



# OELCHECKER

Circulation: 9,500; three issues a year since 1998

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## Liebherr – engine oils allow oil change intervals to be doubled



Liebherr's range of construction machines is more extensive than any other. The wide range of earthmoving equipment includes hydraulic excavators, wheel loaders, crawler tractors and crawler loaders, telescopic handlers and trucks.

**Liebherr – a name that stands for quality, efficiency and precision! Customers expect reliable performance from Liebherr construction machines, and with good reason. To ensure that the machines deliver this over a long period, and thereby realise their full potential, high-quality Liebherr lubricants are recommended.**

Liebherr lubricants meet the company's ambitious quality standards and are tailored precisely to the functionality of the Liebherr machines.

But that's not all: at Liebherr, efficiency is also a top priority. Reducing the types of lubricant and, in particular, the length of time they are in use are an important part of this. Currently it is possible to extend the oil change intervals for the engines produced in the Liebherr factory in Bulle, Switzerland from 500 to 1,000 operating hours (or two years) if Liebherr engine oils are used. What's more, an oil change interval of up to 2,000 operating hours is possible for earthmoving machines and material handlers if „Liebherr Motoroil 5W-30“ is used. In addition to oil quality and virtually sulphur-free fuel, improved engine management also contributed to this development. Numerous field tests,

which were accompanied by OELCHECK lubricant analyses, provide the basis for these extended oil change intervals, which are now listed in the operating manuals as of the beginning of 2016.

### Tailor-made and economical

Liebherr diesel engines have proven themselves over decades in the toughest applications and under extreme operating conditions. Liebherr Motoroil 5W-30, which makes oil change intervals of up to 2,000 operating hours (two years) possible, provides a perfect accompaniment. It is designed for use in Liebherr diesel engines, which comply with the exhaust emission standards both of EU stage IV, introduced in 2013, and Tier 4 in the US with an innovative SCR (selective catalytic reduction) system and the addition of AdBlue. With optimum tuning and operating mode, fuel consumption can be reduced by up to 8% and nitrogen oxide (NOx) emissions by up to 98% with the SCR system. Engine management is optimised constantly, which means that soot ingress into the engine oil is also reduced significantly. Liebherr engine oils have been formulated for long oil change intervals and high wear resistance. They reliably prevent deposits because the detergent-dispersant additives they contain offer a high level of protection against deposits. The mostly synthetic oils work very well with the urea in the AdBlue and are also ideal for use at low temperatures. One advantage in particular is their high alkaline reserve. This enables them to effectively neutralise the acidic components that are formed during the combustion process, for

# Check-up

In summer 2016, OELCHECK will be celebrating its anniversary! It is now 25 years since the company was founded – 25 years characterised, above all, by a willingness to change and the consistent development of our company.

When we founded our company in June 1991, at the time still under the name WEARCHECK, lubricant analysis was practically non-existent in Germany. While some derided it back then, there were others who recognised immediately the huge possibilities it offered. Within just a few months of starting our activities, we could count leading companies among our customers. These companies have remained customers to this day, and many others have joined them over the years. Today we have more than 30,000 customers in total. The „OELCHECK system“ has proven extremely successful. Year after year we have invested in faster and more precise testing devices, optimised a number of testing methods, created our own smart software and offered ever more extensive services.

But what will affect our customers and us most in the years to come? One trend at least is sure to continue: our work will become more mobile and more connected. With the new customer portal at [www.lab.report](http://www.lab.report), we have already taken decisive steps towards “Industry 4.0”. It is now possible, for example, to enter data for new samples quickly using QR codes and to export analysis results into the customer's own systems. There is also a new “old” trend that is becoming increasingly important: the more sustainable use of lubricants. Although many of them remain in use for longer, a large proportion of lubricants are still being changed far too early. If the approximately 1 million tonnes of lubricant used in Germany alone were only replaced when lubricant analysis indicated that this was necessary, around 30% of that, or 300,000 tonnes/350 million litres, could be saved every year. Our task is therefore to continue to reduce our customers' costs and contribute to environmental protection in the long term with even better analysis methods. Onwards and upwards!

