Summer 2019

OELCHECKER

INSIDER INFO • PARTNER FORUM • TECHNOLOGY FOCUS

CONTENT

FuG Elektronik – Global player in an electrified world

FuG power supply unit (600 kW, 40 kV) for a particle accelerator at BESSY in Berlin. Windows and mirrors for the visual inspection of the oil condition and switch position of certain safety-relevant parts.

FuG Elektronik GmbH with its high-precision low- and high-voltage power supply units is the world market leader in many areas. The first-rate high-tech products by the German company are the right solution when highly precise electricity supply is required. Power supply units by FuG are also an important component for medical radiation therapy devices, electron-beam welding devices, electron lasers and particle accelerators such as at CERN. Transformer oil analyses by OELCHECK contribute to the safe and fault-free operation of these systems.

Top references from A to Z

Hardly any other company can list as many internationally renowned companies, universities and institutes as references. From ABB to Carl Zeiss AG, the list of customers is impressive. Founded in 1978, the company has developed into a global player. FuG is a hidden champion, without equal in the industry. All FuG power supply units are developed at the location in Schechen near Rosenheim. All quality-relevant production steps are also performed there in order to fulfil the company's own high quality standards.

Special and standard devices

FuG manufactures many of the power supply units according to individual customer requirements. Moreover, the large program offers more than 600 models from 6.5 V to > 200 kV in many output ranges from 7 W to > 100 kW. Whether custom design or standard model, ready-for-connection parts are delivered all over the world. The service team in Schechen can be reached at any time via the hotline. Rare malfunctions of devices are rectified at the plant or by the service team on-site.

An exciting and electrified world

Wherever power supply units by FuG are used, their applications are electrifying in the truest sense of the word. Transformer oil analyses by OELCHECK ensure a long service life.

FuG power supply units are, for example, indispensable components of chamber systems for electron-beam welding. The output is determined by the acceleration voltage and the beam current. Electromagnetic systems in vacuo manipulate the electron beam, thereby creating clean and slim

Check-up

At OELCHECK, the phenomenon of job hopping is virtually unknown since the majority of our employees remains loyal to us over many years. We are grateful for this and even a little proud! Our company started as a two-person operation in 1991. Today, we have nearly 100 employees. 10 employees have been with us for over 15 years and another 10 for more than 10 years.

Why do we have so many long-term employees? There are various reasons for this. The main reason is that we focus on the person. Mutual appreciation is especially important for us. No one is left to their own devices as we are all part of a strong community. Team spirit is more pronounced with us than with most other companies. It is not only our regular team events that bond us together but also especially the daily interaction with each other. Our conduct is characterised by fairness and respect. We are constantly overcoming new challenges as a team.

Moreover, OELCHECK offers much more than just a workplace. Motivated employees can always find new challenges with us in a constantly growing company. We provide an ideal work environment with many interesting benefits (fitness room, sports offers, cafeteria, ...), above-average further training options, development and advancement opportunities and attractive social benefits. OELCHECK is a 100% owner-operated family company – our focus is on the employee as a human being!

Sincerely, Barbara Weismann

seams with a depth of up to 150 mm. Even aluminium-steel combinations are possible. The procedure is especially popular in the automotive and aviation industry due to low warpage, high productivity and maximum precision.

Particle accelerators are not only used for exploring matter such as at CERN, but also for medical radiation therapy. For example, electrons or protons are accelerated, bundled and guided. FuG power supply units provide acceleration voltage or electricity for magnets with several thousand amperes depending on the specific requirement as extreme precision is a necessity in these cases.

Usage of transformer oils

Among other things, power supply devices consist of transformers and high-voltage rectifiers. High-performance and high-voltage devices require transformer oils for these components. The devices reach the limits of what is physically possible as the oil is used over decades under various climatic conditions. The oil is to provide reliable insulation, heat dissipation, low-temperature and oxidation stability and compatibility with all other materials. As a dielectric medium (electrically non-conductive substance), it must also prevent electric flash-overs between live parts and extinguish electric arcs. The voltage up to which no spark discharge occurs under precisely defined conditions is defined as breakdown voltage. This voltage must be significantly higher than the nominal voltage of the transformer. The oil is delivered in drums that are overlaid with nitrogen since even traces of water can lower the dielectric strength. As an additional safety measure, FuG dries the oil again. Furthermore, the installation of drying cartridges provides another precautionary measure for deployment, which makes the intrusion of moisture in the form of condensation virtually impossible.

FuG recommends analyses by OELCHECK

For many years, FuG has used transformer oil analyses by OELCHECK. FuG also recommends regular analyses according to DIN specifications to all its customers since the analysis statements significantly contribute to fault-free and safe operation. Most transformers are filled with 100 to 1,000 litres of transformer oil and work with a voltage from 150 to 200 kV. Based on the values determined by OELCHECK for the breakdown voltage, water content and viscosity, it is also determined whether a possible drying procedure or even an oil change must be performed.

