



OELCHECKER

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Nordex – Gear lubrication quality offensive



One of the highly efficient N117/2400 wind turbines from Nordex.

There is hardly any other technology that has come as far as wind energy utilisation in recent years. Nordex is at the forefront of this process.

The company has been setting the standard since 1985, with the development of ever larger and thus more efficient turbines. Today, there are more than 6,000 Nordex wind turbines turning in 38 countries, with a total power rating of more than 12,200

megawatts. The company's wind turbines have an impressive technical availability of 98 percent! And this is going up, because the company is constantly increasing the quality and thus the efficiency of its turbines.

Lubricants for wind turbines are also closely examined here. Gear oil plays a very special role. Nordex has always relied on drive trains with gears. This design has proven to be the best from a technical point of view. The gearbox converts the

rotor's low rotational speed of around 15 RPM to the electricity generator's high speed of 1,200 RPM. The gearbox of the latest generation of turbines, Gamma, weighs about as much as 17 small cars and must be designed to convert around nine times the power. The torque achieved at the nominal capacity of a turbine is equivalent to the weight of 150 small cars hanging at arm's length on the gear shaft.

Synthetic gear oils for Nordex wind turbines

Nordex experts place great emphasis on selected gear oils that are only approved if they meet our high standards. Where mineral oil-based products were previously used, wind turbines are now generally filled with a fully synthetic, high performance gear oil of ISO-VG 320 standard. This extensively tested oil is also recommended for future oil changes for older turbines.

The synthetic gear oil has a whole range of benefits. It is more resistant to oxidation and has greater temperature stability, and distinguishes itself with its multigrade characteristics. At low temperature ranges it is not quite as viscous as mineral oil. This makes it easier to pump and filter. At high temperatures, the oil provides additional safety through a higher-viscosity, stable lubricating film.

Check-up

OELCHECK GmbH has been certified in accordance with DIN EN ISO 9001 and 14001 for almost 20 years. All major testing methods are accredited in accordance with DIN EN ISO 17025. Our high quality standards extend to every area of the company. The OELCHECK team puts these standards into practice daily. But better is the enemy of good! And repeat audits after 3 to 5 years are a must, with annual control audits. In summer 2014 we successfully passed three of these repeat audits. Even though they take a lot of work, the input and suggestions for improvement by the auditors in cooperation with our employees are worth the effort.

We are also already planning a further „audit“, one that is just as important for our customers and for us. Although there is no standard for this just yet, we want to perform another large-scale survey of our 15,000 plus customers later in the year. We know that we will get back valuable suggestions this time too. When we performed our last survey in 2012, we received suggestions to expand the customer portal www.laborberichte.com. We are currently revising its design and enhancing its features to make your work and our work easier. For example, it will be possible to enter new test data directly on-site using smartphones. The sample shipping form no longer needs to be completed, since by reading the QR code of the previous sample, the data appears immediately on the display. This saves time, reduces transmission errors and makes working life just that little bit easier! – It's going to take a little longer yet, but you can start looking forward with us to the new and expanded OELCHECK customer portal!



Yours, Barbara Weismann

A special anti-wear additive significantly exceeds the performance of traditional EP-additives. The special additive technology is activated at high, specific surface pressures and corresponding temperatures in particular. It delivers optimisation of friction partner surfaces and actively protects against wear. Together with the more favourable viscosity-temperature relationship, this achieves an improvement in gear efficiency. But that isn't the only benefit for turbine operators.

The synthetic lubricant achieves considerably greater durability than mineral oil based products. While, in the experience of Nordex, a mineral oil-based gear oil needs to be changed after 2 1/2 to no more than 3 years, the synthetic lubricant is not expected to be changed until after at least 5 years. With a capacity of 400-650 litres, this effect of the synthetic oil definitely pays for itself despite its slightly higher cost for the operator. Consequently, this results in lower costs for gear oil, maintenance and disposal.

Safe conversion with oil analyses

A wind turbine filled with mineral oil-based gear oil is primarily converted to the new synthetic gear oil when maintenance or a regular oil change is due. However, if irregular values are found for a gear oil during a half-yearly OIL CHECK, the turbine can certainly be converted to synthetic oil early. This is particularly the case where the lubricant has aged prematurely and oxidation and additive degeneration, amongst other things, are seen on the IR spectrum.