  
Yours, Barbara Weismann



MAN, MTU and Mercedes Benz. This makes it ideal for a mixed fleet because it can also be used in engines made by other machine manufacturers, as well as in HGVs.

However, before the oil change intervals were extended, the Liebherr engine oils 10W-40 and 5W-30 had to pass very rigorous tests: large-scale field tests with regular inspection using OELCHECK lubricant analyses. Only once the field test had been completed successfully with good analysis results did the Liebherr engineers give the go-ahead for extending the service life of the oils. The effort required was enormous, but at Liebherr safety is always given utmost priority.

## Oil analyses since 1992

Liebherr is not only one of the biggest manufacturers of earthmoving machines, material handlers and mining machinery in the world, it is also recognised in many other areas as a provider of technically sophisticated, practically oriented products and services. In the area of earthmoving, Liebherr produces an extensive range of hydraulic excavators, duty-cycle crawler cranes, crawler tractors and crawler loaders, wheel loaders and trucks. And the company's crane range is more extensive than any other. Liebherr sets high quality standards, and leading employees at Liebherr Hydraulikbagger GmbH recognised the benefits of OELCHECK lubricant analyses early on. In 1992, they were the first in the industry to recommend that the hydraulic oils in construction machinery no longer be changed after set 1,500-hour intervals, but according to the condition of the oil based on oil analyses. Liebherr hydraulic oils, which are monitored by oil analysis, now usually reach a service life of 6,000 hours.

Analysis sets from OELCHECK are a permanent feature in Liebherr's spare parts range. Based on the results of lubricant analyses:

- Liebherr customers change the oil at the optimum time.
- they receive all of the details relating to the condition of the lubricant being analysed.
- they can detect impending damage at an early stage.
- less waste oil places less of a strain on the environment.

The vast OELCHECK database now includes the analysis results of hundreds of thousands of lubricant samples from Liebherr machines. These values, taken from real applications, contribute to the design and optimisation of the machines and lubricants from Liebherr.

example from the sulphur in the fuel. This means that Liebherr engine oils not only remain in use for longer, but they are also better equipped for a completely different challenge: if fuel that contains over 10 but under 300 ppm sulphur is used, and which is therefore not compliant with European standards, this can also be neutralised more effectively by the engine oil. This means that the engine is ideally protected against the aggressive effects of sulphur.

However, when fuel oil, which usually contains considerably over 1,000 ppm sulphur, is used as a fuel, which is permitted in some countries, there should be no unchecked extension of the oil change interval. In the case of higher sulphur concentrations, which are permitted in zero-emission engines, the operating manual must be consulted.

## Inspected, tested, approved

Liebherr sets high quality standards for its products. The Group has therefore put together its own panel of experts who define and test the ideal lubricant formulation together with suppliers and design.

Each of these lubricants is monitored during and after approval using a wide range of laboratory tests. An engine oil, for example, must complete extensive test runs on the engine test beds at the Liebherr engine factory in Bulle, Switzerland.



*A strong partner for Liebherr construction machines.*

Following the test runs, practical testing is carried out. Only once the lubricant has successfully completed all tests does it qualify for use in the machines. It is given an official Liebherr designation and is incorporated into the Liebherr product catalogue. But it doesn't end there: the lubricants must also fulfil the highest international specifications and must be usable worldwide. For engine oils, for example, further approvals from other internationally recognised engine manufacturers are obtained through complex procedures. Liebherr Motoroil 5W-30 thus also meets the qualifications of Deutz,

Further information: [www.liebherr.de](http://www.liebherr.de)

# Meet the team!

## The OELCHECK Team – at trade fairs and events



11-17 April 2016

### bauma – the trade fair of superlatives in Munich

It is the world's leading trade fair for construction machinery, building materials machinery, mining machinery, construction vehicles and construction equipment. For us bauma, which takes place every three years, is like a home fixture – the exhibition grounds are just 60 km from Brannenburg – and is one of the most important trade fairs of the year. OELCHECK is after all an important partner of leading OEMs and a well-known company in the construction industry. OELCHECK lubricant analyses are an integral part of their maintenance plans. In Munich, the trade fair team will be presenting our new web portal, among other things, and is looking forward to meeting visitors from all over the world!

