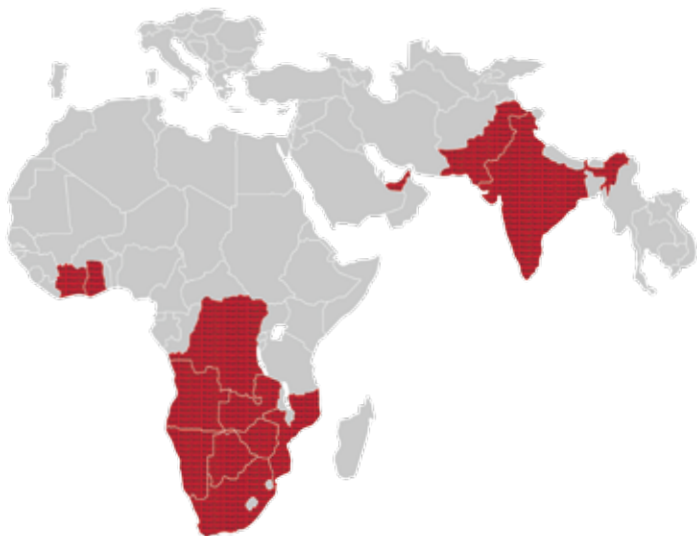


# WEAR<sup>®</sup> CHECK

Condition Monitoring Specialists



Company Profile



**WearCheck** serves the earthmoving, industrial, shipping, aircraft and electrical industries through the scientific analysis of used oil from mechanical and electrical systems.

**WearCheck's** reach is extensive, with offices and laboratories throughout RSA in Bloemfontein, Eastern Cape, Gauteng, KwaZulu-Natal, Middelburg, Northern Cape, Rustenburg, and Western Cape.

We have international locations in the DRC, Dubai, Ghana, India, Mozambique, Namibia, Zambia, and Zimbabwe. Additionally, we have agents in Botswana, Lesotho, Mauritius, Swaziland, Pakistan, and Uganda.

We have **ISO 9001** and **ISO 14001** certification and **ISO/IEC 17025** accreditation.





## Contents

- 01** WearCheck
- 02** Why WearCheck?
- 03** Our Services
- 04** Oil Analysis
- 07** Reliability Solutions
- 10** Advanced Field Services
- 13** Fuel Analysis – Diesel & Petrol
- 15** Turbine Oil Analysis
- 18** Transformer Oil Analysis
- 22** Gas Engine Oil Analysis
- 25** Wind Turbine Oil Analysis
- 28** Heat Transfer Oil Analysis
- 30** Industrial Oil Analysis
- 32** Marine Oil Analysis
- 34** Coolant Analysis
- 36** Water Analysis
- 40** Grease Analysis
- 42** Aircraft Oil Analysis
- 44** On-Site Laboratories
- 46** Hydrocarbon Management
- 48** Filtration
- 51** Reporting
- 54** Training
- 56** Contact Details

# WearCheck

---

## History

WearCheck was founded in 1976 by Gary Brown and Lesley and Wally Crawford, in Durban, South Africa.

The tests carried out consisted of viscosity, six elements, water, fuel, sludge and debris analysis with no automation. The company employed 10 people and processed less than 500 samples per month.

## Today

WearCheck is a member of the International WearCheck Group (IWCG) and is the pre-eminent oil condition monitoring service on the African continent, processing in excess of 750 000 samples per annum. The IWCG is an association of independent laboratories spanning the globe, dedicated to oil and wear particle analysis. WearCheck's relationship with IWCG allows for the ongoing exchange of technical information and the ability to offer a worldwide service.

WearCheck has evolved into an all-in-one reliability solutions hub with the creation of a full reliability solutions division and the addition of a complete transformer health monitoring division. A team of highly-skilled condition monitoring experts are located across the country. Reliability Solutions analysts and technicians conduct specialist services and other non-destructive condition monitoring techniques including vibration analysis, laser alignment, thermography and aerial drone inspections.

At WearCheck, we're proud to have over 45 years' predictive maintenance experience across a wide range of industry sectors covering more than 2 000 customers. We understand that every single sample is equally important and we strive to go the extra mile for every one of our customers.

WearCheck's expansive service offering also includes water analysis through our newly established water division, which analyses the quality of wastewater, groundwater and surface water across a range of industries. From drinking water to factory effluent. We are also able to test Adblue according to the requirements set out in ISO 22241-2.

We pride ourselves on exceptionally low staff turnover, with many employees remaining with the company for 10, 20 and even 35 or 40 years. The long-term staff loyalty leads to exceptional customer and product knowledge which translates into excellent customer service.



# Why WearCheck?

---

## Complete predictive maintenance solutions

WearCheck's vast range of products and services has evolved into an all-in-one reliability services hub, which aims to address every proactive maintenance requirement – including the analysis of oils, fuels, coolants, greases, filters and transformer oils, as well as vibration monitoring, thermography and allied services.

Condition monitoring is our core function – we do not sell machinery or oil, but rather focus on keeping machinery operating in peak condition through a managed predictive maintenance programme.

## Solid infrastructure

With a presence in nine countries, WearCheck is one of the largest condition monitoring operations in the world, and our expansion into areas with a high demand for oil analysis translates into increased accessibility to our services. The WearCheck network currently incorporates 22 branches and 16 laboratories (10 of which are outside of South Africa), and employs over 200 people – all of whom are dedicated to customer service excellence.

## State-of-the-art lab equipment

Under the expert guidance of a team of highly-qualified, experienced chemists, WearCheck's laboratory instruments are constantly monitored to ensure they are operating according to original specifications to minimise deviations. Laboratory equipment is regularly replaced to remain at the cutting edge of available technology internationally. One of the benefits of operating many laboratories is that samples can be processed in any one of our other laboratories seamlessly - the duplicate instruments in each laboratory serve as back-up when necessary, ensuring that downtime is never experienced.

## Technical support and on-site sampling

WearCheck's dedicated technical support and sampling teams are available as an added value service to ensure that you receive a flawless sampling and analysis report. A trouble-shooting service is available to assess and evaluate problems on-site.

## Product knowledge

Over time, WearCheck's team of experienced diagnosticians have amassed a database of over 10 million samples. This knowledge base is a source of pride for WearCheck, and forms the basis of a library of historical data trends across many makes, models, types and brands of equipment and is an invaluable reference for trend analyses. The data is also used extensively in training, both in-house and for customer courses.

## Original equipment manufacturer (OEM) relationships

WearCheck enjoys solid, long-term business relationships with major OEMs and leading lubricant suppliers. However, WearCheck is an independent oil analysis and condition monitoring service provider and we treat the analysis information, product knowledge and intellectual capital of all our customers with integrity and confidentiality.

## Universally-supported software

WearCheck is committed to keeping abreast of the very latest technology. As such, a high-tech reporting system has been developed, which gives customers the flexibility to track samples and gather results anywhere in the world. Sample reports are easily accessed by SMS, online or via the Mobile App. With critical samples, this real-time service is often the difference between the prevention of a failure and an actual failure, thus avoiding the loss of valuable time and money.

## Diagnosis

One of WearCheck's most valuable assets is its team of highly-qualified diagnosticians, who collectively have over 165 years of experience in the industry, and are ICML (International Council for Machinery Lubrication) certified. It is this knowledge and experience which translates laboratory results into accurate reports, which save machinery and prevent down time, and hence save customers money.

# Our Services

---

Oil analysis is as important for maintenance engineering as blood testing is for medicine. It is the scientific analysis of all types of lubricants and transformer oils, coolants, greases and filters and is an established method for predictive and preventive maintenance. Preventive maintenance programmes are essential for optimising operational efficiency and performance of mechanical and electrical systems.

Using WearCheck's services for predictive and preventive maintenance offers many benefits, including competitive pricing and short turnaround time. Analyses are carried out at state-of-the-art, custom-built, automated laboratories with interpretation and reports being completed by highly-qualified staff.

## The company's testing capabilities:

- Viscosity
- Density
- Distillation
- Flashpoint
- Water (by Karl Fischer)
- Appearance/colour
- Wear metals
- Particle contamination
- Dissolved gases
- Total acid and base numbers
- Furanics
- Dielectric strength
- PCB analysis
- RULER test
- Copper and silver corrosion
- Thermography

Continued investment in new technology has ensured that all equipment in WearCheck's laboratories is state-of-the-art, matching or surpassing our local and international counterparts. The ever-increasing range of advanced equipment in these custom-built laboratories include:

- Inductively-coupled plasma spectrometers
- Fourier transform infra-red spectrometers
- HIAC, PAMAS (GmbH) and LaserNet Fines particle counters
- SL Houillon viscometers
- Gas chromatographs
- Rotary particle depositors

- Particle quantifiers
- Microscopes
- Image-processing systems
- Distillation and flashpoint apparatus
- High performance liquid chromatography systems
- Karl Fischer titrators
- Dielectric strength testers
- Digital titrators

A high degree of automation in the laboratories ensures reliability of results and has virtually eliminated time-consuming paper work, reducing the possibility of errors.

## Other services

- Telephonic and on-site support
- Advice, including in-depth investigations and troubleshooting by our highly-qualified diagnosticians
- Suppliers of a wide variety of different sample kits and accessories such as sampling valves and extraction pumps
- Technical publications and conferences
- A comprehensive training programme, offered both on-site and at WearCheck's offices
- WearCheck Online is a web-based service which allows customers to receive their WearCheck results on the Internet and to manage their oil analysis programme from their own computer
- Reports are communicated either by e-mail, fax, SMS, telephone, by post or via our Mobile App
- Several options are available to speed up the delivery of samples to the laboratory and more than 90% of all oil samples are processed within 24 hours of the sample reaching the laboratory
- On-site sampling and sample collections.