Selected service companies that also perform maintenance on turbines in various wind farms carry out the conversion to the new synthetic gear oil. They carry out the work precisely to the specifications of Nordex. After draining the used oil at operating temperature, the gearbox and the

cooling circuit for the oil is thoroughly rinsed. The oil that is not drained into reservoirs in bearings and ribbing is sucked out using special lances. The fresh synthetic oil then used to fill the turbine should not contain any more than 3% of the old mineral oil. Synthetic oil can also only perform to its maximum potential if it is unmixed. On the other hand, the more powerful cleaning effect of the synthetic oil could dissolve any sludge deposits that the mineral oil could not remove. However, if these sludge deposits do enter the overall lubrication system with the oil, the filters will be able to block them more quickly. In a worst case scenario, the lubricant supply lines in the bearings can be blocked by deposits, causing bearing failures and then gear damage.

So that operators are absolutely on the safe side, Nordex requires written proof in the form of a laboratory report that the requirement of less than 3% residual oil has been adhered to when the oil is changed. This is easy to do using the analysis sets designed by OELCHECK specifically for Nordex wind turbines. The proven Nordex analysis sets have been a permanent fixture in our maintenance concept for years. Before a turbine converted to the new synthetic gear oil re-enters operation, a „zero sample“ is sent to OELCHECK. For this, „Oil change“ is simply ticked on the shipping note.



23 – 26 September 2014

Visit OELCHECK in hall B2, booth 306!

Then, in the OELCHECK laboratory, values such as viscosity, wear, impurities and additives are determined, but not only these. As well as specific wave number ranges in the IR spectrum, the residual content of the previously used product in the fresh oil can also be determined precisely, amongst other things, by using its density. If it is under the limit of 3% and everything else is in order, the go-ahead is given for the further operation of the Nordex wind turbine, which will be more efficient thanks to the new synthetic gear oil.

Nordex – We've got the power

Nordex, with its headquarters in Hamburg and its main production site in Rostock, is one of the world's leading manufacturers of on-shore wind turbines. The company's areas of expertise include developing and manufacturing wind turbines, constructing ready to use wind farms and maintenance and service. With its Delta generation, Nordex is offering the fourth generation of its proven multi-megawatt platform. With larger rotors, an increased power rating and optimised technical systems, the Delta generation sets new standards in terms of cost, reliability, ease of service and work safety.

Further information: www.nordex-online.com



Gamma 3D model

OELCHECK initiative: ASTM D7946 – New Standard for i-pH value!

OELCHECK initiated a project at the ASTM (American Society for Testing and Materials) back in the summer of 2011 to standardise i-pH measurements and has assumed responsibility for this project at a technical level. In June 2014, the approximately 50 members of the titration work group decided to adopt the new internationally applicable ASTM standard. Using the standardised method, the values previously calculated using different methods can finally be compared!

The i-pH value (initial pH value or starting pH value) is the third important parameter along with AN (acidity number) and BN (base number), particularly for evaluating oils from biogas engines. While AN and BN both only provide information on the overall content of acidic or alkaline compounds, the i-pH value also allows acidity to be assessed. It can even be used to discover small quantities of strong and thus corrosive acids in oil, even if the AN, i.e. the total content of acidic compounds has not yet increased significantly. Because it provides this crucial piece of information, the i-pH is included in many limit and threshold tables by engine manufacturers and insurance

companies. No standardised method had previously existed for determining this. Moreover, the method has been modified in many laboratories over the years. The values could previously only be compared to a limited extent, often making it difficult to decide whether used oil could continue to be used.

A draft was firstly prepared for the new standard, in which sample weights of oil and solvent, measuring electrodes, measuring times and termination criteria were established. The suitability of the method was proven with an interlaboratory test. OELCHECK took eleven samples for this purpose, which had to cover the entire range from fresh oil to extremely aged oil, which was organised by engine operators. Furthermore, eleven laboratories had to be enlisted to participate in the interlaboratory test. The large number of samples and laboratories was the essential prerequisite in order to provide a solid statistical foundation for the results.

After the interlaboratory test, a research report was produced, containing the precision data (repeatability, reproducibility) of the future standard. During fine-tuning, valuable comments were again received on how to improve the method.

The adoption of the new standard marked the successful completion of a labour-intensive chapter.

And, OELCHECK is already committing to its next project! Both at the ASTM and in a DIN standards work group, chaired by the Scientific Director of OELCHECK, Dr. Fischer, we are working on standardising titrations of the AN and BN with determination of thermometric end-point. In „Working Committee 663 Used Oil Testing“, too, OELCHECK is responsible for the „titrations“ group. An interlaboratory test is currently being evaluated.