**OELCHECK at bauma: Hall A4, Stand 539.**



13-14 April 2016

### UNITI – Mineral Oil Technology Congress in Stuttgart

UNITI, the German federal association of medium-sized mineral oil companies (Bundesverband mittelständischer Mineralölunternehmen e. V.) represents the interests of around 1,500 companies that sell mineral oil. Experts from the mineral oil sector, as well as the machine and vehicle industry, will be meeting at the Mineral Oil Technology Congress in Stuttgart to exchange ideas. The main topics of discussion will be lubricants, fuels and cooling lubricants. The OELCHECK stand at the affiliated trade exhibition continues to be a popular meeting place to discuss current trends and the support of new product developments through lubricant analysis.



16-19 April 2016

### ELGI – Annual General Meeting in Venice

Lubricating greases will take centre stage at the meeting of ELGI (the European Lubricating Grease Institute). Topics of discussion will range from technical application details to economic and environmental issues. Various working groups of ELGI will discuss a wide range of topics.

OELCHECK will be represented in the two working groups that will focus on test methods for lubricating greases and their purity. OELCHECK will discuss analytical methods, involving the analysis of tiny amounts of grease, which can be used to extend and optimise relubrication intervals.

## 在做什么 NEWS FROM CHINA 在做什么

# New! OELCHECK China laboratory becomes CMA-certified and CNAS-accredited



中国认可  
国际互认  
检测  
TESTING  
CNAS L8030



**As is already the case for the OELCHECK laboratory in Germany, the laboratory in China now also holds the certification and accreditation to prove that it meets the highest quality standards.**

In lubricant analysis, the implementation of legal provisions, national and international standards, as well as compliance with internal guidelines on the quality of analysis results and the organisation of company processes are an absolute must for us. The OELCHECK laboratory in China has now been inspected and accredited by national institutions, which operate according to international regulations, and in near record time by Chinese standards – just two years after the laboratory was founded.

- The CMA (China Metrology Accreditation) is broadly equivalent to ISO 9001, the standard customary in Europe. It is an important requirement for proper laboratory operation and defines the workflows which ensure conformity of the analyses and services for the Chinese market.
- Accreditation by CNAS (China National Accreditation Service) corresponds to ISO/IEC 17025:2005, the definitive international quality standard for testing laboratories and other things. Since lubricant samples are analysed in the OELCHECK laboratory in Guangzhou using the same devices and according to the same standards as in Germany, our German specialists were ideally placed to provide support for the accreditation. The CNAS, as China's national accreditation body, is the counterpart to

Germany's national accreditation body DAkkS (Deutsche Akkreditierungsstelle GmbH). Like DAkkS, CNAS also belongs to the umbrella body ILAC (International Laboratory Accreditation Co-operation). This means that both the laboratory in Brannenburg and the OELCHECK laboratory in Guangzhou are internationally accredited in accordance with ISO/IEC 17025:2005 and certified in accordance with ISO 9001.



# Currenta benefits from the oil maintenance service from WESTO and OELCHECK lubricant analyses



Currenta is the manager and operator of Chempark, one of the largest chemical parks in Europe, with sites in Leverkusen, Dormagen and Krefeld-Uerdingen. One third of all chemical production in North Rhine-Westphalia takes place here, employing around 45,000 people.

Over 70 companies from production, research and services have access to a complete infrastructure and services tailored to every requirement at all three sites. All of this is provided by Currenta, a joint venture of Bayer and Lanxess. Currenta supplies the companies at all of the sites with electricity, natural gas, steam, cooling, compressed air and technical gases. One of the biggest daily challenges is supplying energy.



Jointly developed by WESTO and Currenta: a partial flow filter system specially designed for the screw compressors used in refrigeration that takes into account the proportion of ammonia (NH<sub>3</sub>) in the oil circuit.