# OIL ANALYSIS



# Oil Analysis

---

Oil analysis is a predictive maintenance tool in that it can reduce the severity of machine failures and allows maintenance activities to be scheduled. It is also a proactive maintenance technique which permits the reduction of component failure rates and operating costs.

The concept of analysing an oil sample from a machine or component is similar to that of taking a blood sample from a human body – the results determine the health status of the unit. WearCheck's experienced diagnostic team then recommends how to rectify any abnormal findings.

WearCheck's programme analyses for wear, contamination levels and oil condition in any oil-wetted component or oil filter found in equipment used in a wide spectrum of industries.

## The programme is simple

The customer purchases a WearCheck oil sampling kit, takes the oil sample and returns it to the nearest WearCheck depot.

WearCheck laboratory staff analyse the sample, the results are interpreted and a report is generated for the customer.

## The process

A representative sample of oil from a lubricated component undergoes scientific tests – both chemical and physical – in a laboratory, and the results are interpreted by a team of experienced diagnosticians.

The diagnosis of the used oil analysis serves three purposes:

1. To monitor the health of the oil
2. To monitor the health of the machinery being lubricated by the oil
3. To measure levels of contamination

## Reports

Reports contain the analytical results, an interpretation of the results, recommendations on machine and oil conditions, and various checklists from our highly-qualified and experienced diagnostics team. Reports are available in a range of formats, including print, fax, SMS, email as well as via WearCheck's Mobile App and WearCheck Online – a web-based system which enables customers to create charts and graphs to track the test results.

## Laboratory Tests

The exact tests carried out on a sample are determined by the type of machine, the component and the type of oil.

The tests are designed to measure applicable combinations of the following:

- Wear metals
- Contaminants: dirt, water, fuel, soot, coolant
- Additives
- Cleanliness rating
- Viscosity at 40° and 100°C
- Acid level
- Water, in parts per million, by Karl Fisher titration
- Total base number (TBN)
- Total acid number (TAN)
- Analytical ferrography
- Oil filter analysis





**Automotive**

For use on mobile equipment such as earthmoving machines, trucks, buses, light vehicles and generators.



**Mining**

For use on all components of mining equipment, including drills, roof bolters, continuous miners and shuttle cars. WearCheck offers a specialised underground sampling service, where trained technicians take samples from mining machinery on-site, which they access using a specially-modified vehicle.



**Electrical**

Analysis is performed on oil samples from components used in the generation, storage and transportation of electricity, such as transformers, tap changers and switch gears.



**Industrial**

For use on industrial gearboxes, hydraulics, compressors, pumps, turbines, heat transfer fluids, bearing compartments, air conditioning, recirculation and refrigeration systems.



**Marine**

For use on engines, generators, hydraulics, gearboxes and other on-board equipment.



**Aircraft**

Various kits are available for piston and turbine engines as well as hydraulic systems and helicopter rotor gearboxes.

**The ultimate goal of oil analysis is to reduce operating costs and to save money.**

So, how does it do this?

- Detection of abnormal wear
- Detection of oil degradation
- Detection of oil contamination
- Detection of impending failures
- Verification of the oil in use
- Optimising service intervals
- Avoiding unnecessary overhauls
- Avoiding loss of production
- Reliable extension of oil drain intervals

By reducing unscheduled downtime, oil analysis increases the availability of machinery, improving productivity.

# RELIABILITY SOLUTIONS



# Reliability Solutions

---

The addition of a whole new dimension to traditional predictive maintenance services has transformed WearCheck into a complete one-stop condition monitoring destination, offering a highly-sophisticated world-class range of tests over and above the original oil and fuel analysis services.

The Reliability Services division conducts scientific vibration and thermography analysis and a host of related test methods such as structural resonance, ultrasonic services and more - highly specialised technology that helps boost the lifespan of machinery and keep it operating at optimum levels.

The comprehensive package of maintenance options now presents a complete reliability solution for the mining, earthmoving, industrial, transport, shipping, aviation and electrical industries.

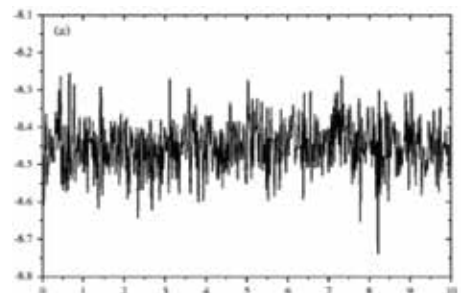
## Plant Asset Optimisation

Condition monitoring forms the basis of a well-established condition based maintenance programme, forming an integral part of plant asset optimisation. This not only increases profit, but plant availability too, by reducing unplanned downtime and catastrophic failure of rotating components on plant assets. It is therefore highly beneficial to know the health and the condition of both machine and plant, through effective measuring and monitoring.

The condition monitoring team consists of experienced personnel, trained in the various technologies and with the ability to perform technical investigation on machines, plant equipment and their structures using specialised techniques such as Operational Deflection Shape (ODS), transient analysis and resonance tests.

The tests are geared to ensure that assets reach their anticipated life expectancy and beyond, and increase their reliability by performing pro-active services such as laser-alignment, in-situ balancing and gear profiling on both pinion and girth gears of large or small mills, to reduce unacceptable forces and vibration levels.

Key among WearCheck's strengths is our trade knowledge, as well as our experience gained from a diverse customer database that covers all machinery and all industries in Southern Africa and beyond. Our expertise is not limited to specific plants, machines or processes.



# Additional Services

---

**Condition Monitoring Programme**  
Audits and implementation

**Vibration**  
Rotating equipment 1 to 60 000RPM

**Vibration**  
Ergonomic whole body, and hand and arm

**Vibration**  
Structural resonance, problem solving and transient analysis

**Electric Motors**  
Motor current signature analysis

**Thermography Electrical**  
Plant HV, LV and reticulation equipment

**Thermography Mechanical**  
Buildings and insulation flow restrictions

**In-situ Balancing**  
Single and multi-plane

**Alignment**  
All coupling types, cardan-shafts and roll

**Ultrasonic**  
Flow, electrical and mechanical

## Balancing

The analysis of the force created when the mass centre does not correspond to the centre of rotation.

## Alignment

Deviation from a common centreline during operation.

## Vibration

Where needed, vibration analysis is performed and corrective action reports generated, with recommendation on all machines (not only the ones where problems are detected), to reduce vibration levels based on predefined international standards, as agreed by plant engineers.

Customers can further increase plant reliability by adopting a proactive approach after any maintenance intervention – such as the performance of in-situ balancing, shaft centre alignment or structural resonance tests. This effectively minimises external forces and unacceptable vibration levels of rotating parts and components.

## Tribology

WearCheck's oil and fluid analysis programmes consist of analysis for wear, level of contamination and the condition of the oil found in any oil-wetted compartment or oil filter equipment, ranging from earthmoving units, transport fleets and processing plants to ships and aircrafts.

## Thermography

Thermography is a non-intrusive technology that allows potential problems - such as electrical, mechanical or flow restrictions - to be 'seen' on a thermal imaging diagram. The potentially problematic surfaces emit radiant heat which is displayed in different colours, indicating abnormal temperature and fluctuations. This can be performed 'at a glance' using digital overlaying of the thermal image - a process also known as fusion.



# ADVANCED FIELD SERVICES



**WEAR  
CHECK**  
Reliability Solutions  
011 363 3427

# Advanced Field Services

---

In addition to the scientific analysis of used oil and other industrial fluids, WearCheck encompasses a one-stop approach to condition-monitoring offering a range of reliability improvement techniques - all of which help our customers to reduce costs and improve the availability and performance of machinery and components.

We have expanded our world-class reliability solutions division with the acquisition of an established field services department that previously formed part of Anglo (Anglo Field Services), adding three completely new testing types to our portfolio and boosting our existing services with new technology, skills and manpower.

The key functions of field services are to create a secure safety environment for both man and machine, and also to reduce operational risks. Our highly-skilled and experienced inspectors are on call 24/7/365 to support customers with identifying underlying defects, and mitigating these risks on critical equipment.

## The new advanced field services are:

### Non-destructive testing (NDT)

Techniques to test the integrity of a component or system without damaging it.

### Technical compliance (TC)

Expert guidance to assist companies with regulatory requirements, highlighting unacceptable conditions and facilitating reticulation equipment compliance during audits.

### Rope condition assessment (RCA)

Inspecting the integrity of steel rope cables, as per OEM or international standards.

## Non-destructive testing (NDT)

This includes a variety of testing techniques through which the properties and condition of a component or system is evaluated without causing any permanent damage to it - critical component assessments, machine condition assessments and inspection of ancillary equipment, including main vent fans, compressors, mills, pumps and conveyors.

The NDT team delivers quality assurance and quality control of new and refurbished components. These NDT tests are conducted: eddy-current, magnetic-particle, liquid penetrant, radiographic, ultrasonic and visual testing.

NDT methods are gaining popularity because they do not permanently alter the test object undergoing inspection, making NDT a valuable tool that can save both money and time in condition monitoring and inspections.



