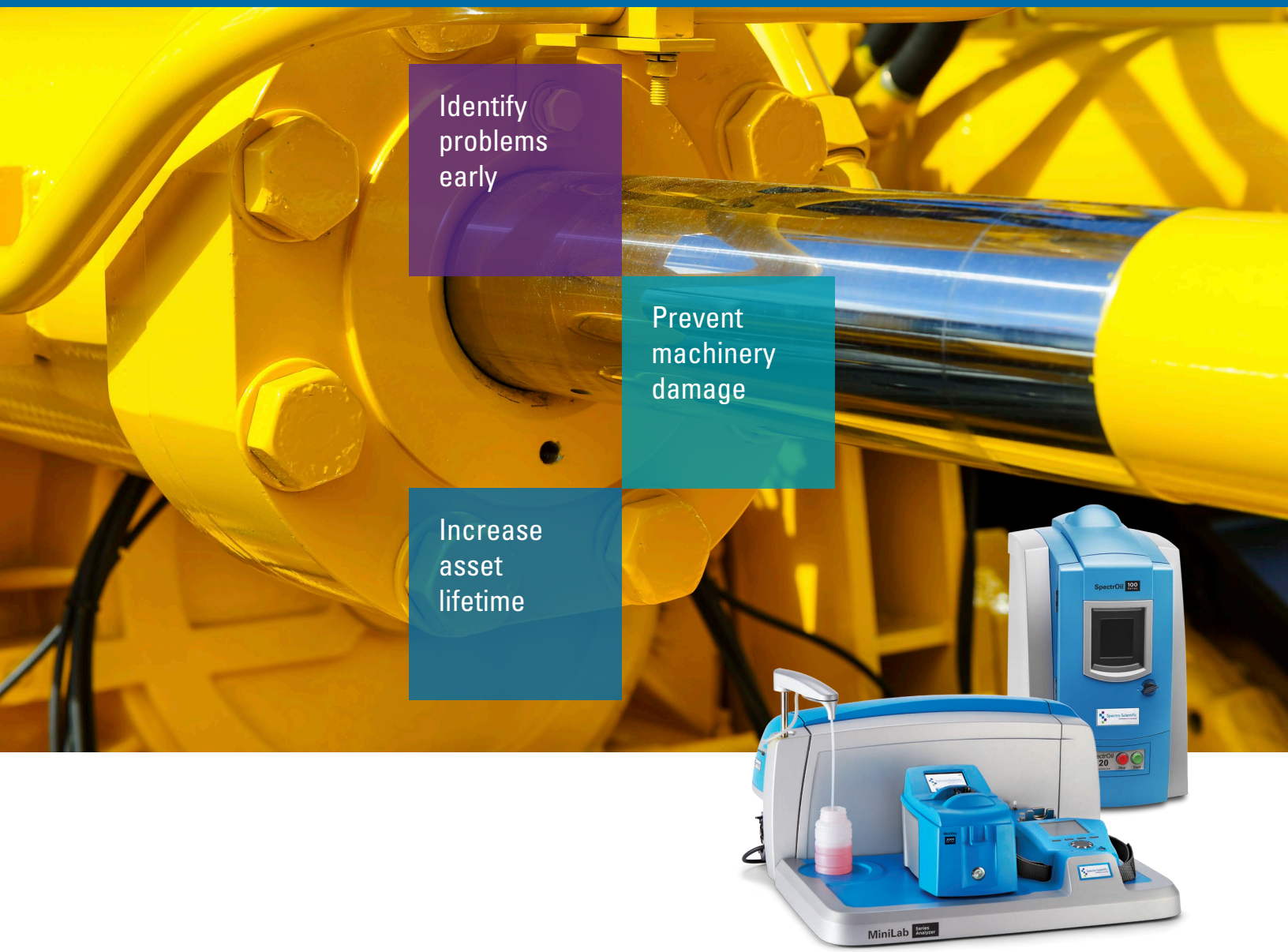
Spectro Scientific

Confidence in knowing

Solutions for Power Generation and Industrial Plants



In-service Oil Analysis for Machine Condition Monitoring

Since the reliable operation of high value, fixed assets is critical to all industrial plants, predictive maintenance programs are implemented to manage machinery uptime.

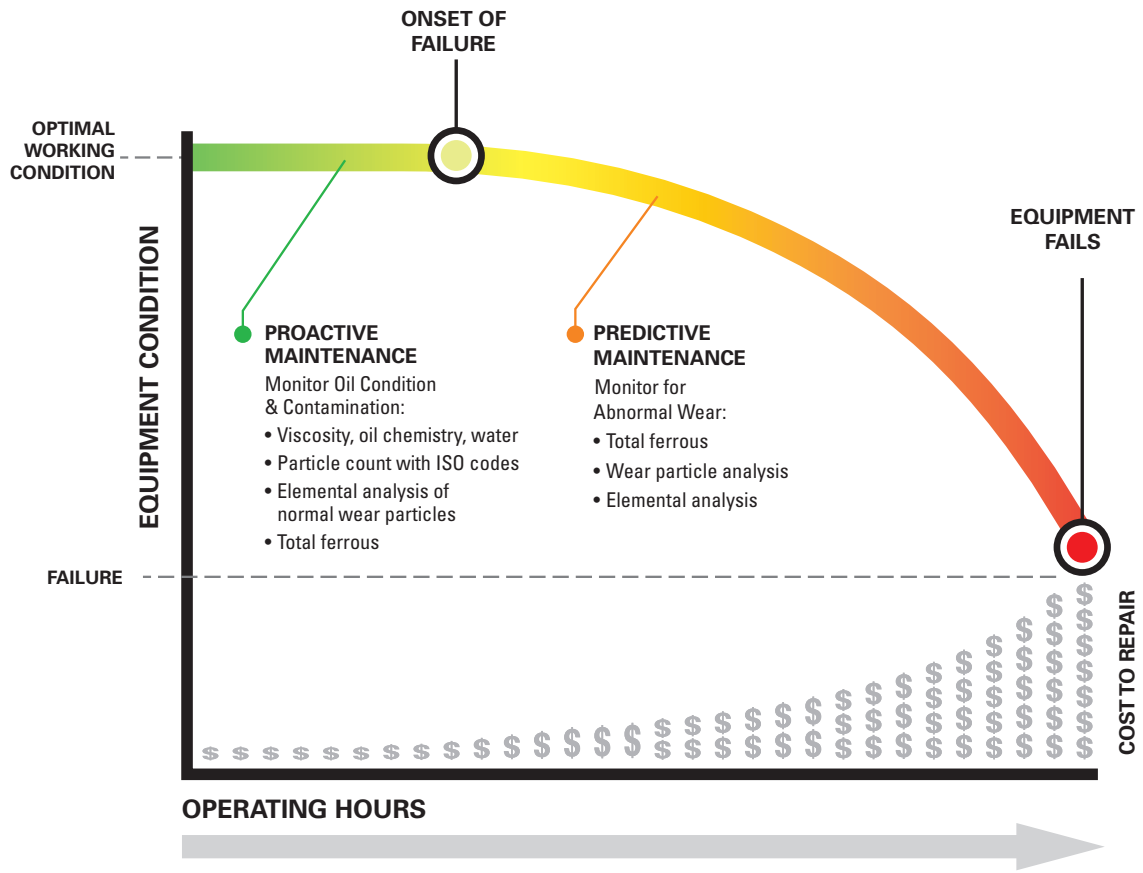
In-service oil analysis is a key machine condition monitoring technique for Condition Based Maintenance (CBM) and Reliability programs. It complements vibration analysis, thermography and other predictive maintenance technologies. In the time it takes external laboratories to return oil sample results, machinery condition can change significantly. On-site oil analysis eliminates this wait and enables immediate decision making.

