

Anderol Specialty Lubricants, a division of Chemtura Corp., announced that the **ANDEROL 5000 PLUS EP Synthetic Gear Oil** product series, which is designed for gear applications requiring high micro pitting resistance and protection under extreme conditions, is the first product to receive approval from General Electric (GE) for use in Off-Highway Vehicle motorized wheel gearbox applications under GE's new gear oil specification D50E35. The approvals are for ISO VG 220, 320, 460 and 680.

The new specification goes into effect on Jan. 1, 2016 and requires high micro pitting resistance and superior performance in other demanding bench tests. The off-highway vehicle industry is a growing market that includes heavy-duty equipment such as construction vehicles and mining haul trucks. These gearboxes are subjected to high loads and low speeds, which highly stress the lubricant. These operating conditions can result in micro pitting damage, a precursor to pitting and gear failure.

“On Jan. 1, the current GE OHV Gearbox oil specification D50E27 will become obsolete, and any future maintenance for existing and new equipment under warranty must use the lubricants approved under the new specification D50E35,” says Salvatore Rea, Chemtura OEM liaison. “We’re proud that ANDEROL(R) 5000 PLUS EP meets the new, rigorous standards set by GE and the growing performance demands of all industrial gearbox manufacturers.”

The PAO/ester-based ANDEROL(R) 5000 PLUS EP gear oils are formulated using a specific balance of synthetic base stocks and additives to provide superior performance to conventional oils, including significantly improved load carrying ability, excellent wear and rust protection, higher viscosity indices, higher flash points, low pour points, cleaner running systems and improved thermal and oxidative stability. This helps promote higher gearbox reliability, extended lubricant life and reduced maintenance costs for the end user.

Additional Tier 1 OEM specification approvals for ANDEROL(R) 5000 PLUS EP Synthetic Gear Oils include Flender (Siemens), Maag Gear, Hansen Industrial Transmissions, Sumitomo (Paramax Series gearboxes), and Fives Cincinnati.

[Larry Hajek](#) senior lubricant technical manager at Citgo

We need to differentiate a basic GL-5 and a SAE j2360. I have had a million mile field test with zero attack on synchronizers, no copper in oil analysis. All GL5 are not the same. GL-5 **only** is not my choice.

I have to concede there is too much GL-5 only using 60 Year old technology that can attack yellow metal but if it is a product GL-5, GL-4, MT-1 and SAE J2360 it passes many more tests including a copper corrosion test, thermal stability and thermal durability.

Widman:

There may be some GL-5 oils that do not peel off microns of brass synchronizers when engaged, but so many do that it is safer to stay away from anything that claims more than GL-4 EP performance. The individual transmission makers are (often) much more careful in their spec, but some are not. The Synchromesh fluids, although too low a viscosity for many applications, stay away from this confusion. But in 80W-90 and even 75W-90, there is too much GL-5/GL-4 in the markets that do not corrode, but peel on pressure. We really need better classifications.

[Petr Vavruch](#) Consultant

Just for people who do not know: API GL-4 no longer officially exists because the necessary tests can't be done, the parts that were tested are not available. Blenders use half the amount of EP additive specified for GL-5 and call it GL-4.

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[Juan Diego Cassarani](#) Oil companies do not test **high speed foam** on their products. It happened to me in the past in an oilfield set of gears. To see this effect, you could use a commercial blender, set

high rpm for a period of time and you will see very easily the foam formation. Test both products. Remember take note of how long does the foam take to decrease. This is not a standard test but something very useful in the field. Some anti-foam additives used in oils help up to a determined rate of treatment. If the lube company that provided the new product exceeded that treat rate, foam could be boosted instead of controlled and standard tests won't show this behaviour.

[V.S.S. Sarma](#) [Ahmet Guven](#) My friend, out of my 37 years of petroleum service, 29 have been in the area of lube formulations. No need to panic. You take 2 kg of Silicone Fluid 12500 and add it to 98 kg of Kerosine. Take 200 ppm of the resultant product and add it to the product. It just suppresses the foam. This is a universal defoamant except for turbine oils wherein a polymer is used because silicone may affect the air release value.

[Petr Vavruch](#) Everything foams when agitated, e.g. water. I vote for leaving the foam alone unless it spills on the floor or is sucked into circulation. Why is it bothering you? I also use the word 'cosmetic' for foam that does no harm. It is probably caused by contamination from previous product or deposits that are not fully compatible with the new brand. Was there a good reason to change the brands??? Gear oil formulations usually contain defoamant, the new brand might contain less of it, no big deal. Oil injectors: if the flow is too strong and oil foams on impact, the gear teeth are probably pitted by now - foam is not a good lubricant.

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The most common is ISO VG 220 EP gear oil containing mineral Group I base stock.

With lubricating oils, it is useful to consider 3 main aspects before anything else:

1. Base oil quality: If not good enough, the lubricant can't be good. For normal conditions, good quality Group I is enough for gear oils. At operating temperatures above 90 °C - or when the OEM insists on it - synthetic PAO EP gear oil should be used. In worm gears with phosphor bronze wheels always use synthetic PAG - but I'll concentrate on spur and helical gears from now on.

2. Viscosity: ISO VG 220 EP gear in large gearboxes. In smaller gearboxes, the next heavier oil, ISO VG 320 is often used.

As usual, the viscosity depends on (a) what you lubricate - gears, (b) the load, and (c) the speed - you assume that the gearbox is designed correctly for the load and speed.

The rule of thumb is that the minimum recommended viscosity for a well designed enclosed gear set driven by an electric motor and not overloaded or exposed to shock loads is 33 mm²/s (cSt) at the operating temperature. The optimum viscosity is 40 mm²/s at the operating temperature.

In the viscosity-temperature chart you then find the right viscosity grade based on the operating temperature.

3. Performance/additives: sulphur-phosphorus EP but only 2.1% of the additive as you do not have hypoid gears found in automotive rear axles. The EP is needed for preventing wear = the crucial performance requirement in gears.

However, you also need quite a few other additives. Almost all lubricants contain Rust and Oxidation inhibitors, gear oils also contain pour point depressants, demulsifiers and defoamants. Perhaps also a friction modifier for better efficiency.

Because you cannot prevent people from using your EP oil in worm gearboxes, you add metal deactivator (yellow metal corrosion inhibitor) to slow down your EP attacking the bronze wheel.

I am ignoring oils needed for continuously variable transmissions and open gears.

Biswa

I expected that someone will follow up on my entry. It concerns types, as you wished, or rather performance levels. I'll discuss only EP gear oils. As you know, the performance is, in this case, achieved by additives, more particularly EP. There are several EP packages available, some are better, some are, particularly older ones, cheaper. Then it depends how much of the additive you

put in. You save money if you use only 1.8% instead of 2.1%.

1.8% could still give you a fail stage 12 in the FZG test (the best EP test for gears because it uses gears to show wear).