# Advanced Field Services

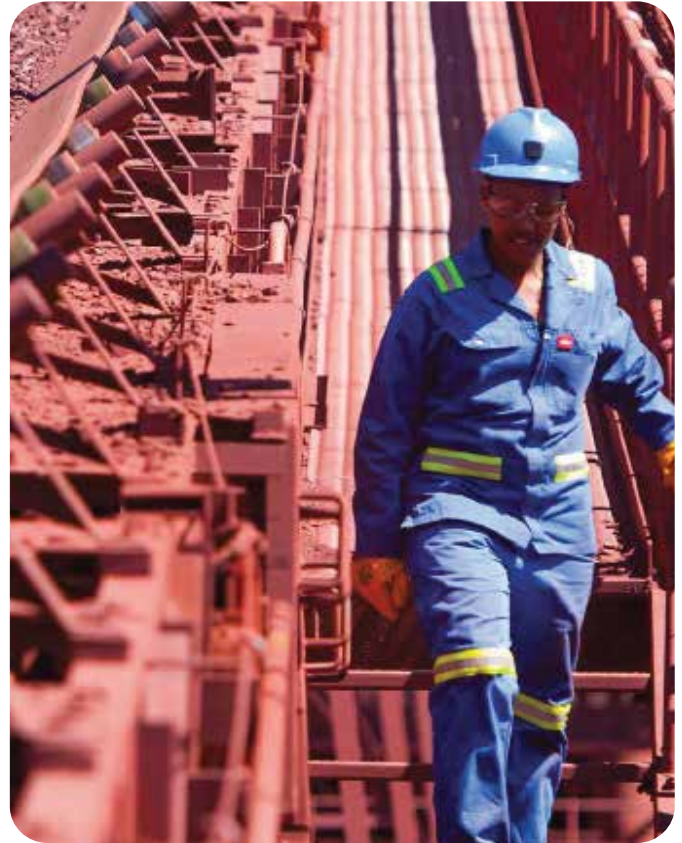
---

## Technical Compliance (TC)

The technical compliance division provides expert guidance to assist companies to comply with regulatory requirements, and how to rectify violations or problems highlighted during audits. Compliance promotes operational and technical excellence through risk identification and corrective action implementation.

Our specialist compliance techniques assist many industries, among them geological, metallurgical, accounting and laboratory reviews. We facilitate international and Group Technical Standards compliance, manufacturing-certified reference material, density determination techniques and quality management systems.

The TC team provides specialist audits on hoisting systems, shaft decelerometer testing, winder level and dynamic break testing, as well as vertical shaft guide alignment. Auditing services encompass AerView, AerView II, Locked Bell, ventilation fan electrical audits and machinery compliance audits.



## Rope Condition Assessment (RCA)

The integrity of steel rope cables is inspected - as stipulated in the SANS 10293:1996 Code of Practice for Steel Wire Ropes – by our seven highly-qualified inspectors (of only 12 people in RSA who are suitably qualified). All are certified to South African Qualification and Certification Committee (SAQCC) level II.

Non-destructive rope inspections improve safety where steel wire ropes play a safety-critical role, where regular RCA is a legal requirement. Examples include mine winders, chairlifts, incline winders, shaft rope guides, elevators, flare/slack stay ropes, as well as stacker/reclaimers and belt wagons.

Some of our more well-known RCA customers include Cape Town's Table Mountain aerial cableway and Namdeb – a shallow-water inshore diamond mine in Namibia.

Rope manufacturers rely on RCA as a means of ensuring compliance with quality specs during the quality assessment (QA) process in the production of new ropes.



# FUEL ANALYSIS





# Fuel Analysis

---

WearCheck's fuel analysis kit has been designed to help customers determine whether their fuel meets SANS requirements. SANS 342:2016 is the specification for South African diesel, and SANS 1598:2006 is the specification for unleaded petrol.

WearCheck is an ISO 9001 and 14 001-certified company. The testing laboratory has ISO 17025 accreditation.

A fair proportion of diesel engine failures can be directly traced back to the quality of the fuel which was in use. Fuel contamination, degradation or adulteration can have serious consequences in terms of blocked filters, stuck or worn injectors, poor spray patterns and atomisation.

## Diesel Tests

- Distillation (ASTM D86)
- Density at 20°C (ASTM D7042)
- Viscosity at 40°C (ASTM D7042)
- Flashpoint (ASTM D93)
- Total contamination (IP440)
- Water content (ASTM D6304)
- Sulphur content (ASTM D4294)
- Cetane index (ASTM D976)

## Petrol Tests

- Distillation (ASTM D86)
- Colour and appearance (In-house)
- Density at 20°C (ASTM D974)
- Lead (Pb) content (In-house)

Additional Tests: Bacterial and fungal growth, Total Acid Number (TAN). Testing in accordance with ASTM to SANS specifications.

Significance of these tests:

### Flashpoint

The flashpoint of diesel is the minimum temperature at which the fuel will ignite on application of an ignition source. Flashpoint varies inversely with the fuel's volatility. This helps identify petrol adulteration.

### Viscosity

Viscosity is a measure of a fluid's resistance to flow. It therefore affects injector lubrication and fuel atomisation. Fuels with low viscosity may not provide sufficient lubrication for the precision fit of fuel injection pumps or injector plungers, resulting in

increased wear or leakage. High viscosity fuels, on the other hand, will increase gear-train, cam and follower wear on the fuel pump assembly due to the higher injection pressures. Diesel fuels with high viscosity also tend to form larger droplets on injection, causing poor combustion and increased smoke and emissions. Fuels that do not meet viscosity requirements lead to loss of performance.

### Sulphur

Diesel with higher sulphur content produces more exhaust particulate emissions than diesel with a lower sulphur content, which has major environmental implications. Local and international regulatory bodies have lowered the allowable percentage of sulphur in diesel to 0.05%. This may change in the near future to 0.005% as we strive to become more environmentally friendly. Most diesel vehicles function optimally with 0.005% sulphur content diesel. Using diesel with higher sulphur content can lead to failures of the emission control systems and/or corrosion of the cylinder liner and piston due to the formation of sulphuric acid.

### Distillation

Distillation measures the temperature range over which a fuel turns to vapour. Volatility is one of the primary methods which distinguishes various fuels from one another. It also gives an indication of the fuel's ability to start the engine, its power, fuel economy, emissions and deposit formation.

### Density

This is a measure of the specific gravity of the fuel. It essentially determines the energy content. The denser the fuel, the more power the engine can generate and vice versa.

### Cetane Number (index)

The Cetane number is a measure of the ignition quality of the diesel. It represents the time delay between injection and ignition. If the Cetane number is too high, the fuel will ignite too close to the injector. This forms a fuel-rich region whilst the rest of the chamber has a weak fuel to air ratio. Incomplete combustion and soot formation will be the result. Low Cetane fuels cause knock, difficult starting, rougher running and increased exhaust emissions.

# TURBINE OIL ANALYSIS



# Turbine Oil Analysis

---

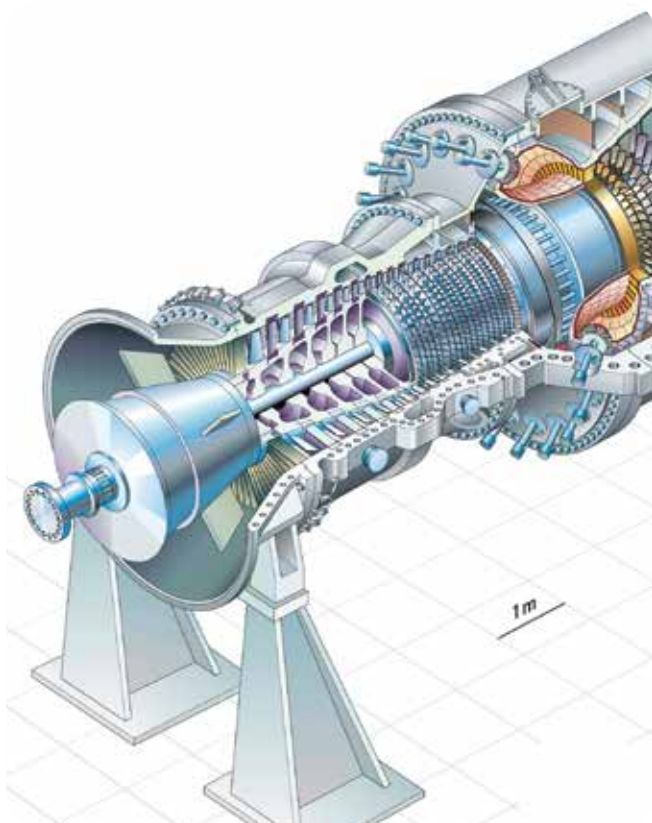
In today's world, companies rely on turbines and compressors to provide power and gas transportation for core processes. Turbines and compressors already have demanding lubrication requirements and those demands are increasing. More demands are being put on these fluids as reservoir size and working clearances decrease and system power outputs, pressures, temperatures and oil service life increase. Lubricants must be highly oxidative and thermally stable to be able to handle these higher operating temperatures. Additionally, the lubricant must remain contaminant-free to properly lubricate bearings and gears, and to act as a favourable hydraulic medium for governors and valving control systems.

Oil oxidation and sludge will lead to sticking servo valves, meaning control valves will not open on demand. Oil contamination will accelerate wear, cause governors and valves to operate erratically and plug system filters. Unmonitored, poor oil condition leads to unplanned outages which are disruptive and potentially very expensive.

In order to achieve peace of mind on the operating condition of your turbine and compressor you need the comprehensive testing that WearCheck provides. Specifically designed for industrial turbines and compressors, WearCheck's turbine oil analysis kit combines well-established industrial tests with more recent advances in industry-testing to provide an unparalleled view of the operating condition of your critical lubricants.

WearCheck's turbine oil analysis kit determines the levels of remaining antioxidants in the oil, detects unwanted oil contamination and will accurately determine the suitability of the lubricant for continued use. A comprehensive diagnosis warns you of any potential for damaging varnish build-up and includes recommendations for any necessary maintenance actions to remove contamination and restore the lubricant to optimum operating condition.