## WESTO undertakes oil maintenance

For Currenta, safe supply of media and energy is the top priority. This is supported by reserve capacities, emergency power supplies and interconnected energy and product pipelines. Much of the overall production at the three sites is dependent on the reliable operation of the turbines, screw compressors and turbocompressors used in the power stations and for cooling and compressed air production.

These systems are running around the clock, 365 days a year. Maintaining their lubricants is therefore extremely important. For this reason, the lubricants are analysed by OELCHECK every six months. WESTO takes care of the resulting oil maintenance measures on-site.

## OELCHECK analyses the oils

Currenta has, with OELCHECK, put together special analysis sets for the cooling systems. Because tests that are carried out for these oils require larger amounts of oil, each oil sample taken is 500 ml.

The oil condition, contaminants and any wear are examined by OELCHECK just as critically as the condition of the additives. Supplementary test procedures, like water and air separation characteristics and foaming characteristics, support the statements given in the commentary that accompanies every sample. The RULER and MPC test are now also carried out for almost all turbine and turbo-compressor oil checks. The MPC test (Membrane Patch Colorimetry, [oelcheck.de/pruefverfahren/mpc-test](http://oelcheck.de/pruefverfahren/mpc-test)) is the only test method in the world that can detect insoluble oil residues (varnish) and quantitatively evaluate them.

## Oil analysis – the basis of all decisions

In turbo machines, oil charges often of several thousand litres are generally in use for several years. OELCHECK lubricant analyses provide:

- Trend data which can be used to estimate the remaining service life of the oil under similar operating conditions.
- Evidence of contaminants showing whether preventive oil maintenance measures need to be taken.
- Information on whether deposits could form in the oil or whether varnish has already appeared.

For WESTO and the Currenta team, the oil analyses provide the basis for consultation and all other measures.

### Sustainable maintenance by WESTO

If the turbine oil needs to be changed or an inspection is due, the oil is not simply replaced. At WESTO, sustainability takes top priority for the benefit of the customer!

Once the system has been drained, it is cleaned thoroughly. If a higher-quality turbine oil is then poured in, WESTO also takes into account another important factor: modern turbine oils, which have a higher oxidative stability and contain fewer harmful substances, are refined differently and with different additives from earlier products. However, substances formed as a result of oil ageing can be held in solution only to a very limited extent. It is therefore important to reduce the remaining waste oil, as well as any impurities and deposits already in the system, to a minimum when changing the oil. Different cleaning plans are implemented depending on the analysis carried out before the oil change.



WESTO's ideal weapon against varnish – the ESP process from Fluitec

Sticky or soft reaction products and deposits (varnish) are removed when the turbine is in operation, even before the oil is changed. This cleaning is carried out by WESTO according to the Fluitec ESP process, in which oil reaction products attach to resins. This prevents contaminants that have dissolved and dispersed in the oil from compromising important properties like air and water separation characteristics or oxidation resistance in the new oil charge, and jeopardising the function of the entire turbine oil charge.

Varnish removal using ESP is also being used increasingly as an oil maintenance measure between changes. WESTO completely avoids the use of cleaning supplements like detergents or water in its cleaning measures!

### Customised partial flow filter system

In 2012, WESTO, in collaboration with Currenta, developed a partial flow filter system customised specially for the turbocompressors used in refrigeration at the Leverkusen and Dormagen sites, that takes into account the proportion of ammonia (NH<sub>3</sub>) in the oil circuit. It has the advantage that it can be connected to any type of compressor that uses NH<sub>3</sub> as a refrigerant. The system also allows the oil purity trend in the oil circuit to be monitored simultaneously. It therefore plays a crucial role in the operational safety of the system components used in refrigeration.

### QR codes allow oil sample management on-site

Since the beginning of the year, Currenta has been producing signs in collaboration with WESTO, OELCHECK and Stell GmbH, a company which specialises in process labelling. These feature a QR code and NFC (Near Field Communication) chip for every site an oil sample is taken from. These oil sample signs installed on turbine, refrigeration and compressed air systems offer an unbeatable advantage: current operating parameters and earlier laboratory reports can be loaded directly onto a smartphone via an app using the NFC and made

available to different partners. This makes work on-site much easier. The data relating to an oil sample that is currently being taken can be entered directly into the OELCHECK system using the QR code on the installation.

