

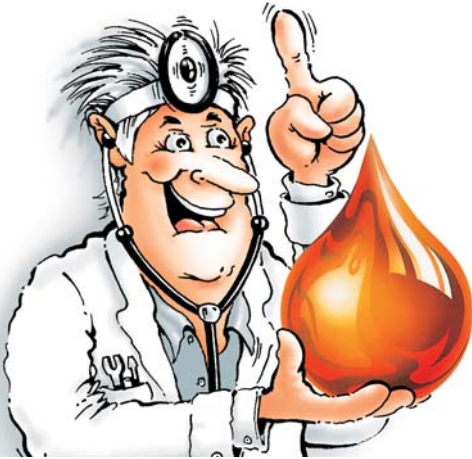
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Putzmeister - offering quality worldwide



When the nuclear power plant in Fukushima broke down, Putzmeister truck-mounted concrete pumps were used to cool it externally. Antonov wide-bodied aircraft were used to transport the world's largest truck-mounted concrete pumps.

When the Japanese nuclear disaster in Fukushima occurred in March 2011, the whole world held its breath. External cooling was a last-ditch rescue attempt to prevent the worst-case scenario. Success was far from guaranteed but the five Putzmeister truck-mounted concrete pumps made the almost impossible possible. One thing was certain from the beginning: Putzmeister's special pumps were the only hope. After all, the German firm from Aichtal near Stuttgart builds the world's largest truck-mounted concrete pump, the M70-5, which has a boom with a vertical reach of up to 70m. Antonov wide-bodied aircraft transported the pumps to Japan. The truck-mounted concrete pumps were able to spray the cooling water exactly where it was needed over the destroyed buildings.

Putzmeister products are causing a sensation time and time again when used during crisis situations, irrespective of their original intended purpose. However, day in, day out, thousands of the German manufacturer's machines and installations constantly prove their reliability under much less spectacular circumstances of use all around the world. Putzmeister, which was founded in 1958 by Grad. Eng. Karl Schlecht, is a company which has grown by itself, has business all around the world and is an innovative specialist machine manufacturer. At the beginning of 2012, the SANY group, the market leader for concrete pumps in China, became its new owner and is continuing to build upon the German company's innovative prowess. Putzmeister develops and produces technically superior and service-oriented machines in the following areas: concrete

pumping, truck-mounted concrete pumps, stationary concrete pumps, booms and accessories, industrial technology, pipe delivery of industrial solids, concrete placement and removal of excavated material in tunnels and underground, robot and materials handling technology, mortar machines, plastering machines, screed conveying, injection and external cleaning of aircraft. The installations are used in the construction industry, for mining and tunnelling in large-scale industrial projects, in the precast industry, power plants and sewage treatment plants as well as in waste incineration plants.

Putzmeister truck-mounted concrete pumps

Truck-mounted concrete pumps have a very wide range of concrete-related uses, for example, the construction of bridges or high-rise buildings. They consist of a truck, a supporting device, a piston pump and a boom with 4 to 6 arm hinges. The hydraulic pump is powered by the truck's diesel engine. Thus, no external power supply is required to operate it. The machine is operated remotely, allowing the operator to move the flexible boom arm as well as control the concrete flow rate. The concrete required is fed through a truck mixer to the feed pump's intake chamber.

The M70-5 used in Fukushima is mounted on a semitrailer, which is driven by a 500 hp tractor unit. In order to distribute the pump's 80-tonne weight evenly, the vehicle has 10 axles with a total length of 2.14 m. Putzmeister's M70-5 is the world's largest truck-mounted concrete pump. As if that wasn't

Check-up

OELCHECK is gearing itself up to set up laboratories outside of Europe, starting with China! Not so long ago, this would have been unimaginable, but now we are facing up to new challenges. Soon we will be opening our first laboratory in one of Chinese industry's main hubs. Modern communication methods already allow our diagnosis engineers located in Germany to assess laboratory values ascertained on site in China in accordance with German engineering expertise. Specialist knowledge about limit values and warning levels will stay with us in-house as it cannot be reproduced on site.

Every year, China's economy grows by about 10 per cent and the population level increases by around the same number of people as live in Australia. Beijing has the world's largest foreign exchange reserves. Lots of European machine manufacturers' order books are full of orders from the so-called „central nation“. More and more European companies are delivering complex machines to China or setting up branches there. They understand the significance of oil analyses because they have their oil specimens analysed by OELCHECK. The need is real since there is no comparable service in China.

Hence, over the last few years, we have been receiving an increasing number of oil specimens from Asia. However, couriering the specimens all the way to Brannenburg takes a long time and is expensive. So now we will be able to accommodate the needs of our clients with oil specimen analyses on site. At present, we are registering trade marks and setting up the company. At the same time we are conducting interviews with qualified employees. If everything goes to plan, the new OELCHECK laboratory in China should be up and running before the year is out! The timing could hardly have been better since, for the Chinese, 2012 is the year of the dragon. It should bring us good luck and will mean that we have to roll our sleeves up and tackle ambitious projects. We're already on it!



Yours, Barbara Weismann



enough, with the M42-5, Putzmeister is bringing another innovative product to the market that is setting the standard once again. The new design, from boom to chassis, has allowed the all-important overall road traffic weight to be reduced to below 32 tonnes. This means that there's still room for things like disposable load, equipment, water and fuel. In addition, the clever relocation of the feed pipe in the boom area and the improved rigidity of the steel construction keep the distribution boom steady. Thus, even when the boom is fully extended, concrete can be poured with precision. The running costs of the M42-5 have been considerably reduced as specially designed parts were used and less fuel is required. The volume of hydraulic oil required alone has been halved to just 300 litres! From September 2012, the M42-5 will be used at construction sites, including for building stadia, in the hot climes of Qatar. In preparation, extensive



Putzmeister truck-mounted concrete pumps in action to construct the Frankfurt Telecommunications Tower.

field tests are already under way, proving its suitability for extreme conditions. Field-test machines are fitted with an array of various online sensors that monitor the hydraulic system as well as having many other functions. Regular inspections provide information, above all, on the mechanical condition of the machines. This, together with feedback from the machine operators, is fed into the ongoing optimisation phase in order to ensure that a comprehensively tried-and-tested, and reliable product is on offer as soon as production begins.

