosity in cP to cSt.

Ordering Information

FG-K1-300-KW:
Electronic Density Meter

Calculations:	Density at 15 °C in vacuo, CCAI, cP/cSt
Range:	800 to 1010 kg/m^3
Accuracy:	Typically with +/-0.1%
Test Time:	Heating from 15°C: 10 minutes
Repeat Test:	maximum 30 seconds
Cleaning:	1 minute

AS-K3-014:
Hydrometer 0.80-1.01

AS-K3-015:
Hydrometer 0.85-0.95

AS-K3-016:
Hydrometer 0.9-1.01

Compatibility Tester


Compatibility Tester

Ensure stability and compatibility of fuel types in minutes.

The compatibility tester will quickly identify potential fuel stability problems. It will also rapidly determine if a fuel is compatible with existing fuel stocks.

- Identify possible stability problems before mixing fuels, giving you peace of mind when accepting fuel deliveries.
- Prevent sludge deposits, failure of fuel handling systems and costly combustion related engine damage.

Ordering Information

FG-K1-500-KW:
Electronic Compatibility Tester

Range:	As per ASTM D4740
Accuracy:	Variation of 1 rating in 20 repeat tests
Test Time:	20 minutes (unattended)
Consumables:	AS-K3-017

FG-K3-018-KW
Compatibility Tubes (25)

Cleaner Kit

Kittiwake provides a Cleaning Kit for cleaning and maintaining the individual test cells.

Ordering Information

FG-K17869-KW:
Cleaner Kit

Multi Parameter Combinations

Fuel and Lube Test Cabinet Configurations

	Part Number	DIGI Water/ TBN Cell	0-2.5% Water Cell & Console	TAN 0-6 Cell	Insolubles Test Cell	Density Meter	Compat-ibility Meter	Heated Viscometer	Salt Test	Pour Point	Fuel Sampler
Marine Fuel & Lube	FG-K4-400-KW	■			ECON	■		■	■	■	
Residual Fuel Driven Equip-ment	FG-K4-600-KW	0-99 TBN Cell	■		■	■	■	■	■	■	■
Steam Power Plant	FG-K4-602-KW		■	■		■	■	■	■	■	■

Electronic Oil Test Centre

Product name	Part number	Combination								
		Test Console	0-0.1% 0-2.5% Water Cell	0-6000ppm Water Cell	5-99 TBN Cell	0-6 TAN Cell	0-3 TAN Cell	Insolubles Test Cell	Unheated Viscometer	Heated Viscometer
OTC-A	FG-K4-120-KW-A	■	■		■			■	■	
OTC-AH	FG-K4-120-KW-AH	■	■		■			■		■
OTC-B	FG-K4-120-KW-B	■	■			■			■	
OTC-BH	FG-K4-120-KW-BH	■	■			■				■
OTC-C	FG-K4-120-KW-C	■		■		■		■	■	
OTC-CH	FG-K4-120-KW-CH	■		■		■		■		■
OTC-D	FG-K4-120-KW-D	■		■			■		■	
OTC-DH	FG-K4-120-KW-DH	■		■			■			■
OTC-E	FG-K4-120-KW-E	■		■	■		■	■	■	
OTC-EH	FG-K4-120-KW-EH	■		■	■		■	■		■
OTC-F	FG-K4-120-KW-F	■		■	■			■	■	
OTC-FH	FG-K4-120-KW-FH	■		■	■			■		■

DIGI/ Econ Test Kits

Product name	Part number	Combination						
		DIGI Vis-cotube	DIGI Water in Oil Cell	DIGI Combined Water in Oil/ TBN Cell	ECON Salt Test	ECON Insolubles	ECON TAN Test	ECON Viscostick
EasySHIP DIGI Water/ Viscosity Kit	FG-K1-102-KW		■					■
EasySHIP DIGI Basic Kit	FG-K1-103-KW		■		■	■		■
EasySHIP DIGI Industrial Kit	FG-K1-107-kW			■		■		■
EsaySHIP DIGI Field Kit	FG-K1-108-KW			■		■	■	■
EasySHIP DIGI Combined Kit	FG-K1-110-KW			■	■	■		■
DIGI Clean Oil Kit	FG-K14971-KW	■	■				■	

		DIGI Low Range Water Cell	Density Hydrometer	Low Range Falling Ball Viscometer	Free Fatty Acid Test/ TAN Test	Visual Test (Cleanliness)
Bio Diesel Test Kit	FG-K16897-KW	■	■	■	■	■

2. Sampling Solutions

Oil Samples are used to obtain a clear indication of the operating status of your machinery. One of the most important aspects of any oil analysis program is the sampling method and equipment used. Often these are weak links that quickly compromise the program.

Obtaining a representative oil sample is one of the most important factors of a scheduled oil analysis program. Representative, uncontaminated oil samples are required for both regulatory and commercial purposes.

A high standard oil sample will contain an accurate representation of the contaminants, additives, oxidation, particulates and wear condition of plant and equipment. If a sample does not represent the true condition of the oil and component at the time of sampling, the reliability of both the test result and it's interpretation is affected.

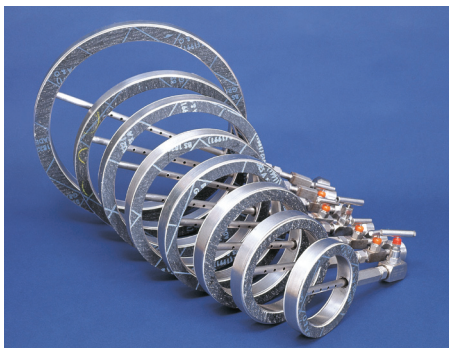
Kittiwake's sampling solutions provide you with everything you need to easily gather an uncontaminated, representative sample of your fuel or lubricating oil, whenever your oil analysis program requires it.

Fuel oil sampling is an essential element of any bunkering operation.

Representative fuel oil samples are required for both regulatory and commercial purposes. Crucial aspects of the sampling process include taking the sample, the sampling location and witnessing the process.

The importance of a suitably drawn and witnessed representative fuel oil sample cannot be over-emphasised. It forms the basis of all discussion, debate or dispute resolution relating to the bunkering.

Drip Type Bunker Samplers



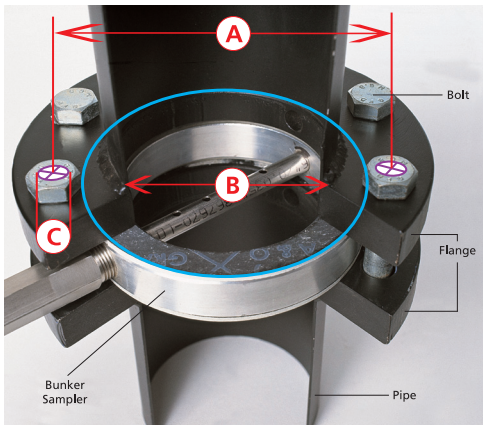
Drip Type Bunker Samplers

Material: Stainless Steel
Nominal Flange Thickness: 25/26 mm
Total Thickness
(Including gaskets): 31/32 mm

The most common and economic means of obtaining a representative sample is by using a drip type Bunker Sampler. In back to back tests performed by a major fuel testing laboratory over an extended period, samples obtained by drip samplers were identical to those from more expensive automatic fuel samplers.

- Lloyds Register approved and manufactured under strict ISO 9001:2000 quality assurance standards.
- IMO MARPOL 73/78 Annex VI compliant - helps you stay within the legal requirements for bunker sampling.
- Lightweight and very easy to install - obtaining a representative sample is quick and easy.
- Bunker Sampler Joint Rings included - all the equipment you need for correct installation.
- Even ex-stock bunker sampler sizes available from Kittiwake's extensive range of equipment.

Selecting the Correct Size of Drip Type Bunker Sampler



A = Pitch Circle Diameter

B = Nominal Pipe Size

C = Bolt Hole Diameter

Calculation

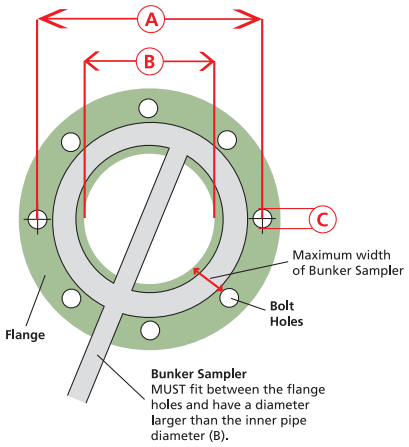
Pitch Circle Diameter (A) - Bolt Hole Diameter (C) = X

Select the nearest size Bunker Sampler with an outer diameter smaller than X and an inner diameter larger than the Nominal Pipe Size (B).

Example

Pitch Circle Diameter (A) = 290 mm
Bolt Hole Diameter (C) = 23 mm
Nominal Pipe Size (B) = 200 mm
290 (A) - 23 (C) = 267 (X)

Therefore the correct Bunker Sampler would be FG-K1-128-KW (8" Bunker Sampler), which has an outer diameter of 266 mm and an inner diameter of 221 mm. The outer diameter is smaller than X (the space between the flange bolts), yet the inner diameter is larger than the nominal pipe size (B), so that fuel flow is not impeded.



Ordering Information

Part Number	Nominal Pipe Size (B)	Inner Diameter	Outer Diameter	Weight	Flange Standard Correlations
FG-K1-122-KW	50 mm/2"	63 mm	95 mm	3.40 kg	JISB2210 5K, 10K, 16K, BS 4504 PN10, PN16, BS10 D, E, F, ANSI B16.5 150, 300
FG-K1-123-KW	75 mm/3"	86 mm	127 mm	3.90 kg	JISB2210 5K, 10K, 16K, BS 4504 PN16, BS10 D, E, F, ANSI B16.5 150,300
FG-K1-124-KW	100 mm/4"	116 mm	157 mm	4.28 kg	BS 4504 PN16, BS10 D, E, F ANSI B16.5 150, 300
FG-K1-125-KW	125 mm/5"	144 mm	188 mm	4.84 kg	JISB2210 5K, 10K, 16K, BS 4504 PN16, BS10 D, E, ANSI B16.5 150
FG-K1-126-KW	150 mm/6"	171 mm	216 mm	5.46 kg	JISB2210 5K, 10K, 16K, BS 4504 PN10, PN16, BS10 D, E, F, ANSI B16.5 150, 300
FG-K1-127-KW	175 mm/7"	194 mm	241 mm	6.16 kg	JISB2210 5K, 10K
FG-K1-128-KW	200 mm/8"	221 mm	266 mm	6.48 gk	JISB2210 5K, 10K, 16K, BS 4504 PN10, PN16, BS10 D, E, F, ANSI B16.5 150
FG-K1-129-KW	225mm/9"	260 mm	307 mm	6.64 kg	ANSI B16.5 300
FG-K1-130-KW	250mm/10"	281 mm	328 mm	7.08 kg	JISB2210 10K, 16K, BS 4504 PN10, PN16, BS10 D, E, F, ANSI B16.5 150, 300
FG-K1-131-KW	275mm/11"	319 mm	361 mm	7.2 kg	JISB2210 10K, BS 4504 PN10, PN16, BS10 d, E
FG-K1-132-KW	300mm/12"	340 mm	401 mm	7.5 kg	JISB2210 16K, BS10 F, ANSI B16.5 150, 300, BS 4504 PN10, PN16, BS10 D, E, F
FG-K1-133-KW	350mm/14"	375 mm	420 mm	7.96 kg	ANSI B16.5 150,300

Automatic Fuel Sampler

Especially bigger vessels are facing the problem of negative pressure at the bunker manifold. Traditional Drip Samplers cannot be used here. They need a positive pressure to allow the sample to flow into the sample container by gravity. The solution is the Automatic Fuel Sampler which does work with vacuum up to -0.8 bar.

The Automatic Sampler is connected to the main bunker line by a flexible hose for the mobile solution or by pipe fittings for the permanent installed version. After start it will automatically sample into the cubitainer and stop after the preset bunker time. The sampler can sample into all size bottles or cubitainers. On special request we can provide a version which can sample into up to 5 individual sample bottles simultaneously or in a sequence. For highest flexibility the sampler can either be mounted on a trolley or permanently installed next to the manifold.

The standard version works as time proportional sampler ensuring a representative sample. For applications with changing flow rates we also offer a flow proportional version.

Because of ATEX regulations the sampler does not use electricity. All our samplers are pneumatically driven with normal working air between 6 and 8 bar. The samplers can be used under all weather conditions. All fittings are made from stainless steel AISI 316, designed and produced to survive in a harsh environment.

Benefits:

- High flexibility and reliability.
- Easy integrated flush system for cleaning purposes.
- Sample container is always filled after bunkering.
- No overflow!
- MARPOL and MEPC.96(47) compliant.
- Time or flow proportional sample.
- No electricity = no ATEX problem.

Specifications:

- Size: 35 x 25 x 50 cm
- With trolley: 110 x 50 x 50 cm
- Weight: 15 kg (40 kg with trolley)
- Material: AISI 316
- Max pressure: 12 bar
- Min pressure: - 0.4 bar (- 0.8 bar)
- Working air: 6 – 8 bar

Bunker Sampler Storage System

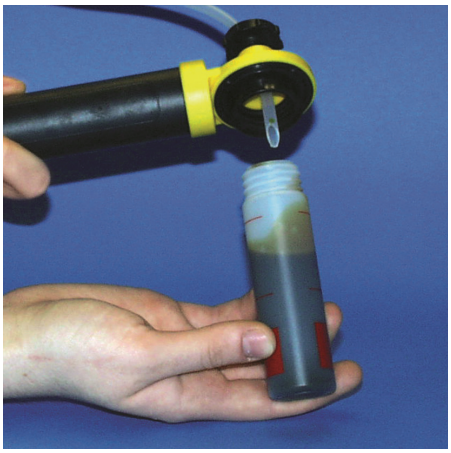
Ordering Information

FG-K16091-KW:
Bunker Sampler Storage System

Certified by Germanischer Lloyd, the Kittiwake Bunker Sample Storage System is a completely self-contained unit providing everything needed to comply with the collection, retention and storage of bunker fuel oil samples in accordance with IMO MARPOL regulations.

- All equipment is contained in a robust, metal case that is fully lockable for safe and secure sample storage.
- Certified by Germanischer Lloyd, providing everything you need to ensure that your fuel samples are compliant with IMO MARPOL 73/78 Annex VI regulations.
- Complete with log book to record your sample details, plus training CDs and full instructions on bunker sampling and the latest regulations.
- Replacement consumables and a full range of bunker samplers are easily available at short notice from Kittiwake and can be shipped to the destination of your choice.

Sample Extraction Pumps



For simple and effective lube oil sampling from machine sumps and storage tanks, Kittiwake supply durable, easy to use and versatile extraction pumps.

These hand operated vacuum pumps can be used for 28 mm and 32 mm screw neck sample bottles. The 28 mm sample pump is designed to fit Kittiwake 50 ml sample bottles and the 32 mm plastic pump is designed to fit 100 ml bottle and the 32 mm metal pump is designed to fit the 750 ml sample bottles.

Sample Extraction Tube (LDPE) - Clean LDPE tubing to fit sample extraction pump which can be used with most oil systems. Supplied in 15 meter rolls.

Ordering Information

FG-K11290:
28 mm Neck Extraction Pump (Plastic)

FG-K11289:
32 mm Neck Extraction Pump (Plastic)

FG-K16991:
32 mm Neck Extraction Pump (Metal)

PL-K10215:
Sample Extraction Tube

Sampling, Bottles and Accessories

Kittiwake produce 750ml HDPE fuel oil sample bottle packs and mailer kits complete with numbered tamper evident caps, labels and mailing cartons*.

Kittiwake sample bottles have been tested and approved for transportation of fuel oil samples by air freight or courier service. All consumables are available either as convenient individual packs, or supplied in bulk to refineries and bunker barge operations.

Mailer cartons only included in FG-K3-210-KW

Sample Bottles - Kittiwake produce a range of HDPE and PET lubricating oil sample bottles. Designed to withstand hot oil under vacuum conditions, supplied in sizes from 50 ml to 750 ml.

Sample Bottle Labels - Self adhesive, preprinted labels for fuel or lube oil samples, supplied with custom artwork and text. 1000 per roll.

Clear Over Labels - Clear self adhesive, over labels to protect label and user annotations.

Fuel Sampler - The fuel sampler is designed to fit into an existing fuel supply line and can be removed with the line full. Supplied in a single size, it can be modified to fit fuel delivery lines between 3 and 12 Inches.

Cubitainers - Drip samplers use disposable 'cubitainers'. These hold the oil sample before mixing and transfer to the sample bottles and keep out all external contamination.

Valve Lock - Some authorities, for example the Port of Singapore, require that the sample flow rate is fixed throughout the bunkering period. The Valve Lock device can be fitted to the sampler to ensure the setting remains stable.

Converter Bobbin - The Converter Bobbin is a low cost device designed to allow DNVPS Samplers to use Kittiwake Cubitainers.

Sampler Gauge - Rapid flow of fuel in bunker lines can result in unusual pressure conditions. A gauge is available for monitoring this to prevent the sample being drawn back into the line.

Elbow Kits For Alternative Positions - It is possible to position the sampler tube at an angle to the vertical. Elbow kits are designed to keep the cubitainer bag hanging vertically as either a 45 or 90 degree Elbow.

Ordering Information

FG-K3-210-KW:
750 ml Sample Bottle and Mailer Kit (40)

FG-K3-211-KW:
750 ml Sample Bottle Pack (70)

FG-K17123-KW:
Sample Bottles, 50 ml, HDPE, Neck: 28mm (360 pieces)

FG-K3-207-KW:
Sample Bottles, 100 ml, PET, Neck: 32mm (288 pieces)

FG-K26280-KW:
IMO MARPOL Approved Fuel Sample Label (1000)

FG-K26783-KW:
Standard Fuel Sample Label (1000)

FG-K17103-KW:
Clear Adhesive Marpol Over Label (1000)

FG-K17111-KW:
Bottle Shoulder and Valve Lock Seals (100)

FG-K11079-WA:
Fuel Sampler

FG-K3-201-KW:
Cubitainers (24)

FG-K1-139-KW:
Valve Lock

FG-K3-021-KW:
Convertor Bobbin

FG-K11168-KW:
Sampler Gauge

FG-K13588-KW:
Elbow Kit for 45 degree Elbow

FG-K13589-KW:
Elbow Kit for 90 degree Elbow

FG-K16692-KW:
Bunker Sampler Plug and Lanyard

3. Independent Laboratory Oil Test

The oil itself is an excellent data medium which is full of valuable information if tested correctly and the findings actioned. This information highlights the condition of the oil and the machine, enabling you to identify the optimal moment for an oil change. Wear particles can be directly related or assigned to a damaged part of a given machine giving information of the condition of the plant and providing early warnings in the fight to reduce and prevent damage.

The Kittiwake Marine Oil Test Service is a comprehensive insight into the functioning of your engine. It covers analysis of the combustion process, cylinder oil feed rates, fuel problems and identification of potential issues such as piston and liner wear, incomplete combustion and crankcase system oil analysis. In particular, we work very hard to minimise your costs related to oil consumption and feed rate. It is not in the interest of Kittiwake to let you spend more on lubrication than necessary.

Kittiwake has formed a strategic partnership with a certified and accredited laboratory with over 15 years experience in used oil lab analysis. A database of more than one million used oil samples from more than fifteen thousand customers all over the world and our cooperation with lube oil suppliers and engine manufacturers allows us to give you appropriate independent recommendations based on the oil analysis.

Typical applications for our independent marine oil lab service on board ships are:

Diesel Engine System Oil, Cylinder Drain Oil, Stern Tube Oil, Hydraulic Oil, Gear Box Oil and other Lubricants

Scope of analysis: (can vary with oil type)

Wear metals:	Iron, Chrome, Tin, Aluminium, Nickel, Copper, Lead, Molybdenum, PQ-Index
Contaminants:	Cat Fines (Aluminium / Silicon), Potassium, Sodium, Soot, Glycol, Fuel, Water %
Oil condition:	Viscosity @ 40° and 100°C including Viscosity-Index, Base Number (BN) Oxidation, Nitration, Sulfation, Sludge carrying properties
Additives:	Calcium, Magnesium, Zinc, Phosphor, Barium, Boron, Sulphur and Molybdenum

Ordering Information

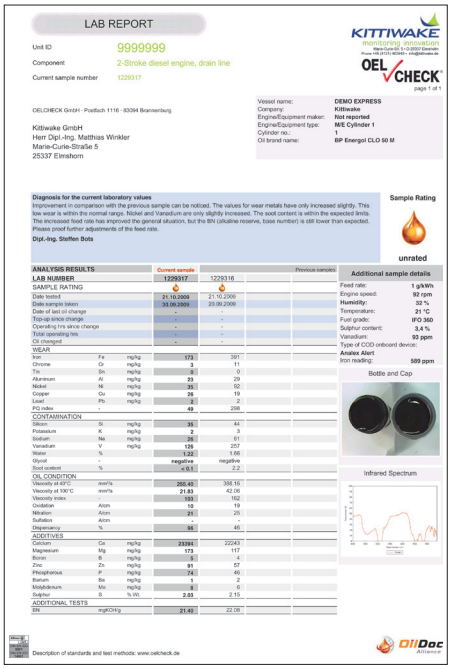
IH-K17599-KW:
Independent Oil Analysis Laboratory Test

The Kittiwake service includes:

- 100 ml sample-bottle (prepaid)
- Addressed envelope to return the sample bottle to our lab
- Sample Information Form with barcode label
- Laboratory tests: All samples are analysed and diagnosed by the end of the next business day. (As long as the samples arrive at our laboratory before noon, in our prepaid sample bottle with a correctly filled out sample information form).
- Laboratory Report complete with a highly detailed diagnostic statement (prepared by a mechanical engineer)
- Dispatch of the Laboratory Report via mail, email, fax or data-file
- Online-recall of all Laboratory Reports and Analysis Data
- Easily check online data entry for new samples
- Quickly view of all your samples
- Check sample status
- Display all lab reports
- Translate lab reports into different languages
- Forward lab reports via e-mail
- Graphically view trend analysis values for individual samples
- Display of the IR spectrum and other diagrams
- View photos of the sample and the inside of the cap / lid
- View photos of the spot test, solid contaminants and much more

Internet:
It is possible to get the current lab reports even faster and to have, at the same time, a comparison with earlier analysed samples.

If you require your results sooner, instead of waiting for an e-mail, fax or mail you can directly log on to our fire wall-protected web server. Where, as soon as we have evaluated your sample, we inform you by e-mail that the results are available. You can see the analysis results in the original version of the lab report and print it or forward it to interested parties.


LAB REPORT

KITTIWAKE monitoring innovation

OEL CHECK

Unit ID 9999999

Component 2-Stroke diesel engine, drain line

Current sample number 1226317

OELCHECK GmbH · Postfach 1116 · 83094 Brannenburg

Kittiwake GmbH
Herr Dipl.-Ing. Matthias Winkler
Marie-Curie-Straße 5
25337 Elmshorn

Vessel name: DEMO EXPRESS
Company: Kittiwake
Engine/Equipment maker: Not reported
Engine/Equipment type: M/E Cylinder 1
Cylinder no.: 1
Oil brand name: BP Energol CLO 50 M

Diagnosis for the current laboratory values

Improvement in comparison with the previous sample can be noticed. The values for wear metals have only increased slightly. This low wear is within the normal range. Nickel and Vanadium are only slightly increased. The soot content is within the expected limits. The increased feed rate has improved the general situation, but the BN (alkaline reserve, base number) is still lower than expected. Please proof further adjustments of the feed rate.

Dipl.-Ing. Steffen Bots

Sample Rating

unrated

ANALYSIS RESULTS

			Current sample	Previous sample
LAB NUMBER			1226317	1223316
SAMPLE RATING				
Date tested			21.10.2009	21.10.2009
Date sample taken			20.09.2009	20.08.2009
Date of last oil change			-	-
Top-up since change			-	-
Operating hrs since change			-	-
Total operating hrs			-	-
Oil changed			-	-
WEAR				
Iron	Fe	mg/kg	173	391
Chrome	Cr	mg/kg	3	11
Tin	Sn	mg/kg	0	0
Aluminium	Al	mg/kg	25	29
Nickel	Ni	mg/kg	35	52
Copper	Cu	mg/kg	28	19
Lead	Pb	mg/kg	2	2
PQ index	-		49	298
CONTAMINATION				
Silicon	Si	mg/kg	35	44
Potassium	K	mg/kg	2	3
Sodium	Na	mg/kg	24	61
Vanadium	V	mg/kg	139	257
Water	%		1.22	1.66
Glycol			negative	negative
Soot content	%		< 0.1	2.2
OIL CONDITION				
Viscosity at 40°C	mm²/s		266.40	398.16
Viscosity at 100°C	mm²/s		21.83	42.06
Viscosity index	-		153	162
Oxidation	A/cm		10	19
Nitration	A/cm		21	25
Sulfation	A/cm		-	-
Dispersancy	%		94	46
ADDITIVES				
Calcium	Ca	mg/kg	23394	22243
Magnesium	Mg	mg/kg	173	117
Boron	B	mg/kg	5	4
Zinc	Zn	mg/kg	91	57
Phosphorous	P	mg/kg	74	46
Barium	Ba	mg/kg	1	2
Molybdenum	Mo	mg/kg	1	6
Sulphur	S	% WI.	2.85	2.15
ADDITIONAL TESTS				
TBN		mgKOH/g	21.40	22.08

Additional sample details

Feed rate:	1 g/kWh
Engine speed:	92 rpm
Humidity:	32 %
Temperatures:	21 °C
Fuel grade:	IFO 360
Sulphur content:	3.4 %
Vanadium:	93 ppm
Type of CCD onboard device:	
Analex Alert	
Iron reading:	589 ppm

Bottle and Cap

Infrared Spectrum

Description of standards and test methods: www.oelcheck.de

OilDoc Alliance

The Independent Marine Oil Laboratory Test Service works with the following test methods for standard engine oils.