**Typical Applications:** gas turbines, steam turbines, hydro-electric turbines, rotary compressors.



TEST	METHOD	BENEFIT	STD. KITS	ADV. KITS
Viscosity at 40°C	ASTM D7279	Indication of the lubricant's resistance to flow at 40°C	✓	✓
Viscosity at 100°C	ASTM D7279	Indication of the lubricant's resistance to flow at 100°C	✓	✓
Elemental Analysis	ASTM D5185*	Concentration of wear and additive elements present in the lubricant	✓	✓
Water Content	ASTM D6304	Presence of moisture in parts per million (ppm)	✓	✓
Total Acid Number	ASTM D974	Acidity of the lubricant	✓	✓
Particle Quantification		Indication of magnetic particles in the lubricant	✓	✓
Particle Count	ISO4406:99	Size and distribution of particles present in the lubricant	✓	✓
Remaining Useful Life	ASTM D6971*	Concentration of antioxidants present as compared to new oil	✓	✓
Membrane Patch Colorimetry	ASTM D7843	Presence of insolubles that may lead to varnish build-up		✓
Foaming Characteristics	ASTM D892	Tendency of the lubricant to produce foam and the stability of the foam produced		✓
Air Release	ASTM 3427	Ability of the lubricant to release entrained air		✓
Water Separability	ASTM D1401	The lubricant's ability to separate from water		✓
Rotating Pressure Vessel Oxidation Test	ASTM D2272	Oxidation stability of the lubricant	Available On Request	

\* Variances to the method are applied

# TRANSFORMER OIL ANALYSIS



# Transformer Oil Analysis

---

## Condition assessment of power transformers

Power transformers are expensive and critical equipment in power systems and play a significant role in the transmission and distribution of electricity. As with all equipment, transformer failures do occur, and there are many degradation mechanisms operating in components and sub-systems that will ultimately limit the useful operating life.

Transformer asset managers generally aim to achieve the required levels of safety and reliability from their fleet of transformers at minimum cost. Knowledge of condition is therefore essential for efficient transformer asset management decisions. Without this information only the most basic activities are possible - such as time-based maintenance, replacement before end of life, or repair after failure.

WearCheck's transformer fluid analysis data is analysed by experts to provide recommendations on remedial actions based on relevant standards and expert knowledge.

There is a range of transformer tests available at WearCheck:

### Transformer tests:

These tests are recommended for a basic fleet assessment of the transformer's active part-solid insulation degradation:

- Dissolved gas in oil test
- Oil quality results including moisture and acidity
- Estimated or measured moisture in cellulose
- Furans analysis
- Polychlorinated biphenyl (PCB)
- Dissipation Factor (DDF/Tan D) or Power Factor (PF) of the major (main) insulation
- Specified additives (restricted to inhibited and or passivated oils)
- Corrosive sulphur in oil test

### Complementary tests:

- Particles (counting and sizing)
- Metals in oil
- Sediment and sludge
- Inhibitor and Passivators
- Environmental contaminants
- Specialist furanic tests (DP)
- Diagnosis of tap changers and diverters test data
- Gassing Tendency of the oil.

### On-Load Tap Changer (OLTC) maintenance

WearCheck's transformer maintenance division has developed a special OLTC programme to optimise maintenance systems based on our transformer diagnostic tests. Spending the maintenance budget where it's needed, makes financial sense.

Condition-based maintenance is an effective cost-saving tool. Focus your maintenance efforts where evidence proves it is required.

### The benefits of OLTC assessment

- A diagnostic programme that does not require equipment outages, thus enabling work management flexibility
- Identifies problem before failure to reduce system outages
- An irreplaceable aid in prioritising maintenance functions
- Reduces time-based maintenance and the associated expense. Why waste time and money maintaining well-working OLTCs?
- Reduces overall costs of maintenance by being selective. Less intrusive than internal visual inspection

### Oil type

The oil type in a transformer will determine the oil and dissolved gas analysis (DGA) level specification. The oil type is extremely important for the correct diagnosis.



# Furanic Testing of Transformer Oils

In South Africa, the single biggest cause of transformer failure is due to the deterioration of the insulating paper inside the transformer. Ten years ago, the average lifespan of a transformer in South Africa used to be 45 years, today it is only 12.5 years.

In the past it was necessary to take an actual paper sample from the transformer to determine the level of deterioration. The DP value (Degree of Polymerisation) is an index that measures the degree of degradation of the paper - the higher the value, the lower the level of deterioration.

This test was highly invasive and in the majority of cases the paper was sampled from the wrong region, giving results that looked better than they actually were. Furanic testing of transformer oils has been developed over the years and this test can now determine a DP value from the oil sample without having to sample the insulation medium itself.

Our laboratory tests for the following furanic compounds in the oil:

Furanic compound	Indicated problem
5-hydroxymethyl-2-furaldehyde (5H2F)	Oxidation
Furfuryl alcohol (2FOL)	High moisture content
2-furaldehyde (2FAL)	Overheating
2-furyl methyl ketone (2ACF)	Lightening strike (rare)
5-methyl-2-furaldehyde (5M2F)	Severe, local overheating

The natural breakdown of the paper insulation medium also produces the following gases:

- Hydrogen (H<sub>2</sub>)
- Carbon monoxide (CO)
- Carbon dioxide (CO<sub>2</sub>)

The ratio of carbon monoxide to carbon dioxide has been used as an indication of paper breakdown. The ratio should be between 3 and 11. However, this test has become unnecessary with the advent of furanic testing.

Paper insulation is the one component that will break down over time and will determine the lifespan of the transformer. With maintenance of the transformer and regular testing of the oil to detect water ingress and acid formation, this process can be slowed but never entirely stopped.

Furanic testing is very accurate compared to the actual testing of the paper, but the test can be influenced by the following:

- Furanic compounds will only be generated in the oil if the transformer is on-line
- Purification of the oil will remove furanic compounds from the oil and result in a much higher DP value than is actually the case. If purification has taken place recently then use the current DP value, DGA (Dissolved Gas Analysis) and other oil analysis parameters as a new baseline and resample in a further one to three months.
- If the oil has been changed, the new oil will not contain any furanic compounds so a new baseline will need to be established and their production rate determined.
- Time between sampling and testing - this should be as short as possible.

# Furanic Testing of Transformer Oils

An accurate diagnosis of furanics cannot be carried out on one sample; this can only be done with regular oil testing to determine a trend and should include DGA, moisture content, acidity and dielectric strength as well as the furanic test. It is also recommended that corrosive sulphur and TAN (TAN Delta) be determined at least once a year.

*Note that a low DP value does not necessarily mean that the transformer is going to fail immediately.*

If the DP value is below 200 (see table below for DP values and their meanings) then:

- The transformer is in a critical state and additional stresses must be avoided.
- No further filtration work can be done on the oil as any disturbance of the insulating medium might cause failure.
- The transformer will still have a limited lifespan but this will depend on the other tests (such as DGA) in addition to

Category	Predictive DP Value	Interpretation
1	<200	Critical - failure may occur and transformer will need to be replaced
2	200-250	Urgent - regular testing recommended to determine DP production rates, DGA and oil testing also recommended
3	260 - 350	Caution/Urgent – resample on a three monthly basis to monitor DP production rates
4	360 - 450	Caution - resample on a three monthly basis
5	460 – 600	Caution - resample on a six to twelve monthly basis
6	>610	Normal - sample yearly





# GAS ENGINE OIL ANALYSIS



# Gas Engine Oil Analysis

---

Growing energy demand and concerns over the environmental impact of coal-fired power generation has led many countries worldwide to explore the use of alternative energy sources, both renewable and non-renewable. One of the alternative technologies identified is the utilisation of natural and biogas for power generation.

The search for inexpensive and reliable energy has prompted interest in natural gas which, in turn, has increased the popularity of stationary gas engines. It has also led to the growing use of alternative gases, such as landfill gas and biogas for power generation. While providing some of the same benefits as natural gas, these alternate gases contain contaminants that present challenges to the efficient running of these engines and their lubricants.

Gas engine lubricants need to withstand the various levels of oil degradation caused by the higher operating temperatures, as well as the combustion process of gas fuels that contain varying impurities depending on the source and quality of the gas fuel. As a result of these higher operating temperatures, oil degradation modes like oxidation and nitration need to be monitored closely.

One of the most effective and least expensive condition monitoring techniques available to gas engine operators and OEMs is oil analysis, as it provides a wealth of information about the lubricant's condition, contaminants and the mechanical wear taking place. When oil analysis results are trended over a period of time, potential problems can be identified and this, in turn, helps machine operators schedule the appropriate maintenance and avoid costly repairs and reduce machine downtime.



# Gas Engine Oil Test Profiles

---

## Viscosity @100°C and @40°C ASTM D7279

Viscosity is the most important physical property of a lubricant, and is defined as a fluid's resistance to flow. This in turn determines the thickness of the oil film that prevents contact between metal surfaces. Trending of viscosity data is important, as deviations from the norm may indicate base oil degradation, additive depletion or the use of an incorrect lubricant.

## Viscosity Index (VI) ASTM D2270

The viscosity index characterises the effect of temperature on an oil's viscosity and is of particular importance in applications where ambient operating temperatures vary significantly.

## Total Base Number (TBN) ASTM D2896 and ASTM D4739

The TBN is a measure of the oil's alkaline reserve and a decrease in the TBN would be an indication of additive depletion. The TBN is also an essential element in establishing the optimal oil drain intervals since it indicates whether the additives are still capable of providing sufficient engine protection.

## Total Acid Number (TAN) ASTM D664

The total acid number is a quantitative measure of acidic compounds in the oil that are generated as a result of oxidation and the formation of acidic degradation by-products.

