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Performance criteria and raw material selection in textile knitting oils

Wind turbine gears

benefit from

NUFLUX™ technology

How electrification will

impact the future of

automotive greases

Infineum's Jacquie Berryman

to become

President of ATC

ÜRETİMDEN SON TÜKETİME KADAR HER AŞAMADA FROM PRIMARY PRODUCTION TO FINAL CONSUMPTION

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Editor's Letter



Turkey is one of the top countries that produce the highest quality and most affordable textiles. While many textile giant brands prefer to manufacture their products in Turkey, Turkey offers them quality workmanship, low prices and easy access. Turkey, which is one of the largest suppliers of textile and apparel products especially for European countries, is therefore a large consumer of knitting machine and needle oils. In this issue, we have covered this lubricant type, which requires a lot of precision in its production.

Speedol Lubricants, which celebrates its 100th anniversary as a brand, is happy to receive approval for its two key products. Speedol Weapon Protective Oil SPD 63460 is approved by SSB and TRtest as a domestically produced weapon cleaning and protection oil for MPT-76 and MPT-55, which are domestically produced Turkish infantry rifles, and Speedol Aero Ultra Diesel S170 is approved by TEI-TUSAŞ as original aviation engine oil for Turkey's first domestic and national Turbodiesel Aviation Engine TEI-PD170. We asked Tayfun Koçak, the company's Chairman of the Board of Directors, about these products.

You can read the second part of our article titled "Wind turbine gears benefit from NUFLUX™ technology", the first part of which was published in our previous issue. In the second part of the article, written by key experts from Evonik, essential information is shared important rig and laboratory tests for industrial gear oils to ensure high performance of wind turbines.

Dr. Gareth Fish from Lubrizol discussed how the automotive greases will be impacted as vehicle systems become more and more electrified. Since the functionality of some parts will remain the same in electric vehicles and vehicles with internal combustion engines, there may not be any change in certain greases. However, different types of grease are being developed that can be used in electric motors and high-volume batteries both for efficiency and for safe driving.

As of this issue, we have a new columnist to share valuable information on oil analysis, which can be compared to a blood test for your machines and engines. Umut Arslan from SGS Turkey Industry & Environment Department told us about the importance of oil analysis in predictive maintenance in this issue.

Here is our 32nd issue, where you can find all these subjects and many more.

Good reading.



Turkey Edition

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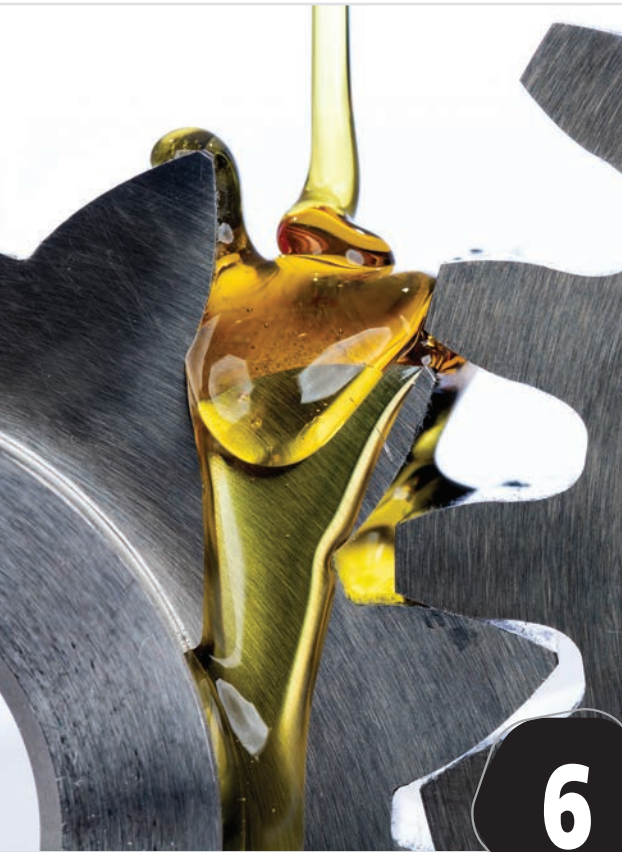
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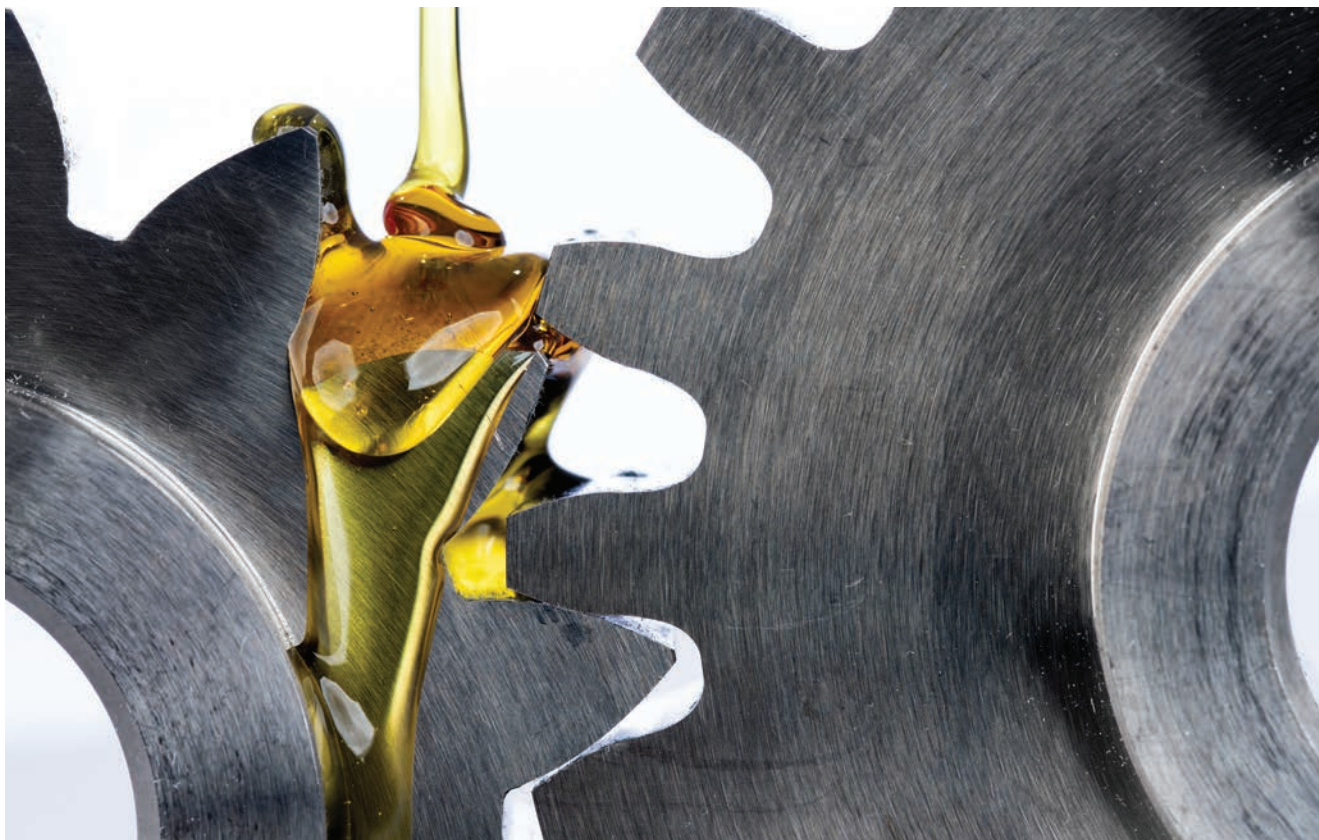
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Infineum's Jacquie Berryman to become President of ATC



Lanxess expands capacity for light-color sulfur carriers

Lanxess is expanding its production capacity for light-color sulfur carriers at its Mannheim site by several kilotons. The specialty chemicals company is investing a double-digit million amount to expand the facilities in response to growing demand. The additional volumes are expected to be available beginning in 2023.

"The market for sulfur-containing additives in the industrial lubricants sector is changing," says Martin Saewe, Head of Lanxess's Lubricant Additives Business (LAB). "We have the right products in our portfolio to support our customers along new paths and grow with them. We intend to use the additional capacity to strengthen our leading market position in extreme pressure additives and exploit global growth potential."

Reducing wear and preventing cold welding

Lanxess sells its light-color sulfur carriers under the brand name Additin EP. These colorless and odorless extreme pressure additives are mainly used in metalworking lubricants. They reduce wear on metal surfaces and prevent cold welding even under extreme conditions such as high pressure.

The Additin EP products are primarily based on locally sourced renewable raw materials like rapeseed oil and its ester derivatives. Because of their beneficial eco-toxicological profile, light-color sulfur carriers are increasingly replacing other chemical substances such as medium-chain chlorinated paraffins, which have been classified in a list as Substances of Very High Concern (SVHCs) by the European Chemicals Agency (ECHA) due to their environmental persistence and high bioaccumulation potential.

Lanxess's Lubricant Additives Business has a long track record of providing technical expertise to customers who are looking to replace substances like chlorinated paraffins in their formulations with high-performing, environmentally friendly sulfur carriers.



New shareholder in Nynas

Davidson Kempner Capital Management LP (together with its affiliates and affiliated investment vehicles, "Davidson Kempner") signed an agreement for the acquisition of the entire equity stake (49.9 percent) in Nynas from Bitumina Industries Limited. Following completion of the acquisition, Davidson Kempner will be the largest individual shareholder of Nynas.