Test methods	Result	Unit	Test prescription
Optical Emission Spectroscopy according (OES) ICP/RDE	Wear-, contamination- and additive elements	mg/kg = ppm	DIN 51396-3 ASTM-D 6595
PQ-Index	Index for ferrous magnetic particles	Index	OPV-9-16
FT-Infrared-Spectroscopy	Contamination: Water, Soot, variation to the fresh oil reference	H^2O and Soot in %	JOAP and reference methods
FT-Infrared-Spectroscopy	Oil Condition: Oxidation, Nitration, Sulfation	A/cm	DIN 51451 DIN 51452
Viscosity	Viscosity at 40°C and 100°C	mm^2/s	DIN 51562
Viscosity Index (VI)	VI for the viscosity/temperature behaviour	Index	DIN ISO 2909
Visual Inspection	Sample picture	None	OPV 9-12
Sludge Carrying Properties	Ability of dispersants	% (of remaining reserve)	OPV-9-30
Gas Chromotography (GC) for the detection of low boiling compounds	Fuel (MFO)	%	OPV 9-32
Water by KF	Content of water	ppm	DIN ISO 12937
Base Number (BN)	Alkalinity reserve (compared to the fresh oil)	mgKOH/g	ISO 3771
Particle Counting	Cleanliness Code	Number of particle	ISO 4406

Note: Many other tests can be done as needed. The above are typical test methods for engine oils. Hydraulic oil, gear oils and some others may require additional testing, which will be carried out as required

4. Online Oil Sensors

The requirement for on-line machinery and oil condition monitoring is becoming evermore apparent as maintenance costs increase and production capacity and equipment performance is maximised. Brought to you by a company that has been delivering low-cost, robust field instrumentation to the lubricants and fuels market for over fifteen years the range of instruments has been designed to accomplish the three primary objectives of oil analysis.

While temperature, pressure and vibration sensors all have their part to play in a condition monitoring package, early detection of changes in oil and lubricant condition and regular, consistent monitoring of wear metal debris in rotating plant provide greater insight into the actual condition of vital machinery and equipment. Real-time monitoring of the root cause lubricant and machine failure will allow you to take immediate action on the first indication of change. Suitable for use with slow, medium and high speed diesel engines, gas turbines, gearboxes, compressors, generators, vehicles and other oil filled plant, these sensors help to increase productivity, reduce costs and improve profitability. Use the range of online sensors to put your oil analysis laboratory on your doorstep.

WaterSCAN Total Water Sensor

WaterSCAN delivers the earliest warning of water ingress and soot build-up in oils, even if they are aged and dirty.

The effect of the ingress of water into an oil system can be rapid and catastrophic. The Kittiwake WaterSCAN removes the risks associated with periodic off-line testing and potential human error.

In comparison to other techniques for water monitoring, WaterSCAN measures the total concentration of water in oil, not just the dissolved water. As it's from Kittiwake, WaterSCAN works in the real world, where oils can oxidise and / or contain high levels of soot.

Robust, waterproof housing and temperature stable circuitry ensures that WaterSCAN can provide accurate, repeatable and reliable real time data in the harshest of conditions.

Continuous on-line monitoring provides the most representative picture of oil condition. Changes are highlighted as they start to occur and not just at scheduled inspections. Preventative action can then be taken before any significant damage has occurred.

WaterSCAN provides accurate feedback of both the water concentration and soot levels in your oil system and gives a rapid alert of water ingress.

With local and optional remote alarms, WaterSCAN instantly puts the information that counts in front of the people that need it most.

Detection Limits

Soot Content (%Wt)	Water Max* (PPM)
0	10,000
0,25	5,000
0,5	N/A

*Water Max is the upper detection limit as a function of soot contamination

Specifications

Ambient Temperature:	+5°C to +55°C
Oil Pressure Range:	2 to 10 bar
Maximum Oil Temperature:	<55°C (at inlet to WaterSCAN unit)
Power:	100 to 240V AC 50/60 Hz
Analogue Outputs:	4 to 20mA x 2
Connectivity:	USB as standard, (CANOpen, Modbus & TCP/IP optional)
Alarms:	Up to 2 programmable alarm levels for water and soot

Ordering Information

FG-K17353-KW:
WaterSCAN Sensor - complete

		Specific Oil Calibration	Generic Oil Calibration
Water	Accuracy	+/- 2%	+/- 5%
	Resolution	100 ppm	100 ppm
Soot	Accuracy	+/- 10%	+/- 10%
	Resolution	0.005% Wt	0.005% Wt

Oil Condition Sensor

The Oil Condition Sensor goes beyond the normal protection systems; it monitors the root cause of lubricant and machine failure. It puts you in control. You know exactly when to change the oil based on condition, not on historical schedules.

Today's lubricants are better quality than ever before. Sticking to old service schedules is expensive and extending oil service life isn't guesswork. Whilst lubricants perform better, you know they are still at risk from changing operating and environmental conditions. That's why your oil analysis service includes an oil condition feedback. It helps you detect when your oil may no longer be fit for service, possibly even pinpointing a contaminant or machine fault as the cause.

The oil condition Sensor can be mounted within almost any lubrication system on any type of machine. The sensor detects changes caused by water and acid levels, using a combination of proven dielectric sensing, combined with smart algorithms to provide a trend.

Whether it's to check on the health of the lubricant, or an alert of changing contaminant ingression, the Oil Condition Sensor provides instant information, complementing your existing laboratory oil analysis programme, and helping you make informed maintenance planning decisions.

Specifications

Ambient Temperature:	-20°C to 70°C (-4°F to 158°F)
Analogue Outputs:	4-20mA
Digital Outputs:	CAN, RS232
Connections:	1/2" BSP male thread
Detection:	Oil Condition (Oil Quality Units)
Fluid Compatibility:	Petroleum and synthetic oils
Fluid Temperature:	-20 to 130°C (-4 to 266°F)
Max Fluid Pressure:	10bar (145psi)
Power Supply:	15-30 VDC
Protection:	IP67
Range:	0-100 Oil Quality Units
Repeatability:	4%
Weight:	250g (9oz)

Ordering Information

FG-16203-KW:
Standard Reach, Analogue Output

FG-K14492-KW:
Long Reach, Analogue Output

FG-K16330-KW:
Standard Reach, Analogue & Digital Output

FG-K16340-KW:
Long Reach, Analogue & Digital Output

FG-K16318-KW:
Evaluation Pack Standard Reach, Dual Outputs, includes case, power supply and display

FG-K16327-KW:
Evaluation Pack Long Reach, Dual Outputs, includes case, power supply and display

All sensors come complete with software for data downloading and trending.

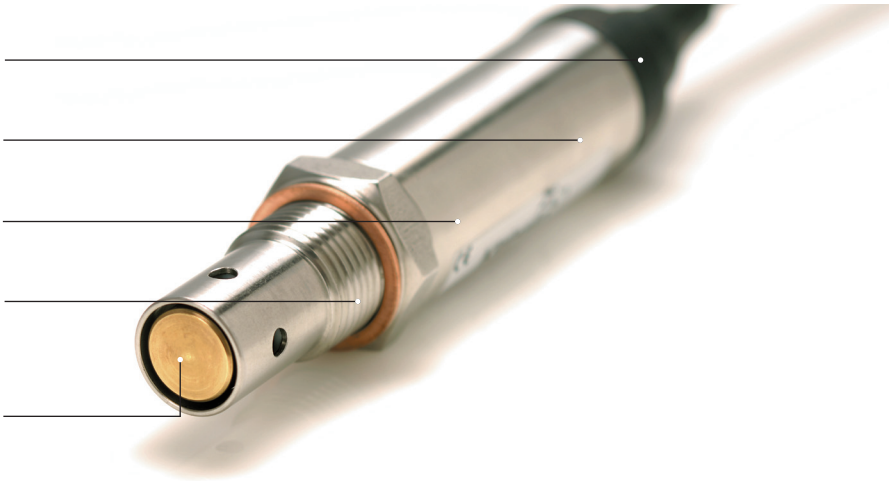
High integrity sealing, using standard automotive techniques.

Internal processing power offers wide interface options.

Stainless steel housing - rugged and long life performance

Widely used 1/2" BSP thread - quick and easy installation to a wide range of machinery

Gold oil sensing contact - long life and sensitivity



Moisture Sensor

The Moisture sensor goes beyond the normal water screening tests to tell you exactly how dry your oil is. You know that the more severe the moisture ingression problem, the greater the potential risk. You can ensure that your oil is always below the saturation point before free and emulsified water starts to form. And take immediate action on the first indication of change.

Providing a % Relative Humidity (RH) and temperature values, now you can monitor real-time, the Moisture sensor can be mounted within any lubrication system on any type of machine. Moisture sensors need not be in the fluid to be effective and are also of use in the headspace of a piece of machinery. The sensor measures the oils percentage Relative Humidity, resulting from the dissolved water within the lubricant, using a combination of proven thin film capacitance sensors, combined with smart algorithms to provide a temperature and % RH value.

Whether it's to check on the health of the machine, or an alert of changing moisture ingression rates, the Moisture sensor provides instant information, complementing your existing laboratory oil analysis programme, and helping you make informed maintenance planning decisions.

Specifications

Accuracy Saturation:	+/-2%
Accuracy Temperature:	+/-1°C
Alarm Defaults:	Saturation: on at 65% (open) off at 60% (closed)
Analogue Outputs:	4-20mA for % Saturation, 4-20mA for temperature of oil
Calibration:	ISO/IEC 17025, NIST & NPL Traceable
Connection Method:	By multicore screened cable
Digital Inputs:	RS232
Digital Outputs:	CAN, RS232
Fluid Compatibility:	Petroleum and synthetic oils
Material:	304 Stainless Steal
Max Oil Pressure:	10 bar (145psi)
Oil Temperature Range:	-40 t0 100°C (-40-212°F)
Power Supply:	12-30 VDC <1w
Sealing on enclosure:	IP67
Weight:	300g

Ordering Information

FG-K16947-KW:
Standard Reach, Analogue Output

FG-K16950-KW:
Long Reach, Analogue Output

FG-K16946-KW:
Standard Reach, Digital Output

FG-K16949-KW:
Long Reach, Digital Output

FG-K16948-KW:
Evaluation Pack Standard Reach, Dual Outputs, includes case, power supply and display

FG-K16951-KW:
Evaluation Pack Long Reach, Dual Outputs, includes case, power supply and display

All sensors come complete with software for data downloading and trending.

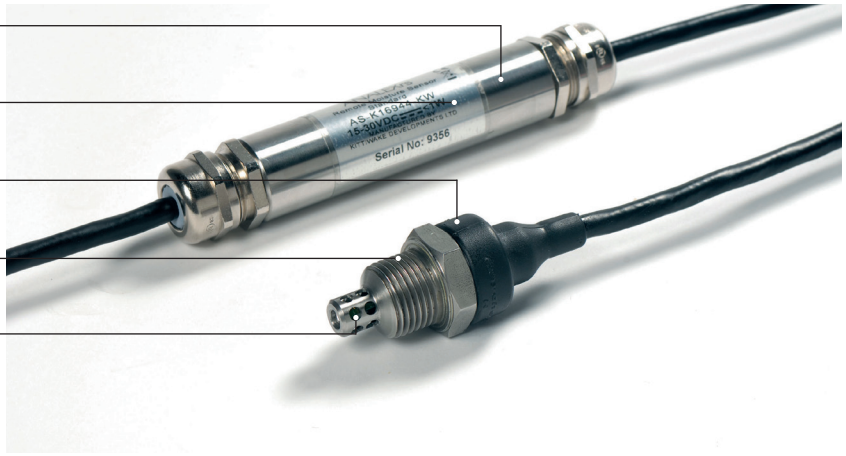
Stainless steel housing - rugged and long life performance

Smart sensor with internal processing power offers wide range of interface options

High integrity sealing, using standard automotive techniques.

Widely used 1/2" BSP thread - quick and easy installation to a wide range of machinery

High pressure resistant glass to metal hermetic seal



Machinery Condition

1. Onsite Wear Debris Analysis 28
2. Wear Debris Sensors 30
3. Diesel Performance Analyser 32
4. Torque Meter.....38
5. Acoustic Emission Solutions 39
6. Application Specific Solutions 51

1. Onsite Wear Debris Analysis

Continuous oil condition monitoring of machinery and lubricant testing is fast becoming the established method of predicting and avoiding impending machinery breakdown. Lost production and expensive capital equipment replacement are major costs associated with any catastrophic failure of machinery, the prevention of which is crucial for optimal operational performance.

By using Wear Debris Analysis & Debris Monitoring Equipment, worn parts can be identified early and replaced before any serious damage occurs. Production can be maintained, machinery life extended and the return on capital investment increased.

Analex Ferrous Debris Analysis Monitors are constructed using sophisticated magnetometers for greater particle measurement accuracy and sensitivity for lubricating oils, hydraulic oils and greases. A sample of oil containing ferromagnetic particles is placed upon or in the sensor, thus altering the magnetic field.

ANALEXfdMplus

The ANALEXfdMplus is a highly accurate instrument designed to measure the contamination of an oil sample with ferrous wear metal particles. It utilises a novel sample adaptor system to measure from any of the following sample media: 50ml Bottle, 10ml Syringe, 5ml Syringe, 5ml Test Tube and 5ml Grease Pots

Benefits: Measures uncombined ferrous wear debris in the oil or grease samples taken from a variety of types of machinery. Suitable for field and laboratory use the ANALEXfdMplus provides you with the ability to successfully monitor your equipment, preventing costly machinery downtime.

Data from each test is stored in the internal memory, which may then be transferred to a host PC via an RS232 interface. Data can then be fully analysed and trends easily monitored by importing into a database.

Specifications

Measurement Range (approx. ppm):	50ml Bottle 0-2500 ppm, 10ml Syringe 0-19000 ppm, 5ml Syringe 0-34000 ppm, 5ml Tube 0-28000 ppm, 5ml Grease Pot 0-8000ppm
Display Resolution:	1 ppm
Sample Media:	50ml Bottles, 10ml Syringes, 5ml Syringes & Test Tubes, 5ml Grease Pots
Test Time:	< 1 minute to stabilise from power on, < 15 seconds per sample
Fuse Rating:	2.5 A 250 VAC HRC A/S T ceramic
Power :	250 VAC autoselected 50/60Hz
Operating Temp. Range:	15-40°C (60-104°F)
Weight:	4.22 kg

Ordering Information

FG-K17144-KW:
ANALEXfdMplus

FG-K14946-KW:
50ml Sample Bottles (360 off)

FG-K15005-KW:
Grease Pots (3000 off)

FG-K17074-KW:
5ml Test Tubes (1000 off)

FG-K17075-KW:
10ml Syringes (500 off)

FG-K17076-KW:
5ml Syringes (500 off)

FG-K16366-KW:
12 V Adapter

ANALEXpqF

The ANALEXpqF is a manually operated Ferrous Debris Monitor. The PQF is designed to detect ferrous wear debris in the oil or grease samples taken from lubricated machinery. Designed for use in the field, this unit is ideal for testing and analysing oil samples on-site or in remote locations where fully laboratory analysis is not possible.

Samples may be presented for analysis in a variety of media. Automatic re calibration is performed between each sample measurement. Data from each test is stored in the internal memory, which may then be transferred to a database on a host < pc via an RS323 interface.

Specifications

Measurement Range:	0-2000 PQ
Display Resolution:	5 PQ
Sample Bottle:	Standard 100ml bottles or 2ml Pots
Test Time:	< 5 minute to stabilise from power on, < 15 seconds per sample
Fuse Rating:	2.5 A 250 VAC HRC A/S T ceramic
Power :	250 VAC autoselected 50/60Hz
Operating Temp. Range:	15-35°C (60-100°F)
Repeatability:	Typically +/-15 PQ or 3 % of average reading
Sample Bottle Detection:	Opto reflective Sensor
Lid Open Detection:	Opto reflective Sensor
Weight:	1.4 kg

Ordering Information

FG-K16000-KW:
ANALEXpqF

FG-K16063-KW:
Adapter for non-standard 43mm bottles

FG-K16064-KW:
Adapter for Millipore Filters

FG-K16065-KW:
Adapter for RPD Slides

FG-K16075-KW:
Adapter for 35ml STS bottles (31mm diameter)

FG-K15004-KW:
5ml Plastic Pots with lids (100)

FG-K15005-KW:
Plastic Pots with lids (3000)

FG-K25043-KW:
5ml Plastic Pots (3000, lipped bases only)

FG-K3-207-KW:
100ml PVC Sample Bottles (288)

2. Wear Debris Sensors

Total Ferrous Sensor

The range of Total Ferrous Debris Sensors place you in complete control of your maintenance. Whether it's to check on the health of the machine, or an alert of changing wear patterns, the Total Ferro Debris Sensor provides instant information, complementing your existing oil analysis programme, and helping you make informed maintenance planning decisions.

Machines give telltale indicators of potential problems. Any change in the wear pattern is going to result in changes in the ferrous density. The Total Ferro Debris Sensor goes beyond the normal chip detectors and magnetic plugs. Providing a ppm value, you can monitor real-time and take immediate action on the first indication of change.

The Total Ferro Debris Sensor can be mounted within almost any lubrication system on any type of machine. The sensor measures ferrous density, resulting from the wear debris within the lubricant, using a combination of proven magnetometry, combined with smart algorithms to provide data in Parts Per Million (ppm). With the digital and analogue outputs, air blast and piston options the total ferrous sensors can be easily integrated into your existing condition monitoring and operating control systems.

Specifications

Ambient Temperature:	-20 to 65°C (-4 to 149°F)
Analogue Output:	Opto isolated 4-20mA
Communications:	CAN, RS232, RS485
Connections:	Piston 1/8" BSP, Air Blast & Non Zeroing Option 3/8" BSP
Detection:	Total Ferrous Wear Debris
Fluid Compatibility:	Petroleum, synthetic oils and water/oil
Fluid Temperature:	-20 to 65°C (-4 to 149°F)
Max. Fluid Pressure:	10 bar (145psi)
Options:	Stand alone unit, Unit with piston zeroing
Power Supply:	18-30 VDC
Protection:	IP65
Range:	0-2000 pmm Uncombined Ferrous Debris
Weight:	2.2kg (4.85lb)
Fluid Viscosity:	350 cst (Piston Vers. & Non Zeroing Option)

Ordering Information

FG-K16344-KW:
Total Ferrous Sensor Piston Version

FG-K16354-KW:
Evaluation Kit Piston Version, includes case, power supply and display

All sensors come complete with software for data downloading and trending.

Available for use in a multitude of applications

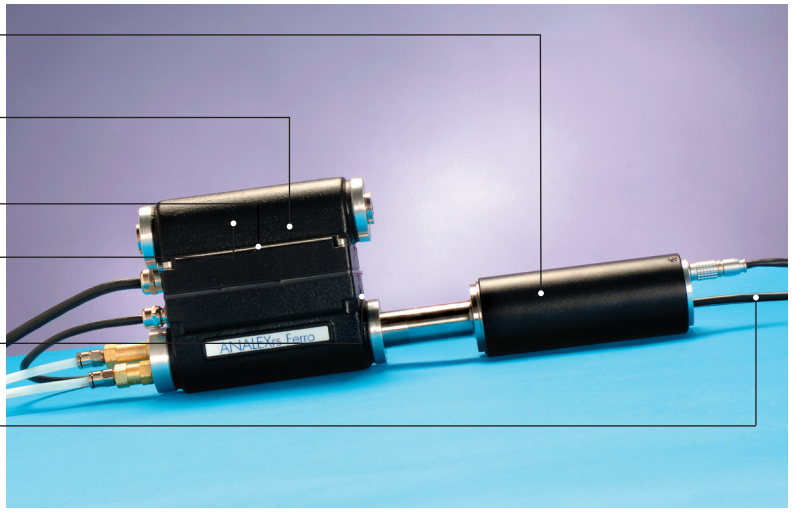
Robust cast iron enclosure providing strength and magnetic shielding

Sealed to IP65 suitable for industrial use

Reference coil for controlled temperature stability

LED display providing a visual indication of sensor status

Wide range of interface options due to variety of industry standard outputs



Metallic Particle Sensor

The Metallic Particle Sensor goes beyond the normal wear debris sensors to offer even greater size resolution. With an unbeatable detection range the sensor provides a debris count for both ferrous and nonferrous metals. Now you can monitor how dirty your oil is, real-time.

The Metallic Particle Sensor can be mounted within almost any lubrication system on any type of machine. The sensor measures ferrous and nonferrous metals, resulting from the wear debris within the lubricant, using a combination of proven inductive coil technology, combined with smart algorithms to provide a particle size distribution count. And that puts you in control. You know that the more severe the wear problem, the more that the machine produces larger wear debris particulate.

With its digital and analogue outputs, it can be easily integrated into your existing Condition Monitoring and operating control systems. It puts you in control. Whether it's to check on the health of the machine, or an alert of changing wear patterns, the sensor provides instant information, complementing your existing laboratory oil analysis programme, and helping you make informed maintenance planning decisions.

Specifications

Ambient Temperature:	-20 to 65°C (-4 to 149°F)
Analogue Outputs:	2 x Opto isolated 4-20mA, 1 x Alarm contacts (0.1A max)
Connections:	3/8" BSPP female, 10 mm ID x 120 mm L bore
Detection Range:	>40 micron (0.4mm) [0.00157 inch] Ferrous >135 micron (0.135 mm) [0.00531 inch] Nonferrous Metallic, Simultaneous quantification of metallic composition, size category and particle count.
Fluid Compatibility:	Petroleum, synthetic oils and water/oil emulsions
Fluid Environment:	<10 bar (145 psi) @ -20°C to 65°C (-4°F to 149°F), 0.28m/s (1.3 Litres/minute) to 4.5 m/s (21 Litres/minute), <500cST @ 40°C
Input:	+24 VDC +/- 10%, Calibration Push Button
Other:	IP65, 1.5 kg (3.3lb)
Flow Rate:	1.3-4.5 m/s
Sensor Bore:	Diameter 10 mm, Length 120 mm
Max Fluid Pressure:	10 bar (145 psi)
Max Fluid Viscosity:	500 cST
Communications:	RS232, RS485, (Modbus option available)
Output:	Simultaneous quantification of metallurgical composition and size category of particles in a fluid

Ordering Information

FG-K16121-KW:
Metallic Particle Sensor

FG-K16355-KW:
Metallic Particle Sensor Evaluation Pack includes case, power supply and display

All sensors come complete with software for data downloading and trending.

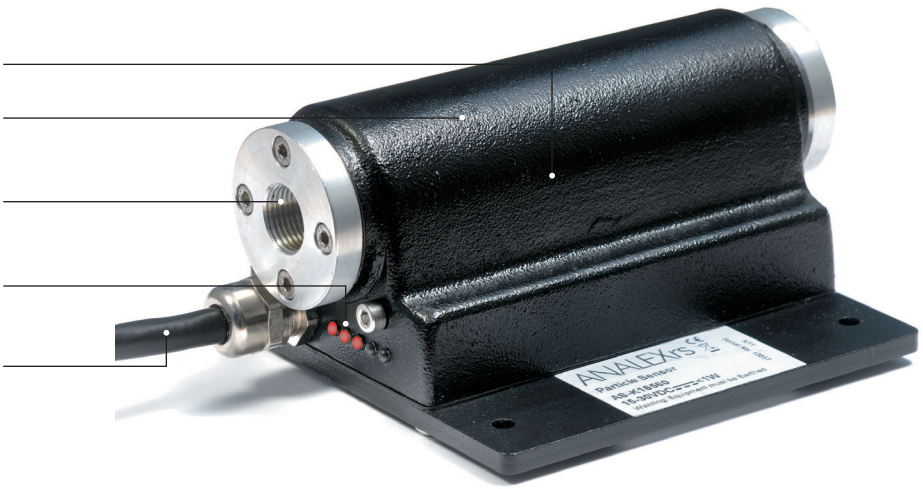
Sealed to IP65 suitable for industrial use

Robust cast iron enclosure providing strength and magnetic shielding

3/8" BSP connections for quick and easy installation

LED display providing a visual indication of sensor status

Wide range of interface options due to variety of industry standard outputs



3. Diesel Performance Analyser

Sea-going vessels require large amounts of fuel to operate. Therefore diesel engine performance is paramount to a ships owner's bottom line. Most marine diesel engines operate on lower-quality fuels that can cause ignition delays and incomplete combustion. Kittiwakes Diesel Performance Analysers can provide early detection of worn or damaged engine components such as piston ring leakage, burnt piston crown, exhaust valve leakage and much more. It also ensures that the engine is well balanced and the injection timing is correct. An optional feature is an acoustic emission sensor that measures fuel injection without penetrating the fuel system. This option delivers enhanced engine performance by utilizing some of the latest technological innovations designed specifically for marine engines.