## Initial pH (IpH) ASTM D7946

The IpH value is considered an important parameter along with the TAN and TBN values, particularly for the evaluation of engine oils in biogas and landfill gas applications, as it represents the strong acids in the oil which directly cause corrosion of engine components. This method can even be used to detect minor quantities of strong corrosive acids in oil, even if the TAN has not yet increased significantly.

## Particle Quantifier (PQ) Index OEM supplied method

The PQ gives a measure of the total ferrous content of the oil sample and from this measurement the total amount of ferrous (iron) debris can be determined irrespective of the size of the particles.

## Fourier Transform Infrared (FTIR) oxidation ASTM D7414 and nitration ASTM D7624 (spectral subtraction method)

The FTIR produces an IR spectrum that is often referred to as the 'fingerprint' of the oil as it contains specific features of the chemical composition of the oil. The IR spectrum can be used to identify types of additives, trend oxidation and nitration by-products that could form as a result of high operating temperatures and thermal degradation.

## ICP spectroscopy (wear, contaminants and additive concentrations) ASTM D5185

The spectrometer measures the concentration of wear metals such as iron, oil additives like calcium and contaminants such as silicon in the oil.

## Microscopic Particle Examination (MPE) in-house method

An MPE is performed by filtering the oil through a membrane patch of a known micron rating and any debris present is examined under a microscope. The membrane patch is examined for wear, contamination and colour. An MPE can provide clues to the source of the debris and the potential severity of a problem that may be causing it.

## % Water ASTM D6304

Water is one of the most destructive contaminants in a lubricant. It can cause a wide range of operational problems and significantly affect engine reliability and longevity. It causes additive depletion, base oil oxidation and impairs the oil's film strength. Water contamination also sharply increases the corrosive potential of acids found in gas engine oils.

# WIND TURBINE OIL ANALYSIS



# Wind Turbine Oil Analysis

---

Wind power is the world's largest growing energy source thanks to advancing wind turbine technology. Wind turbines have the potential to generate enough power to meet the growing need for electricity, and simultaneously reduce consumption of water and emission of pollutants such as carbon dioxide. However, barriers to widespread acceptance of wind turbines include their reliability, costs of operation and maintenance of the equipment relative to alternative means of power generation.

As the growth in wind energy continues, the average size and capacity of wind turbine generators is also increasing. With this increase in size comes an increase in the cost of operation, and specifically the cost of repairs, downtime, and unscheduled maintenance.

The estimated life span of wind turbines is about 20 years, compared to conventional steam turbine generator units that have averaged 40 years. The failure rate of wind turbines is about three times higher than that of conventional generators. Therefore, reliability is essential to the success of wind energy systems and this requires appropriate condition monitoring.

The wind turbine gearbox is the most critical component in terms of high failure rates and down time. These premature gearbox failures are a leading maintenance cost driver that can substantially lower the profit margin of a wind turbine operation as they typically result in component replacement.

Oil analysis, along with other condition monitoring tools, offers the potential to effectively manage gearbox maintenance by detecting early damage as well as tracking the severity of the damage. It is for this reason that most OEMs recommend routine oil analysis as part of an effective maintenance strategy.

## Reasons to analyse wind turbine oils

- Wind turbine gearbox warranties generally only last for two years, therefore maintenance programmes are vital to ensure the turbine operates for the recommended 20 years.
- Predictive maintenance prevents expensive replacement costs and down-time.
- Oil change procedures remove only 70% of the used oil, new oil then mixes with the residual used oil containing contaminants and wear metals.
- Analysis is recommended by OEM manufacturers.



# Wind Turbine Oil Test Profiles

---

## Viscosity @100°C ASTM D7279 and @40°C ASTM D7279

Viscosity is the most important physical property of a lubricant, and is defined as a fluid's resistance to flow. This in turn determines the thickness of the oil film that prevents contact between metal surfaces. Trending of viscosity data is important, as deviations from the norm may indicate base oil degradation, additive depletion or the use of an incorrect lubricant.

## Viscosity Index (VI) ASTM D2270

The viscosity index characterises the effect of temperature on an oil's viscosity and is of particular importance in applications where operating temperatures vary significantly.

## Karl Fisher Moisture ASTM D6304

Water contamination is detrimental to any lubricant and can shorten the service life of a gearbox by accelerating wear. The Karl Fisher method for determining moisture content is recommended, as even small amounts (<500ppm) of water contamination can contribute to micro-pitting which is a recognised failure mode in wind turbine gearboxes. Water can be damaging to both the oil and the component.

## Total Acid Number (TAN) ASTM D974

The total acid number is a quantitative measure of acidic compounds in the oil that are generated as a result of oxidation, and the formation of acidic degradation by-products.

## PQ (Particle Quantifier) Index OEM supplied method

The ferrous debris monitor or PQ (Particle Quantifier) gives a measure of the total ferrous content of the oil sample and from this measurement the total amount of ferrous (iron) debris can be determined irrespective of the size of the particles.

## Oil cleanliness ISO 4406

Wind turbine manufacturers have increasingly focused on oil cleanliness, which has a huge impact on the lifetime of bearings and the performance of the gearbox. Particle counting involves measuring the cleanliness of the oil and can also be used to evaluate the effectiveness of lubricant filters. The numbers of particles per milliliter of oil are counted in a variety of size ranges starting at four micron and going up to 100 microns. The total number of particles greater than four, six and 14 microns is assessed and given range numbers that indicate the cleanliness of the oil according to the ISO 4406 method.

## ICP spectroscopy (wear, contaminants and additive concentrations) ASTM D5185

The spectrometer measures the concentration of wear metals such as iron, oil additives like phosphorus and contaminants such as silicon in the oil.

## Fourier Transform Infrared (FTIR) oxidation ASTM D7414 and nitration ASTM D7624

The FTIR produces an IR spectrum that is often referred to as the 'fingerprint' of the oil, as it contains specific features of the chemical composition of the oil. The IR spectrum can be used to identify types of additives, trend oxidation and nitration by-products that could form as a result of high operating temperatures and thermal degradation caused by aeration/foaming.

## Microscopic Particle Examination (MPE) in-house method

An MPE is performed by filtering the oil through a five-microns membrane patch and examining any debris present under a microscope. The membrane patch is examined for wear, contamination and colour, and a matrix describing the concentration and size of debris is recorded.

# HEAT TRANSFER OIL ANALYSIS



# Heat Transfer Oil Analysis

WearCheck's heat transfer oil test kit has been designed to enhance efficiency in thermal transfer machinery. Degraded or contaminated oil can cause reduced system efficiencies due to damaged pumps or fouled heat exchangers. Compromised oil can become a fire or explosion risk. It is therefore vital that heat transfer oils be tested regularly.

Heat transfer oil analysis targets key areas of the oil's performance, contamination and degradation. For instance, oxidation of the oil will result in elevated acid levels as well as an increased viscosity, and the by-products of this oxidation will lead to deposits in the system resulting in lower thermal efficiencies. Oxidation can be caused by excessive operating temperatures and/or the presence of metallic catalysts such as iron or copper, and over-extended fluid service.

A second area of concern is thermal cracking. Here, the oil's chemical backbone is broken up into smaller, more volatile components. A significant variance between the closed cup and open cup flash point indicates a build up of these volatile fractions which pose real fire and explosion risks. Thermal cracking can also manifest itself with decreased kinematic viscosity.

By providing a comprehensive test profile, not only the problem, but also the root of the problem, can be discovered.

## Heat Transfer Oil Tests

Test	Test Method
Viscosity at 40°C	ASTM D7279
Viscosity at 100°C	ASTM D7279
Viscosity Index	ASTM D2270
Density at 20°C	ASTM D4052
Total Acid Number	ASTM D974
Moisture (ppm)	ASTM D6304
Flash Point PMCC	ASTM D93
Flash Point COC	ASTM D92
Fire Point COC	ASTM D92
Conradson Carbon Residue	ASTM D189
Pentane Insolubles	ASTM D4055
Elemental Concentration Al, Cr, Cu, Fe, Ba, Ca, P, Zn, Na, Si	ASM D5185*
Particle Count (4, 6, 14, 20, 25, 50, 75, 100 micron & ISO code)	ISO 4406:99

\*Based on, but not exactly according to the method

## Typical Applications:

- Tank heating
- Suction heating
- Reactor vessel heating
- Process reboilers
- Platen or press heating
- Ovens and fryers
- Natural gas heating
- Jacketed vessel heating
- Indirect steam generators
- In-line gas heating
- Heated molds or dies
- Crude oil heating
- Calendar roll heating
- Building heaters
- Autoclaves





# INDUSTRIAL OIL ANALYSIS



# Industrial Oil Analysis

---

The analysis of used oil adds value to an operation by serving as a cost-reducing predictive maintenance tool for oil-wetted machinery.

WearCheck's programme analyses for wear, contamination levels and oil condition in any oil-wetted component or oil filter found in equipment used in a wide spectrum of industries, including the electrical, maritime, mining, earthmoving, construction, road transport and aircraft sectors.

## Laboratory tests

The exact tests carried out on a sample are determined by the type of machine, the component and the type of oil.

### Industrial Oil Tests

The tests are designed to measure applicable combinations of the following:

- Wear metals
- Contaminants: dirt, water, fuel, soot, coolant
- Additives
- Cleanliness rating
- Viscosity at 40°C and 100°C
- Water, in parts per million, by Karl Fisher titration
- Total base number (TBN)
- Total acid number (TAN)
- Oil filter analysis

An advanced industrial kit ensures that a particle count (ISO 4406) is carried out on all samples except engines. All samples get MPE (Microscopic Particle Examination) and an image of any debris present irrespective of sample status, and a TAN (Total Acid Number) is measured on all samples except those from engines which get TBN (Total Base Number).

