SPRING 2014

OELCHECKER

Circulation: 9,500; 3 issues a year since 1998
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CONTENTS

Hako GmbH: Citymaster, sweeping for more cleanliness

The Citymaster 2000 in action

Modern and environmentally friendly, multifunctional technologies with an all-inclusive, one-stop service – that's what Hako is all about. Whether it's road sweepers for thorough outdoor cleaning, articulated, multifunctional equipment carriers for all-season use or compact equipment carriers and transporters with three attachment points and up to 300 attachments, Hako municipal cleaning technology offers individual solutions for reliable and cost-effective city cleaning and property, grounds and sports field care through to winter services.

Cleaning solutions marked by environmental efficiency

Hako closely complies with all legal environmental requirements when developing all its products. Furthermore, Hako attaches a great deal of importance to ensuring that products remain efficient throughout their entire life-cycle. This combination means that the machines and their design must be highly energy efficient until they are no longer in use.

Economical diesel engines with exhaust after-treatment systems in line with the most recent legislation facilitate an economical and environmentally friendly operation. Machines fitted with an ECO mode also reduce energy consumption and waste gas emissions without a significant reduction in performance.

Particularly effective gears transfer the performance to the streets with low loss. Intelligent drive controls allow hydrostatically powered machines to save as much fuel as possible when driving. In addition, in order to keep total energy consumption as low as possible during use, all products are fitted with a particularly efficient hydraulics system that meets technical requirements.

Extensive service offer

Hako offers an extensive service offer across all of its high-quality products that is geared towards the customers' needs. This includes computer-supported efficiency calculations and fleet management solutions, as well as financing and purchasing alternatives or ensuring maximum machine availability, for which in Europe alone there are approximately 650 service technicians available around the clock.

This means that customers are protected in all respects by the Hako support services: they guarantee fully calculable maintenance costs, comprehensive machine protection, as well as maximum availability of the used cleaning technology. This means that a Hako maintenance agreement with individual and usage-dependent maintenance fees offers many advantages, for example. Instead of following rigid maintenance plans, equipment is inspected according to a specific maintenance matrix depending on device use.

Maintenance is usually carried out on site by the customers; however, if extensive maintenance work is needed, it is performed in our own specialised workshops.

Oil change intervals extended

Citymasters, a part of Hako's municipal technology range, are hydraulically powered. Depending on the machine type, the filling level is between 50 and 70 litres of ISO-VG 46 hydraulic oil. When choosing the oil, Hako opted for an energy efficient HVLP 46 hydraulic fluid. This is because it protects against wear and tear, can be filtered well and has a high viscosity index and therefore has an ideal viscosity to temperature ratio. This particularly pays off when temperatures fluctuate greatly and in extreme cold. If a Citymaster is working in ecologically sensitive areas, an HEES 46 hydraulic oil is used as it can biodegrade quickly.

Previously, Citymaster oil needed to be changed after 1,000 operating hours.

The high-quality hydraulic oil and modern design used by Hako are, however, considerably more efficient. The perfect oil condition and system purity after 1,000 and 2,000 operating hours can be checked using the hydraulic oil analyses in the OELCHECK laboratory.

These analyses document that everything is in order and that, on this basis, oil change intervals can be extended to 3,000 operating hours. Sparing two oil changes saves resources and the environment, and reduces costs.

Extensive investigations were carried out into used oils in the OELCHECK laboratory before Hako decided to extend the oil service life. The results were analysed by Hako and assessed by experts. On this basis it is clear that extending the oil change intervals does not limit machine availability. However, OELCHECK laboratory investigations are also carried out at 1,000 operating hour intervals.

The OELCHECK system is already well known to the Hako employees. Therefore, Hako does not just use the analyses for hydraulic oils. Diesel engine oils have already been analysed, too. The results provide extensive information on the condition of the engines with regard to dust exposure and fuel quality.

A special Hako analysis set is now used for inspecting hydraulic oils, which contains the ideal scope of investigation for both the standard and bio hydraulic oils. The analysis set allows the oil condition, such as oxidation, additive decomposition and viscosity, wear and impurities, such as, for instance, silicon (dust) and water, to be examined. Furthermore, particles and their sizes are counted and purity classes are determined. Monitoring in this way means that any impurity in the oil during the 3,000 operating hours is discovered.