Davidson Kempner Capital Management LP is a U.S.-registered global institutional investment management firm with more than 35 years of experience and a focus on fundamental investing with a multi-strategy approach. Davidson Kempner has over \$36 billion in assets under management with over 400 professionals in five offices, including New York, Philadelphia, London, Hong Kong and Dublin.

With around 1000 employees, production facilities in Europe and offices in over 30 countries, Nynas is dedicated to researching, producing and supplying specialty naphthenic oils and bitumen for a growing global market.

Davidson Kempner played an active role in the financial restructuring of Nynas which was undertaken during the second half of 2020, restoring Nynas balance sheet equity to SEK 4.6bn on 31 December 2020, with an equity to assets ratio of 39.4 percent. Since that restructuring, Davidson Kempner has played an ongoing role in the financing of Nynas, providing further loan facilities to support Nynas working capital requirements and putting Nynas on a solid financial footing.

"We welcome Davidson Kempner as a shareholder in Nynas and look forward to the continued development of Nynas' business with the strategic and strong financial backing that Davidson Kempner will contribute. We are very satisfied with our strong trading result in the first half of 2021 and will continue to pursue our mission to deliver long lasting, high performance specialty products for sustainable use in our industry with the support of Davidson Kempner, who already is one of the largest financiers of the company," said Bo Askvik, Nynas President & CEO.



Motul launches new iteration of Motul 300V flagship engine oil

French lubricant manufacturer Motul has launched a new and improved version of its flagship engine oil, Motul 300V. The new Motul 300V will be available in the market from September 2021, depending on the country.

The new engine oil is being launched at the 24 Hours of Le Mans (24 Heures du Mans), an endurance-focused sports car race held annually near the town of Le Mans, France.

Launched in 1971, Motul 300V was developed to help racing teams accomplish maximum performance and reliability out of their engines, the holy grail of motorsport. Its name is a tribute to the 300 racing victories achieved by the time of its launch.

The new Motul 300V features the following improvements:

- The new Motul 300V racing oil improves engine performance by reducing internal friction. This new formulation ensures proven power and torque gains across the whole powerband.
- Motul 300V protects engines without compromising performance, by providing high shear stability for maximal oil film resistance, even in most extreme conditions.
- Motul 300V now fulfills modern engine requirements: compatible with exhaust gas after-treatment systems such as particulate filters, compatible with biofuels, especially ethanol, and protects against low-speed pre ignition or LSPI in turbocharged, downsized engines.
- Motul 300V uses non-fossil based renewable materials to reduce its environmental impact. Motul says its carbon footprint is reduced by 25 percent during the manufacturing process, compared to its previous formulation.

The improved Motul 300V product range is available in different viscosity grades. Power series features the lightest viscosity grades, from 0W-8 to 5W-30. Competition series features mid-viscosity grades, from 0W-40 to 15W-50. Le Mans series offers the maximum engine reliability possible and is now available in 10W-60 and 20W-60 viscosity grades.

Besides powering most of the LMP2 teams on the grid, Motul is the official lubricant partner of Scuderia Cameron Glickenhaus, which had the opportunity to test the new Motul 300V. The Le Mans Prototype 2 (LMP2) is a closed-cockpit car developed by four approved constructors. LMP2 cars are eligible to compete in other global series such as the FIA World Endurance Championship, which includes the 24 Hours of Le Mans.

"The new Motul 300V makes a gigantic difference. In challenging racing conditions, the engine often gets stretched to its limits, therefore we need a reliable lubricant which will make the engine able to continue the race. The new Motul 300V is exactly that," says Jim Glickenhaus, founder of Scuderia Cameron Glickenhaus.



Infineum's Jacquie Berryman to become President of ATC

Voted for by her industry peers, Jacquie Berryman became President of The Additive Technical Committee of Petroleum Additive Manufacturers in Europe AISBL (ATC).

The ATC was established to bring members together to discuss technical and statutory topics of industry concern and develop common approaches. It has a long history of leading the industry in areas of Health, Safety and the Environment and for providing strong technical input to performance test development and, with other industry partners, in providing input to the European Automobile Manufacturers' Association (ACEA) in the area of specification development.

Berryman believes ATC will need to adapt to key industry trends like globalization, electrification and digitalization and she is particularly excited about bringing ATC's history of industry leadership to the topic of sustainability.

Recognizing the industry's need for common understanding, ATC set up a Sustainability Sub-Committee in September 2019, with the aim of delivering harmonized approaches and methodologies for calculating sustainability data and ways of working effectively with partners along the value chain.

When asked, what success would look like at the end of her two-year term as president, Jacquie Berryman said: "A common industry approach to carbon footprint and Life Cycle Assessment, recognized for its robustness and benefit to the entire value chain, would be a good outcome."

This approach could facilitate informed discussions with suppliers, so lubricant marketers can ask the right questions to understand what the provided sustainability data mean. Having quality information should then enable informed product purchasing decisions.

From a supplier perspective, a common approach to sustainability data would bring improved certainty of industry expectations and any differences from the norm could be established upfront. Progress and accountability against these metrics, over time should improve the energy efficiency of products and reduce greenhouse gas emissions. Repeatable, reliable and field relevant test data will allow lubricant marketers to compare and consider product quality.



Current figures in Turkish lubricant exports



Turkey exported a total of \$419 million in July 2021 according to the export figures of the mineral oils and mineral fuels sector prepared every month by İKMİB using the TIM Export Database and Trademap data. As per the HS Code, the top 10 product groups and export figures in the export of lubricants are as follows:

HS CODE – DEFINITION	July 2020 (\$)	July 2021 (\$)	Diff. (%)
271019810000 – Engine oils, compressor oils, turbine oils	12.583.782,05	13.986.056,01	11,14
271019990025 – Other lubricating oils	2.243.069,76	2.828.169,87	26,08
271019830000 – Hydraulic fluids	1.673.664,13	2.525.128,73	50,87
271019870000 – Gear and reducer oils	1.771.115,36	2.473.776,46	39,67
340399000000 – Preparations for lubricating machines, devices and vehicles – other	928.549,62	699.760,09	-24,64
271012210000 – Light oils and preparations – special gasoline – white spirit	4.379,46	695.459,27	15780,02
271019930000 – Dielectric oils	6.820,18	694.516,76	10083,26
271019850000 – White oils, liquid paraffin	305.897,92	693.924,71	126,85
271019290000 – Middle oils – other	16.774,70	186.685,07	1012,90
271019910000 – Metalworking fluids, molding oils, anti-wear oils	241.099,58	117.159,08	-51,41

Source: Istanbul Chemicals and Chemical Products' Exporters Association

The product groups with the highest increase in exports in the January–July 2021 period compared to previous year are 271019990011 – Spindle Oil, Light Neutral, Heavy Neutral, Bright Stock, 381129001000 – Prepared Additives for Mineral Oils/Similar Lubricating Oils – Other, 271019290000 – Middle Oils – Other, 381129009000 – Other Prepared Additives – For Lubricating Oils, 381121009000 – Prepared Additives Containing Oils Obtained From Petroleum Oils/Bitumen Minerals, 271019710000 – Lubricating Oils. Other Oils – Subject to Special Process.



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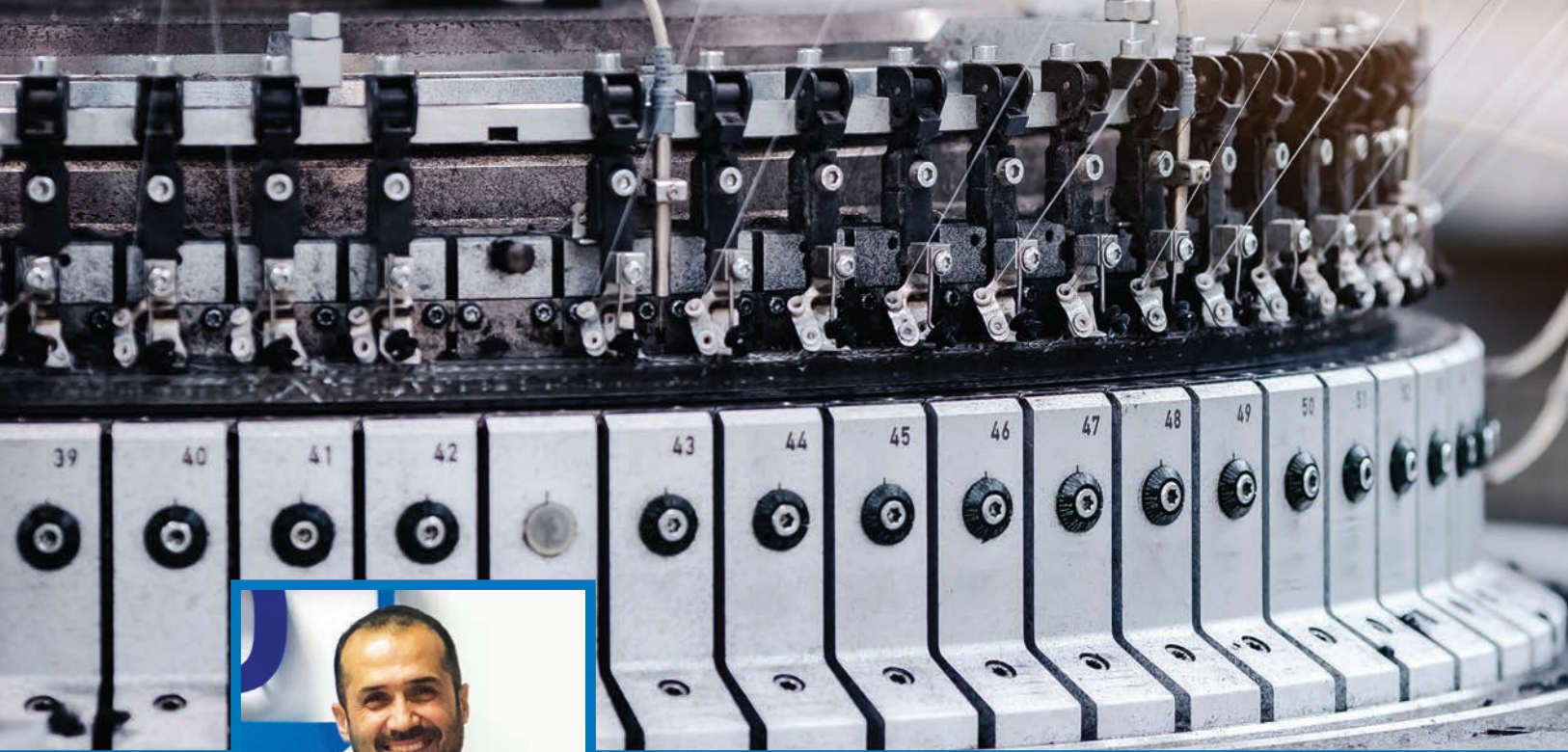
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Performance criteria and raw material selection in textile knitting oils