Corrosion and wear cause surface degradation of the lubricated surfaces in machinery and are the root causes of most mechanically-induced equipment downtime. Corrosion is caused by water or other fluids reacting with metal surfaces, while wear is caused by surface abrasion, adhesion and fatigue.

Oil analysis provides early indications of equipment wear and identifies the root causes of corrosion.

The P-F Curve (Potential-Failure Curve) illustrates how in-service oil analysis provides critical information on machine condition in both Proactive and Predictive Maintenance periods.

In the Proactive period, oil condition and contamination monitoring help prevent the onset of the root causes of machine failure. In the Predictive period, monitoring the increasing severity of wear particles allows maintenance work orders to be executed for component replacement or repair before catastrophic failure.



As part of a proactive maintenance program, on-site oil analysis delivers rapid results with immediate decision making to:

- Lower operating costs
- Reduce unscheduled downtime
- Increase machine availability
- Extend equipment life
- Decrease total lifecycle equipment costs
- Provide immediate retest capability





Trivector™ – oil and machine health simplified

The TriVector™ is a simple representation of the integrity of the lubrication system and the health of the machine itself. The Trivector indicates the degree of health in each vector. Each vector is a representation of Alarm Limits based on underlying parameters, such as viscosity, water contamination, acid number, oxidation, total ferrous, particle count and ISO code, large ferrous particle count, etc.

The following questions can be answered:

- *Is the machine healthy?*
- *Can I predict when the machinery will fail?*



- *Is the oil dry?*
- *Is the oil clean/ free of dirt?*

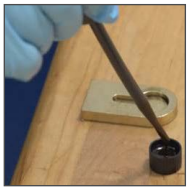
- *Is it the right oil?*
- *Is the oil fit for use?*

*Trivector is a trademark of Emerson Process Systems

MiniLab Series

4 simple tests and less than 15 minutes to comprehensive oil analysis

Can be operated on-site by plant staff; no chemist required.



ELEMENTAL ANALYSIS

The elemental analyzer provides measurement of 23 elements to identify individual contaminants, wear metals and the elemental composition of additives.



PARTICLE COUNT AND FERROUS MONITOR

The direct imaging particle counter and ferrous monitor provides particle counts and ISO codes, wear classification, ferrous particle counts & size distribution, and total ferrous measurement.



VISCOSITY

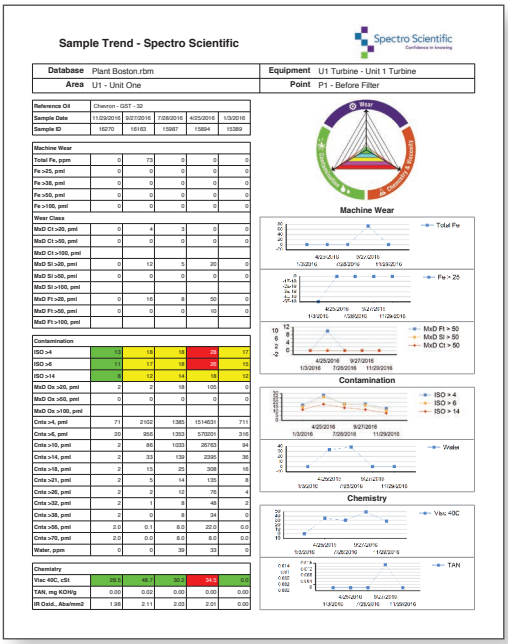
The portable viscometer provides high accuracy 40°C kinematic viscosity measurements.





Trivector reports on machinery health

Easy to interpret results with Trivector sample and trend reports.



Sample Trend - Spectro Scientific

Spectro Scientific
Confidence in knowing

Database	Plant Boston.rbm	Equipment	U1 Turbine - Unit 1 Turbine
Area	U1 - Unit One	Point	P1 - Before Filter

Reference Oil	Chevron - GST - 32				
Sample Date	11/29/2016	9/27/2016	7/28/2016	4/25/2016	1/3/2016
Sample ID	16270	16103	15987	15804	15389
Machine Wear					
Total Fe, ppm	0	73	0	0	0
Fe >25, pml	0	0	0	0	0
Fe >38, pml	0	0	0	0	0
Fe >50, pml	0	0	0	0	0
Fe >100, pml	0	0	0	0	0
Wear Class					
MxD Ct >20, pml	0	4	3	0	0
MxD Ct >50, pml	0	0	0	0	0
MxD Ct >100, pml					
MxD Si >20, pml	0	13	5	20	0
MxD Si >50, pml	0	0	0	0	0
MxD Si >100, pml					
MxD Fi >20, pml	0	16	8	50	0
MxD Fi >50, pml	0	0	0	10	0
MxD Fi >100, pml					
Contamination					
ISO >4	13	18	18	26	17
ISO >6	11	17	18	24	13
ISO >14	6	12	14	18	12
MxD Cx >20, pml	2	2	18	106	0
MxD Cx >50, pml	0	0	0	0	0
MxD Cx >100, pml					
Cnts >4, pml	71	2102	1385	1514631	711
Cnts >6, pml	20	906	1353	570201	316
Cnts >10, pml	2	86	1033	26763	84
Cnts >14, pml	2	33	139	2395	38
Cnts >18, pml	2	15	25	309	18
Cnts >21, pml	2	5	14	135	8
Cnts >26, pml	2	2	12	78	4
Cnts >32, pml	2	1	8	48	2
Cnts >38, pml	2	0	8	34	0
Cnts >56, pml	2.0	0.1	8.0	22.0	0.0
Cnts >70, pml	2.0	0.0	8.0	8.0	0.0
Water, ppm	0	0	39	33	0
Chemistry					
Visc 40C, cSt	29.5	46.7	30.2	34.5	0.0
TAN, mg KOH/g	0.00	0.02	0.00	0.00	0.00
IR Oxid., Abs/mm2	1.98	2.11	2.03	2.01	0.00