Further information at: fug-elektronik.de

For big and small –

Transformer oil analyses are an absolute necessity

Checking insulation or transformer oils in electric operating equipment is an absolute necessity. DIN EN 60422 (VDE 0370-2) specifies this requirement for mineral insulating oils and DIN EN 61203 (VDE 0375-2) for ester-based oils. Routine analyses should be performed every 1-4 years for all oil-filled electrical operating equipment from 72.5 KV to 170 KV. Routine analyses should be performed every 2-6 years for all oil-filled electrical operating equipment up to 72.5 KV and for oil-filled circuit breakers over 72.5 kV.
This also applies to smaller transformers such as in cogeneration units and wind power stations. Five all-inclusive analysis kits are available for the standardised analysis of insulating oils. The kits ISO 2 to 5 contain a gas-tight glass syringe, an aluminium bottle and instructions for correct and standardised sampling.

OELCHECK all-inclusive analysis kits for checking transformers and insulating oils:

Kit	Sample container	Analysis scope
ISO 1	20 ml syringe	Dissolved gas in oil (DGA)
ISO 2	20 ml syringe + 1 l aluminium bottle	Dissolved gas in oil (DGA) Breakdown voltage, water (K.F.), colour index, viscosity 40°C
ISO 3	20 ml syringe + 1 l aluminium bottle	Dissolved gas in oil (DGA) Breakdown voltage, water (K.F.), colour index, viscosity 40°C Neutralisation number, oxidation (FT-IR), dielectric dissipation factor (tan δ)
ISO 4	20 ml syringe + 1 l aluminium bottle	Dissolved gas in oil (DGA) Breakdown voltage, water (K.F.), colour index, viscosity 40°C, neutralisation number, oxidation (FT-IR), dielectric dissipation factor (tan δ) Density, additives, contamination, wear, interfacial tension (IFT)
ISO 5	20 ml syringe + 1 l aluminium bottle	Dissolved gas in oil (DGA) Breakdown voltage, water (K.F.), colour index, viscosity 40°C, neutralisation number, oxidation (FT-IR), dielectric dissipation factor (tan δ) Density, additives, contamination, wear, interfacial tension (IFT) Microscopic particle counting, MPC

The kits ISO 2 to 5 are also available upon request without the DGA analysis.
Contact sales@oelcheck.de, Tel. +49 8034 9047-250 to place an order or receive an individual offer!

REM-EDX determines the composition of larger particles – test method in cooperation with IABG

REM-EDX, this abbreviation says a lot! It stands for a new test method, the "raster electron microscopic analysis by means of energy-dispersive micro range analysis". The process precisely determines the elemental composition of particles. Based on the results of the determined metal alloys, inferences can be made with regard to certain components from which particles with a size of only a few micrometres originate.

Thus, the REM-EDX analysis provides the perfect support when **searching for machine elements with signs of wear** or **determining contaminations in the form of solids**. The analyses are performed by Industrieanlagen-Betriebsgesellschaft mbH (IABG) in Ottobrunn near Munich. OELCHECK's cooperation partner has the necessary high-tech equipment and well-founded expertise for examining and assessing complex damage incidents. OELCHECK separates the particles that are to be analysed from the oil samples, provides background information and assists with the diagnosis of analysis results.

Metallic abrasion quickly intrudes into oil or grease if wear or contamination particles attack lubricated machine components. OELCHECK already detects even the smallest particles in oil samples in the initial stages of the wear process. Atomic emission spectroscopy (AES) detects up to 30 elements that make up the particles. However, this analysis reaches its limits when dealing with particles that are larger than 5 µm. The exact composition and origin of larger particles or hard residue found in filters, oil samples or waste oil can often be clarified with an REM-EDX analysis.

Which particles are examined?

The analysis is suitable for the analysis of all inorganic, solid particles that are filtered from oils, grease or operating fluids, possibly after being treated with a solvent.

How are the samples prepared?

The customer can send a sample with visible particles or particles that he has already separated himself to the OELCHECK laboratory. A clear issue statement and possible comprehensive information regarding lubricated components, the lubricant and other anomalies is very important.

In the laboratory, OELCHECK filters the conspicuous particles from the lubricant or processes them directly. The soap structure of lubricating grease must first be destroyed with solvents prior to filtering.
The particles are restructured from the filter membrane and transferred to a carbon pad with a diameter of 2.5 cm. OELCHECK then sends this pad together with the exact issue statement and information about the lubricant and relevant system to the cooperation partner.

How is the analysis performed?

Up to five representative or conspicuous particles are transferred to a membrane and observed in vacuo in the IABG laboratory. The raster electron microscope is connected to an energy-dispersive micro range analysis EDX (energy dispersive X-ray spectroscopy). The elements that constitute the particles are determined.

An electron beam moves over the particles in a raster pattern during the analysis. An image is generated from the interactions between the electrons and the particles. The surfaces of the particles are enlarged by up to 500,000:1, which corresponds to the lateral resolution of 0.6 mm.