OELCHECK lubricant analyses in use since 1994

Putzmeister stands for maximum quality, which unites the company and its customers. The condition of the hydraulic oil is particularly important for problem-free operation. Putzmeister has been taking advantage of OELCHECK lubricant analyses since 1994. Hydraulic oil is tested for:

■ On-the-job maintenance for the machines

Concrete pumps can be used from as little as a few hours a month to as much as 2,000 hours a year. Reliable operational data is often not available. Therefore, Putzmeister recommends a hydraulic oil analysis after every 500 operating hours. The findings are crucial for ensuring improved oil servicing or determining if an oil

change is necessary. Regular oil analyses come as standard for machines with a maintenance contract. In such cases, oil specimens are sent by the Putzmeister branch or the assembler on site. Putzmeister also recommends immediate extensive laboratory testing if the hydraulic system stops functioning properly or the oil looks strange.

■ Internal process safety

For clean oil testing of the oil used in production, oil analyses are carried out as part of the process audit. Product stability and cleanliness of the hydraulic oils are also checked. Thanks to the checks carried out during the production process, the oil quality specified upon delivery of the machine can be guaranteed.

In the OELCHECK laboratory the main characteristics of the hydraulic oil, such as viscosity, addition and wear protection, are carefully tested in each case. The cleanliness of the hydraulic oil also plays an extremely important role. It is essential for a trouble and wear-free operation of the installations. In general, approximately 80% of hydraulic system failures are caused by impurities in the hydraulic oil. Therefore, by counting the particles, OELCHECK carefully examines hydraulic oil cleanliness (also see „Determining cleanliness categories“, ÖlChecker Winter 2004, pg. 10 et seq. It is available in the Download section at www.oelcheck.de).

Hydraulic oil as a decisive structural component

Putzmeister sees the hydraulic oil used in a pump as an important structural component, which is a decisive factor for performance and functional safety. Therefore, it's not just oil manufacturers' product specifications that are compared. Only hydraulic oils that have been proven to meet the company's high quality requirements are approved for use in Putzmeister machines. As a general rule, HLP hydraulic oils, whose performance often far exceeds the minimum requirements of DIN 51524-T2, are used. Putzmeister will decide which viscosity category to apply for each case (HLP 22, 32, 46 or 68) on the basis of the respective climatic conditions and other operational conditions. The oil levels in the machines vary from < 100 litres to > 1,000 litres. In the new M42-5, the newly developed hydraulic system meant that the oil volume could be reduced to approx. 300 litres. Putzmeister was able to take this even further. Thanks to the considerably lower oil levels, operating costs fall and, after an oil change, less waste oil is released into the environment. However, since the volume of hydraulic oil is considerably lower, the demands made on it are that much greater. However, if only Putzmeister-approved oils are used and regular OELCHECK lubricant analyses are carried out, these oils will rise to any challenge.

Top tip: If you want to learn more about refrigeration machines and their oils, read the article „OELCHECK analyses keep refrigeration machines fit“ in ÖIChecker Summer 2008 at www.oelcheck.de.

Optimised analysis kits and gas-tight sample containers for refrigeration compressor oils

Our test procedures selected for analysing oils from refrigeration compressors have proven themselves time and time again over the years. However, we have further optimised the tests, our laboratory equipment and the sample containers for these products yet again. It's not just the users of modern synthetic refrigeration machine oils who are benefiting!

New analysis kits VK1 and VK2 for refrigeration compressor oils identify:

- Wear metals: iron, chrome, tin, aluminium, nickel, copper, lead and molybdenum
 - Additives: calcium, magnesium, zinc, phosphorus, barium, boron and sulphur
 - Contaminants: silicon, potassium, sodium and lithium
 - PQ index
 - Optical check (colour change, visible particles)
 - Viscosity at 40°C and 100°C as well as the viscosity index
- Oxidation
 - Special outgassing process
 - Water content according to Karl Fischer



In addition to the tests above for analysis kit VK 2:

Neutralisation Number (NN) or Acid Number (AN) or Base Number (BN)

New sample containers

With pre-paid kits VK1 and VK2 for oils from refrigeration compressors, from now on, customers are provided with newly designed gas-tight 100 ml sample containers made from shatter-proof glass with a metal lid. They are suitable for all oil types and refrigerating agents. In addition, they can withstand the internal pressure, which can build up due to residual refrigerating agent in the sample. The sample amount is extracted via the oil outlet provided by the manufacturer in the compressor circuit. If the sample foams quite heavily, some of the gas can be released from the refrigerating agent prior to sealing. Gas should not be released if a synthetic compressor oil is used and/or ammonia is used as a refrigerating agent. The container must be carefully sealed immediately since these substances are extremely hygroscopic and can soak up moisture from the air even if the contact with the atmosphere is short.

Extensive sample preparation

The individual process steps were redesigned for refrigeration machine oils. A partial quantity of max. 5 g is directly extracted when the sample container is first opened. That way, the exact water content can be ascertained according to the Karl Fischer method. To ascertain the other values, the proportions of refrigerating agents in the sample must be removed. The opened sample containers are therefore clamped in a gas-tight appliance. After the samples are warmed to 80°C, inert gas flows through the oil until no more refrigerating agent can be found in the waste air flow. Only after this process, which lasts for more than an hour, has been completed, is the sample ready for further extensive laboratory tests.

Refrigeration compressor oils should lubricate, minimise friction, protect from wear and corrosion, cool, clean, prevent deposits and create a seal or reduce any leakage flow in the compression chamber. However, for the most part they also come into direct contact with the refrigerating agent. A refrigeration machine oil therefore has to work in harmony with it as much as possible. Impurities from seal materials or negative impacts from moisture or even water are one of the criteria for an oil change or additional oil servicing measures. The temperatures during compression of the gaseous refrigerating agent of up to 120°C can significantly accelerate oil oxidation, hence its ageing. During an oxidation process, mostly acids form in the oil which can have a corrosive effect on the compressor components, particularly if there is any residual moisture.

The production capacity of the refrigeration compressor oil and its interaction with the refrigerating agent have decisive effects on the service life of the compressor. Therefore, regular lubricant analyses are vital. They provide information on the condition of the oil and the complex chemical reactions that have taken place in the compressor oil. If necessary, any potential damage and disruptions to operations can be counteracted.

There are special OELCHECK analysis kits for the extremely important task of monitoring refrigeration compressor oils. When the test processes in the kits were compiled, not only were our experience and the recommendations of previous compressor and oil manufacturers taken into consideration, but also the specifications of work group E-DIN 51503-2.