Machine Wear

Contamination

Chemistry



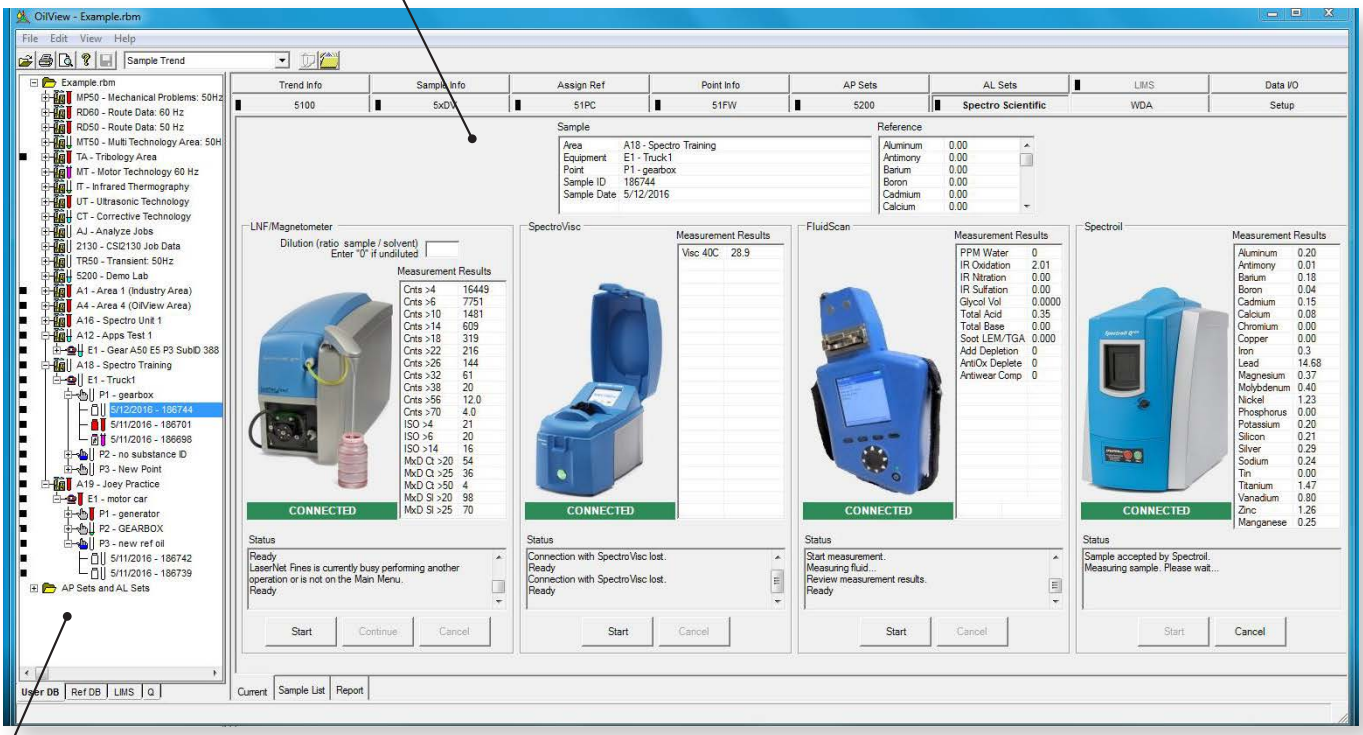
CHEMICAL ANALYSIS

The infrared spectrometer measures Total Acid Number (TAN), oxidation and water for machinery oils and hydraulics.

MiniLab Series Software

The MiniLab Series software is based on a Laboratory Information Management System (LIMS) designed for oil analysis. It includes an asset management database, a reference oil database and reports. The software supports multiple databases and is available with single user or optional network configurations.

Simple, easy to use GUI



Asset management

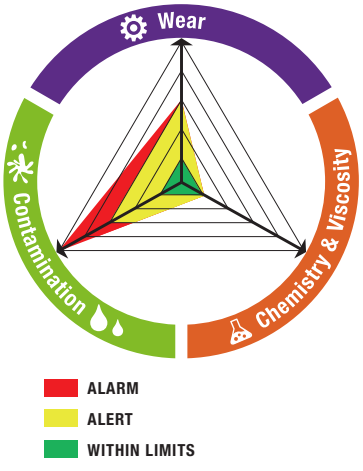
- Each asset in a database is structured as an Area/Equipment/Point/Sample. A Sample has a time stamp and unique Sample ID and is created at the Point asset level.
- Reference oil database. A reference oil is assigned to each asset to allow trending comparison to new oil properties.
- Schedule oil samples for routine sampling intervals.

Alarms

Color-coded Trivector reports provide a clear snapshot of machinery health by identifying parameters that are outside normal limits. Several parameters in each category of Wear-Chemistry-Contamination are assigned limits. The measured values of these parameters compared to these limits are used to generate the Trivector plot of machinery health.

Alarm Limits are initially established for key parameters from the templates provided in the software, machinery component specifications, industry standard recommendations or from user-defined criteria.

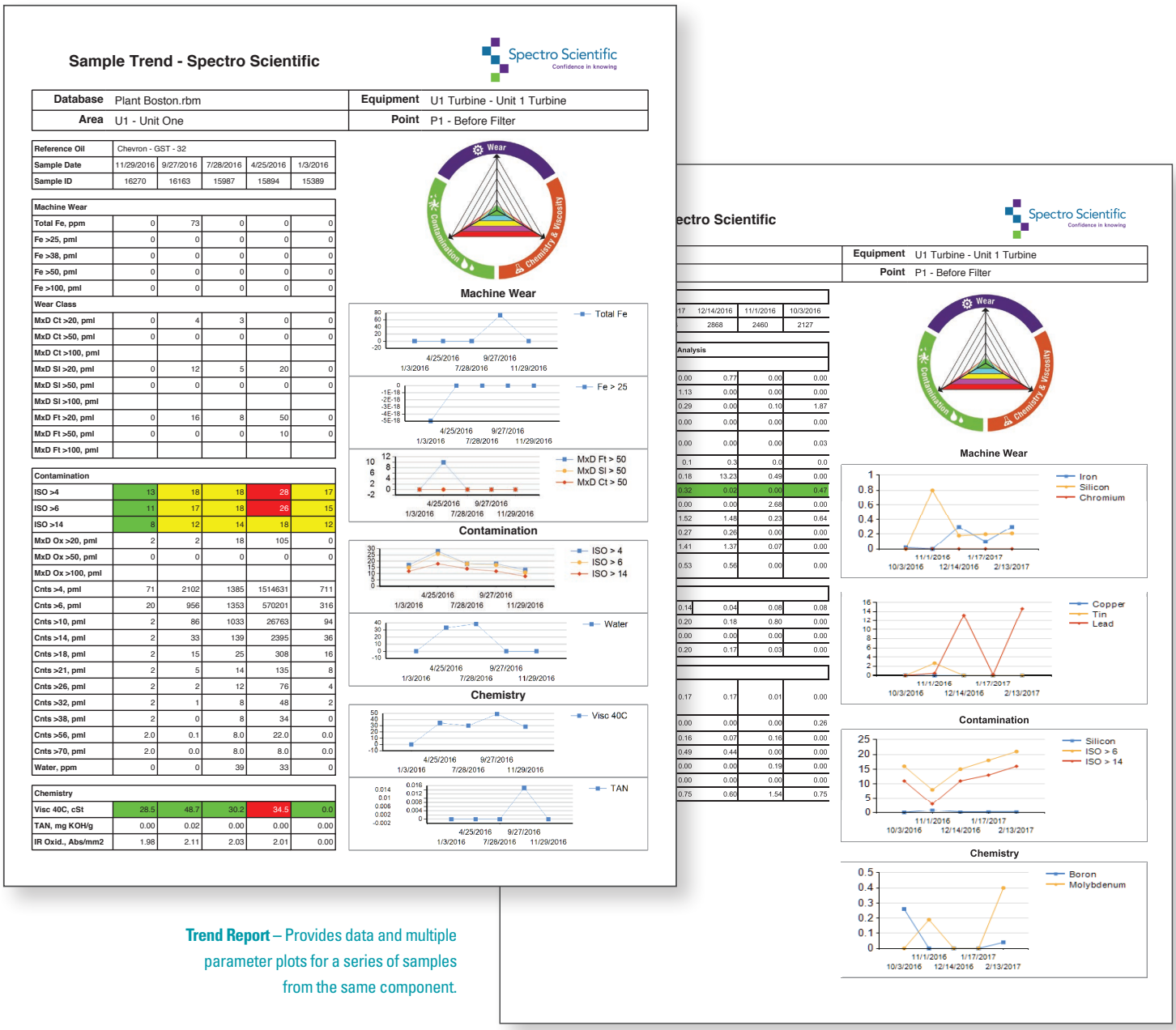
Industry best practice is to refine Alarm Limits based on machine history. Once a series of measurements is made, the initial alarm limits can be analyzed and adjusted.