Samples are taken on site by Hako service technicians. They send the sample containers directly to the laboratory in Brannenburg. Every vehicle is entered into the large OELCHECK database with its identification number. Over time, this allows for extensive documentation to be compiled for each device. Furthermore, Hako has immediate access to all data via the customer portal www.laborberichte.com.

Check-up

A picture often says more than a thousand words! The photo of our laboratory technicians on the opposite page proves this! You can immediately see that this team works together! After having already had the diagnosis engineers' knowledge as Certified Lubrication Specialists (CLS) confirmed by the Society of Lubrication Engineers (STLE) at the turn of the year, our laboratory, technical assistance and sampling employees have now proven their knowledge on an international test bench. Together, under the management of Rüdiger Krether, Managing Director of OilDoc GmbH, they prepared for the ISO-certified Laboratory Lubricant Analysts I (LLA I) and Machinery Lubricant Analyst (MLA I) examinations in accordance with the regulations of the International Council of Machinery Lubrication (ICML) over 24 weeks. In this task it was important to combine different strengths, to help your colleague regardless of age and origin, to motivate themselves and each other and to hold the emerging nervousness in check before the examination.

One thing was clear to everyone from the beginning: we can do it! We will all pass the test! Success proved them right. And in succeeding they not only obtained a certificate – the shared experience of learning and success brought the entire team closer together. This also benefits them in their everyday work in their departments. All of them are even more motivated and fully committed to their work.

The joy we got from passing the test was immense and contagious! Employees from other departments celebrated with the candidates. We at OELCHECK are a strong team that can achieve great things together!

Yours, Barbara Weismann

About Hako GmbH:

For a good 65 years the Hako name has been synonymous with quality, reliability, service and innovative solutions. Today, with its registered office in Bad Oldesloe and branches in 15 countries across the world, the Hako Group is amongst the leading machinery manufacturers on the global market for industrial, building and outdoor cleaning, as well as for property care and winter services. The company supplies customers from around the globe with its cleaning machines, multifunctional equipment carriers and transporters.

Further information: www.hako.com

Our laboratory technicians are certified Laboratory Lubricant Analysts!

Congratulations to our wonderful team!
An in-service course over 24 weeks and an examination with 100 multiple choice questions – 16 of the OELCHECK laboratory technicians have worked flat out over the last few months! And in the end all of them achieved certification as Laboratory Lubricant Analysts I, in accordance with ISO 18436-5!
The LLA I certification examination is taken before the International Council for Machinery Lubrication (ICML). ICML is an independent, non-profit organisation that was founded in order to establish the machine lubrication sector as its own technical field. Certification as an oil analysis specialist (MLA II) according to ISO 18436-4 is one of the ICML's best-known qualifications. The OilDoc academy has been working with the ICML for many years, carrying out the necessary preparatory courses and offering the chance to take the certification examination in German. And this is exactly what the OELCHECK laboratory have in their sights as their next challenge! They aim to be MLA II in 2014.

NEW

Our Laboratory – always state of the art

In recent weeks, two important pieces of equipment have been brought up-to-date with the latest technology. In order to be able to examine all samples as quickly as usual despite the ever increasing number, we have installed the new RULER View™ and the MPC iLab 475. Both pieces of equipment from Fluitec are significantly more user-friendly than their previous models. Data management and transfer has been optimised and they can be adjusted even better to conditions required by specific lubricant samples.

RULER stands for Remaining Useful Life Evaluation Routine. The term „remaining useful life" makes it clear that the RULER device can determine the period in which the oxidation of the lubricant can still be reliably prevented by the antioxidants added to the oil or lubricating grease. Predominantly, highly polluted lubricants, such as turbine oils, gear oils, compressor oils, gas engine oils, circulating lubricants and heat transfer oils, are tested.

The **MPC test**, the Membrane Patch Colorimetry test, detects the danger of deposits in turbines and oil circulation systems. Aging products can form or impurities can get into the system during the long periods in which the oils are used. The MPC test is the only investigation method in the world that can not only detect the insoluble oil residues, but also quantitatively evaluate them.

