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OELCHECKER

INSIDER INFO

PARTNER FORUM

TECHNOLOGY FOCUS

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Turning logistics green – Johann Dettendorfer Spedition



On the road in Europe with biodiesel – Johann Dettendorfer Spedition trucks.

Perfect logistics for Industry 4.0

Johann Dettendorfer Spedition is one of the top 100 German logistics companies. Many international awards attest to the achievements of this traditional, owner-managed company. Its headquarters are in Inntal, Bavaria, directly on one of Europe's major north-south axes. There are further locations in Italy, Poland and several German federal states.

Johann Dettendorfer Spedition was founded in 1825. Today, the core competencies of the company include comprehensive warehousing and logistics services in addition to goods transport. The trend is increasingly towards integrated service solutions. Johann Dettendorfer Spedition's customers benefit from the company's expertise, innovation, modern fleet and intelligent IT concepts. These perfectly meet the requirements of Industry 4.0, with its IT-focused way of working. This ensures deliveries to customers are not only just-in-time, but also just-in-sequence. The Dettendorfer branch at Deizisau in Baden-Württemberg, for example, delivers liquid aluminium to the processing plant at the specified time and in the appropriate quantity at a temperature of 700 °C using special trucks. Transporting and storing raw materials and disposing of foundry waste are also part of the freight forwarder's service package.

The trucks of Johann Dettendorfer Spedition Ferntrans GmbH & Co. KG transport the goods entrusted to them to their destination flexibly, quickly, reliably and safely. Every year they cover millions of kilometres on the roads of Europe. But the environmental impact is as low as possible, because Johann Dettendorfer Spedition has been running its entire fleet on biodiesel (B100) since 1998. This reduces carbon emissions by over 60% compared to diesel from petroleum. The vegetable raw materials for biodiesel, such as rapeseed, consume CO₂ as they grow. This is neutralised and the carbon footprint when using biodiesel is balanced.

However, almost all truck manufacturers still require very short engine oil changes when running on biodiesel. Old findings relating to running engines on rapeseed oil, which at the time was still pure and not esterified, indicate that when using B100 engine oils should be changed after one-third of the usual mileage (usually 30,000km instead of 100,000-120,000km). But are the arguments in favour of short oil usage periods valid? Could the lubricants be used longer? OELCHECK gets to the bottom of these questions and closely monitors the used engine oils from the B100-powered vehicles at Johann Dettendorfer Spedition.

Carbon emissions reduced by over 60 %

The aim is to operate the fleet economically and ecologically. Management has been demonstrating for years how well these aspects, which at first glance might seem contradictory, can be reconciled:

- all vehicles in the large fleet are less than five years old and therefore state-of-the-art.
- As much transport as possible is switched from road to rail.
- The drivers of the trucks regularly take training courses on energy-efficient driving.
- Since 1998, all vehicles have been powered by biodiesel. This reduces carbon emissions by over 60 %!

Biodiesel or FAME (fatty acid methyl ester) can be used in pure form (B 100) in diesel engines if approved by the vehicle manufacturer. The fuel consists of re-esterified vegetable oils.

In Germany, it is almost exclusively based on rapeseed oil. Hence it is also called RME (rapeseed methyl ester). DIN EN 14214 sets out the minimum requirements for biodiesel. However, the freight forwarder's specifications go far beyond this. For example, the total contamination of the fuel may only be 10 mg/kg instead of the 24 mg/kg required by the DIN standard. And instead of a maximum water content of 500 mg/kg, Dettendorfer only accepts 250 mg/kg. After all, water not only causes corrosion and wear and tear; excess water content also makes biodiesel susceptible to microbial growth.

Since biodiesel ceased to enjoy favourable tax treatment in Germany in 2008, filling stations in Germany have become rare. Abroad, however, it is still cheaper than obtaining fossil diesel fuel from petroleum. This is clearly reflected in the operating costs of the fleet. After all, the tank of a large truck can hold up to 1,300 litres of fuel. As far as possible, refuelling takes place at one of the company's own truck stops in nearby Austria, thereby benefiting from favourable tax treatment.

However the quality of the RME, which is monitored by OELCHECK taking random samples, has to meet the high requirements of Johann Dettendorfer Spedition. All other customers who fill up while travelling in their environmentally friendly trucks or cars also benefit from this. The Dettendorfer Group's Austrian truck filling station on the A12 in Inntal, Austria, is particularly popular with truckers. The free Truck Checkpoint is located here. Total weight and axle load are checked and tyre pressure and tread depth measured in just 15 seconds. These are important criteria that affect truck road safety as well as reducing fuel consumption and carbon emissions.



Removing oil from a long-haul truck

Shorter oil-change intervals – prevention or necessity?

Johann Dettendorfer Spedition's vehicles are powered by pure biodiesel. This brings economic and, above all, ecological advantages. But there is also a drawback: most vehicle manufacturers recommend engine oil changes after 30,000 km rather than 100,000 km when trucks run on biodiesel. And this not does not just mean considerable additional costs! The engine of a single 40-ton truck uses approximately 40 litres of engine oil. Changing the oil and oil filter takes about two hours, and the vehicle is not available during this period. In addition, significantly more fresh oil is consumed and correspondingly more waste oil is produced. The total cost of an oil change is about 500 €, which eats up a large part of the fuel costs saved again. This high consumption of engine oil goes against the philosophy of Johann Dettendorfer Spedition, which is to use all resources sparingly. However, engines are also supposed to be operated safely and sustainably and achieve the longest possible service life. This is why engine oil is replaced after a short period of 30,000 km, in line with the specifications of MAN.

Risk: increased fuel entrainment

Specification of shorter oil-change intervals is based on past experience. It has been more than 10 years since it was discovered that using the biodiesel quality available at the time led to increased entrainment of fuel into the engine oil. At the time, laboratory tests were only carried out on engines for agricultural vehicles fitted with the engine technology of that period. Unfortunately, there are no more recent long-term studies into the condition of used engine oils from commercial vehicles with a modern generation of engines and using more refined biodiesel.