The **Trivector** shown has chemistry & viscosity within normal limits, wear in an alert condition, and contamination in an alarm condition.

Reports

Standard and user configurable reports can be automatically generated. The following Spectro Scientific trend report provides a concise report with multiple parameter trend plots.



Sample Trend - Spectro Scientific

Spectro Scientific
Confidence in knowing

Database	Plant Boston.rbm	**Equipment**	U1 Turbine - Unit 1 Turbine
Area	U1 - Unit One	**Point**	P1 - Before Filter

Reference Oil	Chevron - GST - 32				
Sample Date	11/29/2016	9/27/2016	7/28/2016	4/25/2016	1/3/2016
Sample ID	16270	16163	15987	15894	15389
Machine Wear					
Total Fe, ppm	0	73	0	0	0
Fe >25, pml	0	0	0	0	0
Fe >38, pml	0	0	0	0	0
Fe >50, pml	0	0	0	0	0
Fe >100, pml	0	0	0	0	0
Wear Class					
MxD Ct >20, pml	0	4	3	0	0
MxD Ct >50, pml	0	0	0	0	0
MxD Ct >100, pml					
MxD SI >20, pml	0	12	5	20	0
MxD SI >50, pml	0	0	0	0	0
MxD SI >100, pml					
MxD Ft >20, pml	0	16	8	50	0
MxD Ft >50, pml	0	0	0	10	0
MxD Ft >100, pml					
Contamination					
ISO >4	13	18	18	28	17
ISO >6	11	17	18	26	15
ISO >14	8	12	14	18	12
MxD Ox >20, pml	2	2	18	105	0
MxD Ox >50, pml	0	0	0	0	0
MxD Ox >100, pml					
Cnts >4, pml	71	2102	1385	1514631	711
Cnts >6, pml	20	956	1353	570201	316
Cnts >10, pml	2	86	1033	26763	94
Cnts >14, pml	2	33	139	2395	36
Cnts >18, pml	2	15	25	308	16
Cnts >21, pml	2	5	14	135	8
Cnts >26, pml	2	2	12	76	4
Cnts >32, pml	2	1	8	48	2
Cnts >38, pml	2	0	8	34	0
Cnts >56, pml	2.0	0.1	8.0	22.0	0.0
Cnts >70, pml	2.0	0.0	8.0	8.0	0.0
Water, ppm	0	0	39	33	0
Chemistry					
Visc 40C, cSt	28.5	48.7	30.2	34.5	0.0
TAN, mg KOH/g	0.00	0.02	0.00	0.00	0.00
IR Oxid., Abs/mm2	1.98	2.11	2.03	2.01	0.00

Wear / Contamination / Chemistry & Viscosity

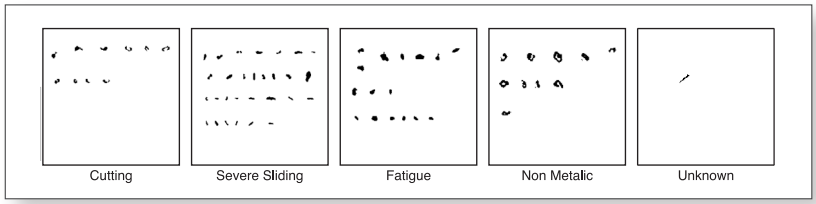
Machine Wear — Total Fe; Fe > 25; MxD Ft > 50, MxD SI > 50, MxD Ct > 50

Contamination — ISO > 4, ISO > 6, ISO > 14; Water

Chemistry — Visc 40C; TAN

4/25/2016 9/27/2016
1/3/2016 7/28/2016 11/29/2016

Trend Report – Provides data and multiple parameter plots for a series of samples from the same component.



Thumbnail images of wear particles

MiniLab Evolution

5200 MiniLab vs MiniLab 153

The MiniLab Series is the next generation of Trivector on-site oil analyzers replacing the 5200 MiniLab.

	5200 MINILAB	MINILAB 153
Wear	Large Ferrous content, trending only	Total ferrous particle content (ppm)
	Wear Debris Analysis (WDA) (Optional)	Wear Debris Analysis (WDA) (Optional)
		Automatic wear particle shape classification, count & distribution
		Ferrous particle count & distribution (> 25 µm)
		Wear elements: Fe, Cu, Pb, Mg, Ag, Sn
Contamination	Particle count & distribution, ISO codes	Particle count & distribution, ISO codes
	Emulsified water only	Dissolved water (ppm)
		Free water (ppm)
		Glycol contamination for engine oils
		Contaminate elements: Si, Na
Chemistry	Dynamic viscosity @ room temperature	Kinematic viscosity @ 40°C
	Dielectric, trending only	Oxidation
		Total Acid Number (TAN)
		Nitration, Sulfation, Anti-wear additive, Total Base Number (TBN), and soot for engine oils
		Additive elements: Ca, P, B, Zn, K
Application	Typical mineral and synthetic lubricant and hydraulics oils for industrial rotating machinery. Not suitable for backup generators.	Mineral and synthetic lubricant and hydraulics for industrial rotating machinery, plus engine oil for backup generators and ground fleet, and special lubricants such as phosphate esters and PAG.

Oil library database

The MiniLab Series includes an extensive industrial oil library database to analyze in-service oils as a variety of lubricants and fluids are used in industrial equipment. The following fluid categories can be tested:

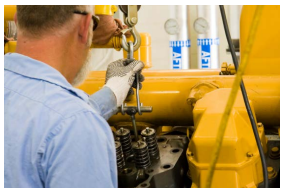
FLUIDS	ELEMENTAL	CHEMISTRY	PARTICLE COUNT & FERROUS	VISCOSITY
Mineral oil based Hydraulic fluids and lubricants	Y	Y	Y	Y
Synthetic hydrocarbon based hydraulic fluids and lubricants	Y	Y	Y	Y
Ester-based Lubricant blends	Y	Y	Y	Y
Oil Soluble Polyglycols (OSP)	Y	Y	Y	Y
Organic Esters (OE)	Y	Y	Y	Y
Phosphate Esters (Fyrquel/Skydrol)	Y	Y	Y[1]	Y
Polyalkylene Glycols (PAG)	Y	Y	Y[1]	Y
Poly Alpha Olefins (PAO)	Y	Y	Y	Y
Polyinternal Olefins	Y	Y	Y	Y
Polyol Esters (POE)	Y	Y	Y	Y
Grease	Y	Y[2]	N	N
Mineral Transformer Oil	Y	N	Y	Y

1: Require factory installed Skydrol tube and fitting kits and compatible solvent 2: Oxidation and water (absorbance units) for trending

Typical limits for machinery

The most common oil analysis tests and typical alarm limits for several component types are shown below. Component manufacturers establish alarm limits for their equipment for specified parameters.