在做什么 NEWS FROM CHINA 在做什么

Overcrowded streets and a high level of air pollution – China's citizens are sick and tired of the bad atmosphere.
At this year's meeting of the National People's Congress, the government defined solving the environmental problem as the main task for the near future. Increasing the oil change intervals for motor vehicles is a small but important part of this. In China, currently motor oil in private cars is changed on average every 7,500 km, and for utility vehicles this figure is between 10,000 and 30,000 km. In Germany, the oil service life is, however, around 30,000 km for private cars and 120,000 km for utility vehicles. This substantial difference is based on fuel qualities in the large Middle Kingdom that, up to now, have been relatively poor and varied greatly depending on region. However, not least thanks to increasing environmental awareness, the trend is moving more and more towards better fuels that contain less sulphur. At the same time, more modern, higher quality lubricants are increasingly being used.
High time, then, to rethink old habits and to increase oil usage times. After all, this saves the environment and plenty of money. Utility vehicle owners are also interested in this. Scania has taken on a pioneering role in this and, with the support of OELCHECK China, is exploring what oil change intervals make sense for Scania HGVs and busses. Field tests for the Scania HGVs with their heavy diesel engines currently show that a service life of up to 80,000 km does not appear to be a problem. Because the fuel is still of relatively poor quality in some cases and the operating conditions are often difficult with extreme traffic jams in the large cities, for the time being it is recommended that oil change intervals only be extended with accompanying oil analyses in accordance with the OELCHECK analysis set 2. However, the first steps have been taken. And the examination of oils from private petrol engines that have been carried out so far show that significantly longer oil change intervals of up to 20,000 km could also be implemented in China without a hitch.

The HEW gas engines have run without damage for 25 years

Electricity, gas, water, long-distance heating – HEW HofEnergie+Wasser GmbH supplies the citizens of Hof, a city in the north of Bavaria, with the four classic utilities and many additional services. HEW is a subsidiary company of Stadtwerke Hof GmbH and supplies district heating directly to the home. To use the environmentally friendly district heating, thermostats in the home need only be set to the desired temperature.

Since then, the experienced and highly motivated HEW HofEnergie+Wasser GmbH team has also carried out maintenance work at third party plants.

District heating is economically and ecologically sound. With better efficiency levels than decentralised heat production, this form of heating can be adjusted to any changing need, is stable in terms of price and does not require lots of maintenance. Water which reaches the customers via a pipe system generally acts as the heat carrier. There, the hot water delivers heat in the heat exchangers to heat or warm water. The cooled water then flows back to the heating station where it is heated again. The district heating supply is therefore no different from a large central heating system. However, this way allows whole city districts to be supplied with ready-to-use heat, rather than just a single building. HEW operates seven combined heat and power stations (CHP stations) in different city districts, each with a manageable district heating supply network. There are 11 natural gas modules and one microgas turbine being used in total. The power of the natural gas powered engines is simultaneously used to run the generators to produce electricity. This power/heat coupling allows up to 90% of the natural gas to be used and at the same time 160 million kWh electricity to be generated a year at the same time.

The first CHP station was commissioned in Hof in 1989 with an electrical output of 920 kW. And from then on, the first customers were supplied with district heating. The further six CHP stations were installed one after the other until 2005. HEW is celebrating the 25th anniversary of district heating in 2014!

HEW is in the lucky position of having a highly motivated team who „think outside the box“ which is very important when operating combined heat and power stations. Its employees also service the nine GE Jenbacher modules each with an average electrical output of approx. 530 kW, the MTU onsite energy modules with 230 kW and the Vaillant modules with 5 kW, as well as a microgas turbine with 30 kW. A modernisation programme has been running since 2009 due to the age of the systems. So far six of the nine GE Jenbacher and the MTU aggregate have been swapped for new modules from the respective manufacturers with an almost equal power rating. The rest of the aggregate are to be modernised in 2014.

Generally, a large inspection is due every 30,000 to 34,000 operating hours and the motor must be swapped after approximately 60,000 operating hours. However, the modernisations of past few months meant that these works could be avoided recently. Nevertheless, oil changes of course could not be dispensed with. Each module requires approximately 230 litres of SAE 40 low-ash gas engine oil. Due to the constant operating conditions when using natural gas, it is changed at fixed intervals and the oil service life is not completely exhausted.