在做什么 NEWS FROM CHINA 在做什么



It is hard to imagine a service technician living on a wind farm in the Western world, but for many of their Chinese colleagues, it is not at all unusual. They perform maintenance on wind turbines and also live where they work.

Such commitment is admirable, but also necessary. China is the world's largest producer of wind power, ahead of the USA and Germany. However, maintenance of the Chinese turbines is still in its infancy and remains far too cost-intensive. Defects in maintenance and operation currently reduce yields by 15-30%. There is an urgent need for action here!

China is aiming to achieve an installed output of 200 GW (the equivalent of around 75 nuclear power plants) by 2020. Off-shore turbines are likely to contribute significantly towards this goal. The goals are ambitious, and the rapid development is already presenting major challenges. Many of the 90,000 or so existing wind turbines are installed in the north, in areas that are difficult to reach and subject to extreme temperatures. A large proportion of the

wind turbines were only produced in the last seven years. The mostly young domestic producers still have little experience, particularly with respect to the long-term operation of the wind turbines.

The Chinese Wind Energy Association (CWEA) estimates that by 2020, approximately 100,000 wind turbines, supplying around 140 of the planned 200 GW of installed output, will no longer be covered by warranty. Expensive repairs, which are often only made after the guarantee period of three to five years, will then be charged to the operators. The operation, monitoring and maintenance of the turbines needs to be made significantly more efficient as soon as possible!

This was precisely the theme of „Offshore Wind China 2014“ and „Wind Energy Operations and Maintenance China 2014“ in July in Shanghai. OELCHECK delivered a presentation at the conference entitled „Oil can talk – Oil Analysis for Wind Turbines“.



We were also represented at the exhibition by a well attended stand. Manufacturers, operators and service companies were unanimous: oil analyses can make a valuable contribution to detecting



Large crowds at the OELCHECK exhibition stand at Wind Energy China 2014

problems and damage at an early stage. Currently, synthetic gear oils are indeed used in the Chinese-built main gears in most turbines in China, but not enough is being said about the monitoring of oil quality, wear, and harmful impurities, and much of what is being said is wrong. The concepts presented by OELCHECK on monitoring gear oil and diagnoses in relation to real-life examples of main gears and grease-lubricated main bearings were received with great interest.

The first manufacturers of wind turbines and components have already taken the initiative. They have already started working together with OELCHECK. After all, OELCHECK has data from more than 300,000 tested lubricant samples from wind turbines at its disposal. Each oil sample examined in the OELCHECK laboratory in China is also evaluated with informative comments from an experienced German engineer. Chinese customers aren't taking any chances either. They know: OELCHECK has the experience!

Full speed ahead with OELCHECK SDA lubricant analyses



© EvrenKaimbacak - Fotolia.com

2-stroke marine diesel is a hard worker with plenty of stamina

Maritime shipping is the largest carrier of traffic in the global economy. Most large freighters, tankers and container ships are driven by slow-speed 2-stroke diesel engines. These engines are often over 30m long and around 13m high. They have a power output of 3,500kW to 80,000kW and between 5 and 14 cylinders. The slow-speed engines operate at 40 to 160 rpm and do not require any expensive gearboxes. Their power output is transmitted directly to the propeller, and the engine can be operated forwards and also in reverse.

Mostly, HFO (heavy fuel oil) is used as the fuel. It is produced mainly from residues of mineral oil processing, and is so viscous that it needs to be heated in storage and particularly before combustion. Although some impurities are already removed from the pre-heated fuel by centrifuges and filtering, the heavy oil remains contaminated with sulphur compounds and metals. This is an immense challenge for any slow-speed 2-stroke diesel engine, which requires two different types of oils in order to operate.

- Large ship engines consume up to 2,000 litres of cylinder oil per day. This oil is pumped directly into each individual cylinder using a central lubrication pump. This very highly viscous oil, generally SAE 50 cylinder oil, must not only lubricate, but primarily it must protect the components from corrosive wear by neutralising combustion residues. It has a high alkalinity reserve (BN), and thus neutralises the aggressive effect of the acids resulting from the combustion of sulphur. If this reserve or the base number

(BN) of the lubricant decreases too far, the door is opened to corrosion and wear. This is why cylinder oils are monitored on board using rapid tests and, above all, are thoroughly examined in the laboratory. Oil samples are obtained by collecting oil residues as „scrape down“ or „drip oil“. The results from the laboratory then provide information about the state of the oil and the cylinders. In addition, the dosage of lubricating oil can be optimised using SDA analyses for the individual cylinders.