Tayfun YILMAZ

General Manager
Engineer MSc.

Vario Engineering and Production Technologies Inc

It is said that knitting was found by the Central Asian Turks and the Egyptians around the same time in the 5th or 6th century.

With the invention of the latch needle in knitting by Matthew Townsend in 1853, the production of the first knitting machine equipped with this needle in 1867 by the researchers of the following years, and

the development of the first circular knitting machine with the same element in 1878, the sound of mechanical knitting in textiles began to be heard.

Knitting machines, new knitting methods and patterns were developed, and therefore the knitting industry improved with the rapid emergence of synthetic fibers and yarns after the World War I.

With a new leap after the World War II, the progress of recent years on both mechanical and electronic basis accelerated the developments in this field, and the method and auto-mechanical-based electronic machinery and knitting technology brought by the last three decades reached its peak.

In the last decade, fully electronic circular knitting machines have started to gain popularity in the market. This leads knitting machine manufacturers to use new technology and to produce machines with faster cycles.

By product groups, knitted fabric exports came after



fiber, yarn and woven fabric exports and constituted 15.2 percent of textile and raw materials exports.

One of the most important features sought in a needle and sinker oil is that it does not damage the paint coat or plastic parts of the machine, does not increase the temperature of the machine, does not destroy the coating of power cables or does not affect the control system, protects against corrosion. Every person working in this industry knows that a needle and sinker oil should show high lubrication performance on the machine while having a high level of washable properties.

Expert selected special oils help not only to ensure maximum operating reliability, but also to reduce maintenance costs. When choosing the appropriate oil, all technical and operational parameters, including machine types, product quality as well as price/performance expectations should be taken into account. The additive package, which ensures the quality properties and

washability of the knitting and sinker oils mentioned above, constitutes the most important cost factor in a knitting oil. The higher the diversity and effectiveness of the additives are, the higher the difference in their costs will be.

A good oil selection and the usual washing methods used in the finishing process will ensure that the oil stains caused by knitting on the fabric will flow off the fabric in the form of soap.

Lubricants must be correctly designed for components exposed to high speeds, temperatures and vibration, as well as to water, steam, acidic and alkaline solutions. Higher efficiency requires longer equipment life or lower oil consumption.

A lubricant that is developed for the specific application area will always present the minimum number of problems. Every movement in machine parts causes wear; because there is no movement without wear. Choosing and using the lubricant that will minimize this wear will reduce the cost and provide the best efficiency.

Washable property of needle oils means that they can be mixed with water in any way. Additives that provide the ability of oil to mix with water are emulsifiers. They reduce the surface resistance of the oil and allow it to mix with water. The use of such a water-miscible oil in knitting machines producing cotton blended fabrics is important for fabric manufacturers.

To minimize the problems experienced especially in the production of lycra, the oils used in the same lines should have better properties. Knitting oil that contacts with lycra spoils the elasticity of the fabric. The manufacturer, on the other hand, subjects the oily fabrics to a high temperature washing process in order to remove the oil from the fabric; this is an undesirable process as it spoils the elasticity of the fabric and therefore the company experiences both production and time losses. At the same time, due to the lubricating feature of the oil, the company will frequently need to change the needle sinker, which creates many problems in terms of production, time and cost.

What do we expect from knitting oils?

- Effective lubrication for a long time
- Preventing viscosity fluctuations at different temperatures
- No resinification

- Keeping the needle channels clean all the time
- Minimizing vibration and noise in the machine
- Reducing the heat generated by friction in the machine
- Resistant to rust
- Contains rust preventive additives
- Does not damage the machine paint and plastic parts
- Less wear on machine parts
- Having the property of spreading and holding on metal parts
- Ability to be used in all lubrication systems
- Not harmful in terms of physiological and environmental aspects in production
- Prolongs the service life of needles and sinkers by protecting against wear, thus reducing maintenance costs
- Reducing energy and operating costs with low frictional resistance
- Compatibility of electronic control systems with elastane fibers and commonly used sealants and plastics

So, how can we have so many features together and protect the machine, while ensuring that it does not leave stains even by washing with water?

Possible raw materials:

► An additive that does not leave ash and carbon, has extreme pressure and also anti-wear properties,

such as Triaryl phosphorothionate / Triphenyl phosphorothionate (TPPT), should be used. It should have having high thermal stability, and should be neutral towards yellow metals, unlike sulfide extreme pressure additives.

► An ashless raw material with amine phosphate mixture, extreme pressure, anti-wear and anti-rust properties should be used.

► A phenolic antioxidant such as 2,6-Di-tert-butyl-4-methylphenol (BHT) should be used.

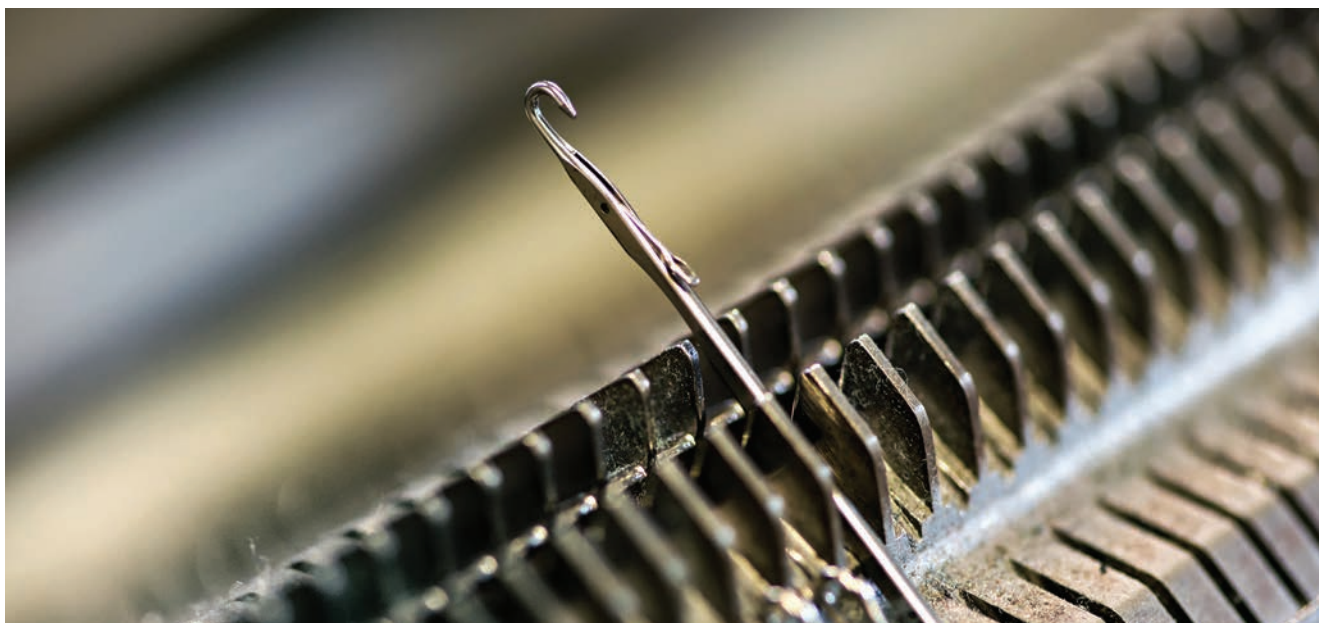
► An amphiphilic oleic acid derivative, which is used as a water-in-oil emulsifier and corrosion inhibitor, should be used for good washing properties.

► A non-ferrous metal deactivator, which is effective in non-polar base oils containing dimercapthiadiaazole, should be used.

► A particularly effective anti-corrosion additive, which is a semi-ester of succinic acid, with excellent demulsifying properties, should be chosen.

A multipurpose raw material is required to obtain a homogeneous mixture by keeping so many raw materials together and at the same time to easily remove these raw materials of different chemical structure from the fabric.