Dipl.-Ing. (FH) Gaby Siliaz, group leader for construction and operation of the heat generation plant and CHP system: „Our philosophy has proven to be successful over the years. We have had no engine failures in 25 years! Being better able to plan maintenance during fixed oil change periods also means that personnel can be deployed in the best way possible. However, we also take samples that we send to OELCHECK to be analysed during every oil change. This means that should there be a claim we can prove, for example to the insurer, that we have completely monitored operation – the entire OELCHECK system is one unit. From sampling with tubing, vials, labels and mailers through to the lab report, which summarises the values in a manner that is easy to understand. The operator, who is an oil expert in the rarest cases, can quickly get an idea of the condition of the engine. We usually receive the results on the second working day after the sample is taken.“

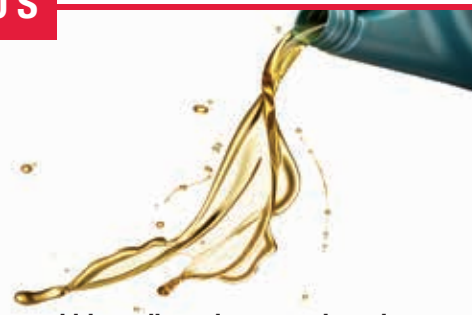
The values for wear, oil oxidation and base number in the OELCHECK lab reports are particularly important for the HEW employees. The latter indicates the content of alkaline additives in the oil and provides information on how many acidic components can still be neutralised and rendered harmless by the oil. The parameters acid number and i-pH value, which are necessary due to the greatly fluctuating gas composition for landfill gas engines, only then play a role if biomethane is added to the natural gas – as is often common practice today.

Ultimately, however, the diagnosis engineer‘s comment is crucial. Each OELCHECK lab report is issued with one. These substantiated comments were also very important criterion for the HEW employees when choosing OELCHECK as the analysis laboratory.

Gaby Siliax: „Our oldest analysis by OELCHECK dates back to 1993, by the way! We unfortunately searched for it in vain in our records, but we struck it rich with the customer portal www.laborberichte.com! Back then the gas engine oil was checked at 5 week intervals and Dipl.-Ing. Peter Weismann gave the oil the go-ahead for recycling in his comment.“

www.stadtwerke-hof.de

New lubricant, improved performance?



Changing your lubricants as easily as changing your shirts – that would be a fine thing! We would buy oils and greases based purely on price, simple storage and immediate availability and it would all run like clockwork. But unfortunately the necessary operating materials are not always that easy to change. Even if two products fulfil a certain specification, changing the lubricating oil or grease type can give rise to nasty surprises. Some lubricants with which positive experiences were made in Europe also bear the same designation in other countries. But their content and their effects on the lubricated components can vary greatly depending on the place of production. It's no accident that the topic of „changing brands" is once more a hot topic for maintainers and international lubricant experts on LinkedIn and other online forums. Using a structured procedure and compatibility analyses could mean that the risks that may arise when changing to another product could be almost eliminated.

Better is the enemy of good! And we should constantly try to continually improve anything concerning machine and system lubrication. Changing the lubricant or oil brand can have many advantages, but can also carry some risks. When changing brands never forget that lubricant is an essential part of a machine. This means that such a change is always disruptive to the machine. Prudence is the better part of valour, and you should have good reasons for changing lubricants, such as:

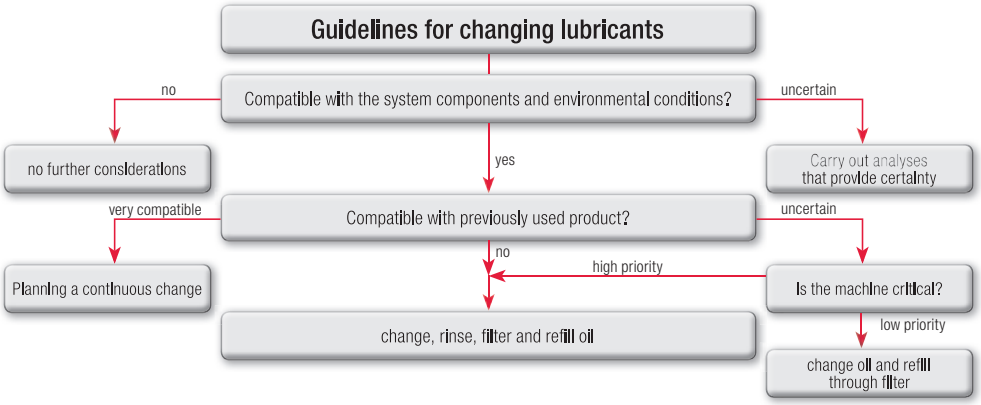
- insufficient protection against wear with the previous product,
- reducing suppliers and lubricant types (storage, mix-up),
- an essential reduction in costs due to lower purchase prices,
- longer oil services lives or relubrication intervals,
- saving energy through improved efficiency (synthetic oils, multigrade oils),
- globally committing to one lubricant manufacturer for all business units,
- the previous product is not longer being manufactured.