- The connecting-rod bearings and all other moving parts are lubricated by a complex circulation system, using an SAE 30 (or SAE 40 for stationary engines) system oil with a base number of approx. 6mgKOH/g. This system oil is also used as hydraulic oil for control systems and as coolant for piston cooling in most engines. The system for engine lubrication takes more than 50,000 litres for large engines.

The system oil is rarely changed completely. A partial change of a maximum of 50% only ever takes place depending on oil analyses, as well as replenishing losses. The oil analyses also provide information about e.g. how much fuel or cylinder oil has contaminated the system oil through leakage.

As the main power source, the 2-stroke engine is the heartbeat of a ship. It is also often relied upon to generate base-load electricity and supply hot water.

There are countless other machines and systems on board that need to be supplied with lubricants. These include, for example, the 4-stroke diesel engines of the generators, compressors, pumps, winches and cranes, lift hydraulics and other hydraulic systems. The lubricating oils and greases in these power units are also monitored reliably using OELCHECK analyses.



Visit us in
Hall A2, Stand 102!

OELCHECK®

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OELCHECK SDA analysis service – for optimum engine management

2-STROKE MARINE DIESEL

In the marine sector, oil can now speak even more clearly!

OELCHECK deciphers the message of oil – and along with the all important lubricant itself, accurate conclusions can be drawn about the state of individual cylinders in 2-stroke engines through a new, clear evaluation of the analysis results. The „OELCHECK system“, with tailor-made and thus more cost-effective analytical sets for almost every issue, is unique. OELCHECK now offers a significantly expanded and, of course, globally usable analysis service for the „Scrape-Down Oil Analysis“ (SDA) of slow-speed 2-stroke diesel engines in which, after a short period, the cylinder oil is exhausted and is lost.



© MAN Blöddatenbank

An 8-cylinder MAN 2-stroke marine diesel S35ME-B – a typical case for the OELCHECK SDA-analysis service

The 2-stroke marine diesel in particular, with an output of over 100,000 HP, is a hard worker with plenty of stamina. These are mostly operated with HFO (heavy fuel oil). Its quality not only varies constantly but it is also contaminated, above all, with sulphur. Then there are also impurities, such as water, salt, nickel, vanadium and cat-fines. These fine-grained aluminium and silicone

compounds have an abrasive effect like that of sand. They originate from the treatment of the HFO with a catalyst which is called **cat-fines**.

HFO fuel and its fluctuating feed rates that depend on its quality pose a constant challenge for engines and their lubrication. The volume of lubricant, which is provided for each cylinder with an individually set dosing pump, needs to be continuously adjusted for the fuel and the operating conditions of the engine. The more sulphur the fuel contains, the higher the concentration of additives needs to be to neutralise the sulphuric acid and the combustion residues.

In order to determine how heavily contaminated the lubricating oil is and whether more or less should be fed in, the cylinder oil running down from the liner is analysed with rapid test equipment, often on board the ship itself.

At times when engines are only operating at partial load due to slow steaming, condensation occurs in the engine, causing corrosion which will deteriorate further if insufficient lubricant is supplied, but will not improve by adding too much engine oil.

To ensure that the main engine of a ship works reliably and efficiently over several years and for well over one hundred thousand hours of operation, even under extremely unfavourable operating conditions, it requires excellent maintenance and effective control mechanisms. If the injection of the heavy fuel oil can also be optimised as part of the engine management, along with optimised feed rates for cylinder oil, the immense operating costs can be significantly reduced.

After all, a large, slow-speed 2-stroke diesel engine requires up to 25 tonnes of HFO fuel per cylinder per day. Moreover, large ship engines consume up to 2,000 litres of cylinder oil per day with their 12 or even 14 cylinders.