Your benefits when using a Diesel Performance Analyser are:

- Reduced fuel consumption
- Well balanced engine
- Correct ignition timing
- Overload protection
- Improved maintenance
- Reduced spare parts
- Reduced emissions

Kittiwake does provide four different systems all with the same high accuracy which all use a PC to evaluate the data:

- Diesel Indicator: Economic and simple device with no display on the indicator unit.
- Diesel Scope: Portable unit with direct graph, bar and table visual mode on a high resolution display.
- Diesel Combustion Analyser – Single Sensor: Similar to the DieselSCOPE functionality but all permanently wired up.
- Electronic Combustion Analyser 24/7 Multi Senor: measures continuously the performance of the main engine.

ECON Diesel Indicator

The Electronic Indicator is a portable unit that monitors the combustion process of diesel engines. It allows you to tune the engine and detect faults or irregularities in their early developing stages.

The Electronic system consists of a robust metal handle unit including cylinder pressure sensor, connected to the indicator valve of the cylinder being measured and a magnetic, optical or inductive pick-up(s) fitted on the flywheel.

It is easy-to-use and very intuitive thanks to the very simple design: just two buttons and three light emitting diodes.

The Electronic Indicator was designed as a measuring unit easy to be connected to PC USB port. No hardware drivers or special IT knowledge is required for the software installation.

It works for about four hours with two standard AA batteries.

The nonvolatile memory stores one engine configuration and indicated diagrams up to 20 cylinders.

The Electronic Indicator can measure with and without pickups and measures very accurate. The angle precision is 0.1 deg and the pressure is 0.1 bar.

The Electronic Indicator is supplied with a PC software package Electronic Indicator Viewer. The transfer of the measurement records and engine data files to PC folders is done by the USB cable.

Benefits:

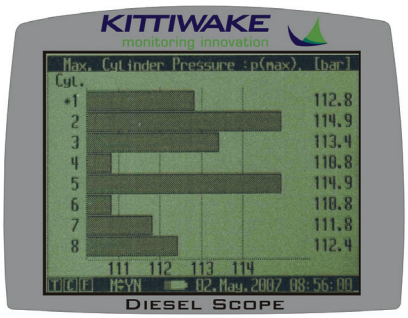
- Low budget version of DieselSCOPE
- Can be used with optional flywheel pick up
- Easy download via USB to the computer
- Equipped with a Kistler sensor
- Uses the same software as DieselSCOPE

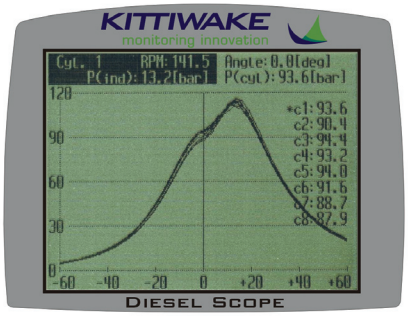
Ordering Information

FG-K17735-KW:
ECON Diesel Indicator
1. ECON Diesel Indicator handheld unit
2. Kistler Pressure Sensor
3. Thompson Adaptor
4. PC to DieselSCOPE USB Cable
5. Battery Charger
6. "ECON Diesel Indicator View" Software Package
7. Instruction Manual

Optional Parts
FG-K17730-KW:
TDC Pick-up for 4 Stroke Engines
FG-K17731-KW:
Pick-up for 2 Stroke Engines (Pair)

DieselSCOPE





The DieselSCOPE is a portable unit that monitors the combustion process of diesel engines in real time. It allows you to tune the engine while measuring and detecting faults or irregularities early in the developing stages.

The DieselSCOPE system consists of a handheld unit, a cylinder pressure sensor connected to the indicator valve of the cylinder being measured, and an optical or inductive pick-up(s) fitted on the flywheel.

It is easy-to-use and very intuitive thanks to the single function buttons: Engine, Measure, File, Graph, Bar, Table, Mode, Setup and Help. There are no hidden sub menus. The large icons are self-explanatory. Navigate with the arrows, confirm by the Yes button, return back by No.

The DieselSCOPE was designed as a stand alone unit. The long battery life, the 320 x 240 pixels screen allows using it without a PC. The big nonvolatile memory stores 60 measurement records, up to 20 cylinders each. The engine library can keep 30 engine data files. It measures in auto-stop and continuous modes.

The DieselSCOPE has Graph, Bar and Table visual modes. All three can be used to measure or to analyse data records.

Graph shows the Pressure - Angle diagram(s). You can compare cylinders, zoom the diagrams, read the pressure at the cursor position from multiple diagrams.

Bar displays either absolute or relative (% deviation) plots of a selected measured or calculated parameter for cylinder-to-cylinder comparison.

Table mode shows the values of RPM, P(ind), P(cmp), P(max) and A(ign) of a selected cylinder.

The values of all other parameters of all cylinders are shown when scrolling through the table of results.

The DieselSCOPE is supplied with a PC software package DieselSCOPE View. Transfer of measurement records and engine data files to PC folders is done by the USB cable.

The DieselSCOPE View software helps to analyse the combustion process, store the measurements in data files, print diagrams or complete reports, sent data files by E-mail to the office.

The DieselSCOPE View facilitates the evaluation of the engine condition. Variety of diagrams, bar plots and tables present the measurements and the manually entered data in a user-friendly way.

The DieselSCOPE View makes it easier to compare current with previously taken reference data and thus to detect worn parts or incorrect adjustment.

The DieselSCOPE helps to reduce the engine's operating cost. Cylinder-to-cylinder load balancing and correct fuel injection settings will optimise engine performance and minimize specific fuel oil consumption.

Ordering Information

FG-K17729-KW:
DieselSCOPE Standard
1. DieselSCOPE handheld unit
   230x105x40mm, 500 gr, 20 hours
   battery life
2. Kistler Pressure Sensor
3. Thompson Adaptor
4. PC to DieselSCOPE USB Cable
5. Battery Charger
6. "DieselSCOPE View" Software Package
7. Instruction Manual

Optional Parts
FG-K17730-KW:
TDC Pick-up for 4 Stroke Engines
FG-K17731-KW:
Pick-up for 2 Stroke Engines (Pair)
FG-K17733-KW:
Acoustic Emission Sensor

Optional Fuel Sensor

Emission (AE) waves are commonly defined as transient elastic waves within a material caused by the release of localized stress energy. Hence, an event source is the phenomenon which releases elastic energy into the material, which then propagates as an elastic wave.

AE events that are commonly studied among material failure processes include the extension of a fatigue crack, or fibre breakage in a composite material.

AE is also related to an irreversible release of energy that can be generated from sources not involving material failure including friction, cavitation and impact. Acoustic emissions can be detected in frequency up to 100 MHz.

The Acoustic Emission Sensors is a piezoelectric sensor with built-in amplifier and signal conditioning. It is optimised to detects elastic waves in the range of 300 to 700 KHz , which are caused be injection of the fuel through the nozzle, exhaust gas flow through the valve, impact of the injector needle, closing and opening of the fuel pump spill

The AE sensor is used to measure the angle at which these events occur and to detect deviations in injection timing, late burning of fuel in the cylinder, leaking injectors.

Specifications

Frequency Range:	200-700 KHz (Acoustic Emission)
Operating Temperature:	130 °C
Power Supply:	5.00 +/- 0.25 VDC
Output Signal:	0.5-4.00 VDC
Attachment:	Alnico Magnet, 5.2 kg pull force
Diameter:	26 mm
Connector:	Neutrik, NC4MP-BAG

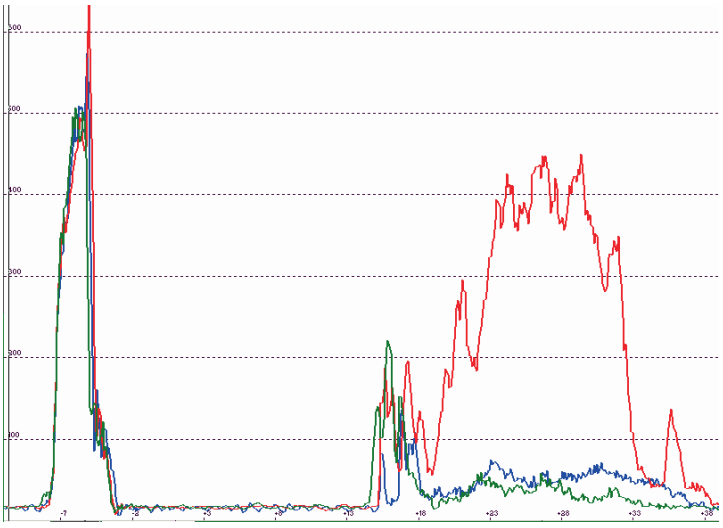
Ordering Information

FG-K17733-KW:
Acoustic Emission Sensor

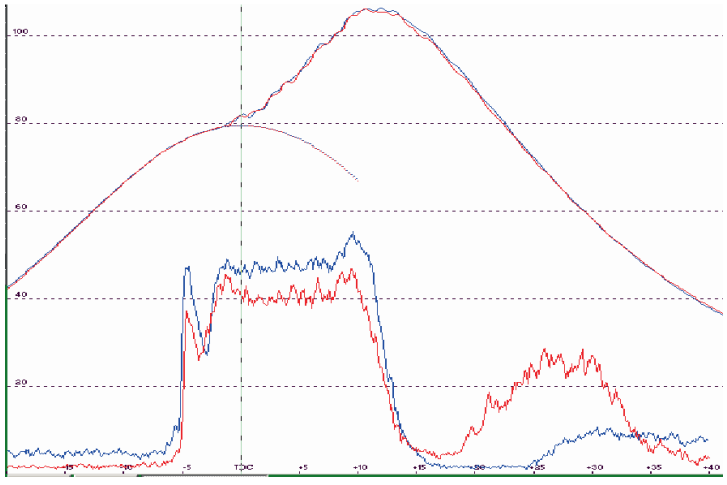
The optional Acoustic Emission (AE) Sensor can be used for the DIGI DieselSCOPE, the DIGI Combustion Analyser and the Electronic Combustion Analyser 24/7. It is not suitable for the use with the ECON Diesel Indicator.

Benefits:

- No penetration into the fuel system eliminates possible fuel leakage
- Latest technology in acoustic emissions
- Applicable for 2-stroke and 4-stroke engines
- Extended life cycle compared to pressure sensors

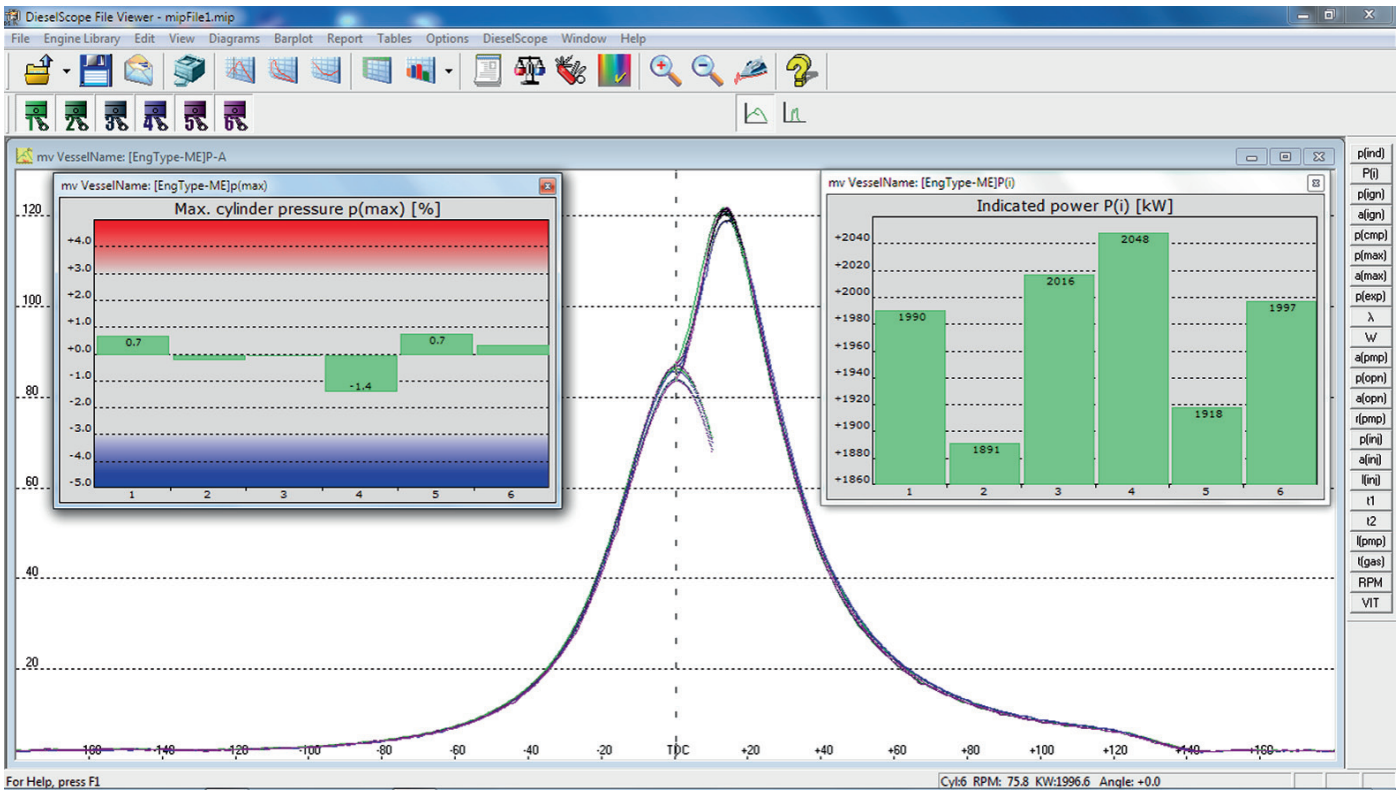


Leaking nozzle



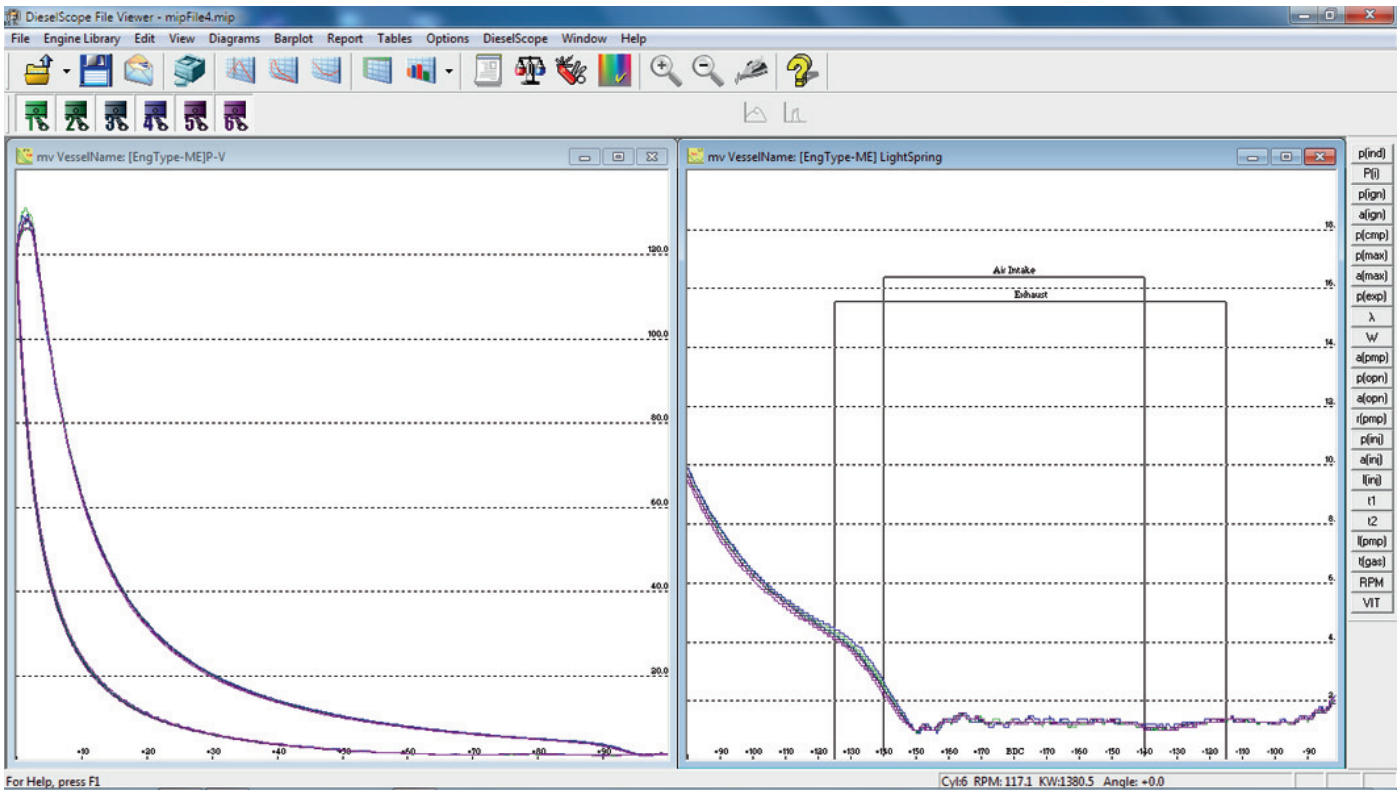
Fuel after burning

View Software



The Viewer software helps to analyse the combustion process, store the measurements in data files, print diagrams or complete reports, sent data files by E-mail to the office

The software facilitates the evaluation of the engine condition. Variety of diagrams, bar plots and tables present the measurements and the manually entered data in an user-friendly way.



The Viewer software makes it easier to compare current with previously taken reference data and thus to detect worn parts or incorrect adjustment.

The software helps to reduce the engine's operating costs. Cylinder-to-cylinder load balancing and correct fuel injection settings will optimise engine performance and minimize specific fuel oil consumption.

Diesel Combustion Analyser - Single Sensor

The Diesel Combustion Analyser has been developed to use for one up to four engines, monitoring the cylinder pressure and fuel injection system.

Operating costs, especially labour and maintenance costs or not running hours, get shorter. The intention is to optimise engine operations while saving time and investigations.

Coloradoan connectors
- no wiring
- easy installation
- no grounding problems

Powered by the PC
- isolated pressure measurement channel
- eliminates 220/110 voltage problems

Small metal junction boxes
- easy trouble shooting
- repairs by component exchange

Handheld repeater unit
- one-man operation
- tune engine while measuring

Ordering Information

customized system
- please contact our office to discuss details -

Benefits:

- Uses existing PC to measure engine performance
- Runs under Windows 2000, XP, Vista and Linux
- USB CJB with lifetime guarantee
- Fast measurement (8 cylinders in 5 minutes)
- Real-time cylinder and fuel pressure measurements
- Small data files (31 KB for 7 cylinder engine)

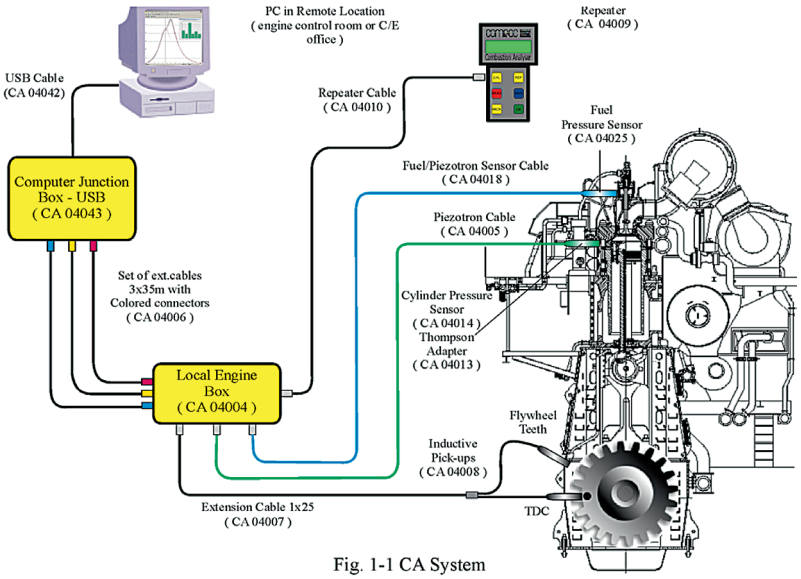
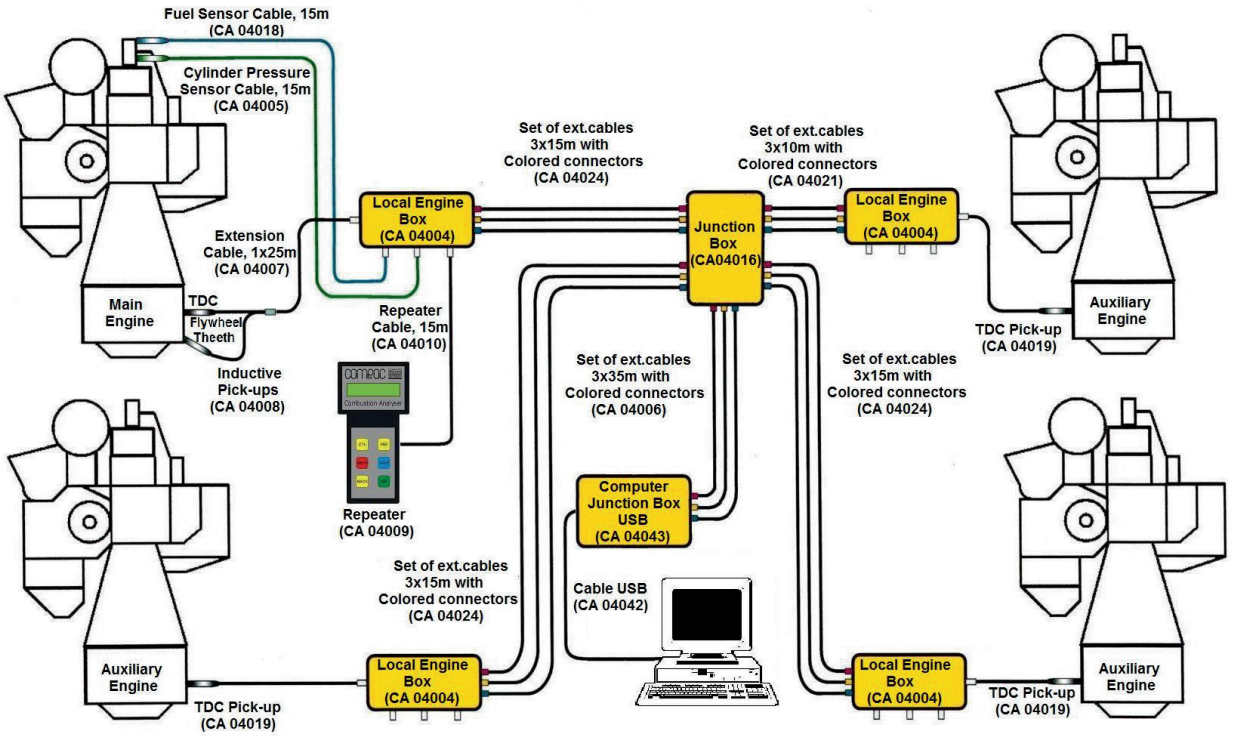


Fig. 1-1 CA System



Electronic Combustion Analyzer 24/7 Multi Sensor

The Electronic Combustion Analyser 24/7 Multi Sensor is the most advanced system for continuous diesel engine performance. It has been developed to use for one Main Engine Only. It can monitor up to 12 cylinders and log the data permanently. The Electronic Combustion Analyser is a comprehensive system for continuous engine performance measurement and monitoring which will provide the key knowledge for obtaining optimum and reliable engine performance. With the aid of the combustion information you will have minimum engine wear, and optimum emission and fuel consumption.