Acids or bases in refrigeration machine oils

The **Neutralisation Number** (Acid Number or AN) provides information on the level of mineral acids as well as water-soluble and insoluble organic acids in a refrigeration compressor oil. Mineral acids, such as hydrochloric or hydrofluoric acid, are formed through the decomposition of halogen refrigerating agents or upon interaction with the refrigeration machine oil. Organic acids result from the oxidation of refrigeration machine oils and the decomposition of ester oils. All of these acids lead to the corrosion of the metallic materials in refrigeration systems, promote oil ageing and cause unfavourable changes in the electrical isolation values of motor compressors. The **Base Number** (BN) provides information on the level of alkaline substances in the oil. They are caused by oxidation in ammonia refrigeration systems in the case of thermal loading. Inside the compressor they lead to oil silting and on the hot side, in pressure chambers and on valves, to carbonaceous deposits.



Measuring the Neutralisation Number for refrigerating machine oils in the OELCHECK laboratory

Our technical team can advise you on the right analysis kit for you: +49(0)8034-9047-210, tsek@oelcheck.de.

More playtime fun - thanks to OELCHECK!

The fun has really begun at the big playground in the municipality of Brannenburg. Just in time for the start of the good weather, on 20 April a fantastic set of climbing ropes was opened, funded by our 2011 Christmas donation.

In line with the motto „making children happy instead of giving Christmas presents“, we stopped giving our customers Christmas presents a few years ago. Instead of giving them Christmas presents we make donations. In 2011, this amounted to 12,000 euros for a project for children in our municipality.

The climbing ropes are used in particular by children from the special-needs school and the day nursery. Lots of children can swing, rock and balance on the ropes at the same time as each other or compete to throw each other off balance. Three angled, hinged poles are connected to each other by ropes at the top and are balanced with long guy wires. Each of the horizontal balance beams is hung in the middle of the poles' connecting ropes in such a way that they affect each other's movements. At first glance, the construction seems straightforward, but it has been cleverly thought out.



The children could hardly wait. Mayor Mathias Lederer (on the right-hand side in the picture) hadn't even finished giving his speech when the children started to tackle the rope construction donated by OELCHECK.

2012 customer survey results – 96% of participants would recommend OELCHECK

A great big „thank you“ to all those who took part in our 2012 customer survey! Out of 14,469 customers, 1,749 took part in the online questionnaire. That's an exceptionally good return rate of 12%. Participants from almost all of our fields of business took the time to answer our various questions. The evaluation of the questionnaires also showed very clearly how highly users rate our lubricant analyses and how interested they are in the potential findings. Our range of analysis services and additional services, our expertise, speed and customer service were all measured along with a whole host of other factors.

The results of the questions on customer satisfaction were as follows:

- 96% of respondents rated their satisfaction with our services as either „very good“ or „good“.
- 87% of customers were happy with our prices.
- Our processing speed was rated as either „very good“ or „good“ by 95% of respondents.
- 84% were either „very satisfied“ or „satisfied“ with the quality of our customer advice.
- 87% rated our employees' willingness to help/politeness as either „very good“ or „good“.

We were also very pleased with the many additional comments and suggestions. We will look into them

in detail and comment on the most popular suggestions in the next edition of ÖChecker. A very important topic, however, is our web portal www.laborberichte.com. 42% of respondents had not actually heard of it. We need to do a lot more work to promote it. After all, it can offer huge benefits for users. Customers who actively use it to manage their laboratory reports and data say that they don't know how they managed without it. Just like visitors to our homepage, who find the extensive information on there extremely useful. The „Knowledge from A-Z“ section alone is fast becoming a standard reference for lubricants and oil analytics.

The viscosity robot - the new OELCHECK laboratory assistant



The new viscosity robot at work

Viscosity is the single most important physical characteristic of an oil or a hydraulic fluid. It describes the oil's flow qualities and is responsible for its ability to protect surfaces against wear by building a hydrodynamic lubricating film. Determining viscosity at 40°C and 100°C is an integral part of the scope of analysis for every OELCHECK analysis kit. Since viscosity changes according to temperature, it is measured twice.

Of all the many tests carried out every day at our laboratory, viscosity measurements take up a very large proportion of our time. The required amounts of oil must be extracted from each container using a pipette for the two viscosity measurements. It's monotonous work but work which requires a lot of concentration on the part of laboratory assistants.

But now our new robot is taking matters into its own hands. It receives 20 samples on tray. It skillfully introduces each 2 mm pipette into the oil and extracts the prescribed amount and checks four samples at the same time. It does everything consistently, quickly and precisely. The sample amounts are exactly right - „measurement error“ is not in the vocabulary of our new „colleague“.

Top tip: If you want to learn more about viscosity and viscosity temperature behaviour, read about it all in ÖChecker Spring 2007 at www.oelcheck.de.

Underground maintenance

K+S KALI GmbH workshops

The K+S KALI GmbH maintenance engineers for the Hattorf/Wintershall mine use the pithead cage to get down to their enormous underground workshop. Their 'office' is 750 m under the Earth's surface. 125 employees maintain and service the more than 1,000 machines currently in use in the mine. They operate round the clock using a three-shift system.



In the 20,000 m² workshop, the devices are serviced and repaired underground.

K+S KALI GmbH is one of the world's leading potash mining companies. They specialise in the extraction and preparation of heterogeneous crude salts, particularly those containing magnesium. They are efficient and environmentally aware, and use a unique technology. As a supplier of speciality and standard fertilizers and products for industrial application, the company operates in all areas of life. The crude salts extracted underground, which all originate from the crystallisation of salty seawater, have different compositions depending on the deposits. Potash is mined in the Hattorf/Wintershall (HW) mine. Potassium, chemical symbol „K“, denotes, amongst other things, potassium-containing fertilizers for application in agriculture.

The salt cannot be produced by synthetic means. As a fertilizer, it is essential for productive and healthy plant growth. Therefore, potassium fertilizers significantly help contribute to improving food supplies, both from a quantitative and qualitative perspective, for the world's growing population. In addition, diverse precursors for the production of industrial and pharmaceutical products originate from potassium.

In order to extract the valuable raw material in the HW mine, holes up to 7 metres deep are dug in the relatively soft rock using special large-hole drilling

carriages. Due to blasting, the rock can loosen into the cavities produced as a result of the relatively thick drills. Large loaders transport the loosened rock to heavy crushers. They reduce the rock in size to fist-size pieces. These are then transported over kilometre-long belt conveyors to the shaft. Above ground, the rock is then further processed into high-quality fertilizers and industrial products.

As with coal mining, an extensive ventilation system ensures a supply of fresh air to the mine. Used air and machine exhaust fumes are diverted via return air tunnels, which cannot be driven down. In the workshop, it is a pleasant 20°C to 28°C all year round. However, the air contains lots

of fine salt particles. So corrosion and rust do not occur in the potash mine. The air is very dry and the metals do not corrode without water or moisture. However, things are very different if one of the devices has to go to the surface. Due to condensation, which develops on the relatively warm machine, it is immediately at risk on account of the accrued salt dust. This is one of the reasons why all maintenance and repair work is carried out underground where possible. What's more, relocating the vehicles is extremely time-consuming. They are carried through a transport shaft with a special goods lift. However, the lift can only take 20 tonnes at a time. Therefore, particularly large machines must be disassembled ready for transport beforehand.