Industrial oil samples can also be married to other condition monitoring techniques such as thermography and vibration analysis. These services are supplied by WearCheck's Reliability Solutions division.

## Reports

Reports contain the analytical results, an interpretation of the results, recommendations on machine and oil conditions, and various checklists from our highly qualified and experienced diagnostic team. Reports are available in a range of formats, including print, fax, SMS, email, via WearCheck Online (which is a web-based system enabling customers to create charts and graphs to track the test results), or via the WearCheck App.

# MARINE OIL ANALYSIS



# Marine Oil Analysis

---

The analysis of used oil adds value to an operation by serving as a cost-reducing predictive maintenance tool for oil-wetted machinery.

WearCheck's programme analyses for wear, contamination levels and oil condition in any oil-wetted component or oil filter found in equipment used in a wide spectrum of industries, including the electrical, maritime, mining, earthmoving, construction, road transport and aircraft sectors.

## Laboratory tests

The exact tests carried out on a sample are determined by the type of machine, the component and the type of oil.

### Marine Oil Tests

The tests are designed to measure applicable combinations of the following:

- Wear metals
- Contaminants: dirt, water, fuel, soot, coolant
- Additives
- Cleanliness rating
- Viscosity at 40°C and 100°C
- Water content
- Total base number (TBN)
- Total acid number (TAN)



# COOLANT ANALYSIS



# Coolant Analysis

---

Monitoring an engine's cooling system performance is imperative, as research shows that 40% to 60% of all diesel engine failures are caused by a faulty cooling system. Therefore, a key factor in avoiding dreaded premature engine failure is to keep the cooling system operating optimally by using the most appropriate coolant and regularly measuring its chemical and physical properties.

Without proper maintenance, cooling systems can lead to failure modes such as overheating, overcooling, pitting, cavitation erosion, cracked heads, piston seizures, reduced critical clearances, low oil viscosity, increased wear and plugged radiators.

The effects of these problems manifest as:

- Acid/alkalinity balance (corrosion)
- Scale and deposit formation (blockages)
- Electrolytic corrosion (electrolysis)
- Cavitation erosion (liner pitting)
- Galvanic corrosion
- Additive loss
- Aeration (erosion)
- Rust

The longer a particular coolant remains in an engine, the greater the probability of these problems occurring. With increased coolant service life, therefore, the need for regular coolant monitoring increases.

WearCheck has devised a set of tests to determine whether the coolant is in good condition and capable of doing its job. If any of the pre-determined parameters are found to be out of spec then remedial action can be taken to ensure the healthy, normal operation of the cooling system and, in turn, the engine.

## Coolant Tests:

- Glycol % (Test Method: ASTM D3306)
- pH (Test Method: ASTM D1287)
- Nitrate ppm (Test Method: in-house)
- Molybdate ppm (Test Method: in-house)
- TDS Total Dissolved Solids ppm (Test Method: OEM)
- Foam (Test Method: in-house)

## Other tests include:

- Freeze Point
- Boil Point



# WATER ANALYSIS



# Water Analysis

---

Our water division offers full suite water analysis. Analysis is conducted using various accredited techniques such as: Photometric, Electrometric, Colorimetric, Gravimetric, ICP-OES and ICP-MS and Enzyme Substrates. These techniques are used to obtain the best possible results in physicochemical and microbiological analysis.

## Industries we serve include:

- Mining and Exploration
- Environmental
- Industrial
- Energy
- Manufacturing Materials
- Food and Beverage
- Agriculture
- Hospitality
- Construction
- Health Care
- Recreation and Tourism
- Private

## Types of Water:

- Waste/effluent water
- Drinking water
- Bottled water
- Agricultural/irrigation water
- Water quality
- Surface and groundwater
- Cooling systems
- Corrosion control

## AdBlue Testing

Selective catalytic reduction (SCR) technology found in Euro IV or Tier 4 and higher rated diesel engines uses a diesel exhaust fluid reductant known commercially as AdBlue, which is injected into the exhaust gas to help reduce Nitrogen oxide (NOx) emissions, over a catalyst. Aqueous urea is the preferred reductant of choice in modern SCR systems.

Purity requirements for SCR catalyst reductants like AdBlue are high and among the specific requirements, metals such as sodium, potassium, calcium, magnesium, copper, zinc, iron or chromium - as well as the content of ash-forming phosphates - must be kept at low levels in SCR-grade urea. As a result of these purity requirements, testing of these reductants is of utmost importance.

WearCheck tests AdBlue according to the requirements set out in ISO 22241-2. We conduct tests for the following parameters: % Urea, Refractive index, % Alkalinity, % Biuret, Aldehydes, Insoluble Matter, and other trace impurities such as Al (Aluminum), Ca (Calcium), Cr (Chromium), Cu (Copper), Mg (Magnesium), Ni (Nickel), K (Potassium), Na (Sodium), and Zn (Zinc).





# Water Analysis

---

## Water Quality

Water quality describes the condition of water, including chemical, physical and biological characteristics, usually with respect to its suitability for drinking, irrigation, bathing, and effluent purposes.

Safe water should contain no chemical or radioactive substances, be free from disease-causing organisms and be stable in terms of corrosion or scaling.

## Why Water Monitoring is important

- Ensuring mining, industrial and sewage effluent is compliant with environmental regulations and municipal by-laws
- Establishing drinking water safety, in compliance with The National Water Act, SANS241 parameters and WHO Guidelines
- Confirming bottled water complies with The National Water Act, SANS1724
- Ground and Surface water is uncontaminated and safe
- Irrigation water is safe and free from toxins or disease
- Pool and spa water is safe for skin contact
- Ensuring water quality is safe for handling and exposure to clients and staff
- Checking water is free from spotting elements at washing facilities
- Accurately determining water treatment type and its effectiveness
- Tracking and monitoring readings over time, identifying changes
- Ensuring water is non-corrosive and won't result in future, unforeseen maintenance
- Identifying any problems before they become long-term

## Mining

WearCheck Water offers wastewater, groundwater and surface water analysis in areas surrounding mining and exploration sites.

### Effluent/Wastewater

Ensuring water is compliant and safe for disposal is essential. Compliance with municipal by-laws and environmental safety standards allows for safe disposal of wastewater into streams, rivers etc.

### Ground and Surface Water

Water quality analysis allows for determination of water safety for use on equipment, drinking and washing.



# Water Analysis

---

## Industry & Manufacturing

Waste/effluent water analysis ensures compliance with municipal by-laws and environmental safety standards allows for safe disposal of effluent into streams, rivers etc.

For successful industry operation and reduced repair costs, it is important to monitor the various water systems of a manufacturing plant.

Cooling systems water should be monitored to ensure optimal functioning, identify corrosive and microbial determinands. These systems provide the perfect environment for bacterial growth.

Water should be continually monitored for scaling and corrosive determinands. This enables early detection of potential equipment risks, reduces excessive repair costs and ensures optimal functioning of machinery.



## Irrigation & Agriculture

Safe and clean irrigation and agricultural water is essential to ensure leaching is not occurring, preventing disease and maintaining a healthy ecosystem in soil structure for plant growth and yield.

## Food & Beverage Production

Water quality is essential in the production of food and beverage. The analysis is conducted in line with various local and international standards:

- SANS241 - drinking Water
- SANS1657 - bottled and processed Water
- WHO guidelines

## Hospitality & Lifestyle

We provide regular water quality analysis for:

- Lifestyle centres and malls
- Retail and business parks
- Restaurants and fast food facilities
- Gym and fitness facilities
- Spas and recreational facilities



# GREASE ANALYSIS



# Grease Analysis

Oil analysis is able to monitor the health of the lubricant, the health of the machine and levels of contamination through a series of chemical and physical tests. However, sometimes it is more beneficial to have a component lubricated by grease.

Grease samples can be submitted to WearCheck in exactly the same way that oil samples are. Ensure that the standard sample bottle is three quarters filled with grease, fill in the submission form and submit in the normal manner.

When the sample arrives in the laboratory the grease is dissolved in a special cocktail of solvents and violently shaken. Any debris present is separated magnetically and the magnetic wear particles are filtered through a standard debris membrane.

The grease sample is then dissolved in the standard laboratory solvent and analysed by the spectrometer for wear metals, contaminants and grease additives. Unfortunately, there is no universal solvent for grease as there is for most oils and it is almost impossible to take a representative sample. This means that spectrometric analysis can be suspect but it does give an idea of what is and is not present. The PQI of the ferrous debris is also measured.

Spectrometric analysis, PQI and debris analysis are then processed in the same manner as an oil sample but a diagnosis is based on debris and contamination only. Physical and chemical properties of the grease require instrumentation not normally used in an oil analysis laboratory. Photographs are taken of any relevant debris and the normal oil analysis report format is used.



Sample of an unused grease that contains very finely-divided aluminium particles that act as a solid lubricant.

# AIRCRAFT OIL ANALYSIS



# Aircraft Oil Analysis

---

The aircraft oil and oil filter analysis programme is designed to:

- Monitor wear rates.
- Detect contamination such as dust, water and fuel in the oil.
- Verify the type of oil in use.
- Detect oil overheating and oil degradation.
- Monitor the cleanliness of hydraulic fluids.

The service includes oil filter analysis. Oil filter analysis supplements spectrometric oil analysis because filters retain the larger wear particles generated by abnormal wear. Customers are encouraged to send the oil filter element with the oil sample where practical. Ferrographic analysis is carried out on the oil sample if no oil filter is provided.