In general, for both biodiesel and fossil fuels, viscosity decreases if too much fuel penetrates an engine oil. The engine oil becomes thinner, lubrication performance decreases and there is a risk of engine wear. If biodiesel is used, this oil dilution may occur to a greater extent because the fuel does not burn com-

pletely. This is due to the physical properties of the fuel. Fossil diesel has a flash point of 55 °C or slightly higher, but the flash point of biodiesel is usually well above 100 °C. The permissible minimum under DIN EN 14214 is 101°C. Conventional diesel in engine oil evaporates at an oil temperature of roughly 80 °C, whereas biodiesel only does so to a limited extent. Uncombusted biodiesel can make the engine oil increasingly thinner. The risk of engine damage increases accordingly. If too much biodiesel is left in the engine oil, some of its incompletely esterified components can lead to greasy or even solid deposits in piston ring grooves or on the piston head and shorten the engine service life.

Unfortunately, OEMs do not specify a maximum value for the proportion of biodiesel in engine oil. OELCHECK regards entrainment of over 6 % as critical for modern SAE 5W-30 low-friction diesel oils. This figure is based on the large number of used oil analyses from newer vehicle engines operated with biodiesel B7, B10 or B100.

Engine oils closely monitored

Are the shortened oil service life times prescribed by almost all vehicle manufacturers pure prevention or real necessity? Johann Dettendorfer Spedition started a preliminary study together with OELCHECK to find out more about the condition and performance of engine oils.

OELCHECK has been monitoring the engine oils of three vehicles belonging to the freight forwarder since spring 2020. In order to take into account as many operating conditions as possible, OELCHECK is examining the oils from a long-haul truck that operates on a two-shift system, a silo vehicle with a compressor and a truck used for regional transport. The engines use SAE class 5W-30 low-SAPS engine oil approved by the vehicle manufacturer. This has a synthetic base oil, meets international specifications and is approved for use in EURO V and VI engines by all well-known vehicle manufacturers.

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The Coronavirus crisis revealed that OELCHECK's systemically important for maintenance

A small virus keeps the big world in check. In spring 2020, the politically ordered lockdown and its economic consequences came on top of the threat to health. Short-time working or furlough affected the majority of the population. But in sectors that ensure the supply of everyday commodities, medical technology, electricity and water, work continued uninterrupted. Technical maintenance in companies was usually still fully operational, even if production was halted. The aim was to ensure that everything would run smoothly when work was resumed. Some plants had to operate at different capacity or shut down altogether. Many technical service companies faced new challenges. Often, remote diagnoses or web meetings supported the work of the plant engineers, because discussions on site were frequently not possible due to distancing regulations, for example. OELCHECK's analyses of lubricants and fuels also contributed to the operational safety of machines and engines, ensuring systems and machinery operated reliably.

No lockdown at OELCHECK

OELCHECK remained active as usual during the critical period, even though many globally active competitor laboratories shut down completely. Action plans were prepared at the first signs of the pandemic. From 19 March, work was changed to a two-shift system, so laboratory reports were available to our customers in the usual 24-hour rhythm. Since the number of samples did not decline as first feared due to coronavirus but actually increased, every single OELCHECK employee had to show flexibility and commitment. OELCHECK considers itself fortunate to employ staff who were willing to work on Saturdays. Employees were pleased that despite being present for only six hours instead of eight, they continued to receive their full salary without having to register for short-time working. It is important for customers to receive timely information to ensure that their production-relevant machines continue to run reliably. OELCHECK tribologists took the changed operating conditions due to the crisis into account in their recommendations. But despite all the difficulties, all OELCHECK laboratory reports are being delivered within one day as usual and all special customer questions are being answered.

Safety thanks to OELCHECK analyses

Particularly in difficult times, OELCHECK analyses support customers in determining the optimal time for an oil change and detecting any worn components early. If an oil change is carried out too late, this can result in a total failure of the lubricated component.

A typical example is the gas engines used in CHP plants. They often run not only on clean natural gas, but also on biogas, which can vary greatly in quality depending on its composition. This places considerable demands on the gas engine oil, which has acidic components that have to be neutralised, for example. If its alkaline reserves are exhausted, aggressive acids can directly damage engine components or seals. To detect this, regular oil analyses are an absolute must. Because if the engine needs to be repaired or overhauled, neither electricity nor heat can be generated. During the coronavirus crisis, OELCHECK made an increased contribution to safeguarding the operation of wind turbines, power plants, gas engines and other energy production systems. This made it crystal clear: **OELCHECK is systemically relevant for the maintenance of power generation systems.**

OELCHECK leading the way in digitalisation

Many politicians and media claim that the coronavirus crisis will give added momentum to digitalisation. What may be the case for some companies in the future has long been part of everyday life at OELCHECK. In recent weeks in particular, our customers have increasingly benefited from the advantages of our digital services.

The free **OELCHECK 4.0 app** offers our customers an easy way to enter sample data for trend-analyses. Customer-specific details and information on the individual units from which the samples originate are entered only once. The OELCHECK customer portal **www.LAB.REPORT** is extremely practical because it contains many control and management processes. All it takes to log in to the OELCHECK world of digital data is your personal password.

Simple handling, clearly explained

The coronavirus crisis was no reason for oil samples not to be taken when due. Our all-inclusive analysis kits contain everything you need for uncomplicated sample removal and shipping. Easy-to-understand instructions for optimal sampling are enclosed with the shipping box or are available at www.oelcheck.de. With the aid of the sample vial, the information form and the return envelope, samples can be taken immediately even by an inexperienced person who may be standing in for the usual service technician.

OELCHECK returned to normal operation under the strictest hygiene conditions and without short-time working on 1 June 2020. All employees and visitors are obliged to strictly adhere to the hygiene and health protection standards set by the RKI and the Federal Ministry of Health in order to minimise the risk of infection at the company as far as possible. The coronavirus pandemic and its consequences present us all with extraordinary challenges. Even in this difficult situation, while complying with the necessary safety measures, we are working hard to provide our services and customer care to the usual quality.

Barbara Weismann, Paul Weismann

OELCHECK 4.0 – data entry for new samples has never been easier ...

Every sample we analyse and diagnose is only complete with the information on the service/lubricant and the machine in which it is used. An app is available to our customers for entering the sample data. The first version was launched in 2016 – now the new, improved version of the sample data entry app has been released: OELCHECK 4.0.

With the expansion of the app, additional features have been added to make entering oil samples even more user-friendly. The new functions are all available in the free login area. In addition to entering data on the sample, up to five photos of the sample can now be added – taken with the app. The last laboratory report for the sample entered with the device can also be accessed. And thanks to the automatic data update, users always have an overview of the current status of their samples.