The workshop in the HW mine is enormous. The workspace and parking areas extend over an overall length of 480 m with a width of 25 m. The workshop's equipment is also impressive. Supported by a SAP system, the maintenance experts are responsible for servicing the 1,154 machines currently in operation. Whether loaders, large-hole drills, blast-hole drills or forklift trucks, they all need to be inspected in the workshop in accordance with strict specifications and, if necessary, repaired. On average, an assessment is required from the maintenance experts after every 300 hours of operation.

OELCHECK lubricant analyses are part of their daily toolkit. The hydraulic oil of the large loaders is tested after every 500 hours of operation.



The crude salt, loosened by blasting, is transported to the crushers using wheel loaders. K+S KALI GmbH produces 8 million tonnes of potash fertilizer in Germany per annum.

Underground, only latest-generation, large-capacity loaders are used. Their hydraulic system works with approx. 700 litres of HLP hydraulic oil. The oil is changed depending on its condition and only then if the OELCHECK laboratory deems it necessary. As part of analysis kit 2, designed for oils from mobile hydraulics, wear metals (Fe, Cr, Cu, Pb, Al, Ni, Sn), additives (Ca, P, Zn, S) and any salt-containing impurities (K, Mg, Na) are identified. Particles are counted in seven size categories in accordance with ISO 4406 and SAE 4059. The general condition of the oil is assessed in terms of its viscosity at 40°C und 100°C, the viscosity index, IR oxidation, additive decomposition and appearance. The diagnosis engineers not only offer advice on oil change extensions but also suggest measures for improved servicing.

As well as for guidance on condition-dependant oil changes, OELCHECK analyses are also used if the cause of damage to a device needs to be ascertained. Oil analytics have also proved invaluable in precautionary screening tests of the gears in the axles of all underground machines. Although the hypoid gear oil should still usually have wear protection reserves after a service life of 600 operating hours, it had already reached its limit in some cases. An immediate oil change, which was diagnosed for some gears, may have prevented more expensive damage. The maintenance engineers in the underground workshop have acquired invaluable knowledge about the work that they do thanks to the screening tests and OELCHECK lubricant analyses have once again proven their worth.

Electrostatic discharges in hydraulic oils and lubricants

OELCHECK conductivity checks increase safety

Lubricants are normally only slightly conductive and therefore sometimes also work as insulators. On the other hand, under certain circumstances, oils are capable of conducting an electric current. In practice, the electric conductivity of turbine and hydraulic oils is becoming increasingly important. They are normally only slightly conductive and under appropriate conditions are prone to becoming electrostatically charged. If there are subsequent discharges, the oil and the system can be damaged. Therefore, to guarantee maximum safety, in the future OELCHECK will be offering to measure conductivity at different temperatures as a supplementary individual test.

Electric conductivity is a measure of the electrostatic chargeability of liquids. Usually it is expressed as a pS/m (picosiemens/metre = 10^{-12} ohm) unit. As well as on the type of liquid, conductivity also depends on the concentration of movable charge carriers. Pure distilled water, for example, is only slightly conductive. However, if the water contains „impurities“ such as salts, acids or bases, then its conductivity increases.

The conductivity of oils

Lubricants are normally only slightly conductive and therefore also work as insulators in transformers or switches. However, oils can also conduct electric current. Their conductivity is dependent on various criteria. The extent to which an oil is conductive depends on its base oil, additives and polarity.

The more polar a lubricant is, the less refined and hence the more conductive it is. Based on their manufacturing method and level of refining, the American Petroleum Institute (API) has classified base oils into 5 groups (see table 1).

The lightly refined, mineral-oil-based base oils of Group I represent the simplest variant and previously used to account for the largest proportion of lubricant production. For a few years now, that proportion has been in steady decline. The more refined base oils of Groups II, III and IV are increasingly being used for modern lubricants. The trend for using more refined base oils and synthetic variants is based on technical grounds since, as a general rule, they have better characteristics, such as a higher ageing stability. However, although the higher-quality base oils have many advantages, some oil characteristics change with them, which can lead to problems in the case of unfavourable combinations. One aspect, which is often discussed, is the varnish phenomenon. Among other things, it is due to base oils' changed dissolving performance with regard to ageing and reaction products. Another phenomenon is damage to components and the lubricant itself. This is caused by electrostatic discharges. The lubricant's conductiv-

Table 1: API base oil groups

<p>Group I – lightly refined base oils (SN or Solvent Neutral) Oils with an increased proportion of aromatics, less than 90% saturates. The VI is between 80 and 120. Additives dissolve relatively easily. Base for: simple gear and hydraulic oils. Conductivity: high polarity, best conductivity of over 2,000 pS/m. Values smaller than <10 pS/m very low conductivity.</p>
<p>Group II – hydrocracked oils Additional treatment with hydrogen reduces unsaturated compounds. More than 90% saturates. VI over 120. Improved oxidation-resistance and evaporation behaviour. Base for: simple engine oils. Conductivity: less polar, less conductive with 1,000 to 2,000 pS/m. Values smaller than <10 pS/m very low conductivity</p>
<p>Group III – highly refined hydrocracked oils Labelled as partly synthetic and in some countries even as synthetic lubricants. However, they contain no chemically produced components. They have a proportion of much more than 90% saturates. VI over 120. They contain hardly any aromatics, therefore poor solubility of additives. Base for: engine oils and modern industry lubricants. Conductivity: as a base oil with no additives, virtually unpolar. With values ranging from 20 to 1,000 pS/m, they have very low conductivity.</p>
<p>Group IV – synthetically manufactured hydrocarbons (SHC) Polyalphaolefins (PAO) are characteristic examples. Unverifiable proportion of unsaturated components. VI over 130. Base for: fully synthetic modern engine oils and some industry lubricants (wind turbine gear oils) Conductivity: base oils with values under 1,000 pS/m, low conductivity. Values smaller than <10 pS/m very low conductivity</p>
<p>Group V – synthetically manufactured liquids, esters or polyolesters Base for: flux oils or blend components for the production of additives. Usually not suitable as a base oil. Conductivity: they contain high proportions of polar components. Conductivity usually over 2,000 pS/m.</p>

ity is an important factor for the build-up of charge. Conductivity is dependent on the type of base oil used (also see table 2).