► A biodegradable, fatty alcohol ethoxylate (2EO) based emulsifier should be chosen, which is stable in hard water, exhibits high solubility in washing, and does not irritate the skin. It should be a low foaming, hydrophobic emulsifier for water-miscible metalworking fluid concentrates with low temperature properties.





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Speedol celebrates its 100th anniversary with two major approvals



Speedol crowned its 100th anniversary with the approvals it received for Speedol Weapon Protective Oil SPD 63460 (S-761) and Speedol Aero Ultra Diesel S170, two important products in its portfolio. We talked about these achievements with Tayfun Koçak, Deputy General Manager of the company.

We congratulate you for topping off the 100th anniversary of the Speedol Lubricants brand with your success as the Speedol Weapon Protective Oil SPD 63460 (S-761) in your product family is approved by the Presidency of Defense Industry (SSB) and TRtest as a weapon lubricating and cleaning oil for MPT-76 weapons, and your Speedol Aero Ultra Diesel S170 product becomes the first domestic engine oil approved by TEI-TUSAŞ after passing the engine and laboratory tests of TEI-PD170.

Your product Speedol Weapon Protective Oil SPD 63460 (S-761) has been approved by the Defense Industry Presidency (SSB) and TRtest as a weapon lubricating and cleaning oil for MPT-76 weapons. Can you tell us about the technical features and benefits of this product?

Speedol Weapon Protective Oil SPD 63460 (S-761)

is a fully synthetic oil with special additives to improve anti-corrosion performance and anti-wear properties, especially developed for military and general purpose weapons for daily use and long-term storage. It provides excellent compatibility for lubrication, protection and cleaning processes of weapon systems.

With the participation and support of SSB and MKE (Mechanical and Chemical Industry Corporation), we are proud to extend our domestic and national weapon oils. Our R&D department developed the 'Speedol SPD 63460 (S-761) Gun Protective and Cleaner Oil', specially formulated for our domestic infantry rifles MPT-55 & MPT-76, to meet their cleaning, lubricating and protection needs in the harshest climatic conditions (with -60 C0 temperature resistance), ensuring their serial operation. This product, which will meet all the maintenance



needs of new generation guns and rifles and extend the life of the guns with its excellent corrosion protection performance, has been formulated with special additives in full synthetic structure with ester technology.

Can you tell us about the SSB approval process and the importance of this approval?

First of all, R&D studies were completed in physical and chemical test processes to meet MIL-PRF-63460F standards, and then, conformity were declared after completing firing tests in cold conditions (6 hours of conditioning at -57 CO) on the infantry rifles, which are the domestic and original products MPT-55 / MKE at MKE Kırıkkale Light Arms Factory and MPT-76 / SSB Weapons Department.

Speedol SPD 63460 / Weapon Oil for SSB original product/MPT-76 guns was approved by SSB after successfully passing all required gun firing performance and testing phases under cold temperature shooting tests as well as hot temperature, wet, pollution and extreme conditions at Düzce Sarsılmaz Arms Factory, one of the contractor companies of SSB.

The SSB Weapons Department officially conveyed to its subcontractors the letter supporting the domestic use of the maintenance oil to be used in the original MPT-76 products. Among the domestic suppliers in this approval letter, Koçak Petrol is also included.

What is 'TRtest Product Conformity Approval' and can you share your views on the importance and benefit of obtaining approval for your product?

In product groups especially for the defense and aerospace industries, where certification is of the highest importance among subcontractors and users, the products of the manufacturers are evaluated by TRtest and its authorized subcontractors according to the test methodologies determined within the framework of the established criteria, and TRtest provides TRtest



Product Conformity Certificate to those who successfully pass the tests and general inspections.

In this context, the certificates are presented to the manufacturers who are entitled to receive the TRtest Product Conformity Certificate as a result of the conformity assessments made in the mentioned product groups.

To sum up the importance and benefits of TRtest Approval in a few sentences; our TRtest approved product has been referenced in the defense industry and among all companies within TRtest, especially for weapons manufacturers. Companies, which note that the product and company with TRtest certificate passed



Tayfun KOÇAK

Deputy General Manager, Koçak Petroleum

all the relevant inspections, would add the domestic manufacturer company and/or product directly to their approved supplier pools with TRtest assurance. This will enable us to take quick action in the project and mass production part by accelerating the inspection processes as well as put us in direct contact with the relevant companies.

In addition, our products, which are produced with domestic and national resources, registered in the Turkish Republic Presidency of Defense Industry Talent Inventory (YETEN) portal within the scope of the Qualified Product List Project carried out by TRtest under the auspices of the SSB, are included in the Qualified Product List by passing the TRtest approval mechanism. TRtest documents will be presented to suppliers in the SSB Industrial Competency Assessment and Support Program (EYDEB) system, as well as to participants of SSB and MSB tenders.

Our company, which has completed the requirements of the YETEN system, successfully finalized the EYDEB Program company audit process in Quality, Production, R&D, Accounting and other departments. For this success, 'Koçak Petrol EYDEB Certificate' was presented to me by Dr. Celal Sami Tüfekçi, Vice President of Defense Industry, and Murat Çizgel, SSB Industrialization Department Head, at the document presentation ceremony held at the IDEF'21 International Defense and Industry Fair. In coordination with EYDEB and TRtest, we will continue to increase the number of domestic products and bring them to the defense industry as a substitute product.

Your other key product, Speedol Aero Ultra Diesel S170, the original product of TEI-TUSAŞ, successfully passed the engine and laboratory tests of TEI-PD170, Turkey's first domestic and national Turbodiesel Aviation Engine, and became the first domestic engine oil approved by TEI-TUSAŞ. Could you give information about this product?

Speedol Aero Turbo Diesel SP170 is a fully synthetic engine lubrication oil, specially formulated in cooperation



with TEI as TEI original product in new generation Diesel Aviation Piston Engine for TEI-PD170 engine (the engine used in unmanned aerial vehicles (UAV)), Turkey's first domestic and national Turbodiesel Aviation Engine.

It is an aviation engine oil that protects the engine and increases its performance by providing an excellent anti-wear system and film structure that prevents the wear of engine parts during cold start, allows the engine to stay within the initial production tolerances, and provides protection with high neutralization performance.

How was the approval process with TEI-TUSAŞ and what is the importance of this approval?

The R&D studies were completed with physical and chemical test processes to meet the relevant ACEA, SAE and ASTM standards, and then the performance tests were carried out on the TEI-PD170, the local original product of TEI-TUSAŞ, the Turbodiesel Aviation Engine.

For TEI original product/PD170 aviation engines, Speedol Aero Ultra Diesel S170 was approved by TEI after passing all necessary performance and test stages in surface engines under the most severe conditions at Eskişehir TEI-TUSAŞ Factory, as well as the used oil tests conducted by TEI.

TEI placed the Speedol Aero Ultra Diesel S170 product in the first place in the appropriate oil category to be used in the engine specification book submitted during engine sales, supporting the domestic use of aviation engine oil

used in the PD170 original engine, which it produces and sells locally.

We know that in order to obtain such approvals and certificates of conformity, it is necessary to go through very difficult stages and meet all the requirements. How did you complete this process? Can you tell us about your efforts to achieve success?

Thanks to our Koçak Petroleum R&D Department, which has been active since its establishment, our experienced technical staff and Koçak Petroleum Laboratory, which has the TS EN ISO / IEC 17025 – Experiment and Calibration Laboratory Competence Certificate, we are confidently laying the foundations of the process.

In terms of the shooting and engine performance tests that followed, we completed the process to obtain SSB and TEI approvals with great effort thanks to the R&D achievements, determination and follow-up capabilities of our technical personnel, the support of all relevant personnel of SSB, MKE, Sarsılmaz Silah and TEI-TUSAŞ.

The approval of these products by TRtest was completed by the experienced TRtest personnel as a result of the relevant product, standard and quality inspections as the last part of the process, and the product approval certificates were given to Ceyhan Çağlar Çapanoğlu, R&D and Project Manager at Koçak Group/Speedol, by Bilal Aktaş, General Manager of TRtest, at IDEF'21 International Defense Industry Fair.



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How electrification will impact the future of automotive greases

Different types of lubricating greases have long been used in numerous applications in passenger cars. But as electrification continues apace, certain grease formulations will need to account for some of the inherent, unique challenges in an electrified drivetrain.

Dr. Gareth Fish

From the development of improved drainage and sewer systems in large metropolises in the 19th century to the reduction of smog generated by vehicles, reducing air pollution has been a goal of humanity for hundreds of years. And as governments around the world continue to pursue aggressive emissions reduction targets in their efforts to mitigate the effects of climate change, we can collectively expect to see new technologies emerge that will make progress toward those goals.

In the automotive space today, one important technological change has been an increasing shift toward the electrification of the drivetrain. Electric cars have a history dating back to the latter part of the 19th century, but it wasn't until Toyota launched the first modern hybrid electric vehicle (HEV) in 1997 that electrified

cars began to gain traction on roads around the world. Though low gas prices initially kept demand low, it was nevertheless the start of the trend that has only grown in the ensuing decades.

Today, HEVs and fully electrified vehicles (EVs) are commonplace, and their adoption is expected to sharply rise as the technology continues to mature. Importantly, HEVs and EVs differ from traditional internal combustion engine (ICE) powered vehicles in a few fundamental ways, and have necessitated changes to the ways we think about common lubricants and greases that are essential to reliable operation.

