Spectro Scientific
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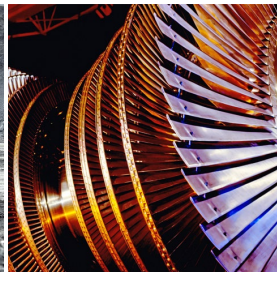
TruVu360
Insight. On-site.

Enterprise Fluid Intelligence for Predictive Maintenance








AMETEK®

A Holistic Approach to On-Site Oil Analysis

TruVu 360™ Enterprise Fluid Intelligence simplifies and streamlines the on-site oil analysis process so high-quality information and actionable intelligence lead to effective decision making.

The software closes the gap between recommendations on the oil analysis report, required maintenance actions and findings for continuous improvement. It also offers a maintenance dashboard so management has visibility into the effectiveness of the global program.

TruVu 360 Enterprise Fluid Intelligence platform delivers real benefits that meet business goals and objectives:

Speed

- Real-time reporting enables immediate decision making
- Rapid feedback for continuous improvement

Quality

- Highest quality information from freshly collected samples
- Simple process with fewer hand offs ensure higher quality data
- Lab-quality results on-site without the complexity of a traditional lab

Simplicity

- Intuitive interface with built-in intelligence
- Simple flow minimizes human error

Intelligence

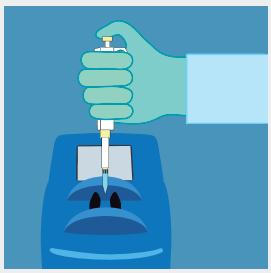
- Closed loop feedback improves diagnostic accuracy over time
- Maintenance dashboard for management views of cost savings and program key performance indicators (KPIs)

TruVu360 Insight. On-site.

The TruVu 360™ platform manages process, information flow and a maintenance dashboard.

TruVu 360 Process Flow

COLLECT A REPRESENTATIVE OIL SAMPLE FROM ASSET



ON-SITE TESTS WITH MINILAB & TRUVU 360 DEVICE CONSOLE (TDC)

Three versions are offered to meet the needs of a company's size and policies

TruVu 360 Versions	BASIC	PRO	CLOUD
Installation	Local PC	Networked PC/ Server	Hosted Cloud Server
User(s) supported	Single	Multiple	Multiple
Site(s) supported	Single	Single	Multiple
Email notification	NA	Yes	Yes

DIAGNOSTICS AND RECOMMENDATIONS WITH TRIVECTOR

ACTION & CLOSED LOOP FEEDBACK

ARCHIVE FOR FUTURE REVIEW

Achieve More with Global Access to Local Intelligence

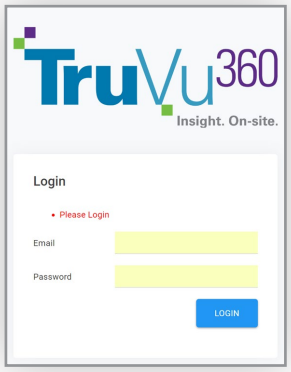
TruVu 360 Enterprise Fluid Intelligence addresses the need for standardizing workflows on a global scale and sharing data and intelligence across the enterprise.

- One, standard on-site oil analysis process
- High-quality, actionable information applied locally to improve productivity and reduce costs
- Maintenance dashboard accessible globally by users and management for continuous improvement