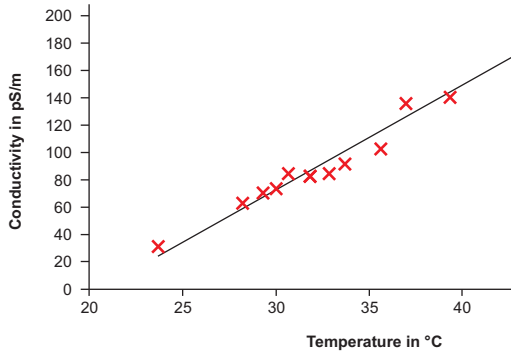
As well as the base oil, additives have a significant influence on the oil's conductivity. The higher the proportion of metalorganic additives, the higher the lubricant's conductivity. A typical example is metalorganic additives such as the frequently used Zinc Dithiophosphate (ZnDTP). As a proven multipurpose additive in engine and hydraulic oils, it improves wear and corrosion protection and simultaneously functions as an antioxidant. However, zinc is considered to have dangerous health implications. Therefore, ZnDTP should be largely avoided. However, this means that the oil's conductivity decreases and the risk of static charging increases.

However, a lubricant's conductivity is not only influenced by the base oil and the additive package. It also depends on temperature. The higher the temperature, the higher the oil's conductivity. Unfortunately however, there is no linear correlation between the two parameters and each oil type has its own conductivity/temperature relationship.

Table 2: Conductivity of oils and synthetic liquids at 23°C

Lube oil and circulating oil	pS/m	Hydraulic oil	pS/m
Gear oil	>2,000	Mobile hydraulics (Bio)	800
Steam turbine oil	13	Industry hydraulics (ZnDTP)	250 – 2,000
Gas turbine oil (PAO)	1,200	Industry hydr. (ester)	>2,000
Gas turbine oil (ester)	1,500	Phosphoric acid ester aeroplane	>2,000
SAE 10W 40	>2,000	Aeroplane hydr. synth	29
Manual transmission gear oil	>2,000	Synthetic	9
Paper machine oil (Zn-P)	350	Aircraft PAO	70
Paper machine oil (S-P)	10		
Silicate ester (refrigeration)	1,500	Insulating liquids	12

Furthermore, at a constant temperature, conductivity still changes during operation due to additive reactions, wear metals, reactions with metal surfaces, water and the formation of ageing and oxidation products.



Conductivity of a zinc-free hydraulic oil during temperature change

The electrostatic charge of oils

Although monitoring conductivity has so far been unable to achieve any great success in the area of sensor technology, the parameter is gaining significance with regard to electrostatic charges and discharges in lubricant and hydraulic systems.

In oil circulating systems, in general, there can be electrostatic charges if there is friction in the flow between the oil and the surfaces surrounding it. The strength of the static charge depends on many different and partly interconnected factors. The energy density, which builds up in the system and then leads to subsequent discharges, depends on the oil's conductivity and the volume flow. The more oil flows that through a circulation pipe per cm² cross-sectional area and the lower the oil's conductivity, the greater the potential for an electrostatic charge.

Oil can be especially electrostatically charged if:

- The oil is formulated with a base oil from Group II or III;
- The oil contains no polarising, e.g. zinc-containing, additives;
- The conductivity of the new or old oil is less than 400 pS/m;
- The oil is fed into pipes which are too small;
- The oil is moved with too high a flow velocity;
- The oil produces friction in poorly designed filter elements;
- Pipes and hoses are not earthed;
- The oil level has become too low;
- The oil contains high proportions of undissolved air (air bubbles).

Optimisation approaches for the prevention of electrostatic problems

- Installation of special stat-free filters instead of conventional filter cartridges. Such filters can discharge the charge or even prevent it from occurring.
- Using an oil with a different make-up and poorer conductivity value can have a remedial effect.
- Choose or amend the selection of material combinations in the system so that, despite electrostatic charge, the formation of microsparks is prevented.
- Optimise flow diameter, tank hold times or tank volumes. As a result, the charge potential can also be minimised.

Discharges (ESD) and possible consequences

If the level of electric charge in the system becomes too great, there will be electrostatic discharge (ESD). In such cases, microsparks occur or sparking. Often you can also hear a crackling or clicking sound near the filter or in the tank. In the case of high charges, this discharge could be repeated several times, in quick succession. Locations at which the discharge primarily occurs are, in particular, areas with vastly different material combinations. Modern filters with a high proportion of plastic are often affected. The microsparks caused by the static charge lead to temperatures of some 1,000°C. In the case of even slightly flammable liquids, this can be extremely dangerous. Also, if hydrocarbon vapours have formed in the tank ventilation area, a system could spontaneously combust. However, if the discharge sparks occur within the circulation system of turbine or hydraulic oils, they are normally smothered very quickly by the oil. Nevertheless, these mini explosions can burn holes in the filters or even seriously impair the oil due to the increased build-up of oil sludge.

Turbine and hydraulic oils are particularly affected

Electrostatic charges and discharges have been occurring more often in recent years in systems with turbine and hydraulic oils. Several developments are responsible for this.

- Modern hydraulic fluids and turbine oils have become increasingly less conductive because of the global trend to use modern base oils and additives. Turbine oils used to be based on relatively conductive, lightly refined base oils from Group I. Since then, in particular for gas turbine oils, more oxidation-resistant, better refined base oils from Group II or even partly synthetic base oils from Group III are being used. Such oils are considerably less conductive. In addition, turbine oils normally contain hardly any metal-organic additives. As such, that should prevent the formation of unwanted deposits (varnish).
- Since new systems enjoy a more compact design, the tank capacity is considerably smaller and the displaced volume is proportionally larger.

- At the same time, requirements for oil purity are increasing. This, in turn, leads to a higher filtration rate.
- The intensity of the filtration and the electrostatic charge properties of the oil (resulting from the filtration) increase.
- Due to the low conductivity of these oils, often far below 1,000 pS/m, in unfavourable conditions, the tendency for electrostatic charging increases.

Measure conductivity and prevent damage

In order to be able to prevent any damage from electrostatic discharges, it is not only the conductivity of fresh oils that needs to be known. For old lubricants, in the case of fill-up quantities of over 1,000 litres, the parameter is also particularly important if nothing is known about the used oil or a burning smell or soot particles are noticeable.

Therefore, OELCHECK is now offering conductivity measurements at different temperatures as an additional test. The process has been tested over several years and is conducted in line with ASTM D2624. Originally it was developed for inspecting aeroplane kerosene in order to avoid accidents due to charging in jet fuel.