You must count on it

If, for example, the previous product has similar additives (concentration of additive elements, IR spectrum) and the viscosity level hardly differs, the products can usually be changed without any big surprises. Also, when a supplier or laboratory has carried out intensive tests into the harmlessness of mixing products and there is corresponding data that is confirmed there should be no problems when changing lubricant brands.

In all other cases, you should however be aware of all possible undesirable side effects:

- If the new lubricant is miscible but incompatible with the old one, even if they are the same viscosity, mixing them can mean that reliable lubrication is no longer guaranteed when changing lubricants.
- Consequential damage, such as wear, cavitation, impaired performance against water, early oxidation or foaming must be expected due to differing additive concentrations or altered surface tensions.
- Before the oil is changed, the system is contaminated with lacquer-like and/or sludgy deposit. The dispersant additive of the new product works differently. Deposits increasingly become detached and contaminate the filters much more than previously calculated.
- The new lubricant reacts differently with seals, inner coats, galvanised or nickel-plated surface coatings or filter materials.
- Additive combinations can have a corrosive effect and attack metal alloys containing tin, copper or lead.
- The new product is less suitable for use under specific operating and/or environmental conditions, such as extreme temperatures, impurities, chemicals, process gasses, cleaning agents, etc.
- The new oil contains a lower concentration of HD or EP additives, has different viscosity index improvers or a different base oil composition and therefore does not have the same performance capacity as its predecessor.



It can become really tricky when oils are mixed together that are miscible and designed for the same use but are not completely compatible with each other, such as:

- zinc-free and zincic hydraulic or circulating oils,
- oils with detergent and non-detergent properties (HLP and/or HLPD),
- glycol-based synthetic oils with other synthetic oils (PG and PAO).

Nevertheless, incompatible or not, risks can only be avoided through structured procedures and any analyses that indicate probable incompatibly in the first place.

The path to the right decision

Our decision path shown above helps you to safely circumnavigate the dangerous cliffs. The important thing is that you follow it to the letter!

Alongside the data sheets and information from the lubricant suppliers, you have access to the **OELCHECK Consultation Service** that is supported by the analysis results.

When comparing supplier specifications you should consider the following characteristic values:

The OELCHECK Consultation Engineers

- For oils: viscosity and viscosity index, additive elements, flash point, density, IR comparison and base oil differences.
- For greases: consistency class, element content, IR comparison, bleeding behaviour, temperature operating range, base oil/thickener types, as well as any solids.

Also compare if available.

- Specifications and standards such as: DIN, ISO ASTM and, for automotive products, ACEA and API
- the results of mechanical testing procedures, such as FZG test, VKA (Vier-Kugel-Apparat [four ball test]), Brugger, FE8, foam testing
- Approvals from engine, system and component manufacturers.

In the OELCHECK laboratory, alongside the stated analysis procedures, there are other options for checking individual lubricants and their mixtures. Values exceeding the manufacturer's specifications from the data sheets can be determined. This includes, for example, the content of the additive elements and the composition of the additive packages, the filterability, the oxidation stability, avoiding corrosion and performance against water and if air gets into. Performance against sealing materials and surface coating must also often be estimated. A viscosity temperature profile shows whether the lubricant is suitable for use in extremely high or low temperatures. Even individual reactions with ammonia or other cooling agents, fuels, metal working oils, hydrogen sulphide or other aggressive substances can be estimated from the existing data.

It often gets very exciting when a mixture of an old and new lubricant should be evaluated. We recommend that customers carry out mixtures that are easy-to-handle themselves. Then a total of five samples, one from the two fresh oils and three mixtures (at a ratio of approx. 50:50, 95:5 and 5:95), should be sent to the laboratory in the analysis set 2 with the note „Compatibility Analysis". The oils and mixtures are tempered over four hours at 60°C in the laboratory. This allows the base oils and additives in the mixtures to react together if applicable. If afterwards there is cloudiness, severe changes in colour or even deposits and peeling, the experiments are abandoned noting that the products are definitely incompatible. Fresh oils and mixtures are only investigated further if there are no major visual changes.