The app functionality has also been expanded to include offline features: data on lubricant and fuel samples can now also be entered offline and transferred later. A valuable addition, because you can't always rely on mobile internet.

Using the app

A QR-code is required to use the app. This can be printed out yourself via our customer portal LAB.REPORT or requested directly from us.

The QR code is then attached to the installation or machine. If a new sample is to be entered, the user scans the QR code with their smartphone and selects the appropriate system component. The app automatically recognises the installation and component and specifies the next steps.



All you need to do is add the sample-related data that change with each sample – no sample information form, pen or paper are required. Sample entry has never been so fast and easy.

OELCHECK 4.0 is available for Android and iOS in German and English. Using the app is **free** of charge.

Data security: Awareness of digital risks



Many companies underestimate digital risks. OELCHECK is aware of its responsibility and has therefore introduced comprehensive cyber crisis management. Should a digital attack occur, a pre-defined crisis team swings into action. This group has been trained with the support of an external service provider. The IT security company also provides preventive support during the crisis and in a subsequent security analysis to quickly identify and close potential weak points.

OELCHECK employees have received online training on phishing, social engineering as well as password and workplace security. Questions such

as “What is a strong password?” and “Why is it important that your password is not in the dictionary?” were discussed and answered in great detail.

Attackers can also steal data from an office that is supposedly secure. Small steps that can significantly increase data security in everyday life were also discussed as part of the online training. After the training, each employee also had to take a small test.

The online training has helped raise awareness of what cyber attacks can look like and how everyone can contribute to IT security.

Impressive visit to paper mill

During a detailed and comprehensive plant tour at Raubling Papier GmbH (Heinzel), OELCHECK employees were able to get an idea of the conditions under which the paper machines are used on a daily basis. The machines run around the clock – in an enclosure at up to 80 °C and up to 90 % humidity. Every year, around 220,000 tonnes of certified special corrugated paper with a width of 2.5 m are produced on two paper machines. The demands placed on the machines are correspondingly high.

The company was acquired by PWA (Papierwerke Waldhof-Aschaffenburg) in 2004 and has been

gradually modernised and reorganised ever since. What was a purely wood processing paper mill with a tradition dating back more than 100 years has become a forward-looking location mainly focused on processing recycled paper.

The impressive insights into the overall production processes made it clear that oil analyses in the paper machines sector are absolutely necessary and appropriate. The entire production process grinds to a halt if the paper machine oil used for lubrication in the oil circulation system no longer does its job reliably in the bearings and gears.



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The engine oils from the three vehicles are closely monitored. Apart from biodiesel entrainment, the general oil condition, wear elements, dust, water and other impurities, additive degradation and oil oxidation are examined. An initial sample was taken after approx. 30,000km when the oil was changed. The fresh oil and the sample were then examined immediately after the oil change. Further analyses are carried out every 5,000km.

An initial conclusion

The results of several analyses from the series of tests are now available. Mileage of up to 30,000km was achieved by the end of May 2020. The wear values are extremely low. The feared increased entrainment of biodiesel into the engine oils did not occur. A maximum of 1.3 % biodiesel was detected in the engine oil of the long-haul truck and 2.1 % in

the silo vehicle. The engine oil from the short-haul truck showed contamination with 2.3-3 % biodiesel. Since operating temperatures of over 60 °C are hardly reached in this truck, OELCHECK had actually forecast slightly higher values.

The preliminary study has not yet been completed. However, the results so far clearly indicate that oil-change intervals could be extended well over 30,000 km; this will be examined in detail as part of a development project. The trend is absolutely positive. Close monitoring of the engine oils with OELCHECK analyses continues.

Flexible, fast, reliable, safe

Johann Dettendorfer Spedition's comprehensive service in transport, logistics and merchandise management can be relied on. Founded in 1825, the owner-managed traditional company is now one of the top 100 in German logistics. Almost 400 highly motivated employees work at the company. The fleet comprises 145 tractor units and 350 trailers for long-haul transport alone. The company's turnover in 2019 was around 220 million euros. Johann Dettendorfer Spedition is ISO DIN EN ISO 9001:2015 certified. Their first-class credit ratings from BUNS, Bürgel and Creditreform speak for themselves.

More information: www.dettendorfer.de

OELCHECK is involved in innovative funding projects

Gefördert durch:



Bundesministerium
für Wirtschaft
und Energie

aufgrund eines Beschlusses
des Deutschen Bundestages

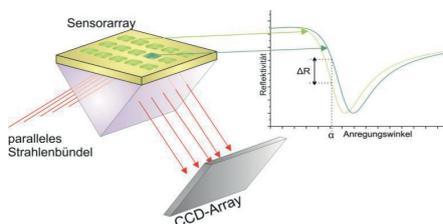
The Federal Ministry for Economic Affairs (BMWi) supports innovative projects with targeted funding programmes. OELCHECK too is active in research and development and is currently involved in three funding projects.

Start of μ -Spin in 2014

As part of a first funding project six years ago, OELCHECK began its cooperation with OTH Regensburg and the University of Regensburg. Project μ -Spin was then launched together with other partners (Starkstrom-Gerätebau GmbH and Maschinenfabrik Reinhausen GmbH), with the aim of developing a new type of sensor based on surface plasmon resonance spectroscopy for insulating oils that enables permanent monitoring of technical fluids using "surface plasmon resonance imaging (SPR-i)" technology. This should make it possible to extend service life and increase energy efficiency. Basic investigations of the lubricating oil were carried out and two types of insulating oil were specifically contaminated during tests and then measured in order to be able to show the changes in the analysis.

The follow-up project **MicroSpinII (which started in November 2019)** is now aiming to bring the sensor to application maturity with the help of new industrial partners (OTH Regensburg, University of Regensburg, Deggendorf Institute of Technology, Starkstrom-Gerätebau GmbH, GEFASOFT GmbH, TOPTICA Photonics AG, Solnovis GmbH, University of Regensburg, FUCHS Schmierstoffe

GmbH and Messko GmbH). Doping of the sensor surface will be realised in contact with the oil to be measured and subject to the measurable changes depending on the degree of ageing. The focus is on the degradation of ageing inhibitors and oxidative degradation of the base oil, with the formation of the respective breakdown products. At the same time, the corresponding oils will be examined at OELCHECK in order to correlate the data obtained by the sensor. Multivariate evaluation algorithms will then be generated in order to be able to show the changes in the oil in real time.