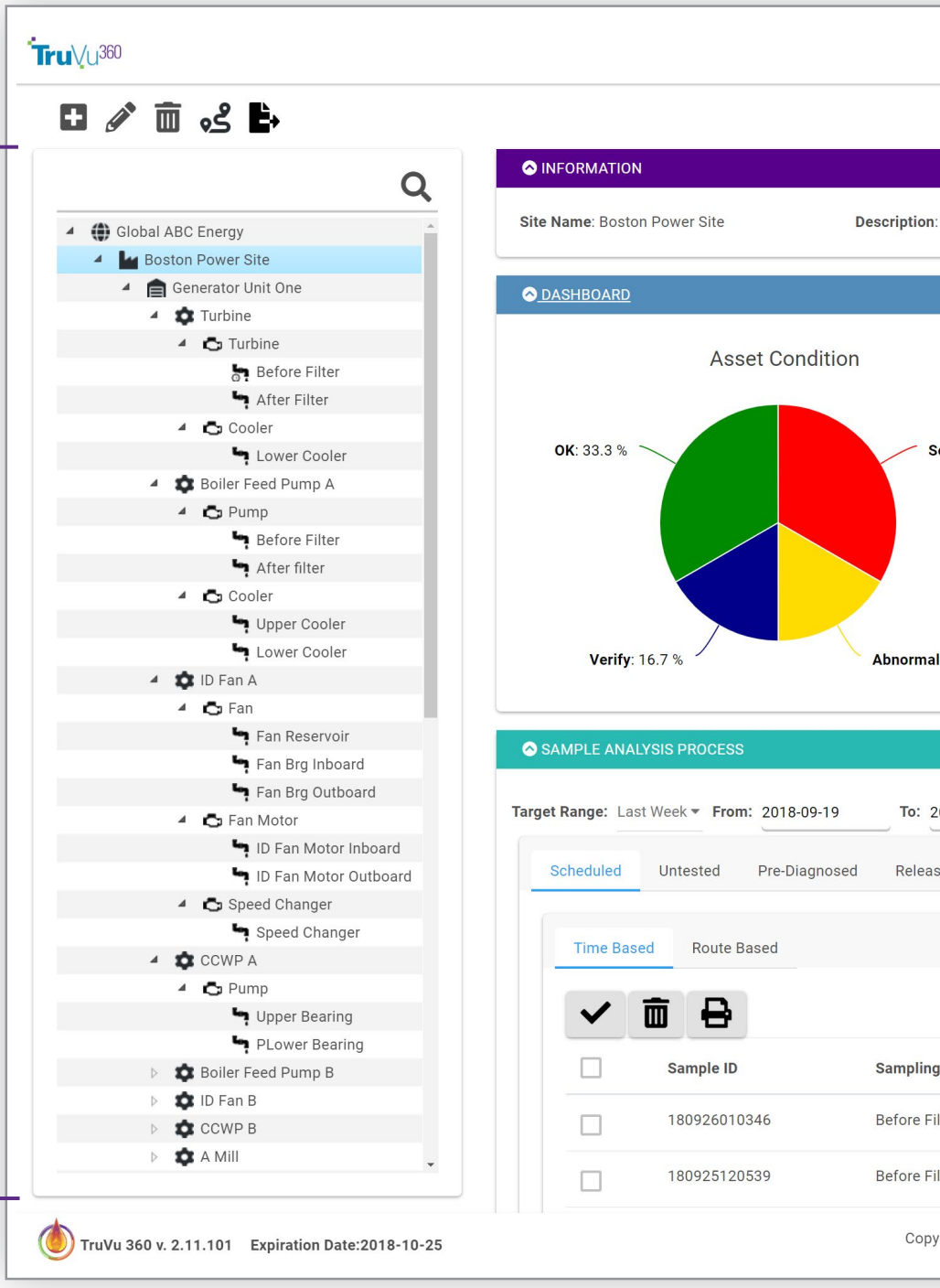
A True View of Process, Information and Intelligence