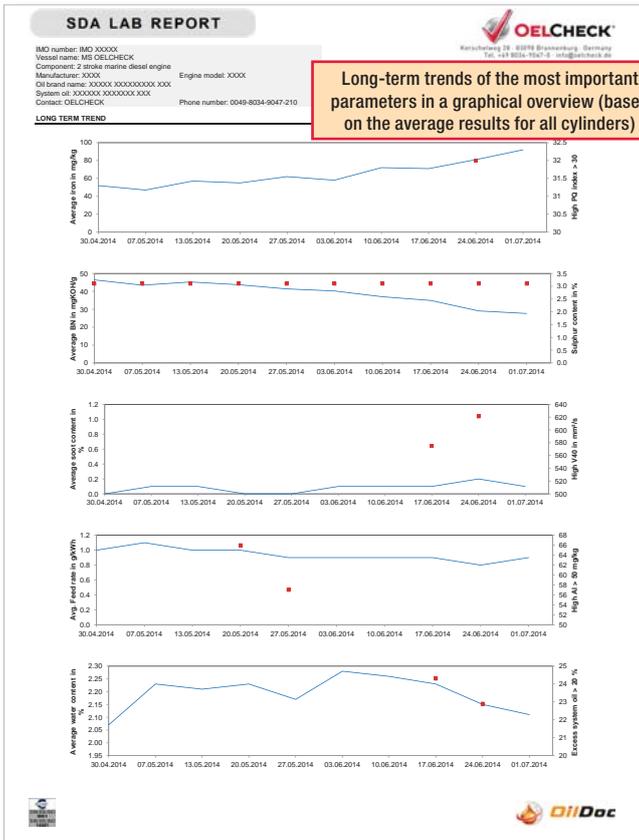
© W. Rademacher, Wikimedia

The longest container ship in the world



Sampling point for SDA oil tests

The OELCHECK SDA analyses that should be performed every two to three months are an indispensable addition to the sensors and rapid tests on board. A clear laboratory report is now available with new, significantly extended data, which provides a comprehensive overview of the state of all cylinders at a glance. In addition, any necessary corrections to the lubricating oil feed rate can be ascertained from it immediately and clearly.



Long-term trends – You are the one who benefits from it the most

The efficient operation of a ship and hence the profit generated by the owner depend on the reliable operation of the main 2-stroke engine, which directly drives the propeller. With the SDA laboratory reports by OELCHECK:

- you can recognise long-term trends and take timely countermeasures.
- you can optimise the cylinder oil feed rate
- you can detect impending damage in good time
- you can schedule maintenance work in advance
- you can avoid unnecessary costs and any outages.

The laboratory reports also allow conclusions to be drawn about the quality of the fuel used, with its varying sulphur content and the amount of lubricating oil required for it. Under MARPOL regulations, HFO may contain up to 3.5% or 35,000mg/kg of sulphur. If a scrubber is installed, these values may even be exceeded. Combustion of HFO, including its sulphur content, gives rise to aggressive acids. To neutralise these, the cylinder oils must have a high alkalinity reserve. To date, SAE 50 cylinder oils with a base number (BN) of 70 (alkalinity reserve of 70mgKOH/g) have mainly been used. For a HFO with a low sulphur content (less than 1.5%), oils with a base number of 40 have also been used. Cylinder oils are now available in additional viscosities and with higher base numbers (up to 100). Furthermore, cylinder oils with a lower BN (around 15 to 20) are currently being introduced for use with diesel fuel with a low sulphur content.

This „environmentally-friendly diesel“ must be used in ECA waters from 1 January 2015. Whichever cylinder oil is used, though, all values in combination and considered over a longer period enable optimum engine management in the long term. **OELCHECK SDA laboratory reports provide an excellent overview of:**

- the residual alkalinity reserve following the combustion process
- the viscosity of the oils used
- the lubricating oil feed rate
- the sulphur content of the HFO
- wear metals
- contamination.

OELCHECK SDA analysis sets – practical, cost-effective and used worldwide



The sets are prepaid. The price includes the costs for the complete oil analysis as well as diagnostics. Laboratory reports are sent by e-mail. The analysis sets are available for examining:

- Scrape down oils, drip oils/cylinder oils – system oils – all lubricating and hydraulic oils as well as greases from all lubricated systems on board.
- With the OELCHECK analysis set, you can take samples quickly, cleanly and easily and ship them to an OELCHECK laboratory in Germany or China.

- All samples that reach the laboratory by 12 pm are tested and evaluated by the end of the following working day.
- The relevant diagnosis is made only by experienced engineers in Germany.

Faster access to all laboratory reports with the online database

Upon request, you will receive your personal password for online access to the laboratory reports of all oil analyses performed, free of charge. You can find results of all previous analyses on the online portal at

- www.laborberichte.de
- view sample shipping notes
- view detailed images
- discern trends using long-term graphs
- place your own comments on laboratory reports and forward them
- fill in shipping notes for new samples

An SDA oil analysis set contains:

- a temperature-stable 100ml sample container embossed with OELCHECK,
- an addressed shipping bag,
- a special SDA sample shipping note with data about the oil sample.

The information should be as complete as possible for cylinder 1. For the remaining cylinders, it should only include the IMO and cylinder number and feed rate.