Greases today

As of 2019, roughly 483,000 metric tons of grease were sold into the automotive industry each year to



provide a wide variety of functionality most drivers probably take for granted. On a given passenger car vehicle—including everything from small sedans to light-duty trucks—there are between 50-60 individual parts that require some form of grease to operate as intended, including wheel bearings, joints, window winders, seat rails, sunroof mechanisms, steering racks, door hinges, brake mechanisms, shock absorbers and many others.

Automotive greases vary in their formulation depending on their intended use, but many contain molybdenum disulfide and graphite as additives (typically with an additive treat rate between 4%-6%). Lithium, lithium complex and polyurea are also common thickeners depending on the geographic region of formulation. Across the vehicle, automotive greases are generally intended to provide one or several of the following four functions: Corrosion protection; lubrication for bearings or other componentry; water resistance; and anti-squeak performance.

Inside the vehicle, greases typically serve light lubrication and antisqueak duties. They must often be compatible with plastics and will not be replaced throughout the vehicle's lifetime, making long-term reliability a key performance characteristic. Exterior greases generally are expected to provide antiwear, anticorrosion, and antioxidant capabilities. They must also be able to withstand on-road conditions (rain, snow, and more) without being washed off. Likewise, they are not typically replaced or reapplied throughout the vehicle's useful life.

A typical passenger car angular contact (AC) wheel bearing provides a good example of an application that demands high levels of grease performance. The right formulation can help reduce churning losses, requiring optimized base oil viscosity and consistency. Synthetic fluids here can deliver lower losses at comparable viscosity levels; Diurea thickeners can additionally provide some improved efficiency.

Elsewhere, greases are found in a variety of electric motors that are included in a typical ICE vehicle, including cooling fans, fuel pumps, starter motors, power steering systems, braking systems and more. Here is where we can begin to identify some of the challenges greases must contend with in increasingly electrified drivetrains.

Greases in HEVs

By and large, the majority of greases on HEVs will likely remain the same as those used in today's ICE vehicles, given that the functionality of things like

seat rails, sunroofs, automatic windows, and other applications will not fundamentally change.

We are anticipating some changes, however. For instance, starter motor greases will no longer need to be formulated with high shock load resistance, because starter motors can now be permanently engaged for stop-start functionality in hybrids. Elsewhere, transmission electric motor bearings may be grease lubricated or oil lubricated when incorporated in the gearbox or differential.

Increasing battery capacities will have implications, as well. Typical hybrids utilize batteries that are capable of lasting up to 50 miles without a charge from the ICE engine, but larger batteries which increase overall vehicle weight can have some implications for wheel bearing greases. Supporting extra loads may involve some changes to the bearings and the greases required to lubricate them.

Greases for EVs

While HEVs are closely comparable to ICE technology in terms of their demands of on-vehicle grease applications, true battery EVs have other implications. 2017 saw global EV sales reach 1 million and 2019 saw sales reach 2 million. As of 2020, EVs make up 4.2% of all light vehicles made. Currently, Europe is the leading market for EVs. As these numbers grow, the automotive industry must be familiar with the changing demands of many common greases found throughout the vehicle.

Increased weight. As noted, increasing vehicle weight due to battery size has implications for wheel bearings. Take, for example, that a 60 kWh electric battery weighs around 950 pounds, contributing to a total midsize EV weight of about 3,500 pounds. This vehicle will have a range of about 250 miles. A similar sized hybrid with an ICE, electric battery and electric drive motor will typically weigh about the same. Meanwhile, an equivalent ICE-only vehicle will only weigh 2,500-2,800 pounds depending on the engine size. This increased weight, both in HEVs and EVs, has the potential to reduce bearing life by up to 30%. Light trucks may have to change the wheel bearing types to support the extra load.

New greases. Elsewhere, EVs will incorporate a few entirely new greases without comparable applications in ICE vehicles. First, transmission electric motor bearings may be grease lubricated when incorporated within the gearbox or differential. Second, electric motor bearing greases in these applications must deliver long life, low noise, conductivity or insulative performance, and

energy efficiency.

Obsolete greases. There are several traditional ICE grease applications that will simply become obsolete in most EVs. These include many applications through the driveshafts, like center bearings, high-speed constant velocity (CV) joints, universal joints, and sliding splines. Accessory drive bearings will also be obsolete, along with the need for grease in water pumps, engine cooling fan bearings, alternators and belt tensioner pulley bearings. Starter motors and their associated greases are not required for EV operation.

Modified greases. Many greases required in today's ICE vehicles will also be required in EV applications, with some notable changes.

One of the most important characteristics of electric bearing motor greases, for example, is their electrical conductivity. There are two primary concerns here: First, if a grease's conductivity is too high, it could lead to current leakages and short-circuiting. There is no hard-and-fast limit on how high is too high; it will depend on the specific application. Second, if a grease's conductivity is too low, this can lead to static electricity buildup and arcing, which can cause significant damage to the motor bearings. Again, there is not a set limit—the specific application will determine how low conductivity should be. OEMs and grease formulators will need to work closely together to determine the optimum levels of conductivity.

Certain greases in EVs also have a significant opportunity to contribute to greater vehicle efficiency, and therefore to improving the range of EVs. These applications include:

- Drivetrain joints and bearings

- Front end accessory drive bearings
- Wheel bearings
- Steering mechanisms

Within these four critical applications, however, delivering higher efficiency comes with some inherent challenges. For example, at low speeds, good lubrication films are not generated. There is a tendency for in-boundary lubrication, which can result in energy losses. While moving to a thicker base oil will increase lower speed film thickness, it will lead to higher speed churning losses. Meanwhile, at higher speeds, the lubrication films generated tend to be thicker. In these instances, lower-viscosity greases can deliver thinner films, which reduce churning losses. However, if the film is too thin, component durability may be compromised.

A balance must be struck, and advanced formulations will be required to deliver the necessary performance. The right base oil selection, thickeners, and additive packages can all contribute to a formulation that is ideal for an efficient EV grease.

As the number of electrified vehicles on roadways continues to increase around the world, it is critical for stakeholders to consider the ways in which grease formulations will be impacted. While there are many unknowns, it is clear that certain critical greases can help deliver increased energy efficiency and range, along with overall vehicle durability. Grease formulations that strike the balance between lower viscosities to reduce churning loss while maintaining the highest level of protective properties can deliver on those goals. As an industry, we must work together to develop the formulations that can help EVs meet their fullest potential for a cleaner future.

Dr. Gareth Fish

Dr. Gareth Fish is a technical fellow at The Lubrizol Corporation. He is an internationally recognized lubricants industry professional with over 37 years of experience. Dr. Fish earned a B.Sc. in Chemistry and a Ph.D. in Tribology from Imperial College of Science, Technology and Medicine, in London, England. He is a Chartered Scientist, has earned STLE CLS and NLGI CLGS certifications, authored more than 60 technical papers on grease and tribology and three book chapters and been awarded three U.S. patents and has taught more than 70 public classes on grease and tribology. In addition, Dr. Fish has won nine industry prizes for papers and publications on lubricating grease, including the NLGI Achievement Award for his more than 30-year contribution to the grease industry.



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Wind turbine gears benefit from NUFLUX™ technology *Part 2*

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Summary

This paper describes important rig and laboratory tests for industrial gear oils to ensure high performance of wind turbines.

Original equipment manufacturers have defined specifications to guarantee designed performances such as anti wear, scuffing, micropitting, shear stability, elastomer compatibility, etc. Foaming behavior is an important test item of the Winergy specification. Stringent filterability tests are required by filter manufacturers Hydac and CC Jenssen.

Part one of this paper described NUFLUX™ technology, a new class of wind turbine gear oils that contain VISCOBASE® synthetic base fluids. The fluid technology has demonstrated its performance in a large number of rig tests and wind turbine field trials.

In part two, laboratory and rig test results of NUFLUX™ formulations are presented and the performance is compared to mineral and PAO based gear oils.

NUFLUX™ industrial gear oils meet the requirements of DIN 51517-3 as well as AGMA 9005-F16 and fulfill the relevant OEM requirements for wind turbine gear oils. Lab, rig and field trials have proven this technology as an



alternative to fully PAO-based wind turbine gear oils.

1. Performance and material compatibility testing – key parameters for bench testing and condition monitoring

To prove the performance of a lubricant formulation for the very demanding purpose of an industrial or wind turbine gear oil, a series of laboratory investigations must be complemented by a number of OEM specific bench tests.

Figure 1 shows the basic performance parameters that the fluid must pass to fulfil the industry standards, and the overlap with more complex requirements specified by individual gearbox manufacturers.

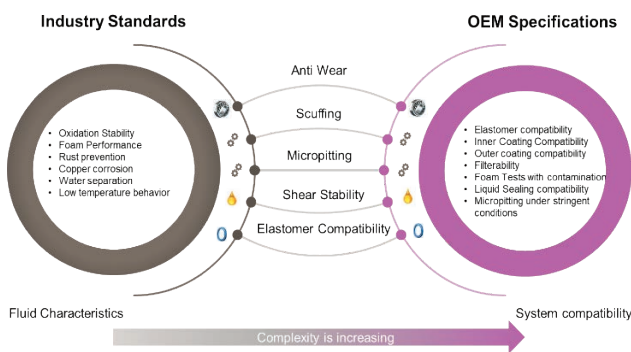


Figure 1: Wind turbine gear oil testing on two levels of complexity

NUFLUX™ technology meets the requirements of an ISO VG 320 industrial gear oil according to

DIN 51517-3 as well as AGMA 9005-F16 and relevant OEM requirements.