MEASUREMENT	TURBINES	GEAR BOXES	HYDRAULICS	ENGINES
Particle Count / ISO Code	< 18/14/12	< 19/16/13	< 15/13/11	
Water	< 100 ppm	< 1,000 ppm	< 150 ppm	< 2,500 ppm
Glycol				0.1% max
Fuel dilution				5% max
Viscosity	+ 15% / - 10% of nominal ISO	+ 15% / - 10% of nominal ISO	+ 15% / - 10% of nominal ISO	+ 20% to - 10% of nominal SAE
TAN	Baseline + 0.1 mg KOH/g max	Baseline + 1.0 mg KOH/g max	Baseline + 1.0 mg KOH/g max	
TBN				20% of Baseline mg KOH/g min
Sodium				< 40 ppm
Boron				< 20 ppm
Aluminum, Chromium, Tin				< 15 ppm
Iron, Lead				< 100 ppm
Silicon				< 10 ppm
Copper	< 30 ppm			< 40 ppm
Zinc	< 2 ppm			

Particle analysis and wearing mechanism

With total ppm, ferrous particles, LaserNet total particles and the wear classifier results, users can make informative actionable decisions by identifying oil drain points, corrosive wear and the onset of a serious abnormal machine wear mechanism.

MONITORING	TOTAL Fe PPM	FERROUS PARTICLES >20 µm	LASERNET LARGE PARTICLES >20 µm	LASERNET CLASSIFIER
	Establish constant wear rate	Dynamic equilibrium levels	Dynamic equilibrium levels	Dynamic equilibrium levels
Oil change interval	Reaches limit level	NA	NA	NA
Onset of corrossive wear	Increase in rate	No change	No change	No change
Transition into abnormal wear mode	Increase in rate	Increase	Increase	Increase – cutting/sliding/fatigue
Ongoing severe wear mechanism (breakdown shear mixed layer)	Same or decrease in rate	Increase	Increase	Increase – cutting /sliding/ fatigue
Temporary wear rate change due to increased load and speed	Increase in rate	No change	No change	No change
Onset of external contamination	No change	No change	Increase	Increase – non-metallic
3 Body abrasive mechanism iron	No change	Increase	Increase	Increase – cutting/sliding
3 Body abrasive mechanism non-ferrous (copper, aluminum)	No change	No change	Increase	Increase – cutting/sliding
Onset of rolling contact failure	**No change**	**Increase**	**Increase**	**Increase – fatigue**

Elemental Analysis

- **Wear particle by metal type**
- **Contamination ID by source**
- **Oil additive levels**

The SpectrOil 100 Series analyzes small particulate wear, lubricant additives and contaminants for trace quantities of elements dissolved or suspended as fine particles. Using the proven rotating disc electrode (RDE) technique, the SpectrOil 100 Series has become the workhorse of industrial, commercial and military oil analysis laboratories requiring rapid analysis of wear metals, contaminants and additives in lubricants.

Coolant, wash-down water and JOAP calibrations are available in addition to in-service lubricating oil and hydraulic fluid analysis.

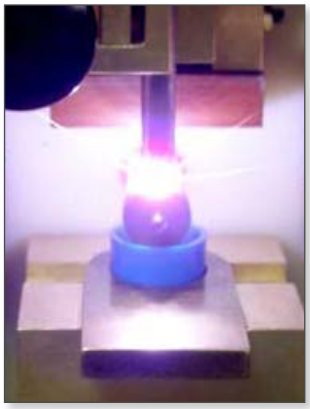
- Measures ppm levels of up to 32 elements in less than 30 seconds
- Easy to operate – no sample preparation, gases, coolants or solvents needed
- Compliant with ASTM D6595 for used oil analysis



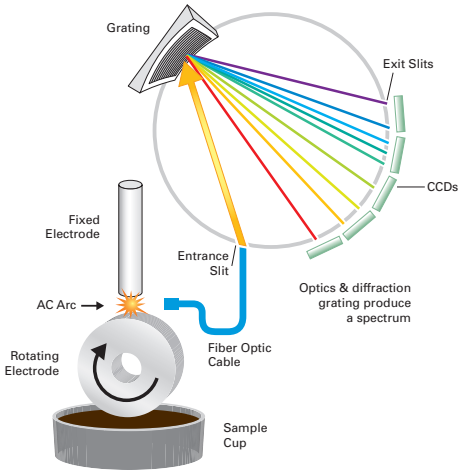
SpectrOil 100 Series instrument can be purchased separately.

On-site oil analysis provides greater insight into contaminant sources by linking elemental parameters with the probable source:

ELEMENT	Oil Chemistry – metallic additives possible sources
Sodium	Corrosion inhibitor additive, also indicates coolant leak into oil, can also be road salt, sea water, ingested dirt
Boron	Corrosion inhibitor additive, antiwear/antioxidant additive; can indicate coolant leak, grease contamination
Magnesium	Detergent/dispersive additive, can also be alloying element in steels
Calcium	Detergent/dispersant additive, alkaline reserve additive for high sulfur fueled engines, can be grease contamination,
Molybdenum	Solid/liquid antiwear additive, alloy in bearing and piston rings
Barium	Corrosion inhibitors, detergents, rust inhibitors
Zinc	Antiwear, corrosion inhibitors, anti-oxidants, alloying element for bearings, thrust washers, galvanized cases
Phosphorus	Antiwear, corrosion inhibitors, anti-oxidants additives, EP additives



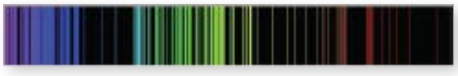
Sample consumed using RDE technology is optically analyzed with AE spectroscopy to detect elements.



SpectrOil 100 Series rotating disc electrode optical emission spectrometer schematic



Emission spectrum of hydrogen



Emission spectrum of iron

Particle Count and Ferrous Monitor

The LaserNet 200 Series provides particle counts and codes, large wear particle classification and ferrous wear monitoring.

- Particle count, size distribution and codes (ISO 4406, NAS 1638, NAVAIR 01-1A-17, SAE AS 4059, GOST, ASTM D6786, HAL, and user defined bins).
- Differentiates contaminants (silica and fibers from machine wear metal)
- Classifies wear particles, stores images, and reports particle count and size distribution for each wear type of Cutting, Sliding, Fatigue, Fibers and Nonmetallics
- Ferrous Monitor measures total ferrous content in the sample and provides Ferrous particle count and size distribution
- Widest range up to 5,000,000 particles/ml
- Test oil viscosity up to ISO320 without dilution
- Images through dark fluids containing up to 2% soot
- Error corrections for water and air bubbles