The development of customised partial flow filter systems for use in refrigeration and the considerably simplified management of oil samples using QR codes on-site are just two examples of how the many years of successful partnership between WESTO and Currenta to promote proper oil maintenance in the system components at all sites is continuously being deepened and strengthened.



[www.currenta.de](http://www.currenta.de)

**WESTO** 

**Focus on day-to-day business – because WESTO makes sure that oils and machines are running safely**

From oil maintenance, regular servicing, inspection support and commissioning to removing varnish (deposits) – WESTO is the expert partner for maintaining small industrial systems, as well as for refineries, the chemical industry and oil supply systems for large turbines. For more than 40 years, the independent, owner-managed company has offered expertise, an established team and an extensive range of outstanding oil maintenance systems which has been expanded continually over recent years.

WESTO operates all over Germany and in neighbouring European countries. Service engineers' assignments are controlled from the company's headquarters in Pulheim near Cologne. Once on-site, they work completely autonomously. Not only are they qualified and experienced, but their vehicles also have unparalleled equipment on board.

WESTO was and is ahead of its time! The team is up to date with current trends because it is in close dialogue with customers, suppliers and partners, like Fluitec (cleaning systems) and OELCHECK (oil analysis). In 1996, for example, when lubricant analysis was still far from mainstream in Germany, the company recognised the unique advantages it offered in terms of system monitoring and began working with OELCHECK. Lubricant analyses have been an integral part of lubricant monitoring for 20 years now. It is only a few weeks, however, since the company officially joined forces with Fluitec to try to comprehensively address current issues surrounding deposits in oil systems. WESTO is now operating in Germany, Austria and Switzerland as one of just three European distribution and service partners. However, the company is known above all for its own innovative products and services. These include special system flushing processes, customised partial flow filter systems (which even work in refrigeration compressors with ammonia) and, most recently, an extremely effective method for removing sticky oil deposits – varnish – in turbines and hydraulic systems!

[www.westo.de](http://www.westo.de)

# Oil analyses – and how our professionals evaluate them



### Oil talks. The important thing is to understand its message!

For every lubricant sample taken, the OELCHECK diagnostic engineers are confronted with over 30 individual values from the laboratory. They evaluate each analysis individually and translate what the oil is telling them into a language that the user will understand. This often means that the professionals are forced to answer tricky questions. In the course of their work they can draw on the enormous wealth of experience of the more than 2 million samples in the OELCHECK database, though individual expertise and complex reasoning are just as essential to making a comprehensive diagnosis as a structured approach.

### Well begun is half done!

Customers have high expectations of OELCHECK lubricant analyses and the accompanying commentaries from the diagnostic engineers, with good reason. The analyses should reflect the actual condition of the oil and machine. They not only allow oil changes to be made on a condition-dependent basis; it is changes in the trend in particular that help the engineers to detect damage at an early stage or identify the causes of abnormal wear processes. However, in order to ensure that this works as well as possible, customers are asked to help too. It is a case of eliminating any distortive influences from the beginning. This can be done without much effort, as OELCHECK is on hand to provide assistance!

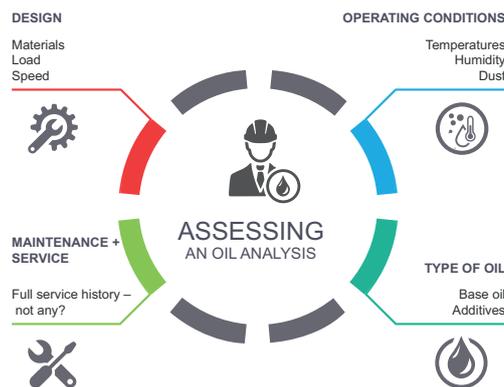
### Correct sampling

With the OELCHECK analysis sets, oil samples can be taken, recorded and shipped quickly, cleanly and easily. OELCHECK has outlined how and where samples should be taken in clear guidelines. These are available to download from [www.oelcheck.com](http://www.oelcheck.com) under the button „Take & send samples“.