Premium products will at least meet the German spec DIN 51517- Part 3 (CLP).

The best products will be approved against the difficult (because it's badly specified) Siemens MD specification (formerly known as the Flender specification).

So you have at least 3 different performance levels.

Other specifications that could be mentioned (and the product designed to meet them) are:

(International:) ISO 12925-1 Type CKD,

(and American:)

US Steel 224

AGMA 9005- EO2

David Brown S1.53.101

Then there are some national specifications in other countries.

Suppliers must be able to tell you what specifications are met.

Clearance and backlash are two design features that can affect lubricant efficiency in gears. Clearance is the distance between the top of one tooth to the base of the tooth on the other gear. It is a function of the height of the tooth. Backlash is the distance between the back of one tooth and the front of the next mating tooth. It is a function of the width of the teeth. If there's not enough backlash, lubricant may not coat the teeth properly, which can lead to overheating, noise, tooth wear and failure.

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In a practical observation you can notice that the PAOs and the PAGs declines about 10 °C of a gearbox shell temperature, so you can conclude that yes the synthetics lubricants indeed has a better energy saving than mineral oils.

[Vergheze PF](#) Manager OEM Business at Indian Additives Ltd.

PAO as base fluid was developed even before Gp III and used typically for meeting cold temperature requirements of both Automotive and industrial lubricants. however, they do have their own limitations like lower additive solubility, limit viscosity grade coverage, impact of seals and finally the price.

On the FE perspective it can be seen both ways that is PAO doesn't all that great performance in terms of FE on account of its coefficient of friction, and when formulated its not great either in shear stability a key requirement for FE in engine oils. The potential to increase drain interval is as good with Gp III as compared to Gp IV or V. PAO probably does well in cold temp performance but then do you want to pay 4 times more for PAO than increase you PPD dosage by few %age.

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[Mile Stojilkovic](#) Director of development lubricants at NIS Gazprom Neft

API MT1- for non-synchronized manual transmissions buses and heavy trucks that are exposed to high operating temperatures, and there is no requirement for the EP performance. For manual transmissions and type EATON FULLER. A similar specification MIL-L-2105 E

[Petr Vavruch](#) Consultant

To Luna: It might not be just an additive, Roadranger (their own) lubricant is synthetic.
<http://www.roadranger.com/rr/ProductsServices/ProductsbyCategory/Lubricants/index.htm>

I don't know if this list is still valid:

<http://www.roadranger.com/Approved> Lubricant Suppliers TCMT0020 October 2010.pdf

[V.S.S. Sarma](#) Technical Manager

Matias: There is one product by name Emgard SAE 50. This meets API MT-1; ArvinMeritor 0-81; Eaton PS 164 Rev 7; International TMS 6816; Mack TO-A Plus; Volvo 97305; ZF-Freedomline specifications.

[http://e-applications.basf-ag.de/data/basf-pcan/pds2/pds2-web.nsf/7DA6D658349142BFC125757700445133/\\$File/EMGARD_2979_SAE_50_E.pdf](http://e-applications.basf-ag.de/data/basf-pcan/pds2/pds2-web.nsf/7DA6D658349142BFC125757700445133/$File/EMGARD_2979_SAE_50_E.pdf)

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[Toby taylor](#) Consultant Tribologist at MT.TRIBOS

Santotrac (Dupont) material has one of the highest pressure coefficient's than any other materials (I have tested) using the Amsterdam Pressure Viscometer Rig. This data is in the public domain). Work I did in the tribology section at Shells Thornton Research Centre circa 1976.

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Ludwig, L. G., "Lubrication Selection for Enclosed Gear Drives," Machinery Lubrication, Noria Corporation, Tulsa, OK, November 2008.

A method attributed to renowned gear expert Robert Erricello (4) is based upon a calculation method that employs the following equation:

$$V_{40} = 7000 / \sqrt{V_1}$$

Where V_{40} is the viscosity at 40°C, in cSt

V_1 = pitchline velocity of the lowest speed gear in the gearbox in feet per minute = 0.262 X speed (pinion rpm) X pinion diameter (inches)

If there is no oil cooler on the industrial gear drive, it is best to determine the maximum expected ambient temperature during operation and:

- a. Increase one ISO viscosity grade if the ambient temperature exceeds 35°C (95°F).
- b. Increase two ISO viscosity grades if the ambient temperature exceeds 50°C (122°F). If there is an oil cooler, the maximum ambient temperature is less important because the oil's temperature can be controlled. Therefore, the oil's temperature should determine the viscosity.
- c. Increase one ISO viscosity grade if the oil temperature exceeds 65°C (150°F).
- d. Increase two ISO viscosity grades if the oil temperature exceeds 85°C (185°F).

If the oil temperature exceeds 90°C (194°F), use a cooler such as a fan or a heat exchanger.

<http://www.gearsolutions.com/article/detail/6430/purchasing-gear-lubricants--be-careful-when-playing-the-numbers-game>

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Alexey Muralev / Richard Widman: I have now verified. It appears that 50 ppm of Calcium is normal in gear oils.

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Micropitting By V.S.S. Sarma?

To identify the right lubricant, operators need to initially understand what can go wrong with the gearboxes. While it is true that the causes behind many failures are the way the gear meshes and bearings are aligned, the choice of lubrication can have a major impact of failure

rates.

Micropitting is surface fatigue that can result in micro-cracking and the formation of minute micropits which can sometimes give a metal surface a frosted or grey appearance. In some instances, micropitting can cause whole gear teeth to break off.

Although micropitting accurately describes the appearance and mechanism of the problem, it is sometimes also referred to as fatigue scoring, flecking, frosting, glazing, grey staining, microspalling, peeling, and superficial spalling.

This condition occurs under mixed-film elastohydrodynamic lubrication (EHL)—where oil film thickness is of the same order as surface roughness average, and where load is borne by surface asperities and lubricant. In addition to contact stress due to normal loading, sliding between gear teeth causes tractional forces that subject asperities to shear stresses.

Micropitting is complex, unpredictable and difficult to control, despite extensive research on the problem. That said, there are ways to help prevent it happening in the first place. Engineers should maximize lambda (using a thicker film to coat the gear teeth and prevent them from touching), optimize gear geometry, optimize metallurgy, optimize lubricant properties, and protect surfaces during running-in.

Testing of different lubricants can actually show how micropitting can progress with inferior lubricants. Lubricants' performance differs under speed and load sometimes giving rise to potential catastrophic pitting:

http://windsystemsmag.com/media/Images/figures/2013_April/0413_Castrol_Fig2.jpg

From:

<http://windsystemsmag.com/article/detail/485/cross-technology-drivetrain-lubrication>

LE 2011:

While the lubricant industry is considered a relatively mature industry, there are still areas of active research. The leading edge for lubricant manufacturers is to formulate products that can be used in the challenging wind turbine gearbox applications.