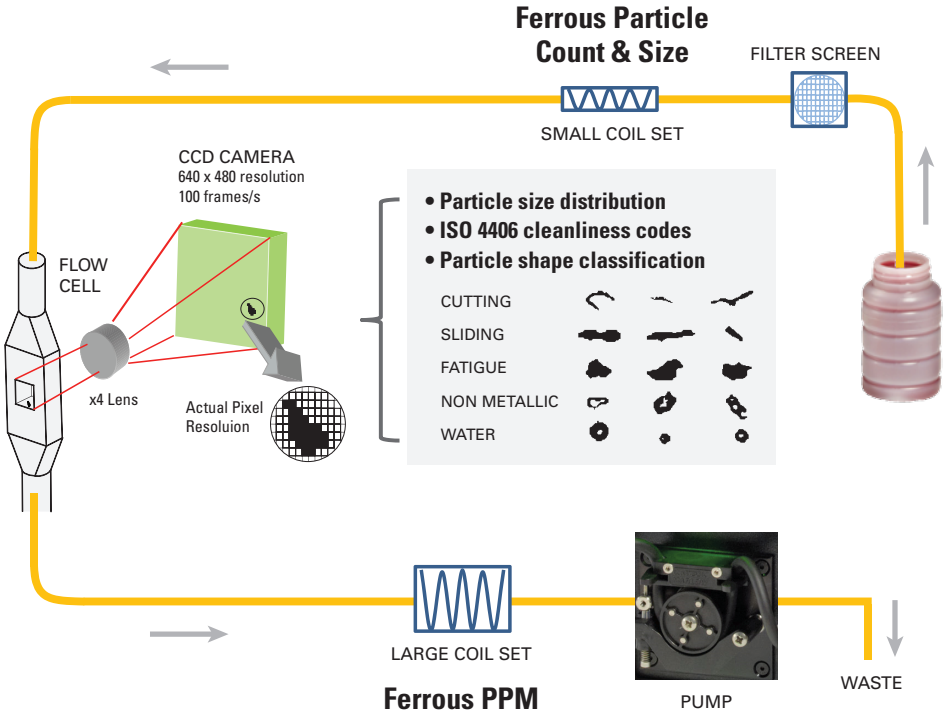
Options include an autosampler for high throughput sample processing as well as configurations without the ferrous monitor and wear classification.

› Ferrous content
› Wear particle shape

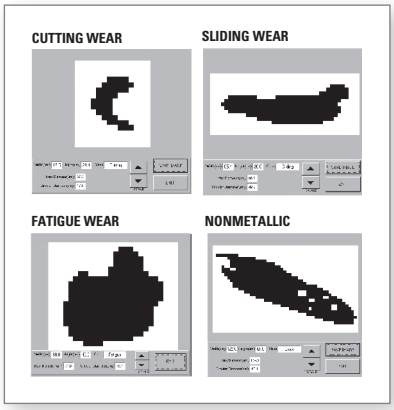
› Particle count and codes



LaserNet 200 Series instrument can be purchased separately.



LaserNet 230 flow diagram



Chemical Analysis

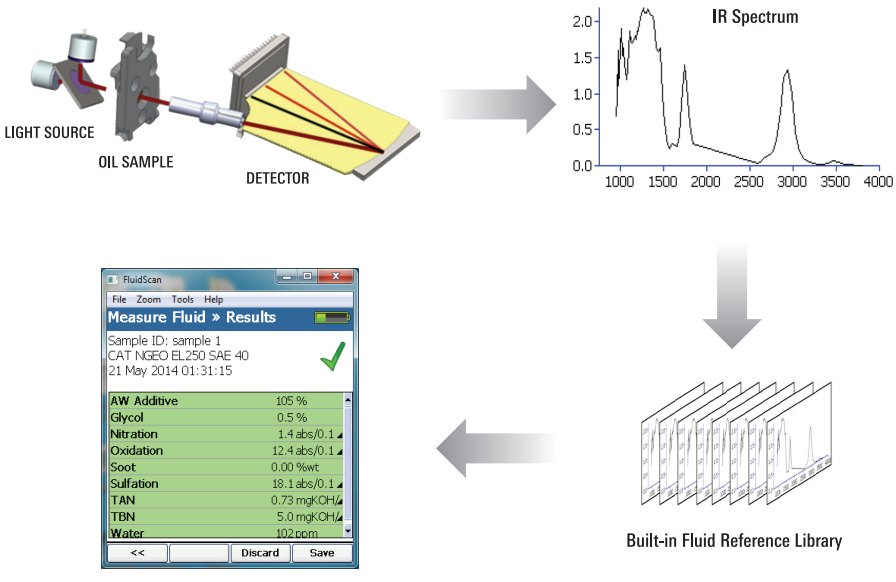
- Water
- TAN
- TBN
- Oxidation
- Nitration
- Sulfation
- Soot
- Additive depletion
- Glycol



FluidScan 1000 Series
handheld infrared spectrometer
can be purchased separately.

The FluidScan® 1000 Series oil chemistry analyzer determines when in-service oil is no longer fit for use due to oil degradation or the ingress of water or glycol. It is fast and easy to use, with just one drop of oil needed for the sample and less than one minute for test results. The analyzer includes an extensive oil library; additional oils can be added by the user.

- Compliant to ASTM D7889 "Standard Test Method for Field Determination of In-service Fluid Properties Using IR Spectroscopy"
- High correlation to TAN and TBN laboratory tests conducted with ASTM D664 and D4739
- Patented, Comprehensive Water Measurement option extends range to 6.5%. (Included with all MiniLab systems.)

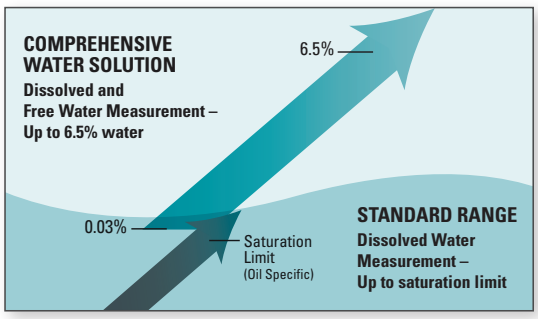


FluidScan operating principle

The oil library contains various categories of fluids. The industrial library provided with the MiniLab series includes the Comprehensive Water Solution and the Industrial Fluid Oil Library.

CATEGORY	Industrial Fluid Library
ASTM EP Gear/Hydro	✔
ASTM Petroleum Crankcase	✔
ASTM Polyol Ester	✔
BIODIESEL FEEDSTOCK	
CHILLER	✔
ENGINE	✔
ENGINE-HEAVY DUTY	
ENGINE-HFO	
ENGINE-NAT GAS	
ETHANOL IN GASOLINE	
FAME	
FAME in DIESEL	
GEAR-PRESSURE	✔
GEAR-SPLASH	✔
HEAT TRANSFER	✔
HYDRAULIC	✔
HYDRAULIC-FIRE RESISTANT	✔
SLIDEWAY	✔
TRANSMISSION	
TURBINE-AERO	✔
TURBINE-CCGT	✔
TURBINE-STEAM	✔





Water measurement range

Viscosity

The MiniVisc 3000 Series provides fast, accurate 40°C kinematic viscosity measurements for easy detection of viscosity variations caused by contamination, mix-up and oil degradation.

- Solvent free, portable, and easy to use
- Viscosity range 1-700 cSt @40°C
- Accuracy +/- 3% to NIST viscosity standards
- Fast results: ISO 15 ~10 seconds, ISO 320 ~ 3 minutes

For machinery oils, the 40°C kinematic viscosity is used as the reference value. Engine oils operate at higher temperatures than rotating machinery, so they require V100°C kinematic viscosity. The Viscosity Index of an oil is a parameter that relates the V40°C measurement value to the V100°C value. A reference Viscosity Index value can be entered in the viscometer and both the measured V40°C viscosity and the calculated V100°C viscosity values are displayed.





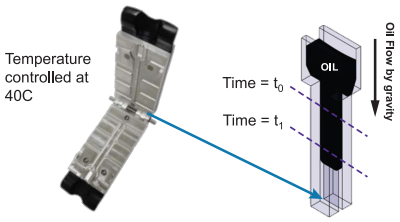
Positive displacement pipette



Open the two parallel plates for easy cleaning.



MiniVisc 3000 Series portable viscometer can be purchased separately.