ASSET & TOOL BAR

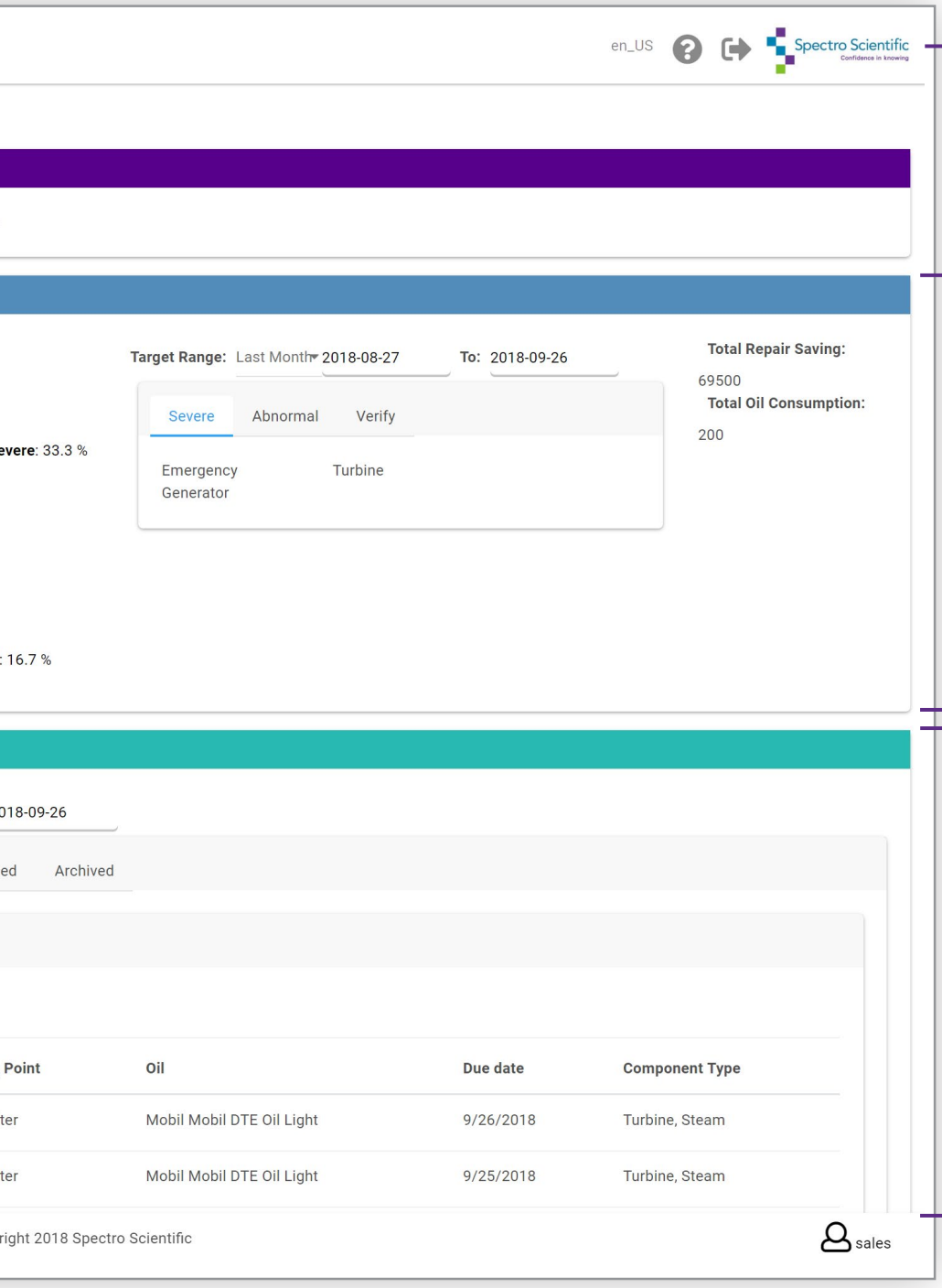
- Create asset database with provided templates of component types
- Customize your own or import existing asset structure
- Assign pre-configured alarm limits that can be adjusted at the component level based upon operating history.
- Assess alarm trends to refine alarm limits.



TruVu 360 login screen



TruVu 360 Enterprise cloud software



NAVIGATION

DASHBOARD

Dashboards bring visibility of lubricant management and savings at the asset, plant and corporate level:

- Oil analysis results by category
- Total repair savings
- Total oil consumption

SAMPLE ANALYSIS PROCESS

- Track samples that are planned, in process and tested.
- Review results and software-generated observations and recommendations.
- Add additional notes and observations before sample report is released.

A Simple Path from Data to Intelligence

Intuitive TriVector™

Representation of oil analysis diagnostics.

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

- *Is the machine healthy?*
- *Can I predict when the machinery will fail?*
- *Is it the right oil?*
- *Is the oil fit for use?*

User-configurable Diagnostic Sets

Open architecture Diagnostic Sets allows user to easily customize rules for continuous improvement.

- Factory alarm limit tables for common components, customizable for each asset.
- Software generated alarm codes, diagnostics and recommended actions that can be adapted to user requirements.