Ordering Information

customized system
- please contact our office to discuss details -

Benefits:

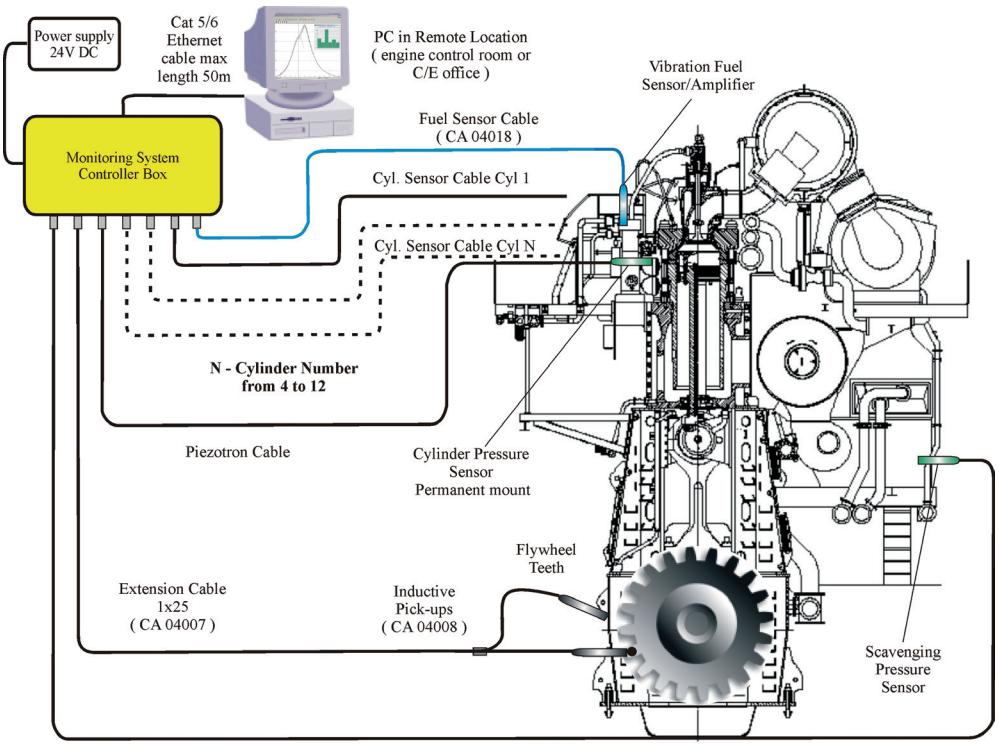
- Longer lifetime of components
- Better maintenance planning
- Early detection for fault
- Increased operational safety
- Lower fuel consumption
- Easy technical reporting

Features:

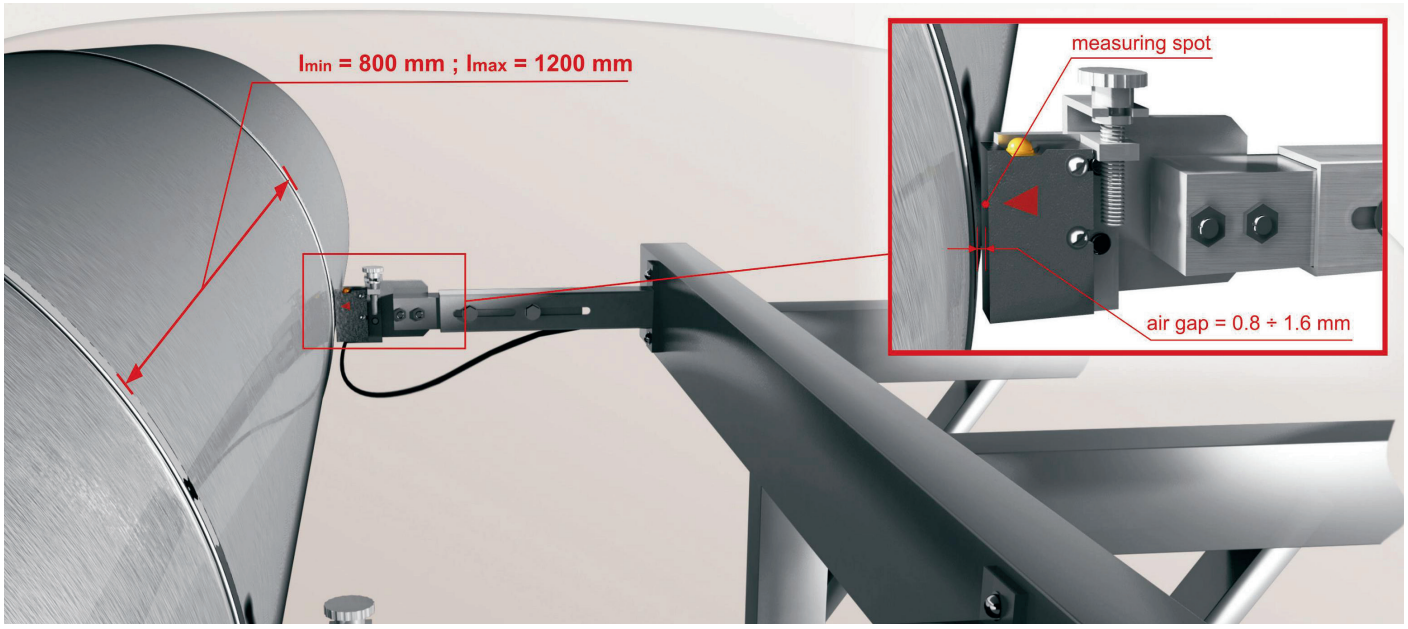
- Synchronous cylinder pressure measurement of up to 12 cylinders
- 3 x 4-20mA Inputs
- 4 x Digital Outputs
- 2 x 62 Diagrams Buffer
- p(max) alarm record
- USB data transfer to PC

Technical Data Sensor

Measuring Range:	A24 (0...200bar), A14 (0...103 bar), A34 (0...300bar)
Sensitivity:	A24 (50 µA/bar), A14 (100 µA/bar), A34 (33,3 µA/bar)
Overload:	300 bar
Connector (IP67):	M12x1
Linearity at 23°C:	< ± 0,75 %FSO
Mounting Torque:	15 N • m
Zero Point (no pressure):	10 mA
Signal Stroke FSO	10 mA
Operating temp. range, Sensor front:	-50...350 °C
Operating temp. at cable connect.:	-20...200 °C
Operating temp. Charge amplifier:	-10...85°C
Supply Voltage:	16...30 VDC
Weight:	150 g



4. Torque Meter

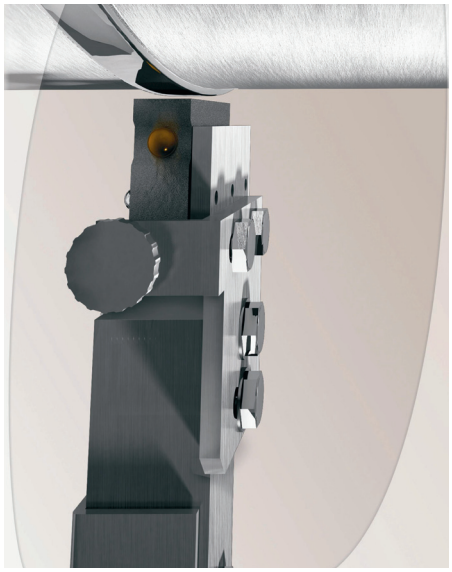


The measurement results are displayed on the easy to read LCD in "real-time". A quick comparison of the actual data with a preset "propeller curve" provides the operator with a tool that helps avoid overloading of the engine. The standard signal output is 4-20 mA which allows simple connection of the system to control panels and other devices, such as Kittiwakes LinerSCAN. An Ethernet connection is also available as an option and alternative digital outputs can be discussed on request.

This ensures a quick and easy installation and a long product life without requiring regular or servicing or engineer visits.

The sensors can be placed anywhere on the shaft. The optimal position is to place one either side of the bearing housing. The installation uses magnetic tape with double sided backing which again ensures rapid and simple installation. The sensors are then adjusted to pick up the signal from the magnetic tape at a gap of 1-2 mm.

The installation can be carried out by crew or shipyard with calibration and zeroing done using the built in software package.



The torque meter package comprises 2 metal strips (with magnetic pattern), two sensors and a transmitter. The tape provides 150 to 600 pulses per revolution, depending on the diameter of shaft. The sequential magnetic north and south poles of the tape are detected by the sensors.

The microprocessor based transmitter detects the shift of pulses of the second tape (the twist of the shaft), caused by the torque and calculates the actual torque reading.

Ordering Information

FG-K18319-KW:
Torque Meter

Contact- free method permanent torque & power measurement

- Permanent torque and power measurement
- Shaft diameter 200-1000 mm. Other sizes on request
- Sensor: Contact-free
- 0.1 ms resolution = 2 x 10^{-6} degrees at 120 RPM
- Two 4-20 mA outputs

5. Acoustic Emission Solutions

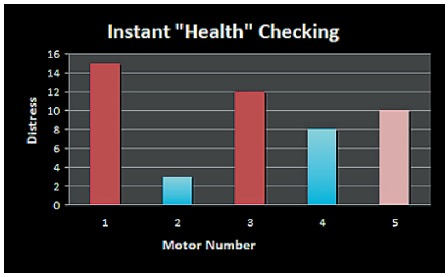
Hand held, rugged instruments giving you instant access to powerful CM diagnostics.

If you need information on the condition of rotating machinery and you need it now, the MHC-Memo instruments are for you.

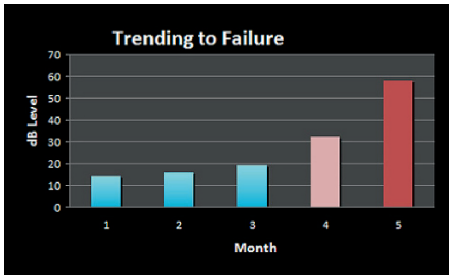
- With Standard and Super Slo modes of measurement, it's easy to monitor down to rotational speeds as low as 0.25 rpm (that's 4 minutes per revolution !).
- What's more, you don't need to know design details like bearing type, size or number.

From day one, MHC-Memo instruments give you crucial information for implementing proactive, rather than reactive, maintenance. Even on machinery you have never monitored before. Unlike traditional vibration analysis, sensor placement is easy as it's unaffected by the plane of the bearing or at any specific orientation.

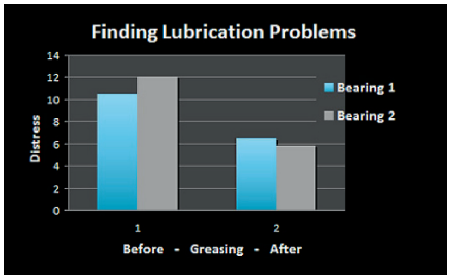
Make no mistake, the outstanding speed and ease of use of the MHC-Memo range are not gained by compromising performance or sensitivity to developing faults. In fact, our unique, patented and well established MHC technology has gained an enviable reputation across all industrial sectors. With thousands of MHC instruments in use around the world you'll not be alone.



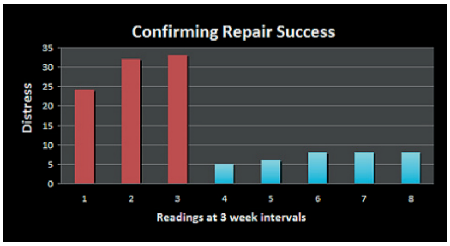
In the illustration, 3 of the 5 motors have Distress® > 10. This information was obtained from a single snapshot using a MHC Memo instrument. As such there was no need for calculations or previous machine knowledge - it's instant. The motor bearings were re-greased, however, since this gave no significant improvement it was clear there permanent damage had occurred. A maintenance action was logged to replace the bearings in a timely fashion and before unplanned shutdown became inevitable.



In this illustration, the Distress® parameter highlighted a potential gearbox problem in Month 1. The application was none critical to plant operation but typical of many similar installations within the same facility. The user was new to the AE and it was decided to trend the results to failure so as to better understand the applicability. dB Level was trended to track progressive wear on a monthly basis. dB Level typically increases exponentially as the defect becomes serious. The gearbox appeared perfect to the site engineer even in month 5 but seized shortly after.



The data beside is similar to the first illustration but with a more successful outcome. In this instance, a snapshot was taken of Distress® level for two motor bearings. Distress® readings are taken every month. When bearings are found with a value > 10, its time to re-grease. Following the maintenance intervention, a further snapshot was taken. The reduction in Distress® confirms the improvement. No need to know speed, bearing type, meshing speed .....



In the last example, Distress® measurements revealed a developing problem, dB Level would also confirm this but there was no need for such confirmation as the problem was so obvious and beyond what would typically be corrected by an improved lubrication regime. All bearings were replaced under planned shutdown conditions. This resulted in an immediate reduction in Distress® value, confirming a successful repair. As simple as falling off a log.

MHC Instruments

MHC-Memo instruments monitor high frequency Acoustic Emissions (AE) signals naturally generated by deterioration in rotating machinery. Our unique way of detecting and processing these signals gives you condition related information in the easiest possible form. They are state of the art Condition Monitoring instruments with extreme sensitivity to developing faults. With thousands of MHC portables in use worldwide and countless successes on ball, roller, white metal and journal bearings, this is a claim we can substantiate.

How do they work ?
As the mechanical condition of machinery deteriorates, energy loss processes such as impacts, friction and crushing generate sound wave activity that spans a broad range of frequencies. By detecting only the high frequency part of this signal with special AE sensors it is possible to detect miniscule amounts of activity (e.g. a slight rub, a brief impact or the crushing of a single particle in the lubricant). The patented MHC sensor gives improved repeatability and is remarkably rugged. With its magnetic front face its also quick to use.

A crucial step is to process these signals so that faults can be easily detected at an early enough stage to allow maintenance to be planned but not to constantly give false alarms. This is where the Standard and Super Slo methods come into their own.

Distress increased from 4 to 26 however FFG Vibration MISSED this!

Headphones (with built-in ear defence):

Irrespective of whether you are in Standard or Super Slo mode you can listen to the nature of the signals in the headphones. The special audio circuitry filters out normal vibrations and audible sounds to let you clearly hear rubs, impacts etcetera as they happen. Different faults types sound like isolated clicks, once per rev scuffing or frying food. The combination of the headphones and the optional MHC- Airborne sensor provides a powerful detection capability for air and vacuum leaks.

It is important not to confuse our MHC instruments with simple vibration meters. The high frequency detection of MHC instruments provides an inherently better Signal to Noise Ratio (SNR). It is fundamental characteristic combined with our patented signal processing methods that gives exceptional sensitivity to developing faults without the need to enter machine or bearing details.

Benefits

Finding lubrication problems
Distress® readings are taken every month. When items are found with a value greater than 10 its time to re-grease. The reduction in Distress® confirms the improvement. No need to know the speed, bearing type etcetera.

Instant "health" checking
3 of the 5 motors have a Distress® > 10. No need for calculations or previous machine knowledge - it's instant. Since re-greasing gave no improvement its clear there is permanent damage.

Confirming repair success
Measurements were taken to reveal a developing problem. When the bearing was replaced the reduced Distress® value immediately confirms a successful repair.

Find leaks FAST!
Save energy & money! Simply plug the airborne sensor (optional accessory) into one of the portable products shown and listen on the headphones - you now have a sensitive leak detector for compressed air. Be surprised how quickly and easily you'll find leaks that you never knew were there.

Ordering Information

FG-G11003-HO
MHC Memo-Classic

FG-G11103-HO
MHC Memo-Classic Plus

FG-G12003-HO
MHC Memo Pro

FG-G10003-HO
Econ Bearing Checker

Easy to use and interpret parameters for quick analysis
Simply attach the unit via the magnetic sensor head and within 10 seconds both dB Level and Distress® values will be displayed. dB Level is an indication of the overall noise of the bearing and is dependent on speed. It increases with speed of rotation, but also with degradation of the bearing or inadequate lubrication. Distress® gives an instant indication of the state of the bearing's health. A reading below 10 generally indicates normal operation, higher then 10 is usually indicative of bearing damage or the need for attention.

Kittiwake Holroyd's **MHC Bearing Checker** is a new, unique hand-held instrument, providing maintenance engineers with an easy to operate, simple to use and quick method of analysing bearing condition and lubrication state.
The **MHC Bearing Checker** monitors high frequency Acoustic Emissions (AE) signals naturally generated by deterioration in rotating machinery. The unique way of detecting and processing these signals gives you condition-related information in the easiest possible form. It is a state-of-the-art Condition Monitoring instrument with extreme sensitivity to developing faults. The unit is powered by an internal rechargeable battery, offering up to 1000 measurements between charges. Recharging is accomplished through a micro USB port and the unit can be connected to any standard PC USB port for easy of recharging. Can you afford not to equip all of your maintenance staff with a unit?

MHC Memo - Classic - Instant Machine Health Checker

The entry level Memo-Classic features Standard mode with a 4 measurement point hold and temporary store feature. Press the ON button, couple the magnetic sensor to the machine and you're away. It couldn't be easier.

The Hold and Store function let's you compare readings on different machines (or parts of the same machine) to home in on the problem and the headphones are a great help in identifying the type of activity.

MHC – Memo Classic Plus - Instant & Versatile Machine Health Checker

If you like the simplicity of the Memo-Classic but in addition to Standard mode you need Super Slo mode then the Memo-Classic Plus is simplicity itself.

In addition the Memo–Classic Plus has a 32 measurement point non- volatile memory which is ideal for comparing Standard or Super Slo readings on similar machines or keeping track of developments on a machine of current concern.

MHC - Memo Pro - Route Mode Data Collector with PC Analysis Software

The Memo Pro is able to monitor a near unlimited number of machines on a periodic basis. In addition to storing Standard and Super Slo modes within its walk around routes the Memo Pro can also store manually input values from any other device (e.g. a pressure gauge, kVA meter etcetera). The Memo Pro can hold up to 6 routes at a time, each having up to 435 measurement points within a Site, Area, Machine & Point hierarchy. All readings can be downloaded to the Memo View Pro software package supplied as standard. Memo View Pro features Trend plots, Alarm Levels, Exception Reports, Missed Points List and User Notes. The addition of Capture Spectrum and AutoLog functions make the Memo Pro the ultimate tool for Condition Monitoring specialists.

Specification MHC Instruments

	Bearing Checker	Memo Classic	Memo Classic Plus	Memo Pro
Headphones	–	■	■	■
Standard Mode (Std)	■	■	■	■
Super Slow Mode (Slo)	–	–	■	■
Manual Input	–	–	–	■
Software	–	–	–	Memo View Pro Memo View Lab
AutoLog	–	–	–	■
Memory (volatile)	–	4 points	–	–
Memory (permanent)	1 point	–	32	2592 points on 6 routes
FFT Frequency Analysis capability	–	–	–	15 spectra
Route Naming Heiracy	–	–	–	4 levels
Compare previous Values	–	–	–	■
PC Interface	–	–	–	■
Keypad	4 Keys	5 Keys	10 Keys	10 Keys
Full trend analysis software	–	–	–	■
Coms	–	–	–	USB
Measurement Std	Distress®, dB Level			
Measurement Slo	Super Slo: Peak, Intensity, Extent, dB Level.			
Keypad	Sealed membrane			
Display	2 x 8 alphanumeric LCD	2 x 10 alphanumeric LCDm backlit		
Power save	30 seconds	8 minutes		
Op. Temp	0-65°C	0-50 °C		
Battery type	NiMH rechargeable	9 V block MN1604 rechargeable		
Size	98 x 62 x 34 mm	115 (w) x 220 (h) x 52 (d) mm		
Weight	225 g	800 g (approx.)		

Sensor

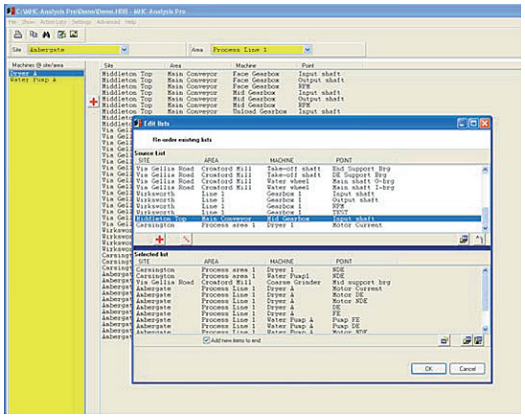
Sensing element	Resonant piezoelectric at ~ 100kHz
Calibration	Factory set

Signal Measurement

Description	Range	Resolution
Fault indicating parameter	0 to 40	1 unit
Logarithmically scaled mean signal level	10 to 80	1 dB

Software for MHC Instruments

Memo View Pro is a full functionality route mode software package for use with the MHC-Memo Pro instrument. It is designed around a machine database with Site, Area, Machine and Point fields of hierarchy. Measurements are taken in Route lists but can be analysed in flexible Action lists irrespective of which Routes they were taken on. Report generation is simplified using the Exception Report, Missed Points listing and the summary printouts showing graphical trends, tabulated readings and even user input machine photos. Organisation and control of the CM task is further aided by features such as User Notes and a Calendar giving a reminder when measurements need to be taken on specific Routes.



Route planning & machinery detail

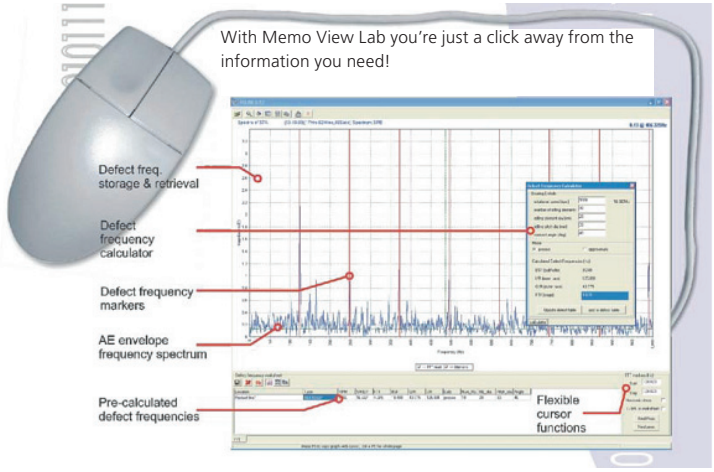
Results, alarms, trends, time & date

Memo View Lab software takes as its input the Capture Spectrum files recorded on the MHC-Memo Pro instrument and displays them as a frequency spectrum to aid in the identification of defects present.

Spectra can be cursor interrogated and overlaid with harmonic markers either manually entered or derived from the defect frequency calculator. Provision is made for exporting of the numerical values of spectra data points (e.g. for viewing in a third party spreadsheet).

Operating Modes of MHC Instruments

Standard Mode is a powerful way of processing the minor clicks and crunches associated with the earliest stages of mechanical deterioration in machinery rotating down to ~ 35 rpm. dB Level and Distress® values take just 15 seconds and there's no need to enter any information about the machine (such as bearing type, size or number) or even shaft speed. Distress® is so sensitive it will even detect inadequate lubrication giving you the opportunity to remedy the problem before any permanent damage has occurred.



Super Slo Mode makes quick work of sensitively monitoring machinery rotating as slowly as 0.25 rpm (4 minutes per rev !). The only information needed is the number of seconds per revolution and the patented Super Slo method does the rest.

In just 9 revolutions you'll get the dB Level, Peak, Intensity and Extent® signal characteristics. Each of these has its role to play but for spreading damage (the most usual form of deterioration) it's the Extent reading that is the most powerful.

Capture Spectrum (requires Memo View Lab) lets you view and analyse the envelope spectrum to reveal repetition (defect) frequencies. If, for example, you need to know whether its an inner race or outer race defect that's causing the increased Distress® then this is the feature for you. (Note : Capture Spectrum is only suitable for machinery rotating above 120 rpm.)

AutoLog stores a sequence of successive readings of either Standard mode or Super Slo mode. The available AutoLog memory of 2,340 sets of readings can comprise any number of sequences in any combination of Standard and Super Slo modes.
The instrument keypad is used to control the length of each AutoLog sequence and to enter its filename at the time of the measurement.

MHC Portable Sensors

The MHC-1000 Portable sensors are designed specifically for use with the MHC–Memo range of On-Site (portable) Condition Monitoring instruments.

Their low power circuitry maximises instrument battery life whilst their rugged designs are enhanced by ergonomically designed rubber housings.

Supplied with standard 1.2m cable length, they are suitable for use with coaxial cable lengths up to 20 metres. Options are available for harsh applications, extended temperature ranges and probe extensions for those hard to reach monitoring points

MHC 1000 Portable Sensors

Ordering Information

FG-HC1031-HO
MHC-1031/Mag/HT
Heavy Duty Sensor
Description: Standard
Mounting: Magnetic
Dimension: 87 x 34 mm
Temperature: -40 to 120°C

FG-HC1040-HO
MHC-1040/Probe
MHC compatible Probe
Description: Extended probe
Mounting: n/a
Dimension: Specify length with order
Temperature: 0 to 70°C

FG-G38500-HO
MHC-1050/Air/40
Air leak detection sensor
Description: Airborne
Mounting: n/a
Dimension: 87 x 34 mm
Temperature: 0 to 70°C

MHC 1000 Series Sensors (portable sensors compatible with MHC instrument range) SERIES MODEL VARIANT

1031	Mag	/HD	Heavy duty magnetic mount sensor
1032	Mag	/HT	Magnetic mount sensor for short term higher temperature use
1033	Mag	/XS	Extra sensitive magnetic mount sensor for hydraulic valve checking
1040	Probe	/XXX	Extended probe. Specify length of probe extension (XXX) in mm
1050	Air	/40	Sensor for airborne noise and gas leak detection

MHC Permanently Mounted Sensors

MHC 2000 Sensors are hard-wired but temporary connection to portable instruments (e.g. behind guards etc.).
They are suitable for coaxial cable lengths up to 20 metres. Extended temperature ranges are available with the coding 21XX.