The next step is carried out if all criteria of the new oil type have been examined by experts based on the manufacturer's specifications or by the laboratory and it has been ascertained that the seals and other system materials will not be impaired. The oil change associated with changing the oil and possibly rinsing and cleaning the system.

Oils – drain, rinse, change

Unexpected situations when changing oil types

Negative reactions	Particularly frequent with	Possible after-effects	Precautionary measures
Individual elements of the lubricant separate	Older machines: Changing from mineral oil to lubricants containing ester, detergents, dispersants and other polar additives	Internal and external leakages, insufficient lubrication as possible result	Rinse the equipment and remedy all leakages before the machine resumes normal operation.
Seals less efficient (e.g. change to structure and/or dimensions, deformation under pressure, material destruction)	Older machines: Changing to a synthetic lubricant that has a significantly different aromatics content compared to the previous product	Internal and external leakages, insufficient lubrication as possible result	Have the new lubricant examined for compatibility with the seals in the system. Repair/replace old, worn seals.
Old deposits and sludge are loosened by new oil	Older machines: Changing from mineral oil to lubricants containing ester, detergents, dispersants and other polar additives	Decreased oil supply causes insufficient lubrication and accelerates wear	Thoroughly clean the whole system by rinsing under high pressure before refilling. Possibly use chemical cleaning additives. Possibly hydrodynamic cleaning by specialist company for large systems.
Lubricant is insufficiently effective due to incompatible additives of base oils	Mixing incompatible lubricants together, their acids/bases react with one another.	- Sludge and other insoluble deposits form - Loss of surface tension leads to chronic problems through air getting in, foam formation and/or the formation of oil/water emulsions - Deficient oxidation stability - Corrosion - Inadequate lubricating film stability	Carefully drain the old oil and rinse in order to remove all residue of the old lubricant.

- **If the old and new product is very similar** the oil can be changed fluently. Shortages can be supplemented with the new product even before the oil is actually changed.
- **If both types show greater differences,** then you should also factor in the condition of the system. If it is very challenging, old or if multiple malfunctions have already occurred, the old oil must be completely drained. When doing so attention should be paid to the fact that generally more than 5% of the old oil in the system remains on the casing walls, in the bearings and sealing spaces, in the lubricating holes and the lines even during a thorough oil change that includes draining the oil at operating temperature.
- **If both oil types are incompatible with each other,** the equipment must be rinsed before the oil is changed. Additional cleaning measures may also need to be carried out to remove sludgy and lacquer-like deposits and residual oil. Remember, residue and impurities can also hide in coolers, heating aggregates, tubing, lines, connections and filters!

If the equipment needs to be rinsed before it is filled with the new oil type, the same oil type should preferably be used at a lower viscosity level (at least two ISO VG classes lower). Additional rinsing output can be achieved through warming and circulating at high speed. Do not use additional detergents to boost the cleaning effect or only use them if the operating oil still being used also contains it.

If rinsing with the operating oil or its thinner agent is not sufficient, special chemical cleaning additives can be used. These contain, for example, calcium sulphonate, which is usually dissolved in mineral oil. A disadvantage of this method is that after rinsing, the cleaning oil that is incompatible with all lubricants must be completely removed from the system with another rinse. Hydrodynamic cleaning can be carried out as an alternative to chemical cleaning for large or tricky oil circulation systems. The procedure is based on the application of water, air and flushing oil. This is carried out, for example, by ECOL, whose employees are internationally specialised in its application and this procedure.

www.ecol.com.pl

Hydrodynamic cleaning of a pipeline by an ECOL employee

Lubricating greases behave differently

Lubricating greases that have proven effective for an application should not be mixed if possible. Depending on the thickening or base oil type, they can be so incompatible with one another that they even lose their structures and become extremely soft upon mixing. However, if a new grease must be chosen, the following criteria must at least be followed:

- the base oil basis (mineral oil, PAO or Ester synthetic oil) must be the same.
- the base oil viscosities should be a maximum of one ISO VG class different from one another. Unfortunately, this information is often very difficult to obtain from the manufacturers.
- the thickener types must be compatible.
- the NLGI classes and grease consistency (penetration) should be identical.

The following overview shows which lubricating greases are compatible, less compatible and not compatible at all.