In combination with the energy-dispersive micro range analysis EDX, the electron beam of the REM also plays an important role. If an electron from the electron beam strikes a negatively charged electron in the atom of the particle that is near the nucleus and moves it from its position, then this space is immediately filled by an energy-rich electron from a higher orbital. The energy difference of both electrons is freed in the form of an X-ray quantum. The resulting X-radiation is characteristic for a specific element. Elements from the atomic number 6 (excluding carbon) and from a mass fraction of 0.3 m% can be verified. Thus, the chemical composition is determined for each examined particle.

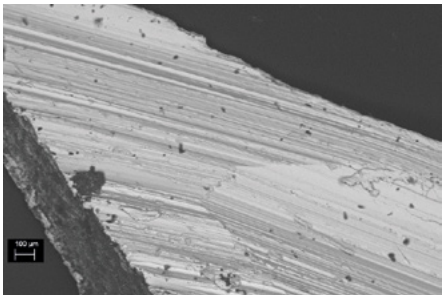
Which information does the customer receive?

A laboratory report is prepared after the analysis.

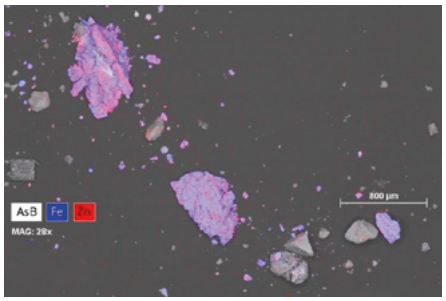
- The report contains a precise description of the task.
- A photo documents the as-delivered condition of the particles on the carbon pad.
- The result of the analysis comprises a list of the main and trace elements of each particle. Possible compounds or alloys are stated that may constitute the original material. Galvanised steel is very likely the material in question if a particle mainly contains iron and additionally zinc, manganese and nickel as trace elements. Additionally, a semi-quantitative analysis is performed for one or multiple particles that are especially conspicuous due to their composition. A table lists the mass fractions of the elements in %.
- The customer receives a diagnostic and assessment statement such as: "The particle can be assigned to a low-alloyed steel such as quenched and tempered steel."
- The annex includes additional pages that illustrate the analysis results with magnified illustrations and diagrams.

Insights into the world of particles

The figures elucidate what is possible with the REM-EDX test method.



The particle consists to 98.5% of iron and contains traces of manganese, aluminium and silicon. It can be assigned to a low-alloyed, manganese-containing steel with a slightly contaminated surface.



The large particle at the top left is zinc-coated steel. In the image, the element distribution is displayed with colours. The particle contains 61.5% iron and 14.1% zinc with traces of manganese, nickel and silicone.

Cooperation partner IABG

IABG offers integrated, innovative solutions for the sectors automotive – information communications – mobility, energy & environment – aerospace – defence & security. We provide independent and competent consultation and realise projects in a future-proof and targeted manner. We operate reliably and sustainably. Our success is based on understanding market trends and requirements, our employees' technological competence and a fair relationship with our customers and business partners.

Hydraulic fluids – clean is not pure

Clean, bright and transparent – this is how most hydraulic fluids appear in the sample bottle. However, appearances can be deceiving! The human eye cannot detect fine contaminations smaller than 50 µm, and it is precisely these fine particles that can severely disrupt a hydraulic system. The particles are measured in µm, which is a millionth of a metre. Caution is already warranted if hydraulic fluid is contaminated with many particles from a size of 4 µm. The purity of fluids is a precondition for the safe operation of modern hydraulic systems. Selection, maintenance and regular monitoring of hydraulic fluids with laboratory analyses are becoming increasingly important.

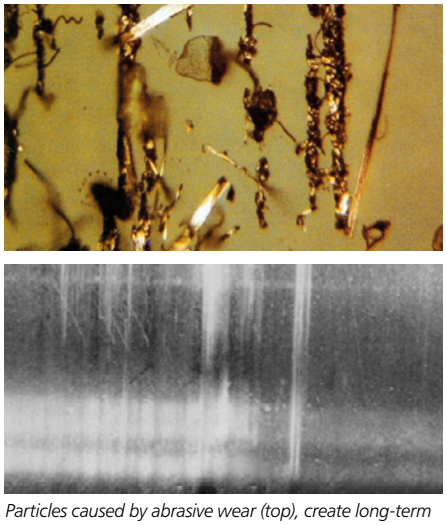
A demanding double role

Hydraulic fluids concurrently function as a medium to the power transmission and as a lubricant. The enormous two-fold benefit provided by hydraulic fluids is often greatly underrated. The requirements placed on these fluids are constantly increasing as they must keep pace with the further technological development of hydraulic systems, which are becoming more and more powerful and compact. Smaller oil filling quantities lead to increased orbital speeds of oils and often also to higher operating temperatures and pressures. Gap tolerances decrease as pistons and valves have less manoeuvrability room. Concurrently, efficient and fault-free long-term usage of hydraulic systems over years has meanwhile become a matter of course. Yet this is only possible if the hydraulic fluids have the respective performance capacity and required degree of purity.