Over the years, wind turbine OEMs have found that their gear sets are notorious for micropitting, also sometimes called fatigue scoring, flecking, frosting, glazing, gray staining, microspalling, peeling or superficial spalling. Erichello describes it like this: "Micropitting is surface fatigue occurring in Hertzian contacts, caused by cyclic contact stresses and plastic flow on the asperity scale that results in micro-cracking, formation of micropits and loss of material."

The FVA 54 test evaluates this phenomenon. This test, which is specific to base fluid, viscosity and additive chemistry, is not easy to pass. This is why some wind turbine OEMs have come to respect the data from this test and have now incorporated it into their specifications. Several OEMs also require a passing result for their general industrial gear specifications, i.e. FVA 54 Micropitting Load Stage > 10.

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If you have a reducer that is water-cooled and the water temperature is too cold, it could condense and put water in the oil. If you notice the gear reducer sweating or water on the floor or on the cooling water lines going into the gear reducer, you probably have water in the gear reducer. When you find this problem, first increase the temperature until the water lines quit sweating. Second, perform oil analysis on the reducer and check for water. If this issue isn't corrected, it could be catastrophic.
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Problems with Komatsu 930E wheel motors, such as varnishing, viscosity shear

[Jean-Michel Demaret](#)

Qualified Engineer / Senior Account Manager

Hello Matt. I assume you are using a ISO VG 680 gear oil approved by GE for the lubrication of your Komatsu.

You can make a parallel between a wind turbine gear set up and the wheel gears of your machine. The power is similar they both have a double planetary reduction (and more for the wind turbine). That's 16 points of meshing (4 planetaries per reduction). The volume of oil in the wheel motor of your Komatsu is half the volume of oil in the wind turbine.

The oil may just shearing under repetitive stress and drops its viscosity. The less oil you have the more repetitive stress each molecule of oil endures.. If the molecule of oil breaks in smaller molecule the viscosity of the oil drops. The gear oil is likely a Poly Alfa Olefin (PAO) base stock. PAO of high viscosity are expensive and sometimes difficult to find. The manufacturer of your oil may use a product called Poly Iso Butene (PIB) to fortify (rise) the viscosity of the oil from a PAO of lower viscosity. PIB are quite easy to shear compared to PAO. You may want to ask you oil supplier the typical/max content of PIB in the gear oil. All the oils meeting GE specs are not equal. GE specs is a minimum to meet the requirement. Finally you may have a leakage of the brake cooling fluid in the gear oil. Ask your oil supplier or lab analysis tech what are the additives in new gear oil and in the new hydraulic/brake cooling (ask for phosphorus, zinc, calcium and magnesium) and check in the used gear oil analysis if you have any foreign metals which may be coming from the brake cooling fluid..

For the varnish it is related to high temp which is just a symptom of the operation. Heavy load, steep ramp and the trucks carry a small volume of oil. Filtering the oil with a 3 to 5 microns filter should remove the oxidation byproduct in suspension in the oil and decrease the varnish deposit. However there are very few filtration system able to work correctly with an ISO VG 680, the oil is very thick.

I use Borate gear oils in worm gears with extremely good results.

By Richard Widman

What is the moisture limit for Shell Omala HD 320 oil

[Peter Weismann](#) Technical Director bei OelCheck GmbH

Moisture limit is not set by the lubricant manufacturer. The component manufacturers like the bearing manufacturers but also some insurance companies have specified limits for gear oils.

Water should be lower than 250 ppm, no matter whether it is in Shelll Omals HD 320 or in any other gear oill (except oils on glycol base).

We found typical values in more than 100.000 samples of Omala HD 320 out of main drive gears for windmills of less than 150 ppm.

The limit for water which may influence the oil if no Regulation is given should in my opinion not exceed the 80% Saturation Point which is at app. 750 ppm at 25 °C.

[Raja Mukherjee](#) Business Head - Cement / Power & Mining at Klueber Lubrication India

Polyglycols – composition and characteristics

Synthetic fluids such as polyalphaolefins and polyglycols are all based on ethylene, which is obtained by cracking petroleum. Polyalphaolefins are made by polymerising the olefin 1-decene, which in turn is the product of the oligomerisation of ethylene. Chain length, branching and branching points in the molecule are the factors determining viscosity, viscosity-temperature behaviour and pour point of the fluid

The reaction of ethylene and propylene with oxygen leads to the generation of ethylene oxide (EO) and propylene oxide (PO). In polymerisation process, these are turned into polyalkylene glycols. The mixing ratio of EO and PO as well as the oxygen contained in the chemical structure have a decisive effect on the behaviour of polyglycols. Most of the polyglycols used in the gear industry have a EO/PO ratio of 50:50 to 60:40 and are consequently very similar in their behaviour. These types of polyglycols are discussed in this article. Polyglycols of this composition are normally referred to as water soluble polyglycols. However, their particular behaviour is due to the fact that they contain oxygen, which lends these polyglycols their strongly polar character.

Water - miscible and water - soluble

Because of their chemical structure, polyglycols absorb a greater or lesser amount of water. This behaviour is dependent on the ethylene glycol to propylene glycol ratio, but a distinction must also be made between water-solubility (absorption due to water being added) and hygroscopicity (water absorbed from air humidity). Water-solubility: The degree of water-solubility of polyglycols is determined by their content of ethylene oxide groups. Pure propylene glycols (EO/PO = 0:1) are not water-soluble, but can still absorb up to 3 % of water. By contrast, polyglycols with a mixing ratio of EO/PO = 1:1 or higher are fully water-miscible, the only limit being temperature, i.e. at higher temperatures solubility decreases depending on the EO/PO ratio. For polyglycols with a EO/PO ratio of 1:1, this temperature is at 60 to 65 °C.

Hygroscopicity: The tendency of polyglycols to form a hydrate envelope is strong enough to absorb air humidity, which means that they are hygroscopic substances. Also for the degree of hygroscopicity it is important which type of polyglycol one is dealing with. While pure propylene glycols can absorb 3 % of water at maximum, this figure is 10 % for 1:1-types (both percentages for ambient temperature and an air humidity of 80 %). However, water absorption from the air is strongly influenced by relative air humidity, temperature, surface and time. The saturation concentration mentioned will rarely be reached in enclosed gearboxes since in such applications the oil surface is very small in relation to the oil volume. Moreover, the gears rarely stand still, so there is not much time for such exchange.

[Pedro Vieira](#) Technical Director, Key Account Manager Industry Customers

In a general way the limits for water in used industrial gear oils may be considered (start to have caution):

Mineral and PAO - 200 ppm

Ester based oils - 100 ppm

Polyglycols - 2% but depends on the type of the PG

[Raja Mukherjee](#) Business Head - Cement / Power & Mining at Klueber Lubrication India

Shell Omala is a synthetic hydrocarbon based high performance oil. My comments was not for any brand specific, as per industries standard maintenance practice, following range is considered as permissible performance limit for PAO , mineral & PG series oil

PAO - within 750 ppm (water contain in used oil)

Mineral oil - within 500 ppm (water contain in used oil)

PG - within 2% (water contain in used oil)

What I feel still there is lack of understanding / confusion regarding safe water contain limit particularly in PG oil.