MHC 2000 Series Sensors for Permanent Installation with 10/24 VDC phantom drive




Code (1)	MHC-2010/LP/X	MHC-2020/CP/X	MHC-2021/CP/DP/X	MHC-2022/CP/WP/X
Description	Low profile	Cylindrical	Cylindrical dip coated	Cylindrical potted
Power Supply	10/24 VDC	10/24 VDC	10/24 VDC	10/24 VDC
Mounting	Adhesive or tab	M8 Male stud	M8 Male stud	M8 Male stud
Mounting Boss	n/a	Boss A	Boss A	Boss A or B
Output note: cable length variants available	SMA connector (2) Dip coated comes with 5m cable as standard	5m Cable	5m Cable	5m Cable & conduit adapter
Special order cable options	n/a	Longer cable, BNC/TNC rear connector	Longer cable	Longer cable
Material (3)	Painted tin plate (standard) polyurethane (dip coated)	304 SS	Polyurethane	Polyurethane
Std operating temp, (20XX) numbering	-40-85 °C	0-70 °C	0-70 °C	0-70 °C
Extended temp, (21XX) numbering	-40-120 °C	-40-120 °C	-40-120 °C	-40-120 °C
Dimensions LxWxH/LxDia	54 x 35 14 mm	83 x 34 mm	85 x 42 mm	155 x 45 mm

Notes:
(1) "X" denotes a family of sensors under this product category, see table below for a full description.
(2) Cables are ordered separately for the MHC-2010 sensor as they are detachable
(3) When considering the application, it is especially important to consider the suitability of the sensor and its cabling for the environment in which it is intended to be installed (temperature, moisture, chemical and physical ruggedness).

MHC 2000 Series Sensors (permanently installed sensors with 10 V phantom drive) SERIES MODEL VARIANT

2010	LP	Low Profile sensor (with SMA connector)
2011	LP /DP	Dip coated Low Profile
2015	LP /Tab	Low Profile with Tab mount
2016	LP /Tab /DP	Dip coated Low Profile with Tab mount
2020	CP	Cylindrical Profile
2021	CP /DP	Cylindrical Profile Dip coated
2022	CP /WP	Cylindrical Profile Waterproof Potted
20XX		standard temperature range sensors itemised above
21XX		sensor variants as above but with ET extended temp range

MHC 4000 Smart Sensors

The MHC 4000 series sensors from Kittiwake are the latest development in smart AE sensors and incorporate proven MHC technology. MH-Smart sensors extend your CM tools far beyond the capabilities of other vibration based technologies. Three sensors are available for fixed installation.
The Smart sensor is designed for permanent installation on continuously rotating machinery. The Sigma sensor monitors intermittent & short duration machine operations All processing capabilities are included in the sensors. To install the sensors a set up software is required which is connected via a PC adapter.

- MHC Smart Standard - sensor for use on shaft speeds above 30 RPM.
- MHC Smart Slow - sensor uniquely developed for monitoring shaft speeds from 60 RPM down to 0.25 RPM.
- MHC Sigma - sensor for intromittent or short duration machine operation. Another unique offer from Kittiwake.

These three smart sensors represent the distillation of the unique technology that underpins a range of field proven Condition Monitoring instruments. Clever, cost effective sensors for permanent installation. A breakthrough in miniaturization incorporating a high frequency transducer, signal conditioning and advanced digital signal processing.

MHC Smart Standard - Reliable on-line monitoring capability for shaft speeds > 30 RPM

The MHC-Smart Standard provides a direct readout of Distress® & dB Level. Over the last 20 years, it has gained an enviable reputation for the sensitive detection of wear and degradation in rotating machinery. It will even detect inadequate lubrication before permanent damage is done. Unlike Vibration Analysis, it is insensitive to other effects such as speed variations, the operation of adjacent machines and changes in operating conditions (such as on/ off line).

- Alarm functions are pre programmed from your PC into nonvolatile memory using the Smart/RT interface.
- The alarm output to a local LED indication of alarm state or input to a PLC or SCADA system.
- Analogue output of Distress® & dB Level for monitoring or trending.

MHC Smart Slow - Unique on-line monitoring capability for slow rotational speeds 60 RPM to 0.25 RPM

The MHC-Smart Slow sensor incorporates the extensively proven and patented Super Slow method. It detects early signs of wear and degradation in very slowly rotating machinery whilst requiring the minimum of set-up. Just enter the time per revolution in seconds. The MHC-Smart Slow uses advanced processing to output any two of the derived parameters of Extent®, Peak, Intensity and dB Level. (Extent is sensitive to generalised damage, Peak to singular defects such as a cracked race & dB Level to constant friction intensity).

Ordering Information

FG-HC4010-HO
MHC Smart Standard

FG-HC4020-HO
MHC Smart Slow

FG-HC4040-HO
MHC Sigma

- Analogue output and alarm pre-programmed into nonvolatile memory from your PC using the Smart/RT interface.
- The alarm output to a local LED indication of alarm state or input to a PLC or SCADA system.
- Analogue output of two selected parameters are also available for monitoring or trending.

MHC Sigma Sensor - uniquely developed for intermittent or short duration machine operation

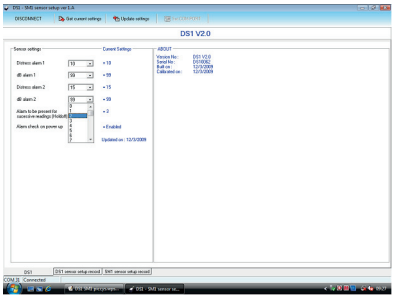
This MHC Sigma sensor is a ground-breaking solution to monitoring machinery that operates intermittently, randomly or only for short durations (as short as 500 ms). This application has been problematic typically requiring operation or production to be interrupted while the machine was run continuously in a 'maintenance mode'. Now for the first time, the Smart Sigma Sensor allows continuous, autonomous monitoring of such machinery without any disruption. Smart Sigma is a complete, stand alone, single channel monitoring and warning system which incorporates the following functions :

- Signal detection - high frequency transducer & signal conditioning.
- Signal processing intelligent signal reconstruction and Distress® & dB Level. Flexible, user configurable alarm settings.
- Data-logging - automatic non-volatile memory of trended values over the last 384 days.
- Digital interface enables PC connection via Sigma/RT for set-up & memory download

Smart/RT - Smart Sensor PC adapter

Smart/RT allows direct communications between the MHC-Smart Std and Smart Slo sensors and the USB port of a PC running Smart View software. Data to be viewed and analysed on the PC, offline in addition to the usual alarm functions available on the sensors themselves. Smart View software is supplied with the Smart/RT.

Smart View Software - Smart Std & Smart Slo Setup Software



Smart View is supplied with the Smart/RT to configure Smart Std or Smart Slo sensors. It is used in conjunction with the Smart/RT unit and a PC to adjust the alarm trip levels for both alarm channels together with a common time out period (or alarm persistence) to avoid false alarms. When connected to the Smart Slo, the user can make machine specific adjustments and selects the alarm output signal for two analogue channels on data collection/SCADA system.

The product also keeps track of what sensor settings for each adjustment applied.

Sigma/RT - Sigma Sensor PC adapter

Sigma/RT allows direct communication between the MHC Sigma sensors and the USB port of a PC running Sigma View software. It is used in conjunction with Sigma Interface Unit.

Sigma View & Pro software is supplied with the Sigma/RT.

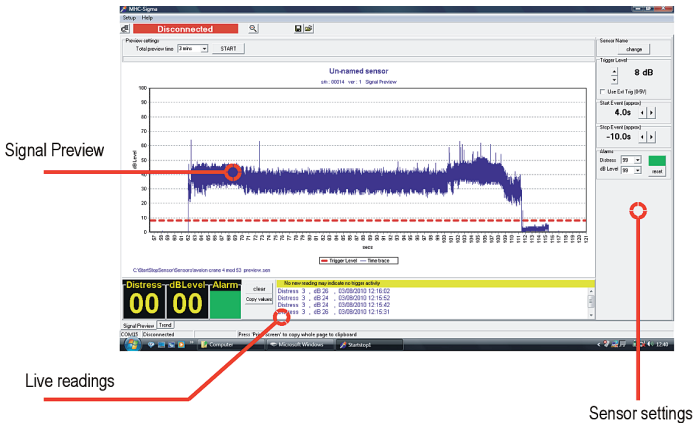
Sigma Interface Unit - Simplifies connector and use

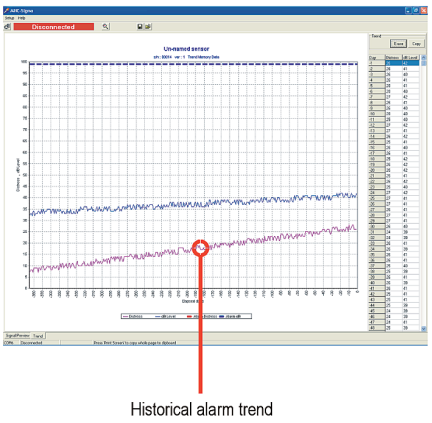
The Sigma Interface Unit has two uses,

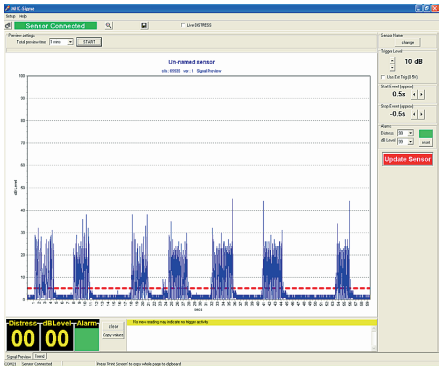
- Sigma/RT and a PC will plug into this unit allowing direct communication without the need to move connectors. Sigma View software can be run to configure the sensors or analyse of up to 384 days of reading.
- Permanent installation to display alarm readings independent of any PC connection.

Sigma View Software - Sigma Sensor Set up Software

Sigma View is supplied with the Sigma/RT unit and lets the user configure the MHC-Sigma sensor to a particular application. Its primary function to preview the acoustic signal (or signature) to derive a suitable starting trigger level and associated Start-Up and Slow-Down delays such that stable & reliable can be made on intermittently running machines. There are also a live reading mode which allows the user to check consecutive readings.







A second function is to allow the user to download and view the internal trend history stored inside the sensor up to a maximum of 384 days of running. Long term trends become immediately obvious.

With Sigma View you can save the actual signal preview and setup data for future reference or your own records. Sigma View is also used to retrieve this data for later, off-line, post processing using Sigma Pro software package as described below.

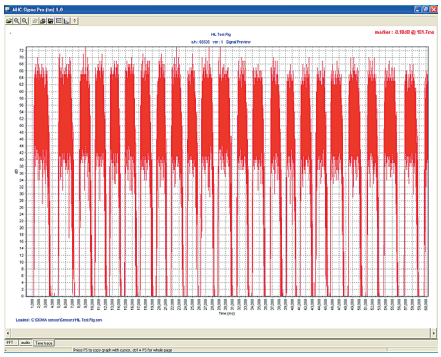
Data shows AE signal from intermittent operation of an overhead crane primary drive gear box:

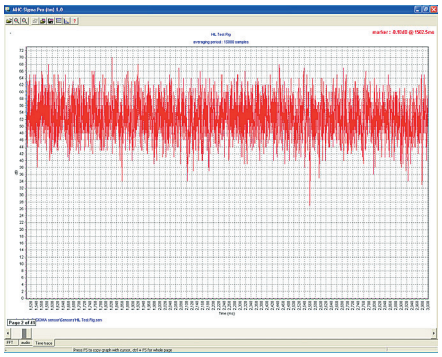
Note - The irregular periods of operation & idle. Sigma sensors are specifically designed for those difficult monitoring applications.

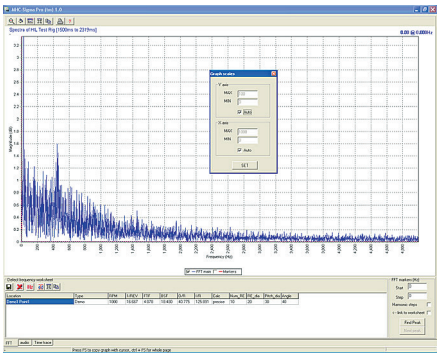
Sigma Pro Software- Sigma Sensor Data Analysis (FFT) Software

Sigma Pro is also supplied with the Sigma/RT. It is a diagnostic programme that reads files saved from Sigma View to derive time profile, frequency spectra (FFT) and audio playback (acoustic stethoscope) of the data. It uses data previously saved in Sigma View so there is no need to be connected to the sensor. Work can be undertaken offline, typically in the office. It is a misconception to believe you cannot perform FFT analysis using AE sensors. You can using Sigma Sensors and Sigma Pro!

Integrated into the product is a bearing defect calculator which assists you identifying typical bearing faults (e.g. inner or outer race defects etc) based on shaft speeds and bearing details. This approach will be familiar to anyone with previous knowledge or experience of traditional Vibration Analysis (VA) products and systems.







Examples of data analysis using Sigma Pro:

- Intermittent machine signal captured by an MHC-Sigma transducer and downloaded to Sigma Pro analysis software.
- An expansion of a short period of steady state operation within the captured wave form.
- A FFT analysis of the captured waveform. Note that to maximise signal/noise ratio, the analysis was undertaken on data from a large number of short periods of steady state operation. This is a feature of MHC technology.

Specifications for Smart Sensors:

Product	MHC-Smart Standard	MHC-Smart Slow	MHC Sigma
Measurement			
Speed range	>30 RPM	60-0.25 RPM	Stop/start
Interval	10 seconds	9xT where T is selected time per rev.	10 seconds of validated composite signal. Contributing signal segments must have a minimum duration of 500ms.
Measurement	dB Level, 0 to 90 dB in 1 dB steps Distress 0-40 steps	dB Level, log scaled overall mean level E-% of rotation with high activity. P, Log scaled peak signal level I, Log scaled average activity level	dB Level, 0 to 90 in dB steps Distress 0-40 steps

Alarm Functions

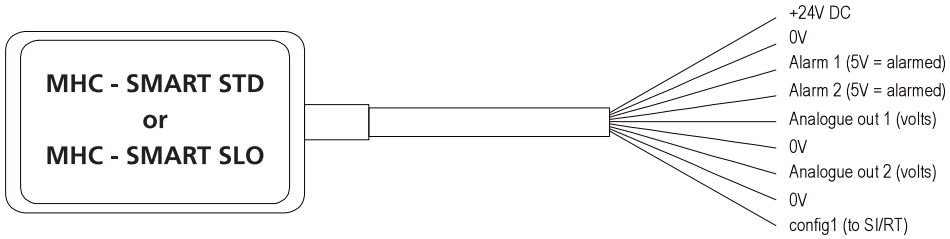
Output	2, programmed via Smart/RT + Smart View	2, programmed via Smart/RT + Smart View as dB, E, P or I.	programmed via Sigma/ RT & PC running Sigma View
Electrical	5V@10mA in alarm for LED or PC input		
Operating Function	Each alarm acts on Distress® or dB configured as OR function.	Each alarm acts upon the parameters selected by the user from dB, E, P, or I as OR function.	Each alarm acts on Distress® or dB configured as OR function
Action	Output alarm only occurs when signal reaches or consistently exceeds the alarm level for a user set holdoff period of 1-255 intervals.		Output alarm only occurs when signal reaches or consistently exceeds the alarm level for a holdoff period of 6 consecutive Intervals.

Analogue Outputs

Quantiiy	2	2	2
Measurement	10 seconds	9xT where T is selected time per rev.	10 seconds of validated composite signal. Contributing signal segments must have a minimum duration of 500 ms.
Electrical	0-10 VDC updated every measurement Interval, scaling at 100mV.		
Analogue 1 output	Distress®	Selectable	Distress®
Analogue 2 output	dB Level	Selectable	dB Level
PC Interface	Smart/RT adapter/ PC running Smart View	Smart/RT adapter/ PC running Smart View	Sigma/ RT adapter & PC running Sigma View

General

Sensing Element	Piezoelectric 100kHz
Power requirement	24V +/- 10% DC at 35 mA when non in alarm. EN6100-6-4, EN6100-6-2 or EN6100-4-5 or compliant.
Operating Temp	-15 to +75 deg.C (extended range available on request)
Dimensions	54 x 35 x 19 mm
Weight	75 g inc 1m of cable
Housing material	Painted mild steel. Polyurethane coated on request Polyurethane coated mild steel
Attachments options	Tab mounted - see sensor specification. Bonded - recommended system - Loctite Structural Adhesive 326 (RS part 496-114) & Activator N Accelerator (RS part 108-716) if bonding to flat metal surfaces



Spares and Accessories

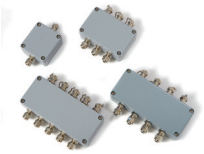
Repeatable results rely on correct positioning of the sensor be it portable or fixed.

- MHC 1000 and Ultraspan 5000 Series Sensors are portable and attach magnetically. Small galvanised steel pads are available for permanent mounting on to the machine to ensure repeatable results.
- All permanently installed cylindrical 2000 and 3000 Series Sensors (e.g. MHC 2020) have an integral M8 male thread that can be engaged into a tapped hole of the correct depth on the machine. An alternative is a Mounting Boss which can be bonded / welded in place if tapping a hole is unacceptable.

Boss A: 316 SS pad for use with 2000, 3000 and 5000 series sensors. Used for mounting sensor perpendicular to machine. O/D 30mm, Height 12mm.

Boss B: 316 SS pad for use with 2000, 3000 and 5000 series sensors. Used for mounting sensor parallel with machine. O/D 30mm, Height 30mm.

Boss C: Galvanised steel pads for use with portable 1000 series sensors. Monitoring pads for MHC magnetic mounted 1000 and 5000 series sensors. O/D 25mm sold in packs of 100.



Junction Boxes

Single channel open bracket BNC connector

We have two methods of terminating the cables in permanently installed sensors. Junction boxes are available from 1 through 6 way or as a right angled bracket with a connector. Both methods come complete with dust caps and BNC connectors. Note that "Bracket" has a fixed cable length and cannot be shortened. Other length options can be made to order.

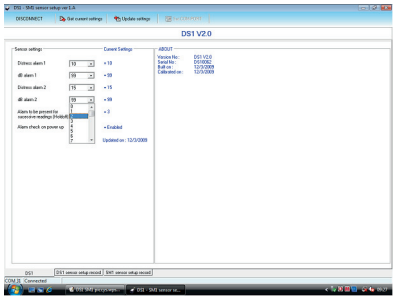
Cables and Leads

Coiled cable for MHC memo

5m high temp lead with SMA connector

Cables are available with TNC, BNC and SMA Terminations and in lengths of 1.2, 5, 10 and 20 m. Coiled and straight cables are available for portable instruments.

Display and Setup Software



Set up your MHC instruments to allow for dormant or stop start operation, low or high level alarms, intermediate alarms, cable integrity checking and a host of other features. Record and plot results and interface MHC-Point with your PLC or SCADA plant monitoring systems and a host of other features.

Cases and Audio Headphones

Spare parts and ancillary equipment for MHC-Memo instruments. Extend the capabilities of your MHC-Memo to detect air, steam or gas leaks. Use your MHC-Memo in areas where ear protection is advisable or mandatory.

Image shows Rugged Case with MHC-Memo instrument and Headphones

ThrusterSCAN

The requirement for on-line machinery and oil condition monitoring is becoming evermore apparent as maintenance costs increase and production capacity and equipment performance is maximised. Kittiwakes ThrusterSCAN delivers early warning of thruster component damage, lubricant degradation and seal failures; whilst providing information to help optimise thruster usage.

Kittiwake's ThrusterSCAN removes the uncertainty related to thruster condition and gives real-time feedback on the effect of altering operating parameters. This critical information can be used to make informed decisions regarding thruster operation, lubricant changes and overhaul intervals. With both local and remote displays, alarms and data management, ThrusterSCAN is easily integrated into any maintenance regime.

Continuous on-line monitoring provides the most representative picture of thruster condition. Changes are highlighted as they start occur and not just at scheduled inspections. Preventative action can than be taken before any significant damage as occurred. ThrusterSCAN provides accurate feedback on the mechanical wear occurring in your thrusters, the condition for their lubricants and gives rapid alert of seal leaks and seal failures.

With flexible display options as standard, ThrusterSCAN instantly puts the information that counts in front of the person that needs it most; whether they are located on-board or even on a different continent.

Individual Thruster Monitoring Units are installed local to each thruster and consist of:

- Touch-Screen Human Machine Interface
- Metallic Particle Sensor
- Oil Condition Sensor
- Moisture Sensor
- Oil Temperature Sensor
- Sampling Pump

Features:

- Fully automated operation
- Accurate and actionable data on your thruster's wear levels
- On-screen trending of all parameters
- Individual thruster room and central control room touch-screen interfaces
- Full, secure logging of all data and system changes
- Remote system control and data access using standard web-browsers
- Automated email warnings and alarms
- Option to simultaneously monitor both thruster and seal oil systems
- Simple installation for both new-builds and retrofits
- Option to display key vibration system data, alarms, etcetera
- Reduce failures and unscheduled downtime
- Effectively manage thruster overall schedules
- Utilize thrusters, based on actual condition
- Provide rapid feedback to engineers during thruster troubleshooting
- Manage lubricant usage, based on actual condition

Ordering Information

FG-K17755-KW:
Thruster Monitoring Unit (One per Thruster)

FG-K17757-KW:
Master Control Panel (One per System)

Sensor Suite

A combination of the sensor range, the 'sensor suite' has been developed to offer real-time monitoring on critical plant such as a wind turbine gearbox. Using its own piston pump the sensor suite makes frequent inspections of remote oil and machine health a feasible option. The risk of sampling error is eliminated and data from the sensors can be streamed via any network system, allowing remote monitoring and increasingly effective maintenance planning.

Designed for mounting into the lubrication system of a machine, the suite reports metallic ferrous wear debris, oil condition, and the moisture content of the oil. Housed in a robust box it includes the Total Ferrous Sensor (Piston Version), Moisture Sensor and Oil Condition Sensor.

The range of sensors includes Oil Condition, Moisture, Total Ferrous Wear Debris and Metallic Particle. The sensors can be purchased separately, or as part of a suite.

Online Sensors:

- Ensure lubricant condition.
- Control contamination.
- Detect and analyse wear debris.
- Can be used in remote locations where continuous monitoring is not always possible by engineers.
- Monitor the presence of wear debris materials that signal a changing wear rate and hence the need for intervention.
- Multiple outputs, the sensors can be easily incorporated into your existing condition monitoring and operating control systems.
- Pro actively monitor critical fluids allowing early maintenance intervention to prevent failure.
- Control the wear rate to ensure longer service life.
- Increase the surveillance level of the machine between oil samples.
- Low cost of purchase and ownership.
- Minimal annual servicing costs.
- Minimal installation costs.

Specifications

Temperature Heated Version:	-20°C to 70°C (-4 - 158°F)
Ambient Operating Temperature:	0 to 70°C (32 - 158°F)
Analogue Communication Interfaces:	4-20mA
Digital Communication Interfaces:	RS232, RS485, CAN Bus
Detection:	0-2000 parts per million [ppm] Uncombined ferrous debris by weight, Oil Quality Units – Index Scale, 0-100% Relative Humidity, -20 – 120°C Temperature
Fluid Compatibility:	Petroleum, synthetic oils – not ester based
Max. System Fluid Pressure:	10 Bar (145psi)
Max. Fluid Viscosity:	350 cst
IP Rating:	IP65
Permitted Fluid Temp.::	10 to 70°C (50 – 158°F)
Power Consumption:	0.8 A
Power Input:	18-30VDC
Weight:	15kg 33lbs

Ordering Information

FG-K16521-KW:
Standard Sensor Suite
- Total Ferrous Sensor
- Moisture Sensor
- Oil Condition Sensor

FG-K16567-KW:
Heated Sensor Suite
(Same Sensors as above)

All sensors come complete with software for data downloading and trending.

Cylinder Drain Oil Management

1. Laboratory Oil Service 56
2. ANALEXAlert.....57
3. LinerSCAN.....58

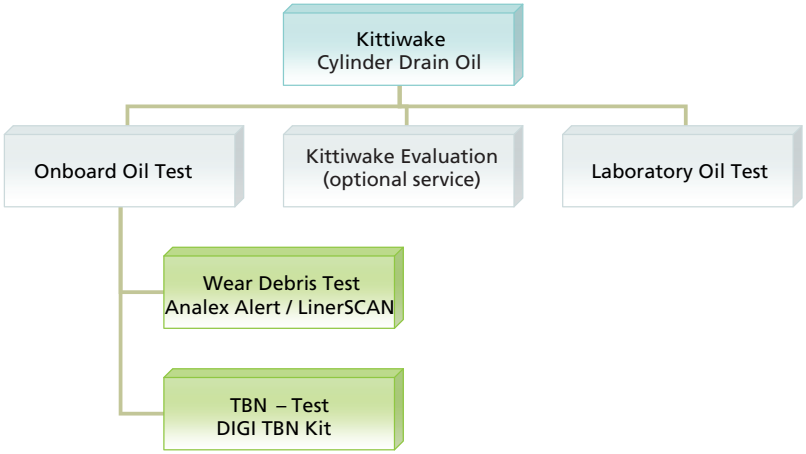
Overview

Cylinder oil in a main engine has two main tasks. It should lubricate the engine to have an acceptable low wear level and it has to neutralize the sulphuric acid to avoid unexpected acid corrosion in the liner.