Oil and oil filter analysis are carried out on the following aircraft components:

- Piston engines
- Turboprop, turbofan and turboshaft engines
- Auxiliary power units (APU)
- Helicopter rotor gearboxes
- Hydraulic systems



# ON-SITE LABORATORIES



# On-Site Laboratories

---

In a bid to overcome the lack of infrastructure in certain mining hotspots in Africa, WearCheck supplies world-class oil analysis services to support industrial operations in those areas by creating mobile laboratories in converted shipping containers and placing them on-site.

The portable laboratories are put together at the company's head office in Pinetown, South Africa and have every available safety feature such as ventilation and air extraction systems, fire prevention and more. Each lab is fully-equipped with the latest laboratory instruments and technology, and even has an uninterrupted power supply, air conditioning and burglar bars. As industry needs evolve, the mobile labs undergo constant redesigning.

The laboratory instruments and movable components are carefully packed to avoid disturbance during transport and the container is despatched either by road or by sea, depending on its destination.

The company's aim is to make world class condition monitoring services as accessible as possible to operations on the African continent. The extraordinary functionality of the container labs eliminates the need for the customer to supply the services for basic infrastructure such as a building, electricity, internet signal, security and safety features. With these hurdles out of the way, WearCheck then places the designer lab within convenient reach of mining operations.

Once the mobile lab is on-site, a WearCheck technician travels to the location to set up the laboratory and calibrate the instruments. Generally, a local lab manager undergoes training in an existing lab and then takes over the reins of the mobile lab along with the necessary technicians. In some cases, the customer manages the laboratory independently.

Offering a wide range of condition monitoring services for the mining sector - including oil analysis, coolant testing, diesel testing and 24 hour sample turnaround time – the mobile labs are also available for use by other industries, such as quarrying, industrial, power generation, transport and shipping operations.

To date, WearCheck has supplied seven container laboratories on-site around Africa, and these are operating successfully in Lumwana (Zambia), Ghana, Mozambique, DRC, Mauritania, Namibia and Burkina Faso. WearCheck operates an additional 16 full-sized laboratories in buildings, in nine countries around Africa.





# HYDROCARBON MANAGEMENT



# Hydrocarbon Management

---

## Hydrocarbon Management

Many organisations are unaware of the danger improper lubricant storage and handling practices create. Protecting your lubricants and ultimately your equipment from the harmful effects of contamination & lubricant degradation begins with proper in-plant storage.

## Total Fluid Management (TFM)

WearCheck's Reliability Solutions (RS) division employs a holistic approach to implementing a world-class fluid management programme that aligns all departments to a customised TFM plan with a common goal – to optimise the efficiency of fluids.

Using condition monitoring technologies, the RS team identifies sub-standard fluid management practices and the effects these have on component life. The team has helped many mines and other operations to reduce lubrication costs and maintenance costs by successfully combining condition monitoring and TFM.

When implementing a TFM programme, the WearCheck technicians ensure that the customer can manage their world-class programme with complete confidence. After handover, WearCheck provides after-sales service and product support. Scheduled re-assessment is fundamental to the success of the programme.

The three pillars that ensure Total Fluid Management success are:

- Keep lubricants clean
- Keep lubricants dry
- Keep lubricants cool

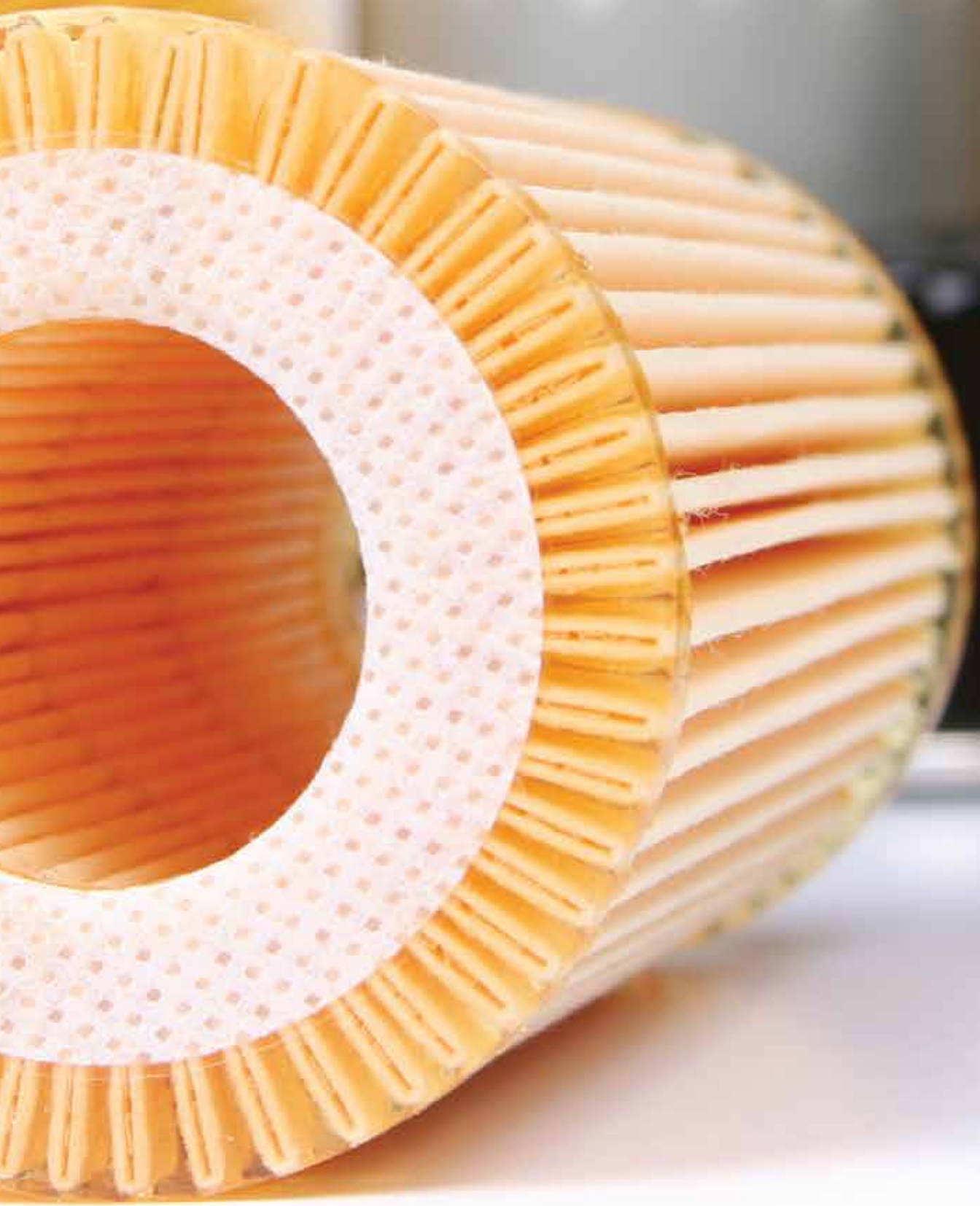
WearCheck considers all aspects of lubrication and overall fluid management instead of just targeting a single department.

A good TFM programme is implemented in four phases, which are: phase 1 - assessment, phase 2 - modification and design, phase 3 - implementation and phase 4 - management and continuity.

TFM technicians assess and improve an existing system and implement new procedures. Once operational, the benefits include reduced lubrication costs and improved equipment availability. Initially, lubrication costs may increase, but once the TFM programme is in place the savings and increased machine availability can be quantified.



# FILTRATION



# Filtration

---

## Lubrigard

Using the correct lubrication for non-stationary machine components plays a key role in keeping equipment healthy, reliable and operating smoothly. WearCheck's LubriGard division helps customers select the correct lubricants for each component to minimise maintenance costs and maximise operational output.

The importance of correct lubrication for any piece of moving machinery is as important as healthy blood circulating through the human body.

The company's Lubrigard technicians frequently see the incorrect type and grade of lubricant being used which is often the direct cause of premature equipment failure.

**COMMON PROBLEM:** General purpose grease is often used as a general lubricant for machinery on plants. When greasing high speed bearings - for instance in electric motors - this can cause viscous drag that may cause higher operating temperatures and energy consumption. Grease with a lower viscosity is more efficient as bearings running at higher temperatures can destroy the additive package in the grease, and cause the grease to drain out, leaving the motor deprived of sufficient lubrication. This damages the bearings and causes premature failure.

**SOLUTION:** LubriGard considers all factors involved when choosing the correct lubricant, such as load conditions, a bearing's rotating speed and the environment to which the equipment is exposed. An automatic lubrication programme is developed, that is tailored to each customer's needs. Over-greasing is not a myth and can result in higher operating temperatures, premature bearing failures as well as increasing the risk of contamination ingress. An automatic lubrication programme combined with condition monitoring applications helps to eliminate these problems completely.

LubriGard recommends specialised oils and greases with more relevant additive packages, breathers and filters that keep out particles as small as five microns, which can cause exponential wear in machinery and contamination. We ensure that expensive and critical equipment stays available - this, in effect, reduces downtime.



# Filtration

---

## Filtration

WearCheck's FLAC (fuels, lubricants, air and coolants) maintenance programme includes unique bypass filters which minimise contaminants, thereby extending the life of the oil and fuel.

The filters were initially trialled in 2016 at a chrome mine on three GHH machines running air-cooled motors. Once proven effective, the filters were then fitted to a further 27 machines in the same mine. After eight months, the mine's consumption of lube and filters was substantially reduced, and the oil drain period was reliably extended – this translated into a savings of R1.7 million after paying for the implementation of the WearCheck programme. The filters, designed to clean oil and fuel, function best as part of a comprehensive condition monitoring programme and have been widely installed on different machines.