The most important additional OEM requirements are: (1) foaming behaviour evaluated according to Winergy-requirements [1];

(2) filterability according to an in-house test of filter-manufacturer Hydac and CC Jenssen, with the focus on fine filtration (2,5-5 µm pore size filters);

(3) static- and dynamic seal compatibility tests, not only with standard elastomer types for small and mid-size gearboxes, but also with seal materials specified by the relevant wind turbine gearbox OEMs, typically conducted at Freudenberg [2, 3];

(4) micropitting tests according to the FVA 54/7 procedure at temperatures of 60°C and 90°C;

(5) FZG scuffing tests, conducted at single and double speed; and

(6) severe multi-stage approval tests by bearing manufacturer FAG.

1.1 Extended Flender Foam tests at different oil temperatures

The foam test that is found in many industry standards is ASTM D892, a test which determines the tendency of gears oils to form surface foam through the use of blown air and a gas diffuser. As this test doesn't correspond to field conditions, Flender developed a foam test that mimics the dynamic mode of moving gears by rotating them at 1405 rpm for five minutes. Strong oil agitation and air entrapment result in foam formation that is closer to field conditions. For general applications, this test is typically run with the pure formulation and with 2% and 4% of impurities (usually flushing oils with detergent additive). Test conditions specify 25 °C as an ambient temperature.

For wind turbine applications, for example the test conditions specified by Winergy, excellent foam performance is expected for a wide range of operating temperatures, going from 0 °C all the way up to 60 °C.

NUFLUX™ VG 320, specifically formulated for wind turbine applications can meet Winergy specification demands (Figure 2).

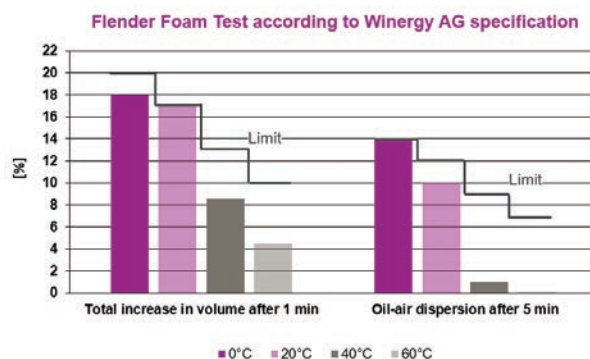


Figure 2: Flender Foam Test results with different oil temperatures, depicted together with limits set up by Winergy specification.

1.2 Mechanical rig tests

There are a few ways of testing and evaluating the wear protection of the lubricant. Some specifications include the four-ball method (ASTM D 2783) for determining load-carrying capacity but caution must be used when correlating these results to field performance. Other specifications have adopted the FE8 wear test (DIN 518 19-3) which uses two roller bearings under axial load and which was developed by FAG Schaeffler. Further tests methods also exist such as FAG 4-step test program, FZG standard scuffing load test, or Micropitting (FVA 54/7).

Micropitting (FVA 54/7)

Micropitting is a wear phenomenon that occurs on the tooth flanks, often seen as surface damage on high rolling gears made of hardened steel.

Microscopically small fatigue fractures continuously form over the operating time of the gear, lead to profile form deviations, increasing performance fluctuations in the system, and finally to more severe follow-up damage modes, such as pitting, wear, or even tooth fracture [4, 5]. Micropitting wear is resulting in noise and vibrations. Its formation can be hindered when the tribological conditions of the system are re-established. Therefore, the use of a robust and efficient additive package dissolved in an appropriate base oil helps to achieve effective surface protection.

To evaluate their ability to protect gears from micropitting, lubricants are usually rated by the results achieved in the FVA micropitting test [6]. This test is divided into two sections: the stepwise phase, where starting from load stage 5 (795 N/mm²), every 16 hours the load is increased up to load stage 10 (1.547 N/mm²); and the endurance phase, where for 400 hours load stage 10 is applied. Typically after each stage, the micropitted area, the wear rate, and most importantly, the profile form deviations are recorded.

After each test period, the test gears are disassembled, and the profile of the tested flanks is measured using a 3-D measurement system. The micropitted area, the wear rate, and most importantly, the profile form deviation is recorded.

In the LS test, the failure criterion has been reached once the mean profile form deviation due to micropitting exceeds the limiting value of 7.5 µm.

The LS in which the failure criterion is reached is called "failure load stage". Lubricants with a high

micropitting load-carrying capacity reach the failure criterion of a profile form deviation of 7.5 µm due to micropitting in LS ≥ LS10 of the LS test (GFT-high).

At the end of the load stage test and endurance test with the first test gears, the load stage test is repeated with new test gears to check repeatability.

Most of the OEM standards relevant for general applications, e.g. Flender, require the test being run at one temperature, commonly 90 °C; wind applications often request LS 10 at 60 °C in addition. At the higher temperature, the test could be viewed as more severe, as lower viscosities produce thinner lubricant films. On the other hand, especially at lower temperatures, chemical factors, more so than viscosimetric factors could influence the outcome of micropitting test. Thus, a mediocre result at such moderate temperatures could be interpreted as lack of additive reactivity. NUFLUX™ exhibits excellent micropitting performance at both temperatures, achieving rating GFT-high for both conditions.

Profile form deviations of the two FVA 54/7 micropitting tests at 60 °C and 90 °C for NUFLUX™ ISO VG 320 are shown in **Figures 3a** and **3b**, respectively.

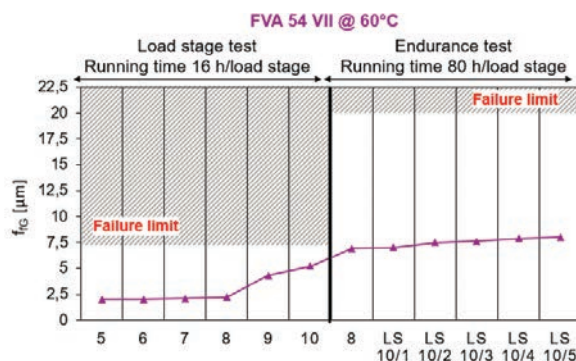


Figure 3a: Profile form deviations at 60 °C for NUFLUX™ ISO VG 320

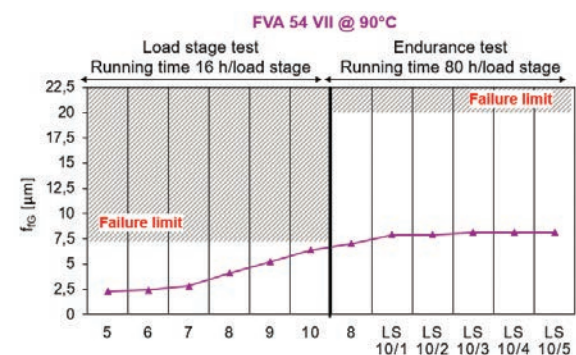


Figure 3b: Profile form deviations at 90 °C for NUFLUX™ ISO VG 320



FZG-Scuffing

The FZG-rig is used to determine the ability of a lubricant to protect gears from scuffing and to reduce friction [7]. In our investigations the test has been carried out at a single-speed of 1500 rpm (= 8,3 m/s pitch line velocity) as required by the DIN 51517-3 and also at double speed [8]. Within this test, the load stages are increased stepwise up to a load stage of 14. **Table 1** shows the results according to DIN 51354-2. NUFLUX™ exceeds (at double speed) the specified requirements.

Test Condition	Requirement	NUFLUX™
FZG A/8,3/90	> 14	> 14
FZG A/16,6/90	> 12	> 14

Table 1: Load stage reached within the FZG load carrying test

As the system is not cooled during the test, the oil sump temperature gives information on friction within the system. A lower temperature correlates with less frictional losses.

Figure 4 illustrates the average oil sump temperature development of 15 individual FZG A/8.3/90 tests with three different ISO VG 320 fluid categories. The mineral based fluids lead to the highest temperatures over all load stages. The PAO-based-fluids generate lower temperatures, especially at higher loads. But NUFLUX™ results in the lowest temperatures over all loads, on average 5 °C lower than the mineral oil formulation.

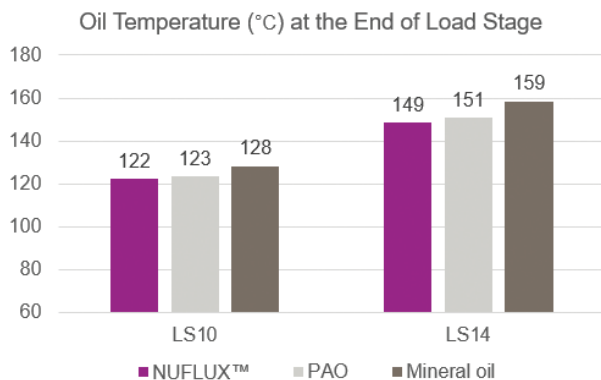


Figure 4: Temperature development at the end of load stages within the FZG A/8.3/90 load carrying test with different ISO VG 320 formulations (NUFLUX™, PAO, mineral oil)

The FZG-scuffing test is not intended to evaluate temperatures. However, it is an informative stepping stone from gears to FE8 (bearings) to real life testing on a gearbox.