### Valuable information

The more information there is regarding the machine, its surroundings and the type of oil used when evaluating the oil analysis, the more accurate the diagnosis. A sample information form which is completed as fully as possible and which contains all of the essential details is invaluable!

By the way: the unique sample ID assigned to the machine must be retained for subsequent analyses. It is only by doing this that it is possible to plot the trend.



### Knowledge is power

A range of factors must be taken into account when evaluating an oil analysis: type of lubricant, usage time and operating conditions are just as significant as maintenance, servicing and the typical design features of a machine or lubricated components. However, factual knowledge of these factors is in itself often not sufficient. If you really want to make the oil talk, having background knowledge of the systems and machines, production processes and lubricants, and knowing how the oil and machines interact is essential.

*Here's an example of this: The customer states that 2,000 litres of hydraulic oil HLPD 68 has been in use in a forming press for around two years (5,000 operating hours). The diagnostic engineer adds that the forming press is used to manufacture plastic parts (query), the HLPD contains the additive zinc (fresh oil database) and is used at temperatures of max. 60°C (machine manufacturer).*

The OELCHECK diagnostic engineers have a fundamental knowledge of mechanical engineering and chemicals. They are also familiar with the production processes of almost all industries. As tribology engineers, they have extensive practical application experience with all types of lubricants. What's more, they specialise in specific fields. This means that they know how a lubricant reacts under certain conditions, or what it could be contaminated with, and they know how different factors relate to one another.

### Optimum testing for a firm foundation

Each sample that arrives in the OELCHECK laboratory in a prepaid „all-inclusive“ analysis kit first of all undergoes a series of tests. The test procedures that will determine the values in the laboratory are selected according to the colour of the cap and the information relating to the system the sample came from. Our laboratories are equipped with state-of-the-art analysis devices. We have optimised many of the testing devices together with the device manufacturers and adapted them to the specific requirements of testing aged, sometimes highly viscous or pasty lubricants, both used and still in use. An experienced team of chemists and laboratory technicians maintain and operate the extensive range of analysis equipment and determine over 30 individual values from up to 2,000 lubricant samples every day.





### All data at the touch of a button

Only once all of the tests for a sample have been carried out in the laboratory and the values have been transferred from the individual laboratory device memory to the central LIMS (Laboratory Information Management System) is the order „Next please!“ given. This means that, for every sample, all of the laboratory values, infrared spectra, photos, titration curves and device diagrams are logged in the LIMS. The diagnostic engineers can access all of the values and information at the touch of a button. For each individual sample, a diagnostic engineer takes time to follow the predefined steps of the analysis process.



### The basis of the analysis

First of all, the diagnostic engineer gets an idea of which oil, from which customer and which system he is dealing with. To do this, he checks the sample information form on the screen, which was scanned when the sample was unpacked, and checks the information provided by the customer for completeness and plausibility, among other things. Then he asks the first key question: why did the customer send the sample in?



#### → Routine check

In most cases a routine check, for trend monitoring if possible, should be carried out. The customer wants to know if the oil can remain in use and if wear or contaminants indicate a problem. Checks are made to establish whether unexpected changes have taken place or whether the values from the sample follow the expected trend.



#### → Problem check

The customer has noticed abnormalities when applying the lubricant, or has specific questions like: What causes clouding or other visual changes in the lubricant? Why is the oil foaming? Why are filter service lives so much shorter? Has the oil really been changed by the service? Is the right oil even being used? What causes damage or are there signs of damage? Fresh oil testing, oil changeover testing or start-up testing are often also required.

### Threefold approach – a firm foundation for analysis

Once the reason for the oil analysis has been established, the diagnostic engineer knows what he needs to look out for during the analysis. With this in mind, he first of all considers the fresh oil values, then the limit and warning values compiled in-house for the relevant system.