Purity is the key

Hydraulic fluids are construction elements for complex systems and not an arbitrarily exchangeable product, which is why they must be conscientiously selected, maintained and monitored.

In addition to their viscosity, the degree of purity plays a decisive role from the very beginning.

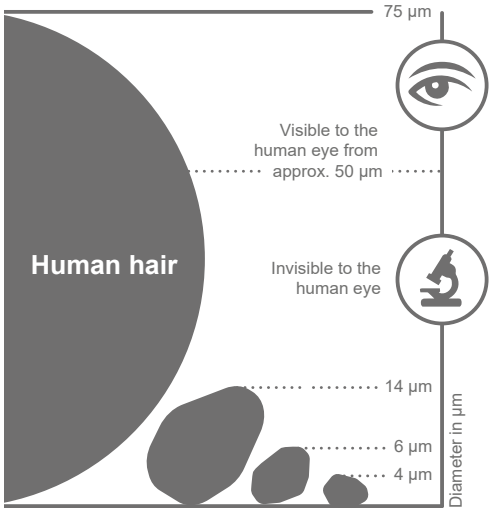


Particles caused by abrasive wear (top), create long-term damage to surfaces (bottom).

Hard but also soft contaminations in the hydraulic fluid are always a risk factor for systems. Depending on the application area, these contaminations cause most hydraulic malfunctions. Especially hard particles such as dust, metal abrasion or sealing materials as well as soft, adhesive parts from aged additive components, oxidation products and water put a strain on hydraulic fluids. Most often, the effect is severe: Particles cause wear in pumps, valves, motors, cylinders, gaskets and hoses. The control edges of valves can adhere and block valves. Filters clog up quicker and must be exchanged more frequently. Deposits in heat exchangers lead to higher operating temperatures and shorter oil life-cycles. Leaks can occur at valves, pumps, cylinders and motors. The effectiveness of hydraulics is also decreased.

Number of particles per 100 ml		Atomic number
More than	Up to and including	
250,000,000		> 28
130,000,000	250,000,000	28
64,000,000	130,000,000	27
32,000,000	64,000,000	26
16,000,000	32,000,000	25
8,000,000	16,000,000	24
4,000,000	8,000,000	23
2,000,000	4,000,000	22
1,000,000	2,000,000	21
500,000	1,000,000	20
250,000	500,000	19
130,000	250,000	18
64,000	130,000	17
32,000	64,000	16
16,000	32,000	15
8,000	16,000	14
4,000	8,000	13
2,000	4,000	12
1,000	2,000	11
500	1,000	10
250	500	9
130	250	8
64	130	7
32	64	6
16	32	5
8	16	4
4	8	3
2	4	2
1	2	1
0	1	0

Table ISO 4406



The purity class according to **ISO 19/17/14** means that
- **250,000 to 500,000 particles ≥ 4 µm**
- **64,000 to 130,000 particles ≥ 6 µm**
- **8,000 to 16,000 particles ≥ 14 µm**

are contained in 100 ml of sample fluid.

Purity classes and contamination degrees

The size of particles in oil is measured in µm (millionth of a metre, micrometre). For illustration purposes: The human eye can easily see a hair, which has a diameter of approximately 75 µm, but can no longer detect objects of less than 50 µm. Specific analysis devices are used to detect fine contamination in oil samples.

The contamination degree of oil depends on the number and size of contained particles. The more particles with a critical size are contained in the oil, the more likely resulting damage to components that come in contact with the oil.

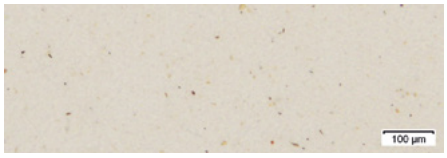
The degree of oil contamination is described by allocation to purity classes, which also provides a basis for comparison.

The current ISO 4406:2017-08 describes the number of particles contained in 100 ml of oil. Organised according to size and quantity, the particles are subsequently cumulatively divided into specified particle ranges. ISO 4406:2017-08 provides a classification for particles with a size of ≥ 4 µm, ≥ 6 µm and ≥ 14 µm. The determined purity class of an oil is stated as a composite number, e.g. as **19/17/14**.

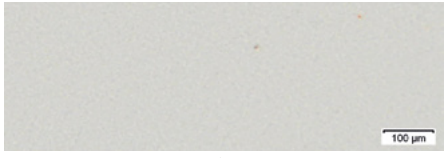
DIN 51524 – not a measure of all things

DIN 51524 (2017) defines the minimum requirements for hydraulic oils in an unused condition with regard to water separation capacity, filter capacity, sealing compatibility, air separation capacity, oxidation stability and wear protection. Part 1 relates to DIN HL oils, part 2 to HLP oils and Part 3 to HVLP oils.