Gear efficiency

Encouraged by these results the same fluids had

been tested on an FZG efficiency test [9]. In this test, the torque losses in an FZG rig are measured at 30 °C and 60 °C. At each temperature, the torque is stepwise increased from 0 Nm (load stage 0) to 373 Nm (load stage 10). The results can be found in **Figure 5**.

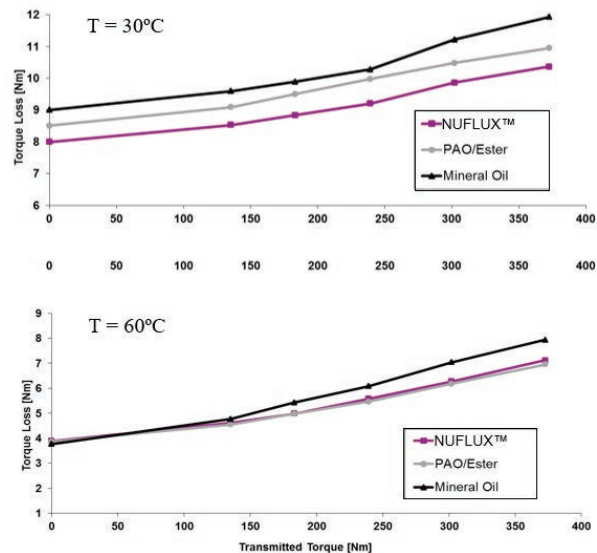


Figure 5: Measured torque losses of three ISO VG 320 formulations according to PV 1456

The FZG torque loss study confirmed the results that were generated within the FZG scuffing test. At 30 °C, NUFLUX™ showed the lowest torque losses across all load stages compared to the mineral oil and even the PAO formulation. The losses of NUFLUX™ were found to be on average 11% lower than those of the mineral oil fluid and 6% lower than those of the PAO formulation.

At 60 °C, it can be seen that both the PAO formulation and NUFLUX™ technology outperform the mineral oil formulation just at higher loads. On average, NUFLUX™ technology and the PAO-fluid show a torque loss reduction of more than 6%.

Bearing tests

Bearings are the crucial connecting components between the highly-loaded mechanical gear sets of a wind turbine and the static gearbox cage.

Roller bearings are a key component of the wind turbine gearbox. The range of their operating conditions is broad and some can be very severe. Therefore, the ability of the oil and additive system to protect the bearings from damage is at least as important as it is for the gear system. Unfortunately, a given lubricant may provide good protection to the gears but not necessarily to the bearings.

To take this into account, bearing manufacturers

have set up their own test procedures covering a broad range of operating conditions.

FE8 wear test (DIN 51819-3)

The FE8 test head is fitted with a shaft and two sets of tapered roller bearings. The test is conducted in two runs under identical conditions (80 kN load, 80°C and 800 rpm). These parameters represent borderline conditions in the gear system (boundary/mixed lubrication). After the first run, the bearings are examined gravimetrically and are exchanged for new ones. The weight loss is then defined as a mean Weibull roller and cage numbers, which has a limit of 30 mg on rollers in most of the specifications, including Flender and DIN 51517-3. Cage weight loss is just reported without particular limits, but usually not forgotten during discussions with OEMs.

Extensive variations have shown that the quality of wear protection of the formulation is mainly controlled by the additive package.

FAG 4-step test

The most important bearing test for wind turbine gearboxes is the 4-step test run mainly on previously mentioned FE8 test rig [10, 11]. This test was developed to simulate different critical conditions in wind turbine gear boxes that could potentially occur in the field.

The procedures has four steps.

1. Short-term test performed on FE8 test rig according to DIN 51819, Parts 1 to 3 with 80 KN axial load and at 80°C for a duration of 80 hours.

2. Fatigue test with moderate mixed friction performed on FE8 test rig at 75 rpm with 100 KN axial load and at 70 °C for a duration of 800 hours.

3. Fatigue test under EHL conditions (10 bearings), performed in FAG test rig L11 at 9000 rpm, with 8.5 KN axial load, and at about 80 °C for a duration of 700 hours.

4. Deposit test at higher temperatures in the presence of water. This modified PM paper-making machine oil test from FAG is performed on a special FAG test rig at 750 rpm, with 60 KN axial load, and at up to 140°C for a duration of 600 hours.

In **Table 2**, the results of the FAG 4-step bearing test program with NUFLUX™ ISO VG 320 is summarized. The formulation achieved excellent overall result.

Test	NUFLUX™
Step 1 Extreme mixed lubrication	1.0
Step 2 Endurance test	1.0
Step 3 Fatigue life	1.0
Step 4 Deposit test	1.7
Overall Rating	1.2

Table 2: Results of the FAG 4-step bearing test

The frictional behaviours of NUFLUX™ in thrust ball bearings and cylindrical roller thrust bearings were independently evaluated in two studies by a group at the University of Porto [12, 13]. In these studies, five ISO 320 wind turbine gear oils were tested in a modified Four-Ball machine where the Four-Ball arrangement was replaced by a rolling bearing assembly which was developed to measure the friction torque as well as the operating temperature at several different points. The five oils included: one PAO-formulation, one ester-based formulation, one PAG-formulation, one mineral oil formulation and NUFLUX™ technology ("MINE"). In these two papers, it was found that NUFLUX™ showed very good frictional behavior, especially in thrust roller bearings, in which it showed by far the lowest frictional torques of all tested fluids.

2. WTGO approval process (Winergy example)

Wind turbine gear oil approvals start with extensive lab and bench testing. Once this testing is completed, and confirmed to meet technical requirements, then an approval to conduct field trials is granted by the wind turbine gearbox manufacturer. The field trial is an official part of the final approval process and can take several years.

The timeline of a full wind turbine gear oil approval is described in **Figure 6**.

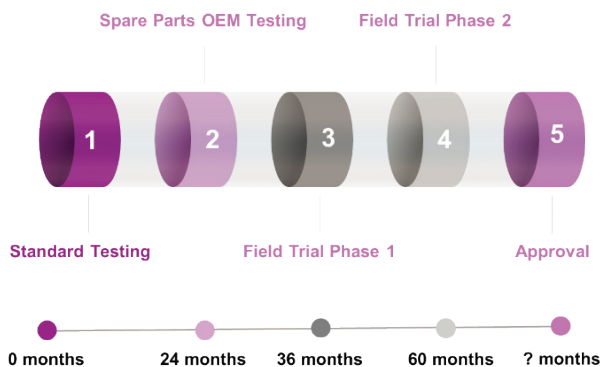


Figure 6: Estimated timeline of lubricant approval according to Winergy

Standard testing of oil parameters according to Winergy specification has estimated an optimistic timeline of six to eight months. Spare part OEM testing such as FAG 4-step test might take up to two years to be completed. Entering the first field trial phase means that the scope of the testing (number of selected turbines, specified gearbox output, frequency and depth of oil monitoring, etc.) needs to be defined in close coordination with the OEM. Usually, the first phase of the field trial is conducted on smaller number of turbines (two to five) and takes one year. After one year of successful operation with promising endoscopy and oil monitoring results, the dialogue with the OEM continues and the field trial is typically extended to more turbines and runs for another



two years. Towards the end of the second field trial phase, the testing extends from standard oil monitoring to more demanding performance tests, such as micropitting, FE 8 or filterability. This adds on significant amount of time to the overall approval timeline and after the successful completion, general approval for using new lubricant is considered. Still this can be restricted to a special customer and special gearbox type depending on the conditions of the overall approval process.

NUFLUX™ ISO VG 320 has successfully completed standard and spare part OEM testing and is approved by Winergy for the field trial phase.

3. Conclusions

After completing a wide range of laboratory and rig tests, NUFLUX™ technology fulfills all technical requirements for wind turbine gear oils. Good compatibility and high solvency of the oil can protect the equipment, and prevent deposits and varnish. Reduced gear operating temperatures allow for extended oil drain intervals.

NUFLUX™ ISO VG 320 has successfully completed the OEM testing and was approved by Winergy to enter a field trial.

As described in part one, NUFLUX™ ISO VG 320 served more than 40 windturbines worldwide. 20 windturbines were operated in Europe over more than six years without any oil change in gearboxes of Winergy, Moventas and ZF Wind.

NUFLUX™ technology has shown equivalent performance to widely adopted PAO-based wind turbine gear oils and received acceptance as a proven alternative for this demanding application.

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- End of the report -



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The Green Deal Action Plan 2021

Following the announcement of the European Green Deal (EGD) dated December 2019, which aims to ensure a green direction in people's life and industrial development, the Working Group that was formed on February 4, 2020 at the Deputy Minister level under the leading coordination of the Ministry of Commerce with the participation of the Presidency of Strategy and Budget, the Ministry of Environment and Urbanization, the Ministry of Foreign Affairs, the Ministry of Energy and Natural Resources, the Ministry of Treasury and Finance, the Ministry of Industry and Technology, the Ministry of Agriculture and Forestry and the Ministry of Transport and Infrastructure, held technical and sectoral meetings to draw up the Green Deal Action Plan 2021 (GDAP), and the relevant circular was published in the Official Gazette dated July 16. EGD aims to put an end to the climate crisis by considering the carbon-water-nitrogen balance on our planet, our lives and our livelihoods, and it particularly strives to achieve the green revolution in industry. With a new lifestyle, the EGD has the goal of ensuring unity within the European Union (EU), a fair transition, being sustainable and competitive. The new Industrial Strategy for a Globally Competitive, Green and Digital Europe, and the Circular Economy Action Plan for a Cleaner and More Competitive Europe are two important documents. These issues are prioritized in the action plans of the Independent Union of the European Lubricants Industry (UEIL) and the European Refining Industry Group of UEIL (GEIR).