[Peter Weismann](#) Technical Director bei OelCheck GmbH

The polyglycol based former called Shell Tivela S 320 gear oil is now (since app. 2 years) renamed to Shell Omala S4 WE 320.

[Hussam Adeni](#) Business Head and Lubricant Specialist at P N Trading

The MSDS of Omala HD 320 and Omala S4 GX 320 mentions it to be a
COMPOSITION/INFORMATION ON INGREDIENTS

Preparation Description : Blend of polyolefins and additives.

<http://www.scribd.com/doc/213950300/Shell-Omala-Oil-HD-320-msds> (Needs scribd subscription for downloading)

http://www.epc.shell.com/Docs/GSAP_msds_00317742.PDF

One of the vertical mill/pulverizers in our power plant is using Castrol OBM 320

[Helmi Mustakim](#) Reliability Engineer at Sarawak Shell Berhad

Other pulverizers are using Shell Omala 320 & 220. The water content for the mill with Castrol OBM 320 is way higher then the Shell ones. Current KF reading is 844 ppm (previously 909 ppm, 800 ppm, 700 ppm & 682 ppm). We don't have any problem with the Shell oil, water content not more than 120 ppm. We have check the lube oil cooler, no leakage. Castrol said the oil is non hygroscopic & suspected from condensation/ingression.

[Peter Weismann](#) Technical Director bei OelCheck GmbH

I assume the Castrol oil (the OBM 320 is not a correct product name, also no information in the internet) contains a moly-organic additive combination. For this oil, the fresh oil values are around 600 to 700 ppm. For Optigear-oils (mineral and synthetic) water values in used oils up to 1200 ppm are typical. Mostly the friction modifying additive reacts with the Karl Fischer Solution and indicates water in the iodine reaction of the K.F.Titration, even water is not present. We have more than 15.000 used oil samples tested in our lab. We could not find any correlation between the high water values and wear or additive depletion. But Note: For the conventional Sulfur/phosphorous oil types water values should not exceed 300 ppm.

[Helmi Mustakim](#)

The correct name is Castrol Optigear BM 320. Previously we used Shell Omala 220 for all the mills. Unfortunately high vibrations of the mills have always been a problem to us; some gears even experienced heavy spalling. While we try to tackle the root cause(s) of the high vibrations, the immediate action we implemented was to put in thicker oil; a few of the units have Shell Omala 320 in & this particular mill with Castrol Optigear BM 320. The idea is to 'smoothen' the contact surface. Now the additional problem to high vibration is the existence of high water content in the oil (Castrol oil). We are concerned of this high water content might have an effect to accelerating the gear tooth wear, or even corrosion, while we are still trying to eliminate the high vibration issue. Castrol representative claimed the high water content was due to high condensation, since we're using thicker oil. I refused to accept that theory because Shell Omala 320 or even 220 did not have any significant increase in water content.

FYI, this Castrol oil has high levels of Moly, P, Mg & Zn in it.

We have been using this Castrol Oil for roughly 4 months. Fresh Castrol oil has 300ppm of water.

The oil came straight away from the supplier, never stored in our warehouse, so if there was any contamination it should be from Castrol. Anyway to answer your questions, the sodium level is low, 1ppm, TAN is high (3.98mgKOH/g for fresh oil).

[Peter Weismann](#) Technical Director bei OelCheck GmbH

Helmi, don't worry about the water or an increased AN. The AN will firstly go down to app. 2.5 (within 5.000 to 10.000 hours) and after that it will increase up to 5.5 (after more than 20.000 hours) what we are using as a condemnig limit. The most sensitive value you should look out for the change is Mo, which used as a friction modifier and is an essential part of the additive concept. But please be aware that most used oil laboratories have no high Mo Standard and therefore not calibrated their ICP or RDE with the Mo up to the high numbers. Also sometimes they are using the wrong line or line shift settings for determination. In the Optigear BM the real fresh oil value for Mo is app. 1.800 ppm). If this value is reduced by more than 40%, you should consider an oil change.

If you would like to receive an independent qualified diagnose by experienced German mechanical engineers (price 18.50€) about your application you can e-mail your lab data to info@oelcheck.de

[Giannis Tzevelekos](#) BP OIL HELLENIC SA

I totally agree with Peter and his comments. Our experience with this oil has only been positive especially compared with mineral oils with conventional EP additives such as Shell Omala or BP Energol GR-XP 220 series. There are many examples of gearboxes with OBM 320 having the same lubricant for more than 7-8 years with no problems.

Although water concentration is important, metal and additives concentration should be your most basic indicators about the gear surface. If you notice metal concentration (Fe, Cu, Cr) above normal limits or an increasing trend of their concentration then there might be some kind of wear on the gear surfaces or the bearings of the gear box. Furthermore if you notice additives depletion (Mo, P, Zn, Ca) through used oil analysis, there is a reason for that depletion (high loads?).

[Karen Kung](#) International Sales in Oil Purifier

Hi, Helmi, sorry couldn't make some suggestions on your problem.. But if finally tested that the problem caused high water content in your oil, you can contact me-----oilpurifier-kung@hotmail.com

we are a Chinese professional manufacture in Oil Purification machine--clean impurities, dehydration, degassing in lube oil & insulating oil.

Keep us in record for in case in the future.

[Ross Kovanda](#) Owner/Vice President at American Chemical Technologies, Inc.

I have heard of this product, but wanted to mention I have developed a new technology PAG based gear fluid utilizing new additive technology. I all tests conducted, it has shown excellent results in all testing conducted. I would be happy to share some of the data with you. Based on the high VI, we have seen applications where we can reduce the ISO grade one or two grades and still maintain the viscosity of PAO or other gear fluid technologies. I can be emailed at rkovanda@americanchemtech.com

[Richard Widman](#) Owner, Widman International SRL

The first step would be eliminate the condensation. Donaldson has a complete line of TRAP respirators that have long lives and cut relative humidity down to 15%.

[Peter Weismann](#) Technical Director bei OelCheck GmbH

if you are changing to glycol based (PAG) products (what I would never recommend), the water content in those oils is even much higher. Fresh oils app 1500 ppm. For used oil up to 3000 ppm can be tolerated. But watch out for the incompatibility of PAG with seals and other mineral or synthetic oils.

Since the water content for the OBM is at 15% humidity in the fresh oil already more than 500 ppm, a respirator would not help much for this oil type. Especially since water in the Optigear BM up to 1.200 ppm is not a problem at all.