As a minimum requirement, new oil must also adhere to the purity class 21/19/16. It has been taken into account that empty oil containers (primarily drums) are not exactly highly pure vessels prior to being filled with oil. While the minimum purity class 21/19/16 is e.g. sufficient for hydraulic oil for a robust lift, it does not usually fulfil the requirements for servo valves and many other applications. Principally the following applies: The more complex the system, the lower the gap tolerances and/or the greater the operating pressure and the higher the requirements for the purity of the hydraulic fluid. This is why many pump, valve and system manufacturers stipulate specific purity classes that are significantly narrower than the minimum requirements of the new DIN 51524 edition.



Minimum requirements for new oil according to DIN 51524: Purity class 21/19/16



Recommended purity class for modern servo hydraulics: Purity class 15/13/10

Purity analysis

Filters and sensors

When buying hydraulic oil, one should already check whether the product fulfils the purity class demanded by the system manufacturer. However, hydraulic fluid can also be contaminated during on-site storage and while filling it into the system. Absolute cleanliness is to be ensured during the process. Even when exercising extreme caution, filling via a special filter is always sensible. The purity of the oil may also be positively influenced during operation with additional and respectively designed partial-flow filters.

For larger and/or sensitive hydraulic systems, it makes sense to permanently monitor the hydraulic fluid with a particle sensor. These sensors usually use light barriers to detect solid or dark particles in the oil flow. The alarm sounds if specified limits are exceeded. Combination devices are also often used that additionally monitor the water content. The following must be clarified before installing the sensors:

- Degree of measurement precision
- Optimal sensor position
- Type of data transfer
- Response to exceeding limit values

Each oil sensor must be calibrated. Evaluation electronics use reference values that are specified for a certain oil and sensor. Particle monitors with online signals can substantially contribute to the operational safety of hydraulic systems. However, the precondition for this is that the oil type is not changed and the oil is not contaminated with ageing products and/or too much moisture. Too much moisture makes the oil opaque, which can make it difficult for the sensor to properly detect particles. The sensor also has difficulties if oils are mixed and maybe even incompatible with each other.

Principally, a particle monitor provides the latest measurement values with regard to the number of particles. However, it does not detect whether external contamination (dust), wear or degraded EP additives or VI improvers are the cause.

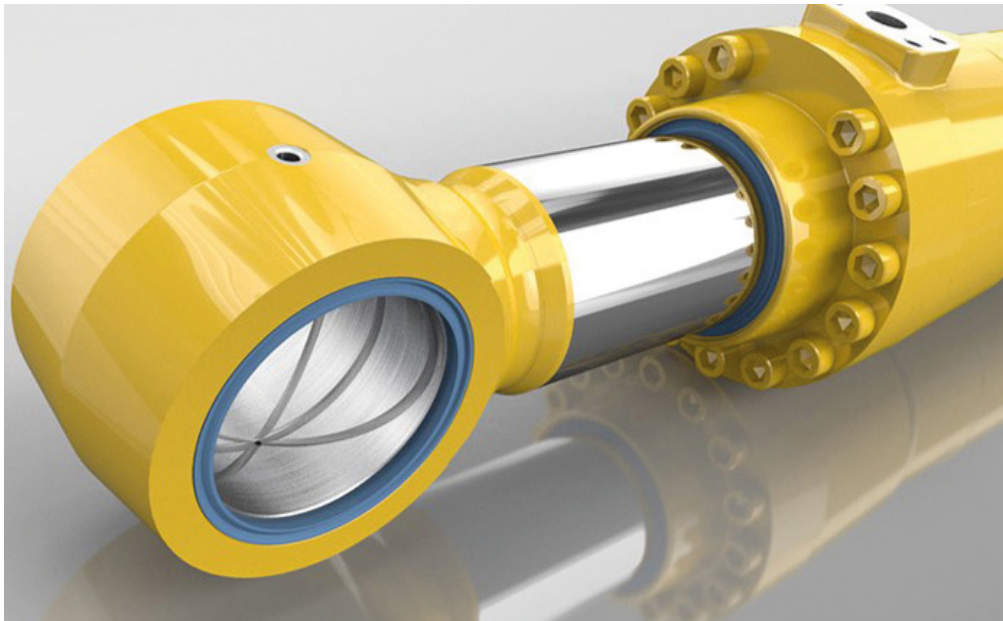
OELCHECK laboratory analyses for maximum security

Although online oil sensors immediately detect possible critical operating conditions, a qualified oil analysis in the laboratory is indispensable. The variety of exact measurement values provides an overall image and thus a decisive basis for assessing the oil condition. The counting of particles with the indication of the purity class is part of all all-inclusive analysis kits for hydraulic fluids that are recommended by tribologists.

Laboratory analyses of hydraulic oils are an important control instrument for the following:

- Examining new products prior to filling these into the system
- Assistance with the search for possible errors or causes of damage if an oil sensor sounds an alarm
- Determination of condition-dependent oil change intervals
- Optimisation of fluid management

Trends can be recognised based on regular lubrication analyses, which can extend the service life of oil and allow for better maintenance planning. Trend analyses sustainably contribute to increasing the operational safety and efficiency of the total system.