### Fresh oil values and oil changes compared

The values that are characteristic of the fresh oil are considered for every sample. In addition to the additive elements present, particular

attention is given to the IR index, IR spectrum and viscosity. For this purpose, the reference values of over 8,000 fresh oils are available in the OELCHECK database. If the wrong oil has been poured in, then this is exactly where the first indications of that will become visible.

The examination of how closely the fresh oil values correspond to those of the used oil sample are taken into account for the diagnosis, particularly where there are noticeable deviations. Where there are questions regarding the inspection of fresh oils or oil changes that have been carried out, comparing with fresh oil values is essential.



### Limit and warning values

Defining limit values for wear and contaminants is the biggest challenge in assessing the analysis values of used lubricants.

Generally applicable limit values are only available from machine/lubricant manufacturers or their associations in a small number of cases. But what value counts as too high or unexpectedly low? What value is still tolerable for the time being and at what point will it become critical? Is it even possible to have fixed limits for wear that is directly linked to the service life of the lubricant? The more analysis results with different usage times for a particular type of machine or engine there are available, the better the limit values for wear based on usage time that can be generated.

When reviewing the laboratory results, the OELCHECK diagnostic engineers use limit values that have been calculated based on many thousands of analyses. In the company's internal database, which is growing daily, there are now, after 25 years, over 2 million records of a wide range of machines, lubricants and applications available. In order to assess the values for wear metals, it is important to know where the elements might come from and in what combination and concentration they could potentially cause problems. Elements which in one application indicate wear could in another case be a component of oil additives or even contaminants. (See also **OELCHECKER** Winter 2014, Spring and Summer 2015).

A number of individual values are taken into account when diagnosing a sample. However these must never be viewed in isolation, but in terms of how they relate to one another.

*Here's an example: the viscosity of an engine oil is higher than expected. This could be the result of oil oxidation, nitration, soot ingress or even cooling water ingress. But it is also possible that the viscosity class stated is simply incorrect, or that there is fuel in the oil which is disguising the result. The abnormally high viscosity value can therefore only be interpreted in relation to other individual values.*



### The individual trend

For wear metals, limit values have only limited significance, particularly for very long oil usage times. If results from previous tests are available, a continual comparison is made of how the values have developed over time for the oil charge of the machine. This means that the different operating and environmental conditions can be considered individually. Detailed prognoses can therefore be made for continued low-wear operation of the machine or the extension of an oil change interval.

*The following example shows just how crucial this can be: an industrial gear oil CLP 220 is monitored at six-month intervals using trend analyses. There are now five oil analyses saved in the database. The copper value was always between 2 and 3 mg/kg in all five of the previous analyses. The limit value for copper for the gears being analysed is set by OELCHECK at 15 mg/kg. In the sixth analysis, the copper value suddenly reaches an unexpected 9 mg/kg. – No problem though, since the defined limit value of 15 mg/kg is still far from being reached? No, watch out!*

*The increased copper value could indicate the early stages of a wear process in a copper-containing component, like a roller bearing with brass cage. The engineer advises in his diagnosis that the gear oil be analysed again after three months at the latest so that countermeasures can be implemented promptly or the cause can be established by other methods.*



### The analysis – three aspects in focus

Once the diagnostic engineer has examined the individual values in relation to the limit values, he produces a diagnose statement which can be easily understood by non-experts.

It includes a summarised evaluation of each of the three aspects wear, contaminants and oil condition.

#### 1 Wear

Higher wear values or significant variations from one sample to the next are an early indication of wear and therefore of a reduced remaining service life of the components, or even of developing damage. If abnormal wear values are detected, then the components from which they may originate must be examined more closely:

- On which components could the abrasion from which the wear particles originated have formed? Are there perhaps even two or more elements with increased values that could point to particular alloys and therefore specific components?



# OELCHECKER

**OelChecker – an OELCHECK GmbH magazine**  
 Kerschelweg 28 - 83098 Brannenburg · Germany  
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 Concept and text:  
 Astrid Hackländer, www.astridhacklaender.com  
 Layout and design:  
 Agentur Segel Setzen, Petra Bots, www.segel-setzen.com  
 Photos:  
 OELCHECK GmbH · Currenta · WESTO · Liebherr · flaticon.com

- Is the cause of the increased wear values obvious from the analysis? Has the wear been formed by abrasive contaminants, water, insufficient lubricity of the oil or by chemical reactions in ageing oil?
- Unlike mechanical wear in the form of particles, which form because of fatigue or from hard contaminants, chemical-abrasive wear dissolved in oil is caused by reaction products with water or acidic oil components.