The critical importance of waste management comes forward when the "Combating Climate Change" and "A Green and Circular Economy" titles among the GDAP actions are evaluated in coordination. In this context, it is important to reduce the effects of lubricants, which have completed their useful life, on the environment and the climate crisis by adopting the best waste management method. It should be kept in mind that waste lubricant is a valuable raw material for green and circular economy. We look forward to the sectoral success of Aciöz, Engin, Golteks, Koza and TAYRAŞ companies, which have environmental licenses on "Waste Oil Refining".

The United Nations Environment Program (UNEP) defines the green economy as "an economy that results in improved

human well-being and reduced inequalities over the long term, while not exposing future generations to significant environmental risks and ecological scarcities". In other words, green economy is the economy that produces increased welfare while protecting our nature and fighting climate change. Resource efficient use of production inputs is essential for sustainable production. Because natural resources are rapidly depleted, and their value is increasing, UNEP defines resource efficiency as "the sustainable production, processing, consumption of natural resources and decreasing the environmental impacts of their production and consumption over the full life cycle". In this way, new technologies are developed, green employment, green growth and profitability are achieved. The most important issue in resource efficiency is the on-site prevention and/or reduction of waste generation in production and the implementation of the best waste management method, and then, if any, bringing waste into the circular economy as within waste hierarchy. One of the driving forces of the green economy is to achieve progress in the circular economy by creating added value in the industry with minimum waste generation and recycling/upcycling the generated waste. Among the cornerstones of the green economy path is the achievement of waste management with current known-best practices. Within the green economy, which is based on ecological economy while advancing upon the principles of sustainable development, the null subject is the "Low Carbon Economy", and the decreasing consumption of carbon-containing resources is essential. Our industrialists are discussing the issues of the impacts of climate change, sustainability management, EGD Sustainable Products Initiative (SPI), Carbon Border Adjustment Mechanism and Emissions Trading System (ETS). The indisputable necessity of reducing greenhouse gas emissions is higher on the agenda. The 7th Istanbul Carbon E-Summit will take place on September 28, 2021 with the theme "Green Recovery for a Climate Resilient Turkey: The Role of Energy and Waste Management". At our summit, stakeholders will come together to discuss climate finance, our industry's fight against climate change, and best practices, and to reward the 2021 Low Carbon Heroes. We look forward to seeing you. You are welcome.

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The importance of oil analysis in predictive maintenance

Maintenance is defined as the measures and practices taken to maintain the condition of the equipment as designed or within acceptable limits. When the current state cannot be maintained and when the equipment lost its function fully or mostly, the downtime is called failure. Institutions and organizations have adopted and implemented strategies such as maintenance after failure, preventive maintenance, condition-based maintenance and reliability-centered maintenance to reduce failures and downtime. In this article, we will discuss the subject of Oil Analysis in Predictive Maintenance.

Blood test is one of the recommended tests when we have an ailment in any organ of our body. The blood test and the analyzes are examined, evaluated and a treatment method is determined. Lubricant is the blood of the equipment, and it contains critical information. These analyzes are determined according to the equipment used. In light of the information we need, the contamination levels of the lubricant, basically the water, pollution, fuel, etc. contained in the lubricant, wear levels, viscosity and additive information can tell us about whether the integrity of the equipment is preserved, whether the right oil is used or whether the wrong oil is added, what the oxidation (aging) levels are, and this information and the information for root cause analysis helps maintenance engineers and technicians to decide on the maintenance plan to be applied for their equipment.

Let's take a closer look at these benefits:

a) Occupational Safety

Fields requiring high occupational safety, steam and gas turbines, transformers are critical equipment. Periodic monitoring of turbine and oil is required as downtime must be minimized and production must be kept at maximum level.

b) Reducing Equipment Damage and Maintenance Cost

Each equipment may go through structural deterioration

and may lose functionality. It is ensured that the root causes, which are the primary causes such as oil degradation, contamination or abnormal wear, etc., are identified and taken under control, and problems such as labor and part costs are prevented with corrective applications.

c) Avoiding Unnecessary Part Replacement

By performing oil analysis on the parts that are changed periodically and by monitoring the wear values, equipment savings are ensured by preventing the replacement of parts before the end of their life.

d) Improved Equipment Life

Downtimes and malfunctions are prevented by identifying and eliminating the root cause of failures in prior through oil analysis. Therefore, it is necessary to adopt an effective oil analysis program.

e) *Appreciated Equipment

In the used equipment market, a machine with a full lubricant history typically has up to 10% higher trade-in value than the same machine without such a history.

f) Improved Operational Safety

In the following period, by having statistical data together with the oil analysis of the equipment; improved maintenance plans are determined, previous failures of the equipment are listed, root causes are identified and eliminated so you can set your own limits and targets.

g) Unnecessary Oil Change and Sustainable Environment

With oil analysis, the remaining life of the oil can be determined, unnecessary oil changes can be prevented, thus making a great contribution to a sustainable environment.

In conclusion, we can keep it under control as much as we can measure. Therefore, we must include periodic oil analysis in our maintenance plans.

***Source: Machinery Oil Analysis – Larry A. Toms Allison M. Toms**

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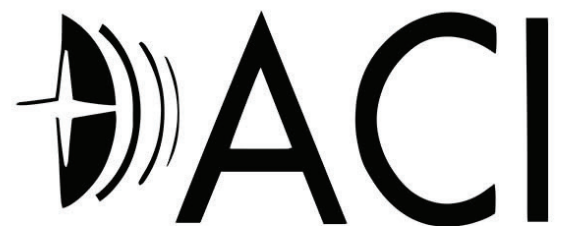
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Engine oil user guide



VISCOSITY GRADE: is the main feature of an engine oil and is important for product selection

Signification of grades



xx refers to viscosity when cold (measured at different temperatures)

The lower the viscosity when cold, the more fluid the oil is at low temperatures and the more easily it can be pumped.

For example, a 0W-20 or 5W-30 oil will make start-ups easier and will protect engines during trips to cold regions. These high technology “fluid” oils will meet the requirements of recent engines.

yy refers to viscosity when hot (measured at 100 °C)

The higher the viscosity when hot, the more viscous the oil is.

For example, a 15W-40 or 20W-50 oil has been developed for use in hot countries, and their “viscous” nature makes them suitable for older engines.



POINTS TO REMEMBER

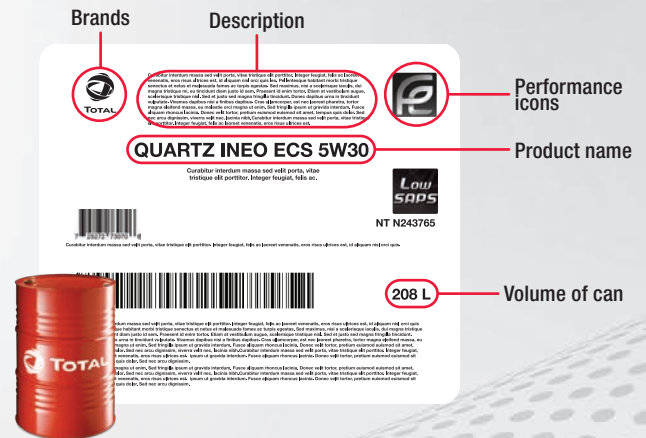
New-generation engine oils and those currently being developed by TOTAL are of increasingly fluid grades: 0W-20, 5W-20, 0W-30 and 0W-16.

How to read a product label for product selection?

Small packaging:



Large packaging:



EDITORIAL CALENDAR



Issue 33	September–October 2021
Features	<ul style="list-style-type: none"> • Latest Trends in Base Oils • Waste Oil Upcycling
Content Deadline	2 Oct 2021
Advert Deadline	9 Oct 2021
Events where magazine will be distributed	<p>Automechanika Istanbul 18-21 November – TUYAP Fair and Convention Center</p> <p>European Base Oils & Lubricants Summit 23-26 November, Amsterdam-The Netherlands</p>

Issue 34	November–December 2021
Features	<ul style="list-style-type: none"> • Bio-Based Lubricants • E-Commerce in Lubricants
Content Deadline	4 Dec 2021
Advert Deadline	11 Dec 2021
Events where magazine will be distributed	


Issue 35	January–February 2022
Features	<ul style="list-style-type: none"> • Importance of Fleets for Oil Suppliers • Electric Vehicle Fluids
Content Deadline	5 Feb 2022
Advert Deadline	12 Feb 2022
Events where magazine will be distributed	

Issue 36	March–April 2022
Features	<ul style="list-style-type: none"> • Oil Analyses • Heavy Duty Lubricants
Content Deadline	1 Apr 2022
Advert Deadline	8 Apr 2022
Events where magazine will be distributed	

Issue 37	May–June 2022
Features	<ul style="list-style-type: none"> • Marine Lubricants • Turkish Lubricant Exports
Content Deadline	3 Jun 2022
Advert Deadline	10 Jun 2022
Events where magazine will be distributed	

Issue 38	July–August 2022
Features	<ul style="list-style-type: none"> • Weapon Lubricants and Turkey • Dielectric Fluids
Content Deadline	5 Aug 2022
Advert Deadline	12 Aug 2022
Events where magazine will be distributed	





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