ADAPTIVE RULES ENGINE (BETA) - DIAGNOSTIC STATEMENTS

Turbine, Steam

TriVector	Parameter	Diagnostic
Wear	Iron	Suspect source to be wear of shaft, reduction gear, bearings, piping, or structural components.
Wear	Lead	Suspect source to be wear of bearings, piping, or structural components.
Wear	Copper	Suspect source to be wear o
Wear	Tin	Suspect source to be wear o
Wear	Total Ferrous	Suspect source to be wear o
Wear	Large Iron	Suspect source to be wear o
Wear	Fe Wear Severity Index	Suspect source to be wear o
Contamination	Boron	Suspect source to be contan
Contamination	Silicon	Suspect source to be contan
Contamination	Water, ppm	Suspect source to be water i
Contamination	ISO 4406 Code (>4µm)	Suspect source of particulat Secondary sources include fi
Contamination	ISO 4406 Code (>6µm)	Suspect source of particulat Secondary sources include fi
Contamination	ISO 4406 Code (>14µm)	Suspect source of particulat Secondary sources include fi
Chemistry	Calcium	Suspect contamination from
Chemistry	Phosphorus	Suspect contamination from system.
Chemistry	Zinc	Suspect contamination from
Chemistry	TAN	Suspect TAN increase due to localized hot spots.
Chemistry	Oxidation	Suspect oxidation rise due to
Chemistry	Visc 40	Oil may be contaminated, se

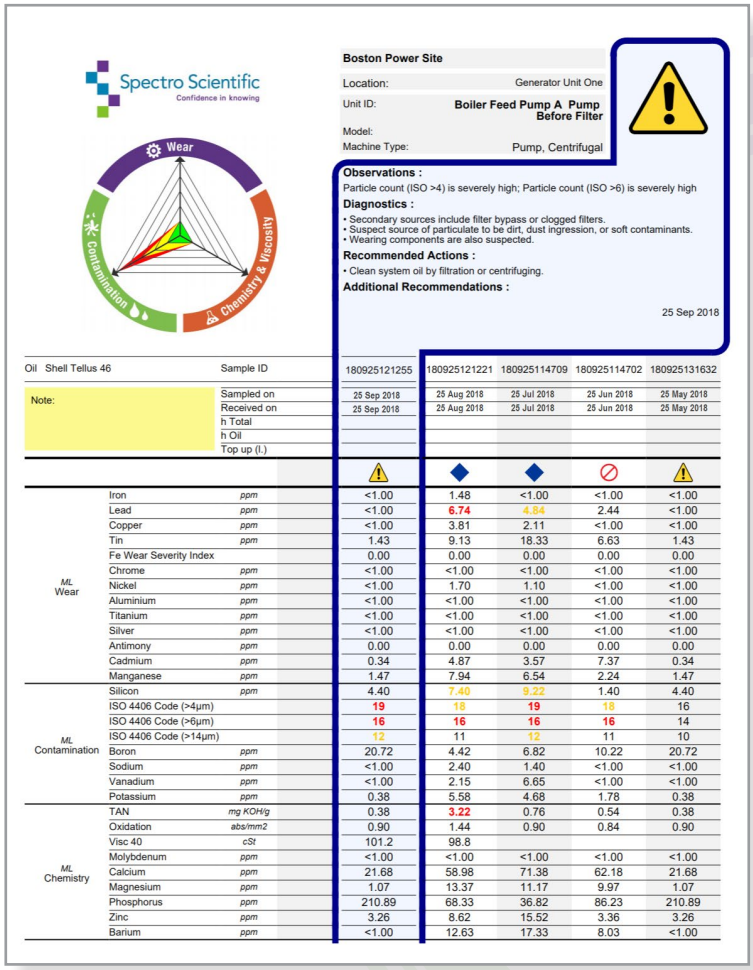
TruVu 360 limit table grouped by Trivector parameters

ADAPTIVE RULE ENGINE (BETA)