[Ross Kovanda](#) Owner/Vice President at American Chemical Technologies, Inc.

You might be talking about OLD technology PAG's with seals and mineral oil incompatibility.

Remember, there is a difference between incompatibility and insolubility. The combination of PAG and mineral or PAO does not create a strata layer or some precipitate, it just splits the two products into a separate level. Yes, these fluids can handle up to 7500 ppm of water in solution, but the gearing only sees DRY Fluid until the level goes beyond 7500 ppm, then you would have free water. I don't understand your comment of "never recommend", PAG technology far surpasses mineral or PAO based fluid technologies in all aspects.

Rüdiger Krethe

The capability of an oil to handle water, that means the water content in ppm before it becomes free or emulsified, depends at first from the fluid type (base oil and additives) and at second from the operating condition (temperature and pressure). It is a normal thing that the oil "communicates" with the humidity in the atmosphere around.

Castrol Optigear BM has a totally different additive technology than oils like Shell Omala. The type of additives and the much higher additive level leads to a much higher saturation level of the Castrol oil (and a high acid number too). Even for the fresh Castrol oil a water content of 500 ppm is not a problem. The Castrol oil in service should have a higher water content in comparison to the Shell Omala oil, this is a normal situation. Higher than 1000 ppm the Castrol oil should not have in service.

Castrol Optigear BM is a mineral oil with their MFT additive (microflux trans) which is claimed to help smooth out imperfections in gear teeth that have already shown signs of wear.

But there is another fact to be considered: The measurement method. **There are two different methods in accordance to "Karl Fischer" available.** For this oil the so called non-direct should be done. The non-direct method uses dry nitrogen to transport only the humidity of the sample in the measurement chamber of the titration device, but not the oil itself. The type of additives in Castrol Optigear BM leads to higher ppm readings using the direct titration method. Be sure that your high water content is measured using the non-direct method. Another way to clarify whether the water is solved or free: Use a sensor onsite to measure the relative humidity in percent. If it is much lower than 100% in operation there is no problem for you.

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How to extend the life of your wind turbines

My view is that current formulations are geared toward anti-wear and have no EPs. Focus is on energy efficiency not equipment protection. From what I see they do not protect against fretting wear nor against shock load. Looking at wind turbines I see them changing direction very quickly, in a jerky fashion. This is the best example of shock load if there is one. Sometimes they barely turn or not at all. Best situation for fretting wear.

Wind mill manufacturers already have strict guidelines for filtration including breathers with desiccant. This is not the issue for premature failure. Philippe-André Boileau

John Lorenzo HCM,Pdm Speciyo as it may sound.alist at Rio Tinto/Kennecott

they are designed to run to fail... I have never seen a piece of equipment so expensive with so many design failures.. I would start with vibration monitoring and most important by-pass filtration!!!! The manufactures in my opinion have the guide lines in place to ensure they fail.. Just my opinion as funn

JR (Rick) Roberts CEO/President at R & R Universal Technologies, Inc

Single biggest problem seems to be vibration, second rate of time during change of direction. These two are in the design. Better filtration will remove the wear metals create by the first two.

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The daunting Siemens MD specification (formerly known as the Flender specification). The Lubrizol products, FM2205A, FM2206A and FM2207A industrial gear oils, ensure trouble-free performance in heavy-duty gearbox application

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Wish to add few more specifications to what Petr has already indicated i.e. API GL-4 & API GL-5. These are: AGMA range of industrial lubricants with approximately similar compositions; API MT-1; ArvinMeritor specifications like 0-76-A, Cincinnati, DAF, David Brown S1.53.101 types, DIN 51517 types; Eaton Europe and Eaton Europe extended drain types; FAG; Ford M2C917A types; ISO 12925; IVECO, Komatsu, Mack, MAN, MAN B&W; Mercedes-Benz; MIL-L-2105D; MIL-PRF-2015E, Renault specns, SAE J2360; Scania, US Steel 224; Voith, Volvo, ZF, etc. I think that these are about 250-300 of them. By Sarma

V.S.S. Sarma • MB 235.1 specification products are perhaps based on Anglamol 99 only.

But then MB has so many specifications for gear oils like 235.0 (Angl 99, Ang 2000), 235.1 (Ang 99), 235.20 (2099G, SLF 2026), 235.27 (Inf D3314), 235.29 (Emgard MTF 4200 75W80), 235.4 (2140, SLF 8219A), 235.5 (Axcel S, Hitec 381, Ang 99), 235.6 (Hitec 381, Ang 99, 2000) 235.8 (Emgard UAF 4209, Emgard UAF 75W90, 2000, SLF 8203A) etc.

Lubrizol's Anglomol 99 is a uniquely high quality gear oil package. Some secrets about this product can not be divulged in a public forum. Lubrizol's Anglomol 2000 has again many excellent applications as can be seen above.

One such additive is Anglamol 99 (meets a variety of specifications such as: API GL-4, API-GL-5, DAF, MAN 341 Type E-1, MAN 341 Type Z-1, MAN 341 Type Z-2, MAN 342 Type M-1, MAN B&W, MB 235.0, MB 235.1, MB 235.5, MB 235.6, MIL-L-2105D, Renault GL-5, Voith 3.325-339, Volvo 97305, Volvo 97310, Volvo 97311, Volvo 97316, ZF TE-ML 02, ZF TE-ML 02A, ZF TE-ML 02B, ZF TE-ML 05A, ZF TE-ML 05C, ZF TE-ML 07A, ZF TE-ML 08, ZF TE-ML 12C, ZF TE-ML 16A, ZF TE-ML 16B, ZF TE-ML 16C, ZF TE-ML 16D, ZF TE-ML 16E, ZF TE-ML 17A, ZF TE-ML 17B, ZF TE-ML 19A, ZF TE-ML 19B, ZF TE-ML 19C, ZF TE-ML 21A).

Another additive is Anglamol 6043 (meets a variety of specifications such as: API GL-4, API GL-5, API MT-1, Arvin Meritor 0-76-A, Arvin Meritor 0-76-B, Arvin Meritor 0-76-D, DAF, IVECO, Komatsu KES 07.868.1, Mack GO-J, MAN 342 Type M-2, MAN B&W, MIL-PRF-2105E, SAE J2360, Scania STO 1:0, ZF TE-ML 05A, ZF TE-ML 07A, ZF TE-ML 08, ZF TE-ML 12E, ZF TE-ML 16B, ZF TE-ML 16C, ZF TE-ML 16D, ZF TE-ML 17B, ZF TE-ML 19B, ZF TE-ML 21A).

In situations warranting limited slip requirement, these manufacturers recommend that a small dosage of about 2.5% by weight of Anglamol 6097 be added to the oils as a top-up. This recommendation is based on field trials.