The sensor is a wafer-thin gold surface with micrometer-sized holes that changes a light beam depending on the surrounding medium (i.e. the oil)

Need for dedicated analytical methods for e-mobility gear oils

Since April 2019, OELCHECK has been involved in a project funded by ZIM (the Central Innovation Programme for SMEs) focusing on "developing a methodology for analysing and characterising e-mobility lubricants". The cooperation partner is the Karlsruhe Institute of Technology (KIT).

The automotive industry is facing enormous changes. Alternative drive forms are entering the market. The requirements for lubricants for electronic final drives have changed and mean that the scope of analysis has to be adjusted – for fresh oil and for the quality inspection of used lubricants.

Nuclear magnetic resonance, a method OELCHECK has already further developed with KIT for analytical characterisation of oils, is suitable for this. The NMR method for quality assessment will now be expanded and tested as an application for the newly developed material systems of e-mobility oils. To begin with, the knowledge of lubricants intended for electric drives will be analysed in order to identify possible ageing processes based on this. The intention is then to develop a basic system for analysing and evaluating known e-lubricants.

OELCHECK would like to establish an efficient and cost-effective test that will provide a practicable basis for evaluation, such as the limit values for the ageing of e-mobility lubricants.

New ZIM InfraOil project

The new ZIM InfraOil project was launched in June 2020. The aim of the project is to develop a near-infrared and an optional fluorescence sensor system for inline detection of signs of ageing or decomposition in hydraulic oils. This should enable continuous quality control and, if necessary, partial reconditioning of the oils.

TEDOM SCHNELL combined heat and power plants – More value from energy



TEDOM SCHNELL CHP solutions are based on future-oriented yet proven technologies.

TEDOM SCHNELL GmbH, based in Wangen/Allgäu, is a manufacturer of combined heat and power plants (CHP) for decentralised generation of electricity and heat. The highly efficient CHP solutions run on natural gas, biogas or sewage gas and function according to the principle of combined heat and power generation. Once the project has been planned and the facilities constructed, the company's own strong service fleet is available to operators around the clock.

TEDOM SCHNELL has one of the largest service networks for CHP plants in Germany. OELCHECK analyses of gas engine oils and coolants optimise condition monitoring in the facilities. This ensures reliable and efficient energy supply in the long term. TEDOM SCHNELL CHP solutions utilise the full capacity of primary energy through highly efficient generation of electrical and thermal energy. The company's 4,100 CHPs already installed are used throughout Europe in biogas plants and landfills as well as for industrial, commercial and municipal energy supply. The different designs, such as compact modules, in containers or in a turbine building, are tailored to individual requirements.

Pioneering technologies

The company's technical developments are trend-setting. Previously it was the "Schnell dual fuel engine", now it's the "passive prechamber" that is setting new standards.

The dual fuel engine is based on the diesel principle. But when operated with biogas, sewage gas or landfill gas, the dual fuel engine can do even more. Gases can be more compressed than diesel fuel, for example. The gas is mixed with the combustion air drawn in. The mixture of gas and oxygen-containing air is compressed in the engine and heats up in the process. Injecting a small amount of ignition oil (heating oil/diesel fuel) initiates the ignition. The higher compression ratio of the gas-air mixture increases efficiency. Higher efficiency means higher energy yield. To achieve this, the intelligent Schnell injection technology for dual fuel engines was developed.

Biogas, sewage gas and landfill gas often change their composition in a short time. Values such as knock resistance and flame rate can double or halve in seconds. These changing conditions are controlled with the Schnell dual fuel technology. This is based on sophisticated electronic injection technology for optimum control of ignition timing – a milestone in the history of dual fuel technology.

TEDOM SCHNELL's new passive prechamber is revolutionising the CHP technology of the future. The fuel-gas/air mixture is already ignited in the prechamber by a specially matched industrial spark plug. This results in an increase in pressure, which drives the ignited mixture far into the main combustion chamber in several torch jets. The result is fast and efficient combustion with low emissions. For robustness, reliability and long service life of the prechamber and spark plug, TEDOM SCHNELL's new development is better than anything currently available on the market.

Germany's largest service network

TEDOM SCHNELL ensures that facilities operate without problems and profitably through a comprehensive range of services. This starts with the first consultation and does not stop at maintenance and repair. Over 300 service technicians and partners throughout Europe are available around the clock. These are all fully trained and certified. TEDOM SCHNELL operates one of the largest service networks for CHP plants in Germany, and it is continuously being expanded with new service locations.



Europe-wide service around the clock

Tailor-made lubricants

TEDOM SCHNELL knows how crucial lubricants and coolants are for systems to run safely and efficiently. The company therefore offers its own tailor-made consumables. These were developed with TEDOM SCHNELL's many years of experience in gas engines and the expertise of renowned lubricant manufacturers.

TEDOM SCHNELL PROTECT OIL is recommended for all CHPs installed by the company. Thanks to its selected base oils and unique high-performance additives, it achieves the highest level of wear protection and stability even under the toughest opera-

ting conditions. Its extremely low tendency to form deposits means engines remain clean. TEDOM SCHNELL PROTECT OIL has a very large alkaline reserve. This allows it to neutralise the typical aggressive acids from biogas, sewage gas and landfill gas over a particularly long period of time. The gas engine oil is extremely resistant to thermal oxidation and is therefore also ideal for use in CHP plants running on natural gas, which operate at extremely high temperatures.

TEDOM SCHNELL PROTECT COOLANT is a ready-mix coolant for engines. The preprepared mixture can be used immediately. This means that operators are always on the safe side and save time and money. The coolant is precisely matched to the materials of engine and attachments. Thanks to the ideal mixing ratio, the anti-corrosion and buffer additives are used optimally and the components are protected over the long term. The decalcified and extremely soft make-up water prevents the formation of encrusted deposits and the damage these cause.

Oil analyses right from the start

Regular inspections of the gas engine oil are important. Right from the purchase of a system, TEDOM SCHNELL offers a certain number of free OELCHECK oil analyses and inexpensive follow-up analyses. Engines that run on biogas, sewage gas or landfill gas in particular are using a gas where the composition can vary greatly. Such gases also often contain aggressive or acidic components such as hydrogen sulphide.