Informative samples

Instructions for sampling are available in the download area at oelcheck.de for proper on-site oil extraction and to ensure that the analysis provides representative results. Many system manufacturers have also published precise specifications for sampling.

Principally, extraction valves/miniature measuring connections should be rinsed with a rinsing device when sampling with these. Extraction from the middle of the filling level is ideal when sampling from a tank.

The various trend analyses that we perform for the hydraulic oils of our customers demonstrate how consistently they follow these recommendations. The oil samples are almost always representative. Usually, larger value deviations only occur if the fluid is contaminated.

Particle counting – standardised and checked three times

The OELCHECK laboratory is equipped with multiple state-of-the-art analysis devices due to the large number of samples that are to be analysed on a daily basis. Various devices are available for counting particles. OELCHECK examines the majority of hydraulic oil samples with a laser particle counter. This counter type is also used for determining particle quantities in turbine oils, oils from compactors and compressors and even transmission oils with high viscosity.

Klotz particle counter with Gilson autosampler CINRG

The particles determined in hydraulic fluids are categorised according to the size classes ≥ 4 µm, ≥ 6 µm and ≥ 14 µm, and the purity class of the oil is determined according to ISO 4406:2017.

The analysis is exactly performed according to the specifications of ISO 11500 and ASTM D7647 in order to ensure a high precision. This also includes the careful preparation of each sample. Thereby, irregularities that can certainly occur during the analysis with an online sensor are excluded.

In the OELCHECK laboratory, 20 ml of oil from the sample are mixed with a solvent in a ratio of 2:1 so that the particles can be optimally identified with the laser sensor. The mixture is homogenised and degassed just prior to the measurement. Air bubbles escape quickly from the diluted sample and are therefore not counted during the analysis. The solvent contained in the sample causes the dissolution and "disappearance" of water drops. The solvent also dissolves existing soft reaction and oil-ageing products and thereby ensures that only the hard particles contained in the oil or soot particles from the diesel effect are counted.

Three consecutive counts are performed with a total volume of approx. 30 ml from which a medium value is then determined. The particle counter discards the entire analysis if the individual values greatly vary from each other.

Particle counting does not closely examine water drops or oil-ageing products. Test methods such as the Karl Fischer test, the determination of the acid number or infrared spectroscopy are used for this. The MPC test provides information about the danger of deposits such as from possible oil-ageing products and/or unusual additives.

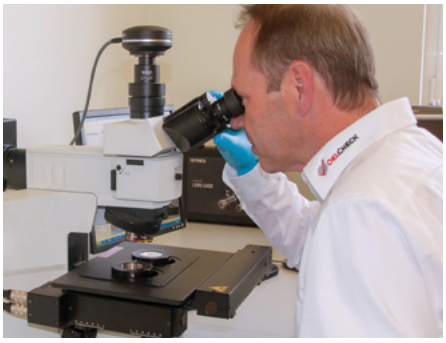
Extras in the OELCHECK laboratory report:

- In addition to the classic particle sizes ≥ 4 µm, ≥ 6 µm and ≥ 14 µm, we also state the number of particles ≥ 21, ≥ 38 and ≥ 70.
- We also determine the less common purity class SAE AS 4059, which is nonetheless highly relevant for some customers The Society of Automotive Engineers defined the class as AS (Aerospace Standard).

Particle counting for aqueous, opaque and dark fluids

Water drops should not be included in the particle count. Yet, what about low-flammable hydraulic fluids of the classes HFA to HFC with a high water content? Using laser particle counters does not make sense for these. OELCHECK examines these and other opaque (milky) or dark or excessively contaminated fluids with an Olympus BX51 microscope.

For this purpose, the homogenised sample is filtered through a filter membrane with a pore width of 1.2 µm. The membrane is dried after rinsing with solvent. A representative surface of the membrane is microscopically "scanned" in the reflected light mode. All particles that appear darker in the grey level of the membrane are photographed with a high-resolution CCD camera, measured with image analysis software and categorised based on the longest expansion.