The challenge for the additive in a CVT is different to that for a step-type automatic transmission (AT). Step AT's employ friction plates with paper (cellulose) friction material. Whereas CVTs have a steel to steel interface requiring different friction properties, strong wear protection and high film strength.

Top treated ATF's deliver the same performance as first-intent formulations.

This is Incorrect. That's a bit like suggesting that by putting an F1 champion behind the wheel of your ordinary road car, your car could go head-to-head with an F1 car on the racetrack. Meeting the stringent formulation parameters set by automakers requires specific base oil and additive combinations. Adding top treats can be seriously detrimental to fluid performance and is not recommended by the automakers. Performance that may be compromised includes shifting, oxidative stability, fuel efficiency and diminished transmission life. There is also a risk of increased wear, caused by an improperly balanced additive system. If the basic performance is not there from the start, then top treating won't miraculously get you there.

All tractor specifications are backwards-compatible, so I only need the manufacturer's newest version.

Never assume compatibility! Although standards tend to get more demanding over time, and some OEM specs do cover previous versions, this doesn't mean the latest fluid will always be compatible. Hardware changes, like new friction material in wet brakes or transmission clutches, could mean newer lubricants are required. Always check your owner's manual for the proper fluid recommendation.

Only a branded transmission fluid will work in my off-road vehicle's transmission.

It sounds plausible but isn't true: any legitimate lubricant that is designed to cover all the performance specifications outlined in the operating manual will work equally well. Certain lubricants may offer added value though – look out for further benefits such as longer drain intervals, reduced parts wear and improved cleanliness.

Is it true that all ATF's needs to be red?

No. Although you'll be familiar with the red dye in most passenger car ATFs, it is not mandatory. The red dye tradition was introduced in early DEXRON® and MERCON® fluids, to help differentiate ATF - with its special friction characteristics - from other lubricants. These days you'll still find red dye in many ATFs, but it's not universal. Many first fill fluids aren't red, and OEMs don't request the dye.

Lower viscosity oils can compromise gear wear protection because of reduced film thickness.

This may or may not be true, depending upon the viscosity required by your vehicle's transmission hardware. Fluids are typically designed in concert with the transmission, and the viscosity is optimized for its operation including the tolerances and the pump capacity. Fluids being developed today are thinner than those of past years to impart fuel efficiency improvements with the new transmission designs. However, these new lower viscosity fluids are formulated with the latest additive chemistry to ensure that they also protect the transmission from premature wear. Using fluids that are too thin for your transmission's design, can create performance issues. Conversely, using fluids that are too viscous for the transmission system, can create inefficiency. Simply put, check your owner's manual and use the viscosity recommended by OEM.

Synthetics (PAO) base fluids are superior in all aspects

This is typically a true statement. PAO fluids are designed to deliver maximum oxidative and thermal stability, and enhanced durability (fluid life) with minimal frictional losses. However, it should be noted that PAO base stocks cost more than mineral base stocks, including Group III base oils.

Group II+ and Group III+ are official API base oil classifications.

No. Groups II and III are the official base oil classifications, II+ and III+ are not. However, while the added '+' is not official, it is acknowledged in the industry as referring to the high end 'cuts' of Groups II and III. More commonly used in Crankcase, but also seen in Driveline, these '+' cuts have a higher Viscosity Index (VI) than other base oils in the same group. (VI is 112-119 for Group II+, VI is >130 for Group III+).

DEXRON®-VI ATF:
HiTEC® 4006Y

Economic standard premium top
HiTEC® 410 HiTEC® 419 HiTEC® 429 HiTEC® 2414 HiTEC® 481 HiTEC® 2018 HiTEC® 4014 HiTEC® 4006

HiTEC® 3421 automatic transmission fluid (ATF) additive has been formulated to meet the stringent transmission fluid requirements of Ford and General Motors, and it suitable for use in all Ford and GM vehicles of model years 2005 and earlier, excluding those vehicles specifying a Type F® fluid.

http://www.aftonchemical.com/ProductDataSheets/Driveline/HiTEC-3421_PDS.pdf

HiTEC® 2414 additive package is a unique single additive solution providing TASA to IIIH performance, allowing oil companies to rationalise their inventories and simplify their logistics. For Ford and GM vehicles of model years 2006 and earlier and the major European HiTEC® 2414 additive package provides additional customer benefits in terms of:

- Compatibility in a wide range of base stocks
- Friction retention, improving clutch durability
- Load carrying and oxidation performance, which extends fluid life and provides transmission protection
- Approvals from all the major commercial vehicle AT manufacturers (ZF, Voith, Allison)
- Core technology approvals by MB, ZF, VW & BMW for passenger car applications

Approvals or meets requirements/approvals not possible/formerly approved/approvals not possible/original approval possible/suitable for use
Allison C-4

CAT TO-2

MB 236.6 / 236.7

TASA

MB 236.1

MB 236.5

IID*Powersports

The aggressive driving conditions and sudden stops common to some on- and off-road motorcycle and ATV applications can literally boil conventional brake fluid, leaving behind a discolored, dirty solution that can promote deposit formation and corrosion on braking components. Worn brake fluid also fails to deliver adequate protection against water ingress common to powersports equipment exposed to the elements.

The synthetic base stocks and superior additives in AMSOIL Synthetic Brake Fluids excel in

Voith 55.6335

ZF 02F

MAN 339 Z1 & V1

MAN 339 Z2 & V2

Ford*

ZF 03D

ZF 04D

ZF 09

ZF 11A

ZF 11B

ZF 14A
ZF 17C
III G*
Allison TES-389
III H*
Volvo 97341
MB 236.9
MB 236.10
Volvo 97340
Voith 55.6336
ZF 14B
ZF 16L

HiTEC® 2414 is recommended for use at a treat-rate of 11.9% wt.

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http://www.aftonchemical.com/ProductDataSheets/Driveline/HiTEC-2414_PDS.pdf

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Phillips 66 Lubricants has announced the addition of two new heavy-duty synthetic transmission lubricants to its Commercial product line—Triton Synthetic MTF and Kendall SHP Synthetic MTF. The new manual transmission fluids are full-synthetic, fuel-efficient transmission lubricants designed for use in heavy-duty commercial manual transmissions operating in extreme temperatures and extended service intervals. Both products are approved for service fill under the new Eaton PS-386 specification (supersedes Eaton PS-164 Rev 7).

“Our Triton Synthetic MTF and Kendall SHP Synthetic MTF were developed to provide excellent shear stability and anti-wear properties to protect synchronizers, reduce component wear and promote longer transmission life,” said Tony Negri, [Phillips 66](#) Lubricants’ director of marketing, commercial lubricants. “Both products are ideal for use in newer, higher torque manual transmissions coupled with increased horsepower engines.”

Full-synthetic Kendall VersaTrans LV **ATF** is formulated to help ensure long service life and to provide consistent shift performance for the life of the fluid. Additionally, this low-viscosity fluid results in less frictional drag for improved transmission efficiency, thereby offering the potential for improved fuel economy.