TEDOM SCHNELL PROTECT OIL is perfectly designed to meet such requirements but, depending on the gas composition, even its performance is eventually exhausted under these extreme loads. Two to four OELCHECK analyses are carried out for every engine oil fill per year and also at every maintenance. These meticulously record the condition of the gas engine oil. OELCHECK tribologists also state in their laboratory reports how long the oil in question can still be used safely under similar operating conditions. Monitored in this way, in many cases TEDOM SCHNELL PROTECT OIL achieves oil change intervals of almost 1,000 hours of operation. Without accompanying oil analyses, TEDOM SCHNELL stipulates oil changes after 600 operating hours.



Two at once – TEDOM SCHNELL lists the OELCHECK all-inclusive kits for gas engines in its own spare parts programme. This enables the analysis of engine oils, regardless of the gas they run on, and of coolants. Like many other OEMs, TEDOM SCHNELL specifies that coolant must be examined once a year. If OELCHECK analyses are consistently good, the coolant change interval can often be extended to two years.

The all-inclusive analysis kit with a turquoise-coloured lid covers the full check scope. For each analysis, the acid-base content of the oil in particular is checked. The acid number (AN) indicates the degree of acidification of the oil. The base number (BN) provides information on the base additives still present to neutralise the acids. OELCHECK also measures the i-pH value, as this provides key additional information on the loading of a used gas engine oil with corrosive acids.



Fast and secure – Thanks to the OELCHECK app 4.0 and QR codes attached to equipment, operators and TEDOM SCHNELL service technicians now save even more valuable working time when entering samples and transmitting data. They only enter the operating hours of the current sample, add any information about work carried out and any abnormalities and scan the barcode on the sample information form, which is identical to the laboratory number they affixed to the sample container. The app then transmits the data to OEL-

CHECK. The smart combination of QR codes and app means all important data is captured. Transmission errors due to poorly legible handwritten entries on the sample information forms are a thing of the past.



Everything under control – The LAB.REPORT web portal is where the data from all analyses initiated by TEDOM SCHNELL and the plant operators (with corresponding approval in accordance with the GDPR) come together. This gives TEDOM SCHNELL a broad overview of all trends, contributing directly to perfect quality management. For plant operators, the web portal not only provides quick access and easy management of their analytical data. It also makes it easier to monitor the systems and document that the OELCHECK analyses recommended by TEDOM SCHNELL have been carried out regularly.

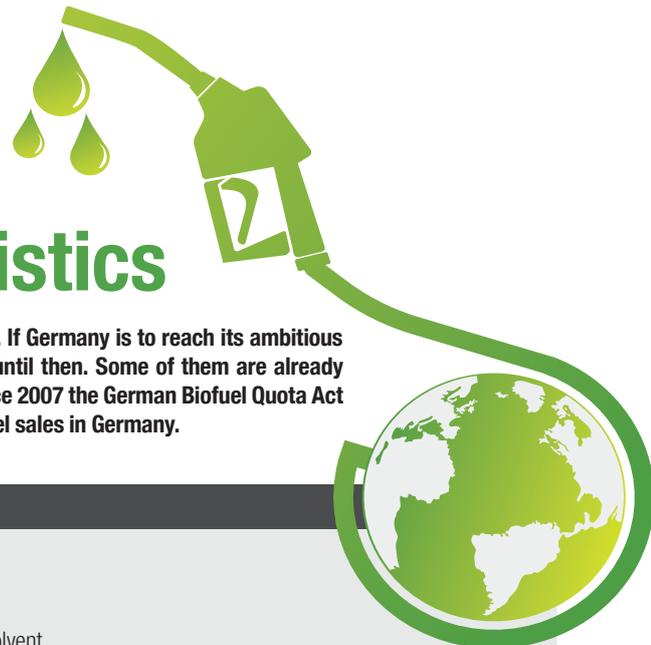
A pioneer with innovative power

Founded in 1992, the company has evolved from a German pioneer and market leader for dual fuel gensets to an international technology specialist that converts energy into performance, efficiency and yield. With CHP solutions based on future-oriented yet proven technologies. The company has already installed around 4,100 CHPs across Europe. Service employees currently look after more than 3,000 systems.

TEDOM SCHNELL has been a member of the TEDOM Group since 2016. TEDOM is a globally active CHP manufacturer and CHP operator from the Czech Republic. The merger allows TEDOM SCHNELL to benefit quickly from many valuable synergies.

More information: www.tedom-schnell.de

Alternative fuels: Types and their characteristics



It will be a long time before we are all travelling in electric cars or under hydrogen power. If Germany is to reach its ambitious goal of climate neutrality by 2050, alternative fuels will play an important role at least until then. Some of them are already widely used today in their pure form or as a mixture with fossil diesel and petrol fuels. Since 2007 the German Biofuel Quota Act (BioKraftQuG) has even stipulated a minimum share of biofuels as a percentage of total fuel sales in Germany.

VEGETABLE OILS



Production/ base materials

- Pure oils pressed from plants, largely untreated.
- Mostly rapeseed; also soya, corn and sunflowers.
- Oils are pressed directly from the plants. They are also extracted from the remaining press cake with solvent.
- This is followed by filtering and cleaning, which reduces solids and also components such as calcium, magnesium and phosphorus.



Availability

- Not available at conventional filling stations.
- Usually only available from the producer (farmer). Manageable logistics.



Properties/ standards

- Vegetable oils are much more viscous (thicker) than diesel and are not suitable as a petrol substitute.
- They are harder to ignite and deliver slightly less energy per litre than diesel.
- They must be preheated in winter. Up to 10% fossil diesel is often added to improve viscosity and ignition characteristics.
- DIN 51623 Fuels for vegetable oil compatible combustion engines.



Use

In tractor and agricultural machinery engines, in stationary CHP plants, rarely in truck engines.



Engine/oil/ analytics

- Almost all types of diesel engines have to be "converted" (other seals, filters, injection system, etc.).
- Manufacturer approval for running on vegetable oil should be available.
- Operated with SAE 10W-40 engine oils - as for diesel engines.
- Significantly reduced oil change intervals. Oil service life only 25-30% (up to about 250 hours) compared to using diesel.
- Vegetable oil does not fully burn, especially when the engine is cold. Higher-viscosity components condense and contaminate the engine oil as uncombusted vegetable oil.
- Engine oil may be mixed with a maximum of 5% vegetable oil. Otherwise there is a risk of piston ring sticking and deposits.
- Oil analyses to determine vegetable oil content and oxidation characteristics are absolutely essential.