Thickener in lubricating greases. ■ compatible ■ less compatible ■ incompatible	Aluminium complex	Barium	Calcium	Calcium 12 hydroxy	Calcium complex	Betonite	Lithium	Lithium 12 hydroxy	Lithium complex	Polyurea
Aluminium complex		■	■	■	■	■	■	■	■	■
Barium	■		■	■	■	■	■	■	■	■
Calcium	■	■		■	■	■	■	■	■	■
Calcium 12 hydroxy	■	■	■		■	■	■	■	■	■
Calcium complex	■	■	■	■		■	■	■	■	■
Betonite	■	■	■	■	■		■	■	■	■
Lithium	■	■	■	■	■	■		■	■	■
Lithium 12 hydroxy	■	■	■	■	■	■	■		■	■
Lithium complex	■	■	■	■	■	■	■	■		■
Polyurea	■	■	■	■	■	■	■	■	■	

Each lubricating grease is therefore so incompatible with at least one grease with a different thickener that damage to the lubricated components occurs within just a few days. Greases containing an aluminium or calcium complex soap or that stick to the oil using polyurea or betonite thickeners are amongst the least compatible.

If incompatible greases are mixed, their structures change. This almost always results in a serious softening: the previously firm greases become „soupy“ and begin to „run“. It is uncommon but lithium soap greases can also become firmer. If betonite soap greases are mixed with barium complex greases, base oil frequently deposit on the surface.

However, even if the thickeners are compatible, it can result in difficulties with the base oils or the additives. Greases are not even compatible within a thickener group. Polyurea greases especially bleed, which can only be counteracted with extremely short lubrication intervals. Ultimately, only investigations in the OELCHECK laboratory and discussion with the diagnosis engineers can provide information on whether and how greases are likely to react with each other and which reactions can be expected when mixing.

Some precautions should be taken if a lubricating grease must be changed. First check whether:

- the old grease can be rinsed out of the lubrication points in a relatively large amount of the fresh grease
- the bearing requires more than the minimum amounts due to its design. Otherwise undesirable high temperatures can occur when changing necessary over-lubrication due to filling losses.

If there are no concerns then nothing is stopping the grease change. When lubricating using a handle grease press, it is best to proceed as follows – the same for central lubrication systems or „grease cups“:

- Only lubricate with the new grease if the old grease has been used as much as possible and a new lubrication interval is due, for example.
- If possible, slowly put the new fat into the running bearing until the emerging grease changes in colour or consistency and the residual grease is the same as the fresh grease.
- Repeat the procedure after a few hours. This means that any residue from the old product is easier to remove.
- Halve the four subsequent lubrication intervals, e.g. instead every two weeks instead of monthly, over a period of four months.

You should be prepared for the fact that during the change-over phase, which can last up to six months, there is a considerably higher grease consumption and that grease disposal can be problematic.

After changing, check

Even if everything is running smoothly after changing oil or grease types, stay vigilant! Surprises can happen to anyone!

- **Monitor the systems with continuing lubricant checks and analyses.**
  When carrying out these checks pay attention to foam, cloudiness, increasing temperatures, vibrations, noticeable running noises and grease that leaks or bleeds out.

- **Have a lubricant analysis carried out in the OELCHECK laboratory a few operating hours (max. one week) after changing oils.**
  This sample serves as a reference for further trend analyses and for monitoring whether there is residual oil content in the flushing oil. You only have confirmation that everything is in order if the analysis gives the green light.

- **And don‘t forget to use the new lubricant name!**
  Change signs on the system, in the lubricant storage space and on the filling devices, where applicable. Correct the information in your electronic data, purchasing and monitoring programmes! It would be a shame if an error crept in further on in the procedure!

OELCHECKER

MASTHEAD

Oilchecker - an OELCHECK GmbH magazine
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Concept and text:
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Photos:
OELCHECK GmbH · HAKO · HEW · iStockphoto · Ecol

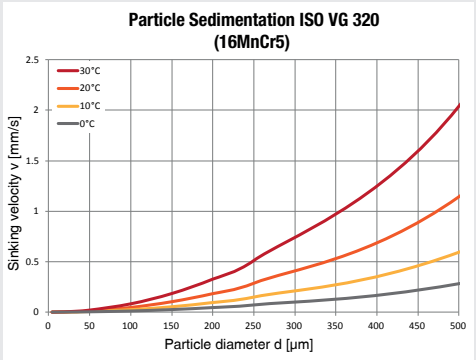
Q & A

Can the validity of an oil sample change because the wear particles suspended in the oil deposit too quickly? One of our industrial gearboxes is regularly monitored using your lubricant analyses. The last analysis suddenly showed an exceptionally low PQ value. All other values were on trend. A control sample taken a few days later showed the expected PQ index. As always, we did not take the anomalous sample from or just in front of the oil sump after a long weekend. However, the gearbox was not in operation, otherwise we have always taken the sample during operation. Could this have influenced the result?