Kendall VersaTrans LV ATF is licensed as **Ford MERCON LV®** and **GM DEXRON® VI** ATF. It is recommended for use in the newer Ford, GM and Toyota passenger car and light truck automatic transmissions, which require use of modern, low viscosity ATFs.

Kendall Motor Oil’s new CVT Fluid offering is designed with carefully balanced frictional properties to meet the unique requirements of passenger cars with belt-driven continuously variable transmissions. Compared to conventional all mineral fluids, this new synthetic fluid provides enhanced performance in oxidation stability, wear protection and service life. Kendall CVT Fluid is recommended for use in most Honda, Jeep, Mitsubishi, Nissan, Subaru and Suzuki vehicles with CVT transmissions, under all operating conditions, including extreme temperatures.

<http://www.phillips66lubricants.com/>

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[Larry Ludwig, CLS, OMA, CMFS](#) • The Type A specification is an obsolete specification GM introduced around 1948 for their **automatic transmissions**. This fluid was the first automatic transmission fluid (ATF) that was frictionally modified. Overtime this specification eventually evolved into the Dexron specifications. You will find that fluids that meet any of the Dexron specifications such as Dexron, Dexron II, Dexron III, Dexron III-E through Dexron III-H and Dexron VI will cover the obsolete Type A specification.

As far as the Ford Type F (ESW-M2C33F) this was a fluid used in Ford automatic transmissions from 1967 till 1979. The fluid specification was obsoleted in 1980. This type of fluid was not frictionally modified and had a high static coefficient of friction characteristic in order to have a high holding capacity once the transmission clutches were engaged. These types of fluids are rarely used except in some types of transmissions or clutch drives used in certain automotive racing applications or variable speed drives found on some industrial equipment. The frictional characteristics of Type F fluids are similar to those found in drive-train fluids that meet the Caterpillar TO-4 specification. Fluids that meet any of the Dexron specification or the Ford Mercon, Mercon V, Mercon SP, Mercon C or Mercon LV specifications or other OEM specifications for ATFs cannot be used in transmissions that specify Type F since these types of fluids are highly frictionally modified. Use of these fluids in a Type F application will result in harsh shifting, poor transmission response, burnt clutches and incompatibility with the types of frictional materials used in the clutches.

"Ford Type A ATF WSS-M2C938-A" this is one specification. you are breaking it into two specs. This is a 2007 specification. usually factory fill rights are with two or three companies not more, very expensive to get the rights.

There is no correlation of WSS-M2C938-A with any other specifications though it resembles some of them. In the absence of Ford's statement regarding equivalence, we should treat that the specification is unique; meant for Ford vehicles; meant for factory fill application.

Product being synthetic & also of very complex specification.

This is a factory fill power steering fluid for Ford vehicles. Extremely complex specification.

I've surfed Ford forums a little and that's what I found.

FORD WSA M2C195 A
Engineering Material Specification — Fluid, Power Steering
General Product Information
Status: Superseded
Superseded By:
FORD WSS M2C204 A2:2003
FORD WSS M2C938 A:2007

FORD WSA M2C195 A:2010 - Red psf fluid, can't find non-original fluids
FORD WSS M2C204 A2:2003 - Green synthetic psf fluid (VI > 300, seems like Pentosin CHF11S)
FORD WSS M2C938 A:2007 - Ford Mercon LV - Manufactured by Motorcraft and Ravenol

OPEN GEARS

[Stuart McKenzie](#)

In an ideal world we'd probably treat an open gear like an enclosed gear and provide it with a continuous supply of lubricant, however, due to the open gear's size and location we accept a few compromises, one of them is to spray the gear (and or pinion) at regular intervals with a lubricant, more viscous than would be required to lubricate it continuously, and in the interval allow it to be squeezed out by the sliding and rolling motion of the gear mesh to a minimum point where lubricant needs to be supplied again to prevent metal to metal contact occurring. To do this efficiently it is critical to know the point when relubrication needs to occur. This can be done theoretically from tables, can be calculated or can be done practically on site with an IR camera, but here is another compromise. The customer usually wants to use the minimum amount of lubricant because it is usually a one-way operation and they pay for it by the Kg and then need to dispose of the waste, whereas the supplier would like to apply the lubricant as often as possible to avoid any mechanical problems. There are practical concerns to consider when using a spray system as each time the system cycles it needs to supply the correct amount over the surface of the gear teeth. If solid lubricant is used in the lubricant (MoS₂, graphite etc) then this can block the spray nozzle or even the supply line from the drum so very regular maintenance and observation is required. My own preference is for a high viscosity gear lubricant (without solid additives) as it seemed to provide an overall better solution (clear so the gear surface can be seen, no solid additives to block the nozzles, higher viscosity to provide a better cushion ... and some buffer) but this did require heating of the supply line. Many others are happy with grease based lubricants. There is much more that can be said and I suggest you search the web for more information and see what other contributors have to say.

To answer your initial question though the best way to lubricate an open gear is with flooded lubrication as occurs in an enclosed gearbox, however, as this is usually not possible we select other ways to do it. As Koustuv has said there are a number of companies that specialise in providing equipment for this purpose and can recommend solutions to the other issues you've raised.

[Laurence King](#)

Lubrication Maintenance Manager at National Reliability Services Australia

on the size of the open gear, we run a SAFEMATIC System MAXILUBE IF-105, ECO to lubricate our Rotary Kiln Open Girth Gear.

1. Twin Nozzles system used, mounted inside the guard 100mm apart giving 100% coverage of gear teeth.
2. The pressure ratio of the Pneumatic pumps used is normally 1:50. The pressure level in the pneumatic system can be set at 4-7 bar(60-100 psi)
3. The distance between nozzle and application area depends on the spray pattern it will deliver anywhere from 50-100mm.
4. The lubrication we use is a grease Molub Alloy 8031-3000(Castrol) in 180kg drums

You must always check weekly the spray pattern that the nozzles will deliver making sure of no blockages and the girth gears are getting full lubrication. Best way to do this is holding a piece of thick cardboard in front of nozzles during a cycle.

[Alvin Chester Oreiro MLAI, MLT1](#) Lubrication Technician at Holcim Philippines Inc.

Automatic spray lubrication for open gears requires Autolubricator, air and grease nozzle, divider blocks, and air system (solenoid valves, FRL and pressure switch).