BIODIESEL – FAME – RME



Production/ base materials

- Biodiesel is often referred to as fatty acid methyl ester (FAME) or RME (rapeseed methyl ester).
- Based on oils and greases of vegetable or animal origin. These are "transesterified" into biodiesel in refineries specially designed for this purpose with the aid of methanol.



Availability

- B100 (pure biodiesel with 100% biodiesel) is available at many truck filling stations and service stations as it can be transported in tankers without intermediate cleaning.
- Only a few refineries specialise in production, so availability is not unlimited.
- Also sold at special pumps as an admixture to diesel, where it is usually called B7 or, depending on the concentration, also B5, B10 or B15.



Properties/ standards

- Slightly higher viscosity and lower cold stability than diesel.
- Reduces mileage slightly, but is usually somewhat cheaper (mainly due to different taxation).
- Largely carbon-neutral (up to 68%), as combustion only releases the amount of carbon dioxide that plants or animals remove from the atmosphere as they grow.
- DIN EN 590 applies to B0 to B7 diesel; DIN EN 14214 applies to admixtures for B0 to B7 and B100.
- B100 is often subject to additional quality requirements from operators for viscosity, combustibility, water content, cold stability, density and solid foreign substances.



Use

- Predominantly as a standard additive to fossil diesel (B7).
- Also in pure form (B100) for truck use (freight forwarders, municipalities).



Engine/oil/analytcs

- No conversion of the diesel engines is required up to B10.
- B100 should be approved by the engine manufacturer.
- Mixed operation using B100 and diesel fuel is also usually possible without problems. Both types of fuel can be refuelled alternately, subject to OEM approval.
- Any residues in the fuel system may be dissolved due to ester residues remaining in the RME/FAME (B100) from the refining process. Plastics, rubber and seals may also swell and non-ferrous metals in the fuel system can be attacked.
- As a precautionary measure, replace the fuel filter more frequently. Perform accompanying fuel and engine oil analyses.
- SAE 5W-30 to 10W-40 diesel engine oils approved by engine manufacturers can still be used.
- When B100 is used, oil-change intervals in truck engine manufacturers' specifications are often reduced to 30,000km instead of 120,000km.

BIOETHANOL



Production/base materials

- Bioethanol, less commonly referred to as agro-ethanol, is made from residues of plants that still have residual sugar or starch content.
- Alcohol is produced by fermenting these raw materials, which are usually not suitable for use in foodstuffs.
- The starting materials are prepared as a mash to which yeast is added. The components result in a fermentation, which produces alcohol.
- The alcohol content is then distilled from the fermented mass. The end-result is bioethanol with an alcohol content of up to 99.9%.



Availability

- Produced on a relatively large scale, but pure bioethanol is not freely available.
- Bioethanol can be used in petrol engines. E10 super petrol at filling stations contains 10% bioethanol.
- Bioethanol is unsuitable for addition to diesel fuel.



Properties/standards

- Pure bioethanol has a higher octane rating than petrol and a different ignition point.
- Ethanol makes rubber (seals and hoses) and plastics softer or more brittle.
- Unlike petrol, it does not vaporise at temperatures below 13°C (preheating may be necessary in winter).
- DIN EN 228 permits the addition of ethanol to petrol in Germany up to 10% by volume (E10).
- However, E10 must meet the quality requirements of DIN EN 15376 for super petrol.



Use

- Pure bioethanol or gasoline-ethanol mixtures containing more than 10% ethanol are no longer used as fuel.
- Bioethanol is usually added to the petrol. In accordance with DIN EN 228, this may contain up to 5% bioethanol (E5) without it having to be declared.
- A higher concentration of 10% admixture is possible in super petrol (E10), but this has to be declared.
- Bioethanol is also often used as a basis for producing fuel additives.



Engine/oil/analytcs

- For years, petrol engines have been able to operate without problems with E5 and E10.
- All engine oils listed in vehicle manufacturers' approval lists can be used.
- E10 can increasingly condense in the engine oil at low engine temperatures in short-haul transport. Its viscosity and lubricity are reduced as a result, and wear and tear occurs.
- An engine oil analysis in the OELCHECK laboratory clearly shows any mixing with unburned bioethanol.

NATURAL GAS – CNG – COMPRESSED NATURAL GAS – PRESSURISED GAS



Production/base materials

- Like petroleum, natural gas is produced from fossil components.
- It is extracted from underground deposits and consists predominantly of highly flammable methane.
- In some cases it has to be cleaned of corrosive, toxic and/or non-combustible foreign gases.
- Water containing minerals is removed in a drying process.
- For use as fuel it is compressed and stored or marketed in overpressure gas tanks.



Availability

- Relatively well-developed filling station network.
- Available at almost all motorway filling stations.



Properties/standards

- Natural gas burns cleanly without harmful hydrogen sulphide (no acid rain).
- Neither nitrogen oxides, particulate matter nor soot are produced in any significant quantities.
- The energy content of 1kg of natural gas is equal to that of 1.5l of petrol or 1.4l of diesel - hence it offers higher performance than other fuels.
- The octane rating is 125 (petrol is roughly 95).
- Due to the high knock resistance, the fuel-air mixture can be highly compressed. High efficiency is achieved with low consumption.
- DIN EN 16723-2:2017-10 specifies natural gas for use in transport and biomethane for feeding into the natural gas network.



Use

- In principle, any petrol engine can be run on natural gas. Steel pressure tanks have to be installed.
- Can also be used in buses or suitably designed new vehicles.
- It is important to distinguish between bivalent vehicles that run on CNG and petrol, and monovalent vehicles that run purely on gas.
- Internal combustion engines of vehicles powered by natural gas may also be used indoors (e.g. forklifts).
- Natural gas-powered engines are used on a large scale for alternative generation of electrical energy, especially where waste heat can be used.

Biogas in natural gas quality:

- Biogas is produced by fermenting any kind of biomass. Its methane content is significantly lower than that of natural gas. It may contain a large proportion of carbon dioxide.
- For biogas to be used like natural gas, it must be purified of harmful gases and its methane content increased to at least 96%.
- Unpurified/unprocessed biogas can only be burned in specially designed engines (usually CHP).