Wear | Contamination | Chemistry

Turbine, Steam

Parameter	Limit Type	Abnormal	Severe	Reference Value	Maintenance Actions (Abnormal)	Maintenance Actions (Severe)
Iron	Absolute	5	10		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Lead	Absolute	3	5		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Copper	Absolute	2	5		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Tin	Absolute	5	10		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Total Ferrous	Absolute	10	20		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Large Iron	Absolute	0.1	0.2		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Fe Wear Severity Index	Absolute	1	4		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Boron	Absolute	15	20		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Silicon	Absolute	5	10		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Water, ppm	Absolute	100	200		• Monitor. Resample at half of normal sampling frequency. Check integrity of seals, breather, or cooler system coupling.	• Install a water removal system (vacuum dehydration) system. Check integrity of seals, breather, or cooler system coupling.
ISO 4406 Code (>4µm)	Absolute	17	18		• Monitor. Resample at half of normal sampling frequency.	• Clean system oil by filtration or centrifuging.
ISO 4406 Code (>6µm)	Absolute	14	15		• Monitor. Resample at half of normal sampling frequency.	• Clean system oil by filtration or centrifuging.
ISO 4406 Code (>14µm)	Absolute	11	12		• Monitor. Resample at half of normal sampling frequency.	• Clean system oil by filtration or centrifuging.
Calcium	Absolute	15	20		• Feed and bleed reservoir with correct lubricant.	• Change oil with approved lubricant. Check seal integrity.
Phosphorus	Absolute	100	200		• Monitor. Resample at half of normal sampling frequency.	• Change oil with approved lubricant. Check seal integrity.
Zinc	Absolute	10	25		• Monitor. Consider feed and bleed. Resample at half of normal	• Investigate equipment urgently.



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Boston Power Site

Location: Generator Unit One
Unit ID: Boiler Feed Pump A Pump Before Filter
Model:
Machine Type: Pump, Centrifugal

Observations :
Particle count (ISO >4) is severely high; Particle count (ISO >6) is severely high

Diagnostics :
• Secondary sources include filter bypass or clogged filters.
• Suspect source of particulate to be dirt, dust ingression, or soft contaminants.
• Wearing components are also suspected.

Recommended Actions :
• Clean system oil by filtration or centrifuging.

Additional Recommendations :

25 Sep 2018

Oil Shell Tellus 46 | Sample ID | 180925121255 | 180925121221 | 180925114709 | 180925114702 | 180925131632

Note:

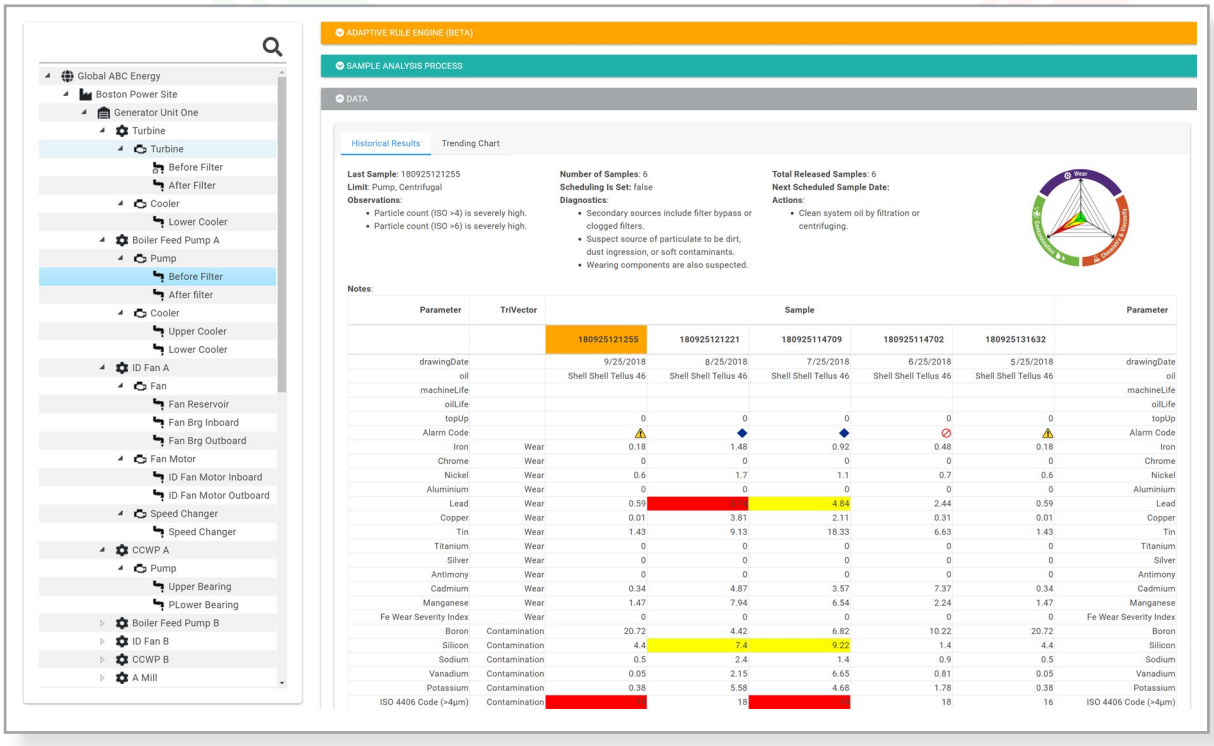
	Sampled on		25 Sep 2018	25 Aug 2018	25 Jul 2018	25 Jun 2018	25 May 2018
	Received on		25 Sep 2018	25 Aug 2018	25 Jul 2018	25 Jun 2018	25 May 2018
	h Total						
	h Oil						
	Top up (l.)						
			⚠	◆	◆	⊘	⚠
ML Wear	Iron	ppm	<1.00	1.48	<1.00	<1.00	<1.00
	Lead	ppm	<1.00	6.74	4.84	2.44	<1.00
	Copper	ppm	<1.00	3.81	2.11	<1.00	<1.00
	Tin	ppm	1.43	9.13	18.33	6.63	1.43
	Fe Wear Severity Index		0.00	0.00	0.00	0.00	0.00
	Chrome	ppm	<1.00	<1.00	<1.00	<1.00	<1.00
	Nickel	ppm	<1.00	1.70	1.10	<1.00	<1.00
	Aluminium	ppm	<1.00	<1.00	<1.00	<1.00	<1.00
	Titanium	ppm	<1.00	<1.00	<1.00	<1.00	<1.00
	Silver	ppm	<1.00	<1.00	<1.00	<1.00	<1.00
	Antimony	ppm	0.00	0.00	0.00	0.00	0.00
	Cadmium	ppm	0.34	4.87	3.57	7.37	0.34
	Manganese	ppm	1.47	7.94	6.54	2.24	1.47
ML Contamination	Silicon	ppm	4.40	7.40	9.22	1.40	4.40
	ISO 4406 Code (>4µm)		19	18	19	18	16
	ISO 4406 Code (>6µm)		16	16	16	16	14
	ISO 4406 Code (>14µm)		12	11	12	11	10
	Boron	ppm	20.72	4.42	6.82	10.22	20.72
	Sodium	ppm	<1.00	2.40	1.40	<1.00	<1.00
	Vanadium	ppm	<1.00	2.15	6.65	<1.00	<1.00
	Potassium	ppm	0.38	5.58	4.68	1.78	0.38
ML Chemistry	TAN	mg KOH/g	0.38	3.22	0.76	0.54	0.38
	Oxidation	abs/mm2	0.90	1.44	0.90	0.84	0.90
	Visc 40	cSt	101.2	98.8			
	Molybdenum	ppm	<1.00	<1.00	<1.00	<1.00	<1.00
	Calcium	ppm	21.68	58.98	71.38	62.18	21.68
	Magnesium	ppm	1.07	13.37	11.17	9.97	1.07
	Phosphorus	ppm	210.89	68.33	36.82	86.23	210.89
	Zinc	ppm	3.26	8.62	15.52	3.36	3.26
	Barium	ppm	<1.00	12.63	17.33	8.03	<1.00

TruVu 360 report

Includes TriVector chart, historical data color coded for parameters exceeding alarm limits, single parameter trend charts for up to (39) parameters, multi-parameter trend graphs by Trivector category, wear images, diagnostics and recommendations.

TruVu 360 trending chart and historical sample data

TriVector chart, diagnostics and recommendations for the last sample is also shown. Interactive display of multiple parameters trend.