By analysing scrapedown oil collected from the scavenge space shipboard personnel are able to monitor the condition of the engine's cylinders and detect changes as they occur. Scrapedown Oil Analysis provides comprehensive laboratory testing and analysis of the oil sample, and offers on-board testing tools that enable ship's engineers to quickly detect substantive changes in cylinder oil feed rates.

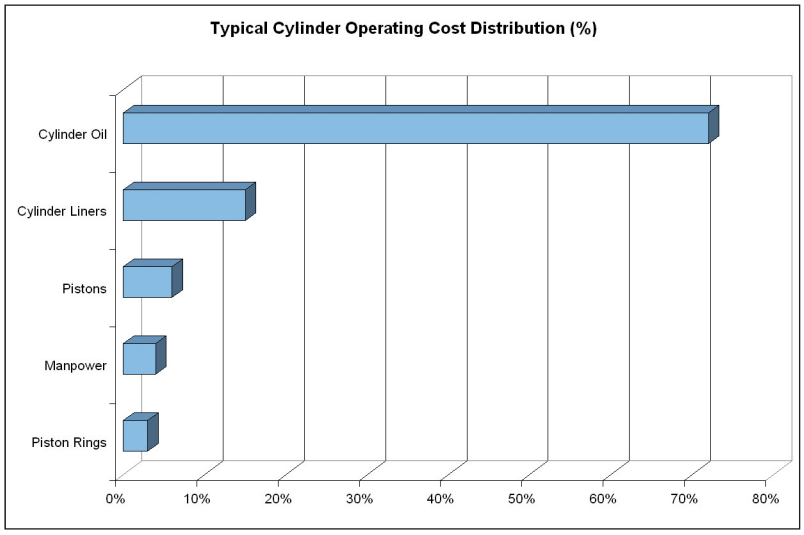
The Kittiwake Cylinder Drain Oil Service does consist of two important major components:

- Frequent on board oil tests of BN (base number) and wear metal. The wear metal can either be tested with the ANALEXAlert manual device or the automatic LinerSCAN system.
- Periodical onshore independent laboratory oil tests providing a complete result about wear, contamination, oil condition and additives together in a diagnostic statement from our tribology experts.



On board testing, using the ANALEXAlert wear debris analyser or alternatively our LinerSCAN online sensor and the Kittiwake DIGI BN Test Kit, provides quick, on-site readouts of the oil's most important properties relative to the engine's cylinder operating condition. The independent laboratory oil test does provide a complete result about wear, contamination, oil condition and additive components combined with a diagnostic statement.

Rapid Return of Investment



This chart shows that the cost of cylinder oil and the liner itself are the biggest cost factors when operating a main engine. Existing installations have proved that significant cost savings can be achieved with return on investment achieved in less than a year in some cases. A cost calculator is provided to highlight the savings and ROI on our webpage.

Feed Rate Optimization

Effective maintenance translates into obvious cost savings, but monitoring liner wear also helps to optimise lubricant feed rate. Even electronic lubrication systems do not offer an exact science, and resultant a safety buffer is often applied. As one of the engine's largest overheads, an average container ship can spend $10 million on cylinder lubrication in its life. Dependent upon trade, load, running hours and other factors, constant real-time monitoring is a vital tool in optimising cylinder lube oil feed rate and, as a result, improving efficiency, decreasing lubricant costs and avoiding issues related with over and under lubrication.

Engines are regularly over lubricated in an attempt to avoid problems including scuffing, but this practice not only causes high lubrication costs, it can sometimes lead to associated problems such as bore polishing. Therefore, although optimising cylinder lubricant usage is one method of achieving commercial advantage, there is a point where savings can be eroded by increased maintenance costs.

Recommended Sampling and Testing Frequency

Kittiwake does have a lot of experience with oil testing and analysis for marine diesel engines. Based on that, we will give you some recommendation for the sampling and testing frequency. Unless advised differently by your superintendent or the engine manufacturer we recommend the following sampling and testing frequencies.

Onboard Oil Test:

a) LinerSCAN: The LinerSCAN system is a fully automated system which does not require human interference. It takes a measurement automatically as soon as enough oil has been sampled.

b) ANALEXAlert: Minimum frequency once per week. To get a much closer picture Kittiwake recommends doing an onboard test for wear metal with the ANALEXAlert once per day if possible. This is essential while adjustments to the feedrate are being done. If your sampling frequency is once per week an additional sample should be taken after each fuel change to get an early indication about cat fines. This is most important for any change between low and high sulphur fuel.

c) DIGI BN Test: This can be done with a much lower frequency. We recommend doing it once per week and after each fuel change to reduce the risk of acid corrosion.

Laboratory oil test: We recommend a quarterly test (or every 1000 - 1500 running hours) under normal running conditions. If there are unusual results in the laboratory report we might recommend a repeat test after a shorter period. It is advisable to follow the recommendation.

An additional test is recommended immediately when you notice any abnormality from the on board test.

ANALEXAlert

LinerSCAN Sensor

DIGI TBN Device

On board oil tests are designed to measure only single parameters. Use them as a supplement to the Laboratory Oil Test - not as a substitute. A comprehensive laboratory oil analysis is essential as part of an effective engine monitoring.

1. Laboratory Oil Service

The Kittiwake Service includes:

- 100 ml sample-bottle (prepaid)
- Addressed envelope to return the sample bottle to our lab
- Sample Information Form with barcode label
- Laboratory tests: All samples are analysed and diagnosed by the end of the next business day. (As long as the samples arrive at our laboratory before noon, in our prepaid sample bottle with a correctly filled out sample information form).
- Laboratory Report complete with a highly detailed diagnostic statement (prepared by a mechanical engineer)
- Dispatch of the Laboratory Report via mail, email, fax or data-file
- Online-recall of all Laboratory Reports and Analysis Data

Lab Report

You will get a detailed lab report completed with a very detailed diagnostic statement prepared by a mechanical engineer. It will be a one page report per sample with a simple rating system which quickly alerts you to problems with your oil or equipment.

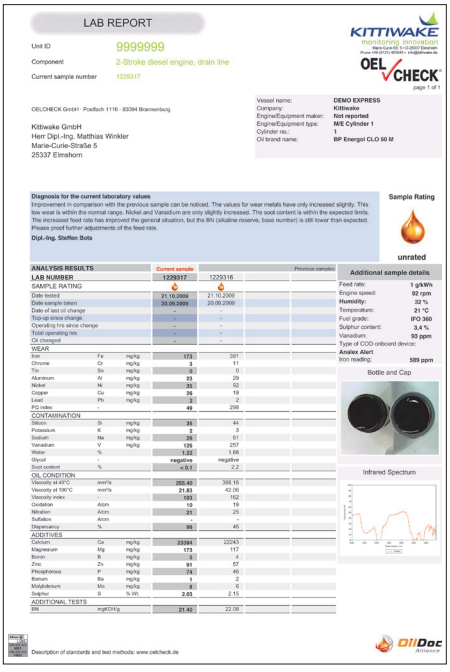
There is no need for you to work through a long report of several pages. The report contains a historical look at the last 4 samples with the complete history available from our web server (including trend graphs). If you have any questions relating to your report or equipment you can call one of our service engineers to discuss your results and provide advice. The lab report will be sent to you by mail, email or fax as agreed with you.

You can also find your lab report on the Internet:

It is possible to get the current lab reports even faster and to have, at the same time, a comparison with earlier analysed samples.

If you require your results sooner, instead of waiting for an e-mail, fax or mail you can directly log on to our fire wall protected web server. Where, as soon as we have evaluated your sample, we inform you by e-mail that the results are available. You can see the analysis results in the original version of the lab report and print it or forward it to interested parties. This service offers you to:

- Easily check online data entry for new samples
- Quickly view of all your samples
- Check sample status
- Display all lab reports
- Translate lab reports into different languages
- Forward lab reports via e-mail
- Graphically view trend analysis values for individual samples
- Display of the IR spectrum and other diagrams
- View photos of the sample and the inside of the cap / lid
- View photos of the spot test, solid contaminants and much more


LAB REPORT

KITTIWAKE monitoring innovation

OEL CHECK

Unit ID 9999999

Component 2-Stroke diesel engine, drain line

Current sample number 1229317

page 1 of 1

OELCHECK GmbH · Postfach 1116 · 83394 Bramsenburg

Kittiwake GmbH
Herr Dipl.-Ing. Matthias Winkler
Marie-Curie-Straße 5
25337 Elmshorn

Vessel name: DEMO EXPRESS
Company: Kittiwake
Engine/Equipment maker: Not reported
Engine/Equipment type: ME Cylinder 1
Cylinder no.: 1
Oil brand name: BP Energol CLO 50 M

Diagnosis for the current laboratory values

Improvement in comparison with the previous sample can be noticed. The values for wear metals have only increased slightly. This low wear is within the normal range. Nickel and Vanadium are only slightly increased. The soot content is within the expected limits. The increased feed rate has improved the general situation, but the BN (alkaline reserve, base number) is still lower than expected. Please proof further adjustments of the feed rate.

Dipl.-Ing. Steffen Bots

Sample Rating

unrated

ANALYSIS RESULTS			Current sample	Previous samples
LAB NUMBER			1229317	1229316
SAMPLE RATING				
Date tested			21.10.2009	21.10.2009
Date sample taken			20.09.2009	20.09.2009
Date of last oil change			-	-
Top-up since change			-	-
Operating hrs since change			-	-
Total operating hrs			-	-
Oil changed			-	-
WEAR				
Iron	Fe	mg/kg	173	391
Chrome	Cr	mg/kg	3	11
Tin	Sn	mg/kg	0	0
Aluminum	Al	mg/kg	23	29
Nickel	Ni	mg/kg	35	52
Copper	Cu	mg/kg	26	19
Lead	Pb	mg/kg	2	2
PQ Index	-	-	49	298
CONTAMINATION				
Silicon	Si	mg/kg	35	44
Potassium	K	mg/kg	2	3
Sodium	Na	mg/kg	26	61
Vanadium	V	mg/kg	139	257
Water	%		1.22	1.66
Glycol			negative	negative
Soot content	%		0.51	2.2
OIL CONDITION				
Viscosity at 40°C	mm²/s		260.40	388.16
Viscosity at 100°C	mm²/s		21.83	42.06
Viscosity index	-		103	162
Oxidation	Abs/cm		10	19
Nitration	Abs/cm		21	25
Sulfation	Abs/cm		-	-
Dispersancy	%		36	46
ADDITIVES				
Calcium	Ca	mg/kg	23394	22243
Magnesium	Mg	mg/kg	173	117
Boron	B	mg/kg	5	4
Zinc	Zn	mg/kg	91	57
Phosphorous	P	mg/kg	74	46
Barium	Ba	mg/kg	2	2
Molybdenum	Mo	mg/kg	3	5
Sulphur	S	% Wt.	2.03	2.15
ADDITIONAL TESTS				
BN		mgKOH/g	21.40	22.08

Additional sample details

Feed rate:	1 g/kWh
Engine speed:	92 rpm
Humidity:	32 %
Temperature:	21 °C
Fuel grade:	IFO 360
Sulphur content:	3.4 %
Vanadium:	93 ppm
Type of COD onboard device:	-
Analex Alert	
Iron reading:	589 ppm

Bottle and Cap

Infrared Spectrum

Description of standards and test methods: www.oelcheck.de

OilDoc

Test Lab Report

2. ANALEXAlert

The ANALEXAlert Wear Debris Monitor from Kittiwake is a unique, portable device that provides on board measurement and recording of metallic iron content in oils and greases, helping you identify and replace worn parts before they cause engine and equipment failure. Using the ANALEXAlert to get an early warning about engine or equipment failure could not be simpler. Simply place a 50 ml Kittiwake / Shell RLA sample bottle containing the oil you wish to analyse into the unit and use the simple touch screen menu to obtain a reading.

ANALEXAlert

Simple and easy to use:

Your results will appear within 10 seconds, displayed in ppm. You can save the reading in the unit's internal memory, with the time and date automatically linked to the sample and the equipment. ANALEXAlert auto zeroes between each sample, so if you want to take another reading, simply remove the sample bottle and follow the prompts.

You can set your own adjustable warning limit, so you can immediately see if the readings are indicating wear and tear that may lead to equipment or engine failure. Then once you've completed a set of results, you can save the session in the unit's permanent memory as a data set, with results grouped together by equipment type. That data can be download to the computer for further analysis or sent to head office for review.

Benefits:

- Easy to use, with a simple, intuitive, touch screen menu that provides visual trending.
- Adjustable alarm / warning limits that can be set by the user.
- Portable, rugged and reliable – no moving parts.
- Readings can be easily downloaded into Microsoft Excel for detailed analysis.
- No calibration required – simply insert the sample bottles or grease pots provided.
- Uses the standard Kittiwake or Shell RLA sample bottle.
- Can be used with all types of oil and grease.

Ordering Information

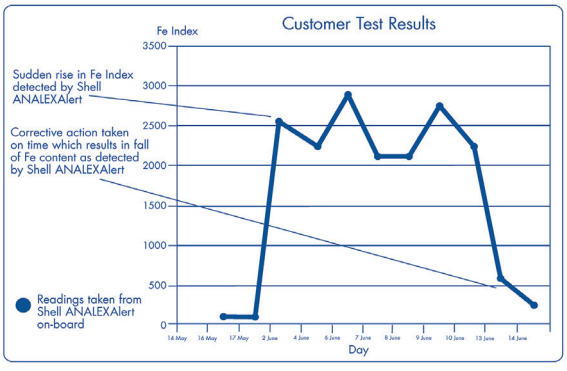
FG-K14940-SH:
ANALEXAlert Metal in Oil Detector

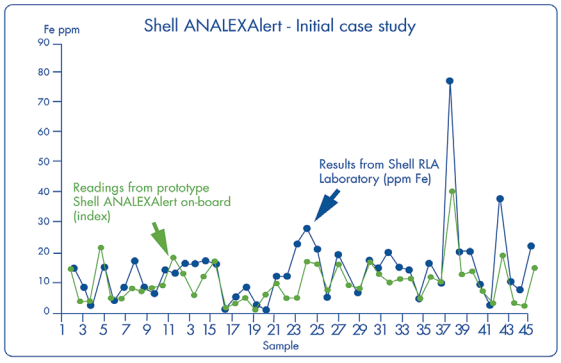
Range:	0-1000 ppm
Resolution:	10 ppm
Accuracy:	+/- 10 ppm
Test Time:	< 1 minute
Power:	115/230 VDC
Sample bottle pack:	FG-K14946-KW

Kittiwakes ANALEXAlert allows you to store up to 90 sets of results for samples taken from the main engine, together with details of cylinder hours run, sample number, maximum cylinder pressure, exhaust temperature and lubrication feed rate. You can also store up to 500 sets of results for auxiliary equipment, together with details of cylinder hours run and sample number.

Once you've completed a set of results, you can view them either as a graph or in a table format on the unit's display screen, with your warning limit clearly shown. You can also connect the unit to a PC and import the readings into a Microsoft Excel spreadsheet (or equivalent) for further examination and graphing.

And because Kittiwakes ANALEXAlert can be used in conjunction with Kittiwake's used oil analysis service, you can despatch samples to a laboratory for more detailed analysis.





3. LinerSCAN

The Photograph shows a typical installation on scrapedown pipe

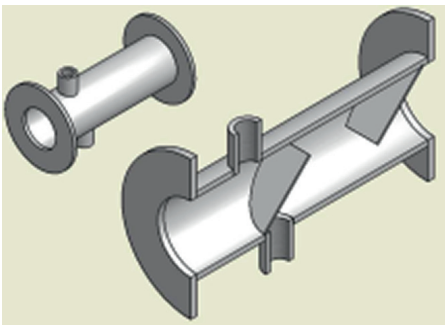
The world's first real-time alarm system for engine liner wear. LinerSCAN marks a new era in asset protection, providing early warning against critical engine damage whilst providing the information needed to save on lube oil costs.

LinerSCAN provides highly accurate feed back about the wear condition in your engine. Trials have shown that LinerSCAN highlights the first signs of damage earlier than other systems and enables safe reduction of lubricant feed rate. If the wear rate increases during normal conditions the system will generate an alarm, which when connected to the ships alarm, provides instant feedback allowing for immediate action. This allows for preventative maintenance during the ships passage to the next port, or even a route change. LinerSCAN is a fully automated system and will help save money by optimizing the lubricant feed rate, reducing your maintenance loads and by helping you prevent unnecessary engine damage.

Kittiwake's LinerSCAN system is designed to remove the uncertainty on cylinder damage resulting from low fuel quality, slow steaming, low sulphur levels, lower oil feed rates and cylinder oil formulation changes.

Benefits:

- Provides accurate and actionable data on your engine wear levels
- Enables safe reduction of cylinder oil feed rates
- Dramatically reduce engine damage by spotting the first signs of scuffing or piston ring damage
- Highlights the issues caused by fuel problems
- Allows an informed running-in process
- Runs fully automated – with no human interference
- Simple installation for both new and retrofit
- Link with ships management and alarm system
- Reliable and robust



The Baffle Section

Measuring Principle:

LinerSCAN measures the amount of iron in cylinder lubricant by a method known as magnetometry, where a sample is tested in a magnetic field. Utilising a novel shielding method the system exploits a fundamental physical effect: namely the change of inductance due to the presence of a magnetic material.

Analysing the scavenging air space drain oil from each cylinder for iron (Fe) has been proven to give the operators an indication of relative changes of cylinder liner wear. At very early stages, the sensors reported the onset of severe wear and other engine problems such as cat fines in the fuel.

The system will also highlight periods where the engine is subjected to increased stress levels and indicates changes in iron levels caused by embedding processes and increases in wear caused by routine inspection.

Baffle Section:

In some cases the collection of cylinder drain Oil is difficult because the oil is drained like a mist. For those engines Kittiwake does provide a Baffle Section allowing the oil to "condensate" on the baffle plates. This does allow easy and reliable sample taking. The Baffle Section is supplied as a flange section and can also be used in all other engines without the oil mist problem for easy connection of the oil hoses to the LinerSCAN sensor boxes. Alternatively simple welding bsses will be provided with each sensor box.

Ordering Information

FG-K17400-KW:
LinerSCAN Sensor Complete

Range:	0-2500 ppm
Resolution:	1 ppm
Accuracy:	+/- 10 ppm
Sample Time:	1 minute min.
Power:	115/230 VDC
Air:	6 bar min.

FG-K17401-KW:
LinerSCAN Software and Network

Operating System:	Windows XP SP2
	Windows 7 32 bit
Screen Resolution:	1280 x 1024 min.

FG-K18155-KW:
LinerSCAN Baffle Section

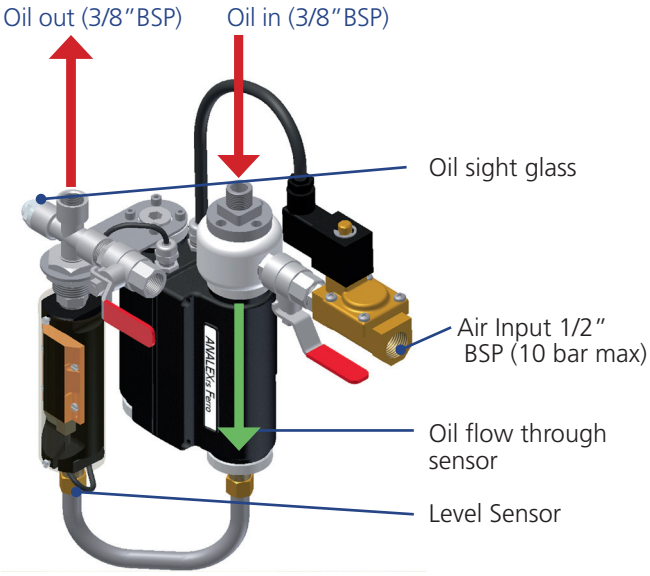
Length:	240 mm
Pipe:	Ø 70 mm
Flange:	DIN 3 inch

Baffle Section installed

The following work is required prior to commissioning:

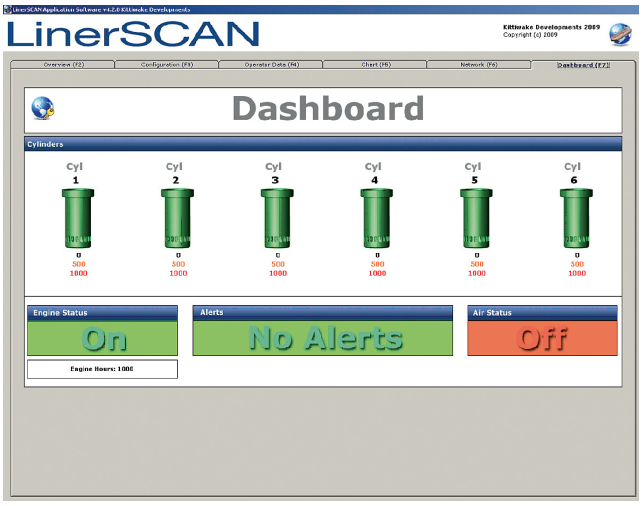
- Welding of bosses to scrape down oil pipe with valves for oil in and out.
- Mounting of the LinerSCAN boxes.
- Install pipe for compressed air along the engine.
- Run cables from Engine to ECR.
- PC provide Windows.
- Provide connection to engine control or ship alarm system if needed.

LinerSCAN is very simple to install on new buildings and as a retrofit to existing ships. Previous installations have proven that the system can be installed by the crew although Kittiwake also provides a commissioning service using experienced engineers. Kittiwake can also assist with data evaluation if requested.



LinerSCAN Software

LinerSCAN software enables you to continually monitor critical cylinder information on screen using a bespoke graphical user interface. A 'Dashboard' highlights all critical information at a glance with colour coded liner symbols showing wear levels and current readings. Alarms are displayed on the screen for system alerts and engine / air status and are also communicated (optional) to the alarm system of your ships automation system.



An 'Overview' tab shows all readings, an event log and allows exporting if the data and log information which can be sent to the head office for further investigation if needed.

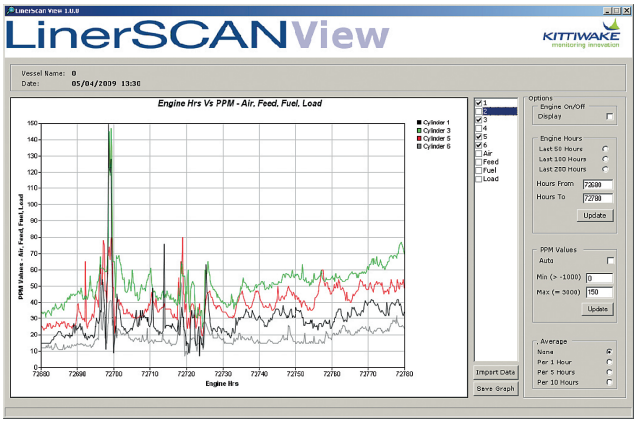
Using the 'Configuration' tab you can set individual alarms for each liner to allow for informed running in processes on individual liners.

The LinerSCAN system can be connected to your ships alarm system via a 4-20 mA connection or the use of trip amplifiers which communicate alarms for liner wear, blockages, and other system alarms.

An extremely informative graphing tool allows for in depth data evaluation on-board and in the office. Simple on-screen options enable the viewer to alter the scaling of running hours and ppm values for detailed and personalised interpretation.

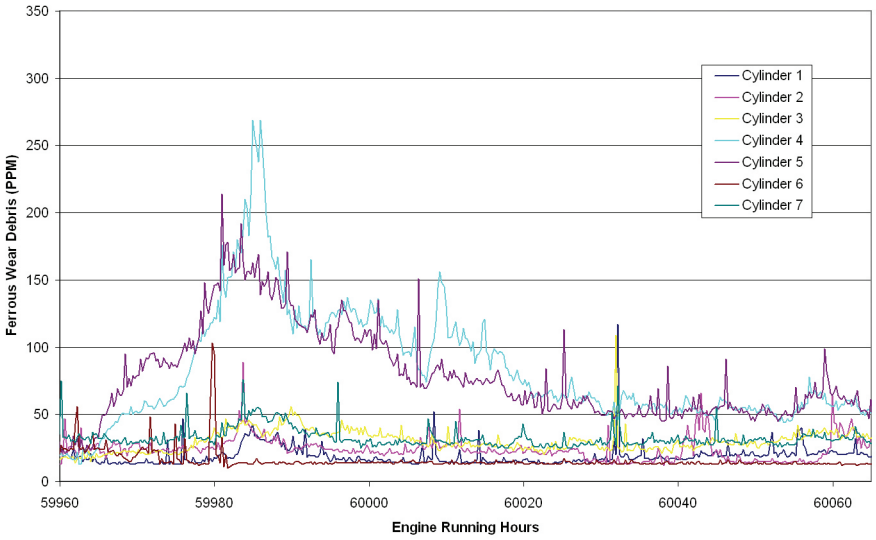
LinerSCAN software provides an informed view of single or multiple liners and (if connected to the system) plots of essential engine information such as rpm, load, sulphur or feed rate can also be included. The data provided then enables the user to react to changes and adjust the feed rate according to the actual liner / engine needs and requirements based on real time data.