LNG (liquefied natural gas):

- Natural gas becomes liquid when cooled to temperatures below -162°C . This reduces its volume by a factor of 600. Natural gas that has been liquefied by refrigeration compressors is called LNG. It is predominantly used in ships and special commercial vehicles.



Engine/oil/analytics

- Significantly higher combustion temperatures occur in gas-powered engines than in petrol engines. The engine and its oil are subjected to extreme thermal loads.
- Unlike petrol, natural gas does not contain additives which have an active cleaning effect, among other things.
- There is an increased tendency to oxidation, with the risk of ash containing hard deposits forming.
- Engine manufacturers generally require the use of low/mid-SAPS engine oils, which have a limited sulphate ash content.
- Some engine oils have been specially developed for natural gas and biogas engines.
- Regular checks on the oxidation tendency and initial pH (i-pH) are recommended.

LPG – LIQUEFIED PETROLEUM GAS – CAR GAS



Production/base materials

- Liquefied petroleum gas is primarily obtained as a by-product when extracting natural gas and crude oil, and when distilling crude oil.
- It may consist of propane, butane or a mixture of the two.
- As a fossil fuel, it can also be used in petrol engines to generate energy.



Availability

- Filling station network is very limited.



Properties/standards

- LPG is gaseous at ambient temperature and pressure. However, it can be liquefied at low pressure, usually 6 bar at room temperature. Once condensed, the volume is reduced by 260 times.
- It has a high knock resistance of over 100 octane.
- LPG burns almost sulphur-free, no soot is produced. Emission values are lower than those of petrol.
- DIN EN 589 defines the quality requirements.



Use

- As fuel for petrol vehicles equipped with a gas tank for LPG operation. This is why it is also known as "autogas".
- Internal combustion engines powered by LPG or natural gas may also be used indoors (e.g. forklifts).
- Also versatile use for heating, cooking or as a heat transfer medium in trade and industry.



Engine/oil/analytics

- The engine oil can become increasingly diluted by condensed LPG gas fractions, especially with many cold starts, such as in short-haul transport.
- LPG, like natural gas, contains no additives or active cleaning agents such as are added to petrol.
- The engine oil has to neutralise the oxidation products that arise when running on LPG, which lead to deposits.
- Usually low- or mid-SAPS engine oils are used, which tend to have a low sulphate ash content.

BTL – BIOMASS TO LIQUID – SYNTHETIC FUELS FROM BIOMASS



Production/base materials

- Raw materials are solid biomass (straw, wood, plant waste) or specially cultivated crops.
- Thermochemical combustion of biomass produces synthesis gas.
- This is converted into liquid hydrocarbons in a synthesis (usually using the Fischer-Tropsch process*).
- The synthetic fuel produced can be converted into diesel or petrol by applying distillation processes used in petroleum refining.



Availability

- Not available in all countries.
- Are added to conventional fuels.



Properties/standards

- BtL fuels are chemically only slightly different from fossil petrol or diesel fuels.
- They usually have a higher cetane rating (around 70) than diesel (50-60).
- Special properties can be tailored during distillation.
- EN 15940:2016 Paraffinic fuels.



Use

- Currently not used in pure form.
- DIN EN 228 or DIN EN 590 allow undeclared addition of BtL to specified petrol and diesel fuels.



Engine/oil/analytics

- No conversion of engines is necessary (also for exclusive use).
- The products recommended by manufacturers can be used as engine oil.
- Oil analysis depends on the load and mileage, as for operation with fossil fuels.

* Fischer-Tropsch synthesis: A large-scale process for converting synthesis gas (CO/H_2) into liquid hydrocarbons developed by Franz Fischer and his employee Hans Tropsch at the Kaiser Wilhelm Institute for Coal Research in 1925. The process was previously mainly used for coal liquefaction by indirect hydrogenation of coal.

GTL – GAS TO LIQUIDS – SYNFUEL



Production/ base materials

- With the help of steam, adding pure oxygen to natural gas produces a synthesis gas.
- Conversion to hydrocarbons takes place by means of Fischer-Tropsch synthesis*.
- This produces long-chain paraffins that are converted into liquid fuels, primarily diesel, by cracking and distillation (fractionation).



Availability

- Permanently available in many countries because gaseous natural gas is more difficult to transport and store than GTL.



Properties/ standards

- Burns cleaner than fossil diesel and produces significantly fewer emissions.
- Almost sulphur-free and contains no aromatic compounds.
- Easier to ignite than fossil diesel (higher cetane rating).
- Cold behaviour similar to fossil diesel.
- EN15940:2016 standard for paraffinic diesel fuels.



Use

- Pure GTL is used in diesel engines on commercial vehicles or mobile machines and devices (construction machinery).
- Low-emission inland waterway vessels are other major users.
- GTL is added to diesel fuels such as Shell V-Power Diesel.
- Leading diesel engine manufacturers have given approval for operation only with GTL.



Engine/oil/ analytics

- No conversion of diesel engines necessary.
- Engine oil analyses to monitor the oil change interval, as for operation with fossil diesel fuel.

OELCHECK INSIDE

For the health of our employees

Motivated, satisfied and healthy employees are essential to the success of a company. That's why we like to invest in the health of our employees. What really matters is continuously putting measures in place in a wide range of areas: the company medical officer Dr. Biller supports us in occupational health care and he is available to give advice on all questions relating to occupational health and safety.

Our laboratory technicians were recently tested for residues of the hazardous substance toluene. All test results were below the detection limit. A reassuring and pleasing result.

Our **second Health Day** was held in February in cooperation with health insurer KKH (Kaufmännische Krankenkasse) and focused on the spine and ergonomics, giving new en-



couragement for a healthy lifestyle. A basic check provided information on general health values. The advice on ergonomics concentrated on correct lifting and carrying. A posture analysis and the MFT Balance Board were available at further stations.

A **health barometer** was carried out so future health promotion activities are better suited to employees' individual needs. By participating in the anonymous online survey, employees were able to play a key part in determining which screening

offers and topics will be the focus in the future. The evaluation of the survey confirmed that there is interest in preventive health offers.

Due to the coronavirus pandemic, the new prevention course originally planned cannot take place. But KKH offers an alternative with online coaches that allows our employees to do something for their health anytime and anywhere. The courses are quality-tested and recognised as certified prevention courses.