Lab Quality On-Site Without a Conventional Lab

MiniLab Series
for Industrial and Power Plants

ELEMENTAL
CHEMISTRY & WATER
VISCOSITY
FERROUS
PARTICLE COUNT

MiniLab EL Series
for Racing, Railway, Aerospace and Gen Set

ELEMENTAL
CHEMISTRY & WATER
VISCOSITY
TOTAL FERROUS
FUEL DILUTION

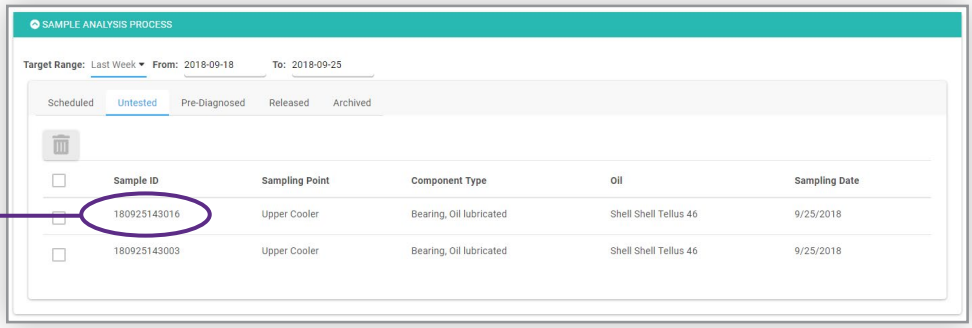
TruVu 360 solutions address common hurdles in implementing on-site oil analysis.

Conventional On-Site Lab	TruVu 360 Solutions
High capital investment	TruVu 360 enabled MiniLab costs about 1/3 of a full size laboratory
Large space and special facilities needed	Tabletop with no special facility requirements
Uses Hazmat chemicals	No hazardous chemicals and reagents, small sample volume, minimum waste stream
Lubricant experience required	TriVector report, built-in oil scheduling, easy-to-use interface, default component and alarm limit templates, open rule engine for quick startup and continuous improvement
Start up time can take months	TruVu 360 based MiniLab start up is less than one week

MiniLab tests are all compliant to ASTM standards

TEST	METHOD	TITLE
Elemental Analysis	D6595	Standard Test Method for Determination of Wear Metals and Contaminants in Used Lubricating Oils or Used Hydraulic Fluids by Rotating Disc Electrode Atomic Emission Spectrometry
Particle Analysis	D7596	Standard Test Method for Automatic Particle Counting and Particle Shape Classification of Oils Using a Direct Imaging Integrated Tester
Chemical and Water Analyses	D7889	Standard Test Method for Field Determination of In-Service Fluid Properties Using IR Spectroscopy
Fuel Dilution	D8004	Standard Test Method for Fuel Dilution of In-Service Lubricants Using Surface Acoustic Wave Sensing
Viscosity	D8092	Standard Test Method for Field Determination of Kinematic Viscosity Using a Microchannel Viscometer
Total Ferrous	D8120	Standard Test Method for Ferrous Debris Quantification

TruVu 360 Device Console Simplifies On-Site Testing



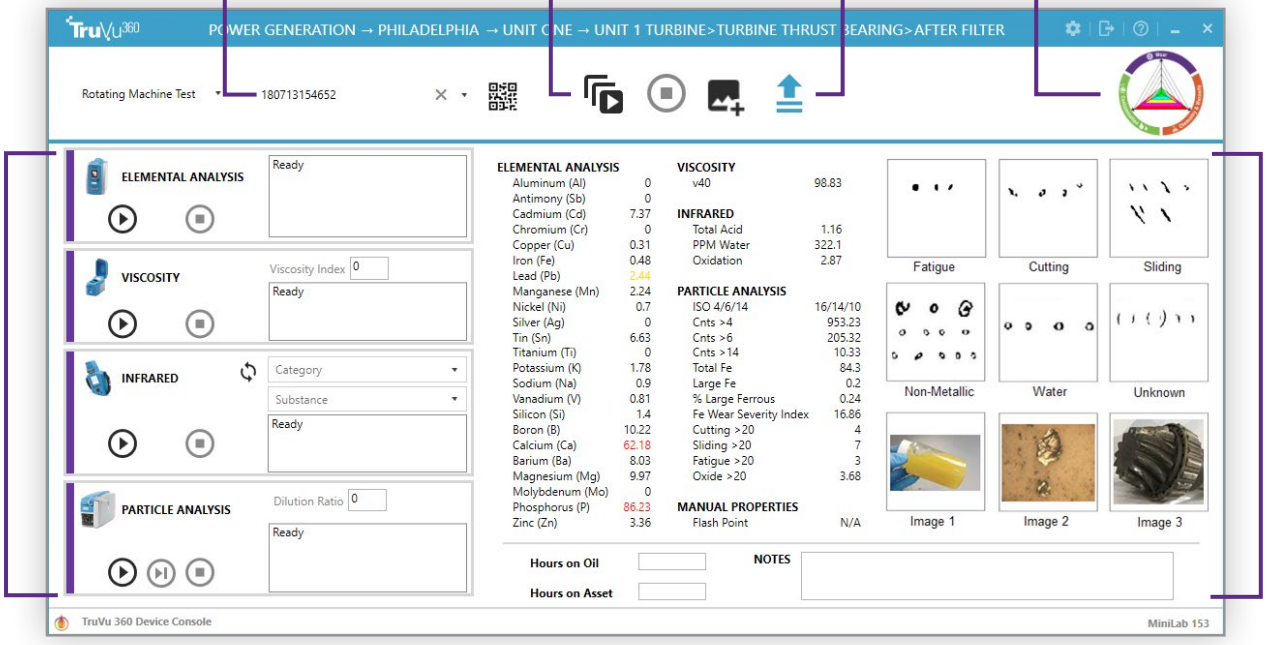
Sample list from TruVu 360 cloud software