An office based version of this software, called LinerSCAN View, is available for easy evaluation of data from remote or shore based locations. Data is easily exported from on board and then imported into the LinerSCAN view software.



MAN B&W Diesel Supported

MAN / B&W Diesel: "…Analysing the scavenging air space drain for iron (Fe) has been proved to give an indication of cylinder liner wear. … Drain analysis can be used as an early indication for discovering suddenly increased wear situations. … Kittiwake has developed equipment … for monitoring of cylinder condition through scavenge drain analysis. Based on successful test results, MAN B&W has no objections that the ANALEXrs Total Ferrous Sensor is used on two-stroke engines. This equipment may be used to monitor the effect of cylinder oil feed rate changes. ... It can also give an early warning if unusual high wear is occurring because of fuel problems such as catalyst fines, or other reasons and can possibly avoid engine damage…"



This chart shows the ability of LinerSCAN to detect and trend the amount of iron particles in the cylinder oil in real time.

Feed rate was reduced by 10% on cylinders 4 and 5 at 59961 engine hours. Wear levels increased for a short time and were monitored before returning to normal levels.

This process was then repeated across the other 5 cylinders providing an overall 10% decrease in cylinder oil usage.

The use of LinerSCAN is not solely limited to the prevention of engine damage. Constant real-time monitoring gives engineers a vital tool in maintaining and optimising cylinder oil feed rates and helps reduce many other associated costs.

Case Study

By using Jensen Lubricators' SIP System on all its ships, Renowned German shipping company, Reederei Hermann Buss GmbH was reducing cylinder oil consumption by up to 40%. But without a reliable feedback system, the company recognised that blindly reducing the feed rate could seriously harm the engine.

To safely achieve the optimum feed rate and realise a further 10% saving, Kittiwake's ANALEXAlert was deployed to monitor lubrication conditions. Recognising the theoretical advantage and potential to save money whilst improving safety, the system was initially tested on two of its vessels.

Solution

A portable device that provides on-board measurement and recording of metallic iron content in oils and greases, ANALEXAlert helps to identify and replace worn parts before they cause engine and equipment failure. It also enables the optimization of lubricant feed rate.

"In the past we simply monitored wear levels with regular visual checks and measurement of some wear limits," explains Anton Hessenius, Technical Superintendent, Reederei Buss. "The disadvantage of this approach is that although useful information is collected, it comes with an inherent delay which means we could miss a critical and costly repair opportunity."

The engineers use ANALEXAlert on a daily basis. A standard sample bottle containing the oil for analysis is placed on the unit and, using a simple touch screen menu, a reading is obtained within seconds.

ANALEXAlert stores up to 90 sets of results for samples taken from the main engine, together with details of cylinder hours run, sample number, maximum cylinder pressure, exhaust temperature and lubrication feed rate. Up to 500 sets of results for auxiliary equipment can also be stored, together with details of cylinder hours run and sample number. Results can be viewed either as a graph or in a table format on the unit's display screen, with the warning limit clearly shown. The unit can be connected to a PC and the readings imported into a spreadsheet for further examination and graphing.

"ANALEXAlert is helping us to make better decisions, faster," says Hessenius, "We are able to follow trends and determine if we are running well or if we need to improve something in the engine or lubrication system. Most importantly we can react quickly to warning signs and make confident and informed on-the-spot judgments. The tool gives us information that we've never had access to on board before."

Penetrating the lubrication safety buffer also impacts the quantity of additives designed to neutralise the sulphur products in the fuel oil. Although wear rate is monitored with the measurement of magnetic iron particles, ANALEXAlert does not monitor corrosive iron oxide particles. To manage this, Reederei Buss employs Kittiwake's Total Base Number (TBN) device after switching to a new fuel, ensuring sufficient additive content.

Results

The trial proved so successful that Reederei Buss has deployed ANALEXAlert to all of its 22 two-stroke vessels.

Although Reederei Buss used Jensen Lubricators' SIP System to reduce peak feed rate by up to 40%, the company didn't have the ability to accurately monitor the effect on the engine. Engineers therefore increased lubrication by 10% to avoid the associated wear caused by lack of lubrication and improve the safety margin.

"Of course it's possible to simply adjust the lubrication according to the OEM's instructions, but this is risky," warns Hessenius. "You may only experience the effects later on when you realise you're losing more liners. Ultimately, if you want to get as close as possible to the optimum feed rate without harming the engine, you need a reliable feedback system."

The adoption of ANALEXAlert is enabling Reederei Buss to optimise the feed rate and safely reduce lubrication by 10% more than the saving achieved by the Alpha Lubricator alone.

"It's rather difficult to quantify the impact of ANALEXAlert in financial terms," surmises Hessenius. Firstly because I could estimate an annual saving of 50,000 € – 60,000 € per ship each year, but of course the saving is dependent upon the size of the ship and output of the engines, and our fleet ranges from 10,000 kW to 40,000 kW. Secondly, I've no doubt that we've realised savings by avoiding the loss of critical components. However as ANALEXAlert has been successful, I can only state that the average cost of replacing a liner is €17,000."

Hessenius concludes: "The advantages of using ANALEXAlert are obvious to both the crew and the company as a whole. Not only is this tool improving the safety of the operation even further, it is also reducing the amount of lube oil that we use and saving us significant amounts of money."

Testament to the value placed on this tool, Reederei Buss is committed to installing ANALEXAlert on every new build with a two-stroke engine.

Marine Water Test Solutions

1. Marine Potable Water Test Kits 64
2. Marine Sewage Water Test Kits.....67
3. Cooling and Boiler Water Test Kits 68

Marine Water Test Kits

Offshore installations and vessels have a variety of systems that require monitoring for either optimal performance, meeting current or forthcoming legislation and to minimize the risks to the crew or visitor's Health and Safety on board.

With these in mind, a new range of Kittiwake Marine Water Kits has been developed to assist and adhere with the above requirements.

The Kittiwake Marine Water Test Solutions comply with:

- MARPOL Annex IV: Resolution MEPC.2 (IV)
- MARPOL Annex IV: Resolution MEPC.115 (51)
- MARPOL Annex IV: Resolution MEPC.159 (55)
- WHO International Health Regulations (2005)
- ILO 178 (2009)
- ILO MLC (2006)
- European Drinking Water Regulations

Non- compliance can result in vessel detention

The systems that will require monitoring are:

- Potable Water
- Sewage Water
- Boiler & Cooling Water
- Ballast Water (coming soon)

According the ever changing legislations Kittiwake is permanently updating the range of Marine Water Test Kits to comply with the current legislations. Currently we are in the process to develop a monitoring equipment to test the ballast water.

1. Marine Potable Water Test Kits

Potable water is our most important nutrient and is used for both drinking and cooking. The water being used for personal hygiene and all types of cleaning requires the same high quality. It is therefore important to have enough water of satisfactory quality to cover all types of usage.

International regulations regarding the Potable Water Quality Monitoring and Control were driven by the World Health Organization (WHO) via its International Health Regulations (IHR). Soon enough adapted for on-board potable water, as part of the overall Ship Sanitation Certificate.

Current International Health Regulations (2005) and ILO 178 (2009) apply to all countries/flag states that have ratified to them. The ILO Maritime Labour Convention, (MLC 2006) does apply to all seagoing vessels.

Monitoring and control compliance procedures are laid out in the Guide for Ship Sanitation detailing:

the systems that require monitoring,

the method and frequency of monitoring

the record keeping requirements

The draft guidelines were created in close collaboration with the International Labour Organisation (ILO) and the International Maritime Organisation (IMO). Alongside SOLAS, MARPOL and the STCW Convention the MLC 2006 has been introduced as the fourth pillar of the regulatory regime of IMO. It will require an MLC 2006 certificate.

Simple regular assessment and testing of the potable water system for microbiological activity, biocide (disinfection control) and implementing a correct control scheme (i.e. temperature monitoring), will ultimately reduce the risk of a disease and save lives.

The Kittiwake Marine Potable Water Test Kits were developed to offer rigs and vessels the complete monitoring solutions for their water systems, with the option of additional extras if required. Suitable control schemes with adequate testing & monitoring will aid with the compliance of the current ILO MLC (2006), IHR (2005) and ILO 178 (2009). These test kits provide real time analysis and simple to perform tests which require no specialist training.

According to ILO MLC (2006), IHR (2005) and ILO 178 (2009) a qualified person is required on board the vessel or rig to perform the test. Kittiwake provides a complete training for Marine Portable Water Tests to ensure the attendee is qualified to perform all test according the legislations. At the end of the training each attendee will get a certificate proving the respective qualification.

Marine Potable Water Test Kit

Potable Water Test Kit

Bacterial Count HTP Reagent Pack

Bacteria Reagent Pack

Full Compliance Option

Potable water can contain Microbes that cause infectious disease or food poisoning, such as bacteria, viruses and parasites. Recent high profile legionella on board ships has highlighted issues of crew and passenger health and safety, particularly in respect of microbiological contamination.

Simple, regular testing of the above systems for micro-organisms like legionella, coli forms, e. Coli and pseudomonas will reduce risks and help keep employees healthy.

The Kittiwake Marine Potable Water Quality Test Kit allows you to test for the most critical bacteria's as well as the main quality parameters. The test kit allows to test the following parameters:

- Total number of bacteria (TVC)
- Coli forms and E. coli
- Pseudomonas
- pH value
- Conductivity
- Total Dissolved Solids (TDS)
- Temperature

Compliance:

To allow full compliance with international regulations MLC (2006) and ILO 178 including local regulations like the Norwegian Drinking Water Regulations it is essential to do some additional testing not included in the Kittiwake Potable Water Test Kit. Those tests will be provided with the Full Compliance Option from Kittiwake. It is also essential to have a proper record keeping which can be done with the Kittiwake log book provided with the manual in the standard kit. International regulations further specify that a trained person needs to be on-board each vessel or rig to perform the tests. Kittiwake does provide different seminars ensuring proper qualification. A certificate will document the respective qualification. You will find our seminar program at the end of this catalogue.

Ordering Information

FG-K29691-KW:
Marine Potable Water Test Kit

Contains equipment for:

a) Bacterial Count HTP (TVC)

Range:	0-400 CFU/ml
	0-1500 CFU/ml
Sample prep.:	1 minute
Incubation:	ca. 44 hours
Reagents:	non hazardous
Reagent Pack	FG-K29697-KW

b) Coli forms / E. Coli

Range:	go/ no go
Sample prep.:	1 minute
Incubation:	24 hours
Reagents:	non hazardous
Reagent Pack	FG-K29676-KW

c) Pseudomonas

Range:	go/ no go
Sample prep.:	1 minute
Incubation:	24 hours
Reagents:	non hazardous
Reagent Pack	FG-K29675-KW

d) pH value

Range:	4,5 – 10 pH
Test time:	< 1 min
Reagents:	non hazardous
Reagent Pack:	BI-K21308

e) Conductivity / TDS

Range:	0 – 2000 µS; 2-20mS
	0 - 13000 ppm
Accuracy:	+/- 2%
Test time:	< 1 min
Reagents:	non hazardous
Reagent Pack:	AS-K20016-KW

f) Temperature

Range:	0-90°C
Accuracy:	+/-0,5 °C
Test time:	3 minutes to stabilize

FG-K29704-KW
MLC (2006) Full Compliance Option

Range:	
Colour:	0-500 mg Pt/l
Turbidity:	0-1000 FAU
Iron:	0.02-3 mg/l
Copper:	0.05-5 mg/l
Test Time:	1 minute
Iron Reagent Pack:	FG-K29702-KW
Reagents:	UN 3289
Copper Reag. Pack:	FG-K29701-KW
Reagents:	UN 1789 / UN 3262

Marine Potable Water Test Kit Options

Chloride Option and Reagents

Chloride Comparator Disc

Free Silver Option

Chlorine (LR) Reagent Pack

Kittiwake has developed options for the Marine Potable Water Test Kit depending on which system is used.

Once the potable water is produced or bunkered it is essential to keep the water free of bacteria. There are different ways of treating the water. One common way is to use the ultraviolet light source to remove any possible bacteria before the water is distributed and consumed. Alternatively the water can be ionized with Silver Ions with the advantage of keeping silver ions in the water to deal with any possible bacteria until the water is consumed. Most effective and also very common is to treat the water with chemicals to keep it free of bacterial growth during storage and distribution. Most common on-board seagoing vessels is Chlorine or Chlorine dioxide.

If you use chemicals as sanitizer you will need in addition one of our sanitizer options – depending on what chemical you are using. Kittiwake also provides an option to test for Hardness or Chloride.

There are three sanitizer options available:

- Chlorine Option
- Chlorine dioxide Option
- Silver Ion Option

To measure the effectiveness of treatment chemicals it is important to measure the amount of available chemical to deal with the bacteria. Therefore Kittiwakes test devices allow to measure the free Chlorine and the free Silver Ions what is not possible in a laboratory since the free ions will be combined once the sample has arrived in the lab. Therefore it is essential to measure this on-board. In a lab it is only possible to measure the combined or total chemical which can be measured on board as well to avoid any health risk or bad taste of the water.

Ordering Information

FG-K28763-KW:
Potable Chlorine Option

Range free Cl:	0 – 1.0 ppm
	0 – 3.5 ppm
Range total Cl:	0 – 3.5 ppm
	0 – 125 ppm
Accuracy:	+/- 10%
Test time:	2 min for free Cl
	4 min for total Cl
Reagents:	non hazardous
Reagent Pack (HR):	FG-K29680-KW
Reagent Pack (LR):	FG-K29679-KW

FG-K29681-KW:
Chlorine Dioxide Option

Range :	0 – 0.6 ppm
	0 – 2.0 ppm
	0 – 6.0 ppm
Accuracy:	+/- 10%
Test time:	2 minutes
Reagents:	non hazardous
Reagent Pack:	FG-K-29683-KW

FG-K29693-KW
Free Silver Option/ Consumables

Range:	0 – 100 ppb
Accuracy:	+/- 20%
Test time:	3 minutes
Reagents:	non hazardous

FG-K29694-KW:
Enterolert Option/ Consumables

Range:	presence/absence
Accuracy:	go/ no go
Sampling Prep.:	1 minute
Incubation:	ca. 16-24 hrs
Reagents:	non hazardous

FG-K29695-KW:
Potable Chloride Option/ Consumables

Range:	20-400 ppm
Test Time:	3 minutes
Reagents:	UN 3264

FG-K29696-KW:
Potable Hardness Option/ Consumables

Range:	0.5-60 ppm
Test time:	3 minutes
Reagents:	UN 3267

2. Marine Sewage Water Test Kits

The discharge of raw sewage into the sea can create a health hazard, while in coastal areas sewage can also lead to oxygen depletion and an obvious visual pollution.

MARPOL Annex IV, as adopted in resolution MEPC.115(51), which entered into force on 27th September 2008, applies to ships on international voyages which are:

- 400gt and greater; or
- Less than 400gt when certified to carry more than 15 persons, which includes passengers and crew

The effluent standards and performance tests, as adopted in resolution MEPC.159(55), which entered into force on 1st January 2010, applies to ships having a sewage effluent plant installed or delivered and ships with a keel laid date on or after 1st January 2010.

Ships with a keel laid date and ships with an existing sewage effluent plant before the 1st January 2010 will require the plant certified to either the 1976 standards contained in MEPC.2(IV) or an applicable national specification.

For vessels visiting countries that have ratified to MARPOL Annex IV, these vessels will need to demonstrate compliance with the regulations, with the relevant certification (ISPPC).

ISPPC (International Sewage Pollution Prevention Certificate) are issued upon successful inspection and are valid for 5 years.

For renewal and random inspections, maintaining the system operating requirements in line with the effluent standards will be required. With this in mind, the Kittiwake Marine Sewage Effluent Test Kit will provide simple and accurate testing for BOD, Chlorine (Free), COD, Coliform Bacteria, pH and Total Suspended Solids. Regular testing will allow rapid corrective action to take place if required, helping to maintain optimum operating conditions, minimum downtime and reducing costs. Ultimately the Kittiwake Marine Effluent Cabinet will aid compliance with MARPOL Annex IV.

Ordering Information

FG-K28418-KW:
Marine Sewage Effluent Cabinet

Range:	
Free Chlorine	0 – 1.0 ppm
	0 – 30 ppm
Coliform:	yes / no
pH Value:	4.5 – 10
TSS:	0 – 500 JTU
BOD (calculated):	7.5 – 255 ppm/l O2
COD:	0 – 150 ppm
Accuracy:	typically 10%
Reagents:	UN 1789 / UN 3264

FG-K27973-KW:
Sewage Effluent Test Kit
(Same as above in two cases)

AS-K29466-KW:
Sewage Effluent Spares Kit

Reagents:	UN 1789/UN3264

3. Cooling and Boiler Water Test Kits

Engine cooling systems contain carefully blended additives that prevent scale deposits and corrosion of engine waterways. It is very important that the concentration of the additive is maintained at the correct level for optimum protection.

Low and medium pressure steam boilers are also treated with special corrosion and scale inhibitors. It is vitally important to maintain precise levels of these additives to ensure correct and efficient steam generation. Failure to regularly maintain and monitor treatments will inevitable end in system failure and expensive corrective maintenance.

Kittiwake supply treatment test kits for engine cooling water and steam boiler water. The kits are very simple to operate and will enable the ships engineer to monitor scale and corrosion inhibitor concentrations. Regular testing will allow rapid corrective action to take place helping you to maintain optimum operating conditions, minimise down-time and reduce energy costs.

To measure Chloride in cooling water treated with the corrosion inhibitor Glysacorr G-93/94 the standard Chloride test will not work.

Please order the Glysacorr Chloride Test Kit. To measure the level of Glycol in cooling water Kittiwake provides a Glycol Refractometer. The Refractometer allows easy tests of the level for Propylene and Ethylene Glycol up to 70% securing a protection down to -50 °C.

Benefits:

- Optimise operating conditions
- Reduce energy costs
- Measure key boiler and cooling water inhibitors
- Simple step-by-step instructions
- No operator training necessary

Ordering Information

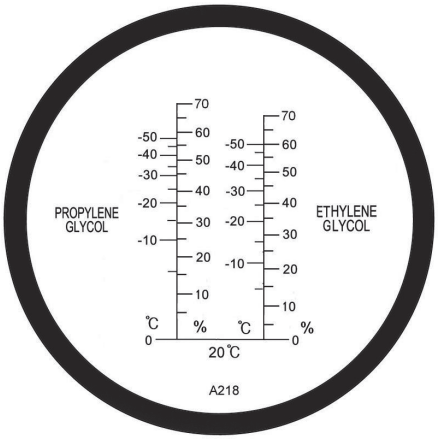
FG-K29200-KW:
ECON Cooling Water Test Kit
100 x Chloride LR (20-400 ppm)
100 x Nitrate (75-2500 ppm)
100 x pH Test Stripes (pH 4,5-10)

FG-K27258-KW
Glysacorr Chloride Test
Range: (50-300 ppm)

FG-K27456-KW
Glycol Refractometer
Range: 0-70%

FG-K29201-KW:
ECON Boiler Water Test Kit I
100 x Chloride LR (20-400 ppm)
100 x Alkalinity (40-400 ppm)
100 x pH Test Stripes (pH 7-14)

FG-K29202-KW:
ECON Boiler Water Test Kit II
100 x Chloride LR (200-1200 ppm)
100 x Alkalinity (40-400 ppm)
100 x pH Test Stripes (pH 7-14)
40 x Phosphate Test (10-100 ppm)



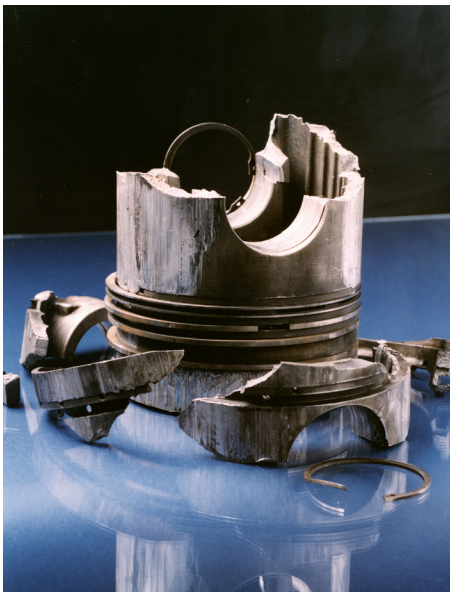
Laboratory Devices

1. ANALEXpqL 72
2. ANALEXrpd 73
3. ANALEXrobot R19 74
4. FTIR Oil Analyser 75

What is Ferrous Debris Monitoring?

Ferrography, the science of ferrous metal analysis was originally developed in the USA during the 1970's by the late Vernon C. Westcott.

Ferrography can be divided into two techniques; the Analytical Ferrograph (AF) which separates wear debris from used oils by magnetic methods, producing glass slides for subsequent examination by microscopy. For AF techniques, the preparation time per sample is usually about 20 minutes. The ANALEX rpd combines the magnetic and centrifugal separation of wear debris in one operation. It is faster than the AF and presents a sample ready for microscopy in about 6 minutes.



The second technique is the Direct Reading Ferrograph (DRF), which separates the wear debris into small and large particles and gives a quantitative measurement by a photometric method. The analysis time per sample is usually around 10 minutes.

The DRF may be loosely compared with the ANALEXpq and they are similar in price. The ANALEXpq is faster than the DRF and is easier to use. Unlike the DRF, the ANALEXpq does not require the sample to be diluted and does not suffer from interference due to carbonaceous material within the sample.

The DRF is considered to be slow and there is a significant cost in consumables per sample. The PQ is equally sensitive to the DRF.

If one measures a well-shaken bottle on the ANALEXpq and then takes further readings as the debris settles, an indication of particle size distribution and thus "severity of wear" is produced.

Ferrous Debris Monitoring is the measurement of ferromagnetic wear debris particles of iron and steel in an oil or grease sample. Many methods exist for the measurement of ferrous wear debris particles, ranging from the basic analytical ferrography mentioned above through to sophisticated spectroscopy techniques such as Atomic Absorption (AA) and Inductively Coupled Plasma (ICP). Analex pq technology was developed to provide a simple, effective, low cost and accurate method of monitoring and trending ferrous debris found in oil samples.

It is generally recognised that the identification of abnormal levels of ferrous wear debris in a lubricated compartment is the first indicator that wear is occurring. The ANALEXpq range of instruments provide a low cost means of monitoring ferrous debris that will identify those samples requiring additional investigation and analysis.

ANALEXpq instruments are built around sensitive magneto meters that measure the mass of ferrous wear debris in an oil sample. This mass is reported as the PQ index. The PQ index is a quantitative, proprietary number that can be trended with acceptable linearity over a range ferrous debris content and particle sizes.

At this time, no ISO / ASTM / IP methodologies exist for the measurement of ferrous wear debris. The main reason for this is that the nature of the instrumentation and the samples being measured make it very difficult to arrange a laboratory "round-robin" sample rotation that would provide the necessary reproducibility to establish such a method.

A number of prominent users are currently considering taking on this task, however Kittiwake's position is that the work required to achieve such a method and the related time scales involved, would not be justified.

The ANALEXpq technology has been accepted worldwide and has now become the de facto industry standard for ferrous debris monitoring.

ANALEX Ferrous Debris Monitors will improve production efficiency and increase operational profitability wherever they are utilised.

Lost production and expensive capital equipment replacement are major costs associated with any catastrophic failure of machinery, the prevention of which is crucial for optimal operational performance. Condition monitoring of machinery lubricants is the established method of predicting and avoiding impending machinery breakdown. Using Ferrous Debris Monitoring, worn parts can be identified early and replaced before any serious damage occurs. Production can be maintained, machinery life extended and the return on capital investment increased.

