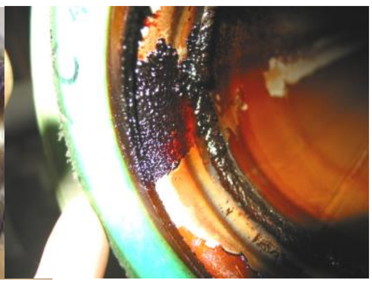
Vartector

The world's first automatic MPC Tester conforming to ASTM D7843 standards for laboratory use

Lubrication Plus®
QUMENSUS



USA & CANADA Distributor

AG

AG Fuel Analytics Inc.
E: sales@agfuelanalytics.com
Ph: +1 2267007125 (Canada)
Ph: +1 8482282828 (USA)

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Summary

Vartector diagnoses risk of varnish generation by using CIE delta E value, an optical color numerical representation specified in ASTM D7843 (Standard Test Method for Measurement of Lubricant Generated Insoluble Color Bodies in In-Service Turbine Oils using Membrane Patch Colorimetry). The potential risk of varnish in turbine oil is warning that problems such as vibration and temperature rise of turbine bearings, filter clogging, poor temperature control, and turbine oil degradation may occur.

Vartector diagnoses the potential risk of varnish and soot in the control oils of the EHC system (phosphate ester-based flame-retardant hydraulic oil) through the optical color numerical representation of CIE delta L value and a,b value. It diagnoses whether composition of the degraded by- product is a soot or a varnish, or both soot and varnish. If the CIE delta L Value is high, it means generation of soot coming from a bubbles in the system and a pump cavitation problem, and if a,b values are high, it means the risk of varnish generation which will bring malfunction of servo valves accordingly.

Features

- **Fully Automated :** Unlike existing handheld type MPC testers, after preparing patch, all processes such as sample loading, validation and testing are done automatically within 10 seconds.
- **Display :** Patch image, MPC delta E, delta L, a,b values. Trend for specific equipment can be monitored.
- **Conforming to ASTM D7843 :** The world's first laboratory MPC tester that meets ASTM D7843 regulations
- **Automatic Diagnostic Reporting :** Automatic diagnosis of measured results as Normal a, Normal b, Caution and Warning
- **Automatic Validation :** Unlike existing handheld MPC testers, automatic validation function is built in as standard. It automatically performs device validation after power on.
- **Automatic Self Diagnostic: :** After power on, main components such as spectrophotometer and board performs self-diagnosis automatically.
- **Trend Management :** Trend management is possible by saving measured data.
- **Advanced Software :** Manual validation, Set standard values for each management target, Trend Management, Saving over 1000 data, Calibration

Photos of Varnish and Sludge

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	Turbine Oil	Control Oil (EHC Oil)
Formulation	Mineral based oil	Phosphate ester based oil
Cause of main degradation	Oxidation	Hydrolysis + Oxidation + Heat
Degradation accelerating factors	Temperature, Degradation, Air, Metal Particles, Water,.. etc	Water, Oxygen, Air, Bubbles
Material generated by degradation	Soluble Organic Acid	Inorganic, Acid, Soot, GEL
Collected Degraded by-products		

■ Mineral Turbine Oil Application

Turbine oil is degraded due to oxidation and contamination by temperature, air, metal, water, etc., and depletion of additives, and varnish is generated as a result of degradation. Varnish generated in this way can be evaluated as ‘ Varnish Potential Risk MPC(ΔE) Value’.

When the value of varnish increases, bearing vibration and temperature hunting occurs, and a varnish layer is formed on the bearing surface, which interrupts flow of turbine oil and makes cooling difficult. It brings many problems such as early clogging of the filter and preventing cooling of turbine oil due to varnish attached to the cooler.

“Oxidation of turbine oil changes fluid properties and reduces machine life”

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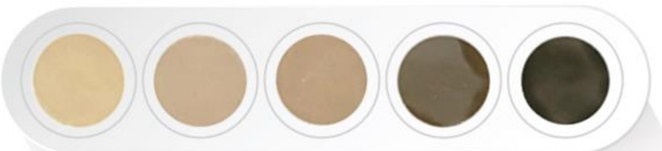
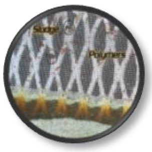