MiniVisc 3000 Series kinematic viscometer schematic

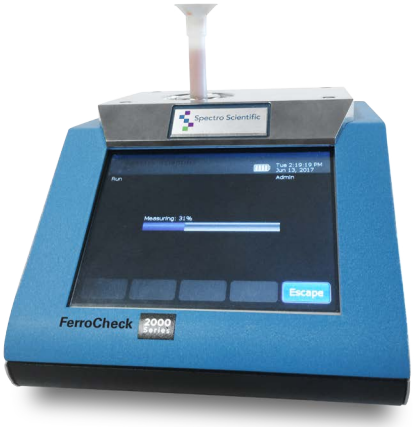
Total Ferrous

The MiniLab 33 includes the FerroCheck, a portable ferrous analyzer that measures the total ferrous content of a sample. It is easy to operate; simply insert the sample vial with fluid sample to measure.

- Small sample requirement with results in 30 seconds
- No sample preparation and no solvents required to clean
- Measurement range 0-10,000 ppm for oil, 10-150,000 ppm for grease



Grease boat and sample introduction vials



FerroCheck 2000 Series portable ferrous analyzer can be purchased separately.

Four MiniLab Options. Which One is for You?

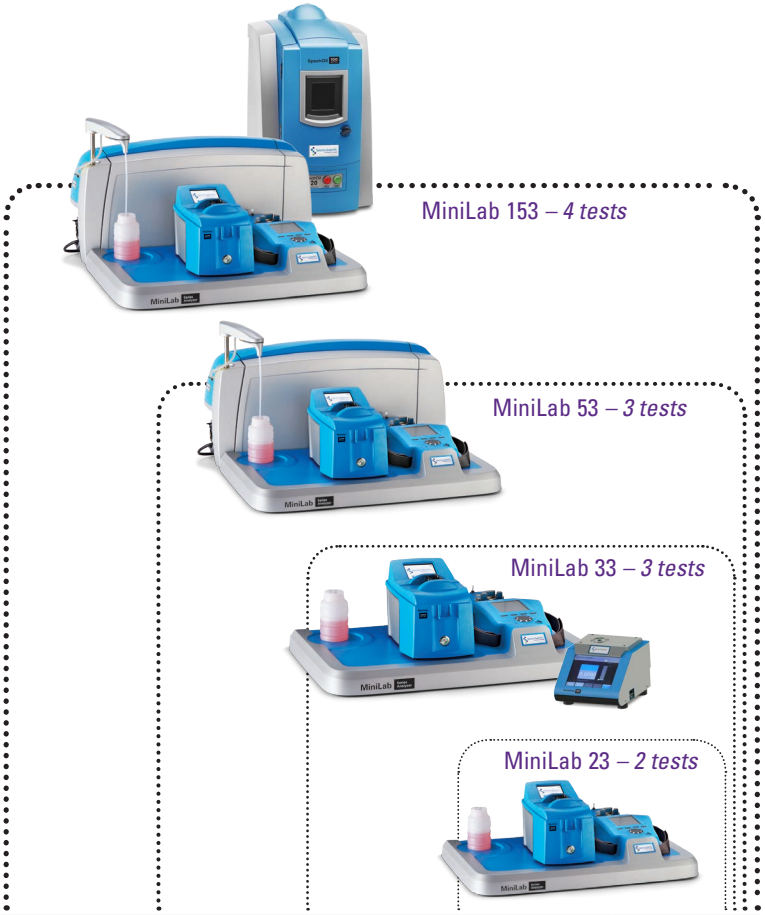
MiniLab 153 – provides a complete oil analysis report with elemental analysis, comprehensive wear particle analysis, solid and water contamination, fluid chemistry and viscosity. It is ideal for large power plants and manufacturing plants with many assets.

MiniLab 53 – provides a Trivector report with comprehensive wear particle analysis, solid and water contamination, fluid chemistry and viscosity.

MiniLab 33 – provides a basic Trivector report with total ferrous wear, fluid chemistry, water in oil and viscosity.

MiniLab 23 – provides basic oil condition information including viscosity, chemistry and water in oil.





	PARAMETER	Elemental ASTM METHOD D6595	Particle Count and Ferrous ASTM METHOD D7596	Ferrous ASTM METHOD D8120	Viscosity ASTM METHOD D8092	Chemical ASTM METHOD D7889
Contamination	Particle count and ISO codes		✔			
	Non-metallic particle count, distribution and images		✔			
	Boron, Calcium, Sodium, Lithium, and Potassium	✔				
	Total Water					✔
Chemistry	Viscosity				✔	
	Total Acid Number (TAN)					✔
	Oxidation					✔
	Total Base Number (TBN), Oxidation, Nitration, and Sulfation for engine oils					✔
	Copper, Chromium, Boron, Magnesium, Calcium, Barium, Zinc, Silicon, Sodium, Molybdenum, and Phosphorus	✔				
Wear	Wear particle images, counts and distribution		✔			
	Total Ferrous content, ppm		✔	✔		
	Ferrous particle count and size distribution		✔			
	Copper, Silver, Chromium, Titanium, Aluminum, Silicon, Magnesium, Nickel, Zinc, Iron, Manganese, Lead, Tin, Molybdenum, Cadmium, and Vanadium	✔				

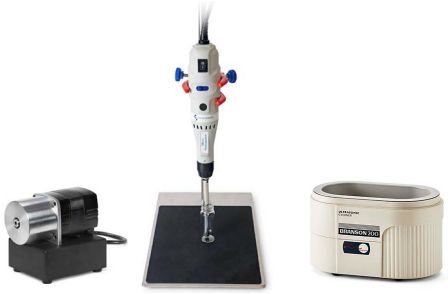
Accessories & Consumables

Sample Preparation Equipment

Sample preparation equipment such as the Homogenizer, Ultrasonic Deaerator, Electrode Sharpener and Consumables for 100 samples is included with each MiniLab 153 system.

SAMPLE PREPARATION – 3 SIMPLE STEPS

1. Sharpen electrode
2. Homogenize the sample for better water measurement
3. Ultrasonically degas the sample for particle analysis



Consumables

Spectro Scientific consumables are selected and carefully tested with all Spectro Scientific instruments to ensure consistent, repeatable results. Always use Spectro Scientific certified consumables for best results.



Validation Standards and ASTM Standards

Validation standards are supplied for all MiniLab Series instrumentation. These NIST traceable standards support internal quality programs and compare current instrument performance against factory calibration.

All instruments in the MiniLab Series have an associated ASTM Standard Test Method.



- PARTICLE COUNTER STANDARD
  LNF-509 calibration checkfluid
- SPECTROMETER STANDARDS
  CS-24 100 ppm, 900ppm, baseoil
- FERROUS PARTICLE ANALYZER
  LNF-545 Ferrous Validation Standard for Magnetometer
  – Total Ferrous Content, nominal 100 ppm
  – Large Ferrous particle count, nominal 42 µm particles
- FLUIDSCAN IR CHECK FLUID
  FL310 FluidScan CheckFluid
- VISCOSITY STANDARDS
  PV1025 Visc 30 standard
  PV1026 Visc120 standard

Accessories

A variety of accessories to support your oil analysis program are available, from drawing a sample from an oil sump to preparing it for analysis.



Solvent Filtration and Dispenser (A5051SF)



Sampling Pump (350-00030)



Wear Debris Anlaysis Kits:
115V (400-00101)
220V (400-00102)

Service Contracts and Repair

Spectro Scientific's service offerings for the MiniLab Series include:

System Installation & Training for instrument operation and routine maintenance.

Service Contracts for extended warranty and preventive maintenance.