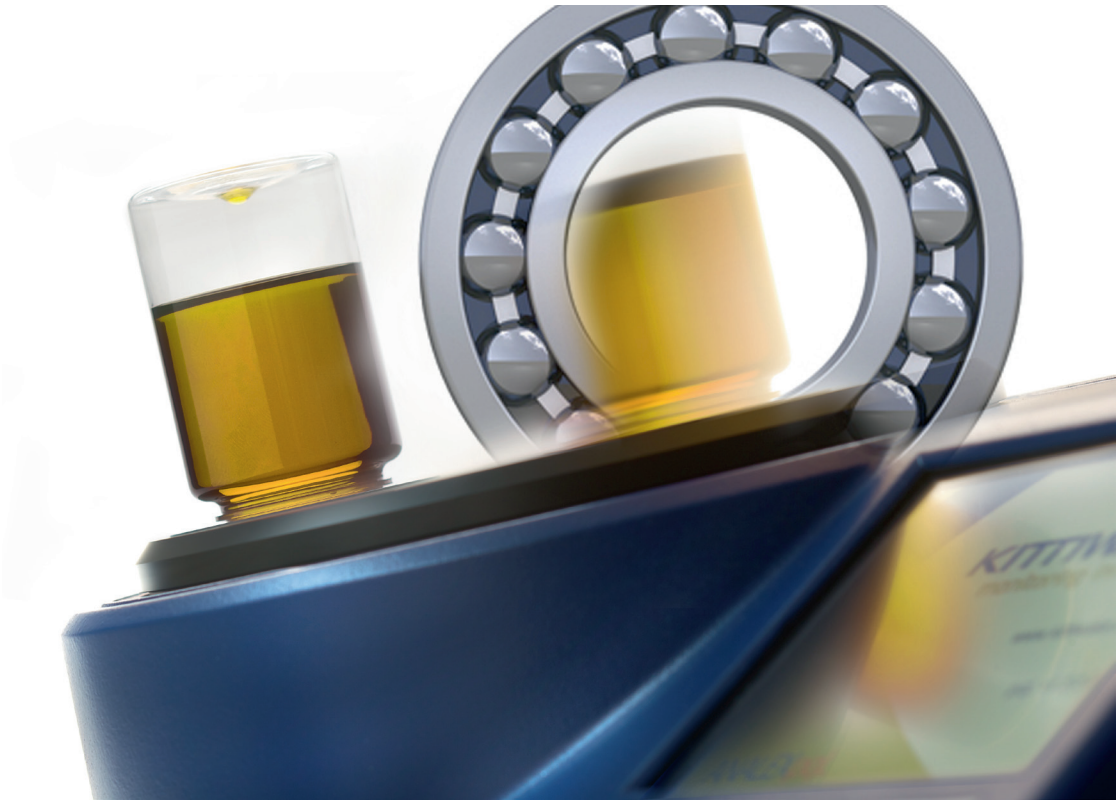
Monitor lubricant condition, quickly identify wear trends, prevent potential problems, avoid expensive repairs, minimise equipment downtime, improve production efficiency, increase operational profitability

ANALEX Ferrous Debris Monitors provide the most accurate means of detecting and measuring ferrous wear debris in lubricating oils, hydraulic oils and greases. These rugged, compact and stable monitors deliver retrievable data quickly and simply, ensuring fast, accurate and consistent management of lube condition samples. With the ANALEX range, used oil samples are easy to prepare and with a short test turnaround, laboratory time is minimised.

Without any sample preparation, ANALEX Ferrous Debris Monitors can be used to identify the presence of larger ferrous particles (greater than 5-10 microns) missed by other more expensive analytical techniques. Built around a sensitive magneto meter, Kittiwakes' unique ANALEX technology detects and measures the mass of ferrous wear debris within a lubricant sample irrespective of the size of the wear particles present. The result is displayed as a PQ Index. The PQ Index is a proprietary unit that can be trended with accepted linearity over a wide range of ferrous debris content and particle sizes.

Through consistent and regular sampling, the PQ Index highlights important trend indicators for the early detection of abnormal wear conditions and impending machinery failure.

The Index can also provide a use full screening check to quickly identify samples hat require further detailed analysis. PQ technology measures the distortion of a magnetic flux field when a ferromagnetic sample (Iron or Nickel) is placed into the field. The resulting PQ Index can be compared with DL and DS ferromagnetic measurements or with the PPM output provides by other spectroscopy techniques. As wear debris in the tested sample settles, repeat readings will show an increasing PQ Index. A high rate of increase indicates the presence of large particles. For multi- element oil analysis, for example diesel engines, PQ is invaluable in identifying larger particle releases often associated with filter breakthrough. ANALEX monitors can be operated remotely using bespoke WinPQBase software and a standard RS232 cable connection. PQ units can also be programmed to perform automatic repeat measurements if required.



1. ANALEXpqL

Ferrous Debris Monitor adds or upgrades PQ Index measurements for your laboratory.

The ANALEXpqL is a completely new instrument developed to replace the widely used pqM and pqA. Using all new hardware, software and the latest technology the highly accurate ANALEXpqL is an essential addition to the modern used oil analysis laboratory.

Specifications

Display Resolution:	1 PQ
Cycle Duration:	4 Seconds
Minimum PQ Detection:	5 PQ
Repeatability:	+/- 4 PQ or +/- 1% (whichever is greater)
Weight:	3.6 kg
Range:	0-5000 PQ

Benefits:

- Wear debris measured
- Irrespective of particle size and distribution to reduce risks
- Established, trusted PQ Index and improved accuracy & repeatability
- Measurement time more than halved, sample ID entry simplified and device footprint reduced
- Improved reliability and durability
- Sample container flexibility
- Backwards data compatibility
- PC & Ether´net Connectivity and 4 x USB Ports

Ordering Information

FG-K17000-KW:
ANALEXpqL

FG-K18300-KW:
Printer Kit

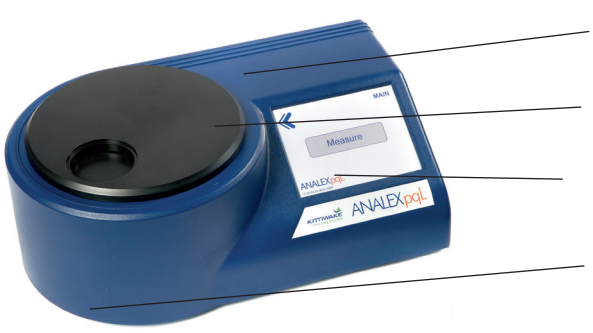
FG-K18311-KW:
Barcode Scanner

FG-K18305-KW:
Spare Paper

FG-K3-208-KW:
100ml HDPE Sample Bottles (288)

FG-K3-207-KW:
100 ml PET Sample Bottles (288)

FG-K15005-KW:
5ml Plastic Sample Pots or oil & greases (3000)



Flexible communications inc. RS232 Ethernet & USB

Fast Measurement Time

Anti-Glare Touch Screen, with on-screen instructions

Small Footprint

ANALEXpq Ferrous Debris Monitors are constructed using sophisticated dual-coil magneto meters for greater measurement accuracy. When no oil sample is present, the sample coil (sensor) and the reference coil are in balance. Both coils are designed to maintain this balance in conjunction with changes in the ambient temperature. A sample of oil containing ferromagnetic debris is placed on the sensor, thus altering the balance between the coils. The resulting 'out-of-balance' signal is amplified, filtered and displayed as a PQ Index, which relates directly to the mass of the ferromagnetic debris in the sample.

On-screen instructions provide a step-by-step guide to using the monitor and a printed user manual includes practical tips gathered form users worldwide.

2. ANALEXrpd

Rotary Particle Depositor

The RPD Particle Depositor offers a rapid and simple method of debris separation. A measured volume of sample is applied, by pipette, to a glass substrate located on a rotating magnet assembly. Particles of debris are deposited radially as three concentric rings by combined effects of rotational, magnetic and gravitational forces.

Removal of the lubricant by solvent washing and drying gives a stable well-separated deposit pattern ready for examination by optical or electron microscope. The Guide to Wear Particle Recognition, which is supplied with the RPD, provides users with an indication for the type of wear taking place by observation of the distinctive features or compositional aspects of the debris being produced. The separated debris can also be measured quantitatively by placing the substrate in an ANALEXpq ferrous Debris Monitor.

- Simple method of both ferrous & non- ferrous metallic debris separation, enabling you to effectively analyse the results of your oil sample.
- Suitable for lubricating oil, hydraulic fluids and greases.
- Supplied complete with a comprehensive Guide to Wear Particle Recognition
- Excellent particle separation-deposition path length is equivalent to a linear 160mm.
- The separated debris can also be measured quantitatively by placing the substrate in an ANALEX pq Ferrous Debris Monitor.

Ordering Information

FG-K15003-KW:
ANALEXrpd

The RPD combines magnetic and centrifugal separation. The instrument is faster than other recognised ferrography techniques and does not require the sample to be diluted and does not suffer from interference due to carbonaceous material in the sample. Particles of debris are deposited radially as three concentric rings. There is no particle deformation and a wide particle size range- typically 1 to 2000 microns.

Specifications

Rotational speed:	0-200 rpm (4 preset speeds)
Display:	Backlit alphanumeric LCD
Operating Temp. Range:	10° - 30°C
Serial connector:	9-pin D (male plug required)
Power :	115/230 V +/-10%
Power consumptions:	75 watts
Electrical connection:	IEC 6A3 pin connect
Weight:	5.5 kg

3. ANALEXrobot R19

The ANALEXrobot R19 is ideal for highly accurate, bench top handling of samples and is the perfect way to get more from your PQ device. Henry Ford said:"If you need a machine and don't buy it, then you will ultimately find that you have paid for it." Do not make this mistake in your laboratory.

The ANALEXrobot R19 will allow you to decrease unnecessary costs, increase productivity and save labour, provide more results with greater consistency and eliminate human error. The ANALEXrobot R19 will soon become a irreplaceable part of your laboratory.

The function of the computer is to:

– Program the Controller

– Copy (back up) the contents of Controller RAM to disk

– Perform a supervisory role, sending commands to the Controller through the serial interface.

The system comprises 2 main units:

- The Robot: With a cylindrical workspace and a nominal reach of 550mm, the robot is driven by stepper motors and controlled by intelligent micro-stepping metal oxide semiconductor (MOS) power drives with incremental encoder feedback. A choice of grippers is available; either pneumatic or electric. The pneumatic gripper is operated by compressed air from 5 to 7 bar (the compressor is included as part of the kit).
- The Controller: Making instant decisions by reading real time signals from all associated equipment, the controller manages the complete movement and testing process. Once programmed, it is capable of running without a host computer, but is normally connected to a computer which supervises robot operation and logs PQ measurements. The controller may also be connected to a computer or LIMS system.

Specifications

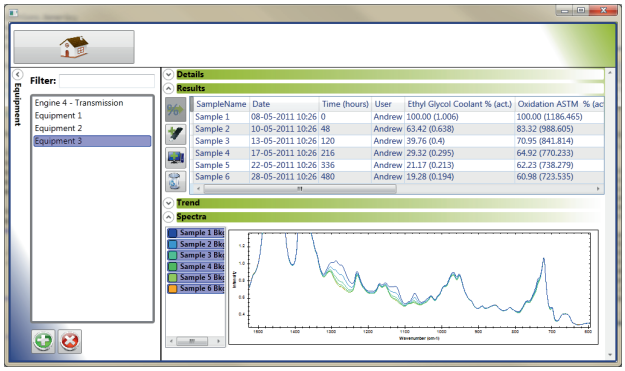
Sample:	Pots and bottles as used by any ANALEXpq device
Maximum Samples:	Approximately 200
Time per Sample:	Approx. 15-25 seconds to load, measure, and unload depending on gripper version and type of sample
Max. Outputs:	6 expandable to 54 buffered and opto-isolated
Max. Inputs:	2 to 51 including opto-isolated
AC Power input:	15/230V +/-10%
Baud rate:	Programmable 1200 to 56000 baud, (default 19200), optional USB
Ambient Temperature:	-10 to +40° C
Weight:	25 kg

Ordering Information

ALX-R-01-KWD:
ANALEXrobot R19

4. FTIR Oil Analyser

The FTIR Oil Analyser is a powerful tool for oil analysis and condition monitoring in the field. It is designed to be extremely user-friendly, while providing a full suite of analytical options. The FTIR Oil Analyser comes pre- loaded with standard ASTM test parameters for all lubrication oil types and requires only minimal intervention.



The FTIR Oil Analyser is comprised of four main components:

- FTIR spectrometer
- Sampling system
- Computer (Windows operating system)
- Carrying Case

Simple to operate, the unit requires only 10ml of oil sample to produce accurate, reproducible results in minutes.

Multiple machines and sample points can be measured, stored and trended over time using the powerful supplied measurement and analysis software, simplifying your condition monitoring program to ensure you get the ultimate performance from your capital equipment.

Specifications

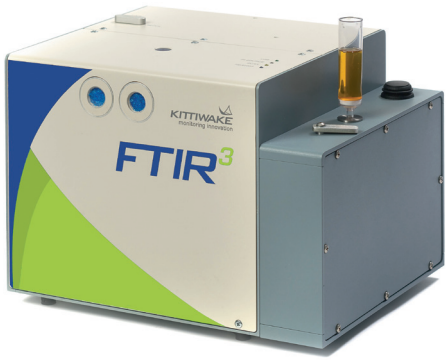
Spectral Range:	5000 - 600 cm^{-1} @ 2 cm^{-1} resolution
Resolution:	2 cm
Interferometer:	Pendulous type, self-compensation for tilt & shear
Beam splitter:	ZnSe
Source:	Ceramic, air cooled
Data acquisition:	18 bit ADC
OS	Microsoft ® Windows XP ®
Weight:	9 kg
Power:	12 VDC, 30 W
Temperature:	15 °C to 30° C
Humidity:	Below 65%, none condensing

The FTIR Oil Analyser is configured to ASTM D7418 Standard Practise and the included software comes pre- loaded with the complete range of JOAP and ASTM approved methods used for the condition monitoring of in-service lubricants, including:

- Antioxidant depletion
- Glycol contamination
- Water
- Fuel Contamination
- Sulphonating to ASTM D 7415-09
- Oxidation to ASTM D7414-09
- Nitration to ASTM D 7627-10
- Phosphate Anti wear to ASTM D 7412-09

Ordering Information

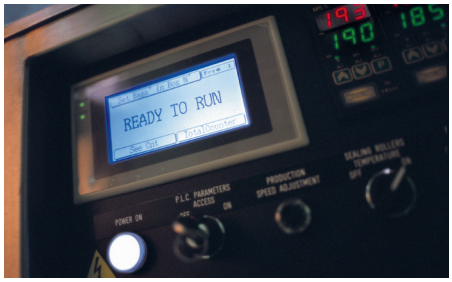
FG-K19000-KW
FTIR Oil Analyser



Kittiwake Training

1. Basic Oil Seminar.....79
2. Marine Potable Water Tests..... 80
3. Cylinder Drain Oil Management 81
4. Monitoring with Acoustic Emission 82
5. Diesel Performance 83

Overview



We understand how important ease of doing business is to our customers. Enhancing the monitoring skills and knowledge of your personnel is one of the ways Kittiwake can help. Increasing your personnel's understanding of monitoring related subjects can translate to an increase in equipment life and reliability, reducing your overall maintenance cost.

Listed below are some skills and courses our engineers offer:

To conduct half day to full day sessions on basic to advanced monitoring topics for vessel / office engineering / maintenance personnel involved with monitoring activities.

To share Kittiwakes engineering and monitoring expertise with your personnel to improve operation, avoid break downs and / or comply with legislations.

To training in our modern seminar rooms in one of our world wide offices. Alternatively we offer external training on-board your ships, in your office or any other location like hotel conference rooms.

To adapt the training to meet your specific needs in terms of content and presentation.

To emphasize application, technical issues, problem identification and resolution rather than products.

To use an interactive problem solving approach to involve training participants in knowledge building.

To create an awareness of the impact of poor and good monitoring practices.

Deliverables:

- Training on basic to advanced monitoring topics, professionally delivered by knowledgeable Kittiwake personnel and, as appropriate, by external speaker.
- Certificate to participants documenting the content of the training provided.
- Detailed seminar documentation for later reference.
- Small groups for most effective training.

Potential Benefits:

- Increase competency and value of personnel
- Increase equipment life, reliability and availability trough effective and efficient monitoring practices
- Opportunity for engineering / maintenance personnel to learn and exchange useful information
- Updated on most current industry knowledge and experience as well as on latest legislation

1. Basic Oil Seminar

Oil is used in various different applications and does have different tasks to fullfill.

Lubrications oil is use to avoid friction between moving parts. Hydraulic oil is used to transmit forces. Oils are also expected to cool or to avoid contaminations to harm the engine. Oils in modern equipment are complex and expensive liquids. It is therefore important to understand and maintain the oil.

Lube oil is the life blood of your engine!

Training Topics

- Introduction
- Basic tribology
- Friction, wear and lubrication
- Life-cycle of the oil• Sampling and sample handling
- Trend analysis in laboratories
- Interpretation of results
- On-site testing - blessing or burden
- Frequencies of testing

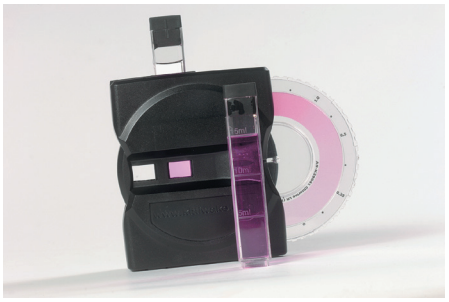
Oil can tell us long stories about the performance of the equipment. It is essential to be able to read and understand this valuable information. It also tells us a story about itself. Oil does age and might need to be replaced when it does come to the end of its lifetime. However, similar to a human there is no predefined lifetime for an oil. It is a waste of money to change oil too early and a big risk to wait too long. Only the oil itself can tell us whether it is still fit for further use or should be replaced.

It is an essential part of the maintenance process to analyse the oil.

2. Marine Potable Water Tests

Potable water is our most important nutrient and is used for both drinking and cooking.

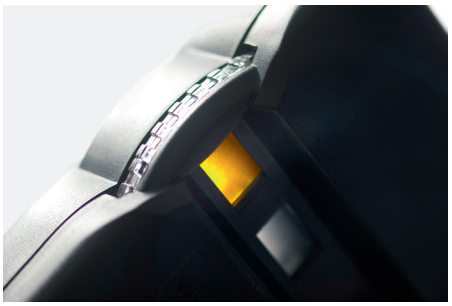
The water being used for personal hygiene and all types of cleaning requires the same high quality. It is therefore important to have enough water of satisfactory quality to cover all types of usage.



Safe potable water secures good health!

Training Topics

- Introduction into potable water
- Risks for fresh water supply and making on board
- Hazardous contaminations (microbes / chemical elements)
- Different methods of disinfection
- Legionella and other bacteria
- Legislation framework (MLC 2006 / IHR)
- Risk Management and Water Safety Plan
- Ship owners / masters duties
- Water testing: What, When, Where, Why?
- How to use on-board test kits



International regulations regarding the Potable Water Quality Monitoring and Control were driven by the World Health Organization (WHO) via its International Health Regulations (IHR). Soon enough adapted for on-board potable water, as part of the overall Ship Sanitation Certificate.

Monitoring and control compliance procedures are laid out in the Guide for Ship Sanitation detailing:

- the systems that require monitoring,
- the method and frequency of monitoring
- the record keeping requirements

The draft guidelines were created in close collaboration with the International Labour Organisation (ILO) and the International Maritime Organisation (IMO).

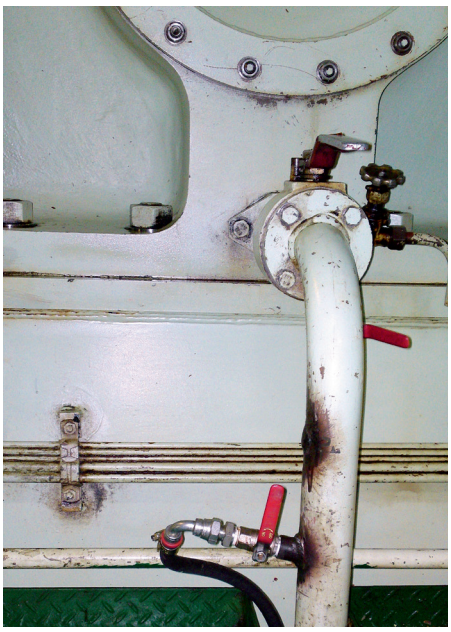
Alongside SOLAS, MARPOL and the STCW Convention the MLC, 2006 has been introduced as the fourth pillar of the regulatory regime of IMO. It will require an MLC 2006 certificate and enters into force 2012.

3. Cylinder Drain Oil Management

Cylinder oil in a main engine has two main tasks. It should lubricate the engine to have an acceptable low wear level and it has to neutralize the sulphuric acid to avoid unexpected acid corrosion in the liner.

By analysing scrapedown oil collected from the scavenge space shipboard personnel are able to monitor the condition of the engine's cylinders and detect changes as they occur.

Improve the efficiency of your engine!



Training Topics

- Introduction into Cylinder Drain Oil Management.
- Cylinder Oil
- How is a cylinder lubricated / piston running conditions / different lubrication systems
- Cylinder wear, types of wear and how is it detected and measured / monitored
- Low / high sulphur fuel – what does sulphur in respect of the lubrication regime? Legislations
- The sulphur / base balance – optimise the feed rate
- Cylinder Drain Oil Analysis – onshore / on board
- Sampling the drain oil, how and when
- Interpreting results and taking actions
- Field experience
- Open discussion

OEM Testimonial:

"It is MAN's experience that, in addition to regular scavenge port inspections; drip oil analysis can be a very useful tool to monitor combustion and cylinder condition. Drip oil analysis can detect changes in cylinder liner wear and help with cylinder oil feed rate optimization programs."

Wärtsilä Switzerland: "Measuring the total iron content of piston underside oil provides a very valuable feedback of the piston running conditions in each cylinder, and allows the operator to optimise cylinder oil feed rates for a specific set of operating conditions."

4. Monitoring with Acoustic Emission

Kittiwake Holroyd Acoustic Emission Sensors and Condition Monitoring Systems are designed for harsh marine environments. We employ the advantages of AE technology so that vibration analysis can be easily and quickly applied by engineers on board your vessel!

Vibration monitoring can be classified in three categories, Broad band vibration (ISO 10816), Vibration analysis in the frequency domain (VA) and Acoustic Emissions (AE) – (ISO 22096). If you know VA and want easy installation, rapid results and no complicated usage then Acoustic Emissions is the technology for you.

Improve the efficiency of your equipment!

Training Topics

- Introduction into Acoustic Emission Monitoring
- Differences between Vibration and Acoustic Monitoring
- Finding lubrication problems
- Instant "health" checking – finding equipment problems
- Confirming repair success
- Air leaks detection
- Hands-on training with MHC portable instruments
- Using the Memo View software for trend analysis
- FFT Frequency analysis and data export
- Field experience
- Open discussion

The power of Acoustic Emission lies in the fact that it directly detects the physical processes such as friction, impacts and metal removal associated with failure. MHC acoustic testing can be applied to virtually all rotating machinery including those traditionally difficult areas such as slow speed machinery, bearing analysis and complex gearboxes. The key to the success in the industrial environment lies in its high sensitivity to machine faults and in an inherent immunity to audible noise and low frequency vibrations. Because of this, MHC is ideally suited to places where the background levels of noise and vibration are likely to be high and variable.

5. Diesel Performance

The challenge of upholding a maintenance regime on board ships is to protect the vessel against costly downtime. It is important to detect defects early enough to avoid serious problems resulting in downtimes. Engine maintenance can be planned, thus saving in parts and labor by changing engine parts based on need, not based on timing intervals.

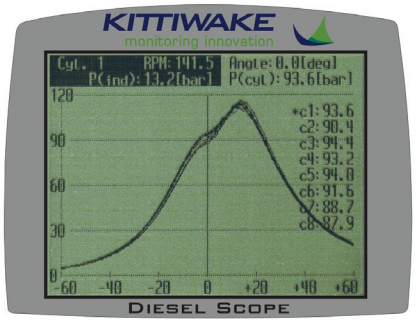
Monitoring diesel engine performance by conventional "draw card" methods, along with planimeter calculations, is time consuming and subject to human error. Unfortunately engine efficiency still suffers from timing problems and load imbalances that occur and remain undetected between scheduled maintenance.

Slow or late combustion is one of the most common problems in diesel engine operation. Balancing the cylinder load extends engine life, increases efficiency, and reduces emissions to assist with environmental compliance. Proper ignition timing reduces the exhaust gas temperature and rate of excess carbon build-up. Tuning the engine may reduce specific fuel oil consumption resulting in significant savings.

Improve the efficiency of your engine!

Training Topics

- Introduction into Diesel Engine Performance Analysis
- Defining different pressures and angles calculate indicated power
- Identification of problems by using the pressure / angle and pressure / volume diagram
- Cylinder load balance
- What influences the ignition time?
- What are the results of late ignition and how can it be identified?
- Slow or late combustion. What are the results and how can it be identified?
- Differences between different diesel performance analysers
- Interpreting results and taking actions.
- Field experience
- Open discussion



KITTIWAKE
monitoring innovation

Kittiwake GmbH
Marie-Curie-Str. 5
25337 Elmshorn Germany
Tel: +49 (4121) 463948
Email: info@kittiwake.de
Web: www.kittiwake.de

MA-K12001-DE – issue 1