The oil's conductivity value is measured in pS/m. If conductivity at 20°C is more than 400 pS/m, there is hardly any risk of any damage to the oil or the system from electrostatic charges. However, if the value is lower, there is a very real possibility that the phenomenon could occur. If an oil with an increased ESD risk is being used, earthing the entire system is not a credible countermeasure. The voltage inside the system cannot be discharged through an earth wire. However, there are several other optimisation approaches for active prevention.



OEL ✓ **CHECK**®

Öl Checker

ÖlChecker – a magazine from OELCHECK GmbH

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QUESTION TIME

When our gears were last inspected, about three months ago, as always, we took oil samples. Unfortunately, however, we forgot to send them straight to OELCHECK. Will the analysis results still be representative if we send the samples off for analysis today? Can values, which provide meaningful information on the condition of the gears and lubricants, change if the oil samples are stored for a long period of time?

OELCHECK:

In principle, we can also examine oil samples that were taken a long time ago. Storing oil samples for a long period of time doesn't significantly affect analysis data. However, the analysis values will only reflect the conditions at the time when the sample was taken. Only you can decide whether this „obsolete“ information, which only partially describes the real condition of the lubricant used and the gears, is still useful. The oil and the elements that it contains are constantly changing. A sample only provides information about a particular moment in time.

Prompt tests provide representative results

Wear metals, impurities, oil additives and the condition of the oil don't change when stored in the original OELCHECK sample container at normal ambient temperature. However, the more time that elapses from the point that the sample is taken to the point where the test is carried out, the more significantly the condition of the sample can deviate from the condition of the lubricant currently being used. Therefore, samples should always be sent to our laboratory as quickly as possible. If, however, you forget to send them, an experienced diagnosis engineer can estimate which values will have changed in the meantime in current operations, if previous trend analyses are available.

In the case of a gear with oil change intervals of more than 40,000 operating hours and 6-monthly oil samples, one or two days won't make a difference. However, in the case of a biogas engine that operates around the clock and whose oil must be changed after less than 600 operating hours (25 days), forgetting to send an oil sample could cause

an engine failure. Therefore, make sure that samples reach the OELCHECK laboratory no later than a week after they have been taken. If a sample has been lying around for several weeks or even months we would not recommend sending it for testing. The information that it contains would no longer reflect current operations.

Only if a sample is examined promptly can you benefit from the invaluable advantages of our lubricant analyses, carry out oil changes based on the condition of the oil and detect possible damage in advance.



Quick, clean and reliable - the OELCHECK despatch department combines your individual analysis kit orders for you.

Special OELCHECK sample containers for all lubricants

So that you receive meaningful results based on the oil samples that you send in, follow our guidelines on how to take samples. You will find them under „Take & send samples“ on www.oelcheck.de. Please only use the pre-paid OELCHECK sample containers, which were specially developed for lubricant samples. They comprise the relevant full scope of the test and a meaningful diagnosis, depending on the colour of the lid.

The empty containers and their lids are packaged individually. That way, we can ensure that the containers remain as pure as possible. Contamination of samples, for example with dust particles or moisture, is impossible if the packaging is not opened until on site. However, not even our sturdy sample container made from PET can fully protect the lubricant sample from environmental influences forever. If you leave a sample in the sunlight for a long time, the colour of the oil could change. Antioxidants in turbine oils can make the oil look

violet after a few days and light hydraulic oils turn darker under the effects of light. However, with the exception of the colour, the typical characteristics ascertained don't change. If the oil sample is exposed to greater fluctuations in temperature, the water content of some oil types can also change during storage time.

Our specially designed PET sample containers are clean and temperature-stable, can be sealed firmly and have proven themselves on millions of occasions. However, even they're not suitable for every type of lubricant. Refrigeration compressor oils, for example, almost always contain residual gaseous

refrigerating agents. For these, we offer gas-tight sample containers made from shatter-proof glass with a metal cover (see pg. 3 of this edition). They can withstand the pressure of the gaseous refrigerating agents and ensure that even tricky samples make it to the OELCHECK laboratory safely. Also for transformer and insulating oils, special gas-tight glass

syringes and aluminium containers (see ÖlChecker Winter 2011) are integral parts of the relevant analysis kit.

Conclusion: Avoid storing samples for any unnecessary length of time

Always send lubricant samples to our laboratory as quickly as possible! They are tested and assessed by the end of the following working day if they reach us by 12.00 p.m.

The analysis values that we measure will not change drastically in storage. However, if several days or weeks elapse between the point when the sample was taken and the time when it is tested, the analysis values could deviate from the current condition of the lubricant still being used.

By sending your samples in good time, you are actively helping to ensure that you benefit as much as possible from the OELCHECK laboratory's speed and the unbeatable advantages of OELCHECK lubricant analyses.

**OELCHECK will also answer your questions on tribology and lubricant analyses.
Send us your questions by e-mail (info@oelcheck.de) or by fax (+49 8034/9047-47).**



OilDoc

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The countdown has begun!

The next OilDoc Conference and Exhibition will take place in Rosenheim (near Munich) from 22 to 24 January 2013. Preparations for the event are already under way. As expected, our call for papers has been met with a great response. However, we were very surprised by the large number of new topics. Whether it's ideas from the world of tribology, the latest lubricant development trends or, in particular, successful concepts and practical examples from the areas of fluid management and maintenance, the topics and abstracts that have been submitted all look extremely promising.

An ambitious programme

The programme committee have really got their work cut out now. The topic suggestions that have been submitted are all top-notch and, given the quality, making a selection will be no mean feat. Led by Peter Weismann and Rüdiger Krethe, the committee are still compiling the ambitious programme and it's already May 2012.