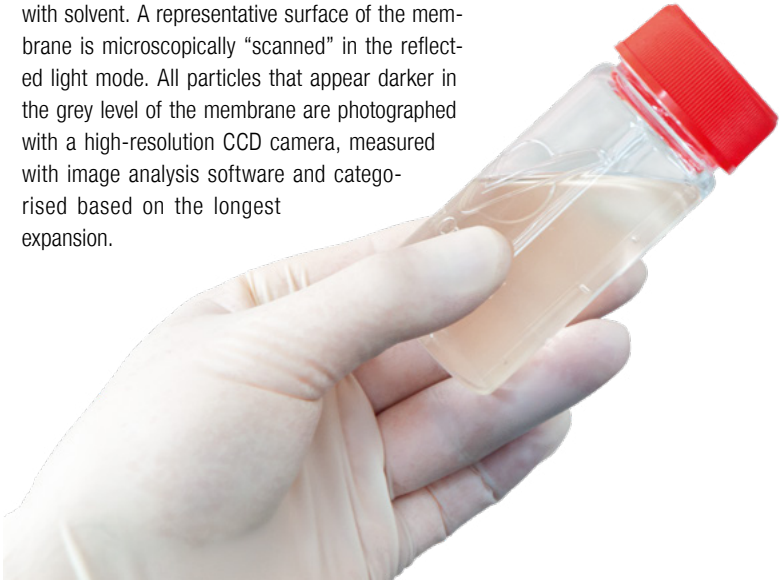
Dr. Thomas Fischer at the Olympus BX51 microscope

The categorisation into the size classes ≥ 5 µm and ≥15 µm is specified for microscopic particle counting while ISO 4406:2017 envisages the categorisation into the size classes ≥ 4 µm, ≥ 6 µm and ≥ 14 µm for laser particle counting. The OELCHECK laboratory performs the microscopic particle count according to the stipulations of ISO 4407, which allows for a determination of particles in the size classes ≥ 2 µm, ≥ 5 µm, ≥ 15 µm, ≥ 25 µm, ≥ 50 µm and ≥ 100 µm.

Extras in the OELCHECK laboratory report:

- For particle counting with the microscope, OELCHECK specifies more differentiated size classes than stated in ISO 4407. The following classes are listed in the laboratory report: ≥ 2 µm, ≥ 5 µm, ≥ 10 µm ≥ 15 µm, ≥ 25 µm, ≥ 50 µm, ≥ 100 µm, ≥ 150 µm, ≥ 250 µm and ≥ 500 µm. The Olympus BX51 microscope delivers these additional values with its first-rate software.
- The laboratory report also depicts a representative photo of the test membrane and the largest detected particle. The analysis results are also visually elucidated with the microscope.

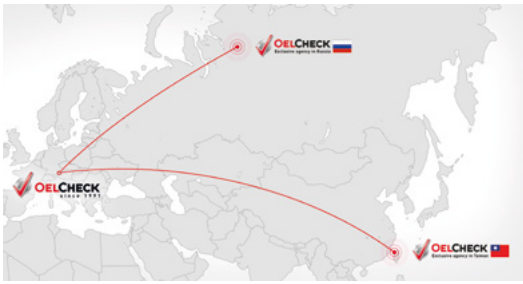
The particle count in the OELCHECK laboratory is performed with maximum precision. We are nonetheless still actively involved in research projects that deal with the optimisation and further development of particle counting techniques, specifically in the online method by means of sensors.



Exclusive agents in Russia and Taiwan are “standing by”

The international presence of OELCHECK is expanding: As of now, all-inclusive analysis kits can be obtained via our **exclusive agents in Russia and Taiwan**. Since 2013, our customers in China have placed their trust in the reliability and competence of OELCHECK.
Agents support customers on-site and organise express shipping of samples to Germany – experienced tribologists perform the analysis and diagnosis at the OELCHECK laboratory in Brannenburg.

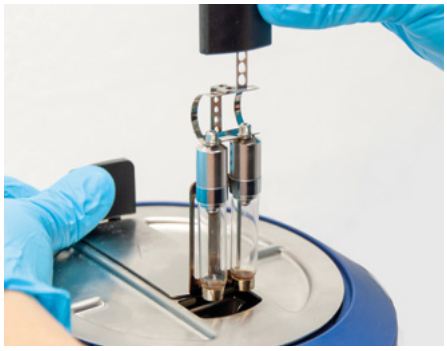
Customs clearance can be especially challenging due to the company’s global orientation. Thus, delays occurred with regard to the import of our analysis kits to Russia. These problems have now been resolved – our agent in Russia can now also sell all-inclusive OELCHECK analysis kits.
We are looking for other international sales partners **in non-European countries in order to further advance these positive developments with regard to exclusive agents**.



Please contact our Managing Director Paul Weismann if you are interested in becoming an exclusive agent for OELCHECK (paw@oelcheck.de, Tel. +49 8034-9047-250).
We are looking forward to collaborating with you and receiving many samples from all over the world!

OELCHECK laboratory upgrade

We are consistently investing in new automated analysis devices so that we can continue to fulfil our **quality promise** – analysis within one business day.



Dripping point determination by means of video recording

As of late, a Mettler Toledo DP70 is in use at OELCHECK for **determining the dripping point**. The new device determines the dripping point with a video recording and simultaneous image analysis instead of by means of a light barrier. Two samples can even be analysed simultaneously.

Our laboratory is also equipped with another **Metrohm photometer with autosampler** with space for 96 samples. We currently have three in-house devices for the determination of the neutralisation number.
We can also perform the particle count according to DIN ISO 4406 with **three automated particle counters**. Each particle counter can assess over 100 samples overnight.