Air pressure being used in our plant ranges from 100-150psi

Distance of nozzle to the pinion gear is 200mm ± 50

orientation of a spray nozzle is 30degrees to pinion gear pitch

[Koustuv Mohanty](#) Owner, KINETICS COMMERCIAL COMPANY

Somehow my initial comment seems to have been truncated. Repeating the same. The basic parameters that we need to know in this case are

- 1) Main drive rating (KW)
- 2) What is the application - Kiln, Mill (Wet or dry grinding), etc
- 3) Continuous operation or batch processing

This will give an idea whether a spray system will be economically viable or you continue with the sump/dip lubrication (if system is already in operation)

As far as final selection of lube is concerned, apart from all factors the ambient conditions mainly temperature prevailing in plant area play a major role. We will come to that subsequently. Secondly if application is encountering heavy shock loads, solid lubricants may be required maybe not in the usual colloidal form which cause nozzle chocking but in some other state, though for any application incl girth gears, an oil is the best alternative ; viscosity to be determined depending on requirements.

As far as the parameters of an ideal lube for open gears described by Stuart minus the demerits - its available in the product mentioned by Laurence MA 8031.

[Peter De Vos](#) Owner, ILS3 Benelux and ILS3 Maintenance Support

Perhaps a solution for you... see application on <http://flexxpump.be/pagina4.html>

[Muhammad Hassan Abbasi](#) Lubrication Engineer at MAL Pakistan Limited

- 2) The application is Kiln.
- 3) Yes it is a continuous 24 hour operation.

[Kausar Rizwan](#)

Industrial Lube Marketing / Tech Services

Depend on the gear size I personally feel spray one is good but by brush little more viscos as compare to spray oil viscosity. may kiln gear very hot so it difficult by brush.

[Brent Winter](#) Industrial Field Marketing Advisor at ExxonMobil

I would like to add some thoughts: clearly I'm biased on some products but you can search those on your own. There is one that is outstanding for open gears. Its a PAO extremely viscous and clear.

1. There are a lot of things to consider. Make sure you cover the simple things. look at the installation manual
2. Make sure the spray covers the entire tooth. You can do a visual inspection or with a cardboard sheet. Be safe and don't have the gears running. LOTO.
3. If using a grease type product with a tackifier/ diluent. It should be sprayed on the pinion gear going away from mesh. This way the tackifier has time to adhere to the teeth.

[Fernando Oscar Bilotti](#)

Senior Field Engineer Support - Argentina Area -Minería y Marine & Aviation Lubricants en Axion Energy S.R.L.

We need more information, for example: tell us if the open gear is for Mill (mining) or Cement Industry. For mill , OG with high diameter we have a lot of good experience with Mobiltac 325 N/C (High viscosity lubricant with Non Chlorine Solvent) used with spray nozzle or Mobil SHC M 46 or 22 depends del lambda (film) required and and frequency and amount of product applied. Take in consideration de difference between Grase and Lubricant, because the application is different

(pinion or crown), the angle of application. You need to see the AGMA Table according to report of FALK 638-050 and then you can calculate the amount and frequency. The most used lubrication system is Farval and you can find the air pressure and other requirements.

[Jason Davis](#) Techenomics Resident Blogger - Oil Analysis Professional

Hi Muhammed, whilst many topics have already been previously mentioned, one topic you are forgetting and that should be considered to be equally as important as setting up the system is continued monitoring (Preventative Maintenance) correct functioning of the sprays, injectors, lubricant, air pressure and many other factors that need to be regularly checked on down days when the Kiln is having its general maintenance or even worse, while its in every day motion. Whilst setting up Lubrication systems is not that hard, getting the factors correct as you first mentioned - air pressure settings, spray patterns, spacing between and distance from the open gears, timing of the system (firing frequency), spray run times, all these have an effect on the way that the open gear is lubricated, incorrect adjustments or loss of air pressure can itself result in catastrophic failures. The last thing you want is for the open gear to have unnecessary pitting or spalling. Whilst I'm not trying to sell you anything, Techenomics have been consistently involved with Lubrication Inspections and monitoring of Open Gears for the past 15 years, please feel free to drop me a line, I do have report templates that may even help you, why start from the beginning when the hard work has already been done.

[Tom Muckian](#) Tech Service Mgr. at Whitmore Group

Personally, I prefer to lubricate from a sump, using an oiler wheel that engages with the pinion. But some machines, especially ball mills, are not built to allow for this.

[Kruno Huskanovic](#) Lubrication Systems District Manager at SKF

If you are considering traditional way of spraying fluid grease with very fine solid additives (graphite or molybden di sulfide) e.g. Fuchs Ceplatin or Castrol Mollub Aloy and apply standard equipment first goal is to cover fully side of the tooth, to obtain the right coverage (spray pattern overlapping). Grease is usually applied on pinion right before contact with gear crown. There is a lot of available literature on internet explains positioning of the nozzles in cases of incoming or outgoing pinion. Nozzles are placed under angle of 30 degrees relative to the line connecting center of the pinion and point on the side of the tooth you are aiming to hit. Distance from nozzle to pinion surface is usually between 150 and 250mm. Air pressure in case of spraying fluid grease should not exceed 2 bars. If pressure is higher you'll create fog and have more grease on housing than on pinion. One sprayer usually covers 100-120 mm of width. Standard solution is to use progressive system with pneumatic pump and monitor both air and grease supply. Downsize of this solution is often blockage of the nozzles or progressive feeder especially in case of high contamination like in cement production. This can be prevented by having grease drum exchange under control (apply lift) and to heat grease drum and grease line in winter period (better pump-ability and spray-ability and less sprayers blockage). There are several producers offering open gear lubrication systems but company with most experience, references world wide especially in heavy duty industries on Open Gear application is definitely Lincoln.

[Koustuv Mohanty](#) Owner, KINETICS COMMERCIAL COMPANY

Hi Kruno, with due apology would like to submit that the brand mentioned by you, though one of the best, I have multiple no-so-good experience with the same at least for open gear application. There is poor synchronisation between air and lube with both of them being dispensed at random. As a result the desired spray does not happen. Once in many cycles, the sequence and timing of lube & air fall in line and good spray does take place. Secondly, for reasons best known to the OEM, they use very thin lube lines. With high base oil viscosity greases, this becomes a problem. Entire system is under unnecessary stress. I have seen in every plant using this system, without an exception. The support service our region is also not ok. Wont be very different for Muhamad too. This is my personal advice.

[Kruno Huskanovic](#) Lubrication Systems District Manager at SKF

Hi Koustuv, you are unfortunately right saying big no of installed open gear lub systems are not running properly.

Reason is partly due to unprofessional installation partly due to high contamination and bad system maintenance practice.

Air - grease synchronisation is never a problem as long as you have reliable equipment and good air supply (enough pressure in air network).

Solenoid 2/2 way valve is responsible for bringing the air to the nozzles and being activated along with pump (usually pneumatic) which is started in the same time.

There is always certain buffer of grease in nozzles and due the type of system (progressive) lines are always full with grease and under residual pressure.

Therefore after pump starts grease feedback on the nozzles is almost in the same second especially if you take into account that there is certain buffer grease volume in divider and nozzles. I have very good experiance with SKF both progressive and dual line systems (Ex Safematic).