The new building will be completed by the end of the year

It all began in 1991 with premises in the railway station: this year the third and largest OELCHECK company building will be completed. There were delays during the coronavirus pandemic, but the new building is in the final phase – interior fitting out is now underway. The three-storey building covers approx. 2,000 m² and will accommodate up

to 50 employees. They can look forward to modern office workplaces and a generously designed cafeteria with eating and lounge area. A new and innovative corporate catering concept will be rolled out. The vision is to enrich daily work at the company with local ingredients, uncompromising freshness and skilfully prepared meals. Our employees can enjoy a healthy and individual lunch every day – freshly cooked by a chef. Eating together promotes a shared spirit and encourages communication and satisfaction. This is another reason

why OELCHECK has newly created and already filled the position of Food & Beverage Manager. All catering offerings, quality assurance and operational processes in the kitchen and service sector are their responsibility.

The entire move into Kerschelweg 18 will be completed by the end of the year. By then the management team, plus the tribology, sales, accounting and media design departments will be able to move into their new offices.





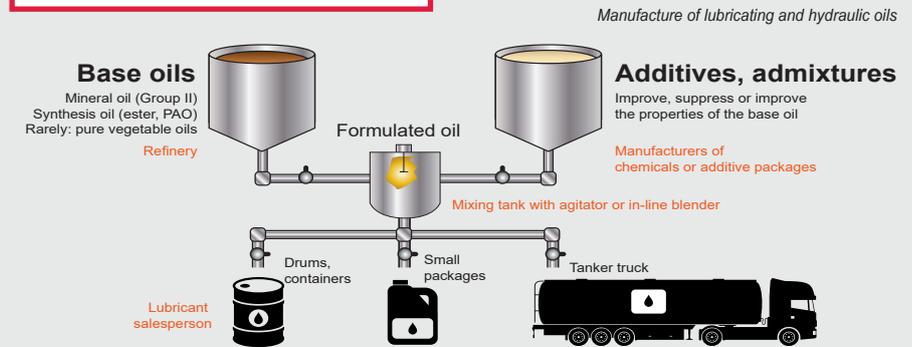
FAQ

For years we have always been using an oil from the same manufacturer with the same name and specification to lubricate our systems. It is regularly monitored with trend analyses. Oil changes are carried out on the basis of the suggestions of OELCHECK tribologists in the laboratory report. We have never noticed any abnormalities. However, the latest laboratory report now shows discrepancies under the heading “Additives” that do not fit with previous analyses or fresh oil. Do the changed values indicate a mixture of two different types of oil? What other reason could there be?

OELCHECK:

Almost all lubricants and hydraulic oils contain between 0.5% and 10% VI improvers, as well as oxidation inhibitors and organometallic additives. If additives are detected in an oil sample for the elements calcium, zinc, boron, phosphorus, barium or sulphur that were not found in previous studies or in another concentration, it is likely that different oil types have been mixed. Since other parameters such as viscosity or VI generally change in addition to the additive elements in a mixture, the oil manufacturer may have “upgraded” their product with another base oil without this being apparent from a change in the name or the specification sheet. Such a change usually also goes hand in hand with a slight adjustment of the additives.

Since recently, a base oil that can be assigned to Group II has increasingly been used for mineral oil-based oils. Unlike Group I oils, which are only distilled with the aid of solvents, Group II base oils produced by hydrocracking have a higher VI and the proportion of saturated, oxidation-stable compounds is 90%. The sulphur content is also significantly lower. However, with the Group II oils produced on an increasingly large scale in modern refineries, there is no reduction in the performance of the end product or any quality impairment. Nevertheless, the formulation and additives must be adapted to the improved initial conditions.



Base oils can be mineral or synthetic. The American Petroleum Institute (API) divides them into five groups:

API BASE OIL CLASSIFICATIONS				
Base oil classification	Origin	Sulphur content	Saturated compounds	Viscosity index
Group I (mineral oil)	approx. 1930	usually > 0.03%	usually > 90%	80-90
Group II (mineral oil)	1971	max. 0.03%	at least 90%	90-120
Group III (mineral oil)	1993	max. 0.03%	at least 90%	min. 120
Group IV (PAO synthesis oil)	1974	sulphur-free	100 %	125-200
Group V (esters, glycols)	1940	unspecified	unspecified	unspecified

The intended use and the requirements placed on the respective lubricant are what matters when selecting base oil types and additives.

Mineral oil-based **Group I base oils** are the least changed during their production process, which is solvent refining. As pure base oils, they are usually only used for applications with relatively low technical requirements, such as recirculating, insulating or heat transfer oils.

Mineral oil-based **Group II base oils** are usually produced using an elaborate hydrocracking process that removes impurities from the oil. Not only do they have a clearer colour, they also contain more than 90% saturated hydrocarbons. In addition, they contain less than 0.03% sulphur and mostly have a viscosity index of over 90. As a result, they have a significantly higher performance than Group I oils. They are chiefly distinguished by their better antioxidant properties and hence optimised ageing. This also means that less oxidation inhibitors or VI improvers need to be added to Group II-based oils.

New lubricating oil refineries usually only produce Group II oils, because although production is more expensive than that of Group I, manufacturers of finished products can offset the additional costs

by saving additives. With the current oversupply of Group II oils, cheaper purchase prices can be achieved. The use of Group II oils is predominantly

price-neutral for the user and does not entail any technical disadvantages.

Lubricant manufacturers are also not obliged to inform users of a base oil change by changing the product name or putting a note in the sales documents or data sheet. At OELCHECK, however, such changes stand out immediately due to a direct fresh oil comparison of the oil with the same name a few years ago and today. The additive changes caused by base oil are also evident in trend observations of machines in which only re-fills are carried out.

If these permissible deviations do not result in any loss of quality, they will not be commented on in particular. Improved ageing stability can usually only be seen anyway by our tribologists in a direct fresh oil comparison with the help of the IR spectrum. The situation is different with defoamer additives containing silicon, which lead to lower silicon values at a lower additive concentration and thus give the impression that less silicon-containing dust is in the oil.

If the elements, the content of the additives or the IR spectrum suddenly no longer match fresh oil or previous trend, this is obviously immediately apparent to the tribologist. However, this is only commented on where there is certainty that this indicates mixing with another type of oil, which could lead to damage if used again.