1 Download sample list and component types

2 Test

3 Upload test results

4 Trivector chart from rules engine



TruVu 360 Device Console

Instrument Control

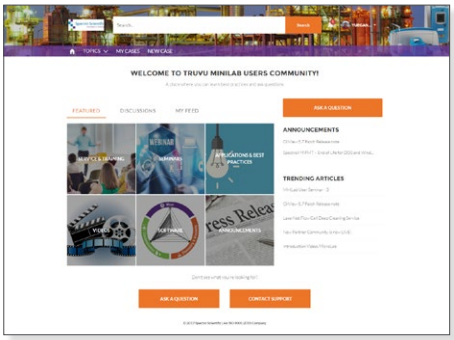
Results Display

TruVu 360 Product Information

TruVu 360 BASIC/PRO	
750-00155	TruVu 360 Basic software, on DVD & USB media
750-00138	TruVu 360 Pro software, on DVD & USB media
100-00886	Additional TruVu 360 Pro site user license, perpetual
TruVu 360 CLOUD	
100-00795	TruVu 360 hosting service, annual fee per site
100-00741	TruVu 360 site user license, 1 year, 1 user
100-00744	TruVu 360 Enterprise user license, 1 year, 1 user
PC REQUIREMENTS	
Personal Computer	Windows 7 or Windows 10 Pro, 32 or 64 bit, US English version. Quad core microprocessor speed of 2.6 GHz or higher and 8 GB RAM minimum.
TruVu 360 WORKSTATION	
800-00171	Windows 10 Pro touchscreen workstation, with software installed
TruVu 360 SERVICE OFFERINGS	
SpectroCare	SpectroCare annual contract
SVC089	TruVu 360 Onboarding – MiniLab. Assistance for initial set-up includes configuring asset tree and reference oils, importing asset trees.
SVC092	OilView to TruVu 360 data migration service
SVC130	Oil Analysis Fundamentals online course
EDC303	Online live training, 3 hours

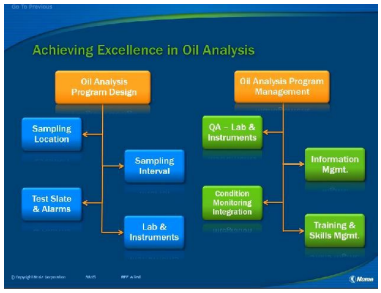
TruVu 360 USER COMMUNITY

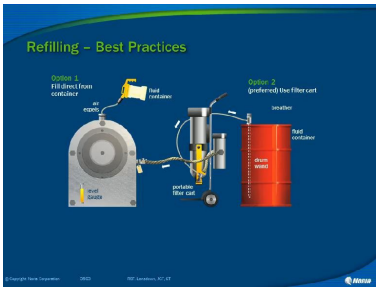
Continuous education is important for a successful on-site lubricant program. With ever growing articles, videos, and structured learning modules, TruVu 360 User Community is a digital community for users to share, communicate and learn the best practices of doing oil analysis on site.



OIL ANALYSIS FUNDAMENTALS ONLINE COURSE

The Oil Analysis Fundamentals online course provides comprehensive information regarding lubricant analysis and its critical role in increasing machinery life and uptime. The course is designed to assist reliability professionals in defining oil sample frequencies, proper sampling methodologies and best-practices in equipment retrofitting.





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