The members of the programme committee are:

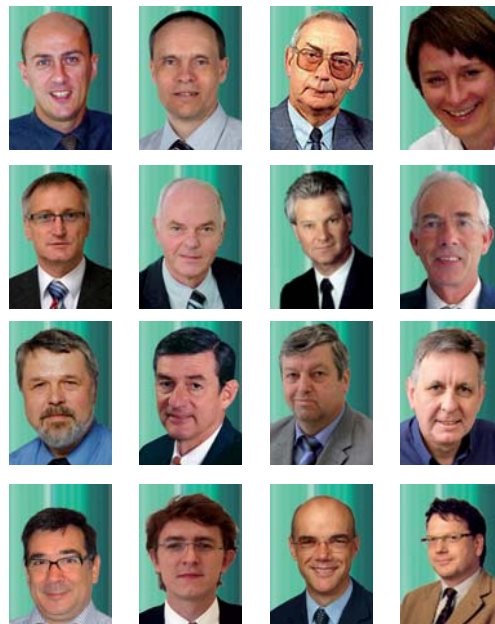
- ✓ **Jo Ameye**, Executive Vice President - Global Sales, Fluitec International, Belgium
- ✓ **Josef Barreto-Pohlen**, Business Development for Tribology, TUNAP Industrie Chemie GmbH & Co. Produktions KG, Germany
- ✓ **Prof. Dr. Eng. Wilfried J. Bartz**, Technical Academy of Esslingen, Germany
- ✓ **Dr. Karin Baumann**, Technical Manager Competence Center Lubes, OMV Refining & Marketing GmbH, Austria
- ✓ **Dr. Günther Bodesheim**, Head of Tribology & Chemistry, Klüber Lubrication München KG, Germany
- ✓ **Grad. Eng. Jürgen Deckert**, Head of Research & Development, Addinol Lube Oil GmbH, Germany



OilDoc Conference & Exhibition

Lubricants Maintenance Tribology

- ✓ **Univ. Prof. Dr. Eng. Ludger Deters**, Chair of Machine Elements and Tribology, Otto-von-Guericke University Magdeburg, Germany
- ✓ **Ph.D (Sciences) Gerd Dornhöfer**, Chief Expert Lubrication Technology, Robert Bosch GmbH, Germany
- ✓ **Dr. Eng. Gerhard Gajewski**, Quality - Product Safety & Lubricant Management, SIEMENS AG, Germany
- ✓ **Dr. Robert M. Gresham**, Director of Professional Development, STLE Society of Tribologists and Lubrication Engineers, USA
- ✓ **Richard Karbacher**, Schaeffler Technologies AG & Co. KG, Germany
- ✓ **Stuart Lunt**, Research Manager, Kitiwake Developments Ltd., UK
- ✓ **Jesús Terradillos**, TEKNIKER Technological Centre, Spain
- ✓ **MSc. Eng. Wojciech Majka**, President of the Board, CEO ECOL Sp. z o.o., Poland
- ✓ **Dr. Arthur Wetzel**, Head of Lubricants and Fuels, ZF Friedrichshafen AG, Germany
- ✓ **Dr. Eng. Mathias Woydt**, German Federal Institute for Materials Research and Testing (BAM), Germany



(photos, clockwise)

Register now – Save early bird discount!
 Until 30/9/2012 only 850 € + VAT.
 Registration is quick and easy:
www.oildoc-conference.com
 After 30/9/2012, the attendance fee increases to 945 € + VAT.



OilDoc news

Highlights of the Spring 2012 edition:

- OilDoc Conference and Exhibition 2013
- Infrared spectroscopy in practice
- Certified Lubrication Specialist (CLS) certification
- Seminars, workshops and symposia
- OilDoc at the IHA conference
- OilDoc under way in the USA
- OilDoc Academy successfully certified



The OilDoc executives: Rüdiger Krethe, Grad. Eng. and Peter Weismann, Grad. Eng.

Four top-class supporters

The OilDoc Conference and Exhibition 2013 will soon be supported by four companies or organisations. They are:



Noria Corporation, USA

This company, which was originally founded as a publishing house, publishes the internationally renowned „Machinery Lubrication“ magazine. The successful publisher’s team is made up exclusively of practitioners from the fields of maintenance and tribology. Therefore, Noria also offers a variety of system and machine lubrication services as well as oil analytics. Noria experts offer training and consultancy services and actively contribute to symposia and conferences.



OELCHECK GmbH, Germany

The lubricant analysis laboratory offers over 50 test processes and, at least in Europe, is the most modern of its kind. It tests and comments on over 200,000 samples every year. As a result, its database is huge, with over 1.5 million analyses and findings. OELCHECK experts provide support for the selection of lubricants and offer expert opinions for damage clarification. In 2010, the OilDoc Academy was established as part of a spin-off from OELCHECK GmbH.



STLE, USA

The Society of Tribologists and Lubrication Engineers (STLE) represents the interests of more than 4,000 technical experts from industry, science and government in the USA, Canada and many other countries. Its members can take advantage of an extensive array of seminars and Certified Lubrication Specialist (CLS), Oil Monitoring Analyst (OMA) and Certified Metalworking Fluids Specialist (CMFS) training sessions, the „Tribology & Lubrication Technology Journal“ (TLT) and lots of technical newsletters.



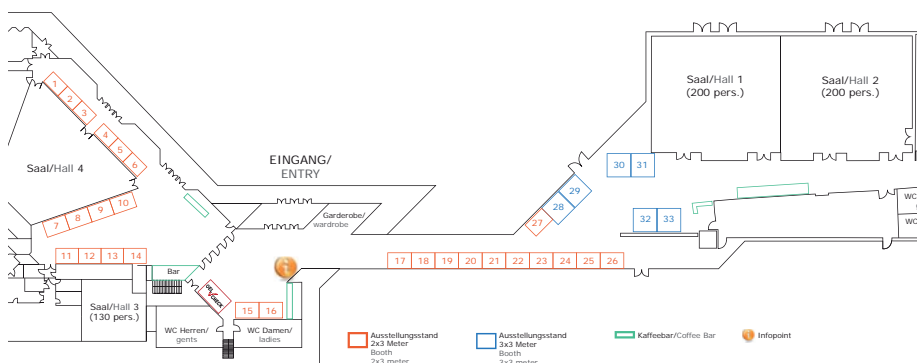
TAE, Germany

The Technical Academy of Esslingen (TAE) has been a professional training and education partner for companies and their specialists and executives for over 50 years. TAE’s International Colloquium on Tribology is world renowned. It is held every two years in Osterfildern, near Stuttgart. Led by Prof. Dr. Eng. Wilfried J. Bartz, the TAE will be contributing to the OilDoc Conference 2013 with an extensive session on tribology. In return, OilDoc held a session at TAE’s 18th International Colloquium on Tribology in 2012.

Your chance to be at the OilDoc Exhibition

OilDoc will once again be organising an international exhibition at the OilDoc Conference 2013. More than 30% of the stands have already been taken. If you want to book a place as an exhibitor, take this opportunity to secure your place at the OilDoc Conference and Exhibition. You will make invaluable contacts with international decision makers and opinion formers.

Current exhibitor list & hall plan (last updated: April 2012)



We can offer you ready-made modular booths with white side and back walls, 250 cm high, with a triple-socket power outlet.

The exhibition fee for a type A modular booth (2 x 3 m) is EUR 1,750 and for a type B modular booth (3 x 3 m) is EUR 1,920, plus VAT. Additional

furniture and equipment, such as seating, tables, shelves, spotlights, etc. can be booked separately.