Field Repair by certified customer service engineers on site.

In-house Instrument Calibration, Maintenance, Repair, and Upgrades performed at our facility near Boston, MA.



MiniLab Series Product Information

PART NUMBER	
800-00029	MiniLab 153 with OilView LIMS and PC, 115 VAC, 60 Hz.
800-00027	MiniLab 153, 115 VAC, 60 Hz. Requires OilView LIMS.
800-00030	MiniLab 153 with OilView LIMS and PC, 220 VAC, 50 Hz.
800-00028	MiniLab 153, 220 VAC, 50 Hz. Requires OilView LIMS.
800-00076	MiniLab 153 with OilView LIMS and PC, 240 VAC, 60 Hz.
800-00079	Minilab 153, 240 VAC,60 Hz. Requires Oilview LIMS.
800-00077	MiniLab 153 with OilView LIMS and PC, 120 VAC, 50 Hz.
800-00078	Minilab 153, 120 VAC, 50 Hz. Requires Oilview LIMS.
800-00017	MiniLab 53, 115 VAC,50/ 60 Hz. Requires OilView LIMS.
800-00018	MiniLab 53, 220 VAC, 50/60 Hz. Requires OilView LIMS.
800-00025	MiniLab 53, 115 VAC, 50/60 Hz with OilView LIMS
800-00026	MiniLab 53, 220 VAC, 50/60 Hz with OilView LIMS.
800-00059	MiniLab 33, 115 VAC, 50/60 Hz. Requires OilView LIMS.
800-00060	MiniLab 33, 220 VAC, 50/60 Hz. Requires OilView LIMS.
800-00061	MiniLab 33, 115 VAC, 50/60 Hz with OilView LIMS.
800-00062	MiniLab 33, 220 VAC, 50/60 Hz with OilView LIMS.
800-00037	MiniLab 23, 115 VAC, 50/60 Hz. Requires Oilview LIMS.
800-00038	MiniLab 23, 220 VAC, 50/60 Hz. Requires Oilview LIMS.
800-00041	MiniLab 23, 115 VAC, 50/60 Hz with Oilview LIMS.
800-00042	MiniLab 23, 220 VAC, 50/60 Hz with Oilview LIMS.

* Oilview LIMS v5.61 or higher is required for MiniLab operation.

ACCESSORIES AND CONSUMABLES	
800-00031	MiniLab 153 Standard Accessories Kit
800-00032	MiniLab 153 Consumables Kit for 500 samples
800-00019	MiniLab 53 Standard Accessories Kit
400-00088	MiniLab 53 Consumables Kit for 500 samples
800-00063	MiniLab 33 Standard Accessories Kit
800-00064	MiniLab 33 Consumables Kit for 500 samples
SA1022	MiniLab 23 Standard Accessories Kit
800-00040	MiniLab 23 Consumables Kit for 500 samples
600-00123	Minilab 153 Validation standards kit
600-00122	Minilab 53 Validation standards kit
600-00120	Minilab 33 Validation standards kit
600-00119	Minilab 23 Validation standards kit
800-00073	MiniLab 153 with Skydrol kit standard accessories
800-00072	MiniLab 53 with Skydrol kit standard accessories
LNF-905	Skydrol kit (phosphate ester fluids) for LaserNet 230 only; factory installation
FL360	All Libraries license for Fluidscan

PRODUCT INFORMATION	
Applications	Mineral and synthetic lubricants including gear, engine, hydraulic, turbine and distillate fuels
Methodology	ASTM D7596, ASTM D7889, ASTM 40831 ASTM D6595
Calibration	Factory calibrated, field calibration not required. Validation and standardization fluids supplied.

OPERATIONAL SPECIFICATIONS	
Environmental Requirements	5-40°C ambient temperature, 10-80% RH non-condensing, 2000 m maximum altitude
Sample Volume	30-50 ml, varies with viscosity
Solvents	Lamp oil, odorless kerosene, or Electron 22

USER INTERFACE SPECIFICATIONS	
Software/Operating System	Personal Computer with Windows 7 Pro, 32 or 64 bit, US English version. Quad core microprocessor speed 2.6 GHz or higher and 8 GB RAM minimum.

POWER REQUIREMENTS	
Power	MiniLab 153: 1 Phase power, 1200 W (max) MiniLab 53/33/23: 1 Phase power, 110 W (max)

MECHANICAL SPECIFICATIONS	
Dimensions (H x W x D)	MiniLab 153: 71 cm x 214 cm x 66 cm (28" x 84" x 26") MiniLab 53: 35 cm x 50 cm x 53 cm (13.8" x 19.7" x 21") Minilab 33: 14 cm x 69 cm x 48 cm (5.5 x 27" x 19") Minilab 23: 10 cm x 51 cm x 48 cm (4" x 20" x 19")
Weight	MiniLab 153: 84 kg (185 lbs) MiniLab 53: 14 kg (31 lbs) MiniLab 33: 9 kg (22 lbs) MiniLab 23: 6 kg (14 lbs)

COMPLIANCE
CE Mark-EMC directive, RoHS

ANALYTICAL RANGE AND REPEATABILITY		
Output	Analytical Range	Repeatability
Particle count and size distribution ISO codes per 4402/4406, other codes selectable	Particle count 4-100 µm	≤ 6% RSD
Ferrous particle count and size distribution	25-100 µm	≤ 5% RSD
Total Ferrous, ppm	10-2,000 ppm	≤ 5% RSD
Wear particle counts and size distribution by wear mode : fatique, sliding, cutting,non-metallic, fibers	20-100 µm	
40°C Kinematic viscosity, cSt	1-320 cSt at 40°C 320-700 cSt at 40°C	≤ 3% RSD ≤ 5% RSD
Total Acid Number (TAN), mg KOH/g	0-6 mg KOH/g	≤ 3% RSD
Total Base Number (TBN), mg KOH/g	0-70 mg KOH/g	≤ 3% RSD
Oxidation, abs/0.1 mm	5-32	≤ 3% RSD
Nitration, abs/cm	0.5-18	≤ 3% RSD
Sulfation, abs/0.1 mm	16-39	≤ 3% RSD
Water, dissolved ppm	100 ppm-saturation*	≤ 3% RSD
Water, free, ppm	0.03-6.5% (300-65,000 ppm)	≤ 25% RSD
Elemental concentration of 23 elements, ppm	Elemental analysis range and repeatability vary with element	

*Oil specific. RSD = Relative Standard Deviation.

SUPPORT RESOURCES	
SVC019	Service Contract – MiniLab 33
SVC015	Service Contract – MiniLab 53
SVC057	Service Contract – MiniLab 153

Spectro Scientific offers On- and Off-site Product Training, Field Repair, In-house Instrument Calibration, Maintenance, Repair, and Upgrades and Service Contracts. See previous page for more information about service and customer support.

To learn more about Spectro Scientific products please call 978-431-1120 or visit us online at www.spectrosci.com.

Spectro Scientific
Confidence in knowing

Spectro Scientific | One Executive Drive, Suite 101, Chelmsford, MA 01824-2563
978-431-1120 | www.spectrosci.com | sales@spectrosci.com | An ISO 9001:2008 company

Copyright © 2017 Spectro Scientific. All rights reserved. While every effort is made to assure the information in this document is accurate, Spectro Scientific does not accept liability for any errors or mistakes that may arise. Specifications are subject to change without notice.
Industrial_BRv3_2017-06-29