80 PQ measurements in 20 minutes with IMP Auto PQ

We recently also received an IMP Auto PQ for the **automated determination of the PQ index**, which makes it possible to measure 80 samples within 20 minutes. This “ground-breaking” automation is a tremendous help since all samples that are to be examined are subjected to this test.
We are able to optimally cope with the increasing number of samples due to our **state-of-the-art laboratory equipment**.

Driving force of success: Professional development

Only a well-trained workforce ensures first-class service, which is why we regularly invest in the further training of our employees. Currently, 13 employees from the laboratory, sample acquisition, sales and technical assistance are participating in the MLA II further training in order to gain expertise for their daily work.
The **MLA II certificate (“Machine Lubricant Analyst”)**, which is issued after passing the examination by ICML (International Council for Machinery Lubrication) certifies well-founded knowledge in the area of machine lubrication, specifically within the context of machine status inspection and maintenance.

Carsten Heine, Head of Tribology Team at OELCHECK, holds the weekly preparatory examination course within our company. Participants attend 25 course units in preparation for the MLA II examination held in the fall of 2019.

Once again, several OELCHECK employees also received the internationally recognised **CLS certificate (“Certified Lubrication Specialist”)**, which is greatly valued in the industry. Most recently, our tribologists Arne Simon and Daniel Rossow successfully completed the certificate course. Additionally, Max Schuldeis, Head of Laboratory at OELCHECK, also extended his CLS certificate this year.
The CLS certificate, which is issued by STLE (Society of Tribologists and Lubrication Engineers) certifies a high degree of competence in the areas tribology and lubrication technology. In addition to extensive basic knowledge about lubrication correlations, trainees also require in-depth knowledge of lubrication application in order to pass the exam.
Already 11 OELCHECK employees have received the sought-after CLS certificate.

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OELCHECK INSIDE

A heart for our Brannenburg community

Before Christmas, we donated to various projects in our home community of Brannenburg.

The donation to **Christliches Sozialwerk Degerndorf-Brannenburg-Flintsbach e.V.** – a **new citizen mobile** – has been handed over. We are covering the leasing costs for the electric vehicle for four years, which amounts to a total value of **€15,000**.

In addition to company management of the charitable organisation (Monika Kaiser-Fehling and Evi Faltner), Mayor Matthias Jokisch (Brannenburg) and Mayor Stefan Lederwascher (Flintsbach) were also present at the handover of the modern speedster.

Another project is bringing great joy to children: OELCHECK donated **€13,500** for the **circus project ZappZarap** at the **Maria-Caspar-Filser School**.
For one week, approximately 240 pupils from grades 1-4 immersed themselves in the fascinating circus world under the direction of two circus educators. A tremendous success!

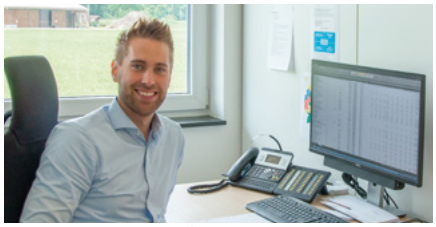
A different kind of knowledge transfer: Further education at Deutsches Museum

A different kind of knowledge transmission – this was the motto for the one-day event at which six OELCHECK employees participated. On the basis of models, our employees learned about the fascinating world of natural science and technology at **Deutsches Museum** in Munich.
Company founder **Peter Weismann** talked joyfully and passionately about his experiences in the lubrication and operating fluid industry. The goal: To further develop the professional skills of employees in an exciting and professional atmosphere based on observation.

The mechanical engineer who had written his diploma thesis in the field of tribology also led interested OELCHECK employees through the departments for tool and power machines, shipping, ceramics and energy technology and vividly explained the importance of lubricants and other factors based on various rolling and slide bearings, worm, planetary and spur gears and their sealing as well as other factors that affect the oil and machine status.
The visit to Deutsches Museum provided a special kind of **practical knowledge transfer** – all about the topic of oil.

Young and motivated Head of Internal Sales Manager

We have successfully expanded our internal sales team in recent months in order to optimally support our customers. The **internal sales team** consists of 6 employees. The increasingly extensive services in the area of lubrication and operating fluid analysis and the associated service offer are resulting in a greater need for consultation. In addition to questions related to analysis kits, individual analyses and offers, our team also provides support for our web portal and the OELCHECK-App.



Marcel Giehl – Head of Internal Sales

Marcel Giehl took over management of the internal sales office in June. For more than three years, he has worked in the sales department at OELCHECK.

In addition to professional experience, he also has well-founded technical lubrication knowledge, which he acquired in the certification courses Certified Lubrication Specialist (CLS) and Machine Lubricant Analyst (MLA II) as well as through other further training sessions. Furthermore, he also completed extra-occupational further training as sales engineer/technical sales manager (IHK).
Daniel Hilpert has also switched over to the team in order to provide support for the sales department. He had previously been employed in the shipping department for two and a half years.