OELCHECK:

The time when the sample was taken can affect certain values. It is not without reason that we advise as follows in our sampling guidelines: „During operation or just after standstill as dirt and wear particles are suspended." If, however, you take oil, for example, in the morning from a machine that was not in operation over the weekend or hours after a wind power station was stopped operating, the sample may not contain all information. However, the time factor not only plays an important role when taking samples. It also has a significant role in our laboratory. In order to be able to optimally carry out the visual check, the sample containers must rest upside-down for approximately 15 minutes at 40°C. This allows the wear particles from the highly viscous oils to settle on the white cover seal.

The sealed sample containers are also placed upside down on the particle quantifier to determine the PQ index'. It detects magnetisable iron wear particles in the sample using its magnetic coils. While the value given in the lab report for „iron" in mg/kg only relates to particles smaller than 5 µm, the PQ index provides information on all magnetisable iron particles regardless of particle size. In order to obtain a representative sample, they should always be taken as close as to when the machine is in operation as possible. However,



some values can only be determined after a rest time. The velocity at which particles in the oil move and deposit through gravitation depends on:

- the size of the particle and its density (its weight, too)
- the oil viscosity, which is also temperature dependent.

The velocity at which a spherical particle sinks or sediments in a liquid can be calculated using „Stoke's Law". For non-spherical bodies half of its equivalent diameter is used rather than the particle radius. We have used this „Stoke's Law" to obtain comparable values for the sinking velocities of metal particles in a lubricating oil.

During these calculations we assumed that the metal particles are almost spherical in shape. A magnetisable chrome steel, which is typically used for gear teeth in gearboxes, was taken as the material for the particles. At approx. 8 kg/dm³, it is almost nine times as dense as the oil which is approx. 0.9 kg/dm³. The sinking velocity of particles with a diameter of 5 µm (> 4 µm smallest particle size during particle count in accordance with ISO 4406), 50 µm (just visible with the naked eye) and 500 µm (particle from a damaged aggregate) was calculated. A conventional CLP 320 gearbox oil was taken as the lubricant. Depositing was calculated for temperatures of 0°C, 20°C and 60°C, as can occur when taking typical samples.

Sedimentation speeds and duration

Steel particle size	Sedimentation speed	Sedimentation duration for 0.5m distance
at 0°C in oil ISO VG 320		
5 µm	0.000018 mm/s	322 days
50 µm	0.003 mm/s	2 days
500 µm	0.282 mm/s	30 minutes
at 20°C in oil ISO VG 320		
5 µm	0.000073 mm/s	79 days
50 µm	0.011 mm/s	12.5 hours
500 µm	1.14 mm/s	7 minutes
at 60°C in oil ISO VG 320		
5 µm	0.00052 mm/s	11 days
50 µm	0.082 mm/s	1.5 hours
500 µm	8.16 mm/s	1 minute

In principle, the following is true:

- 5 µm particles never completely settle. Even after an aggregate has stopped, they remain in full concentration in an oil sample, regardless of how long after downtime and where the oil was taken.
- 50 µm particles, which are visible to the naked eye and are counted at > 14 µm during particle counting, can fall over a distance of 0.5 m over a weekend. In this case at least a short start should take place before the sample is taken or the sample should be taken from further down.
- 500 µm particles, which indicate acute damage, can sink into the oil sump in a few minutes. Depending on where the sample was taken, if the sample was only taken after a long downtime, the sample contains either too many or none at all. Such large particles, which would block the particle counter with the measuring cell cross-section of 100 µm, should not be considered in the particle count.

In our laboratory the time span of 20 minutes in which the oil samples stand upside down is completely sufficient for detecting all the magnetisable particles. In return, samples should always be taken during operation or as quickly as possible after the machine stops moving. A sample can only be representative if this is done, which is necessary for or lab reports to be valid. **An accurate and quick sample is therefore completely in your best interest!**

If you have questions about tribology or lubricant analysis, OELCHECK can answer them. Send us your questions by e-mail (info@oelcheck.de) or by fax (+49 8034-9047-47).