Fuel typically passes through three filters – first the OEM water separator, next the OEM diesel filter, and finally WearCheck's depth filter, which is last in line, and which provides extremely fine microfiltration, screening particles between 0.5 and 1 microns in diameter.

The advantage of cleaner burning fuel means more power. With fewer by-products passing into the crank case oil, such as soot, the additive packages do not have to work so hard, so they also last longer.

Using scientific data on the oil's condition and knowing that the filters have cleaned the oil or fuel effectively, WearCheck can advise when it is feasible to extend the oil drain interval without risk, thereby saving you money.



# REPORTING



# Reporting

WearCheck offers several options for receiving sample reports. Two of the most popular are WearCheck Online and the WearCheck Mobile condition monitoring app. All data is secure and the login process uses the same username/password credentials for both the online option and the mobile app.

WearCheck Online is a web-based system which allows customers to log in securely and view sample and fleet information as it becomes available.

WearCheck Mobile is a free app that is compatible with both Android and Apple (iOS) mobile devices. Simply search for "WearCheck Mobile" on the Google Play Store or the App Store. Downloading the app is only about 40mb, and it requires minimal data when in use.

Besides WearCheck Online and the Mobile app, all customers are phoned regarding urgent or critical samples and those who do not have access to the online or the app get their reports either faxed or emailed in PDF to them.

<b>Features &amp; Functions</b>	<b>WearCheck Online</b>	<b>WearCheck App</b>
Generate PDF reports	✓	✓
View current samples list – read, unread and notifications	✓	✓
Email reports	✓	✓
Submission of sample data	✓	✓
Submit feedback	✓	✓
Various search options and filters	✓	✓
Printing of sampling labels	✓	
Submission via sampling label list	✓	
View sample process status	✓	✓
Severity summary (total or per month)	✓	
Problem type listing/graphs (total or per month)	✓	
Problem type by group	✓	
Problem type using Pivot Tables	✓	
Manage your users	✓	
Create new equipment /component info via submission	✓	✓
View five day submission history	✓	✓
Send enquiry direct to a Diagnostician		✓
Scan sample barcode		✓





# TRAINING COURSES



# Training Courses

---

WearCheck has developed specialised training courses to help customers gain maximum benefit from their oil analysis and condition monitoring programmes. The courses on offer have proved highly successful in enhancing understanding of oil analysis and boosting the confidence of the maintenance teams with their new knowledge. The overall result is a general improvement in the effectiveness of the maintenance programme, with increased productivity and cost savings, which translate into boosted return on investment in the monitoring programmes.

An added bonus is that graduates of WearCheck-run Mobius courses can earn CPD (continuing professional development) points – this is approved by the South African Institute for Mechanical Engineers (SAIMEchE).

The Engineering Council of South Africa (ECSA), in agreement with international engineering bodies, stipulates that South African engineering professionals must undertake CPD activities to keep abreast of expert knowledge, to demonstrate competence and to renew professional registration.

The training courses have been successfully run for many years, and are geared for employees operating at various levels within an organisation:

<b>Course</b>	<b>Duration (days)</b>	<b>CPD Credits</b>
Precision Shaft Alignment	1	
Precision Balancing	2	
Vibration Analysis ISO CAT-1	5, incl. exam	4
Vibration Analysis ISO CAT-2	5, incl. exam	5
Vibration Analysis ISO CAT-3	6, incl. exam	5
Infrared CAT-1	5	
Oil Analysis 1	2	
Oil Analysis 2	1	
WearCheck Practical (English/Zulu)	1/2	
WearCheck Customised	1	

All courses can be presented on-site at a customer's premises for a minimum number of delegates. Alternatively, oil analysis courses are presented at various WearCheck offices throughout Africa, while Mobius courses are presented by WearCheck at the ABB School of Maintenance in Johannesburg.

To book a WearCheck training course, please contact [training@wearcheck.co.za](mailto:training@wearcheck.co.za) or call (031) 700 5460.

# Contact Details

---

## South African Offices & Laboratories

### Head Office

Unit 4, The Terrace, Westway Office Park,  
Westville, KwaZulu-Natal  
t : +27 31 700 5460

### Bloemfontein

55 Rontgen Avenue, Hospitaalpark,  
Bloemfontein  
t : +27 51 101 0930

### Eastern Cape - East London

Shop 9, Beacon Bay Retail Park, Beacon Bay  
East London  
t : +27 72 510 5755

### Eastern Cape - Port Elizabeth

8 Van Wyk Road,  
Westering  
t : +27 82 290 6684

### Gauteng

55 Angus Crescent, Longmeadow Business  
Estate ext.1, Edenvale  
t : +27 11 392 6322

### Klerksdorp

Unit 19 Buffelspark office complex,  
48 Buffeldoorn Road  
t : +27 83 281 6896

### Middelburg & Witbank

Unit 7a Nungu Industrial Park  
13 Mandela Drive, Middelburg  
t : +27 13 246 2966

### Northern Cape

4 Arrows premises, Bestwood Estate,  
Kathu  
t : +27 66 474 8628

### Rustenburg

F&F Office Park, Block D1,  
219 Beyers Naude Drive, Rustenburg  
t : +27 83 938 1410

### Western Cape

Unit 25 Reserve 3, cnr Kruispad & Capricorn  
Way, Brackenfell  
t : +27 21 001 2100

## International Offices & Laboratories:

### DRC

Kibali Mine,  
Kibali  
t : +260 977 622 287

### Ghana - Kumasi

Plot 2, 3, 11 & 12, Block P, Kaase Industrial Area,  
Fan Milk Depot, Kumasi  
t : +233 54 431 6512

### Ghana - Tarkwa

Adjacent PanAfrican (Zen Yard), Akyempin Road,  
Tarkwa  
t : +233 54 431 6512

### India - Chennai

#16 - B Kamokoti Nagar Main Road, Palli  
Karanaï, Chennai, 600 100, Tamilnadu  
t : +91 44 4557 5039

### India - Durgapur

Ground floor, MNA V21-C, Amnuja, City Centre,  
Paschim Bardhaman, West Bengal, 713216  
t : +91 343 2545422

### Mozambique - Maputo

Esquina da EN4 and Mozal Rd, Talhão no. 11/15,  
Bairro Mussumbuluco, Municipio da Matola  
t : +258 85 792 7933

### Mozambique - Tete

EnSerMo Yard, Estrada National No 7,  
Bairro Chitatha, Moatize, Tete  
t : +258 84 697 7006

### Namibia

Unit 14, Lafrenz Industrial Park – Erf R/E 26 W,  
Rendsburger Street, Windhoek  
t : +264 81 141 7205

### UAE – Dubai

Plot 271, Sector 18  
Al Jaraf Area, Ajman  
t : +971 6 740 1700

### Zambia

Plot 3717, Prescott Road  
Light Industrial Area, Kitwe  
t : +260 212 210 161

### Zimbabwe

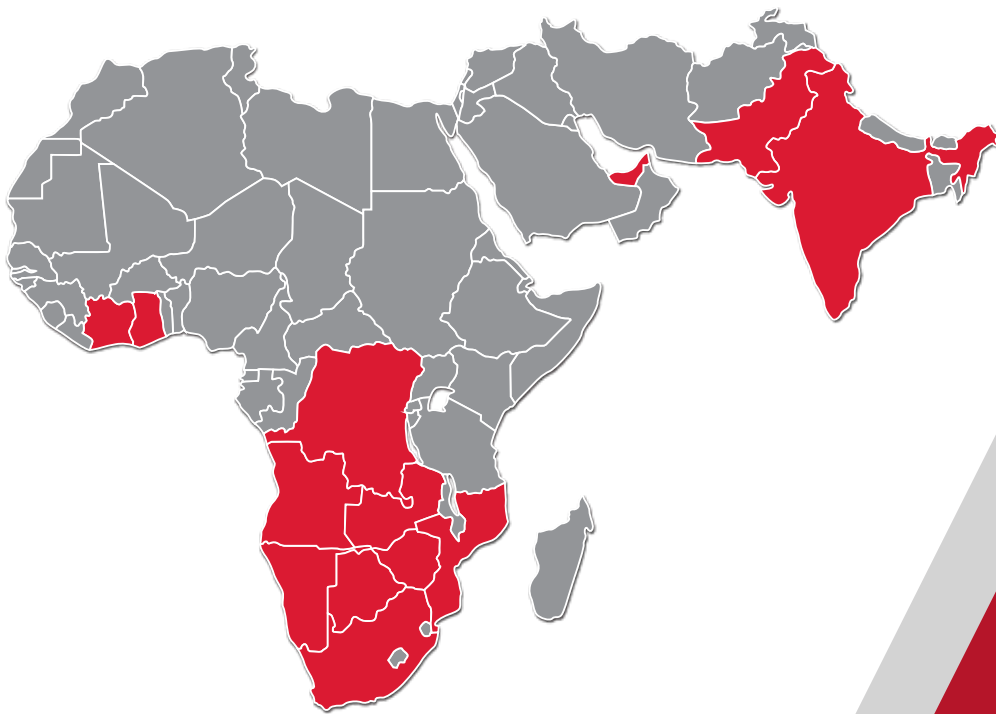
23 Amby Drive, Amby, Harare  
t : +263 24 244 6369

### \*Agents & other contacts details:

Scan the QR code.



CONTACT US



Since

1976

To Download the WearCheck App



Android



Apple

[www.wearcheck.co.za](http://www.wearcheck.co.za)

**SABS** ISO 9001 | ISO 14001 | **SANS** 17025

ds108 - July 2024