Normal A	Normal B	Caution	Warning
<15	15 - 29	30 - 40	>40

Progress of degradation = increase in MPC

Bearing vibration and temperature hunting



Line filter early clogging

Temperature rise due to deposits attached to the cooler

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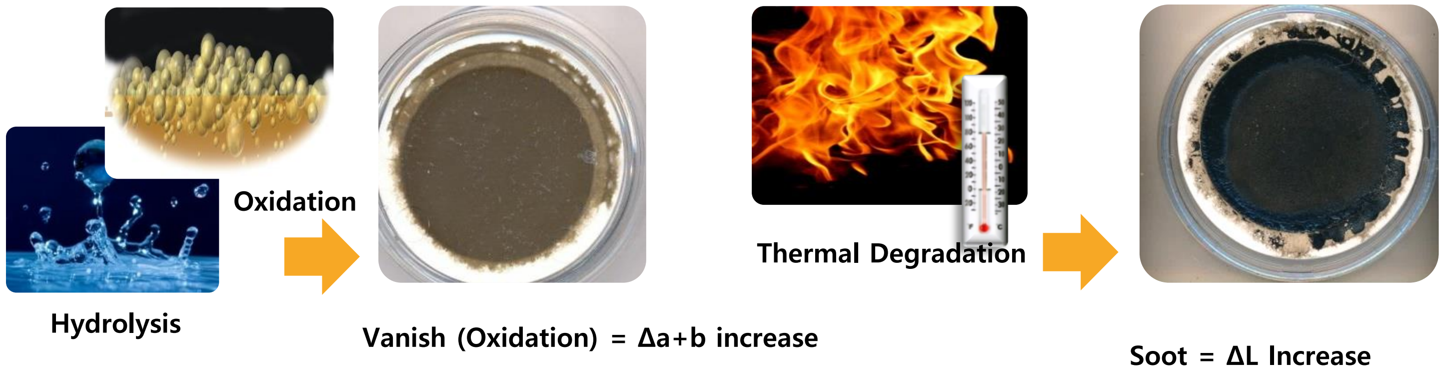
■ Control Oil (Phosphate Ester) Application – EHC Oil

Control oil is mainly hydrolyzed by water, and degraded by oxidation and thermal degradation.
As a result of degradation, varnish and soot are generated, and the generation degree of varnish and soot can be managed by MPC (ΔL or Δa+b) values. Soot and varnish of phosphate ester control oil, which cannot be distinguished by MPC gravimetric method, can be quantified by measuring ΔL and Δa+b.

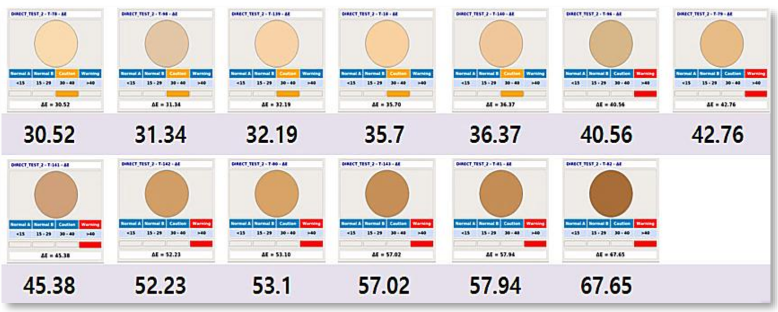
If the values of both ΔL and Δa+b are high, it means that the risk of soot and varnish is high, and if Δa+b is low and ΔL is high, it is contamination of soot. When Δa+b is low and ΔL is also low, the patch has a light yellow color and the control oil is in very good condition.

Oxidation of control oil is main cause of oil degradation, causing malfunction of valve control and valve sticking, and soot mainly causes valve wear which brings problems of leakage and valve sticking.

Control Oil Degradation

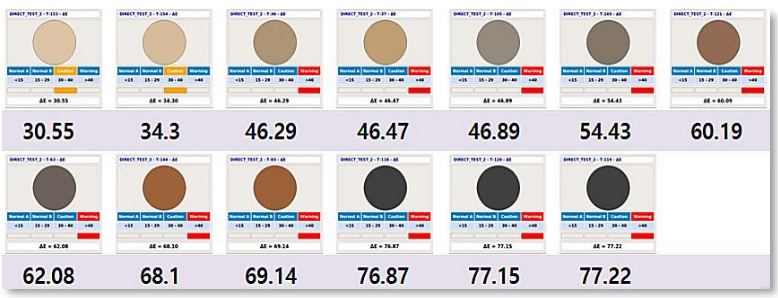


Oxidation (Δa+b↑): oil with high ΔE and high Δa+b



√ **Bad valve control**
√ **Valve sticking**
√ **Acceleration of oil degradation**