- The sticker with barcode number on the shipping note is glued to the sample container with your oil sample for identification purposes. The barcode number is a unique laboratory number.

The lubricant samples of all the cylinders of an engine are sent in one package with their respective shipping notes to the OELCHECK laboratory in Germany or China.



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ON OUR OWN BEHALF

The OELCHECK consultation service

Free service and individual support!

In our laboratory reports, more than 25 values are considered individually and weighted using our internal warning and limit value tables. In addition, one of our OELCHECK engineers examines the wear state, any impurities, additive degeneration and the further usability of the lubricant in his personal diagnosis. If there are still any queries regarding a laboratory report, an expert will always be on hand for you personally by telephone. Some consultations can be quite time consuming, but generally we have never charged for this service. Your laboratory reports and sample data are, of course, available online at any time, anywhere in the world (password protected). We will send you your personal login details free of charge!

A charge will now apply for special services.

In recent years, OELCHECK has developed into the leading independent source of information in the industry. When it comes to questions about issues relating to lubricants, analysis and tribology, OELCHECK has become the first port of call for expert information. Whether it's information for an academic paper or practical tips, our engineers have, to date, assisted anyone who needed their advice. And all this for free! However, we now receive so many requests that have nothing to do with comments on paid oil analyses that we

are often unable to answer the questions of our analysis customers promptly. We will therefore not be able to continue providing time-consuming expert opinions free of charge over the phone. OELCHECK engineers will, of course, still answer the questions of customers and prospective customers in future. However, from now on, we will have to charge for all telephone and written consultation services that go beyond questions relating to values in laboratory reports, particularly for experts, institutions and individuals as part of the OELCHECK consultation services.

The OELCHECK consultation service

Our experts are there for you: Monday to Friday from 8 am to 4 pm Every OELCHECK customer can benefit from the consultation service, either at a reasonably priced flat rate (currently €50 for the first 15 minutes, €145/hour or €1,050/day) or for a fee, individual services (separate offer). OELCHECK engineers will advise you on the following matters:

- longer oil change intervals, simpler maintenance
- optimising and simplifying internal lubrication technology
- using the right lubricant in the right place
- formulations for preparing expert opinions
- significance of testing methods and individual values
- warning and limit values.



The Head of Engineering Department, Dipl.-Ing. Stefan Mitterer and his team are there for customers and prospective customers with advice and assistance by telephone on 08034-9047-210

A query form is available for you in relation to these matters at oelcheck.de/beratungs-service/anfrage-beratung. Here, you can describe your issue to us in detail, so that we consider all questions accordingly in our answer. We will contact you immediately!

Top tip: www.oelcheck.de!

Our homepage doesn't just tell you about our great range of services! It is also an extensive point of reference with almost 50 already published issues of OelChecker available for download. You will be also given understandable answers to nearly all questions relating to the issues of lubricant analysis and the use and handling of lubricants. Here, we pass on our knowledge like hardly any other company – completely free!

OELCHECK Laboratory – Repeat audits DIN EN ISO 17025, DIN EN ISO 9001 and DIN EN ISO 14001 successfully passed!



Accreditation in accordance with **DIN EN ISO 17025** is the definitive international quality standard for testing laboratories and others. Companies certified in accordance with ISO 17025 thereby demonstrate that they comply with the high „standards for management“ and meet the corresponding „technical requirements for the laboratory“.

Some of the requirements of DIN EN ISO 17025 overlap with certification standard ISO 9001, but they also deal very specifically with the expertise, capabilities and operation of the laboratory. They describe the competence of the employees, the

testing methods, the equipment and the quality and preparation of test reports. As part of the accreditation, the correct performance of the testing methods is also closely examined.

For OELCHECK, as the leading laboratory for lubricant analysis in the German-speaking world, the accreditation of selected testing procedures in accordance with DIN EN ISO 17025 is an absolute must. In 2009, we were awarded the accreditation certificate, which is valid for five years, for the first time. In June 2014, we again demonstrated our adherence to the high standards and test criteria,

and thus the excellent quality of our laboratory, in a repeat audit.

Certificates at www.oelcheck.de

You can view the certificate from DAkkS, Deutsche Akkreditierungsstelle GmbH, under „News & Downloads“. The same goes for the two certificates **DIN EN ISO 9001 (Quality Management)** and **DIN EN ISO 14001 (Environmental Management)**.

We also successfully passed the repeat audit for this certificate, which has been valid since 1995, in July 2014!