## 2 Contaminants

Contaminants affect the service life of the lubricant and the wear behaviour of the components. Warning values for contaminants apply independently of the service life, oil type or oil quantity. The lubricant analysis must identify contaminants at an early stage and comment on them. Often only an early oil/filter change or improved oil maintenance measures can prevent negative consequences. Water and dust are among the most common contaminants. Residues from manufacturing processes, release agents, assembly aids or entry of other lubricants are also often the cause of contamination. As with the wear values, background knowledge and insight are essential when analysing contaminants. Individual numerical values alone can otherwise quickly lead to confusion.

*Here's another example: silicon (Si), for example, can get into the lubricant in the form of dust. However, it could also be an anti-foaming additive from the fresh oil or residues from assembly greases/pastes that contain silicon. It is also possible that silicon has been released from seals made from silicone rubber.*

## 3 Oil condition

The condition of the oil provides information in terms of if and how much longer the oil can remain in use. Every application has its own „ageing scenario“:

- Motor oils age differently from gear oils, circulating oils and hydraulic fluids, not least because of higher oil temperatures and contamination by soot and sulphurous fuel.
- Mineral oils, bio-oils and synthetic oils also display different ageing behaviour.
- An oil ages differently in continuous operation compared to stop-and-go operation.

- Oils also age differently in systems which are structurally identical but which operate in different environmental conditions.
- Maintenance and servicing of the system and oil also have a huge effect on oil ageing.

When the oil condition is being analysed, particular consideration is given to the values for the viscosity, oxidation, nitration, sulfation and often also the acid number (AN, NN - neutralisation number) and base number (BN), as well as the change in the additive elements. The IR spectrum and IR index recently defined by OELCHECK (see **OELCHECKER** Winter 2015) play a fundamental role here. Often only limit values that are difficult to apply generally can be defined for the oil condition. The diagnostic engineer must have a detailed knowledge of a wide range of lubricants, their characteristics and typical reactions in different applications to be able to give an accurate statement. Here too it is a case of making typical patterns of change clear rather than simply „ticking off“ individual values in isolation.

## 4 The recommendation

After the standard procedure of examining and analysing limit and warning values, taking into account the oil type, usage time and application site, come the specifics:

### The individual diagnosis statement contained in every OELCHECK laboratory report is produced.

The diagnostic engineer comments on wear, any contaminants and changes in the oil condition. He then gives a recommendation for further action. This could be a recommendation to maintain the oil better, to change the oil or to continue using the oil without any corrective measures. It is also stated when the next sample should be analysed in order to monitor a trend.

Once the basic commentary has been given, specific questions from customers, like „Why is my oil foaming?“ are answered. Particular care is taken here to ensure that the complete text of the recommendation is easily comprehensible to a non-expert.

## 5 The diagnosis symbol

Finally, the diagnostic engineer assigns a green, yellow or red diagnosis symbol as a way of summarising his diagnosis. These symbols have the following meanings:

-  The values analysed are within the normal range. Further use of the oil is possible without any corrective action.
-  Some values are outside the normal range but are not critical. Further use of the oil is possible. The recommended corrective measures must be implemented or shortened analysis intervals observed.
-  At least one value, which has been commented on separately, is in the critical range. The recommended corrective measures must be implemented.

The symbols, which are based on the globally recognised traffic light colours, are intended to give non-experts and those who have to manage a large number of reports on a daily basis a quick understanding of the analysis results.

On the web portal at [www.lab.report](http://www.lab.report), the analysis results can also be sorted easily according to the symbols and the critical results dealt with first.

Only once the diagnostic engineer has provided a individual statement and released the PDF laboratory report with the evaluation symbol, he gives the order „Next please!“ again.