Soot (ΔL↑): Oil with high ΔE and high ΔL



√ **Leakage by valve wear**
√ **Valve sticking**

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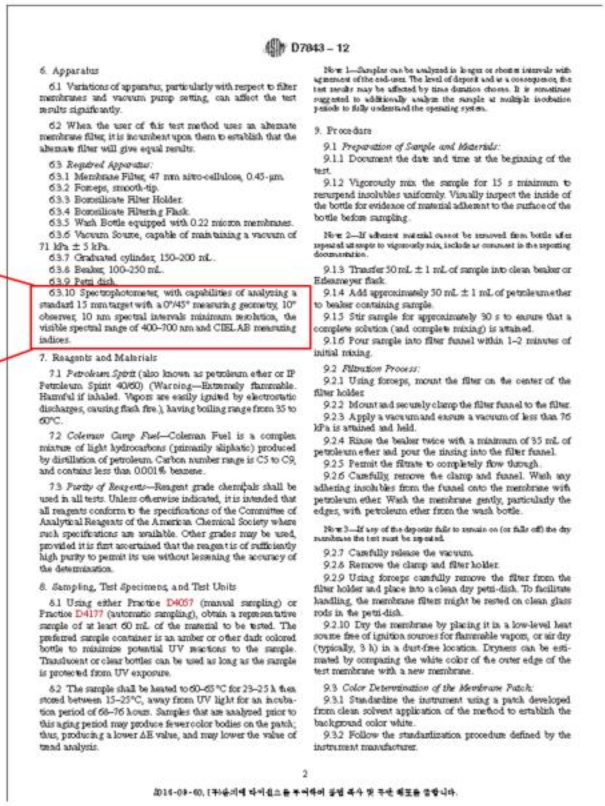
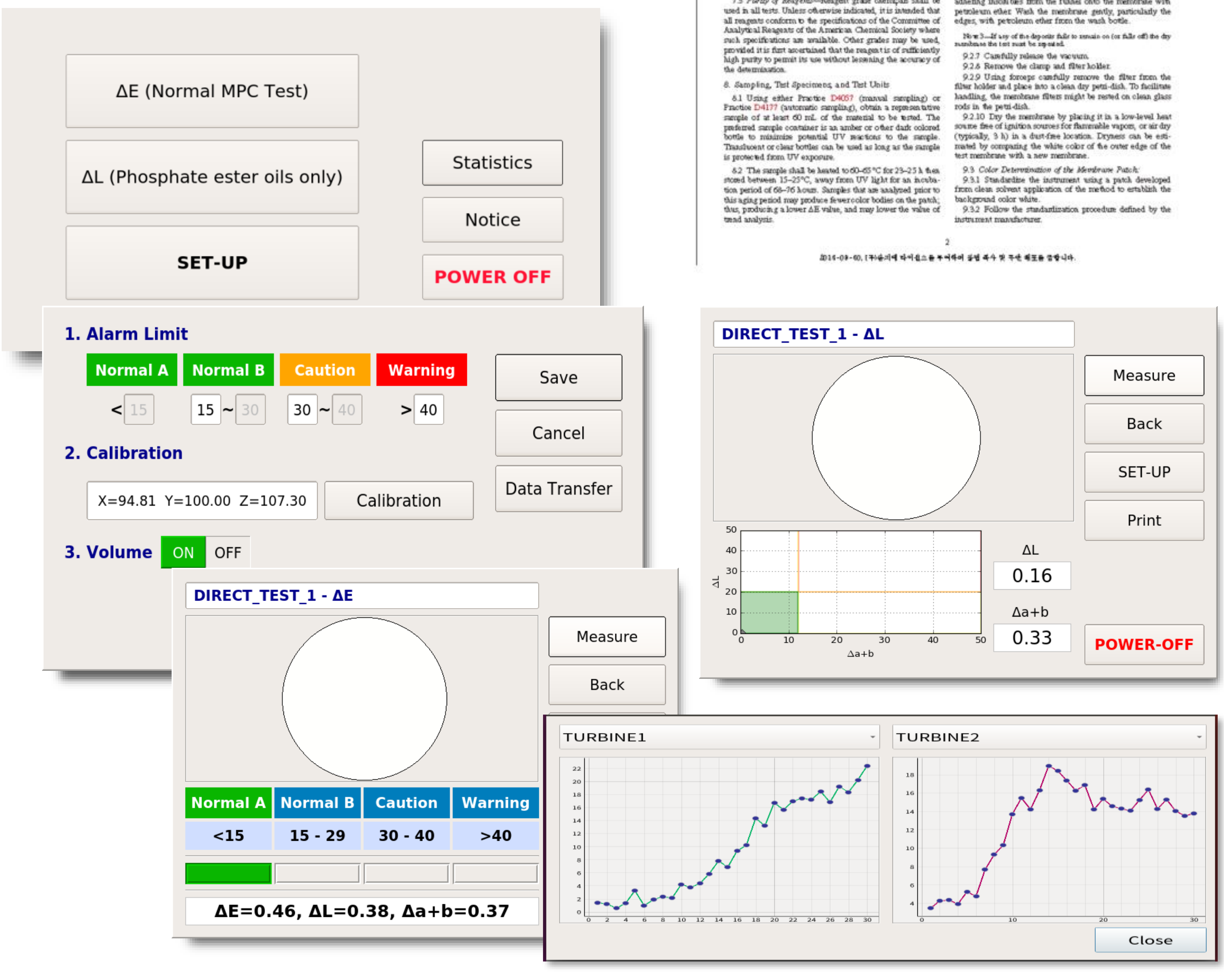
Fully Conforming to ASTM D7843-12