In addition to the choice of modular booth, the exhibition fee includes an entry ticket for one person for the three-day conference, including participation in both evening events.

OilDoc at IHA's (International Hydraulics Academy, Dresden) 3rd Maintenance and Service Conference



IHA's (International Hydraulics Academy, Dresden) 3rd Maintenance and Service Conference will take place from 21 to 22 June 2012 in HANSA-FLEX AG's Weiterstadt branch, with our support. The event is specifically geared towards the maintenance of hydraulic systems. There will be talks on the following topics: oils, oil analytics, failure

causes and how to avoid them, fluid service, practical and legal safety as well as training opportunities. Grad. Eng. Rüdiger Krethe, from the OilDoc Academy, will be speaking on the following topics in particular:
 ✓ The production capacity of hydraulic oil as a structural component;

- ✓ Selecting the most suitable fluid and quality-related criteria;
 - ✓ The diverse potential of lubricant analytics for service life optimisation as well as the analysis and, above all, prevention of damage.
- You can find more information on the IHA and the event at www.hydraulik-akademie.de.



OilDoc under way in the USA

Reliable Plant Conference 1 to 3 May in Indianapolis, USA

The 13th Reliable Plant conference and exhibition, run by the American company NORIA, is taking place this year from 1 to 3 May in Indianapolis. The talks and seminars will be rounded off with a large exhibition. During the three-day event, the focus will be on „operational safety, lubricant application and oil analytics“. After all, a company's long-term success is dependent on its operational safety. In terms of tribology, it is, and has been for some time, no longer just a question of selecting the best-fit lubricant. Innovative technology, as well as training and monitoring concepts, are particularly in demand, whereby oil analytics are playing an in-



creasingly bigger role. A particularly complex topic will be covered by Grad. Eng. Rüdiger Krethe at the Reliable Plant conference.

In his talk „Grease can talk – grease analysis for wind turbines“, he will present the potential of modern grease analysis for wind turbine lubricants.

STLE meeting From 6 to 10 May in St. Louis, USA

From 6 to 10 May, the 67th STLE (Society of Tribologists and Lubrication Engineers) meeting will take place in St. Louis. At STLE's highly respected

annual events, the latest technical information and developments in the field of tribology and lubricants are presented in over 400 talks.

Grad. Eng. Peter Weismann (OilDoc GmbH executive) will have an information stand at the OilDoc Conference and Exhibition 2013.

As an additional extra at the event, talks with European STLE representatives and members of the international committee for CLS exams are planned.



Seminars, workshops and symposia			
Dates		Dates	
7 - 9/5/2012	Optimal CLS exam preparation *NEW*	19 - 21/11/2012	Lubrication and oil monitoring for combustion engines
24 - 26/9/2012	Lubrication and oil monitoring for hydraulics	22/11/2012	Workshop day: combustion engines
27/9/2012	Workshop day: hydraulic systems	26 - 27/11/2012	Symposium for power plants and the chemical industry *NEW*
8 - 10/10/2012	Lubrication and oil monitoring for industrial plants	3 - 4/12/2012	Symposium for the cement and building materials industry *NEW*
11/10/2012	Workshop day: industrial plants		
15 - 16/10/2012	Paper machine symposium		
22 - 24/10/2012	Fundamental principles of grease lubrication and machine monitoring through lubricating grease analyses		
25 - 26/10/2012	Lubrication and machine monitoring for refrigerating machines		
29 - 30/10/2012	Infrared spectroscopy in practice		
5 - 7/11/2012	Lubrication and machine monitoring for wind turbines *NEW*		
8/11/2012	Workshop day: wind turbines *NEW*		



Ideal additional qualification for maintenance and consultant engineers CLS certification now in German



The exam isn't easy and the required level of knowledge is higher than average but, for maintenance and consultant engineers, becoming a Certified Lubrication Specialist (CLS) can only be of benefit. The CLS certification is highly rated worldwide. In

the USA, the Society of Tribologists and Lubrication Engineers (STLE) has been awarding the certification for 20 years. The CLS certification is the only independent certification for lubricants experts in the world. In practice, the certification will help with: reducing costs in the application of lubricants, protecting resources and improving operational safety.

On **10 May 2012**, for the first time ever, applicants will be able to take the exam in German. It will be facilitated by an independent STLE representative at the OilDoc Academy premises. During the exam, candidates will be tested on their extensive knowledge of lubrication fundamentals and in-depth knowledge of lubricant applications. All applicants

must have at least three years' professional experience in the field of system and machine lubrication. In addition, they take part in our special seminar to intensively prepare for the exam during the three days leading up to it.



Back due to popular demand Infrared spectroscopy in practice

In January 2012, we held our new seminar „Infrared spectroscopy in practice - understanding and interpreting IR spectra“ for the first time. The event was so popular that not all of the applicants were able to take part. Therefore, on 17/18 April, we held the seminar again. For anyone interested who couldn't make that date either, we are planning to repeat the seminar again on 29/30 October 2012.

Infrared spectroscopy is one of the most effective methods in lubricant analytics. How its findings can be evaluated and what uses they have, however, had not previously been publicly demonstrated.

For the first time, our seminar gives an overview of the fundamental principles and the practice of

FT-IR spectroscopy of new and old lubricants. It covers the following content:

- ✓ Safe application of FT-IR spectroscopy in lubricant analytics;
- ✓ Identification of important base oil and additive components;
- ✓ Application of FT-IR spectroscopy in quality assurance, identification checks and incoming goods inspections;
- ✓ Use of classic and chemometric calculation methods for monitoring used lubricants;
- ✓ Practice-oriented interpretation of FT-IR spectra of used lubricants in consideration of boundary conditions and the resulting potential for failures;

- ✓ Identification of unknown substances and/or of their classification into typical substance categories with the help of FT-IR libraries;
- ✓ Linking the findings to other lubricant analytics processes and verification possibilities.



OilDoc Academy successfully certified in accordance with DIN ISO 29990



From left to right: Paul Weismann (OELCHECK exec.), Rüdiger Krethe (OilDoc exec.), Kathrin Gottwald (OilDoc) and Willi Lauer (TÜV Süd Management Service)



On 20 December 2011, Willi Lauer from TÜV Süd Management Service GmbH provided us with our certificate for OilDoc GmbH in accordance with DIN ISO 29990. This certifies the high level of OilDoc Academy's advanced training events. For participants in our seminars and symposia, the certificate offers additional proof that they will benefit not only from our extensive know-how but also from our quality management system which meets the latest requirements.