6.3.10 Spectrophotometer, with capabilities of analyzing a standard 15mm target with a 0'/45' measuring a geometry, 10' observer, 10 um spectral intervals minimum resolution, the visible spectral range of 400-700 um and CIELAB measuring indices.





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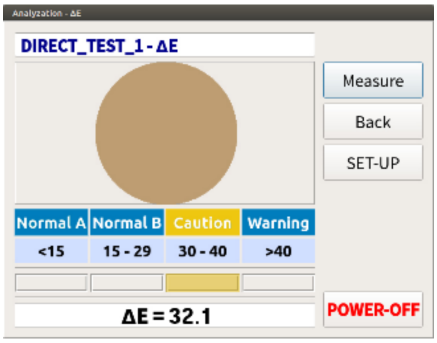
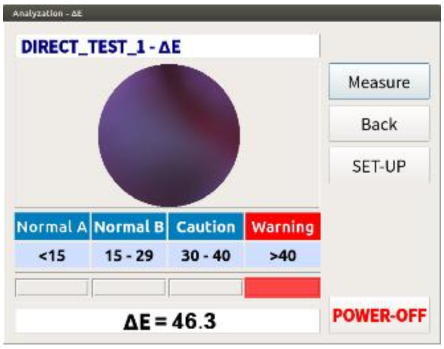
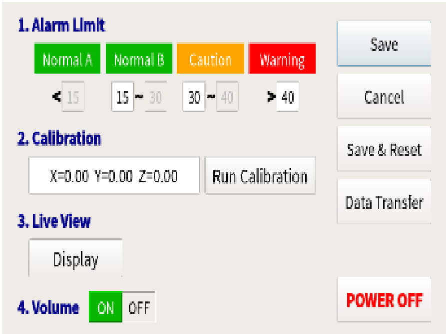
Specification

Features	Specification
Appearance	
Size	214(W) x 306 (L) x 254 (H) / 5.5kg
Power	DC 220V with 24V, 5A
Measuring Principle	
Measuring Geometry	0˚/45˚ measuring geometry (in full compliance with ASTM D7843)
Measurement Condition	Observer: CIE 10˚ Standard Observer
Light Source	LED Light
Receiver	Spectrum scan
Detector	Spectrophotometer
Measuring Time	3 Seconds
Operating Temperature	0˚ C ~ 50˚ C
Output Value	CIE delta E, delta L, a, b
Patch Color Image Display	YES
Interface	
OS	Linux
Moving	Stepping motor
Analog Peripherals	7” Capacitive Touch Screen LCD,







▪ Additional Features

- Automatic sample loading system
- Self-diagnosis and verification
- Output : Delta E for Turbine and L for EHC
- Unique calibration function
- Key board connection possible
- Automatic storage of measured results & Export, USB storage
- Automatic diagnostic evaluation report function
- Portable printer available as optional

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